TM 55-1520-211-20
C6

CHANGE
No. 6

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D. C., *20 September 1966*

Organizational Maintenance Manual

ARMY MODELS UH-1A AND UH-1B HELICOPTERS

TM 55-1520-211-20, 20 January 1966, is changed as follows:

1. Remove and insert pages as indicated below:

	Remove page	Insert page
Chapter 1, Section II	1-3 and 1-4	1-3 and 1-4
Sections II, III	1-20C thru 1-22	1-20C thru 1-22
	1-29 thru 1-30A	1-29 thru 1-30A
	1-33 thru 1-40	1-33 thru 1-40
Chapter 3, Section II	3-3 and 3-4	3-3 and 3-4
	3-13 thru 3-18	3-13 thru 3-18
	3-21 and 3-22	3-21 and 3-22
	3-27 thru 3-30B	3-27 thru 3-30B
Section III	3-35 thru 3-38	3-35 thru 3-38
Sections III, IV	3-47 thru 3-56	3-47 thru 3-56
	3-59 thru 3-62A	3-59 thru 3-62A
Chapter 5, Sections I, II	5-1 and 5-2	5-1 and 5-2
	5-5 thru 5-10A	5-5 thru 5-10A
Sections II, III	5-13 thru 5-32	5-13 thru 5-32
Section IV	5-37 and 5-38	5-37 and 5-38
Section V	5-43 thru 5-46A	5-43 thru 5-46A
Sections V, VI	5-50A thru 5-58	5-50A thru 5-58
	5-63 thru 5-66	5-63 thru 5-66
	5-69 thru 5-72A	5-69 thru 5-72A
Sections VI, VII	5-75 thru 5-78A	5-75 thru 5-78A
Section VII - IX	5-81 thru 5-94	5-81 thru 5-94
	5-99 thru 5-106	5-99 thru 5-106
Chapter 6, Section II	6-17 thru 6-24	6-17 thru 6-24
Chapter 7, Section II	7-15 thru 7-16A	7-15 thru 7-16A
Chapter 8, Section III	8-65 and 8-66	8-65 and 8-66
	8-73 and 8-74	8-73 and 8-74
	8-81 and 8-82	8-81 and 8-82
Chapter 11, Section III	11-29 thru 11-32	11-29 thru 11-32
Chapter 16, Sections II, III	16-5 thru 16-10	16-5 thru 16-10
Appendix	AI-1 and AI-2	AI-1 and AI-2
Alphabetical Index	1 thru 8	1 thru 8
	13 and 14	13 and 14

2. Retain this page in front of manual for reference purposes.

By Order of the Secretary of the Army:

HAROLD K. JOHNSON,
General, United States Army,
Chief of Staff.

Official:
KENNETH G. WICKHAM,
Major General, United States Army,
The Adjutant General.

DISTRIBUTION:

To be distributed in accordance with DA Form 12-31 requirements for organizational maintenance instructions for UH-1A and UH-1B aircraft.

A EQUIPMENT	B PART DESIGNATION	C NUMBER OF UNITS	D AMPERES PER UNIT	E OPERATING TIME-MIN.	F OPERATING CONDITIONS																					
					START & WARM UP F-2					TAKE OFF F-4					CRUISE F-5					LAND F-7					EMERGENCY F-8				
					AMPS	AVERAGE AMPS				AMPS	AVERAGE AMPS				AMPS	AVERAGE AMPS				AMPS	AVERAGE AMPS				AMPS	AVERAGE AMPS			
						0.5 MIN.	2.0 MIN.	15.0 MIN.	MIN.		0.5 MIN	2.0 MIN.	15.0 MIN.	MIN.		0.5 MIN.	2.0 MIN.	30.0 MIN.	MIN.		0.5 MIN.	2.0 MIN.	5.0 MIN.	MIN.		0.5 MIN.	2.0 MIN.	30.0 MIN.	60.0 MIN.
C FLIGHT CONTROLS																												
MAGNETIC BRAKE-FORCE TRIM	AIRBORNE ACC R460M10	3	0.5	30.0	1.5	1.5	1.5	1.5		1.5	1.5	1.5	1.5		1.5	1.5	1.5	1.5		1.5	1.5	1.5	1.5		1.5	1.5	1.5	1.5	1.5
SOLENOID-HYDRAULIC CONTROL	ADEL 52657	1	1.5	2																								
E ENGINE INSTRUMENTS																												
ENGINE OIL TEMPERATURE	AERNO 61-8833 (MS28009-1)	1	0.04	30.0	0.1	0.1	0.1	0.1		0.1	0.1	0.1	0.1		0.1	0.1	0.1	0.1		0.1	0.1	0.1	0.1		0.1	0.1	0.1	0.1	0.1
XMSN OIL TEMPERATURE	AERNO 61-8842 (MS28009-2)	1	0.04	30.0																								
F FLIGHT INSTRUMENTS																												
GYRO COMPASS	TYPE J-2	1	0.6	30.0	0.8	0.8	0.8	0.8		0.8	0.8	0.8	0.8		0.8	0.8	0.8	0.8		0.8	0.8	0.8	0.8		0.8	0.8	0.8	0.8	0.8
POWER INTERLOCK RELAY	LEAR 5819C	1	0.2	30.0																								
HEATER-PITOT TUBE	AERNO 60-9660 (AN5813-1	1	4.0	30.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0
VERTICAL GYRO IND SYSTEM																												
CONTROL	AERNO 60-8553 (TYPE K4B)	1	0.6	30.0																								
INDICATOR	AERNO 60-5601 (TYPE B1A)	1		30.0	0.8	0.8	0.8	0.8		0.8	0.8	0.8	0.8		0.8	0.8	0.8	0.8		0.8	0.8	0.8	0.8		0.8	0.8	0.8	0.8	0.8
POWER INTERLOCK RELAY	LEAR 5819C	1	0.2	30.0																								
TURN & SLIP TYPE MD-8	AERNO 60-5704 (MS28024-3)	1	0.1	30.0	0.1	0.1	0.1	0.1		0.1	0.1	0.1	0.1		0.1	0.1	0.1	0.1		0.1	0.1	0.1	0.1		0.1	0.1	0.1	0.1	0.1
H HEATING																												
CABIN HEATER	JANITROL S-100	1	29.6	30.0						29.6	29.6	29.6	29.6		29.6	29.6	29.6	29.6		29.6	29.6	29.6	30.4						
HEATED BLANKET OUTLETS		2	10.0	30.0						20.0	20.0	20.0	20.0		20.0	20.0	20.0	20.0		20.0	20.0	20.0	20.0						
ENGINE ANTI-ICING		1	11.0	1	11.0	2.9	2.9	2.9		11.0	2.9	2.9	2.9		11.0	2.9	2.9	2.9		11.0	2.9	2.9	2.9		11.0	2.9	2.9	2.9	2.9
CABIN HEATER PURGING			4.75	2.0																					4.7	4.7	4.7	0.3	0.2
J ENGINE IGNITION SYSTEM		1	1.5	0.5	1.5	1.5	0.4	NEG																				
K ENGINE CONTROLS																												
STARTER-GENERATOR	AERNO 42-7028 TYPE MC1, MIL-S-9181	1	1.0	0.5	1.0	1.0	0.2	0.1																				
RELAY STARTER	MS2417201	1	0.04	0.5																								
		1	2.0	0.01	NEG.																							
L LIGHTING																												
DOME LIGHT BULB - RED	MS25235R311 LAMP	3	1.28	1	2.6	2.6	2.6	2.6		2.6	2.6	2.6	2.6		2.6	2.6	2.6	2.6		2.6	2.6	2.6	2.6						
COCKPIT LIGHT BULB	MS25221-313 LAMP	2	0.17	1	0.3	0.3	0.2	NEG.		0.3	0.3	0.2	NEG.		0.3	0.3	0.2	NEG.										
INSTR. & EDGE LIGHT BULB	MS25237-327 LAMP	94	0.04	30.0	3.8	3.8	3.8	3.8		3.8	3.8	3.8	3.8		3.8	3.8	3.8	3.8		3.8	3.8	3.8	3.8		3.8	3.8	3.8	3.8	3.8
INSTR. SECONDARY LIGHT BULB	MS25069-1495 LAMP	4	0.34	2																								
FUS. LT. BULB - TOP & BOTTOM	AN3120-1047 LAMP	3	2.7	30.0																								
FUS. LIGHT BULB - SIDE	ASA-7512 LAMP	4	0.83	30.0	12.6	12.6	12.6	12.6		12.6	12.6	12.6	12.6		12.6	12.6	12.6	12.6		12.6	12.6	12.6	12.6		12.6	12.6	12.6	12.6	12.6
FUS. LIGHT BULB - TAIL	MS25232-1683 LAMP	1	1.15	30.0																								
FLASHER-FUSELAGE LIGHTS	TYPE C-2 MIL-F-7414	1	0.4	1																								
MASTER CAUTION PANEL	204-075-223-1	1	0.2	30.0	0.2	0.2	0.2	0.2		0.2	0.2	0.2	0.2		0.2	0.2	0.2	0.2		0.2	0.2	0.2	0.2		0.3	0.3	0.3	0.3	0.3
SEARCHLIGHT	TYPE MA-3 (MIL-L-26998)	1	17.0	5.0											17.0	17.0	17.0	2.8		17.0	17.0	17.0	17.0						
LANDING LIGHT	GRIMES G-8385-1	1	16.5	5.0																16.5	16.5	16.5	16.5		16.5	16.5	16.5	2.8	1.4
ANTI COLLISION LIGHT	GRIMES G-7740-8-24	1	3.0	30.0						3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0						
M MISCELLANEOUS																												
WINDSHIELD WIPER	ALCO VALVE CO.	1	3.5	30.0						3.5	3.5	3.5	3.5		3.5	3.5	3.5	3.5		3.5	3.5	3.5	3.5		3.5	3.5	3.5	3.5	3.5
SOLENOID CARGO HOOK RELEASE	EASTERN ROTORCRAFT SP-3094	1	1.0	0.1											10.2	2.1	0.5	NEG							10.2	2.1	0.5	NEG	NEG
RELAY - HOOK RELEASE	AN3311-2 IUS 130R1302-3-1	1	0.2	0.1	65.6	65.6	65.6	65.6																				
P POWER																												
BATTERY CHARGING	24 A.H. NICKEL CADMIUM, TYPE MA-4	1		1						26.4	26.4	16.5	8.9		64.8	64.8	40.5	15.3		21.6	21.6	11.5	10.8		21.6	21.6	13.5	5.1	2.8
RELAY-BATTERY	MS24171D1	1	0.6	30.0	0.6	0.6	0.6	0.6		0.6	0.6	0.6	0.6		0.6	0.6	0.6	0.6		0.6	0.6	0.6	0.6		0.6	0.6	0.6	0.6	0.6
RELAY-NON ESSENTIAL BUS	MS24171D1	1	0.6	30.0	0.6	0.6	0.6	0.6		0.6	0.6	0.6	0.6		0.6	0.6	0.6	0.6		0.6	0.6	0.6	0.6						
RELAY-BUS CONTROL	MS25024-2	1	0.35	30.0	0.3	0.3	0.3	0.3		0.3	0.3	0.3	0.3		0.3	0.6	0.3	0.3		0.3	0.3	0.3	0.3						
INVERTER - MAIN	AN3532-2	1	12.9	30.0	12.9	12.9	12.9	12.9		12.9	12.9	12.9	12.9		12.9	12.9	12.9	12.9		12.9	12.9	12.9	12.9		12.9	12.9	12.9	12.9	12.9
INVERTER - SPARE	AN3532-2	1	29.6																									
RELAY - A-C LOAD TRANSFER	AN3311-2	1	0.2																									
Q FUEL & OIL																												
PUMP - FUEL BOOST	204-060-627-1	1	2.5	30.0	2.5	2.5	2.5	2.5		2.5	2.5	2.5	2.5		2.5	2.5	2.5	2.5		2.5	2.5	2.5	2.5		2.5	2.5	2.5	2.5	2.5
PUMP - FUEL TRANSFER	204-060-627-1	1	2.5	30.0																								
VALVE - FUEL SHUTOFF	WE452-1D	1	1.0	0.02	2.0	0.1	NEG													2.0	0.1	NEG			2.0	0.1	NEG		
VALVE - OIL SHUTOFF	WE450-1D	1	1.0	0.02																								
SOLENOID VALVE - IGNITER		1	0.75	0.5	0.8	0.8	0.2	NEG																				
SOLENOID VALVE - GOV BYPASS		1	1.0	30.0	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0	1.0
ACTUATOR - GOVERNOR R P M	204-060-730-3	1	0.9	1.0	0.9	0.9	0.4	0.1							0.9	0.9	0.4	NEG.										
SOLENOID - IDLE STOP RELEASE	CANNON 1700	1	6.5	0.03																NEG					NEG			
R RADIO NAVIGATION & COMM.																												
RADIO COMPASS	AN/ARN-59	1	2.8	30.0	2.8	2.8	2.8	2.8		2.8	2.8	2.8	2.8		2.8	2.8	2.8	2.8		2.8	2.8	2.8	2.8		2.8	2.8	2.8	2.8	2.8
MARKER BEACON RCVR	AN/ARN-32	1	0.59	30.0	0.6	0.6	0.6	0.6		0.6	0.6	0.6	0.6		0.6	0.6	0.6	0.6		0.6	0.6	0.6	0.6						
FM HOMING ADAPTER	AN/ARA-31	1	1.0												1.0	1.0	1.0	1.0										
FM TRANSCEIVER - RECEIVER	AN/ARC-44	1	4.92	30.0	4.9	4.9	4.9	4.9		4.9	4.9	4.9	4.9		4.9	4.9	4.9	4.9		4.9	4.9	4.9	4.9		4.9	4.9	4.9	4.9	4.9
(ADDITIONAL PWR) - TRANSMIT			1.43							1.4	1.4	0.7	0.1							1.4	1.4	0.7	0.3		1.4	1.4	0.7	0.1	0.1
UHF TRANSCEIVER - RECEIVE	AN/ARC-55	1	17.0	30.0	17.0	17.0	17.0	17.0		17.0	17.0	17.0	17.0		17.0	17.0	17.0	17.0		17.0	17.0	17.0	17.0		17.0	17.0	17.0	17.0	17.0
(ADDITIONAL PWR) - TRANSMIT			3.0		3.0	3.0	1.5	0.3		3.0	3.0	1.5	0.3		3.0	3.0	1.5	0.3		3.0	3.0	1.5	0.6		3.0	3.0	1.5	0.3	0.3
OMNI RECEIVER	AN/ARN-30A (POWER PROV)	1	2.9	30.0	2.9	2.9	2.9	2.9		2.9	2.9	2.9	2.9		2.9	2.9	2.9	2.9		2.9	2.9	2.9	2.9						
RELAY - INTERCOM	AN3303-1	2	0.15		0.3	0.3	0.1	NEG		0.3	0.3	0.1	NEG		0.3	0.3	0.1	NEG		0.3	0.3	0.1	0.1		0.3	0.3	0.1	NEG	NEG
SIGNAL DISTRIBUTION PANEL	SB-329/AR	2	0.28	30.0	0.6	0.6	0.6	0.6		0.6	0.6	0.6	0.6		0.6	0.6	0.6	0.6		0.6	0.6	0.6	0.6		0.6	0.6	0.6	0.6	0.6
SIGNAL DISTRIBUTION PANEL - AUX	MX-1646/AIC	2	NEG																									
RELAY AUX DIST PANEL	MS24115-6	2	0.14	30.0	0.3	0.3	0.3	0.3		0.3	0.3	0.3	0.3		0.3	0.3	0.3	0.3		0.3	0.3	0.3	0.3		0.3	0.3	0.3	0.3	0.3
S RADAR																												
IFF TRANSPONDER	AN/APX ( ) (POWER PROV)	1	4.0	30.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0
W WARNING																												
FIRE DETECTION	EDISON 227-28-5	1	0.07	30.0	0.1	0.1	0.1	0.1		0.1	0.1	0.1	0.1		0.1	0.1	0.1	0.1		0.1	0.1	0.1	0.1		0.1	0.1	0.1	0.1	0.1
		TOTALS - AVERAGE AMPS			101.90	91.9	84.49	81.10		236.20	228.10	198.10	165.80		242.20	226.00	197.80	156.00		206.50	196.50	185.90	181.90		144.90	126.80	114.60	85.70	81.90

204475-40-1

Figure 1-1. UH-1A Helicopter power loading chart (Serial No. 58-2078 thru 58-3047) (Sheet 1 of 2)

1-22. *Chapter 15 — External Stores — Nonarmament.* This chapter contains organizational maintenance instructions for all nonarmament external stores which may be utilized by the aircraft covered by this manual.

1-23. *Chapter 16 — Storage of Aircraft.* This chapter contains comprehensive procedures for preparing the aircraft and components for flyable, temporary and limited storage. Activation after storage and demolition methods are also contained herein.

1-24. *Appendix I — References.* This appendix consists of a list of official publications available to organizational maintenance personnel.

1-25. *Appendix II — Maintenance Allocation Chart.* This chart reflects the maintenance functions to be performed at each maintenance level.

1-26. *Appendix III — Aircraft Inventory Master Guide.* This appendix provides standard inventory procedures and furnishes the using activities with a master guide to determine the inventoriable items of installed and loose equipment authorized and required by the specific aircraft in performance of its mission.

1-27. *Appendix IV — Weight and Balance.* Necessary data for this appendix is covered by reference to applicable manual.

1-28. *Index.* The index lists, in alphabetical order, every important subject under the topic which may be of significance to organizational maintenance.

1-29. Coding Data. The contents of this manual are applicable to Army Model UH-1A helicopters and Army Model UH-1B helicopters. The following code system has been used in the text and illustrations to designate applicability to a given model or version.

CODE	APPLICATION
No Code	All UH-1A and UH-1B helicopters.
A	UH-1A helicopters only.
B	UH-1B helicopters. (Including 540.)
B 5	UH-1B helicopters with T53-L-5 Engine.
B 9	UH-1B helicopters with T53-L-9 and L9A Engine.
B 11	UH-1B helicopters with T53-L-11 Engine.
B 13	UH-1B helicopters equipped with T53-L-13 engines.
5 4 0	Peculiar to 540 UH-1B equipped helicopters only.

1-30. Reference Data. In addition to the referenced publications contained in Appendix I, a list of consumable materials will be found in Section III of this chapter. Repair parts and special tools are contained in TM 55-1520-211-20P.

1-31. Systems Description and Diagrams. Necessary descriptions and diagrams will be found in either TM 55-1520-211-10 or adjacent to the procedural paragraph(s) which they clarify.

1-32. Ground Support Equipment. Descriptions and necessary illustrations of ground support equipment required for organizational maintenance will be found in chapters 4 through 16 adjacent to the applicable instructions for their use.

1-33. Maintenance Data. The following paragraphs contain maintenance data of a general nature which is applicable to the aircraft as a unit. Detailed maintenance instructions will be found in chapters 4 through 16.

1-34. *Power Load Charts.* Power load data for all electrical items used on the aircraft covered by this manual will be found on figures 1-1 through 1-8.

1-35. *Servicing Materials.* Basic servicing materials for the aircraft covered by this manual are as follows:

Item	Specification
JP-4 Fuel	MIL-J-5624
JP-5 Fuel	MIL-J-5624
Engine and Transmission Oil	MIL-L-7808
Hydraulic Fluid	MIL-H-5606

Other servicing materials, such as lubricants, miscellaneous cleaning materials, paint, sealing compound, etc., will be found in the Consumable Materials List in Section I. Procedural paragraphs requiring their use will refer to the appropriate item number on this list. External power requirements of 500 amperes, 28.5 volts will be supplied by an auxiliary power unit capable of delivering 650 to 800 amperes. A suitable hydraulic test unit capable of producing pressure to 2300 psig, and having a flow rate of at least six gpm, shall be used for testing the hydraulic systems. Lubrication charts and data will be found in chapter 2.

1-36. *Miscellaneous Fuel Data.* General Information regarding fuel is to be found in the following paragraphs.

1-37. *Jet Fuel Limitations.* Jet fuel, Grade JP-4 (item 1, table 1-1), is intended for use in jet aircraft under all operating conditions. Experience to date indicates that no undue difficulties will be encountered in starting and operating the helicopter's jet engine at low temperatures on Grade JP-4 fuel. Helicopters equipped with Lycoming T53-L-9A (scoopless) and T53-L-11/13 engines only, may use Grade JP-5 (item 1, table 1-1) jet fuel. JP-5 fuel may cause slower engine starts at low ambient temperatures. The T53-L-13 engine is designed to operate on Grade JP-4 or JP-5 fuel. For details regarding alternate and emergency fuels refer to TB AVN 2.

1-38. *Combustion Heater.* Fuel filter and drain lines should be checked daily for accumulations of ice or water. During low temperature operation below 32°F water vapor in the combustion gases flowing through the drain line may condense and form ice. Water produced during combustion may collect on the fuel nozzles and ignitor plug and form ice after the heater has been turned off. This ice may be sufficient to make it difficult, if not impossible, to start the heater without preheating.

1-39. *Miscellaneous Oil Data.* General information regarding oil is to be found in the following paragraphs.

1-40. *Synthetic Base Oil, Specification MIL-L-7808.* This oil is to be used in preference to petroleum based oil because of its superior temperature characteristics. In addition to a synthetic chemical base, this oil contains oxidation inhibitors and anti-wear additives. MIL-L-7808 oil may cause swelling of O-ring seals that are designed for use in petroleum based oils.

Note

If oil is inadvertently spilled on painted surfaces of the helicopter, those surfaces should be immediately wiped clean to avoid possible blistering and peeling of paint.

Caution

This oil is poisonous and readily absorbed through the skin. Make certain that this oil does not remain on the skin.

1-41. *Dusty Conditions.* More frequent oil changes are recommended for helicopters operating under unusually dusty conditions. The frequency of oil changes will depend upon the severity of the dust condition. Failure to change oil more frequently in high dust areas can result in accelerated engine wear.

1-42. *Contamination of Synthetic Base Oil.* This oil is a synthetic jet engine lubricant, and is extremely susceptible to contamination by water. In addition this oil has a limited storage life and must be tested periodically. Due to the susceptibility of this oil to contamination, it is purchased, stored and handled in hermetically sealed containers. These containers, once opened, must be emptied immediately, and not retained in opened condition for future use. When dispensing oil into aircraft, it should be filtered through a 10 micron filter to remove any lint, can sealant (metal slivers) or dirt that may have entered the oil during the canning and/or opening processes.

1-43. *Tire and Tube Data.* Tires and tubes should be stored under normal temperature

conditions if at all possible. If it becomes necessary to store tubes at subnormal temperatures, partially inflate them in order to remove creases and folds. Tires and tubes should be warmed before mounting so that normal handling will not flex them to the point of cracking. When not actually in use ground handling wheels should be removed from the helicopter and placed in warm storage. If tires inadvertently become frozen to the ground they can be released by heat application or by over-inflation. Under no circumstances should the applied heat exceed a temperature of 160°F. The proper procedure should be determined by considering the individual problem. If the tires are to be released by over-inflation, the tires may be inflated to one and one-half times normal pressure, provided the following precautions are observed.

a. Careful inspection should be made before inflation for evidence of wheel cracks or breaks in the tires.

b. In order to prevent injury to personnel in case of wheel rim failure, all persons should stand in line with the tire, rather than broadside of the wheel, during inflation.

c. Heat must not be applied to over-inflated tires because of its action in further increasing tire pressure.

d. Tire pressure must be reduced to normal immediately after tires are freed.

Note

When tires are over-inflated, as described above, immediate action cannot be expected. One-half to one hour may be required before tires are free because of the slow action of the frozen casings in responding to the increased tire pressure.

1-44. *Weather or Environment Factors.* Refer to TM 55-405-1 for data regarding weather or environment factors.

1-45. *Main Rotor Grip Seal Leakage.* Should main rotor grip seal leakage occur when operating at low climatic temperatures, the shutdown procedure outlined in TM 55-1520-211-10 should be followed.

1-46. Maintenance Forms. Forms required in the performance of the prescribed maintenance operation of the aircraft are contained in the aircraft Log Book. Assignment of responsibilities and instructions for preparation and use of Log Book Forms are outlined in TM 38-750 (Army Equipment Record Procedures) and TM 55-405-9 (Army Aviation Maintenance Engineering Manual, Weight and Balance).

Section III — Aircraft General

1-47. Description. The UH-1A and UH-1B helicopters (figure 1-8) described in this handbook are utility type, compact design, aircraft which feature a low silhouette and low vulnerability to meet combat requirements. The fuselage consists of two main sections; the forward section (1) and the aft, or tail boom, section (2). The wide cabin, with large cubic foot volume, permits these helicopters to be used for transportation of personnel, special equipment and supplies. These helicopters are capable of operating from prepared or unprepared landing areas by day or night. They can also operate under instrument conditions, including light icing, and can navigate by dead reckoning or by the use of radio aids to navigation. Maximum visibility is afforded the crew by extensive use of transparent plastic panels at the top, front, bottom and sides of the cabin. Crew entrance is accomplished through two swing-hinged doors (3) located in the forward cabin area next to the pilot and copilot's station. For maximum principal dimensions refer to TM 55-1520-211-10, Chapter 2.

1-48. Entrance to the passenger-cargo area is by means of two large sliding doors (4) located one on each side of the aft cabin. The passenger-cargo area of the Model UH-1A helicopters contains a four passenger, web, seat which can be folded and stowed against the aft cabin bulkhead. In the UH-1B helicopters this is a five passenger seat. When these seats are folded and stowed a large, unrestricted loading area is available for transportation of cargo and/or equipment. Model UH-1A helicopters have provisions for a medical attendant's seat just behind the pilot and copilot. This seat faces aft. UH-1B helicopters have provisions for two individual passenger seats in this same area. For ambulance, or mercy mission service, litter rack and medical attend-

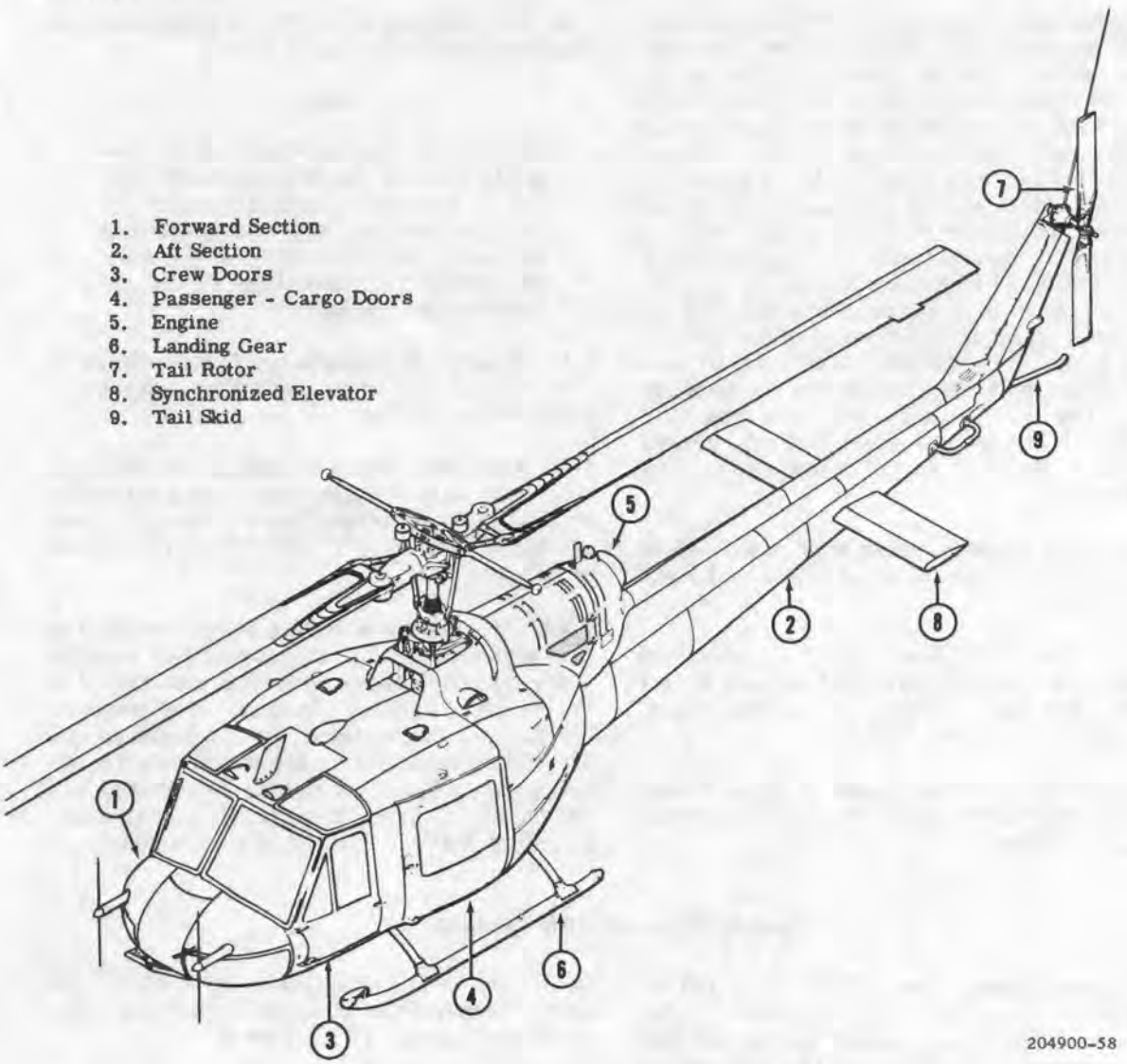


Figure 1-8. UH-1A and UH-1B helicopter

ant seat can be quickly installed. Two litter patients can be carried in Model UH-1A helicopters, while the Model UH-1B will accommodate three.

1-49. When it is not considered feasible to load cargo and/or equipment inside the helicopter, such material can be transported by means of cargo suspension. The cargo suspension assembly is attached to the under side of the pylon support at the center of gravity, and operates through an opening in the bottom of the helicopter.

1-50. The propulsion system, consisting of the engine (5) and the drive system, is located aft of the cabin, and is mounted above the fuselage on a platform which provides footing for maintenance personnel while servicing the helicopter. The engine and the drive system are enclosed by cowling that can be quickly opened, or removed, for easy access. The drive system, with its independently mounted units and quick-disconnect couplings, permits rapid servicing, repair, or replacement under combat conditions without the use of special tools or ground equipment. Maximum availablity of the helicopter for mission accomplishment is thus obtained.

e. Be sure battery switch is in OFF position and external power is disconnected before fueling or defueling the helicopter.

f. Ground the helicopter at the receptacle located aft of and below the fuel filler cap on the right-hand side of the helicopter. On UH-1B helicopters, (Serial No. 64-14101 and subsequent), the grounding receptacle is located on the left-hand side of the helicopter.

g. Fuel truck shall be grounded. (Truck to ground and truck to nozzle.)

h. Ground the truck filler-nozzle to the helicopter before removing the helicopter fuel tank filler cap. This will equalize static electrical potential.

i. Do not use "SPLASH" filling. Fill the tanks slowly and evenly.

j. When filling fuel tanks on UH-1B helicopters Serial No. 64-14101 and subsequent DO NOT OVERFILL. Excess fuel will run along door tracks into electrical compartment and possibly create fire hazard.

k. After completion of servicing, wash down and remove any spillover of jet fuel. This fuel does not evaporate as rapidly as gasoline, and constitutes a fire hazard for a much longer time. Cleaning materials or clothing which have become saturated with jet fuel shall be disposed of well away from any aircraft or hanger.

TANK CAPACITY
(U.S. Gallons)

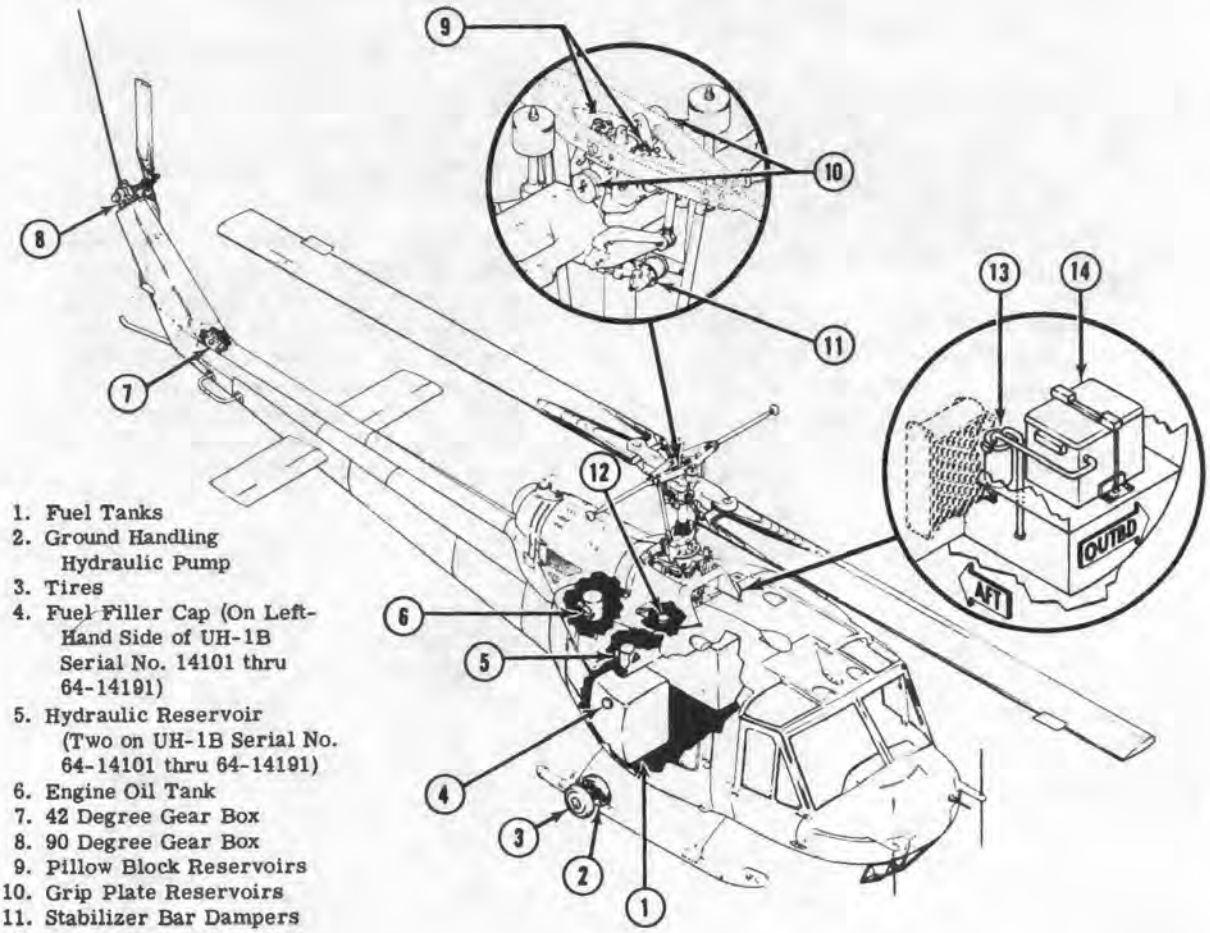
	Normal Service	Spillover Level
UH-1A (Serial No. 58-2078 thru 58-3047)	125.0	138.0
UH-1A (Serial No. 59-1607 and Subsequent)	155.0	166.0
UH-1B (Serial No. 60-3546 thru 64-14100)	165.0	168.0
UH-1B (Serial No. 64-14101 and Subsequent	242.0	245.0

1-72. *Recording of Alternate or Emergency Fuel.* If the aircraft is serviced with fuel other than the specified fuel, the type of fuel, quantity and operating time shall be entered in Form 2408-13 (Aircraft Inspection and Maintenance Record). This record is for the purpose of scheduling any additional maintenance that may be required. (Refer to figure 1-12.)

Note

No alternate fuels are permitted for use in T53-L-13 engine. Emergency fuel data for T53-L-13 engine is not available.

1-73. *Auxiliary Fuel Systems.* Various auxiliary fuel systems are available for use on UH-1A and UH-1B helicopters to provide additional fuel for extended distance and ferry missions. A 165 gallon capacity non-sealing fuel bladder, enclosed in a metal container, may be installed in the passenger-cargo compartment of UH-1A and UH-1B helicopters. (Refer to paragraph 11-313.) A larger, 350 gallon capacity, metal enclosed fuel tank is also available for installation in the passenger-cargo compartment of UH-1B helicopters only. (Refer to paragraph 11-323.) Two 60 gallon capacity external auxiliary fuel tanks may be installed on UH-1B helicopters, Serial No. 62-1872 and subsequent. (Refer to paragraph 15-3.) Internal 50 or 60 gallon capacity, self-sealing auxiliary fuel tanks may be installed in either the forward or the aft portion of the passenger-cargo compartment of UH-1A



1. Fuel Tanks
2. Ground Handling Hydraulic Pump
3. Tires
4. Fuel Filler Cap (On Left-Hand Side of UH-1B Serial No. 14101 thru 64-14191)
5. Hydraulic Reservoir (Two on UH-1B Serial No. 64-14101 thru 64-14191)
6. Engine Oil Tank
7. 42 Degree Gear Box
8. 90 Degree Gear Box
9. Pillow Block Reservoirs
10. Grip Plate Reservoirs
11. Stabilizer Bar Dampers
12. Transmission Assembly
13. Battery Sump Jar (UH-1A and UH-1B Serial No. 60-3546 thru 64-14100)
14. Battery

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Figure 1-11. Typical servicing diagram

and UH-1B helicopters. (Refer to paragraph 11-333.)

1-74. *Servicing — Auxiliary Fuel Tanks.* See figures 11-10, 11-12, 15-1 and 11-14, for appearance of auxiliary tanks and location of fuel tank filler caps.

Note

Be sure battery switch is in the "OFF" position, external power is disconnected and the helicopter is grounded before fueling or defueling the aircraft.

a. Make certain all lines and electrical leads are properly connected before servicing.

b. Service with fuel in accordance with precautions and limitations stated for main fuel system servicing.

Note

When filling the 165 and 350 gallon auxiliary fuel tanks, depress the poppet type valves in the top of each end bulkhead to release any air trapped between the cell and the fuel tank cover.

1-75. *Engine Oil System.* The supply tank (6, figure 1-11) for the engine oil system is located on the right-hand side of the forward engine firewall. A radiator type oil cooler is mounted in an opening through the bulkhead

TYPES OF FUEL AND PERMISSIBLE HOURS OF OPERATION ON EACH BETWEEN SCHEDULED HOT END INSPECTIONS

ENGINE MODEL	SPECIFIED FUEL	ALTERNATE FUEL		EMERGENCY FUEL	
		Type	Hours	Type	Hours
T53-L-1A	JP-4	Gasoline, All Types JP-5 Type	50 Unlimited	None	None
T53-L-5	JP-4	Gasoline, All Types	50	JP-5 Type	10
T53-L-9/9A	JP-4	Gasoline, Unleaded	50	JP-5 Type Gasoline, Leaded	10 10
T53-L-11 and Scoopless T53-L-9A	JP-4 JP-5	Gasoline, Unleaded Diesel Fuel	50 150	Gasoline, Leaded Compression Ignition Fuel	30 10
T53-L-13	JP-4 JP-5	NONE		NONE	

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Figure 1-12. Fuel usage chart

a. Remove filler cap (4, figure 1-13) and fill damper to full mark with hydraulic oil (item 3, table 1-1).

b. Replace and safety wire filler cap.

1-88. *Hydraulic Reservoir.* The hydraulic reservoir (5, figure 1-11) for UH-1A and UH-1B, Serial No. 60-3546 through 64-14100, helicopters is mounted on the right-hand side of the cabin aft bulkhead. Access to this reservoir is gained by opening right-hand transmission cowling. Oil level can be checked from inside cabin by means of a sight glass located on forward side of reservoir. Reservoir drain plug is located in bottom of reservoir.

Warning

To avoid contamination, do not use previously opened cans of hydraulic fluid. A new, sealed can of fluid must be opened and used.

1-89. *Servicing — Hydraulic Reservoir.* Service hydraulic reservoir for UH-1A and UH-1B, Serial No. 60-3546 through 64-14100, with hydraulic fluid (item 3, table 1-1).

HYDRAULIC CAPACITIES

Total Hydraulic Reservoir Capacity	4.0 U.S. Pints
Reservoir Refill Level	3.0 U.S. Pints
Total Hydraulic System Capacity	8.0 U.S. Pints

1-90. *Hydraulic Reservoir.* UH-1B helicopters, Serial No. 64-14101 and subsequent, are equipped with two hydraulic reservoirs (5, figure 1-11) mounted on the right-hand side of the cabin aft bulkhead. Access to these reservoirs is gained by opening right-hand transmission cowling. Outboard reservoir supplies System No. 2, and inboard reservoir supplies System No. 1. Oil level in each reservoir can be checked by means of sight glasses which are visble when right-hand transmission cowling is opened. A drain plug is located in the bottom of each reservoir.

Warning

To avoid contamination, do not use previously opened cans of hydraulic fluid. A new, sealed can of fluid must be opened and used.

Caution

On UH-1B helicopters Serial No. 66-491 and subsequent do not service reservoir with the accumulator charged hydraulically. Accumulator should be bled down.

1-91. *Servicing — Hydraulic Reservoir.* Service hydraulic reservoirs for UH-1B, Serial No. 64-14101 and subsequent, with hydraulic fluid (item 3, table 1-1).

HYDRAULIC CAPACITIES

Total System No. 1 Reservoir Capacity	3.25 U.S. Pints
Total System No. 2 Reservoir Capacity	3.25 U.S. Pints
Reservoir Refill Level	2.60 U.S. Pints
Total System No. 1 Capacity	6.60 U.S. Pints
Total System No. 2 Capacity	6.05 U.S. Pints

1-92. *Tires.* Two, six ply, tires (3, figure 1-11) are used on the helicopter ground handling gear. Those used on the Model UH-1A helicopters are 3.50 x 6; those on the Model UH-1B helicopters are 7.00 x 6.

1-93. *Servicing — Tires.* Inflate ground handling gear tires as follows:

Model Helicopter	Tire Size	Inflate To
UH-1A	3.50 x 6	75 to 80 PSI
UH-1B	7.00 x 6	38 PSI

1-94. *Ground Handling Hydraulic Pump.* A hydraulic pump (2, figure 1-11) is part of each ground handling gear. This manually activated pump facilitates raising and lowering of the ground handling wheels.

1-95. *Servicing — Ground Handling Hydraulic Pump.* a. Remove ground handling gear from helicopter and perform the following:

b. Position ground handling gear so that hydraulic pump is in vertical position with filling hole at top.

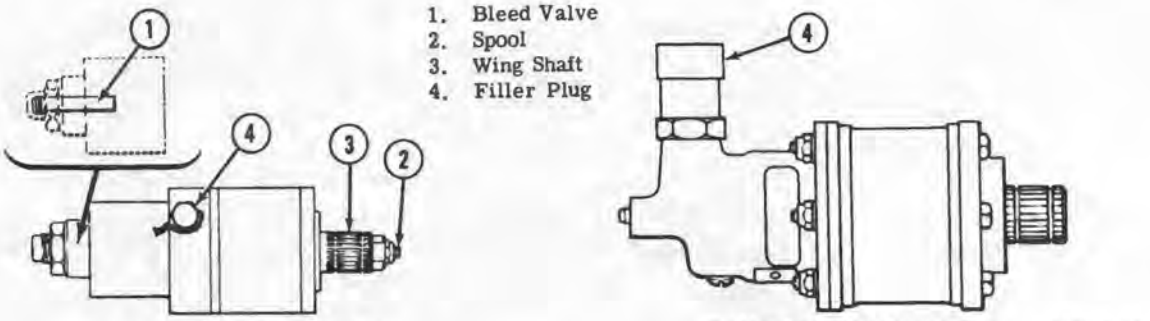
c. Remove filling screw and fill pump tank with hydraulic fluid, (item 3, table 1-1), until fluid comes out the filling hole.

d. Reinstall filling screw and tighten securely.

1-96. *Battery.* The nickel-cadmium battery (14, figure 1-11) is mounted in the lower section of the electrical compartment, and is connected to the helicopter's electrical system through a relay, which is controlled by the battery switch on the DC power panel. Two overflow, or vent, tubes extend from the battery to the underside of the fuselage. They are accessible through the lower left-hand door of the electrical compartment. The acceptable battery is a 24 volt, 34 ampere hour unit.

Caution

Battery failures and explosions may be caused by an excess of electrolyte in the cells. The specific gravity of a nickel-cadmium battery remains constant when the battery is in either a charged or discharged condition; consequently the state of charge cannot be determined by a test of the electrolyte. Neither can the state of charge be determined by a voltage test, due to the fact that the voltage remains constant over 90 percent of the discharge time. Since the state of charge cannot be determined by a check of either voltage or the electrolyte, the charging input to a completely discharged battery must be monitored in both current and time until the ampere hour capacity of the battery has been reached.



1. Bleed Valve
2. Spool
3. Wing Shaft
4. Filler Plug

Figure 1-13. Stabilizer bar dampers

1-97. *Servicing — Battery.* The battery shall be removed from the helicopter (refer to paragraph 12-84) at 100 hour intervals and sent to the Battery Shop for inspection, repair, charging capacity test, and adjustment of electrolyte level.

1-98. *Deleted.*

1-99. *Deleted.*

1-99A. Hoses and Electrical Lines. The inspection, repair, removal, and replacement of oil, fuel, air, and hydraulic hoses and electrical lines is accomplished in the same manner for all aircraft.

1-99B. *Removal — Hoses and Electrical Lines.* a. Remove clamps from brackets. Brackets are left on engine unless otherwise stated.

Note

Be sure that mating parts are marked, if necesisary, for proper indexing at reassembly.

b. When disconnecting electrical connections, hose, and tubing fittings, place caps or covers on all exposed openings.

Caution

Do not use tape to seal fuel or oil openings. Tape adhesive is soluble in fuel or oil and can cause contamination.

c. Remove clamps on brackets as required to gain slack and avoid damage to connectors and fittings.

d. When removing oil, fuel, hydraulic, and air hoses do not apply torque to the narrow hex nut of the sleeve and nipple. Torque must be applied only to the wide hex nut. When loosening or tightening the wide hex nut, secure the nipple or sleeve to prevent twisting of the hose assembly. (See figure 1-13A.)

1-99C. *Inspection — Hoses and Electrical Lines.* a. Inspect hose assemblies for stripped or damaged threads.

b. On hydraulic lines, disconnect assembly having leaky flareless fitting. Inspect for evidence of improper tightening, presence of foreign matter, or defective part.

Caution

Do not tighten leaky flareless fittings.

c. Inspect hose and electrical lines for fraying, cuts, burns, or worn spots.

d. Inspect connectors for looseness, corrosion, cracked insulators, and bent or broken pins.

e. Check electrical cables by performing continuity check.

1-99D. *Cleaning — Hoses and Electrical Lines.* a. Clean hose assemblies with trichlorethylene (item 306, table 1-1).

a. Remove corrosion with crocus cloth (item 401, table 1-1) and dry cleaning solvent (item 302, table 1-1).

b. Clean fittings. Remove all foreign matter.

1-99E. *Repair or Replacement — Hoses and Electrical Lines.* a. During replacement, be sure all oil passages, oil lines, hydraulic lines, strainers and screens, are clean and unobstructed.

b. On hydraulic assemblies replace with new tubing assembly if nut, sleeve, or tubing is defective.

c. Repair damaged threads using fine stone. Replace hose assemblies when threads are stripped or cannot be repaired.

d. Minor fraying and chafing in localized areas and minor cuts in braided area of hose and electrical lines shall be repaired as follows.

(1) Clean surface of hose and electrical line with trichlorethylene (item 306, table 1-1), and dry thoroughly.

(2) Wrap damaged area with tape (item 402, table 1-1).

Note

During reassembly or replacement, use new packings, cotter pins, gaskets, tab washers, lockpins, key washers, and lockwashers.

1-99F. *Installation — Hoses and Electrical Lines.* a. Care shall be taken to route and clamp hose assemblies securely. Chafing shall be

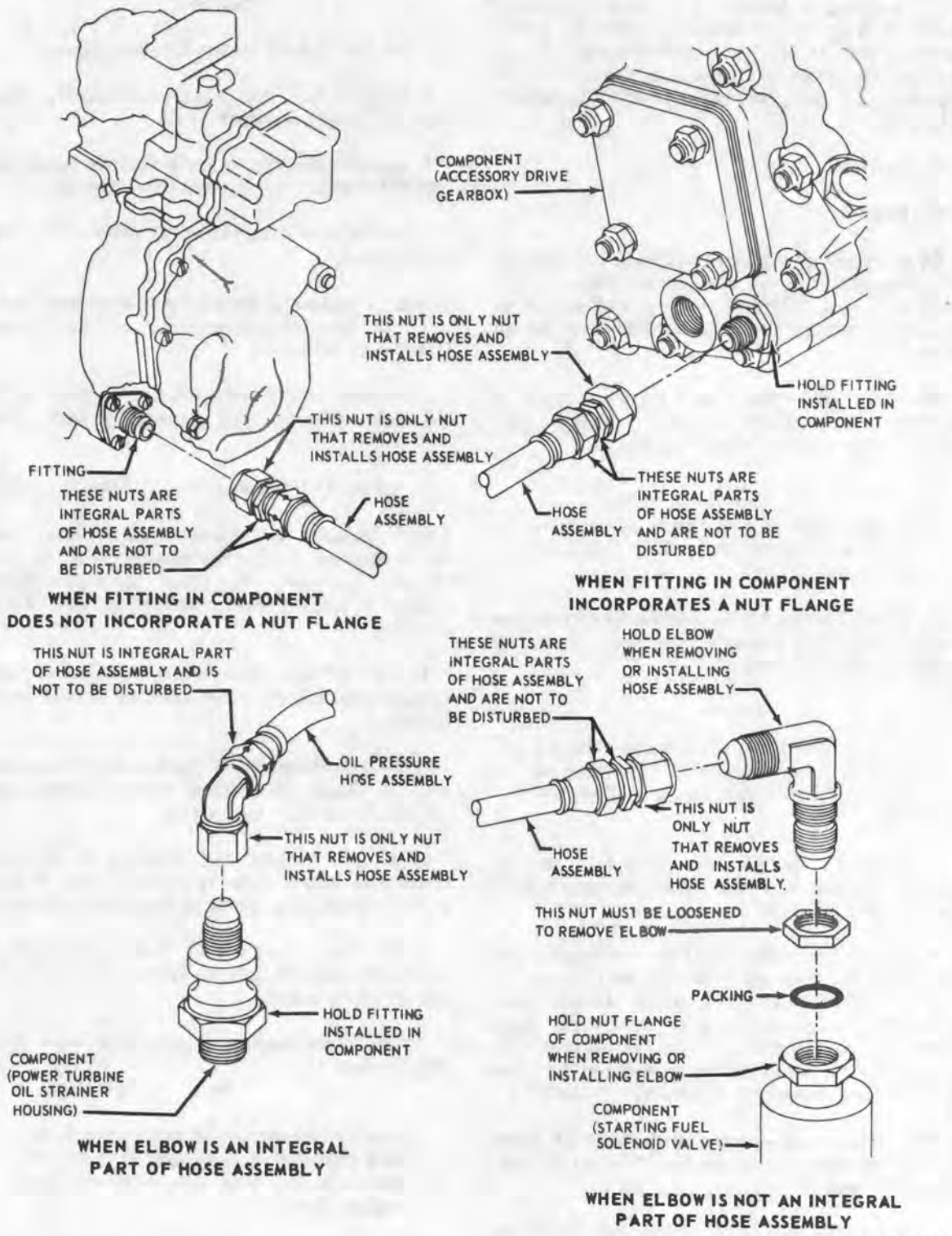


Figure 1-13A. Hose removal and installation procedure

avoided at all times. Proper clamping and use of chafe pads shall be used at all times. (See figure 1-13A.)

b. When installing oil, fuel, air, and electrical assemblies, do not apply torque to the narrow hex nut of the sleeve and nipple. Torque must be applied only to the wide hex nut. When loosening or tightening the wide hex nut, secure the nipple or sleeve to prevent twisting of the hose assembly. (See figure 1-13A.)

c. Installation of hydraulic fittings. (Refer to paragraph 6-46.)

1-100. Cleaning. Clean aircraft and components in accordance with TM 55-405-3 unless otherwise specified. Special cleaning procedures will be covered in this manual under individual component.

1-101. Painting. Instructions for painting and paint touchup will be found in TB AVN-7. Requirements which are peculiar to UH-1A and UH-1B helicopters will be found in this manual under the applicable component.

1-102. List of Consumable Materials. Table 1-1 lists all consumable materials authorized for use by organizational maintenance personnel.

1-103. Special Tools and Equipment. Special tools and equipment authorized for use by organizational maintenance personnel will be found in TM 55-1520-211-20P.

Caution

Do not use cadmium plated tools for any procedures outlined in this manual. Cadmium plating will chip. If these chips enter the engine they will contaminate the lubrication system and cause deterioration of magnesium engine parts.

Table 1-1. List of consumable materials (Sheet 1 of 6)

FUELS AND LUBRICANTS

ITEM NO.	NOMENCLATURE	SPECIFICATION
1	Jet Fuel, Grades JP-3, JP-4, and JP-5	MIL-J-5624
2	Lubricating Oil, Synthetic Base, Aircraft Turbine Engine	MIL-L-7808
3	Hydraulic Fluid, Aircraft, Petroleum Base, Missile and Ordinance	MIL-H-5606
4	Lubricating Oil, General Purpose, Low Temperature	MIL-L-7870
5	Lubricating Oil, Jet Engine	MIL-O-6081 (Grade 1010)
6	Lubricant, Corrosion Inhibiting, Solid Film Heat Cured	MIL-L-46010
7	Graphite, Lubricating	MIL-G-6711
8	Grease, Aircraft. Helicopter Oscillating Bearing	MIL-G-25537
9	Lubricant, Bell Helicopter Company	204-040-755-3
10	Corrosion Preventive, Synthetic Base, Aircraft Gas Turbine Engine	MIL-C-8188
11	Grease, Pneumatic System	MIL-G-4343
12	Calibrating Fluids, Aircraft Fuel System Components	MIL-F-7024
13	Grease, Aircraft and Instrument	MIL-G-23827
14	Petrolatum, Technical	FED. SPEC. VV-P-236

Table 1-1. List of consumable materials (Sheet 2 of 6)

ITEM NO.	NOMENCLATURE	SPECIFICATION
	FUELS AND LUBRICANTS (Cont)	
15	Lubriplate	FED. MFG. CODE 73219
16	Preservative, Hydraulic Fluid, Petroleum Base	MIL-H-6083 (Type II)
17	Aircraft Engine Corrosion Preventive	MIL-C-6529 (Type II)
18	Hydrogenated Vegetable Shortening	EE-S-321
19	Medicinal Castor Oil	JJJ-C-86
20	Plastilube, Moly No. 3	FED. MFG. CODE 02307
21	Grease	MIL-G-3543

ITEM NO.	NOMENCLATURE	COLOR NO.	SPECIFICATION
	PAINTS, PRIMERS, THINNERS AND MARKING COMPOUNDS		
	(Note: All color numbers shall be in accordance with Federal Standard 595)		
100	Lacquer, Acrylic, Interior		TT-L-20
101	Lacquer, Acrylic, Gloss Marking, Inside		TT-L-32
102	Epoxy Primer (Super Koropon) DeSoto Chemical Coatings, Inc., Garland, Texas		
103	Prussian Blue Color, Thinned with Oil		TT-P-691
104	Enamel, Aluminum, Heat Resistant	XA 147	FED. MFG. CODE 77359
105	Lacquer, Acrylic, Black, Camouflage	37038	P-95 NAVY
106	Lacquer, Acrylic, Olive Drab, Camouflage	34087	P-95 NAVY
107	Lacquer, Acrylic, Olive Drab, Gloss	X14087	P-95 NAVY
108	Lacquer, Acrylic, Insignia Red, Gloss	11136	P-95 NAVY
109	Lacquer, Acrylic, Insignia Blue, Gloss	15044	P-95 NAVY
110	Lacquer, Acrylic, Insignia White, Gloss	17875	P-95 NAVY
111	Lacquer, Acrylic, Black, Gloss	17038	P-95 NAVY
112	Lacquer, Acrylic, Orange Yellow	13538	P-95 NAVY
113	Lacquer, Acrylic, Insignia Red	ANA509	P-95 NAVY
114	Lacquer, Acrylic, Orange-Yellow, Lusterless	33538	P-95 NAVY

Table 1-1. List of consumable materials (Sheet 3 of 6)

PAINTS, PRIMERS, THINNERS AND MARKING COMPOUNDS (Cont)			
ITEM NO.	NOMENCLATURE	COLOR NO.	SPECIFICATION
115	Lacquer, Acrylic, Black, Lusterless	37038	P-95 NAVY
116	Lacquer, Acrylic, Bright Red, Lusterless	31136	P-95 NAVY
117	Lacquer, Non-Acrylic, Dark Gull Grey	36231	MIL-L-6805
118	Primer, Locquic, Grade Q		MIL-S-22473
119	Primer Coating, Zinc Chromate, Low Moisture Senstivity		MIL-P-8585

ADHESIVES, CEMENTS AND SEALING COMPOUNDS		
ITEM NO.	NOMENCLATURE	SPECIFICATION
200	Putty, Zinc Chromate, General Purpose	MIL-P-8116
201	Sealing Compound, Anaerobic, Single Compound, Retaining (Red)	MIL-S-22473 Grade Q Grade CV (4-10)
202	Anti-Seize Compound, High Temperature (Navy)	MIL-A-907
203	Lubricant, Molybdenum Disulfide Powder	MIL-M-7866
204	Sealant, Anaerobic, Retaining, AAV 15-10	MIL-R-46082
205	Sealing Compound, High Adhesion, Temperature Resistant, Integral Fuel Tanks and Fuel Cell Cavities	MIL-S-8802
206	Anti-Seize and Sealing Compound, Thread, Oxygen Systems	MIL-T-5542
207	Epoxy, Engine Grey, A. D., Compound A Part No. E-2833A	FED. MFG. CODE 16193
208	Epoxy, Engine Grey, A. D., Compound B Part No. E-2833A	FED. MFG. CODE 16193
209	Sealing Compound, Pressure, Cabin	MIL-S-7124
210	Sealer, RP1257-2	FED. MFG. CODE 02684
211	Cement, A6 with Activator A	FED. MFG. CODE 98911
212	Cement, A4000, Silicone Adhesive	FED. MFG. CODE 71984

Table 1-1. List of consumable materials (Sheet 4 of 6)

ADHESIVES, CEMENTS AND SEALING COMPOUNDS (Cont)		
ITEM NO.	NOMENCLATURE	SPECIFICATION
213	Cement, Proseal 584	FED. MFG. CODE 83527
214	Metalset, A4	FED. MFG. CODE 90414
215	2216 Adhesive (Scotch-Weld)	FED. MFG. CODE 76381
216	Epon 934	MIL-A-5090
217	Primer, A934B	FED. MFG. CODE 76500

CHEMICALS, COATINGS AND CLEANING COMPOUNDS		
ITEM NO.	NOMENCLATURE	SPECIFICATION
300	Defrosting Fluid, Anti-Icing and Deicing	MIL-A-8243
301	Cleaning Compound, Aircraft Surface, Alkaline, Waterbase	MIL-C-25769
302	Solvent, Dry Cleaning	P-D-680
303	Detergent, Anionic, Synthetic (Alkyl Benzine Sulfonate)	MIL-D-26937
304	Cleaning and Polishing Compound, Transparent Plastic Aircraft Materials	MIL-C-18767
305	Ammonium Hydroxide, 10%	A-O-451
306	Trichloreothyline, Technical	O-T-634
307	Trichloreothyline, Stabilized, Degreasing	MIL-T-7003
308	Naphtha, Aliphatic	TT-N-95 Type 2
309	Methyl-Ethyl-Ketone (For use in organic coatings)	TT-M-261
310	Corrosion Inhibiter	RUST LICK 606
311	Acetone, Technical	O-A-51
312	Cleaning Compound, Biodegradable	MIL-C-18687
313	Alcohol, Methyl	O-M-230
314	Anti-Icing Fluid (Isopropyl Alcohol)	MIL-F-5566
315	Corrosion Preventive Compound, Petrolatum, Hot Application	MIL-C-11796 Class 3

Table 1-1. List of consumable materials (Sheet 5 of 6)

CHEMICALS, COATINGS AND CLEANING COMPOUNDS (Con't)		
ITEM NO.	NOMENCLATURE	SPECIFICATION
316	Dessicant, Activated, Bagged, Packaging Use and Static Dehumidification	MIL D-3464
317	Chemical Films and Chemical Film Materials for Aluminum Alloys	MIL-C-5541
318	Corrosion Preventive Compound, Cold Application, Solvent Cutback	MIL-C-16173 Grade 2
319	Fingerprint Remover, Corrosion Preventive	MIL-C-15074
320	Protective Coating, Sprayable, Strippable	MIL-C-6799 Type II, Class 2
321	Sodium Dichromate	FED. SPEC. O-S-595
322	Nitric Acid	O-N-350
323	Oakite, VisStrip (Paste)	FED. MFG. CODE 44389
324	Stripper, 5-A	FED. MFG. CODE 44389
325	Nitrogen	BB-N-411
326	Turco Compound, No. 713	FED. MFG. CODE 61102
327	Injection Fluid, Anti-Detonating	FED. MFG. CODE 94647
328	Methanol (Grade A or B)	O-M-232
329	Perchloroethylene	O-T-236
330	Sodium Bicarbonate	O-S-576

FABRICS AND TAPES		
ITEM NO.	NOMENCLATURE	SPECIFICATION
400	Outing Flannel	CCC-F-466
401	Crocus Cloth, Abrasive	P-C-458

Table 1-1. List of consumable materials (Sheet 6 of 6)

CHEMICALS, COATINGS AND CLEANING COMPOUNDS (Con't)		
ITEM NO.	NOMENCLATURE	SPECIFICATION
402	Adhesive Tape, Pressure Sensitive, Waterproof, For Packaging and Sealing	PPP-T-60
403	Cloth, Abrasive (Scotchbrite)	FED. MFG. CODE 76381
404	Vinyl Tape, No. 455 (Scotchcal)	FED. MFG. CODE 76381
405	Vinyl Tape, No. 472 (Scotchcal)	FED. MFG. CODE 76381

ABRASIVES, PAPER, PLASTICS, AND MISCELLANEOUS		
ITEM NO.	NOMENCLATURE	SPECIFICATION
500	Wire, Carbon Steel, Round, Bare and Coated	QQ-W-461
501	Wire, Steel, Corrosion Resisting	QQ-W-423
502	Brush, Aircraft Cleaning	MIL-B-5612
503	Grain, Soft, Abrasive, for Carbon Removal	MIL-G-5634 Type III
504	Rubber Sheet, Oil Resistant, Synthetic, Solid, Molded and Extruded Shapes	MIL-R-7362 Type I Composition A
505	Aircraft Wax, Solvent Type, Waterproof	MIL W-18723
506	Barrier Material, Flexible, Greaseproofed, Waterproofed	MIL-B-121
507	Barrier Material, Flexible, Water-Vaporproof	MIL-B-131
508	Sandpaper, No. 320	
509	Sandpaper, No. 400	
510	Abrasive Grain (Walnut Shells)	MIL-G-5634

Section II — Special Inspection

3-3. Definition and General Information. This section supplements the scheduled inspections as outlined in the Preventive Maintenance Inspection Checklists in TM 55-1520-211-20 PMD, -20PMI, and -20 PMP to include inspection of items which are required to be inspected at intervals not compatible with airframe operating time or airframe inspection intervals. Typical of this type inspection items are:

a. Inspection which is contingent upon specific conditions or incidents that arise, and only because of these conditions or incidents, immediate inspection is required to insure further safe flight; such as, hard landings, overspeed, sudden stoppage, etc.

b. Inspection of components or airframe, on a calendar basis; such as, safety belts, first aid kits, weight and balance check, aircraft inventory, etc. This type inspection will be accomplished during the nearest intermediate or periodic inspection.

c. Specific definitive inspections on aircraft engines based strictly upon engine operating time.

d. When special inspection items become due and are performed, the applicable forms, records and worksheets pertaining thereto will be completed and up-dated as required (TM 38-750).

AIRCRAFT INSPECTION CHECKSHEET	TYPE OF INSP. (Daily, Intermediate, etc.) SPECIAL	PAGE NO. 1	NO. OF PAGES 28
AIRCRAFT AND SERIAL NO.	INSPECTION NO.	DATE OF INSPECTION	

AREA NO.	REQUIREMENT EVERY	ITEM	STATUS	RECORDED ON WORKSHEET
		After Every Hard Landing		
1,2,3, 4,5,6				
2		a. Inspect landing gear skid tubes and cross tubes for damage or more than normal deflection. (Refer to paragraph 4-244 for limits.) Inspect aft cross tube mounting for damage.		
1,2, 3,4, 5,6		b. Check all cowling and doors for proper fit and alignment. Misaligned cowling may indicate a distorted fuselage resulting in major stresses and damage to components.		
1,2,3, 4,5,6		c. Remove all cowling necessary to perform a complete visual inspection.		
4		d. Airframe structure with a ten-power magnifying glass at the transmission mounting points. Particular attention should be given to the rubber mount attachment points. Inspect lift link and attaching parts. Inspect aft cross tube mounting brackets and adjacent areas for structrual damage.		
6		e. Tail skid tube and mounting for damage. Inspect tail boom internally and externally for cracks, distortion and loose rivets. Inspect the tail boom attachment points for elongated bolt holes and damaged structure.		
2,4		f. Carefully inspect the flight control system from pilot's controls to rotor head for bent or damaged tubes, bellcranks, supports, and damaged bearings. Particular attention should be given to the mast control rods and collective sleeve assembly.		
3,4, 5		g. Using a hydraulic test unit, pressurize hydraulic control system and check for leaks, interference or binding and satisfactory operation. (Refer to paragraph 6-5 and 6-49.)		

AIRCRAFT INSPECTION CHECKSHEET	TYPE OF INSP. (Daily, Intermediate, etc.) SPECIAL	PAGE NO. 10	NO. OF PAGES 28
AIRCRAFT AND SERIAL NO.	INSPECTION NO.	DATE OF INSPECTION	

AREA NO.	REQUIREMENT EVERY	ITEM	STATUS	RECORDED ON WORKSHEET
		a. Start. (1) When EGT exceeds 620°C (1150°F) for more than five seconds for T53-L-5/9/9A engines, or 650°C (1200°F) for more than five seconds for T53-L-11/13 engines, record a hot start. A hot end inspection is required after three hot starts of T53-L-5/9/9A engines and after one hot start of T53-L-11/13 engines. (2) When EGT exceeds 760°C (1400°F). b. Acceleration. (1) When EGT exceeds 650°C (1200°F) for more than five seconds. (2) When EGT exceeds 760°C (1400°F). ***Note*** An over temperature condition, as defined in steps a. and b., requires a hot end inspection to be performed. Reference TB 55-2800-30/1. c. Take-off. When EGT exceeds 610°C (1130°F) for T53-L-5 engine, or 640°C (1180°F) for T53-L-9/9A/11 engines, or 615°C (1140°F) for T53-L-13 engine. d. Military. When EGT exceeds 600°C (1110°F) for T53-L-5 engine, or 640°C (1180°F) for T53-L-9/9A/11 engines; T53-L-13 engine exceeds 615°C (1140°F). e. Normal (Continuous Operation). When EGT exceeds 590°C (1100°F) for T53-L-5 engine, or 620°C (1150°F) for T53-L-9/9A/11 engines; T53-L-13 engine exceeds 580°C (1075°F.) ***Note*** If engine cannot be operated within temperature limits for takeoff power, military power or normal rated power, this is an indication of possible engine malfunction or instrument error. To determine cause and corrective action, refer to paragraph 5-30.		

AIRCRAFT INSPECTION CHECKSHEET	TYPE OF INSP. (Daily, Intermediate, etc.) SPECIAL	PAGE NO. 11	NO. OF PAGES 28
AIRCRAFT AND SERIAL NO.	INSPECTION NO.	DATE OF INSPECTION	

AREA NO.	REQUIREMENT EVERY	ITEM	STATUS	RECORDED ON WORKSHEET
2,4, 5,6		**A Engine overspeed exceeding 7140 rpm power output shaft (nll) speed, but engine appears still operable.**		
2,4, 5,6		**B Engine overspeed exceeding 7180 rpm power output shaft (nll) speed, but engine appears still operable.** If overspeed limits are exceeded, the following inspections must be performed in addition to those outlined in Special Inspection headed "Engine overspeed reaching but not exceeding (noted) rpm power output shaft speed." The inspections described in that Special Inspection shall be used to determine engine disposition only if a fluorescent-penetrant inspection of the second stage turbine disc shows the disc has not been damaged. a. If power turbine overspeed limits have been exceeded, a fluorescent-penetrant inspection of the power turbine discs must be made at the appropriate higher echelon. b. If compressor rotor overspeed limits have been exceeded and the engine appears to be operable, the compressor must be inspected by field maintenance as follows. (1) A check shall be made for evidence of rubbing. (2) Compressor spacer land runout shall be measured. (T53-L-9/9A/11) (3) Compressor rotor blade tip clearance must be checked. (T53-L-9/9A/11) (4) Gas producer turbine face and hub runout and blade tip clearance must be measured. c. Check engine, 42° and 90° gear boxes, and transmission magnetic chip detectors for metal chips.		

AIRCRAFT INSPECTION CHECKSHEET	TYPE OF INSP. (Daily, Intermediate, etc.) SPECIAL	PAGE NO. 12	NO. OF PAGES 28
AIRCRAFT AND SERIAL NO.	INSPECTION NO.	DATE OF INSPECTION	

AREA NO.	REQUIREMENT EVERY	ITEM	STATUS	RECORDED ON WORKSHEET
5		**Engine overspeed exceeding three percent (3%) above gas producer (nl) rpm limit for three (3) seconds, but engine appears still operable.**		
5		a. Remove upper half of compressor housing to inspect for evidence of rubbing, compressor spacer run-out, and rotor blade tip clearance.		
5		b. Mounting flange areas of following parts for loose bolts, nuts, studs, or connections: Engine mount pads, accessory drive gear box, overspeed governer and tachometer drive gear box, fuel control, oil pump, oil filter, starter generator, tachometer generator and all other accessories.		
		After engine overspeed An engine overspeed exists under the following conditions. a. When nI speed exceeds 101.5 percent. b. When steady-state output shaft speed exceeds: (1) 7180 rpm as a maximum limit. (2) 6640 rpm for more than 3 seconds (2 seconds for T53-L-13). ***Note*** At an nI speed of 85 percent or less, a steady-state output shaft speed of 6900 (6700 for T53-L-13) is permissable. The overspeed governor should prevent output shaft overspeed when ENGINE GOV switch is set on AUTO.		

AIRCRAFT INSPECTION CHECKSHEET	TYPE OF INSP. (Daily, Intermediate, etc.) SPECIAL	PAGE NO. 13	NO. OF PAGES 28
AIRCRAFT AND SERIAL NO.	INSPECTION NO.	DATE OF INSPECTION	

AREA NO.	REQUIREMENT EVERY	ITEM	STATUS	RECORDED ON WORKSHEET
		Caution		
		There is no overspeed control if ENGINE GOV switch is set on EMER, or if nII adjustment is incorrect.		
		Engine subjected to loadings possibly exceeding 10G vertical, 4G lateral, 3G forward, and 4G aft.		
		If it is suspected that excessive G loads have been imposed on an engine, the following inspections must be made immediately after the flight during which the excessive loads occurred.		
5		(1) Check accessory drive gear box for cracked flanges.		
5		(2) Check overspeed governor and tachometer drive for cracks, distortion and bent shafts.		
5		(3) Oil filter for loose bolts, damaged filter elements, and metal particles.		
5		(4) Oil pump for loose bolts and cracked flanges.		
5		(5) Check fuel control assembly for cracked flanges.		
5		(6) Check engine mounting pads for cracks.		
5		(7) Check air, oil and fuel hose connections for tightness.		
5		(8) Check all accessories for loose bolts, nuts and connections.		
		Note		
		If engine is found unsatisfactory for further operation, components must be repaired or replaced.		

AIRCRAFT INSPECTION CHECKSHEET	TYPE OF INSP. (Daily, Intermediate, etc.) SPECIAL	PAGE NO. 13 A	NO. OF PAGES
AIRCRAFT AND SERIAL NO.	INSPECTION NO.	DATE OF INSPECTION	

AREA NO.	REQUIREMENT EVERY	ITEM	STATUS	RECORDED ON WORKSHEET
4,6		**B Every ten hours.**		
6		a. Tail rotor slider, Part No. 204-010-720-1, visually inspect for condition, security and cracks. (Magnetic particle check upon reaching 50 hours.)		
4				
2,4, 5,6		**A Engine overspeed reaching but not exceeding 7090 rpm power output shaft speed.**		
5,6		**B Engine overspeed reaching but not exceeding 7180 rpm power output shaft speed.**		
		a. Check oil filter for metal chips, lint, or other foreign material.		
4,5,6		b. Check magnetic chip detector for metal chips.		
		Note		
		If chips are found inspect power turbine and rear bearing housing oil strainers.		
5		c. Power turbine blades for cracks, burns, and dented or missing blades.		
5		d. Check power turbine blade tip clearance at eight (8) points.		
		Note		
		Tip clearance shall be at least 0.025 inch, excluding T53-L-13 engine.		

AIRCRAFT INSPECTION CHECKSHEET	TYPE OF INSP. (Daily, Intermediate, etc.) SPECIAL	PAGE NO. 14	NO. OF PAGES 28
AIRCRAFT AND SERIAL NO.	INSPECTION NO.	DATE OF INSPECTION	

AREA NO.	REQUIREMENT EVERY	ITEM	STATUS	RECORDED ON WORKSHEET
2,5		e. If preceding steps are satisfactory, run-up engine at various power settings, checking instruments for normal operation. Any variation from normal is cause for shut-down. Listen for unusual noises during engine coast-down.		
2,4, 5,6		f. After shut-down, repeat steps a., b., c., and d. If all engine operations are normal and inspected areas are within limits return engine to service.		
5		**Internal inspection of engine at every 300 hour engine period.** Perform internal inspection of engine at each 300-hour engine period. (Refer to TB 55-2800-200-30/1, T53 Engine Inspection Guide). ***Note*** UH-1A T53-L-1/1A Hot Section Inspection: Hot section will be inspected at each 300 operating hours. T53-L-1A engines that have not had the gas producer turbine wheel removed since overhaul are allowed to operate for 300 hours until the first hot section inspection. Units having the engine vibration		

AIRCRAFT INSPECTION CHECKSHEET	TYPE OF INSP. (Daily, Intermediate, etc.) SPECIAL	PAGE NO. 15	NO. OF PAGES 28
AIRCRAFT AND SERIAL NO.	INSPECTION NO.	DATE OF INSPECTION	

AREA NO.	REQUIREMENT EVERY	ITEM	STATUS	RECORDED ON WORKSHEET
		kit, Part No. LTCT 484, available are allowed to continue hot section inspections at 300 hour intervals. If vibration equipment is not available, hot section inspection will then revert to 100 hour intervals until kit is received. Engines that have had the gas producer turbine wheel removed since overhaul will be limited to 100 hour hot section inspections until the vibration kit is available to run a vibration survey on that engine. At this time, hot section inspections can be extended to 300 hour intervals.		
5		Reduction Gear Inspection T53-L-1/1A: The engine reduction gear will be inspected at 300 operating hours. The planet gear bearing, clamp retainer, Part No. 1-030-038-01, and the planet gear front bearing, retainer nut, Part No. 1-030-037-01, will be disassembled only if a 0.004 inch feeler gage can be inserted between the rear face of the planet gear front bearing, retainer nut, Part No. 1-030-037-01, and the inner race of the roller bearing, Part No. 1-300-014-01. The disassembled parts must be cleaned in solvent and the threads of the planet gear bearing, clamp retainer, must be coated with Loctite Grade (AA) (Green). The planet gears will not be disassembled if the 0.004 inch feeler gage cannot be inserted between the planet gear front bearing retainer nut, and the roller bearing inner race.		

