TM 55-1520-228-20

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

Organizational Maintenance Manual ARMY MODEL OH-58A HELICOPTER

HEADQUARTERS, DEPARTMENT OF THE ARMY

JULY 1969

WARNING

Personnel performing operations, procedures, and practices which are included or implied in this technical manual shall observe the following instructions. Disregard of these warnings and precautionary information can cause serious injury, death, or an aborted mission.

HIGH VOLTAGE

Do not make contact with exposed radio wires or connectors. Turn all power switches off before making any connections or disconnections.

Before removing igniter, be sure ignition system has been OFF for at least 5 minutes. Dissipate all energy stored in the condenser by grounding the igniter lead to engine using an insulated screwdriver.

TOXIC POISONS

Battery electrolyte is a strong alkaline solution and is harmful to the hands and clothing. Wear protective clothing that is used exclusively for servicing nickel-cadmium batteries. Use a 3 percent solution of boric acid to neutralize any spilled electrolyte. Flush contacted areas thoroughly with water.

Turbine fuels and lubricating oils contain additives which are poisonous and readily absorbed through the skin. Do not allow them to remain on skin longer than necessary.

NOISE

Operating and maintenance personnel should wear ear protective devices when in or around aircraft while aircraft is operating.

GROUND OPERATION

Engines will be started and operated only by authorized personnel. Reference AR95-13.

FIRE EXTINGUISHER

Exposure to high concentrations of monobromotrifluoromethane (CF_3BR) extinguishing agent or decomposition products should be avoided. The liquid should not be allowed to come into contact with the skin, as it may cause frost bite or low temperature burns.

ARMAMENT

Loaded weapons, or weapons being loaded or unloaded, shall be pointed in a direction which offers the least exposure to personnel or property in the event of accidental firing. Personnel should remain clear of hazardous area of all loaded weapons.

ANY ROTATION OF THE GUN ARMAMENT SUBSYSTEM BARRELS WILL CAUSE THE GUN TO FIRE. Upon landing, immediately alert personnel to probable presence of live rounds in the gun. Summon armament repairman to clear weapon.

FUELING AND DEFUELING

When refueling aircraft, the refueling vehicle must be parked a minimum of 20 feet from the aircraft. Before starting the fueling operation, always insert fueling nozzle grounding chain of fuel truck ground wire into GROUND HERE receptacle located on the right side of the aircraft aft of the cabin area.

When defueling, turn off all electrical switches and disconnect external power from the aircraft. The aircraft must be electrically grounded prior to defueling.

*TM 55-1520-228-20

TECHNICAL MANUAL
No. 55-1520-228-20

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D. C., *22 July 1969*

Organizational Maintenance Manual

ARMY MODEL OH-58A HELICOPTER

*This manual supersedes TM 55-1520-228-20, 3 April 1969.

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CHAPTER AND SECTION PAGE

CHAPTER 1

INTRODUCTION

SECTION I GENERAL INFORMATION

1-1. SCOPE.

1-2. This manual, issued expressly for organizational maintenance, is the official document for the Army Model OH-58A helicopters, Serial Numbers 68-16687 through 68-16986. The purpose of this manual is to familiarize you with the maintenance functions to be performed at the organizational maintenance level. The Table of Contents for this manual is provided to assist in determining the chapter in the manual in which individual functions are covered. The study and use of this manual will enable a maintenance crew of limited experience to perform the assigned functions with maximum efficiency. This manual provides all essential information for personnel to accomplish Army organizational maintenance on the complete airframe, its components, and systems with related functions of the same scope and magnitude, as prescribed for organizational maintenance activities in the Maintenance Allocation Chart. (Refer to Appendix B.)

Maintenance forms required in the performance of the prescribed maintenance operation of the aircraft are contained in the aircraft log book. Refer to TM 38-750 and TM 55-405-9.

Note

Do not destroy any pages in this manual unless the data contained herein has been replaced, superseded, or included in the manual by a change or revision.

1-3. PUBLICATION INFORMATION.

1-4. Throughout this manual reference is made to Notes, Cautions, and Warnings to emphasize important and critical instructions. The Notes, Cautions and Warnings are used as applicable for the following conditions.

Note

An operating procedure, condition, etc., which is essential to highlight.

Caution

Operating procedures, practices, etc., which, if not strictly observed, will result in damage to, or destruction of equipment.

Warning

Operating procedures, practices, etc., which, if not strictly observed, may result in personal injury or loss of life.

1-5. REQUIREMENTS FOR REPORTING RECOMMENDATIONS AND COMMENTS.

1-6. Report of errors, omissions, and recommendations for improving this publication by the individual user is encouraged. Reports should be submitted on DA Form 2028 (Recommended Changes to DA Publications) and forwarded direct to: Commanding General, U.S. Army Aviation Systems Command, ATTN: AMSAV-R-M, P.O. Box 209, St. Louis, Missouri, 63166.

1-7. PURPOSE.

1-8. This organizational manual is divided into 16 chapters, 5 appendices, and an index. The contents of each chapter, the appendices, and the index are described and summarized in subsequent paragraphs of this section.

1-9. CHAPTER 1 - INTRODUCTION.

1-10. This notes the intent of this technical manual and outlines the requirements for reporting recommendations and comments on the information contained in this manual. Each chapter, the appendices, and the index are briefly described. General information pertinent to ground handling methods, consumable service materials and servicing of aircraft is covered here.

1-11. CHAPTER 2 - LUBRICATION INSTRUCTIONS.

1-12. This chapter covers the lubrication requirements of the aircraft by inclusion of complete lubrication instructions and applicable lubrication charts.

1-13. CHAPTER 3 - INSPECTION REQUIREMENTS.

1-14. This chapter contains complete requirements for special aircraft inspections, test flight, overhaul and retirement schedule, and standards of serviceability applicable to the aircraft.

1-15. CHAPTER 4 - AIRFRAME AND ALIGHTING GEAR.

1-16. The purpose of this chapter is to provide all the essential information for maintenance personnel to accomplish organizational maintenance on the airframe structure and alighting gear.

1-17. CHAPTER 5 - POWER PLANT AND RELATED SYSTEMS.

1-18. The function of this chapter is to provide essential information as a basis for performing maintenance on complete power plant and its related systems.

1-19. CHAPTER 6 - HYDRAULIC AND PNEUMATIC SYSTEMS.

1-20. This chapter is to supply all the information for organizational maintenance to maintain the complete hydraulic system.

1-21. CHAPTER 7 - POWER TRAIN SYSTEM.

1-22. This chapter provides organizational maintenance information and instructions for maintenance on the drive shafts, main transmission, and tail rotor gearbox.

1-23. CHAPTER 8 - MAIN AND TAIL ROTOR GROUPS.

1-24. This chapter includes instructions and procedures for performing organizational maintenance on the main and tail rotor systems.

1-25. CHAPTER 9 - FLIGHT CONTROLS.

1-26. This chapter contains information and instructions for organizational maintenance on the flight control systems.

1-27. CHAPTER 10 - INSTRUMENTS.

1-28. The purpose of this chapter is to provide maintenance information on flight instruments, navigation instruments, engine instruments, and miscellaneous instruments.

1-29. CHAPTER 11 - UTILITY SYSTEMS.

1-30. This chapter contains information pertaining to the heating and ventilating system.

1-31. CHAPTER 12 - ELECTRICAL SYSTEMS.

1-32. The purpose of this chapter is to supply the organizational maintenance personnel with information to maintain the complete electrical system.

1-33. CHAPTER 13 - WIRING DIAGRAMS.

1-34. The purpose of this chapter is to provide organizational maintenance with all electrical and electronic systems and circuits, diagrams, loading charts, and wiring information for maintaining this aircraft.

1-35. CHAPTER 14 - AVIONICS, PHOTOGRAPHY, AND ARMAMENT.

1-36. The function of this chapter is to provide information essential to maintenance personnel for maintenance on the applicable systems incorporated.

1-37. CHAPTER 15 - EXTERNAL STORES - NONARMAMENT. (Not Applicable.)

1-38. CHAPTER 16 - STORAGE OF AIRCRAFT.

1-39. This chapter contains procedures for preparing aircraft for flyable, short term, and intermediate storage of components, outlining methods necessary for proper preservation and depreservation. Demolition of aircraft for various reasons is also covered.

1-40. APPENDIX A - REFERENCES.

1-41. Consists of a list of official publications applicable and available to organizational maintenance personnel.

1-42. APPENDIX B - MAINTENANCE ALLOCATION CHART.

1-43. This reflects the maintenance functions to be performed at each maintenance level.

1-44. APPENDIX C - AIRCRAFT INVENTORY MASTER GUIDE.

1-45. Provides standard inventory procedures and furnishes the using activities with a master guide to determine the items that are to be inventoried of installed and loose equipment authorized and required.

1-46. APPENDIX D - WEIGHT AND BALANCE.

1-47. This information is provided for maintenance personnel to acquire proper forms and procedures to accomplish weight and balance of the aircraft.

1-48. APPENDIX E - ILLUSTRATED FIELD MANUFACTURE ITEMS LIST.

1-49. This appendix includes simplified line drawings, with bills of materials, for all items appearing in the applicable Organizational Maintenance Repair Parts and Special Tools List (TM 55-1520-228-20P manual) bearing MO source code, and specified for inclusion by the government.

SECTION II AIRCRAFT GENERAL.

1-50. DESCRIPTION.

1-51. The OH-58A is a single engine, light observation, land based helicopter. Principle dimensions and detailed description will be found in TM 55-1520-228-10.

1-52. Electrical and heating equipment is located above and aft of the passenger seats. Avionics equipment and battery are located in the avionics compartment.

1-53. Main rotor is a two-blade, semi-rigid type. Tail rotor is a two blade assembly. Main and tail rotor blades are of all-metal construction with honeycomb core.

1-54. Power train consists of a free-turbine power plant, transmission assembly, mast, drive shafts, and tail rotor gearbox. Engine and transmission are enclosed by cowling. Tail rotor drive shaft is located along top of tail boom.

1-55. Landing gear is skid type, attached to forward fuselage at four points. Two detachable landing wheels are provided for use in ground towing and moving. Support tubes are provided which allow handling wheels to be left in place during flight as an optional practice.

1-56. GROUND HANDLING.

1-57. The following paragraphs contain information necessary for hoisting, jacking, leveling, mooring, parking, towing, and power application.

1-58. HOISTING. (Figure 1-1.)

a. Attach a hoisting clevis or cable (2) to eye (3) provided on retaining nut at top of main rotor mast. Connect a suitable hoist to clevis or cable (2) and take up slack.

b. Station a man at tail skid to steady helicopter when hoisted. If lifting beyond reach from ground, use of a steadying rope will be necessary.

c. Hoist slowly with a steady lifting force.

1-59. JACKING. (Figure 1-1.)

a. Place two short jacks under two forward jack pad fittings (6) located forward of the landing gear cross tube at each side, and one taller jack under the one jack pad (6) aft of the anti-collision light. Refer to TM55-1520-228-20P for proper jacks.

b. Raise helicopter evenly. Observe the following precautions while helicopter is supported on jacks:

(1) Do not climb on or enter helicopter.

(2) Personnel in immediate area shall use caution to avoid bumping or otherwise disturbing helicopter while on jacks.

(3) It is recommended that area around helicopter be roped off and signs displayed to warn that: THIS HELICOPER IS ON JACKS.

c. After necessary work, lower helicopter slowly and evenly. Remove jacks.

1-60. LEVELING. Drop plumb bob from smaller hole in upper plate at water line 72.0 and fuselage station 90.0. When pointer is at center of "+" target on lower plate secured to compartment floor, helicopter is level. (Refer to TM 55-1520-228-10, Chart E.) Apply jacking procedures to correct helicopter position.

1-61. MOORING INSTRUCTIONS. (Figure 1-1.)

Caution

Structural damage can occur from flying objects during high wind conditions. Helicopter should be hangared or evacuated to a safe weather area when wind conditions above 75 knots are expected.

a. If a paved ramp with suitable tie-down rings is available, park helicopter on skid landing gear headed in direction from which highest forecast winds are expected. Secure helicopter to ramp tie-downs at helicopter jacking tie-down fittings. Use of a clevis at each of the tie-down fittings will permit use of larger diameter rope.

b. If suitably spaced ramp tie-downs are not available, park the helicopter on an unpaved parking area headed in the direction from which the highest forecast winds are expected and retract ground handling wheels. Use mooring anchors or make "dead man" anchors. Moor helicopter as described in step a.

c. Secure main rotor with tie-down strap.

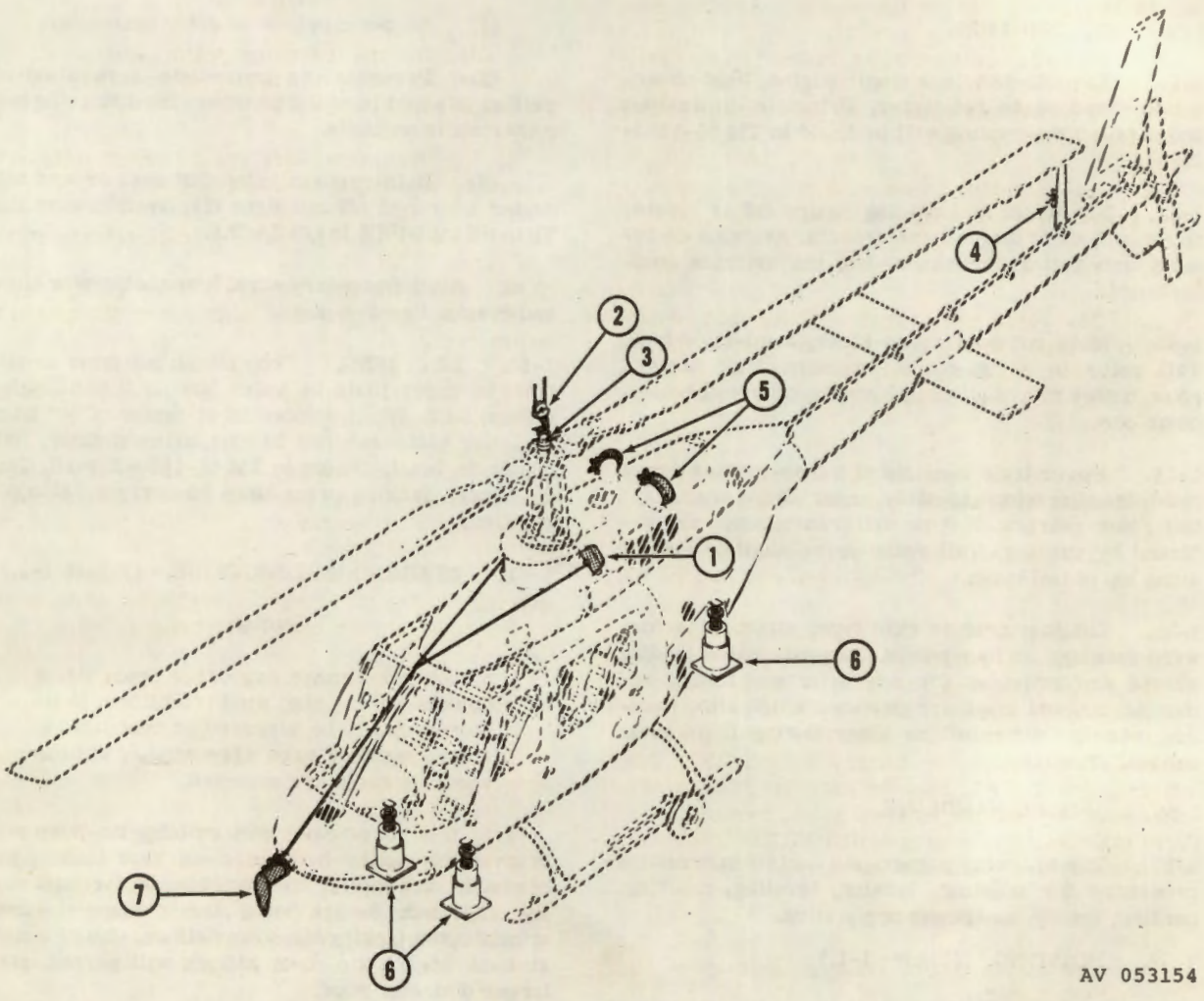
d. Install covers on pitot tube (7), engine exhaust (5), and engine inlets (1).

e. Tighten friction on cyclic and collective controls.

f. Close all windows, doors, and access panels.

g. Fill fuel tank to capacity with prescribed fuel.

h. Secure all ground handling equipment.



1. Engine Inlet Shield
2. Hoisting Cable and Clevis
3. Main Rotor Mast Nut
4. Main Rotor Tie-Down
5. Engine Exhaust Cover
6. Jack and Jack Pad
7. Pitot Cover

Figure 1-1. Ground handling diagram

1-62. PARKING. (Figure 1-1.)

a. Retract the ground handling wheels and allow the helicopter to rest on the skid type landing gear.

b. Secure main rotor blades if the helicopter is parked in the wind or parked in an area subject to turbulence created by jet, prop, or rotor blast from other aircraft.

c. Install shield assemblies in engine induction fairing and covers on engine exhaust.

1-63. TOWING.

a. Tow rings are provided on forward inboard portion of each landing gear skid for attachment of a standard aircraft tow bar. Helicopter is towed on ground handling wheel assemblies mounted on the landing skids.

b. Station one man at the vertical fin to guide the helicopter and balance it on the wheels.

c. Tow the helicopter slowly, observing obstructions to prevent damage to main rotor blades.

1-64. APPLICATION OF EXTERNAL POWER. (Figure 1-2.) A source of external power capable of 350 to 450 amperes and 28 volts is recommended for starting the engine, however limits of 300 to 750 amperes and 28 volts are allowable for starting the engine. Turn helicopter battery switch OFF. Turn external power OFF. Plug the external power source cable securely into the external power receptacle (5). Turn external power source switch ON. The helicopters electrical system should be energized.

Note

Engine starts can be made on helicopter battery power.

1-65. SERVICING.

1-66. Instructions and information for complete servicing of the helicopter with fuel, oil, and hydraulic fluid are provided in the following paragraphs. Location of fillers, sight gages, and drains are shown on servicing diagram as required, with indication of how frequently each reservoir should be checked and serviced. Instructions for use of greases and other lubrication will be found in Lubrication Instructions, Chapter 2.

1-67. FUEL SYSTEM.

1-68. The fuel supply system consists of the fuel cell, fuel pump and lines. The filler cap (7, figure 1-2) is located on right side of helicopter aft of passenger door. The static ground receptacle is in adjacent area.

1-69. PRECAUTIONS IN FUEL SERVICING AND DEFUELING.

Warning

Observe the following precautions in all fuel servicing and defueling operations as applicable.

a. Position auxiliary ground power units on the windward side of the helicopter.

b. Do NOT fuel or defuel during electrical storms.

c. Do NOT fuel or defuel while ground or aircraft radar sets are operating within 300 feet of the helicopter.

d. Servicing personnel shall not wear metal taps on their shoes.

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 adjacent to the filler cap on right side of helicopter to the filler-nozzle before removing filler cap.

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

h. Do NOT use "SPLASH" filling. Fill the tanks slowly and evenly.

i. 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 the aircraft or hangar.

1-70. SERVICING FUEL SYSTEM. Fill tank cells with specified fuel (item 1, table 1-1). Fuel tank capacity is 73 gallons.

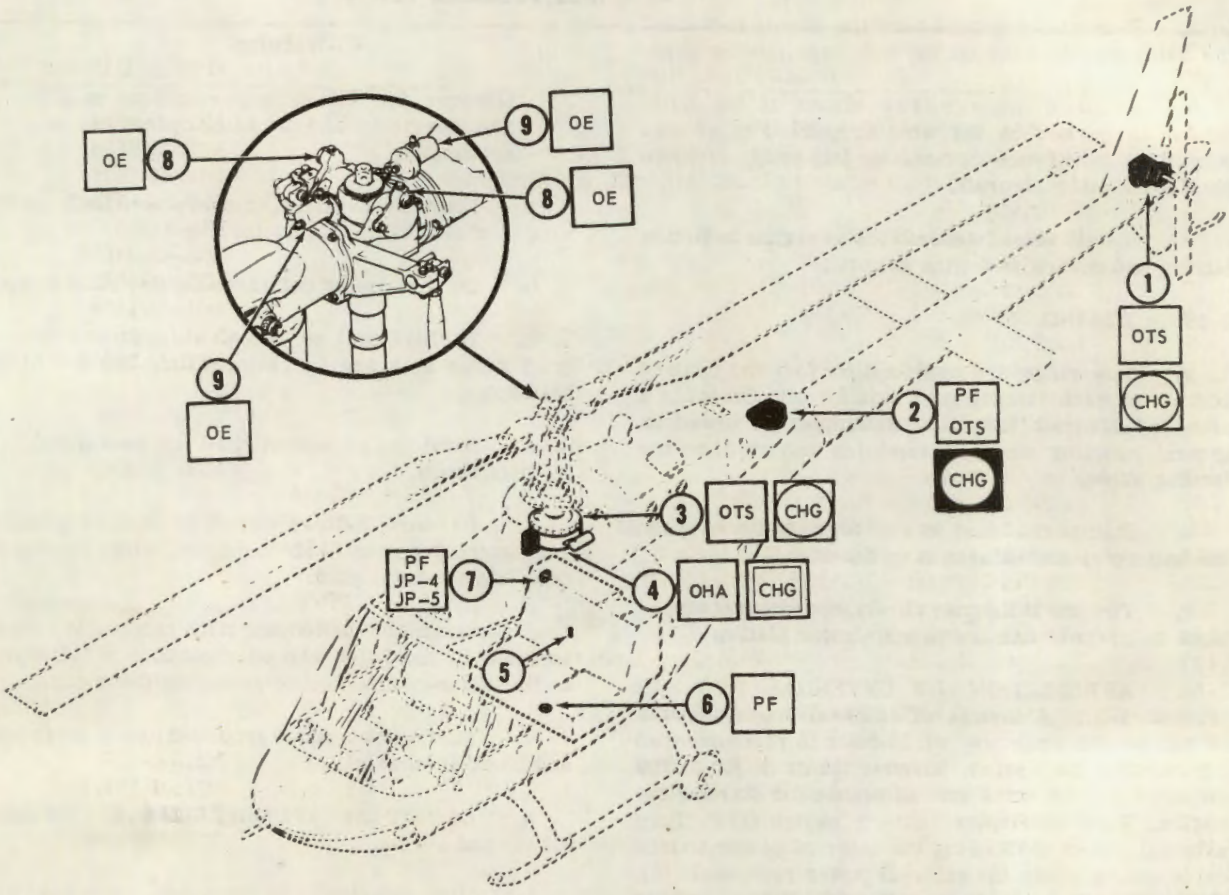
Note

When specified fuel is not available, refer to TB 55-9150-200-25 for information on other fuels and limitations on their use.

1-71. DEFUELING AND DRAIN VALVES.

a. Insert a suction pickup from a defueler truck into the fuel filler opening and remove all possible fuel.

b. To complete defueling, drain remaining fuel into a suitable container by opening fuel cell sump drain (6).



	Daily	CHG	Change each 100 hours
		CHG	Change each 150 hours
PF	Preflight	CHG	Change each 500 hours

Symbol	Specification
OE	MIL-L-2104
OTS	MIL-L-7808 MIL-L-23699
OHA	MIL-H-5606
JP-4 JP-5	MIL-J-5624

1. Tail Rotor Gear Box
2. Engine Oil Tank
3. Transmission
4. Hydraulic Reservoir
5. External Power Receptacle
6. Fuel Cell Sump Drain Valve
7. Fuel Cell Filler
8. Pillow Block Reservoir
9. Grip Reservoirs

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Figure 1-2. Servicing diagram

TABLE 1-1. LIST OF CONSUMABLE MATERIALS

ITEM NO.	NOMENCLATURE	COLOR NO.	SPECIFICATION
1	Jet Fuel, Grades JP-4 and JP-5		MIL-T-5624
2	Lubricating Oil, Synthetic Base, Turbine Engine		MIL-L-7808
3	Hydraulic Fluid, Petroleum Base, Aircraft, and Ordinance		MIL-H-5606
4	Lubricant, BHC		204-040-755-3
5	Petrolatum, Technical		VV-P-236
6	Lubricant		MIL-G-25537
7	Lubricating Oil, Jet Engine (Grade 1010)		MIL-L-6081
8	Lubricating Oil (10W-30)		MIL-L-2104
9	Lubricating Oil		VV-L-825
10	Lubricating Oil Synthetic Base, Turbine Engine		MIL-L-23699
	PAINTS, PRIMERS, AND MARKING COMPONENTS		
100	Zinc Chromate Primer		MIL-P-8585
101	Acrylic Lacquer - Black Camouflage	37038	
102	Acrylic Lacquer - Olive Drab Camouflage	X34087	
103	Acrylic Lacquer - Insignia Red (Gloss)	11136	
104	Acrylic Lacquer - Insignia White (Gloss)	17875	
105	Acrylic Lacquer - Black (Gloss)	17038	
106	Acrulic Lacquer - Orange Yellow	13538	
107	Lacquer (Non-Acrylic) Dark Gull Grey Lusterless	36231	
	ADHESIVES, CEMENTS AND SEALING COMPOUNDS		
200	Anti-seize Compound, High Temperature		MIL-A-907
201	Retaining Sealing Compound, Anaerobic		MIL-S-22473
202	Adhesive		EPON 934
203	Adhesive		FSCM 99384
	CHEMICALS, COATINGS, AND CLEANING COMPOUNDS		
300	Dry Cleaning Solvent		P-D-680
301	Methyl-Ethyl-Ketone		TT-M-261
302	Corrosion Preventive Compound		MIL-C-16173
303	Barrier Material, Water-proofed		MIL-B-121
304	Corrosion Preventive, Aircraft Engine		MIL-C-6529
305	Coating, Sprayable, Strippable, Protective		MIL-C-6799
	FABRICS AND TAPES		
400	Pressure Sensitive Adhesive Tape, Waterproofing for Packaging and Sealing		PPP-T-60, Type II
401	Tape		MIL-T-23142
402	Fiberglass Cloth		MIL-C-9084
	ABRASIVES, PAPER, PLASTICS AND MISCELLANEOUS		
500	Wax		MIL-W-18723
501	Sandpaper No. 320		

1-72. ENGINE OIL SYSTEM.

1-73. Engine oil tank (2, figure 1-2) is located aft of the engine and oil cooler blower fan. Oil level is checked by a sight gage on the tank. Normal capacity is 1.5 U.S. gallons. Service with lubricating oil (item 2 or 10, table 1-1). Tank drain valve is accessible through small door on left side of aft cowl and has an overboard drain line.

1-74. USAGE OF OILS.

Note

If is not advisable to mix MIL-L-7808 and MIL-L-23699 oils except in cases of emergency. If this becomes necessary, it is recommended that the system be flushed within 6 hours of operation according to procedure in paragraph 1-75.

a. MIL-L-23699 oil use in engine oil system is authorized and directed for ambient temperatures above minus 25°F.

b. MIL-L-7808 oil use in engine oil system is specified for operation in ambient temperatures below minus 25°F. This oil may also be used when MIL-L-23699 oil is not available.

1-75. PROCEDURE FOR CHANGING OILS. When changing over from MIL-L-7808 oil to MIL-L-23699 oil in engine oil system, accomplish steps below.

a. Drain MIL-L-7808 oil from system.

b. Inspect, clean, and reinstall all engine oil filters and strainers.

c. Fill engine oil tank with MIL-L-23699 oil. Motor engine to pump oil into cooler and lines. Check tank level and refill. Repeat until tank level does not change, indicating that cooler and lines are refilled.

d. Operate engine for 30 minutes to 1 hour. Shut down engine.

e. Inspect, clean, and reinstall all engine oil filters and strainers.

(1) If oil filter was heavily contaminated, accomplish all steps below.

(2) If oil filter was not heavily contaminated, omit steps f. and g. and accomplish steps h. through j. below.

f. Drain all oil from engine oil system, and discard oil.

g. Fill engine oil system with new MIL-L-23699 oil and release helicopter for service use.

h. After 5 hours operation, inspect and clean all engine oil filters and strainers.

i. After 15 hours since oil change, inspect and clean all engine oil filters and strainers.

j. Revert to normal schedule of inspections of engine oil filter and strainers.

1-76. TRANSMISSION OIL SYSTEM.

1-77. Service the transmission with lubricating oil (item 2 or 10, table 1-1). A sight glass, located on the transmission housing, is used to check the quantity of oil added at the filler-breather cap in top of case. Oil level must be visible in sight glass. Transmission is drained by removing the chip detector and plug assembly allowing oil to drain into a trough and into a container.

Caution

Care should be taken NOT to fill above center line in sight glass of transmission as oil foams and expands and overflow through filler cap may occur.

1-78. TAIL ROTOR GEARBOX.

1-79. Service the gearbox with lubricating oil (item 2 or 10, table 1-1) at the filler-breather cap. A sight glass is provided for ease in checking oil level. Drain oil by removing chip detector and plug assembly and catching oil in a suitable container.

Note

Care should be taken to NOT overfill gearbox as excessive oil leakage may occur.

1-80. MAIN ROTOR HUB.

1-81. Service two pillow block reservoirs and two grip reservoirs with lubricating oil (item 8, table 1-1). Sight glasses are provided for each of the four reservoirs. Fill to one-half full level. Lockwire filler plugs after servicing.

1-82. HYDRAULIC RESERVOIR.

1-83. Service the hydraulic reservoir with hydraulic fluid (item 3, table 1-1). The reservoir is located on the forward side of the transmission. A sight glass with ball float is provided to determine low quantity of fluid in the reservoir. Fill to overflow lip in reservoir.

1-84. CLEANING.

1-85. Clean aircraft and components in accordance with procedures contained in TM 55-405-3. Special cleaning procedures will be covered in this manual under individual components.

1-86. PAINTING - TOUCH-UP.

1-87. Refer to TB 746-93-2 for touch-up painting.

1-88. LIST OF CONSUMABLE MATERIALS.

1-89. Refer to table 1-1.

1-90. SPECIAL TOOLS AND EQUIPMENT.

1-91. Special tools and equipment provided for organizational maintenance will be found in TM 55-1520-228-20P.

1-92. TORQUE PROCEDURES AND REQUIREMENTS.

1-93. For torque requirements and acceptable limits on self-locking nuts refer to TB 55-1500-200-20/3.

CHAPTER 2

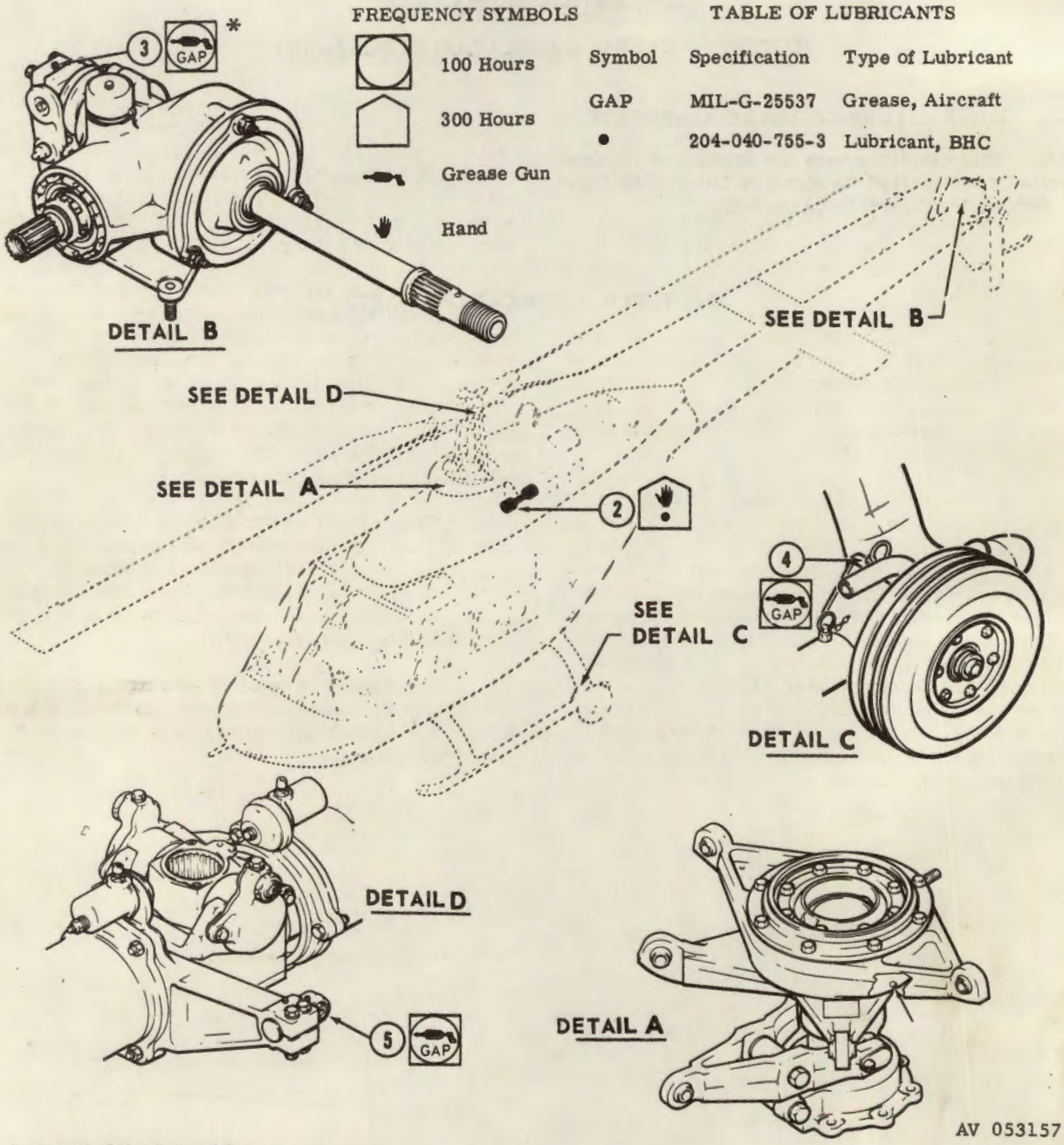
LUBRICATION INSTRUCTIONS

SECTION I GENERAL LUBRICATION REQUIREMENTS

2-1. GENERAL LUBRICATION REQUIREMENTS.

2-2. This chapter covers the lubrication requirements of the aircraft as shown on Lubrication Chart in Section II. (Reference figure 2-1.)

SECTION II LUBRICATION CHART



1. Swashplate Outer Plug
2. Engine to Transmission Drive Shaft Couplings
3. Tail Rotor Pitch Change Mechanism
4. Ground Handling Wheel Supports
5. Main Rotor Pitch Change Trunnion

* Remove boot and purge bearings with grease

Figure 2-1. Lubrication chart

CHAPTER 3

INSPECTION REQUIREMENTS

SECTION I GENERAL INFORMATION AND SCOPE

3-1. GENERAL INFORMATION.

3-2. This chapter contains complete requirements for special inspections, test flight, overhaul and retirement schedule, and standards of serviceability applicable to the aircraft.

3-3. SCOPE.

3-4. The inspections prescribed in this chapter will be accomplished at specified periods by organizational maintenance activities with the assistance of direct support activities when required. The following conditions will be noted during the performance of these inspections.

3-5. The inspection requirements are stated in such a manner as to establish what and when certain equipment is to be inspected and the condition to be sought. Compliance with the provisions outlined herein and with the Preventive Maintenance Inspection Checklists (TM 55-1520-228-20PMD, and -20PMP) are required in order to assure that latent defects are discovered and corrected before malfunctioning or serious trouble results. In order to arrange inspection requirements as nearly as possible according to the manner in which work will be assigned, the requirements in each section are divided into groups under area headings. (See figure 3-1.) This figure will be the same as the area diagram presented in the appropriate Preventive Maintenance Inspection Checklist. An area title indicates a specific aircraft location which may be comprised of several systems or groups of related components within this given area.

3-6. Inspection methods employed; environmental and geographical conditions; availability of specialized, skilled, or semi-skilled manpower; and facilities utilized are extremely variable; therefore, flexibility is provided with respect to the order of performance of the various inspections as required by efficient management of the inspection function assuring that the inspection requirements designated are adhered to and accomplished.

3-7. This manual pertains to all OH-58A series aircraft and may therefore contain inspection requirements applicable to specific equipment not installed on individual aircraft. When this situation is encountered, those requirements that are not applicable should be disregarded.

3-8. The inspection requirements contained herein are printed on inspection checksheets which will be locally reproduced and utilized while performing the respective inspection.

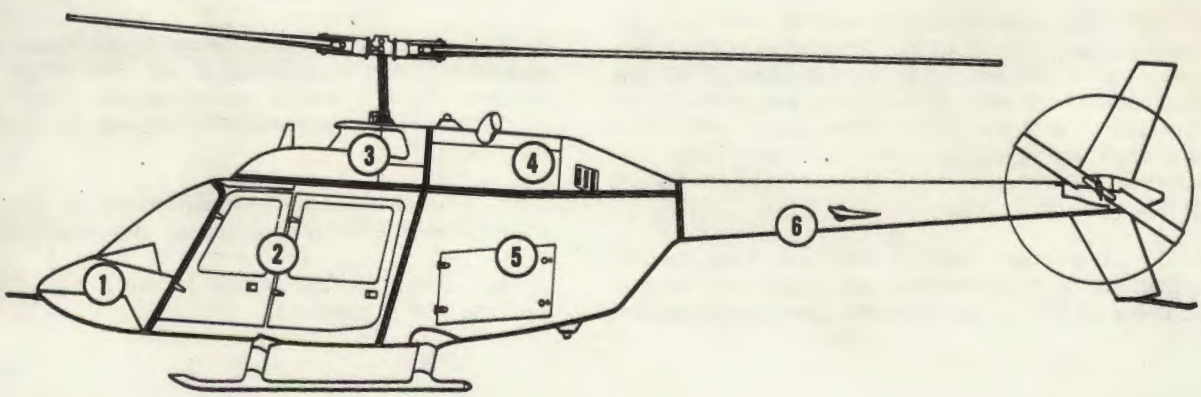


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Figure 3-1. Area diagram (Sheet 1 of 2)

Area No. 1 Nose Area

All surfaces and components in nose compartment and on exterior ahead of crew doors.

Area No. 2 Cabin and Landing Gear Area

All surfaces, components, and equipment inside cabin, and on cabin exterior between forward side of crew doors and aft side of passenger doors and cabin overhead. Includes complete landing gear and fuel cell sumps and filler.

Area No. 3 Transmission and Pylon Area

All surfaces, components, and equipment of the main rotor pylon group, from top of mast to cabin roof. Includes main rotor, mast and rotating controls, transmission with accessories and mounts, and main drive shaft.

Area No. 4 Engine Area

All surfaces, components, and equipment associated with engine installation, located above engine work deck and within engine cowling and tailpipe fairing.

Area No. 5 Avionics and Aft Fuselage Area

All surfaces, components, and equipment in fuselage below engine deck level, between cabin area and tail boom attachment bulkhead.

Area No. 6 Tail Boom

All surfaces, components, and equipment located in the tail boom and vertical fin structure. Includes tail rotor, elevator, and control linkages. Also all supports, bearings, and shafting mounted on tail boom.

Figure 3-1. Area diagram (Sheet 2 of 2)

SECTION II SPECIAL INSPECTION

3-9. DEFINITION AND GENERAL INFORMATION.

3-10. This section supplements the scheduled inspections as outlined in the Preventive Maintenance Inspection Checklists (TM 55-1520-228-20PMD and -20PMP) to include inspection of items which are required to be inspected at intervals not compatible with airframe operating time or airframe inspection intervals. Paragraphs 3-11 through 3-13 are typical of this type inspection.

3-11. 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.

3-12. Inspection of components or airframe, on a calendar basis; such as first aid kits, weight and balance check, aircraft inventory, etc. This type inspection will be accomplished during the periodic inspection.

3-13. Specific definitive inspections on aircraft engines based strictly upon engine operating time.

3-14. Refer to TM 38-750 for applicable forms, records, and worksheets.

AIRCRAFT INSPECTION CHECKSHEET	TYPE OF INSP (Daily, Intermediate, etc.) SPECIAL	PAGE NO. 1	NO. OF PAGES 8
AIRCRAFT AND SERIAL NO.	INSPECTION NO.	DATE OF INSPECTION	

AREA NO.	REQUIREMENT EVERY	ITEM	STATUS	RECORDED ON WORKSHEET
All Areas		AFTER A HARD LANDING Definition: Hard landing is defined as any accident or incident in which ground impact of the helicopter causes severe pitching of main rotor, allowing hard contact of hub with mast, or results in noticeable yielding or cracking of fuselage pylon support structure or landing gear. This definition is confined only to those accidents not involving sudden stoppage of main rotor or tail rotor. Inspections: When a probable hard landing incident has occurred, proceed as follows: a. Inspect landing gear skid tubes and cross-tubes for damage and deflection. Inspect cross-tube attachment points for damage or distortion. b. Check all cowling and doors for proper fit and alignment. Misaligned cowling may indicate a distorted fuselage, resulting in major stresses and damage. c. Remove all cowling necessary to perform a complete visual inspection. d. Inspect structure with a ten-power magnifying glass around the transmission mounting points. Particular attention should be given to the isolation mount and pylon support mounts. Inspect the transmission support where the spike on the drag pin assembly fits into the stop. This area is directly under the transmission on the cabin. e. Inspect 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 bolts and damaged structure. f. Completely inspect the flight control system from pilot's controls to rotor head for bent or damaged tubes, bellcranks, and supports, and for damaged bearings. Particular attention should be given to the mast control rods and collective sleeve assembly. g. Check for leaks in the hydraulic system and interference or binding, and for satisfactory operation. h. Inspect mast for indentation caused by hard contact with static stop and run-out. i. Inspect main rotor blades for contact with tail boom. If damage is found, refer to AFTER SUDDEN STOPPAGE - MAIN ROTOR. j. Inspect tail rotor blades for damage. If damage is found refer to AFTER SUDDEN STOPPAGE - TAIL ROTOR.		

AIRCRAFT INSPECTION CHECKSHEET	TYPE OF INSP (Daily, Intermediate, etc.) SPECIAL	PAGE NO. 2	NO. OF PAGES 8
AIRCRAFT AND SERIAL NO.	INSPECTION NO.	DATE OF INSPECTION	

AREA NO.	REQUIREMENT EVERY	ITEM	STATUS	RECORDED ON WORKSHEET
		k. Inspect fuel and oil systems for damage. Before flight, check fuel and oil systems for leaks. l. Inspect engine mounts at fuselage attachment points for cracks. m. If damage or misalignment to fuselage structure, skid gear, or tail boom is such that a major repair, replacement or alignment is necessary, refer to next higher level of maintenance for replacement or repairs needed for the following items: (1) Main rotor blades and attachments. (2) Main rotor hub. (3) Swashplate and support assembly. (4) All controls and control bolts. (5) Control rods (rotor-to-swashplate levers). (6) Transmission and mast assembly. (7) Transmission-to-engine coupling assembly. (8) Tail rotor shafts and bearings. (9) 90-degree gearbox. (10) Tail rotor hub and blade. (11) Isolation mount. (12) Inspect engine mounts at fuselage attachments points for cracks. n. If damage is found in rotating controls, inspect and/or replace the following: (1) Main rotor pitch horns. (2) Swashplate assembly. (3) All connecting control tubes and control bolts. o. Check power and accessory gearbox for cracked flanges. p. Inspect magnetic chip detectors for metal accumulation. q. Check engine mounting pads for cracks.		

AIRCRAFT INSPECTION CHECKSHEET	TYPE OF INSP (Daily, Intermediate, etc.) SPECIAL	PAGE NO. 3	NO. OF PAGES 8
AIRCRAFT AND SERIAL NO.	INSPECTION NO.	DATE OF INSPECTION	

AREA NO.	REQUIREMENT EVERY	ITEM	STATUS	RECORDED ON WORKSHEET
		r. Check air, oil, and fuel hose connections for tightness.		
		s. Check all engine accessories for cracked flanges, loose bolts and nuts, connections, and general condition.		
All Areas		AFTER SUDDEN STOPPAGE - MAIN ROTOR		
		a. If visible damage is evident remove the following components and return to depot maintenance for evaluation and disposition.		
		(1) Main rotor blades and attachments.		
		(2) Main rotor hub.		
		(3) Mast.		
		(4) Mast controls.		
		(5) Swashplate assembly.		
		(6) Control tubes.		
		(7) Control rods (rotor-to-swashplate levers).		
		(8) Transmission.		
		b. After sudden stoppage with no visible damage, inspect the following:		
		(1) Exterior of blades for security of all bonds and visible damage.		
		(2) Remove tip cover plate. If any movement of the tip weights has occurred, the blade shall be scrapped.		
		c. Inspect engine mounts for security, cracks, or misalignment.		
		d. Inspect each magnetic plug for metal accumulation.		
		e. Inspect compressor rotor and stator blades and turbine blades for foreign object damage.		
		f. Inspect engine inlet for foreign objects; then motor engine and check for unusual noise.		
		g. Reinspect magnetic plugs after eight hours of engine operation.		

AIRCRAFT INSPECTION CHECKSHEET	TYPE OF INSP (Daily, Intermediate, etc.) SPECIAL	PAGE NO. 4	NO. OF PAGES 8
AIRCRAFT AND SERIAL NO.	INSPECTION NO.	DATE OF INSPECTION	

AREA NO.	REQUIREMENT EVERY	ITEM	STATUS	RECORDED ON WORKSHEET
6		AFTER SUDDEN STOPPAGE - TAIL ROTOR a. Visually inspect the tail rotor drive shaft support hangers for cracks. b. Inspect the bonds between the tail rotor drive shafts and adapters for integrity. c. Inspect the tail boom in the area of the tail rotor gearbox mounting studs using a ten-power magnifying glass. d. Inspect the four tail boom attachment points for cracks, distortion damage and security. Check torque on nuts of attachment bolts. e. Inspect the tail boom internally for cracks, distortion and loose or missing rivets. Check external skin of tail boom for cracks in area of the attachment of the horizontal stabilizer. f. Inspect the horizontal stabilizer for skin cracks and looseness in mounting. g. Inspect the vertical fin for security and overall condition. Check the tail skid for condition and security.		
3 & 4		AFTER MAIN ROTOR OVERSPEED If main rotor overspeeds in excess of 114 percent perform the following inspections: a. Main rotor blades. (1) Remove the tip cap assembly from the blade and inspect the tip cap attaching screws for deformation. Any deformation of screws or elongation of mating holes in the spar is cause for blade scrappage. (2) Visually inspect the blade for skin wrinkles or deformation. If any indications of wrinkles or deformation exist, return the blade to depot maintenance for evaluation. (3) If blades pass the above inspection they are acceptable for service. b. Tail rotor blades. (1) If one of the blades of a pair has been damaged badly enough that metal has been torn or any bond lines have separated, then the other blade must be scrapped also. (2) If one of the blades of a pair has been damaged slightly by denting, return both blades to depot maintenance for evaluation.		

AIRCRAFT INSPECTION CHECKSHEET	TYPE OF INSP (Daily, Intermediate, etc.) SPECIAL	PAGE NO. 5	NO. OF PAGES 8
AIRCRAFT AND SERIAL NO.	INSPECTION NO.	DATE OF INSPECTION	

AREA NO.	REQUIREMENT EVERY	ITEM	STATUS	RECORDED ON WORKSHEET
		(3) If any movement of the tip end or root end balance weights has occurred, scrap the blade.		
		(4) If the tip block is cracked, scrap the blade.		
		(5) If blades pass the above inspection requirements, and no other discrepancies exist, the blade is serviceable.		
		c. Inspect tail rotor drive shaft bearing hangers for security of attachment and for cracks or bends.		
		d. Inspect oil cooler fan impeller for visible distortion or cracks of the brazed vane joints.		
4		ANYTIME ENGINE IS REMOVED		
		a. Seal all openings with proper caps and covers.		
		b. Wash outside of engine with solvent (item 300, table 1-1) if required.		
		c. Touch up with paint if required.		
4		AFTER INSTALLING AN ENGINE OR ENGINE COMPONENT		
		a. Operate engine and check for leaks.		
		b. Shut down and recheck for leaks.		
4		SUSPECTED FOREIGN OBJECT DAMAGE		
		a. Inspect compressor rotor blades and stator vanes.		
		b. Inspect turbine blades.		
		c. Motor engine and listen for unusual noises. Observe starter limitations.		
4		AFTER OVERTEMPERATURE OPERATION		
		a. If during start temperature was 749°C for more than 10 seconds or above 927°C anytime, refer to TM 55-1520-228-35 for Overtemperature Maintenance action.		
		b. If during power transient temperature was 749°C for more than 6 seconds or exceeded 843°C anytime, refer to TM 55-1520-228-35 for Overtemperature Maintenance Action.		
		c. If during flight TOT exceeded 693°C for more than 30 minutes, remove engine and ship to overhaul.		