AIRCRAFT INSPECTION CHECKSHEET	TYPE OF INSP. (Daily, Intermediate, etc.) SPECIAL	PAGE NO. 18	NO. OF PAGES 28
AIRCRAFT AND SERIAL NO.	INSPECTION NO.	DATE OF INSPECTION	

AREA NO.	REQUIREMENT EVERY	ITEM	STATUS	RECORDED ON WORKSHEET
5	n.	Compressor housing. Check all compressor housing flange areas for cracks.		
5	o.	Remove, clean and reinstall: strainer at inlet of the oil tube for Nos. 3 and 4 bearings, and the strainer for No. 2 bearing at the five o'clock position on the diffuser outer housing.		
5	p.	Starter generator. Check the starter cooling duct for flecks of metal or carbon dust. If metal particles are present or dust is excessive, replace the starter.		
5	q.	Exhaust thermocouple. Check the exhaust thermocouple harness for cracks and the points for deterioration. Check for continuity using jet-cal test equipment.		
5	r.	Power turbine nozzles. Check for nicks, cracks, or burned areas. Inspect nozzle air seal (asbestos ring) for deterioration.		
5	s.	On T53-L-5/9/9A engines inspect air scoops for burns and cracks.		
5	t.	Combustor curl. Inspect for cracks or burns.		
5	u.	Fuel vaporizer legs for burning or warping. Inspect for carbon deposits inside vaporizers. A small amount of carbon on the outside of the vaporizers is normal and may be removed with a stiff fiber brush. Inspect exhaust cone and fire shield for cracks, severe burning and indications of hot spots. Remove igniter nozzles and check with filtered air pressure for plugged air passages. If nozzle is plugged, replace with a new nozzle.		
5	v.	Reduction gear assembly.		

AIRCRAFT INSPECTION CHECKSHEET	TYPE OF INSP. (Daily, Intermediate, etc.) SPECIAL	PAGE NO. 19	NO. OF PAGES 28
AIRCRAFT AND SERIAL NO.	INSPECTION NO.	DATE OF INSPECTION	

AREA NO.	REQUIREMENT EVERY	ITEM	STATUS	RECORDED ON WORKSHEET
		Note Perform reduction gear inspection on T53-L-1/1A engines at 300 hour intervals. T53-L-5/9/9A/11/13 engine reduction gear section will be removed only if excessive metal particles are evident on magnetic drain plug as defined in step c.		
5		(1) Remove from inlet housing, check (sunring) gears for wear pattern, nicks or flaking of the teeth. Check for cracks. Replace part if there is severe wear, cracks, or flaking.		
5		(2) Check the primary and secondary planet (reduction idler) gears for excessive wear. Check planet gear bearings for wear, fretting, and end float. Check sun gear for axial movement.		
5		(3) Check the carrier clamps and clamp bolts for looseness. Replace as necessary. Check torquemeter assembly for operation and proper torque of bolts.		
		w. When to accomplish engine vibration survey:		
		(1) After removal and installation of the first stage turbine rotor assembly.		
		(2) After removal and installation of the combustion section, exhaust section, or power turbine wheel.		
		(3) Any time excessive engine vibration is suspected.		

AIRCRAFT INSPECTION CHECKSHEET	TYPE OF INSP. (Daily, Intermediate, etc.) SPECIAL	PAGE NO. 24	NO. OF PAGES 28
AIRCRAFT AND SERIAL NO.	INSPECTION NO.	DATE OF INSPECTION	

AREA NO.	REQUIREMENT EVERY	ITEM	STATUS	RECORDED ON WORKSHEET
6		(1) Remove the skin from the tail boom fin adjacent to the 90° gear box mounting. Inspect all support structures in this area and repair as required. Install new skin.		
6		(2) Make close visual inspection of complete tail boom structure for distortion, buckles, skin cracks, sheared or loose rivets, paying particular attention to tail boom attachment points at fuselage station 195 and adjacent fuselage to tail boom structure and the 42° gear box support structure.		
4		(3) Make close visual inspection of main rotor pylon support and engine mount attachment structure for distortion, buckles, cracks, sheared or loose rivets, etc.		
		(4) If discrepancies found during inspections, items (1), (2) and (3) cannot be repaired by standard procedure, make detailed report to: Commanding General, USAAVCOM, P. O. Box 209, Main Office, St. Louis, Missouri, 63166, for further instructions.		
3		**Overflow of battery.**		
3		a. Sheet metal surfaces and overlaps both internal and external for damage.		
3		b. Rivets, bolts, screws and other hardware in area internally and externally for damage.		
3		c. Hidden areas in vicinity of battery for damage.		

AIRCRAFT INSPECTION CHECKSHEET	TYPE OF INSP. (Daily, Intermediate, etc.) SPECIAL	PAGE NO. 25	NO. OF PAGES 28
AIRCRAFT AND SERIAL NO.	INSPECTION NO.	DATE OF INSPECTION	

AREA NO.	REQUIREMENT EVERY	ITEM	STATUS	RECORDED ON WORKSHEET
3		d. All metal parts throughout length of tail boom assembly for damage.		
2,5		**Post installation inspection shall be accomplished any time an engine is removed and reinstalled or replaced.**		
5		a. Check all linkage (nI and nII) for proper adjustment, alignment and damage.		
5		b. Fuel control stops.		
5		c. Calibration of power settings on fuel control with corresponding settings on cockpit power control. Check operation and calibration of the E.G.T. system with Jet-Cal tester after engine installation.		
2		d. Twist grip for flight idle detent.		
5		e. Energize the master switch and check action of the air all connections, particularly fuel control.		
2,5		f. Energize the master switch and check action of the air flow regulator.		
5		g. With ignition unit, starting fuel and main fuel systems disconnected, energize the starter and check for sounds which indicate interference between moving and stationary parts, indication of oil pressure and fuel flow from starting fuel line and main fuel line.		
5		h. Perform a complete Daily Inspection on engine.		

AIRCRAFT INSPECTION CHECKSHEET	TYPE OF INSP. (Daily, Intermediate, etc.) SPECIAL	PAGE NO. 26	NO. OF PAGES 28
AIRCRAFT AND SERIAL NO.	INSPECTION NO.	DATE OF INSPECTION	

AREA NO.	REQUIREMENT EVERY	ITEM	STATUS	RECORDED ON WORKSHEET
5		i. Perform engine run-up with complete operational vibration check.		
5		j. Inspect the following components for chips or foreign material: (1) Main fuel strainer. (2) Fuel control inlet screen. (3) Fuel control pump discharge screen. (4) Servo filter. (5) Oil filter. (6) Magnetic plug. (7) Externally accessible engine oil strainers.		
5		k. If oil filter and magnetic plug show excessive accumulation repeat check after five (5) minutes operation at seventy-five (75) per cent power.		
		l. Repeat check of fuel strainers, screens, and filter as follows: (1) After five (5) hours operation. (2) After fifteen (15) hours operation. (3) If contamination exists, at fifteen (15) hour intervals until eliminated.		

AIRCRAFT INSPECTION CHECKSHEET	TYPE OF INSP. (Daily, Intermediate, etc.) SPECIAL	PAGE NO. 27	NO. OF PAGES 28
AIRCRAFT AND SERIAL NO.	INSPECTION NO.	DATE OF INSPECTION	

AREA NO.	REQUIREMENT EVERY	ITEM	STATUS	RECORDED ON WORKSHEET
		(4) At twenty-five (25) hour intervals thereafter.		
5		**Engines dropped during handling.** a. If an engine is dropped during handling, make the following inspections and tests. (1) Check accessory gear box for cracked flanges. (2) Check overspeed governor and tachometer drive for cracks, distortion, and bent shafts. (3) Inspect oil filter for loose bolts and damaged filter element. (4) Inspect oil pump for loose bolts and cracked flanges. (5) Check fuel control assembly for cracked flanges. (6) Check engine mounting pads for cracks. (7) Check air, oil, and fuel hose connections for tightness. (8) Check all accessories for loose bolts, nuts, and connections. b. If no visual damage is apparent, the engine will be functionally tested on the mobile engine test unit (LTCT744). A complete operational test run shall be made and shall include a vibration check, coast-down check and post test inspection of oil filter, screens and chip detector for metal chips, lint or other foreign material. **Whenever fuel cell has been punctured. Replace fuel cell.**		

AIRCRAFT INSPECTION CHECKSHEET	TYPE OF INSP. (Daily, Intermediate, etc.) SPECIAL	PAGE NO. 27A	NO. OF PAGES 28
AIRCRAFT AND SERIAL NO.	INSPECTION NO.	DATE OF INSPECTION	

AREA NO.	REQUIREMENT EVERY	ITEM	STATUS	RECORDED ON WORKSHEET
		Prior to every armed flight.		
		Make thorough inspection of fuel tank and fuel lines for leaks and the filler cap for proper seal, security and spillage.		
		After washing helicopter.		
1		Pitot-static system for moisture (drain plug removed).		
All Areas		**After the helicopter has been subjected to salt water or salt spray.**		
		Wash entire helicopter with fresh water, inside of engine compartment doors; wash all components which were exposed to salt water; wash engine; make a detail check of all surfaces for corrosion. Apply corrosion preventive compound to exposed non-painted, anodized or cadmium plated assemblies. (Refer to paragraph 1-100.)		
		12 Months		
		Replace cotton seat belt and shoulder harness. (Refer to TM 55-405-3).		
		3 Years		
		Replace nylon and dacron seat belt and shoulder harness. (Refer to TM 55-405-3).		
All Areas		**When available information indicates exposure to radioactivity.**		
		Accomplish the following: (Refer to TM 3-220.)		
		a. Survey helicopter for level of radioactivity.		
		b. Decontaminate helicopter as required.		

AIRCRAFT INSPECTION CHECKSHEET	TYPE OF INSP. (Daily, Intermediate, etc.) SPECIAL	PAGE NO. 27B	NO. OF PAGES 28
AIRCRAFT AND SERIAL NO.	INSPECTION NO.	DATE OF INSPECTION	

AREA NO.	REQUIREMENT EVERY	ITEM	STATUS	RECORDED ON WORKSHEET
All Areas		**Upon transfer and upon receipt of an aircraft, upon expiration of twelve months elapsed time since last inventory, and upon placing aircraft in storage and upon removing from storage. (Aircraft need not be inventoried while in storage.)** Inventory aircraft for availability of inventoriable property. (Reference DA Form 2408-17 and Appendix III.)		
All Areas		**After installation, removal or relocation of equipment and/or major modification which results in an unknown change in the basic weight and balance: After report of unsatisfactory flight characteristics.** Weigh helicopter and accomplish necessary entries in the Weight and Balance Data. (DD Forms 365) (Refer to TM 55-405-9.)		

UH-1A AIRCRAFT TEST FLIGHT INSPECTION CHECKSHEET PART I - GROUND CHECK (Continued)				PAGE NO. 3	NO. OF PAGES 12
6. ITEM NO.	7. INSPECTION ITEMS	8. RANGE		9. ACTUAL INDICATION	10. LEGEND (See Note)
		MIN	MAX		
	i. Check caution panel warning light.				
	j. Fuel valve.				
	k. Fuel boost pump.				
	l. Oil valve.				
	m. Governor.				
	n. RPM Increase-Decrease switch. Decrease and hold.		5 sec.		
	o. Throttle.				
	p. Cyclic control.				
6	Engine starting and warm-up.				
	a. Fire guard.				
	b. Rotor blades.				
	c. Throttle.				
	d. Starter ignition switch ON and HOLD		40 sec. 28% RPM or 400°C	(EXH. TEMP whichever comes first)	
	e. Engine oil pressure. (PSI)	25			
	f. Main generator.				
	g. Return starter generator to Stand-by generator position after main generator is on line.				
	h. Radio.				
	i. Inverter.				

UH-1A AIRCRAFT TEST FLIGHT INSPECTION CHECKSHEET PART I - GROUND CHECK (Continued)				PAGE NO. 4	NO. OF PAGES 12
6. ITEM NO.	7. INSPECTION ITEMS	8. RANGE		9. ACTUAL INDICATION	10. LEGEND (See Note)
		MIN	MAX		
	j. Headset.				
	k. AC phase selector check.				
	l. Throttle.				
	m. Exhaust gas temperature.	385°C	570°C		
	n. Engine oil pressure. (PSI)	60	80		
	o. Engine oil temperature.		88°C		
	p. Transmission oil pressure. (PSI)	40	60		
	q. Transmission oil temperature.		110°C		
	r. Torque meter.				
	s. TD voltmeter — check at 28V.				
	t. Check engine fuel system operation. After installing an engine or a fuel control, or during the airframe intermediate inspection, or when a special verification of the proper operation of the fuel control emergency (manual) system is required, perform the following check.				
	CAUTION: Select maximum nII (6400 RPM) speed with the GOV RPM INCR-DECR "beep" switch, before stabilizing engine at 70% gas producer speed.		6400		
	(1) With the fuel control selector switch in the AUTO position, stabilize engine at 70% nI speed.		70%		

UH-1A AIRCRAFT TEST FLIGHT INSPECTION CHECKSHEET PART I - GROUND CHECK (Continued)				PAGE NO. 5	NO. OF PAGES 12
6. ITEM NO.	7. INSPECTION ITEMS	8. RANGE		9. ACTUAL INDICATION	10. LEGEND (See Note)
		MIN	MAX		
	(2) Move the fuel control selector switch to the EMER position.				
	(3) Note the indicated nI speed; it should drop.				
	(4) Return the fuel selector to the AUTO position within five seconds.	% RPM drop	5 sec.		
	(5) If the power lever has not been moved, nI speed should return to 70% and then stabilize.		70%		
	NOTE: These instructions apply only to this operational check of the fuel control.				
	u. Operation of RPM IN-CREASE-DECREASE switch at 6400 RPM.	5800	6400 ±50		
	v. Fuel boost pump switch (if applicable) — OFF.		30±2 sec	(Then ON)	
	w. Hydraulic boost switch OFF, check controls, then ON.				
7	Before take-off.				
	a. Collective — minimum pitch, adjust friction.				
	b. Cyclic — neutral or slightly into wind.				
	c. Flight instruments check.				
	d. Pitot heater (if required).				
	e. Cabin heater (as required)				

UH-1A AIRCRAFT TEST FLIGHT INSPECTION CHECKSHEET PART I - GROUND CHECK (Continued)				PAGE NO. 6	NO. OF PAGES 12
6. ITEM NO.	7. INSPECTION ITEMS	8. RANGE		9. ACTUAL INDICATION	10. LEGEND (See Note)
		MIN	MAX		
	f. Throttle (advance slowly).				
	g. Tachometer (synchronization of needles).				
	h. Engine oil pressure. (PSI)	60	80		
	i. Engine oil temperature.		88°C		
	j. Transmission oil pressure. (PSI)	40	60		
	k. Transmission oil temperature.		110°C		
	l. Fuel pressure. (PSI)	5	20		
	m. Check nII operation governor.				
	n. All doors latched (if applicable).				

UH-1B AIRCRAFT TEST FLIGHT INSPECTION CHECKSHEET PART I - GROUND CHECK (Continued)				PAGE NO. 3	NO. OF PAGES 11
6. ITEM NO.	7. INSPECTION ITEMS	8. RANGE		9. ACTUAL INDICATION	10. LEGEND (See Note)
		MIN	MAX		
	j. Fuel gage.				
	k. Caution panel warning light.				
	l. Cyclic control.				
6	Engine Starting.				
	a. Fire guard.				
	b. Check rotor blades.				
	c. Battery switch.				
	d. Main fuel switch — ON.				
	e. Starting fuel switch — ON.				
	f. ENGINE GOV switch — AUTO.				
	g. Throttle — Just below ENG IDLE STOP release.				
	h. GOV RPM INCR/DECR switch — decreased to minimum rpm.				
	i. Starter switch — ON and HOLD.		40 sec.		
	j. START FUEL switch — OFF at	23% or	28% 400°C		
	k. Starter switch — Release at	35%	42%		
7	Engine warm-up.				
	a. Accelerate to FLIGHT IDLE (rpm)	56%	58%		
	b. Check oil pressure (psig) and torquemeter (some indication)	25			

UH-1B AIRCRAFT TEST FLIGHT INSPECTION CHECKSHEET PART I - GROUND CHECK (Continued)				PAGE NO. 4	NO. OF PAGES 11
6. ITEM NO.	7. INSPECTION ITEMS	8. RANGE MIN	8. RANGE MAX	9. ACTUAL INDICATION	10. LEGEND (See Note)
	(1) Deleted.				
	(2) Deleted.				
	(3) Deleted.				
	c. Check operation of avionics equipment.				
	d. Advance throttle to full open and check the following:				
	(1) Exhaust gas temperature B-5 B-9/11 B-13	 385°C 390°C 390°C	 590°C 640°C 615°C		
	(2) Engine oil pressure (psig)	60	80		
	(3) Engine oil temperature		93°C		
	(4) Transmission oil pressure (psig)	45	55		
	(5) Transmission oil temperature		110°C		
	(6) Torquemeter (check for indication).				
	(7) DC Voltmeter (volts)		28		
	(8) Check operation of GOV RPM INCR/DECR switch through range of rpm	6000 ±50	6700 ±50		
	(9) Turn fuel boost pump switch off, allow approximately 30 seconds to purge air from system, then return switch to ON position.				
	(10) Check hydraulic servo controls for proper operation.				
	(11) Bleed air heater (check operation).				

UH-1B AIRCRAFT TEST FLIGHT INSPECTION CHECKSHEET PART I - GROUND CHECK (Continued)				PAGE NO. 5	NO. OF PAGES 11
6. ITEM NO.	7. INSPECTION ITEMS	8. RANGE		9. ACTUAL INDICATION	10. LEGEND (See Note)
		MIN	MAX		
	e. Check engine fuel system operation. (Only after engine change, after fuel control change, and during Intermediate Inspection.)				
	(1) Set nII speed with GOV RPM INCR/DECR switch		6600		
	(2) Retard throttle to flight idle, then advance and stabilize nI rpm at 70%		70%		
	(3) Position ENGINE GOV switch to EMER for five seconds. (Do not exceed.) Note that indicated nI speed drops as fuel solenoid valve operates		5 sec.		
	(4) Return ENGINE GOV switch to AUTO. Note that indicated nI speed returns and stabilizes at 70 percent.		70%		

UH-1B AIRCRAFT TEST FLIGHT INSPECTION CHECKSHEET PART I - GROUND CHECK (Continued)				PAGE NO. 6	NO. OF PAGES 11
6. ITEM NO.	7. INSPECTION ITEMS	8. RANGE		9. ACTUAL INDICATION	10. LEGEND (See Note)
		MIN	MAX		
8	Engine Acceleration Check.				
	a. Check anti-icing system by operating the hot air solenoid valve. A slight rise in egt will indicate that system is operating. Turn off system.				
	Note This check is performed only to ensure that the anti-icing system is operating satisfactorily and that the hot air solenoid valve is closed during the following engine operational checks.				
	b. Set collective pitch to minimum position (flat pitch).				
	Note On cool days, aircraft may need additional weight to prevent lift-off.				
	c. Advance throttle to full open.				
	d. Set nII rpm selector.		6400		
	e. Retard nI speed and allow to stabilize.		60%		

UH-1B AIRCRAFT TEST FLIGHT INSPECTION CHECKSHEET PART I - GROUND CHECK (Continued)				PAGE NO. 7	NO. OF PAGES 11
6. ITEM NO.	7. INSPECTION ITEMS	8. RANGE		9. ACTUAL INDICATION	10. LEGEND (See Note)
		MIN	MAX		
	f. Use clock to check engine acceleration as follows: (1) Rapidly open throttle and note time to 85% nI rpm. (2) Retard throttle and stabilize.		60%		
	g. Compare engine performance to specified max. acceleration time (4.5 seconds for T53-L-9/9A, or 3.5 seconds for T53-L-11/13 with correction for elevation and ambient temperature. (See figure 3-1A.)				

UH-1B AIRCRAFT TEST FLIGHT INSPECTION CHECKSHEET PART II - IN FLIGHT CHECK (Continued)				PAGE NO. 8	NO. OF PAGES 11
6. ITEM NO.	7. INSPECTION ITEMS	8. RANGE MIN	8. RANGE MAX	9. ACTUAL INDICATION	10. LEGEND (See Note)
1	Take-off to hovering:				
	a. Engine for specified:				
	(1) RPM (engine and rotor synchronized)				
	(Rotor)	294	324		
	(Engine)	6000	6600		
	(2) Engine oil pressure (psig)	60	80		
	(3) Engine oil temperature		93°C		
	(4) Transmission oil pressure (psig)	30	70		
	(5) Transmission oil temperature		110°C		
	(6) Fuel pressure (psig)	5	35		
	(7) Tailpipe temperature				
	B-5	385°C	610°C		
	B-9/11	390°C	640°C		
	B-13	390°C	615°C		
	(8) % RPM tachometer smooth operation in steady state.				
	b. Helicopter for control, stability, proper response to control forces.				
	(1) Cyclic response.				
	(2) Collective pitch response.				

UH-1B
AIRCRAFT TEST FLIGHT INSPECTION CHECKSHEET
PART II - IN FLIGHT CHECK (Continued)

PAGE NO. 9 | NO. OF PAGES 11

6. ITEM NO.	7. INSPECTION ITEMS	8. RANGE MIN	8. RANGE MAX	9. ACTUAL INDICATION	10. LEGEND (See Note)
	(3) Directional control response.				
	c. Flight characteristics.				
	(1) Hovering 360 degree turns left and right.				
	(2) Sidewards.				
	(3) Rearwards.				
2	In-flight.				
	a. Engine for specified:				
	(1) RPM (engine and rotor synchronized).				
	(Rotor)	294	324		
	(Engine)	6000	6600		
	(2) Engine Oil pressure (psig)	60	80		
	(3) Engine Oil temperature		93°C		
	(4) Transmission oil pressure (psig)	30	70		
	(5) Transmission oil temperature		110°C		
	(6) Fuel pressure (psig)	5	35		
	(7) Tailpipe temperature				
	B-5	385°C	590°C		
	B-9/11	390°C	640°C		
	B-13	390°C	615°C		
	(8) % RPM tachometer smooth operation in steady state.				

UH-1B AIRCRAFT TEST FLIGHT INSPECTION CHECKSHEET PART II - IN FLIGHT CHECK (Continued)				PAGE NO. 10	NO. OF PAGES 11
6. ITEM NO.	7. INSPECTION ITEMS	8. RANGE		9. ACTUAL INDICATION	10. LEGEND (See Note)
		MIN	MAX		
	b. Rotors (1) RPM (engine and rotor synchronization). (2) Observe tip path for in-track condition. c. Instrument check. (1) Airspeed indicator. (2) Compass. (3) Altimeter. (4) Free air temperature. d. Check communication equipment for proper operation. e. Autorotation check (keep to a minimum).				

UH-1B AIRCRAFT TEST FLIGHT INSPECTION CHECKSHEET PART III - AFTER FLIGHT CHECK			PAGE NO. 11	NO. OF PAGES 11
1. TYPE ACFT	2. SERIAL NO.	3. ORGANIZATION	4. DATE	PURPOSE OF TEST FLIGHT 5.

NOTE: Symbol for Block 10 (✓) Satisfactory (X) Unsatisfactory (Explain in Remarks)

6. ITEM NO.	7. INSPECTION ITEMS	8. RANGE MIN	8. RANGE MAX	9. ACTUAL INDICATION	10. LEGEND (See Note)
1	Reduce Power to Flight Idle Position Prior to Shutdown and Observe the Following Readings:				
	a. Gas producer speed (rpm)				
	B-5	58%	62%		
	B-9/11/13	56%	58%		
	b. Exhaust gas temperature				
	B-5	385°C	590°C		
	B-9/11	427°C	±50		
	B-13	390°C	615°C		
	c. Engine oil pressure (psig)	25	80		
	d. Engine oil temperature		93°C		
	e. Transmission oil temperature		110°C		
	f. Transmission oil pressure				
	B-5 (psig)	40	60		
	B-9/11/13 (psig)	30	70		
2	Engine Shutdown.				
	a. Exhaust gas temperatures — Stabilized				
	b. Throttle — Push and hold idle detent button, throttle to full off				
	c. Main fuel valve — Closed as soon as engine has stopped				
3	Note discrepancies on applicable forms.				

Section IV — Overhaul and Retirement Schedule

3-7. Scope. This section lists units of operating equipment that are to be overhauled or retired at the period specified. Removal of equipment for overhaul may be accomplished at the inspection nearest the time when overhaul may be accomplished at the inspection nearest the time when overhaul is due unless otherwise specified in TB AVN 23-10.

3-8. Overhaul Interval. The maximum authorized operating time of parts prior to removal for overhaul at echelon authorized in accordance with the Maintenance Allocation Chart.

3-9. Retirement Schedule. a. The operating time specified for removal, condemnation, and disposal of parts in accordance with applicable directives.

b. Upon replacement of items listed in this chapter, all applicable forms, records and worksheets will be completed and updated as required (TM 38-750).

Overhaul and Retirement Schedule
Model UH-1B Helicopters
Serial No. 60-3546 through 64-14100

Area	Part Number & Item		Overhaul Interval	Retirement Interval
	Main Rotor			
4	204-011-001-7	Blade Assembly		400
4	204-011-001-15	Blade Assembly		1000
4	204-011-101-1	Hub Assembly	400	
4	204-011-101-3, -5, -9	Hub Assembly	1100	
4	204-011-113-1	*Strap Assembly		1100
	Transmission			
4	204-040-009-7, -13, -19, -31	Transmission Assembly	1100	
4	204-040-366-1, -3, -5	Mast Assembly	300	
4	204-040-366-7, -9	Mast Assembly	1100	
4	204-040-136-3, -5	*Mast Bearing		300
4	204-040-136-7	*Mast Bearing		1100
4	204-040-010-3, -7	Engine to Transmission Drive Shaft	1100	
	Tail Rotor and Drive System			
6	204-011-702-11, -15	Blade Assembly		1100
6	204-011-701-7	Hub Assembly		1100
6	204-040-003-13, -23	42° Gear Box	1100	
6	204-040-012-1	90° Gear Box	600	
6	204-040-012-7	90° Gear Box	1100	
6	204-040-600-5, -7	Drive Shaft Hanger Assembly	1100	
	Mast Controls			
4	204-011-400-1, -3, -5, -7	Swashplate and Support Assembly	1100	
4	204-011-404-1, -5	*Support		3300
4	204-011-438-1	Collective Lever		3300
4	204-011-401-3, -5, -7	Scissors and Sleeve Assembly	1100	
4	204-011-326-1	Stabilizer Bar Assembly	1100	

Area	Part Number & Item		Overhaul Interval	Retirement Interval
	Synchronized Elevator			
6	204-030-858-43, -44	Elevator Assembly		3000
	Rotating Control System Bolts (See figure 3-2)			
4	NAS464-6-26 (Index No. 4)	Pitch Horn to Pitch Link		1000
4	NAS1306-31D (Index No. 4)	Pitch Horn to Pitch Link		1000
4	NAS1306-27D (Index No. 3)	Pitch Link to Universal		1000
4	NAS464-6-35 (Index No. 2)	Universal to Mixing Lever		1000
4	NAS1306-34D (Index No. 2)	Universal to Mixing Lever		1000
4	NAS464-5-27 (Index No. 1)	Mixing Lever to Scissors Tube		1000
4	NAS1305-27D (Index No. 1)	Mixing Lever to Scissors Tube		1000
4	NAS464-5-27 (Index No. 5)	Scissors Tube to Scissors		1000
4	NAS1305-27D (Index No. 5)	Scissors Tube to Scissors		1000
4	NAS464-8-90 (Index No. 6)	Scissors Pivot Bolt		1000
4	NAS464-8-69 (Index No. 7)	Scissors to Drive Link		1000
4	NAS464-5-30 (Index No. 9)	Drive Link to Swashplate		1000
4	NAS1305-30D (Index No. 9)	Drive Link to Swashplate		1000
4	AN175H16 (Index No. 8)	Cyclic Tubes to Swashplate		1000
4	AN175H16 (Index No. 8)	Collective Tube to Collective Levers		1000
	Power Plant			
5	T53-L-5	**Engine	1200	
5	T53-L-9	**Engine	1200	
5	T53-L-9A	**Engine	1200	
5	T53-L-11	**Engine	1200	
5	T53-L-13	**Engine	1200	

*Parts will be retired by the maintenance level overhauling the assembled components.

**Internal Inspection required every 300 engine hours.

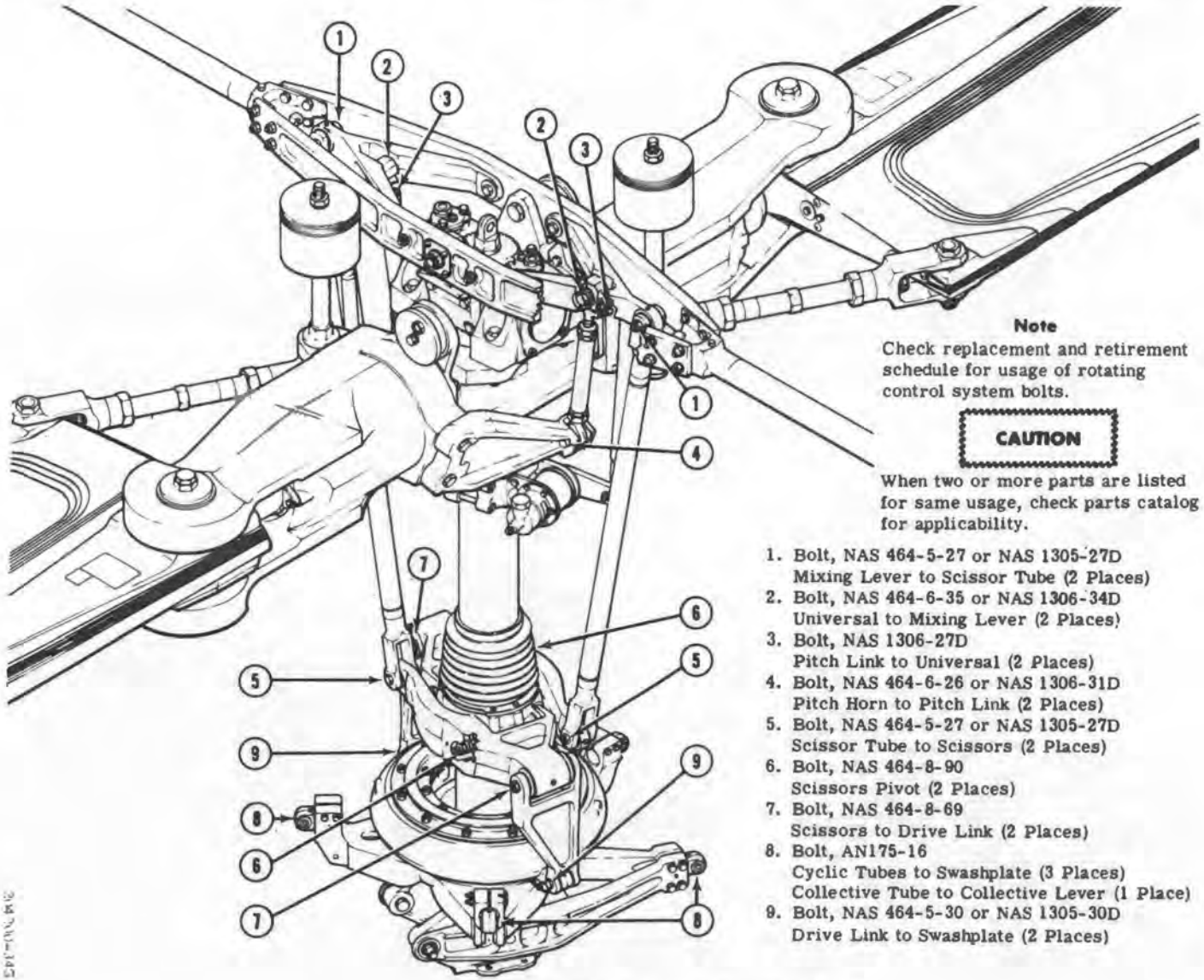
Overhaul and Retirement Schedule
Model UH-1B Helicopter
Serial No. 64-14101 and Subsequent

Area	Part Number & Item		Overhaul Interval	Retirement Interval
	Main Rotor			
4	540-011-001-5	Main Rotor Blade Assembly		1100
4	540-011-101-3	Main Rotor Hub Assembly	1100	
4	540-011-102-5	*Yoke		2200
4	540-011-153-9	*Extension Assembly		2200
4	540-011-154-5	*Grip		2200
4	540-011-147-1	*Pitch Horn		2200
4	204-012-112-7	*Retention Straps		2200
	Transmission			
4	204-040-009-53, -57	Transmission Assembly	1100	
4	204-040-366-11	Mast Assembly	1100	
4	204-040-136-7	*Mast Bearing		1100
4	204-040-010-7	Engine to Transmission Drive Shaft	1100	
	Tail Rotor and Drive System			
6	204-011-702-17	Blade Assembly, Tail Rotor		1100
6	204-011-701-13	Tail Rotor Hub Assembly	1100	
6	204-011-706-9	*Grip		2200
6	204-010-781-9	*Yoke		2200
6	204-040-003-23, -37	42° Gear Box	1100	
6	204-040-012-7, -13	90° Gear Box	1100	
6	204-011-620-3	Drive Shaft, Tail Rotor	1100	
6	204-040-600-5	Drive Shaft Hanger Assembly	1100	

Area	Part Number & Item		Overhaul Interval	Retirement Interval
	Mast Controls			
4	540-011-450-3	Swashplate and Support Assembly	1100	
4	540-011-454-5	Collective Lever	1100	2200
4	540-011-451-1	Scissors and Sleeve Assembly	1100	
4	540-011-300-3	Stabilizer Bar Assembly	1100	
4	540-011-468-1	Stop Assembly	1100	2200
	Synchronized Elevator			
6	205-030-856-45	Elevator		3000
6	205-030-856-47	Elevator		3000
6	205-001-914-1	Horn, Elevator Control		3000
	Power Plant			
5	T53-L-11**	Engine	1200	
5	T53-L-13	Engine	1200	

*Parts will be retired by the maintenance level overhauling the assembled components.

**Internal Inspection required every 300 engine hours.



Note

Check replacement and retirement schedule for usage of rotating control system bolts.

CAUTION

When two or more parts are listed for same usage, check parts catalog for applicability.

1. Bolt, NAS 464-5-27 or NAS 1305-27D
   Mixing Lever to Scissor Tube (2 Places)
2. Bolt, NAS 464-6-35 or NAS 1306-34D
   Universal to Mixing Lever (2 Places)
3. Bolt, NAS 1306-27D
   Pitch Link to Universal (2 Places)
4. Bolt, NAS 464-6-26 or NAS 1306-31D
   Pitch Horn to Pitch Link (2 Places)
5. Bolt, NAS 464-5-27 or NAS 1305-27D
   Scissor Tube to Scissors (2 Places)
6. Bolt, NAS 464-8-90
   Scissors Pivot (2 Places)
7. Bolt, NAS 464-8-69
   Scissors to Drive Link (2 Places)
8. Bolt, AN175-16
   Cyclic Tubes to Swashplate (3 Places)
   Collective Tube to Collective Lever (1 Place)
9. Bolt, NAS 464-5-30 or NAS 1305-30D
   Drive Link to Swashplate (2 Places)

Figure 3–2. Rotating control system bolts

CHAPTER 5

POWER PLANT AND RELATED SYSTEMS

Section I — Scope

5-1. Scope. The purpose of this chapter is to provide all essential information for maintenance personnel to accomplish organizational maintenance on the complete power plant and related systems. This information includes a detail description and chronological instructions as to methods and procedures. It also includes the special tools and equipment required for accomplishment of these maintenance phases in accordance with the Maintenance Allocation Chart. Special tools required for performance of organizational maintenance will be found in TM 55-1520-211-20P, Repair Parts and Special Tools List.

Section II — Power Plant

5-2. Power Plant. Power plant installation consists of a shaft turbine engine, horizontally mounted above a service deck behind main rotor pylon, with adapting parts and connections to fuel, oil, electrical, instrument, and engine control systems. (Figures 5-1, 5-2, and 5-3.) A hinged cowling panel at each side provides access to engine compartment between forward and rear firewalls. Exhaust area, at rear end, is covered by a removable fairing. Air intake and drive shaft to main transmission are under forward cowling, and are also protected by an induction baffle and screen which have removable sections for access. Hoses and electrical cables between engine and fuselage have quick-disconnect couplings. Other connections, such as control linkages, firewalls, drive shaft couplings and engine mounts, have simple and rapid means of attachment so that engine with its fittings can be considered a quick-change assembly.

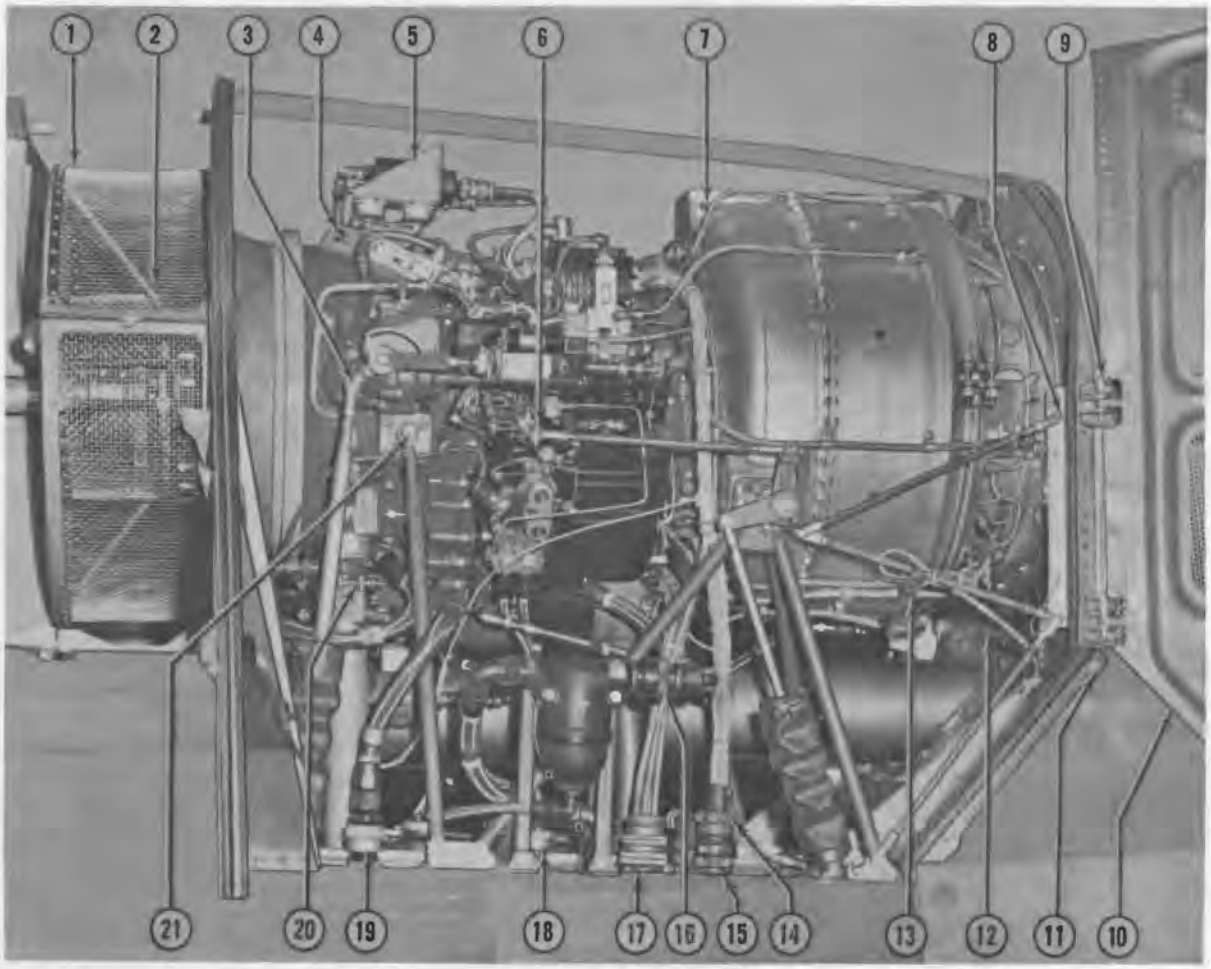
5-3. Engine. Seven engine models are used on helicopters covered by this manual. UH-1A helicopters are equipped with T53-L-1 or T53-L-1A engines. UH-1B helicopters are equipped with T53-L-5, T53-L-9, T53-L-9A, T53-L-11 or T53-L-13 engines.

Note

The suffix "A" after the engine serial number identifies T53-L-11 engines that have the improved output reduction carrier and gear assembly.

5-54. *Engine Orientation.* (See figures 5-4 through 5-7.) All directions and locations of equipment on or around the engine will be stated as viewed from rear of engine looking forward. General size, shape, main sections arrangement, and output shaft rotation are alike for all engine models. The T53-L-1 and T53-L-1A engines differ from other models as to size and design of inlet housing, reduction gearing, arrangement of external parts, and internal parts of the combustion section. These engines use 2 igniter plugs, 5 starting fuel nozzles, and 11 vaporizers (fuel atomizers.) UH-1B helicopter engine models are successively improved versions of the same basic engine T53-L-9/9A and -11 engines are directly interchangeable. When T53-L-13 engine is used to replace T53-L-9/9A/11 engine, a different main driveshaft adapter is required. (Refer to Chapter 7.) The T53-L-5/9 and -9A unmodified use 2 igniter plugs, 5 starting fuel nozzles, and 11 vaporizers. The T53-L-9A modified and -11 use 2 igniter plugs, 2 starting fuel nozzles, and 11 vaporizers. The T53-L-13 uses 4 igniter plugs, 4 starting fuel nozzles, and 22 fuel atomizers (vaporizers). Further detail differences are provided in maintenance procedural paragraphs.

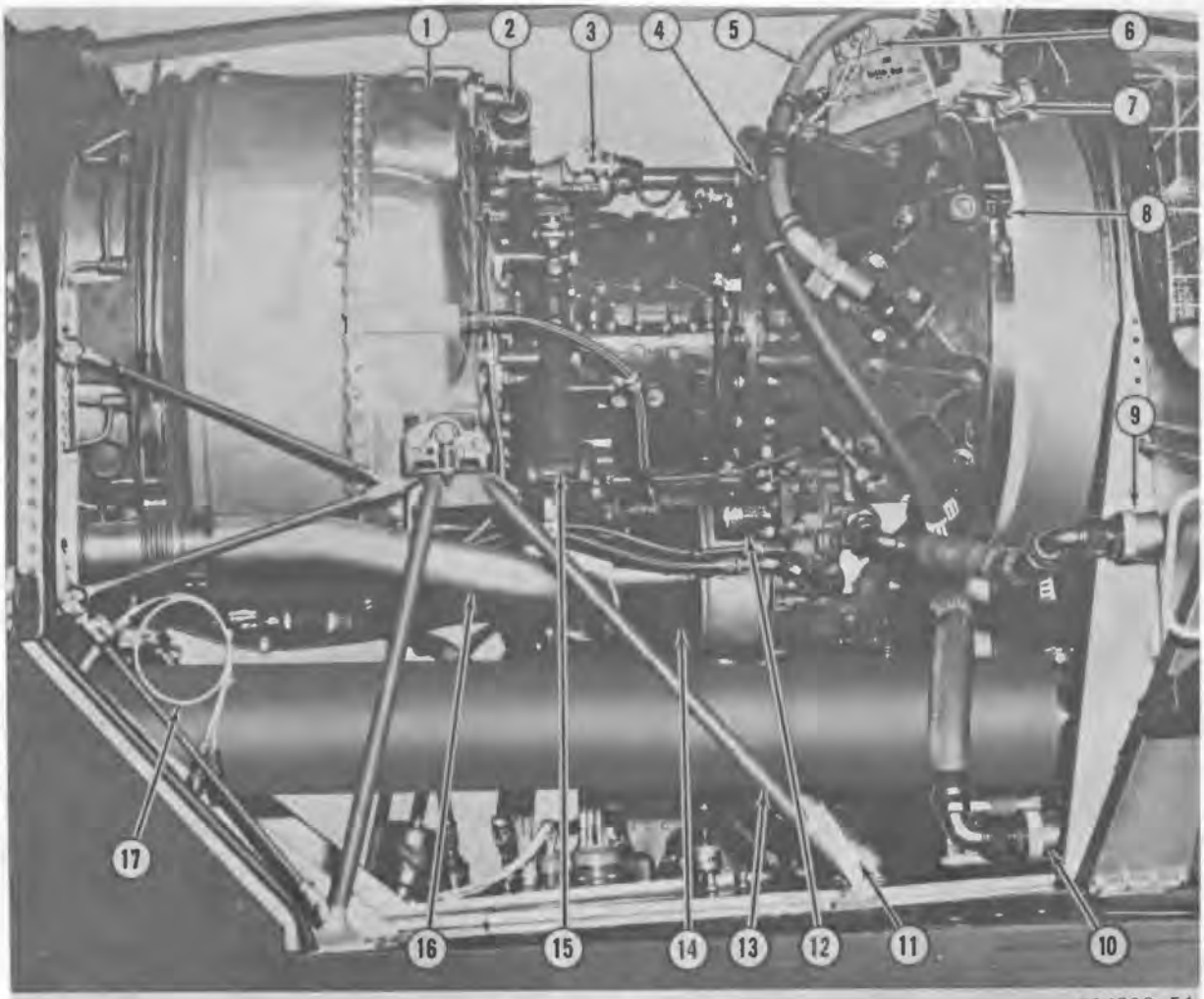
5-5. *Engine Description.* Basic engine consists of an inlet housing and reduction gear section, an axial-centrifugal compressor, a diffuser, a combustion chamber, a gas producer turbine driving the compressor, a power turbine driving a power shaft, and an exhaust diffuser. Fuel



204200-18

1. Intake Screen Fasteners
2. Access to Drive Shaft Coupling
3. Droop Compensator Control Tube Bolt
4. Forward Hoist Point
5. Transmitter Support Assembly
6. Power Lever Control Rod Bolt
7. Rear Hoist Point
8. Firewall Brace Rod Pins
9. Cowling Hinge Pins
10. Access to Tailpipe Hose Coupling, Anti-Collision Light and Antenna Connectors
11. Tailpipe Fairing Fasteners
12. Upper Firewall Fasteners
13. Fire Detector Wiring Connectors
14. Combustor Drain Valve and Fuel Control Seal Drain Hose Coupling
15. Main Electrical Cable Connector
16. Fuel Control Inlet Hose Coupling
17. Starter Cable Connector
18. Starter Pad Seal Drain Hose Coupling
19. Oil Pump Return Hose Coupling
20. Oil Cooler Fan Drive Shaft Coupling
21. Forward Mount Tube Bolt

Figure 5-1. UH-1A Power plant installation — LH side (typical (Sheet 1 of 2)



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Engine Installation - Right Hand Side

1. Engine Diffuser
2. Bleed Air Connecting Manifold
3. Inline Valve
4. Accessory Gear Box Pressure Hose to Torque Pressure Transmitter
5. Torque Pressure Hose
6. Low Oil Pressure Warning Switch
7. Ice Detector Wiring Connector
8. Engine Inlet Housing to Bellmouth Coupling
9. Engine Breather Hose Coupling
10. Engine Oil "IN" Hose Coupling
11. Support Spring
12. Tachometer Generator (ng)
13. Bipod Engine Mount
14. Starter Generator
15. Air Bleed Actuator
16. Starter Generator Cooling Air Exhaust Duct
17. Fire Detector Wiring

Figure 5-3. UH-1B Power plant installation — RH side (typical)

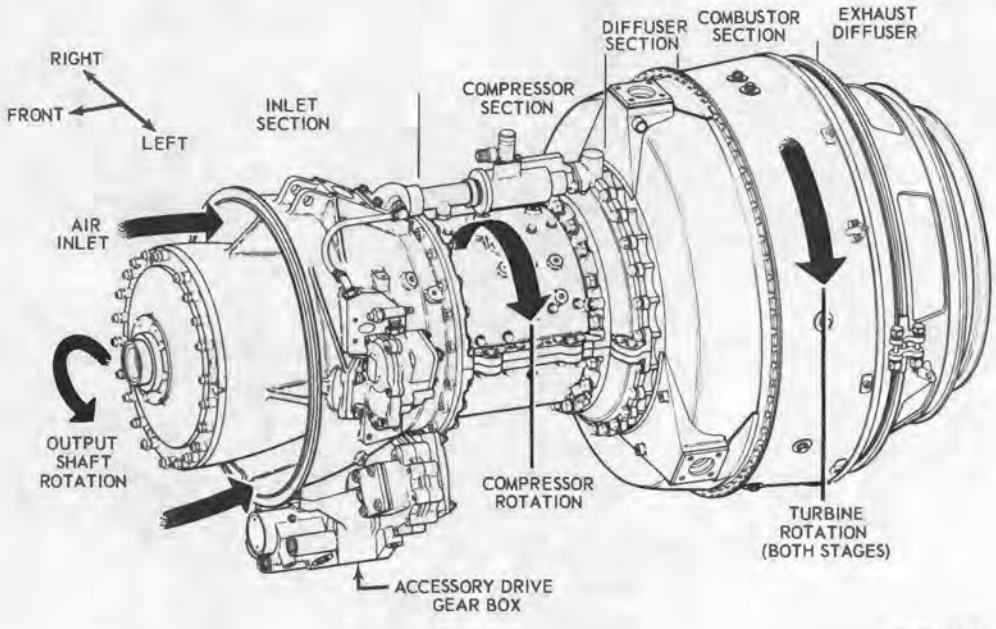


Figure 5-4. Engine orientation and main sections diagram T53-L-1A

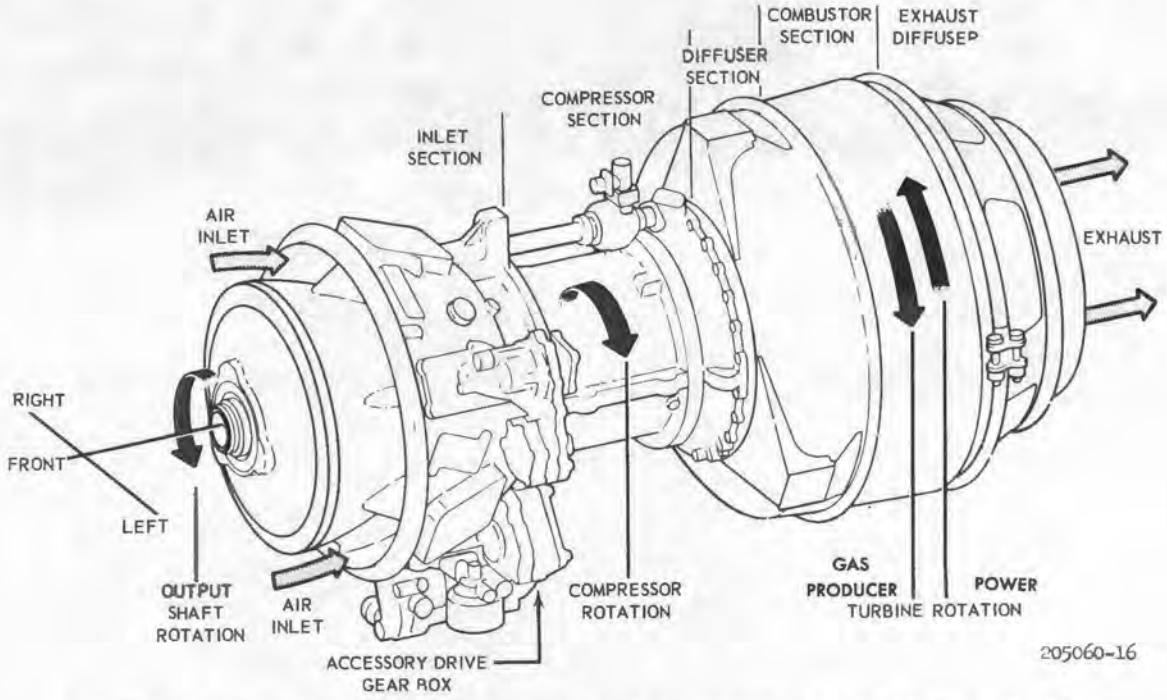
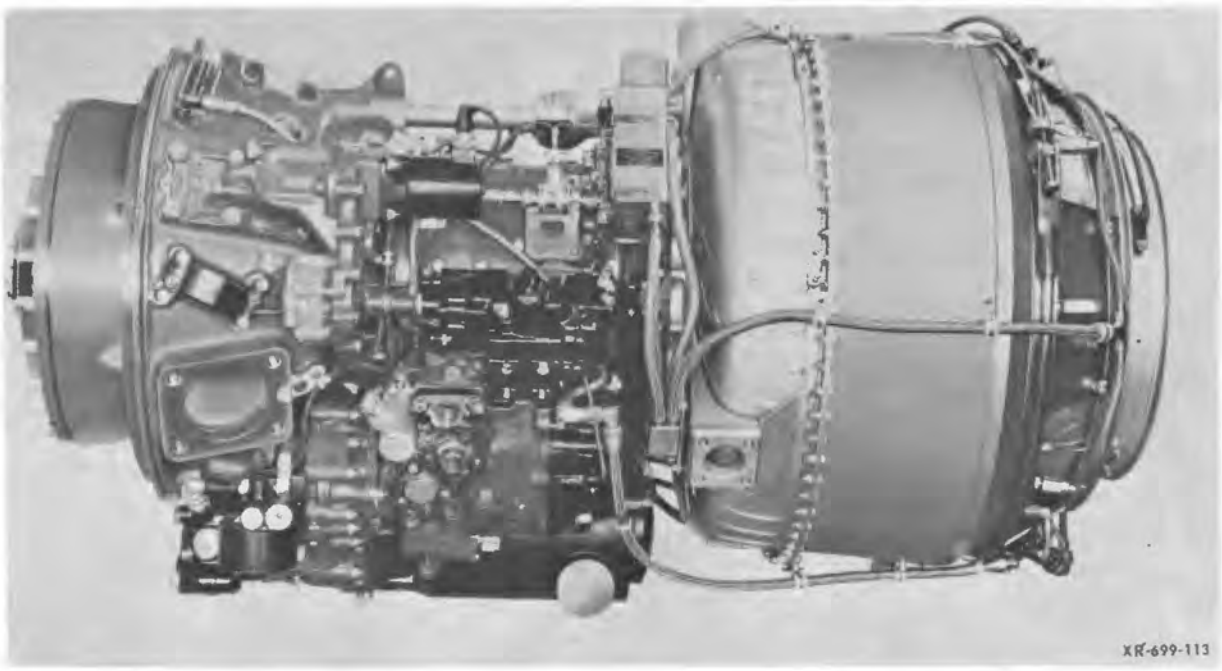


Figure 5-5. Engine orientation and main sections diagram — T53-L-5, T53-L-9, T53-L-9A and T53-L-11 series



(RH side view)

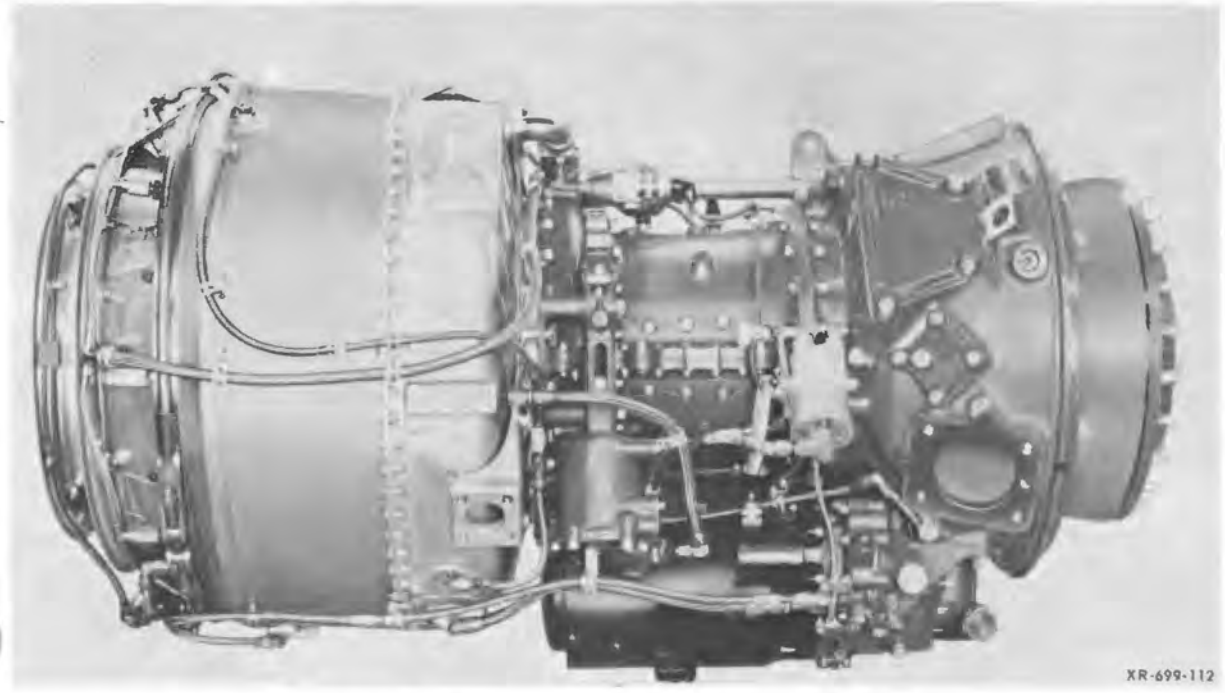


Figure 5-5A. T53-L-13 Engine — (LH side view)

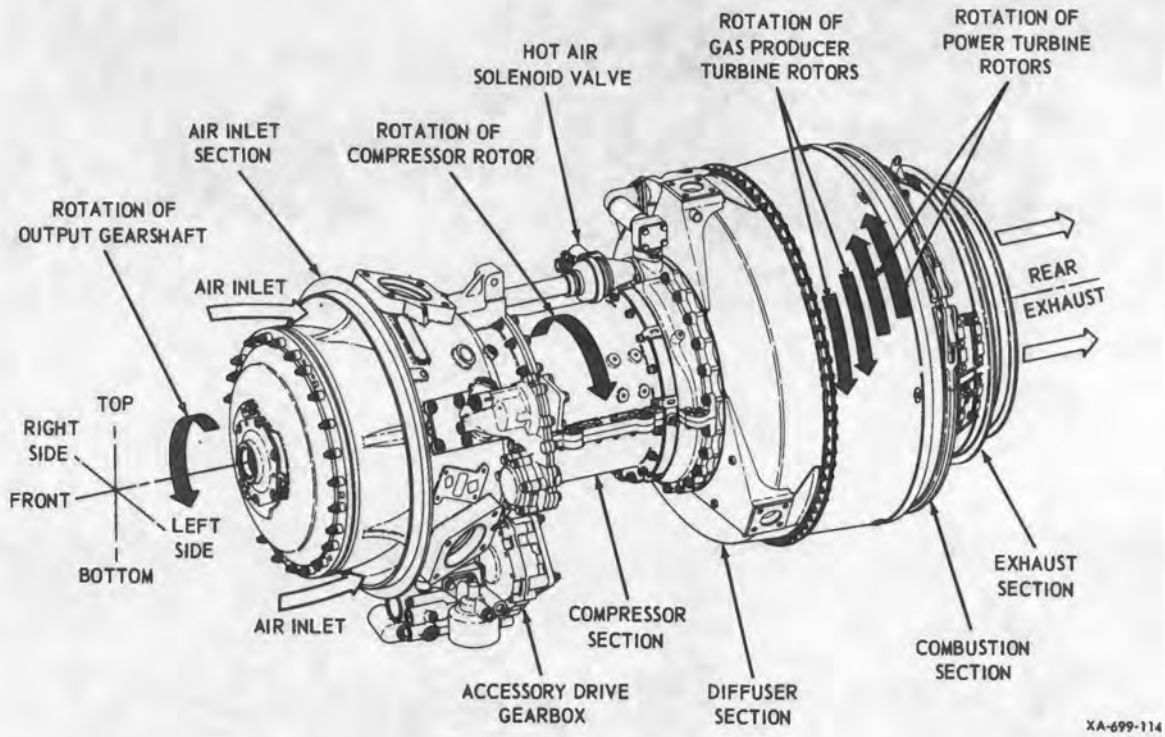


Figure 5-5B. Engine orientation and main sections diagram — T53-L-13 engine

control, starting and ignition, lubrication, and air systems are separately discussed in detail. Considered functionally the engine is made up of two mechanically independent groups: The gas producer turbine and associated components, commonly designated as nI on charts and other references; and the power turbine and associated components, designated as nII.

5-6. *Gas Producer Group.* Gas producer (nI) components include air inlet housing, gas producer or compressor rotor assembly (first-stage turbine and compressor which are joined to form a rotating unit), diffuser assembly, combustion chamber assembly, and accessory drive gear box as a driven unit. Speed of gas producer rotor is indicated in percent rpm by means of a tachometer generator mounted on accessory drive gear box.

5-7. Air inlet housing is a one-piece magnesium casting formed as an inner housing and an outer shell with six hollow connecting struts. The inner housing assembly contains all reduction gears of power train, output reduction carrier and gear assembly, the oil transfer support assembly, accessory drive carrier assembly, the torquemeter valve and cylinder and the (variable inlet guide vane assembly for T53-L-13). The inlet housing provides mounting for the overspeed governor and tachometer drive assembly and accessory drive gearbox assembly. Outer shell diffuses intake air to compressor and provides mounting for external components. Connecting struts provide passages for anti-icing hot air, oil scavenge return, and enclose shafts for gear trains to external components. Entire housing is a main support structure, having pads for engine mounting and an eye for engine hoisting.

5-8. Gas producer rotor consists of five axial-flow compressor rotor stages, a centrifugal impeller, and a driving turbine, all mechanically joined to form a rotating assembly. Axial compressor is made up of disc and blade assemblies alternating with spacers on a rotor sleeve, supported at front end by No. 1 main bearing and attached at rear to centrifugal impeller. Axial compressor blades turn between vane assemblies attached in two halves of a cylindrical cast magnesium housing. Centrifugal impeller has integral blades, and turns within a two-piece cast magnesium housing. Diffuser housing between centrifugal impeller and combustor section, is of low alloy steel and functions to slow air leaving compressor. Compressor outlet pressure ratio is 6:1 with air inlet pressure. Gas producer turbine is a single-stage axial-flow assembly, formed of hollow steel blades secured in rim of a steel disc, attached to compressor and supported by No. 2 main bearing.

5-9. Combustion chamber is formed of stainless steel liner, shroud, and deflector assemblies supported in cylindrical combustor and diffuser housings. Chamber so formed is termed an external-annular reverse flow type, chosen to allow compact design of the engine.

5-10. Accessory drive gear box, which contains all of accessory gear train, is mounted on underside of inlet housing and driven through bevel gears from front end of compressor rotor. Drive pads are provided on rear of gear box for fuel control regulator, starter-generator, and gas producer (nI) tachometer generator. Front of gear box provides mounting for oil pump, and has an unused drive pad with connection for vent line from torquemeter pressure transmitter. All drive shaft gears turn clockwise, viewed facing drive pad. Gear box also serves as a scavenge oil collector sump, kept practically empty by pump.

5-11. *Power Turbine Group.* The power turbine rotor, exhaust diffuser, power shaft, and output reduction gearing constitute the power turbine (nII) group. The turbine is supported by No. 3 and 4 main bearings in exhaust diffuser housing and consists of a steel wheel with tip-shrouded blades secured in its rim. Power turbine is splined to a power shaft extending co-axially through open center of compressor rotor to drive reduction gears and power output gearshaft at front end of engine. An external gear box, mounted at upper left on inlet housing and driven from power shaft, drives an overspeed governor of fuel control assembly which regulates speed of power turbine. A tachometer generator on governor drive gear box provides indication in rpm on dual tachometer.

B 13 5-11A. *Combustor Turbine Assembly.* The combustor turbine assembly consists of the exhaust diffuser support cone assembly, fuel manifold assembly, fire shield assembly, exhaust diffuser assembly, power turbine rotor and bearing housing assembly, V-band coupling, combustion chamber assembly, second stage power turbine nozzle, first stage power turbine rotor, and first stage power turbine nozzle. The power turbine rotor and bearing assembly con-

1. Inlet Housing
2. Axial Compressor
3. Centrifugal Compressor
4. Diffuser Housing
5. Combustion Chamber
6. Louvers
7. Fuel Vaporizing Tube
8. Igniter Nozzle
9. 1st Stage Turbine Nozzle
10. 1st Stage Turbine
11. 2nd Stage Turbine Nozzle
12. 2nd Stage Turbine
13. Power Shaft
14. Planetary Sun Gear
15. Torquemeter Assembly
16. Ring Gear Output Shaft
17. Exhaust Diffuser

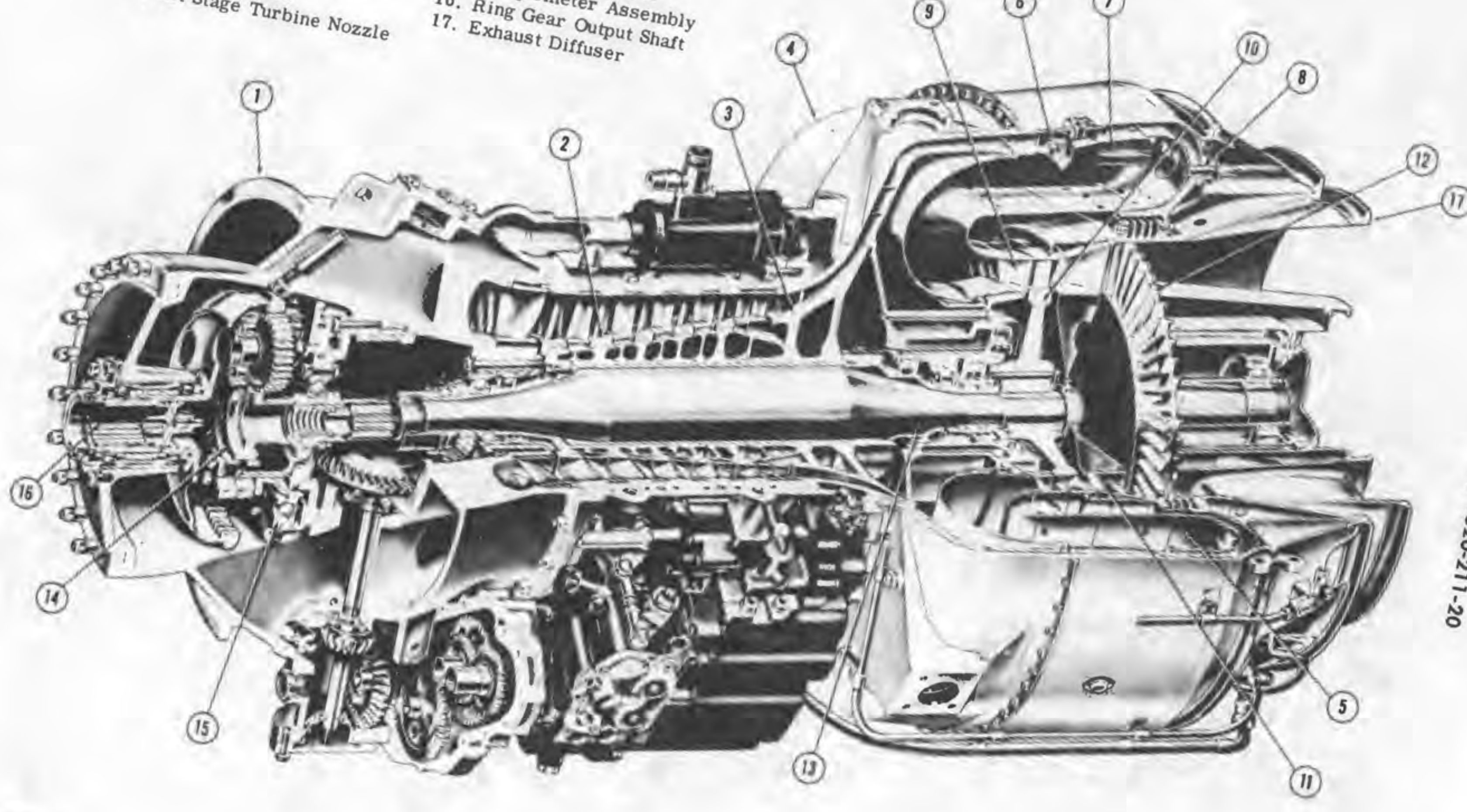


Figure 5-6. Engine cutaway — T53-L-1A

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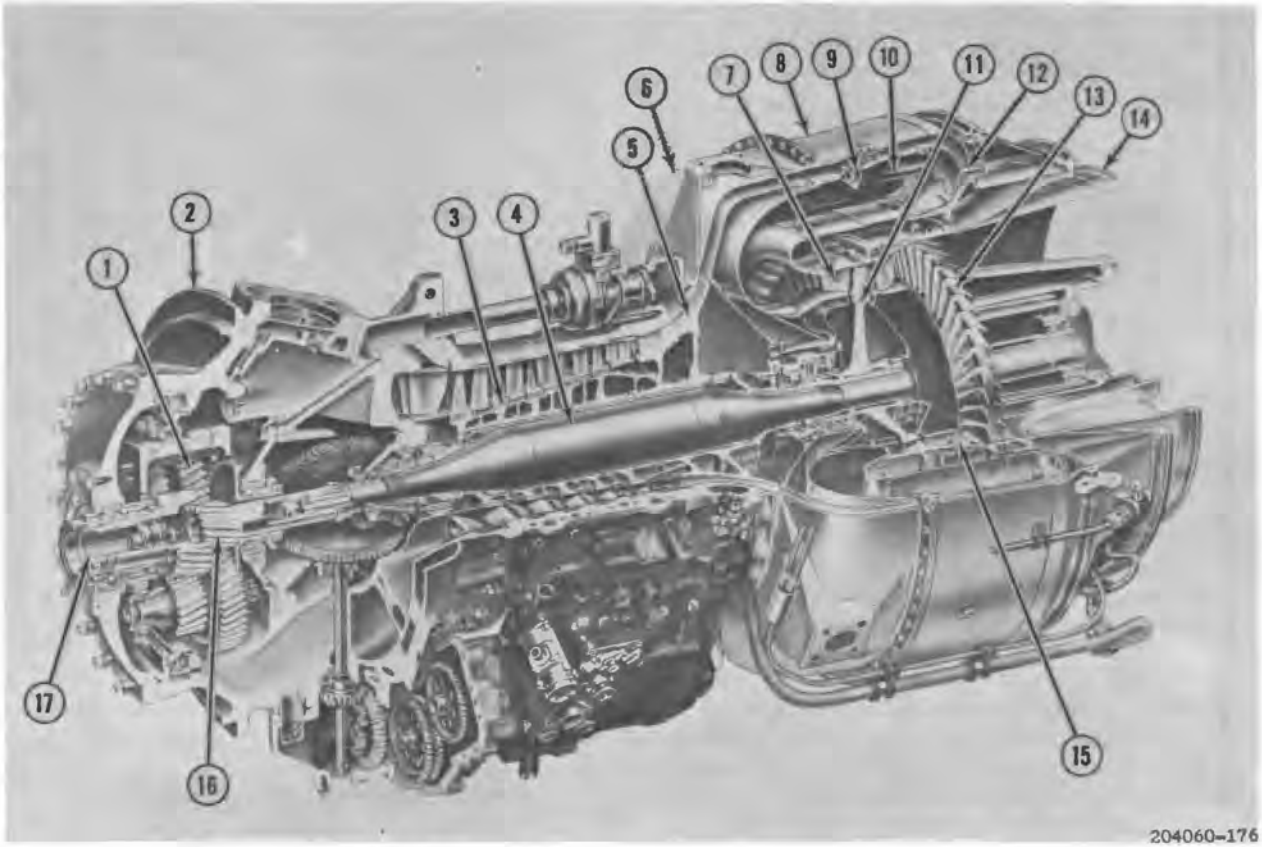


1. Output Reduction Gears
2. Inlet Housing
3. Axial Compressor Rotor Disc
4. Power Shaft
5. Centrifugal Compressor Impeller
6. Diffuser Housing
7. First Stage Turbine Nozzle
8. Combustion Chamber Housing
9. Scoops
10. Fuel Vaporizers
11. First Stage Turbine
12. Igniter Nozzles
13. Second Stage Turbine
14. Exhaust Diffuser
15. Second Stage Turbine Nozzle
16. Sun Gearshaft
17. Output Gearshaft

Figure 5-7. Cutaway of typical UH-1B engine

sists of the turbine disc and blades, the No. 3 and No. 4 bearings, the No. 3 bearing seal, and the No. 3 and 4 bearing housing. The exhaust diffuser contains hollow structs through which cooling air is supplied to the No. 3 and 4 bearing housing and the rear face of the second power turbine disc. The combustion chamber assembly consists of the combustion chamber liner and the combustion chamber housing.

5-12. The output reduction carrier and gear assembly, contained in the inner portion of inlet housing, consists of the support housing, carrier assembly, three planetary gear assemblies, a torquemeter assembly, and output gearshaft. The assembly is driven by the sun gearshaft splined to the power shaft. The sun gearshaft drives three planetary gears mounted in the carrier assembly and gear assembly which in turn drive the output gearshaft. The torquemeter assembly is the means of providing continuous gage indication of torque applied on output gearshaft. This device is a grooved plate and ball system working with oil pressure, varied according to torque, to an external pressure transmitter. On UH-1A, oil supply to torquemeter inlet is at system pressure: on UH-1B, oil pressure is increased by a boost pump on overspeed governor drive gearbox.

5-13. *Engine Principles of Operation.* (See figure 5-6 or 5-7.) Air entering through inlet housing is drawn through axial and centrifugal stages of the compressor, which is turned initially by the starter through the accessory gear box, then by the gas producer turbine in normal operation. Compressed air is directed through vanes of the diffuser, with reduction of velocity and swirling of air flow to increase its pressure, then enters combustion chamber to mix with vaporized fuel and form a combustible mixture. Initially, fuel is supplied through nozzles of the starting fuel system and combustion occurs when igniter plugs are energized. Thereafter, the starting system is manually deactivated and combustion is sustained by fuel supplied by main fuel system through fuel vaporizers in the combustion chamber. Expanding gases are directed through gas producer nozzle and turbine blades, then through power nozzle and power turbine, and out of engine through exhaust diffuser. Approximately two-thirds of the gas energy passing through the gas producer turbine is used to drive the compressor rotor assembly, the rest is used by the power turbine to drive the power shaft. The T53-L-13 engine is a shaft turbine engine with a two-stage, free-type power turbine, a two-stage gas producer turbine that drives a combination axial-centrifugal compressor, and an external annular atomizing type combustor. Five major sections of the engine are air inlet, compressor, diffuser, combustor, and exhaust. Other engine equipment and features are discussed elsewhere in this section, with systems to which they pertain.

5-14. *Engine Maintenance Precautions.* When performing maintenance on engine, the following precautions shall be observed.

Warning

Do not use cadmium plated tools for any procedures outlined in this chapter. Cadmium plating will chip. If any of these chips enter the engine they will contaminate the lubrication system and cause deterioration of magnesium engine parts.

Warning

Lubricating oil (item 2, table 1-1) contains an additive which is poisonous and readily absorbed through skin. Do not allow oil to remain on skin longer than necessary.

a. On removal or disassembly of engine components, exercise care to prevent dirt or other foreign matter entering engine. Caps, plugs or temporary covers shall be used to close all exposed openings.

Caution

Do not use tape to seal fuel or oil openings. Tape adhesive is soluble in fuel or oil and can cause contamination.

b. Protect engine from dust and inclement weather. When possible, perform maintenance in a sheltered area.

c. Before removing engine components, disconnect the wiring harness at the ignition exciter and ground the ignition leads.

d. Carefully inspect condition of all parts to be installed on engine.

e. Discard used lockwire, cotter pins, tabwashers, lock-pins, lock-washer, gaskets and packing rings. Replace with serviceable parts.

f. In removal of external lines and components, brackets will be left in place whenever possible to facilitate reinstallation.

g. When removing or installing engine fuel, oil, or air hoses, do not apply torque to the narrow hex nut of the sleeve and nipple. Apply torque to the wide hex nut only. When loosening or tightening the wide hex nut, hold the nipple or sleeve to prevent twisting of the hose. (Refer to paragraph 1-99A.)

h. When disconnecting electrical connectors, or hose and tube fittings, remove clamps on brackets as required to gain slack and avoid damage to connectors and fittings. (See figure 1-13A.)

5-15. *Torque Values.* a. Apply special torque values wherever stated or shown in maintenance instructions.

b. For general applications other than engine parts, use standard torque values for aircraft structural hardware.

c. On engine only, where no special torque is given, use the following table of torque values provided by engine manufacturer.