AIRCRAFT INSPECTION CHECKSHEET	TYPE OF INSP (Daily, Intermediate, etc.) SPECIAL	PAGE NO. 6	NO. OF PAGES 8
AIRCRAFT AND SERIAL NO.	INSPECTION NO.	DATE OF INSPECTION	

AREA NO.	REQUIREMENT EVERY	ITEM	STATUS	RECORDED ON WORKSHEET
4		AFTER OVERSPEED OR OVERTORQUE OPERATION Remove engine and red tag to indicate overtorque or overspeed.		
3,4, & 6		ANYTIME MAGNETIC CHIP LIGHT GOES ON a. Request a special oil analysis in accordance with TB 55-6650-300-15. b. Remove chip detector leads in turn, to determine which magnetic plug caused the light. c. Remove and inspect the applicable magnetic plug for metal accumulation. d. Clean oil filter if engine is acceptable.		
4		IF ENGINE OIL TEMPERATURE EXCEEDS 225°F WITHOUT ANY CHANGE IN NORMAL OIL PRESSURE a. Drain and refill engine oil system. b. Inspect the magnetic drain plugs. c. Inspect oil filter and clean or replace as required. d. Ground run aircraft for ten minutes. Obtain as high a power level as possible without lift-off. e. Reinspect the magnetic drain plugs. If the magnetic drain plugs are free of particles, reinspect after five hours of operation.		
4		IF ENGINE OIL TEMPERATURE EXCEEDS 225°F WITH A CHANGE IN NORMAL OIL PRESSURE a. Do not attempt to adjust the oil pressure regulating valve setting; replace the oil filter housing assembly. b. Drain and refill engine oil system. c. Inspect magnetic drain plugs. d. Start engine and check oil pressure at 78.2% N_I speed or above; if pressure is not within 90 to 130 psig, adjust oil pressure regulator valve as required. e. If correct oil pressure is obtained, perform steps d. and e. under IF ENGINE OIL TEMPERATURE EXCEEDS 225°F WITHOUT ANY CHANGE IN NORMAL OIL PRESSURE. f. If correct oil pressure cannot be obtained by regulator valve adjustment, replace engine.		

AIRCRAFT INSPECTION CHECKSHEET	TYPE OF INSP (Daily, Intermediate, etc.) SPECIAL	PAGE NO. 7	NO. OF PAGES 8
AIRCRAFT AND SERIAL NO.	INSPECTION NO.	DATE OF INSPECTION	

AREA NO.	REQUIREMENT EVERY	ITEM	STATUS	RECORDED ON WORKSHEET
All Areas		AFTER THE HELICOPTER HAS BEEN SUBJECTED TO SALT WATER OR SALT WATER SPRAY Wash entire helicopter with fresh water, particularly inside of engine compartment doors; wash all compartments which were exposed to salt water; make a detail check of all surfaces for corrosion. Apply corrosion preventive compound to exposed nonpainted, anodized, or cadmium plated assemblies. Water-wash engine internally.		
1		AFTER WASHING HELICOPTER Check pitot-static system for moisture.		
All Areas		AFTER PROBABLE EXPOSURE TO RADIOACTIVITY Accomplish the following: a. Survey helicopter for level of radioactivity. b. Decontaminate helicopter as required. (Refer to TM 3-220.)		
All		AFTER INSTALLATION, REMOVAL OR RELOCATION OF EQUIPMENT OR MAJOR MODIFICATION WHICH RESULTS IN UNKNOWN CHANGE IN BASIC WEIGHT AND BALANCE; AFTER REPORT OF UNSATISFACTORY FLIGHT CHARACTERISTICS Weigh helicopter and accomplish necessary entries in Weight and Balance Data, DD Forms 365. (Refer to AR95-16 and TM 55-405-9.)		
3		AT FIRST 25 HOURS AFTER INSTALLATION OF SWASHPLATE Check uniball friction.		
5		AT FIRST 100 HOURS AFTER INSTALLATION OF TAIL BOOM Retorque tail boom attachment bolts (375 to 415 inch-pounds).		
3		DAILY WHEN OPERATING IN HIGH HUMIDITY OR SALT-LADEN AIR Wash main rotor blades with mild soap detergent, rinse with clear water, and dry.		
3		WEEKLY OR EACH 25 HOURS OF OPERATION (WHICHEVER IS FIRST) Thoroughly clean and wax main rotor blades.		

AIRCRAFT INSPECTION CHECKSHEET	TYPE OF INSP (Daily, Intermediate, etc.) SPECIAL	PAGE NO. 8	NO. OF PAGES 8
AIRCRAFT AND SERIAL NO.	INSPECTION NO.	DATE OF INSPECTION	

AREA NO.	REQUIREMENT EVERY	ITEM	STATUS	RECORDED ON WORKSHEET
2	6 MONTHS	CF3BR type extinguisher weight check cylinder less valve. If cylinder is within 4 ounces of stenciled weight, reassemble and reseal.		
2	12 MONTHS	First aid kit inspection per TB 55-1500-308-25.		
		Replace cotton seat belt and shoulder harness. (Refer to TM 55-405-3.)		
All	12 MONTHS; OR WHEN HELICOPTER IS TRANSFERRED, RECEIVED, PLACED IN STORAGE, OR REMOVED FROM STORAGE.	Inventory helicopter for availability of inventoriable property (not required while helicopter is in storage). (Refer to TM 38-750.)		
2	5 YEARS	Replace nylon and dacron seat belt and shoulder harness. (Refer to TM 55-405-3.)		
All Areas	AT EACH OIL CHANGE	a. Inspect transmission oil filter for metal particles. b. Drain freewheeling unit. c. Inspect and clean engine oil filter. d. Remove, inspect, and clean electric chip detector plugs. (Two transmission, two engine and one 90° gearbox.)		

SECTION III TEST FLIGHT

3-15. DEFINITION AND GENERAL INFORMATION.

3-16. This section contains test flight inspection requirements peculiar to Army Model OH-58A aircraft. Conditions requiring accomplishment of test flight shall be in accordance with TB AVN 23-16 and changes thereto. The requirements herein are established to assure a thorough inspection of the aircraft before flight, during flight, and upon completion of test flight. When a test flight is performed for the purpose of determining if specific equipment or systems are in proper operating condition, requirements not related to such equipment or systems should be disregarded.

3-17. The test flight inspection checksheets are presented in a format for local reproduction. Continuation sheets shall be used when necessary for each part. Explanation of the checksheets is as follows:

Block 1 Aircraft Model and Series

Block 2 Complete Aircraft Serial Number

Block 3 Organizational Unit Performing Test Flight

Block 4 Day, Month, and Year

Block 5 Reason Test Flight is Being Performed

Block 6 Numerical Inspection Item Identification Number

Block 7 Inspection Requirements Arranged in Chronological Order

Block 8 Instrument Minimum and Maximum Operating Ranges

Block 9 Actual Indication Entered at Time of Test Flight

Block 10 Enter satisfactory or unsatisfactory symbol (as shown in note) at time of test flight. All unsatisfactory symbols will be explained in remarks (Test Flight Checksheet, Part IV).

AIRCRAFT TEST FLIGHT INSPECTION CHECKSHEET PART I - GROUND CHECK				PAGE NO. 1	NO. OF PAGES 4
1. TYPE ACFT	2. SERIAL NO.	3. ORGANIZATION	4. DATE	5. PURPOSE OF TEST FLIGHT	

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

6. ITEM NO.	7. INSPECTION ITEMS	8. RANGE		9. ACTUAL INDICATION	10. LEGEND (See note)
		MIN	MAX		
1.	Aircraft forms inspected.				
2.	Daily inspection completed.				
3.	Flight readiness completed.				
4.	Instrument check.				
	a. Static pressure reading.				
	b. Range markings.				
	c. Adjust altimeter.				
	d. Verify barometric pressure with control tower.				
	e. Fuel quantity indicator reading against known quantity in fuel cells.				
5.	Perform engine start and run-up in accordance with TM 55-1520-228-10.				
6.	Instruments checked for correct indication.				
	a. Turbine outlet temperature.	330°C	693°C		
	b. N2 speed.	101%	104%		
	c. N1 speed.	97%	104%		
	d. Torque indication.	OPSI	79 PSI		
	e. Engine oil pressure.	110 PSI	130 PSI		
	f. Engine oil temperature.	0°C	107°C		
	g. Rotor speed.	330 RPM	390 RPM		

AIRCRAFT TEST FLIGHT INSPECTION CHECKSHEET PART II - INFLIGHT CHECK	PAGE NO. 2	NO. OF PAGES 4

1. TYPE ACFT	2. SERIAL NO.	3. ORGANIZATION	4. DATE	5. PURPOSE OF TEST FLIGHT

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

6. ITEM NO.	7. INSPECTION ITEMS	8. RANGE		9. ACTUAL INDICATION	10. LEGEND (See note)
		MIN	MAX		
1.	Takeoff and climb.				
	a. Engine parameters for takeoff and climb in accordance with TM 55-1520-228-10.				
	b. Aircraft for control and stability and proper response to control forces.				
2.	Cruise.				
	a. Engine parameters for cruise in accordance with TM 55-1520-228-10.				
	(1) Turbine outlet temperature.	330°C	693°C		
	(2) N2 speed	101%	104%		
	(3) N1 speed.	97%	104%		
	(4) Torque indication.	OPSI	79 PSI		
	(5) Engine oil pressure.	110 PSI	130 PSI		
	(6) Engine oil temperature.	0°C	107°C		
	(7) Rotor speed.	330 RPM	390 RPM		
	b. Main rotor for proper control response.				
	c. Heating and ventilating system for proper operation.				
	d. Flight instruments for proper indication.				
	(1) Altimeter.				
	(2) Directional indicator.				
	(3) Airspeed indicator.				
	(4) Turn and slip indicator.				

AIRCRAFT TEST FLIGHT INSPECTION CHECKSHEET PART II - INFLIGHT CHECK (CONTINUED)				PAGE NO. 3	NO. OF PAGES 4
1. TYPE ACFT	2. SERIAL NO.	3. ORGANIZATION	4. DATE	5. PURPOSE OF TEST FLIGHT	

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)
2.	Cruise. (Cont)				
	(5) Attitude indicator.				
	(6) Outside air temperature indicator.				
	(7) Magnetic compass.				
	(8) Clock.				
	e. Communications equipment for proper operation.				
3.	Hover.				
	a. Engine parameters in accordance with TM 55-1520-228-10.				
	(1) Turbine outlet temperature.	330°C	693°C		
	(2) N2 speed.	101%	104%		
	(3) N1 speed.	97%	104%		
	(4) Torque indication.	OPSI	79 PSI		
	(5) Engine oil pressure.	110 PSI	130 PSI		
	(6) Engine oil temperature.	0°C	107°C		
	(7) Rotor speed	330 RPM	390 RPM		
	b. Main rotor for proper control response.				
	c. Tail rotor for proper control response.				
4.	Autorotational flight.				
	a. Rotor and N2 tachometer needles split.				
	b. Rotor speed in accordance with TM 55-1520-228-10.				

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

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

6. ITEM NO.	7. INSPECTION ITEMS	8. RANGE		9. ACTUAL INDICATION	10. LEGEND (See note)
		MIN	MAX		
1.	Land aircraft.				
2.	Perform normal engine shutdown in accordance with TM 55-1520-228-10.				
3.	Repeat daily inspection.				
4.	Record discrepancies noted on DA Form 2408.				

SECTION IV OVERHAUL AND RETIREMENT SCHEDULE

3-18. SCOPE.

3-19. 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 is due unless otherwise specified in TB AVN 23-10.

3-20. OVERHAUL INTERVAL.

3-21. The maximum authorized operating time or calendar interval of parts prior to removal for overhaul at category of maintenance authorized in accordance with the Maintenance Allocation Chart.

3-22. RETIREMENT SCHEDULE.

3-23. The operating time or calendar interval specified for removal, condemnation, and disposal of parts in accordance with applicable directives.

Note

Items replaced on a calendar basis (for the purpose of overhaul or retirement) will not be listed on DA Form 2408-16, Component Installation and Removal Record, but will be listed on DA Form 2408-18, Equipment Inspection List, for scheduling purposes.

OVERHAUL AND RETIREMENT SCHEDULE

Model OH-58A Helicopter

Area	Part Number and Item		Overhaul Interval (Hours)	Retirement Interval (Hours)
	Main Rotor			
3	206-011-250-3	Blade Assembly		1200
3	206-011-100-1	Hub Assembly	1200	
3	206-010-102-9	Grip Assembly		4800
3	206-010-105-3	Strap Assembly		1200
3	206-010-123-1	Pin, Strap Retaining		1200
3	206-010-155-7	Fitting Assembly		1200
	Transmission			
3	206-040-003-5	Transmission Assembly	1200	
3	206-040-003-7	Mast Assembly	1200	
3	206-010-332-9	Mast		1200
3	206-040-100-13	Drive Shaft Assembly, Main	1200	
3	206-030-539-3	Pylon Isolation Mount		1200
	Main Rotor Controls			
3	206-010-450-5	Swashplate and Support Assembly	1200	
3	206-010-420-3	Bearing, Swashplate Assembly		1200
3	206-010-452-1	Support, Swashplate Assembly		4800
3	206-010-454-1	Sleeve, Swashplate Assembly		4800
3	206-001-524-11	Lower Collective Tube Assembly		4800
3	206-010-407-1	Collective Idler Link Assembly		4800
3	206-010-467-1	Collective Lever Assembly		4800
	Engine			
4	206-040-230-13	Freewheeling Assembly	1200	
4	687 4201	Engine, Turboshaft	300	
	Tail Rotor and Drive System			
6	206-010-750-5	Blade Assembly		1200
6	206-011-801-7	Hub Assembly	1200	
6	206-011-803-5	Trunnion Assembly		2400
6	206-040-400-7	Gearbox Assembly	1200	
6	206-040-339-3	Bearing		1200
6	206-022-100-1	Horizontal Stabilizer		4800

SECTION V STANDARDS OF SERVICEABILITY

3-24. PURPOSE.

3-25. This section provides a guide to all personnel engaged in the maintenance of Department of the Army aircraft in determining serviceability of aircraft.

3-26. MAINTENANCE FUNCTIONS AND INSPECTIONS.

3-27. The availability of serviceable aircraft is contingent upon effective maintenance management; therefore, the maximum utilization of available capabilities, faithful and timely performance of assigned maintenance functions, and conscientious performance of specified maintenance inspections augmented by careful supervision and strict quality control will enhance aircraft availability and serviceability.

3-28. STANDARDS OF SERVICEABILITY.

3-29. Serviceability can be determined only by actual inspection of the aircraft and can be determined at any time throughout the life cycle of the aircraft. Wear tolerance and maximum allowable deterioration, specified in maintenance and inspection requirements, have been designed to assure a high degree of serviceability, availability, and safety. These tolerances and limits are the basic standards for serviceability and are embodied in aircraft maintenance and inspection manuals; therefore, inspection for serviceability is performed during every maintenance inspection.

3-30. DEGREE OF SERVICEABILITY.

3-31. Transfer of aircraft generates administrative and technical problems for supply and maintenance management. To minimize the impact upon the receiving activity of a transferred aircraft, degrees of serviceability are established to supplement basic standards included in present maintenance and inspection requirements. The supplementary standards, contained in this section, have been designed to assure that sufficient reliable hours of flight are remaining on the aircraft and components to satisfy immediate operational and logistical requirements of the receiving activity when the aircraft is being transferred within CONUS, overseas, or into combat operations. The degree of serviceability required for aircraft upon completion of overhaul will be to the same degree required for transfer within CONUS: except when aircraft is predetermined to be destined for overseas or into combat, in which case the overhauled aircraft will conform to the standard for the specific transfer condition.

STANDARDS OF SERVICEABILITY

Item No.	Item	Degree of Serviceability Required for Transfer Within Theater of Operations or from an Overseas Theater to CONUS	Degree of Serviceability Required for Transfer From One Theater of Operation to Another Theater of Operations	Degree of Serviceability Required for Transfer From a Noncombat Theater to a Combat Theater of Operations
	General			
1	Inspection	Perform next periodic inspection	Perform next periodic inspection	Perform next periodic inspection
2	Modification	Accomplish all urgent and normal MWO and TCTM	Accomplish all urgent MWO and TCTM. Accomplish all normal MWO and TCTM which have an issue date of 3 months prior to date of transfer	Accomplish all urgent MWO and TCTM. Accomplish normal MWO and TCTM which have an issue date of 1 month prior to date of notice of transfer when aircraft is to be transferred and for which, more than 60 days notification was received.

STANDARDS OF SERVICEABILITY (CONT)

Item No.	Item	Degree of Serviceability Required for Transfer Within Theater of Operations or from an Overseas Theater to CONUS	Degree of Serviceability Required for Transfer From One Theater of Operation to Another Theater of Operations	Degree of Serviceability Required for Transfer From a Noncombat Theater to a Combat Theater of Operations
3	Mission Essential Equipment	Assure mission essential equipment is installed	Assure mission essential equipment is installed and is completely operational	Assure mission essential equipment is installed and is completely operational
	Helicopter			
4	Helicopter Paint Condition	Touch up by area spraying as necessary to provide a protective seal on all required surfaces	Touch up by area spraying as necessary to provide a protective seal on all required surfaces. Completely repaint if condition of existing paint warrants. Paint necessary peculiar markings on helicopter required by the theater of operations	Touch up by area spraying as necessary to provide a protective seal on all required surfaces. Paint necessary peculiar markings on helicopter required by theater of operations
	Component Replacement			
5	a. Items having a scheduled replacement of retirement time below 500 hours	Replace if less than 50 hours of scheduled operating time remains	Replace if less than 100 hours of scheduled operating time remains	Replace if less than 300 hours of scheduled operating time remains
	b. Items having scheduled replacement time over 500 hours	Replace if less than 10% or 100 hours of scheduled operating time remains (whichever is least)	Replace if less than 25% or 200 hours of scheduled operating time remains (whichever is least)	Replace if less than 300 hours of scheduled operating time remains
	c. Items having a scheduled change based on calendar months	Replace only if change is due	Replace only if change is due	Replace if less than three months remain before change is required
6	Communications, Compass, Electronic and Navigation Equipment	Assure equipment is complete and fully operational	Assure type of equipment installed is compatible to type and system utilized at destination and equipment is fully operational	Assure type of equipment installed is compatible to type and system utilized at destination and equipment is complete and fully operational

CHAPTER 4

AIRFRAME AND ALIGHTING GEAR

SECTION I SCOPE

4-1. SCOPE.

4-2. The purpose of this chapter is to provide all the essential information for maintenance personnel to accomplish organizational maintenance on the complete airframe and alighting gear in accordance with the Maintenance Allocation Chart.

SECTION II FUSELAGE SECTION

4-3. DESCRIPTION.

4-4. Fuselage consists of three main sections; the forward section which extends from the cabin nose to the bulkhead aft of the passenger compartment, the intermediate section which extends from the bulkhead aft of the passenger compartment to the tail boom, and the tail boom section. The forward section utilizes aluminum honeycomb and sheet metal structures and provides the major load carrying elements of the forward cabin. The forward section provides for pilot and passenger seating, fuel cell enclosure, and pylon support. The intermediate section utilizes an aluminum and honeycomb semimonocoque construction and provides a deck for engine installation, and a compartment under the engine deck for electrical equipment.

Caution

The tail boom and fuselage inspection panels are structural members and must be in place for flight and ground runup.

4-5. DOOR ASSEMBLIES.

4-6. Four entrance doors are provided for access to the cabin. The doors are sheet metal construction with stretched acrylic windows. A latch assembly, which may be operated from either side, secures the door in the closed position. In an emergency, doors may be jettisoned by pulling EMERGENCY RELEASE handle on the inside of each door forward support.

4-7. REMOVAL - DOOR ASSEMBLIES.

a. Open door and support to prevent damage.

b. Remove cotter pins, nuts (1), washers (2), Belleville washers (3), spacers (4) and bolts (5) at hinge points. (Refer detail A, figure 4-1.) Remove door assembly.

4-8. INSPECTION - DOOR ASSEMBLIES.

a. Inspect door for cracks, dents, damage, and seals for condition and security.

b. Check latches for broken or loose handles, loose mountings, proper latching, and hinges for condition and wear.

c. Inspect snap vents for security in windows, cracks, and operation.

4-9. INSTALLATION - DOOR ASSEMBLIES.

a. Position door in hinge fittings.

b. Install spacer (4), bolt (5), washers (2), Belleville washers (3) and nut (1).

c. Tighten nut approximately one quarter turn past finger tight. Install cotter pin.

4-10. ADJUSTMENT - DOOR LATCH ASSEMBLY.

a. Remove pin (6). Refer detail B, figure 4-1.

b. Turn roller assembly (7) in or out as required to properly engage striker on airframe.

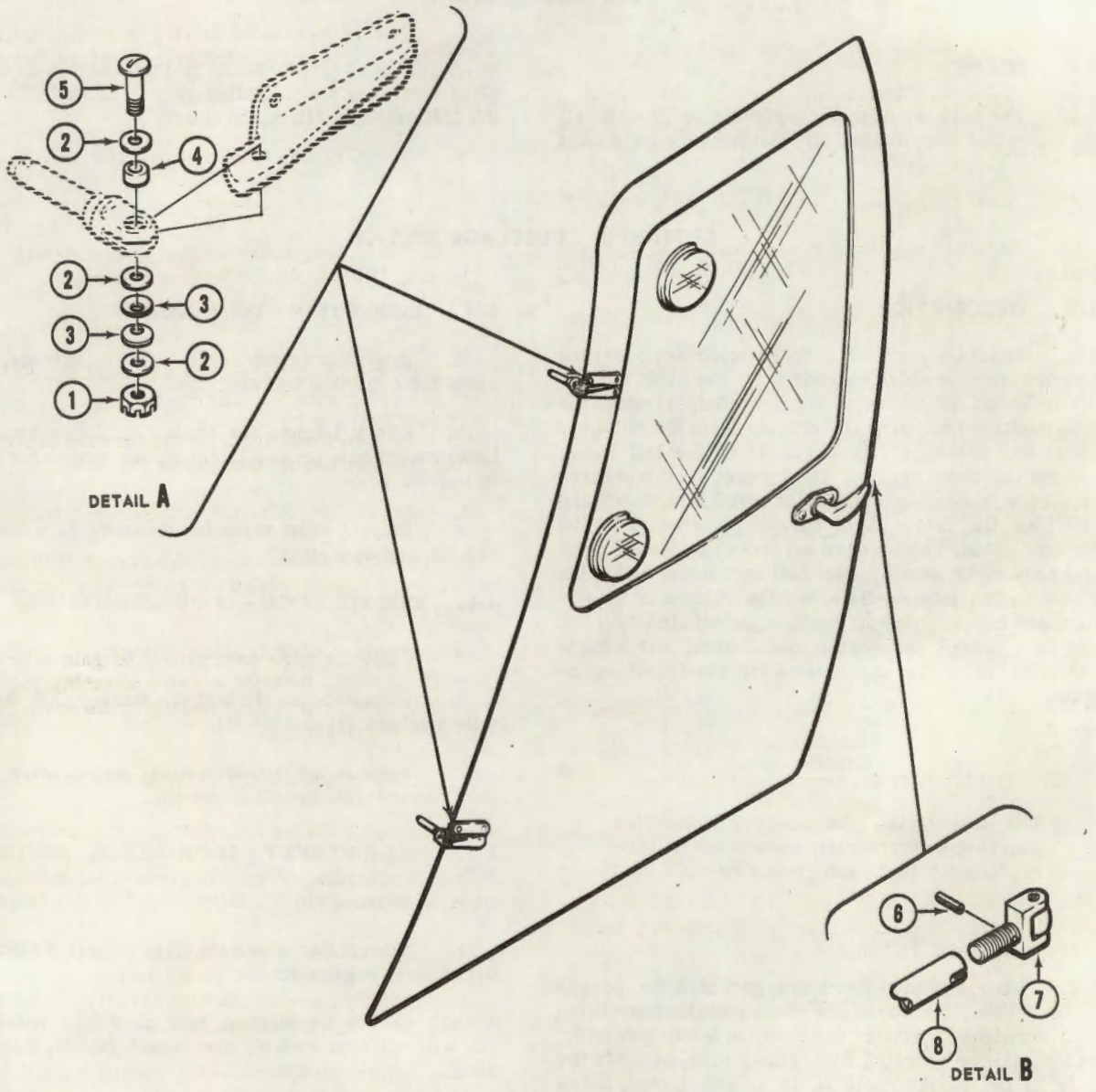
c. Secure by aligning hole in roller assembly (7) with slot in rod (8) and insert pin (6). Recheck for fit.

4-11. JETTISON MECHANISM.

4-12. The jettison mechanism consists of a handle and rod assembly to facilitate emergency exiting of aircraft.

4-13. REMOVAL - JETTISON MECHANISM.

a. Remove cover plates and screws over rear door units.



1. Nut
2. Washers
3. Belleville Washers
4. Spacer
5. Bolt
6. Pin
7. Roller Assembly
8. Rod

Figure 4-1. Typical door assembly

b. Remove handles and rods.

4-14. INSPECTION - JETTISON MECHANISM.

a. Inspect handles for cracks or bends.

b. Inspect rods for bends or corrosion.

4-15. REPAIR - JETTISON MECHANISM. Replace defective handles or rods as required with serviceable items.

4-16. INSTALLATION - JETTISON MECHANISM.

a. Install rods making sure they engage door hinge.

b. Install handles with bolts, nuts, and washers.

c. Attach rods to handles and lockwire handle to bulkhead with MS20995CU20 lockwire.

4-17. AVIONICS COMPARTMENT DOOR.

4-18. The avionics door is on left side aft of the cabin doors and provides ready access to the avionics equipment. This door is secured when not in use by two latches.

4-19. REMOVAL - AVIONICS COMPARTMENT DOOR. Open door and remove screws, washers, and nuts. Remove door.

4-20. INSPECTION - AVIONICS COMPARTMENT DOOR.

a. Inspect door for damage, cracks, and wear.

b. Inspect hinges and latches for wear, damage, and serviceability.

4-21. INSTALLATION - AVIONICS COMPARTMENT DOOR. Position door in hinges and install screws, washers, and nuts.

4-22. INSPECTION PLATES.

4-23. Inspection plates, secured with screws or fasteners, are provided whenever needed for inspection and maintenance of the helicopter.

4-24. REMOVAL - INSPECTION PLATES. Remove screws attaching plates to structure.

4-25. INSTALLATION - INSPECTION PLATES. Position inspection plate in opening and attach to structure with screws.

4-26. COWLING AND FAIRING.

4-27. Cowling and fairings are used to protect and provide easy maintenance access to engine compartment, intake and exhaust tailpipe areas, and top of main transmission.

4-28. TRANSMISSION FAIRING.

4-29. The transmission fairing is in two sections consisting of forward and induction fairings. Induction section provides for air intake to the particle separator. (Figure 4-2.)

4-30. REMOVAL - TRAINSMISSION FAIRING.

Caution

Protect compressor inlet port opening when the induction fairing is removed.

Note

Forward fairing must be removed before removing induction fairing.

a. Loosen studs securing the forward section of fairing (1). Lift fairing from aircraft.

b. Loosen studs securing induction fairing (2).

c. Unlatch access door on each side of induction fairing and remove screws attaching induction fairing to roof deck.

d. Unlatch engine cowl panels to gain access to internal screws. Remove screws attaching particle separator part of induction fairing to forward firewall. Remove assembly.

4-31. INSPECTION - TRANSMISSION FAIRING.

a. Inspect fairing for cracks, tears, and damage.

b. Inspect hinges and fittings for wear damage and unserviceability.

4-32. INSTALLATION - TRANSMISSION FAIRING.

a. Position induction fairing assembly on forward firewall and align mounting holes.

b. Install screws securing fairing to roof deck.

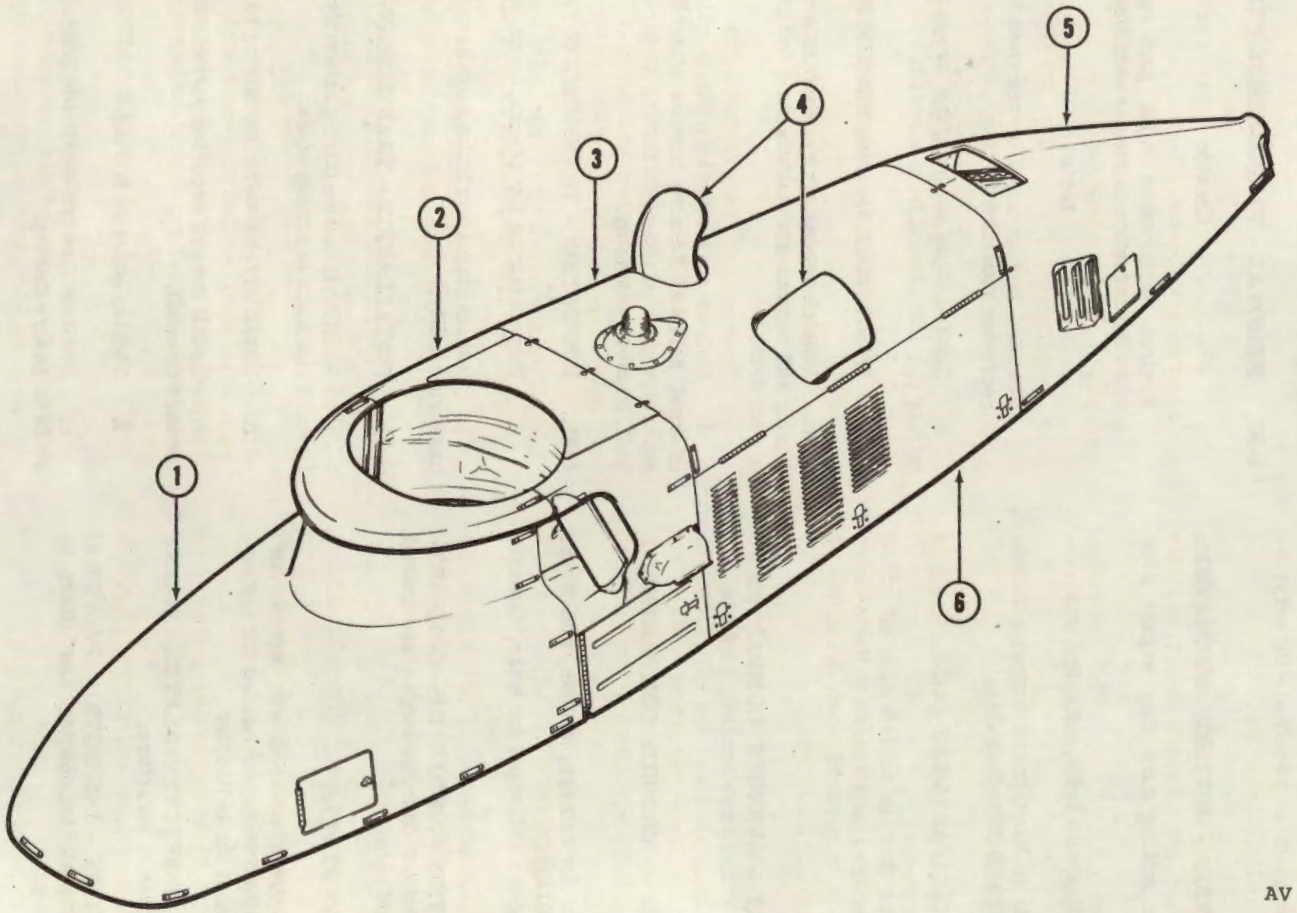
c. Install screws securing particle separator to forward firewall.

d. Tighten studs on fairing.

e. Position forward section in place and tighten studs to secure fairing.

4-33. ENGINE COWLING.

4-34. The engine cowling (3, figure 4-2) is constructed of aluminum alloy and is removable for



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1. Forward Fairing
2. Induction Fairing
3. Engine Cowl
4. Exhaust Stacks
5. Aft Fairing
6. Cowl Side Panel

Figure 4-2. Engine and transmission cowling

engine change. Cowling access panels are provided with snap-open fasteners which permit inspection without removing the cover unit.

4-35. REMOVAL - ENGINE COWLING.

a. Unlatch engine cowling side panels (6) and remove exhaust stack assemblies (4).

b. Disconnect anti-collision light.

c. Unlatch fasteners attaching upper cowling to forward firewall and aft firewall. Remove engine cowling.

4-36. INSPECTION ENGINE COWLING. Inspect engine cowling for cracks, dents, and damage.

4-37. INSTALLATION - ENGINE COWLING.

a. Position engine cowling over forward and aft firewall and latch fasteners.

b. Install exhaust stacks.

c. Connect anti-collision light.

4-38. AFT FAIRING.

4-39. The aft fairing encloses the oil cooler, oil cooler blower fan, and the oil reservoir system. For removal, inspection, and installation follow same procedures as outlined in paragraphs 4-30 through 4-32 as applicable.

4-40. PILOT AND COPILOT SEATS.

4-41. The pilot and copilot seats are constructed of tubing and stretched nylon material. Each seat is equipped with provisions for cushions, safety belts, and shoulder harness.

4-42. REMOVAL - PILOT AND COPILOT SEATS.

a. Remove screws, washers, and nuts securing bottom cushions to supports.

b. Remove seat back cushion by pulling loose from fasteners.

4-43. INSPECTION - PILOT AND COPILOT SEATS.

a. Inspect seat webbing for tears and cuts.

b. Inspect cushions for tears and fraying.

4-44. INSTALLATION - PILOT AND COPILOT SEATS. Install seatback cushions by fasteners and screws, washers, and nuts on bottom cushions.

4-45. PASSENGER SEATS.

4-46. The passenger seats are constructed of aluminum honeycomb panels and form an integral part of the airframe. The center panel of the seat back is removable to gain access to fuel cell. Seats are equipped with shoulder harness, safety belts, and cushions. Seating is provided for two passengers or without seats, space is provided for cargo.

4-47. REMOVAL - PASSENGER SEATS.

a. Seat cushions are removable by pulling cushion and separating fasteners.

b. Remove screws and washers from seat and back panels. Remove seat panels.

4-48. INSPECTION - PASSENGER SEATS.

a. Inspect panels for cracks, dents, and damage.

b. Inspect cushions for tears, fraying, and loose fasteners.

4-49. INSTALLATION - PASSENGER SEATS.

a. Position seat and back panels and secure in place with screws and washers.

b. Secure cushions with fasteners.

4-50. SEAT BELTS.

4-51. Seat belts are provided for pilot, copilot, and two passengers. All belts are secured to seat structure.

4-52. REMOVAL - SEAT BELTS. Remove bolts, washers, and nuts at attaching fittings; lift belts.

4-53. INSPECTION - SEAT BELTS. Inspect belts for cuts, fraying and loose stitching, buckle condition.

4-54. INSTALLATION - SEAT BELTS. Install seat belts to bulkhead fittings with bolts, washers, and nuts.

4-55. SHOULDER HARNESS.

4-56. Web type shoulder harness is provided for each crew member and passenger seat. The forward harness attaches to an inertia reel and passenger harness is secured to a support assembly.

4-57. REMOVAL - SHOULDER HARNESS.

a. Remove aft shoulder harness by removing soundproof blanket and remove screw, washer, and nut securing harness to support assembly.

b. Remove forward shoulder harness by removing bolt, washers, and nut attaching harness to inertia reel strap assembly.

4-58. INSPECTION - SHOULDER HARNESS. Inspect strap for fraying, wear, and loosened stitches.

4-59. INSTALLATION - SHOULDER HARNESS.

a. Install aft shoulder harness at support assembly with screw, washer, and nut and install soundproof blanket.

b. Install forward shoulder harness over seat support assembly and secure with bolt, washer, and nut to inertia reel strap.

4-60. INERTIA REEL.

4-61. An inertia reel, with a manually operated control handle, is incorporated on each pilot seat. The inertia reel is a mechanical restraining device that is designed to hold pilot in a normal seated position during any maneuver which would tend to pitch the pilot forward. Each reel is connected to a shoulder harness with a web strap. An automatic locking mechanism, a webbing roller, and a manual control are incorporated in each unit.

4-62. OPERATIONAL CHECK - INERTIA REEL.

a. Inspect shoulder harness for security of attachment to seat and to reel webbing. Inspect inertia reel for security and attachment to floor structure.

b. Place manual control handle in AUTO position. Disconnect shoulder harness from reel webbing, attach spring scale to end of reel webbing and, while watching scale, slowly pull length of webbing out of inertia reel. The tension indicated shall be not less than two pounds initially nor more than six pounds when the final increment is pulled out of the reel.

c. Cycle control handle from AUTO to MANUAL several times as the reel webbing is being reeled in and out. The reel shall positively lock and hold each time the handle is moved to MANUAL.

4-63. REMOVAL - INERTIA REEL.

a. Remove forward seat panels to gain access.

b. Disconnect control cable and housing from seat.

c. Disconnect reel strap assembly from shoulder harness. (Refer to paragraph 4-55.)

d. Remove screws, washers, and nuts securing reel to airframe.

4-64. INSPECTION - INERTIA REEL.

a. Inspect reel strap for fraying, cuts, and loosened stitches.

b. Inspect the reel for cracks and damage to housing.

4-65. INSTALLATION - INERTIA REEL.

a. Secure reel to airframe with screws, washers, and nuts.

b. Install shoulder harness. (Refer to paragraph 4-55.)

c. Secure control cable and housing to seat.

d. Install forward seat panels.

4-66. WINDSHIELDS AND WINDOWS.

4-67. The windshield and lower windows are constructed of acrylic plastic. The skylight windows in the roof are constructed of tinted polycarbonate plastic.

4-68. INSPECTION - WINDSHIELD AND WINDOWS. Inspect for cracks or damage that might impair pilot's vision.

4-69. REPAIR AND CLEANING - WINDSHIELDS AND WINDOWS.

Caution

Do not use any solvent other than clean water on polycarbonate plastic.

a. Repair polycarbonate windows in steps outlined.

(1) Stop drill at each end of crack using a number 40 drill.

(2) Lightly sand area to be repaired with sandpaper (item 501, table 1-1) about 3/4 inch beyond crack for adhesive application.

(3) Wipe area with dry, clean cloth to remove residue. Do not use any solvent.

(4) Cut section of fiberglass (item 402, table 1-1) to extend a minimum of 1/2 inch around crack or area to be repaired.

(5) Apply one brush coat of urelane adhesive (item 203, table 1-1) to repair area and lay fiberglass over repair area.

(6) Rub patch lightly to assure adhesion to repair area and brush another coat of adhesive over area.

(7) Allow to cure for two days. Handling strength is developed in 24 hours. Accelerated cure time will be two hours under a heat lamp at 160 degree fahrenheit.

b. Repair acrylic windows in accordance with TM 55-405-4.

4-70. SOUNDPROOFING.

4-71. Cabin interior is covered with blankets of soundproofing material to reduce noise level for crew and passengers during operation. Blankets are attached to structure by hook-and-pile and snaptype fasteners. Blankets may be removed for access to equipment for maintenance purposes.

4-72. REMOVAL - SOUNDPROOFING. Each blanket section and control cover may be removed by detaching snaps and/or fasteners as applicable.

4-73. INSPECTION - SOUNDPROOFING. Soundproofing blankets are inspected for missing snaps, loose fastening tape, and tears in cloth.

4-74. INSTALLATION - SOUNDPROOFING. Each blanket section and cover is installed by securing fasteners and tapes in proper areas.

4-75. PLATFORM - CARGO AND SERVICE.

4-76. A platform may be installed in the passenger area for cargo handling. Platform is constructed of plywood sheeting. Provisions for mounting are pins inserted on each end into existing fuselage hardware.

4-77. MAP AND DATA CASE.

4-78. The map and data case is mounted on the aft of the control column with four screws. The case has an ash tray attached to one side.

4-79. REMOVAL - MAP AND DATA CASE. Remove four screws attaching case to column mount.

4-80. INSTALLATION - MAP AND DATA CASE. Position case on mount and install four screws.

4-81. FIRST AID KIT.

4-82. The first aid kit is installed on the right side of the center control column.

4-83. REMOVAL - FIRST AID KIT. To remove first aid kit pull outward on kit to release fasteners.

4-84. INSTALLATION - FIRST AID KIT. To install first aid kit position on fasteners and push to engage snaps.

4-85. FIRE EXTINGUISHER.

4-86. Provisions for mounting a fire extinguisher are provided on the side of the center control column below the first aid kit.

4-87. REMOVAL - FIRE EXTINGUISHER AND BRACKET.

a. Loosen the retaining clamp from around the upper section of the extinguisher by pulling the hinged lever aft. Tension on the extinguisher will be released so that the catch on the hinged lever will be disengaged from the attaching ring.

b. Grasp the fire extinguisher by the handle and remove from the hanger bracket.

c. Remove screws, washers, and nuts attaching hanger bracket to center control column and remove bracket.

4-88. INSPECTION - FIRE EXTINGUISHER. All fire extinguishers should be weighed every six months to determine that they are fully charged. The fully charged weight of fire extinguisher should not be less than four ounces below the gross weight stamped on the nameplate. If this weight is not met the extinguisher should be recharged.

4-89. INSTALLATION - FIRE EXTINGUISHER AND BRACKET.

a. Position bracket on center control column and install attaching screws, washers, and nuts.

b. Position fire extinguisher in hanger bracket with extinguisher handle opposite bracket.

c. Hook the latch of the retaining clamp handle through ring on inboard section of the retaining clamp. Force free end of clamp handle to the left and forward. This will close the clamp and secure the fire extinguisher in the hanger bracket.

4-90. TAIL BOOM.

4-91. The tail boom is a basic monocoque structure and attaches to the fuselage by four bolts. The tail boom supports the tail rotor drive shafting, tail rotor, gear box, vertical fin, and horizontal stabilizer.

4-92. INSPECTION - TAIL BOOM. Inspect for cracks, damage, dents, corrosion, and brackets for cracks.

4-93. TORQUE REQUIREMENT - TAIL BOOM.

a. Remove inspection plate on right side of fuselage at tail boom attaching point.

b. Torque four tail boom attaching bolts 375 to 415 inch-pounds.

c. Install inspection plate.

4-94. HORIZONTAL STABILIZER.

4-95. The horizontal stabilizer is constructed of aluminum and mounted through the tail boom. The stabilizer is supported and secured by plates on each side.

4-96. REMOVAL - HORIZONTAL STABILIZER.

a. Remove screws and washers attaching two upper supports to boom and stabilizer.

b. On each side of tail boom, remove two screws inside of boom attaching forward edge of horizontal stabilizer.

c. Disconnect position light wires at terminal block.

d. Remove screws and washers attaching two lower supports to boom and stabilizer.

e. Slide stabilizer out of tail boom taking care not to damage the surface.

4-97. INSPECTION - HORIZONTAL STABILIZER. Inspect horizontal stabilizer, support plates, and tail boom attaching points for cracks, dents, and damage. Check for loose or worn rivets.

4-98. INSTALLATION - HORIZONTAL STABILIZER.

a. Slide stabilizer into tail boom taking care not to damage the surface.

b. Install lower supports attaching with screws and washers to tail boom and horizontal stabilizer.

c. On top, forward edge of horizontal stabilizer install two screws each side of tail boom at clip supports.

d. Connect position light wires at the terminal block.

e. Install upper supports, attaching with screws and washers.

4-99. VERTICAL FIN.

4-100. The vertical fin is of aluminum honeycomb construction and provides a mount for the tail skid and radio antenna.

4-101. REMOVAL - VERTICAL FIN.

a. Disconnect antenna cable at terminal block or connector.

b. Remove four bolts attaching tail fin to tail boom fittings.

4-102. INSPECTION - VERTICAL FIN.

a. Inspect vertical fin for cracks, dents, and discoloration.

b. Inspect mounting bolts and plate nuts for damaged threads and security.

4-103. INSTALLATION - VERTICAL FIN.

a. Position fin on tail boom and install four bolts of proper length.

b. Connect antenna cable at terminal block or connector.

4-104. TAIL SKID.

4-105. A tubular steel tail skid is attached to the lower section of the vertical fin. The purpose of the tail skid is to warn the pilot of a tail-low attitude when landing.

4-106. REMOVAL - TAIL SKID. Remove attaching spring pin with suitable drift and withdraw tail skid from vertical fin.

4-107. INSPECTION - TAIL SKID. Inspect tail skid for permanent buckles, cracks, and dents.

4-108. INSTALLATION - TAIL SKID. Position tail skid in vertical fin and install spring pin.

SECTION III EMPENNAGE SECTION

(Not Applicable)

SECTION IV PYLON SECTION

(Not Applicable)

SECTION V WING SECTION

(Not Applicable)

SECTION VI ALIGHTING GEAR

4-109. LANDING GEAR

4-110. The landing gear assembly (figure 4-3) consists of two tubular aluminum alloy main skid tubes and two curved tubular aluminum alloy cross tubes. The landing gear is attached to the fuselage structure with four strap assemblies and may be removed and installed with ease. Provisions are made on the skid tubes for installing ground handling wheels and two rings are provided for towing. Each skid tube is provided with replaceable skid shoes. The skid shoes absorb the wear caused by normal ground contact of the helicopter.

4-111. REMOVAL - LANDING GEAR. Complete landing gear can be removed as an assembly, or skids and cross tubes can be removed separately.

a. To remove complete landing gear: With helicopter supported, but not raised on hoist or jacks, remove bolts and washers at each strap assembly which secures cross tubes to structure. Identify caps for location. Raise helicopter off landing gear. (Refer to paragraph 1-59.)

b. To separate skids from cross tubes, remove bolts and washers at saddles on skid tubes. Pull ends of cross tubes from sockets of saddles.

c. Remove four screws on each skid shoe and raise skid tube sufficient amount to remove skid shoes as required.

4-112. INSPECTION - LANDING GEAR.

a. Inspect landing gear cross tubes after hard landings or overloading, checking landing gear to determine if cross tubes have taken a permanent set at excessive spread as follows:

(1) Raise and level helicopter on jacks, so that landing gear is relieved of weight. (Refer to paragraph 1-59.)

(2) Determine center of either cross tube by measurement between bearing straps. Drop a plumb line from center of cross tube to ground. (See figure 4-3, detail C.)

(3) Measure from plumb line to center of each skid at cross tube attachment points. Normal dimension is 37.25. If any measurement exceeds 38.25 inches from center line, or 76.50 inches between skid center lines, replace defective cross tube.

b. Inspect skid shoes for wear and damage.

c. Inspect skid tubes for damage and wear.

d. Inspect tow rings for security and damage.

4-113. INSTALLATION - LANDING GEAR.

a. If separated, assemble skids and cross tubes by inserting ends of cross tubes into sockets of skid saddles and installing bolts and washers.

b. Position skid shoes on skid tube. Install four retaining screws.

c. Position landing gear and carefully lower helicopter to seat four mounting points of structural beams on bearing straps of cross tubes. Install four cap assemblies, and secure each assembly to plate nuts in fuselage by bolts and washers. Remove jacks or hoist.

4-114. GROUND HANDLING EQUIPMENT.

4-115. Two ground handling gear assemblies are provided for quick mounting on landing skids to allow moving helicopter on ground. Each assembly consists of a wheel, support, and lever which retracts or extends the wheels. The wheels are manually operated to extend or retract position and held by a lock pin in either position.

4-116. REMOVAL - GROUND HANDLING EQUIPMENT.

a. Retract wheels and lock in up position.

b. Remove quick release pin from skid tube.

c. Slide wheel and support assembly forward.

4-117. REMOVAL - WHEEL ASSEMBLY.

a. Remove cotter pin and washer from axle. Remove wheel.

b. Remove lock pin and washer from inboard end of axle to remove axle.

4-118. INSTALLATION - WHEEL ASSEMBLY.

a. Install washer on axle and install wheel.

b. Install washer next to wheel and insert cotter pin.

c. Install axle in support and install washer and cotter pin.

4-119. INSTALLATION - GROUND HANDLING EQUIPMENT.

a. Position the support assembly over skid tube with the wheels outboard. Align forward slot of support over the forward mount bolt and slide the support aft engaging the aft mount bolt.

b. Insert quick release pin in skid tube forward of the support assembly. Check security of pin.

4-120. SERVICE - GROUND HANDLING EQUIPMENT. Inflate tires to 75 to 80 psi.