ENGINE HARDWARE TORQUE VALUES
(inch-pounds)

SIZE	HEX BOLTS AND NUTS	SLOT HEAD SCREWS
10-32	40-45	18-20
7/32-24	65-70	22-25
1/4 -28	70-95	30-35
5/16-24	120-165	40-45
3/8 -24	250-325	55-60
7/16-20	400-475	80-90
1/2 -20 or -13	500-700	100-110
9/16-18	750-1000	
5/8 -18	1000-1400	

PIPE THREAD PLUGS

	SQUARE OR INTERNAL HEX HEAD	SLOT HEAD	
SIZE	STEEL	BRASS OR ALUMINUM	STEEL
1/16	35-40	10-15	20-25
1/8	75-125	30-40	35-50
1/4	200-250	70-85	60-90
3/8	300-375	95-110	100-140
1/2	400-500	140-160	150-200
3/4	500-600	175-200	200-250
1	600-700	230-260	250-300

water into engine inlet housing at 1½ to 2½ gallons per minute until all visible deposits have been removed. Distribute spray so that it washes inlet housing struts and water enters all inlet duct areas leading to compressor section. Allow engine to coast down until combustion chamber drain valve opens and water drains out.

Note

If temperature is below freezing, use anti-detonating injection fluid containing a 40 percent methanol and 60 percent water mixture instead of fresh water.

f. Motor engine again for 15 to 20 seconds, to rid combustor of water vapor.

g. Reconnect ignition and operate engine at idle speed to dry out engine.

h. During engine coastdown, use suitable spray nozzle and associated equipment with filtered air at 90 psi pressure to spray approximately one-half gallon of corrosion inhibitor (item 310, table 1-1) or equivalent, into the entire engine inlet. If inhibitor is not available, use one pint of corrosion-preventive oil (item 10, table 1-1).

i. With engine stopped, use nozzle through exhaust tailpipe to spray power turbine rotor with enough corrosion-preventive oil (item 10, table 1-1) to cover blades.

B j. Reconnect interstage airbleed hose to fitting on engine diffuser housing, and fuel control pressure sensing hose to fitting on inlet housing.

k. Reinstall or close cowling.

5-20. *Removing Missile or Rocket Exhaust Deposits from Engine.* When engine has operated in areas subjected to missile or rocket exhaust, remove all deposits as soon as possible.

a. Prepare engine for treatment according to paragraph 5-19, steps a. through d.

b. Remove engine intake screen. Wipe the air inlet surfaces, all accessible external surfaces and all accessible blades in engine with a clean cloth dampened with cleaning solvent (item 302, table 1-1).

c. Spray the engine inlet and compressor with corrosion inhibitor or corrosion-preventive oil according to paragraph 5-19, step h. Hold spray nozzle 18 to 20 inches from inlet housing to apply spray while motoring engine with starter to 12 percent nI speed, then allowing it to coast down to two percent nI speed. Repeat cycle as necessary.

d. With engine stopped, spray power turbine blades with corrosion-preventive oil according to paragraph 5-19, step i.

e. Reconnect engine hoses and reinstall intake screen and cowling when treatment of engine is completed.

5-21. *Removing Extinguishing Agent Residue From Engine.* When an engine has been exposed to corrosive type fire extinguishing agents, such as chlorobromomethane or soda-acid, the residue shall be immediately removed from the engine.

Note

Non-corrosive dry chemical or foam deposits should be removed as soon as practical, using clean water.

a. Prepare engine for treatment according to paragraph 5-19, steps a. through d.

Note

If cleaning procedures would damage other equipment or components of aircraft engine, the engine should be removed and cleaned on a stand, using a suitable cranking device to turn engine.

b. Prepare a mild alkaline solution, using eight ounces sodium bicarbonate to five gallons water.

c. Spray or pour alkaline solution into engine inlet while motoring engine with starter.

d. With a portion of alkaline solution, wash all external engine surfaces affected by the extinguishing agent. Wash off solution with clean water.

e. Flush engine internally with about five gallons of water introduced through inlet while motoring engine with starter, then dry the engine and apply corrosion preventives to compressor and power turbine. (Refer to paragraph 5-19, steps e. through i.)

f. Reconnect engine hoses and install cowling.

5-22. *Engine Internal Cleaning with Walnut Shell Grit.* Use walnut shell grit to clean engine compressor when high exhaust gas temperatures or power loss is observed.

Caution

Tests have shown that walnut shell material may collect behind the turbine segment seal ring and ignite and

burn with a resulting local temperature high enough to anneal the seal spring and reduce the effectiveness of the asbestos seal. If this condition occurs, it can be readily observed by steady state exhaust gas temperatures in excess of limits. No power loss will result. Instead, a slight increase in output shaft power will accompany the high exhaust gas temperature.

Note

A turbine cylinder seal, Part No. 1-300-052-01, has been approved for field retrofit of T53-L-5/9/9A/11 engines. This seal is less susceptible to deterioration than the previously used part, due to more effective sealing characteristics at lower spring pressure.

a. Provide 2.5 to 3 pounds of walnut shell grit (item 503, table 1-1). Remove any foreign object that might damage engine.

b. Remove forward cowling and access section of engine air intake screen. Remove cowling doors at both sides of engine.

c. Detach fuel control sensing element and cover from left side of engine inlet housing.

B d. Disconnect fuel control pressure sensing hose from fitting on inlet housing. Cap open fitting.

e. Disconnect fitting of bleed air hose, which supplies engine air to air-frame-mounted equipment, from impeller housing port (on T53-L-1A/5/9 engines) or from exit port of adapter on impeller housing (on T53-L-9A/11/13 engines). Install a cover on open port. Connect an external source of compressed air, regulated at 50 psi, to inlet of oil cooler blower in order to operate blower during engine operation.

B f. Disconnect interstage airbleed hoses and prepare for closing of bleed band after engine is started.

(1) On T53-L-5/9/9A engine, disconnect air-bleed valve hose from fitting on inlet housing. Cap hose and fitting on housing.

(2) On T53-L-11 or -13 engine disconnect fuel control sensing hose from upper fitting on airbleed actuator. Cap actuator fitting.

(3) On any UH-1B engine, disconnect actuator pressure hose from fitting on engine diffuser housing. Cap diffuser fitting. Connect a source of clean compressed air, regulated to not more than 50 psi pressure, to the airbleed hose which is normally connected to diffuser pressure.

g. Start and run engine at flight idle speed. Be sure that oil cooler blower is being operated by compressed air to keep engine oil temperature within limits. Close interstage airbleed band by compressed air applied to actuator.

Warning

Keep away from drive shaft and other moving parts.

h. Slowly feed approximately one-half pound of cleaning grit into engine inlet housing between two struts. Allow engine to clear itself, in approximately one minute.

i. Repeat step h. at each of the other openings between inlet housing struts.

Note

A power check shall be made after engine cleaning with walnut shell grit. If maximum allowable exhaust gas temperature is not exceeded, this will confirm that no secondary damage to the asbestos seal has resulted.

j. Shut down engine and allow it to cool. Remove external sources of compressed air.

k. With a flashlight, visually inspect inlet guide vanes and first-stage of compressor rotor through front of inlet housing. If vanes are not completely clean, swab with a cloth wet with trichlorethylene (item 307, table 1-1). Reinstall intake screen section.

l. Remove protective caps and covers from engine ports and fittings, clean out any accumulated grit residue, and connect engine hoses. Attach fuel control temperature sensing element on inlet housing.

m. Install cowling.

5-23. *Spot-Painting On Engine.* Scratches or exposed painted areas shall be spot-painted to prevent surface corrosion.

5-24. *Aluminum — Painted Surfaces.* a. Lightly sandpaper the area to be spot-painted.

b. Clean area with trichlorethylene (item 307, table 1-1) and air dry.

c. Spot-paint exposed area with heat-resistant aluminum enamel (item 104, table 1-1) or equivalent.

d. Air dry, or use heat lamp to force-dry in humid conditions.

5-25. *Magnesium-Base Alloy Surfaces.* The following procedure may be used to remove corrosion and to touch-up all magnesium engine parts that have been previously treated. No distinction shall be made between areas coated with engine gray and areas coated with clear epoxy sealant.

a. Blend nicks, scratches, or reworked areas with surrounding metal surface, using a smooth stone or crocus cloth (item 401, table 1-1). The blend shall be smooth and continuous to prevent possible stress-concentration areas.

b. Thoroughly clean area to be treated with methyl-ethyl-ketone (item 309, table 1-1), or acetone (item 311, table 1-1).

c. With a cotton swab, locally apply chrome pickle solution (1.5 pounds sodium dichromate (item 321, table 1-1) and 1.5 pints nitric acid (item 322, table 1-1), specific gravity 1.42, to one gallon of water) to exposed area. Allow solution to remain on surface two to five minutes, then rinse well with clean water.

Warning

Chrome pickle solution is poisonous. Do not allow solution to touch skin, as its entry through cuts or bruises may cause serious illness. Wash any traces of solution from skin with soap and water.

d. Dry part with clean cloth, then with 500-watt heat lamps or equivalent for 5 to 10 minutes.

e. Prepare engine gray A.D. epoxy (items 207 and 208, table 1-1) or equivalent, by mixing equal parts of compounds A and B. Apply one brush coat of mixture over the exposed area.

f. Using 500-watt heat lamps or equivalent, dry part for two hours. Air dry part, at least 24 hours, until paint is no longer tacky.

B 5-26. *Replacing Miscellaneous Seals.* a. If leak occurs at pinion bearing housing (1, figure 5-9) at bottom of accessory drive gear box: Open engine cowling doors. Drain trapped oil by removing chip detector plug (3). Remove three bolts and pull housing from gear box. Replace packing (2) and install housing, tighten and lockwire bolts.

b. Replace packing (4) on chip detector; install in gear box port and lockwire.

c. To correct a leak at pad cover (5): Disconnect torquemeter transmitter vent hose. Remove nuts and washers and pull cover from studs. Replace gasket (6). Install cover. Connect hose to fitting on cover.

d. To correct leak at plug (7): Remove plug and replace packing (8). Install and lockwire plug.

e. To correct leaks at oil pump, replace parts in accordance with applicable instructions. (Refer to paragraph 5-189 or 5-192.)

B 5-27. *Replacing Starter Drive Pad Seal.* (See figure 5-9.) a. Open right engine cowling. Remove starter-generator. (Refer to paragraph 5-247.) Leave gaskets (13 and 15) and support (14) in place.

b. Remove lockwire and six bolts at flange of oil seal housing (16). Use two 10-32 puller screws to remove housing. Remove screws. Remove packing (17).

c. Place seal housing on an arbor press, and use tool LTCT100 to press out seal (19) and packing (18).

d. Dip new seal in oil (item 2, table 1-1). Place packing (18) and seal in housing and press into place. Install new packing (17) on seal housing (16).

e. Install seal housing assembly into gear box drive pad, using tool LTCT511, and secure with six bolts. Lockwire bolts.

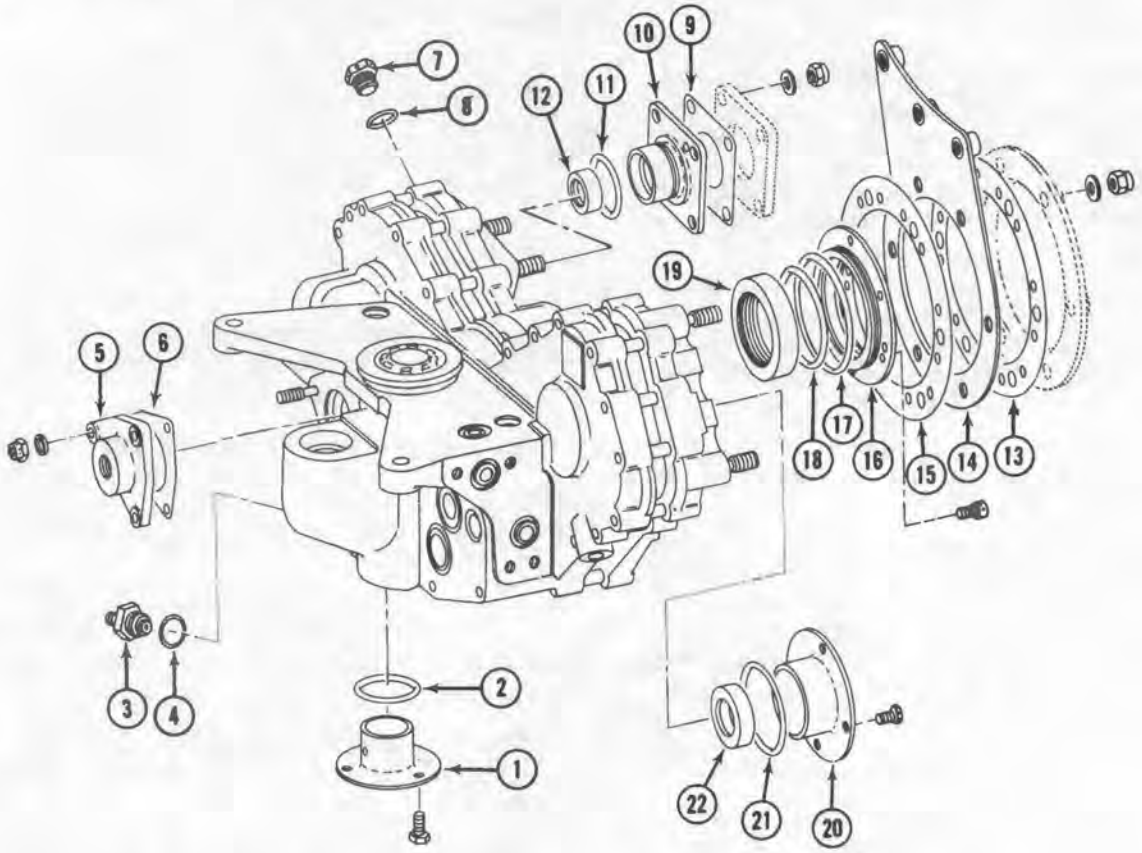
f. Install starter-generator. (Refer to paragraph 5-248.) Close cowling.

B 5-28. *Replacing Tachometer Drive Pad Seal.* a. Open right engine cowling. Remove gas producer tachometer generator by disconnecting electrical connector and removing nuts and washers which secure unit and gasket (9, figure 5-9) on drive pad studs.

b. With two 10-32 puller screws, remove flange (10). Remove screws and packing (11).

c. Place flange assembly on an arbor press. Use tool LTCT101 to remove seal (12).

d. Dip new seal in oil (item 2, table 1-1) and press into flange using tool LTCT501. Place new packing on flange.



1. Pinion Bearing Housing
2. Packing
3. Chip Detector
4. Packing
5. Pad Cover
6. Gasket
7. Plug
8. Packing
9. Gasket
10. Tachometer Drive Flange
11. Packing
12. Seal
13. Gasket
14. Support
15. Gasket
16. Oil Seal Housing
17. Packing
18. Packing
19. Seal
20. Fuel Control Drive Liner
21. Packing
22. Seal

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Figure 5-9. Accessory drive gear box seals (T53-L-5/9/9A/11/13 engines)

e. Install flange assembly over mounting studs and into drive pad.

f. Install gasket and tachometer generator, secured by four nuts and washers. Connect lockwire electrical connector. Close cowling.

B 5-29. *Replacing Fuel Control Drive Pad Seal.* (See figure 5-9.) If fuel control assembly has been removed, the drive pad seal is then accessible for replacement.

a. Remove bolts that secure flange of fuel control drive liner (20). Use 10-32 puller screws to remove liner. Remove screws and packing (21).

b. Place liner on an arbor press, and use tool LTCT100 to press out seal (22).

c. Dip new seal in oil (item 2, table 1-1), and press seal into liner, using tool LTCT100.

d. Install packing and liner into drive pad, secured with bolts. Lockwire bolt heads.

5-30. *Trouble Shooting — Engine.* A chart of possible engine troubles, causes, and remedial action is included below. Power plant malfunctions may be obvious, or may be of a nature which is not obvious but which can cause considerable damage to engine if not detected. It is essential that maintenance personnel have thorough knowledge of exhaust gas temperatures, fuel pressures, lubricating oil pressures, and other important details of normal engine performance in order to recognize power plant troubles quickly when they occur. Having recognized trouble, the mechanic must then isolate it by a process of elimination of possible causes, beginning with those most probable and most readily checked. Thorough check of fuel and ignition systems should be made for possible leaks and defective wiring. Accuracy of exhaust gas temperature indication system should be checked at once in case of engine operating troubles, in which abnormal readings occur, using a Jetcal tester in accordance with its instructions to test thermocouple harness and exhaust gas temperature indicator. Correction of trouble may require simple repair of faulty installation, replacement of an accessory or part, or removal of engine assembly for inspection and repair by a high maintenance level. Certain corrective actions in chart are beyond the scope of organizational maintenance, but are included to preserve continuity of the trouble shooting task.

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
1. Failure to crank	Low voltage; battery defective	Replace battery; use auxiliary power
	Faulty electrical system	Check circuits, repair connections or replace faulty units
	Starter motor faulty or shaft sheared	Replace starter-generator
2. Cranking difficulty or failure	Compressor rotor seized by icing	Duct hot air into inlet
	Internal seizing of compressor or first-stage turbine	Internal inspection and repair of engine compressor or combustor sections
3. Failure to start		
a. Igniter plugs not firing; no crackling sound when starting system is energized	Weak battery or faulty airframe electrical system	Check for 14 volts minimum input to ignition exciter. Replace battery or repair electrical circuit if required
	Faulty ignition exciter	If plugs still do not fire, replace ignition exciter
	Faulty igniter plugs	Disconnect leads from plugs if still failing to fire. Attach plugs known to be good on leads and let hang free. Energize system. If spark occurs now, replace old plugs.
	Faulty ignition leads	If still no spark, replace ignition leads.
	Low input voltage to ignition unit **Note** Fourteen volts minimum for cranking	Check voltage connector.
b. No starting fuel; no rise in exhaust gas temperature	Starting fuel nozzles or manifold clogged or damaged	With ignition disconnected, disconnect starting fuel line from manifold. Simulate a start to check for flow at open line. If there is flow, clean or replace starting nozzles or manifold

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
	Inoperative boost pumps or system shut-off valve	If no fuel flow in previous test, check fuel supply system operation. Repair circuits or replace faulty units.
	Starting fuel solenoid valve inoperative	Disconnect starting fuel line at valve inlet. If there is flow from fuel control, replace solenoid valve or repair connections
	Clogged strainers in fuel control	If still no flow, clean fuel control strainers and replace servo filter
	Faulty fuel control	If still no starting fuel flow, replace fuel control
c. No main fuel; engine stabilizing at 100°C exhaust gas temperature and about 15 percent nI rpm	Faulty fuel supply system	Check fuel service. Check operation of boost pumps and system shut-off valve, repair circuits or replace faulty units. Clean main strainer or replace filter element
	Clogged strainers in fuel control, manifold or line	Check all fuel strainers and lines for restrictions
	Faulty fuel control	With ignition disconnected, disconnect main fuel line from manifold. Motor engine at 12 to 16 percent nI rpm to check for fuel flow. If no flow, replace fuel control
	Flow divider inoperative on T53-L-13 engine only	Check flow divider assembly as follows: Install flow assembly that is known to be good. (Refer to paragraphs 5-143B and 5-143D.) Attempt to start engine. If engine still does not start, reinstall original divider assembly. Check fuel control.
	Faulty fuel control	Check fuel control assembly as follows: Disconnect hose assembly between fuel control and flow divider assembly at flow divider assembly. Position fuel valve ON. Turn on aircraft boost pump. Open throttle. Motor engine at 12 to 16 percent nI. If fuel does not flow, replace fuel control.

INDICATION OF TROUBLE	CORRECTIVE ACTION	PROBABLE CAUSE
d. In cold weather	Wrong fuel B When using JP-5 fuel on a T53-L-11/13 engine and scoopless T53-L-5/9/9A engines, wrong starting fuel port of fuel control being used for temperature below 10°F	Service with correct fuel Connect starting fuel line to elbow-type fitting of alternate (unscheduled) starting fuel port of fuel control. Cap banjo fitting on normal (scheduled) port
4. Excessive time in starting	Refer to item 3	Refer to item 3

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
5. Hung start; engine fails to accelerate beyond approximately 30 percent nI rpm and exhaust gas temperature rapidly rises toward over-temperature limit	Excessive fuel used for start	Shut down engine. If necessary, motor engine to stabilize exhaust temperature. Use proper starting procedure
	Internal engine binding	Refer to item 2
6. Hot start; exhaust gas temperature limits exceeded	Weak battery	Replace battery
	Wrong starting procedure	Use correct procedure
	Starting fuel solenoid valve fails to shut off	Check operation: Disconnect starting fuel line from manifold. Motor engine with main fuel switch on, starting fuel switch off. If fuel flows, replace valve
	Air inlet obstructed	Clear air inlet
	Faulty fuel control	Replace fuel control
7. Torching start: flames shoot from exhaust	Wrong procedure: late introduction of starting fuel	Use correct procedure
	Fuel accumulation in tailpipe or combustion chamber	Check tailpipe and combustion chamber drain lines for obstruction. Remove and inspect combustion chamber drain valve. Replace faulty parts
8. Flame-out during start	Insufficient starting fuel	Maintain starting fuel longer in next start
	Defective starting fuel nozzles	Check starting fuel nozzles for cracks around the disc orifice and for freeness of ball bearing. Replace defective starting fuel nozzles.
	Power lever control linkage rigged incorrectly	Rig power control linkage.
9. Idle speed low	ENGINE GOV switch at EMER position, or not wired properly, or faulty transfer solenoid valve	Check operation with switch at AUTO; repair circuit or replace faulty solenoid and valve
	Wrong idle speed setting	Adjust rigging trim as required
	Fuel flow restricted	Check fuel strainers and lines
10. Idle speed high	Power lever control linkage rigged incorrectly	Rig power lever control linkage
	Wrong idle speed setting	Adjust rigging trim as required

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
11. Actual nI speed higher than computed speed at maximum power lever setting	Computation error	Check calculations, ambient temperature, use of correct engine data sheet and chart of allowable deviation due to temperature
	Faulty tachometer	Replace tachometer or generator
	Wrong maximum speed setting on fuel control	Adjust rigging trim as required
	Faulty fuel control	Replace fuel control
12. Actual nI speed lower than computed speed at maximum power lever setting	Computation error	Check as in item 11.
	ENGINE GOV switch in EMER position	With speed retarded to 60 percent switch to AUTO; speed should increase. If defective, repair circuit or replace solenoid
	Faulty tachometer system	Replace tachometer or generator
	Power lever control linkage rigging incorrect	Check and correct power lever control rigging
	Fuel flow restricted	Check all fuel strainers
	Wrong maximum speed setting on fuel control	Adjust fuel control trim as required
	Faulty fuel control	Replace fuel control
	Air leakage and high exhaust gas temperature	Refer to item 16.
	Improper inlet guide vane operation. T53-L-13 engine	Check inlet guide vane.
13. Low nII speed	Aircraft maximum gross weight exceeded	Correct loading
	Wrong governor control rigging	Correct rigging of linkage to governor control arm
	Low nI speed	Refer to item 12.
	Faulty overspeed governor	Replace governor
14. Excessive droop of nII speed	Aircraft maximum gross weight exceeded	Correct loading
	Droop compensator adjustment wrong	Adjust droop compensator cam setting and check rigging of linkage
	Low nI speed	Refer to item 12
15. Overspeed nII	Faulty overspeed governor	Replace governor
	ENGINE GOV switch in EMER position or faulty transfer solenoid	Refer to item 9
16. High exhaust gas temperature during steady-state operation	High setting of nI speed	Refer to item 11.
	Air inlet obstructed	Clear air inlet
	Anti-icing valve staying open; external loss of air	With anti-icing switch at closed position and engine operating,

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
		check for flow of hot air from vent holes at forward engine mounts. Air flow means valve is open. Repair electrical circuit or replace faulty valve
	Faulty interstage airbleed band; external loss of air	Inspect band for severe bends, damage to teflon, teflon separating from band, and adjustment for proper closure. Repair or replace band if necessary
	Combustion chamber drain valve fails to close; external loss of air	With engine operating, place finger over end of drain line. If air is felt, valve is open; repair or replace
	Low air flow; dirty compressor	Clean engine internally with walnut shell grit
	Faulty exhaust gas temperature gaging system	Check system with Jet-Cal tester; repair or replace faulty wiring or units
	Internal loss of air; damaged first stage turbine nozzle or leaking asbestos seal	Internal inspection and repair of engine combustion section
	Fuel control not properly adjusted	Refer to item 11
17. High exhaust gas temperature during acceleration	All probable causes for same condition in steady-state operation	Refer to item 16
	ENGINE GOV switch in EMER position, or transfer solenoid faulty	Refer to item 9
18. Exhaust gas temperature fluctuating or not indicating	Faulty indicating system	Check indicating system with Jet-Cal tester. Repair wiring or replace faulty units
19. Fluctuating exhaust gas temperature, nI and nII speeds, and torquemeter pressure	Faulty overspeed governor	Replace governor
	Faulty fuel control	Replace fuel control
	Faulty indicating system	Check separate indicating systems; repair or replace faulty parts
20. Slow acceleration	Refer to item 17	Refer to item 17
	Faulty fuel control	Replace fuel control
	Improperly adjusted fuel control	On T53-L-11/13 engines replace fuel control; on all other engines adjust fuel control
21. Engine surge during acceleration	ENGINE GOV switch in EMER position, or transfer solenoid faulty	Refer to item 9

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
	Fuel control faulty or not correctly adjusted	Adjust or replace fuel control
	Interstage airbleed malfunction	Check operation. Clear any restriction in air lines. Replace faulty units
	Improper inlet guide vane operation (T53-L-13)	Check inlet guide vane operation
22. Low torquemeter indication	Faulty pressure indicator or transmitter	Check by using direct reading pressure gages at torquemeter and vent connections on engine. Replace faulty units.
	Low nI speed	Refer to item 12
	B Low torquemeter boost oil pump pressure	Check and adjust torquemeter boost oil pump pressure, by instructions for oil system
	Damaged torquemeter sealing ring	Internal inspection and repair of engine reduction gear section
	Improper inlet guide vane operation on T53-L-13	Check inlet guide vane operation.
23. High torquemeter indication	Faulty pressure transmitter or indicator	Refer to item 22.
	B Torquemeter valve fails to close	Check torquemeter valve as follows. Remove plug at front of overspeed governor and tachometer drive gearbox. Install fitting, P/N AN919-4D, into torquemeter booster pressure port. Disconnect pressure line at torquemeter transmitter. Apply 100 psi air pressure to installed fitting. No air flow will indicate that valve is functioning properly. If flow is observed, apply 100 psi air pressure to fitting at torquemeter transmitter port on inlet housing. This should free any foreign object and permit valve to close. Apply air pressure alternately to torquemeter booster pump port and torquemeter transmitter port until valve seats properly.
	High nI speed	Refer to item 11.
	Main drive shaft binding	Align drive shaft
	Faulty fuel control	Replace fuel control.
24. Torquemeter response slow	Clogged torquemeter filter	Remove and clean filter
25. No oil pressure	Loose hose connections	Check oil system for leaks
	Oil tank empty or shut-off valve closed	Fill tank. Test valve operation, replace if faulty

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
	Faulty oil pressure gage system	Try direct reading gage at pressure tap on engine oil filter. If pressure is indicated, repair circuit or replace units of gage system
	Oil pump coupling sheared	Replace pump coupling
26. Low oil pressure	Low oil level	Service tank
	Faulty oil pressure gage system	Refer to item 25
	Clogged oil filter	Clean filter
	Oil pump inlet fitting incorrectly installed	Install fitting correctly
	Oil pump relief valve setting wrong	Adjust oil pressure, or replace faulty pump
27. High oil pressure	Faulty oil pressure gage system	Refer to item 25
	Oil pressure lines restricted	Check lines for restrictions
	Clogged oil filter, bypass valve open	Clean filter
	Oil pump relief valve setting wrong	Adjust oil pressure, or replace faulty pump
28. High oil temperature	Low oil supply	Fill tank
	Oil cooler blower inoperative	Repair or replace faulty air line or blower
	Obstructed or faulty cooler or thermal valve	Clear oil cooler air flow. Replace faulty cooler or valve
	Restriction in oil system	Clean oil filter and check all lines for restrictions
29. Excessive oil consumption.	a. Excessive oil in aircraft oil tank.	a. Drain to proper level. Refer to airframe manual.
	b. Seals, fittings and lines	b. Tighten or replace fittings or lines. Replacement of internal seals will be required of overhaul.
	c. Output shaft seal damaged.	c. Replace output shaft seal. Request assistance from field maintenance.
	d. Number one main bearing seal leaking.	d. Check for indications of oil leakage on inlet guide vanes, compressor bleed band holes, or mating surfaces of compressor housings. If evident, engine shall be forwarded to overhaul for seal replacement.

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
	e. Number three main bearing seal leaking.	e. Check for smoke from tailpipe and oil stains on rear face of power turbine disc. Replacement of the second stage turbine rotor seal is required, if such indications are evident. Request assistance from field maintenance.
	f. Cracked pressure or scavenge oil tubes in oil diffuser.	Brazing at tubes will be required.
	g. Number two bearing aft seal leaking. Request assistance from field maintenance. Check for smoke from tailpipe and oil stains on the forward face of first turbine rotor and curl. Replacement of seal is necessary if such indications are evident.	
	h. Cracked pressure or scavenge oil tubes in air diffuser. Indications are same as (f), above. Brazing of tubes will be required. Request assistance from field maintenance.	
29A. Lubrication Contamination	An excessive amount of chips are found in the engine oil filter element and/or chip detector (output reduction gear and carrier assembly remains free).	a. Remove chips from oil filter element and retain for analysis. Clean filter elements and reinstall. b. Drain all oil from the accessory drive gearbox and the airframe oil tank and oil cooler. c. Remove chips, if any, from chip detector and retain for analysis. Clean chip detector and reinstall. d. Remove and inspect lubrication system strainers (for numbers 2, 3, and 4 bearings). If any chips are present, forward engine to overhaul. e. Inspect scavenge hose assemblies to determine if the hose assemblies, or residual oil in the hose assemblies, are visually contaminated with chips. If so, request assistance from Direct Support Maintenance for bearing replacement. If no contamination is found, proceed with step f.

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
		f. Replenish the airframe oil tank to capacity with new oil. g. Start engine and run at flight idle until temperatures have stabilized. Check the instruments for proper engine operation. ***Caution*** Any fluctuation in oil pressure in excess of plus or minus five psi, or rise in oil temperature above the established limits at any preset power setting, is cause for immediate engine shutdown. h. Shut down engine and again inspect oil filter elements, chip detector, and strainers. i. If the quantity of chips remains the same after the second engine run, forward the engine to next higher maintenance echelon for additional inspection. ***Note*** Chips in filter may come from tank, chips on chip detector come from engine.
30. Engine fails to shut-off	Faulty fuel system control circuits	Check operation of circuits, replace faulty switches or units
31. Coastdown noisy	Internal binding	Motor engine to check for noise and signs of binding. Refer to item 2.

1. Support Spring
2. Bipod
3. Pillow Block
4. Latching Eyebolt
5. Bearing
6. Trunnion
7. Bearing Cap
8. Bellcrank Bracket
9. Rear Firewall Brace Rods
10. Tripod
11. Support Tube
12. Forward Mount Fitting (UH-1A)
13. Forward Mount Fitting (UH-1B)
14. Cambox Bracket (UH-1B)

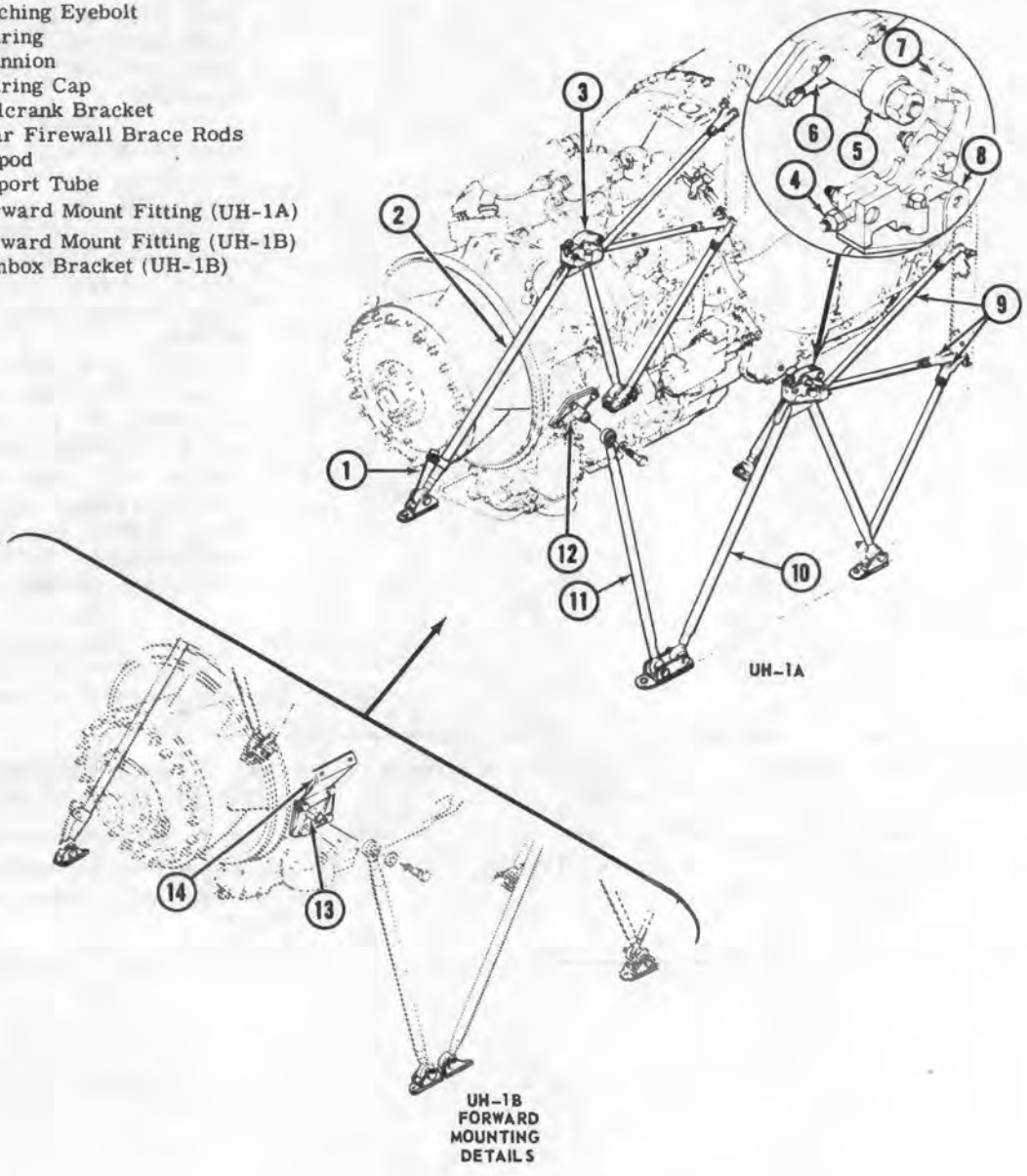

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Figure 5-10. Engine mounts

Table 2-3. Engine differences

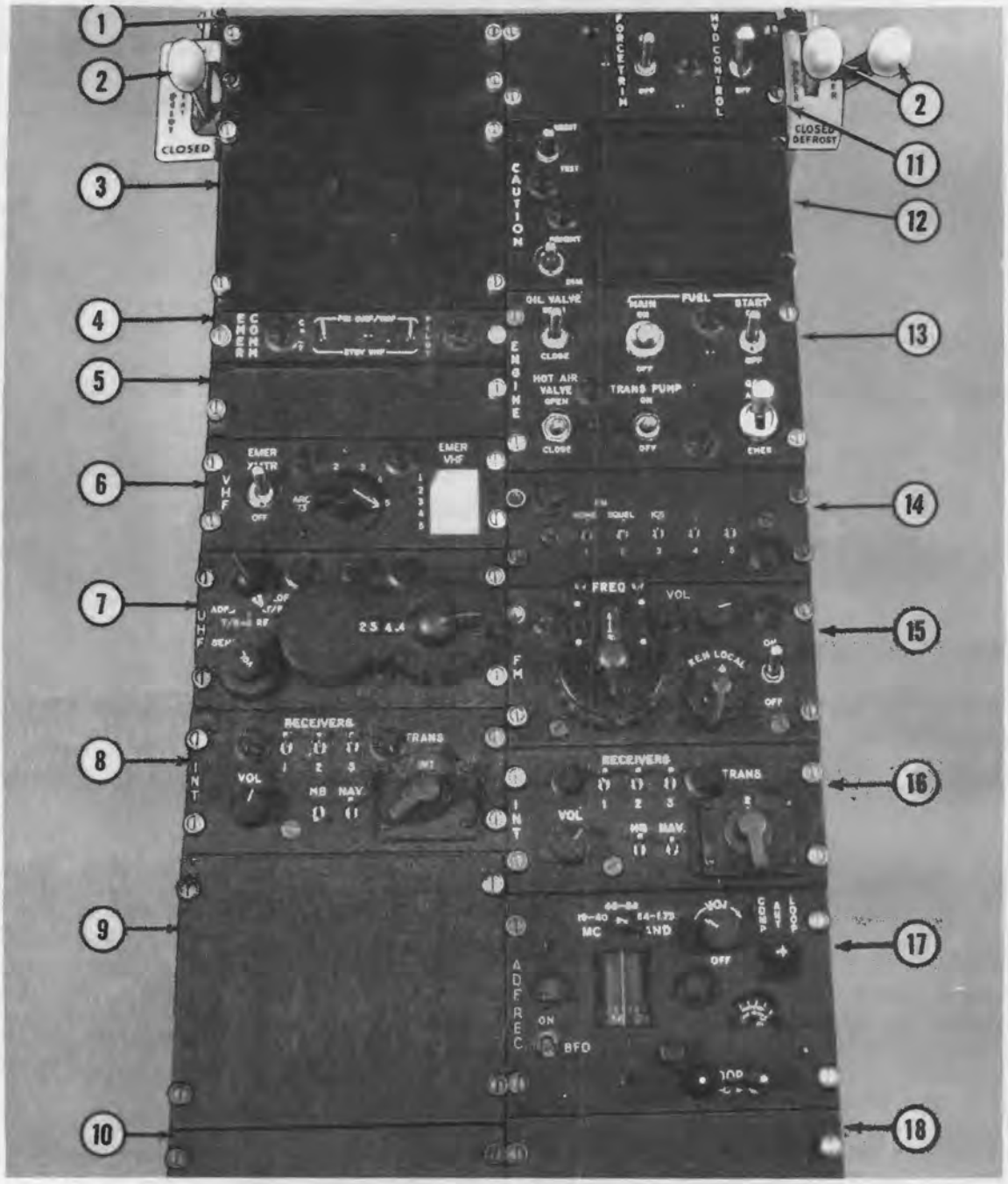
MILITARY DESIGNATION	T53-L-1A	T53-L-5	T53-L-9	T53-L-9A	T53-L-11
Bell Application	UH-1A	UH-1B	UH-1B	UH-1B	UH-1B
SHP, T/O (Min)		960	1100	1100	1100
SHP, Military (Min)	860	900	1000	1000	1000
SHP, Normal Rated (Min)	770	825	900	900	900
Dry Weight	484	487	485	490	505
Acceleration, 60% to 90% nI	5 Sec (Max)	5 Sec (Max)	5 Sec (Max)	5 Sec (Max)	4 Sec (Max)
Combustor	Scoops Uncoated	Scoops Uncoated	Scoops Coated	Scoops Coated	Scoopless Uncoated
Customer Air Extraction	Compressor	Compressor	Compressor	Diffuser	Diffuser

assembly and functions to reduce the fuel flow when power turbine speed (nII) exceeds the selected rpm.

2-15. *Fuel Control System Operation.* Fuel flow control is accomplished by operation of switches located on the pedestal-mounted ENGINE control panel (See figure 2-3). The panel contains two FUEL switches (MAIN ON/OFF and START ON/OFF), two INT FUEL TRANS PUMP switches (LEFT/OFF and RIGHT/OFF), and a GOV AUTO/EMER switch. The engine fuel and power control system permits the pilot to obtain maximum performance from the engine with a minimum of attention.

2-16. *Emergency Fuel Flow.* The switchover to emergency fuel flow is accomplished by retarding the power control (throttle) to flight idle, moving the GOV AUTO/EMER switch on the ENGINE panel to EMER, and then advancing the power control to operational rpm. The emergency control manually meters fuel to the engine without the incorporation of any automatic features. It is possible to fly the helicopter by utilizing smooth, coordinated use of the rotating power control. When operating on emergency control, it is possible to overspeed the gas producer turbine and the power turbine, and to exceed redline tailpipe temperature.

2-17. *Power Control (Throttle).* The rotating griptype power controls (See figure 2-4) are located on the collective pitch control levers (pilot and copilot). The power control is a simple single throttle grip which is used for starting engine, adjusting to flight idle, autorotational landings, and in full decrease serves as idle cutoff. The throttle grip is rotated to the left to increase or to the right to decrease power. Friction can be induced into the throttle grip by rotating the ring at the upper end of the throttle grip. Rotating the ring to the left increases friction in the system and prevents



1. Cover Plate
2. Manual Heater Control
3. Cover Plate
4. Emergency Communication Panel
5. Cover Plate VHF Navigation Control Panel
6. VHF Control Panel (Emergency)
7. UHF Transceiver Panel
8. Signal Distribution Panel
9. Cover Plate
10. Cover Plate
11. Hydraulic Control Panel
12. Caution Panel
13. Engine Control Panel
14. Switch Panel Assembly - AN/ARC-44
15. FM AN/ARC-44 Control Panel
16. Signal Distribution Panel
17. ADF Receiver Panel
18. Cover Plate

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Figure 2-3. Pedestal panels installation – Typical

grip creepage during long flights. A 28-volt DC powered solenoid-operated idle detent is incorporated in the throttle to prevent inadvertent closing of the throttle during flight or ground run. To bypass the idle detent, depress and hold the engine idle release switch until gas producer speed of 40 to 44 percent rpm is obtained, then release switch and close throttle. The idle detent limits only the decrease rotation of the rotating grip. Under normal flight conditions the power plant free power turbine rpm speed is controlled by the power turbine speed governor. The gas producer speed governor safeguards the engine against overloading: and on acceleration and deceleration, the control prevents engine damage or combustion blowout due to sudden changes in power selection made at any rate and in any sequence.

2-18. *Starter-Ignition System.* Combination starter-ignition trigger-actuated snap switches (figure 2-4) (pilot and copilot) are mounted on the undersides of the collective pitch control lever switch boxes. Both the starter and ignition unit circuits are wired to these trigger switches, as the engine ignition will only be required while accomplishing engine starts.

2-19. *Power Supply.* The circuits are supplied power from the 28-volt DC essential bus. The starter circuit is actuated when the STARTER/GEN switch is in START position and the trigger switch (figure 2-4) is pulled. The ignition circuit is actuated when the FUEL MAIN ON/OFF switch on the ENGINE control panel is ON and the trigger switch is pulled.

2-20. *Governor RPM Switch.* The GOV RPM INCR/DECR switch is mounted in a switch box attached to the end of the collective pitch control lever (figure 2-4). The switch is a three-position momentary type and is held up in INCR position to increase the power turbine (nII) speed or down to DECR position to decrease the power turbine (nII) speed. Regulated power turbine speed may be adjusted in flight, through the operating range of 6000 to 6700 rpm, by movement of the switch as required. Electrical power for circuit operation is supplied by the 28-volt DC essential bus.

2-21. *Droop Compensator.* A droop compensator is installed on the governor control to maintain nII speed, as power is increased, to the rpm value selected by the pilot. (Refer to Chapter 9.) Governor droop should not be confused with rpm variations due to the acceleration-deceleration limiters (transient droop), or exceeding maximum power limits. Rapid movements of the collective control stick may require power changes at a rate in excess of the capabilities of the engine.

2-22. *Engine Idle Release Switch.* The ENGINE IDLE REL switch (figure 2-4) is pushbutton momentary-on type switch mounted in a switch box attached to the end of the collective pitch control lever. The pushbutton switch operates on electrical solenoid with a retractable plunger. The solenoid is mounted so that the plunger acts as a stop in the power control system linkage. The stop prevents the pilot from accidentally retarding the power control beyond the flight idle position. This acts as a safety feature by preventing inadvertent engine shutdown. The switch need not be depressed when performing an engine start or runup; however, the switch must be depressed when accomplishing an engine shutdown or when it is desired to retard the power control below the flight idle position. Electrical power for circuit operation is supplied by the 28-volt DC essential bus. Circuit protection is provided by IDLE STOP REL circuit breaker on the DC circuit breaker panel (See figure 2-12.)

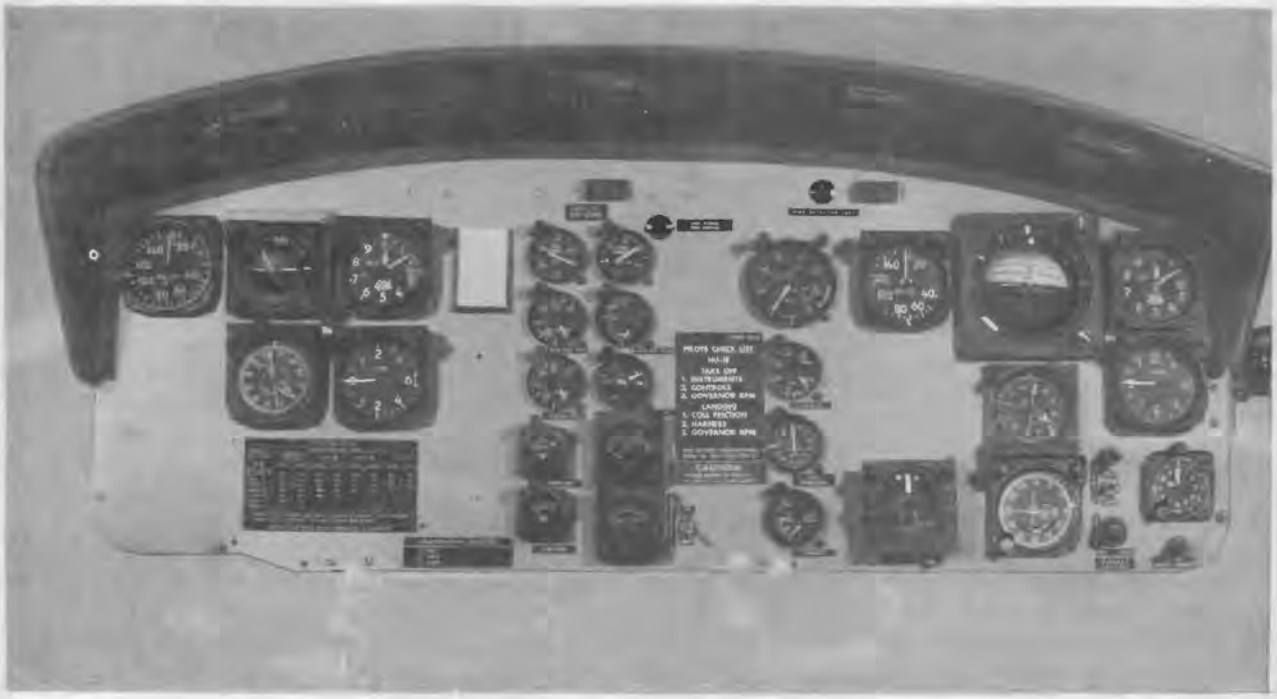
2-23. *Engine Instruments and Indicators.* All engine instruments and indicators are mounted in the instrument panel (see figure 2-5). The engine instruments and indicators consist of the following: torquemeter, exhaust gas temperature indicator, dual tachometer, gas producer tachometer indicator, engine oil pressure indicator, engine oil pressure low caution light, engine oil temperature indicator, fuel quantity indicator, fuel gage test switch, fuel quantity caution light, fuel pressure indicator, and engine fuel pump caution light.

2-24. *Torquemeter.* A low pressure torquemeter indicator is located on the instrument panel (see figure 2-5) and is connected to a transmitter which is part of the engine oil system. The torquemeter indicates torque pressure in psi readings of the torque imposed upon the engine output shaft. The torquemeter circuit is powered by 28 volts ac and is protected by a circuit breaker located on the ac circuit breaker panel mounted on the right side of the pedestal. (See figure 2-13.)

Note

To convert torque pressure to horsepower multiply Torque X nII rpm X 0.00352.

2-25. *Exhaust Temperature Gage.* An exhaust temperature gage (see figure 2-5) is located



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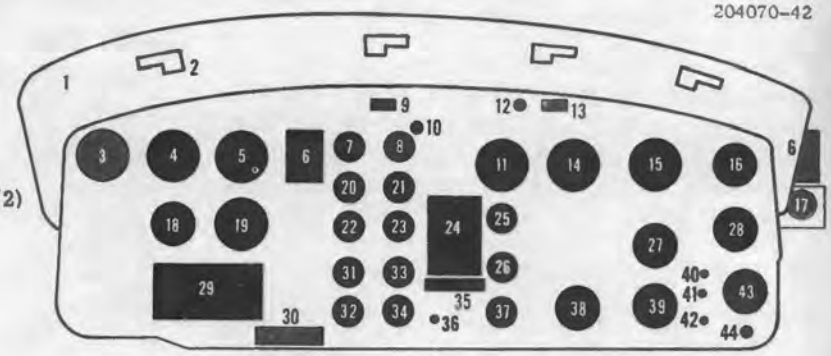


1. Glare Shield
2. Secondary Lights (4)
3. Airspeed Indicator
4. Attitude Indicator
5. Altimeter
6. Compass Correction Card Holder (2)
7. Fuel Pressure Indicator
8. Fuel Quantity Indicator
9. Master Caution Light
10. Fuel Gage Test Switch
11. Dual Tachometer
12. Fire Detector Test Switch
13. Fire Warning Indicator Light
14. Airspeed Indicator
15. Attitude Indicator
16. Altimeter
17. Standby Compass
18. Radio Magnetic Compass Indicator
19. Vertical Velocity Indicator
20. Engine Oil Pressure Indicator
21. Engine Oil Temperature Indicator
22. Transmission Oil Pressure Indicator
23. Transmission Oil Temperature Indicator
24. Pilot's Check List
25. Torque Meter
26. Gas Producer Tachometer
27. Radio Magnetic Compass Indicator
28. Vertical Velocity Indicator
29. Operating Limits Decal
30. Transmitter Selector Decal
31. Loadmeter - Main Generator
32. Loadmeter - Standby Generator
33. DC Voltmeter
34. AC Voltmeter
35. Engine Caution Panel
36. Compass Slaving Switch
37. Exhaust Temperature Indicator
38. Turn and Slip Indicator
39. Omni Indicator
40. Marker Beacon Light
41. Sensing Switch - Marker Beacon
42. Volume Control - Marker Beacon
43. Clock
44. Cargo Release Armed Light

Figure 2–5. Instrument panel – typical (UH-1B)

5-31. *Engine Over-Limits Conditions.* a. In any case where engine is operated over normal limits, be sure exact circumstances are recorded properly on DA Form 2408-13 (Pilot's and Mechanic's Remarks column).

b. Notify proper authority to initiate action for special inspections, when required, to be accomplished by qualified personnel.

c. Fuel specified for normal use for each engine model is designated in fuel servicing instructions. (Refer to paragraph 1-71.) For alternate and emergency fuels refer to TM 55-1520-211-10 and TB AVN 2.

5-32. Engine Mounts. (See figure 5-10.) Engine is suspended at three points by supports made of steel tubing which are attached to fittings on service deck. Bipod at right and tripod at left have pillow blocks with hinged caps to hold bearings of two trunnion fittings installed on mounting pads at each side of engine diffuser housing. Left pillow block has a bracket for a bellcrank in power lever control system, and rear firewall brace rods attach on pillow blocks and aft deck fittings. A forward support tube is bolted to a trunnion fitting on left side of engine inlet housing. On UH-1A forward support tube and front leg of tripod are on a single deck fitting; on UH-1B, two separate deck fittings are provided at this location. On both models, a flat spring is installed to hold bipod upright when engine is removed.

5-33. *Inspection — Engine Mounts.* a. Inspect engine mount adapters for security, cracks and general condition.

b. Inspect all support arms, brace rods, bipod and tripod assemblies for bent, cracked or damaged tubes. Inspect rod end bearings and end fittings for suitability for continued service.

c. Inspect shock mounts for deterioration and separation. Inspect housing and retainer nut for damaged threads.

d. Inspect engine mount trunnion for security and scored or damaged shaft. Check trunnion bearing assembly for suitability for continued service. Inspect trunnion bearing cap and bellcrank bracket for security and damage.

e. Inspect all engine floor mount attaching brackets and all fittings for security, cracks and general condition.

f. Inspect aft trunnion bearing (5, figure 5-10) and upper rod-end bearing on forward support tube (11) for maximum allowable radial wear of 0.003 inch and maximum allowable axial wear of 0.006 inch.

5-33A. *Repair or Replacement — Engine Mounts.* Replace all parts which do not meet inspection requirements. (Refer to paragraph 5-33.)

B H 5-33B. Variable Inlet Guide Vane System. T53-L-13 engine is equipped with variable inlet guide vanes which change the angle of incidence between inlet air and the first compressor rotor blades to maintain the air flow requirements of the compressor rotor assembly. At zero to 75 percent nI speed, the vanes are at minimum-open position. Opening starts to increase at 75 percent nI speed, with full open position reached at 90 percent nI speed. The vanes are positioned by the inlet guide vane actuator through a synchronizing ring. The actuator is positioned by a pilot valve located in the fuel control. This valve responds to nI speed and compressor inlet temperature. While making the desired motion to the guide vanes, the actuator relays its position back to the fuel control through an external control rod. This action nullifies the fuel out pressure signal so that at any steady-state nI speed between 75 to 90 percent the inlet guide vanes assume a constant position.

B H 5-33C. *Operational Check — Variable Inlet Guide Vane System.* (Information not available.)

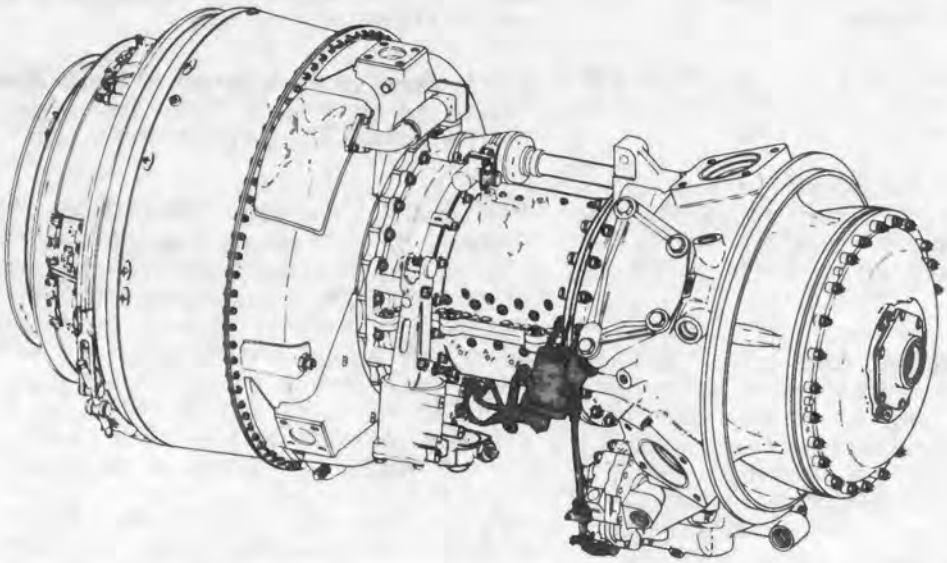
B H 5-33D. *Removal — Inlet Guide Vane Actuator.* a. Remove cotter pin (1, figure 5-10A), nut (2), bolts (3 and 4) and washers (5, 6 and 7). Remove tube assembly (8).

b. Cut lockwire and loosen locknut (9). Unscrew bearing (10) from connector.

c. Disconnect three hose assemblies (11) from actuator assembly (12). Cap or cover hoses and ports in actuator to prevent entrance of foreign matter.

d. Cut lockwire and remove nuts (13), bolts (14), support (15) and spacer (16). Carefully remove actuator (12) from engine.

B H 5-33E. *Cleaning — Inlet Guide Vane Actuator.* Clean actuator and all removed parts with dry cleaning solvent (item 302, table 1-1).



1. Cotter Pin
2. Nut
3. Bolt
4. Bolt
5. Washer
6. Washer
7. Washer
8. Tube Assembly
9. Lock Nut
10. Bearing
11. Hose Assemblies
12. Actuator Assembly
13. Nuts
14. Bolts
15. Support
16. Spacer

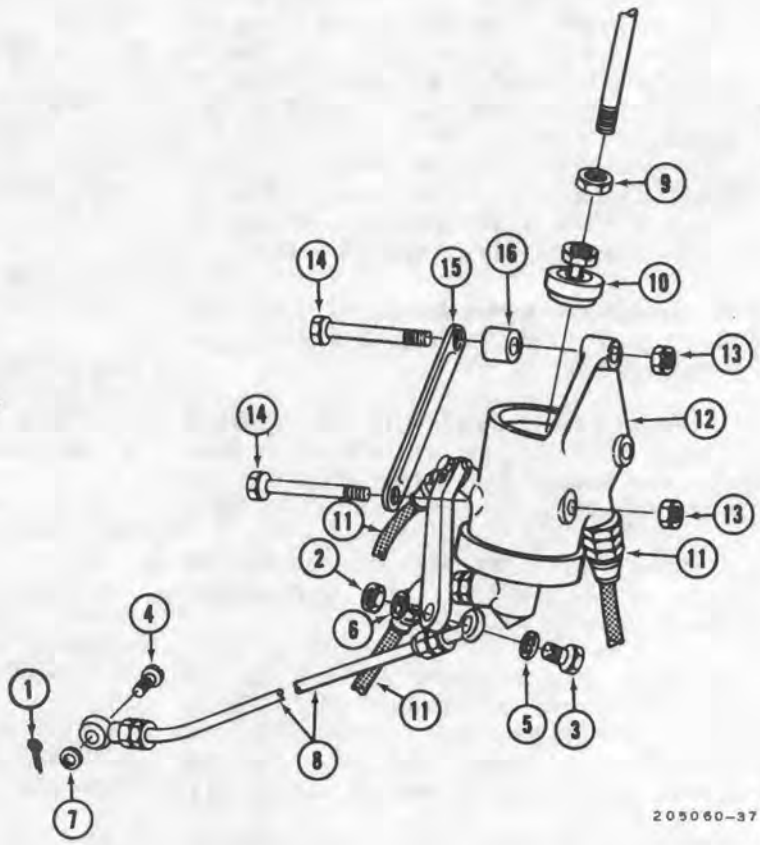


Figure 5-10A. Inlet guide vane actuator assembly

B 13 **5-33F. *Inspection — Inlet Guide Vane Actuator.*** a. Inspect threaded parts for damaged or stripped threads.

b. Inspect actuator for cracked flanges.

B 13 **5-33G. *Repair or Replacement—Inlet Guide Vane Actuator.*** Replace all parts that do not meet inspection requirements. (Refer to paragraph 5-33F.)

B 13 **5-33H. *Installation — Inlet Guide Vane Actuator.*** a. Position actuator (12, figure 5-10A) on rear flange of inlet housing and install attaching spacer (16), support (15), bolts (14) and nuts (13). Tighten nuts and lockwire.

b. Install bearing (10) on connector. Hold actuator full open and adjust bearing until open mark on connector aligns with scribe mark on indicator plate. Tighten nut as necessary and secure with locknut (9).

c. Uncap or uncover hoses and ports in actuator. Connect hose assemblies (11) to actuator (12).

d. Position tube assembly (8) under engine and connect to actuator (12) with bolts (3 and 4), washers (5, 6 and 7), nut (2) and cotter pin (1).

e. Hold actuator (12) in full open position and adjust tube assembly (8) rod ends until fuel control lever indicator aligns with OPEN position on fuel control indicator plate.

Note

When adjusting rod ends, a mirror must be used to observe fuel control indicator plate.

f. Tighten and lockwire rod end nuts.

g. Perform operational check. (Refer to paragraph 5-33C.)

B **5-34. Interstage Airbleed System — UH-1B.** On UH-1B an interstage airbleed system is provided on the engine to aid acceleration of compressor rotor by automatic release of some compressed air through bleed holes around exit end of axial compressor housing. A bleed band over these holes is operated by a piston-type actuator, spring-loaded to open position. Closing of band occurs when air pressure taken from engine diffuser, is applied to actuator piston.

B 5-35. On T53-L-5/9/9A engines, the airbleed actuator is controlled by a valve assembly which senses the ratio of compressor discharge air pressure to inlet air pressure, through hoses connected to the diffuser and to the inlet housing. (See figures 5-11 and 5-11A.) With this system, bleed band is open during start and acceleration until approximately 74 percent nI rpm is reached. At this point, the bleed band closes tightly over bleed holes and remains closed during operation at higher power settings.

B 5-36. On T53-L-11/13 engines, the airbleed actuator incorporates a relay valve with an air pressure connection to the diffuser housing and a sensing connection to a controlling valve in the engine fuel control assembly. (See figure 5-12.) In T53-L-11 system the bleed band is open not only at speeds below approximately 70 percent nI rpm, but also in response to transient acceleration demands at higher speeds, as directed by sensors in the engine fuel control assembly. On T53-L-13 engine, the bleed band will be closed at all steady-state nI rotor speeds above 77 to 80 percent and open during all decelerations and at nI rotor speeds below 77 to 80 percent at standard sea level conditions as directed by the sensors in the fuel control.

B 13 5-36A. On the T53-L-13 engine the interstage air bleed actuator is mounted on the right side of the compressor housing assembly. Air pressure for operation of the actuator is obtained from a bleed port at the right side of the diffuser housing. The actuator is controlled by a signal from the fuel control assembly.

B 11 B 13 **5-37. *Operational Check of Interstage Airbleed on T53-L-11/13 Engine.*** Whenever a fuel control or an airbleed actuator has been replaced on a T53-L-11 or -13 engine, perform this procedure to determine proper opening and closing operation of bleed band.

Note

Comparable procedures for T53-L-5/9/9A engines are not performed in Organizational Maintenance.

a. Start engine and stabilize at flight idle.

b. Advance throttle twist-grip gradually until bleed band is seen to close by an observer stationed near engine. Note speed at which closing occurs. Closing shall not occur before 70 percent nI rpm.

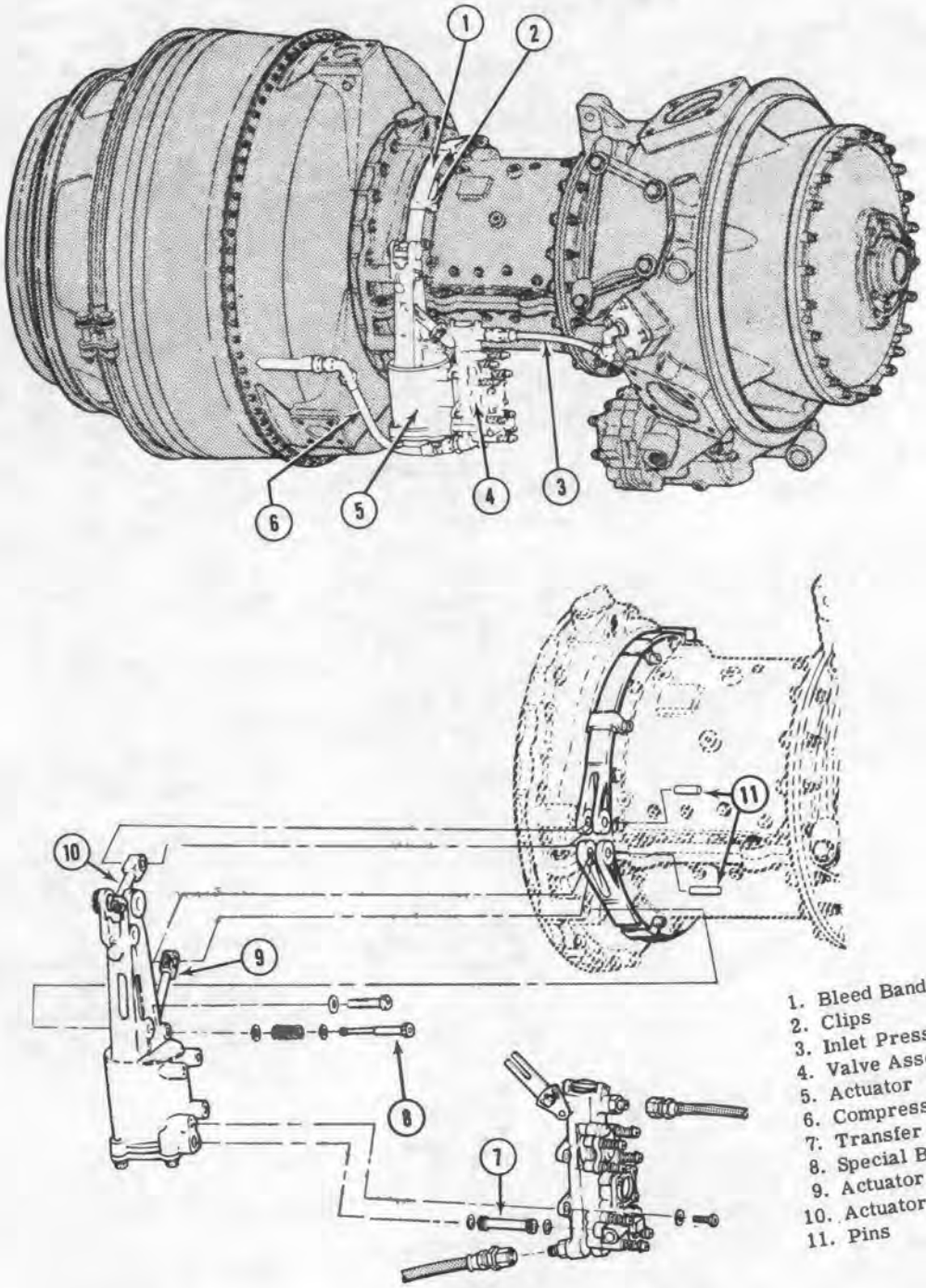


Figure 5-11. Interstage airbleed system — T53-L-5/9/9A engines

1. Airbleed Valve Assembly
2. Packing
3. Strainer
4. Dirt Cover
5. Screw

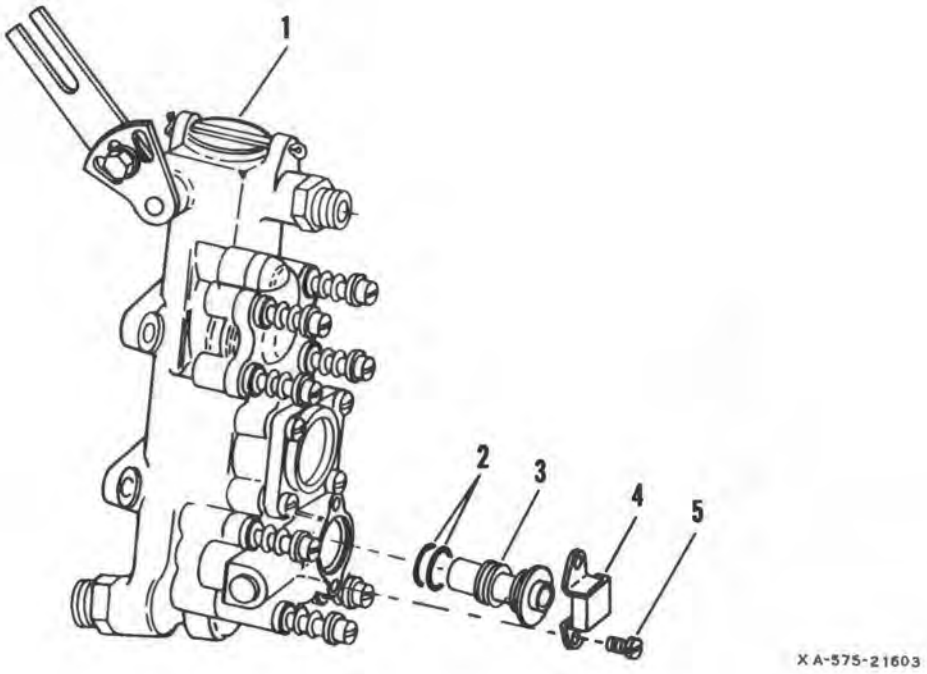
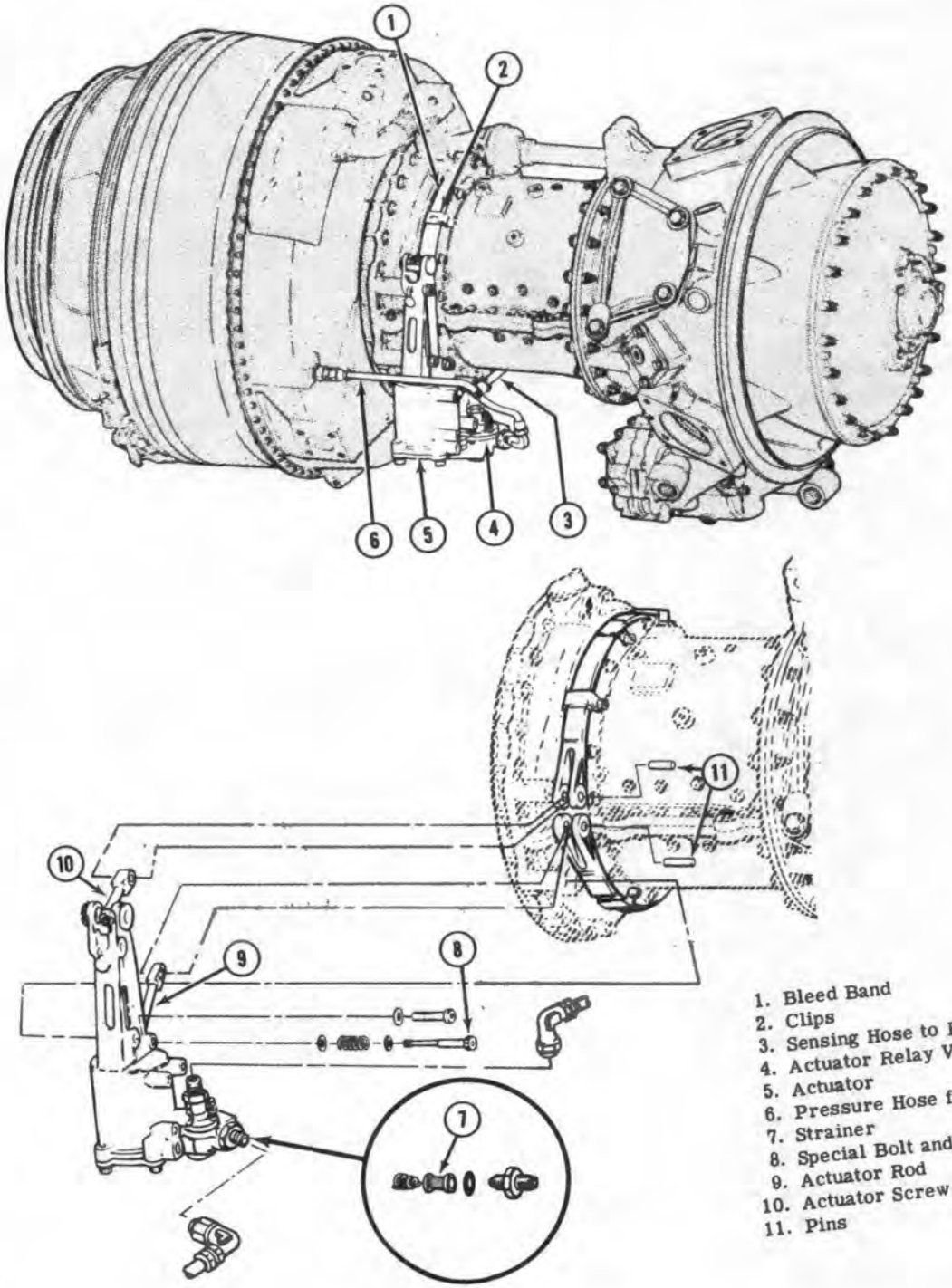


Figure 5-11A. Airbleed valve assembly — T53-L-5/-9/-9A



1. Bleed Band
2. Clips
3. Sensing Hose to Fuel Control
4. Actuator Relay Valve
5. Actuator
6. Pressure Hose from Diffuser
7. Strainer
8. Special Bolt and Spring
9. Actuator Rod
10. Actuator Screw
11. Pins

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Figure 5-12. Interstage airbleed system — T53-L-11 engine

Note

If throttle control movement is too rapid, fuel control will sense acceleration and will delay bleed band closing to a higher nI rpm.

c. Be sure bleed band is closed, then rapidly accelerate (jam throttle) to obtain 80 percent nI rpm. Observe that bleed band opens during acceleration, then closes when speed is stabilized.

d. Return throttle very slowly until bleed band opens. Note nI speed at which band opens. This shall be within 2 to 8 percent of speed at which band closed during acceleration. (See figure 5-13) Example: During deceleration on a 40°F day, bleed band should not open before 70.5 percent, but must open before 64.5 percent nI rpm.

Note

If throttle movement is too rapid, the fuel control will sense a deceleration and will delay bleed band opening to a lower nI speed.

e. If bleed band does not operate within specified limits, proceed with corrective action as required, in the following sequence:

(1) Disconnect compressor pressure hose line from airbleed actuator. Check that line is free from restrictions. Blow dry, filtered compressed air through line to be sure that port in diffuser is clear. Remove strainer 7 (see figure 5-12) and clean with dry cleaning solvent (item 302, table 1-1). Reinstall strainer and reconnect hose. Repeat steps a. through d.

(2) Disconnect fuel control sensing hose (3) from actuator. Check hose for restrictions. With hose connected to fuel control, blow air through line to determine that air is bled off through fuel control without restrictions. Reconnect hose. Repeat steps a. through d.

Note

Be sure all connections are tight.

(3) If trouble still exists, replace airbleed actuator. Repeat steps a. through d.

(4) If further corrective action is necessary, fuel control will be replaced. Repeat steps a. through d. to determine that bleed band operates normally.

B 5-38. ***Removal — Airbleed Assemblies.*** a. Open engine cowling.

b. Disconnect and remove both hoses from interstage airbleed assembly. Cap open fittings and hoses.

(1) On T53-L-5/9/9A engines, disconnect hoses from unions on airbleed valve assembly, from elbow on inlet housing, and from union on diffuser housing. (See figure 5-11.)

(2) On T53-L-11/13 engines, disconnect pressure hose between engine diffuser and airbleed actuator, and sensing hose between actuator and fuel control (See figure 5-12.)

c. If necessary to remove airbleed valve assembly separately on T53-L-5/9/9A engine, support the valve assembly (4, figure 5-11) while removing four bolts and washers which secure it to actuator (5). Carefully remove valve, transfer tube (7) and packings.

d. Support the actuator. Remove two bolts and washers at upper and lower outboard attachment points, and remove inboard bolt with washers and spring.

e. Pull actuator outward to expose ends of bleed band connected to actuator rod and screw. Remove two pins to detach bleed band. Remove actuator.

f. Remove nut, washer, and screw to separate two sections of bleed band. Remove band by sliding each section out through clips.

B 5-39. ***Inspection — Airbleed Assemblies.*** a. Inspect hoses and fittings for deterioration and damage.

b. Inspect airbleed actuator for cracks, nicks, burrs and wear. Inspect springs for distortion and rods for bending. Inspect strainer of air bleed valve assembly for cuts and dents.

c. Inspect teflon tape on upper and lower bleed bands for tears, cuts and separation from bands.

d. Inspect bleed bands for worn or elongated bushings and for bending that may cause improper seating on compressor housing.

e. Inspect screw that joins upper and lower bleed bands to make sure that it can be installed flush with or below the surface of the inside diameter of the bleed band assembly.

B 5-39A. *Cleaning — Airbleed Assemblies.* a. Clean all parts of airbleed valve assembly with dry cleaning solvent (item 302, table 1-1). If necessary use soft bristle brush. (See figures 5-11A and 5-12.)

b. On T53-L-9/9A engines clean strainer in airbleed valve assembly as follows:

(1) Remove screws securing dirt cover (4, figure 5-11A) to valve. Remove dirt cover.

(2) Carefully remove strainer (3) and packings. Discard packings.

(3) Clean parts with solvent (item 302, table 1-1). If necessary, use a soft bristle brush to clean strainer. If strainer is damaged or foreign matter cannot be removed, replace strainer.

(4) Coat new packings with grease (item 11, table 1-1) and install on strainer (3). Carefully install strainer and packings in valve assembly.

(5) Position dirt cover (4) over strainer (3) and secure with screws. Tighten screws 20 to 25 inch-pounds torque.

c. On T53-L-11 and T53-L-13 engines, clean sediment strainer located in actuator under reducer fitting to which diffuser pressure hose connects.

(1) Remove reducer and packing, using care that strainer (7, figure 5-12) is not thrown out by spring action. Remove strainer and spring.

(2) Clean parts with solvent (item 302, table 1-1). Replace packing and any damaged parts.

(3) Place small end of spring on flange of strainer. Insert spring and strainer into port at front of actuator relay valve housing.

(4) Place packing, coated with grease, (item 11, table 1-1). Be sure strainer and spring are properly seated while installing reducer into actuator port.

B 5-40. *Repair or Replacement — Airbleed Assemblies.* a. Replace all hoses, strainers, and fittings unsuitable for continued service.

b. If tape separation occurs on either section, remove tape from both sections to allow use without tape. Proceed as follows:

(1) Loosen end of tape from band with a knife. Grasp end of tape with suitable pliers. Carefully hold band so as to avoid deforming while rolling back tape until removed.

Warning

Use protective garments and avoid prolonged breathing of vapors when using stripping compounds.

(2) Remove epoxy resin adhesive residue from band by applying paste stripping compound, (item 232, table 1-1) or equivalent, with a brush. Allow paste to remain at least 20 minutes or until adhesive has loosened completely.

(3) As an alternate method of removing adhesive, immerse band sections in a stripping solution, (item 324, table 1-1) or equivalent, for 20 minutes or until adhesive is loosened.

(4) Wash band in hot water to remove all residue. Air dry.

(5) After reinstalling airbleed assemblies, adjust for proper fit of bleed band to compressor housing. (Refer to paragraph 5-42.)

c. Replace bleed band assembly if band is damaged.

d. If screw joining upper and lower bleed bands cannot be installed flush with or below the surface of the inside diameter of the bleed band assembly reduce thickness of screw head and height of countersink in lower bleed band. (See figures 5-13A and 5-14.)

B 5-41. *Installation — Airbleed Assemblies.* a. Insert bleed band sections through clips from right side of engine compressor housing. At left side, lap end of upper section over lower section, align holes and insert flathead screw from inside band. Hold screw while installing washer and nut.

Note

Make sure that flathead screw is installed flush with, or below, surface of inside diameter of bleed band assembly.

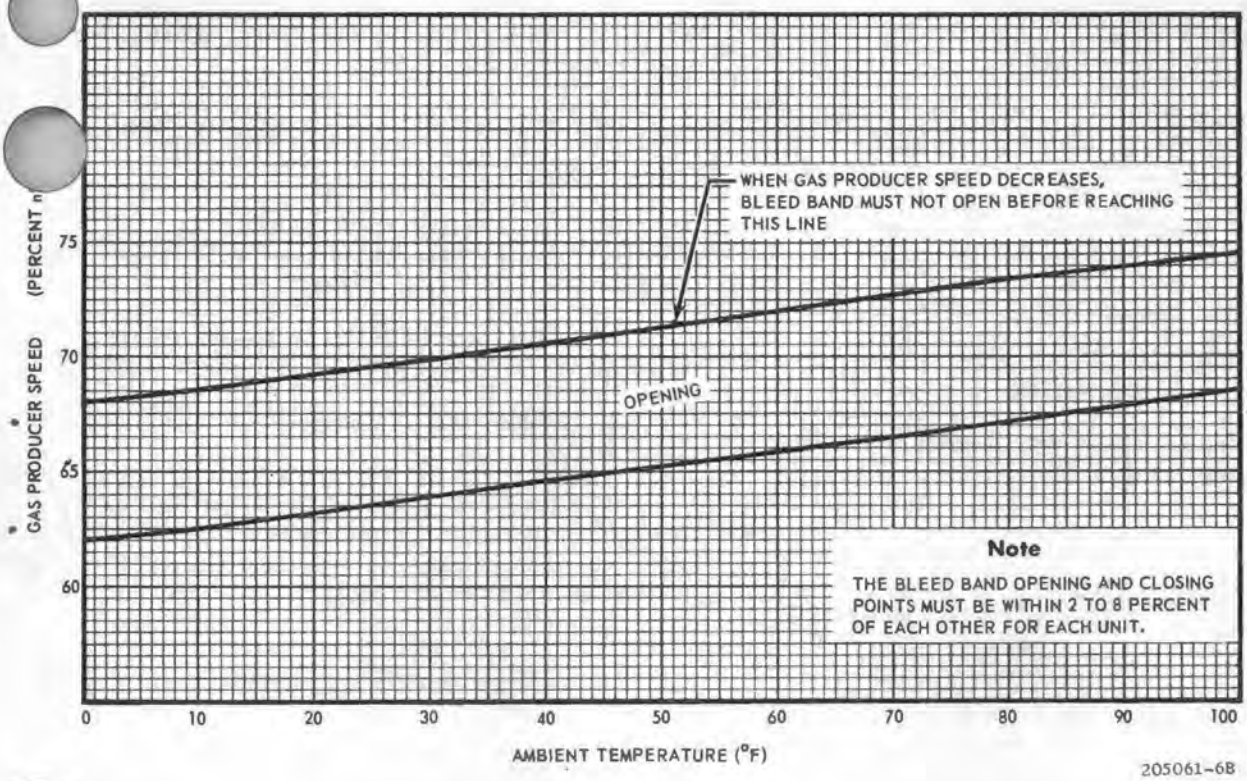


Figure 5-13. Bleed band open — close limits — T53-L-11 engine

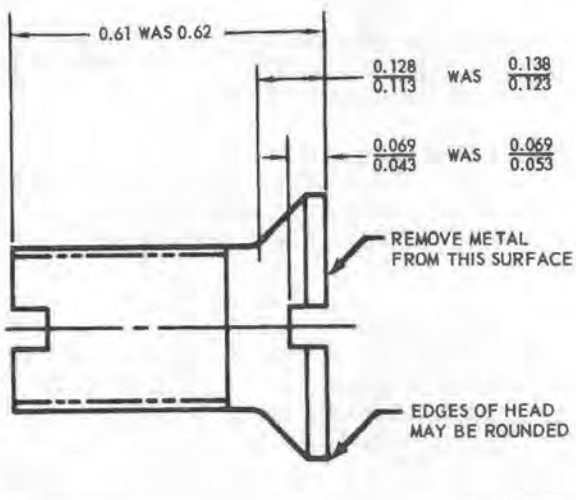


Figure 5-13A. Bleed band screw rework

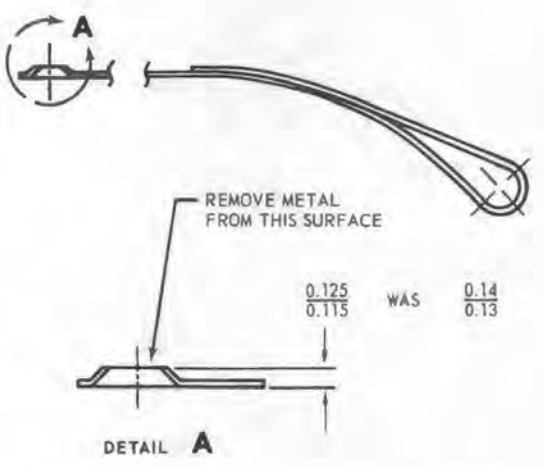


Figure 5-14. Bleed band and screw rework

b. Hold actuator at mounting position while attaching ends of bleed band to actuator rod and actuator screw with pins.

c. Align actuator to mounting bosses, making sure that actuator rod and screw with attached ends of bleed band are properly within actuator housing. Install two bolts, with washers, in lower outboard and upper mounting holes. Finger tighten bolts.

d. Place spring, with a washer at each end, on special bolt and insert in lower inboard mounting hole of actuator. Bottom spring-loaded bolt in tapped hole.

e. Tighten upper and lower outboard bolts. Lockwire all bolt heads.

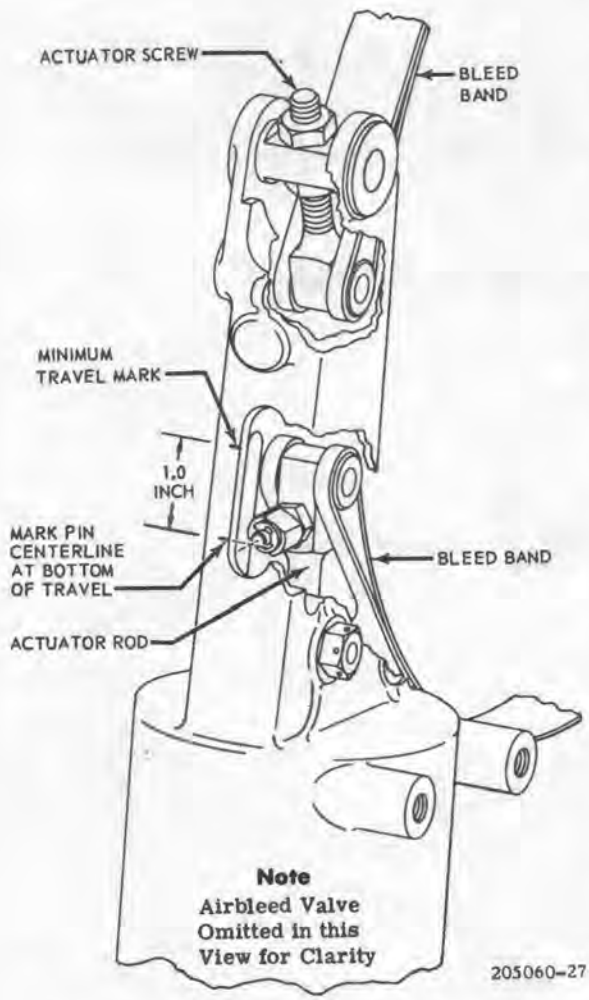


Figure 5-15. Adjusting bleed band (Typical)

f. On T53-L-5/9/9A engine, install airbleed valve assembly (if separated from actuator) and connect hoses as follows:

(1) Place packings on each end of transfer tube (7, figure 5-11) and insert tube into actuator port.

(2) Hold airbleed valve assembly (4) to mounting position against actuator, with transfer tube inserted into valve body.

(3) Guide forked lever of valve onto sleeve of controller drive pin, located on actuator rod.

(4) Secure valve assembly to actuator lockwire bolts.

(5) Connect hose (3) between elbow on engine inlet housing and union on upper front of valve. Connect hose (6) between unions on engine diffuser housing and on lower rear of valve assembly.

g. On T53-L-11/13 engines connect hoses to actuator as follows:

(1) Connect hose (3, figure 5-12) from fitting on rear of fuel control to union on upper side of actuator relay valve (4).

(2) Be sure sediment strainer (7) is installed under reducer at front of actuator relay valve housing. Connect hose (6) from fitting on engine diffuser housing.

h. When a new airbleed actuator is installed on T53-L-11/13 engines, perform an operational check. (Refer to paragraph 5-37.)

B 5-42. *Adjusting Bleed Band.* Travel of airbleed actuator piston rod and tightness of bleed band should be checked and adjusted after any replacement of bleed band or actuator assembly.

a. With engine not operating and piston rod in retracted position, observe piston rod through slot in actuator housing. Place a mark on actuator housing at horizontal center line of controller drive pin (on T53-L-5/9/9A engines) of open tapped hole (on T53-L-11/13 engines). For minimum travel limit place another mark exactly one inch higher. (See figure 5-15.)

b. Disconnect both hoses from airbleed assembly. Connect a source of dry compressed air,

regulated at 35 to 60 (40 on T53-L-13 engine) psig, to fitting that is normally connected to pressure hose from engine diffuser.

c. Back off outer nut to end of actuator screw, leaving at least one full thread showing beyond nut.

d. Actuate piston rod to full travel by placing finger over open upper fitting of airbleed control valve. Check travel of rod to be not less than 1.0 inch nor more than 1.2 inch.

e. Tighten outer nut on actuator screw until bleed band is snug against compressor housing, as indicated by an increase of torque on nut.

f. Release finger from valve fitting. Tighten inner nut on screw.

g. Repeat step d. If rod travel is still within limits, proceed to step j.

h. If rod travel is below 1.0 inch minimum, replace band or actuator assembly, as required, and repeat preceding steps.

i. If rod travel is more than 1.2 inches, continue to tighten outer nut on actuator screw until travel is within limits at 35 to 37 (40 on T53-L-13 engine) psig applied air pressure.

j. Place finger over valve fitting and increase air pressure to 60 psig. (Apply 40 psig on T53-L-13 engine.)

k. Check clearance with a feeler gage between compressor housing and bleed band at each clip and where band sections join. Clearance shall be 0.001 inch loose to 0.002 inch drag fit.

l. Adjust nuts on actuator screw as necessary to obtain required bleed band clearance.

(1) To tighten band, loosen outer nut and tighten inner nut.

(2) To loosen band, loosen inner nut and tighten outer nut.

(3) After last adjustment, be sure opposite nut is tight for locking. Lockwire nuts together.

m. Release pressure and disconnect regulated pressure air hose. Connect engine hoses to airbleed assembly.

5-43. Accessory Drive Gear Box. The accessory drive gear box contains the accessory gear train. It is mounted on the underside of the inlet housing and is driven through bevel gears from the front end of compressor rotor. This gear box also serves as a scavenge oil collector sump, kept practically empty by pump.

Note

On the T53-L-13 engine special tools are required to perform maintenance on the gear box assembly; LTCT100 (Installing tool), LTCT101 (Removal tool), LTCT511 (Installation tool), and LTCT270 (seal installer).

5-44. *Removal — Accessory Drive Gear Box.* a. Disconnect hose assemblies from gearbox.

b. Remove power driven rotary pump.

c. Remove fuel control.

d. Remove starter generator and nI tachometer generator, if installed.

e. Remove three bolts (5, figure 5-16) and washers (4) that secure gearbox support to rear flange of inlet housing assembly.

f. Support gearbox assembly (6) and remove shouldered bolt (8), bolt (9), two bolts (11), and washers (7, 10, and 12).

g. Remove gearbox (6) and drive shaft (1) from inlet housing.

h. Remove packings (2 and 3) from mounting face of gearbox.

i. Remove drive shaft (1), packings (13 and 15), and screen and transfer tube (14) from top of accessory drive gearbox.

Note

If accessory drive gearbox is to be replaced, retain the power driven rotary (oil) pump, oil filter, and chip detector. Remove and retain support for installation.

5-45. *Cleaning — Accessory Drive Gearbox Assembly.* Clean all parts using dry-cleaning solvent (item 302, table 1-1).

5-45A. *Inspection — Accessory Drive Gearbox Assembly.* a. Inspect all parts for damage or excessive wear.

b. Inspect all parts for stripped or damaged threads.

c. Inspect all mounting studs on gearbox cover for looseness.

5-46. *Repair or Replacement — Accessory Drive Gearbox Assembly.* a. Blend repair nicks and burrs. Replace all parts that are cracked, distorted, or excessively worn.

b. Blend repair damaged threads. Request assistance from Direct Support Maintenance for replacement of screw thread inserts.

c. If mounting studs are loose, tighten. If studs cannot be tightened, request assistance from Direct Support Maintenance for replacement of studs.

Note

It is not necessary to remove the accessory drive gearbox from the engine in order to replace seals.

5-47. *Installation — Accessory Drive Gearbox Assembly.* (See figure 5-16.) a. Install packings (13 and 15) on screen and transfer tube (14).

b. Install tube in gearbox (6).

c. Position packings (2 and 3) on mounting face of gearbox.

d. Insert drive shaft (1) into inlet housing and mesh with internal spline of accessory drive gear and support shaft.

1. Accessory Drive Shaft
2. Packing
3. Packing
4. Washer
5. Bolt
6. Accessory Drive Gearbox Assembly
7. Washer
8. Shouldered Bolt
9. Bolt
10. Washer
11. Bolt
12. Washer
13. Packing
14. Screen and Transfer Tube
15. Packing

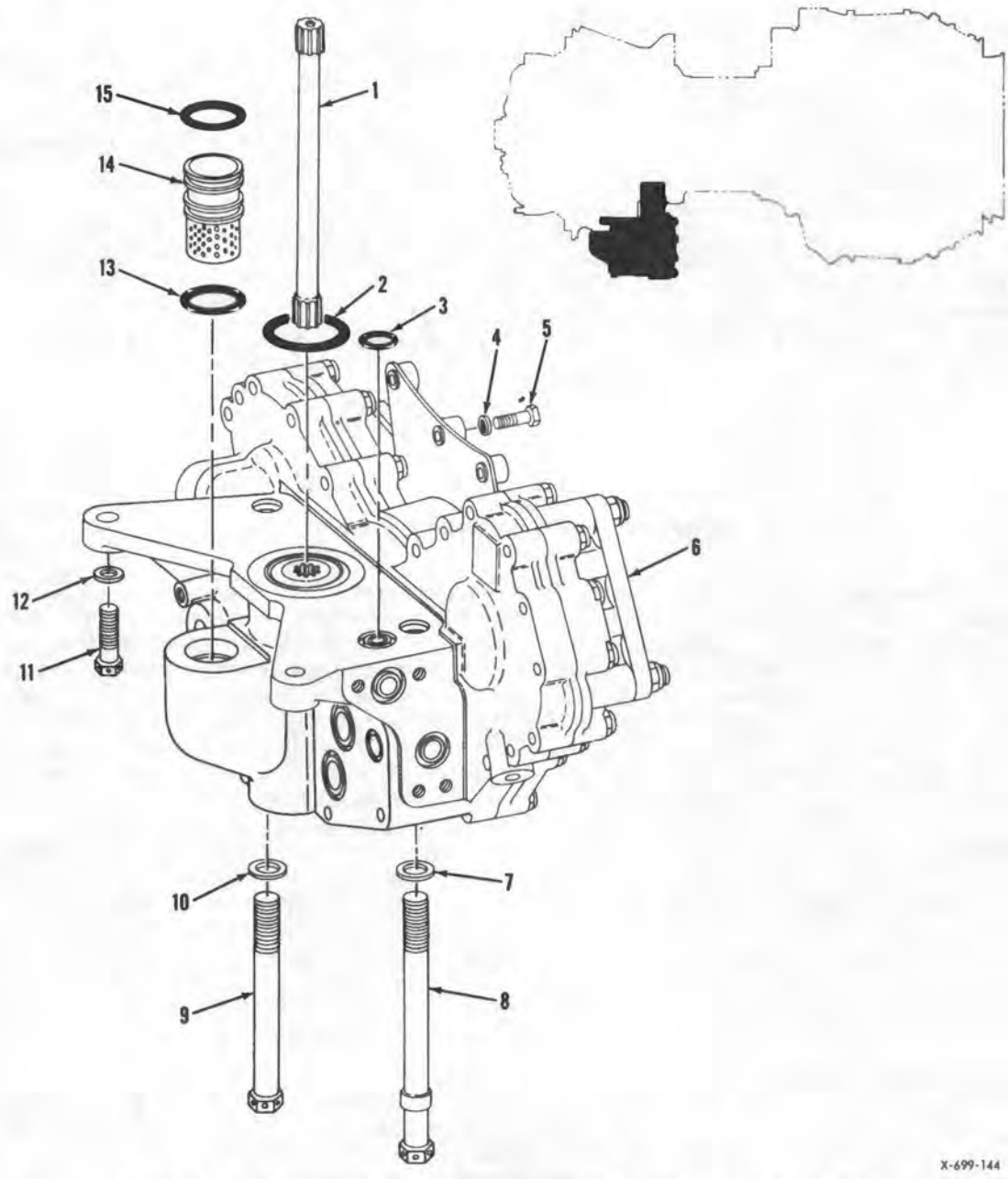


Figure 5-16. Accessory drive gearbox assembly and attaching parts (Typical)

e. Position gearbox on engine, ensuring that drive shaft drops and meshes with gearbox.

f. Carefully raise gearbox, inserting exposed end of drive shaft into inlet housing until the spline meshes with accessory drive gear and the gearbox mates with inlet housing.

g. Place washer (7) on shouldered bolt (8). Insert bolt and finger tighten.

h. Place washer (10) on bolt (9). Insert bolt and finger tighten.

i. Place washers (12) on bolts (11). Insert bolts and finger tighten.

j. Place washers (4) on bolts (5). Insert bolts and finger tighten.

k. Using ¼-inch drive extension and ratchet, turn gearbox tachometer drive gear. Check through inlet housing to ensure that compressor rotor is turning. This indicates proper meshing of drive shaft.

l. Tighten bolts (8 and 9) to 400 to 475 inch-pounds torque.

m. Tighten bolts (11) to 250 to 325 inch-pounds torque.

n. Tighten bolts (5) to 100 to 120 inch-pounds torque.

o. Lockwire bolts.

p. Install starter generator and nI tachometer generator.

q. Install fuel control. (Refer to paragraph 5-254F.)

r. Connect inlet guide vane actuator seal drain hose assembly to adapter fitting on gearbox. Tighten connector as required.

s. Reconnect hose assemblies to accessory drive gearbox assembly.

Section III — Air Induction System

5-48. Air Induction System. (See figure 5-17.) Engine intake air enters through inlets at top of forward cowling into an induction baffle, consisting of panels assembled to form a box partially enclosing area between rear of pylon supports and forward firewall around inlet opening. A ring-shaped intake screen of coarse wire mesh covers front end of an intake bellmouth, which is mounted in central opening of forward firewall and clamped on outer flange of engine inlet housing. A gasketed flange on bellmouth forms a slip-joint seal with firewall. On UH-1A, screen is mounted on front and bellmouth on rear of firewall. On UH-1B, bellmouth extends forward through firewall, has mounting brackets for ice detector, and screen is attached directly on its front end flange.

5-49. *Engine Internal Airflow.* (See figure 5-18.) Air entering engine passes through compressor and is routed to several paths for different uses: (1) Anti-icing air is diverted at exit from centrifugal impeller into an annular chamber in its housing, to flow forward to inlet housing area. (2) Internal cooling and seal pressurization air is supplied from diffuser manifold and directed by baffles, deflectors, and internal passages to cool power shaft, compressor rotor sleeve, both faces of gas producer turbine wheel, and front face of power turbine wheel. This air also is routed to pressurize controlled-gap carbon or positive contact seals which are located behind No. 1 main bearing, at both sides of No. 2 main bearing on compressor rotor, and ahead of No. 3 bearing on power turbine shaft. (3) Main portion of air flow from diffuser manifold surrounds combustion chamber and enters it through a complex pattern of scoops, louvers, slots and holes to combine with fuel in combustion, to act as a flame-fence, and for sufficient cooling to prolong service life of parts.

5-50. Atmospheric air, entering between exhaust diffuser and support cone, passes through hollow struts of exhaust diffuser to cool No. 3 and 4 bearing housing and rear face of power turbine wheel.

g. Place protective cover on tailpipe.

5-59. Exhaust Thermocouples. Three thermocouple probes, on rigid harness with a flexible cable connection to exhaust gas temperature indicator, are inserted into diffuser ahead of tailpipe.

5-60. *Removal — Exhaust Thermocouple.* a. Remove exhaust tailpipe. (Refer to paragraph 5-55.)

b. Remove upper section of rear firewall.

(1) Disconnect fire detector leads. Pull hinge pins to remove engine cowling doors.

(2) Remove brace between tops of front and rear firewalls by pulling out pin at each end.

(3) Disconnect brace rods by pulling two pins at each side of rear firewall.

(4) Disconnect exhaust temperature indicator circuit leads at connector on right front of rear firewall.

B (5) On UH-1B, disconnect starter-generator cooling exit duct by removing V-band clamp at right side ahead of rear firewall.

(6) Unlatch five fasteners which secure upper to lower sections of rear firewall.

(7) Remove lockwire and open-V-band clamp which secures adapter ring of rear firewall to support cone flange of engine.

(8) Carefully remove firewall assembly and clamp from engine.

c. Remove six nuts which secure three flanges of thermocouple assembly on exhaust diffuser studs.

d. Remove thermocouple assembly, working probes carefully out of exhaust diffuser with least possible flexing or bending of rigid conduit.

5-61. *Inspection — Exhaust Thermocouple.* Make functional and continuity checks of thermocouple harness with standard test equipment. Inspect rigid and flexible sheaths and connector for visible damage.

5-62. *Repair or Replacement — Exhaust Thermocouple.* Replace damaged or unserviceable thermocouple and harness.

5-63. *Installation — Exhaust Thermocouple.* a. Place thermocouple assembly on exhaust diffuser carefully to avoid excessive flexing of conduit or damage to probes. Insert probes in three mounting ports, with flexible cable to lower right. Install three pairs of nuts to secure mounting flanges on studs.

b. Reinstall upper section of rear firewall.

(1) Place V-band clamp on exhaust diffuser support cone.

(2) Place upper firewall assembly over end of exhaust diffuser. Seat clamp over mating flanges of support cone and firewall adapter ring, securing clamp bolts temporarily.

(3) Attach brace rods to sides of firewall with pip-pins.

(4) Secure upper to lower firewall with five fasteners.

(5) Install brace between tops of front and rear firewalls, secured by pin at each end.

(6) Loosen 16 screws around adapter ring to permit alignment.

(7) Position V-band clamp so that end loops will not touch ends of screws, and to clear fuel manifolds. Seat clamp securely by tapping with soft hammer from middle of each section toward ends, while tightening nuts with 40 to 50 inch-pounds torque. Lockwire.

(8) Tighten 16 screws around firewall adapter ring.

(9) Connect exhaust temperature indicator circuit wiring at connector on right front of firewall.

B (10) On UH-1B, connect starter-generator cooling exit duct. (Refer to paragraph 5-243.)

(11) Reinstall engine cowling doors on firewall hinges. Connect fire detector wiring.

c. Install exhaust tailpipe. (Refer to paragraph 5-58.)

Section V — Fuel System

A 5-64. Fuel System — Model UH-1A. (See figure 5-20.) Fuel supply on Model UH-1A is from two rubber cells, located in fuselage at each side of cargo sling compartment, interconnected by two crossover tubes and a vent line. Filling is through right-hand cell, and both cells can be emptied through a defueling valve on aft crossover tube. Left-hand cell has a fuel quantity gage tank unit, a float switch for 20 MIN FUEL caution panel light, a sump with drain valve, and an electrically operated boost pump with external poppet drain valve and seal drain tube. Pump discharges through a submerged hose to an outlet connection on left wall of cargo sling compartment. Main fuel line extends from this tank outlet aft through a shut-off valve in main fuselage compartment, up through service deck to main fuel strainer, then through a quick-disconnect hose to inlet of engine fuel control unit. A thermal relief valve accommodates expansion of fuel trapped above shut-off valve. Fuel pressure gage transmitter, pressure switch for caution panel light, and fuel supply line to heater are connected to main fuel line below deck. On Serial No. 59-1607 and subsequent, right-hand fuel cell is provided with a sump assembly having a manual drain valve. A fuel control vent line extends from the engine deck coupling to a connection on fuel cell forward crossover tube. This line has a check valve and during operation, carries a continuous return flow from a hose tap on overspeed governor housing to rid system of any trapped air which might cause engine flame-out.

B 5-65. Fuel System — Model UH-1B (Serial No. 60-3546 through 64-14100.) (See figure 5-21.) Fuel supply system on UH-1B helicopters (Serial No. 60-3546 through 64-14100) has two interconnected cells, filled from right side and drained through defueling valve at left. Each cell is equipped with a sump and boost pump assembly, a float switch for 20 MINUTE FUEL caution panel light, and a fuel quantity gage tank unit. Both pumps are electrically operated and controlled by MAIN FUEL switch. Pump outlet lines are separate branches to main supply line tee on rear wall of cargo sling compartment, each line having a check valve to prevent reverse flow and a pressure switch to light one of two caution panels if a pump failure should occur. Either pump alone can maintain normal fuel flow and pressure. A shut-off valve, connected to MAIN FUEL switch, controls supply line flow through main fuel strainer to a quick-disconnect coupling for engine fuel control inlet hose. Two thermal pressure relief valve lines are provided to relieve expansion of fuel trapped in upper part of system. A branch line from strainer outlet tee serves a pressure gage transmitter, provides a connection for heater fuel supply, and has a trap drain valve and line. Fuel control vent line piping, with a directional check valve, is installed between a quick-disconnect coupling on engine deck and a connection on fuel cell forward crossover tube. With T53-L-9, -L9A, -L-11 or -L-13 engines, or with any T53-L-5 engine modified to have a fuel control vent hose from a tap on governor housing, this line carries a continuous return flow from fuel control to rid system of any trapped air which might cause engine flameout.

Note

Model UH-1B helicopters have a fuel low level warning light which warns the pilot when there is enough fuel remaining for approximately 20 minutes flight time at cruise power. If either fuel boost pump fails and the fuel low level light illuminates, flight time is reduced to five minutes.

B 5-66. Fuel System—Model UH-1B. (Serial No. 64-14101 and subsequent.) (See figure 5-22.) Fuel supply system on Model UH-1B helicopters, Serial No. 64-14101 and subsequent, has two interconnected, self-sealing type, fuel tanks which are filled through the top of the left-hand tank. Additional fuel may be transferred into the main fuel tanks from internal auxiliary fuel tank(s) through the lower crossover assembly (11), and from external auxiliary fuel tanks through sump fittings (21). Both main fuel tanks are equipped with a sump assembly and a fuel boost pump (17). A fuel pump drain valve (20) and pump seal drain line (25) facilitate draining the system. A sump drain valve is incorporated in the external auxiliary fuel fitting (21). A gravity defuel valve (22) is located in the bottom of the left-hand fuel tank sump assembly,

Note

Do not wipe cell after spraying.

g. Install fuel quantity tank unit. (Refer to paragraph 5-96.) Install sumps, cell doors and deck panels. (Refer to paragraphs 5-77 and 5-143.)

5-69. ***Purging — Fuel System.*** Purge fuel cells in accordance with instructions contained in TM 55-405-3. Purge fuel lines in accordance with instructions contained in TM 55-405-7.

5-70. Fuel System on Engine. (See figure 5-23 and 5-24.) Basic engine is equipped with a fuel control unit and two separate sub-systems, starting fuel and main fuel, for delivering regulated flow of vaporized fuel into combustion chamber. A pressure actuated valve, at bottom of combustor housing, drains away any unburned fuel in combustion chamber when engine stops. Adapting parts added to engine include fuel control inlet hose, seal drain tube and hose, combustor drain hose, a differential pressure switch with hoses from sump pressure taps on fuel control to provide caution panel indication if one element of dual pump should fail, and linkages for engine control systems. A fuel control vent hose is used on engines equipped with an overspeed governor.

5-71. Starting fuel system consists of external fuel lines (and air purge line on UH-1A only), a solenoid valve connected in starter-ignition circuit, a starting fuel manifold, and igniter nozzles. Solenoid valve is opened as starter is energized, allowing fuel at pump pressure to be injected through nozzles and ignited in combustion chamber by igniter plugs. When starter trigger switch is released, solenoid valve closes to shut off starting fuel flow.

5-72. Main fuel system includes an external fuel line, a manifold, and eleven fuel vaporizers through which flow is established as soon as engine speed provides sufficient fuel pressure from dual-element pump of fuel control unit. On the T53-L-13 engine, the main fuel system includes external fuel line, twenty-two fuel vaporizers, flow divider and dump valve assembly, and a manifold. (Refer to paragraph 5-143A for data on flow divider and dump valve assembly.)

5-73. Fuel Cell Fittings. Externally accessible fittings on fuel cells include filler cap adapter, two crossover tubes, and tank outlet. Each cell port has an integral fitting with an O-ring seal groove and threaded inserts for attachment bolts.

5-74. ***Repair or Replacement — Fuel Cell Fittings.*** a. Replace defective O-ring seal under any fuel cell port fitting by general procedure outlined below.

b. Drain fuel to level below cell port to be opened.

c. Disconnect attached lines or clamps to allow fitting to be moved enough to expose O-ring.

d. Remove O-ring. Check that seal groove and mating face of fitting are clean and free of burrs or nicks.

e. Install serviceable O-ring in seal groove.

f. Reinstall fitting. Tighten bolts evenly with 45 to 50 inch-pounds torque.

g. Reconnect any lines or clamps as necessary.

5-75. Fuel Cell Door. Removable sections of service deck between cabin and engine firewall will give access to a large door in top of each cell. Door provides connection for tank vent line, and electrical connectors for fuel quantity gage tank unit. Left cell door also includes an assembly of two float switches for the auxiliary fuel transfer pump circuit.

5-76. ***Removal — Fuel Cell Door.*** a. Defuel cells. (Refer to paragraph 5-67.)

b. Remove section of transmission cowling with support frame by removing lock-pin and rod to detach from deck fittings and roller track.

c. Remove screws around edge of deck panel above fuel cell, leaving fittings attached where possible. Lift off deck panel.

d. Disconnect vent tube from tee in cargo sling compartment and from elbow on cell door. Pull tube inboard through bulkhead grommet until clear of door.

e. Disconnect fuel quantity gage circuit leads from connectors on door. On left cell door, also disconnect auxiliary fuel transfer circuit leads from terminal block.

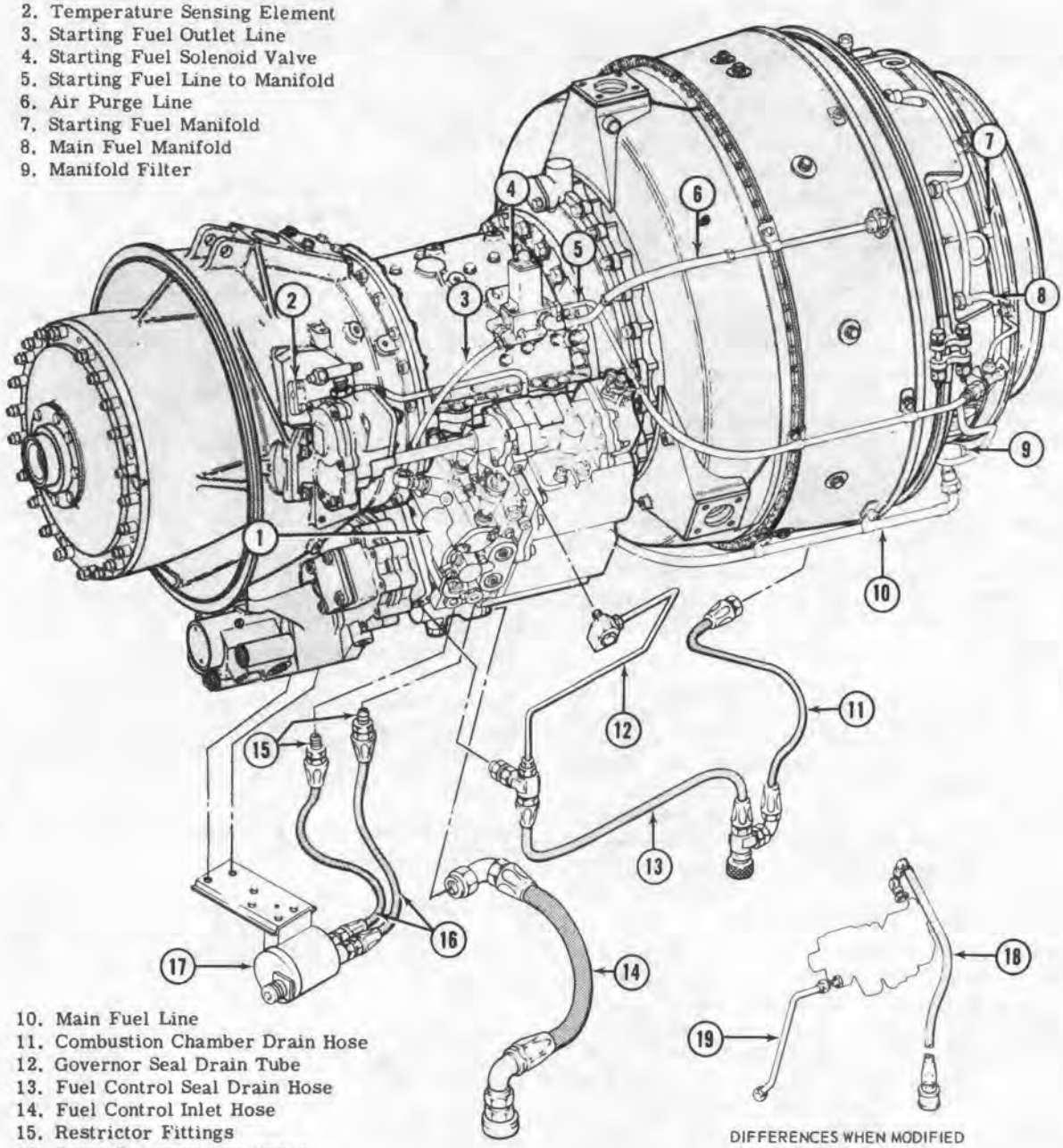


Figure 5-23. Fuel system on engine — UH-1A (typical)

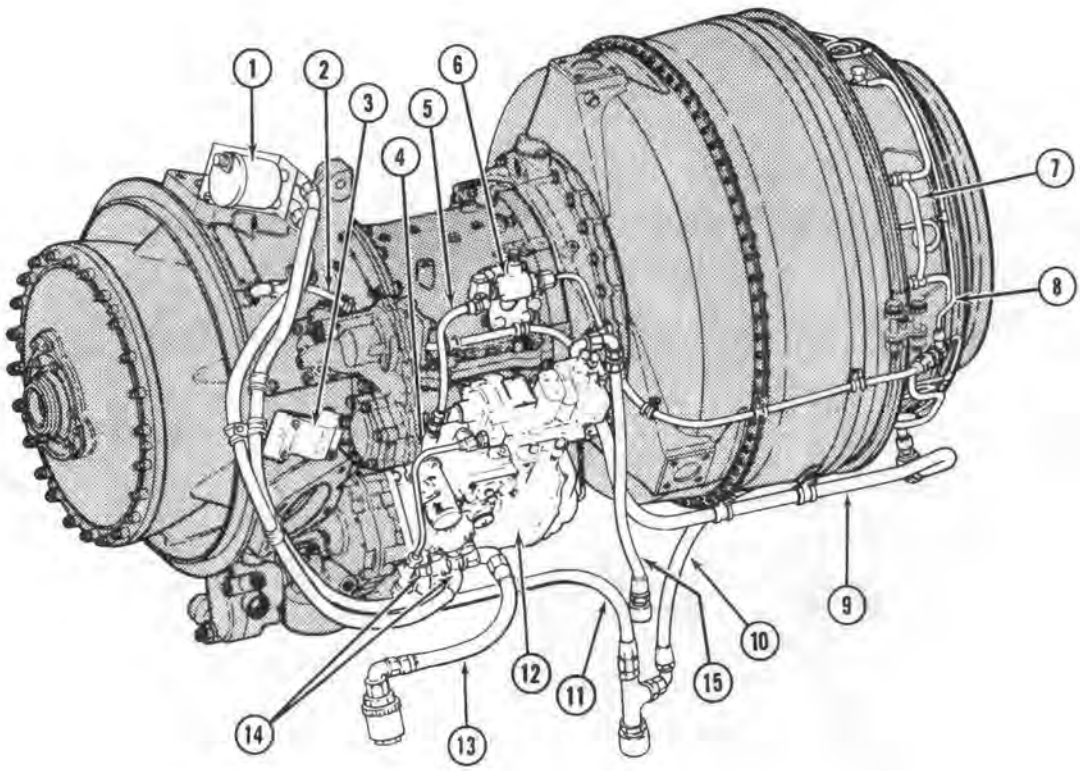
f. Remove 20 bolts and lift cell door. Disconnect fuel quantity transmitter leads from connectors on underside. Remove door (with attached float switch assembly, if left cell). Keep door opening covered when not in use.

5-77. Installation — Fuel Cell Door. a. Check that seal groove and face of door are clean and free of burrs or nicks. Install O-ring in groove.

b. Position door assembly on cell opening, with vent fitting pointing inboard. (If on left cell, float switch assembly will be at forward end of door.)

c. Raise door as necessary to connect quantity gage transmitter leads to connectors on underside of door. (Refer to paragraph 12-125.)

d. Secure door with bolts and thin aluminum alloy washers. Tighten bolts evenly with 45 to 50 inch-pounds torque.



1. Differential Pressure Switch
2. Inlet Air Pressure Sensing Line
3. Temperature Sensing Element
4. Governor Seal Drain Line
5. Starting Fuel Line
6. Solenoid Valve
7. Main Fuel Manifold
8. Starting Fuel Manifold
9. Main Fuel Line
10. Combustor Drain Hose
11. Fuel Control Seal Drain Hose
12. Fuel Control Assembly
13. Fuel Inlet Hose
14. Pump Tap Restrictor Fittings
15. Fuel Control Vent Hose

204060-165

Figure 5-24. Fuel system on T53-L-5/-9/-9A/11 engine

1. Air Pressure Sensing Hose
2. Starting Fuel Line
3. Starting Fuel Solenoid Valve
4. Starting Fuel Line
5. Main Fuel Manifold
6. Starting Fuel Manifold
7. Flow divider and Dump Valve
8. Flow Divider Drain Hose
9. Combustion Chamber Drain Valve
10. Main Fuel Line
11. Overspeed Governor
12. Fuel Regular
13. Temperature Sensing Element

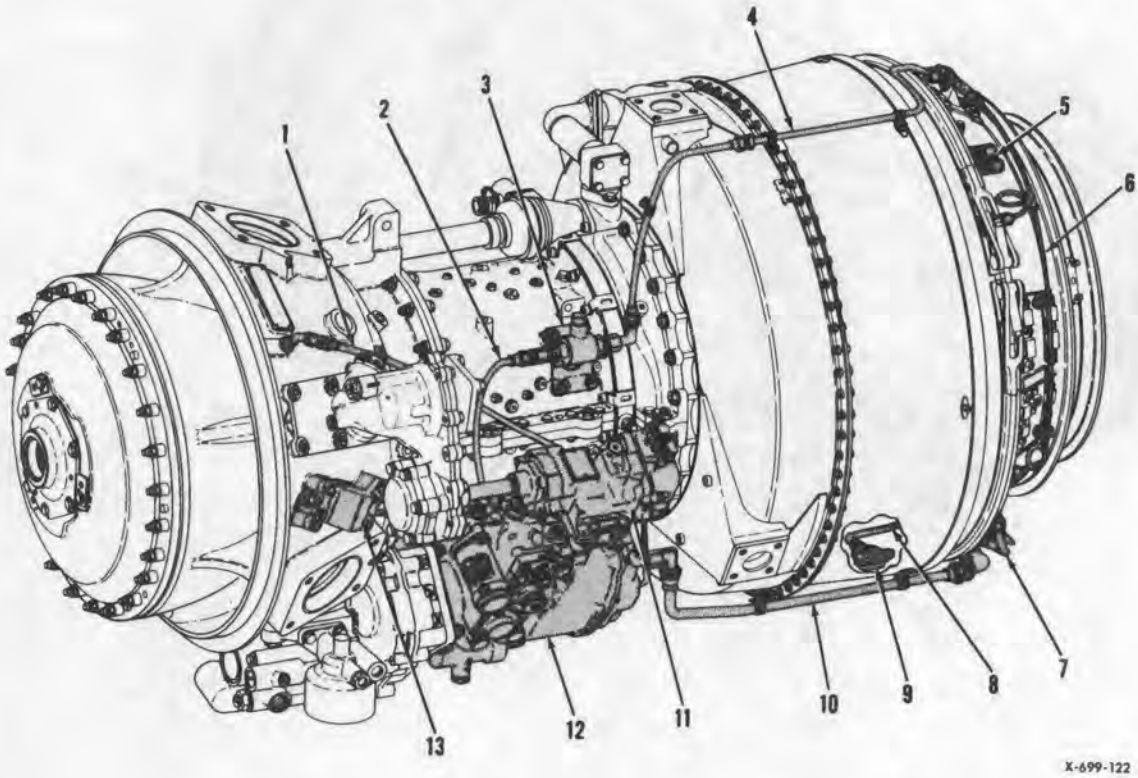


Figure 5-24A. Fuel system on T53-L-13 engine

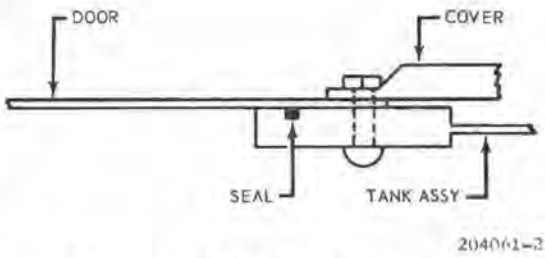


Figure 5-25. Correct installation of fuel cell access doors

e. Connect vent line tube to fitting on door.

f. Connect quantity gage circuit leads between connectors on cell door and at aft inboard corner of cell compartment. (Refer to paragraph 12-125.)

g. Reinstall deck section over cell compartment, sealing edges fumetight with a bead of sealing compound, (item 209, table 1-1). Reinstall cowling and support frame assembly.

A 5-78. Main Fuel Strainer. (U H - 1 A through Serial No. 58-3047.) (See figure 5-24.) A main strainer in fuel supply line to engine is mounted on a bracket above service deck at left side of engine. Unit consists of a housing body with a removable bowl, enclosing a screen element. A bypass valve in strainer body assures continued flow if screens should become clogged. Connections are inlet hose, outlet quick-disconnect coupling for hose to fuel control, and strainer drain line hose with manual valve.

A 5-79. *Removal — Main Fuel Strainer. (UH-1A through serial No. 58-3047.)* a. Disconnect fuel control inlet hose from coupling on strainer outlet.

b. Drain trapped fuel from strainer by opening valve located inboard on deck.

c. Disconnect drain hose and inlet hose from fittings on strainer. Cap lines and fittings.

d. Detach strainer from bracket by removing two bolts, with spacers and nuts.

A 5-80. *Disassembly — Main Fuel Strainer (UH-1A through Serial No. 58-3047.)* (See figure 5-26.) a. Hold strainer body securely. Remove lockwire and use wrench on square shoulder to unscrew and remove strainer bowl, with O-ring.

b. Cut lockwire and remove nut, retainer cup, and screen element, with gaskets and O-rings, from tube.

c. Unscrew and remove tube, with O-ring, from strainer body.

A 5-81. *Cleaning — Main Fuel Strainer. (UH-1A through Serial No. 58-3047.)* Wash strainer parts with cleaning solvent (item 302, table 1-1). Use a soft bristle brush as necessary on screen. Dry with filtered compressed air.

A 5-82. *Inspection — Main Fuel Strainer. (UH-1A through Serial No. 58-3047.)* Inspect screen element for suitability for continued service. Check threads on body, bowl and nut. Inspect gaskets and O-ring for deterioration.

A 5-83. *Repair or Replacement — Main Fuel Strainer (UH-1A through Serial No. 58-3047.)* Replace unserviceable parts.

A 5-84. *Reassembly — Main Fuel Strainer (UH-1A through Serial No. 58-3047.)* a. Install tube, with O-ring on threaded end, in strainer body. Tighten with 60 to 90 inch-pounds torque.

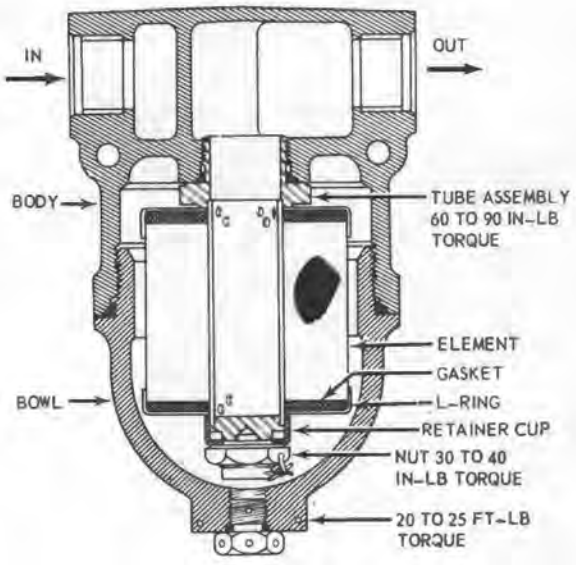


Figure 5-26. Fuel strainer cross-section — UH-1A thru Serial No. 58-3047

5-114A. ***Inspection — Manifold Assembly (UH-1B Serial No. 64-14101 and subsequent).*** Inspect manifold assembly for leakage, cracks, or damage.

Note

Inspect manifold assembly while it is installed.

5-115. ***Removal — Manifold Assembly (UH-1B Serial No. 64-14101 and subsequent).*** a. Disconnect battery. Drain fuel to extent necessary.

Note

Removal of manifold assembly shall not be accomplished unless replacement is intended.

b. Disconnect electrical leads from pressure switches.

c. Disconnect fuel lines from inlet and outlet fittings on manifold assembly. Cap or cover

lines and fittings to prevent entrance of foreign material.

d. Remove nuts, spacers, washers and bolts attaching manifold assembly to bulkhead and remove manifold assembly.

5-116. ***Installation — Manifold Assembly (UH-1B Serial No. 64-14101 and subsequent.)*** a. Position manifold assembly on bulkhead and install attaching bolts, washers, spacers, and nuts.

b. Remove caps or covers from fuel lines and manifold assembly fittings and connect fuel lines to manifold assembly.

c. Connect electrical leads to pressure switches.

d. Check for leaks and operation.

5-117. Starting Fuel Solenoid Valve. (See figure 5-23 or 5-24.) An electrically operated solenoid valve, on left side of engine compressor housing, is connected in starting fuel line between fuel control and starting fuel manifold.

5-118. ***Removal — Starting Fuel Solenoid Valve.*** a. Disconnect electrical harness connector from valve.

b. Disconnect fuel lines from valve fittings. On UH-1A, also disconnect air purge line. Cap open lines and fittings.

A c. Remove two screws, washers, and nuts to detach valve from mounting bracket.

B d. Remove two screws to detach valve from mounting bracket.

e. Remove solenoid valve, leaving bracket on compressor housing.

f. Remove union and packing from valve.

5-119. ***Inspection — Starting Fuel Solenoid Valve.*** Inspect starting fuel solenoid valve inlet port filter for cleanliness and damage to filter mesh.

5-120. ***Repair or Replacement — Starting Fuel Solenoid Valve.*** Clean filter if necessary; replace if screen is damaged or unserviceable; replace union and packing if damaged.

Note

If it is necessary to install a new filter, use the rubber eraser end of a pencil to insert the filter into the valve.

5-121. ***Installation — Starting Fuel Solenoid Valve.*** A a. Position solenoid valve to mounting bracket on compressor housing. Secure with two screws, washers, and nuts.

B b. Position solenoid valve to mounting bracket on compressor housing. Secure with two screws. Install packing and union on inlet port of solenoid valve.

c. Connect starting fuel line hoses from fuel control to valve inlet fitting, and from starting fuel manifold to valve outlet union. On UH-1A, connect air purge line to elbow on outboard side valve.

d. Connect electrical harness connector to solenoid. On UH-1B, make certain that adequate clearance exists between cable and hold-down clamp of ignition unit. (See figure 5-29.) Lockwire connector.

B 5-122. Electrical Indicator Type Main Fuel Filter. On UH-1B beginning with Serial No. 63-8500 (and on earlier helicopters if so modified), the main fuel filter has a micronic type element and electrical means of indicating any impeding bypass condition which may occur. Filter is a cylindrical unit, horizontally

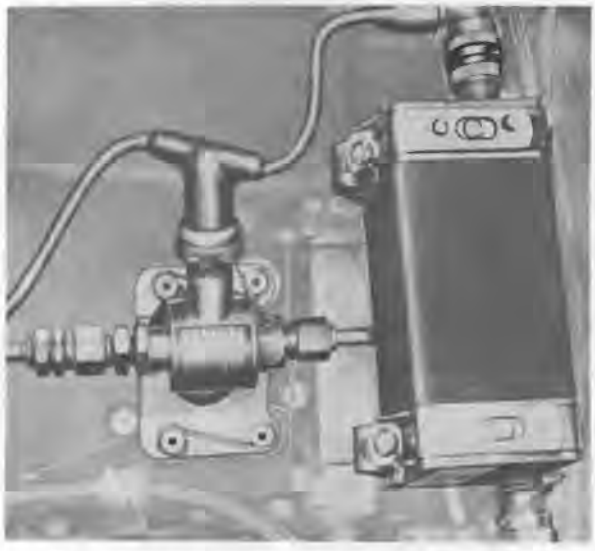


Figure 5-29. Starting fuel solenoid valve and ignition unit — UH-1B

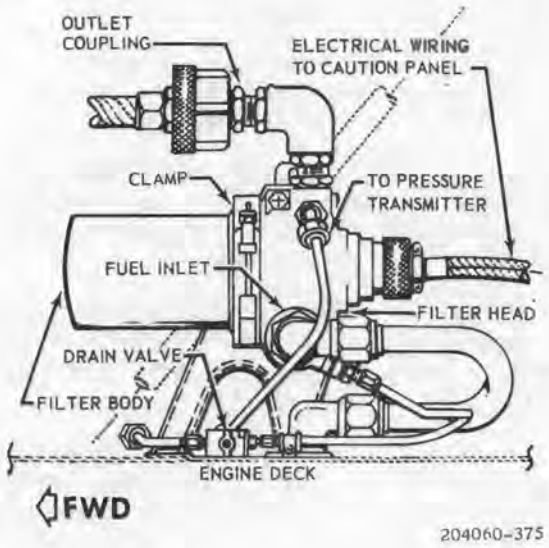


Figure 5-30. Fuel filter — electrical bypass indicator type — UH-1B

mounted on a support bracket attached on forward leg of engine mount tripod at left side of engine deck. (See figure 5-30.) Piping connections to the filter head include an inlet from the fuel shut-off valve of the supply system, an outlet coupling for engine fuel control hose, a drain line with a manual valve, and a line to the pressure gage transmitter. Filter element and other parts, except head assembly and O-rings, are interchangeable with those used in external filter of the transmission oil system. If a clogging condition should develop in filter element, a normally-open switch would be closed by differential pressure, lighting FUEL FILTER caution panel as warning that further clogging may cause fuel to flow through bypass valve without filtration.

B 5-123. *Removal — Electrical Indicator Type Main Fuel Filter.* a. Open left-hand engine compartment cowling.

b. Disconnect fuel hose from outlet coupling on filter. Manually open drain valve to drain fuel from filter.

Note

Use suitable tool to depress self-closing valve in filter outlet coupling to admit some air and facilitate drainage.

c. Disconnect electrical cable plug and all piping from filter head. Remove bolts attaching filter to support bracket and remove filter.

B 5-124. *Disassembly — Electrical Indicator Type Main Fuel Filter.* a. Open V-band clamp.

b. Remove filter body and element from filter head.

c. Separate element and O-rings from filter body.

B 5-125. *Cleaning — Electrical Indicator Type Main Fuel Filter.* Clean filter body and head with dry cleaning solvent (item 302, table 1-1), and dry with filtered compressed air. Protect electrical connections when cleaning the filter head.

B 5-126. *Inspection — Electrical Indicator Type Main Fuel Filter.* Inspect filter element for contamination to determine if any corrective action is needed beyond replacement of element and O-rings.

B 5-127. *Repair or Replacement — Electrical Indicator Type Main Fuel Filter.* Replace unserviceable filter and O-rings.

B 5-128. *Reassembly — Electrical Indicator Type Main Fuel Filter.* a. Place O-ring on boss in bottom of filter body.

b. Position clean filter element in body, firmly seated on boss.

c. Install O-ring around upper lip of filter body next to flange.

d. Place O-ring around center boss in filter head.

e. Install body assembly into filter head. Press firmly into place to seat.

f. Install V-band clamp around mating flanges of filter head and body assembly. Tighten nut with 50 inch-pounds torque.

B 5-129. *Installation — Electrical Indicator Type Main Fuel Filter.* a. Position filter head to support bracket and install bolts, washers and nuts, using thin washers under bolt head and under nuts.

b. Connect fuel line tube to inlet fitting, transmitter line to pressure tap fitting, and drain line to fitting at bottom of head. Connect and lockwire electrical cable plug.

c. Connect hose from engine fuel control inlet to outlet coupling on filter.

d. During next ground run-up, check fuel filter and connections for leaks. Also check that FUEL FILTER caution panel does not light.

5-130. Combustion Chamber Drain Valve. A pressure actuated drain valve, located on lowest point of engine combustion section, is automatically open whenever engine is not in operation. Excess fuel, or any other fluid, is drained through a hose, deck coupling, and drain tube. On T53-L-13 engine, the valve has another hose connection from the flow divider to drain the main fuel manifold after engine shutdown.

5-131. *Removal — Combustion Chamber Drain Valve.* a. Disconnect drain hose from valve. On T53-L-13, also disconnect flow divider drain hose.

b. Remove lockwire and four bolts to detach valve and gasket from combustion housing. Discard gasket and cover opening.

5-131A. *Cleaning — Combustion Chamber Drain Valve.* Clean valve with solvent, (item 302, table 1-1).

5-131B. Inspection — Combustion Chamber Drain Valve. Inspect valve for damage and mating surface for uneveness and cracks. Check functioning of valve by depressing plate and observing return to original position.

5-131C. *Repair or Replacement — Combustion Chamber Drain Valve.* Replace drain valve if inspection has shown any defects or malfunction.

5-132. *Installation — Combustion Chamber Drain Valve.* a. Using a new gasket, position drain valve in opening at bottom of engine combustion chamber housing, with drain nipple pointing forward. On T53-L-13, the other nipple will point to right side. Install four bolts and lockwire heads.

b. Connect drain hose to nipple on front of valve. On T53-L-13, connect flow divider drain hose to nipple at right side of valve.

5-133. Fuel Shut-Off Valve. A motor-operated gate valve in main fuel supply line, located in main fuselage compartment on left bulkhead opposite door, is electrically controlled by a switch on cabin pedestal. Switch is marked FUEL VALVE on UH-1A; MAIN FUEL on UH-1B. Valve has a manual override handle which also serves as a visual position indicator when used in ground maintenance. A guard is provided for valve handle on UH-1B.

5-134. *Removal — Fuel Shut-Off Valve.* a. Open shut-off valve manually. Defuel system. (Refer to paragraph 5-67.)

b. Disconnect electrical leads at connector on valve.

c. Disconnect fuel line tubes from valve inlet and outlet fittings. Catch trapped fuel in suitable container.

d. Remove four bolts to detach valve, guard (on UH-1B), outlet elbow, and gaskets from support bracket.

5-135. *Installation — Fuel Shut-Off Valve.* a. Position valve with inlet fitting through bracket from aft side, with actuator at right and electrical connector forward.

b. Insert four bolts through bracket and valve. Assemble gasket and outlet elbow, pointing up on bolts at aft side of valve body.

A (1) On UH-1A, secure with nuts and washers on bolts.

B (2) On UH-1B, place an aluminum alloy washer on each bolt. Place guard, extending to right, over end of elbow and secure with thin aluminum alloy washer and nuts on bolts.

c. Connect fuel line tubes to valve inlet and outboard fittings.

d. Connect electrical cable connector to valve actuator.

e. Close valve manually. Before refueling, check electrical operation of valve.

5-136. Fuel Boost Pump. An electrical operated boost pump is mounted through plate of a sump assembly in bottom of left fuel cell on UH-1A; or in each cell on UH-1B. Pump is equipped with a drain valve, a seal drain tube, an intake screen, a discharge fitting inside cell, and a plugged discharge port outside cell.

5-137. *Removal — Fuel Boost Pump.* a. Disconnect battery. Defuel cells. (Refer to paragraph 5-67.)

b. Remove access plate under fuel cell sump. Disconnect seal drain tube from pump fitting. Drain trapped fuel through pump and sump drain valves.

c. Disconnect pump electrical leads from terminal block at aft side of access opening.

d. Remove bolts and washers around pump mounting flange. Lower pump through opening in sump plate until discharge hose connection is exposed. Disconnect hose from fitting. Remove pump and gasket. Cover sump opening immediately.

5-138. *Installation — Fuel Boost Pump.* a. At pump mounting hole in sump plate, check for proper installation of flange ring and split gasket at inner side, secured by two countersunk screws through plate.

b. Place gasket on pump flange. Hold pump slightly below sump plate opening, with discharge port fitting aft and 30 degrees inboard. Connect hose from cell outlet to pump fitting.

c. Secure pump flange and gasket to sump plate with bolts and washers. Tighten bolts evenly with 45 to 50 inch-pounds torque.

d. Connect pump electrical leads to terminal block at aft side of access opening.

e. Attach seal drain tube to pump fitting. Install access plate, inserting drain tube through grommet.

5-139. Fuel Sump Assembly. Sump assembly has a drain valve and a float switch for fuel-low caution light. Right cell sump on UH-1A, Serial No. 59-1607 and subsequent, has no equipment except a drain valve.

5-140. *Removal — Fuel Sump Assembly.* a. Proceed as for removal of boost pump, which may either be separately removed or remain mounted to sump plate. (Refer to paragraph 5-137.) Disconnect float switch electrical leads at terminal block.

b. Remove bolts and washers around sump plate. Lower sump assembly and withdraw from cell, disconnecting pump discharge hose if pump was not separately removed. Remove O-ring from mounting port groove. Cover opening immediately.

5-141. *Inspection — Fuel Sump Assembly.* a. Inspect sump O-ring, drain valve and gasket for leakage.

b. Inspect pump gasket, fittings and O-rings for continued serviceability.

c. Inspect float switch and gasket on sump standpipe for general condition and continued serviceability.

5-142. *Repair or Replacement — Fuel Sump Assembly.* Replace unserviceable parts, O-rings and gaskets.

5-143. *Installation — Fuel Sump Assembly.* a. Check that O-ring groove around sump mounting port is clean and free of nicks and burrs. Also check mating face of sump plate. Place O-ring in groove.

b. Position sump assembly under port, with float switch aft. If pump is mounted on sump plate, connect hose to outlet fitting. (Refer to paragraph 5-138.)

c. Raise sump assembly into place. Secure with bolts and washers. Tighten bolts evenly with 45 to 50 inch-pounds torque.

5-144. Fuel Manifolds and Starting Nozzles. Starting and main fuel manifolds are bracketed together and mounted around exhaust diffuser ahead of rear firewall. Main manifold delivers fuel to eleven vaporizers, and has a strainer at its inlet on T53-L-5/9/9A/13 engines. On T53-L-11 engine the strainer is located in the main fuel line. The starting manifold is of smaller tubing and serves the starting nozzles. On the T53-L-13 engine the main fuel manifold is secured to the rear of the combustion chamber housing. It receives fuel from the flow divider assembly and delivers it to twenty-two fuel atomizers through either of two separate fuel passages. Four starting fuel nozzles deliver atomized fuel to the combustion chamber during starting. A ball check valve permits air from the combustion chamber to purge the nozzle when starting fuel stops. On T53-L-13 engine, refer to paragraphs 5-146A and 5-150A for information on main fuel manifold and starting fuel manifold and nozzles.

5-145. *Removal — Fuel Manifolds and Starting Nozzles.* a. Remove upper section of rear firewall from engine.

b. Disconnect main and starting fuel hoses from inlet fittings of fuel manifolds. Cap or plug open fittings and hoses.

Caution

To prevent cracking the manifolds, loosen nuts evenly and progressively.

c. Remove lockwire and disconnect main fuel manifold fitting nuts from 11 fuel vaporizers at aft side of engine fireshield.

d. Remove lockwire and disconnect starting fuel manifold nuts from starting nozzles.

e. Remove main and starting fuel manifolds as an assembly.

f. Install protective caps on exposed ends of fuel vaporizers and manifold fittings.

g. Remove starting nozzles as necessary for cleaning or replacement. Do not attempt removal of fuel vaporizers, since this requires disassembly of engine combustion section.

5-146. *Cleaning — Fuel Manifolds and Starting Nozzles.* a. Clean fuel manifolds and associated lines with solvent (item 302, table 1-1).

b. On T53-L-1A/5/9/9A engines wash strainer on plug located in main manifold near inlet in solvent (item 302, table 1-1).

c. On T53-L-11 engine wash bypass filter element in clean fuel (item 1, table 1-1) and air dry.

d. Clean starting fuel nozzles with calibrating fluid (item 12, table 1-1).

B 13 5-146A. Main Fuel Manifold, Flow Divider, and Associated Parts (T53-L-13 Engine). (See figure 5-24A.) The main fuel system on T53-L-13 engine consists of a hose from the fuel control, a flow divider and dump valve assembly with connecting hoses, and two semicircular sections of main fuel manifold equipped with twenty-two atomizers mounted in rear of the combustion chamber housing. Each dual-orifice atomizer has two separate passages connecting to corresponding passages in the manifold. At low nI speeds (beginning at 8 to 13 percent rpm) the flow divider sends fuel through the primary system of the manifold. As fuel pressure increases with higher nI speed, the flow divider opens ports to the secondary system of the manifold. After engine shut-down, the flow divider dump valve drains fuel from the manifold through a hose connected to the combustion chamber drain valve.

Note

Hoses and adapting parts used to connect the engine to the airframe fuel system are not shown, but are like those on preceding engine models.

B 13 5-146B. *Removal — Main Fuel Manifold, Flow Divider and Associated Parts (T53-L-13).* (See figures 5-24A, 5-30A, and 5-30B.)

Note

Neither the main fuel manifold assembly nor the flow divider and dump valve assembly shall be removed unless replacement is intended. Hoses can be disconnected and removed as necessary for maintenance.

a. Disconnect main fuel hose (10, figure 5-24A) from flow divider.

b. Disconnect and remove hoses (1, 2, 7, and 8, figure 5-30A) between flow divider assembly (6) and main fuel manifold. Disconnect and remove hose (13) between flow divider and combustion chamber drain valve (12).

Caution

Immediately cap flow divider and fuel manifold ports.

c. Remove screws (3, 4, and 5) to detach flow divider and dump valve assembly and spacer (9) from exhaust diffuser support cone.

d. Disconnect ignition leads from igniter nozzles and from clamps securing leads to support cone. (Refer to paragraph 5-241.)

e. Remove starting fuel manifold. (Refetr to paragraph 5-115.)

f. Remove bolts (8, 9, 13 and 15, figure 5-30B) and retainers (6, 7, 12 and 16) that secure support assemblies (10 and 17) to support cone.

g. Withdraw pins (11 and 14) and support assemblies from support cone.

h. Remove bolts (4) that secure fuel manifold assembly (5) to rear face of combustion chamber housing. Carefully withdraw manifold

assembly from combustion chamber to avoid damage to parts. Cover open combustion chamber ports.

i. Remove caps (2 and 3) from manifold and seals (1) from atomizers.

j. Remove opposite section of fuel manifold in the same manner.

B 5-146C. ***Cleaning — Flow Divider Hoses (T53-L-13).*** Clean hose assemblies with trichlorethylene (item 306, table 1-1).

5-146D. ***Inspection — Main Fuel Manifold, Flow Divider and Associated Parts (T53-L-13).*** a. Inspect hose assemblies for fraying, chafing, cuts and stripped or damaged threads.

Note

Inspect fuel manifold and flow divider while they are installed.

b. Inspect fuel manifold for leakage, and cracks or other damage.

c. Inspect flow divider for leakage and damage.

B 5-146E. ***Repair or Replacement — Main Fuel Manifold, Flow Divider and Associated Parts (T53-L-13).*** a. Repair minor fraying and chafing in localized areas and minor cuts in braided area of hose assemblies by cleaning with trichlorethylene (item 306, table 1-1), drying throughly, and wrapping damaged area with tape (item 402, table 1-1).

b. Replace hose assembly if cuts are other than minor or if leakage occurs.

c. Replace fuel manifold if leakage, cracks or damage occur.

d. Replace flow divider if leakage or damage occurs.

B 5-146F. ***Installation — Main Fuel Manifold, Flow Divider and Associated Parts (T53-L-13).*** a. Position seal (1, figure 5-30B) on each atomizer. Install caps (2 and 3) over unused ports on manifold assembly (5).

b. Carefully position manifold assembly against rear face of combustion chamber housing, and align atomizers with ports. Secure manifold to housing with bolts. Tighten bolts evenly and lockwire.

c. Position support assemblies (10 and 17) on support cone and install pins (11 and 14). Secure support assemblies to support cone with retainers (6, 7, 12, and 16) and bolts (8, 9, 13, and 15). Tighten and lockwire bolts.

d. Install opposite manifold assembly in the same manner.

e. Position spacer (9, figure 5-30A) and flow divider and dump valve assembly (6) against exhaust diffuser support cone.

f. Secure flow divider with screws (3, 4, and 5). Tighten and lockwire screws.

g. Connect hose assemblies (1, 2, 7, and 8) between flow divider and fuel manifold, and drain hose (13) between flow divider and combustion chamber drain valve. Tighten connectors with 70 to 120 inch-pounds torque.

h. Connect hose (10, figure 5-24A) from fuel control to flow divider inlet. Tighten hose connector with 100 to 250 inch-pounds torque.

i. Connect ignition leads to igniter nozzles. (Refer to paragraph 5-242.)

j. Install starting fuel manifold. (Refer to paragraph 5-116.)

1. Hose Assembly
2. Hose Assembly
3. Screw
4. Screw
5. Screw
6. Flow divider and Dump Valve Assembly
8. Hose Assembly
9. Spacer
10. Gasket
11. Bolt
12. Combustion Chamber Drain Valve Assembly
13. Hose Assembly

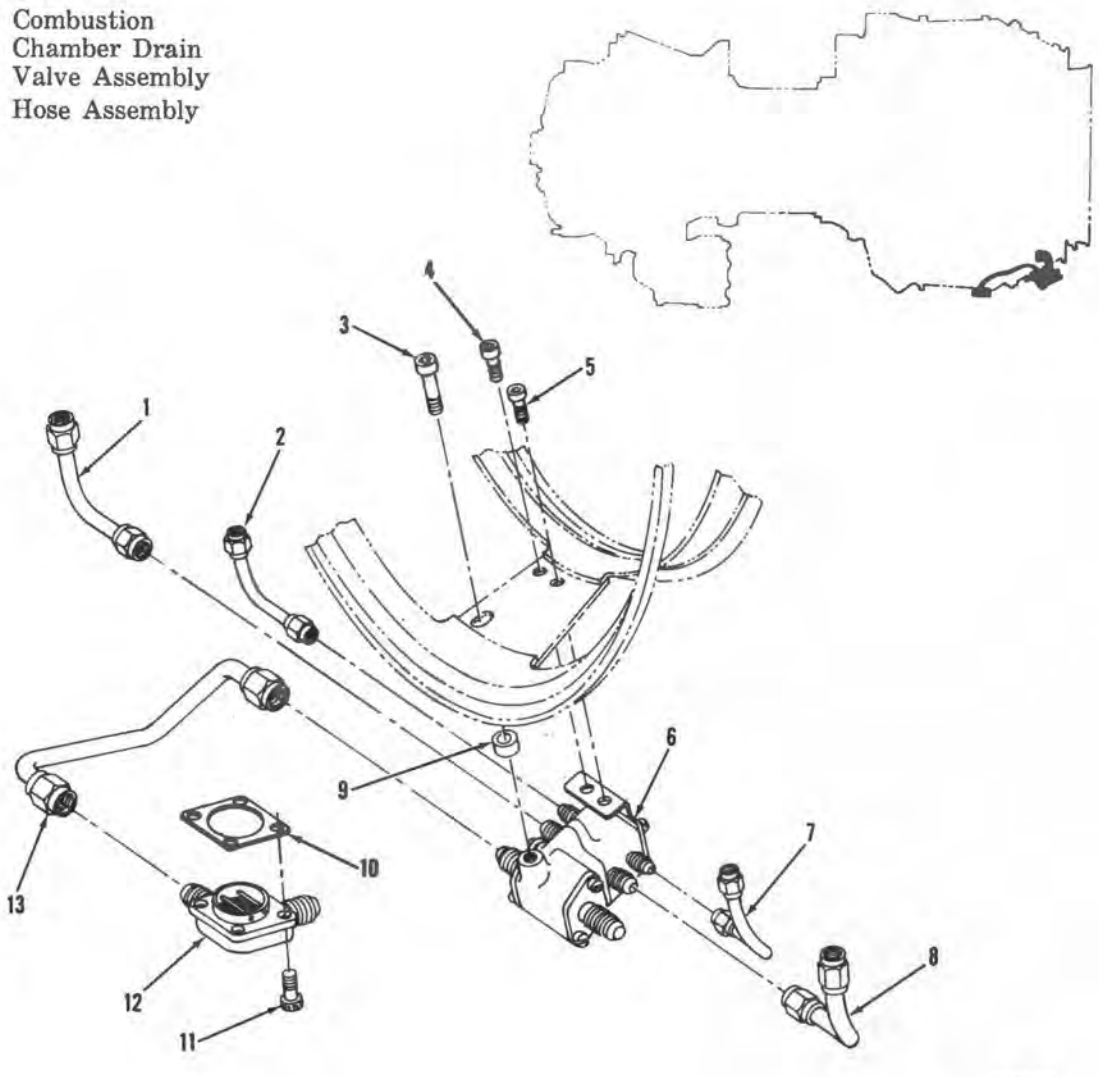


Figure 5-30A. Flow divider and dump valve and combustion chamber drain valve

1. Seal
2. Cap
3. Cap
4. Bolt
5. Fuel Manifold Assembly
6. Retainer
7. Retainer
8. Bolt
9. Bolt
10. Support Assembly
11. Pin
12. Retainer
13. Bolt
14. Pin
15. Bolt
16. Retainer
17. Support Assembly

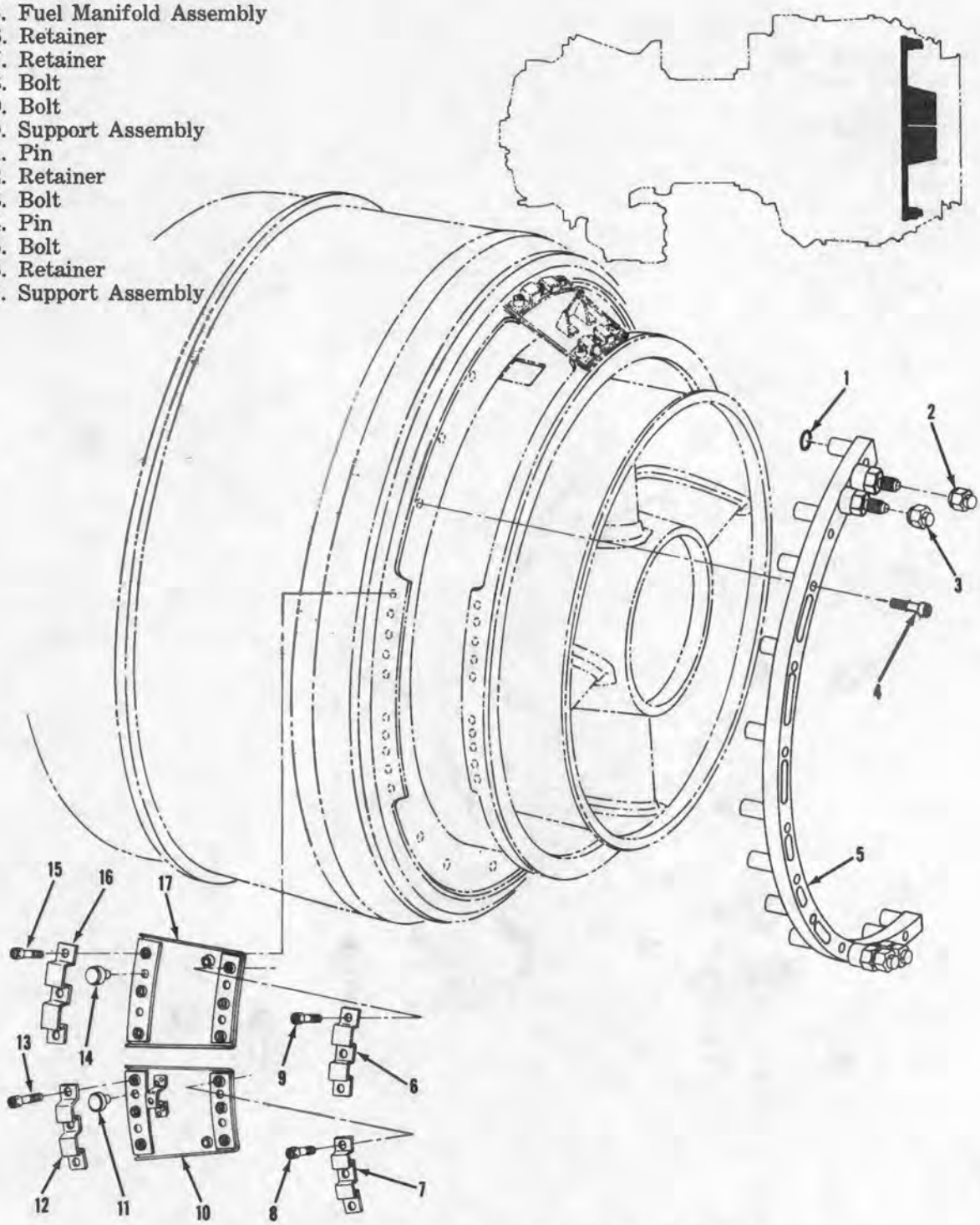


Figure 5-30B. Fuel manifold assembly and attaching parts

5-147. *Inspection — Fuel Manifolds and Starting Nozzles.* a. Inspect fuel manifolds and associated lines for cracks or other damage.

b. Inspect strainers for cleanliness and condition as scheduled in Inspection Requirements, or whenever contaminated or restricted fuel flow is suspected.

c. On T53-L-1A/5/9/9A engines inspect strainer on plug located in main manifold near inlet for cleanliness and damage.

d. On T53-L-11 engine inspect bypass filter element, spring, and plug for general condition and continued serviceability.

e. Using a pressure source of dry filtered air, check starting fuel nozzles for clogged condition.