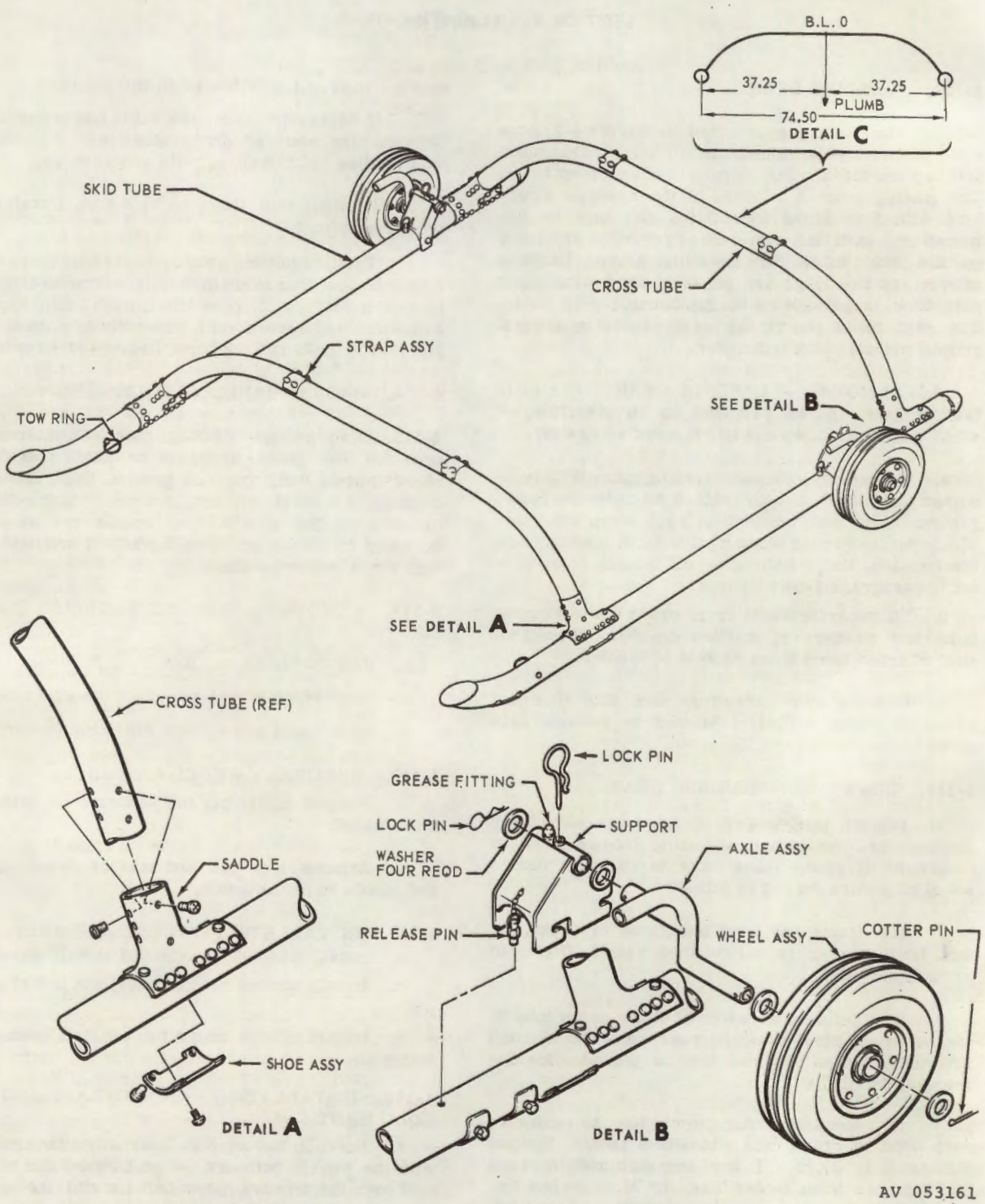

Figure 4-3. Landing gear assembly

CHAPTER 5

POWER PLANT AND RELATED SYSTEMS

SECTION I SCOPE

5-1. PURPOSE.

5-2. This chapter is intended to be used by maintenance crews to perform engine and related system maintenance with maximum efficiency at the organizational maintenance level. Maintenance functions are grouped into sections by component assembly or by system of the engine to which they are related. Each section includes a detail description and chronological instructions as to methods and procedures.

5-3. GENERAL PRACTICES AND PRECAUTIONS.

5-4. When performing maintenance on the engine, the following practices and precautions must be observed.

Warning

USE OF LUBRICATING OIL. Prolonged contact with lubricating oil, (items 2 and 10, table 1-1) may cause a skin rash. Those areas of skin and clothing that come in contact with lubricating oil should be thoroughly washed immediately. Areas in which lubricating oil is used should be adequately ventilated to keep mist and fumes to a minimum.

Lubricating oil may soften paint upon contact. If lubricating oil is spilled on painted surfaces, these surfaces should be thoroughly washed.

Note

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

b. On removal of engine components, exercise care to prevent dirt and other foreign matter from entering the engine. Caps, plugs, or temporary covers shall be used to close all openings. Do not use tape to cover fuel and oil openings. Tape adhesive is soluble in fuel or oil and can cause contamination.

c. Before removing ignition components, disconnect the input power lead at the ignition exciter.

d. If inspection reveals cracking or surface damage, the component or the part must be replaced.

e. Carefully inspect the condition of all replacement parts before installation.

f. Use MS20995C20 lockwire in all locations unless noted otherwise.

SECTION II POWER PLANT

5-5. ENGINE.

5-6. The T63-A-700 gas turbine engine (figure 5-1) consists primarily of multistage axial-centrifugal-flow compressor, combustion section, two-stage gas producer turbine, two-stage power turbine, and power and accessory gearbox. Other engine components are grouped into systems which are fuel control, lubrication, and ignition. Anti-icing air and compressor bleed air components are included in compressor maintenance. The power plant is a free turbine engine which means there is no mechanical coupling between the gas producer turbine and the power turbine. The discharge from the gas producer turbine is directed to and drives the power turbine. Since the turbines are gas-coupled, the output speed of both turbines must be controlled. The fuel control has a throttle lever which is connected to the twist grip on the collective pitch stick through the gas producer controls. The power turbine governor has a similar lever which is connected to the collective pitch stick through the power turbine governor control. Any change in collective pitch resets the governor to a new load demand with power turbine (N2) speed remaining nearly constant. This information is transmitted to the gas producer fuel control, which resets and varies the speed of the gas producer (N1) accordingly. The rpm governor trim actuator is installed in the power turbine governor controls between the collective pitch stick and the power turbine fuel governor lever. It is operated by the N2 GOV switch on the collective pitch stick and allows N2 speed to be varied over a

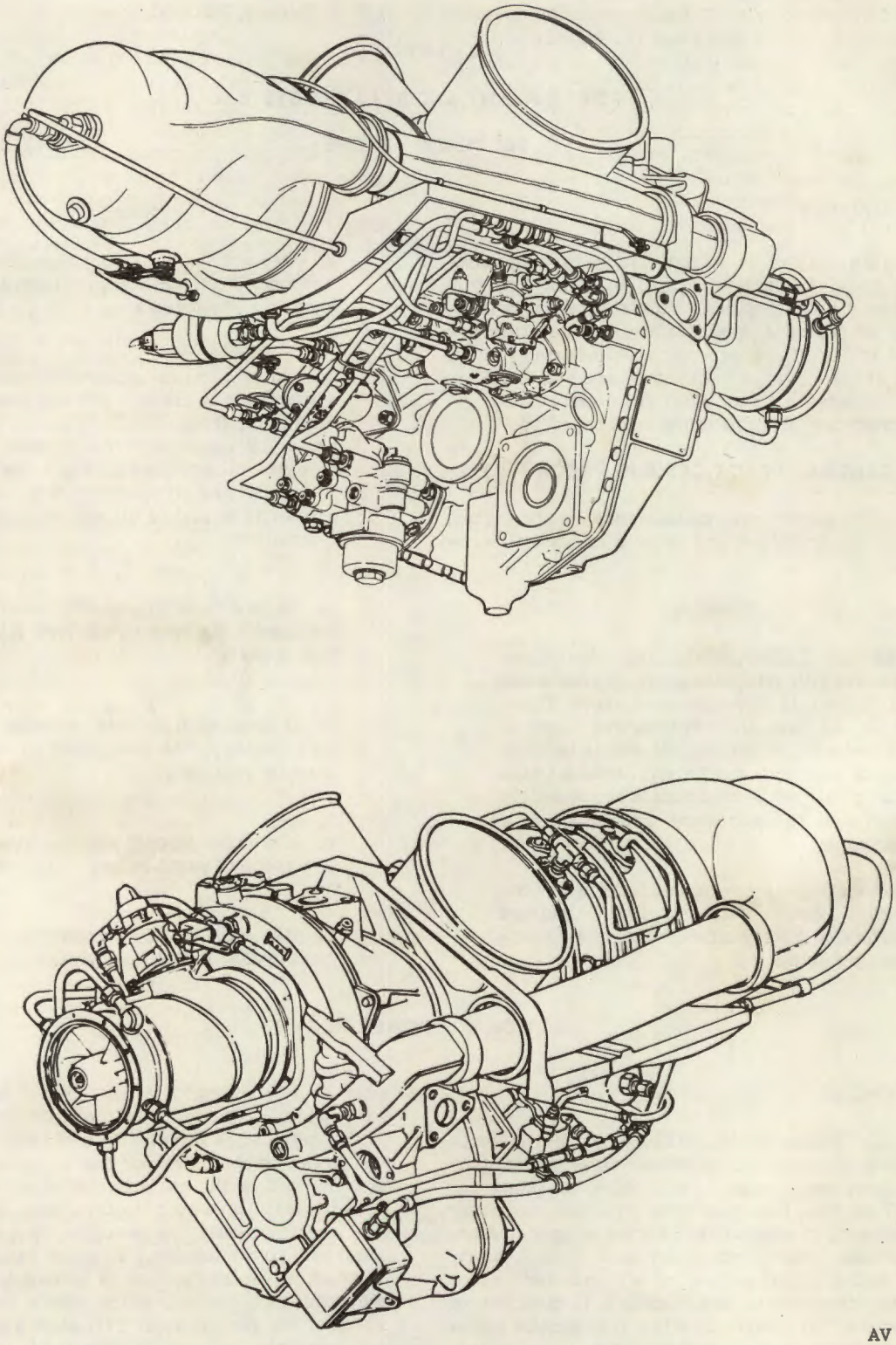

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Figure 5-1. Engine view

range of approximately 98-103 percent. The aircraft employs a collective pitch control system whereby collective pitch of the main rotor establishes the power output demand on the engine. For all practical purposes, the main rotor speed is held constant. As collective pitch is changed, the load on the power turbine changes, tending to change its speed (N2). The gas producer turbine then corrects for this tendency by changing its own speed (N1) accordingly. Speed and load are controlled by a gas producer fuel control and a power turbine governor. Both controls, mounted on the rear side of the power and accessory gearbox, sense change in speed through the reduction gearing. When an N2 offspeed condition is sensed by the power turbine governor, the governor transmits a signal to the gas producer fuel control to change N1 speed.

5-7. ENGINE TROUBLESHOOTING.

5-8. The following lists possible engine troubles, causes, and remedies to aid troubleshooting. Maintenance personnel should have thorough knowledge of turbine outlet temperatures, fuel pressures, oil pressures, and other important details of normal engine performance in order to recognize engine malfunctions if they occur. Malfunction correction may require simple repair of a faulty installation, replacement of an assembly or part, or removal of the engine for inspection and repair. Certain remedies are beyond the scope of organizational maintenance, but are included to preserve continuity in troubleshooting. Refer to the Maintenance Allocation Chart (Appendix B) for the proper maintenance level before attempting any malfunction correction.

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
Engine fails to reach 15% cranking speed	Inadequate torque at starter pad	Check starter system wiring - confirm to aircraft schematics. Check battery or APU for correct output
	N1 binding	Replace affected component
Engine fails to light off	Air in fuel lines	Try a second start. Prime fuel pump
	Faulty spark igniter	Listen for exciter operation. Observe for fuel vapor coming out of exhaust. Replace with known satisfactory unit.
	Faulty circuit to ignition unit	Listen for ignition operation. Observe for fuel vapor coming out of exhaust. Check input power to ignition unit. Isolate and replace defective part.
	Faulty ignition exciter	Listen for ignition operation. Observe for fuel vapor coming out of exhaust. Replace with known satisfactory unit
	Fuel pump inoperative. (Fuel vapor will not be observed leaving the exhaust)	Check pump for sheared drives or internal damage; check for air leaks at inlet lines or pressure differential switch or fluid leaks at outlet
	Fuel nozzle flow obstructed	Replace nozzle if necessary
	Gas producer fuel control remains in cutoff	Check linkage for proper travel

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
	Water or other contaminant in fuel or improper fuel	Check a sample of fuel from the bottom of the tank. If contaminated, disconnect the fuel line at the fuel spray nozzle, drain all fuel then flush the system with clean fuel
	Insufficient fuel in tanks	Fill tanks with fuel
Engine lights off but will not accelerate to idle speed in 45 seconds	Inadequate torque at starter pad	Check condition of battery and starter-er to determine if sufficient gas producer cranking speed is attain-able.
	Improper pneumatic signal to gas producer fuel control	Check air lines and fittings for looseness
		Check for crack accumulator, com-pressor discharge air tubes or outer combustion case
	Gas producer fuel control start derichment too rich	Adjust start derichment
	Faulty gas producer fuel control	Replace control
	Dirty compressor	Inspect and clean the compressor
	Foreign object damage or erosion to compressor	Inspect compressor
	Faulty power turbine governor	Replace governor
	Anti-icing valve open and/or cabin heat on	Close anti-icing valve and/or turn off cabin heat
	Fuel spray nozzle check valve stuck partially open	Replace nozzle
Acceleration temperature too high during start	Dirty inlet filter	Clean air inlet filter
	Obstructed air inlet	Inspect and clean air inlet system
	Reduce battery capacity. This can produce low cranking speed	Recharge or replace battery
	High residual TOT in excess of 200°C (392°F)	Motor engine with starter leaving gas producer lever at FUEL CUT-OFF for at least 10 seconds and until residual TOT drops below 200°C (392°F) before attempting another start
	Leaking engine anti-icing valve or lines	Check rigging. Check lines for prop-er installation. Replace valve if required
	Faulty gas producer fuel control	Replace control

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
	Gas producer fuel control start derichment too rich	Adjust start derichment
	Depreciated starter which is not capable of dry motoring gas producer (N_1) above 15 percent	Replace starter
	Gas producer lever (twist grip) in ground idle (start) position prior to and during starter engagement	Review starting procedure
	Fuel spray nozzle valve stuck full open	Replace nozzle
	Improper installed air discharge tube seal rings	Install rings
Engine speed oscillates at idle	Double check valve	Clean valve; replace valve
	Faulty gas producer fuel control	Replace control
	Faulty governor	Replace governor
Engine instability above idle speed	Airframe vibration	Refer to airframe troubleshooting
	Double check valve	Clean or replace double check valve
	Air sensing tubes leaking	Correct leak
	Fuel control or governor	Isolate governor from the system by removing T fitting from governor and capping governor end of T fitting Cover open governor port to protect from entry of dirt. Make normal engine start and carefully increase power to 100% N_2 with twist control friction on. Check stability at this power. If engine is unstable, replace the fuel control. If stable, replace governor
Idle speed too low	Incorrect gas producer fuel control lever setting	Check lever position and rigging
	Gas producer fuel control idle adjustment incorrectly set	Correct setting
	Tachometer	Replace tachometer
	Air sensing lines leaking	Correct leaks
	Cracked accumulator	Replace accumulator
	Excessive generator load	Reduce electrical load

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
Idle speed too high	Incorrect gas producer fuel control lever setting	Check lever position and rigging
	Gas producer fuel control idle adjustment incorrectly set	Correct the setting
	Contaminated fuel control	Replace control
	Tachometer	Replace tachometer
Excessive oil pressure fluctuation	Oil supply low	Check oil supply and refill
	Oil contamination and foaming	Drain and replace filter. Inspect magnetic chip detectors for metallic particles. Thoroughly flush with engine oil while motoring engine. Drain and refill with engine oil.
	Gage records inaccurately	Check gage and transmitter
Low oil pressure	Lack of oil in reservoir	Fill reservoir with correct oil
	Oil pressure transmitter or indicator giving false indication	Check transmitter or indicator and repair or replace if necessary
	Clogged oil filter	Clean or replace oil filter
	Oil contamination	Drain and replace filter. Inspect magnetic chip detectors for metallic particles. Thoroughly flush with engine oil while motoring engine. Drain and refill with engine oil
	Oil pressure not adjusted	Adjust oil pressure regulating valve
	Increase in oil pump internal clearances or sheared drive	Replace engine
High oil pressure	Oil pressure gage and transmitter records inaccurately.	Check gage and transmitter
	Pressure regulating valve improperly adjusted	Readjust oil pressure regulating valve
No response to oil pressure adjustment	Malfunction of pressure regulator valve	Replace oil filter housing assembly
Oil consumption exceeds 0.2 quart (6.5 ounces) per hour	External oil leaks	Repair leaks
	Oil leakage from power turbine oil bellows seal. (Smoking exhaust on shutdown)	Replace seal
	Leaking turbine rear bearing sump nut	Tighten nut

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
Low power with high TOT	Dirty compressor	Clean the compressor
	Eroded compressor	Replace compressor
	Dirty barrier filter	Clean filter
	Anti-icing valve leaking	Check linkage or replace valve

The effect of anti-icing airflow on the engine performance is as follows:

Type of Operation	Approximate Effect on Performance Available at Power Levels Above 40,000 N_1 Speed*
Constant TOT	A 30 hp decrease and a 1000 rpm (1.95%) decrease in N_1 (gas producer) speed.
Constant N_1 speed	A 7 hp decrease and a 45°F (25°C) increase in TOT
Constant hp and constant collective pitch (load) operation	A 300 rpm (0.59%) increase in N_1 speed and a 60°F (33°C) increase in TOT

*The effects at lower powers and speeds will be only slightly different but still immediate and definite

	Compressor foreign object damage	Replace compressor if damage exceeds limits
	Restricted compressor air inlet	Remove restriction
	Interstage bleed control valve has failed to close	Check compressor discharge pressure sensing line for leaks and for security
		Replace valve
	Heat control valve leaking	Cap off engine bleed manifold to isolate trouble
	Excessive compressor air leaks	Repair leaks
	Faulty TOT indicator	Replace indicator
	Faulty torquemeter indicating system	Bleed gage line. Replace gage
Low measured TOT at normal or high power	Faulty TOT indicator	Replace indicator
	Loose thermocouple wire terminal	Tighten terminals
	Faulty TOT thermocouple assembly	Replace thermocouple assembly

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
Engine N_1 overspeed above maximum limits	Faulty N_1 tachometer	Replace generator or indicator
	Faulty gas producer fuel control	Replace fuel control
Engine N_2 overspeeds	Faulty gas producer fuel control or power turbine governor	Replace fuel control or governor
	Note During ground run after overspeed incident, note the idle speed with the twist grip at the 30° position. If idle speed is normal, suspect the governor - if idle speed is high, suspect the gas producer fuel control as the faulty component.	
	Faulty N_2 or N_R tachometer	Replace generator or indicator
Slow to accelerate from idle detent to power	Loose pneumatic fittings	Tighten or replace as required
	Dirty compressor	Clean the compressor
	Gas producer fuel control acceleration schedule too lean	Replace control
	Excessive compressor air leakage	Check for leaks and repair
	Eroded compressor	Change compressor
	Excessive generator load	Reduce electrical load
TOT approx 28°C (50°F) low with twist grip at idle detent	Interstage bleed control valve stuck closed	Replace valve
Compressor stall during starting or near idle speed. Refer to TM 55-1520-228-10 for stall definition	Interstage bleed control valve stuck closed	Replace valve
	Dirty compressor	Clean the compressor
Compressor stall during acceleration	Compressor erosion	Inspect compressor. Correct as required
	Interstage bleed control valve has failed to open	Replace valve
	Excessively rich gas producer fuel control	Replace control
Fuel dripping from drains and weep holes	Fuel pump drive shaft seal diaphragm ruptured or leaking	Replace pump
	Gas producer fuel control failure	Replace control

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
Faulty torquemeter indication	Faulty torque indicating system	Bleed air from line to gage. Replace gage
	Faulty engine torquemeter	Replace engine
Lack of anti-icing air	Improper rigging	Correct rigging
	Anti-icing air valve stuck closed	Replace valve
Continuous exhaust smoking	Oil leakage from power turbine oil bellows seal	Replace seal
	Internal turbine assembly seal	Replace turbine assembly
Exhaust smoking on shutdown or engine start	Turbine rear bearing sump nut	Tighten sump nut
Static oil leakage from burner drain valve	Airframe check valve	Replace check valve
	Turbine rear bearing sump nut	Tighten sump nut
Compressor rear bearing labyrinth seal venting oil vapor	Diffuser vent orifice loose	Secure vent orifice with lockwire
	Diffuser vent orifice too large	Replace vent orifice with smaller size. If this fails to correct oil venting replace compressor
Exhaust duct emitting sparks	Sand or dirt in engine	Continue engine runup and monitor
	Turbine or compressor blade, vane, or seal damaged	Replace faulty component
Excessive vibration	Bearing failure or accessories section internal failure	Check magnetic plugs and oil filter element for particles. If accumulated particles are found, replace engine
	Compressor damage	Check visible sections of the compressor
	Loose engine mounts	Inspect for security and condition of mounts
	Turbine wheel blade failure	Inspect fourth-stage turbine wheel blades
	Cause uncertain	Install engine in another aircraft or in test stand for comparison. Replace engine if excessive vibration persists
Unable to stop engine	Gas producer fuel control cutoff valve not closed	Close the aircraft fuel shutoff valve to stop the engine. Then check control linkage rigging or replace gas producer fuel control if faulty

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
After fire	Sticking burner drain valve	Replace valve
	Burner drain valve line obstruction	Check the drain lines. Clean or replace as necessary
	Gas producer fuel control cutoff valve not fully closed	Check linkage; replace fuel control
	Fuel spray nozzle valve stuck open	Replace nozzle
Oil leakage from compressor forward bearing seal	Seal failure	Replace compressor
Static oil leakage from power and accessory gearbox breather	Airframe check valve	Replace check valve
	Internal check valve failure under the oil filter housing	Replace check valve
Starter unable to rotate engine immediately after shutdown	Gas producer turbine blade tip rub	If engine will rotate after cooldown, no corrective action required
		If unable to rotate engine after cooldown, replace turbine
Unable to rotate helicopter rotor blades backward	Dirt or sand between No. 4 turbine wheel and shroud	Blow out dirt with compressed air
	Internal engine binding	Replace turbine
Main rotor does not rotate before N_1 reaches 25% during start	Binding N_2 rotor.	Blow out dirt with compressed air
		Replace turbine
Unable to obtain maximum N_2 rpm	Air leak in control lines	Tighten line fitting
	Improper control rigging	Rerig control
	Faulty governor	Replace governor

5-9. ENGINE INSPECTION.

a. Visually inspect engine for any broken or missing lockwire, loose bolts, broken or loose connections, security of accessories, and fuel and oil leaks.

b. Inspect inlet duct for foreign objects, check security of linkages and check lube oil level.

c. Visually inspect compressor discharge air tubes for cracks and dents. Cracks are not permitted. Do not allow more than three dents up to 1/16 inch deep and 1/2-inch in diameter.

d. Check diffuser vent orfice to ensure that it is properly lockwired to vent tube (figure 5-2). Ensure that neither dirt nor other foreign matter is lodged in orifice. Only remove orifice to clean; use solvent (item 300, table 1-1) and a bristle brush. Be sure to install and lockwire orifice to vent tube after cleaning.

5-10. COMPRESSOR.

5-11. Air is supplied to the inlet of the engine from an airframe furnished air inlet duct which is attached to the compressor front support (figure 5-3). The struts of the compressor front support guide air in the proper direction into the first stage of the compressor rotor. As the air passes through the compressor, it is alternately speeded up by the rotor blades and slowed down by the compressor (stator) vanes. At the same time, the air is squeezed into an ever decreasing space. This results in increases of both the air pressure and temperature. The sixth-stage compressor vanes direct air into the impeller. The impeller vanes accelerate the air into an ever decreasing space to further increase the air pressure and temperature. The impeller discharges air into the

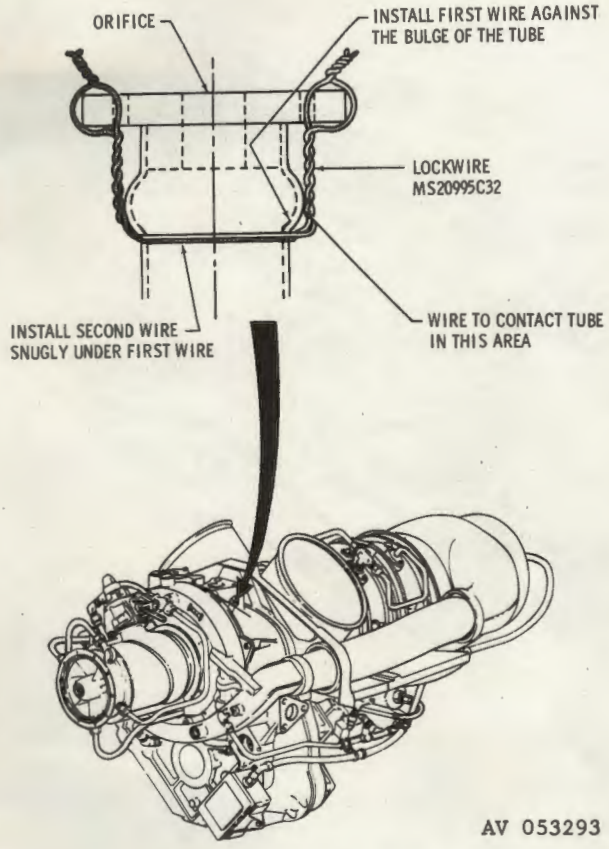

Figure 5-2. Diffuser orifice

vanes of the front diffuser. The front diffuser vanes direct air into the diffuser scroll. The diffuser scroll collects the compressor outlet flow at a constant velocity and directs it through two elbows to two ports of equal size. Each elbow has turning vanes which direct air rearward. Compressor discharge air is delivered to the combustion section through two compressor discharge air tubes which are located on either side of the engine.

5-12. INSPECTION - COMPRESSOR.

a. Visually inspect the general condition and security of the interstage bleed control valve.

b. Visually inspect the general condition and security of the sensing line.

(1) Cracks are not allowed.

(2) Chafing at flared tube ends is not allowed.

(3) Chafing in other areas, deeper than 0.010 inch is not allowed.

(4) Nicks deeper than 0.010 inch are not allowed.

(5) Dents deeper than 0.015 inch are not allowed.

5-13. ACCELERATION BLEED AIR SYSTEM.

5-14. The compressor bleed air system permits rapid engine response. The system has a compressor discharge pressure sensing port on the scroll, tubing from the sensing port to the bleed valve, a compressor bleed control valve (figure 5-4), and a bleed air manifold on the compressor case. Elongated slots between every other vane at the compressor fifth stage bleeds compressor air into a manifold, which is an integral part of the compressor case. The manifold forms the mounting flange for the compressor bleed control valve when the compressor case halves are assembled. Compressor discharge air pressure sensing, for bleed control valve operation, is obtained at a sensing port on the compressor scroll. The bleed control valve is normally open; it is closed by compressor discharge pressure. See figure 5-5 for bleed control valve opening and closing speeds.

5-15. COMBUSTION SECTION.

5-16. An outer combustion case and the combustion liner form the combustion section. A spark igniter and a fuel nozzle are installed on the rear of the outer combustion case. Air enters the single combustion liner at the rear through holes in the liner. The air is mixed with fuel sprayed from the fuel nozzle, and combustion occurs. Combustion gases move forward out of the combustion liner to the first stage gas producer turbine nozzle.

5-17. INSPECTION - COMBUSTION SECTION.

a. Visually inspect the combustion section outer shell for cracks and dents. Cracks are not allowed. Do not allow more than three dents up to 1/8-inch deep and 1.0-inch in diameter.

b. Ensure that the fuel supply hose, ignition lead, and burner drain valve are securely installed.

5-18. TURBINE.

5-19. The gas producer turbine and power turbine supports, a turbine and exhaust collector support, a gas producer turbine, and a power turbine form this assembly. The turbine is mounted between the combustion section and the power and accessory gearbox. The two-stage gas producer turbine drives the compressor and accessory gear train. The two-stage power turbine furnishes the output power of the engine. The expanded gas discharges upward through the twin ducts of the turbine and exhaust collector support.

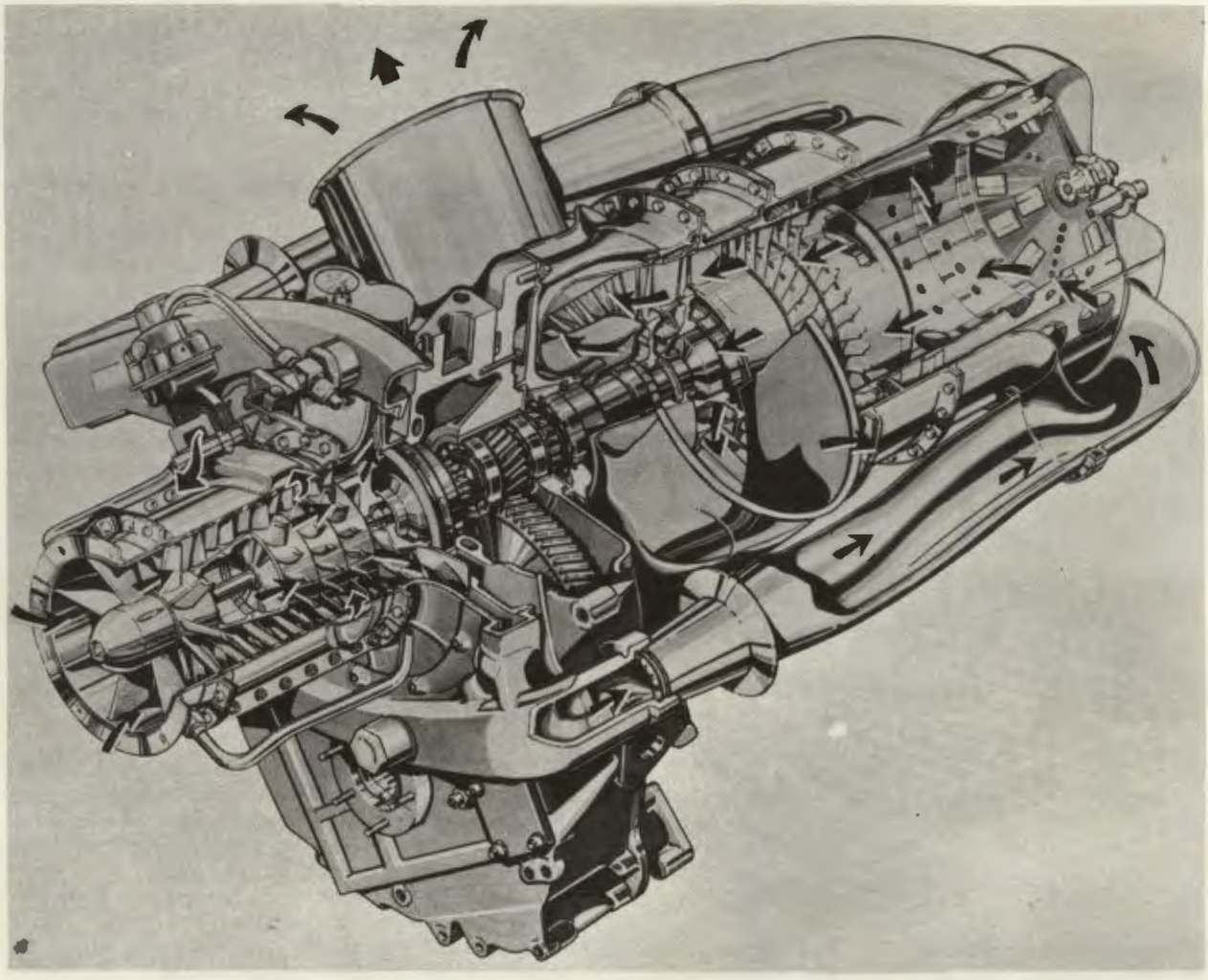

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Figure 5-3. Air flow

5-20. INSPECTION - TURBINE.

a. Visually inspect thermocouple system (terminal block and wiring harness) for external damage, security of electrical connections, and broken or frayed wires.

b. Visually inspect turbine firewall and firewall shield for any cracking. No cracks or tears are allowed.

c. Visually inspect exhaust collector for any cracking. No cracks in the exhaust ducts and outboard structure are allowed.

5-21. POWER AND ACCESSORY GEARBOX.

5-22. The main power and accessory drive gear trains are enclosed in a single gear case. The gear case serves as the structural support of the engine. All engine components, including the engine-mounted accessories, are attached to the case. At 100% engine speed, reduction gearing reduces power turbine speed from 35,000 to 6,000 rpm at the output drive pads. The power turbine gear train has a torquemeter to measure engine output torque. Accessores driven by the power turbine gear train are the power turbine tachometer-generator (N_2) and the power turbine governor. The gas producer gear train drive the oil pump, fuel pump, gas producer fuel control, and gas producer tachometer-generator (N_1). The gearbox has a spare accessory mounting pad. If an accessory is installed on this pad, it would be driven by the gas producer gear train. During starting, the starter-generator cranks the engine through the gas producer gear train.

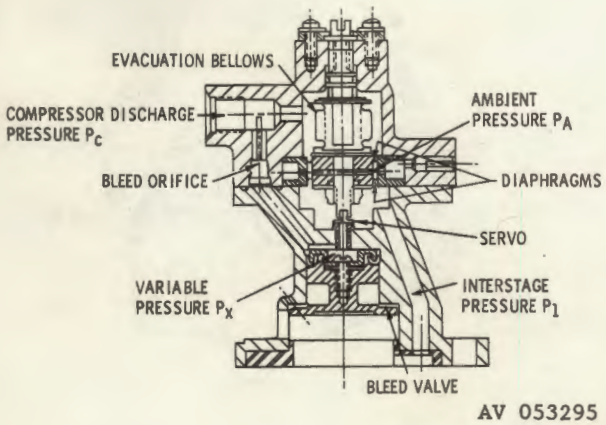


Figure 5-4. Compressor bleed control valve

5-23. INSPECTION - POWER AND ACCESSORY GEARBOX.

a. Visually inspect the gearbox for cracks especially in these stress areas: engine mounts, accessory pads, and splitlines. Cracks are not permitted.

b. Visually inspect gearbox for oil leaks. If area below seal at any accessory pad (figure 5-6) is dripping, the seal assembly must be replaced.

c. If the ignition exciter, fuel control, governor, or fuel pump has been removed, visually inspect the gearbox studs for security, worn areas, and damaged threads. Loose or damaged studs are not permitted.

5-24. ENGINE MOUNTS.

5-25. The engine is supported on the engine deck with three bi-pod mounts, located on the right, left and lower side of the engine.

5-26. INSPECTION - ENGINE MOUNTS. Inspect tube assemblies and weld areas for cracks.

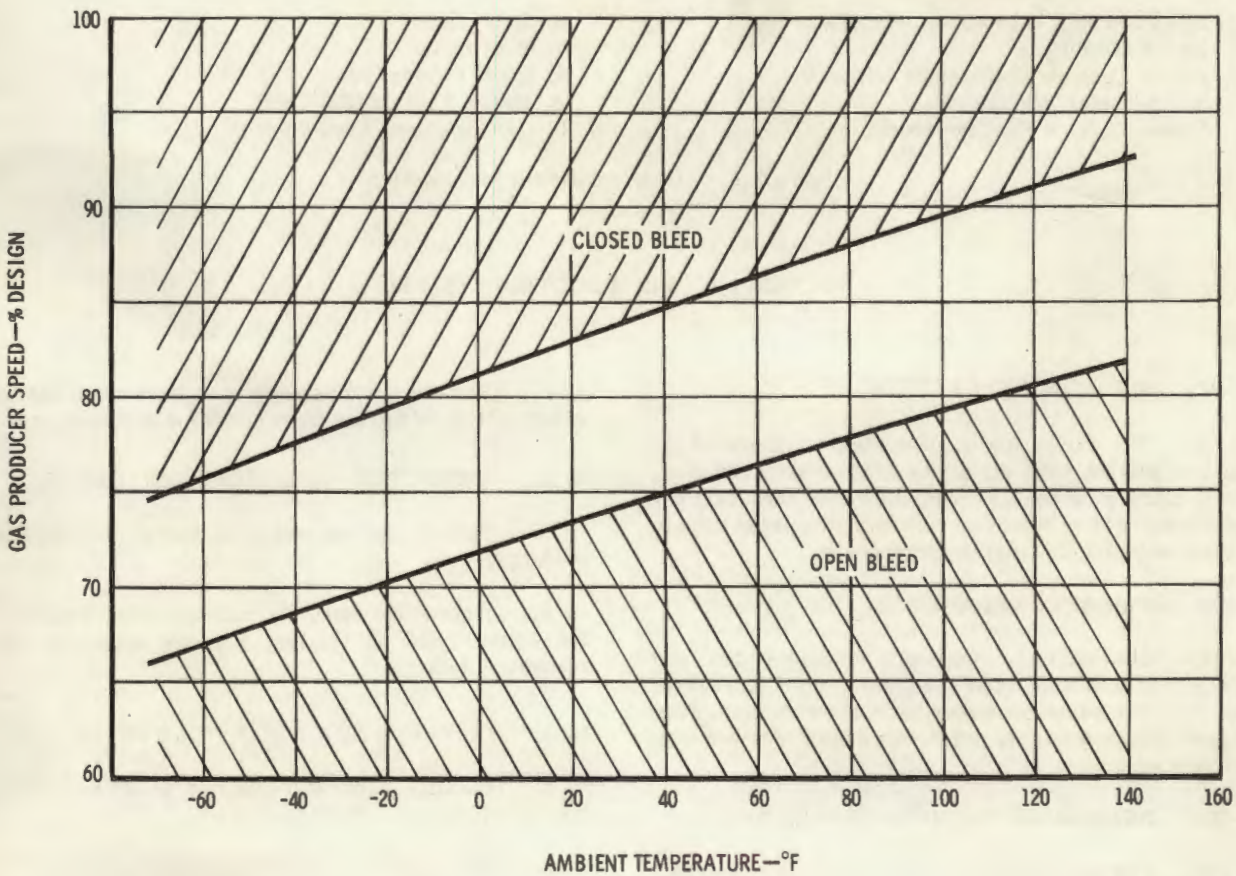
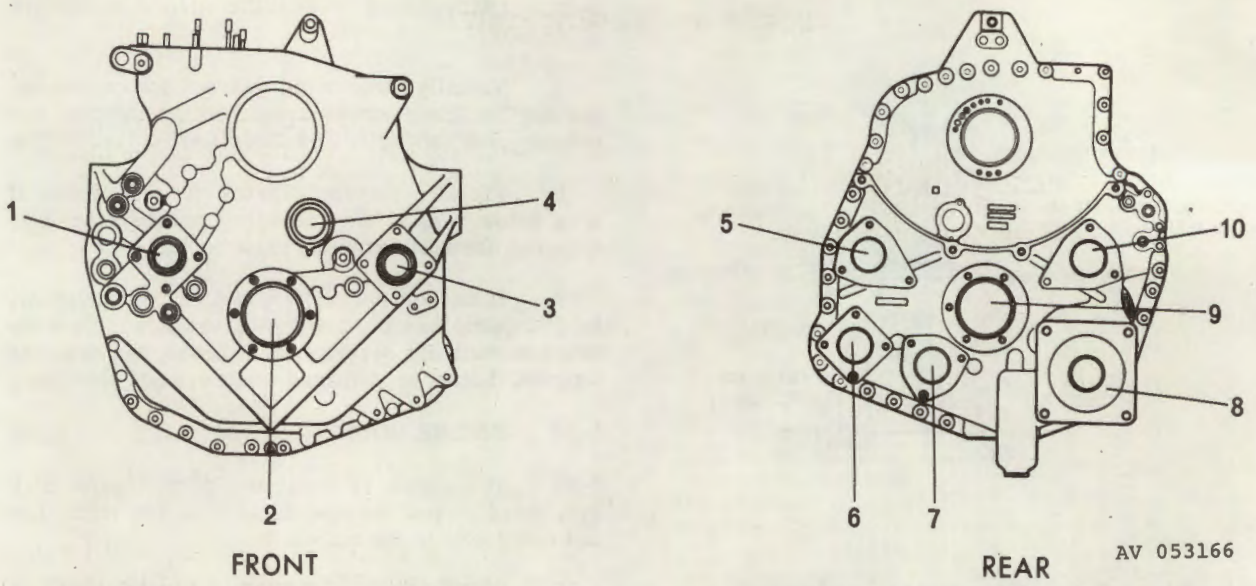


Figure 5-5. Bleed valve operation



1. Gas Producer Tachometer-Generator
2. Power Output
3. Power Turbine Tachometer Generator
4. Torquemeter Spanner Nut
5. Power Turbine Fuel Governor
6. Spare (Not Used)
7. Fuel Pump
8. Starter-Generator
9. Power Takeoff (Not Used)
10. Gas Producer Fuel Control

Figure 5-6. Gear accessory pad location

SECTION III AIR INDUCTION SYSTEM

5-27. AIR INDUCTION SYSTEM.

5-28. The engine air inlet system consists of induction fairing with air inlets on each outboard side. This fairing provides mounting for the particle separator which removes contaminates from the air before entering the engine compressor.

5-29. PARTICLE SEPARATOR.

5-30. The particle separator removes dirt and other contaminates from the incoming air and ejects the dirt out ducts on either side of the fairing. This allows cleaned air to enter the engine compressor section.

5-31. REMOVAL - PARTICLE SEPARATOR.

a. Remove fairing. (Refer to paragraph 4-28.)

b. Remove particle separator from mount inside of aft section of fairing by removing attaching screws.

5-32. INSPECTION - PARTICLE SEPARATOR.

a. Inspect for cracked, damaged, or clogged openings.

b. Inspect for security and condition of mounting screws and nut plates. Replace separator for inspection failure.

5-33. INSTALLATION - PARTICLE SEPARATOR.

a. Position particle separator in aft section of fairing and install attaching screws.

b. Install fairing. (Refer to paragraph 4-28.)

SECTION IV EXHAUST SYSTEM

5-34. DESCRIPTION.

5-35. The exhaust system consists of two engine tailpipes and attach clamps. These are removed and installed by the clamp on the engine.

5-36. INSPECTION - EXHAUST SYSTEM. Inspect the engine tailpipes for large dents, damaged flanges, cracks, corrosion or other damage, and security.

SECTION V FUEL SYSTEM

5-37. FUEL SYSTEM.

5-38. The fuel system incorporates a single bladder type, self-sealing cell with a total usable capacity of 73 gallons. The cell is located below and aft of the passenger seat. Mounted in the bottom of the cell is one boost pump, one fuel quantity transmitter, low fuel transmitter, and one fuel sump drain. Installed in the top of the cell is one fuel quantity transmitter and a vent line. The fuel quantity gage registers in pounds. A fuel filler cap is located on the right side just aft of the passenger door. The fuel shut-off valve is mounted on the upper right side and is manually operated. The cell is laced with nylon cord to the ship's structure for support. A fuel filter, low fuel level, and fuel boost caution light are located on the caution panel.

5-39. TROUBLESHOOTING - FUEL SYSTEM. Troubleshoot the fuel system according to the following table.

Note

Prime the fuel system by disconnecting the ingition exciter input lead, the fuel line at the engine fuel spray nozzle, and motoring the engine until full flow of fuel is observed. Do not exceed starter operating limits.

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
No Fuel Flow to Engine Driven Fuel Pump	No fuel in fuel cells	Service fuel cells (paragraph 1-65)
	Disconnected fuel line	Check all fuel lines for security
	Ruptured or broken fuel line	Replace ruptured or broken fuel line
	Defective fuel shutoff valve	Replace fuel shutoff valve
Restricted Fuel Flow to Engine Drive Fuel Pump	Clogged filter	Drain filter and replace filter element
	Clogged fuel line	Clean or replace defective fuel line
	Defective fuel shutoff valve	Replace fuel shutoff valve

5-40. GENERAL MAINTENANCE - FUEL SYSTEM.

5-41. Organizational maintenance will consist of visual inspections, ground operational checks, cleaning of filter and strainers, specified adjustment of control linkage systems and fuel control unit as required, the replacements of piping, fittings, seals, and units which are accessible without extensive disassembly. Observe general notes and precautions below, and procedures for replacement or adjustment of principal components in subsequent paragraphs.

Note

a. Conduct any defueling or drainage of fuel in accordance with applicable directives, and with extreme care to avoid fire hazards.

b. Before removing any line or hose, be sure it is properly identified and its route understood for replacement in same manner.

c. Cap or cover any open lines, fittings, or exposed opening in units (other than normal vents and drains) to protect fuel system from contamination. Be sure vent lines are not obstructed.

d. Defuel aircraft for removal of any parts in the fuel cell area.

5-42. BOOST PUMP.

5-43. Boost pump (1, figure 5-7) is electrically operated, mounted on a plate in the sump assembly and accessible under the fuselage. The boost pump supplies a head pressure of fuel to the engine fuel pump.

5-44. REMOVAL - BOOST PUMP.

Note

Mark position of fuel boost pump flange to sump plate before removal to aid in reassembly.

a. Disconnect electrical wiring from pump.

b. Remove 12 bolts and washers to detach boost pump (1) mounting flange and gasket from sump plate.

c. Lower pump from fuel cell and remove bolt, plug and packings attaching fuel hose (2) to pump. Remove pump.

5-45. INSTALLATION - BOOST PUMP.

a. Replace gasket and packings. Connect fuel hose (2) to boost pump with bolt, plug, and packings in place.

b. Position boost pump mounting flange by alignment of marks on sump plate and install 12 bolts and washers. Torque bolts 45 to 55 inch-pounds.

c. Connect electrical wiring.

5-46. INSPECTION AND TESTING. Inspect for leaks after fueling and operating.

5-47. PRESSURE SWITCH.

5-48. Pressure switch (3) is installed in fuel line (2) fitting at top of tank. This lights the "Fuel Boost" light in the cockpit when the boost pump malfunctions or any loss of pressure is evident.

5-49. REMOVAL - PRESSURE SWITCH.

a. Remove access plate above the filler cap. Disconnect electrical wire.

b. Cut lockwire and remove switch (3).

5-50. INSPECTION - PRESSURE SWITCH.

a. Inspect electrical terminal for damage and leakage.

b. Inspect valve for evidence of leakage and thread condition.

5-51. INSTALLATION - PRESSURE SWITCH.

a. Install new gasket and install switch.

b. Connect electrical lead.

c. Lockwire valve and install access plate.

5-52. LOW LEVEL SWITCH.

5-53. The low level switch (4) is a float type switch located in the fuel sump. This lights the "20 MIN FUEL" warning in cockpit when fuel level drops low enough to activate the switch.

5-54. REMOVAL - LOW LEVEL SWITCH.

Note

Low level switch (4) must be removed through either the fuel transmitter opening or boost pump opening.

a. Disconnect electrical leads from switch.

b. Remove nut attaching switch standpipe and remove low level unit from fuel cell.

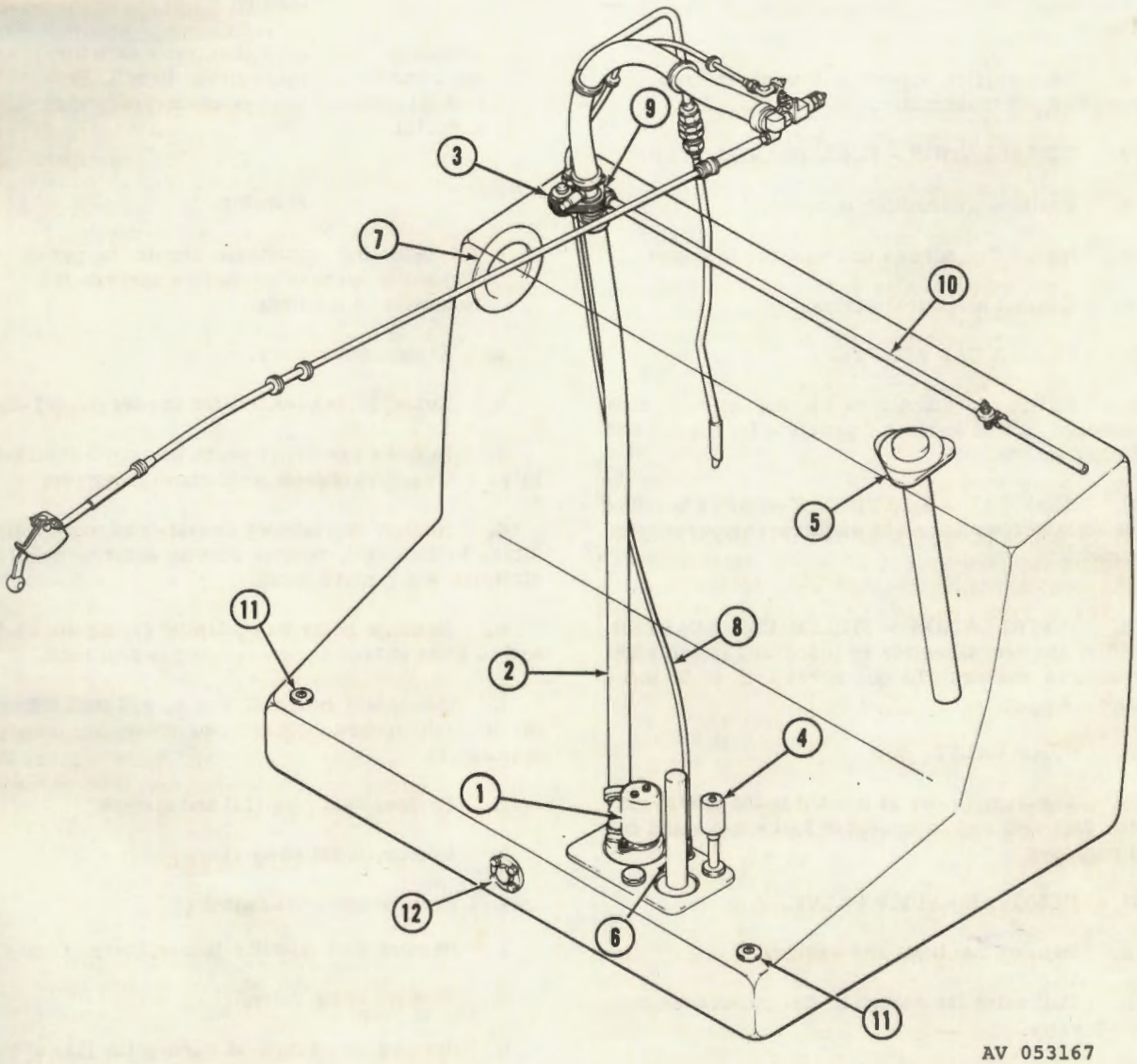
5-55. INSTALLATION - LOW LEVEL SWITCH.

a. Position switch in fuel sump and attach with nut and washer.

b. Connect electrical leads.