5-148. *Repair or Replacement — Fuel Manifolds and Starting Nozzles.* a. Replace all unserviceable parts.

b. On T53-L-1A/5/9/9A engines, when replacing strainer on plug located in main manifold near inlet, coat a new packing with petrolatum (item 14, table 1-1) and place on strainer.

c. On T53-L-11 engine, when replacing bypass filter plug, place new packing on plug and lubricate threads with oil (item 5, table 1-1).

d. If starting fuel nozzles remain clogged after cleaning, replace nozzles.

5-149. *Installation — Fuel Manifolds and Starting Nozzles.* a. Install starting nozzles into combustion chamber ports.

(1) On T53-L-1A/5/9/9A engines with scoop type combustor place a lock-nut on each of three starting nozzles. Install nozzles in combustion chamber housing ports at 10, 12, and 2 o'clock locations. Tighten nozzles and nuts, and lockwire. Install remaining two nozzles into mounts at 4 and 8 o'clock locations, tighten and lockwire.

(2) On T53-L-11 engine and T53-L-5/9/9A engines with scoopless type combustor, install two starting nozzles through mounting pads on fireshield at approximately 4 and 8 o'clock locations. Secure each nozzle with two lockwired screws.

b. Position the assembled starting and main fuel manifolds on rear support cone of engine. Place a washer on starting manifold inlet, insert nipple through bracket located at lower left on support cone.

c. Connect main and starting fuel manifold coupling nuts to vaporizers and starting nozzles. Start and tighten all nuts evenly and progressively to prevent cracking manifolds, and hold manifolds to prevent twisting. Tighten starting manifold nuts with 150 to 175 inch-pounds torque. Use tool LTCT219 or LTCT2051 to tighten main manifold nuts with 350 to 400 inch-pounds torque. Lockwire nuts.

d. Install nut on starting manifold inlet. Connect starting and main fuel hoses to inlet fittings of manifolds.

e. Install upper section of rear firewall.

f. Check for fuel leaks during next ground runup of engine.

5-150. *Adjustment — Fuel Manifolds and Starting Nozzles.* Use following instructions if fuel leaks occur at main fuel manifold connections to vaporizers.

a. Check torque of main fuel manifold nuts on fuel vaporizers. If leak continues, remove fuel manifolds. (Refer to paragraph 5-145.)

b. Check for leaks as follows:

(1) Connect hose from a regulated source of compressed air to inlet of main fuel manifold.

(2) Pressurize manifold with 30 to 100 psi air pressure.

(3) Apply liquid soap around fuel manifold connection to fuel vaporizer and check for bubbles indicating leakage.

c. Check for fuel leaks during next ground runup of engine.

d. If leaks continue after above checks, replacement of fuel vaporizers is required. However, if a normal seal is indicated on seating surface of fuel vaporizer but leak continues, replace fuel manifold.

B 13 5-150A. Starting Fuel Manifold and Nozzles (T53-L-13 Engine). The starting fuel manifold (6, figure 5-24A) on T53-L-13 engine is secured on the support cone behind the combustion chamber housing. Fuel, supplied through a hose (4) from the starting fuel solenoid valve (3), is delivered by the manifold to four starting nozzles installed at 2, 4, 8, and 10 o'clock positions in rear of combustion chamber. Each nozzle has a ball check valve which allows air from the combustion chamber to purge the nozzles when starting fuel flow stops.

B 13 5-150B. *Removal — Starting Fuel Manifold and Nozzles (T53-L-13).* a. Disconnect starting fuel hose (4, figure 5-24A) from tee at top of starting fuel manifold (6). Cap end of hose.

b. Remove nut and washer from nipple of manifold tee at front of support cone bracket.

c. Remove screws that secure four clamps of starting fuel manifold to support cone.

d. Loosen connector nuts evenly to detach manifold from four starting nozzles.

Note

If rear firewall is not in place, starting fuel manifold can now be removed rearward without further disassembly. If firewall is in place, perform step e. below.

e. Remove either right-hand or left-hand manifold section by detaching connector from tee fitting. Pull tee aft out of bracket and remove remaining section with tee attached. Remove washer from tee. Cap all openings.

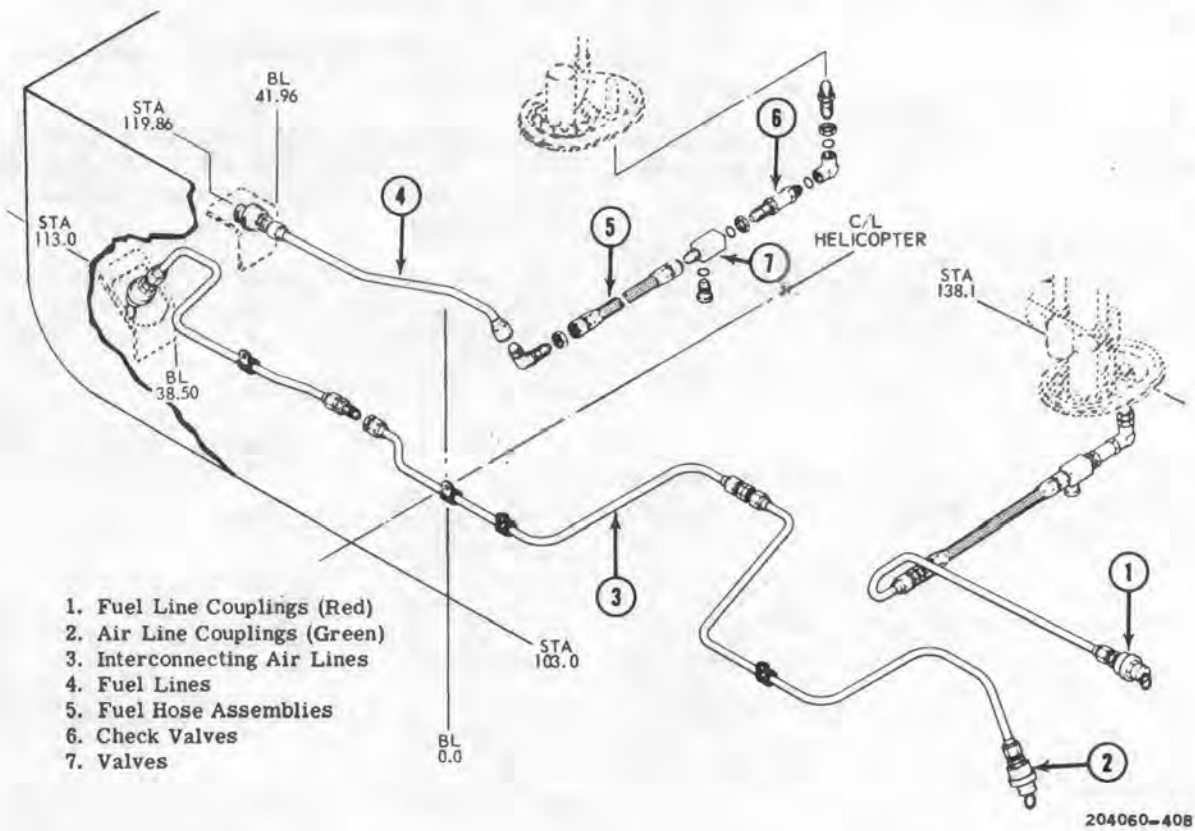


Figure 5-31. Permanently installed fuel lines — external auxiliary tanks (typical — UH-1B serial No. 62-1872 and subsequent)

f. Remove each of four starting nozzles by removing screw and withdrawing nozzle from combustion chamber. Cover openings.

B 5-150C. *Cleaning — Starting Fuel Manifold and Nozzles (T53-L-13).* a. Clean starting fuel manifolds, inside and out, with dry cleaning solvent (item 302, table 1-1).

b. Clean starting fuel nozzles with dry cleaning solvent and a soft wire brush.

Caution

To avoid enlarging holes in starting fuel nozzles, use brush with wire no larger than 0.010 inch diameter.

B 5-150D. *Inspection — Starting Fuel Manifold and Nozzles (T53-L-13).* a. Inspect manifold sections for cracks and dents, connector nuts and tee for tripped or damaged threads.

b. Inspect starting fuel nozzles for clogging or damage.

B 5-150E. *Repair or Replacement — Starting Fuel Manifold and Nozzles (T53-L-13).* a. Replace manifold sections found to have defects. Replace tee or attaching parts if damaged.

b. Replace nozzles if damaged or if clogging cannot be removed.

B 5-150F. *Installation — Starting Fuel Manifolds and Nozzles (T53-L-13).* a. Install starting fuel nozzles into mounting pads located at approximately 2, 4, 8, and 10 o'clock positions in rear of combustion chamber housing. At each location: Uncover mounting pad, insert and align nozzle, install attaching screw, tighten and lockwire screw.

b. Disconnect and lay aside one section of starting fuel manifold from tee fitting. Place a washer over forward nipple of tee. Position assembly on support cone, with tee nipple through bracket at top of cone. Align manifold connector nuts with two starting nozzles and hand-tighten nuts. Install washer and nut on tee at front of bracket.

c. Position remaining section of manifold on opposite side of support cone. Hand tighten manifold connector nuts on tee fitting and two starting nozzles.

d. Tighten all connector nuts and nut attaching tee to bracket with 35 to 50 inch-pounds torque.

e. Install screws to attach four manifold clamps to support cone. Tighten and lockwire screws.

f. Connect hose from starting fuel solenoid valve to tee on starting fuel manifold. Tighten connector with 70 to 120 inch-pounds torque.

5-151. Auxiliary Fuel Provisions. Permanently installed provisions for use of internally installed auxiliary fuel tanks include drain, vent, and fuel transfer lines with quick-disconnect couplings. (See figures 5-20, 5-21, and 5-22.) Comparable provisions for use of externally installed auxiliary fuel tanks include interconnecting air lines between the tanks, and fuel lines which are connected to each fuel tank. (See figure 5-31.) A stowed transfer pump relay circuit with flow switch in the left-hand main fuel tank limits fuel level during transfer.

Section VI — Oil System

A 5-152. Engine Oil System — UH-1A. (See figure 5-32.) Oil is supplied from an external tank, on right side of deck ahead of forward firewall. An electrically operated shutoff valve controls flow through a quick-disconnect hose to an engine driven pump, located on front of accessory gear box. Pump is equipped with a pressure relief valve and a thermobulb for oil-in temperature gage, and delivers oil to a filter for distribution through engine lubrication system. Oil pressure gage transmitter and a pressure switch for ENGine OIL PRESsure LOW caution panel light, mounted at top and right on inlet housing, are connected by external lines to a pressure tap on filter. Torquemeter pressure transmitter, at top of engine, is connected to torquemeter tap on right side of inlet housing. On Serial No. 59-1607 and

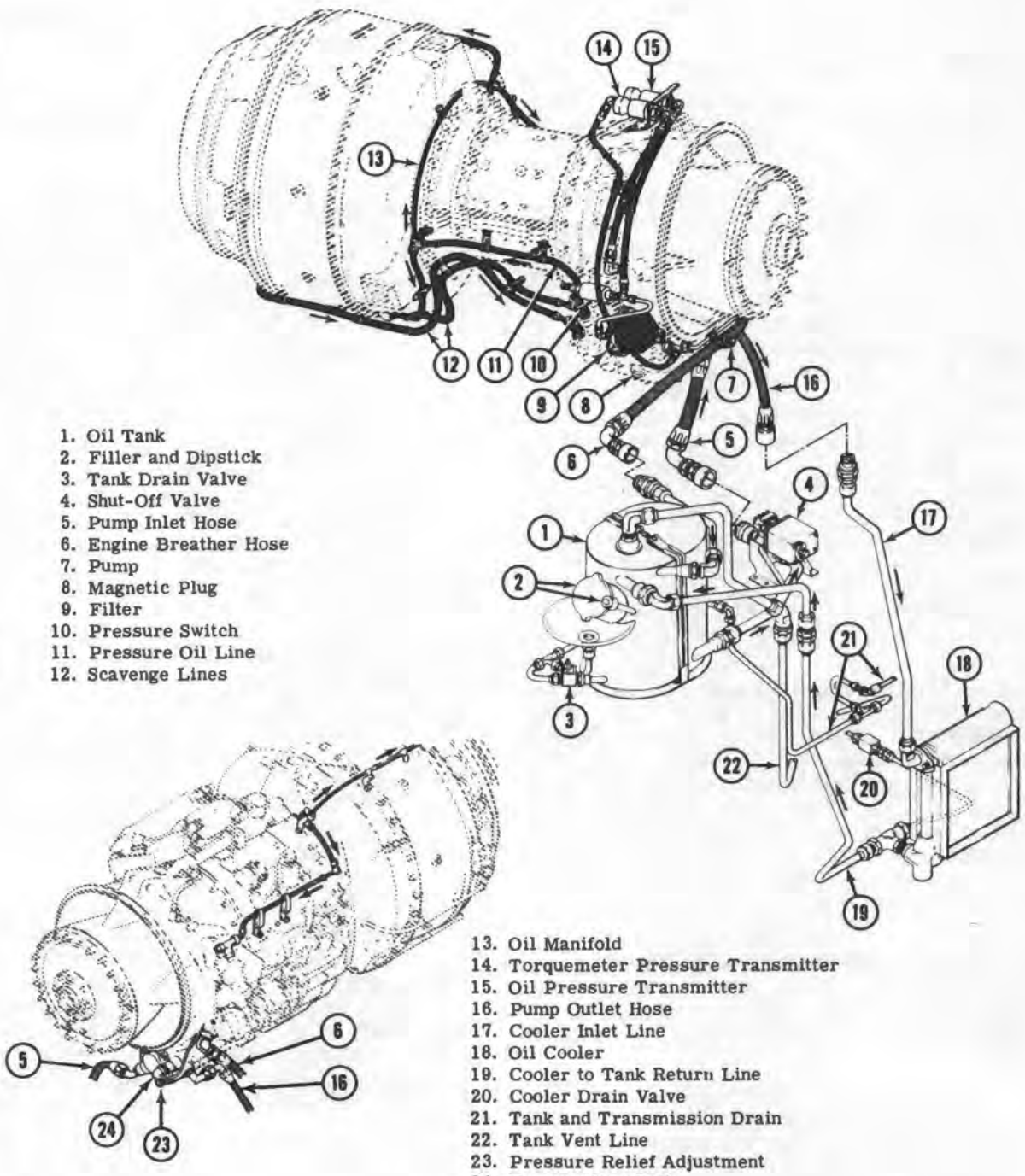


Figure 5-32. Engine oil system — UH-1A (typical)

subsequent, torquemeter transmitter is also vented by an external line to accessory drive gear box, at cover of an unused drive pad on right front side. A breather hose from left front of accessory gear box is vented into tank through a quick-disconnect coupling. A quick-disconnect hose from scavenge pump outlet returns oil from engine through external piping and a cooler to supply tank. Tank and cooler have separate drain lines with manual valves.

A 5-153. ***Engine Lubrication — UH-1A.*** (See figure 5-31.) Oil under pump pressure is delivered through internal passages to filter on right side of accessory gear box. From filter, oil takes two main routes; through internal passages into engine inlet housing, and through external lines to rear end and left side of engine. Oil flow to inlet housing is distributed through passages, transfer tubes, and nozzles to lubricate reduction and accessory drive gears, shaft bearings, and splines. This sub-system also provides pressure oil to the torquemeter incorporated in support mounting of planetary reduction gears. Oil leaving filter through external line flows to a manifold tube from which it is distributed through branch lines to No. 2 main bearing inlet strainer, No. 3 and 4 main bearings strainer, and a tee strainer on overspeed governor drive gear.

A 5-154. ***Engine Oil Scavenge — UH-1A.*** All engine scavenge oil returns to accessory drive gear box, by drainage from inlet housing and by external lines from aft end of engine and fan drive gear box, passing through a course strainer in gear box throat. Gear box sump has a magnetic drain plug and is kept nearly empty during operation by scavenge element of engine driven pump, which delivers oil to external return lines.

5-155. ***General Maintenance — Engine Oil System.***
a. Replace any unserviceable external lines, hose, fittings, units, gaskets, and seals which are accessible without unauthorized disassembly.

b. Before removing any tube or hose, be sure it is properly identified and its route understood for replacement in same manner. When possible, leave supporting brackets in place to simplify reinstallation.

c. Cap or cover openings immediately when disconnected, and take all possible precautions to prevent contamination or dirt entering oil system.

d. Follow procedures below for replacement and adjustment of units in oil system.

e. Follow schedules in Inspection Requirements for inspection and cleaning of filter and strainers.

B 5-156. Engine Oil System — UH-1B. (See figures 5-34, 5-38, and 5-38A.) Oil is supplied from an external tank, mounted ahead of forward firewall at right side of service deck, and flows through a shut-off valve and a quick-disconnect hose to inlet of engine driven dual-element pump on front of accessory gear box. Pump is equipped with a pressure relief valve and a thermobulb for oil-in temperature gage, and delivers oil through internal passages to a filter on left side of accessory gear box for distribution through engine lubrication system. Oil pressure gage transmitter and pressure switch, for ENGine OIL PRESSure LOW caution panel light, are mounted at top of engine inlet housing and connected by external hose to pressure tap on filter.

B 5-157. ***Engine Lubrication — UH-1B.*** Filtered oil is distributed through internal passages and transfer tubes to lubricate gears and bearings at forward end of engine, and through external hoses and oil manifold to strainers lubricating main bearings at aft end of engine. (See figure 5-35.) Main bearing areas are provided with carbon seals and with paddle-pump slingers to assist oil scavenge.

B 5-158. ***Torquemeter Pressure System — UH-1B.*** The torquemeter, incorporated in reduction gearing to provide continuous gage readings of engine output torque, requires oil at higher than normal pressure. A rotary pump, on overspeed governor and tachometer drive, supplies oil to torquemeter through internal passages at 150 psi (plus or minus 10) regulated by an adjustable bypass valve. A second element of rotary pump scavenges oil from governor drive assembly. Torque gage transmitter, mounted at top of inlet housing, has two hose connections: From pressure port of transmitter to torquemeter tap above right mount pad of inlet housing; and from vent port to a tap on cover of an unused drive pad at right front on accessory gear box.

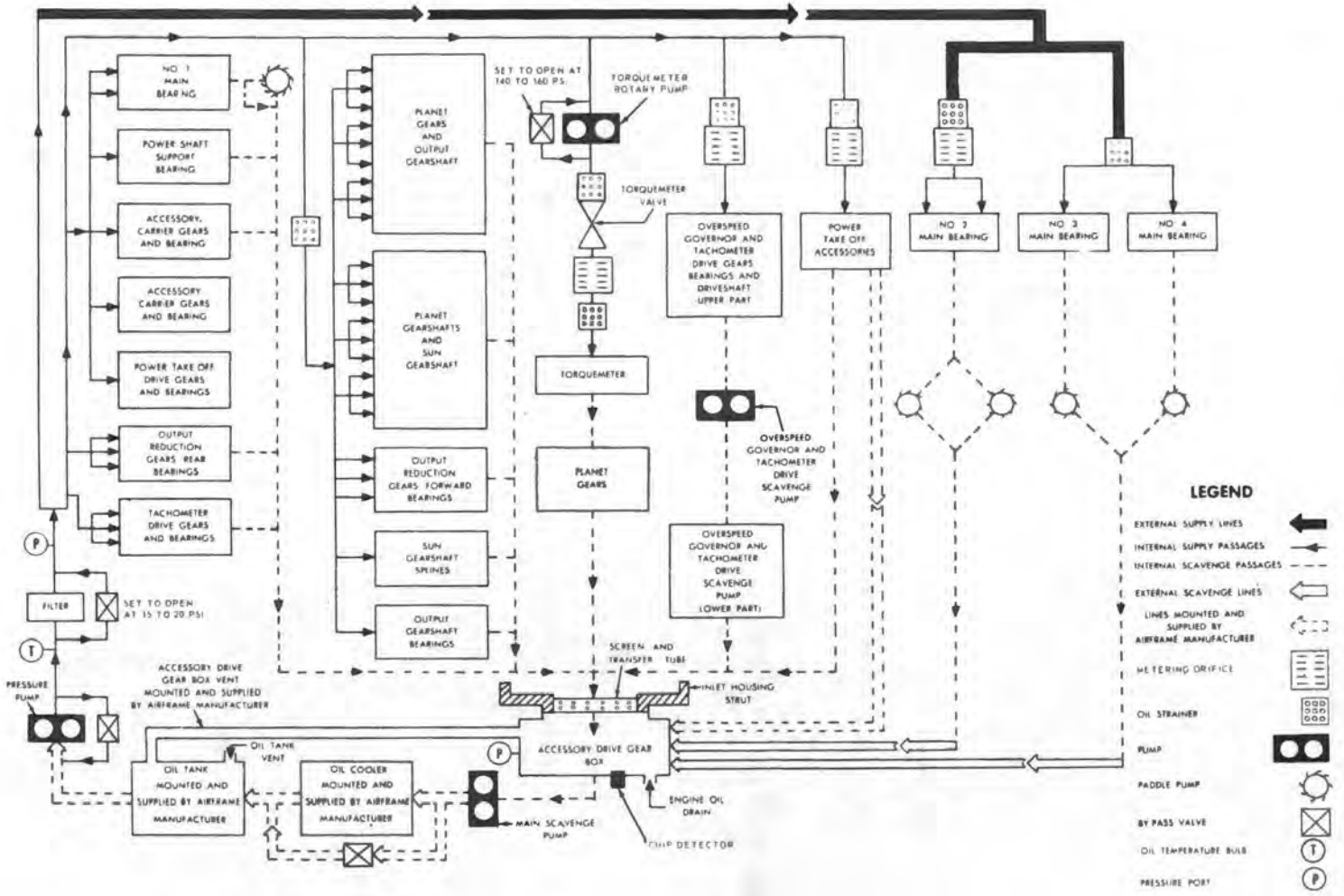


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Figure 5-35. Engine lubrication system diagram — T53-L-5/9/9A/11 engine (Typical)

B 5-159. *Engine Oil Scavenge and Return — UH-1B.* Scavenge oil drains into accessory gear box from inlet housing and through external lines from aft end of engine, passing through a coarse strainer in gear box throat. Scavenge element of engine driven pump circulates this oil through external lines to a thermal bypass valve and oil cooler, in fuselage compartment below deck, and returns it to supply tank. Separate drain lines, with manual valves, are provided at cooler inlet and outlet and at supply tank. A breaker hose from right side of accessory gear box is vented into tank through a quick-disconnect coupling. A chip detector type drain plug is located at lower right on accessory gear box.

5-160. *General Maintenance — Engine Oil System.* Refer to paragraph 5-151.

A **5-161. Engine Oil Tank — UH-1A.** Engine oil supply tank is a welded metal container equipped with filler neck and cap, dipstick, a scupper with drain, and fittings for connection of outlet, return, vent, drain, and engine breather lines. Internal screens are provided at filler neck and vent, and inlet fittings have internal baffles. Tank is secured by straps on a padded support at right forward side of engine firewall.

5-162. *Removal — Engine Oil Tank.* a. Open right forward cowling. Drain tank by opening valve, located below scupper, in drain line which discharges at left aft underside of fuselage.

b. Disconnect all lines from tank. Cap or cover openings.

c. Cut lockwire, loosen tank strap turnbuckle, and remove tank from support.

5-163. *Cleaning — Engine Oil Tank.* Clean exterior and interior of tank with dry cleaning solvent (item 302, table 1-1). Drain thoroughly and dry with filtered compressed air.

5-164. *Inspection — Engine Oil Tank.* a. Inspect oil tank for punctures or leaks, torn or punctured internal screens, damaged threads at ports or on fittings, and for any damage affecting capacity or function.

b. Inspect pads on tank straps and support for deterioration or damage. Inspect tank straps for damage and general condition.

B c. On UH-1B helicopters inspect oil level sight gage glasses for damage and internal stains.

5-165. *Repair or Replacement — Engine Oil Tank.* a. Replace unserviceable fittings and O-rings.

b. Replace tank if damaged.

c. Replace unserviceable pads on tank straps and support. Replace support assembly if straps are unserviceable.

B d. Faulty oil level sight gage glasses on UH-1B helicopters shall be cleaned or, if necessary, replaced.

5-166. *Installation — Engine Oil Tank.* a. Check that pads are in place on support base and straps. Open straps to place tank on support, with filler neck outboard. Connect straps over tank, with turnbuckle loose to permit alignment.

b. Install fittings and connect tubes to tank ports. (See figure 5-32.)

c. Tighten tank strap turnbuckle with 10 to 14 inch-pounds torque. Lockwire turnbuckle.

B **5-167. Engine Oil Tank — UH-1B.** (See figure 5-34.) Engine oil supply tank is similar to that on UH-1A, except it has oil level sight gages rather than a dipstick, and can be maintained by same instructions. (Refer to paragraphs 5-162 through 5-166.)

A **5-168. Engine Oil Cooler—UH-1A.** (See figure 5-36.) A cooler for engine oil system is mounted in an opening through the bulkhead between main fuselage compartment and cargo-sling compartment, and is connected into the oil return line from engine to tank. Cooling air flow is provided by a turbo blower driven by bleed air taken from top of the engine centrifugal compressor housing.

A 5-169. The UH-1A oil cooler installation was modified in service to incorporate the same type of cooling blower as that used on UH-1B. Maintenance can be performed by applicable portions of instructions for the UH-1B installation. (Refer to paragraphs 5-166 through 5-171.) The following differences on UH-1A must be considered:

a. No transmission oil cooler.

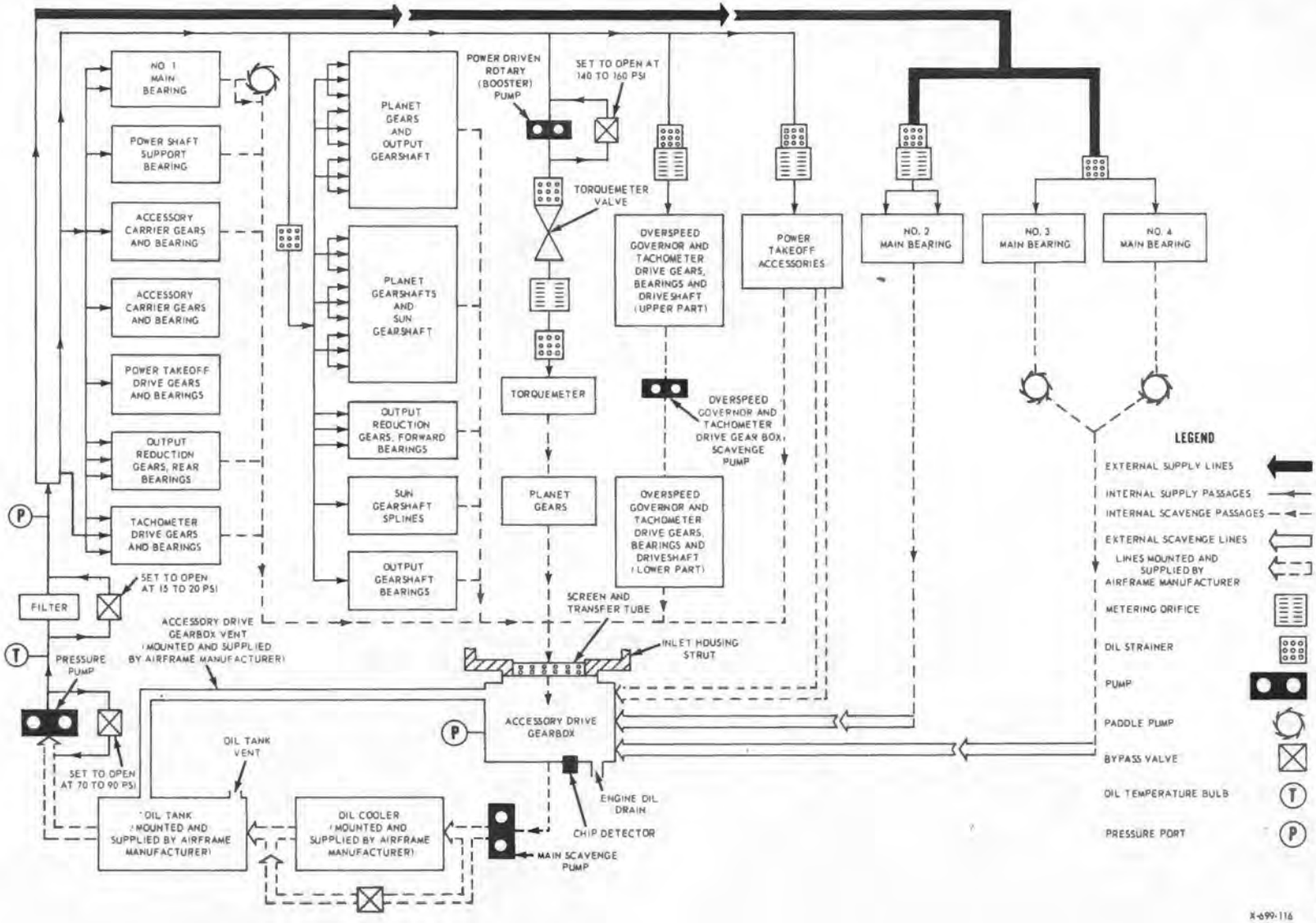
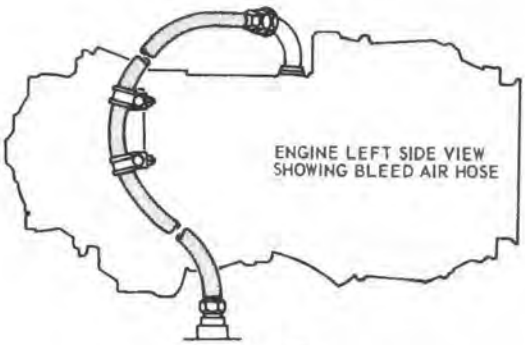


Figure 5-35A. Engine lubrication system diagram — T53-L-13 engine

1. Engine Deck
2. Quick Disconnect Coupling
3. Blower Air Hose
4. Blower Screen
5. Turbo Blower
6. Shroud
7. Oil Cooler



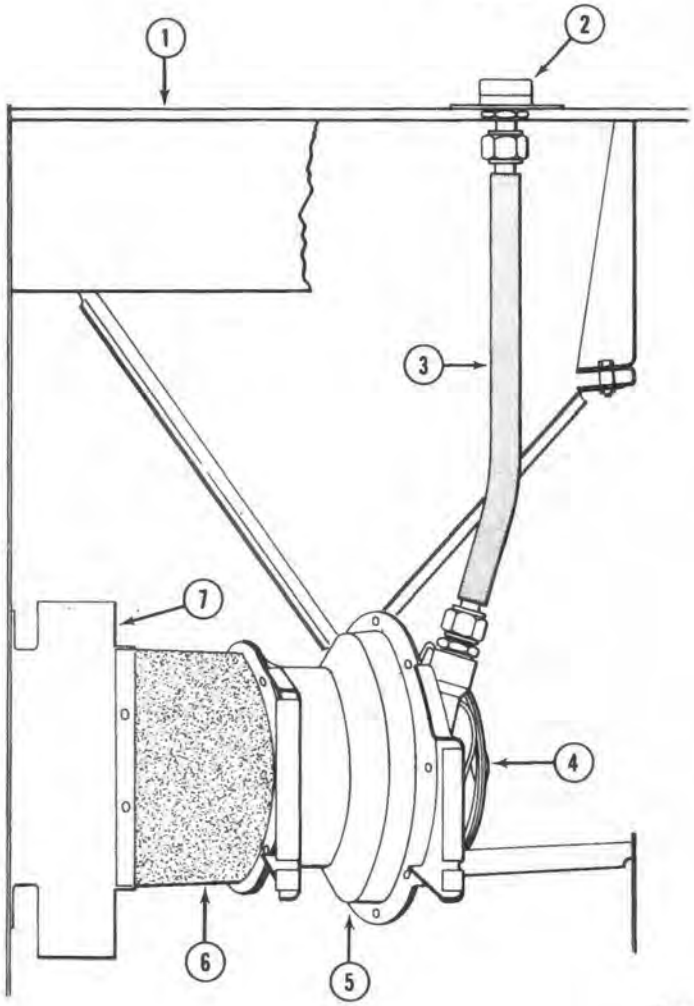


Figure 5-36. Engine oil cooler installation — UH-1A

b. Thermal bypass valve is in cooler rather than a separate unit.

c. A fabric shroud, instead of a metal duct, connects blower to cooler. There is no connection for starter-generator cooling.

d. Different structural supports for blower are used.

e. Bleed air supply hose has different routing on engine, and connects to a quick-disconnect fitting on deck.

B 5-170. Engine Oil Cooler — UH-1B. (See figure 5-37.) A cooler for engine oil is mounted in an opening through the bulkhead between main fuselage compartment and cargo-sling compartment, and is connected into oil return line through a thermal bypass valve mounted on the same bulkhead. Cooling air flow is provided by a turbo blower driven by bleed air taken from engine at an adapter on top of the centrifugal compressor housing. A starter-generator cooling duct is connected to top of the duct between blower and oil cooler. Another cooler, for transmission oil, is mounted side by side with engine oil cooler, but there is no functional connection between the two oil systems.

B 5-171. *Bleed Air Fittings for Engine Model Change on UH-1B.* The bleed air source on T53-L-9A/11/13 engines provides compressed air in greater volume and at higher temperature than on T53-L-5/9 engines. To avoid overspeed of oil cooler blower, it is necessary to use a more restricted inlet fitting on blower with an engine model which takes air from the diffuser housing than with an engine which supplies air directly from the centrifugal compressor housing. A similar situation exists as to a fitting on selector valve of the bleed air heater-defroster system. An alternate set of two fittings is stowed in a bracket on the engine forward firewall at left side, for use in event of an engine model change in accordance with an adjacent placard which reads as follows:

Warning

Install 204-060-494-1 fitting in turbo fan inlet housing and 204-061-410-1 fitting in bleed air heater outlet housing with T53-L-9A/11/13 engine installations.

Install AN919-23D fitting in turbo fan inlet housing and 204-060-453-1 fitting in bleed air outlet housing with T53-L-5 or T53-L-9 engine installation.

Stow removed fitting in clip provided.

Note

If a T53-L-9A/11/13 engine is to replace a T53-L-5/9 engine, a part number 500516-16C adapter will be required to connect the bleed air hose to the new engine.

B 5-172. *Removal — Engine Oil Cooler — UH-1B.* a. Enter fuselage compartment through door at right-hand side. Disconnect bleed air hose from blower. Cap or cover line and blower inlet fitting. Detach and remove blower screen from base as necessary.

b. Remove eight bolts to detach blower flange from duct. Keep shims for reinstallation. Remove bolts at left side to detach blower from support bracket.

c. Disconnect starter-generator cooling duct. Detach forward end of duct from support plates of cooler by removing mounting bolts.

d. Drain engine oil cooler and connecting lines through inlet and outlet drain valves.

e. Disconnect oil tubes from thermal valve fittings. Remove two mounting screws, with nuts and washers to detach valve and spacer plate from bulkhead.

f. Disconnect oil tube from cooler inlet fitting, and drain line from cooler outlet tee.

g. Detach engine oil cooler from transmission oil cooler by removing two upper and two lower bolts, with nuts and washers, at mating flanges of coolers.

h. Remove four bolts through engine oil cooler support plate and left side mounting flange on front of bulkhead. Remove cooler assembly aft through fuselage compartment.

i. When replacing cooler, detach elbow and tee assemblies from studs of cooler inlet and outlet by removing nuts and washers.

j. Cap all open lines and fittings to prevent contamination.

A **5-180. *Inspection — Engine Oil Strainers — UH-1A.*** Inspect strainers and gaskets for suitability for continued service. Be sure all passages and openings are clear.

A **5-181. *Repair or Replacement — Engine Oil Strainers — UH-1A.*** Replace unserviceable parts.

A **5-182. *Reassembly — Engine Oil Strainers — UH-1A.*** Insert strainers in nozzles. Use new O-ring packing in groove around upper end of nozzle.

A **5-183. *Installation — Engine Oil Strainers — UH-1A.*** a. Install strainer and gasket in top of No. 2 bearing oil inlet fitting at lower right side of engine diffuser housing. Lockwire.

b. Carefully insert nozzle through adapter into transfer tube at top of exhaust diffuser. Turn nozzle very gently to find position where locating lands on lower end seat in mating grooves.

c. Install strainer housing, with new O-ring packing. Hold adapter with wrench to prevent turning. Use second wrench to tighten strainer housing. Lockwire housing to adapter.

d. Connect flexible oil line from oil manifold to strainer housing. Tighten oil line connector to 50 to 75 pound-inches torque.

5-183A. Chip Detector. A chip detector is mounted on the bottom side of the accessory drive gear box. On Serial No. 66-746 and subsequent this unit is wired into the caution panel.

5-183B. *Removal — Chip Detector.* a. If installed, disconnect electrical wiring from chip detector.

b. Unscrew and remove chip detector and packing. Discard packing.

5-183C. *Inspection — Chip Detector.* Inspect threads for damage and for contamination in accordance with Inspection Requirements (Refer to Chapter 3.)

Note

If contamination is evident upon removal of chip detector, record type and amount on the engine historical record. Determine source of contamination.

5-183D. *Cleaning—Chip Detector.* Clean with dry-cleaning solvent, (item 302, table 1-1).

5-183E. *Repair or Replacement — Chip Detector.* Replace chip detector if damaged.

5-183F. *Installation — Chip Detector.* a. Place packing (4) on chip detector (3). Install chip detector in accessory drive gear box.

b. Connect electrical wiring, if so equipped.

B **5-184. Engine Oil Strainers.** Two oil strainers in the engine assembly can be inspected and cleaned in Organizational Maintenance. The rear bearing housing oil strainer is located in a fitting on lower right side of the engine diffuser housing, at the pressure oil inlet to No. 2 main bearing. The power turbine oil strainer is located in a fitting at top left on the engine exhaust section, at the pressure oil inlet to No. 3 and 4 main bearings.

B **5-185. *Removal — Engine Oil Strainers.*** a. Cut lockwire from hexagon head of rear (No. 2) bearing housing oil strainer (similar location on T53-L-13). Unscrew and remove strainer and gasket. Remove packing from strainer. Cover opening.

b. Disconnect pressure oil hose from power turbine oil strainer housing.

c. Unscrew and remove housing and strainer. Cover opening. Remove packing and strainer from housing (on T53-L-13 only, strainer must be unscrewed from housing adapter).

5-186. Deleted.

B **5-187. *Cleaning — Engine Oil Strainers.*** Clean strainers and attaching parts with a fine wire brush. Rinse with dry cleaning solvent (item 302, table 1-1).

B **5-188. *Inspection — Engine Oil Strainers.*** Inspect strainers for clogging or damage. Inspect housing adapter for stripped or damaged threads.

B **5-189. *Repair or Replacement — Engine Oil Strainers.*** Replace strainers if clogging cannot be removed, or if damaged. Replace housing adapter if damaged.

5-190. Deleted.

B 5-191. *Installation — Engine Oil Strainers.* a. Uncover mounting port for rear (No. 2) bearing housing oil strainer. Place gasket and packing on strainer. Screw retainer into diffuser housing, tighten and lockwire.

b. Uncover mounting port for power turbine (No. 3 and 4 bearing) oil strainer. Place packing on strainer housing. Insert strainer into adapter (on T53-L-13 only, screw strainer into housing adapter).

c. Install strainer housing, tighten with 80 to 100 inch-pounds torque, and lockwire (on T53-L-9/9A/11, hold lower adapter with wrench while tightening strainer housing).

d. Connect pressure oil hose to oil strainer housing. Tighten connector with 50 to 75 inch-pounds torque.

A 5-192. Engine Oil Pump — UH-1A. Engine-driven oil pump is mounted at front of accessory drive gear box. External features are inlet and outlet connections, pressure relief valve adjustment and a temperature bulb.

A 5-193. *Removal — Engine Oil Pump — UH-1A.* a. Open engine cowling. Place suitable vessel to catch trapped oil.

b. Disconnect electrical harness connector from oil temperature bulb. When required, remove temperature bulb and gasket.

c. Disconnect hoses from pump inlet and outlet fittings.

d. Remove lockwire and four bolts to detach pump from accessory drive gear box. Remove pump, coupling shaft assembly with snap-ring, and three packings at shaft and two oil passages.

e. Cover openings to prevent contamination.

A 5-194. *Installation — Engine Oil Pump — UH-1A.* a. Install snap-ring on coupling shaft. Insert shaft into middle opening of pump mounting pad on accessory drive gear box.

b. Install oil pump, with three packings in place, meshing pump shaft with coupling shaft. Secure pump to gear box with four bolts. Lockwire bolt heads.

c. Install 45 degree elbow with O-ring and nut in pump inlet, with open end pointing right. Attach hose assembly on elbow, and connect to shut-off valve outlet coupling.

d. Install elbow with O-ring and nut in pump outlet, with open end pointing aft. Attach hose assembly on elbow, and connect to return line coupling on deck.

e. Install oil temperature bulb with gasket in port at upper left on pump. Connect electrical harness connector to oil temperature bulb.

A 5-195. *Adjustment — Engine Oil Pump — UH-1A.* a. Before making any oil pump pressure adjustment, thoroughly check other elements of oil system, including pressure indication system.

(1) Oil pressure should not change during normal engine service.

(2) Check oil filter for cleanliness, since dirty filter discs can cause low oil pressure.

(3) Be sure operating checks of oil pressure are made according to normal procedures of engine operation, with oil temperature stabilized in normal range. (Refer to TM 55-1520-211-10.)

Caution

Do not make pressure adjustments during engine operation.

b. Adjust engine oil pressure, when necessary, at adjusting screw on front of oil pump housing.

(1) Loosen adjusting screw lock-nut.

(2) Turn adjusting screw clockwise to increase oil pressure or counter-clockwise to reduce pressure. One full turn will change oil pressure approximately eight psi.

(3) Tighten adjusting screw lock-nut with eight to ten foot-pounds torque.

(4) Recheck indicated oil pressure during engine operation.

B 5-196. Engine Oil Pump — UH-1B. An oil pump, mounted on front of accessory drive gear box, has pressure and scavenge elements on same drive shaft. External features on pump

are inlet and outlet hose connections, pressure relief valve adjustment screw and lock-nut, and a thermobulb for oil temperature indicator.

B 5-197. *Removal — Engine Oil Pump — UH-1B.* a. Disconnect electrical harness connector from thermobulb. Remove thermobulb and gasket when necessary.

b. Disconnect hoses from pump inlet reducer fitting and outlet elbow fitting. Remove fittings with gaskets when necessary.

c. Remove lockwire and four through bolts which secure pump to gear box. Remove pump, three packings, and coupling shaft with snap-ring from mounting pad.

d. Cover openings to prevent contamination.

B 5-197A. *Cleaning — Engine Oil Pump — UH-1B.* a. Clean parts with dry-cleaning solvent, (item 302, table 1-1).

B 5-197B. *Inspection — Engine Oil Pump — UH-1B.* a. Inspect pump for damaged threads and cracked flanges.

B 5-197C. *Repair or Replacement— Engine Oil Pump — UH-1B.* a. Remove temperature bulb from oil pump and install in new pump.

b. Check drive shaft assembly for damaged splines.

c. Replace drive shaft assembly, if splines are damaged.

B 5-198. *Installation — Engine Oil Pump — UH-1B.* a. Install snap-ring on coupling shaft. Insert shaft into middle opening of pump mounting pad on accessory drive gear box.

b. Install oil pump, with three packings in place, meshing pump shaft with coupling shaft. Secure pump to gear box with four bolts. Lockwire bolt heads.

c. Install reducer fitting with gasket in pump inlet port. Connect hose.

d. Install elbow fitting with gasket in pump outlet port. Align elbow to point straight down. Tighten fitting and lock-nut with 300 to 325 inch-pounds torque. Connect hose.

e. Install thermobulb with gasket in port at upper left on pump housing. Connect electrical harness connector to thermobulb.

B 5-199. *Adjustment — Engine Oil Pump — UH-1B.* Refer to paragraph 5-195.

B 5-200. Torquemeter Rotary Pump — UH-1B. A dual element pump is mounted on front of overspeed governor drive gear box. Pressure element supplies oil to torquemeter at 140 to 160 psi, regulated by an adjustable bypass valve. Other element of pump aids circulation and scavenging of oil in governor drive gear box and to accessory mounting pad (unused) or right upper side of inlet housing.

B 5-200A. *Removal — Torquemeter Rotary Pump —UH-1B.* a. Remove mounting bolts and washers that secure rotary pump to the overspeed governor and tachometer drive assembly.

b. Remove rotary pump and discard packing.

B 5-201. *Inspection — Torquemeter Rotary Pump.* Inspect seal for leaks or damage. Inspect pump for proper operation.

B 5-202. *Repair or Replacement — Torquemeter Rotary Pump — UH-1B.* a. Replace seal which is accessible without disassembly of pump or valve.

Note

On the T53-L-13 engine an LTCT215 wrench is required to remove and replace torquemeter rotary pump.

b. Replace pump assembly in event of malfunction. Carefully note position of pump when removing, after removal of six mounting bolts, and align its ports to internal passages of mounting pad when reinstalling.

c. Use an accurate test gage, connected at port provided (9, figure 5-37), for checking or adjusting rotary pump pressure to 140 to 160 psi at bypass valve (11) during a ground run. Remove gage and reinstall plug in port after adjustment.

B 5-202A. *Installation — Torquemeter Rotary Pump — UH-1B.* a. Establish proper end float of overspeed governor drive shaft.

b. Install shims on either end of overspeed governor drive shaft, as required.

c. Install packing in rotary pump housing.

d. Mount rotary pump on overspeed governor and tachometer drive housing, mating its splined shaft with internal spline of overspeed governor drive shaft.

e. Secure pump with mounting bolts and washers. Tighten bolts. Lockwire.

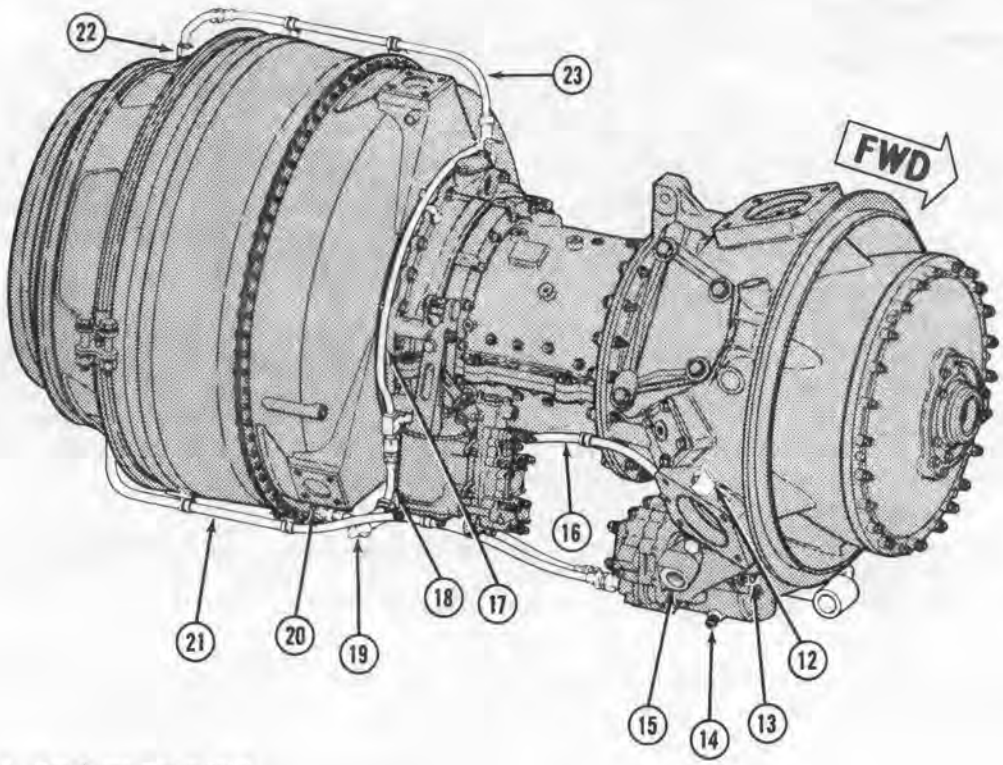
B 5-203. *Adjustment – Torquemeter Rotary Pump — UH-1B.* Torquemeter oil pressure may be adjusted as follows: (See figure 5-39.)

a. Remove plug from overspeed governor and tachometer drive and install a pressure gage that provides readings of 0 to 200 psi.

b. Operate engine and check torquemeter oil pressure.

Note

Normal pressures at test connection should be 150 (plus or minus 10) psi



1. Pressure Pump Inlet
2. Pressure Relief Valve Adjustment
3. Thermobulb Location
4. Scavenge Pump Outlet
5. Main Filter
6. Oil Pressure Tap
7. Filter By-Pass Valve
8. Torquemeter Boost Pump
9. Test Gage Connection
10. Strainer and Metering Cartridge
11. Boost Pump Pressure Adjustment
12. Torquemeter Pressure Tap
13. Accessory Gear Box Pressure Tap
14. Magnetic Chip Detector Plug
15. Accessory Gear Box Breather Port
16. Pressure Oil Line
17. Oil Manifold
18. Oil Line to No. 2 Bearing
19. Scavenge Line - No. 2 Bearing
20. Inlet Strainer - No. 2 Bearing
21. Scavenge Line - No. 3 and 4 Bearings
22. Inlet Strainer - No. 3 and 4 Bearings
23. Pressure Oil Line

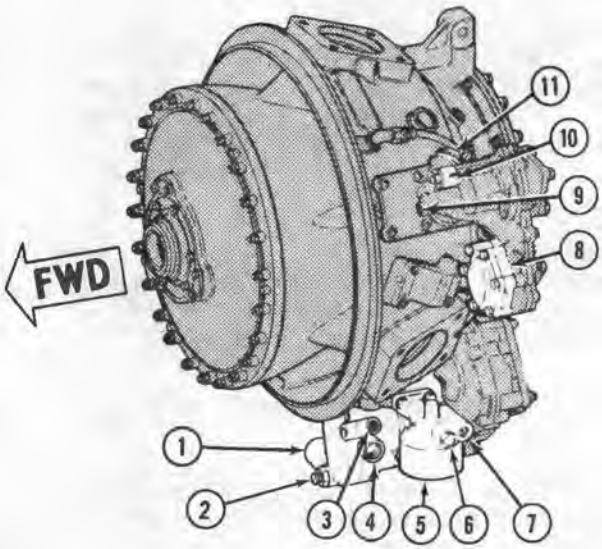


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Figure 5-38. Oil system components — T53-L-9/9A/11 series engines

1. Oil Pressure Hose to No. 3 and 4 Bearings.
2. Oil Pressure Hose to Lube Pressure Manifold
3. Oil Scavenge Hose from No. 2 Bearing
4. Oil Pressure Hose to No. 2 Bearing Filter
5. Lube Pressure Manifold
6. Oil Scavenge Hose from No. 3 and 4 Bearings Bearings
7. No. 3 and 4 Bearing Oil Strainer Housing Adapter
8. Power Driven Rotary (Booster) Pump
9. Lube Oil Filter Assembly
10. Power Driven Rotary (Oil) Pump

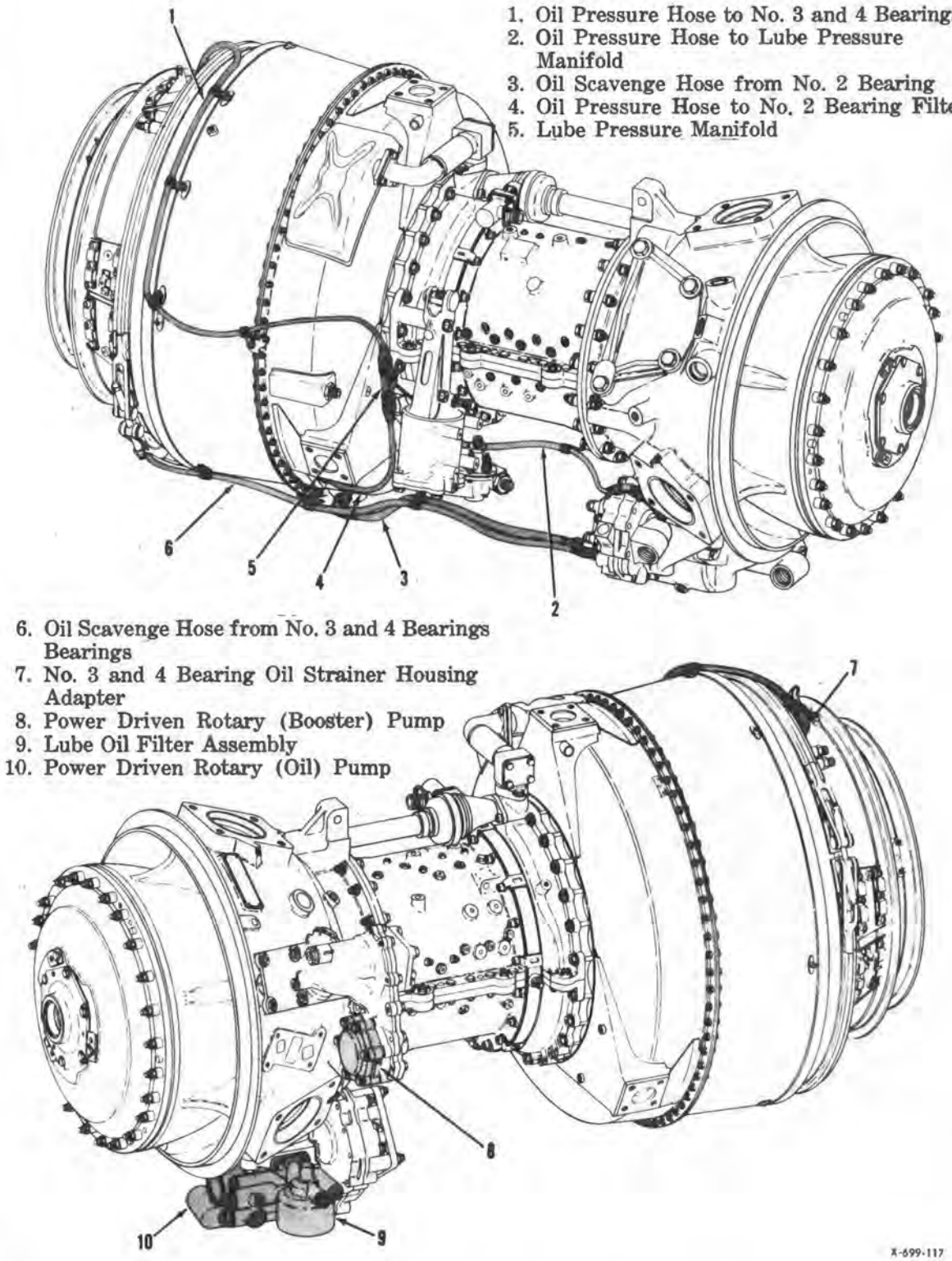


Figure 5-38A. Oil system components — T53-L-13 engine

c. Inspect container (3), stud (10) and filter body (11) for damage and general condition.

d. Inspect magnetic plug for accumulation of metal chips and foreign material. Check condition of threads.

A ***5-213. Repair or Replacement — Engine Oil Filter — UH-1A.*** a. If accumulation of metal chips and foreign material on screens is excessive replace screens and immediately investigate source to determine corrective action.

b. If accumulation of metal chips and foreign material on magnetic plug is excessive immediately investigate source to determine corrective action. If threads are damaged replace magnetic plug.

c. Replace packings and unserviceable parts as necessary.

A ***5-214. Reassembly—Engine Oil Filter—UH-1A.*** a. Assemble seven filter discs, six spacers, and retainer cup on filter cartridge tube. Place cartridge assembly on stud. Secure with jam nut, tighten so that parts will not rotate.

b. Place O-ring and container on filter body, aligning pierced lugs for lockwire. Install seal nut with packing. Tighten with 70 to 90 inch-pounds torque. Lockwire nut to container, and container to filter body.

Caution

Do not attempt to correct oil leakage between packing and container by increasing torque on seal nut. If leak occurs, check mating surfaces and install new packings.

Warning

Do not allow oil to remain on skin longer than necessary, since it contains a toxic additive which is readily absorbed through skin.

A ***5-215. Installation—Engine Oil Filter—UH-1A.*** a. Position oil filter on engine with new O-ring packings (14, figure 5-40).

b. Install attaching washers (13) and bolts (12).

c. Install magnetic plug, with new packing, and lockwire.

d. Close and secure engine cowling.

B **5-216. Engine Oil Filter — UH-1B.** Oil filter on T53-L-5, -L-9, -L-11 or -L-13 engines is located at left side of inlet housing. Filter element is reusable wafer disc type, enclosed in a cylindrical housing equipped with a bypass valve preset to open at 15 to 20 psi differential pressure for continued oil flow if screens should become clogged. Flow to and from filter is through internal passages. A pressure line from a tap on filter housing connects to oil pressure gage transmitter and pressure switch for caution panel light.

B ***5-217. Removal — Engine Oil Filter.*** a. Open cowling at left-hand side of engine. Position suitable container to catch oil.

b. Disconnect oil lines and cap or cover openings.

c. Remove bolts, washers, tab washers, and brackets attaching filter to engine. Remove filter and packings.

B ***5-218. Disassembly — Engine Oil Filter.*** a. Remove retaining ring (1, figure 5-41A.)

b. Use ¼-28 screw to remove plug (2) from housing. Remove packing (3).

c. Carefully remove spring (4) and relief valve (5).

d. Cut lockwire and loosen bolt (6) that secures cover assembly (7) to housing (8) and withdraw cover assembly from housing. Remove packing (9).

e. Remove retaining ring (10) and end plate (11).

f. Carefully lift filter elements (12) from cover (13).

g. Remove nut (14), bolt (6), packing (15) and washer (16) from cover (13).

B ***5-219. Cleaning — Engine Oil Filter.*** Engine oil filter shall be cleaned after initial installation of an engine and after first ground run-up.

a. The following procedure may be used for cleaning engine oil filter without removing entire unit from engine.

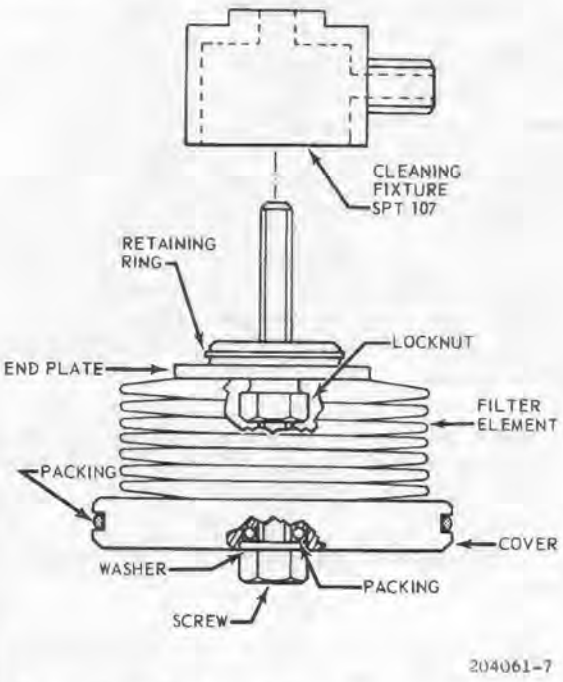


Figure 5-41. Engine oil filter, cover assembly and cleaning fixture — UH-1B

(1) Opening cowling at left-hand side of engine. Position suitable container to catch oil.

(2) Loosen bolt (6) that secures cover assembly (7) to housing (8) and withdraw cover assembly from housing.

(3) Place cleaning fixture SPT 107 on filter screw of cover assembly and tighten to snug fit against end plate (11). (See figure 5-41.) Cap fixture nipple.

(4) Immerse cover assembly and fixture in dry cleaning solvent (item 302, table 1-1) and soak until contaminants are removed from external surfaces of elements.

(5) Attach an air line to nipple of cleaning fixture. Continue rinsing in solvent until there is no discoloration.

(6) Remove cleaning fixture with filter screw. Dry cover assembly with clean compressed air. Protect cover assembly from contamination after drying.

(7) Wash filter housing (8) with dry cleaning solvent (item 302, table 1-1).

b. Completely removed and disassembled engine oil filter may be cleaned as follows:

(1) Clean all components, except filter elements and packings, with dry cleaning solvent (item 302, table 1-1).

(2) Install filter elements on a shaft having the same diameter as the filter element orifice.

(3) Immerse shaft and elements in an agitating bath of Turco compound (item 328, table 1-1) at 160°F to 200°F (71°C to 93°C) until all contamination is removed.

Caution

Perform this cleaning operation in a well ventilated area.

(4) Rinse under hot, running water or in tank of boiling water. Dry with clean, compressed air at a maximum pressure of 100 psi.

B 5-220. ***Inspection — Engine Oil Filter.*** Engine oil filter shall be inspected after initial installation of an engine and after first ground run-up.

a. Inspect all parts for nicks, burrs, scratches, cracks, distortion and excessive wear.

b. Inspect all threaded parts for damaged threads.

c. Inspect filter elements for corrosion and accumulation of metal chips and foreign material. Check for tears, breaks or other damage.

d. If cover assembly has been disassembled, measure thickness of filter elements at inner ring. Thickness shall be 0.126 to 0.136 inch.

B 5-221. ***Repair or Replacement — Engine Oil Filter.*** a. If accumulation of metal chips or foreign material on elements is excessive, immediately investigate source of contamination to determine corrective action.

b. Blend repair nicks, burrs, and scratches.

c. Replace all cracked, distorted, or excessively worn parts. Replace all packings and parts with damaged threads.

d. Replace damaged elements.

B 5-222. *Reassembly — Engine Oil Filter.* a. Install new packing (15, figure 5-41A) in groove on face of cover (13) and new packing (9) in groove of cover outside diameter.

b. Install washer (16) on bolt (6) and insert bolt through cover (13). Install nut (14) and tighten until it bottoms.

c. Carefully install elements (12) and end plate (11) on cover (13). Secure with retaining ring (10).

d. Install cover assembly (7) into housing (8). Tighten bolt (6) with 20 to 35 inch-pounds torque and lockwire to housing (8).

e. Carefully install relief valve (5) and spring (4) in housing (8).

f. Install new packing (3) on relief valve. Install plug (2) and secure with retaining ring (1).

B 5-223. *Installation—Engine Oil Filter.* a. Place new packings on mounting face of engine accessory drive gearbox.

b. Position oil filter on gearbox and install attaching brackets, tab washers, and bolts.

c. Uncap or uncover openings in oil lines and connect lines to filter.

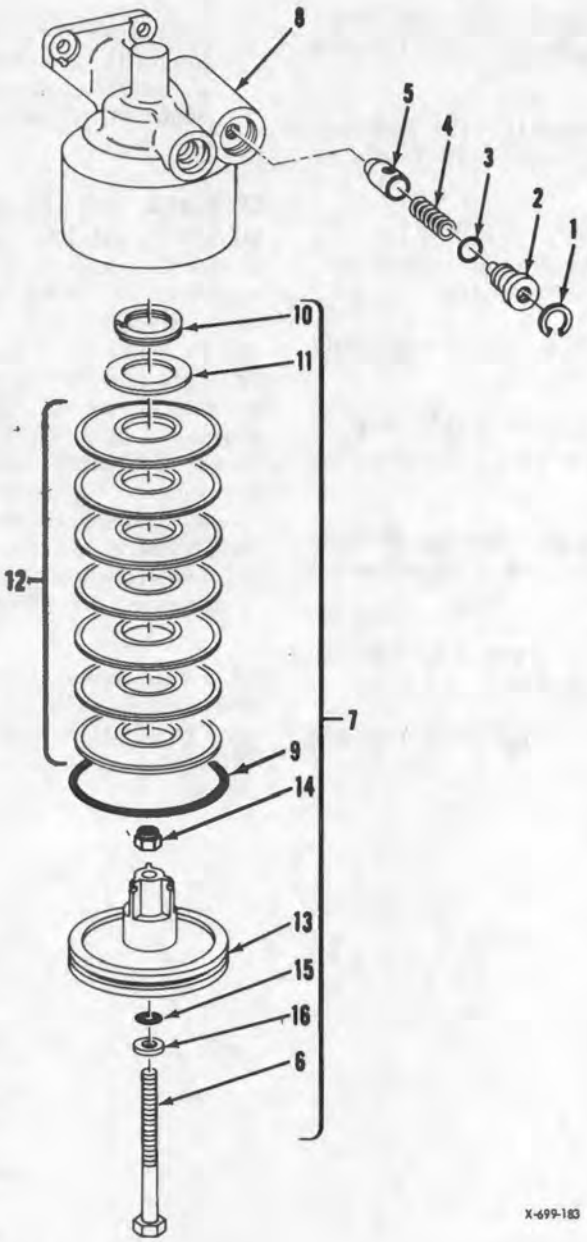
d. Remove drainage vessel. Close and secure engine cowling.

Warning

Do not allow oil to remain on skin any longer than necessary, since it contains a toxic additive which is readily absorbed through skin.

A **5-224. Oil Pressure Transmitters and Switch — UH-1A.** (See figure 5-32.) Pressure switch for engine oil pressure caution light is mounted on right side of inlet housing just above oil filter, with a connecting line from filter pressure tap. Transmitters for engine oil pressure and torque indicators are mounted on a bracket at top of inlet housing. Through Serial No. 58-3047, transmitters are in a shock-mounted bracket, with all oil connections on front ends. On Serial No. 59-1607 and subsequent, bracket is secured directly to engine pad, a different type of transmitter is used, and torquemeter transmitter has a vent line hose to accessory drive gear box.

A *5-225. Removal — Oil Pressure Transmitters and Switch — UH-1A.* a. Open right-hand engine cowling and position suitable container to catch oil.



1. Retaining Ring
2. Plug
3. Packing
4. Spring
5. Relief Valve
6. Bolt
7. Cover Assembly
8. Housing
9. Packing
10. Retaining Ring
11. End Plate
12. Filter Elements
13. Cover
14. Nut
15. Packing
16. Washer

Figure 5-41A. Engine oil filter assembly

b. Disconnect electrical leads and oil lines from pressure switch. Cap or cover openings in lines to prevent entrance of foreign material.

c. Cut lockwire, remove bolts and washers and lift switch from engine.

d. Disconnect oil lines and electrical cable from transmitter. Cap or cover lines to prevent entrance of foreign material.

e. Remove mounting screws or nuts to detach transmitter from bracket and remove transmitter.

A ***5-226. Installation—Oil Pressure Transmitters and Switch — UH-1A.*** a. Position pressure switch on bracket and secure with washers, bolts and lockwire.

b. Use tee fitting in replacement switch. Uncap or uncover openings in oil lines and connect oil lines and electrical leads to pressure-switch. Lockwire connector.

c. Transfer fittings to replacement filter. Check that plug with orifice is installed in "V" connection on either transmitter through aircraft Serial No. 58-3047, or on oil pressure gage transmitter only on aircraft Serial No. 59-1607 and subsequent.

d. Position transmitter in bracket and install mounting screws or nuts.

e. Uncap or uncover openings in oil lines and electrical cable to transmitter. Lockwire connector.

f. Remove drainage vessel. Close and secure engine cowling.

B **5-227. Oil Pressure Transmitters and Switch — UH-1B.** (See figure 5-34.) Transmitters for engine oil pressure and torque indicators are mounted in a support at top of inlet housing. Pressure switch for engine oil pressure caution light is mounted on top of same support assembly.

B ***5-228. Removal — Oil Pressure Transmitters and Switch — UH-1B.*** a. Open engine cowling doors and position suitable container to catch oil.

b. Disconnect electrical cable connector from pressure switch. Disconnect oil pressure line hose and tube from tee fitting on switch and cap or cover openings to prevent entrance of foreign material.

c. Remove two bolts to detach switch from top of support assembly and remove switch.

d. Cut lockwire and disconnect electrical cable connector from oil pressure transmitter. Disconnect oil tube and remove elbow, nut, gasket and large retaining nut at front end of transmitter. Cap or cover openings in oil tube to prevent entrance of foreign materials. Remove transmitter from support.

e. Cut lockwire and disconnect electrical cable connector from torquemeter transmitter. Disconnect vent line hose from rear of transmitter and remove union and gasket. Cap or cover openings in hose to prevent entrance of foreign material.

f. Disconnect pressure line hose from front of transmitter and remove elbow, gasket, nut and large retaining nut. Cap or cover opening in hose to prevent entrance of foreign material. Remove transmitter from support.

B ***5-229. Installation—Oil Pressure Transmitter and Switch — UH-1B.*** a. Install tee fitting with nut and gasket on replacement pressure switch. Align tee nipples to point forward and to left when switch is in place.

b. Position switch on top of support assembly and install two mounting bolts.

c. Uncap or uncover oil lines and connect oil tube between oil pressure transmitter elbow and forward nipple of switch tee. Connect oil pressure hose from filter to switch tee. Connect and lockwire electrical cable connector.

d. Check that oil pressure transmitter plug with orifice is installed in "V" port of transmitter. Position transmitter in support.

e. Install fittings in front end of transmitter. Uncap or uncover opening in oil tube and connect to front end. Connect electrical cable connector to rear end. Lockwire connector.

f. Position torquemeter transmitter in bracket and install retaining nuts.

g. Install fittings and gaskets. Uncap or uncover openings in hoses and connect hoses to transmitter.

h. Connect electrical cable and lockwire connector. Lockwire retaining nut to oil pressure transmitter retaining nut.

B **5-229A.** ***Reseating — Torquemeter Valve — UH-1B.*** Abnormally high torquemeter gage indication may be caused by torquemeter valve in engine failing to close. This malfunction can be checked and possibly corrected as follows:

a. Disconnect torquemeter transmitter hose from pressure tap port (12, figure 5-38) or right side of engine inlet housing.

b. On left side of engine, remove plug from test gage connection port (9) at front of overspeed governor drive gear box. Install a suitable fitting in port and apply air pressure at 100 psig.

c. Check for air flow from open port on right side of inlet housing.

(1) If there is no air flow, torquemeter valve in engine is operating properly.

(2) If there is air flow, valve is sticking open. Detach air pressure source from gear box port, and apply pressure to port on right side of engine. This should free valve of any foreign matter and allow it to operate properly. Repeat check for proper closing with air applied at gear box port.

d. If the above procedure fails to seat the valve, request assistance from higher maintenance level.

e. When valve operation is satisfactory, reinstall plug in port on gear box and reconnect torque pressure transmitter.

Section VII — Ignition System

5-230. Ignition System. Starter - generator and other electrical units on engine connect into 28 volt DC system of airframe at two large receptacles on engine deck at left side. Main cable bundle is routed from outboard receptacle to main connector of engine electrical harness, and has branching leads to units on power plant. (See figure 5-42, typical installation for UH-1B.) Inboard receptacle accommodates starter-generator cables. Fire detector wiring on engine cowling doors connects at smaller receptacles on each side of deck. Circuit details are contained in Wiring Diagrams. (Refer to paragraph 12-125.)

5-231. A harness assembly, furnished by engine manufacturer and mounted on compressor housing, provides connectors for fuel control changeover solenoid, starting fuel solenoid, ignition system exciter unit, oil inlet temperature bulb, anti-icing valve or other units, and for gas producer (nI) and power turbine (nII) tachometer generators. (See figures 5-43 and 5-44.)

5-232. Ignition system is a capacitor discharge type, and consists of an ignition exciter unit, output leads, and surface-gap igniter plugs. (See figures 5-43 and 5-44.) System is activated simultaneously with starting fuel system. Input from 28-volt DC electrical system is stepped up in ignition unit to 2500-volt output, discharged through igniter plugs in combustion chamber at a spark rate of two to eight per second, depending on input voltage.

5-233. General Maintenance — Ignition System.
a. Visually inspect harness and cable for damaged insulation, connectors for signs of corrosion and damaged threads. Remove any corrosion fom pin sockets and terminals by wire brushing or light rubbing with crocus cloth (item 401, table 1-1). Minor thread damage may be repaired to make connectors serviceable.

b. Be sure connectors are clean and dry. Check continuity of circuits, when required, in accordance with wiring diagrams. (Refer to paragraph 12-125.)

c. Replace harness or cable as assemblies when unserviceable.

d. Replace unserviceable starter-generator and ignition system components.

e. Ignition exciter unit, leads, and igniter plugs are not repairable or adjustable, and must be replaced when inoperative.

Note

On the T53-L-5/L-9/L-9A/L-11/L-13 engines use special tool (LTCT4457, socket adapter) to disconnect spark lead assembly and igniter plug connectors.

Caution

It is imperative that input lead to ignition exciter box shall be disconnected whenever any maintenance is being performed on engine combustor section.

A 5-234. Ignition Unit — UH-1A. (See figure 5-43.) The ignition unit is located on the right-hand side of the engine. The purpose of this unit is to step up 28 volt DC current to 2500 volts and discharge it through the igniter plugs into the engine combustion chamber.

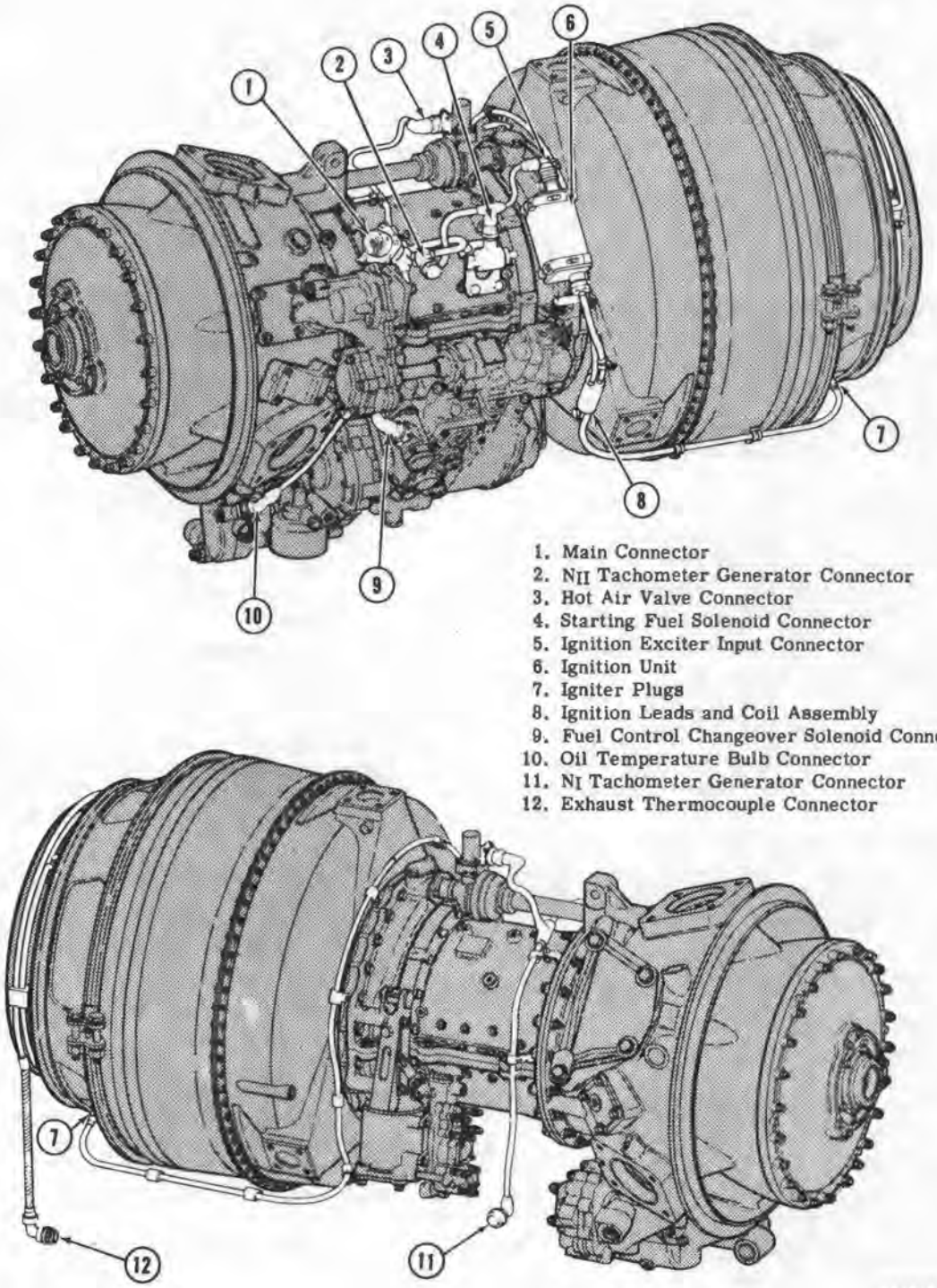
A ***5-235. Removal — Ignition Unit — UH-1A.*** a. Disconnect input lead (11, figure 5-43) and two output leads (13) from connectors on ignition unit.

b. Remove four nuts and screws at corners of mounting flanges to detach ignition unit from support brackets and remove unit.

c. Reinstall screws and nuts temporarily to hold anti-icing interpreter.

Warning

The ignition exciter contains a very small amount of radioactive material (Cesium-Barium 137) and normally requires no handling precautions. However, heavily damaged units that have been broken open must be handled with forceps or gloves and disposed of in accordance with AR 755-380, Disposal of Supplies and Equipment.



1. Main Connector
2. N_{II} Tachometer Generator Connector
3. Hot Air Valve Connector
4. Starting Fuel Solenoid Connector
5. Ignition Exciter Input Connector
6. Ignition Unit
7. Igniter Plugs
8. Ignition Leads and Coil Assembly
9. Fuel Control Changeover Solenoid Connector
10. Oil Temperature Bulb Connector
11. N_I Tachometer Generator Connector
12. Exhaust Thermocouple Connector

Figure 5-44. Engine electrical harness and units — T53-L-5/9/11 series engines

B **5-239. *Installation—Ignition Unit—UH-1B.*** a. Position ignition unit on mounting bracket and fit slots of loop clamps over lugs on unit. Secure clamp ends with screws and nuts.

b. Check condition of all connectors on ignition leads. Connect spark-splitter coil lead to output connector on lower end of ignition unit.

c. Connect electrical harness lead from starting fuel solenoid to input connector on upper end of ignition unit. Make sure lead cannot chafe against clamp on unit. Lockwire all connectors.

5-240. Igniter Plugs or Leads. Igniter plugs (6, figure 5-43; 7, figure 5-44; 11, figure 5-44A) discharge electrical current into the engine combustion chamber.

5-241. Removal—Igniter Plugs or Leads. a. Disconnect ignition unit input lead as safety precaution.

b. Disconnect leads from igniter plugs.

c. Remove igniter plugs from mount plates on rear side of engine combustion chamber. Cap or cover ends of plugs and open ports in engine to prevent entrance of foreign material.

5-241A. Inspection — Igniter Plugs — UH-1B. a. Visually inspect igniter plug gap surface material.

b. Inspect shank for fretting condition.

5-242 Installation — Igniter Plugs or Leads. a. Uncap or uncover igniter plug ends and ports in engine.

b. Position washer on each igniter plug except as noted. On the T53-L-13 engine use spacer on each plug. On the T53-L-11 engine use neither washers nor spacers.

c. Screw igniter plugs into combustion chamber at approximately 5 and 7 o'clock positions. (On the T53-L-13 engine at the 2, 4, 8, and 10 o'clock position.) Tighten to 85 to 95 inch-pounds torque. Lockwire to adjacent vaporizer locking nut.

d. Connect igniter plug connectors to igniter plugs.

e. Check for 0.010 inch minimum clearance between combustor liner and igniter plug.

f. Connect input lead to ignition unit.

A **5-243. Starter-Generator — UH-1A.** A starter-generator, mounted to a drive pad on right rear side of accessory drive gear box and connected to 28 volt DC electrical system serves to drive compressor rotor during engine starting cycle and also functions as an engine driven stand-by generator at normal engine speeds. Cooling air is circulated through starter-generator by ducts and shrouds. A seal drain hose from starter drive pad connects to a drain line coupling at left side of deck.

A ***5-244. Removal—Starter-Generator — UH-1A.*** a. Open engine cowling doors. Disconnect starter-generator cable (17, figure 5-1) at deck connector.

b. Pull end of flexible duct (27, figure 5-1) from inlet on starter blast cap. Cover open end of duct.

c. Pull ends of flexible exit duct from elbow on right side of engine inlet housing, and from outlet of air collector on starter.

d. Detach collector outlet tube support clamp from engine flange bolt. Loosen two clamping bolts at right side of air collector. Slip collector aft on starter.

e. Loosen six nuts on starter mounting studs. Turn starter-generator counterclockwise, and carefully pull assembly aft to remove.

f. Disconnect cable from starter-generator terminals. Remove four screws to detach blast cap. Remove air collector.

g. When required, remove elbow with four bolts and gasket from engine inlet housing. Cover opening.

A ***5-245. Installation — Starter-Generator — UH-1A.*** a. Place air collector on starter-generator, aft of brush opening and with outlet pointing up and right. Tighten two clamping bolts temporarily.

b. Install blast cap on rear end of starter-generator, with inlet pointing down at left, secured with four screws. Coat male splines with plastilube Moly No. 3 (item 20, table 1-1) and pack female splines ⅔ full.

c. Lift starter to position on studs, meshing shaft splines, turn clockwise and tighten mounting nuts.

d. Slip air collector forward to normal position, over brush area, and align clamping joint at right on horizontal center line of starter. Attach support clamp of outlet under head of bolt through engine housing flanges. Tighten collector bolts.

e. Place an O-ring packing on each end of flexible exit duct. Insert one end in air collector outlet, other end in elbow. Position elbow and gasket on mounting port at right side of engine inlet housing. (See figure 5-1.) Secure elbow to housing with four bolts, lockwired in pairs.

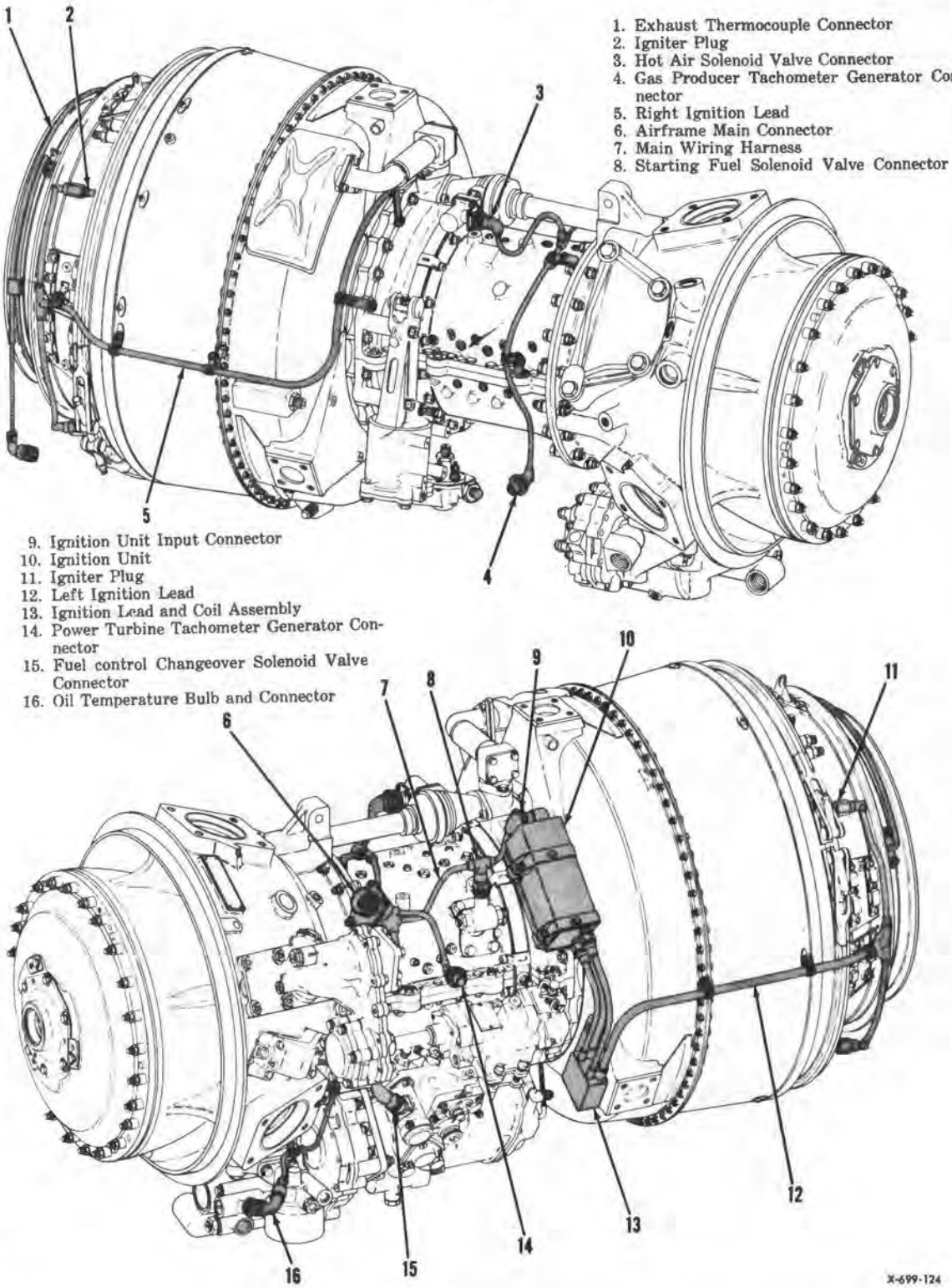


Figure 5-44A. Engine electrical harness and units — T53-L-13 engine

f. Place O-ring packing on end of flexible inlet duct (27, figure 5-1). Insert duct end in blast cap inlet.

g. Connect cable to starter - generator terminals. (Refer to paragraph 12-125.) Connect cable at deck connector (17, figure 5-1). Close cowling.

B 5-246. Starter-Generator — UH-1B. (See figure 5-45.) A starter-generator unit, mounted to right rear side of accessory drive gear box and connected to the 28-volt electrical system, serves to drive compressor during engine starting cycle and also functions as an engine-driven stand - by generator at normal engine speeds. Cooling air from oil cooler blower is circulated through starter-generator by ducts and shrouds, and is discharged into exhaust tailpipe. A seal drain hose from starter drive mounting pad leads to deck coupling of a discharge line at left side.

B 5-247. *Removal—Starter-Generator — UH-1B.* a. Remove cover (8, figure 5-45) and disconnect electrical leads at aft end of starter-generator. Insulate wire terminals.

b. Disconnect air ducts from flanged necks on forward and aft cooling shrouds by removing V-band clamps (2 and 12). Loosen two clamping bolts at right side of forward shroud (12), and slide shroud aft to expose starter mounting studs.

c. Loosen nuts and washers on six mounting studs. Turn starter-generator counterclockwise, and pull carefullly straight aft until free of studs and drive shaft engagement. Cover mounting pad.

d. Detach shroud from aft end of starter by removing two locating screws at top and two clamping bolts at joint on left side. Remove forward shroud.

B *5-248 Installation — Starter-Generator — UH-1B.* a. On a new starter, remove manufacturer's brush cover from aft end, keeping two small locating screws for installation of cooling shroud.

Note

Turn starter so the two screwholes are at top center for correct position when installed.

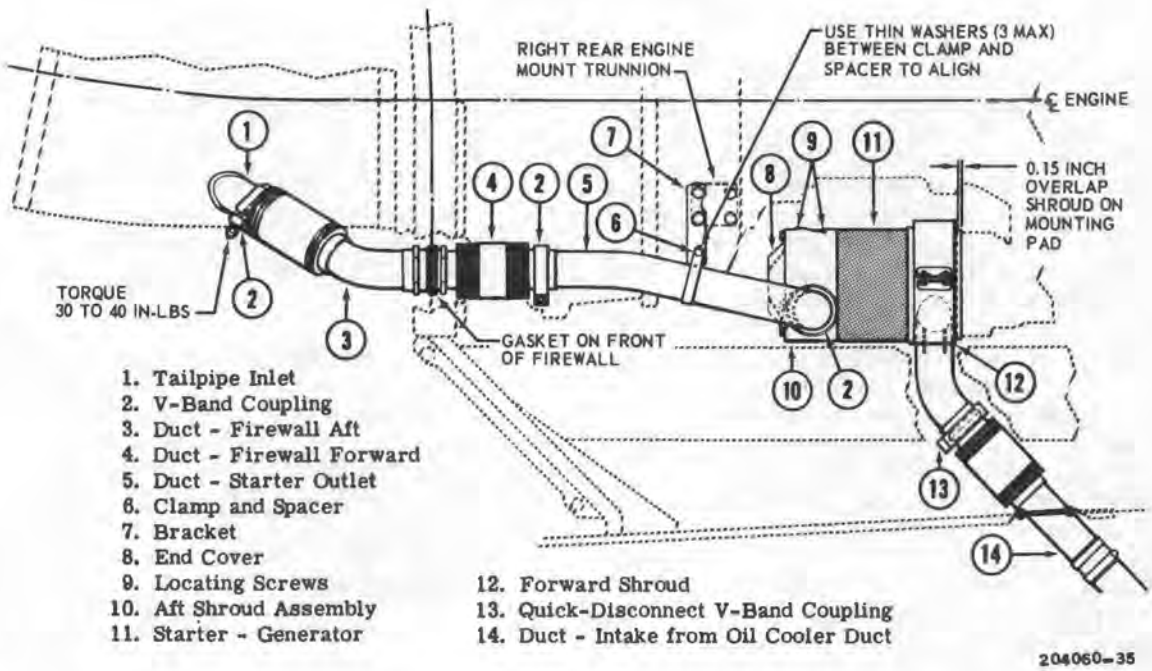


Figure 5-45. Starter generator and cooling ducts — UH-1B

b. Place forward shroud around starter, far enough aft to allow access to mounting flange and with clamping joint on right-hand side.

c. Install aft shroud with two locating screws and washers, and two bolts with washers tightened in clamping joint at left side. Lockwire screws. Coat male splines with Plastilube Moly No. 3 (item 20, table 1-1) and pack female splines ⅔ full.

d. Lift starter to position on studs, meshing shaft splines, turn clockwise and tighten mounting nuts.

e. Slide forward shroud to position, overlapping 0.15 inch on mounting pad. Align intake neck to flange of duct, above deck at left of drive shaft tunnel, and install V-band clamp with nut tightened 30 to 40 inch-pounds. Tighten two bolts in shroud clamping joint.

f. Secure exit air duct to outlet of aft shroud with V-band clamp, tightened 30 to 40 inch-pounds. Install cover on aft end of starter with six screws and washers. Lockwire screw heads.

g. Connect electrical leads from cable connector on deck at left side to terminals on starter-generator. (Refer to paragraph 12-125.)

Section VIII — Cooling System

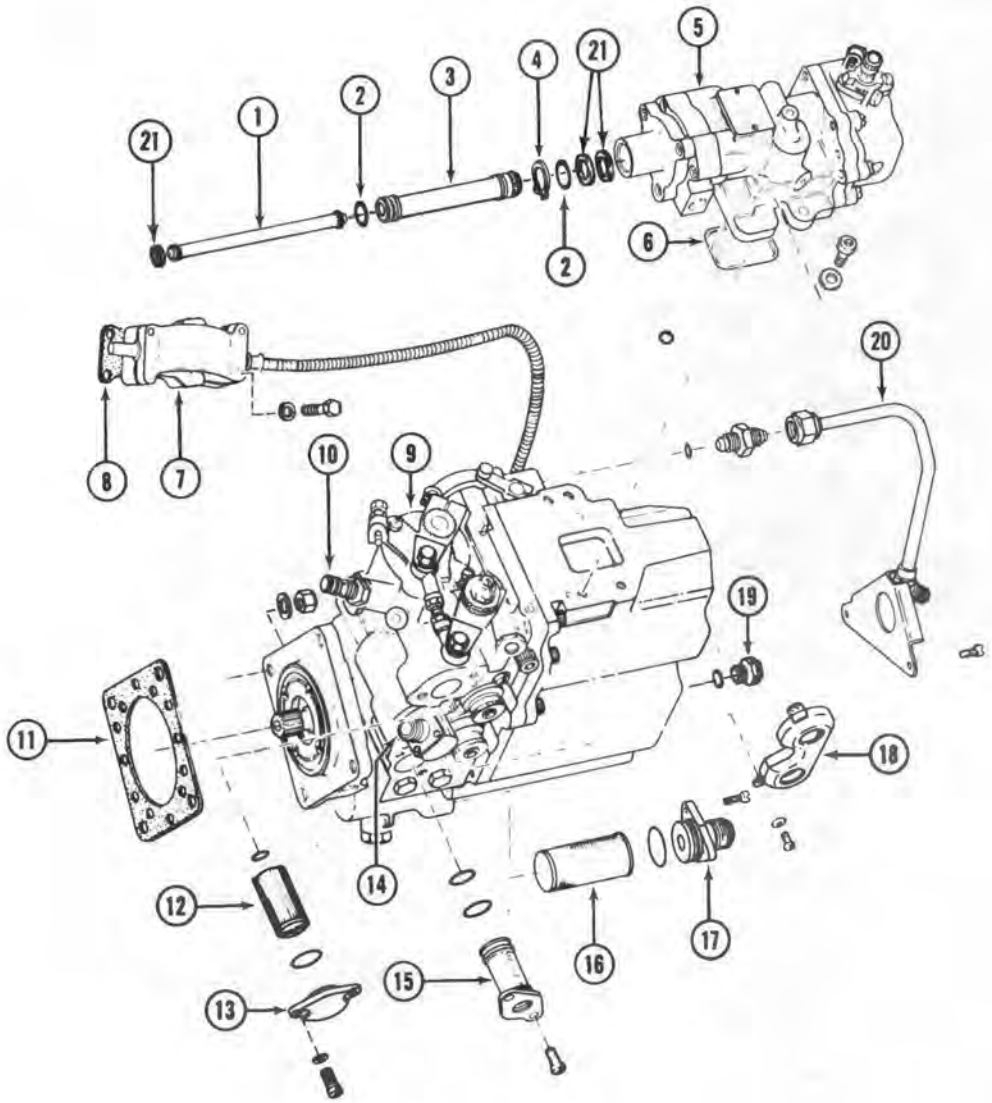
(Not Applicable)

Section IX — Fuel Control

5-249. Fuel Control. (See figure 5-46, 5-47, or 5-48.) Engine fuel control is a hydro-mechanical mechanism made up of a fuel regulator assembly and an overspeed governor assembly. Fuel regulator is mounted on a drive pad at left rear side of accessory drive gear box, driven through a gear train by compressor rotor and first-stage (nI) turbine. With solenoid operated changeover valve in AUTOmatic position for normal operation, a dual-element pump supplies fuel at high pressure through a strainer to main metering valve, bypassing excess fuel through main pressure regulator, then through a manually-controlled stop cock valve to main discharge port and external line. Fuel flow rate is determined by computer mechanisms in relation to first-stage turbine speed, air pressure, inlet air temperature (through an external sensing element) and power lever settings manually selected by means of linkage to twist-grip control. Overspeed governor, mounted on regulator and driven through gear train from power output shaft, acts through regulator to limit fuel flow when power turbine (nII) rpm tends to exceed speed selected by means of external control system.

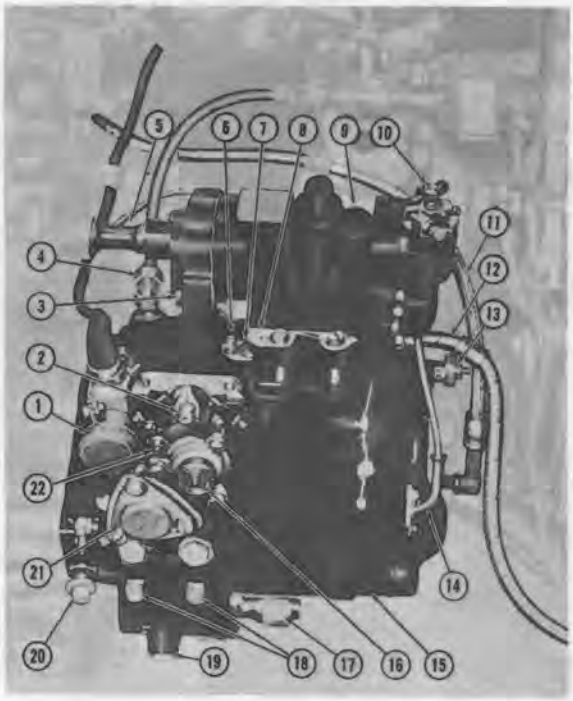
5-250. In starting cycle of T53-L-1A and T53-L-5/9/9A engines without scheduled fuel, fuel flow is through servo filter directly to starting fuel discharge port and external line, and is controlled only by the starting fuel solenoid valve.

B 5-251. In starting cycle of T53-L-11 and T53-L-5/9/9A engines with scheduled fuel, starting fuel for normal conditions is a scheduled flow from the fuel regulator to a port with a banjo-type fitting to which the starting fuel solenoid hose is connected. There is another other port with an elbow fitting, which is capped in normal conditions and is called the unscheduled starting fuel port because it is not subject to flow control by the fuel regulator scheduling devices. The T53-L-13 engine functions in a similar manner. The starting fuel switch opens the starting fuel solenoid valve, allowing starting fuel from the fuel regulator to flow through the starting fuel manifold; four



1. Governor Drive Shaft
2. Packings
3. Shaft Tube
4. Retaining Ring
5. Overspeed Governor Assy
6. Governor Seal
7. Temperature Sensing Element Housing
8. Gasket
9. Fuel Regulator
10. Starting Fuel Outlet
11. Gasket
12. Filter Puller
13. Filter Cover
14. Changeover Solenoid
15. Fuel Strainer
16. Fuel Inlet Strainer
17. Inlet Fitting
18. Pressure Regulator Shield
19. Pressure Sensing Port Plug
20. Fuel Discharge Tube
21. Shims

Figure 5-46. Fuel control unit — T53-L-1A engine



1. Changeover Solenoid
2. Power Lever Control Shaft
3. Governor Seal Drain Tap
4. Starting Fuel Outlet
5. Governor Drive Shaft
6. Maximum nI Speed Trim
7. Adjustment Locking Screw
8. Idle nI Speed Trim (Hidden)
9. Overspeed Governor Assembly
10. Governor Control Shaft
11. Air Pressure Sensing Line
12. Main Fuel Outlet
13. Maximum Fuel Stop
14. Air Temperature Sensing Line
15. Fuel Regulator Assembly
16. Main Pressure Regulator
17. Fuel Inlet
18. Dual Pump Pressure Taps
19. Inlet Pressure Tap (not used)
20. Seal Drain Fitting
21. Discharge Strainer and Filter
22. Emergency Fuel Stop

204060-44C

Figure 5-47. Fuel control unit — T53-L-5/9/9A engines (typical)

starting fuel nozzles; and into the combustion chamber where it is ignited by four igniter plugs. When the gas producer rpm reaches sufficient speed, the ignition system is de-energized causing the solenoid valve to close and stop the flow of starting fuel. The starting fuel nozzles are self-purging and automatically remove excess fuel. When JP-5 fuel is being used and cold weather starting is difficult, the unscheduled starting fuel port may be connected instead of the scheduled port, which would then be capped.

5-252. Deleted.

B **5-253. *Interchangeability — Part No. 70800 Engine Fuel Control.*** The following procedures are necessary to convert a Part No. 70800 engine fuel control for use on either a T53-L-5 or T53-L-9/9A engine.

Note

All Part No. 70800 engine fuel controls shipped from the engine manufacturer are adjusted for use on T53-L-9/9A engines.

a. To convert a Part No. 70800 engine fuel control from usage on a T53-L-9/9A engine to usage on a T53-L-5 engine proceed as follows:

(1) Adjust maximum fuel stop (13, figure 5-47) six serrations clockwise to decrease fuel flow.

(2) Adjust emergency fuel stop (2) one-half turn clockwise to decrease fuel flow.

b. To convert a Part No. 70800 engine fuel control from usage on a T53-L-5 engine to usage on a T53-L-9/9A engine proceed as follows:

(1) Adjust maximum fuel stop six serrations counterclockwise to increase fuel flow.

(2) Adjust emergency fuel stop one-half turn counterclockwise to increase fuel flow.

c. Lockwire adjusting screws.

d. Record conversion data on engine Form 2408-16.

Note

An engine run-up check must be made after change of fuel control.

B 5-254. *General Maintenance—Fuel Control — UH-1B.* a. Check fuel regulator for corrosion and contamination every time strainers and filter are cleaned and inspected. Also inspect regulator at any time such conditions may be indicated or suspected.

Note

Corrosion is a rust-like deposit on surfaces of internal parts exposed when overspeed governor is separated from fuel regulator assembly. Contamination is any foreign matter found in fuel or clinging to surfaces of internal parts.

b. If corrosion is found, fuel control assembly must be replaced.

c. Flush fuel control with clean fuel whenever necessary. The following procedure shall be utilized in flushing:

(1) Disconnect main and starting fuel hoses at manifold connections. Connect hoses to drain fuel regulator into a clean container.

(2) Disconnect electrical harness at ignition unit.

(3) Connect a source of clean fuel to inlet port of fuel regulator.

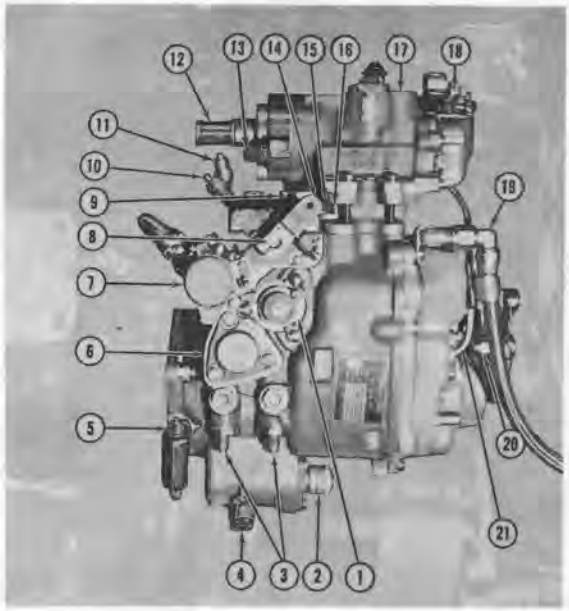
(4) Motor engine at 13 to 15 percent gas producer rpm, without exceeding starter limitations. (Refer to TM 55-1520-211-10.)

(5) While motoring engine, operate engine control linkages to simulate engine starting and running.

(6) Check for contamination of fuel flushed into container.

(7) Replace fuel control if it cannot be flushed clean in three 30-second motoring operations.

d. When an engine no-start condition occurs, and cause seems to be associated with fuel system, establish systematic, trouble shooting technique. (Refer to paragraph 5-30.)



1. Main Pressure Regulator
2. Fuel Inlet
3. Pump Pressure Taps
4. Inlet Pressure Tap (not used)
5. Seal Drain Fitting
6. Strainer and Filter Cover
7. Changeover Solenoid
8. Power Lever Control Shaft
9. Part-Power Plunger
10. Alternate Starting Fuel Outlet
11. Starting Fuel Outlet
12. Governor Drive Shaft Cover
13. Governor Seal Drain Fitting
14. Maximum nI RPM Trim
15. Trim Locking Screw
16. Idle nI RPM Trim
17. Overspeed Governor
18. Governor Control Shaft
19. Main Fuel Outlet
20. Airbleed Sensing Line
21. Air Temperature Sensing Line

204061-6

Figure 5-48. Fuel control unit — T53-L-11 engine

1. Bolt
2. Washer
3. Temperature sensing element housing
4. Screw
5. Washer
6. Temperature housing
7. Lower temperature housing
8. Shims
9. Overspeed governor driveshaft
10. Driveshaft tube
11. Shims
12. Overspeed governor
13. Retaining ring
14. Nut
15. Washer
16. Gasket
17. Packing
18. Packing
19. Retaining ring
20. Gasket

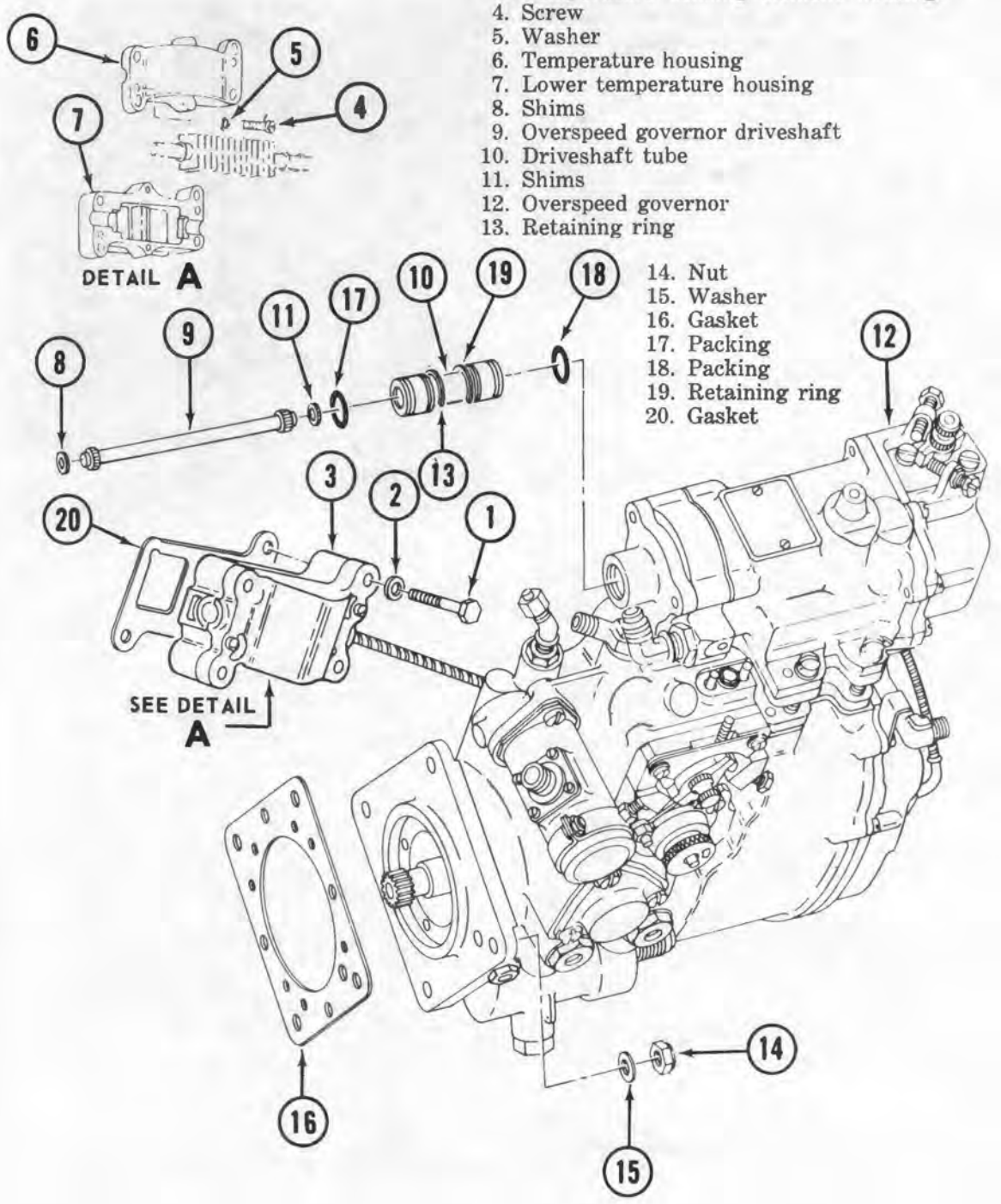


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Figure 5-48A. Fuel control unit— UH-1B.

5-254A. *Removal — Fuel Control Assembly.* (See figures 5-46 and 5-48A.)

Note

When fuel control assembly is being removed and is not to be reinstalled within 48 hours, accomplish preservation best applicable. (Refer to paragraph 16-35.)

Warning

Ensure that all electrical power is disconnected.

a. Disconnect and tag all fuel, air, mechanical, and electrical connections.

b. Remove bolts, washers, and gaskets that secure temperature sensing element housing to the inlet housing, and remove the temperature sensing assembly.

Caution

Exercise extreme care in removing and handling the housings which contain the temperature sensing element. Mashing, dents, or sharp bends will destroy the capillary action of the tube.

c. Remove screws and washers that secure upper temperature housing to lower temperature housing. Mark position of element fins in lower temperature housing.

d. Remove torquemeter rotary pump. (Refer to paragraph 5-200A.)

e. Remove shims from forward end of overspeed governor driveshaft and identify for reinstallation in their proper location. Plug open ports. Gap open fittings and lines.

f. Using a rod at least six inches long, ¼ inch or less in diameter, with one end sized and threaded 8-32 for ¼ inch of length, pull the overspeed governor drive shaft through driveshaft tube.

g. Using same rod, remove aft shims from overspeed governor and identify for reinstallation in their proper location.

h. Slide forward retaining ring aft toward the center of tube and push tube forward into overspeed governor and tachometer drive housing.

i. Support the fuel control assembly and remove nuts and washers.

j. Withdraw the fuel control assembly, keeping it as level as possible to prevent damage or distortion to driveshaft. Remove and discord gasket.

5-254B. *Cleaning — Fuel Control.* Thoroughly clean driveshaft, mounting flange, overspeed governor driveshaft port and all threaded areas with dry-cleaning solvent (item 302, table 1-1).

5-254C. *Inspection — Fuel Control.* a. Inspect all fittings for damaged or crossed threads.

b. Inspect fuel control driveshaft for chipped or worn splines.

c. Inspect mounting flange for elongated mounting holes and warpage.

d. Inspect solenoid valve for security of mounting, bent or broken contact pins, and damaged insulator.

e. Inspect temperature sensing assembly housing for cracks, warpage, and elongation of mounting holes.

f. Inspect temperature sensing cable for security of installation, fraying, cracks, dents, and sharp bends.

g. Inspect overspeed governor for security of installation.

h. Inspect fuel control for corrosion and contamination.

Note

Corrosion is a rust-like deposit on surface of internal parts that are exposed when main fuel regulator and overspeed governor are separated. Contamination is any foreign matter found in fuel or clinging to surfaces of internal parts that are exposed when main fuel regulator and overspeed governor are separated.

5-254D. *Repair or Replacement — Fuel Control.* If corrosion is found, replace fuel control.

A 5-254E. *Installation—Fuel Control.* a. On T53-L-1A engine, remove shipping plug if installed in ambient pressure sensing port, located on rear side of fuel control regulator just inboard

of temperature sensing tube connection. This port must remain open for operation.

b. On T53-L-1A engine with Part No. 80300 series overspeed governor: Install fitting with special hollow bolt and O-rings in seal drain tap on outboard side of governor housing. Position fitting with nipple pointing aft. Connect drain tube to nipple and to reducer on fuel control seal drain tee. Lockwire bolt to nearest bolt on governor mounting flange.

c. On T53-L-1A engine with Part No. 87000 series overspeed governor: Install unit with O-ring in seal drain tap on front end of governor housing. Connect drain tube to union and to reducer on fuel control seal drain tee.

d. Install restrictor ends of two fittings in pump pressure taps at bottom of fuel control regulator. Connect two hoses from differential pressure switch.

e. On engine with Part No. 87000 series overspeed governor: Install fuel control vent hose with elbow in tap provided on inboard side of governor housing.

f. Install control levers on overspeed governor and power lever control shafts. When engine is installed in aircraft, connect and rig control linkage systems. (Refer to paragraph 5-290.)

g. Connect fuel supply hose on inlet fitting at bottom of fuel control regulator.

h. Connect starting fuel and main fuel lines to outlet fittings of fuel control unit.

i. Connect electrical harness connector to fuel control changeover solenoid. Lockwire connector.

j. Check fuel control screens and filter and accomplish other checks as required in post-installation inspection and engine test runs.

B 5-254F. *Installation — Fuel Control — UH-1B.* When replacing fuel control, transfer serviceable fittings from old to new assembly. Install fuel control in accordance with the following instructions. (See figure 5-48A.)

Caution

The capillary tube of the temperature sensing assembly is connected to the fuel control. Use extreme care to avoid damage to the tube. Do not separate the tube from the fuel control.

Note

If a new fuel control is being installed, an end float check of the overspeed governor shaft is required. (Refer to paragraph 5-276.)

a. Slide overspeed governor driveshaft (9, figure 5-48B) into the overspeed governor shaft tube (10).

b. Place new packings (17 and 18) in grooves at both ends of the shaft tube.

c. Insert shim(s) (8 and 11), if required, into overspeed governor housing (12).

d. Insert overspeed governor shaft and shaft tube into overspeed governor and tachometer assembly, mating the spline of the shaft with the overspeed governor shaftgear.

Note

The splines on both ends of the overspeed governor driveshaft are identical. Either end may be inserted into the overspeed governor and tachometer drive housing.

e. Install shims, if required, at forward end of overspeed governor driveshaft.

f. Position new gasket on fuel control pad of accessory drive gearbox.

g. Place fuel control on accessory drive gearbox. Carefully insert exposed spline of overspeed governor shaft into overspeed governor.

Caution

Use caution when installing fuel control to prevent damage to the driveshaft carbon seal.

Note

To mesh the splines of the fuel regulator with the fuel regulator drive shaftgear, remove tachometer generator and using a 1/4 inch drive extension and ratchet, turn tachometer

drive gear until fuel regulator drive shaftgear splines mesh with splines on fuel regulator. Reinstall tachometer generator. To mesh splines of overspeed governor driveshaft with spline in overspeed governor, slowly rotate power turbine.

h. Secure fuel control to studs on accessory drive gearbox with washers (15) and nuts (14). Tighten nuts to between 125 and 140 inch-pounds torque.

i. Slide shaft tube aft into overspeed governor.

j. Position retaining rings (13 and 19) into grooves on both ends of tube. Adjust tube to allow retaining rings to position properly.

k. Assemble upper and lower temperature housings (6 and 7) and secure with washers (5) and screws (4).

Caution

Do not damage packings on element within lower temperature housing.

Note

Ensure that element is installed in same position as when removed. The curved ends of the fins at forward end of tube should face inboard.

l. Using a new gasket (20), position temperature sensing element housing (3) on inlet housing.

m. Secure the temperature sensing element housing with washers (2) and bolts (1).

n. Install torquemeter rotary pump. (Refer to paragraph 5-202A.)

o. Connect all fuel, air, mechanical and electrical connections.

p. Prime fuel control.

A **5-254G.** ***Gas Producer RPM Adjustments — UH-1A Fuel Control.*** Idle and maximum fuel trim adjusting screws and lockscrew are located in top of fuel control throttle shaft, at inboard upper side of fuel regulator housing ahead of overspeed governor. (See figure 5-48B.)

a. Use 0.125 inch wrench to adjust internal hexagon head screws. To increase fuel rate, turn screw counterclockwise. To decrease fuel rate, turn screw clockwise.

b. Loosen lockscrew.

c. At ground idle or flight idle, observe change in gas producer speed (percent nI rpm) as idle fuel trim screw is adjusted.

d. At ground idle, adjust maximum fuel trim screw by estimate. One turn of trim screw is equivalent to ten percent change in fuel rate at military rated power.

Note

Take up backlash between increase and decrease settings before counting turns in either direction.

e. Tighten lockscrew. Record adjustment on engine data sheets.

A **5-254H.** ***Adjusting Pressure Regulating Valve —UH-1A Fuel Control.*** Pressure regulating valve adjustors are located on face of fuel control. (See figure 5-48C.)

a. Remove shield, with two attaching screws and washers, for access to valves.

b. Remove lockwire from automatic system pressure regulator valve adjustor. Observe and record existing setting of valve by location of index mark in relation to numbers visible through window on adjustor.

c. Turn valve adjustor counterclockwise, in direction of arrow, to increase acceleration rate and shorten time required, or clockwise to retard acceleration.

Note

One turn equals approximately one second change in acceleration time.

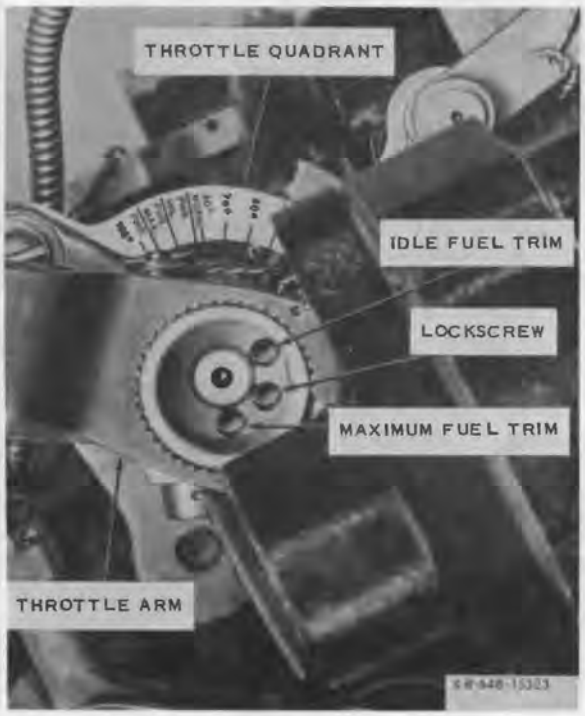


Figure 5-48B. Fuel trim adjustment — T53-L-1A

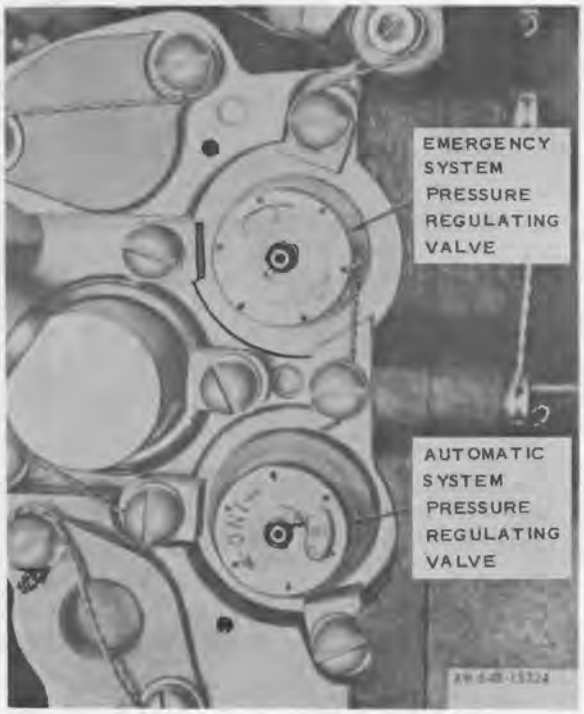


Figure 5-48C. Fuel control regulator adjuster T53-L-1A

d. Record adjustment.

e. Lockwire adjustor. Reinstall shield and lockwire two screws.

f. Observe effect of adjustment during ground run-up of engine. When acceleration rate has been increased, check carefully for any indication of engine surge condition.

5-254J. *Adjustment — Fuel Control.* The fuel control trim shall be checked and adjusted at installation of a new engine, installation of a new fuel control, or when incorrect adjustment is suspected. Adjustment of the fuel control installed on an engine is limited to ground idle rpm and takeoff rpm.

Warning

Adjustments to the fuel control may affect safety-of-flight. Only designated and qualified personnel will be permitted to perform the adjustments. Record original fuel control settings before making any adjustment.

a. Computation of take-off gas producer (nI) speed for a given ambient temperature is performed as follows:

Note

The engine data sheet (log), assigned to each engine, records the percent of nI speed required to obtain take-off horsepower at standard day, sea level conditions (59°F or 15°C) for that particular engine.

(1) Note the required percent nI speed for take-off power from engine data sheet.

(2) Determine the nI speed correction factor for the local ambient temperature at the time of the check run. (See figures 5-48D and E.) Add or subtract factor, as required, to the nI speed noted in preceding step (1).

(3) The result of step (2) is the computed nI speed required to develop take-off power for this temperature.

b. Ground idle rpm adjustment is accomplished as follows:

(1) Loosen trimmer lock bolt. (See figure 5-48F.)

(2) Adjust ground idle trimmer to obtain 40 to 44 percent nI speed at 23 to 26 degrees fuel control throttle lever position.

Note

One-half turn of ground idle trimmer will change the nI speed by approximately seven percent. Turn trimmer counterclockwise to increase nI speed.

(3) Tighten trimmer lock bolt.

c. Take-off rpm trim adjustment is accomplished as follows:

Note

The use of part power permits the adjustment of the fuel control for take-off power at a predetermined power setting below computed take-off power (16.6 percent) and eliminates the necessity of a tiedown facility or airborne checks.

(1) Compute the required take-off gas producer (nI) speed. (Perform step a.)

(2) Subtract 16.6 percent from computed nI speed. The result is the maximum nI speed that the engine should develop with the part power plunger in the engaged position.

(3) Start the engine.

(4) Slowly open cockpit throttle twist-grip until part power plunger can be engaged by pushing plunger into shaft.

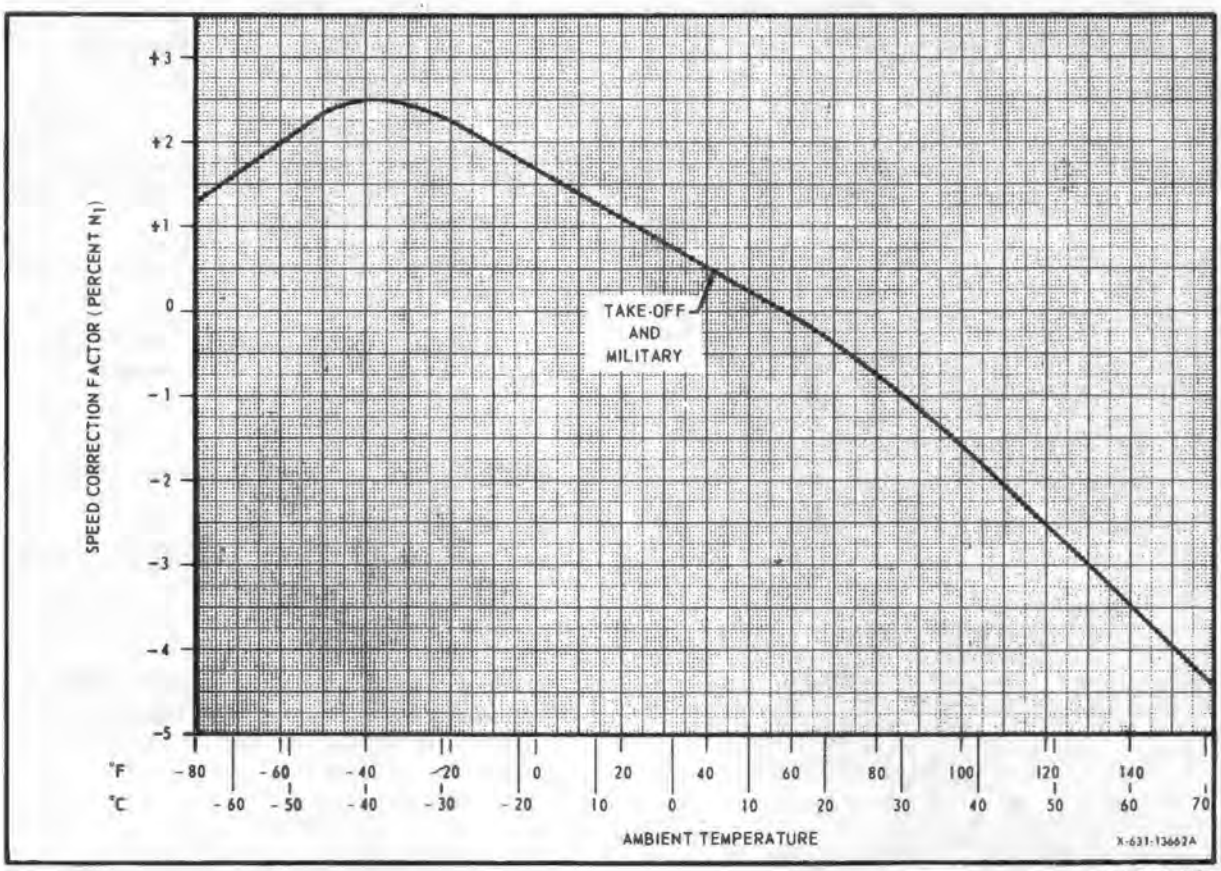


Figure 5-48D. Deviation in regulation gas producer speed vs ambient temperature (T53-L-11)

Warning

Maintain a flat collective pitch (full down) while opening throttle.

(5) After part power plunger has been engaged, slowly raise the collective pitch stick.

Note

Ensure that plunger remains engaged.

(6) Observe the maximum nI speed obtainable after nII speed starts to drop off. Record nI speed.

(7) Compare reading recorded in preceding step (2) with indication obtained in step (6).

(8) Lower collective pitch control lever and retard throttle.

(9 Loosen trimmer lock and adjust take-off rpm trim. (See figure 5-48F.)

Note

One-eighth of a turn of the take-off trim will produce approximately one percent change in nI speed.

(10) Repeat preceding steps (4) through (9) until adjustment is correct.

(11) Tighten trimmer lock bolt and lockwire both take-off trimmer and ground idle trimmer to lock bolt.

d. Perform acceleration check as follows:

(1) Position aircraft, facing upwind, on smooth flat surface.

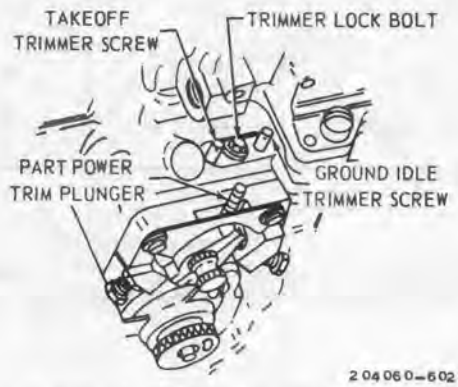


Figure 5-48F. Fuel control adjustment

Note

Wind velocity should not exceed 15 mph during check.

(2) Start engine and operate at flight idle for five minutes to stabilize temperatures. Check anti-icing system by operating the hot air solenoid valve. A slight rise in egt will indicate that the system is operating. Turn off system.

Note

This check is performed only to ensure that the anti-icing system is operating satisfactorily and that the hot air solenoid valve is closed during the following engine operational checks.

(3) Set collective pitch to minimum position (flat pitch).

Note

On cool days, aircraft may need additional weight to prevent lift-off.

(4) Advance power lever until highest power, without gaining flight attitude, is obtained (between 80 and 85 percent nI). Set nII rpm selector at 6400 rpm.

(5) Retard nI speed to 60 percent and allow to stabilize.

(6) Using airframe clock, time acceleration from 60 percent nI to 85 percent nI.

Note

Power lever movement shall be made in one second or less.

(7) Acceleration time should not exceed 3.5 seconds. Perform check three times.

Note

Leave power lever fully open until acceleration time has been measured before returning to 60 percent nI speed.

Note

Maximum allowable acceleration time varies with ambient temperatures and field elevation. For acceleration time correction, see figure 5-48G. If acceleration is slow, check airframe link-

age for proper adjustment. If aircraft rigging adjustment is within limits and acceleration time compromises aircraft operation, replace fuel control.

5-255. Fuel Control Strainers and Filter — UH-1A. Engine fuel control is provided with an inlet strainer, a pump discharge strainer, and a servo supply filter. Strainers are made of wire cloth and can be cleaned for repeated use. Filter is pleated-paper type and is replaced at scheduled inspections. On UH-1A, servo filter and bypass are under separate covers on face of fuel control. (See figure 5-46.) Inlet strainer on all models is located at bottom of fuel regulator housing and covered by an inlet fitting.

5-256. Removal — Fuel Control Strainers and Filter — UH-1A. a. Open left-hand engine cowling door. Position suitable container to catch fuel drainage.

b. Remove inlet strainer as follows:

(1) Disconnect fuel supply hose from fuel control inlet fitting (17, figure 5-46). Cap or cover opening in hose to prevent entrance of foreign material.

(2) Cut lockwire and remove three attaching screws and remove inlet fitting. Remove packing from fitting. Remove strainer (16) from port. Cap or cover port to prevent entrance of foreign material.

c. Cut lockwire and remove two screws attaching pump discharge strainer (15) to fuel control. Pull strainer from fuel control. Cap or cover port to prevent entrance of foreign material.

d. Cut lockwire and remove two screws and washers attaching servo supply filter cover (13). Remove cover.

e. Use wire handle provided to withdraw filter puller assembly (12) from fuel control port. Cap or cover port to prevent entrance of foreign material.

5-257. Cleaning — Fuel Control Strainers and Filter — UH-1A. a. Clean and inspect fuel control inlet strainer and pump discharge strainer and replace servo filter as required, at following intervals: Initial installation of engine, at end of initial ground run-up, after first five hours operation, and after first 15 hours operation.

b. If contamination is found on strainer or filter after first 15 hours of operation, inspect each 15 hours thereafter until contamination is eliminated.

TEMPERATURE	SEA LEVEL	1000 FT.	2000 FT.	3000 FT.	4000 FT.	5000 FT.
50°F (10°C)	0.0	0.0	0.1	0.2	0.3	0.4
60°F (16°C)	0.0	0.1	0.2	0.3	0.4	0.5
70°F (21°C)	0.2	0.3	0.4	0.5	0.6	0.7
80°F (27°C)	0.4	0.5	0.6	0.7	0.8	0.9
90°F (32°C)	0.5	0.7	0.8	0.9	1.0	1.1
100°F (38°C)	0.7	0.8	0.9	1.0	1.1	1.2
NOTE: All time correction factors are given in seconds and must be added to time attained at standard day conditions.						

204060-603

Figure 5-48G. Acceleration time correction factors

c. When strainer and filter are free of contamination after 15 hours interval, inspection period shall be extended to 25 hours operation.

d. If contamination persists due to adverse climatic conditions, local authorities may determine inspection periods.

e. Clean all parts with dry cleaning solvent (item 302, table 1-1) and dry with filtered compressed air.

A 5-258. *Inspection — Fuel Control Strainers and Filter — UH-1A.* a. Refer to paragraph 5-257, steps a. through d.

b. Visually inspect strainers and filter for damage and general condition.

c. Visually inspect inlet fitting (17, figure 5-46), filter cover (13) and screws for damage and stripped threads.

A 5-259. *Repair or Replacement — Fuel Control Strainers and Filter — UH-1A.* Replace all parts unsuitable for continued service.

A 5-260. *Installation — Fuel Control Strainers and Filter — UH-1A.* a. Uncap or uncover fuel inlet strainer port in fuel control.

b. Install new packing on inlet fitting (17, figure 5-46).

c. Carefully insert inlet strainer (16) into inlet port. Install fitting (17) and secure with three lockwired screws.

d. Uncap or uncover opening in fuel hose and connect hose to inlet fitting.

e. Install two new packings on pump discharge strainer (15).

f. Uncap or uncover pump discharge port and carefully insert strainer into fuel control housing. Secure with two lockwired screws.

g. Uncap or uncover servo supply filter (12) port. Install new packing on inner end of new filter and carefully insert filter into port.

h. Place new packing on cover (13) and install cover over port, securing with washers and lockwired screws.

i. Remove drainage vessel. Close and secure engine cowling door.

B 5-261. Fuel Control Strainers and Filter — UH-1B. Refer to paragraph 5-255. Description is the same, with the exception that on UH-1B helicopters the servo filter and bypass are attached on inner end of pump discharge strainer. (See figure 5-49.) On UH-1B aircraft the inlet strainer has a spring, and on T53-L-11/13 engines it is also enclosed in a retainer.

B 5-262. *Removal — Fuel Control Strainers and Filter — UH-1B.* a. Open left-hand engine cowling door. Position suitable container to catch fuel drainage.

b. Disconnect fuel inlet hose (1, figure 5-49) from inlet fitting (2) and cap or cover opening in hose to prevent entrance of foreign material.

c. Cut lockwire and remove three screws attaching inlet fitting. Remove inlet fitting.

d. On T53-L-5/9/9A engines remove strainer (4) and spring (5) from port.

e. On T53-L-11/13 engines remove retainer (6) from port, then carefully remove strainer and spring from retainer.

f. Cap or cover port to prevent entrance of foreign material.

g. Cut lockwire and remove three screws attaching pump discharge strainer and servo supply filter cover (7). Remove cover and strainer assembly from fuel control port. Cap or cover port to prevent entrance of foreign material.

h. Remove retainer ring (9). With a twisting motion carefully pull filter and reinforcement strainer group from cover and strainer assembly.

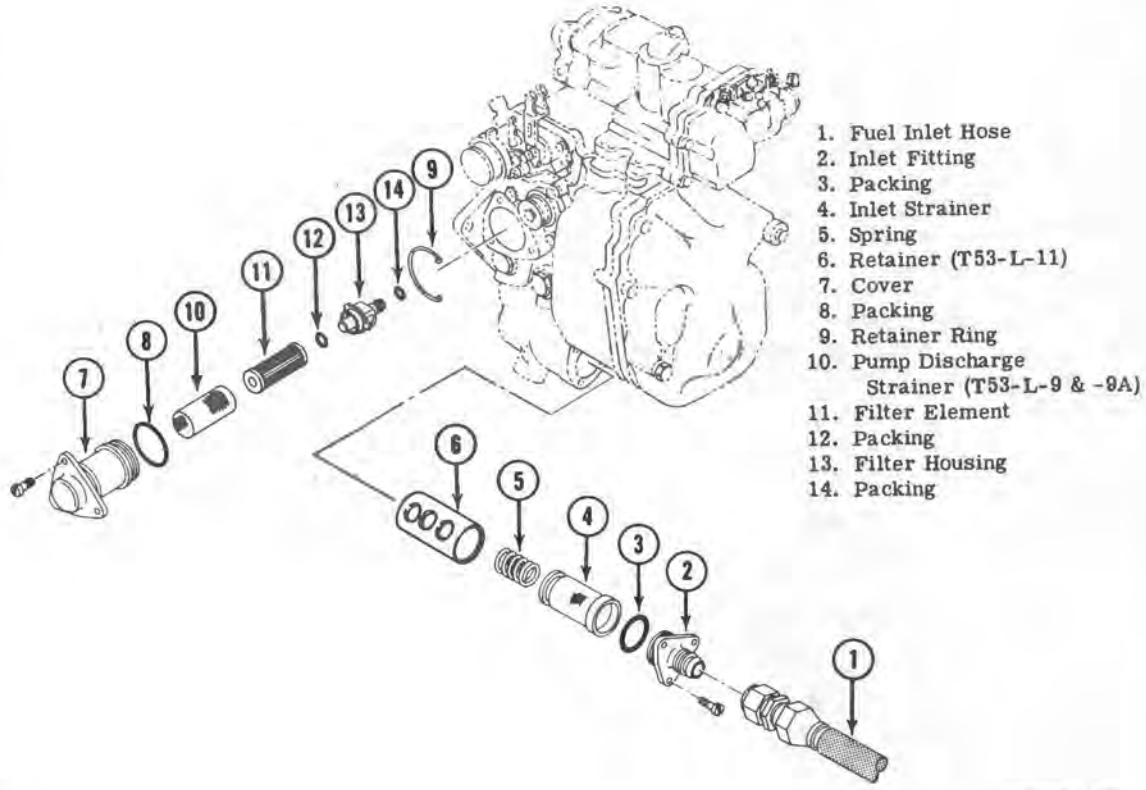


Figure 5-49. Fuel control strainers and filter — UH-1B (typical)

i. Slide reinforcement strainer (10) from filter element (11). Separate element from housing (12).

B 5-263. *Cleaning — Fuel Control Strainers and Filter — UH-1B.* Refer to paragraph 5-257.

B 5-264. *Inspection — Fuel Control Strainers and Filter — UH-1B.* a. Refer to paragraph 5-257, steps a. through d.

b. Visually inspect strainers and filter for damage and general condition.

c. Visually inspect all ports, including screws, for damage and stripped threads.

B 5-265. *Repair or Replacement — Fuel Control Strainers and Filter — UH-1B.* Refer to paragraph 5-259.

B 5-266. *Installation—Fuel Control Strainers and Filter—UH-1B.* a. Uncap or uncover fuel inlet strainer port in fuel control.

b. Place new packing on inlet fitting (2, figure 5-49).

c. On T53-L-5/9/9A engines place spring and strainer into fuel control inlet port. Insert a phenolic rod, 0.25 inch diameter and six inches long, against bottom of strainer and press inward against spring until bottomed. To be sure strainer is not binding, check for 0.375 inch measurement from end of strainer to face of housing. Install inlet fitting over end of rod, keeping pressure against spring until fitting is secured with three screws. Remove rod. Lockwire screws.

d. On T53-L-11/13 engines carefully install spring and strainer into retainer. Insert retainer into fuel control port. Install inlet fitting, secured by three lockwired screws.

e. Uncap or uncover opening in fuel inlet hose and connect hose to fuel inlet fitting.

f. Place new packings on servo supply filter housing and install a new element.

g. Place new packing on cover and pump discharge strainer. Install reinforcement strainer into cover, then use a twisting motion to install filter element and housing. Secure in cover with retaining ring.

h. Uncap or uncover port. Install cover and strainer assembly in fuel control port and secure with three lockwired screws.

i. Remove drainage vessel. Close and secure engine cowling door.

5-266A. Fuel Control Solenoid Changeover Valve — UH-1B. An emergency fuel metering system is incorporated in fuel regulator, to allow bypassing of automatic flow regulator in case of malfunction. With solenoid operated changeover valve is in EMERgency position, fuel from pump flows to an emergency metering valve, which is positioned by power lever under manual control by means of twist-grip control linkage. An emergency pressure regulating valve maintains pressure proportional to metering valve area. This system must be used with extreme caution since there are no automatic safeguards against exceeding engine limits and causing serious damage.

5-266B. *Removal—Fuel Control Solenoid Changeover Valve.* (See figure 5-49A.)

a. Remove screws that secure support bracket to fuel control.

b. Loosen nut and screw, and slide support bracket from solenoid.

c. Remove screws that secure solenoid valve to fuel control.

d. Remove solenoid and shim. Record thickness of shim, then wire to solenoid to facilitate installation.

Note

Withdraw solenoid only enough to insert finger between solenoid and valve. Holding finger on valve, continue to remove solenoid. The valve shall remain in the solenoid until solenoid is installed.

Caution

If valve is removed without balls, balls may be lost.

e. If either sleeve or valve is damaged, both parts must be replaced. Remove sleeve as follows.

(1) Using sleeve puller STD63557, remove sleeve from fuel control.

(2) Remove packings.

5-266C. *Installation — Fuel Control Solenoid Changeover Valve.* (See figures 5-49A and 5-49B.)

a. If sleeve was replaced, compute thickness of shim as follows. If the same sleeve is used, proceed to following step b.

(1) Install new sleeve, without packings, into fuel control.

(2) Insert new valve into solenoid.

(3) Using depth micrometer, measure distance from fuel control solenoid mounting face to top of sleeve (Dimension A, figure 5-49B).

(4) Using depth micrometer, measure height of boss of solenoid (Dimension B).

(5) Subtract dimension A from dimension B. The difference, minus 0.0013 inch, is required shim thickness (Dimension C).

(6) Using sleeve puller STD63557, remove sleeve.

(7) Lubricate and install packings onto sleeve.

(8) Install sleeve into fuel control housing.

b. Install shim on fuel control.

Note

If the old sleeve is used, use shim that was removed. If new sleeve is used, use shim of thickness computed in preceding step a.

c. Install solenoid and valve. Secure with screws. Tighten screws as required and lockwire.

d. Install support bracket and secure with screws.

e. Secure bracket to solenoid with screw and nut.

5-266D. *Operational Check — Fuel Control Solenoid Changeover Valve.* After installing an engine, or a fuel control, or during the airframe intermediate inspection, or when a special verification of the proper operation of the AUTOMATIC/EMERGENCY system is required, perform an operational check. (Refer to TM 55-1520-211-10.)

A 5-267. Fuel Control Overspeed Governor — UH-1A. The overspeed governor is mounted on the fuel control regulator and is driven through a gear train from the power output shaft. It acts through the regulator to limit fuel flow when power turbine rpm tends to exceed speed selected by means of external control system.

A 5-268. *Removal — Fuel Control Overspeed Governor — UH-1A.* Paragraphs 5-268 through 5-271 apply only to T53-L-1A engines.

a. Remove linear actuator and governor control lever. (Refer to paragraph 5-287.)

b. Disconnect and remove governor seal drain tube, with fitting. Also remove fuel control vent hose and fitting, if so equipped. Install plugs and caps in open ports and fittings.

c. Remove two snap-rings at ends of tube covering overspeed governor drive shaft.

d. Remove lockwire and four screws with three washers that secure overspeed governor to fuel regulator housing. Temperature sensing line support clamp will also be detached from one of inboard screws.

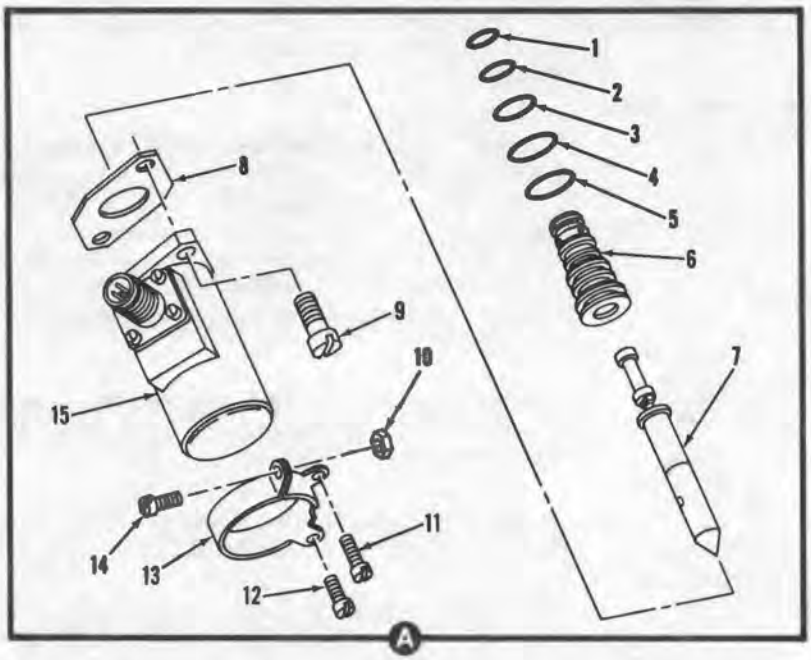
Caution

Overspeed governor must be kept as level as possible during removal, to prevent damage to the drive shaft between governor and fuel control regulator.

e. Carefully lift governor assembly above locating pins, then pull aft until free. Remove governor drive shaft and cover tube.

A 5-269. *Inspection — Fuel Control Overspeed Governor — UH-1A.* Check internal condition of governor and fuel regulator through exposed openings. Protect both assemblies from contamination.

1. Packing
2. Packing
3. Packing
4. Packing
5. Packing
6. Sleeve
7. Valve
8. Shim
9. Screw
10. Nut
11. Screw
12. Screw
13. Support Bracket
14. Screw
15. Solenoid



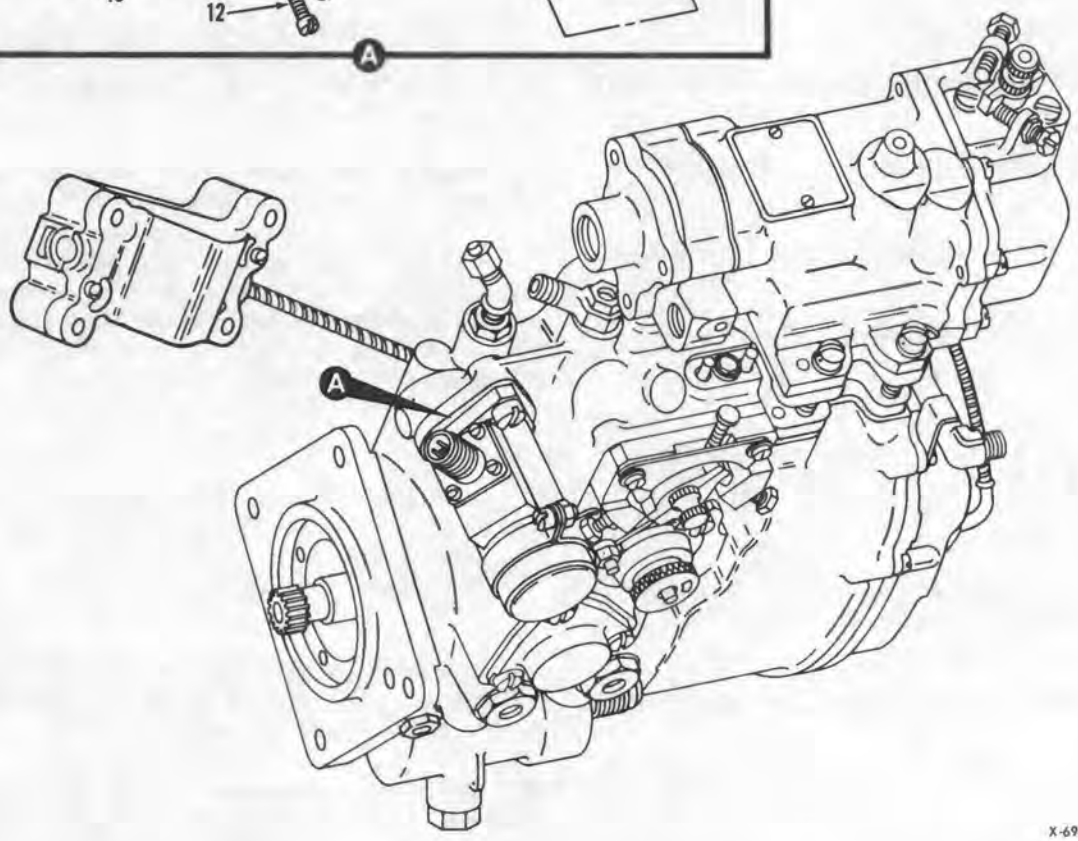


Figure 5-49A. Fuel control solenoid valve and attaching parts — UH-1B

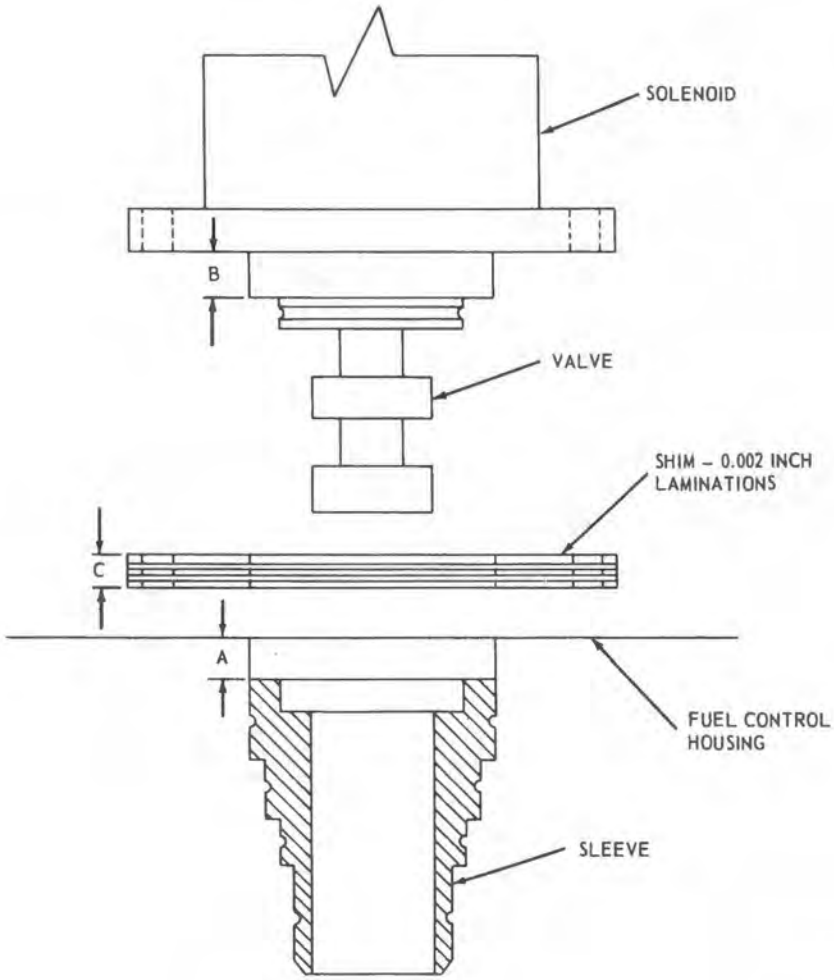


Figure 5-49B. Solenoid and valve assembly shim measurement — UH-1B

A **5-270. *Installation — Fuel Control Overspeed Governor — UH-1A.*** a. Remove and discard governor seal and packing ring. If governor is not to be reinstalled accomplish preservation as required.

b. Check stop setting of replacement governor. (Refer to paragraph 5-277.)

c. Remove shipping cover and gasket from replacement governor. Coat a new seal and packing ring lightly with petrolatum (item 14, table 1-1) and install on governor.

d. Place one shim (part number 1-160-589-02) and the governor drive shaft into opening at front of governor.

Note

Do not install cover tube on governor drive shaft at this time.

e. Install governor and drive shaft assembly. To assist meshing spline of drive shaft in governor drive gear box, the power turbine can be manually rotated through rear end of engine. Secure governor temporarily on fuel control with four screws.

f. Refer to paragraph 5-271 and perform step a. Upon completion continue as follows.

g. Coat two new packings with petrolatum (item 14, table 1-1) and place on ends of drive shaft cover tube. Insert drive shaft and cover tube into governor drive gear box. Install a snap-ring in each end of tube.

h. Engage governor on shaft and tube while sliding it forward to seat over locating pins on fuel control regulator. Install washers and screws. Tighten screws evenly with 30 to 40 inch-pounds torque and lockwire heads.

Note

All screw fasteners on the fuel control shall be secured with appropriate safetying method.

i. Install governor seal drain tube and fuel control vent hose.

j. Install governor control lever and linear actuator (refer to paragraph 5-290) and adjust in accordance with instructions in paragraph 5-291, step b.

A **5-271. *Adjustment — Fuel Control Overspeed Governor — UH-1A.*** a. Measure end play of governor drive shaft by the following procedure.

(1) Mount a small C-clamp at a convenient location on governor drive shaft.

(2) Set up a dial indicator, on any convenient mounting, to contact the clamp and indicate end play of shaft.

(3) Move the shaft axially and note total indicated end play. Maximum allowable is 0.280 inch.

(4) Remove governor assembly and drive shaft.

(5) If total end play exceeds maximum allowable limit, add two more shims in front of governor assembly (in addition to the shim installed in step d., paragraph 5-270) and also place two shims into the shaft opening in the governor drive gear box.

b. Rig in conjunction with power turbine governor RPM controls as outlined in paragraph 5-291.

B **5-272. Fuel Control Overspeed Governor — UH-1B.** Refer to paragraph 5-267. Description is the same.

B ***5-273. Removal — Fuel Control Overspeed Governor — UH-1B.*** a. Remove linear actuator and governor control lever. (Refer to paragraph 5-287.)

b. Disconnect and remove governor seal drain tube and fitting and fuel control vent hose and fitting. Install plugs and caps in open ports and fittings.

c. Remove torquemeter rotary oil pump and packing from front of overspeed governor drive gear box by removing six mounting bolts and washers.

d. Remove shims if any, from forward end of overspeed governor drive shaft, and record thickness. (See figure 5-50.)

e. Using a rod at least six inches long and 1/4 inch or less in diameter, with one end sized and threaded 8-32 for 1/4 inch of length, pull governor drive shaft through governor drive gear box.