5-56. FUEL TRANSMITTER.

5-57. Two fuel transmitters, upper (5) and lower (6) are installed in fuel cell. These measure fuel quantity in the fuel cell.



1. Boost Pump
2. Fuel Hose
3. Pressure Switch
4. Low Level Switch
5. Upper Transmitter
6. Lower Transmitter
7. Filler Cap Adapter
8. Hose
9. Fuel Fittings
10. Vent Pipe
11. Attach Point
12. Attach Point

Figure 5-7. Fuel cell assembly

5-58. REMOVAL - FUEL TRANSMITTER.

a. Disconnect electrical wiring from transmitter.

b. Remove five screws and washers from unit flange. Remove transmitter.

5-59. INSTALLATION - FUEL TRANSMITTER.

a. Position transmitter in fuel cell.

b. Install five screws and washers in flange.

c. Connect electrical wiring.

5-60. FILLER CAP ADAPTER.

5-61. Filler cap adapter is located on right side of fuselage, aft of doors and provides for fueling and defueling access.

5-62. REMOVAL - FILLER CAP ADAPTER. Remove eight screws and eight washers, remove adapter assembly.

5-63. INSTALLATION - FILLER CAP ADAPTER. Position adapter assembly in place and install eight screws and washers. Torque screws 45 to 55 inch-pounds.

5-64. SUMP VALVE.

5-65. The sump valve is located in the lowest part of the fuel cell and is used for fuel sample and defuel purposes.

5-66. REMOVAL - SUMP VALVE.

a. Remove two bolts and washers.

b. Pull valve far enough to disconnect hose, then remove valve.

5-67. INSPECTION - SUMP VALVE. Inspect valve for positive cutoff and thread condition.

5-68. INSTALLATION - SUMP VALVE.

a. Connect hose to valve and position valve in sump.

b. Install two bolts and washers. Torque bolts 45 to 55 inch-pounds.

5-69. FUEL CELL.

5-70. The fuel cell is constructed of self sealing material and is a bladder type single unit installed in the fuselage cavity under the passenger seat.

5-71. REMOVAL - FUEL CELL.

Caution

Handle the fuel cell with extreme care during removal to avoid damage to cell. Protect all openings to prevent entry of foreign material.

Warning

All defueling operations should be performed in an area where fire hazards are reduced to a minimum.

a. Disconnect battery.

b. Defuel helicopter. (Refer to paragraph 1-65.)

c. Remove passenger seats, soundproof blankets in rear area, and access panel above filler cap.

d. Remove two screws in seat-back panel which attach to fuel cell, remove screws securing panel to airframe and remove panel.

e. Remove filler cap adapter (7, figure 5-7) and 10 bolts at tank access opening in seat back.

f. Disconnect hoses (2 and 8) and fuel fittings (9) through access opening and filler cap adapter opening (7).

g. Remove vent pipe (10) and clamps.

h. Remove boost pump (1).

i. Remove low level switch (4).

j. Remove fuel quantity transmitters (5 and 6).

k. Remove sump valve.

l. Remove one screw at each point (11) of the seat panel which attaches fuel cell to airframe. Remove four bolts at attach point (12) on front of seat.

m. Remove nylon lashing attaching cell to fuel cell cavity and two nuts and washers attaching cell to top of cavity.

n. Collapse cell and remove from fuselage cavity through seat opening.

5-72. INSPECTION - FUEL CELL.

a. Inspect the exterior bottom of the fuselage beneath the fuel cells for indications of fuel leakage.

b. Inspect fuel cell drain valve for leaks and lockwire for security.

c. Inspect fuel lines, fittings, and fuel cell covers for leakage, damage, and security.

d. Inspect tank unit and electrical wiring for damage and security.

e. Inspect fuel shut off valve for leaks, damage, and security.

f. Open left-hand engine access door. Inspect fuel inlet line, engine pump drain valve, and fuel line connections at pump and bulkhead fittings for leaks, damage, and security. Inspect fire sleeve for cuts, tears, and punctures. Close left-hand engine access door.

g. Check that vent fairing opening is free of obstructions such as ice, mud, or other foreign matter that may have come in contact with underside of aircraft. Inspect for damage and security.

5-73. INSTALLATION - FUEL CELL.

Caution

Inspect fuel cell cavity for foreign objects before installation of fuel cell. Exercise extreme caution to preclude dropping of tools, hardware, etc. in the fuel cell cavity or the fuel cell. Ensure that all sharp edges, corners, and rivet heads are protected with tape and/or chafing strips. Be sure that cell is warm enough to be flexible.

a. Insert the collapsed cell through the seat-back opening and position the forward section of the cell under the seat.

b. Install screw and washer at each forward point of the seat panel (11) and four bolts and washers at attach point (12).

c. Lace and tie securely the rear edge then front edge of upper cell section to the top of cell cavity and install two nuts and washers at top of cell.

d. Install three bolts and washers at upper transmitter (5) mount bracket, torque 45 to 55 inch-pounds.

e. Install vent line (10) and clamps on inner top of cell.

f. Install hoses (2 and 8) and fuel fittings (9) through access opening and filler cap opening (7).

g. Install filler cap adapter (7) and 10 bolts at tank access opening in seat back.

h. Attach fuel cell sump to airframe with four screws.

i. Install low level switch (4).

j. Install fuel transmitters (5 and 6).

k. Install sump valve.

l. Install boost pump (1).

m. Install seat-back panel and install two screws attaching cell to panel.

n. Fuel aircraft and check for leaks at all visible connections.

o. Install access panel above filler cap, passenger seats and soundproofing.

5-74. FUEL SHUT-OFF VALVE.

5-75. Fuel shutoff valve is manually operated by lever and push-pull cable assembly located along the top of the cabin. The lever is accessible to both crew members. The valve is mounted in cabin roof at front of engine pan.

5-76. REMOVAL - FUEL SHUT-OFF VALVE.

a. Remove fuel tank to valve inlet hose nut and nut, washer and screw on attaching clip.

b. Remove cotter pin, washer, and pin connecting control cable to valve actuating lever.

c. Remove engine inlet fuel hose, nut and washer at firewall. Remove valve.

5-77. INSPECTION - FUEL SHUT-OFF VALVE.

a. Check valve for smooth operation full travel of on-off lever.

b. Inspect for fuel leaks at attaching hoses and fittings on installation.

5-78. INSTALLATION - FUEL SHUT-OFF VALVE.

a. Position valve in firewall and install screw, washer, and nut in attaching clip.

b. Install washer, nut, and engine inlet fuel hose on firewall fitting of valve.

c. Install fuel hose and control cable with pin, washer, and cotter pin.

5-79. FUEL PUMP AND FILTER ASSEMBLY.

5-80. The fuel pump and filter assembly (figure 5-8) has two gear-type pumping elements arranged in tandem and driven by a common drive shaft. Fuel enters the engine fuel system at the inlet port of the pump and passes through a low pressure filter before entering the gear elements. The gear elements are in parallel. Each pumping element has sufficient capacity

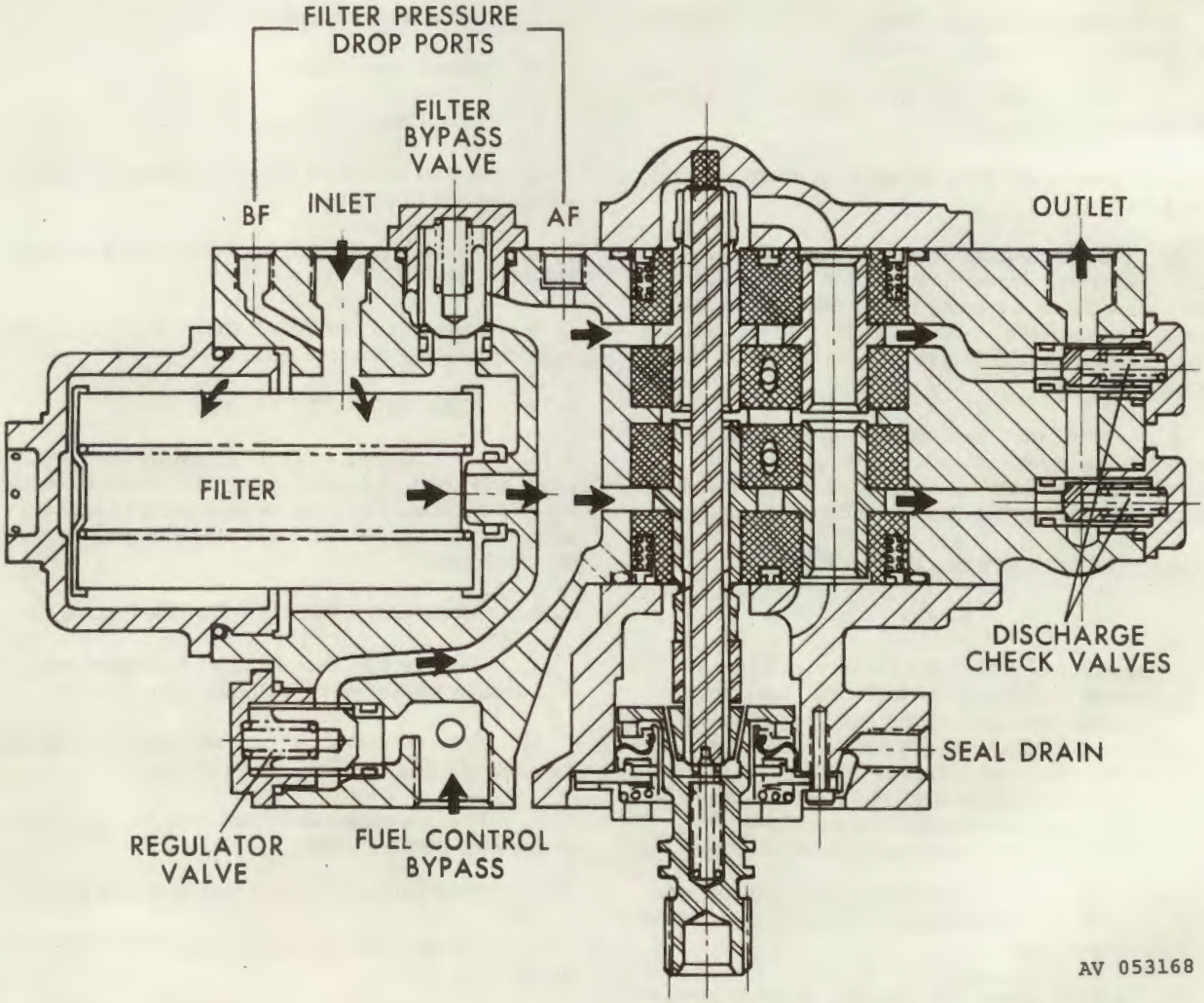


Figure 5-8. Fuel pump and filter assembly

to permit takeoff power operation if the other pumping element fails. Two discharge check valves are in the assembly to prevent reverse flow if one gear pumping element fails. A bypass valve in the pump assembly bypasses fuel if the filter element becomes clogged.

5-81. The bypass return flow from the fuel control is passed back to the inlet of the gear elements through a pressure regulating valve which maintains the bypass flow pressure above inlet pressure. By means of passages leading to auxiliary filling ports on the periphery of the gear elements, a portion of the bypass flow is used to fill the gear teeth when vapor-liquid conditions exist at the inlet to the gear elements.

5-82. FUEL FILTER.

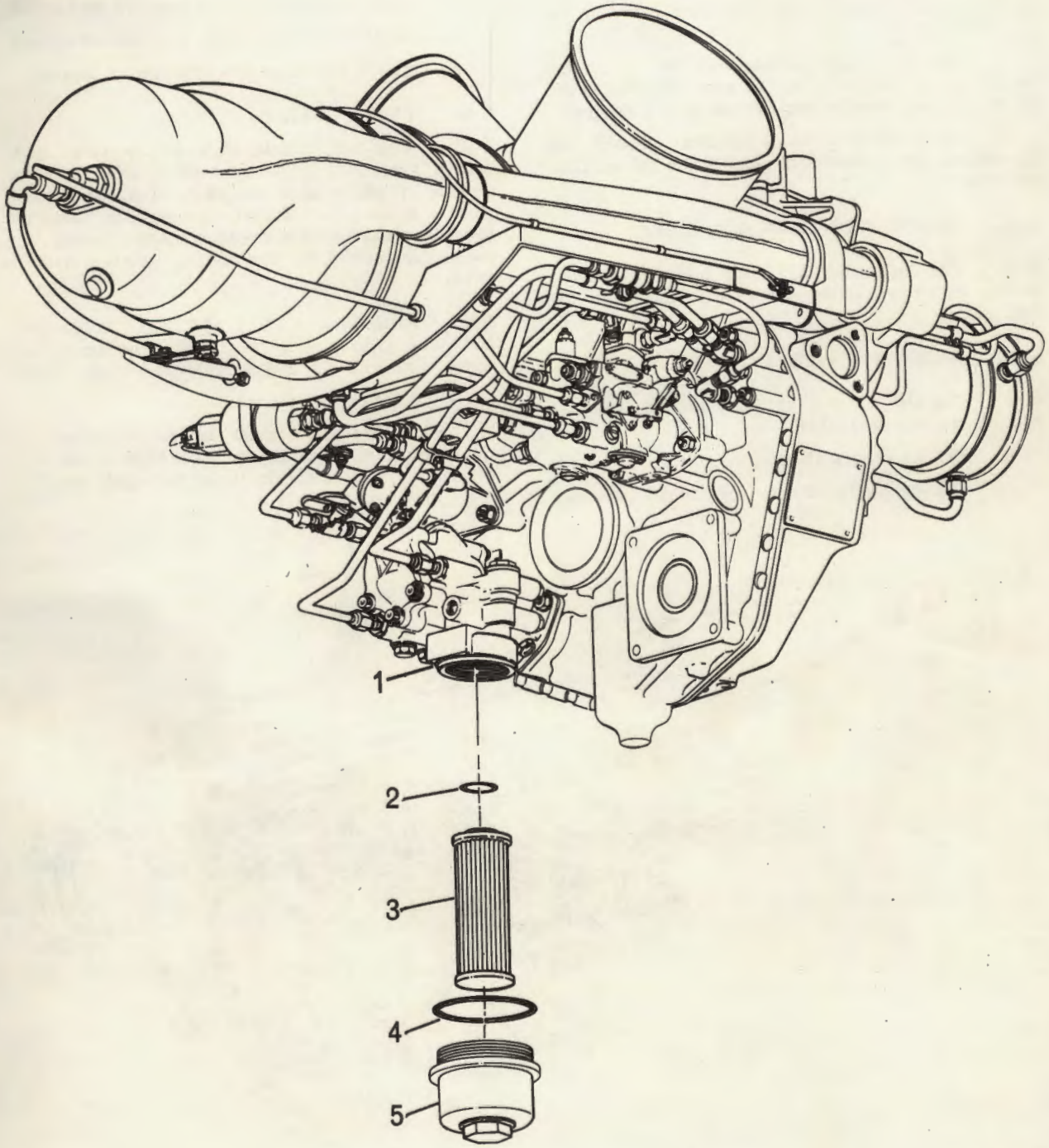
5-83. A 10-micron paper filter is located inside the fuel pump assembly (figure 5-8) upstream of the gear elements. It is retained by a threaded cover (distinguished by a hex) which can be found on the lower side of the pump assembly. A container should be used to catch undrained fuel when the filter cover is removed.

5-84. REMOVAL - FUEL FILTER.

a. Cut the lockwire and loosen the cover (5, figure 5-9) by turning the one-inch hex head off. Place a container under the pump assembly as some fuel spillage is likely.

b. Remove the cover (5) and element (3). Discard the element (3) and packings (2 and 4).

5-85. CLEANING - FUEL FILTER. Clean filter cover with fuel-soaked cloth or solvent (item 300, table 1-1).



AV 053297

1. Fuel Pump
2. O-Ring
3. Filter Element
4. O-Ring
5. Cover

Figure 5-9. Fuel filter assembly

5-86. INSTALLATION - FUEL FILTER.

a. Install new packing (2) in the new element (3) and insert element into the filter cavity in the pump housing.

b. Install a new packing on the cover and install cover on the pump housing. Tighten cover 50 to 60 inch-pounds and secure with lockwire.

c. After replacement of the filter element, run the engine for a short time and check the splitline for leaks.

5-87. ENGINE FUEL LINES AND TUBES.

5-88. The engine fuel lines are fuel lines located on the engine excluding the supply line from the fuel cells.

5-89. INSPECTION - FUEL LINES AND TUBES.

a. Visually inspect for loose clamps, cracked fittings, and damaged tubes.

b. Cracks are not allowed.

c. Chafing at flared tube ends is not allowed.

d. Chafing, in other areas, deeper than 0.010 inch is not allowed.

e. Nicks deeper than 0.010 inch are not allowed.

f. Dents deeper than 0.015 inch are not allowed.

g. Check fuel lines for evidence of leakage.

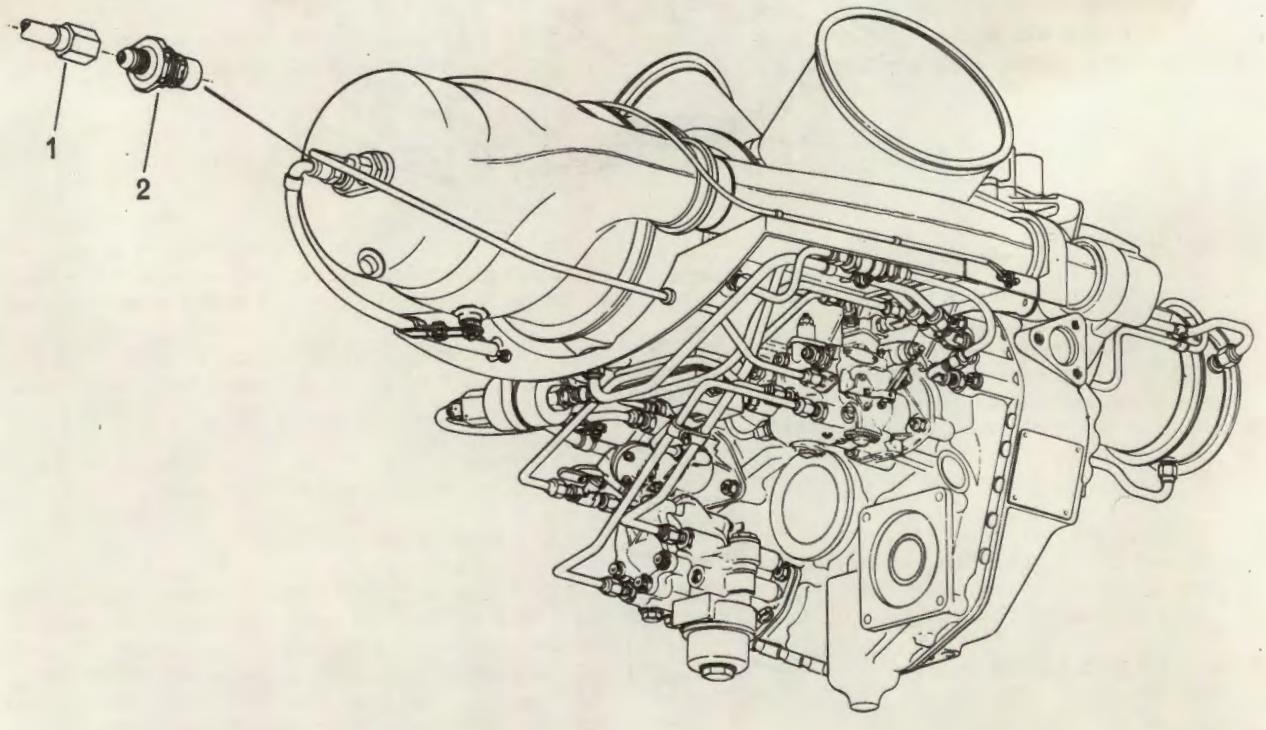
5-90. FUEL NOZZLE.

5-91. The fuel nozzle is a single-entry, dual-orifice type unit. It contains an integral valve for dividing primary and secondary flow. This same valve acts as a fuel shutoff valve when fuel manifold pressure falls below a predetermined pressure, and keeps fuel out of the combustion chamber at shutdown.

5-92. REMOVAL - FUEL NOZZLE. Disconnect fuel tube (1, figure 5-10). Remove lockwire; unscrew the nozzle (2); and carefully remove the nozzle.

Caution

Particular care must be taken during nozzle removal not to damage nozzle spray tip. If nozzle tip is damaged, replace nozzle.



AV 053298

1. Fuel Tube
2. Fuel Nozzle

Figure 5-10. Fuel nozzle assembly

5-93. CLEANING - FUEL NOZZLE.

a. When carbon deposits appear on spray tips as shown in figure 5-11, clean the nozzle before reinstallation.

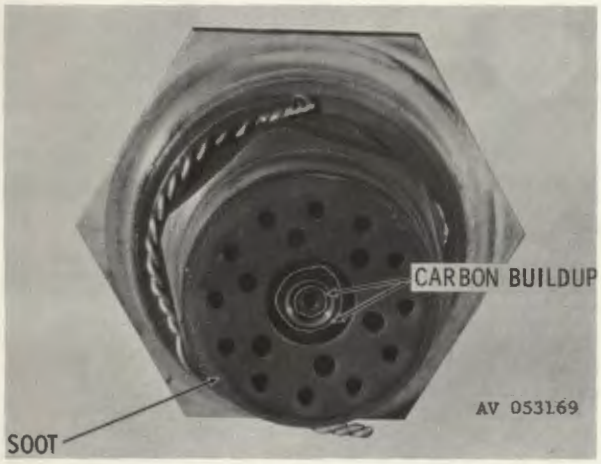


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Figure 5-11. Carbon buildup on fuel nozzle

b. Gently clean spray tips with a soft cloth dampened with solvent (300, table 1-1). Flow air or fuel through nozzle to prevent carbon from lodging in spray tips.

Caution

Use extreme care to avoid damaging mirror finish and edge of spray tips.

Clean air shroud face with clean dry cloth; air holes must be open. Be careful that loosened carbon does not enter spray tips. Apply air or fuel through nozzle to insure carbon is not lodged in spray tips.

5-94. INSPECTION - FUEL NOZZLE. Visually inspect nozzle for any damage. Replace damaged nozzles.

5-95. INSTALLATION - FUEL NOZZLE.

a. Carefully install nozzle.

b. Tighten nozzle to 200-300 inch-pounds; lockwire to igniter.

c. Connect fuel spray nozzle line and tighten tube coupling to 80-120 inch-pounds.

Caution

Exercise care to avoid tube twisting or lockup when tightening coupling nut.

SECTION VI OIL SYSTEM

5-96. OIL SYSTEM.

5-97. Drain and refill the engine lubrication system with engine oil (item 2 or 10, table 1-1) every 150 hours of engine operation. After each oil change, motor the engine with the starter until the proper oil pressure is reached. Closely monitor the oil pressure for the first five minutes of engine operation.

Warning

Lubricating oil contains tricresylphosphate. This additive is poisonous and readily absorbed through the skin. Make certain this oil does not remain on the skin.

5-98. ENGINE LUBRICATION.

a. Do not mix MIL-L-23699 oil with MIL-L-7808 oil except in emergency. If this is necessary, flush the system within six hours as follows.

b. Drain oil from engine oil system. Inspect and clean oil filter. Fill engine oil system with lubricating oil (item 2 or 10, table 1-1).

c. Operate engine until oil reaches proper operating pressure. Shut down engine; inspect and clean engine oil filter. Release aircraft for service use.

d. Inspect and clean engine oil filter after five and 15 hours of engine operating after oil changeover.

e. After 15 hour inspection of engine oil filter, revert to normal inspection interval.

5-99. ENGINE OIL SYSTEM.

5-100. The engine oil system (figure 5-12) consists of a self-sealing oil tank with an approximate 1.5 gallon capacity, a self-locking drain valve for both oil tank drain and system drain, an oil cooler, a bypass valve, and vent line. Provisions are included for an oil pressure indicator, a temperature indicator, and a combination low level and oil cooler bypass valve caution light. In addition, two engine magnetic chip detectors are connected to a caution light. The oil tank is mounted aft of the engine rear firewall on top of the cabin section. The engine is a dry sump type with an external reservoir and heat

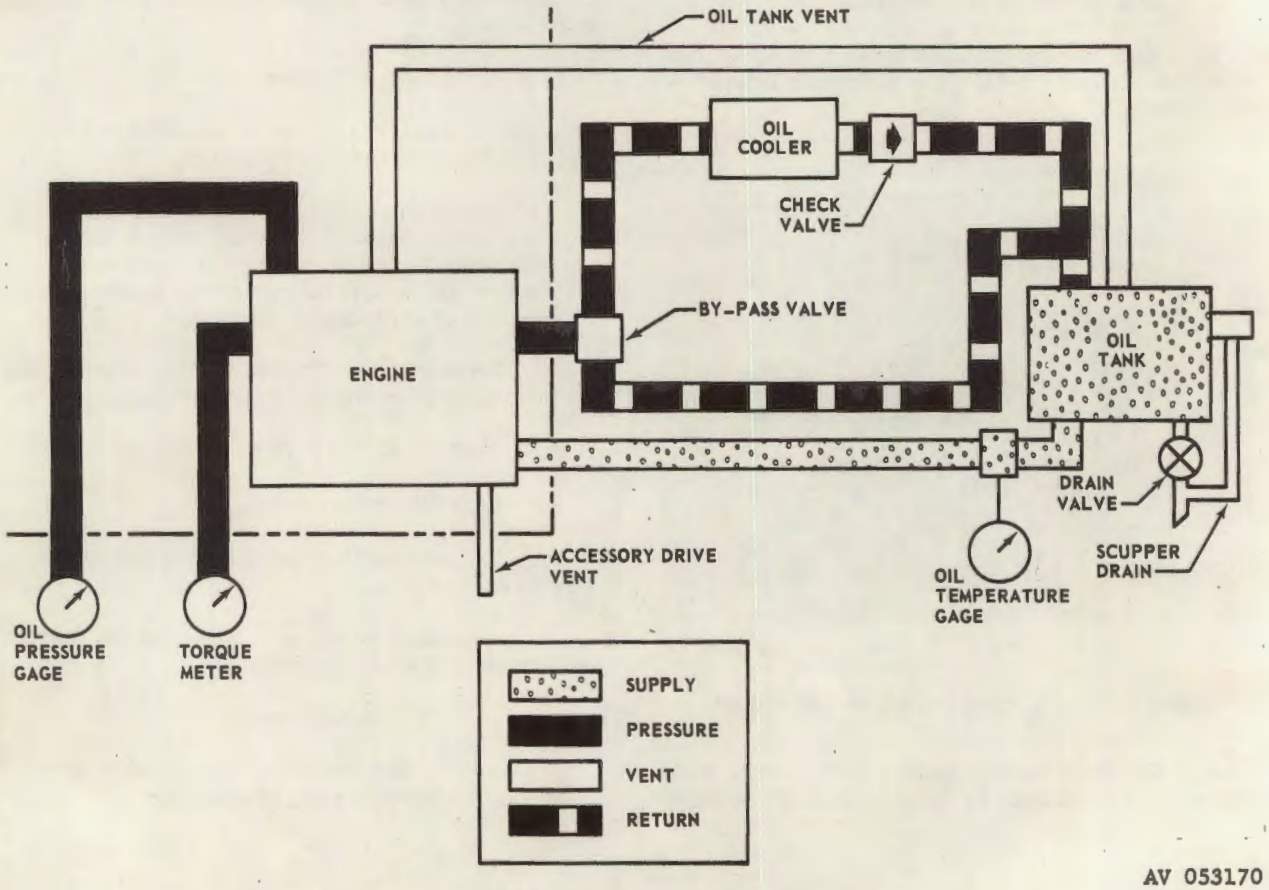

Figure 5-12. Engine oil system schematic

exchanger. A gear type pressure and scavenge pump assembly is mounted within the power and accessory gearbox. (See figures 5-13 and 5-14.) The oil filter, filter bypass valve, and pressure regulating valve are in a unit which is located in the upper right-hand side of the power and accessory gearbox housing and are accessible from the top of the engine. A check valve is located between the housing and the filter unit. Indicating type magnetic chip detectors are installed at the bottom of the power and accessory gearbox, and at the engine oil outlet connection. All engine oil system lines and connections are internal with the exception of pressure and scavenge lines to the front compressor support, the gas producer turbine support, and the power turbine support.

5-101. OIL TANK.

5-102. Engine oil supply tank (1, figure 5-15) is a self sealing container equipped with a sight gauge (2), filler neck and cap (3) scupper with drain (4) and fittings for line connections. Tank is mounted aft of the blower fan and above the tail rotor drive shaft.

5-103. REMOVAL - OIL TANK.

Note

Cover all openings to prevent system contamination.

a. Remove aft fairing (5, figure 4-2) to gain access to oil tank area.

b. Drain tank into suitable container through overboard drain.

c. Remove all lines and fittings from tank.

d. Remove four bolts and washers attaching oil tank to support assembly (5, figure 5-15). Remove tank.

5-104. INSPECTION - OIL TANK.

a. Inspect tank for the following:

(1) Punctures or leaks.

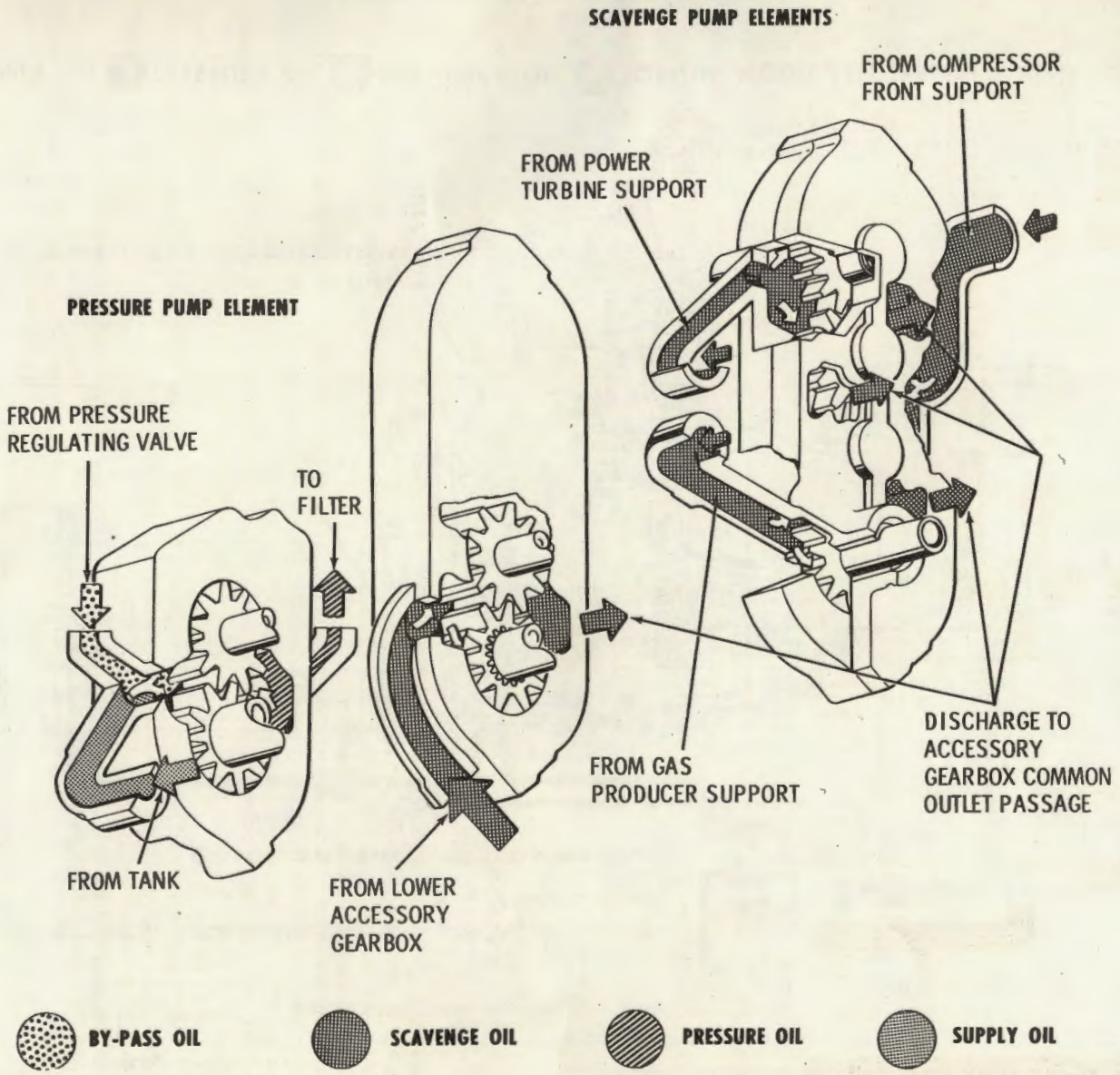

Figure 5-13. Oil pump

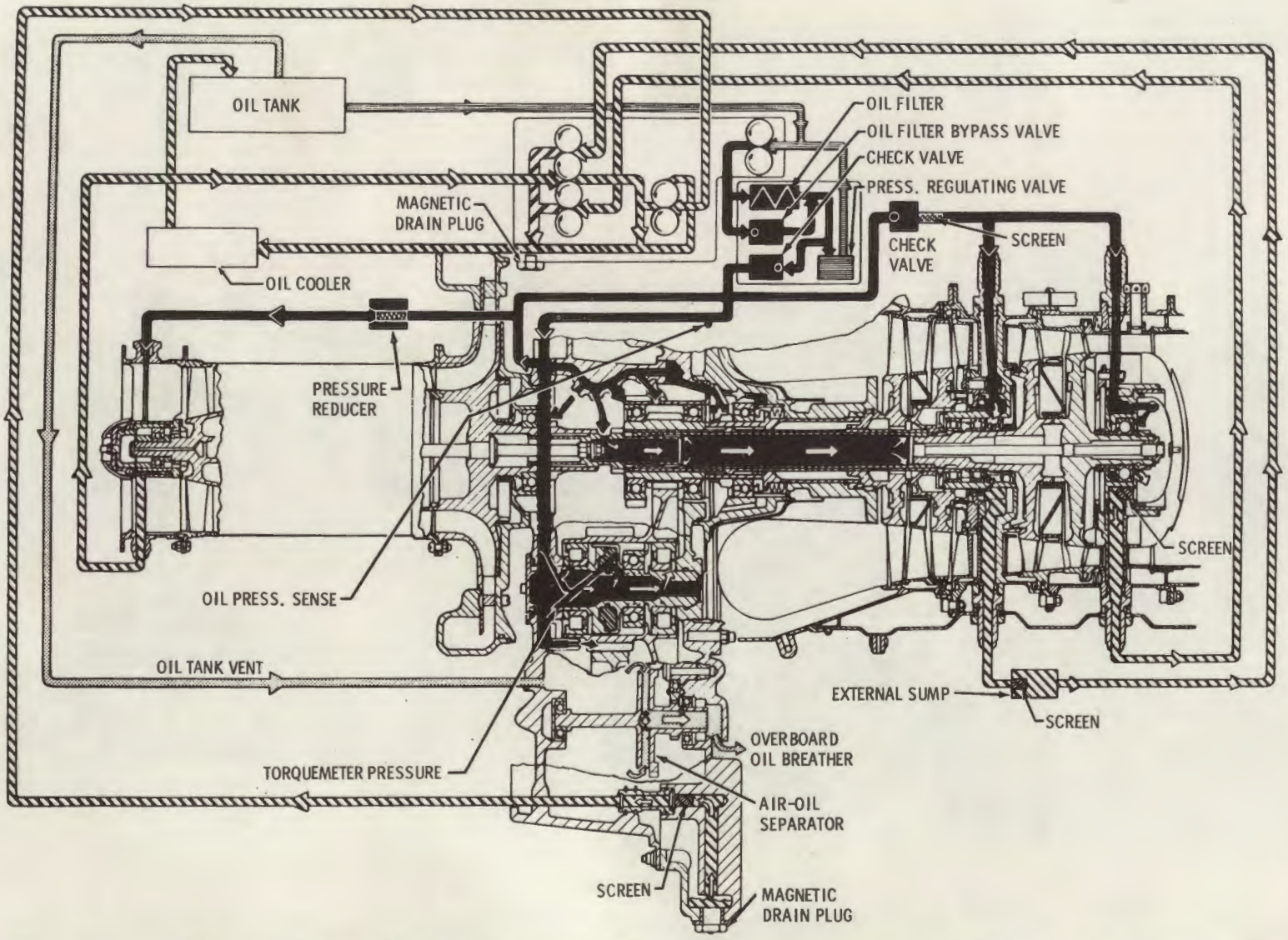

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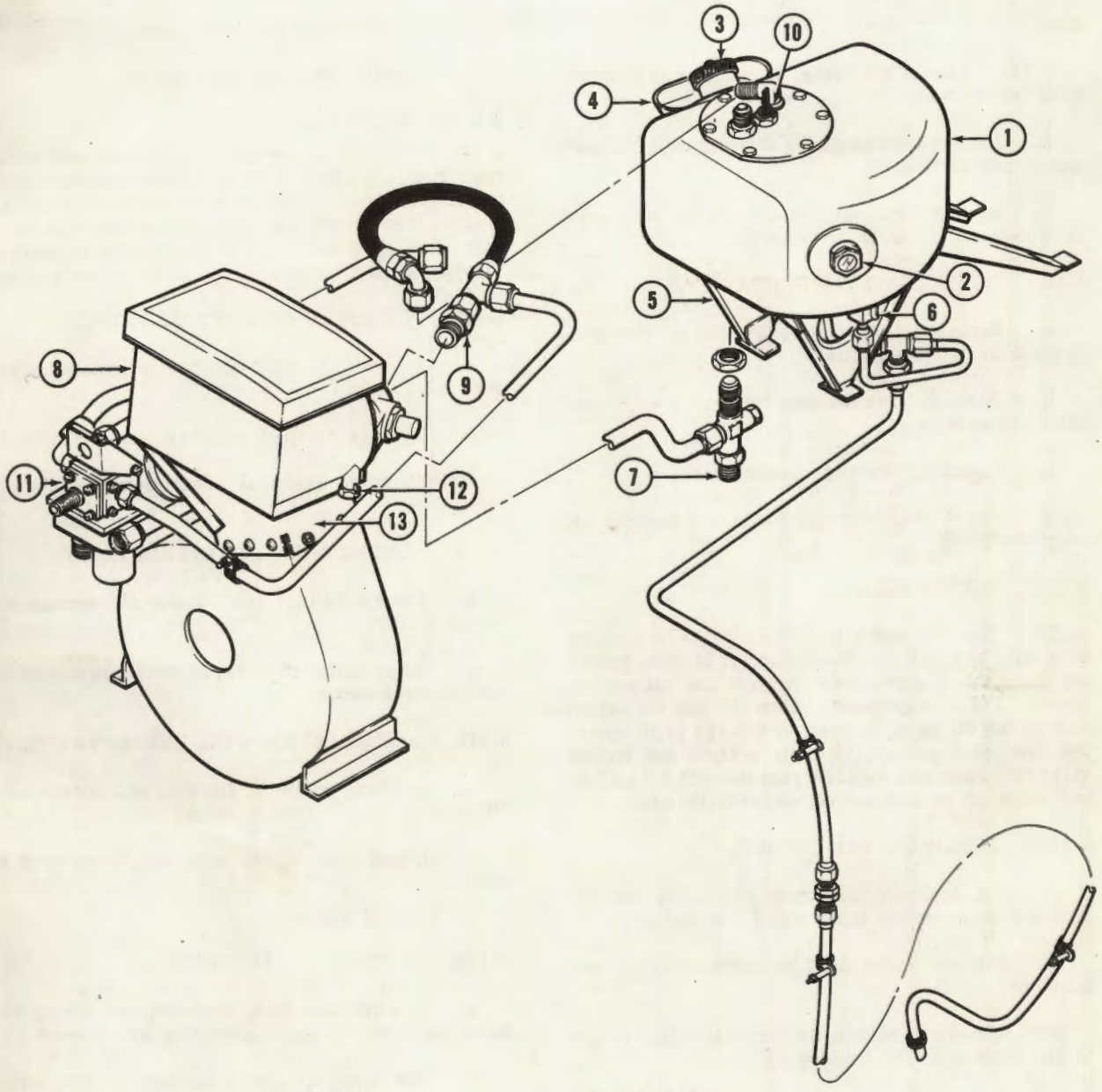
Figure 5-14. Engine lubrication schematic



1. Oil Tank
2. Sight Gauge
3. Filler Neck
4. Scupper
5. Support Assembly
6. Drain Valve
7. Temperature Bulb
8. Oil Cooler
9. Check Valve
10. Low Level Switch
11. Bypass Valve
12. Drain Plug
13. Duct Extension

AV 053171

Figure 5-15. Engine oil system

(2) Damaged threads in fittings.

(3) Damage which affects capacity or function.

(4) Inspect for loose, missing or improperly installed hardware.

b. Inspect sight plugs for discoloration, damage and proper sealing.

c. Inspect tank support for cracks and mount area on tank for cracks or damage.

5-105. INSTALLATION - OIL TANK.

a. Replace all packings affected by removal. Replace any damaged fittings.

b. Position tank on support and install four bolts and washers.

c. Install fittings and connect lines.

d. Check drain valve (6) for closed position and service oil tank.

5-106. OIL COOLER.

5-107. The oil cooler (8, figure 5-15) is mounted on a duct extension on the oil cooler blower. Return oil from the engine flows through the oil cooler, through a one way check valve (9) into the return line to the oil tank. In event of damage to oil cooler the low level switch (10) will actuate the bypass valve (11) when tank capacity gets down to 1.1 gallons and route oil around the oil cooler to the tank.

5-108. REMOVAL - OIL COOLER.

a. Cut lockwire on drain plug (12), remove plug and drain cooler into a suitable container.

b. Remove outlet hose at check valve (9) and inlet line.

c. Remove 13 bolts and washers attaching cooler to duct extension (13). Remove cooler.

5-109. INSPECTION - OIL COOLER.

a. Inspect oil cooler for cleanliness of air passages.

b. Inspect oil cooler for unserviceable or damaged fittings, oil passage leaks and elongated mount holes.

5-110. INSTALLATION - OIL COOLER.

a. Position cooler on duct extension with inlet fitting on right side.

b. Align mounting holes and install 13 bolts and washers.

c. Connect inlet and outlet lines.

d. Install drain plug and lockwire.

5-111. OIL BYPASS VALVE.

5-112. The oil bypass valve (11) is mounted on the rear firewall, right side and either automatically, directs oil fron engine to oil cooler in normal operation, or directs oil from engine straight to oil tank when oil level drops to 1.1 gallons in oil tank. This prevents total oil loss due to oil cooler damage.

5-113. REMOVAL - OIL BYPASS VALVE.

a. Remove the inlet and two outlet lines at bypass valve ends.

b. Remove "B" nut attaching valve to firewall.

c. Remove electrical connections and remove valve.

5-114. INSPECTION - OIL BYPASS VALVE.

a. Inspect fittings and threads for damage and serviceability.

b. After installation check for leaks and security of attachment.

5-115. INSTALLATION - OIL BYPASS VALVE.

a. Position valve in firewall and secure with "B" nuts.

b. Connect electrical wire and three lines to valve.

5-116. OIL FILTER.

5-117. REMOVAL - OIL FILTER.

a. Remove the nuts, washers, and slowly remove cap with O-rings from housing. (See figure 5-16.)

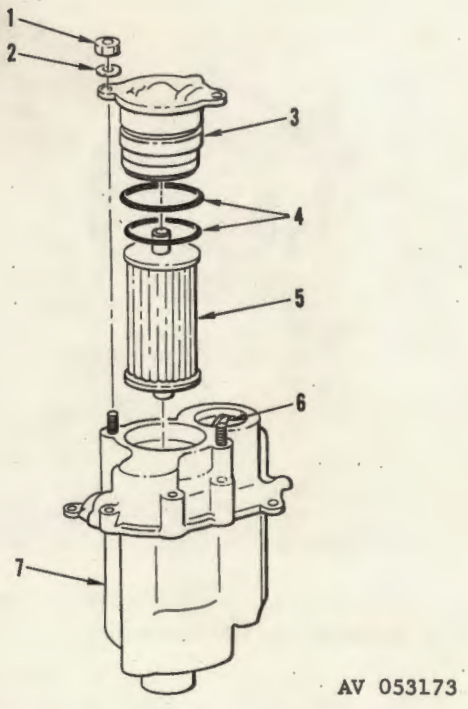
b. Use a suction gun or another suitable device to remove the puddled oil from within the filter housing before removal of the filter element. Do not damage the filter element.

c. Remove the filter element.

d. Install the cap with O-rings on housing to prevent dirt from entering the housing.

5-118. CLEANING - OIL FILTER.

a. Agitate filter element in mineral spirits (item 300, table 1-1) until clean.



1. Nut
2. Washer
3. Cap
4. Packing
5. Oil Filter Element
6. Poppet Guide
7. Oil Filter Housing

Figure 5-16. Oil filter and regulator

b. Air dry filter element.

c. Thoroughly clean the oil filter cavity of all residual oil and/or sludge prior to the installation of a cleaned or new filter element.

5-119. INSTALLATION - OIL FILTER.

a. Remove cap with O-rings from housing. Discard O-rings. Clean cap with a clean lint-free cloth. Install new O-rings lubricated with engine oil (item 2 or 10, table 1-1) on filter cap.

b. Install cleaned filter element in filter housing.

c. Install filter cap.

d. Tighten nuts which secure filter cap to housing 30 to 45 inch-pounds.

5-120. TESTING - OIL FILTER. After filter element has been cleaned or replaced, run the engine for a short duration and check the splitline for leaks.

5-121. OIL PRESSURE REGULATOR.

5-122. INSPECTION - OIL PRESSURE REGULATOR. Check the external condition of the regulator; insure that the regulator is lockwired. Do not remove regulator poppet guide from housing.

5-123. TESTING - OIL PRESSURE REGULATOR. With the engine running at ground idle rpm, check that the oil pressure is within the range given in the Operator's Manual (TM 55-1520-228-10).

5-124. ADJUSTMENT - OIL PRESSURE REGULATOR. Remove the lockwire. Using a wrench turn poppet guide (6, figure 5-16) clockwise to increase and counterclockwise to decrease oil pressure. An approximate adjustment can be made by bottoming the poppet guide, then backing it out 5-1/2 turns. One turn will change the oil pressure approximately 13 psig. After adjustment, lockwire regulator poppet guide.

5-125. CHIP DETECTOR.

5-126. Each engine chip detector consists of a magnetic plug with a single pin electrical receptacle. The threaded plug portion of the chip detector includes a terminal shaft and pole piece separated from a magnet in the plug body by insulators. When ferrous metal particles are sufficient in size of accumulation to bridge the gap between the pole piece and the magnet, an electrical (ground) circuit between the chip detector and the ENG CHIP DET indicator light is completed.