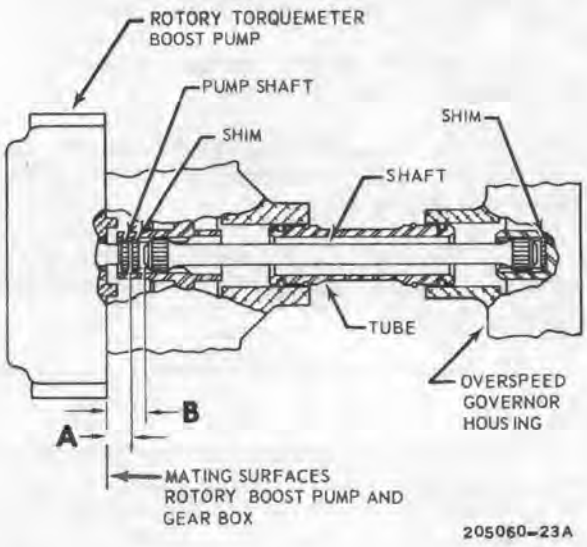


Figure 5-50. Governor drive shaft end play — UH-1B

f. Using same rod, remove aft shims, if any, from overspeed governor. Record thickness of shims.

g. Disengage snap-ring from groove at forward end of drive shaft cover tube and move ring toward middle of tube. Push tube forward into gear box housing.

h. Remove screws and washers that secure overspeed governor to fuel regulator housing.

Caution

To prevent damage to drive shaft between governor and fuel regulator, the governor must be kept as level as possible while being removed.

i. Carefully lift governor assembly above locating pins, then pull aft until free. Remove shaft cover tube and packings.

B 5-274. *Inspection — Fuel Control Overspeed Governor — UH-1B.* Refer to paragraph 5-269.

B 5-275. *Installation — Fuel Control Overspeed Governor — UH-1B.* a. Check stop setting of replacement governor. (Refer to paragraph 5-277.)

b. Coat a new seal and packing ring with petrolatum (item 14, table 1-1) and install on governor assembly.

c. Install new packings on drive shaft cover tube, and check that two snaprings are loosely on middle of tube. Insert tube into governor drive gear box and push forward into opening.

d. Position governor over splined shaft in fuel control. Install four attaching screws and three washers, with temperature sensing line support clamp under head of inboard rear screw. Tighten screws evenly, and secure with lockwire.

e. Position snap-ring in aft groove on cover tube, and pull tube aft into governor housing until stopped by ring. Secure tube with second snap-ring in forward groove on tube.

f. Coat splines of governor drive shaft with grease (item 8, table 1-1). Use threaded rod (refer to paragraph 5-273, step e.) to install drive shaft through front of governor drive gear box shaft into cover tube and governor housing. Mesh splines by manually rotating power turbine through rear of engine, and remove rod.

g. Refer to paragraph 5-276 and perform steps a. through f. Upon completion continue as follows.

h. Install torquemeter rotary oil pump on front of governor drive gear box. (Refer to paragraph 5-202.)

i. Install fittings and connect governor seal drain tube and fuel control vent hose.

j. Install governor control lever and linear actuator (refer to paragraph 5-290) and adjust in accordance with instructions in paragraph 5-291, step g.

B 5-276. *Adjustment — Fuel Control Overspeed Governor — UH-1B.* a. Check end play of governor drive shaft, and adjust by installing shims if required, by following steps.

Note

End play of governor drive shaft must be established whenever a governor, a complete fuel control, or a torquemeter rotary oil pump is being installed. Excessive end play can cause wear of shaft splines and may lead to malfunction or failure of the overspeed governor.

b. Measure and record dimension, in thousandths of an inch, from mounting face of torquemeter rotary pump to end of pump shaft. (See dimension A, figure 5-50.)

c. With governor drive shaft bottomed at rear end, measure with a depth micrometer and record dimension from front end of shaft to face of pump mounting pad on front of gear box. (See dimension B, figure 5-50.)

d. Subtract dimension A from B to obtain total existing end play.

e. If end play is less than 0.090 inch, do not shim the drive shaft. Continue installation procedure. (Refer to paragraph 5-270, step g.)

Note

No minimum end play is established. However, it is important that some end play shall exist to avoid jamming the drive shaft solidly between rotary pump and governor.

f. If end play exceeds 0.090 inch, install shims (part number 1-160-589-02) according to the following requirements.

(1) If end play is between 0.090 and 0.280 inch, install one shim behind rear end of shaft.

(2) If end play is more than 0.280 inch, install a total of four shims, placing two at each end of shaft.

(3) Use threaded rod, as described in paragraph 5-273, step e. to remove and install shaft and shims.

g. Rig in conjunction with power turbine governor RPM controls as outlined in paragraph 5-291.

5-277. Checking Stop Setting — Fuel Control Overspeed Governor. Replacement fuel control overspeed governors, part number 87000-B4 through 87000-B7, are usable on both UH-1A and UH-1B (except not on T53-L-11 engines), but may have either of two basic stop settings: 0° to 60° for T53-L-1A engine on UH-1A; of 12° and 72° for T53-L-5/9/9A engines on UH-1B. Therefore, it is essential to check markings on a spare governor of this type and, if necessary to change settings of stop screws to obtain the correct nII speed range for engine model on which it is to be used. (Information for checking stop setting on T53-L-13 engine not available at this time.)

Note

Do not interchange overspeed governor used on T53-L-11 engine with governors used on any of the other engine models.

a. Examine governor assembly for decal or other marking to determine whether stops are correctly set for engine.

Ab. If governor is set for use on UH-1B (T53-L-5/9/9A engines) but is to be installed on UH-1A (T53-L-1A engine), change stop setting as follows:

(1) Measure length of high rpm (upper) stop screw extending from inner face of mounting boss. Record dimension for reference if any doubt should occur during adjustment.

(2) Cut lockwire and loosen jam nut on high rpm stop screw. Turn stop in exactly four turns (clockwise) to lower setting by 12°. Stop is now set at 60° (plus or minus 2°). Secure stop by tightening jam nuts.

(3) Measure and record length of low rpm stop screw from inner face of mounting boss. Adjust in same manner as for upper stop, except back screw out exactly four turns (counterclockwise). Stop will now be at 0° setting. Tighten jam nut.

(4) Measure and record length of stops at new setting.

(5) Change markings on governor as required.

(6) Lockwire stops when adjustment is complete.

Note

Further adjustment of governor stops may be required in rigging and operational checks of power turbine governor rpm controls.

Bc. If governor is set for use on UH-1A (T53-L-1A engine) but is to be installed on UH-1B (T53-L-5/9/9A engines), change stop settings in accordance with rigging procedure. (Refer to paragraph 5-284.)

Bd. If governor stop setting is unknown on UH-1B, proceed according to rigging procedure as in step c. above.

Ae. If governor stop setting is unknown on UH-1A, apply most suitable of following procedures:

(1) Check length of stops by comparison with those on another governor (87000-B4) on an engine of same model. Record facts of situation clearly so that all personnel concerned will regard settings as tentative until checked in rigging and operational test.

(2) If other components of governor control linkage system are considered to be properly rigged, adapt normal rigging procedure to determine tentative settings of governor stops. (Refer to paragraph 5-284.)

(a) Install control lever on serrated shaft of governor as nearly as possible at right angle to center line of shaft stop arm.

(b) Place controls in extreme high rpm position, with collective stick full up and actuator fully retracted by use of governor rpm switch held to "increase".

(c). Adjust high rpm governor stop to have 0.010 inch clearance with stop-arm when control lever is connected to actuator jackshaft.

(d) Adjust low rpm governor stop according to rigging procedure.

(e) Make final adjustments as required by operational tests.

Caution

First run-up of engines must be performed with care to avoid possible overspeed.

Section X — Power Controls

5-278. Power Controls. (See figures 5-51 and 5-52.) A mechanical linkage system actuated by twist-grips on collective pitch control sticks provides manual control of power lever on fuel control unit, modulating engine from zero to full power by controlling gas producer (nI) turbine rpm. Power lever shaft is serrated and grooved to accept a control arm, and has a quadrant marked with power settings in travel range between stops pre-adjusted by engine manufacturer or overhaul facility. Linkage is a series of control rods, bellcranks, and a torque tube, with adjustable tubes at each end of series and between control sticks. On UH-1B Serial No. 61-686 and subsequent, first bellcrank aft of collective pitch control stick as adjustable to change total travel of linkage.

5-279. An adjustable stop, on bellcrank below engine deck, contacts plunger of solenoid to arrest travel of control linkage at flight idle position when power is reduced from higher settings. Release is accomplished by use of ENGINE IDLE STOP RELease push-button switch, on pilot's collective stick, to retract solenoid plunger.

5-280. Power Lever Control Linkage. Refer to paragraph 5-281 for description.

5-281. *Removal — Power Lever Control Linkage.* Parts of control system can be removed as necessary for inspection, lubrication, or replacement. To facilitate reinstallation, identify removed parts as to location and keep attaching parts in place or in sets.

tubes are correct parts for this series of helicopters and that available adjustments have been used to best effect. If necessary, replace bellcrank at Station 85. Using undrilled bellcrank (204-060-7281), locate doubler on slotted arm so as to provide 2.83 inches travel measured on vertical control tube where it passes through boot support. Rivet doubler when travel is correct. If undrilled bellcrank is not available, use bellcrank assembly (204-060-728-7) with doubler riveted to provide 1.95 inch dimension between bolt hole and bearing, center to center.

B (b) On UH-1B Serial No. 61-686 and subsequent, which are equipped with adjustable bellcrank (21, figure 5-52) adjust serrated attachment for control tube (5) so that power lever shaft on engine fuel control bottoms out approximately five degrees short of extreme positions of twist-grips.

Ab. Adjust UH-1A idle stop and solenoid as follows.

(1) Check solenoid assembly (13, figure 5-51) for any binding where plunger passes through end of bracket. If required for alignment, shim on four screws between solenoid and bracket.

(2) Position solenoid to mounting holes with threaded inserts at underside of engine deck inboard of bellcrank (11). Provide proper clearance between tip of fully extended solenoid plunger and face of bellcrank before tightening three bolts, with washers, through slotted holes of bracket.

A (a) On UH-1A through Serial No. 58-2093, set solenoid plunger 0.25 inch from bellcrank face. This installation can be recognized by chamfered tip of solenoid plunger and nearly square, non-recessed stops attached by countersunk screws.

A (b) On UH-1A Serial No. 58-3017 and subsequent, set solenoid plunger 0.150 inch from bellcrank face. Solenoid plunger tip is rounded and chromium plated; stop is recessed at area of contact and is attached with roundhead screws.

(3) For preliminary approximate adjustment, place power lever controls at operational idle position, as shown on fuel control quadrant. Loosen two attachment screws on stop. Set slotted stop against solenoid plunger and tighten screws.

(4) Prior to engine run-up, check that solenoid plunger will move clear of stop when actuated by idle stop release switch on control stick.

(5) In initial ground run-up, make final adjustment of idle stop as required for prescribed gas producer tachometer indication. (Refer to TM 55-1520-211-10.)

Bc. Adjust UH-1B idle stop on solenoid as follows. (See figure 5-53.)

(1) Check that solenoid plunger operates freely through bushing of mounting bracket. If necessary for alignment, shim on four screws between solenoid and bracket.

(2) Check attachment of solenoid assembly with four bolts through slotted holes of bracket into nut-plates of support below bellcrank. Be sure idle stop, attached to bellcrank assembly by two bolts with washers, is centered laterally over solenoid plunger. (Refer to paragraph 5-283, step e.)

(3) Position solenoid on serrated base plate to obtain 0.040 (± 0.010) inch clearance between tip of plunger and surface of stop projection when solenoid is in actuated position. (See figure 5-53.) Secure by tightening four bolts, with thin aluminum washers under heads, through slotted holes in bracket into mounting pad.

(4) Use twist-grip to position power lever shaft stop arm at 38-degree mark on fuel control quadrant. This is approximate flight idle position.

(5) Adjust stop so that projection rests against side of solenoid plunger. Tighten bolts to engage mating serration of lockwashers and stop face.

(6) Check operation of flight idle stop in ground run. If necessary, readjust stop to obtain 56 to 58 percent RPM indicated on gas producer (nI) tachometer. Check release by actuating solenoid. Recheck clearance dimension of 0.040 (±0.010) inch.

5-285. *Connecting Control Sticks — Power Lever Control Linkage.* a. Remove access plate at left side on lower cabin skin, in line with gear and sector on lower end of copilot's collective pitch control stick.

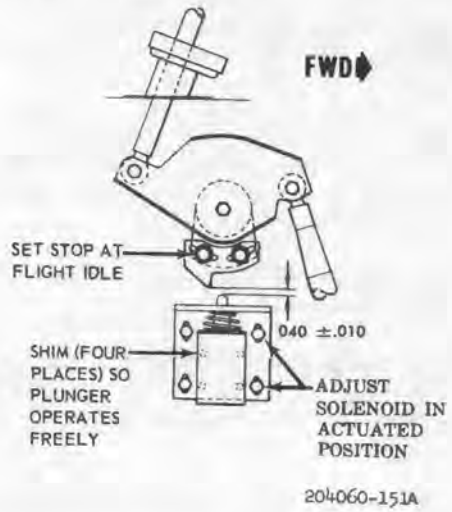


Figure 5-53. Adjusting idle stop — UH-1B

b. Position tube (4, figure 5-51 or 5-52) under floor, with adjustable end toward pilot's stick.

c. Set pilot's twist-grip so that pinion gear on lower end is centered on mating gear sector.

d. Set copilot's twist-grip to center its pinion on gear sector. (See figure 5-51.)

e. Adjust and connect tube between control arms of sticks.

5-286. Power Turbine Governor Actuator and Control Lever. (See figures 5-54 and 5-55.) An electrically operated linear actuator, remotely controlled by a GOVernor RPM INCRease-DECRease switch on each collective pitch stick moves a lever on overspeed governor of fuel control unit to accomplish settings of power turbine (nII) rpm, indicated on dual tachometer. Droop compensation to stabilize rpm as engine load fluctuates with changes in main rotor pitch, is provided by mounting actuator to a cambox which is mechanically linked to a bellcrank in collective pitch control system. Compensator linkage consists of two push-pull tubes and a torque tube, which has a shear pin in its forward arm to assure unhindered operation of collective pitch controls if compensator linkage should become fouled.

5-287. Removal — Power Turbine Governor Actuator and Control Lever. a. Open engine cowling at left side.

b. Remove terminal cover with attaching screws from top of linear actuator. Disconnect and stow electrical leads. Reinstall cover.

c. Detach actuator jackshaft rod-end from control lever on overspeed governor by removing bolt, with nut, cotter pin, and washer.

d. Detach actuator front end-fitting from cam box slider by removing bolt, with nut, cotter pin, and washer.

B (1) On UH-1B, avoid loss of spring washer installed between cambox slider and actuator end-fitting clevis.

(2) On either model, cambox slider bolt hole may have a bushing which is light press fit. Avoid loss of bushing.

e. Remove lockwire and retaining bolt to pull lever from serrated shaft at top of overspeed governor. Keep bolt with lever.

5-288. Inspection — Power Turbine Governor Actuator and Control Lever. a. Inspect actuator shaft rod-end for continued serviceability.

b. Check to be sure that actuator and governor control lever are correctly aligned.

c. If actuator is inoperative, remove screws attaching rear cover to motor. Remove motor cover and inspect for corrosion. Check motor shaft for freedom of rotation.

d. If electrical malfunction is suspected, check electrical connections. (Refer to paragraph 12-125.)

5-289. Repair or Replacement — Power Turbine Governor Actuator and Control Lever. a. Replace actuator shaft rod-end if unserviceable.

B ***Note***

In some instances a satisfactory field repair can be made to the linear actuator with the actuator installed, in accordance with the following procedure.
1. Remove four screws used to secure top cover of actuator.

2. Remove four screws used to secure motor to actuator assembly.
3. Move motor aft to disengage drive spline, being careful not to damage motor wiring.
4. Lubricate worm gear liberally with graphite (item 7, table 1-1).
5. Extend and retract actuator by rotating gears to distribute lubricant.
6. Re-engage motor and secure with four screws.
7. Electrically retract and extend actuator shaft.
8. Secure top cover of actuator.

b. Check rigging and operation after replacement of any parts. (Refer to paragraph 5-280.)

5-290. *Installation — Power Turbine Governor Actuator and Control Lever.* a. Place control lever, without retaining bolt, on governor control shaft according to rigging instructions. Install retaining bolt, with washer, from aft side into lever and through shaft groove. After rigging, lockwire bolt head to shank of lever.

b. Attach actuator front end-fitting clevis on end of cambox slider.

(1) Install bolt from top, secured with nut, washer, and cotter pin.

B (2) On UH-1B, install washer on bolt between clevis and underside of slider.

c. Attach actuator shaft rod-end in clevis of governor control lever with bolt, washer and nut. Omit cotter pin until rigging is complete.

Note

Do not add shim washers between clevis and actuator governor arm. Clearance is necessary for proper operation.

d. Remove actuator terminal cover with three screws. Connect electrical leads on terminals. (Refer to paragraph 12-125.) Reinstall terminal cover.

5-291. *Adjustment — Power Turbine Governor Actuator and Control Lever.* a. Rigging for various configurations will be in accordance with the following instructions.

Ab. Model UH-1A helicopters equipped with 80300 series overspeed governor shall be rigged as follows. (See figure 5-54.) Perform step c. if governor is Part No. 87000-B-4.

(1) Be sure collective pitch control system is rigged before proceeding.

(2) Open engine cowling at left side. Disconnect actuator shaft from governor control lever, and support actuator assembly so as to permit free movement as required.

(3) Check and adjust cambox and linkage:

(a) If cambox is Part No. 204-060-741 series, set cam adjustment for maximum compensation: Loosen lock-nut and set-screw. Raise bellcrank to place screw in serration nearest cam slot. Tighten set-screw and lock-nut.

(b) If cambox is Part No. 204-060-777 series, set cam at middle of adjustment: Loosen nut on cam adjustment bolt to disengage serrated washer from cam serrations. Position bolt at middle of its slot and tighten nut. Be sure washer serrations seat with those on cam face.

(c) With collective pitch stick full down, be sure that cam follower does not bottom in end of cam slot. Adjust control tube connected to cam bellcrank, if necessary. Also check in same manner for clearance at opposite end of cam slot, with collective pitch stick full up.

(d) Check both control tubes for safe thread engagement of adjustable rod-ends.

(4) Check control lever for correct initial position on governor control shaft.

(a) On Serial No. 58-2078 through 58-3047: With shaft stop arm midway between stops, lever should extend outboard perpendicular to long axis of engine.

(b) On Serial No. 59-1607 and subsequent: With shaft stop arm midway between stops, lever should be approximately 17 degrees aft of perpendicular to engine axis.

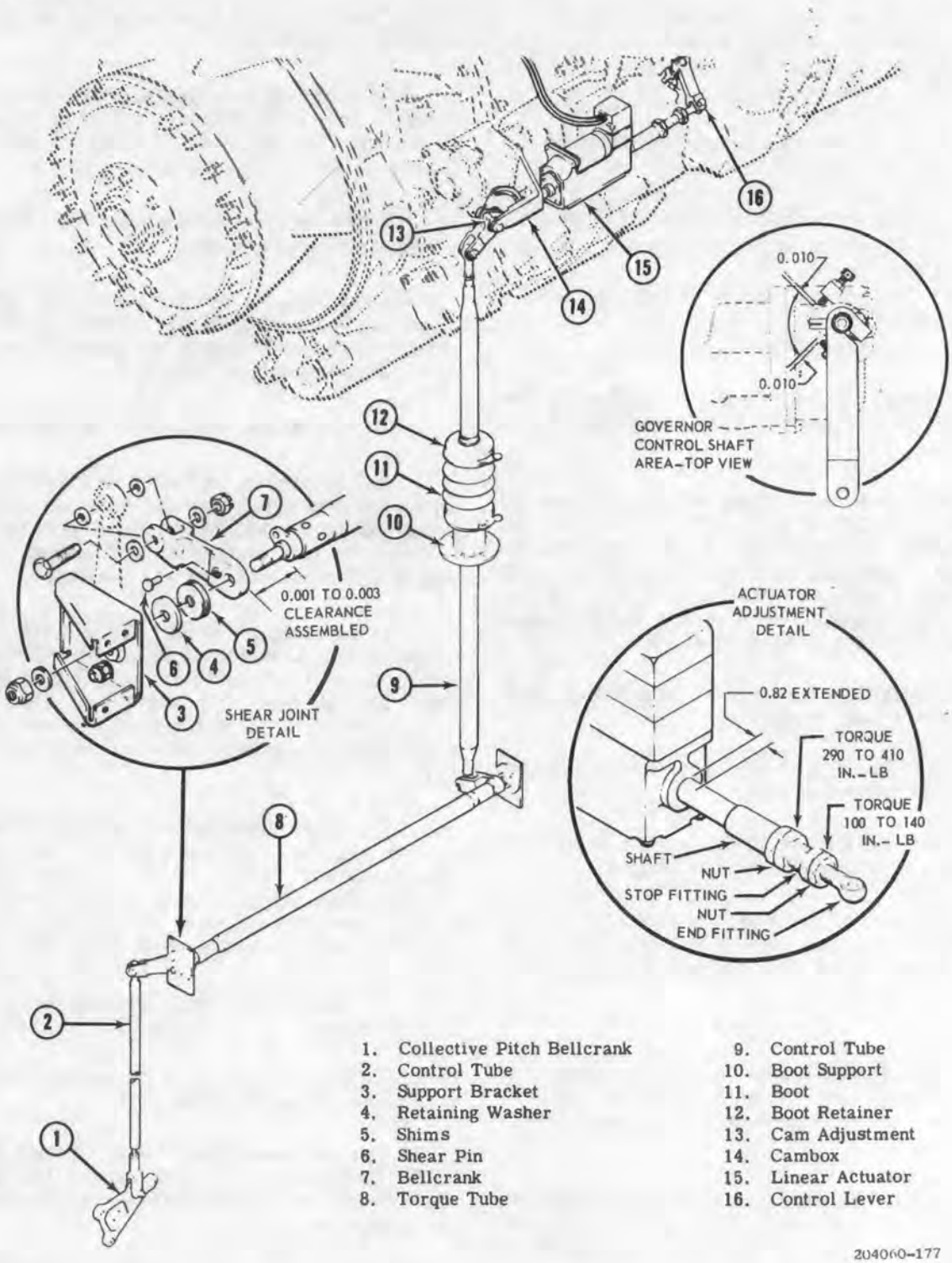
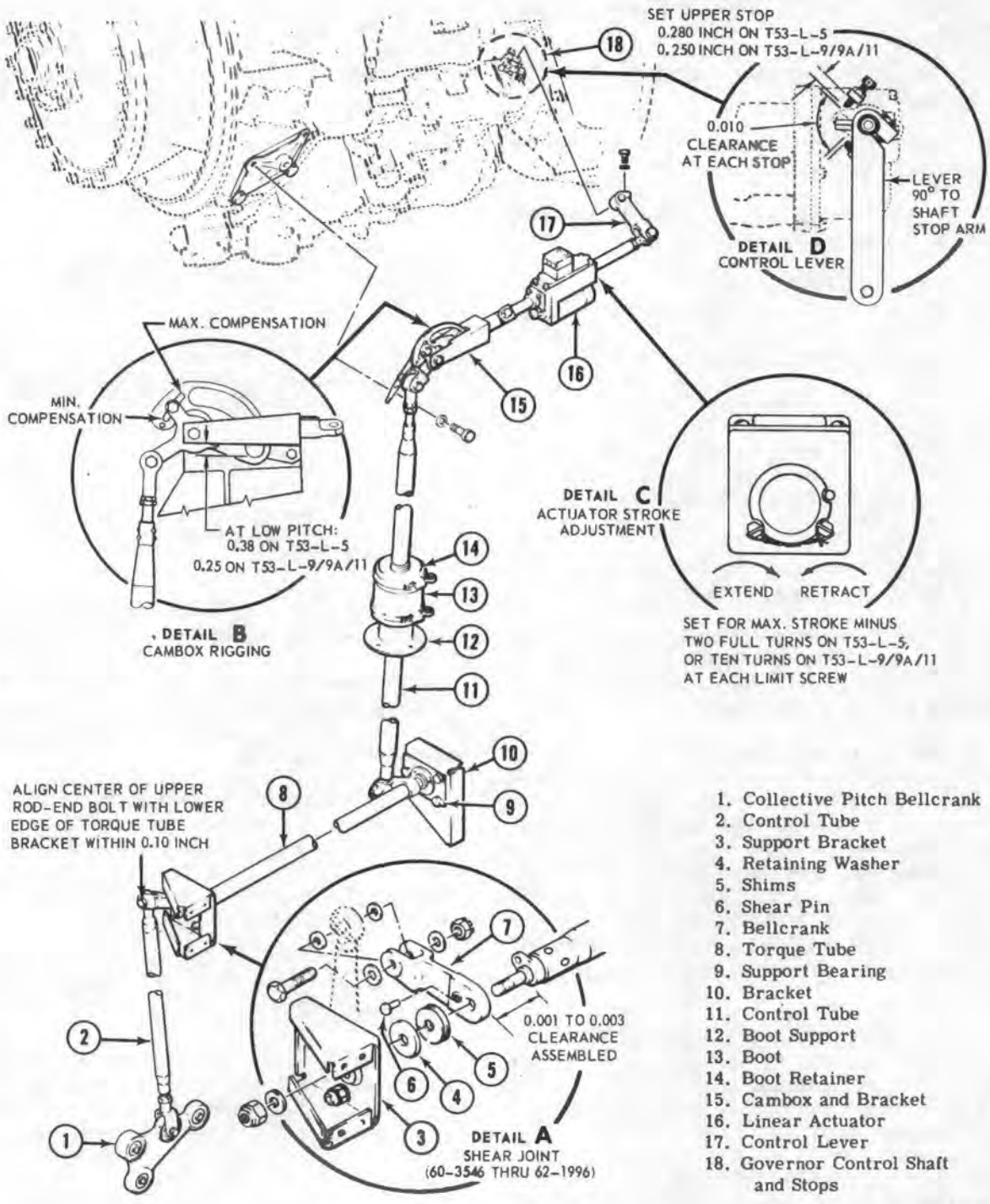


Figure 5-54. Power turbine governor RPM controls — UH-1A



1. Collective Pitch Bellcrank
2. Control Tube
3. Support Bracket
4. Retaining Washer
5. Shims
6. Shear Pin
7. Bellcrank
8. Torque Tube
9. Support Bearing
10. Bracket
11. Control Tube
12. Boot Support
13. Boot
14. Boot Retainer
15. Cambox and Bracket
16. Linear Actuator
17. Control Lever
18. Governor Control Shaft and Stops

Figure 5-55. Power turbine governor RPM controls — UH-1B

(c) If serrations do not permit exact alignment, install lever on next serration clockwise.

(5) Adjust actuator jackshaft for total stroke of 0.82 inch.

(a) Extend actuator fully by holding GOVernor RPM switch to DECRease.

(b) Measure and pencil-mark jackshaft 0.82 inch from actuator body.

(c) Cut lockwire and loosen large jam nut on shaft, to permit adjustment of "retract" stop fitting. Screw stop fitting out enough to avoid premature bottoming.

Caution

Hold shaft with wrench on hexagon shoulder when adjusting stop fitting, to avoid damaging anti-rotation device in actuator.

(d) Electrically retract actuator shaft until pencil mark aligns with housing.

(e) Screw stop fitting in to contact with internal stop. Tighten large jam nut with 290 to 410 inch-pounds torque. Recheck shaft stroke. Lockwire jam nut to end of shaft.

(6) Lock collective pitch stick full up. Fully retract actuator shaft by holding GOVernor RPM switch to INCRease. Move governor control lever to high rpm position, with 0.010 inch clearance between stop arm and upper stop screw by use of a thickness gage. Cut lockwire and loosen small jam nut on actuator shaft, and adjust rod-end to connect on control lever at position described. When connected, center rod-end in clevis, tighten jam nut and lockwire.

(7) Place collective pitch stick full down. Extend actuator to full decrease position. Check for 0.010 inch clearance at lower stop. If necessary, adjust lower stop screw, tighten and lockwire jam nut.

(8) On initial ground run, with collective pitch stick held full down, check for minimum to maximum rpm range controlled by GOVernor RPM switch. If necessary, readjust actuator stroke and length to obtain required range, repeating clearance checks and adjustments of governor stop screws.

(9) Make final adjustment of droop compensator cam as required by ground run and test flights. Set cam to maintain 6400 rpm from full low pitch to red line torque or full power available, whichever occurs first. If rpm droop occurs, move cam up toward maximum compensating setting. If adjustment cannot be made on cam, shorten control tube attached to cam bellcrank.

Note

Readjust governor stop screws for proper clearance after any change in rigging.

Ac. Model UH-1A helicopters equipped with 87000-B4 overspeed governor shall be rigged as follows. (See figure 5-52.)

Note

These instructions are for UH-1A aircraft with overspeed governor Part No. 87000-B4.

(1) Be sure collective pitch control system is rigged before proceeding.

(2) Open engine cowling at left side. Disconnect actuator jackshaft from governor control lever. Support actuator to permit free movement as required.

(3) Set cambox for maximum compensation: Loosen nut on cam adjustment bolt to free serrated washer from cam face. Move bolt clockwise in slot, to position nearest end of cam slot. Tighten nut on bolt so that serrated washer engages last serrations of cam.

(4) Check that governor stops are correctly set for use on T53-L-1A engine. (Refer to paragraph 5-277.)

(5) Set actuator shaft stop-fitting to 1.04 inch length from end of shaft, and rod-end fitting to 1.25 inch length from face of stop-fitting to center of rod-end bolt hole. (See figure 5-56.) Tighten but do not lockwire jam nuts.

(6) Fully retract actuator shaft by holding GOVernor RPM to INCRease. Loosen rod-end jam nut slightly to allow alignment. Place 0.010 inch thickness gage against upper governor stop screw, and hold governor shaft stop

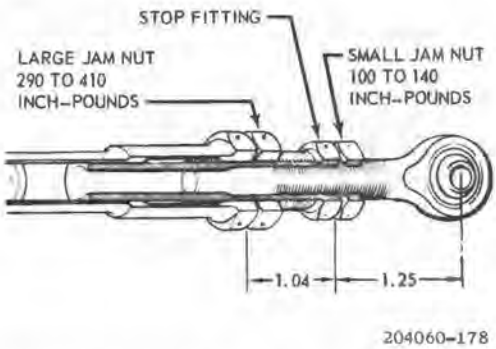


Figure 5-56. Actuator shaft dimensions — UH-1A with 87000 B4 overspeed governor

arm against gage. With collective pitch stick held full up, install control lever on serrated shaft of governor, so aligned as to allow connection of actuator shaft to lever. Turn shaft rod-end to enter lever clevis, and install bolt with washers, nut and cotter pin.

(7) Check for 0.010 inch clearance at lower governor stop with collective pitch stick full down and actuator extended to full decrease position. Readjust lower stop screw if necessary. Secure all adjustments, with lockwire where applicable.

(8) Make final checks and adjustments in ground run and after flight tests. (Perform sub-steps (8) and (9) of step b.)

Bd. Model UH-1B helicopters shall be rigged as follows. (See figure 5-53.)

(1) Be sure collective pitch control system is rigged.

(2) Lock collective stick in full down position.

(3) Adjust control tube (2) to align center of upper rod-end bolt with lower edge of torque tube bracket (3) within 0.10 inch.

(4) Set cam adjustment bolt at middle of slot. (See Detail B.)

(5) Adjust control tube (11) to obtain required position of cam, by measurement of cam slot exposed below cambox housing. (See Detail B.)

B5 (a) On T53-L-5 engine, bottom of cam slot should be 0.38 inch below housing.

B9 B11 B13 (b) On T53-L-9, T53-L-11, and T53-L-13 engines, bottom of cam slot should be 0.25 inch below housing.

(6) Check installation of governor control lever, as nearly at 90° to stop arm as serration alignment will permit. (See Detail D.)

(7) Adjust upper governor stop screw by length measured from inner side of mounting boss. (See Detail D.) Remove and discard lead seal on lockwire, if existing.

B5 (a) On T53-L-5 engine, upper stop screw should extend 0.280 inch from inner side of boss.

B9 B11 B13 (b) On T53-L-9, T53-L-11, and T53-L-13 engines, upper stop screw should extend 0.250 inches from inner side of boss.

Caution

Never shorten either upper or lower stop screw to less than 0.060 inch length from inner side of boss.

(8) Disconnect actuator shaft from governor control lever by removing bolt.

(9) Electrically position actuator shaft to approximate midpoint of stroke. Turn both adjusting screws to obtain maximum stroke. (See Detail C.) Reduce stroke by turning each screw away from maximum adjustment, according to engine on which installed.

B5 (a) On T53-L-5 engine, turn each screw two full turns.

B9 B11 B13 (b) On T53-L-9, T53-L-11, and T53-L-13 series engines, turn each screw ten full turns.

(10) Fully retract actuator shaft by holding GOVernor RPM switch to INCRease. Lock collective stick in full up position.

(11) Reinstall bolt connecting actuator to governor control lever, adjusting actuator shaft rod-end to obtatin 0.010 inch clearance between governor stop arm and upper stop screw, measured with a thickness gage. (See Detail D.) If necessary, reposition control lever one serration on governor shaft to accomplish this adjustment while keeping safe thread engagement of rod-end.

Note

When tightening jam nut on actuator shaft, center rod-end in clevis of lever so that self-aligning bearing will absorb any rotation of shaft. Do not add shim washers between clevis and actuator governor arm. Clearance is necessary for proper operation.

(12) Fully extend actuator shaft by holding GOVernor RPM switch to DECRease. Lock collective pitch control stick in full down position.

(13) Adjust lower stop screw for 0.010 inch clearance with governor shaft stop arm, measured with a thickness gage. Remove and discard seal on lockwire, if existing. Observe minimum length limitation. (Refer to CAUTION, under step (7) (b).

(14) Check security of all adjustments and connections, installing lockwire where applicable.

(15) On initial ground run, with collective pitch control stick full down, check for 6000 to 6700 rpm range controlled by GOVernor RPM switch. If necessary, readjust actuator stroke and length to obtain required range, repeating clearance checks and adjustment at both governor stop screws.

(16) Make final adjustments of droop compensator cam as required by flight checks. Set cam to maintain 6700 rpm (plus or minus 50) from full low pitch to full power. If rpm droop occurs, rotate cam counterclockwise toward maximum compensation. If maximum compensation does not correct droop, adjust control tube rod-end attached to cambox bellcrank. (Refer to step (5).)

(a) If cambox assembly is Part No. 204-060-787-5, shorten control tube to reduce amount of cam slot showing below housing. Be sure roller does not bottom in cam slot.

(b) If cambox assembly is Part No. 204-060-787-7, lengthen control tube to increase amount of cam slot showing below housing, not to exceed 0.31 inch.

Note

Readjust governor stop screws for clearance after any change in rigging.

5-292. Power Turbine Governor Cambox and Linkage. (Refer to paragraph 5-286.)

5-293. Removal — Power Turbine Governor Cambox and Linkage. a. Disconnect control tube rod-end from bellcrank of cambox by removing bolt with nut and washer.

b. Remove cambox and bracket as an assembly. (If Part No. 204-060-741 series, cambox housing has integral bracket.)

A (1) On UH-1A, remove two nuts and washers which secure cambox assembly on tachometer generator mounting studs. Reinstall nuts on studs temporarily.

B (2) On UH-1B, cut lockwire and remove two bolts which secure cambox bracket on top of forward engine mount trunnion. Reinstall bolts temporarily.

c. Loosen clamps to detach boot from support or retainer. Disconnect push-pull tube by removing bolt from arm of torque tube in fuselage compartment. Pull tube up through deck. Remove snap-ring and push split bushing down out of retainer, remove retainer from either end of tube. Remove four screws to detach boot support from deck.

d. In cargo-sling compartment, disconnect push-pull tube by removing bolts at torque tube bellcrank and collective pitch bellcrank.

e. To remove torque tube: Detach forward support bracket from bulkhead by removing four screws. Remove retaining nut, bracket assembly, washer, shims shear pin, and bellcrank from forward end of tube. Keep attaching parts together for reinstallation. Enter fuselage compartment. Pull tube forward out of rear bearing then aft through hole in bulkhead. Rear bearing can be detached from bracket by removing three bolts.

5-294. Inspection — Power Turbine Cambox and Linkage. Inspect the following items as noted.

a. Shims on cambox bellcrank pivot bolt at each side of bearing should center cam in slot, and should provide 0.001 to 0.003 inch total clearance before nut is tightened on pivot bolt.

A b. On UH-1A cambox Part No. 204-060-777 series, nut on bellcrank pivot bolt should be fingertight plus one castellation.

ground test fitting located on right-hand side of helicopter in inboard module assembly. Repeat step (6) above.

Note

Throughout performance of steps (6) and (7) above, observe all portions of system for external leakage. Appropriate action shall be taken to correct any cause of leakage.

(8) Upon completion of steps (6) and (7) above, test unit shall be shut down and cyclic and collective hoses shall be connected to cylinders.

(9) Connect left and right-hand hydraulic armament system pressure and return lines.

(10) Set test unit to a minimum flow rate of at least three gpm. Use test unit pressure setting sufficient to maintain three gpm flow through system for at least five minutes. Activate test unit and flush system for at least five minutes.

Note

Throughout performance of step (10) above, observe all portions of system for external leakage. Appropriate action shall be taken to correct any cause of leakage.

(11) Shut down test unit and disconnect left- and right-hand hydraulic armament system pressure and return lines. Cap lines.

(12) Disconnect hoses from tail rotor cylinder and connect hose ends together with reducer. Cap or cover ports in cylinder to prevent entry of dirt.

(13) Disconnect test unit hoses from System No. 1, and connect to System No. 2. (Refer to step (4).)

(14) Accomplish step (10) above, including note.

(15) Upon completion of step (14) above, test unit shall be shut down and hydraulic system hoses shall be reconnected to cylinder.

(16) Set test unit pressure relief valve for a cracking pressure of 2100 psig and set pump so that it is capable of at least six gpm flow. Set pressure compensation at 1475 to 1525 psig. System No. 1 and System No. 2 shall both be connected to the test unit at the ground test connections.

b. Perform functional tests by accomplishing the following steps. Tests shall be performed after successful completion of step a., above.

(1) Apply 1475 to 1525 psig to the hydraulic systems for at least 15 minutes. While pressure is maintained, accomplish the following:

(a) Observe all portions of both systems for external leakage. Appropriate action shall be taken to correct any cause of external leakage.

(b) Slowly cycle all controls to limits and observe movement of power cylinders. Clearance shall be such that fouling of adjacent parts cannot occur. Check flexible connections to ensure that pinching of hoses does not occur and that vibration does not loosen attaching fittings.

(c) Cycle the cyclic controls, collective control and tail rotor control pedals through full stroke at least ten times to bleed air from system.

(2) Apply pressure to the hydraulic systems. Slowly increase pressure and check warning lights. Lights should go OFF when pressure reaches 700 to 900 psig. Slowly decrease pressure. Lights should come ON when pressure reaches 600 to 400 psig.

(3) Test single system operation as follows:

(a) With pressure in systems at 1475 to 1525 psig, shut off System No. 1 by use of switch on console. System No. 1 warning light shall come ON.

(b) Operate cyclic, collective and tail rotor controls. Operation shall be smooth and positive.

(c) Shut off System No. 2 by use of switch on console. System No. 1 warning light shall go OFF and System No. 2 warning light shall come ON.

reaches 700 to 900 psig. Slowly decrease pressure. Lights should come ON when pressure reaches 600 to 400 psig.

(3) Test single system operation as follows:

(a) With pressure in systems at 1475 to 1525 psig, shut off System No. 1 by use of switch on console. System No. 1 warning light shall come ON.

(b) Operate cyclic, collective and tail rotor controls. Operation shall be smooth and positive.

(c) Shut off System No. 2 by use of switch on console. System No. 1 warning light shall go OFF and System No. 2 warning light shall come ON.

(d) Operate cyclic and collective controls. Operation shall be fully powered, smooth and positive.

Note

When testing System No. 1 tail rotor controls are not powered by hydraulic pressure and will require more force to operate.

(4) Connect System No. 1 to test unit and slowly increase pressure until relief valve on System No. 1 module opens. Relief valve shall open between 1626 and 2140 psig.

(5) Repeat step (4) above, for System No. 2.

(6) Disconnect hydraulic systems from ground test unit and remove ground test unit.

(7) Test system pressure by connecting calibrated (0 to 3000) gages to both hydraulic systems at pressure ground test fittings. With rotor turning at 285 to 314 RPM, hydraulic pressure shall be 1475 to 1525 psig on each system, with cyclic, collective and tail rotor controls fixed.

c. Upon completion of tests, replace filter element in both module assemblies. Refill hydraulic systems, using test unit. Bleed systems in accordance with instructions in paragraph 6-49, step b. (1) (c). Disconnect and remove test unit. Close all test ports on unit and on hydraulic systems. Connect hydraulic reservoirs to module assemblies and lockwire quick disconnect couplings. Service reservoirs in accordance with instructions contained in paragraph 1-91.

6-49A. Testing — Hydraulic Systems (UH-1B Serial No. 66-491 and subsequent). The test equipment shall consist of a thoroughly clean portable hydraulic test unit, serviced to use hydraulic oil (item 3, table 1-1). The test unit shall include a ten micron filter to filter all oil leaving the test unit. The unit shall be capable of producing pressure to 2300 psig, and shall have a flow rate of at least six gpm. A calibrated pressure gage with a minimum of 2500 psig capacity shall be provided on the test unit. The test unit shall have provisions in the pressure and return lines for connecting to both hydraulic systems for simultaneous operation.

a. Prepare the systems for testing as follows:

(1) The complete system shall be thoroughly cleaned to assure removal of all foreign matter from lines and components.

(2) Fill hydraulic reservoirs to capacity and keep filled during tests.

Caution

Do not service reservoir with the accumulator charged hydraulically. Accumulator should be bled down.

(3) On initial test of newly installed system, disconnect hoses from cyclic and collective cylinders. Connect hose ends together with unions. Cap or cover ports in cylinders to prevent entry of dirt.

(4) Connect test unit hoses to System No. 1 through ground test fittings, located on right hand side of helicopter in inboard module assembly.

(5) Visually inspect complete hydraulic system to insure that all components and lines are securely attached and appear capable of satisfactory operation.

(6) Set test unit to a minimum flow rate of six gpm. Use test unit pressure setting sufficient to maintain six gym flow through hydraulic system for at least five minutes. Use test unit reservoir for this flushing procedure.

Caution

Flush each hydraulic system separately.

(7) Disconnect test unit hoses from System No. 1 and connect to System No. 2 through ground test fitting located on right-hand side of helicopter in outboard module assembly. Repeat step (6) above.

INDICATION OF TROUBLE	PROBABLE CAUSE	CHECK FOR TROUBLE	CORRECTIVE ACTION
	Module pressure switch inoperative		Replace pressure switch.
Collective stick will not stay in position	Springs on collective servo actuator mislocated		204-076-318-1 spring is the heavier of two springs used and shall be located in the top position between clip and nut on 204-076-005-5 hydraulic cylinder assembly. On the 204-076-005-9 assembly, the spring is positioned between clip and lower bracket. Refer to paragraph 9-17 or 9-22 for adjustment instructions.
Controls do not operate smoothly	Sticky servo control valve		Replace faulty servo actuator
	Servo valve requires more than 12 ounces to operate		Replace servo actuator
Hydraulic system too hot	Pump generates excessive pressure, higher than relief valve cracking pressure		Replace pump
Relief valve cracking pressure set lower than system pump pressure	Check with hydraulic test stand		Replace module
Servo actuators chatter when moving controls	Air in servo actuators		Cycle controls through full stroke 10 times with more than 850 psi pressure applied to eliminate air. Some chatter is normal in the directional servo actuator when rotor is not rotating
	Servo actuator mounting bearings loose		Adjust bearings

INDICATION OF TROUBLE	PROBABLE CAUSE	CHECK FOR TROUBLE	CORRECTIVE ACTION
	Any looseness in hydraulic cylinders		Replace cylinder
Hydraulic control switch ineffective	Circuit breaker not pushed in		Close circuit
	Solenoid valve not connected		Connect wiring
	Improper electrical wiring		Repair or replace
	Solenoid valve not functioning properly		Replace with new solenoid valve
	Check valve located at hydraulic pump pressure port installed backward		Remove and install properly
Excessive feedback	Air in servo actuator or System has not been bled		Turn hydraulic system ON and cycle the cyclic controls, collective control, and tail rotor through a full stroke at least ten times to bleed air from system
	Improperly adjusted rotor	Refer to paragraph 8-7.	
Note: The following items are peculiar to the hydraulic system incorporated in UH-1B helicopters Serial No. 66-491 and subsequent:			
Coupling halves in drain circuit cannot be connected	Drain valve button has been depressed prematurely (before coupling halves were connected)		Open bleed valve in line between drain valve and drain valve coupling half to relieve pressure
Accumulator will not hold pressure in green band of gage	Accumulator piston seal leaking	If accumulator will not hold nitrogen pressure after charging	Replace accumulator
Less than four full strokes of collective control available	Improper nitrogen precharge in accumlator	Check accumulator pressure gage for proper precharge	Properly charge accumulator with nitrogen
	Improper hydraulic fluid charge in accumulator		Use hydraulic cart to charge accumulator
		Note: If hydraulic cart is not available, qualified personnel may run-up helicopter to provide necessary hydraulic power.	

INDICATION OF TROUBLE	PROBABLE CAUSE	CHECK FOR TROUBLE	CORRECTIVE ACTION
	Pressure operated shut-off valve defective	When checking accumulator precharge, it is evident that fluid is remaining in the accumulator after collective stick becomes inoperative	Replace valve
Four full strokes, minimum, still not obtainable on collective control	Faulty accumulator		Replace accumulator and charge with nitrogen and hydraulic fluid

6-52. Removal — Hydraulic Pumps (UH-1B Serial No. 64-14101 and subsequent). Removal of both hydraulic pumps is the same. a. Drain hydraulic reservoir.

b. Disconnect and drain all lines connected to hydraulic pump. Immediately cap or cover all openings in lines and pump to prevent entrance of foreign matter.

c. Remove nuts and washers which mount pump to transmission drive quill. Disengage pump from drive quill and remove pump and gasket.

6-53. Installation — Hydraulic Pumps (UH-1B Serial No. 64-14101 and subsequent). Installation of both hydraulic pumps is the same.

a. Position pump, with new gasket, on mounting studs. Align splines of pump shaft with splines of transmission quill and install washres and nuts.

b. Uncap or uncover openings in lines and pump and connect hydraulic lines to pump. Refer to paragraph 6-46 for installation methods of hydraulic fittings.

Note

Make sure hydraulic reservoirs are full in order to completely fill reservoir to pump line and pump case drain port. If pump case drain port and reservoir to pump line are not completely filled, before connecting line to pump, air will be trapped in pump. Excessive bleeding procedures will then be necessary.

c. Refill, bleed and test hydraulic systems. (Refer to pragraph 6-49.)

6-54. Hydraulic Module Assemblies (UH-1B Serial No. 64-14101 and subsequent). Two hydraulic module assemblies are attached to the right-hand side of the cabin aft bulkhead. Access to these units is gained by opening the right-hand transmission cowling. The outboard module is a part of System No. 2, and the inboard unit is used with System No. 1. Each module contains a two position, three way, solenoid operated, hydraulic valve (1, figure 6-8), a relief valve (2), return and pressure filters (4 and 5), with differential pressure indicators (3 and 6, and a pressure switch (7).

6-55. Removal — Hydraulic Module Assemblies (UH-1B Serial No. 64-14101 and subsequent). Removal of both module assemblies is the same.

a. Open right-hand transmission cowling.

b. Disconnect electrical wiring from module assembly.

c. Disconnect all lines and hoses from module assembly. Cap to retain hydraulic fluid if system has not been drained. Cap openings in module to prevent entrance of foreign matter.

d. Remove three bolts and washers attaching module assembly to cabin aft bulkhead, and remove module.

6-56. Cleaning — Hydraulic Module Assemblies (UH-1B Serial No. 64-14101 and subsequent). a. Clean electrical components with dry, filtered compressed air. Clean all other parts, including inside and outside of module, with dry cleaning solvent (item 302, table 1-1).

b. Flush module assembly with hydraulic fluid (item 3, table 1-1).

6-57. Inspection — Hydraulic Module Assemblies (UH-1B Serial No. 64-14101 and subsequent). Visually inspect solenoid valve (1, figure 6-8), relief valve (2), filter indicators (3 and 6) and pressure switch (7) for cleanliness, damage and evidence of malfunction.

6-58. Repair or Replacement — Hydraulic Module Assemblies (UH-1B Serial No. 64-14101 and subsequent). Replace parts which do not meet inspection requirements. (See figure 6-8.) Replace module if unserviceable. (Refer to paragraph 6-57.)

6-59. Installation — Hydraulic Module Assemblies (UH-1B Serial No. 64-14101 and subsequent). Installation of both module assemblies is the same.

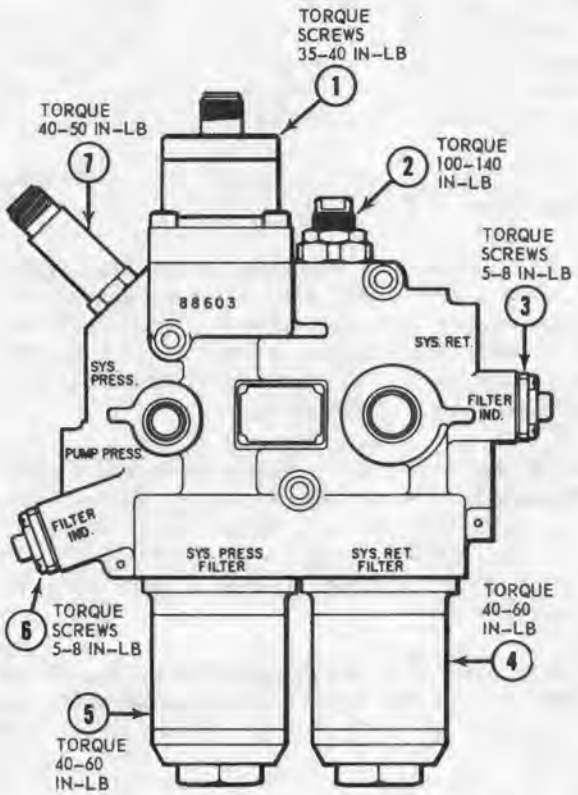
a. Position module assembly to cabin aft bulkhead and install attaching washers and bolts. Uncap or uncover all hoses, lines and openings in module assembly. Connect lines and hoses to module. Refer to paragraph 6-46 for installation methods of hydraulic fittings.

b. Connect electrical wiring to module assembly.

6-58. *Repair or Replacement — Hydraulic Module Assemblies (UH-1B Serial No. 64-14101 and subsequent).* Replace parts which do not meet inspection requirements. (See figure 6-8.) Replace module if unserviceable. (Refer to paragraph 6-57.)

6-59. *Installation — Hydraulic Module Assemblies (UH-1B Serial No. 64-14101 and subsequent).* Installation of both module assemblies is the same.

a. Position module assembly to cabin aft bulkhead and install attaching washers and bolts. Uncap or uncover all hoses, lines and openings in module assembly. Connect lines and hoses to module. Refer to paragraph 6-46 for installation methods of hydraulic fittings.



1. Solenoid Valve
2. Relief Valve
3. Return Filter Indicator
4. Return Filter
5. Pressure Filter
6. Pressure Filter Indicator
7. Pressure Switch

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Figure 6-8. Hydraulic module assembly (UH-1B serial no. 64-14101 and subsequent)

b. Connect electrical wiring to module assembly.

c. Refill, bleed and test hydraulic system. (Refer to paragraph 6-49 or 6-49A.)

6-60. Filter Elements (UH-1B Serial No. 64-14101 and subsequent). Each hydraulic module is equipped with two filters (4 and 5, figure 6-8) which screw into the module. Elements are of the pleated paper type.

6-61. *Removal — Filter Elements (UH-1B Serial No. 64-14101 and subsequent).* Cut lockwire and remove filter from module. Remove element from filter.

6-62. *Inspection — Filter Elements (UH-1B Serial No. 64-14101 and subsequent).* a. Apply power to hydraulic systems and operate controls.

b. Observe position of module assembly filter indicators (3 and 6, figure 6-8).

c. Manually push indicators in, if extended. If indicators stay in, filter elements do not require replacement.

Note

Ignore extension of filter indicators if hydraulic fluid temperature is below plus 20°F.

6-63. *Repair or Replacement — Filter Elements (UH-1B Serial No. 64-14101 and subsequent).* Replace filter elements when inspection requirements are not met. (Refer to paragraph 6-62.)

Caution

When replacing filter element be sure to replace existing filter element O-ring with new O-ring, Part No. MS-28775-212.

6-64. *Installation — Filter Elements (UH-1B Serial No. 64-14101 and subsequent).* Insert element in filter and screw filter, with new O-ring, into module. Lockwire filter.

6-65. Hydraulic Reservoirs (UH-1B Serial No. 64-14101 and subsequent). Two reservoirs are mounted on the cabin aft bulkhead just to the right of helicopter center line. Access to these units is gained by opening the right-hand transmission cowling. The outboard reservoir is

part of System No. 2, and the inboard unit supplies System No. 1. Each reservoir has a total capacity of four U.S. pints, and is equipped with a sight gage which is visible when the right-hand transmission cowling is open. Drain plugs are located in the bottom of each reservoir, and a screened vent is located at the top of each unit.

6-66. Removal — Hydraulic Reservoirs (UH-1B Serial No. 64-14101 and subsequent). Removal of both reservoirs is the same. a. Open right-hand transmission cowling.

b. Drain hydraulic fluid by cutting lockwire and removing drain plug from bottom of reservoir.

c. Disconnect all lines and hoses from reservoir. Cap or cover openings in lines, hoses and reservoir immediately to prevent entrance of foreign matter.

d. Remove bolts, brackets, and washers attaching reservoir to cabin aft bulkhead and remove reservoir.

6-67. Cleaning—Hydraulic Reservoirs (UH-1B Serial No. 64-14101 and subsequent). a. Thoroughly wash and clean all fittings and inside and outside of reservoir with dry cleaning solvent (item 302, table 1-1). Dry with filtered compressed air.

b. Flush reservoir with hydraulic fluid (item 3, table 1-1).

6-68. Inspection — Hydraulic Reservoirs (UH-1B Serial No. 64-14101 and subsequent). a. Visually inspect filler cap strainer screen for rust, corrosion and breaks.

b. Inspect sight plug glass for scratches, cracks, checks or marring which are sufficient to impair visual or structural function.

Caution

Careful inspection must be made of oil level sight gages to be sure that they are not oil stained internally and are giving erroneous indications of proper oil level. Upon inspection, faulty glasses should be cleaned, or, if necessary, replaced.

c. Inspect vent screen for cleanliness, rust, corrosion, or breaks.

d. Inspect mating parts for damage and crossed threads.

6-69. Repair or Replacement — Hydraulic Reservoirs (UH-1B Serial No. 64-14101 and subsequent). a. Replace filler cap strainer if inspection shows any signs of rust, corrosion or breaks.

b. Replace sight plug if inspection requirements are not met. Replace packing when installing new sight plug.

c. Replace vent screen if considered necessary after inspection. Vent screen must be point staked in three places.

d. Replace any mating part which has been damaged or has crossed threads.

e. Replace reservoir if damaged or unserviceable.

6-70. Installation — Hydraulic Reservoirs (UH-1B Serial No. 64-14101 and subsequent). Installation of both reservoirs is the same.

a. Position reservoir to cabin aft bulkhead and install attaching brackets, washers and bolts. Washers are to be placed under brackets.

b. Uncap or uncover openings in lines, hoses and reservoir and connect lines and hoses to reservoir. Refer to paragraph 6-46 for installation methods of hydraulic fittings.

c. Install drain plug, with new packing, in bottom of reservoir and lockwire.

d. Refill, bleed and test hydraulic systems. (Refer to paragraph 6-49.)

6-70A. Air Valve — (UH-1B Serial No. 66-491 and subsequent). This high pressure air valve (10, figure 6-7A) is used to charge the system accumulator (12) with nitrogen.

6-70B. Removal — Air Valve (UH-1B Serial No. 66-491 and subsequent). a. Connect coupling halves (14 and 15, figure 6-7A).

b. Relieve fluid pressure from accumulator by depressing button on drain valve (13).

c. Remove cap from top of air valve (10) and relieve pressure.

Caution

Open valve very slowly and allow air pressure to escape. Be sure all pressure is relieved.

d. Unscrew air valve from tee on top of accumulator (12). Cap or cover openings.

6-70C. Inspection — Air Valve (UH-1B Serial No. 66-491 and subsequent). Inspect valve for leaks, damage and malfunction.

6-70D. Repair or Replacement — Air Valve (UH-1B Serial No. 66-491 and subsequent). Replace valve if inspection requirements are not met. (Refer to paragraph 6-70C.)

6-70E. Installation — Air Valve (UH-1B Serial No. 66-491 and subsequent). a. Uncap or uncover openings in tee and valve.

b. Screw air valve into tee on top of accumulator (12).

c. Disconnect coupling halves (14 and 15, figure 6-7A).

d. Refill, bleed and test hydraulic systems. (Refer to paragraph 6-49A.) Install air valve cap.

6-70F. Air Pressure Gage — (UH-1B Serial No. 66-491 and subsequent). Pressure contained in accumulator (12, figure 6-7A) is measured by this gage (11).

6-70G. Removal — Air Pressure Gage (UH-1B Serial No. 66-491 and subsequent). a. Connect coupling halves (14 and 15, figure 6-7A).

b. Relieve fluid pressure from accumulator (12) by depressing button on top of drain valve (13).

c. Remove cap from top of air valve (10) and relieve pressure.

Caution

Open valve very slowly and allow air pressure to escape. Be sure all pressure is relieved.

d. Unscrew pressure gage (11) from tee on top of accumulator (12). Cap or cover openings.

6-70H. Inspection — Air Pressure Gage (UH-1B Serial No. 66-491 and subsequent). Inspect gage for leaks, damage and malfunction.

6-70J. Repair or Replacement — Air Pressure Gage (UH-1B Serial No. 66-491 and subsequent). Replace gage if inspection requirements are not met. (Refer to paragraph 6-70H.)

6-70K. Installation — Air Pressure Gage (UH-1B Serial No. 66-491 and subsequent). a. Uncap or uncover openings in tee and gage.

b. Screw gage onto tee on top of accumulator (12).

c. Disconnect coupling halves (14 and 15, 6-7A).

d. Refill, bleed and test hydraulic systems. (Refer to paragraph 6-49A.) Install air valve (10) cap.

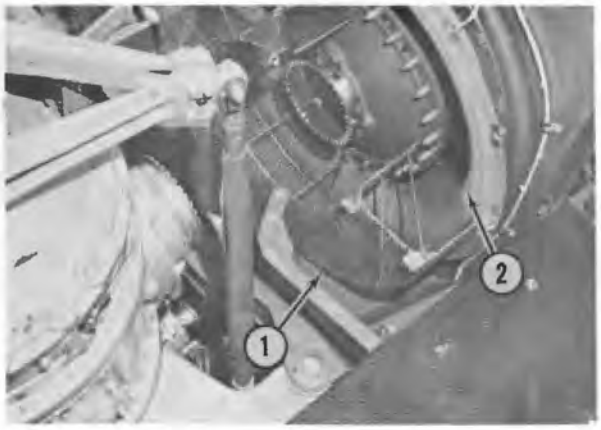
6-70L. Accumulator — (UH-1B Serial No. 66-491 and subsequent). Hydraulic fluid contained in this accumulator (12, figure 6-7A) temporarily maintains pressure throughout the collective control system for emergency use in the event both hydraulic systems fail.

6-70M. Removal — Accumulator (UH-1B Serial No. 66-491 and subsequent). a. Connect coupling halves (14 and 15, figure 6-7A).

b. Relieve fluid pressure from accumulator (12) by depressing button on top of drain valve (13).

c. Remove cap from top of air valve (10) and relieve pressure.

d. Remove air valve (10) (refer to paragraph 6-70B) and air pressure gage (11) (refer to paragraph 6-70G).



DETAIL **S**

DETAIL **T**

DETAIL **U**

DETAIL **V**

DETAIL **W**

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Figure 7–6. Inspection and lubrication main drive shaft (Sheet 4 of 4)

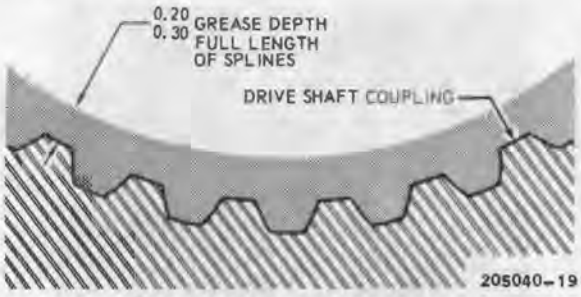


Figure 7-7. Drive shaft coupling

(1) Nicks and scratches, running within 15 degrees of shaft axis, which are not in excess of 0.005 inch in depth are permissible without polishing out.

(2) Nicks and scratches, running within 15 degrees of shaft axis, which are not in excess of 0.010 inch in depth are permissible if polished out provided total polished area does not exceed 20 percent of circumference of shaft at any point.

(3) Nicks and scratches not running within 15 degrees of shaft axis must be polished out. A maximum depth of 0.005 inch may be polished out on 100 percent of shaft circumference. A maximum depth of 0.010 inch may be polished out provided the total polished area does not exceed 20 percent of shaft circumference at any point.

b. A minimum radius of ½ inch should be used in polishing out nicks and scratches. Polished areas must be refinished with two coats of zinc chromate primer, (item 119, table 1-1).

7-12. *Installation — Main Drive Shaft.* Install main drive shaft as follows:

Note

Before installing drive shaft CAREFULLY wipe clean the area surrounding the drive shaft, especially the intake screen, fifth mount beam, synchronized elevator tube and collective tube. (See figure 7-6, details R and S.)

a. Coat shaft splines of adapter (9, figure 7-3) and pack female splines of engine output shaft ⅔ full with Plastilube, Moly No. 3 (item 20, table 1-1).

Note

When a T53-L-13 engine is used to replace earlier engine models, or the L-13 engine is replaced by an earlier model, a different adapter must be used. T53-L-1A, L-5, L-9 and L-11 engines use adapter (Part No. 204-040-630), bolt (Part No. 204-040-631), and washer (Part No. 204-040-634). T53-L-13 uses adapter (Part No. 204-040-812), bolt (Part No. 204-040-813), and washer (Part No. 204-040-814).

b. Insert adapter into engine shaft. Install retaining bolt (7, figure 7-3) and key washer (8), with short tab of washer in adapter slot. Tighten bolt with 100 to 140 inch-pounds torque, and lockwire head to outer tab of washer.

Caution

When installing driveshaft, be sure that coupling with cooling fins is at forward end, to reduce possibility of damage due to overheating in operation.

c. Place drive shaft assembly, with cooling fins at forward end, between engine adapter and transmission input drive coupling (see figure 7-6, detail T). Do not compress shaft couplings more than necessary, as this will tend to force grease past the micarta inboard seal rings.

d. Install clamp sets (1, figure 7-3) to secure each end of shaft as follows:

(1) Carefully wipe inside grooves clean of all traces of grease, (See figure 7-6, detail O and P) and fit clamp halves around coupling joint, checking that serial numbers on both halves are alike and on same side (see figure 7-6, detail Q). Clamp halves should fit snugly and hold themselves in place without bolts.

Note

On UH-1A, both serialized and non-serialized coupling sets may be used. DO NOT mismatch serialized coupling halves.

(2) Install clamp bolts (10, figure 7-3) with heads toward shaft rotation.

A (a) On UH-1A, use two washers (11) on each bolt with countersunk sides next to bolt head and nut. Additional washers may be used, equal on both sides for balance.

B (b) On UH-1B, install each bolt with two half-round pivot spacers (13) next to clamp ends with flat sides out, a steel washer next to bolt head and another next to nut. Thin washers can be added under nut as required, using equal amount on opposite bolt to maintain balance.

(3) Position two clamp sets with slots at 90 degrees around shaft from each other.

(4) Tighten bolts evenly with 100 to 130 inch-pounds torque, keeping equal gaps at ends of clamp set within 0.030 inch. Tap around outside of clamp for good seating, and recheck bolt torque. Secure nuts with cotter pins.

e. Carefully wipe any grease from shaft exterior, intake screen, and areas around forward

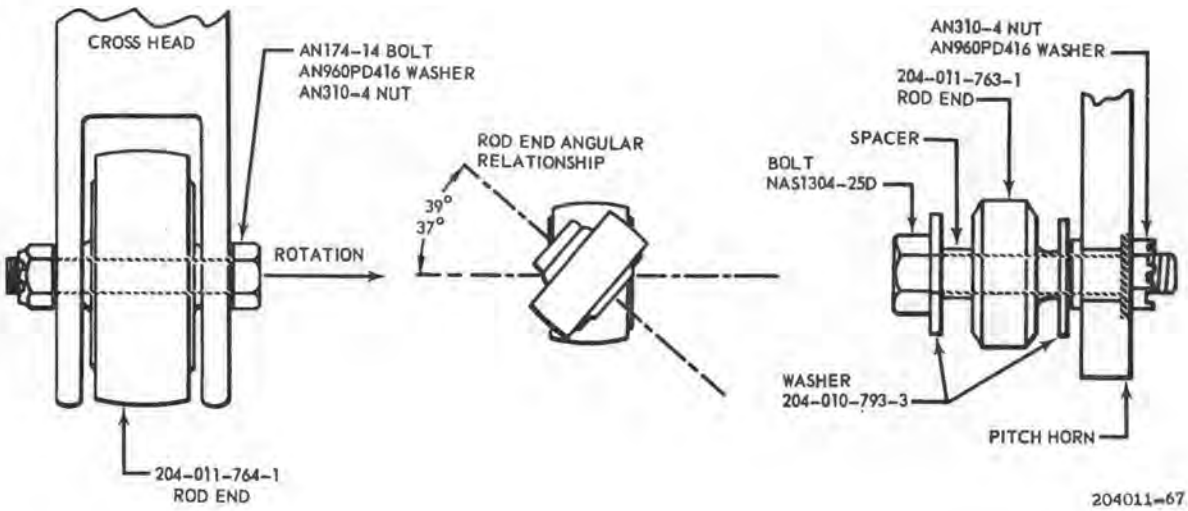


Figure 8-33. Link assembly installation (UH-1A)

c. The following maintenance procedures will be performed after installing 204-011-762 link assemblies.

(1) Check for interference between rod end and cross head with full right and full left pedal.

(2) Check rigging. Rig, if necessary.

(3) It is mandatory to retrack the tail rotor blades in accordance with instructions contained in paragraph 8-127.

8-137. *Installation — Tail Rotor Blades (UH-1A).* Tail rotor blade attaching bolts may be installed with bolt heads either inboard or outboard, but all four bolt heads must be installed the same.

a. Installation of same blades.

(1) Same blades without repair, or same blades with allowable minor repair or minor touchup, may be installed without balancing of hub and blade assembly.

(2) Install blade with previously removed bolts, washers and nuts, and with bolts in same grip and hole from which previously removed. Torque nuts 270 to 300 inch-pounds.

b. Installation of new blades.

(1) New blades cannot be installed in same or new hubs at second echelon level due to requirement for balancing tail rotor hub and blade assembly as a complete assembly. This function must be performed at direct support facility.

(2) Installation of the balanced tail rotor hub and blade assembly may then be performed by organizational personnel.

Caution

Track blades after every installation.

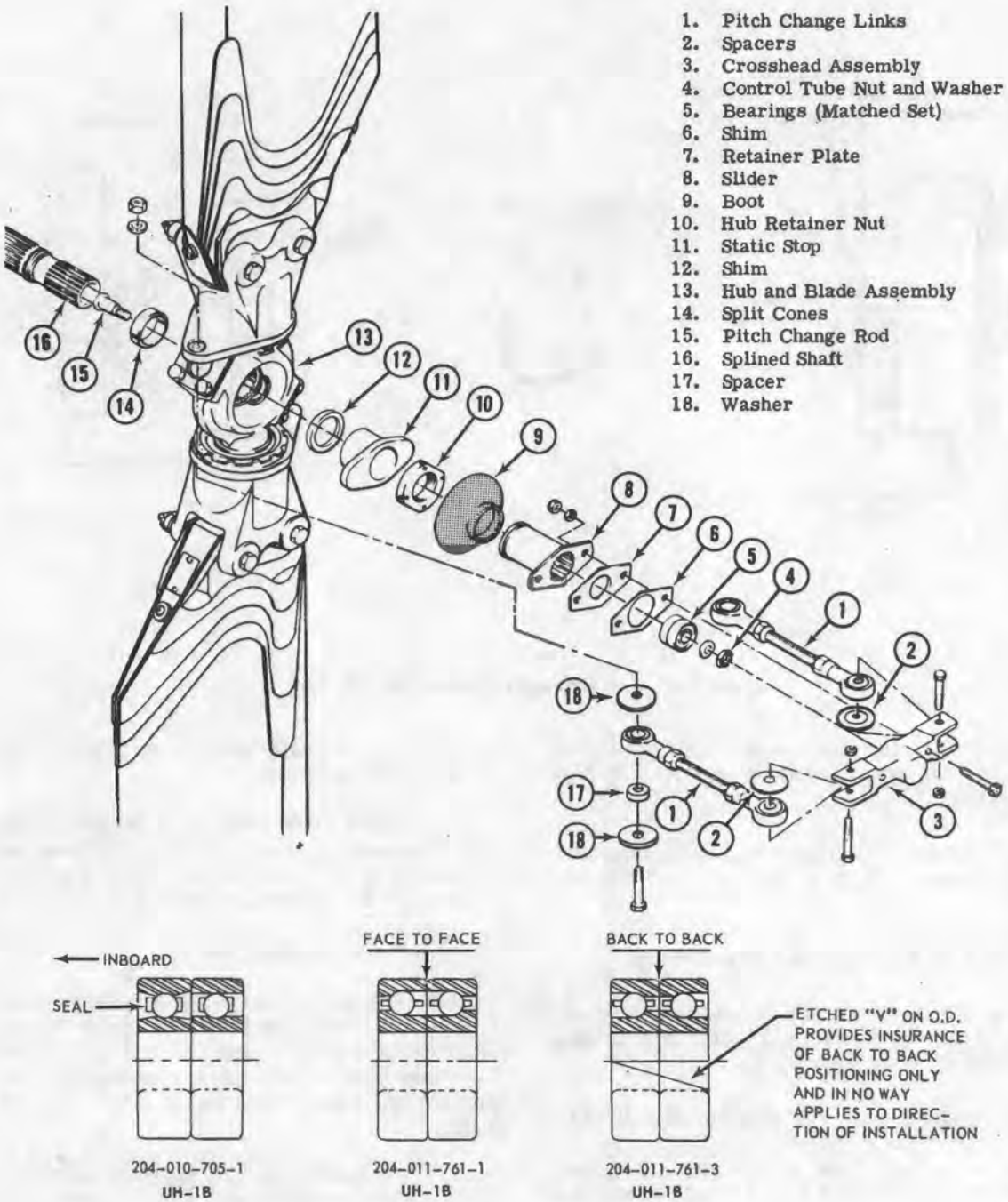


Figure 8-34. Tail rotor hub and blade assembly (UH-1B Serial No. 60-3546 thru 64-14100)

8-149. *Replacement — Link Assembly 204-011-762 (UH-1B Serial No. 60-3546 through 64-14100).* a. Link assembly, 204-011-762, is furnished as a replacement for link assembly, 204-010-777. The 204-011-762 link assembly provides a radial type rod end bearing with a great bearing area and will provide increased service life.

b. Refer to figure 8-38 for the combination of bolts, nuts, washers, spacers and cotter pins used with the 204-011-762 link assembly. Discard 204-010-792 washers when replacing existing 204-010-777 link assemblies.

c. The following maintenance procedures will be performed after installing 204-011-762 link assemblies.

(1) Check for interference between rod end and cross head with full right and full left pedal.

(2) Check rigging. Rig, if necessary.

(3) It is mandatory to retrack the tail rotor blades in accordance with instructions contained in paragraph 8-140.

8-150. *Installation — Tail Rotor Blades (UH-1B Serial No. 60-3546 through 64-14100).* Tail rotor blade attaching bolts may be installed with bolt heads either inboard or outboard, but all four bolt heads must be installed the same.

a. Installation of same blades.

(1) Same blades without repair, or same blades with allowable minor repair or minor touch up, may be installed without balancing of hub and blade assembly.

(2) Install blade with previously removed bolts, washers and nuts, and with bolt in same grip and hole from which previously removed. Torque nuts 270 to 300 inch-pounds.

b. Installation of new blades.

(1) New blades cannot be installed in same or new hubs at second echelon level due to requirement for balancing tail rotor hub and blade assembly as a complete assembly. This function must be performed at direct support facility.

(2) Installation of the balanced tail rotor hub and blade assembly may then be performed by organizational personnel.

Caution

Tracks blades after every installation.

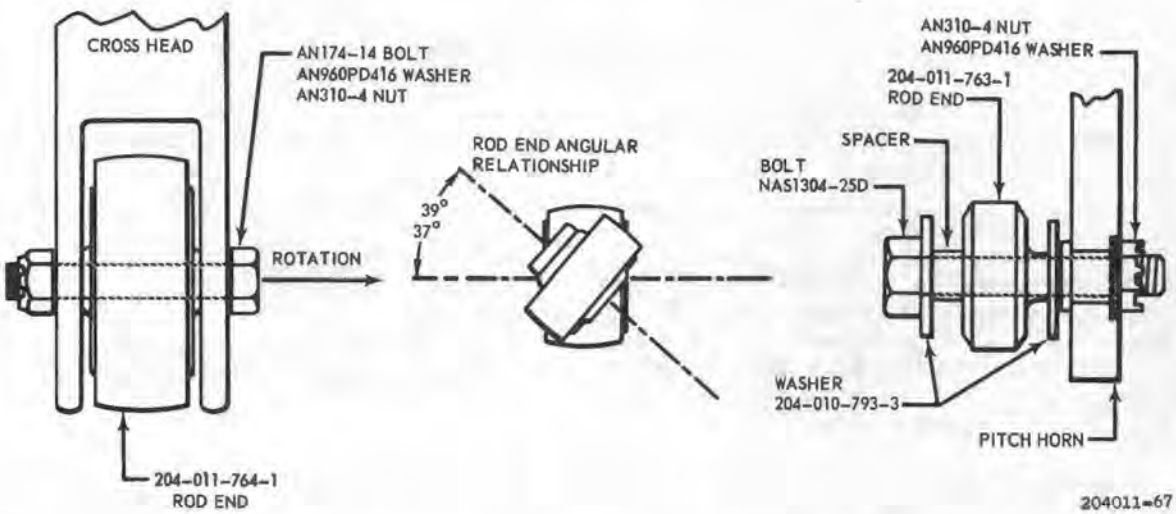


Figure 8-38. Link assembly installation(UH-1B Serial No. 60-3546 thru 64-14100)

8-151. Tail Rotor Hub and Blade Assembly (UH-1B Serial No. 64-14101 and subsequent). (See figure 8-39.) Tail rotor, on UH-1B Serial No. 64-14101 and subsequent, is a two-blade controllable — pitch hub and blade assembly, mounted on gear box shaft at left side of tail boom vertical fin and connected to control system by means of a crosshead assembly and pitch change links. All parts are similar to those used on earlier helicopter of this series, but rotor blades are stronger construction and linkage allows greater range of blade pitch to compensate for increased main rotor torque.

8-152. *Troubleshooting — Tail Rotor Hub and Blade Assembly (UH-1B Serial No. 64-14101 and subsequent).* A chart of possible tail rotor hub and blade assembly troubles, causes and remedial action is included below.

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
High frequency vibration	Tail rotor out of track	Track tail rotor
	Tail rotor out of balance	Remove tail rotor for balance on fixture.
	Worn or loose hinge mounting	Replace rotor
	Loose retaining nut	Torque nut.
	Bent pitch change link	Replace pitch change link
	Loose pitch change link bearings	Replace pitch change link
	Worn or loose pitch change rod duplex bearings	Replace bearings
	Worn or loose pitch change slider	Replace slider
Inability to make normal right and left turns in flight	Blade angles not set properly	Check pitch settings and rigging

8-153. *Operational Check — Tail Rotor Hub and Blade Assembly (UH-1B Serial No. 64-14101 and subsequent).* Following replacement or installation of the tail rotor hub, blades or pitch change systems, check the tail rotor system rigging and track the tail rotor blades.

a. Attach a small piece of sponge rubber 1/8 to 1/4 inch thick to end of a 1/2 x 1/2 inch pine stick or any other flexible device, and cover sponge rubber with Prussian blue (item 103, table 1-1) or similar type of coloring thinned with oil.

Note

The run-up shall be performed by personnel authorized in accordance with AR95-13.

b. Start engine. Run engine at 6600 rpm with pedals in neutral position. Rest marking device on under side of tail boom assembly. Slowly move marking device into disc of tail rotor just far enough to mark near blade approximately one inch from tip.

blade attaching bolts may be installed with bolt heads either inboard or outboard, but all four bolt heads must be installed the same.

a. Installation of same blades.

(1) Same blades without repair, or same blades with allowable minor repair or minor touch up, may be installed without balancing of hub and blade assembly.

(2) Install blade with previously removed bolts, washers and nuts, and with bolts in same grip and hole from which previously removed. Torque nuts 120 to 150 inch-pounds.

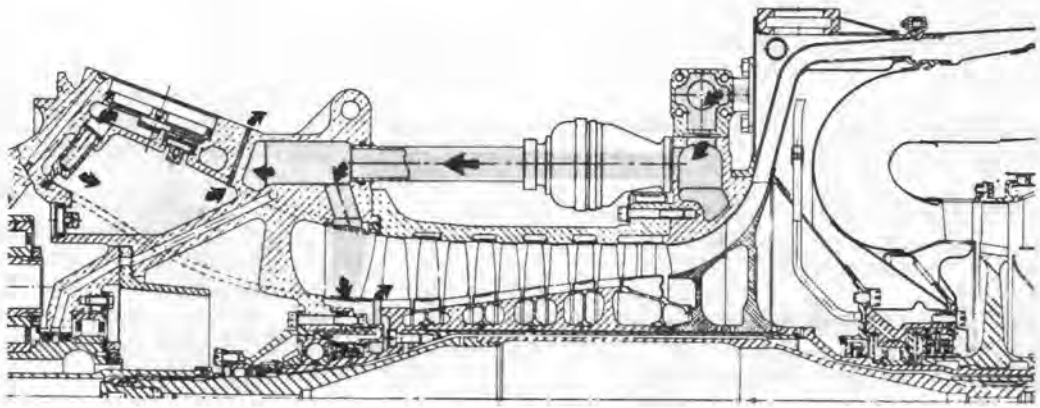
b. Installation of new blades.

(1) New blades cannot be installed in same or new hubs at second echelon level due to requirement for balancing tail rotor hub and blade assembly as a complete assembly. This function must be performed at direct support facility.

(2) Installation of the balanced tail rotor hub and blade assembly may then be performed by organizational personnel.

Caution

Track blades after every installation.



205061-3

Figure 11-4. Anti-icing air flow on T53-L-9A/11/13 engines

11-280. ***Removal — Air Flow Regulator — UH-1A.*** (See figure 11-5). a. Disconnect air hose from temperature sensing element pad and anti-icing elbow. Remove fittings and packings.

b. Remove lockwire, four bolts, and washers to detach anti-icing elbow from inlet housing.

c. Disconnect electrical harness connector from regulator.

d. Remove two bolts and washers to detach regulator flange from centrifugal compressor housing port. Separate regulator, tube, elbow, and gaskets.

e. Cover open ports on centrifugal compressor and inlet housings. Protect regulator connector and ports as required.

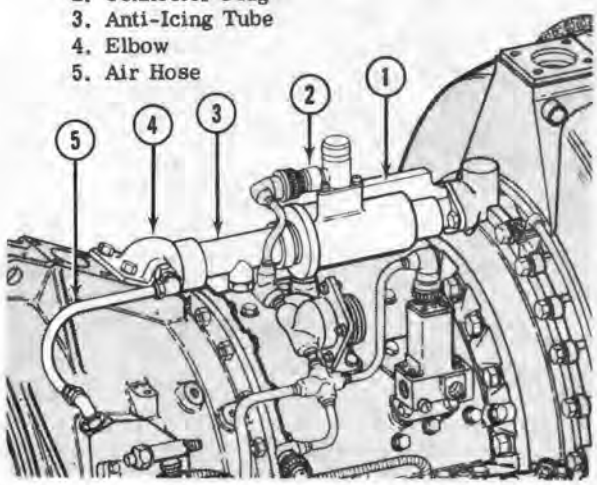
11-281. ***Installation — Air Flow Regulator UH-1A.*** (See figure 11-5.) a. Uncover mounting pads on centrifugal compressor housing and inlet housing.

b. Position regulator with gasket on port of centrifugal compressor housing, and secure with two bolts and washers. Lockwire bolt heads together.

c. Assemble anti-icing tube, with packing on each end, and elbow with regulator. Secure elbow, with gasket, on inlet housing pad with four bolts and washers. Lockwire bolts in pairs.

d. Install union, with packing, in port at left side of anti-icing elbow.

1. Air Flow Regulator
2. Connector Plug
3. Anti-Icing Tube
4. Elbow
5. Air Hose



204060-125

Figure 11-5. Anti-icing air flow regulator on T53-L-1A engine

e. Install elbow, with packing and nut, in port at top of temperature sensing element pad on left side of inlet housing.

f. Connect air hose between fittings on elbow and pad.

g. Connect electrical harness lead to connector on air flow regulator.

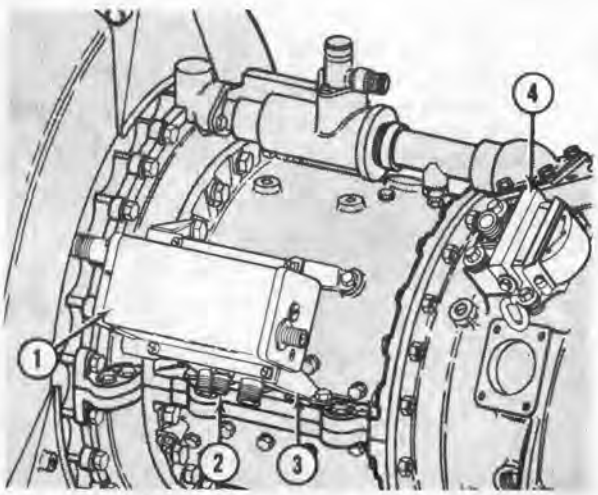
11-282. Ice Detector — UH-1A. (See figure 11-6). Ice detector on T53-L-1A engine is mounted on inlet housing at upper right side.

11-283. *Removal — Ice Detector — UH-1A.* (See figure 11-6). a. Disconnect electrical harness lead from connector on detector unit.

b. Remove lockwire and two screws to detach strap from detector support plate. Remove strap.

c. Remove lockwire and two bolts securing jumper and intermediate support plate to lower support plate. Remove two flat washers, four shock washers, and two spacers.

d. Remove lockwire and two bolts which pass through detector case, with four flat washers and two shock washers. Remove detector. Protect sensory holes in probe with suitable covering. Remove two bushings and shock pad from bottom of detector.



1. Ignition Unit
2. Anti-Icing Interpreter
3. Bracket
4. Ice Detector

204060-126

Figure 11-6. Anti-icing assemblies and ignition unit on T53-L-1A engine

e. Remove lockwire and two bolts to detach lower support plate from inlet housing.

f. Cover openings in inlet housing, and connector plug of detector.

11-284. *Installation—Ice Detector — UH-1A.* (See figure 11-6). a. Install lower support plate on inlet housing, secured by two bolts with heads lockwired.

b. Place a spacer and a shock washer on each end of lower support plate. Place intermediate support plate over shock washers. Place a shock washer and a flat washer on intermediate plate. Install two bolts through assembly into lower plate.

c. Position shock pad over probe on bottom of detector. Insert two mounting bushings into detector mounting holes from bottom.

d. Position detector on inlet housing mounting pad. Secure with two bolts, with a shock washer between two flat washers under each bolt head.

e. Position strap over detector, and secure to intermediate support plate with two screws.

f. Remove bolt from right side of intermediate support plate, install jumper connector under head, and reinstall bolt.

g. Lockwire all bolts and screws.

h. Connect electrical harness lead to detector.

11-285. Anti-Icing Interpreter—UH-1A. (See figure 11-6). Interpreter unit of anti-icing system is mounted under ignition exciter unit, on brackets at right side of compressor housing.

11-286. *Removal Anti-Icing Interpreter — UH-1A.* (See figure 11-6). a. Disconnect electrical harness leads from two connectors of ignition unit and three connectors of interpreter unit.

b. Remove four screws and nuts through corners of ignition unit. Remove ignition unit. Lift off interpreter and bracket assembly, leaving front and rear ignition unit support brackets on compressor housing.

c. Remove four bolts and nuts to detach interpreter from bracket plate.

d. Cover connectors.

11-287. ***Installation — Anti-Icing Interpreter-UH-1A.*** (See figure 11-6). a. Check condition of interpreter shock mounts. Attach bracket plate, with mounting flange joggle away from unit, with four bolts inserted through plate and shock mounts and secured by nuts.

b. Position interpreter assembly and ignition unit on two support brackets at right side of compressor housing. Secure with four screws and nuts.

c. Connect electrical harness leads to three connectors on interpreter and two connectors on ignition unit.

11-288. Anti-Icing Air Valve—UH-1B. (See figure 11-7). Electrically actuated valve is mounted with a tube above engine compressor section, connecting centrifugal housing to inlet housing.

B H 11-288A. On the T53-L-13 engine the hot air solenoid is mounted on top of the compressor and impeller housing assembly. The solenoid operated valve controls the flow of anti-icing hot air from the diffuser housing to the inlet housing to prevent the formation of ice. During engine operation, the valve is normally energized in the CLOSED position. When anti-icing air is secured, the valve is de-energized to the OPEN position by manually actuating a switch in the cockpit. In case of an electrical power failure, the fail-safe, spring-loaded valve returns to the OPEN position to provide continuous anti-icing air.

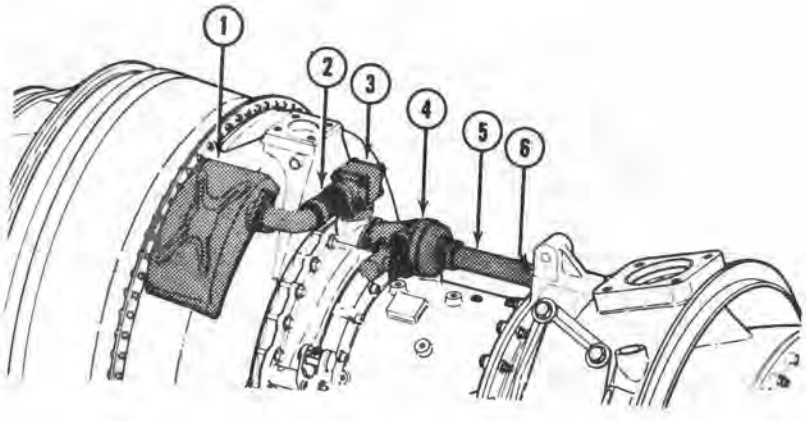
11-289. ***Removal — Anti-Icing Air Valve — UH-1B.*** (See figures 11-7 and 11-8.) a. Disconnect electrical harness plug from valve connector.

b. Remove two bolts with washers to detach rear flange of valve from impeller housing.

c. Spread retaining ring to disengage from groove at forward end of tube. Slide ring toward rear.

d. Push tube forward into inlet housing until free of valve.

e. Remove valve and gasket. Remove tube.



1. Bleed Air Chamber
2. Connecting Manifold
3. Bleed Air Adapter
4. Anti-Icing Valve
5. Tube
6. Inlet Housing Port

205061-4

Figure 11-7. Anti-icing components on UH-1B T53-L-9A/11/13 engine

Figure 11-8. Removing anti-icing air valve UH-1B T53-L-5/9 engine

f. Remove packings from valve and from inlet housing port. Cover open port.

11-290. ***Installation — Anti-Icing Air Valve UH-1B.*** (See figure 11-7 and 11-8.) a. Insert a packing into inlet housing port, and another packing into forward port of valve.

b. Place retaining ring loosely on tube. Insert large end of tube into inlet housing port. Push tube forward, with a twisting motion, far enough into housing to allow installation of valve.

c. Attach rear flange of valve, with gasket, to mounting pad on impeller housing with two bolts and washers.

d. Slide tube rearward, with twisting motion, into port of valve. Install retaining ring in groove at forward end of tube, firmly against inlet housing. Tighten and lockwire bolts at rear flange of valve.

e. Connect and lockwire electrical harness lead to valve solenoid connector.

11-291. Ice Detector — UH-1B. (See figure 11-9). Ice detector unit on UH-1B is mounted on air intake bellmouth, just behind forward engine firewall.

11-292. ***Removal — Ice Detector — UH-1B.*** a. Open engine cowling doors.

b. Disconnect electrical leads from ice detector.

c. Remove four mounting bolts. Tilt detector to right, and spring longest brackets to left. Withdraw detector with gasket from hole at top of bellmouth.

11-293. ***Installation — Ice Detector — UH-1B.*** a. Place gasket over probe of detector unit. Insert probe through hole near top of intake bellmouth, behind firewall.

b. Work detector into place by springing brackets slightly.

c. Secure unit in brackets with four bolts and washers.

d. Connect electrical leads and ground jumper.

e. Close engine cowling.

11-294. Anti-Icing Interpreter—UH-1B. The interpreter unit of the anti-icing system is located in the lower radio compartment. Refer to wiring diagrams for wiring information.

11-295. ***Removal — Anti-Icing Interpreter UH-1B.*** a. Remove four screws, washers and nuts securing interpreter to shelf.

b. Disconnect two wires from terminals.

c. Lift interpreter from helicopter.

11-296. ***Installation — Anti-Icing Interpreter UH-1B.*** a. Position interpreter on shelf.

b. Secure with four screws, washers and nuts.

Section IV — Oxygen System

(Not Applicable)

Section V — Fire Detector System

11-297. Fire Detector Installation. The engine fire detection installation consists of a heat sensitive detector wire routed on the inside of each engine cowl. These wires are mounted in spring retention clips, and are attached to an indicator light and a test switch located on the instrument panel.

11-298. ***Trouble Shooting—Fire Detector.*** The following is a list of indication of trouble, probable causes and corrective action.

16-19. *Instruments Preparation—Temporary Storage.* a. Install cover on airspeed (pitot) tube.

b. Cut a piece of barrier material (item 507, table 1-1) to fit over each static vent of airspeed system. Secure material in place with tape (item 402, table 1-1).

16-20. *Avionic Equiment Preparation—Temporary Storage.* a. Remove, attach condition tags, and return all head-sets and microphones to supply.

b. Leave all other unclassified avionic equipment installed in helicopter.

16-21. *Landing Gear Preparation — Temporary Storage.* a. Place blocks or shoring under skid tubes to provide free air passage.

b. Remove and clean ground handling wheel assemblies. Inflate tires to normal pressure. Stow wheel assemblies in cabin cargo area.

c. Clean cross tubes and skid tubes, and treat for corrosion in accordance with TM 55-405-3.

16-22. Helicopter Preparation — Extended Storage. Prepare helicopter for extended storage, from 46 to 180 days, according to paragraphs 16-23 through 16-35.

Note

A renewal of preservation shall be accomplished at each 45 day interval. (Refer to paragraph 16-50.)

16-23. *Airframe Preparation—Extended Storage.* Apply the following procedures in addition to those for temporary storage. (Refer to paragraph 16-10.)

a. Install standard covers, or suitable waterproof covering, over any openings which could allow water or other foreign matter to contact equipment or structural parts.

b. Clean external surfaces of transparent plastic windows. (Refer to TM 55-405-4.)

c. Allow windows to dry thoroughly. Apply an 0.008 inch minimum dry film of plastic coating compound (item 320, table 1-1).

Note

This white pigmented coating must extend at least two inches onto metal surface around window if possible. No further covering of plastic windows is necessary.

16-24. *Engine Preparation — Extended Storage.* a. Preserve engine that can be motored as follows:

(1) Check oil level; service, if necessary.

(2) Disconnect cable connector from ignition exciter to prevent accidental firing of engine.

(3) Remove fuel inlet strainer, pump discharge strainer, and servo supply filter from fuel regulator. Clean with dry-cleaning solvent (item 302, table 1-1), and reinstall.

(4) Remove two bolts and washers to loosen inline valve from impeller housing.

(5) Install a blocker plate between impeller housing and inline valve.

Note

As an alternate method, energize the inline valve to the closed position.

(6) Disconnect the main fuel hose from main fuel manifold and the starting fuel hose from inlet side of starting fuel solenoid valve. Install temporary lines on end of hoses to allow drainage into suitable container.

(7) Connect hose from a source of lubricating oil (item 5, table 1-1), to fuel control inlet fitting.

(8) Remove temperature sensing element with housing from engine inlet housing. Wrap element in barrier metal (item 506, table 1-1) and secure it to engine to prevent any physical damage. Cover opening in inlet housing.

(9) Disconnect airbleed hose from diffuser housing. Apply dry filtered air through airbleed hose to tighten bleed band, using 40 psi on T53-9/9A or 15 psi on T53-L-11 and -13.

(10) Check that engine has cooled enough to prevent auto-ignition.

(11) Set throttle arm to idle position.

(12) Motor engine, with starter, to jump lubricating oil into fuel system.

Caution

Do not exceed starter limitations.

(13) Using a suitable spray gun with filtered air at a pressure of 90 psi, spray ½ pint of corrosion preventive oil (item 10, table 1-1) or corrosion inhibitor (item 310) into inlet during motoring. Hold spray gun approximately 18 inches from inlet housing and move it constantly to cover entire area. Continue until all the oil is used.

(14) Open and close throttle to ensure flushing of the fuel control.

(15) Continue motoring until oil is observed draining into container.

(16) With engine stopped, spray power turbine rotor with sufficient amount of corrosion-preventive oil or corrosion inhibiter to cover blades.

(17) Disconnect air pressure from air-bleed hose and connect hose to diffuser housing.

(18) Disconnect lubricating oil hose from fuel control and connect fuel inlet line.

(19) Remove temporary lines from fuel hoses and connect main fuel hose to main fuel manifold. Connect starting fuel hose to starting fuel solenoid valve.

(20) Remove blocker plate at inline valve and connect valve to impeller housing with two bolts and washers. Lockwire bolts.

(21) Connect valve connector to ignition exciter.

(22) Place four eight-unit bags of desiccant (item 316, table 1-1) in air inlet opening and four bags in exhaust diffuser or tailpipe opening.

(23) Install engine inlet and exhaust covers.

Note

When covers are not available, seal openings with greaseproof barrier material (item 506, table 1-1) and secure with tape (item 402, table 1-1).

(24) Seal the gap between bleed band and compressor housing by encircling the engine with a narrow strip of barrier material (item 506, table 1-1) and secure with tape (item 402, table 1-1).

(25) Visually check entire engine. Plug all holes, cap all ports, and check that external parts are complete and secure. Bare metal, including internal and external threads, should be covered with a film of corrosion-preventive oil or corrosion inhibitor.

(26) Record date of preservation, and maintenance during preservation, on engine historical form.

b. Preserve engine that cannot be motored as follows:

Note

An engine removed from an aircraft, because of an inflight malfunction, and scheduled for overhaul, shall have the words INFLIGHT SHUTDOWN typed or printed in red on the applicable engine historical record.

(1) Disconnect cable connector and disconnect fuel inlet and outlet hoses from fuel control.

(2) Remove fuel inlet strainer, pump discharge strainer, and servo supply from fuel control. Clean with dry-cleaning solvent (item 302, table 1-1) and reinstall.

(3) Remove overspeed governor and drain fuel.

(4) Connect cable and fuel hoses.

(5) Lockwire throttle arm in closed position.

(6) Pour lubricating oil (item 5, table 1-1) into openings made accessible by removal of overspeed governor, until fuel regulator is filled.

(7) Pour lubricating oil into overspeed governor while rotating the drive shaft by hand.

(8) Reinstall overspeed governor.

(9) Spray ½ pint corrosion-preventive oil (item 10, table 1-1) into inlet housing and exhaust diffuser openings. Constantly move spray gun to cover all internal surfaces.

(10) Place four eight-unit bags of desiccant (item 316, table 1-1) in air inlet openings and four bags in exhaust diffuser or tailpipe opening.

(11) Install engine inlet and exhaust covers.

Note

When covers are not available, seal openings with greaseproof barrier material (item 501, table 1-1) and secure with tape (item 402, table 1-1).

(12) Seal the gap between bleed band and compressor housing by encircling the engine with a narrow strip of barrier material (item 506, table 1-1) and secure with tape (item 402, table 1-1).

(13) Visually check entire engine. Plug all holes, cap all ports, and check that external parts are complete and secure. Bare metal, including internal and external threads, should be covered with a film of corrosion preventive oil, or corrosion inhibitor.

(14) Record date of preservation, and maintenance during preservation on engine historical form.

16-25. *Deleted.*

16-26. *Fuel System Preparation — Extended Storage.* Apply same procedures as for temporary storage. (Refer to paragraph 16-10.) Any auxiliary fuel tanks will be removed, preserved, tagged, and returned to stock in accordance with TM 55-405-3.

16-27. *Power Train Preparation — Extended Storage.* a. If engine is operable, preserve power train for extended storage by same procedures as for temporary storage. (Refer to paragraph 16-15.)

Note

If engine cannot be rotated, preserve power train for extended storage according to steps b. through h. below.

b. Remove main rotor. (Refer to paragraph 8-6, 8-51 or 8-97.)

c. Remove mast assembly. (Refer to paragraph 7-83.)

d. Spray inside of transmission, through top opening, with approximately one gallon of corrosion-preventive oil (item 10, table 1-1). While spraying manually rotate internal gears and bearings with input drive quill.

e. Reinstall mast assembly. Apply fingerprint remover (item 319, table 1-1) to all unpainted surfaces of mast assembly. Wipe mast dry with clean lint-free cloth. Apply corrosion-preventive compound (item 315, table 1-1), to all unpainted surfaces.

f. Reinstall main rotor.

g. Reinstall main drive shaft.

h. Be sure intermediate and tail rotor gear boxes have been filled with corrosion-preventive compound.

16-28. *Hydraulic System Preparation — Extended Storage.* Apply same procedures as for temporary storage. (Refer to paragraph 16-16.)

16-29. *Rotors and Controls Preparation — Extended Storage.* Apply same procedures as for temporary storage. (Refer to paragraph 16-17.)

16-30. *Battery Preparation — Extended Storage.* a. Remove battery and maintain in accordance with TM 11-6140-230-12.

b. Wrap battery quick-disconnect with barrier material (item 507, table 1-1) secured with tape (item 402, table 1-1).

16-31. *Instruments Preparation — Extended Storage.* Apply same procedures as for temporary storage. (Refer to paragraph 16-19.) Also remove clock, apply condition tag, and turn in to supply.

16-32. *Avionic Equipment Preparation — Extended storage.* Apply same procedures as for temporary storage. (Refer to paragraph 16-20.)

16-33. *Utility Equipment Preparation — Extended Storage.* a. Remove fire extinguishers, apply condition tag, and return to local supply.

b. Remove, apply condition tag, and return to supply such items as first-aid kits and other equipment subject to mildew and deterioration.

16-34. *Landing Gear Preparation — Extended Storage.* Apply same procedures as for temporary storage. (Refer to paragraph 16-21.)

16-35. *Preservation of Fuel Regulator Removed From Engine.* A fuel control removed from an engine for longer than 48 hours must be preserved as follows:

a. Remove pump discharge strainer and servo filter.

b. Allow fuel to drain from fuel control.

c. Install high pressure caps on main and starting fuel outlets, fuel inlet fitting, and filter port and pump discharge pressure ports.

d. Pour lubricating oil (item 5, table 1-1) into fuel control through pump discharge strainer port.

e. Rotate fuel control drive shaft by hand.

f. Turn fuel control over several times allowing oil to penetrate all sections. Remove cap and add oil as necessary. Recap port.

g. Reinstall pump discharge strainer and servo supply filter.

h. Enclose fuel control in plastic envelope or if fuel control is defective and is being forwarded to higher maintenance, install in fuel control shipping box.

16-36. Engine Preservation — Permanent Storage. Preservation of an engine for permanent storage requires that the engine be installed in a metal shipping container. Preservation of such an engine is the same as for extended storage. (Refer to paragraph 16-24.)

16-37. Activation. Activation of the helicopter and depreservation of component parts will be accomplished in accordance with the following described methods for cleaning, flushing and removing preservation materials.

16-38. *Helicopter Activation — After Flyable Storage.* Helicopter in flyable storage requires no depreservation, and can be returned to active flight status by accomplishing a complete Daily Inspection. (Refer to TM 55-1520-211-20PMD.)

16-39. *Helicopter Activation — After Temporary or Extended Storage.* A helicopter being removed from temporary or extended storage requires depreservation in accordance with paragraphs 16-40 through 16-49, in addition to a complete Daily Inspection.

16-40. *Airframe — Depreservation.* Clean airframe in accordance with instructions in TM 55-405-4. Remove all protective covers, coatings, and barrier material.

16-41. *Fuel Cells — Depreservation.* Flush fuel cells with dry cleaning solvent (item 302, table 1-1). Thoroughly dry inside of cells with filtered compressed air.

Caution

Do not exceed three psig pressure during drying operation, as excessive pressure can rupture fuel cell.

16-42. *Power Train — Depreservation.* a. Drain preservative compound from transmission, intermediate gear box, and tail rotor gear box. Flush and fill each unit with oil (item 2, table 1-1).

b. Check and clean transmission oil filters.

c. Clean drive shafts as necessary with cleaning solvent (item 302, table 1-1).

16-43. *Rotors and Controls — Depreservation.* a. Clean main and tail rotor assemblies with dry cleaning solvent (item 302, table 1-1). Wipe dry with lint-free cloth.

b. Lubricate in accordance with Lubrication Order. (Refer to paragraph 2-1.)

c. Check stabilizer bar dampers to be full of hydraulic oil (item 3, table 1-1). If fluid level is much below top of window on damper, check timing after refilling and replace damper if unsatisfactory. (Refer to paragraph 8-30, 8-76 or 9-117.)

16-44. *Battery — Depreservation.* Remove protective material from battery connector. Install and connect battery.

16-45. *Landing Gear — Depreservation.* Remove block from under skid gear. Inflate ground handling wheel tires to normal pressure.

16-46. *Engine Activation — After Storage.* The following procedures apply to installed engines immediately, or after installation, in aircraft; the particular procedure chosen depends

on the length of time that the engine has been inactive. Examine the preservation record tags and the historical records of the engine to determine period of inactivity

16-47. *Engine in Aircraft — Activation — After Flyable Storage.* Remove covers or barrier material from inlet and exhaust housings and remove any tape residue with dry cleaning solvent (item 302, table 1-1). Engine is ready for ground test.

16-48. *Engine in Aircraft — Activation — After Temporary or Extended Storage.* a. Remove bleed band, inlet, and exhaust covers or barrier material, and remove desiccant bags.

b. Inspect openings for foreign material and corrosion. Wipe clean with dry cleaning solvent (item 302, table 1-1).

c. Remove chip detector from accessory drive gearbox and drain plugs from fuel control. Allow oil to drain; clean and replace chip detector and plugs.

d. Disconnect cable connector to ignition exciter to prevent accidental firing of engine.

e. Remove lockwire from throttle arm of fuel control and set to idle position.

f. Disconnect main fuel hose from main fuel manifold (or flow divider on T53-L-13 engine) and drain into a container of at least a two-gallon capacity.

g. Check oil level; service, if necessary.

h. Operate aircraft boost pump to prime fuel system and motor engine with starter.

Caution

Do not exceed starter limitations.

i. Move throttle arm to maximum until a solid stream of fuel with no air bubbles is observed flowing into container. At least one gallon of fuel must flow into container.

Note

Engine lubrication system is fully primed when oil pressure gage shows a steady positive indication.

j. Connect main fuel hose to main fuel manifold (or flow divider on T53-L-13 engine) and inspect engine for leakage.

k. Unwrap and install temperature sensing element on inlet housing.

l. Connect cable connector to ignition exciter. Lockwire connector.

m. Start engine and operate for five minutes at approximately 75 percent rated speed or at highest power possible without gaining flight altitude.

n. Shut down engine.

o. Remove oil filter. Check for excessive contamination and replace.

p. Remove chip detector. Check for excessive contamination, clean, and reinstall.

q. Remove fuel inlet strainer, pump discharge strainer, and servo supply filter from fuel control; check for contamination, clean and replace.

r. If no contamination is evident, the engine is ready for ground test.

s. If oil system accumulation is slight, drain the oil and refill system with new oil.

t. Repeat steps m. through p. Evidence of continued contamination in oil system requires a thorough investigation.

Note

If there is less than ten hours operating time on engine since new, or since last overhaul, repeat steps m. through p. until no contamination is evident or analysis of the contamination determines that engine must be replaced.

16-49. *Engine — Activation. New, Overhaul, or Permanent Storage.* A new, overhauled, or permanent storage engine is preserved in a shipping container. It will be removed from the container and installed on an airframe, with proper fuel and oil supplied. Activate engine in same manner as outlined for an extended storage engine. (Refer to paragraph 16-48.)

16-50. Preservation — Renewal. Preservation may be repeated as often as necessary, but when conditions warrant it, a permanent preservation should be considered for a flyable or an extended storage engine. Renew preservation as follows:

a. Remove inlet and exhaust covers or barrier material and remove desiccant bags.

b. Inspect openings for foreign material and corrosion. Wipe clean with dry-cleaning solvent (item 302, table 1-1).

c. Repeat preservation procedure for flyable or extended storage. (Refer to paragraph 16-24).

16-51. Accident Engines — Preservation. Engines removed from an aircraft, which has been involved in an accident in which engine failure or malfunction is known or suspected to have been a factor, should not be treated for corrosion protection. No attempt should be made to operate, motor, or disassemble an accident engine. All accident engines must be transported to an overhaul depot or designated investigation area within ten days after the accident.

a. Without disconnecting lines or fittings make every effort to prevent the remaining fuel and oil in the engine from leaking out.

b. To prevent the accumulation of moisture, place four eight-unit bags of desiccant (item 316, table 1-1) in the inlet housing and four bags in exhaust diffuser.

c. Plug all ports and cap all fittings and lines. Seal all openings with covers or barrier material (item 506, table 1-1) and secure with tape (item 402, table 1-1).

16-52. Engines — Damaged, Cannibalized or Failed — Preservation. Inoperable engines that are idle because they require parts, maintenance or overhaul shall be preserved as required (depending on storage time) and stored in a shipping container or in a clean, dry area, adequately protected from dirt and physical damage.

Section III — Demolition

16-53. Destruction of The Helicopter. When it is evident that an enemy may possibly come into possession of the helicopter, every effort should be made to evacuate the aircraft to a defendable location. If the helicopter is not in operational readiness, destruction of the aircraft shall be accomplished by one of the following procedures, the most logical of which should be determined by evaluating the existing circumstances.

16-54. *Destruction by Explosives.* Place a charge of dynamite, or comparable explosive, in the engine compartment. Attach a suitable time delay fuse so personnel may attain a safe distance after igniting. Ignite fuse, evacuate to a safe distance, and lie flat on the terrain with face down.

16-55. *Destruction by Mechanical Means.* The helicopter may be destroyed mechanically in several different ways. The most logical manner of destruction is to smash all instruments, transmission case, engine compressor housing, gear boxes and rotor blades, using an entrenching tool or other suitable devices. Another means of destroying the helicopter mechanically is to run engine at flight idle rpm and lock collective control stick in down position. Open oil drain valves on transmission, engine, and gear box reservoirs so as to allow oil to drain. Leave engine running and evacuate personnel to a safe distance. A mechanical seizure of all rotating parts will subsequently occur thus damaging the helicopter to such an extent that further operation would be impossible.

16-56. *Destruction by Fire.* The simplest method of destroying the helicopter by fire is to open the fuel drain valve and allow fuel to saturate the terrain beneath the helicopter. Pour a vein of fuel from the saturated spot to a point ten to twelve feet from the helicopter. Ignite the vein of fuel and evacuate the area. The flame will subsequently travel the distance of the vein and ignite the saturated point.

APPENDIX I

REFERENCES

The following references, of the issue in effect, in addition to those references contained in TM 55-1520-211-10, Appendix I, are required for use by Organizational Maintenance personnel in performance of their duties.

NUMBER	TITLE
AR 775-380	Disposal of Supplies and Equipment
DA Pamphlets 310-4	Index of Technical Manuals, Technical Bulletins, Supply Bulletins, Lubrication Orders, and Modification Work Orders
TM 1-8D10-2-3-13	Handbook Overhaul Instructions: Electrically Retractable Landing Light Assemblies
TM 11-6140-203-12	Operator and Organizational Maintenance Manual Nickel Cadmium Storage Batteries
TM 38-250	Preservation, Packaging and Packing of Military Supplies and Equipment
TM 55-2800-200-30/1	T53 Engine Inspection Guide
TM 55-403	Fundamentals of Army Helicopter Maintenance
TM 55-405-1	Army Maintenance Engineering Manual: General Practices
TM 55-405-2	Army Aviation Maintenance Engineering Manual: Aircraft Hardware and Materials
TM 55-405-3	Army Aviation Maintenance Engineering Manual: Maintenance of Aircraft Systems
TM 55-405-4	Army Aviation Maintenance Engineering Manual: Aircraft Structural Repair
TM 55-405-5	Army Aviation Maintenance Engineering Manual: Aircraft Engines
TM 55-405-6	Maintenance of Department of the Army Aircraft: Aircraft Maintenance Tools
TM 55-405-7	Maintenance of Department of the Army Aircraft: Shop Practices
TM 55-405-8	Army Aviation Maintenance Engineering Manual: Ground Support Equipment

NUMBER	TITLE
TM 55-405-9	Army Aviation Maintenance Engineering Manual: Weight and Balance
TB AVN 7	Painting and Marking of Aircraft
TB AVN 10	First Aid Kits — Aircraft — Without Narcotics
TB AVN 23-10	Aircraft Accessory Replacement and Reuse Procedures
Technical Index No Number	Index of Specifications and Standards
Technical Manual TM 38-750	The Army Equipment Record System and Procedures

ALPHABETICAL INDEX

TM 55-1520-211-20
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CHANGE
No. 7

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, D. C., *4 October 1966*

Organizational Maintenance Manual

ARMY MODEL UH-1A AND UH-1B HELICOPTERS

TM 55-1520-211-20, 20 January 1966, is changed as follows:

	Remove page	Insert page
Chapter 5, Section VII	5-83 and 5-84	5-83 thru 5-84
Chapter 6, Section II	6-24C and 6-24D	6-24C thru 6-24E
Chapter 9, Section II	9-7 thru 9-8A	9-7 thru 9-8A
	9-17 and 9-18	9-17 thru 9-18

Retain this sheet in front of manual for reference purposes.

By Order of the Secretary of the Army:

HAROLD K. JOHNSON,
General, United States Army,
Chief of Staff.

Official:
KENNETH G. WICKHAM,
Major General, United States Army,
The Adjutant General.

DISTRIBUTION:

To be distributed in accordance with DA Form 12-31 requirements for organizational maintenance instructions for UH-1A-1B aircraft.

f. Place O-ring packing on end of flexible inlet duct (27, figure 5-1). Insert duct end in blast cap inlet.

g. Connect cable to starter - generator terminals. (Refer to paragraph 12-125.) Connect cable at deck connector (17, figure 5-1). Close cowling.

B 5-246. Starter-Generator — UH-1B. (See figure 5-45.) A starter-generator unit, mounted to right rear side of accessory drive gear box and connected to the 28 volt electrical system, serves to drive compressor during engine starting cycle and also functions as an engine-driven stand - by generator at normal engine speeds. Cooling air from oil cooler blower is circulated through starter-generator by ducts and shrouds, and is discharged into exhaust tailpipe. A seal drain hose from starter drive mounting pad leads to deck coupling of a discharge line at left side.

B 5-247. *Removal—Starter-Generator — UH-1B.* a. Remove cover (8, figure 5-45) and disconnect electrical leads at aft end of starter-generator. Insulate wire terminals.

b. Disconnect air ducts from flanged necks on forward and aft cooling shrouds by removing V-band clamps (2 and 12). Loosen two clamping bolts at right side of forward shroud (12), and slide shroud aft to expose starter mounting studs.

c. Loosen nuts and washers on six mounting studs. Turn starter-generator counterclockwise, and pull carefullly straight aft until free of studs and drive shaft engagement. Cover mounting pad.

d. Detach shroud from aft end of starter by removing two locating screws at top and two clamping bolts at joint on left side. Remove forward shroud.

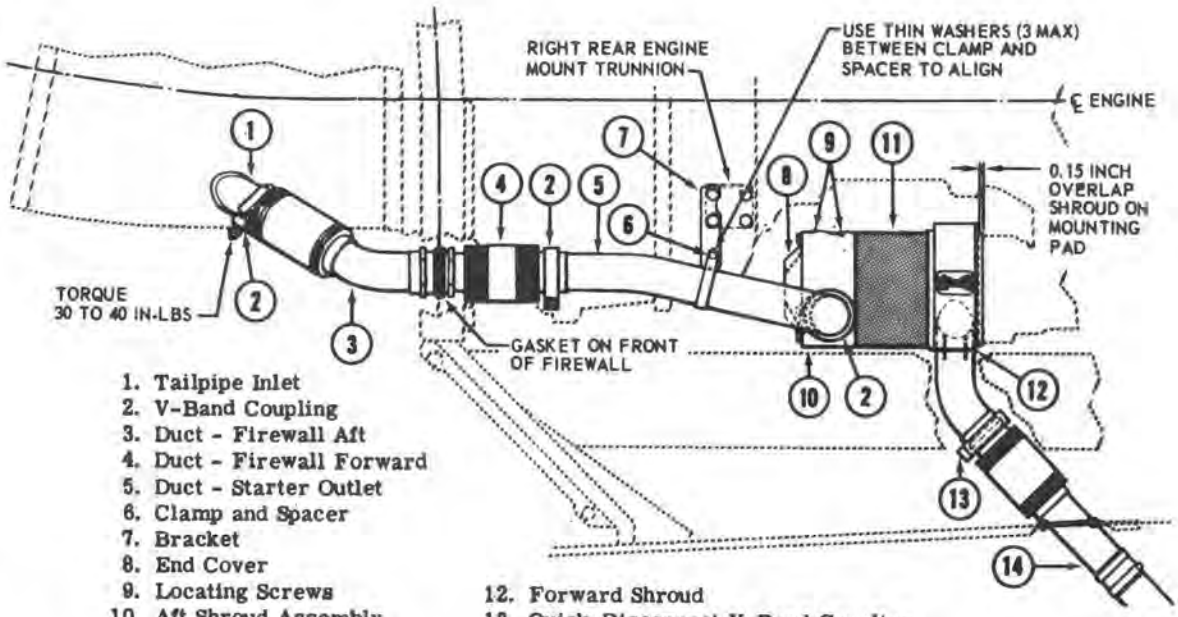
B *5-248 Installation — Starter-Generator — UH-1B.* a. On a new starter, remove manufacturer's brush cover from aft end, keeping two small locating screws for installation of cooling shroud.

Note

When replacement starter generator is requisitioned the possibility exists of receiving a different manufacturers component. If this occurs, wiring diagram and interchangeability chart figure 5-45A is to be utilized. Starter generator P/N 204-060-200-3 should be used in conjunction with the T53-L-13 engine in cold weather operations.

Note

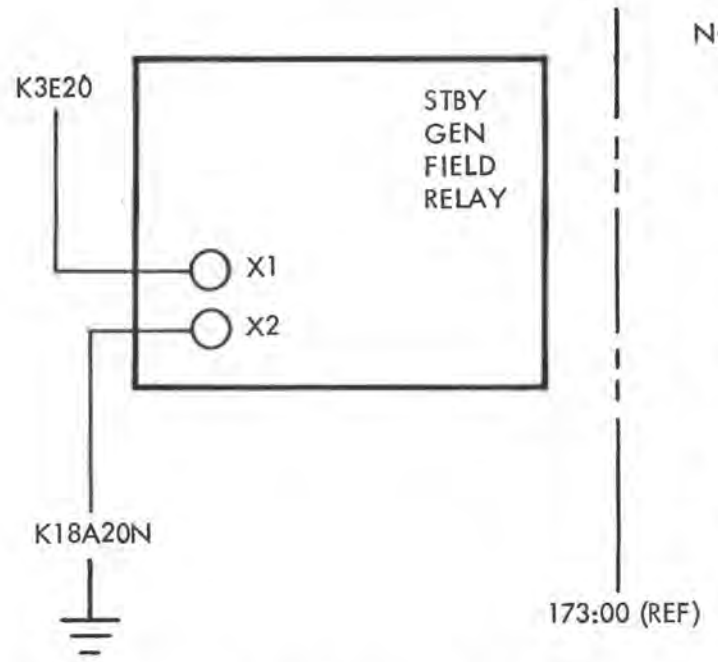
Turn starter so these two screw-holes are at top center for correct position when installed.



1. Tailpipe Inlet
2. V-Band Coupling
3. Duct - Firewall Aft
4. Duct - Firewall Forward
5. Duct - Starter Outlet
6. Clamp and Spacer
7. Bracket
8. End Cover
9. Locating Screws
10. Aft Shroud Assembly
11. Starter - Generator
12. Forward Shroud
13. Quick-Disconnect V-Band Coupling
14. Duct - Intake from Oil Cooler Duct

204060-35

Figure 5-45. Starter generator and cooling ducts — UH-1B



NOTE:
DISCONNECT AND STOW WIRE K18A20N FROM TERMINAL X2 WHEN INSTALLING GENERAL ELECTRIC CO. STU6/A

DISCONNECTING AND STOWING IS OPTIONAL WHEN LEAR SIEGLER CO. STU6/A STARTER GENERATOR IS INSTALLED.

WIRE AS SHOWN WHEN P/N 204-060-200-3 IS INSTALLED.

204-060-200-3 Starter Generator Installation
FY 66 UH-1B 66-491 and subsequent

204-060-200-1	Starter
204-060-200-7	Shroud
204-060-200-11	Shroud

NOTE: Wire as shown in Figure for this installation.

Lear Siegler STU6/A Starter Generator Installation

STU6/A	Starter
204-060-468-1	Shroud
204-060-419-1	Shroud
204-060-472-1	Cover

NOTE: Wiring change optional when Lear Liegler manufactured starter generator is installed.

General Electric STU6/A Starter Generator Installation

STU6/A	Starter
204-060-468-1	Shroud
204-060-419-1	Shroud
204-060-472-1	Cover

NOTE: Wiring change is mandatory when General Electric manufactured starter generator is installed.

Figure 5-45A. UH-1B Starter generator interchangeability chart.

b. Place forward shroud around starter, far enough aft to allow access to mounting flange and with clamping joint on right-hand side.

c. Install aft shroud with two locating screws and washers, and two bolts with washers tightened in clamping joint at left side. Lockwire screws. Coat male splines with Plastilube Moly No. 3 (item 20, table 1-1) and pack female splines ⅔ full.

d. Lift starter to position on studs, meshing shaft splines, turn clockwise and tighten mounting nuts.

e. Slide forward shroud to position, overlapping 0.15 inch on mounting pad. Align intake neck to flange of duct, above deck at left of drive shaft tunnel, and install V-band clamp with nut tightened 30 to 40 inch-pounds. Tighten two bolts in shroud clamping joint.

f. Secure exit air duct to outlet of aft shroud with V-band clamp, tightened 30 to 40 inch-pounds. Install cover on aft end of starter with six screws and washers. Lockwire screw heads.

g. Connect electrical leads from cable connector on deck at left side to terminals on starter-generator. (Refer to paragraph 12-125.)

Section VIII — Cooling System

(Not Applicable)

Section IX — Fuel Control

5-249. Fuel Control. (See figure 5-46, 5-47, or 5-48.) Engine fuel control is a hydro-mechanical mechanism made up of a fuel regulator assembly and an overspeed governor assembly. Fuel regulator is mounted on a drive pad at left rear side of accessory drive gear box, driven through a gear train by compressor rotor and first-stage (nI) turbine. With solenoid operated changeover valve in AUTOmatic position for normal operation, a dual-element pump supplies fuel at high pressure through a strainer to main metering valve, bypassing excess fuel through main pressure regulator, then through a manually-controlled stop cock valve to main discharge port and external line. Fuel flow rate is determined by computer mechanisms in relation to first-stage turbine speed, air pressure, inlet air temperature (through an external sensing element) and power lever settings manually selected by means of linkage to twist-grip control. Overspeed governor, mounted on regulator and driven through gear train from power output shaft, acts through regulator to limit fuel flow when power turbine (nII) rpm tends to exceed speed selected by means of external control system.

5-250. In starting cycle of T53-L-1A and T53-L-5/9/9A engines without scheduled fuel, fuel flow is through servo filter directly to starting fuel discharge port and external line, and is controlled only by the starting fuel solenoid valve.

B 5-251. In starting cycle of T53-L-11 and T53-L-5/9/9A engines with scheduled fuel, starting fuel for normal conditions is a scheduled flow from the fuel regulator to a port with a banjo-type fitting to which the starting fuel solenoid hose is connected. There is also another port with an elbow fitting, which is capped in normal conditions and is called the unscheduled starting fuel port because it is not subject to flow control by the fuel regulator scheduling devices. When JP-5 fuel is being used and cold weather starting is difficult, the unscheduled starting fuel port may be connected instead of the scheduled port, which would then be capped.

5-252. An emergency fuel metering system is incorporated in fuel regulator, to allow bypassing of automatic flow regulator in case of malfunction. With solenoid operated changeover

c. Attach lines to pressurized lock out valve, relief valve and tee fitting.

6-71. Collective Pitch Control Hydraulic Cylinder (UH-1B Serial No. 64-14101 and subsequent). The collective pitch control hydraulic cylinder (1, figure 6-2) reduces operational loads on the collective pitch control system and facilitates pilot control of the helicopter.

6-72. Removal — Collective Pitch Control Hydraulic Cylinder (UH-1B Serial No. 64-14101 and subsequent). a. Disconnect control tube (2, figure 6-2) from hydraulic cylinder (1). Disconnect control rod (3) from collective pitch control lever (4)

b. Disconnect hydraulic lines from control valve (6) and cap or cover openings to prevent entrance of foreign material.

c. Remove nuts and washers attaching cylinder to support assembly (7) and remove cylinder assembly from support.

6-73. Inspection—Collective Pitch Control Hydraulic Cylinder (UH-1B Serial No. 64-14101 and subsequent). (Refer to paragraph 6-24.)

6-74. Repair or Replacement — Collective Pitch Control Hydraulic Cylinder (UH-1B Serial No. 64-14101 and subsequent). (Refer to paragraph 6-25.)

6-75. Installation — Collective Pitch Control Hydraulic Cylinder (UH-1B Serial No. 64-14101 and subsequent). a. Adjust cylinder and rod assembly before installation. (Refer to paragraph 6-76, perform step a.)

b. Position cylinder assembly (1, figure 6-2) on studs of support assembly (7) and install attaching washers and nuts.

c. Uncap or uncover hydraulic lines and connect to control valve (6).

d. Connect control rod (3) to collective pitch control lever (4). Install one chamfered washer under bolt head and one under nut. (See View "A", figure 6-2.)

e. Connect control tube (2) to hydraulic cylinder (1).

f. Check rigging of collective pitch control system. (Refer to paragraph 9-17 or 9-22.)

6-76. Adjustment — Collective Pitch Control Hydraulic Cylinder (UH-1B Serial No. 64-14101 and subsequent). a. Adjust cylinder and rod assembly with clevis set at 2.19 inches. (See figure 6-9). Adjust spring tension with 0.12 inch of threads showing above spring adjustment nut. (See View A, figure 6-9.)

Note

Lost motion develops due to normal wear between the servo valve spool and pilot's input lever. (See figure 6-4.) This condition may be corrected as follows:

b. Break safetywire and loosen jam nut.

c. Insert 0.002 inch feeler gage in orifice in power cylinder and hold gently but firmly against bottom of spool valve. Carefully adjust screw in to reduce lost motion. Preferred clearance is 0.002 inch. Minimum clearance is plus 0.001 inch with a maximum of 0.004 inch permissible before adjustment is required.

Caution

Use extreme care in adjusting screw. After obtaining preferred clearance of 0.002 inch, ¼ additional turn of screw will break horseshoe washer and collective will lock in full up position.

Note

Care must be exercised when adjustments are made on a badly brinelled screw, as a side force on the servo valve may result in excessive servo valve wear and a higher valve operating force. Valve should operate freely, with no binding.

d. After adjustment is complete, lock screw with jam nut, recheck valve operating force and safetywire screw.

Note

If screw is being replaced, exercise care as ball is not secured to screw.

e. Final adjustments of hydraulic cylinder will be made concurrent with rigging. (Refer to paragraph 9-17 or 9-22.)

6-77. Cyclic Control Hydraulic Cylinders (UH-1B Serial No. 64-14101 and subsequent). The cyclic control hydraulic cylinders (8, figure 6-2) reduce operational loads on the cyclic control system and facilitate pilot control of the helicopter.

6-78. Removal — Cyclic Control Hydraulic Cylinders (UH-1B Serial No. 64-14101 and subsequent). a. Disconnect lower control tubes (9, figure 6-2) from control valves (10).

b. Disconnect upper control tubes (11) from swashplate horns (12).

c. Disconnect hydraulic lines from control valves (10) and cap or cover openings to prevent entrance of foreign material.

d. Remove nuts and washers attaching cylinders (8) to support assemblies (7 and 14) and remove cylinder assemblies from supports.

6-79. Inspection — Cyclic Control Hydraulic Cylinders (UH-1B Serial No. 64-14101 and subsequent). (Refer to paragraph 6-24.)

6-80. Repair or Replacement — Cyclic Control Hydraulic Cylinders (UH-1B Serial No. 64-14101 and subsequent). (Refer to paragraph 6-25.)

Note

(UH-1B Serial Number 64-14101 and subsequent) When reverse collective system is installed, it will be necessary to reverse positions of springs P/N 204-076-318-1 and P/N 204-076-399-1 to balance the collective controls, this applies to cylinder assembly P/N 204-076-005-9. Spring position shown in figure 6-8A shall be followed for reverse collective system. If motoring in the collective controls is encountered during operation, it is permissible to install washer P/N AN960-PD10 between spring P/N 204-076-399 and nut, washers are to be added one (1) at a time until tendency to motor stops, a maximum of six (6) washers can be utilized.

6-81. Installation — Cyclic Control Hydraulic Cylinders. (UH-1B Serial No. 64-14101 and subsequent). a. Adjust cylinder and rod assemblies before installation. (Refer to paragraph 6-76. Perform step a.)

b. Position cylinder assemblies (8 figure 6-2) on studs of support assemblies (7 and 14) and install attaching washers and nuts.

c. Uncap or uncover openings in hydraulic lines and connect lines to control valves (10).

d. Connect upper control tubes (11) to swashplate horns (12). Install one chamfered washer under bolt head and one under nut. Chamfered side of washer towards rod-end. (See View A, figure 6-2.)

e. Connect lower control tubes (9) to control valves (10).

f. Check rigging of cyclic control system. (Refer to paragraph 9-38 or 9-44.)

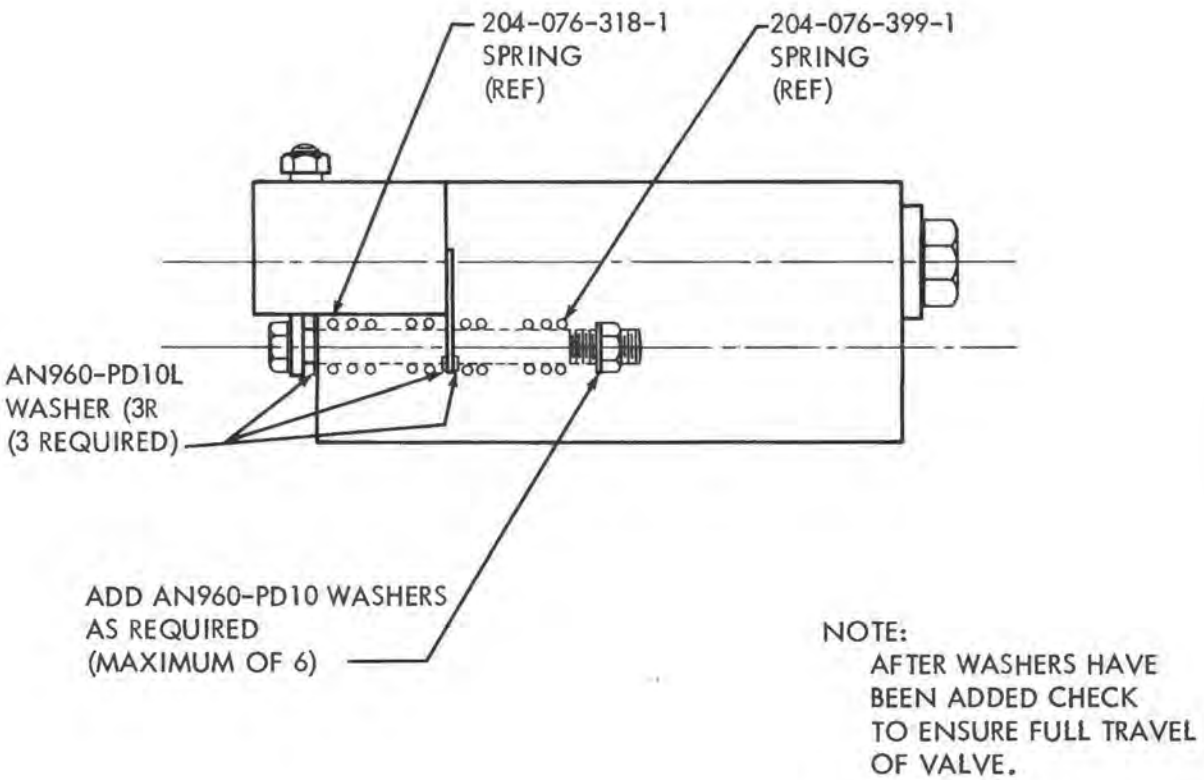


Figure 6-8A. 204-076-005-9 Cylinders only

b. Install bellcrank (13) and attach control tubes (12) and (14). Place boots over forward end of control tube (12).

c. Adjust and install power cylinder (16) with irreversible valve (19) and control valve (17). (Refer to paragraph 6-26.)

d. Uncover hydraulic lines and connect to irreversible valve (19) of power cylinder (16).

e. Check rigging of collective pitch control system and rig if necessary. (Refer to paragraph 9-17.)

9-17. *Adjustment — Collective Pitch Control Linkage (UH-1A and UH-1B Serial No. 60-3546 through 64-14100).* a. Install all fixed length tubes and links in collective control system. (See figure 9-1.)

b. Position collective control lever against the UP stop and secure with friction adjustment.

c. Adjust control tube (14, figure 9-1) to the cylinder attachment point with the cylinder bottomed in the UP direction and servo control valve in UP position. (See View C.) Shorten tube (14) three turns and install bolt, nut and cotter pin.

d. Place the collective control lever against the LOW stop. Position the collective lever to dimension illustrated in View A.

e. Exert sufficient downward pressure on collective cylinder assembly to hold valve lever at top of travel (View B.) Adjust clevis or rod end of control tube (18) to fit collective pitch lever (20); shorten cylinder by one full turn, and connect.

Note

When bottoming valves do not exert a force on the collective lever that will cause the controls to move below the valve as a result of structure and/or component deflection, or misrigging will occur.

f. Check for full free travel of collective pitch control system with boost pressure off.

g. Apply boost pressure and check for travel of collective sleeve. (View A.)

h. Check minimum pitch angle of rotor hub.

i. Inspect complete collective control system for security and safetying of parts.

9-18. *Removal — Collective Pitch Control Linkage (UH-1B Serial No. 64-14101 and subsequent).* a. Disconnect control tubes (10 and 12, figure 9-2 and 9-3A) from lever (11) and bellcrank (13). Remove bolt and lever (11).

Note

Tube (10) may be removed from the helicopter through the access opening in lower center nose section.

b. Disconnect control tube (14) from bellcrank (13) and remove bellcrank.

c. Disconnect control tube (14) from power cylinder (17). Disconnect control rod (18) from collective pitch control lever (19).

d. Disconnect and cover hydraulic lines from control valve (15) of power cylinder (17).

e. Remove power cylinder (17) with control valve (15). (Refer to paragraph 6-72.)

9-19. *Inspection — Collective Pitch Control Linkage (UH-1B Serial No. 64-14101 and subsequent).* (Refer to paragraph 9-14.)

9-20. *Repair or Replacement — Collective Pitch Control Linkage (UH-1B Serial No. 64-14101 and subsequent).* (Refer to paragraph 9-15.)

9-21. *Installation — Collective Pitch Control Linkage (UH-1B Serial No. 64-14101 and subsequent).* a. Install lever (11 figure 9-2 and 9-3A) in bracket with long end down. Attach control tube (10) to lever (11).

b. Install bellcrank (13) and attach control tubes (12) and (14).

c. Adjust and install power cylinder (17) with control valve (15). (Refer to paragraph 6-75.)

d. Uncover hydraulic lines and connect to control valve (15) of power cylinder (17).

e. Check rigging of collective pitch control system and rig if necessary. (Refer to paragraph 9-22.)

9-22. *Adjustment — Collective Pitch Control Linkage (UH-1B Serial No. 64-14101 and subsequent).* a. Install all fixed length tubes and links in collective control system. (See figure 9-2 and 9-3A.)

Note

For adequate clearance between bolt and cowling at attaching point of control tube (18) to collective lever (19) bolt head must be outboard.

Note

(UH-1B Serial Number 64-14101 and subsequent) When reverse collective system is installed, it will be necessary to reverse positions of springs P/N 204-076-318-1 and P/N 204-076-399-1 to balance the collective controls, this applies to cylinder assembly P/N 204-076-005-9. Spring position shown in figure 6-8A shall be followed for reverse collective system. If motoring in the collective controls is encountered during operation, it is permissible to install washer P/N AN960-PD10 between spring P/N 204-076-399 and nut, washers are to be added one (1) at a time until tendency to motor stops, a maximum of six (6) washers can be utilized.

b. On UH-1B helicopters Serial No. 64-14101 through 65-12744 and 65-12772 position collective control lever against the UP stop and secure with friction adjustment.

c. On UH-1B helicopters Serial No. 66-491 and subsequent position collective control lever against the LOW stop and secure with friction adjustment.

d. Adjust control tube (14) to the cylinder bottomed in the UP direction and servo control valve in UP position. (See View B, figure 9-2 and 9-3A.) Shorten tube (14) three turns and install bolt, nut and cotter pin.

e. Place the collective control lever against the LOW stop. Position the collective lever to dimension illustrated in View A.

f. Exert sufficient downward pressure on collective cylinder assembly to hold valve lever at top of travel (View B). Adjust clevis or rod end of control tube (18) to fit collective pitch lever (19); shorten cylinder by one full turn, and connect.

Note

When bottoming valves do not exert a force on the collective lever that will cause the controls to move below the valve as a result of structure and/or component deflection, or misrigging will occur.

g. Check cylinder boot location. (See figure 9-2 and 9-3A.)

h. Release adjustable friction with nut (1, figure 9-3B) and disconnect control tube (10, figure 9-2 and 9-3A) from collective jackshaft (9).

i. Tighten setscrews (2, figure 9-3B) in friction connector (3) until a spring scale applied at the center, plus or minus 0.050 inch, of and perpendicular to the throttle grip (4) indicates a breakaway force of 14 to 16 pounds up with collective stick positioned approximately one-third of full travel from bottom stop.

j. Apply boost pressure and check for travel of collective sleeve. (View A.)

k. Check minimum pitch angle of rotor hub.

l. Inspect complete collective control system for security and safetying of parts.

9-23. Cyclic Control Stick. The cyclic control stick is the means by which the pilot controls directional movement of the helicopter. When installed, the copilot's cyclic control stick is linked to the pilot's stick and has the same function.

9-24. *Removal — Cyclic Control Stick.* a. Disconnect fore and aft, and lateral control tubes.

b. Remove eight screws and remove boot.

c. Remove four bolts from support.

d. Disconnect wiring at bulkhead fitting and remove stick assembly from structure.

e. Remove opposite stick in the same manner.

9-25. *Installation — Cyclic Control Stick.* a. Position stick assembly in place. Install bolts through support. Install boot and plate and secure with eight screws.

b. Plug in electric fitting at bulkhead.

c. Attach fore and aft and lateral control tubes.

9-26. Cyclic Control Tube and Lever Assembly. The cyclic control tube and lever assembly interconnects the pilot and copilot control sticks for distribution of fore and aft control forces to the swashplate.

9-27. *Removal — Cyclic Control Tube and Lever Assembly.* a. Disconnect fore and aft control tubes (1 and 2, figure 9-6).

b. Disconnect control tube (3).

c. Disconnect fore and aft force gradient (4).

d. On UH-1B, Serial No. 64-14101 and subsequent, helicopters remove counterweight balance assembly (5).

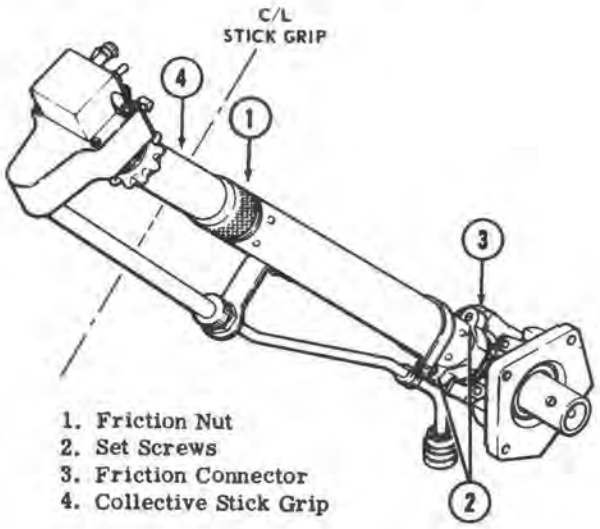
e. Remove bolts from right and left housing assemblies (6 and 7).

f. Remove bolts (8) and tapered bushings attaching arm (9) and tubes (10 and 11).

g. Withdraw tubes (10 and 11) through access openings in right and left sides of cabin.

9-28. *Inspection — Cyclic Control Tube and Lever Assembly.* a. Inspect bearings for wear and roughness.

b. Inspect assembly for maximum allowable 0.200 inch lateral chuck. (See figure 9-6.)



1. Friction Nut
2. Set Screws
3. Friction Connector
4. Collective Stick Grip

204001-78

Figure 9-3B. Collective friction adjustment (UH-1B serial no. 64-14101 and subsequent)

9-43. *Installation—Cyclic Control Linkage (UH-1B Serial No. 64-14101 and subsequent).* a. Install bellcranks (8 and 23, figure 9-5) on support. (Refer to figure 9-8 for installation of mixing bellcranks.)

b. Install and attach all fixed length control tubes.

Note

If adjustable control tubes are not correct length to be attached, leave one end free until controls are rigged.

c. Adjust and install power cylinders (14 and 17, figure 9-5) with control valves (12 and 19). (Refer to paragraph 6-81.)

9-44. *Adjustment—Cyclic Control Linkage (UH-1B Serial No. 64-14101 and subsequent).* a. Install all fixed length tubes in cyclic control system.

b. Place pilot's and copilot's cyclic sticks in either extreme right or left lateral position against stops. Secure in this position and adjust and connect lateral control tube (30, figure 9-5).

c. Place pilot's and copilot's cyclic sticks in extreme forward or extreme aft position against stops. Secure in this position and adjust and connect fore and aft control tube (29).

d. Place pilot's cyclic stick in extreme aft left corner position so that upper arm of bellcrank (10) is in its uppermost position. With cyclic stick in this position bottom out piston in UP position at top of cylinder (14) and set control valve (12) in UP position, (View A). Adjust control tube (11) to fit; shorten three full turns and install bolt, nut and cotter pin.

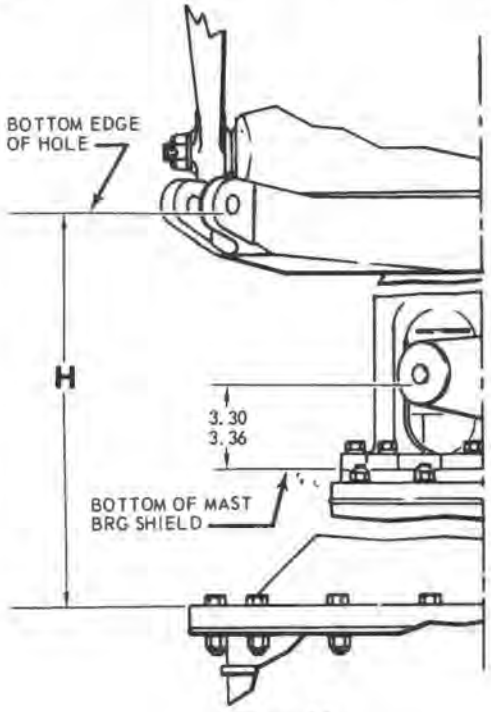
Note

(UH-1B Serial Number 64-14101 and subsequent) When reverse collective system is installed, it will be necessary to reverse positions of springs P/N 204-076-318-1 and P/N 204-076-399-1 to balance the collective controls, this applies to cylinder assembly P/N 204-076-005-9. Spring position shown in figure 6-8A shall be followed for reverse collective system. If motoring in the collective controls is encountered during operation, it is permissible to install washer P/N AN960-PD10 between spring P/N 204-076-399 and nut, washers are to be added one (1) at a time until tendency to motor stops, a maximum of six (6) washers can be utilized.

e. Place pilot's stick in extreme aft right corner position and adjust control tube (20) in same manner as control tube (11) was adjusted in step d.

f. Install T101330 cyclic stick fixture on copilot's cyclic stick. (See View B.)

g. Position swashplate as illustrated in figure 9-10 and place cylinder valves in neutral. Maintain position and adjust control tubes (15 and 16, figure 9-5) to make proper fit with swashplate.



Rigging dimension tolerances are plus or minus 0.06

Left Horn		Right Horn
11.75	1/2° Down Left	11.88
11.66	1° Down Left	11.96
11.60	1-1/2° Down Left	12.03

Adjust from 1/2° to 1-1/2° down left as required for satisfactory flight.

204001-68A

Figure 9-10. Adjusting swashplate (UH-1B serial No. 64-14101 and subsequent)

h. Position arm on fore and aft magnetic brake (24) as illustrated in View C, with scribe mark on shaft opposite "F" on arm. Position arm on lateral magnetic brake (31) with scribe mark on shaft opposite "L" on arm.

i. With cyclic stick in neutral, position arm on lateral magnetic brake (31) in center of travel. Adjust and install lateral force gradient (32).

j. Remove rigging fixture, T101330.

k. Position boots on control tube (15 and 16) to dimension shown on figure 9-5.

l. Place cyclic stick against forward stop, and arm on fore and aft magnetic brake (24) against its full aft stop. Adjust fore and aft force gradient (28) to fit and connect.

m. Check controls for full free travel with boost pressure applied.

n. Adjust cyclic control system balance to eliminate all motion of cyclic stick with hydraulic boost on and hands off. Adjust by moving washers (one at a time) on jackshaft counterweight balance assembly from location A to location B. (See figure 9-11.) Relocate washers in even quantities on both bolts.

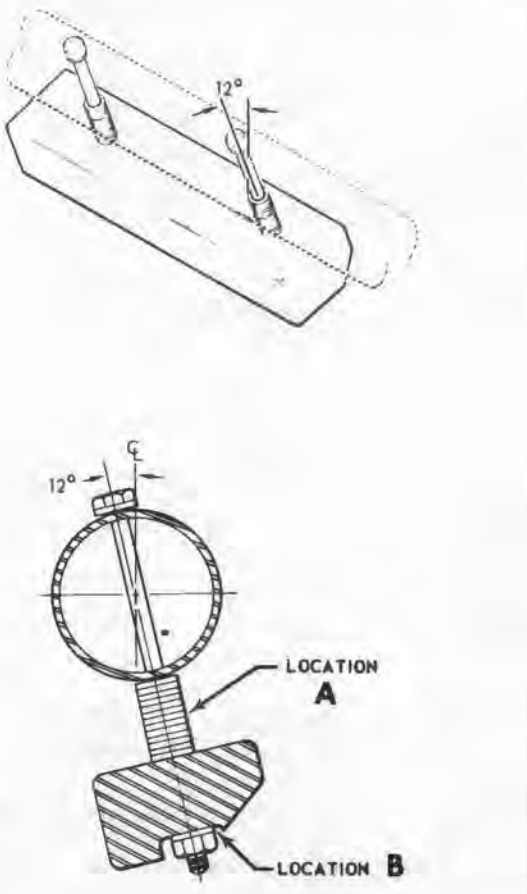


Figure 9-11. Counterweight balance assembly (UH-1B serial no. 64-14101 and subsequent)

o. Inspect complete cyclic control system for security and safetying of parts.

9-45. Magnetic Brake. A magnetic brake, used in conjunction with a force gradient assembly, is mounted in each control element; the fore and aft cyclic, the lateral cyclic and the tail rotor pitch control. All three assemblies are identical except for the position of the arm on the brake. By positioning one of the letters "D", "L" or "F" relative to the brake shaft the brake may be used in either the D-irectional, L-ateral, or F-ore and aft control assembly.

9-46. *Removal—Magnetic Brake.* Disconnect electrical plug from brake body. Remove attachment bolt through force gradient and brake arm. Remove four bolts attaching brake body to structure.

9-47. *Installation—Magnetic Brake.* a. Mount brake arm on brake in appropriate position. Secure arm with retaining bolt. Position brake in place on structure and install mounting bolts.

b. Attach force gradient assembly to brake arm with bolt, nut, and washers. Install cotter pin in bolt. Attach and lockwire electrical plug to brake body.

c. Check flight controls for unobstructed full travel.

9-48. Tail Rotor Control Pedal and Adjuster Assembly. Two sets of control pedals are mounted on a forward bulkhead located in the cabin floor, and are connected by control tubes to a pedal adjuster assembly. Pilot and copilot assemblies are connected by an adjustable tube assembly.

9-49. *Removal—Tail Rotor Control Pedal and Adjuster Assembly.* a. Disconnect two control tubes (4, figure 9-12) from pedal lever assembly (2), and pedal adjuster assembly (5).

b. Remove bolt, washers and nut securing each pedal lever assembly (2) to pedal support (3), and remove each pedal (1) and lever assembly (2) as a unit.

c. Remove four bolts, washers and nuts securing pedal support (3) to bulkhead and remove pedal support.

TM 55-1520-211-20
C 8

CHANGE
No. 8

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, D. C., *2 November 1966*

Organizational Maintenance Manual

ARMY MODEL UH-1A AND UH-1B

HELICOPTERS

TM 55-1520-211-20, 20 January 1966, is changed as follows:

	Remove page	Insert page
Chapter 5, Section VII, IX	5-83A and 5-84	5-83A and 5-84

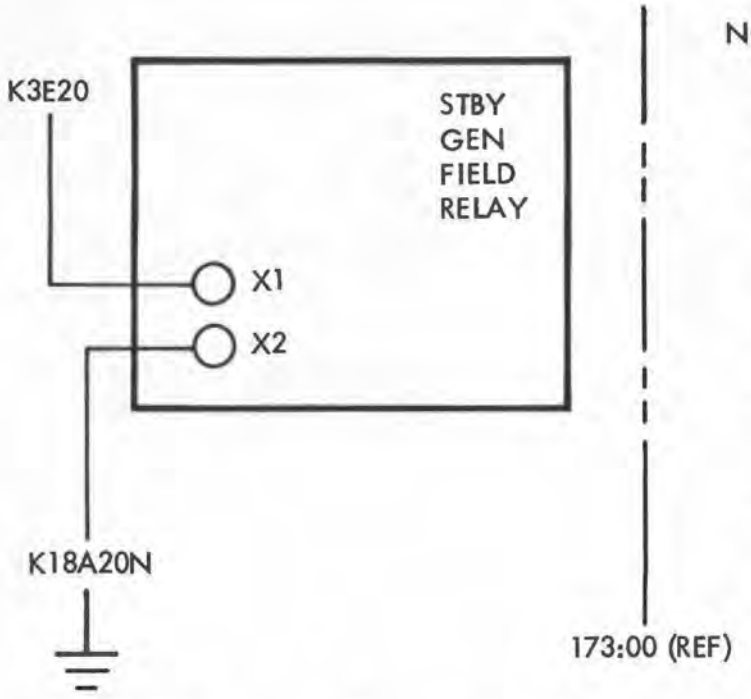
Retain this sheet in front of manual for reference purposes.

By Order of the Secretary of the Army:

HAROLD K. JOHNSON,
General, United States Army,
Chief of Staff.

Official:
KENNETH G. WICKHAM,
Major General, United States Army,
The Adjutant General.

DISTRIBUTION:
To be distributed in accordance with DA Form 12-31 requirements for Organizational Maintenance Instructions for UH-1A-1B aircraft.



NOTE:
DISCONNECT AND STOW WIRE K18A20N FROM TERMINAL X2 WHEN INSTALLING GENERAL ELECTRIC CO. STU6/A

DISCONNECTING AND STOWING IS OPTIONAL WHEN LEAR SIEGLER CO. STU6/A STARTER GENERATOR IS INSTALLED.

WIRE AS SHOWN WHEN P/N 204-060-200-3 IS INSTALLED.

204-060-200-3 Starter Generator Installation
FY 66 UH-1B 66-491 and subsequent

204-060-200-1	Starter
204-060-200-7	Shroud
204-060-200-11	Shroud

NOTE: Wire as shown in Figure for this installation.

Lear Siegler STU6/A Starter Generator Installation

STU6/A	Starter
204-060-468-1	Shroud
204-060-419-1	Shroud
204-060-472-1	Cover

NOTE: Wiring change optional when Lear Liegler manufactured starter generator is installed.

General Electric STU6/A Starter Generator Installation

STU6/A	Starter
204-060-468-1	Shroud
204-060-419-1	Shroud
204-060-472-1	Cover

NOTE: Wiring change is mandatory when General Electric manufactured starter generator is installed.

Figure 5-45A. UH-1B Starter generator interchangeability chart.

b. Place forward shroud around starter, far enough aft to allow access to mounting flange and with clamping joint on right-hand side.

c. Install aft shroud with two locating screws and washers, and two bolts with washers tightened in clamping joint at left side. Lockwire screws. Coat male splines with Plastilube Moly No. 3 (item 20, table 1-1) and pack female splines ⅔ full.

d. Lift starter to position on studs, meshing shaft splines, turn clockwise and tighten mounting nuts.

e. Slide forward shroud to position, overlapping 0.15 inch on mounting pad. Align intake neck to flange of duct, above deck at left of drive shaft tunnel, and install V-band clamp with nut tightened 30 to 40 inch-pounds. Tighten two bolts in shroud clamping joint.

f. Secure exit air duct to outlet of aft shroud with V-band clamp, tightened 30 to 40 inch-pounds. Install cover on aft end of starter with six screws and washers. Lockwire screw heads.

g. Connect electrical leads from cable connector on deck at left side to terminals on starter-generator. (Refer to paragraph 12-125.)

Section VIII — Cooling System

(Not Applicable)

Section IX — Fuel Control

5-249. Fuel Control. (See figure 5-46, 5-47, or 5-48.) Engine fuel control is a hydro-mechanical mechanism made up of a fuel regulator assembly and an overspeed governor assembly. Fuel regulator is mounted on a drive pad at left rear side of accessory drive gear box, driven through a gear train by compressor rotor and first-stage (nI) turbine. With solenoid operated changeover valve in AUTOmatic position for normal operation, a dual-element pump supplies fuel at high pressure through a strainer to main metering valve, bypassing excess fuel through main pressure regulator, then through a manually-controlled stop cock valve to main discharge port and external line. Fuel flow rate is determined by computer mechanisms in relation to first-stage turbine speed, air pressure, inlet air temperature (through an external sensing element) and power lever settings manually selected by means of linkage to twist-grip control. Overspeed governor, mounted on regulator and driven through gear train from power output shaft, acts through regulator to limit fuel flow when power turbine (nII) rpm tends to exceed speed selected by means of external control system.

5-250. In starting cycle of T53-L-1A and T53-L-5/9/9A engines without scheduled fuel, fuel flow is through servo filter directly to starting fuel discharge port and external line, and is controlled only by the starting fuel solenoid valve.

B 5-251. In starting cycle of T53-L-11 and T53-L-5/9/9A engines with scheduled fuel, starting fuel for normal conditions is a scheduled flow from the fuel regulator to a port with a banjo-type fitting to which the starting fuel solenoid hose is connected. There is another other port with an elbow fitting, which is capped in normal conditions and is called the unscheduled starting fuel port because it is not subject to flow control by the fuel regulator scheduling devices. The T53-L-13 engine functions in a similar manner. The starting fuel switch opens the starting fuel solenoid valve, allowing starting fuel from the fuel regulator to flow through the starting fuel manifold; four