5-127. REMOVAL - CHIP DETECTOR. Remove lockwire and unscrew magnetic plug. Some oil spilling is likely. Remove O-ring from plug and discard.

5-128. INSPECTION - CHIP DETECTOR.

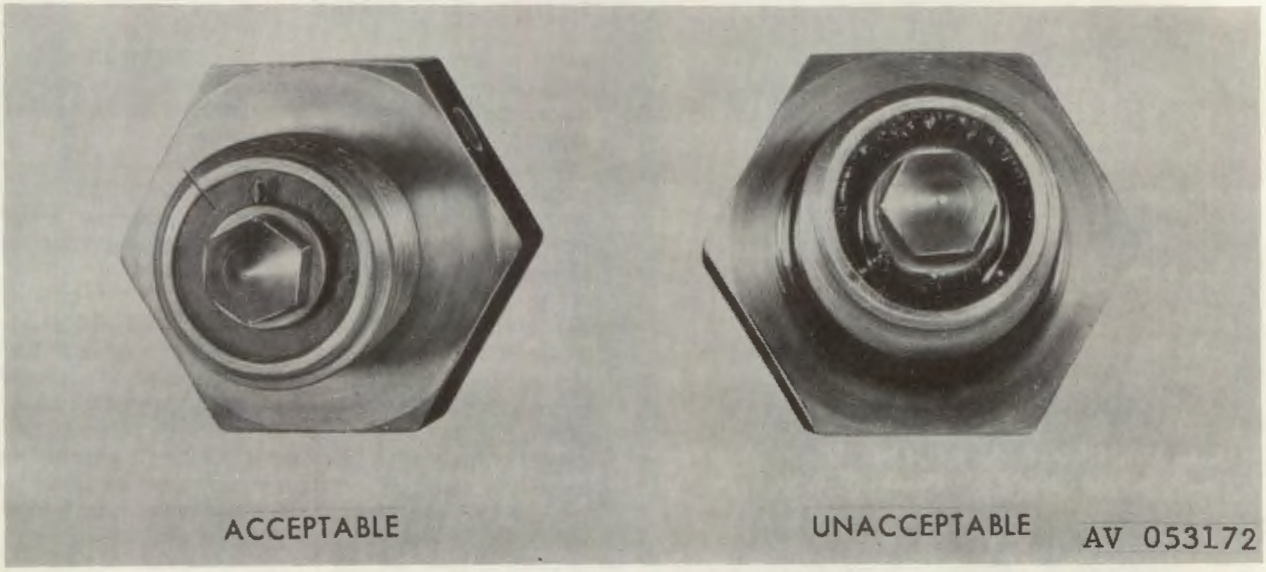
a. Visually check each plug for metal accumulation.

b. Flakes of magnetic material having 1/16-inch or more diameter are indications of an incipient failure and are cause for engine removal. (See figure 5-17.)

c. Fuzz or hair-like magnetic particles can normally be found on the magnetic plug and are not cause for engine replacement. (See figure 5-17.)

5-129. CLEANING - CHIP DETECTOR. Wipe chip detectors with a clean, lint-free cloth.

5-130. INSTALLATION - CHIP DETECTORS. Install a new O-ring lubricated with engine oil (2 or 10, table 1-1) on magnetic plug. Install magnetic plug; tighten to 60-80 inch-pounds and lockwire.



AV 053172

Figure 5-17. Particle accumulation on magnetic plug (chip detector)

5-131. TESTING - CHIP DETECTOR.

a. Place BATT-OFF switch to OFF and apply external power.

b. Remove electrical connector and temporarily connect a jumper wire from detector connector plug pin to an unpainted (grounding) surface of the airframe or engine.

c. Observe ENG CHIP DET indicator light. If light is on, circuit tests good; remove jumper wire and reinstall connector.

d. If ENG CHIP DET indicator light does not illuminate, check that jumper is properly grounded. If so, check circuit components for continuity and replace defective parts.

e. With engine running, check the magnetic chip detector light; the light should be out.

5-132. OIL SUPPLY SYSTEM HOSES, FITTINGS, AND TUBING.

5-133. The hoses and tubing used in the oil supply system are light-weight assemblies incorporating permanent fittings. The hoses located near the engine are provided with fire shields. The oil cooler bypass lines are corrosion resistant steel.

5-134. INSPECTION - OIL SUPPLY SYSTEM HOSES, FITTINGS, AND TUBING.

a. Inspect oil lines for kinks, uniformity of diameter, breaks, and freedom from interference with adjoining structure or other components. Replace defective oil lines.

b. Inspect fittings and hardware for cracks, crossed threads, obstructions in openings, burrs, or other damage. Replace all damaged fittings. Replace all seals, packings, self-locking nuts, cotter pins, and lockwire when they are removed from a unit.

SECTION VII IGNITION SYSTEM

5-135. IGNITION SYSTEM.

5-136. The engine ignition system consists of a low tension capacitor discharge ignition exciter, a spark igniter lead, and a shunted surface gap spark igniter. The system receives its input power from a 14 to 29 volt dc external power source.

5-137. SPARK IGNITER.

5-138. REMOVAL - SPARK IGNITER.

Warning

Insure ignition system has been off for at least five minutes before removing igniter to dissipate all energy stored in condenser. Ground igniter lead to engine using an insulated screwdriver.

a. Disconnect igniter lead (2, figure 5-18) at igniter. Prevent lead from twisting while removing nut.

b. Separate lead from igniter by pulling straight out without any rotational motion.

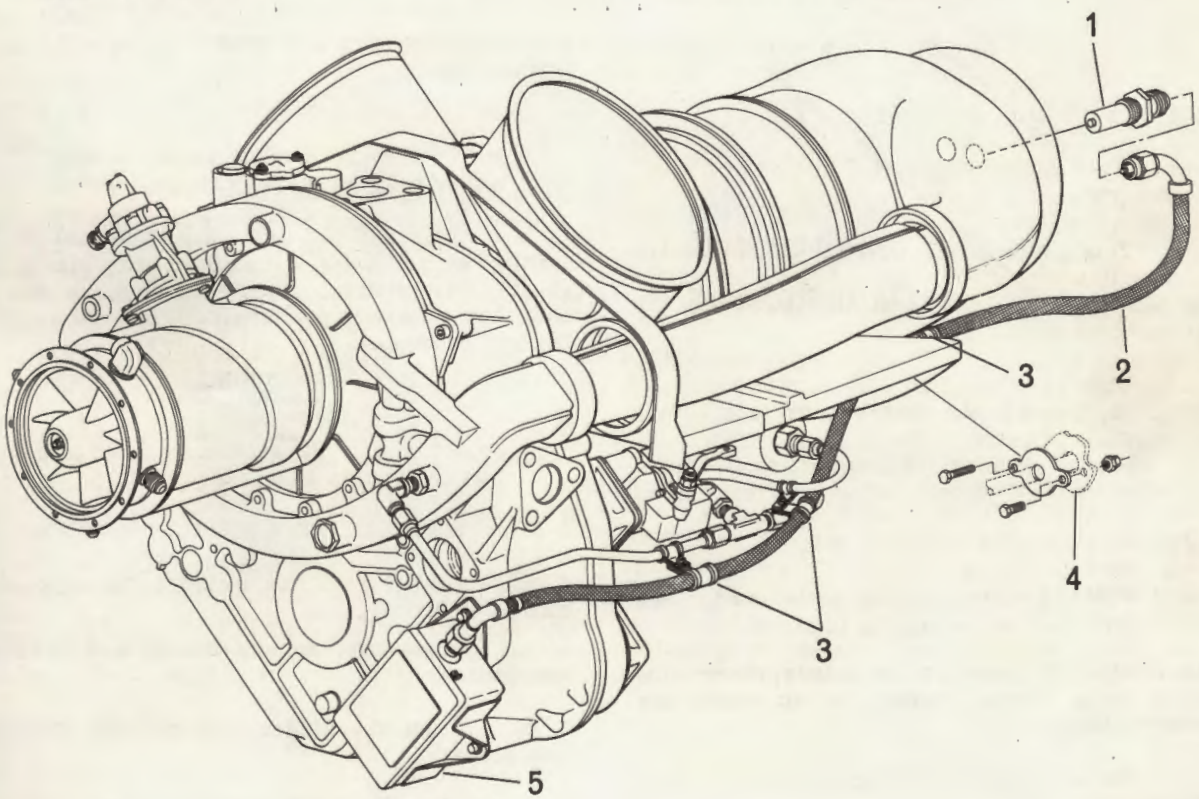
c. Remove lockwire and unscrew igniter.

Caution

The igniter connector well must be kept dry and free from foreign material.

5-139. CLEANING - SPARK IGNITER.

a. Clean igniter connector well with a clean dry cloth. Do not wash with solvent.



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1. Spark Igniter
2. Spark Igniter Lead
3. Clamping Points
4. Firewall Shield
5. Ignition Exicter

Figure 5-18. Engine ignition system components

b. Normal soot or carbon formation on the tip is not detrimental to igniter operation and need not be removed. If cleaning is desired, wipe the metal tip with a soft dry cloth.

Caution

Under no circumstance, wire brush, sand blast, vapor blast, or scrape the igniter. Any of these cleaning methods can damage the semi-conductor.

c. Remove any sizeable carbon deposits with a blunt non-metallic instrument. Be careful not to damage the semi-conductor material.

5-140. INSPECTION - SPARK IGNITER.

a. Inspect center electrode; replace igniter if electrode is loose. (See figure 5-19.)

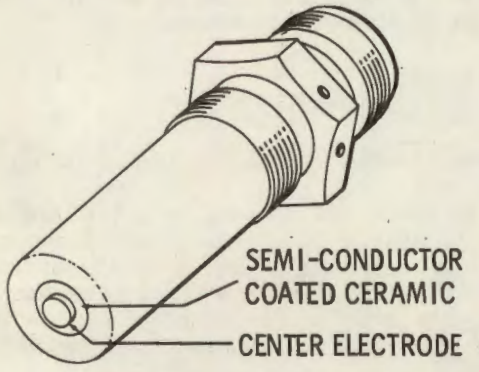

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Figure 5-19. Spark igniter

b. Inspect ceramic for cracks; if any cracks are visible through carbon coating, replace igniter.

5-141. TESTING - SPARK IGNITER.

a. With a good exciter and igniter lead, check igniter operation before installing in engine.

b. Apply 28 volts dc to the exciter; observe the rate of firing. Normal operation is six sparks per second minimum.

c. Replace igniter if it fails to fire or fires intermittently.

5-142. INSTALLATION - SPARK IGNITER.

a. Install serviced or new igniter; tighten to 200 inch-pounds and lockwire to fuel nozzle.

b. Connect igniter lead; tighten to 70-90 inch-pound.

5-143. IGNITION EXCITER.

5-144. REMOVAL - IGNITION EXCITER.

Warning

Ensure ignition system has been off for at least five minutes before disconnecting any leads. Ground leads to engine using an insulated screwdriver.

a. Disconnect power input and igniter leads from exciter.

b. Remove three bolts and washers which secure exciter (5, figure 5-18) to gearbox housing.

5-145. INSPECTION - IGNITION EXCITER. Visually inspect the general condition of ignition exciter input power terminal, and igniter lead connector.

5-146. TESTING - IGNITION EXCITER.

a. Connect a known satisfactory igniter lead and spark igniter of type used on engine to the ignition exciter.

Caution

Do not energize ignition exciter if spark igniter and lead are disconnected.

b. Apply 28V DC to the input terminal of the ignition exciter using a minimum wire size of 16 gauge. Observe firing. If a repetitive spark rate of less than six sparks per second is observed, replace the ignition exciter.

Caution

Do not operate the exciter for more than 4 minutes in any 30 minute period.

5-147. INSTALLATION - IGNITION EXCITER.

a. Install serviceable exciter on the engine and connect electrical leads.

b. Torque attaching self-locking nuts 30 to 40 inch-pounds.

c. Torque the igniter lead coupling 50 to 70 inch-pounds.

d. Torque input lead nut 8 to 12 inch-pounds.

5-148. SPARK IGNITER LEAD.

5-149. REMOVAL - SPARK IGNITER LEAD.

a. Ensure ignition system has been off for at least five minutes before disconnecting igniter lead. Ground lead to engine using an insulated screwdriver.

b. Remove the lead (2, figure 5-18) from the ignition exciter (5) and the spark igniter (1); detach from retention clamps (3) at the power turbine governor and from the aft flange of the firewall shield (4).

5-150. INSPECTION - SPARK IGNITER LEAD.

a. Inspect the outer part of the lead for braid damage; replace lead if there are more than five broken strands in any localized area, the braided conduit is punctured, or discolored and brittle from extreme heat.

b. Inspect terminals of lead to ensure all parts are intact and no pitting is evident; replace lead if any part is missing and pitting is present.

5-151. INSTALLATION - SPARK IGNITER LEAD.

a. Reinstall the cable and the retention clamps.

b. Tighten igniter coupling to 70-90 inch-pounds.

c. Tighten exciter coupling to 50-70 inch-pounds.

SECTION VIII COOLING SYSTEM

(Not Applicable)

SECTION IX FUEL CONTROL

5-152. FUEL CONTROL.

5-153. The gas producer fuel control is located schematically in the fuel system between the fuel pump assembly and the fuel nozzle. (See figure 5-20). A power turbine governor, also a part of the control system, provides control intelligence to the gas producer fuel control.

5-154. The system controls engine power output by controlling the gas producer speed. Gas producer speed levels are set up by the action of the power turbine governor which senses power turbine speed. Power turbine speed is selected by the operator. The power required to maintain this speed is automatically maintained by power turbine governor action on gas producer fuel flow.

5-155. The power turbine governor lever schedules the governor requirements. The power turbine governor, in turn, schedules the gas producer speed to a changed power output to maintain output shaft speed.

5-156. Fuel flow for engine control depends on compressor discharge pressure (Pc), engine speed (gas producer --N1 and/or power turbine--N2), and gas producer lever angle. Fuel flow is a function of Pc as sensed in the fuel control. Variations of the fuel flow schedules are obtained by modulating the Pc to Px and Py pressures to the control through the action of a bleed down circuit actuated by the governors (figure 5-21).

5-157. GAS PRODUCER FUEL CONTROL.

5-158. The gas producer fuel control has a bypass valve, metering valve, acceleration bellows, governing and enrichment bellows, manually operated cutoff valve, maximum pressure relief valve, torque tube seal and lever assembly, and a start derichment valve. The maximum pressure relief valve protects the system from excessive fuel pressure.

5-159. Fuel enters the control from the engine fuel pump and filter assembly and is delivered to the metering valve. The bypass valve maintains a constant pressure differential across the metering valve. Also, excess fuel is bypassed to the fuel pump and filter assembly through an external line connecting the pump bypass inlet to the bypass outlet port of the gas producer fuel control.

5-160. The metering valve is operated by lever action through movement of the governor and acceleration bellows. Metering valve area depends on valve travel. Before light-off and acceleration, the metering valve is set at a predetermined open position by the acceleration bellows under the influence of ambient pressure (Pc at zero rpm).

5-161. The start derichment valve is open during light-off and acceleration to a set Pc. The open derichment valve vents Py pressure to atmosphere. Venting Py allows the governor bellows to move the metering valve against the minimum flow stop. At minimum flow the metering valve provides the required lean fuel schedule after light-off. As compressor rpm increases, the derichment valve is closed by Pc acting on the derichment bellows. When the derichment valve

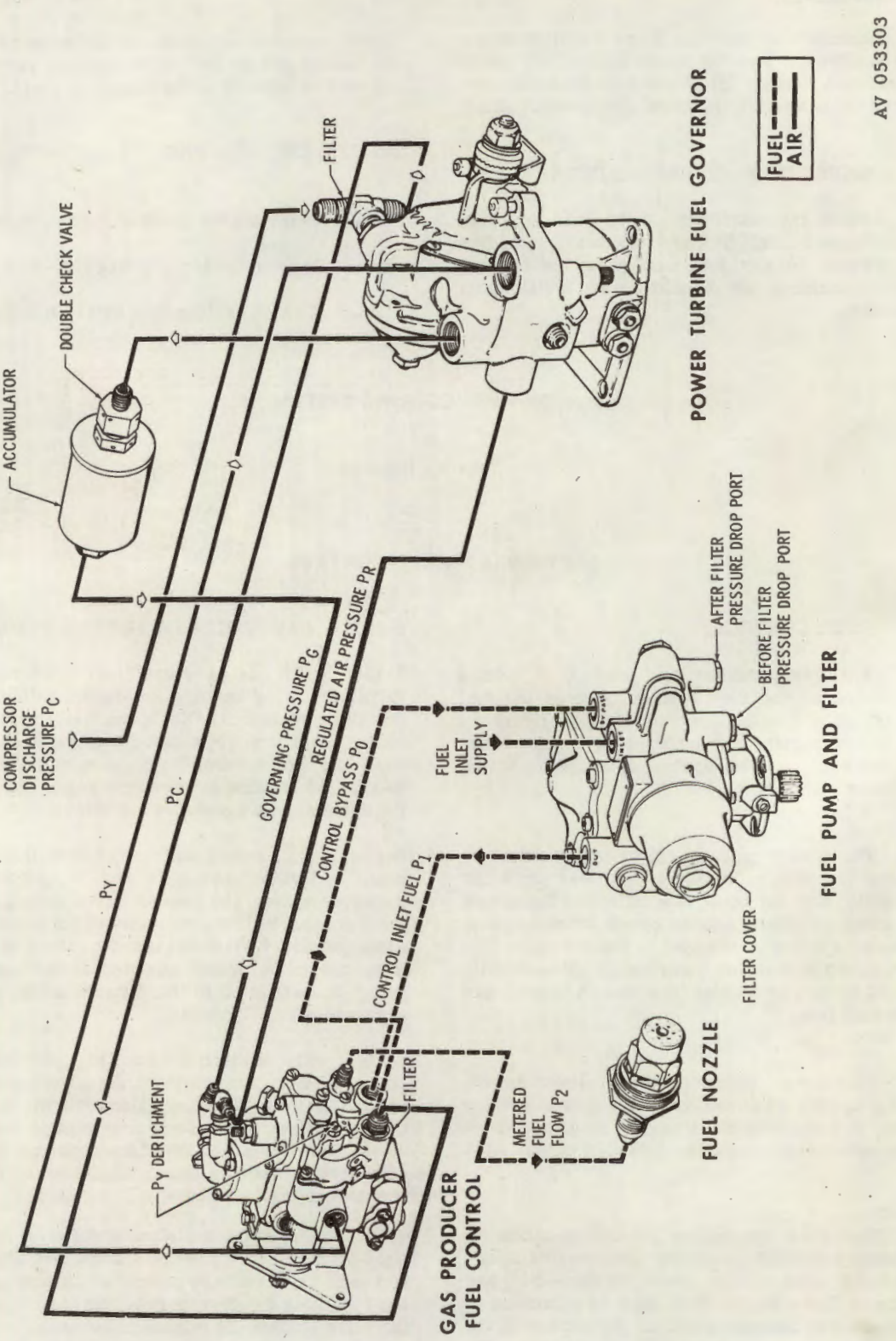


Figure 5-20. Engine fuel and control system

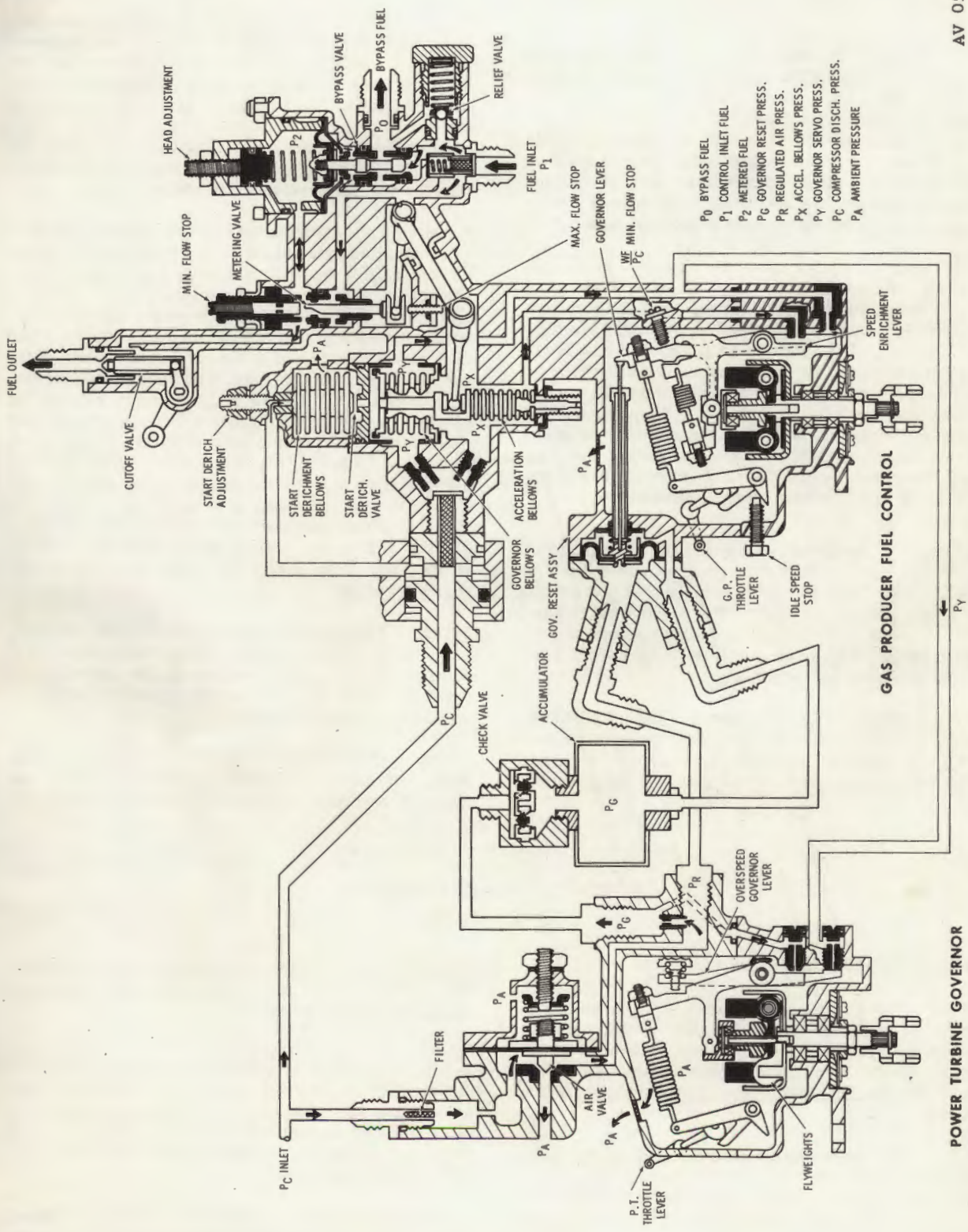


Figure 5-21. Fuel controls system schematic

is closed, control of the metering valve is returned to the normal operating schedule.

5-162. During acceleration, the Px and Py pressures are equal to the modified compressor discharge pressure (Pc) up to the point where the speed enrichment orifice is opened by flyweight action. Opening the speed enrichment orifice bleeds Px pressure while Py remains at a value equal to Pc. Under the influence of the Py minus Px pressure drop across the governor bellows, the metering valve moves toward the maximum flow stop where it increases fuel flow.

5-163. Gas producer speed is controlled by the gas producer fuel control governor. A set of flyweights operate the governor lever which controls the governor bellows (Py) bleed at the governing orifice. Flyweight operation of the governor lever is opposed by a variable spring load. The spring force is established by the throttle lever acting on a spring scheduling cam. Opening the governing orifice bleeds Py pressure and allows Px pressure to control the governor bellows. The Px influence on the bellows moves the metering valve toward minimum flow and at a position where metered flow is at steady state requirements.

5-164. The governor reset assembly in the gas producer fuel control limits or governs power turbine speed. Control of the reset assembly is derived from the power turbine governor. The power turbine governor also provides quick responding overspeed protection by bleeding governor servo (Py) pressure from the gas producer fuel control.

5-165. INSPECTION - GAS PRODUCER FUEL CONTROL. Visually inspect for general condition, security of control, connections, and vent screens; check weep holes for fuel dripping. No dripping allowed.

5-166. POWER TURBINE GOVERNOR.

5-167. Power turbine speed is scheduled by the power turbine governor lever and the power turbine speed scheduling cam. The cam sets a governor spring load which opposes a flyweight output. As the desired speed is approached, the flyweights operating against the governor spring move a link to open the power turbine governor orifice. The flyweights also open the overspeed bleed (Py) orifice but at a higher speed than the regular governor (Pg) orifice.

5-168. The governor orifice is downstream of a bleed supplied by a regulated air pressure, Pr. Opening the orifice results in a reduced pressure downstream of the bleed (Pg) as an inverse function of increasing speed. Regulated pressure (Pr) and governing pressure (Pg) are applied to opposite sides of a diaphragm in the governor reset section of the gas producer fuel control. The force generated by (Pr) minus (Pg) across the diaphragm acts on the gas producer power output link through the governor reset rod. This force supplements the weight force in the gas producer fuel governor to reset (reduce) the gas producer speed. Gas producer speed cannot exceed the gas producer fuel governor setting. The (Pr) minus (Pg) diaphragm is preloaded for establishing the active (Pr) minus (Pg) range. Pr pressure is supplied from engine (Pc) pressure by an air regulator valve.

5-169. The overspeed orifice bleeds (Py) pressure from the governing system of the gas producer fuel control. Bleeding (Py) pressure at the power turbine governor gives the fuel control system a rapid response to overspeed conditions.

5-170. INSPECTION - POWER TURBINE GOVERNOR. Visually inspect for general condition, security of governor, connections, and vent screens.

SECTION X POWER CONTROLS

5-170. POWER CONTROLS.

5-171. The OH-58A helicopter uses a conventional control system. The collective pitch of the helicopter rotor establishes the power output demand on the engine. For all practical purposes, helicopter rotor speed is held constant by the engine and its control system.

5-172. The fuel control is connected to the twist grip on the pilot's and copilot's collective pitch sticks. The power turbine governor is interconnected to the collective pitch sticks through a corrodinated system of bellcranks and linkages. Any change in collective pitch resets the governor to a new power demand. This demand is transmitted to the gas producer fuel control, which resets and varies the N_1 speed of the gas producer turbine accordingly.

5-173. A motor-actuated speed trimming device is installed in the linkage between the collective pitch sticks and the power turbine governor lever. It is operated by a beeper switch on each collective pitch stick, and allows engine output speed to be varied over the normal range.

5-174. REMOVAL - POWER CONTROLS. Tubing, cable, and bellcranks are removed by removing attaching bolts and clamps as required.

5-175. INSPECTION - POWER CONTROLS.

a. Inspect and replace any erroded, damaged or worn parts of linkage.

b. Inspect all cables, tubes, and bellcranks for security and cotter keys for proper installation.

c. Inspect for binding or chafing controls.

5-176. INSTALLATION - POWER CONTROLS. Seall tubes, cables, and bellcranks in position with proper bolts, nuts, clamps and other necessary parts.

5-177. RIGGING - GAS PRODUCER (N_1).

a. Connect the control cable rod end (figure 5-22) to the throttle arm located at the end of the collective pitch lever (View B-B).

b. Disconnect tube (1) from bellcrank (2). Rotate the twist grip and check the control cable for security and freedom from binding or twisting.

c. Position twist grip in flight idle position and accomplish the following maintaining flight idle position.

d. Position bellcrank (2) as shown in figure 5-22 and connect tube (1).

e. Position lever (5) at the 30 percent mark on the fuel control and install lever (4) as shown in reference to the engine torque nut 40 to 60 inch-pounds.

f. Adjust to fit and install tube (3). Check to ensure, with twist grip at flight idle lever (5) should point to 30 percent on the control.

g. Some further adjustment may be necessary to ensure that full power and off positions of the power lever twist grip will bottom out to the factory stops.

h. Flight idle 62.5 percent should be checked and reset if required after the power turbine governor control is rigged.

5-178. RIGGING - DROOP COMPENSATOR CONTROL NII.

Note

Rig collective pitch controls before rigging governor controls.

a. Adjust rod assembly (1, figure 5-23) to a length of 38.40 inches and install forward end (adjustable) in center hole of torque tube assembly (2).

b. Install the non-adjustable end in bellcrank (3). Boot must be in place.

c. Adjust actuator (4) stroke for 0.75 inch travel from full extend to full retract by turning adjusting screw right to increase travel and left to decrease travel.

d. Install actuator in center hole of bellcrank (3).

e. Back out stop screw (5) until 0.06 inch of threads show on the upper side of the bolt.

Note

Do not change the maximum stop screw setting. This is set by the manufacturer.

f. Install the governor arm (6) on the shaft approximately 90 degrees to the centerline of the stop arm (7) on the shaft.

g. Lock the collective stick in the full up position. Set the RPM beep switch to full increase. Position governor arm (6) 30 degrees forward of the vertical centerline.

h. Adjust actuator rod end to arm (6) and install bolt and nut.

i. Final rigging is accomplished after initial ground run. Start engine with the collective full down and the "beep switch" in full decrease. Check for a minimum 97 percent N_{II}. Actuate the "beep switch" to full increase. Check for a maximum of 104 percent N_{II}.

j. To obtain N_{II} speed, select range of 97 to 103 percent N_{II}. Adjust the actuator (4) rod end to governor arm (6) length.

Note

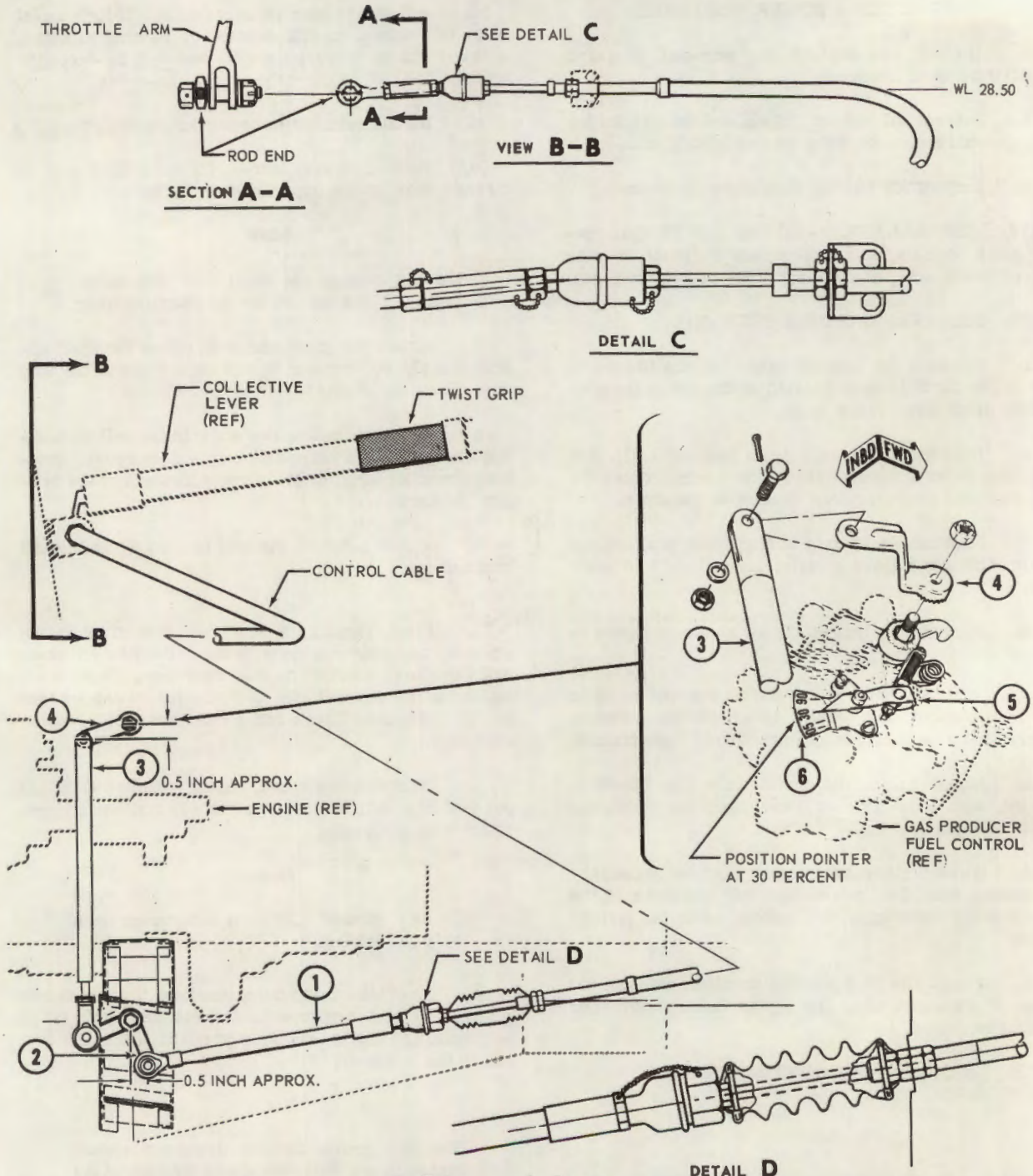
Do not exceed 0.75 inch adjustment from original setting.

k. To obtain droop compensation, the rate can be changed by changing position of rod assembly (1) at bellcrank (2) and/or changing position of the actuator end in the bellcrank (3).

Note

The N_{II} power turbine governor should maintain any selected speed throughout the collective travel.

l. With N_{II} at 97 percent minimum and 104 percent maximum and the rigging complete, position the collective stick "full down" and the "beep switch" in "full decrease" set screw (5) and bolt (8) to provide 0.010 inch minimum clearance to the governor stop arm (7).



1. Tube
2. Bellcrank
3. Tube
4. Lever
5. Lever
6. Quadrant

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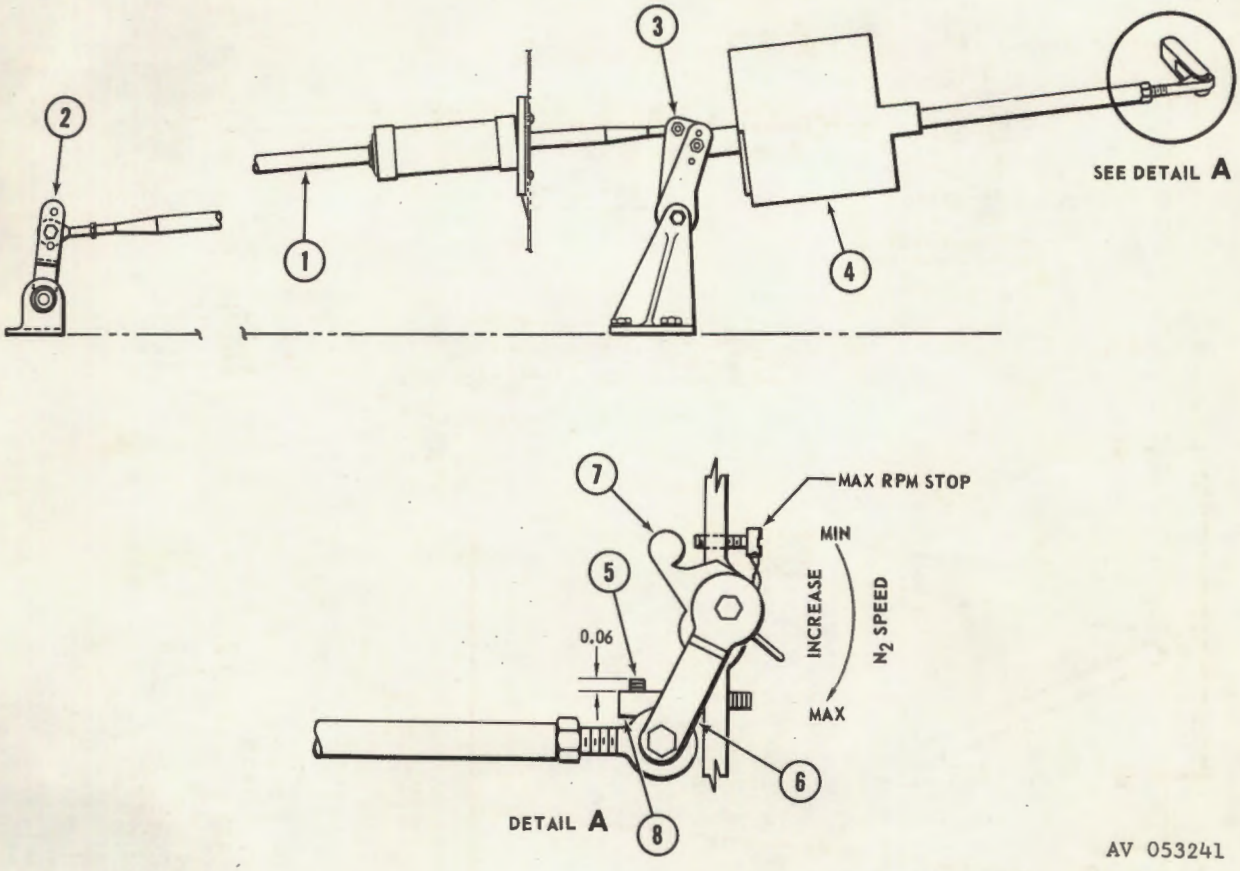
Figure 5-22. Power controls - gas producer



1. Rod Assembly
2. Torque Tube Assembly
3. Bellcrank
4. Actuator
5. Stop Screw
6. Governor Arm
7. Stop Arm
8. Bolt

Figure 5-23. Power controls - turbine governor

CHAPTER 6

HYDRAULIC AND PNEUMATIC SYSTEMS

SECTION I SCOPE

6-1. SCOPE.

6-2. The purpose of this chapter is to provide all the essential information for maintenance personnel to accomplish organizational maintenance on the complete hydraulic system.

6-3. The special tools and equipment required for performance of organizational maintenance will be found in TM 55-1520-228-20P, Organizational Maintenance Repair Parts and Special Tools List Manual.

SECTION II HYDRAULIC SYSTEM

6-4. HYDRAULIC SYSTEM.

6-5. The flight control hydraulic system (figures 6-1 and 6-2) provides power to operate the cyclic and collective power control cylinders. The system includes a variable delivery pump, reservoir, two filters, relief valve, solenoid valve, directional flow check valve, servo valves, irreversible valves, power cylinders, pressure switch, couplings for a ground test stand and connecting lines. The pump is located on the forward side of the transmission and is driven by the transmission oil pump through the rotor tachometer generator. The reservoir is located on the transmission above the pump. The filler opening is in the top of the reservoir. A scupper and drain line are provided to drain excess fluid overboard. The low fluid level may be observed through a sight gage in the right side of the reservoir. Pressure and return filters are located on the right side of the system. Both filters have indicator buttons which pop out to indicate an impending filter stoppage. Filters and fluid level can be check through the inspection door on the right side of the forward transmission fairing. A solenoid valve, for turning the system on and off, and a relief valve and pressure switch are located on the work deck forward of the transmission. A boost ON-OFF switch is mounted on the pedestal for pilot control of the solenoid valve. Access to the hydraulic system is gained by removal of the forward transmission fairing.

6-6. OPERATION - HYDRAULIC SYSTEM.

6-7. System pressure of 575 to 625 psig is produced by the transmission driven pump. Fluid is drawn from the reservoir by the pump. The pump forces fluid through the filter and a normally-open solenoid operated system shutoff valve. When the HYD BOOST switch is ON this valve is open and system pressure is supplied to the two cyclic and one collective flight control power cylinders. Each power cylinder assembly includes a servo valve which is mechanically controlled by the flight control linkages. When the linkage moves any servo valve control lever the cylinder moves in the same direction. When the lever is centered, system pressure is applied equally to both sides of the cylinder piston but the system return port is shut off and the cylinder does not move in either direction. Irreversible valves for each power cylinder prevent power feed back in the event of hydraulic failure. Each irreversible valve incorporates a check valve to isolate surge pressures produced by rotor feedback in power cylinders from the system pressure lines. A differential relief valve in the servo opens automatically to relieve pressures in excess of 600 psi above system pressure. When no system pressure is available and the power cylinders are operated manually, fluid flows from one side of the piston directly through the servo valve and check valve to the other side of the piston. The hydraulic pump is driven by the transmission, therefore hydraulic boost is provided during autorotation.

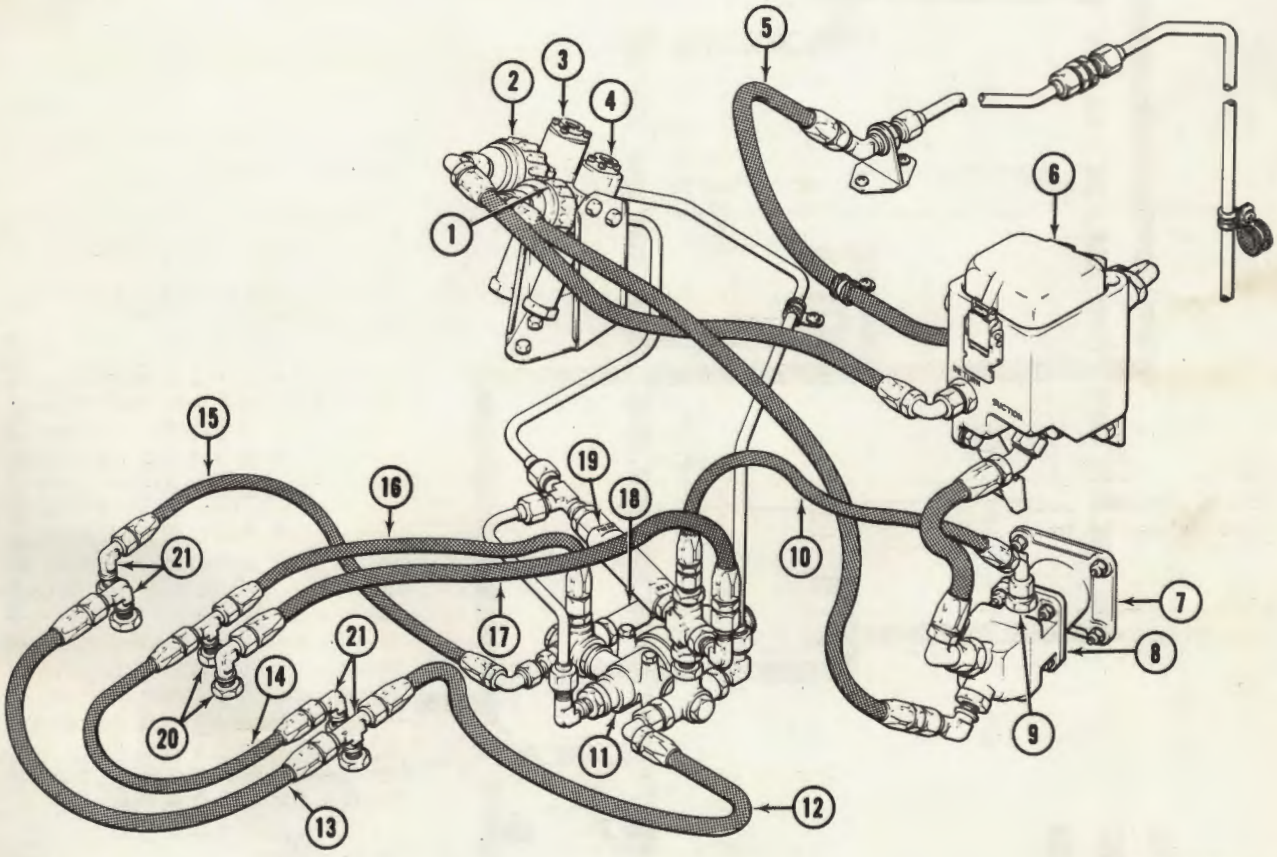
6-8. TROUBLESHOOTING HYDRAULIC SYSTEM.

6-9. Indications, probable causes, and corrective action for trouble in the hydraulic system are covered in the following:

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
Hydraulic oil leaks	Worn seals	Replace seals
	Leaky fittings	Tighten fittings to proper torque. If leak still persists, replace tube assembly.

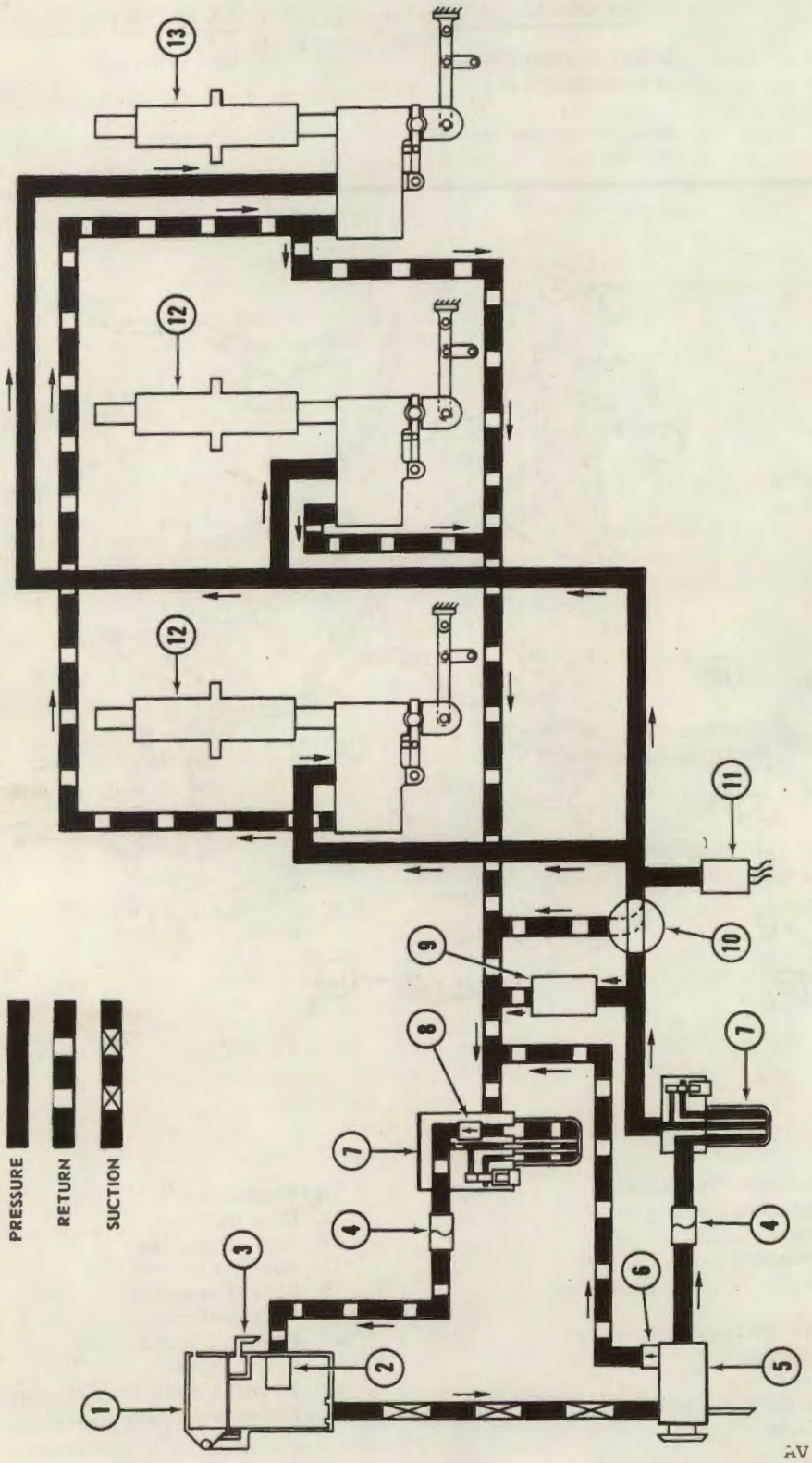
INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
Hydraulic warning light ON	Hydraulic system turned OFF	Turn system ON
	Low hydraulic pressure due to loss of oil	Check for leak and correct. Fill system with hydraulic oil
	Relief valve locked open	Replace valve
	Pump not producing pressure	Replace pump
	Solenoid valve not operating properly	Replace solenoid valve
	Electrical wiring to warning light, solenoid valve, or pressure switch not correct	Check for proper wiring hookup and correct as required
Controls do not operate smoothly	Sticking servo control valve	Replace servo actuator
	Pivot bolts in input lever are sticking	Free bolts with crocus cloth or replace actuator
	Air in system	Bleed system, check reservoir level. Connect ground test cart to helicopter and cycle the controls at least 10 times through full stroke.
Servo actuators chatter when moving controls	Air in servo actuators	Bleed system. Check reservoir level Connect ground test cart to helicopter and cycle the controls at least 10 times through full stroke.
Excessive feedback	Air in system	Bleed system. Check reservoir level Connect ground test cart to helicopter and cycle the controls at least 10 times through full stroke
	Improperly adjusted rotor	Correct rotor track. Refer to paragraph 8-16
	Low pump pressure	Replace pump
	Faulty relief valve in servo actuator	Replace actuator
	Faulty main system relief valve	Replace relief valve
	Irreversible valves in servo actuator head faulty	Replace actuator
Hydraulic control switch ineffective	Circuit breaker not pushed IN	Close circuit
	Switch failed	Replace switch
	Solenoid valve not connected	Connect wiring
	Improper electrical wiring	Repair or replace
	Solenoid valve not functioning properly	Replace valve

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
Hydraulic system too hot (The low pressure caution light may illuminate)	Relief valve cracking pressure set low	Replace relief valve
	Pump generates excessive pressure	Replace pump



1. Quick Disconnect (Pressure)
2. Quick Disconnect (Return)
3. Filter (Return)
4. Filter (Pressure)
5. Vent Line
6. Reservoir
7. Tachometer Generator
8. Hydraulic Pump
9. Check Valve
10. Case Drain Hose
11. Solenoid Valve
12. Hose (Return)
13. Hose (Return)
14. Hose (Pressure)
15. Hose (Pressure)
16. Hose (Pressure)
17. Hose (Return)
18. Pressure Switch
19. Relief Valve
20. To Servo Actuator (Collective)
21. To Servo Actuator (Cyclic)

Figure 6-1. Hydraulic system



1. Reservoir
2. Baffle
3. Scupper Drain
4. Quick Disconnects
5. Pump
6. Check Valve
7. Filter
8. Filter By-Pass Valve
9. Relief Valve
10. Solenoid Valve
11. Pressure Switch
12. Servo Actuator, Cyclic
13. Servo Actuator, Collective

Figure 6-2. Hydraulic system schematic

6-10. TESTING HYDRAULIC SYSTEM WITH GROUND TEST STAND.

6-11. A portable hydraulic test stand can be used to provide pressure to test or bleed the hydraulic system without operation of the helicopter engine. Prior to use, the test stand shall be thoroughly cleaned and serviced with hydraulic fluid (item 3, table 1-1). The stand shall be equipped with a 10 micron filter and a calibrated pressure gage with a capacity of 1000 psig. The stand shall be capable of producing pressure to 1000 psig and shall have a minimum flow rate of two gallons per minute at 1000 psig.

6-12. PREPARATION FOR TEST-HYDRAULIC SYSTEM.

Note

A complete visual inspection of the hydraulic system shall be accomplished before the functional test is performed to ensure that all components and lines are attached, secure, and appear capable of satisfactory operation.

a. Position ground test stand on right side of helicopter by engine compartment.

b. Remove forward transmission fairing. Remove hoses at quick disconnects (1 and 2, figure 6-1).

c. Cover ends of removed hoses to prevent entrance of foreign matter.

d. Connect test stand hoses.

e. Apply electrical power to helicopter.

f. Position boost switch to ON.

6-13. FLUSHING HYDRAULIC SYSTEM.

a. Remove and clean in solvent (item 300, table 1-1) the following parts of the hydraulic system. (Figure 6-1.)

(1) Reservoir (6).

(2) Pump inlet hose.

(3) Pump outlet hose.

(4) Return hose from filter to reservoir.

(5) Pump case drain hose (10).

b. Cap or plug all openings.

c. Remove filter elements and reinstall filter bowl.

d. Connect ground test stand pressure line to quick disconnect at filter (4).

e. Connect a hose to the return filter (3) of sufficient length to reach a container overboard for contaminated fluid.

f. Start test stand and adjust to 600 psi.

g. Cycle the collective stick full up to full down 10 times, with collective full down cycle the cyclic left corner to right corner 10 times. When fluid appears clean shut down test stand. Connect test stand return line to helicopter, start test stand and cycle controls again a minimum of 10 times.

h. Remove test stand connections and install clean filter elements and all lines and components removed in step a.

i. Fill reservoir with clean fluid (item 3, table 1-1).

Note

For pump failure, the pressure line filter will trap all particles. When replacing failed pump replace pressure line to filter.

6-14. BLEEDING HYDRAULIC SYSTEM USING GROUND TEST STAND.

a. Set test stand pressure at 600 psig.

b. Move cyclic and collective controls a minimum of 10 times to bleed air from the system.

c. Fill reservoir with hydraulic fluid (item 3, table 1-1).

6-15. FUNCTIONAL TEST OF HYDRAULIC SYSTEM USING GROUND TEST STAND.

a. Connect test stand at quick disconnect couplings (1 and 2, figure 6-1) located on right side of helicopter.

b. Set test stand pump to provide a minimum flow of 2-1/2 gpm with pressure compensator adjusted to 600 psig. Apply 600 psig to the hydraulic system and maintain for at least 15 minutes.

(1) Leakage: Observe all portions of the system for evidence of external leakage and correct causes. Servo actuators are allowed one drop of fluid leakage per 25 cycles.

(2) Clearance: Slowly cycle the cyclic and collective controls to the limit of stroke and observe movement of hydraulic servo actuators. Clearance between all moving parts shall be sufficient to prevent fouling of adjacent parts. Particular attention shall be given to flexible connections to insure that pinching does not occur and cycling does not loosen attaching fittings.

c. Check operation of hydraulic pressure warning light.

(1) Slowly decrease pressure. Light should illuminate by 300 psig.

(2) Slowly increase test stand pressure to hydraulic system. Light should extinguish by 400 psig.

d. Check operation of pressure relief valve in hydraulic system. While operating pressure is slowly increased, place hand on relief valve to determine when it opens. Valve should open between 670 psig and 750 psig. Valve should reseat by 670 psig.

e. With system pressure at 600 plus or minus 25 psig, place boost switch to OFF to test operation of solenoid valve. Hydraulic pressure warning should illuminate. Cycle the cyclic and collective controls. They should require more force to operate if valve closed properly. Position boost switch to ON position. The hydraulic pressure warning light should extinguish.

f. Check operation of servo actuators as follows:

(1) Set hydraulic test stand pressure to zero psig.

(2) Slowly increase hydraulic pressure until it can be determined that the control system is functioning with hydraulic power. Change over from mechanical to hydraulic operation should occur between 100 psig and 188 psig. Actuate both cyclic and collective controls to determine if this requirement is met on all cylinders.

(3) Reduce pressure to zero psig.

(4) Check each servo actuator for irreversibility by grasping rod end of power cylinders, and pushing or pulling with approximately 50 pounds of force. Piston rod should not move.

g. When test is complete, refill and bleed system as necessary. Disconnect hydraulic test stand and connect helicopter hydraulic hose couplings.

6-16. TESTING HYDRAULIC SYSTEM WITH TRANSMISSION-DRIVEN PUMP. When a ground test stand is not available, the transmission driven hydraulic pump can be used to perform operational checks and to bleed the hydraulic system. Operation of the engine shall be performed in accordance with instructions contained in TM 55-1520-228-10.

6-17. OPERATIONAL CHECK-HYDRAULIC SYSTEM.

Note

Make sure that the hydraulic system has been bled and filled.

a. Start and ground run the helicopter.

b. Increase engine rpm until flight idle speed is reached. Maintain flight idle speed for at least 15 minutes.

c. While speed is maintained, place boost switch to ON and make the following checks.

(1) Observe all hydraulic fittings and components for evidence of external leakage.

(2) Repair or replace components and fittings as necessary to correct leakage.

(3) Slowly cycle the controls to allowable limits for flight idle speed and observe movement of hydraulic servo cylinders. No fouling should occur.

(4) Check flexible hoses and connections to ensure that pinching of hoses does not occure.

(5) Position boost switch to OFF. Solenoid valve should energize and close. Hydraulic pressure warning light should illuminate, and more force should be required to move the controls.

6-18. HYDRAULIC SYSTEM PRESSURE TEST.

a. Remove plug at test port of one servo actuator and connect a claibrated pressure gage (0-1000 psi) to hydraulic system. With engine running at normal speed hydraulic pressure should be 600 plus or minus 25 psig.

b. If pressure is out of limits replace pump and repeat step a.

c. Shut down helicopter, remove gage, and replace plug.

6-19. BLEEDING HYDRAULIC SYSTEM USING TRANSMISSION DRIVE PUMP.

a. Start and ground run the helicopter.

b. With main rotor turning at flight idle, cycle the cyclic and collective controls a minimum of 10 times to bleed air from system.

c. Fill reservoir with hydraulic fluid (item 3, table 1-1) and repeat step b. as necessary until all air is out of system.

d. Shut down the engine.

6-20. HYDRAULIC PUMP.

6-21. The variable-delivery hydraulic pump (8, figure 6-1) is mounted on the rotor tachometer generator, on the forward side of the transmission. It is driven by the transmission through the tachometer

generator and has three connections; inlet, pressure outlet, and case drain port. The pump is self lubricating and has a seepage drain port, to allow fluid that may leak past the drive seals to escape.

6-22. REMOVAL - HYDRAULIC PUMP.

a. Remove forward transmission fairing. Provide suitable container to catch hydraulic fluid.

b. Drain reservoir.

c. Disconnect three hoses from the pump. Cap or cover ends of hoses and pump fittings.

d. Remove four nuts which secure pump mounting flange to tachometer; pull pump free of drive pad and remove from helicopter.

6-23. INSPECTION - HYDRAULIC PUMP.

a. Inspect pump for damaged port threads and cracked flange.

b. Inspect drive shaft for worn or chipped splines.

6-24. REPLACEMENT - HYDRAULIC PUMP. Replace pump if defective.

6-25. INSTALLATION - HYDRAULIC PUMP.

Note

Ensure that all tubing and fittings are clean and that connecting hoses are not frayed or cracked.

a. If new pump is being installed, remove plug from pump, and drain shipping fluid.

b. Reinstall plug. Fill pump with clean hydraulic fluid (item 3, table 1-1).

c. Apply a thin coat of lubricant (item 200, table 1-1) to splines on pump and mating splines on tachometer generator.

d. Position pump and gasket on tachometer generator mounting pad, engaging pump shaft in splined gearshaft. Check that pressure outlet is at lower side of pump. Install four nuts with washers on mounting studs.

e. Connect pressre line to pressure port and suction line to suction port. Connect case drain hose (10, figure 6-1) to case drain port, at top of pump.

f. Fill reservoir with hydraulic fluid (item 3, table 1-1) to overflow.

g. Check hydraulic pressure. Refer to paragraph 6-18 for hydraulic pressure check procedure. Observe hydraulic system for leakage while making pressure check.

6-26. HYDRAULIC RESERVOIR.

6-27. The hydraulic reservoir (6, figure 6-1) is mounted on brackets on the forward side of the transmission above the hydraulic pump. The reservoir has a filler cap, a filler screen, and an internal baffle vent screen, overflow scupper drain plug, a fluid low level sight gage, and connections for suction, return and scupper vent line.

6-28. REMOVAL - HYDRAULIC RESERVOIR.

a. Remove forward transmission fairing. Provide suitable container to catch hydraulic fluid.

b. Drain reservoir.

c. Disconnect suction, return, and scupper drain lines from reservoir fittings. Cap or cover open lines and fittings.

d. Remove three bolts, nuts and washers securing reservoir to mounting bracket and remove reservoir.

6-29. INSPECTION - HYDRAULIC RESERVOIR.

a. Inspect reservoir body, filler cap, sight gage plug and all fittings for damage and corrosion.

b. Inspect reservoir screen and vent screen for rust, corrosion, cleanliness, cuts and breaks. Clean screens with solvent (item 300, table 1-1) and brush, air dry.

c. Inspect for leaks and check filler cap and drain plug for proper locking and safetying. Inspect drain line for obstructions.

d. Inspect sight gage for cracks and discoloration.

6-30. REPAIR OR REPLACEMENT- HYDRAULIC RESERVOIR. Replace any damaged or unserviceable parts or fittings.

6-31. INSTALLATION - HYDRAULIC RESERVOIR.

a. Position reservoir on mounting bracket on forward side of transmission. Install three bolts, nuts and washers.

b. Connect lines to return, suction and scupper drain fittings of reservoir.

c. Fill reservoir to proper level with hydraulic fluid (item 3, table 1-1).

d. Bleed hydraulic system. (Refer to paragraph 6-13.)

6-32. HYDRAULIC SYSTEM FILTERS.

6-33. Two hydraulic filters (3 and 4, figure 6-1) are installed in the hydraulic system. The filters are located on the right side of the engine work deck. Both filters incorporate pop out buttons that pop out to indicate an impending filter stoppage. Only the filter on the return line incorporates a bypass valve.

6-34. REMOVAL - HYDRAULIC FILTER ASSEMBLIES.

a. Remove forward transmission fairing.

b. Disconnect hydraulic lines from filter and cap openings.

c. Remove two bolts, nuts, and washers securing filter to mounting bracket and remove filter from bracket.

6-35. INSPECTION - HYDRAULIC FILTER ASSEMBLIES.

a. Check threads and ports for damage.

b. Check that red pop-out button is not extended indicating an impending filter stoppage.

6-36. REPLACEMENT - HYDRAULIC FILTER. Replace filter assembly packing, element or body if inspection requirements are not met. Reset the red pop-out button by pressing down.

6-37. INSTALLATION - HYDRAULIC FILTER ASSEMBLIES.

a. Position filter on mounting bracket and install two mounting bolts, nuts and washers.

b. Connect hydraulic lines to filter. Bleed hydraulic system. (Refer to paragraph 6-13.)

6-38. REMOVAL - FILTER ELEMENT. Remove lockwire and screw bowl from filter head. Remove filter element.

6-39. INSPECTION - HYDRAULIC FILTER ELEMENT. Check for deterioration.

6-40. REPLACEMENT - HYDRAULIC FILTER ELEMENT. Replace filter element if red pop-out button is extended indicating an impending filter stoppage or if element is deteriorated.

6-41. INSTALLATION - HYDRAULIC FILTER ELEMENT. Position filter element into bowl with new packing in place. Screw bowl in filter head and secure with lockwire.

6-42. SOLENOID VALVE.

6-43. An electrical solenoid control valve is incorporated in the hydraulic system for turning the system on or off. The solenoid valve is installed forward of the transmission in the center work deck area.

6-44. REMOVAL - SOLENOID VALVE.

a. Remove forward transmission fairing.

b. Turn battery switch off and disconnect external power. Disconnect electrical connectors from solenoid (11, figure 6-1) and pressure switch (18).

c. Place wiping cloth around solenoid valve to catch hydraulic fluid. Disconnect hydraulic lines from body assemblies at right and left side of solenoid valve. (Cap or cover open lines and ports.)

d. Remove two bolts to release solenoid valve from mounting and remove solenoid valve.

e. If solenoid valve is to be replaced in helicopter, remove fitting and retain for reinstallation.

6-45. INSPECTION - SOLENOID VALVE. Visually inspect solenoid valve for damage.

6-46. INSTALLATION - SOLENOID VALVE.

a. Install all hydraulic fittings previously removed from solenoid valve using new packings. Lockwire nut and bolt securing fitting bodies to solenoid valve.

b. Position solenoid valve on mounting and secure with two mounting bolts and washers.

c. Install cross in left fitting body with packing and nut.

d. Attach hydraulic lines and hoses. (See figure 6-1.)

e. Move cyclic and collective controls through full range of travel and ensure that hoses do not bind or chafe.

f. Connect electrical connectors to solenoid valve and pressure switch.

g. Bleed hydraulic system and test solenoid valve. (Refer to paragraphs 6-13 and 6-15 for bleeding and testing procedures.)

6-47. HYDRAULIC PRESSURE SWITCH.

6-48. A hydraulic pressure switch (18, figure 6-1) is installed on the right side of the solenoid valve.

When hydraulic pressure is below 300 psig the pressure switch causes the hydraulic pressure warning light in the pedestal to illuminate.

6-49. REMOVAL - PRESSURE SWITCH.

a. Remove forward transmission fairing.

b. Turn battery switch off and disconnect external power. Disconnect electrical connector from pressure switch.

c. Place wiping cloth around pressure switch to catch hydraulic fluid. Screw pressure switch out of fitting body and remove.

6-50. INSPECTION - PRESSURE SWITCH. Visually inspect pressure switch for damage.

6-51. INSTALLATION - PRESSURE SWITCH.

a. Install packing, and screw pressure switch into fitting body.

b. Install electrical connector.

c. Bleed hydraulic system and test pressure switch. (Refer to paragraphs 6-14 and 6-15.)

6-52. SERVO ACTUATORS AND SUPPORT - CYCLIC AND COLLECTIVE

6-53. The cyclic and collective control servo actuator support is installed on the cabin roof. It serves as a mount for the servo actuators and associated bellcranks. The collective control servo actuator is mounted in the center position, and the two cyclic servo actuators are mounted in the outboard positions. The cyclic and collective servo actuators reduce the operational loads of these flight control systems. An irreversible valve is incorporated in each servo valve. In the event of loss of hydraulic pressure to a servo actuator, the plunger (12, figure 6-3) in the sequence valve (3) is pushed up by the lower spring and poppet valve (10); the upper spring holds the valve seat (11) down. This action closes the hydraulic return port and maintains irreversibility independent of hydraulic pressure. This provides safe control of the helicopter even though hydraulic power is lost. The sequency valve (3) also serves to relieve themal pressure build-up should this occur while the system is inactive. The sequence valve (3) would normally be closed when system pressure is below 100-180 psig. If internal pressure builds up, the valve seat (11) is pushed up compressing the upper spring. The poppet valve (10) on the lower spring is prevented from following by an internal obstruction in the valve shown as a line above the poppet valve on figure 6-3. The differential relief valve (4) serves to relieve pressure build-up which could occur from excessive rotor loads.

6-54. REMOVAL - SERVO ACTUATORS. (See figure 6-4.)

a. Disconnect hydraulic lines from servo actuator to be removed. Cap or plug open lines and fittings on servo actuator.

b. Disconnect cylinder extension tube assembly (10) at servo actuator end of tube assembly.

c. Remove two bolts (16 and 18) to permit seperation of the two plate assemblies, (8) or trunnion plates (3) as applicable for servo actuator being removed. Remove servo actuator.

Note

Do not disturb position of shim plates under plate assemblies or trunnion plates. Retain in original positions.

6-55. INSPECTION - SERVO ACTUATORS.

a. Visually inspect servo actuators for cracks, breaks and other signs of obvious damage.

b. Inspect all threaded parts for damaged threads.

c. Inspect ports for dirt or other foreign material.

d. Inspect exposed portion of shaft at end of actuator for scoring and evidence of corrosion.

6-56. REPLACEMENT - SERVO ACTUATORS.

a. Clean fluid inlet and outlet ports.

b. Replace servo actuators that do not meet inspection requirement.

6-57. INSTALLATION - SERVO ACTUATORS.

a. Place two trunnion plates (3) on servo actuator with flanged side of bushings inboard toward servo actuator. Install two bolts (18) to secure trunnion plates to support (19) with shims (4) in place between trunnion plates and servo actuator. Check clearance between trunnion plates and servo actuators. (See detail A.) If necessary add additional shims (4) to obtain 0.005 to 0.020 inch total clearance.

b. Place two plate assemblies (8) on servo actuator with flanged bushings inboard toward servo actuator. Install two bolts (16) to secure plate assemblies (8) and shims (9) to support (19). Check clearance between plate assemblies and servo actuators. (See detail B.) Add or take out shims (9) to obtain

a gap of 0.030 to 0.070 inch between each side of servo actuator and plate assemblies.

Note

Use one washer (17 and 15) under head of bolt (16 and 18) and two washers (2 and 7) under nut (1 and 6). Omit one washer under nut if needed to allow two threads to be exposed.

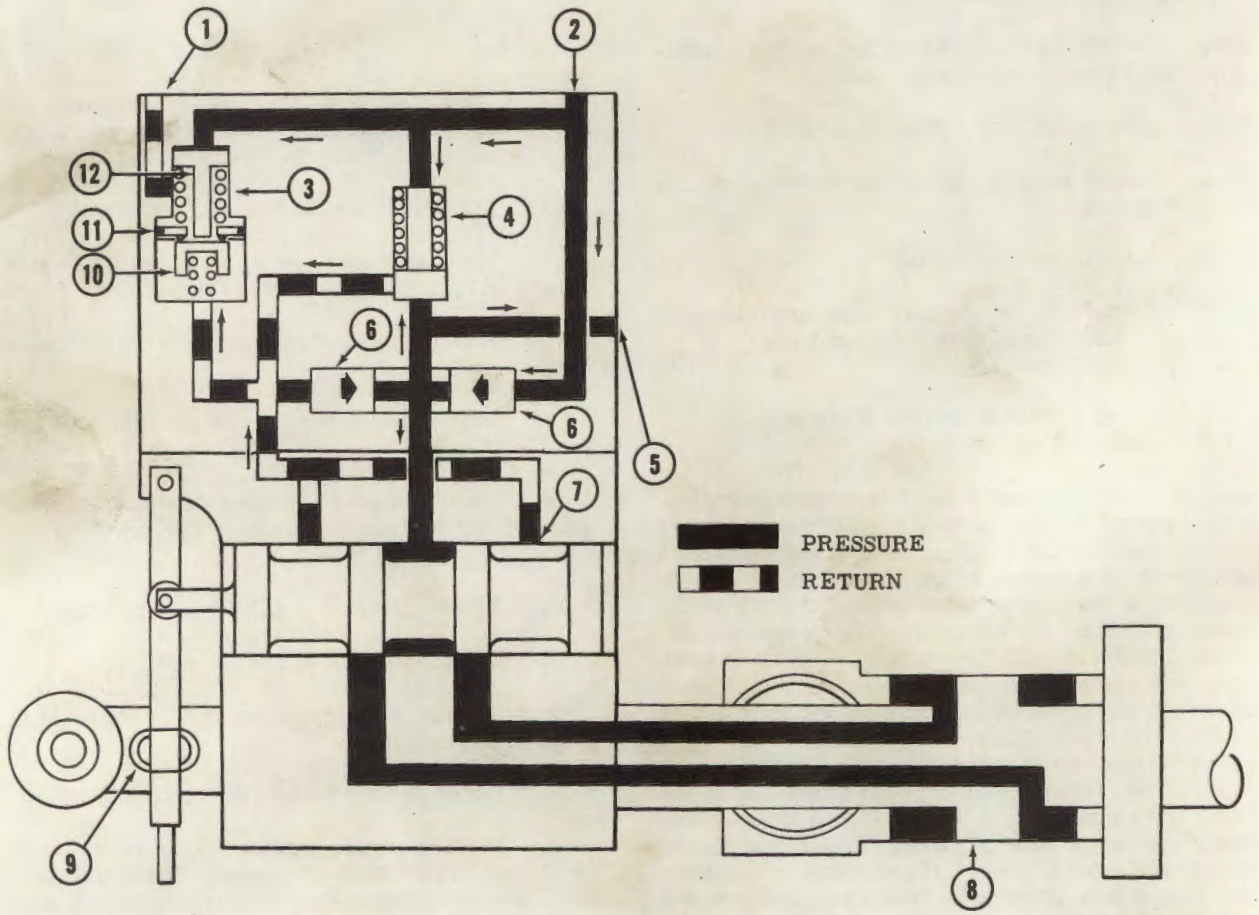
c. Connect cylinder extension tube (10) at aft end of servo actuator with bolt (14), washers (12 and 13), and nut (11). Install cotter pin.

d. Remove caps and plugs and connect hydraulic lines to servo actuator.

e. Bleed hydraulic system and test servo actuators. (Refer to paragraphs 6-10 through 6-15 as applicable.)

6-58. HYDRAULIC CHECK VALVE.

6-59. A check valve is installed in the hydraulic pump adjacent to the mounting flange. (See 9, figure 6-1). The purpose is to prevent hydraulic fluid from entering the hydraulic pump through the case drain port.



1. Return Port
2. Pressure Port
3. Sequence Valve with Thermal Relief Provisions, Sequence Valve Cracks at 100-180 psi, Full Flow at 250 psi
4. Differential Relief Valve - Flow 575-645 psi Above System Pressure
5. Test Port
6. Check Valves
7. Slide and Sleeve Assembly
8. Actuator
9. Input Control
10. Poppet Valve
11. Valve Seat (Floating)
12. Plunger

Figure 6-3. Cyclic and collective servo actuator schematic

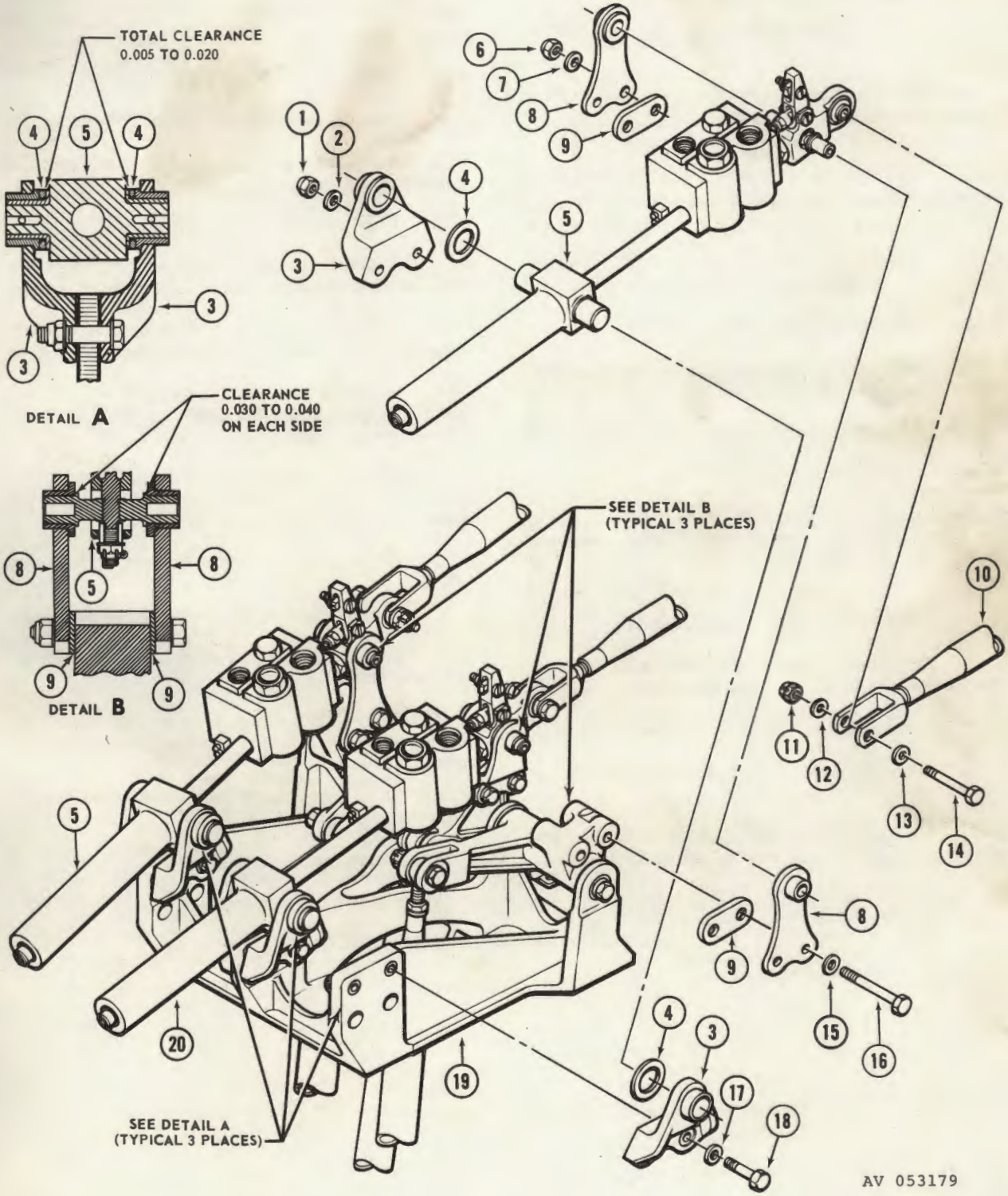


Figure 6-4. Cyclic and collective servo actuator installation

6-60. REMOVAL - CHECK VALVE.

a. Remove case drain hose (10, figure 6-1) from check valve.

b. Remove check valve (9) and packing from hydraulic pump case drain port.

6-61. INSPECTION - CHECK VALVE. Inspect for damage, corrosion or pitting. Check threads for distortion.

6-62. REPLACEMENT - CHECK VALVE. Replace check valve if inspection requirements are not met.

6-63. INSTALLATION - CHECK VALVE.

a. Install check valve and new packing in hydraulic pump case drain port adjacent to pump flange.

b. Connect case drain hose (10) to check valve.

6-64. QUICK DISCONNECTS.

6-65. Quick disconnect hoses are attached to the two hydraulic filter assemblies to provide a means of connecting a ground test cart to the hydraulic sytem.

6-66. REMOVAL - QUICK DISCONNECT.

a. Disconnect hose coupling half from coupling half installed in hydraulic filter assembly.

b. Remove coupling half from hose.

c. Remove coupling half and packing from filter assembly.

6-67. INSPECTION - QUICK DISCONNECTS. Inspect for porper locking, cracks, and distortion.

6-68. REPLACE - QUICK DISCONNECTS. Replace quick disconnects that fail to meet inspection requirements.

6-69. INSTALLATION - QUICK DISCONNECT.

a. Install hose coupling half on hose fitting.

b. Install new packing and quick disconnect half in filter assembly.

6-70. HYDRAULIC HOSES AND LINES.

6-71. Hydraulic hoses and lines are utilized to connect the various components of the hydraulic system.

6-72. REMOVAL - HYDRAULIC HOSES AND LINES. Disconnect each end of hose from attachment points.

6-73. INSPECTION - HYDRAULIC HOSES AND LINES. Inspect hydraulic hoses and lines for damage and serviceability.

6-74. REPLACEMENT - HYDRAULIC HOSES AND LINES. Replace hydraulic hoses and lines that fail to meet inspection requirements.

6-75. INSTALLATION - HYDRAULIC HOSES AND LINES.

a. Remove caps from end fittings of hose or line.

b. Inspect hose or line being installed for thorough cleanliness.

c. Secure each end of hose or line to components from which defective hose or line was previously removed.

d. Bleed hydraulic system and fill reservoir as outlined in paragraph 6-13.

e. Inspect connections for leaks.

SECTION III PNEUMATIC SYSTEM

(Not Applicable)

CHAPTER 7

POWER TRAIN SYSTEM

SECTION I SCOPE

7-1. SCOPE.

7-2. This chapter provides all the instructions and information necessary for maintenance authorized to be performed by organizational maintenance activities on the power train system. The power train system comprises a transmission, freewheeling drive unit, freewheeling to transmission drive shaft, oil cooler fan and drive shaft, two short tail rotor drive shafts, a long tail rotor drive shaft, and tail rotor gearbox. The freewheeling unit, mounted in the engine power take-off gear case, connects the transmission and tail rotor gearbox to provide that main and tail rotor rotate together, and to permit free rotation of rotors when engine is not operating. (Figure 7-1.)

7-3. TROUBLESHOOTING - POWER TRAIN. Below is a brief summary of power train troubles which may be encountered in organizational maintenance. Conditions and possible causes listed have been limited to those reasonably probable (though not necessarily frequent in normal service) which could become known through pilot reports or by inspection methods applicable in organizational maintenance, and which would be subject to some evaluation at this level, although final corrective action by a higher level might be required in some instances. Conditions involving obvious major damage are omitted, as are those caused by accident or an unusual chain of events which would require evaluation by a competent authority. Notes below provide information in addition to that available in troubleshooting section and in maintenance instructions for systems and components of power train.

a. In transmission troubleshooting, observe the following;

(1) Low oil level will not cause a low oil pressure indication, provided sump contains enough oil to cover pump inlet. Oil temperature might rise, however, overfilling, above standard oil level, may cause low pressure indication due to foaming of the oil caused by excessive churning by the gears.

(2) Effects of an oil leak will depend on its location in system and rate of leakage. An external leak can eventually allow sump to be pumped dry, causing failure of transmission. While oil remains to supply pump, the pressure relief valve would tend to maintain normal system pressures compensating for leakage. This applies especially to leaks located between pump and relief valve. Leaks occuring beyond relief valve could cause some indication of low oil pressure. Leakage to interior of transmission, while not affecting oil level, could starve lubrication areas beyond the leak and might affect indicated oil pressure and temperature.

(3) Cumulative clogging of oil filter screens will not be shown by a gradual drop of indicated oil pressure as it may on some other aircraft or automobile oil systems. Pressure relief valve would maintain normal pressure even if filter screens become so clogged as to force oil flow through filter bypass valve.

b. For main drive shaft troubleshooting, apply the following:

(1) Trouble conditions of main drive shaft can seldom be detected in operation, since there are no reliable indications except possibly in an extreme condition. "Suspected vibration" is only partially accurate as a term for such conditions as dynamic out-of-balance or faulty coupling action. Vibration would result, as well as abnormal stresses and wear, but would be absorbed in structure and pylon mounts or effectively masked by normal vibrations of the helicopter, providing no distinct indication to pilot.

(2) Drive shaft trouble indications are, therefore, usually those revealed by careful inspection.

(3) Principal causes of drive shaft trouble are faulty installation procedure and improper lubrication of spherical tooth couplings.

c. For tail rotor drive system troubleshooting, apply same principles as for main drive shaft.

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
MAIN TRANSMISSION:		
Low oil pressure	Faulty caution light circuit or transmitter	Repair electrical circuit or replace transmitter
	Low oil level	Service with lubricant

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
	Pressure relief valve malfunction	Adjust or replace valve
	Faulty oil pump	Replace pump
	Leakage or restriction between pressure relief valve and transmitter	Repair oil line connections or replace O-ring seals in pressure relief valve seat
	Damaged or torn packings on oil jets	Replace packings
Low oil level in transmission with high oil level in engine	Damaged packing in freewheeling unit	Replace freewheeling unit
High oil pressure warning light.	Faulty indicator circuit or transmitter	Repair electrical circuit or replace transmitter
a. At normal operating temperatures	Pressure relief valve malfunction	Adjust or replace pressure relief valve
b. At low operating temperatures	Oil viscosity high due to low starting temperature	Run ship long enough to thin oil
	Improper lubricant	Service with proper lubricant
High oil temperature warning light	Faulty indicator circuit or transmitter	Repair electrical circuit or replace transmitter
	Obstructed duct into transmission oil cooler	Clear duct
	Oil cooler clogged or obstructed	Clean cooler core air passages. Replace cooler if internally clogged, and flush oil lines. Check transmission filters, pump screen, and magnetic chip detectors
	Oil cooler by-pass valve malfunction	Replace oil cooler
	Clogged oil jets	Clean or replace jets. Replace transmission if internally damaged
	Seized bearings or other internal transmission failure	Replace transmission and flush all external oil lines
Metal chips on electric chip detectors (warning light) or in pump screen	Internal transmission failure of gears or bearings or wear	If metal chips are visible; replace transmission. If detector has fuzz but no visible metal chips: clean detector and recheck after 5 hours operation
Rubber pieces on pump screen	Cut O-rings in pressure relief valve seat	Remove pressure relief valve, check transmission case for sharp edges, replace O-rings
Excessive pylon motion	Loose bearing on isolation mount fitting	Replace fittings or bearings
	Deterioration of isolation mount	Replace isolation mount
	Static stop on bottom of transmission bent or loose	Replace stop or replace transmission
	Worn or loose transmission mounting spindles	Check transmission mounting spindles for wear or looseness.
FREE WHEELING UNIT:		
Metal chips on magnetic plug	Internal failure of clutch or bearings	Replace freewheeling unit

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
MAIN DRIVE SHAFT:		
Grease leakage	Cut or torn O-ring seal	Replace O-rings, assemble with care
	Cut or torn boot seat	Replace boot seal(s)
Abnormal coupling wear	Faulty lubrication or wrong lubricant	Clean and lubricate couplings or replace drive shaft
TAIL ROTOR DRIVE SYSTEM:		
Suspected vibration	Loose bolts in disc type couplings	Tighten bolts or replace couplings if damaged
	Shaft hanger bearings rough or failed	If no visible sign of overheating, recheck after 5 hours operation. If signs of overheating or BRG still rough after 5 hours; replace bearing.
	Worn splined adapters	Replace adapter
	Oil cooler fan unbalanced or failure	Inspect and replace oil cooler fan and shaft assembly if damage is found.
Excessive loss of grease from hanger bearings **Note** Some grease will leak out and help to form seal around face of bearings; this is acceptable. DO NOT clean this grease off.	Misalignment of bearings in hangers	Loosen torque on each hanger bearing clamp bolt to 5-15 inch-pounds. Run ship up. Retorque clamp bolts to 50-70 inch-pounds and lockwire
Binding or roughness when drive shaft is manually rotated	Dry or faulty hanger bearings	Isolate faulty hanger by disconnecting shafts. Replace faulty hanger assembly
	Defective tail rotor gearbox	Replace gearbox
	Interference of oil cooler fan and housing	Align or replace oil cooler fan assembly
Metal chips on tail rotor gearbox electrical chip detector (Warning light)	Internal failure of gears or bearings	If metal chips are visible; replace gearbox. If detector has fuzz but no visible metal chips; clean detector and recheck after five hours operation

7-4. METAL PARTICLES CONTAMINATION OF GEARBOXES. Metal particles found on gearbox oil filters or chip detector plugs may indicate failure of an internal part of the gearbox. The presence of metal particles, however, is not necessarily an indication that the gearbox is no longer serviceable. The quantity, source, form and type of metal found, together with the service history of the particular gearbox, must be taken into consideration. The time accumulated since the gearbox was new or overhauled, previous failures and the type of operation are important factors in determining the further serviceability of the unit. The particles found may be steel, silver, aluminum, magnesium, copper (bronze) or phenolic in

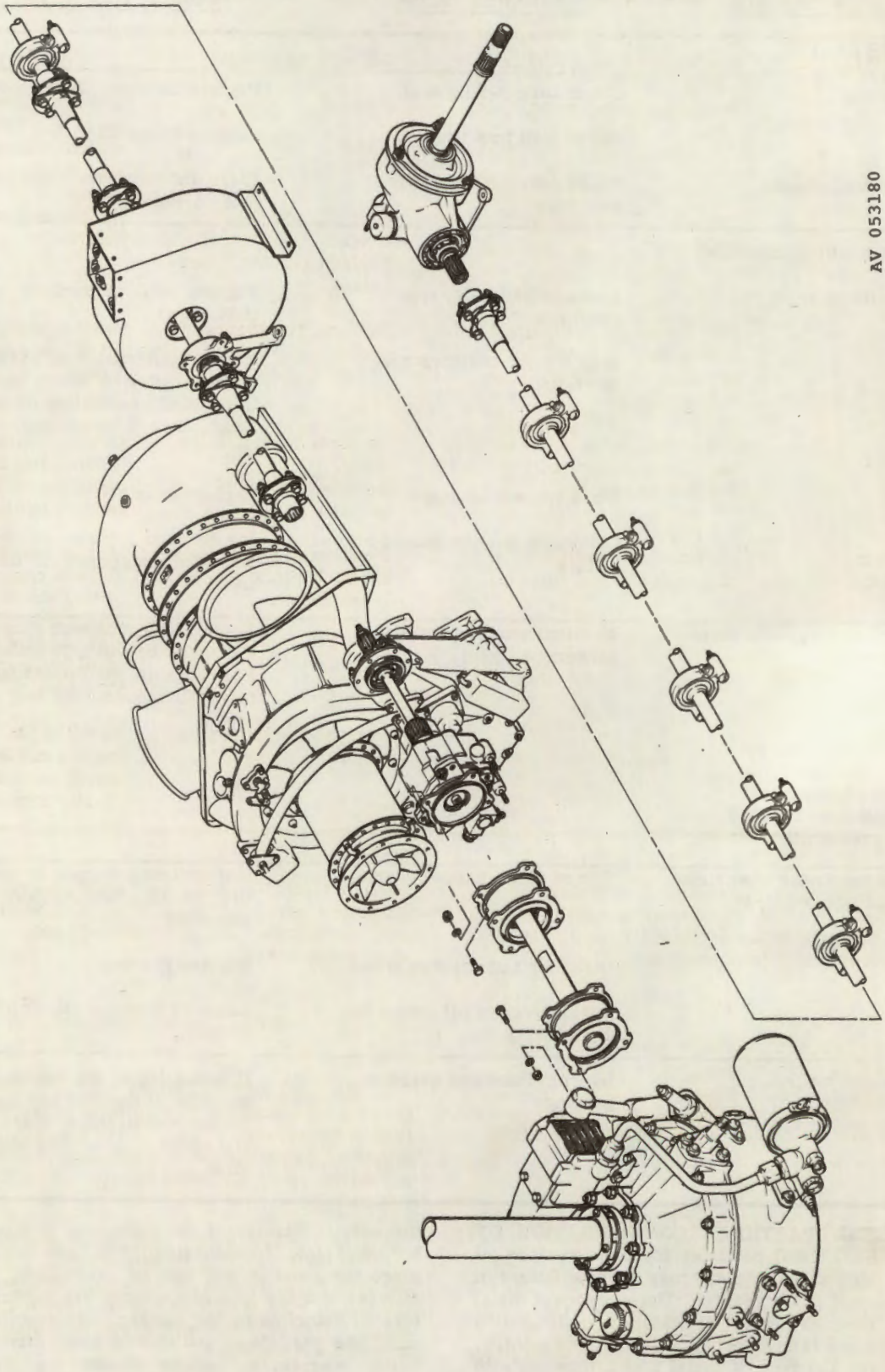


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Figure 7-1. Power train system

METAL PARTICLES CONTAMINATION - GEARBOX OIL

KIND OF METAL	QUANTITY AND/OR SIZE	ACTION REQUIRED	NOTES
Steel	Fuzz, fine hair-like particles.	None	Result of normal wear. May have exaggerated appearance because of oil.
	Particles in splinter or granular form.	Perform serviceability check. Replace gearbox if necessary.	Usually indicates failure.
	Thin flakes not exceeding 1/64 inch in thickness and 1/16 inch in length. Quantity not to exceed 10 flakes.	Perform serviceability check.	Small quantity may not indicate bearing failure.
	More than 10 flakes not exceeding 1/64 inch in diameter and 1/4 inch in length.	Perform serviceability check. Replace gearbox if necessary.	Usually indicates failure. May be bearing in one of the accessory quills.
Aluminum or Magnesium	Particles in granular form or like minature lath turnings.	Perform serviceability check. Replace gearbox if necessary.	May be result of use of these materials as mallets or drifts during assembly. May indicate wear of oil pump interior surfaces.
Phenolic		Perform inspection for source.	Result of the use of mallets and drifts during assembly of bearing retainer

various shapes and quantities. For a detailed explanation of the action made necessary by the presence of each of the possible types of particles in the gearbox, refer to figure 7-2.

Warning

When any particles found are readily identified as fragments of gearbox parts, such as gears, nuts, bearings, snap-rings, lockwire, or other components, replace gearbox and oil cooler, flush all oil lines and tubes.

7-5. IDENTIFICATION OF METAL PARTICLES AND SERVICEABILITY CHECK.

a. A visual inspection of color and hardness will occasionally suffice to identify the particles. When visual inspection does not positively identify the particle, the kind of particle present may be determined by a few simple tests. Equipment to perform tests includes a permanent magnet, electric soldering iron, sodium chloride, and concentrated nitric acid. Check each as follows:

(1) STEEL. Isolate steel particles with permanent magnet.

(2) SILVER. Identify silver by dissolving a particle in a solution of 50% by volume nitric acid. It may be necessary to warm the solution. Add a few drops of 5% by weight sodium chloride solution. A white precipitate identifies silver.

(3) ALUMINUM. Determine aluminum particles by their reaction to hydrochloric acid. When a particle of aluminum is dropped into hydrochloric (muriatic) acid it will fizz with a rapid emission of bubbles. The particles will gradually disintegrate and form a black residue.

Note

Magnesium and aluminum react similarly in hydrochloric acid, when in doubt drop particle into nitric acid. Aluminum does not react noticeably in nitric acid.

(4) COPPER OR BRONZE AND MAGNESIUM. Differentiate copper or bronze and magnesium by their respective reactions to nitric acid. When a particle of copper or bronze is dropped into nitric acid it forms a bright green cloud in the acid. When a particle of magnesium is dropped into nitric acid it fizzes with a rapid emission of bubbles. Phenolic and aluminum do not react noticeably to nitric acid.

b. The following procedure should be employed if any doubt exists as to the serviceability of the transmission after finding metal particles in the oil.

(1) Drain transmission, oil cooler, and connecting lines.

(2) Flush oil cooler and connecting lines with clean oil.

(3) Clean magnetic plug, oil pump inlet screen, and inspect and discard oil filter.

Caution

Note condition of packings, seals and gaskets before reinstallation of units. Replace if damaged.

(4) Install new oil filter element, magnetic plug and oil pump inlet screen.

(5) Service transmission with proper oil.

(6) Ground-run transmission for one hour. Drain oil into a clean container and inspect for chips. Inspect magnetic plug and oil filter for chips. If the number of particles has increased, or if any particles are found which may be visually identified as chips or flakes from a bearing or gear, replace the transmission. If the number of particles has decreased and only minute particles are found, continue the transmission in service.

c. The following procedure should be employed if any doubt exists as to the serviceability of the 90 degree tail rotor gearbox.

(1) Drain gearbox.

(2) Flush gearbox with clean oil. Inspect oil for chips.

Caution

Note condition of packings, seals and gaskets before reinstallation of units. Replace if damaged.

(3) Clean magnetic plug and reinstall with drain plug.

(4) Service gearbox with proper oil.

(5) Ground-run gearbox for one hour. Drain oil into a clean container and inspect for chips. Inspect magnetic plug. If the number of particles has increased, or if any particles are found which may be visually identified as chips or flakes from a bearing or gear, replace gearbox. If the number of particles has decreased and only minute particles are found, continue the gearbox in service.

SECTION II MAIN DRIVE SHAFT

7-6. MAIN DRIVE SHAFT.

7-7. A main drive shaft (figure 7-2) with flexible gear couplings is installed between the freewheeling coupling on the engine and the adapter flange on the transmission input drive. Flexibility of couplings is required to accommodate movement of transmission on pylon mounts. A spring in each coupling assists centering of shaft during operation and tends to hold shaft assembly in center.

7-8. REMOVAL - MAIN DRIVE SHAFT.

a. Remove cowling to gain access to main drive shafts.

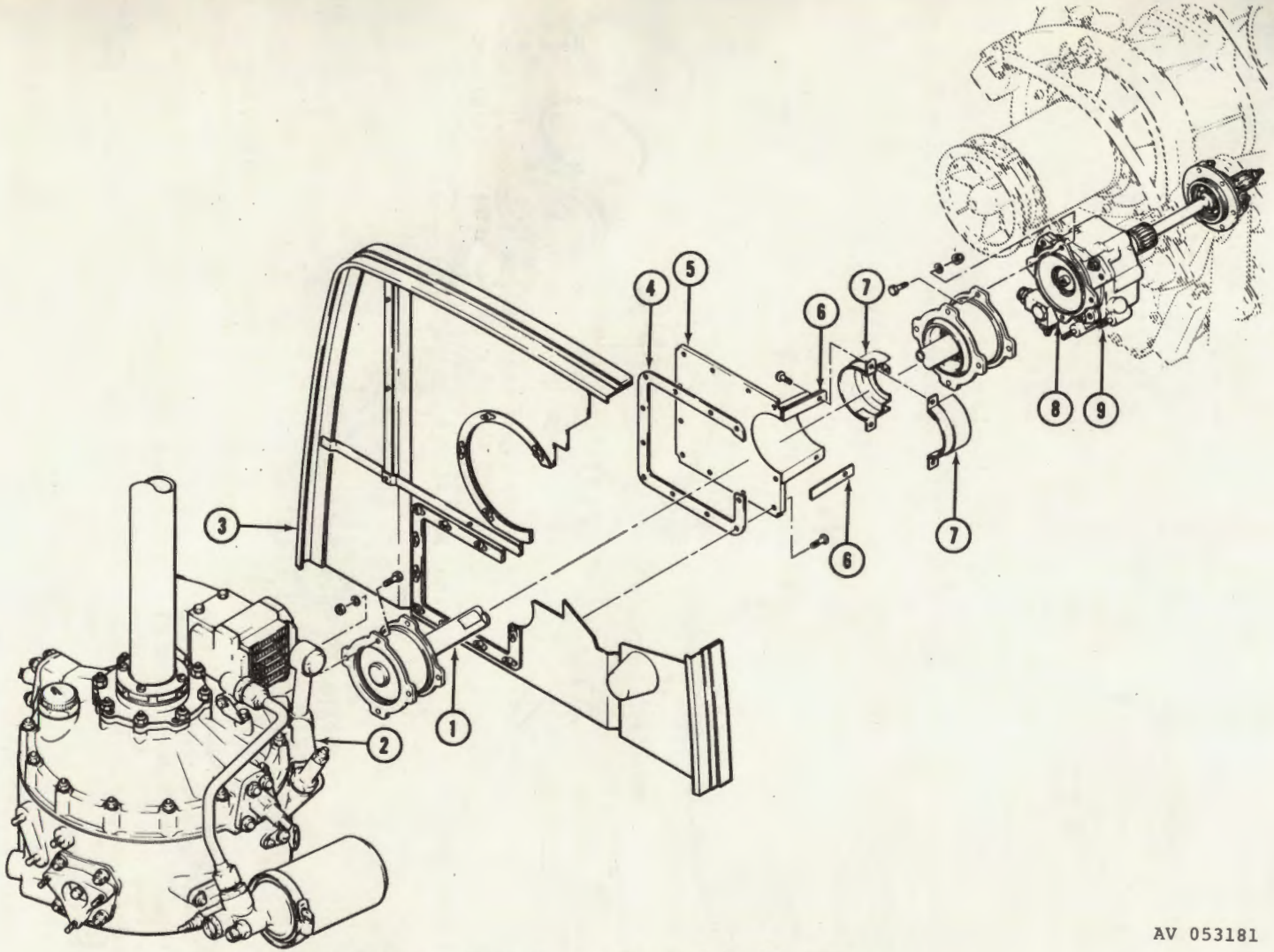
b. From right side of helicopter remove all screws necessary to remove drive shaft cover (7).

c. Remove all screws securing drive shaft door (5) to aft side of firewall (3).

d. Remove four bolts attaching forward drive shaft coupling to input adapter on transmission.

e. Remove four bolts attaching aft drive shaft coupling to freewheeling adapter flange.

f. Push aft on forward coupling, to compress springs and obtain clearance between forward drive shaft coupling and input adapter flange. Move forward



1. Driveshaft, Engine to Transmission
2. Transmission
3. Forward Firewall
4. Gasket, Door
5. Door, Driveshaft
6. Gasket, Cover
7. Cover, Driveshaft
8. Freewheeling Unit
9. Rotor Brake Mounting Studs*

* Not Used

Figure 7-2. Engine to transmission drive shaft

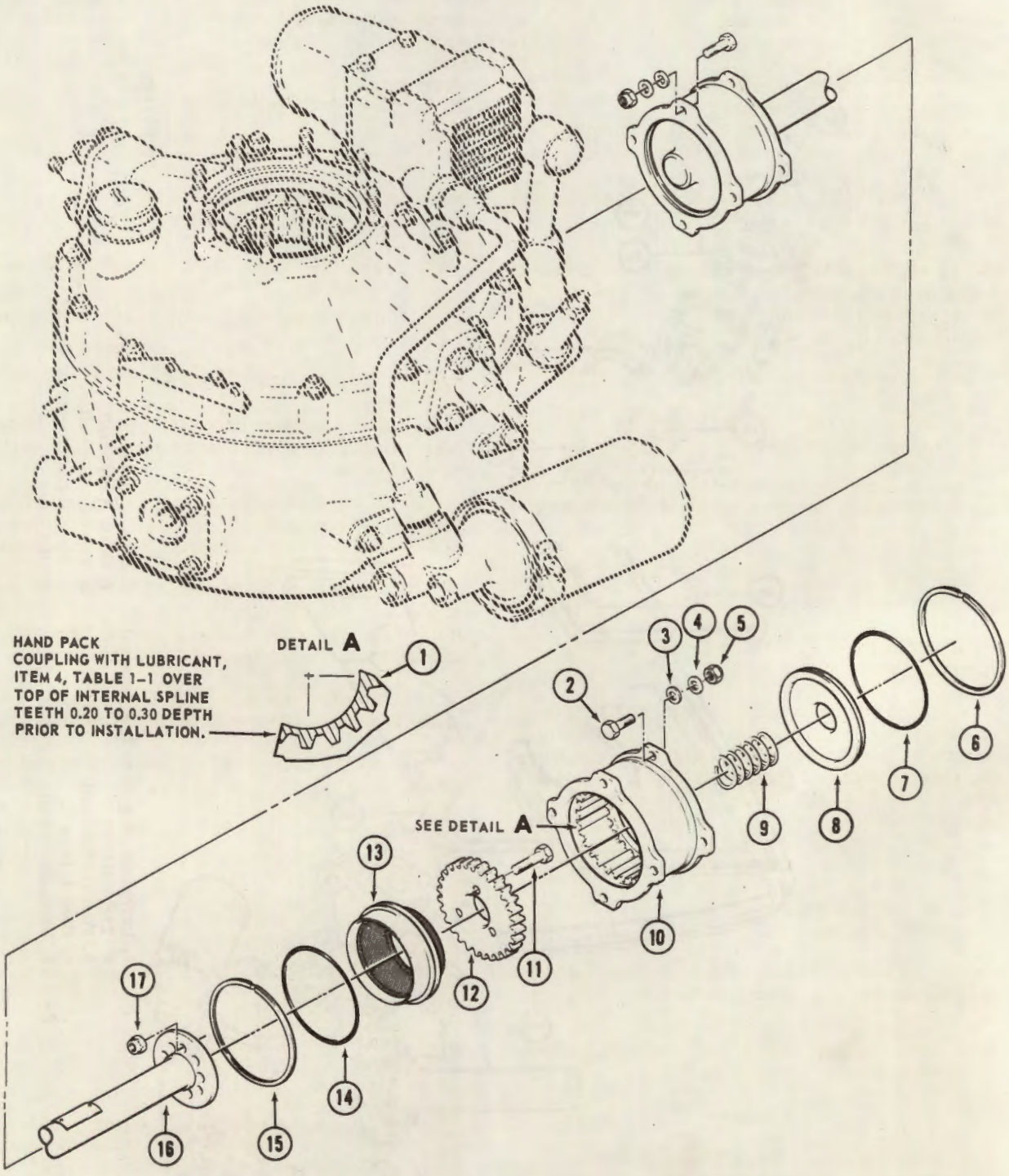


Figure 7-3. Engine to transmission coupling (Sheet 1 of 2)

1. Lubricant
2. Bolt
3. Washer
4. Washer
5. Nut
6. Retainer Ring
7. Packing
8. Plate, Grease Retainer
9. Spring, Shaft Centering
10. Coupling, Spherical Spline Outer
11. Bolt
12. Coupling, Spherical Spline Inner
13. Seal, Drive Shaft Coupling
14. Packing
15. Retainer Ring
16. Shaft, Engine to Transmission
17. Nut

Figure 7-3. Engine to transmission coupling (Sheet 2 of 2)

end of shaft outboard to clear input adapter flange. Move shaft assembly aft passing forward coupling through opening and remove shaft assembly from helicopter.

7-9. DISASSEMBLY - MAIN DRIVE SHAFT.

a. Remove retainer ring (6, figure 7-3) from outer end of outer coupling (10).

b. Remove grease retainer plate (8) with packing (7) and shaft centering spring (9) from outboard end of outer coupling.

c. Remove retainer ring (15) from inboard end of outer coupling (10).

d. Remove outer coupling (10) from seal (13) and spherical inner coupling (12).

e. Remove three bolts and nuts attaching inner coupling (12) to flange on shaft (16). Hold nut with wrench to prevent nut turning with bolt and scoring shaft. Release of shaft from inner coupling will also release seal (13) which is assembled on end of shaft.

Caution

Do not scratch seal with tools or other rough objects.

f. Repeat above instructions for disassembly of coupling assembly on other end of shaft.

7-10. CLEANING - MAIN DRIVE SHAFT. Clean all parts with clean wiping cloths.

Caution

If solvent is used inside couplings or seal, dry thoroughly with filtered compressed air prior to reassembly.

7-11. INSPECTION - MAIN DRIVE SHAFT.

a. Inspect parts for nicks and scratches.

b. Visually inspect teeth and splines for wear, cracks, or damage. (Figure 7-4.)

c. Inspect seals and packings for condition and replace as necessary.

7-12. REASSEMBLY - MAIN DRIVE SHAFT.

a. Place retainer ring (15, figure 7-3) loosely over shaft. This will be used later to retain seal in outer coupling.

b. Position seal (13) on end of shaft with aluminum cone toward center of shaft. Be sure rolled edge of seal is seated in groove around face on end of shaft.

c. Position inner coupling (12) on end of shaft and secure with three bolts (11) and three nuts (17). Hold nuts (17) with wrench to prevent turning and scoring shaft. Torque bolts to 50-70 inch-pounds.

d. Repeat steps a. through c. on opposite end of shaft. Set shaft assembly aside for time being.

e. Install packing (7) in groove in grease retaining plate (8) and coat packing (7) with light coat of lubricant (item 4, table 1-1). Position grease retaining plate in end of outer coupling (10) and secure with retaining ring (6).

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Figure 7-4. Acceptable tooth wear pattern

f. Evenly distribute lubricant (item 4, table 1-1) over spline teeth of outer coupling. Refer to detail A, figure 7-3.

g. Repeat steps e. and f. for other outer couplings.

h. Install packing (14) in seal on each end of shaft and apply light coat of lubricant.

i. Lay outer coupling on work bench with open end up. Place centering spring inside outer coupling and in depression.

j. Push inner coupling into outer coupling, supporting seal ring to insure its entrance into outer coupling. When seal (13) is seated in outer coupling, secure with retainer ring (15) placed loosely on shaft.

k. Repeat steps i. and j. on opposite end of shaft. Index second outer coupling so that bolt holes are aligned with first.

l. Wipe grease from outside of shaft.

7-13. INSTALLATION - MAIN DRIVE SHAFT.

a. Place shaft through opening in forward firewall and position shaft in place between transmission input adapter and freewheeling adapter flange.

b. Align attachment bolt holes and install four bolts (2, figure 7-3) (head inboard) in each assembly with washers (3 and 4) under nut (5).

c. Install firewall drive shaft door and drive shaft cover on aft side of firewall.

SECTION III CLUTCHES

7-14. FREEWHEELING ASSEMBLY.

7-15. The freewheeling unit is mounted on the engine gearbox and its shaft is splined directly to the power take-off gear shaft. Engine power is transmitted to the outer race of the freewheeling unit, then through the full-phasing sprag elements of the unit which couples the outer race to the inner race shaft. The inner shaft adapts to the transmission drive shaft and the tail rotor drive shaft to provide power to the main and tail rotors respectively. During autorotation the main rotor drives the tail rotor through the inner shaft while the sprag clutch provides a disconnect to the outer race and hence the engine. The freewheeling assembly is lubricated from the transmission lubrication system. Lubrication oil is metered through an orfice fitting, through flexible hoses, to the aft freewheeling assembly housing. After the oil has flowed forward through the freewheeling shafts to the forward housing, it is pumped, by centrifugal action of the outer race, through a flexible return hose to the transmission sump. A vent valve assembly is installed at the forward end of the inner shaft to provide equalization of air pressure and assist oil return pumping action.

7-16. VENT ASSEMBLY.

7-17. A vent assembly is installed in the forward end of the freewheeling shaft. This is mounted slightly off center and spring loaded to open to outside pressure at higher speeds and close at lower speeds to prevent oil leakage.

7-18. REMOVAL - VENT ASSEMBLY.

a. After main drive shaft has been removed, remove retaining ring (1, figure 7-5).

b. Using a 1/4-28 bolt screwed into the vent hole of valve housing (3) remove assembly.

c. Remove ring (8), washer (7), spring (6), and valve (5).

7-19. CLEANING - VENT ASSEMBLY. Clean entire assembly using solvent (item 300, table 1-1), and a bristle brush.

7-20. INSPECTION - FREEWHEELING ASSEMBLY.

a. Inspect lubrication fittings, seals, and hoses for leakage and security.

b. Inspect housing for cracks, scratches, and security of attachment.

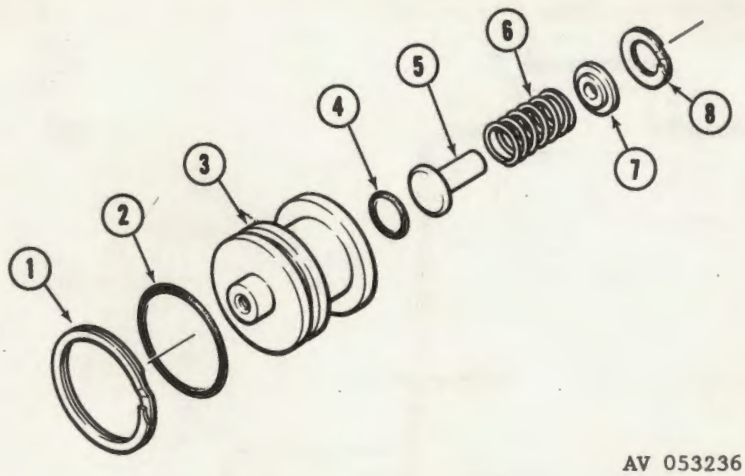
7-21. REPAIR OR REPLACEMENT - VENT ASSEMBLY. Replace packings (2 and 4) and any damaged parts.

7-22. INSTALLATION - VENT ASSEMBLY.

a. Insert valve (5), spring (6) and washer (7) in valve housing (3).

b. Compress spring in housing and install ring (8).

c. Insert vent assembly in freewheeling unit and install retaining ring (1).



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1. Retaining ring
2. Packing
3. Valve housing
4. Packing
5. Valve
6. Spring
7. Washer
8. Retaining ring

Figure 7-5. Vent assembly

SECTION IV MAIN TRANSMISSION

7-23. MAIN TRANSMISSION.

7-24. The transmission provides a two stage reduction of 17.44 to 1.0 (6180 to 354). The first stage is a bevel gear arrangement with 3.74 to 1.0 reduction; the second stage reduction is obtained with a planetary gear train providing 4.67 to 1.0 reduction. An accessory drive pad is provided on the lubrication pump on the forward side of the transmission for mounting the rotor tachometer and flight control hydraulic pump. This drive pad has an rpm of 4349; 1.42 to 1.0 reduction from the engine. The transmission is mounted on the cabin roof deck, forward of the power plant. The main rotor mast is secured in the top of the transmission by the main rotor bearing, bearing liner, and bearing and seal plate. Transmission is flexibly supported on the airframe by a system composed of two pylon support links, one on each side: a drag link secured to bottom of transmission and connected by bolt to the rubber isolation support mount on the airframe. A cylindrical boss extends downward from forward end of drag link and fits loosely in a hole in the pylon stop mounted on airframe, providing a positive limit of travel of the pylon. Lubrication is provided by a system, (figure 7-6) which includes a pump, relief valves, filter, spray jets, and an oil cooler. The pump is a constant volume type driven by the accessory gear. An oil level sight gage is located on the right side of the transmission case. A breather type filler cap and two electrical magnetic chip detectors and drain plugs are incorporated. The transmission also furnishes lubrication for the freewheeling unit mounted in the engine accessory gear case. A pressure line and a return oil line pass through the forward bulkhead to connect the transmission and freewheeling unit. Two pressure switches, low and high pressure, are connected to warning light on instrument panel.

7-25. PYLON SUPPORTS.

7-26. The main transmission is supported on each side by a pylon support on the cabin roof and attached by clevis arrangement to the roof and spindle to the transmission.

7-27. INSPECTION - PYLON SUPPORT. Inspect pylon supports for cracks, scratches, security of attachment, and elongation of holes in selfaligning bearing.

7-28. DRAG PIN ASSEMBLY.

7-29. The main transmission is supported and attached at the lower rear section by a rubber isolation mount. A round pin extends down into a plate on the

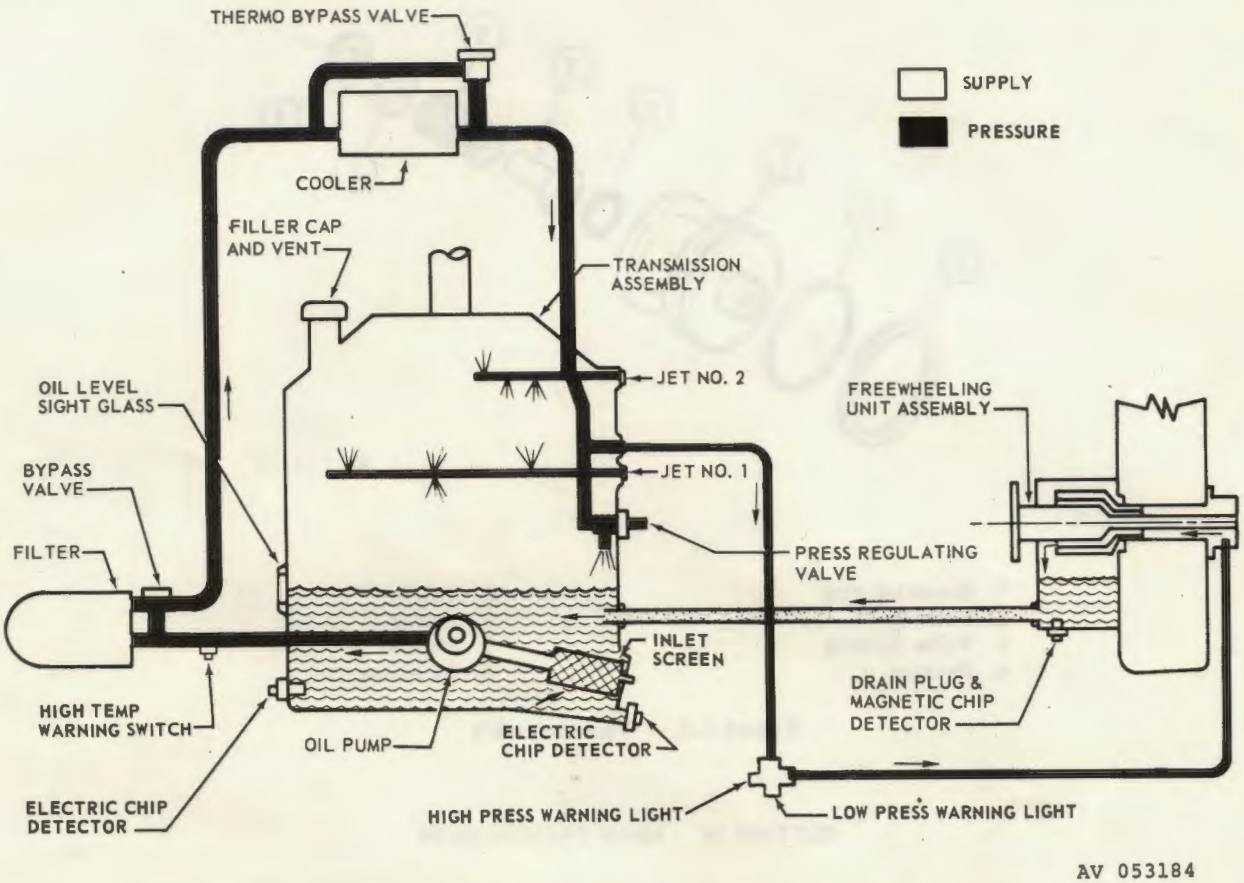


Figure 7-6. Transmission oil system schematic

deck and this limits travel of the transmission in the mounts.

7-30. INSPECTION - DRAG PIN ASSEMBLY. Inspect drag pin for cracks, security of attachment, rubber deterioration and wear. Inspect bearing for looseness and security in its bushing (staking).

7-31. INPUT DRIVE QUILL SEALS.

7-32. An input drive quill is located on aft side of transmission main case. Engine torque is transmitted through the main drive shaft into the input drive quill assembly.

7-33. INSPECTION - INPUT DRIVE QUILL SEALS. Inspect area around the input drive quill for oil leakage, security of attachment of quill and any apparent damage.

7-34. OIL PUMP ASSEMBLY.

7-35. A constant delivery pressure transmission oil pump (17, figure 7-7) is flush mounted on the forward side of the transmission main case and is driven by the accessory bevel gear. The outboard end of the oil pump has an accessory drive pad for mounting the rotor rpm tachometer and, through it, the flight control hydraulic pump.

7-36. INSPECTION - OIL PUMP ASSEMBLY. Inspect oil pump mounting area for oil leaks and hold down nuts for security.

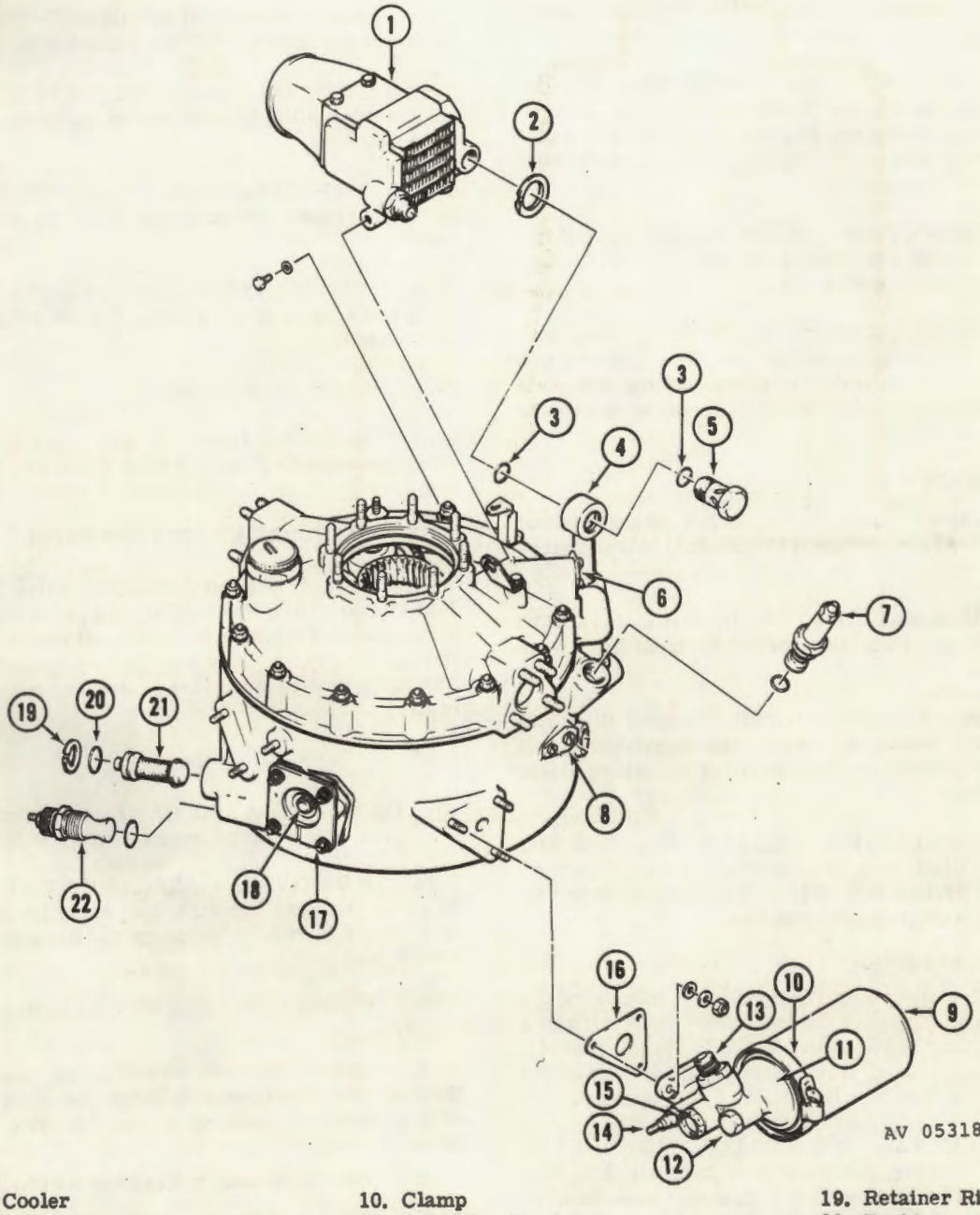
7-37. THERMO SWITCH.

7-38. The thermo switch (14, figure 7-7) is mounted on the filter head assembly and senses a high temperature of filter inlet oil. This gives an indication in cockpit by lighting a warning light on instrument panel.

7-39. INSPECTION - THERMO SWITCH. Inspect for broken or loose terminal, evidence of leakage and visible damage.

7-40. OIL FILTER HEAD ASSEMBLY.

7-41. The transmission is provided with an oil filter head assembly (11, figure 7-7) mounted on the left side



1. Oil Cooler
2. Gasket
3. Packing
4. Oil Transfer Tube
5. Bolt
6. Oil Jet No. 2
7. Oil Pressure Regulating Valve
8. Oil Jet No. 1
9. Oil Filter Assembly
10. Clamp
11. Oil Filter Head
12. Plug
13. Union Filter to Cooler Oil Line
14. Thermoswitch
15. Oil Bypass Valve
16. Gasket
17. Oil Pump
18. Splined Shaft
19. Retainer Ring
20. Packing
21. Strainer
22. Electric Chip Detector and Drain Plug

Figure 7-7. Transmission external components

of the transmission with an inlet to the assembly through an internal passage sealed with a gasket. Provisions are made for incorporation of a filter bypass valve, the thermo switch and the filter element.

7-42. REMOVAL - OIL FILTER HEAD ASSEMBLY. Remove oil line to the oil cooler and disconnect electrical wiring. Remove three nuts and washers attaching assembly to transmission case. Remove oil filter head assembly.

7-43. INSPECTION - OIL FILTER HEAD ASSEMBLY. Inspect for cracks, damage, and oil leakage after installation and turn-up.

7-44. INSTALLATION - OIL FILTER HEAD ASSEMBLY. Install new gasket on studs and position oil filter head assembly in place. Secure with nuts and washers and connect electrical wiring and cooler oil line.

7-45. FILTER.

7-46. The oil filter (9, figure 7-7) is installed on the oil filter head assembly by screwing on and clamping in place.

7-47. REMOVAL - FILTER. Remove clamp around filter seat and turn filter cartridge from filter head assembly.

7-48. INSPECTION - FILTER. Inspect filter receptacle for damaged threads, clamp condition, and filter for amount of contamination by cutting open. Discard filter.

7-49. INSTALLATION - FILTER. Wipe light film of oil on filter seal of new filter, screw filter into place and secure with clamp. Tighten clamp (10) by thumbscrew until securely seated.

7-50. OIL COOLER.

7-51. The oil cooler (1, figure 7-7) mounts on the transmission top above the input drive quill and has a thermo bypass valve incorporated to bypass cool oil. Oil is cooled as it flows through the cooler by air which is supplied by a fan and duct arrangement.

7-52. REMOVAL - OIL COOLER. Disconnect oil inlet line. Remove clamp and hose from air duct. Remove oil outlet transfer bolt in transfer tube. Remove bolts holding cooler to mount brackets.

7-53. INSPECTION - OIL COOLER. Inspect oil cooler for damaged cooler fins, oil leakage in core, cracks, and security.

7-54. INSTALLATION - OIL COOLER. Position oil cooler on mount brackets and install bolts securing cooler to brackets. Connect oil inlet line and outlet transfer bolt. Connect air hose and clamp on air inlet duct.

7-55. OIL TRANSFER TUBE.

7-56. The transfer tube (12, figure 7-7) carries oil from the oil cooler to the transmission top case.

7-57. REMOVAL - OIL TRANSFER TUBE. Remove oil transfer bolts, top and bottom, and remove transfer tube.

7-58. INSPECTION - OIL TRANSFER TUBE. Inspect for cracks and scratches on the gasket and seal surfaces.

7-59. INSTALLATION - OIL TRANSFER TUBE. Install bolts using new gaskets. Torque bolts 100-200 inch-pounds.

7-60. HOSES AND LINES.

7-61. Hoses and lines are used to carry oil to and from freewheeling unit. Check lines and hoses for leaks, chafing, and deterioration.

7-62. PRESSURE REGULATOR VALVE.

7-63. The oil pressure regulator valve (7, figure 7-7) is mounted on the left, aft side, of the transmission case and limits the system oil pressure by relieving excess oil back into the transmission case. The oil pressure regulator is located below the oil cooler.

Caution

Do not loosen jam nut or turn external pressure adjusting screw.

7-64. REMOVAL - PRESSURE REGULATOR VALVE. Remove lockwire. Use wrench on hexagonal shoulder of valve body to loosen and remove valve assembly with packings.

7-65. INSPECTION - PRESSURE REGULATOR VALVE.

a. Inspect valve for scored areas, and damaged threads. Using a blunt rod, check piston for freedom of movement by pushing it into the body several times.

b. Inspect packing and replace as required.

7-66. INSTALLATION - PRESSURE REGULATOR VALVE.

a. Lubricate threads and packing with oil, and place packing on valve.

b. Install body in case.

c. Check oil pressure in operation. If a new valve assembly is being installed or incorrect adjustment of the valve is seriously suspected, check pressure setting as follows:

(1) Remove either the high or low pressure sensing switches mounted on the cabin roof to the left of the transmission. Do not remove both switches; just one.

Note

This can be used to check sensing switch operation by removing one switch and checking operation of installed switch.

(2) Connect a test pressure gage, 0-100 psi range preferred, using suitable lines and 1/4 inch tube fittings.

(3) Run up helicopter to warm lubricating oil. Do not attempt adjustment of valve until oil is hot or unless pressure is below 30 psi when at full rpm.

(4) Check pressure to range of 40 to 60 psi when at 103% rpm with hot oil. If not within this range, adjust to 45 to 55 psi. Back off adjusting screw jam nut; increase pressure by clockwise rotation of the adjusting screw. Tighten jam nut and shut down ship.

(5) Remove test gage and attaching lines.

(6) Reinstall pressure warning switch, electrical connection, and lockwire.

7-67. CHIP DETECTORS.

7-68. The chip detectors (two) are installed in the transmission case. One is adjacent to the oil pump inlet screen on the forward right-hand side of the transmission, this also is the drain for the transmission. The second one is a few inches aft of the other. The chip detector is the removable center portion of the chip detector and drain plug assembly. It consists of a self-lock bayonet probe with a cylindrical permanent magnet on the end. When the magnet attracts sufficient metal chips to complete the circuit between the pole and the ground, the "XMSN CHIP DET" segment will illuminate on the caution panel. If the drain plug is removed, on installation torque the forward plug to 100-175 inch-pounds and the aft plug to 150-250 inch-pounds.

7-69. REMOVAL - CHIP DETECTORS.

a. Disconnect the electrical lead from chip detector stud.

b. Press detector in, turn counterclockwise and remove from plug.

7-70. INSPECTION - CHIP DETECTORS.

a. Inspect chip detector for stripped or damaged bayonet pins.

b. Check for accumulation of metal particles on magnet. Presence of metal may indicate need for further investigation and corrective action. Compare particles found with metal particle identification list.

7-71. INSTALLATION - CHIP DETECTORS.

a. Replace packings on chip detector insert if removed.

b. Engage pins on insert into groove on plug and push insert in as far as possible and turn clockwise to lock in place.

c. Connect electrical wire to stud.

7-72. MAST ASSEMBLY.

7-73. Main rotor mast assembly is a tubular steel shaft fitted with a bearing and seal assembly which secures the mast in top of transmission and supports mast in the vertical position. Mast driving splines engage with transmission planetary gear assembly. Splines on the upper portion of mast provide mounting for main rotor.

7-74. INSPECTION - MAST ASSEMBLY.

a. Visually inspect parts for wear, damage and condition of parts.

b. Inspect retainer plate for corrosion or leakage in seal area.

c. Inspect shaft for scratches or nicks on exposed area not to exceed 0.010 inch depth full circumference or 0.015 inch depth half circumference or 0.020 inch depth quarter circumference after repairing damage.

(1) External repairs must have minimum radius of 0.50 inch.

(2) Mast should be repaired one time only.

SECTION V TAIL ROTOR DRIVE SHAFT

7-75. TAIL ROTOR DRIVE SHAFT.

7-76. The tail rotor drive shaft is made up of the following four sections; the forward short shaft (3, figure 7-8), the oil cooler fan shaft (4), the aft short shaft (6) and the long shaft (7). Steel laminated disc flexible couplings, requiring no lubrication, are used to connect the shaft sections, freewheeling assembly, and the tail rotor gearbox. Sealed bearings used on the tail rotor drive shafts do not require lubrication. These sealed bearings have a spherical outer diameter that mates with the spherical bore of the bearing hangers. The bearing hangers are split, with clamping bolt, and shim, to adjust fit with the bearing. This permits the bearing to be aligned with the shaft regardless of the angle of the hanger support on the tail boom.

7-77. REMOVAL - TAIL ROTOR DRIVE SHAFT.

Note

Any section of drive shaft, except the fan shaft, may be removed without removing the other sections.

a. Remove forward and aft short shafts (3 and 6, figure 7-8).

(1) Remove two opposed bolts from splined couplings at each end of aft short shaft (6). Leave laminated disc assemblies (14) assembled on aft short shaft (6). Remove aft short shaft (6) from helicopter.

(2) Remove two opposed bolts from splined couplings at each end of forward short shaft (3). Leave laminated disc assemblies assembled on forward short shaft. Remove forward short shaft (3) from helicopter.

(3) Remove safety pin (10) from forward end of long drive shaft (11). Remove splined adapter (6) from long drive shaft.

b. Remove long aft shaft (11, figure 7-9).

Caution

Do NOT wipe grease from tail rotor driveshaft bearing seal area. Slight amount of grease leakage is normal and necessary for lubrication of seal lip.

(1) Remove two opposed bolts (2) from coupling at each end of shaft. Leave laminated discs assembled on splined adapter on tail rotor gearbox and on aft end of aft short tail rotor drive shaft (1).

(2) Remove two hanger bolts (23) attaching each of six bearing hangers (14) to support brackets mounted along top center of tail boom. Remove tail rotor shaft and bearing hangers from tail boom.

(3) Remove safety pin from forward end of long drive shaft (11). Remove retainer spring (5) and remove splined adapter (6) from long drive shaft.

(4) Clean shaft of all accumulated dirt or grease. Petrolatum (item 5, table 1-1) applied to the shaft will serve as a lubricant and aid in removal and installation of bearing assemblies. Hanger brackets and bearing assemblies may then be removed.

7-78. INSPECTION - TAIL ROTOR DRIVE SHAFT.

a. Surface of shaft to be smooth and unmarred. Scratches up to 0.002 inch deep around entire circumference may be blended out with maximum stock removal not to exceed 0.003 inch. Scratches up to 0.005 inch deep, axial or circumferential but not longer than 25 percent of circumference, may be blended with maximum stock removal not to exceed 0.006 inch.

b. Inspect bearing collars (12, figure 7-9). Replace collar or collars, when material is hard and/or cracked. Press collar between thumb and finger to check for cracks.

c. Inspect bearings for smoothness and evidence of overheating.

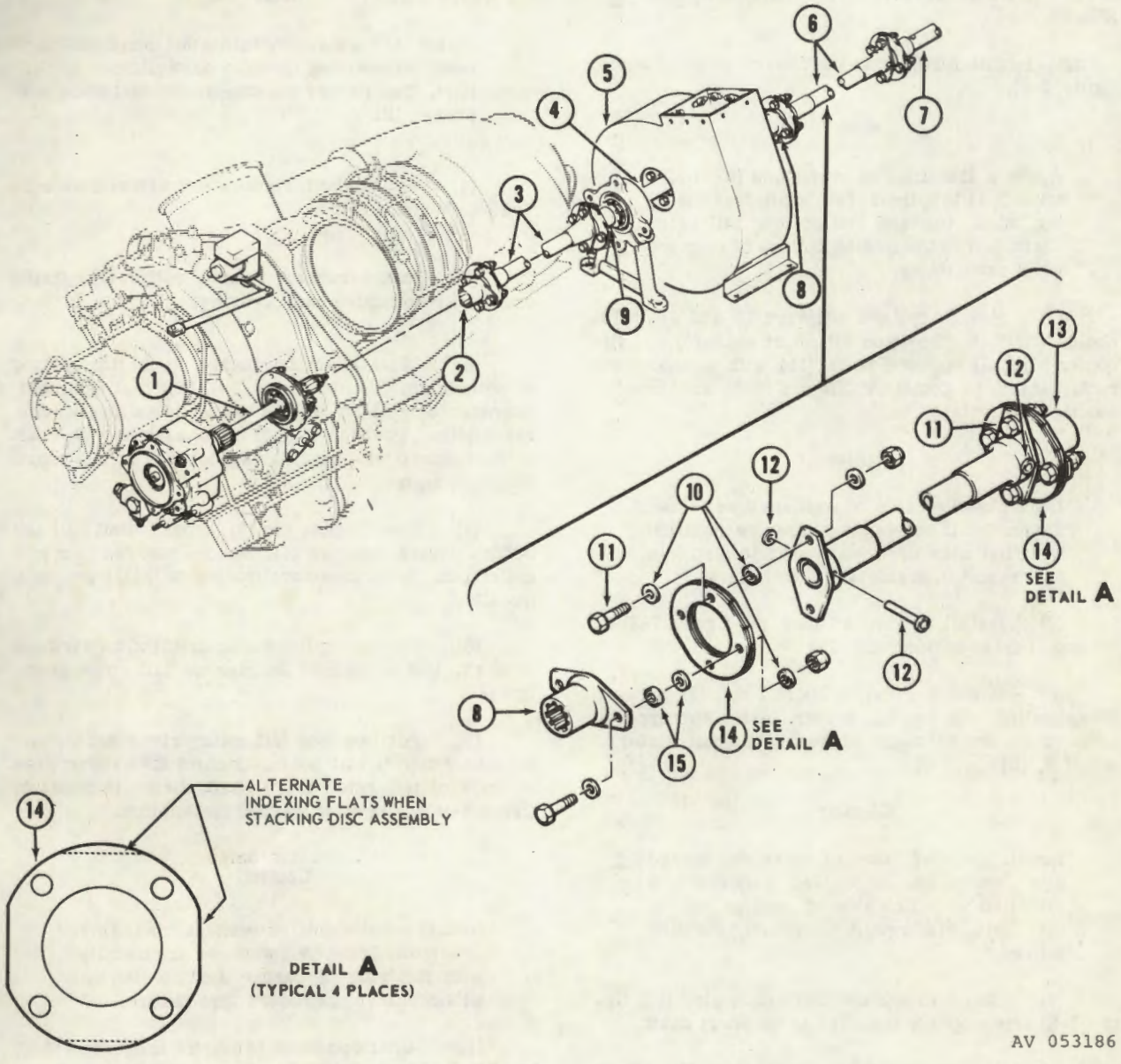
d. Inspect splines for chips, cracks, or wear.

e. Check tail rotor shafts for security of bonding of coupling adapters to ends of shafts, and security of bonding of splined adapter on forward end of long shaft. To test bond, attempt to twist adapter on end of shaft and place end of thumb on head of pin and rotate pin in its hole. If pin is tight in hole and will not turn with thumb pressure, remove pin and check for failure of bond between adapter and end of shaft. Replace shaft if bond has failed.

f. Inspect the coupling disc assemblies for cracks, wear, or damage. Replace disc assemblies which fail. Do not mix old and new discs together; replace in complete assembly units.

Caution

The grain of each disc in disc assemblies (detail A, figure 7-8) runs parallel to indexing flat edges. When installing disc assembly, alternate indexing flats. Change only in complete units.



1. Freewheeling Shaft
2. Splined Adapter
3. Forward Short Shaft
4. Fan Shaft
5. Blower Assembly
6. Aft Short Shaft
7. Long Tail Rotor Drive Shaft
8. Splined Adapter
9. Splined Adapter
10. Beveled Washers
11. Bolt
12. Pin, Washer, And Cotter Pin
13. Splined Adapter
14. Disc Assembly
15. Beveled Washers

Figure 7-8. Forward and aft short tail rotor drive shafts

7-79. INSTALLATION - TAIL ROTOR DRIVE SHAFT.

a. Install forward and aft short shaft (3 and 6, figure 7-8).

Note

Apply a thin film of compound (item 200, table 1-1) to splines of fan shaft, freewheeling shaft, forward end of long tail rotor shaft, and to the mating splines of adapters when assembling.

(1) Install splined adapters (8 and 9) on oil cooler shaft (4). Position aft short shaft (6) on helicopter. Install opposed bolts (11) with washers and nuts. Refer to detail A, (figure 7-9) for beveled washers (3) installation.

Caution

Install beveled side of washers toward disc assembly. If beveled washers are installed with flat side of washer next to disc this will result in premature disc failure.

(2) Install splined adapter (2, figure 7-8) on aft end of freewheeling unit (1).

(3) Position forward short shaft (3) between freewheeling unit and oil cooler. Install two opposed bolts to secure each disc assembly to shaft. Refer to detail A, (figure 7-9).

Caution

Install beveled side of washers toward disc assembly. If beveled washers are installed with flat side of washer next to disc this will result in premature disc failure.

(4) Check to ensure that safety pins (12, figure 7-8) are properly installed in aft short shaft.

b. Install long tail rotor drive shaft (10, figure 7-9.)

(1) Insert bearings (11) in each of six bearing hangers (13). Bearings are sealed and do not require lubrication.

(2) Install bolt (15), washers (14) and shim (17) in hanger (13); torque bolt 50-70 inch-pounds. Bearing should not pivot axially or rotate radially under hand pressure.

(3) Loosen bolt and install 0.002 inch shim with shim (17); torque bolt to 50-70 inch-pounds. Using hand pressure bearing should pivot axially, but not radially.

Note

Shims (17) are available in 0.002 inch thickness differences noted by dash number on part. Use proper thickness shim to obtain proper fit.

(4) Loosen bolt, remove extra shim and torque 5-15 inch-pounds.

(5) Insert rubber bearing collar (12) inside each tail rotor drive shaft bearing.

(6) Clean shaft thoroughly. Apply thin coating of petrolatum (item 5, table 1-1) to shaft and inner diameter of collars (12) to aid in installing bearing assemblies. Position each bearing assembly on shaft to correspond with bearing support (22) on tail boom. (Refer to figure 7-11.)

(7) Insert safety pin (9) through shaft (10) and bonded spline adapter (8). Secure with washer and cotter pin. Check to ensure that safety (25) is properly installed.

(8) Position splined adapter (5) on forward end of shaft. Install splined adapter on tail rotor gearbox (24).

(9) Position long tail rotor drive shaft assembly along top of tail boom. Connect disc assemblies at ends of tail rotor drive shaft. Refer to detail A, figure 7-9, for beveled washer installation.

Caution

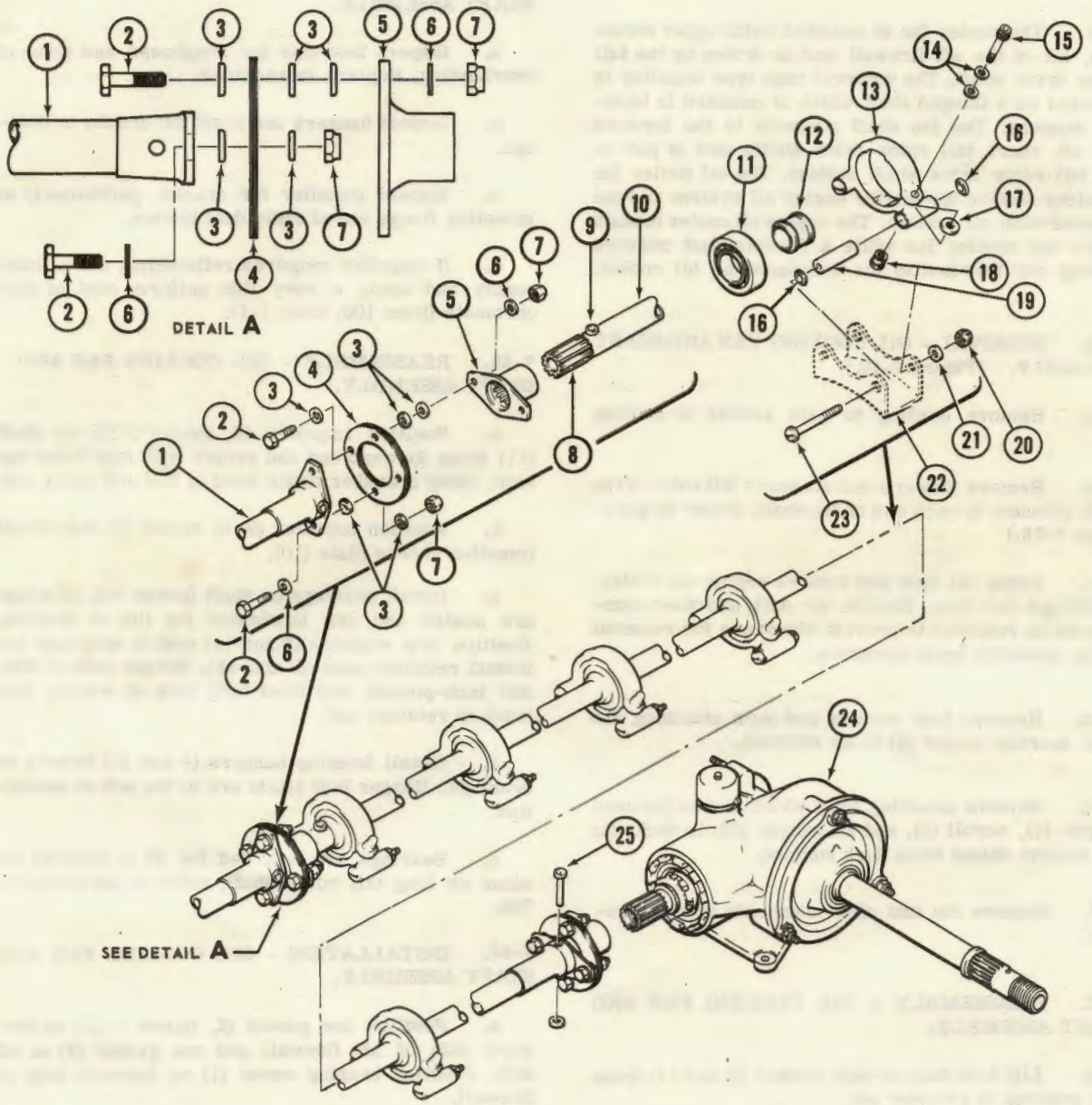
Install beveled side of washers toward disc assembly. If beveled washers are installed with flat side of washer next to disc this will result in premature disc failure.

(10) Check position of bearing hangers on shaft to give 0.110 to 0.170 in clearance between aft end of adapter (4, figure 7-12) and gearbox (11). See detail in figure 7-12.

(11) Secure each bearing hanger (13, figure 7-9) with two hanger bolts (23) through tail rotor drive shaft bearing hanger and hanger bracket (22). Ensure bushings (19) are in place and hangers centered within 0.030 of mid-point of boom supports. Install washer (21) and nut (20) on each bolt, torque to 30-45 inch-pounds and install cotter pin.

Note

Install packings as spacers on the bushings of the fifth hanger from the front.



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1. Aft Short Tail Rotor Drive Shaft
2. Bolt
3. Beveled Washer
4. Disc Assembly
5. Splined Adapter
6. Flat Washer
7. Nut
8. Splined Adapter
9. Safety Pin, Washer and Cotter Pin
10. Long Tail Rotor Drive Shaft
11. Bearing
12. Bearing Collar
13. Bearing Hanger
14. Washers
15. Bolt
16. Packing*
17. Shim
18. Nut
19. Collar
20. Nut
21. Washer
22. Bearing Support
23. Hanger Bolt
24. Tail Rotor Gearbox
25. Safety Pin, Washer and Cotter Pin

* No. 5 Bearing Only

Figure 7-9. Long tail rotor drive shaft installation

7-80. OIL COOLING FAN AND SHAFT ASSEMBLY.

7-81. The cooler fan is mounted on the upper structure, aft of the aft firewall and is driven by the tail rotor drive shaft. The squirrel cage type impeller is mounted on a flanged shaft which is mounted in bearing hangers. The fan shaft connects to the forward and aft short tail rotor drive shafts and is part of the tail rotor drive shaft system. The oil cooler fan provides cooling air for the engine oil system and the transmission oil system. The engine oil cooler mounts above the cooling fan while a flexible duct conveys cooling air forward to the transmission oil cooler.

7-82. REMOVAL - OIL COOLING FAN AND SHAFT ASSEMBLY. (Figure 7-10.)

a. Remove cowling to gain access to cooling fan.

b. Remove forward and aft short tail rotor drive shaft attached to each end of fan shaft. (Refer to paragraph 7-76.)

c. Drain oil tank and remove engine oil cooler, oil fittings and lines, flexible air duct, and other components as required to provide clearance for removal of fan assembly from structure.

d. Remove four screws and nuts attaching fan shaft bearing hanger (4) to aft firewall.

e. Remove mounting bolts which secure forward hanger (4), scroll (8), and aft hanger (12) to deck. Do not remove shims from deck surface.

f. Remove fan and shaft assembly from structure.

7-83. DISASSEMBLY - OIL COOLING FAN AND SHAFT ASSEMBLY.

a. Lift lock tang of each washer (6 and 14) from lock position in retainer nut.

b. Use 2 inch spanner wrench and remove retainer nuts (5 and 15).

c. Remove forward bearing with hanger from shaft. Remove aft bearing with hanger from shaft. Loosen hanger clamp bolt and remove bearing from hangers.

d. Remove impeller access plate (10) from scroll (8) and remove shaft (11) and impeller (9).

e. Remove four bolts attaching impeller to flange of cooler shaft (11) and remove impeller from shaft.

7-84 INSPECTION - OIL COOLING FAN AND SHAFT ASSEMBLY.

a. Inspect bearings for roughness and signs of overheating. Replace as required.

b. Inspect hangers and shaft for cracks or damage.

c. Inspect impeller for cracks, particularly at mounting flange and at individual blades.

d. If impeller requires refinishing, clean thoroughly and apply a very thin uniform coat of zinc chromate (item 100, table 1-1).

7-85. REASSEMBLY - OIL COOLING FAN AND SHAFT ASSEMBLY.

a. Position impeller (9, figure 7-10) on shaft (11) from forward end and secure with four bolts and nuts, using a washer under head of bolt and under nut.

b. Position impeller (9) in scroll (8) and install impeller access plate (10).

c. Install bearings on shaft (press on). Bearings are sealed and are lubricated for life of bearing. Position new washers (6 and 14) next to bearings and install retainer nuts (5 and 15). Torque nuts to 200-300 inch-pounds and bend tang lock of washer into notch in retainer nut.

d. Install bearing hangers (4 and 12) loosely on bearings. Hanger bolt heads are to the left of centerline.

e. Bearings are adjusted for fit in hangers the same as long tail rotor shaft, refer to paragraph 7-78b.

7-86. INSTALLATION - OIL COOLING FAN AND SHAFT ASSEMBLY.

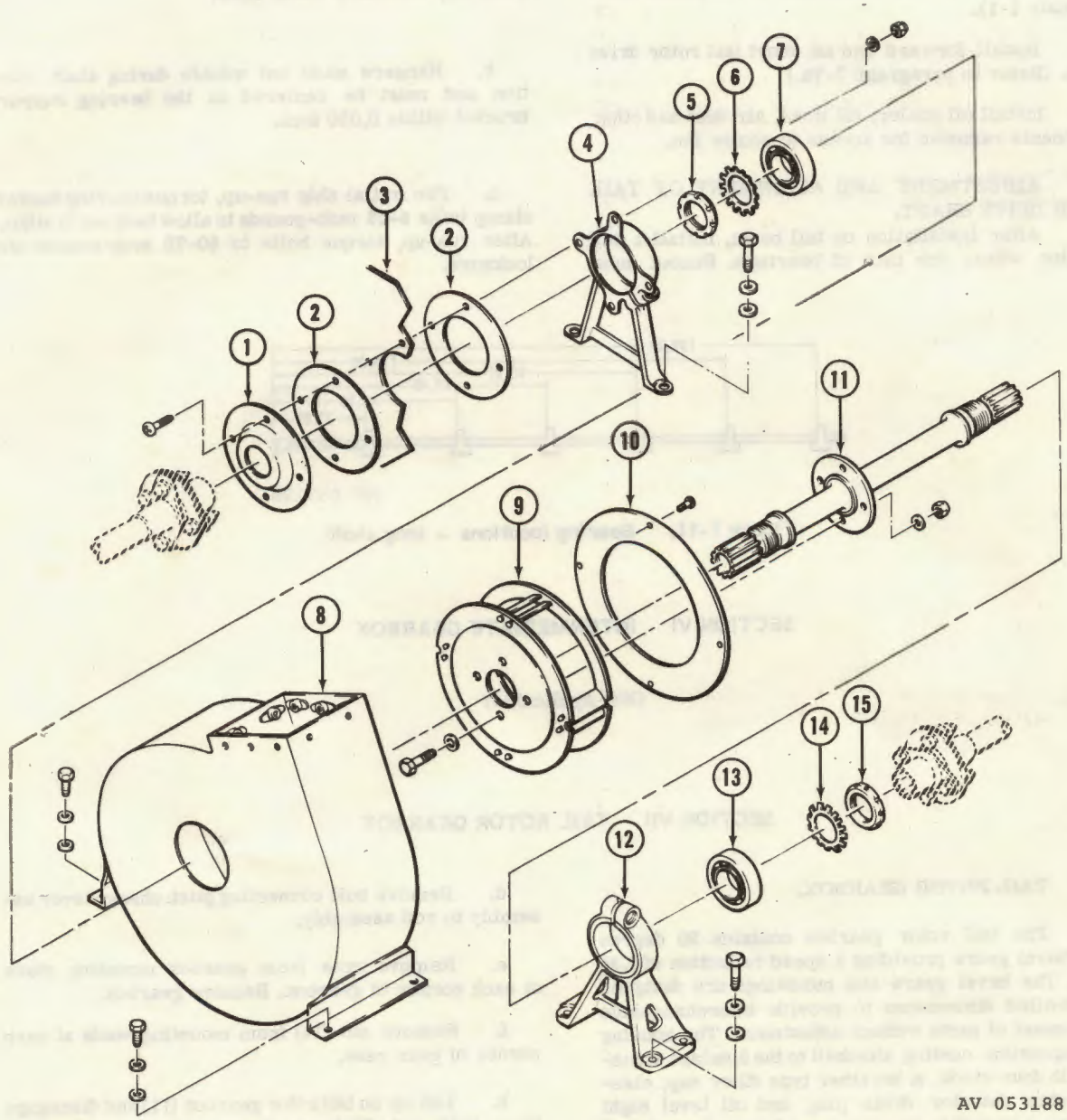
a. Position one gasket (2, figure 7-10) on forward side of aft firewall and one gasket (2) on aft side. Position bearing cover (1) on forward side of firewall.

Note

Check that shims are in proper place on deck surface.

b. Position fan and shaft assembly in place over shims on deck. Install mounting bolts through fore and aft hangers and scroll. Safetywire bolts in pairs. Install four screws through cover (1), gaskets and rings (4), place a washer under each nut.

c. Check impeller for clearance in scroll and for free rotation.



1. Bearing Cover, Fan Shaft
2. Gasket
3. Aft Firewall
4. Forward Bearing Hanger, Oil Cooler
5. Bearing Retainer Nut, Fan Shaft
6. Lockring
7. Bearing
8. Scroll
9. Impeller
10. Impeller Access Plate
11. Shaft, Oil Cooler
12. Aft Bearing Hanger, Oil Cooler
13. Bearing
14. Lockring
15. Bearing Retainer Nut, Fan Shaft

Figure 7-10. Oil cooling fan and shaft assembly

d. Install splined couplings on each end of shaft. Lubricate splines with a thin film of compound (item 200, table 1-1).

e. Install forward and aft short tail rotor drive shafts. (Refer to paragraph 7-78.)

f. Install oil cooler, oil lines, air duct and other components removed for access to cooler fan.

7-87. ADJUSTMENT AND ALIGNMENT OF TAIL ROTOR DRIVE SHAFT.

a. After installation on tail boom, install a dial indicator within one inch of bearings. Runout must not exceed 0.006 maximum indicated low to high. Replace any assembly which fails.

b. Hangers must not wobble during shaft rotation and must be centered in the bearing support bracket within 0.030 inch.

c. For initial ship run-up, torque bearing hanger clamp bolts 5-15 inch-pounds to allow bearing to align. After run-up, torque bolts to 50-70 inch-pounds and lockwire.

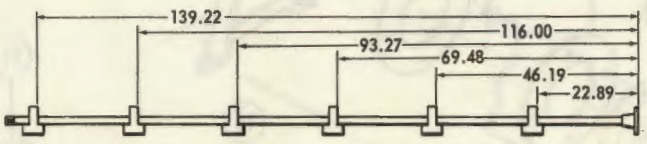


Figure 7-11. Bearing locations - long shaft

SECTION VI INTERMEDIATE GEARBOX

(Not Applicable)

SECTION VII TAIL ROTOR GEARBOX

7-88. TAIL ROTOR GEARBOX.

7-89. The tail rotor gearbox contains 90 degree spiral bevel gears providing a speed reduction of 2.35 to 1.0. The bevel gears and mountings are designed to controlled dimensions to provide interchangeable replacement of parts without adjustment. The housing is a magnesium casting attached to the fuselage structure with four studs. A breather type filler cap, electrical chip detector drain plug and oil level sight gage are accessible from ground level. (See figure 7-12.)

7-90. REMOVAL - TAIL ROTOR GEARBOX.

a. Disconnect electrical lead from chip detector.

b. Remove tail rotor hub and blade assembly. Refer to paragraph 8-45.

c. Remove two opposed bolts to disconnect disc assembly on aft end of long tail rotor drive shaft from splined adapter on gearbox input shaft.

d. Remove bolt connecting pitch change lever assembly to rod assembly.

e. Remove nuts from gearbox mounting studs at each corner of gearbox. Remove gearbox.

f. Remove nut (14) from mounting studs at each corner of gear case.

h. Lift up on tail rotor gearbox (11) and disengage lower bellcrank (7) from pitch change control tube (5). Remove gearbox from tail boom with pitch change mechanism attached.

i. Check two spacer washers on tail boom at gearbox mounting point for secure bonding to tail boom. If a washer or washers are loose, retain washer and refer to following paragraph for bonding instructions.

7-91. INSPECTION - TAIL ROTOR GEARBOX. Inspect tail rotor gearbox for leaking seals, cracks, security, and metal contamination.

Note

When oil level is below sight glass after maximum endurance mission oil leakage is considered excessive.

7-92. INSTALLATION - TAIL ROTOR GEARBOX.

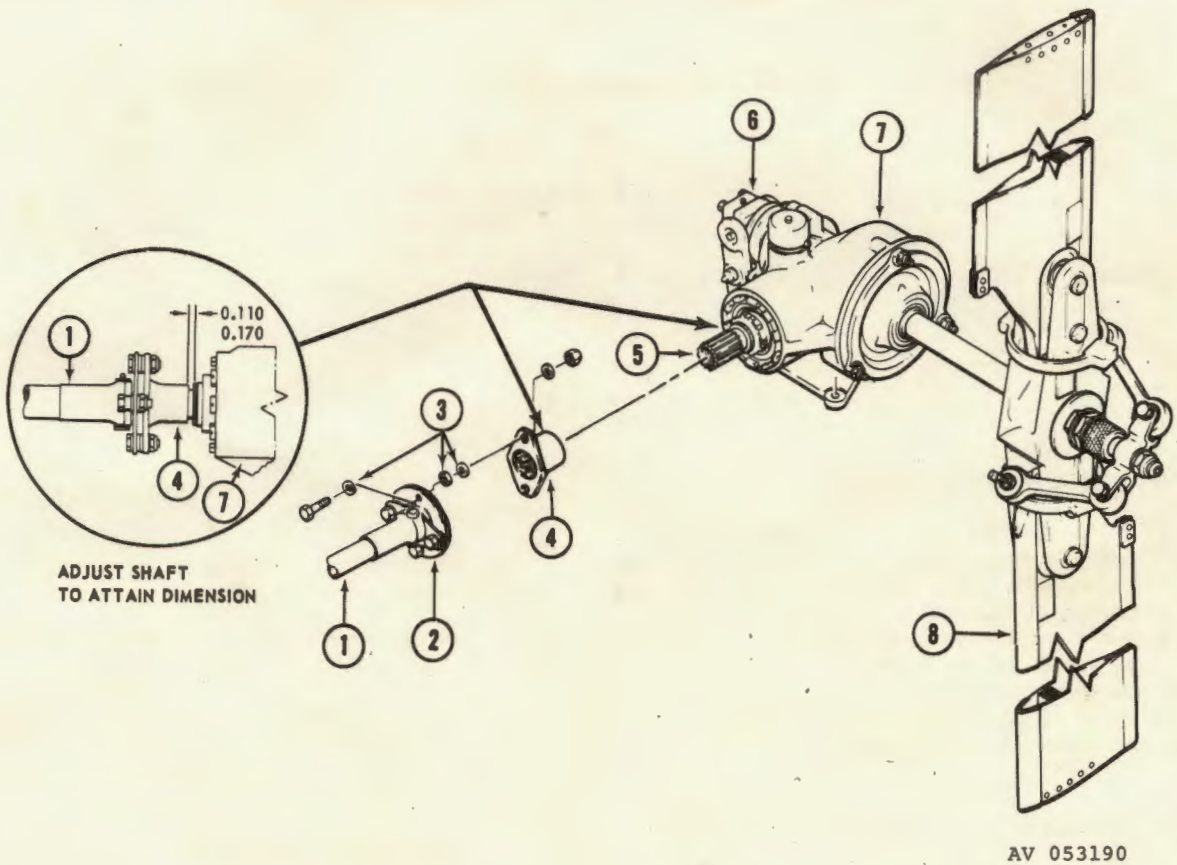
a. Check tail rotor gearbox mounting area on tail boom to ensure that aft two washers and forward aluminum angle are bonded in place where tail rotor gearbox lugs rest on tail boom. Position gearbox on tail boom and check to ensure that gearbox rests evenly on all four points. If one or more above parts are missing proceed as follows:

(1) Fabricate a plate from sheet metal approximately 1/2 inch thick, the same size as the tail rotor gearbox base, with a true surface over its entire face. Drill four holes in plate to match gearbox mounting holes.

(2) Clean paint from tail boom to bare metal to 1.0 inch diameter area around mounting bolt holes where parts are missing or loose. Use sandpaper or paint remover.

(3) Clean area where paint was removed with methyl-ethyl-ketone (item 301, table 1-1). Allow to dry.

(4) Bond angle and/or washers to upper surface of tail boom with adhesive (item 200, table 1-1) as needed for replacement. Use only one washer with maximum thickness of 0.020 inch thickness at each aft point and only one thickness of angle at forward edge. While adhesive is still wet, place cellophane



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1. Drive Shaft, Tail Rotor
2. Flex Coupling Disc Assembly
3. Beveled Washers
4. Splined Adapter
5. Input Pinion Shaft
6. Pitch Change Assembly
7. Tail Rotor Gearbox
8. Tail Rotor Hub and Blade Assembly

Figure 7-12. Tail rotor gear box installation

or other like material between plate and mount points to prevent bonding of plate. Install four bolts to line up washers in position. Do not allow plate to rock during bolt installation. Do not clamp plate to tail boom.

(5) Allow adhesive to dry and remove bolts. Check for plate contact on all four points. Surface points must be in the same level within 0.002 inch. Each point must be within 0.001 inch of level across the surface.

(6) Prime and touch up paint on tail boom. Do not paint gearbox seating areas at attaching points, put tape (item 401, table 1-1) in these areas.

b. Apply a thin film of compound (item 200, table 1-1) to the mating splines of adapter (4) and gearbox shaft (8). Install adapter.

c. Position gearbox on tail boom and connect pitch rod assembly. Secure gearbox with nuts (14) and washer (13). Connect electrical lead to chip detector plug.

d. Install tail rotor assembly. Refer to paragraph 8-48.

e. Connect long tail rotor drive shaft to gearbox splined adapter.

CHAPTER 8

MAIN TAIL ROTOR GROUPS

SECTION I SCOPE

8-1. PURPOSE.

8-2. The purpose of this chapter is to provide all essential information for maintenance personnel to accomplish originizational maintenance on the complete main and tail rotor groups. The information includes a detailed description and chronological instructions as to methods and procedures.

8-3. The special tools and equipment required for performance of origanizational maintenance will be tenance Repair Parts and Special Tools List.

SECTION II MAIN ROTOR HUB AND BLADE

8-4. DESCRIPTION.

8-5. The main rotor assembly is a two bladed, semi-rigid, seesaw type rotor with underslung mounting. The blades are mounted in the hub assembly grips with through bolts, which have hollow shanks for installation of weights to balance the hub. After balancing, the bolts must be kept with their respective rotor hub grips. Blade alignment is accomplished by adjustment of blade latches, which engage the root end of the blade. The blade grips are retained on the hub yoke by means of tension-torsion strap assemblies. Changes in blade pitch angle are made by turning the grips on the yoke; each grip has two pitch change bearings. Oil reservoirs, with sight gages, are provided for pitch change bearings in the two grips and for two pillow block bearings utilized with the flapping axis trunnion. The rotor blades are all metal, five piece assemblies consisting of an extruded aluminum alloy nose block, aluminul alloy trailing edge, and an aluminum honeycomb filler. (Figure 8-1.)

8-6. TROUBLESHOOTING - MAIN ROTOR. A table of possible main rotor troubles, causes, and corrective action is shown below. Refer also to figure 8-2, Vibration Analysis and Corrective Action Chart, and paragraphs 8-16 through 8-21 for additional information and specific testing and mechanical procedures for adjusting the main rotor.

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
Vertical 1:1 vibration increasing with sirspeed (approximately 6-1/2 per second)	Rotor blades out of track	Refer to paragraph 8-16, Tracking Main Rotor Blades
Lateral 1:1 vibration	Spanwise unbalance (normally vibration increasing with rpm in hover)	Refer to paragraph 8-17, Spanwise balancing-main rotor
	Chordwise Unbalance (normally vibration increases)	Refer to paragraph 8-18, Chordwise balancing - main rotor
	Check for end play in excess of 0.004 inch on main rotor trunnion	Refer to next higher category of maintenance
2/rev vibration (approximately 13 per second	Check for insufficient friction on swashplate uniball	Refer to paragraph 8-25, Testing - Swashplate and Support Assembly
	Check for excessively loose control linkage or swashplate parts	Replace all parts found excessively worn

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
	Check for tail boom attachment bolts which are loose or which are not up to correct torque	Retorque bolts 375 to 415 inch-pounds
	Check for loose blade latch bolt/nuts	Retorque nuts (75 to 95 foot-pounds) Use care not to disturb blade alignment
	Check for deteriorated or separated pylon isolation mount; also for worn transmission to isolation mount attachment bolt or bearing	Replace defective parts
Spike knocking	Spike knocking will not be encountered in normal service with a serviceable isolation mount installed except in cases of extremely rough air or excessively abrupt maneuvers. Spike knocking may be encountered in normal service if the isolation mount is deteriorated	Replace isolation mount. Refer to next higher category of maintenance
Autorotation rpm high (Low pitch setting on blades too low)	Pitch links too short	Lengthen both pitch links. (Refer to paragraph 8-21.c.)
Autorotation rpm low (Low pitch setting on blades too high)	Pitch links too long	Shorten both pitch links. (Refer to paragraph 8-21.c.)

8-7. INSPECTION - MAIN ROTOR HUB ASSEMBLY.

a. Inspect main rotor hub (1, figure 8-1) for damage, minor nicks, scratches, and gouges that may be polished out.

b. Inspect main rotor blade latch assembly (4) for security.

c. Inspect main rotor retaining nut (2) for damage and security in locking.

d. Inspect blade retention bolts (3) for visible damage, evidence of corrosion and security of attachment.

e. Inspect grip seal areas for evidence of leakage. Some oil leakage is normal. Replace seals when loss of oil is equivalent to the amount visible in the reservoir sight glass for a two hour flight duration.

8-8. MAIN ROTOR RESERVOIRS AND SIGHT GLASS.

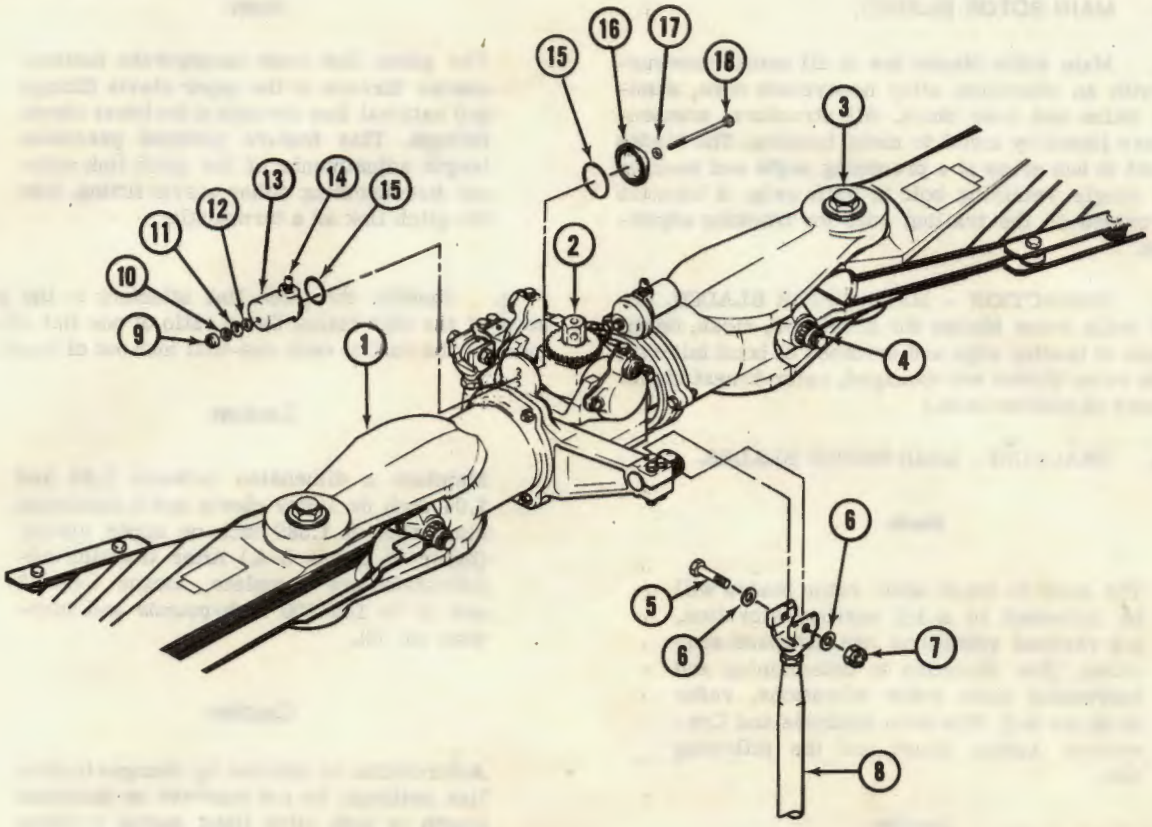
8-9. Blade grips and pillow blocks on hub are lubricated with oil from these reservoirs. Oil level can be checked through transparent covers and sight glasses.

8-10. REMOVAL - MAIN ROTOR RESERVOIRS AND SIGHT GLASS.

a. Place wiping cloths under reservoir (13, figure 8-1) to catch excess fluid.

b. Remove nut (9), spring washer (10), washer (11) and stat-o-seal (12).

c. Remove bolt (18), and stat-o-seal (17). Remove reservoir (13), sight glass (16), and packings, (15).



1. M/R Hub and Blade Assembly
2. M/R Retaining Nut
3. Blade Bolt
4. Blade Latch Nut
5. Bolt
6. Washer
7. Nut
8. Pitch Link Assembly
9. Nut
10. Springwasher
11. Washer
12. Stat-O-Seal
13. Reservoir
14. Fitting
15. Packing
16. Sight Glass
17. Stat-O-Seal
18. Bolt

Figure 8-1. Main rotor hub and blade assembly

8-11. INSPECTION - MAIN ROTOR RESERVOIRS AND SIGHT GLASS.

a. Inspect sight glasses for nicks and scratches Replace defective parts.

b. Inspect seals for cuts and serviceability. Replace unusable parts.

8-12. INSTALLATION - MAIN ROTOR RESERVOIRS AND SIGHT GLASS.

a. Position packing (15, figure 8-1) on reservoir (13) and packing (15) on sight glass (16); position reservoir and sight glass on pitch horn.

b. Install stat-o-seal (17) on bolt (18) and insert bolt through sight glass and reservoir.

c. Install stat-o-seal (12), washer (11), spring washer (10), and nut (9). Torque nut until spring washer is completely compressed, back nut off one full turn.

d. Fill reservoir at filler plug (14) with 10W30 motor oil (item 8, table 1-1). Work out air and fill to one-half full level on sight glass (16). Install filler plug.

8-13. MAIN ROTOR BLADES.

8-14. Main rotor blades are of all metal construction with an aluminum alloy honeycomb core, aluminum skins and nose block. All structural components are joined by metal to metal bonding. The blades are set in hub grips at a preconing angle and secured by a single retaining bolt in each grip. A trim tab is provided on the trailing edge for tracking adjustments.

8-15. INSPECTION - MAIN ROTOR BLADES. Inspect main rotor blades for scratches, nicks, dents, erosion of leading edge and evidence of bond failures. (in the event blades are damaged, refer to next higher category of maintenance.)

8-16. TRACKING - MAIN ROTOR BLADES.

Note

The need to track main rotor blades will be indicated by a 1:1 vertical vibration. 1:1 vertical vibrations are airspeed sensitive. For direction in determining and correcting main rotor vibrations, refer to figure 8-2, Vibration Analysis and Corrective Action Chart and the following text.

Caution

Only experienced pilots and maintenace men should track main rotor blades.

a. Position rotor blade trim tabs to zero degrees, hereafter referred to as trail position. Use tab bending tool, T101444, and tab gage, T101445.

b. Install target assembly, tool T101536, on lower outer surface of each blade with reflectors pointing toward main rotor hub assembly. (Refer to figure 8-3.)

c. Tap or mark a portion of one of the reflectors to provide a means of indentifying each blade during tracking operation.

d. Plug tracking light, MS28925, into receptacle located in aft section of overhead console.

e. Operate helicopter at 70-75 percent N2 rpm.

f. Sight the tracking light from inside the rotor disc on the target assembly reflectors. If the reflection does not make one line, adjust the main rotor blades as follows in the next steps.

Note

Record all changes made in pitch links.

Note

The pitch link rods incorporate national coarse threads at the upper clevis fittings and national fine threads at the lower clevis fittings. This feature permits precision length adjustments of the pitch link without disconnecting either clevis fitting. Use the pitch link as a turnbuckle.

g. Shorten the pitch link attached to the pitch horn of the high blade. Use a ratio of one flat adjustment on the link to each one-half inch out of track.

Caution

Maintain a dimension between 0.84 and 1.04 inch on lower clevis and a maximum dimension of 1.380 inch on upper clevis. (Refer to figure 8-4.) After tracking adjustments are complete, torque nuts (2 and 6) to 150-200 inch-pounds and lockwire nut (6).

Caution

Autorotation is affected by changes in pitch link settings. Do not increase or decrease length of both pitch links during tracking procedure.

h. After rotor has been placed in track by adjustment of the pitch link on the high blade, operate the helicopter of 103 percent N_2 rpm. Apply sufficient collective control to make helicopter light on skids. Maintain 103 percent N_2 rpm and track rotor blades. This is a reference track only. Do not make any tab adjustments at this time.

Note

The ground track is a starting point only and does not mean that the rotor is in the best flight configuration.

i. At a stabilized hover, observe the in or out-of-track tip path plane for 1:1 vertical reference. Also observe the possible bounce in the center line of the cockpit area. Corrective action not required at this time.

j. Check the 1:1 lateral vibration level at high and low beep on the governor actuator. If the amplitude of the lateral is worse at 103 percent N_2 rpm, the lateral is probably from spanwise balance. If it is worse at 97 percent N_2 rpm, the lateral is probably caused by chordwise balance problems.

GROUND-RUN

1 Trail the trim tabs. Install target assemblies

2 Make a low-speed track at 70-75% N_2 RPM. Roll the low blade up until a good low-speed track is obtained.

3 Make a high-speed track at 103% N_2 RPM and light on the skids. This is a reference track only. Do not make any tab adjustments at this time.

Note: The ground track is a starting point only and does not mean that the rotor is in the best flight configuration.

I.G.E. HOVER

4 At a stabilized hover observe the in or out-of-track tip path plane for 1:1 vertical reference. Also observe the possible bounce in the centerline of the cockpit area. No corrective action here.

5 Check the 1:1 lateral vibration level at high and low beep on the governor actuator. If the amplitude of the lateral is worse at 103% N_2, the lateral is probable from spanwise balance. If it is worse at 101% N_2 the lateral is probably caused by chordwise balance problems.

6 If spanwise, add two wraps of 1-inch tape on one blade. (If the lateral is mild, use one wrap.) If this is worse, remove the tape and put it on the opposite blade. Add tape in 1-wrap or 1/2-wrap increments until the smoothest high-RPM level is reached. Recheck low RPM 97% N_2 level now.

7 If worse at low RPM, sweep one blade aft 1/2 point. If this is worse, remove the sweep and sweep the opposite blade aft 1/2 point. Sweep until the best low RPM lateral vibration level is obtained. Recheck the high RPM level before proceeding further.

8 Best hovering vibration level

FORWARD FLIGHT AND LETDOWN

9 Accelerate into forward flight. If a vertical is present (visual out-of-track of tip path plane and/or a bounce in the centerline of the cockpit),

10 and does not increase in hardness as airspeed is gained, note the speed where the vertical comes in and

11 enter an autorotative descent at the idle RPM. The vertical hardness should be more noticeable in letdown. If so, correct by

12 Rolling the low blade up 2 flats as indicated by the high-speed ground-track. If the vertical is worse after repeating steps 9-11, zero the roll and go down 2 flats more on the same blade. Continue rolling on which ever blade offers the least vertical level and until the vertical is as smooth as is possible in letdown and flight.

Note: Excessive rolling (2 flats or more) can induce chordwise lateral vibrations, so recheck at IGE hover to determine if lateral level has changed. Correct if required.

13 If the vertical vibration level increases with airspeed, note the airspeed where the vibration comes in and tab the low blade up as indicated by the high-speed ground track. One degree of tab will change the vertical threshold about 13-17 knots. Excessive tab can hurt high-speed 2-per rev vibration levels above 100 knots, so a happy medium between high-speed 1/rev and 2/rev levels might have to be accepted. Recheck the letdown vertical level.

FORWARD FLIGHT AND LETDOWN

(9) Accelerate into forward flight. If a vertical is present (visual out-of-track of tip path plane and/or a bounce in the centerline of the cockpit),

(10) and does not increase in hardness as airspeed is gained, note the speed where the vertical comes in and

(11) enter an autorotative descent at the idle RPM. The vertical hardness should be more noticeable in letdown. If so, correct by

(12) Rolling the low blade up 2 flats as indicated by the high-speed ground-track. If the vertical is worse after repeating steps 9-11, zero the roll and go down 2 flats more on the same blade. Continue rolling on which ever blade offers the least vertical level and until the vertical is as smooth as is possible in letdown and flight.

Note: Excessive rolling (2 flats or more) can induce chordwise lateral vibrations, so recheck at IGE hover to determine if lateral level has changed. Correct if required.

(13) If the vertical vibration level increases with airspeed, note the airspeed where the vibration comes in and tab the low blade up as indicated by the high-speed ground track. One degree of tab will change the vertical threshold about 13-17 knots. Excessive tab can hurt high-speed 2-per rev vibration levels above 100 knots, so a happy medium between high-speed 1/rev and 2/rev levels might have to be accepted. Recheck the letdown vertical level.

ZERO AIRSPEED OGE HOVER (50 PSI TQ OR ABOVE)

(14) Recheck the lateral vibration in OGE hover at high and low beep settings and smooth-out any remaining lateral vibration by using the methods in steps 6 and 7. Recheck letdown for vibrations if much sweep is necessary, as it can induce a roll-vertical in descent.

FINAL ACCEPTANCE OR REJECTION

(15) Recheck IGE hover, foreward flight, letdown, OGE hover with power and low-gross weight flight for overall vibration level being satisfactory.

(16) Recheck boost-off forces and autorotation RPM.

(17) Ship is acceptable vibration-wise

(18) Ship is rejected due to the abnormal vibration level

(19) Return to step 1 and start over, or change one or both blades.

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Figure 8-2. Vibration analysis and corrective action chart

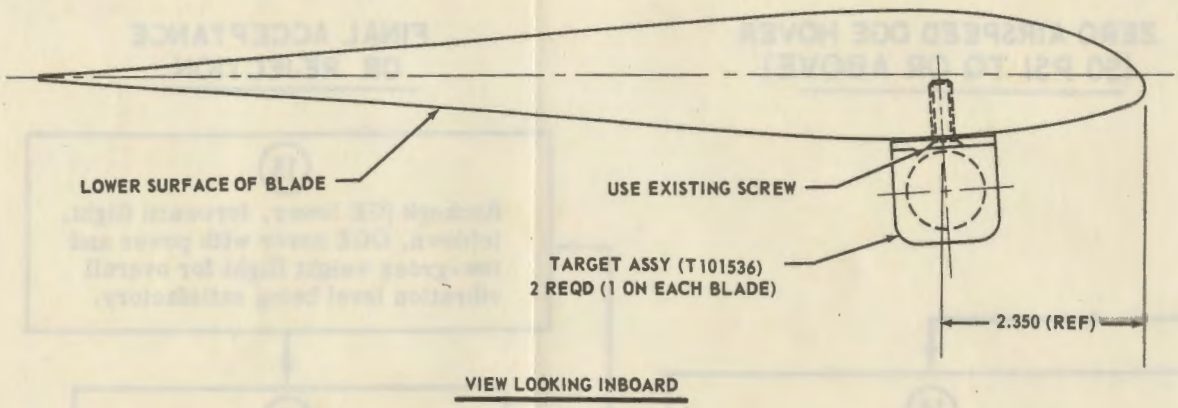


Figure 8-3. Main rotor blade tracking target installation

8-17. SPANWISE BALANCING - MAIN ROTOR.

Note

The need to spanwise balance main rotor blades will be indicated by a 1:1 lateral vibration. 1:1 lateral vibrations are rpm sensitive - not airspeed sensitive.

a. To spanwise balance main rotor blades, add two wraps of one-inch tape on one blade. (If the lateral is mild, use one wrap.) If this is worse, remove the tape and put it on the opposite blade. Add tape in one wrap or 1/2 wrap increments until the smoothest high-rpm level is reached. Recheck low rpm 97 N_2 rpm level.

Note

If the rotor cannot be balanced by use of tape, it is probable that the rotor is out of chordwise balance. Check chordwise balancing.

b. If rotor vibration was corrected by spanwise procedure, remove tape and install a quantity of lead weight, equal to 10.8 times the weight of the tape, in the hollow shank of the appropriate blade bolt (3, figure 8-1).

Note

The amount of lead weight to be installed in the blade bolt to compensate for one wrap of one-inch-wide masking tape is, 28 grams or one ounce.

c. Carefully remove cap from blade bolt (3, figure 8-1) and place weight in blade bolt. Record the amount of weight added. Replace cap and operate helicopter at 103 percent N_2 rpm to confirm that the correct amount of weight has been added.

8-18. CHORDWISE BALANCING - MAIN ROTOR.

a. Correct for spanwise out of balance if not previously accomplished before proceeding to chordwise balancing.

b. If chordwise balance is required, as determined in paragraph 8-16, j., sweep one blade aft slightly as follows: Do not sweep blades forward.

(1) Index with a pencil mark, the position of nut (4, figure 8-1) on the leading edge side of the main rotor blade and loosen nut approximately 1/2 point.

Caution

Blade sweep adjustments are sensitive. Do not exceed a maximum of three points turn on the nuts (4, figure 8-1). Record all adjustments made.

(2) Torque nut (4) on the trailing edge side of the main rotor blade to 75 to 95 foot-pounds.

(3) Torque nut (4) on the leading edge side of main rotor blade to 75 to 95 foot-pounds.

(4) If condition is worse, remove sweep and sweep the opposite blade aft 1/2 point. Sweep until the best low rpm lateral vibration level is obtained.

(5) Recheck the high rpm level and sweep blades aft as indicated by amount of vibration noted.

8-19. FORWARD FLIGHT AND LET DOWN CHECK.

a. Accelerate into forward flight. If a vertical is present (visual out-of-track of tip path plane and/or a bounce in the center line of the cockpit) and does not increase in hardness as airspeed is gained, note the speed where the vertical comes in and enter an autorotative descent at the idle rpm.

b. The vertical hardness should be more noticeable in letdown. If so, correct by rolling the low blade up 2 flats as indicated by the high-speed ground-track. If vertical is worse after repeating above step, zero the roll and go down two flats more on the same blade. Continue rolling on which ever blade offers the least vertical level and until the vertical is as smooth as is possible in letdown and flight.

Note

Excessive rolling (2 flats or more) can induce chordwise lateral vibrations, so recheck at IGE hover to determine if lateral level has changed. Correct if required.

c. If the vertical vibration level increases with airspeed, note the vertical speed when the vibration comes in and tab the low blade up, using tab tool, T101444, and gage, T101445, as indicated by the high speed ground track. One degree of tab will change the vertical thershold about 13-17 knots. Excessive tab can hurt high-speed 2-per-rev vibration levels above 100 knots, so a medium between high-speed 1/rev and 2/rev levels may have to be accepted. Recheck the letdown vertical level.

8-20. ZERO AIRSPEED OGE HOVER (50 PSI torque or above).

a. Recheck the lateral vibration in OGE hover at high and low beep settings and smooth-out any remaining lateral vibration by using the methods outlined in paragraphs 8-17 and 8-18.

b. Recheck letdown for vibrations if much sweep is necessary, as it can induce a roll vertical in descent.

8-21. FINAL ACCEPTANCE OR REJECTION OF MAIN ROTOR BLADES.

a. Recheck IGE hover, forward flight, letdown, OGE hover with power and low-gross weight for overall vibration level being satisfactory.

b. Recheck boost-off forces and autorotation rpm. It is recommended that aurotoration rpm be checked at low gross weights. Determine autorotation rpm at 55 knots airspeed. Autorotation rpm should be 330 with minimum safe fuel load, one pilot (150 pounds) and with collective full down. Autorotation rpm should be 354 at maximum gross weight.

c. If required, correct autorotation rpm as follows:

Caution

Maintain a dimension between 0.84 and 1.04 inch on lower clevis and a maximum dimension of 1.380 inch on upper clevis. (Refer to figure 8-4.) After tracking adjustments are complete, torque nuts (2 and 6) to 150-200 inch-pounds and lockwire nuts (6).

(1) If autorotation is low, decrease length of both pitch links (figure 8-4) an equal amount.

(2) If autorotation rpm is high, increase length of both pitch links (figure 8-4) an equal amount.

(3) Test fly helicopter to confirm that autorotation rpm is set correctly.

d. If helicopter is rejected due to abnormal vibration level, return to paragraph 8-16 and start over, or change one or both blades. Refer to next higher category of maintenance if blades are to be changed.

e. If helicopter is acceptable vibration wise, remove reflectors from blade tips and return helicopter to flight configuration.

8-22. SWASHPLATE AND SUPPORT ASSEMBLY.

8-23. The swashplate and support assembly (figure 8-5) encircles the mast directly above the transmission. The swashplate is mounted on a universal support (pivot sleeve) which permits it to be tilted in any direction. Movement of the cyclic control stick results in a corresponding tilt of the swashplate and the main rotor. Movement of the collective pitch lever actuates the sleeve assembly which raises or lowers the swashplate and transmits collective control to the main rotor. The cyclic controls are properly corrdinated with collective control by action of the mixing lever at the base of the control column.

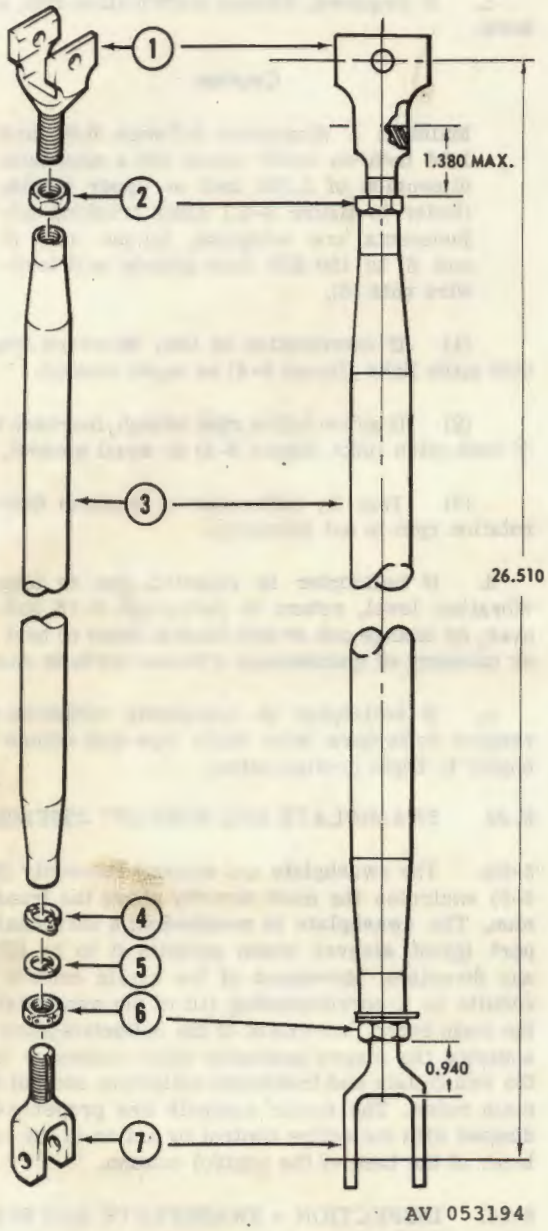
8-24. INSPECTION - SWASHPLATE AND SUPPORT ASSEMBLY.

a. Inspect swashplate for evidence of grease leakage at seals.

b. Check swashplate and support assembly for freedom of operation. Check collective vertical movement and cyclic tilting movement of the inner ring on collective sleeve spherical ball.

(1) Cut safetywire and free lower end of boot (16, figure 8-8).

(2) Tilt swashplate inner ring forward. Inspect side walls of pivot sleeve bearing slot (2, figure 8-5)



1. Upper Clevis (7/16-14 UNC Threads)
2. Nut
3. Tube
4. Lock
5. Lock
6. Nut
7. Lower Clevis (7/16-20 UNF Threads)

Figure 8-4. Pitch link assembly

for signs of abnormal wear. Inspect top outboard edges of bearing (5) for evidence of physical damage and abnormal wear of teflon bearing material. Tilt swashplate inner ring aft and repeat inspection on opposite side of pivot sleeve.

(3) If sleeve slots and/or bearings show signs of abnormal wear, replace swashplate and support assembly.

c. Inspect swashplate and support assembly for minor nicks, scratches, and gouges.

8-25. TESTING - SWASHPLATE AND SUPPORT ASSEMBLY.

a. Adjust friction of swashplate inner ring to pivot sleeve spherical ball and inspect associated controls as follows.

b. Disconnect pitch links and control tubes at swashplate inner and outer ring arms (2 and 3, figure 8-6).

c. Check friction adjustment of bearings (5 and 11, figure 8-5). Place swashplate in level position on pivot sleeve and attach a spring scale to self aligning bearings in swashplate outer ring arm. (Refer to figure 8-7.) Pull vertically with scale to cause swashplate to tilt on pivot sleeve. Make this check at two points. Check the swashplate friction while tilting the swashplate forward and aft; then rotate outer ring 90 degrees and check friction while tilting the swashplate laterally. Pull vertically with scale to cause swashplate to tilt on pivot sleeve and note pounds of pull required to tilt swashplate. If force is not within the range of 24 to 28 pounds, adjust friction. Friction to be within 2.0 pounds in each position. Refer to step i.

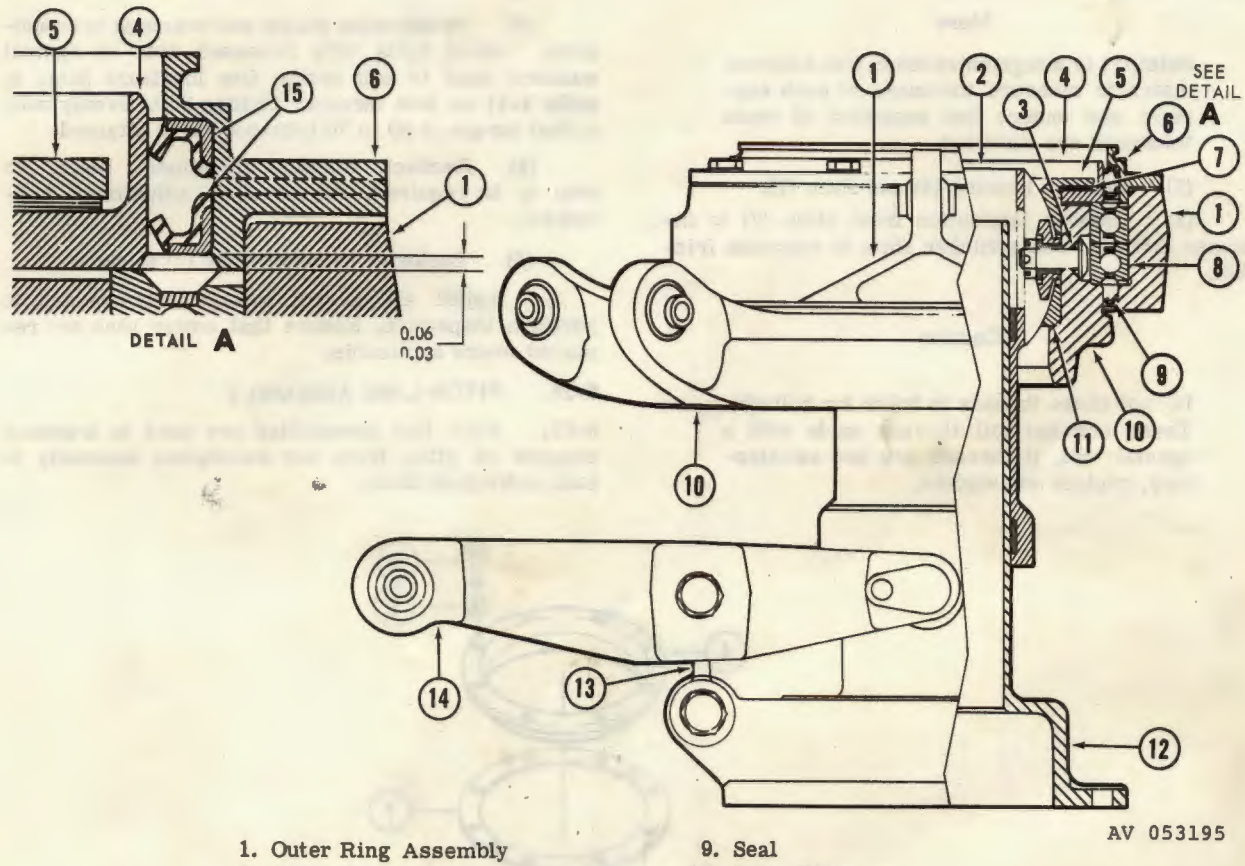
Note

Repeat check with spring scale three or more times to ensure that accurate values are obtained. The values for forward and aft and lateral friction must both fall within the range of 24 to 28 pounds. If the forward and aft friction and lateral friction vary appreciably, suspect dragging bearings (5, figure 8-5).

d. Check for binding and dragging of pivot sleeve bearings, Disconnect control tube at forward end of lever assembly (14, figure 8-5). Grasp level assembly (14) and move vertically through full range of travel. Collective movement of the swashplate pivot sleeve (2) should be smooth with no dragging as it moves on the swashplate support (12).

e. Check for clearance between the swashplate support (12) and pivot sleeve (2). Grasp pivot sleeve and attempt to move laterally on swashplate support. If clearance is 0.020 inch or more replace swashplate and support assembly.

f. Check for binding and dragging of bearings (8). Rotate swashplate outer ring on swashplate assembly. If resistance to turning is not smooth and



1. Outer Ring Assembly
2. Pivot Sleeve
3. Packing
4. Cap
5. Bearing
6. Cap
7. Laminated Shim
8. Bearing
9. Seal
10. Inner Ring
11. Bearing
12. Swashplate Support Assembly
13. Collective Lever Link
14. Lever Assembly
15. Seal

Figure 8-5. Swashplate and support assembly

moderate throughout 360 degree rotation in both directions, replace swashplate and support assembly.

g. Check for looseness at the following points.

(1) Pivot sleeve (2) to lever (14).

(2) Link(13) at attachment points to lever (14) and swashplate support (12).

(3) Lever (5, figure 8-8) and idler link (11) at all attachment points from main rotor mast to swashplate.

(4) If teflon is gone and metal to metal contact is made, replace part that bearing is installed in.

h. Check self aligning bearings in swashplate inner and outer ring arms (2 and 3, figure 8-6) and collective lever (1). If inner ball portion of a self aligning bearing can be moved 0.010 inch or more parallel to the bolt hole axis, replace the part that this bearing is installed in.

i. Swashplate friction adjustment is made as follows:

(1) Cut lockwire and remove eight bolts (5, figure 8-6). Index position of bearing (4).

Caution

Bearing (4) can be installed in eight different positions. Bearing must be index marked before removal and installed in exactly the same position from which removed to ensure smoothness of operation of the cyclic flight controls.

Note

Shim (7) is a segmented shim. Use a micrometer to measure thickness of each segment and ensure that segments of equal thickness are installed.

(2) Remove bearing (4) and shim (7).

(3) Remove lamination from shim (7) to increase friction. Use a thicker shim to decrease friction.

Caution

Do not chase threads in holes for bolts(5). These are helicoil threads made with a special tool. If threads are not satisfactory, replace swashplate.

(4) Reassemble shims and bearings in swashplate. Install bolts with recessed side of special washers next to bolt heads. Use lubricant (item 6, table 1-1) on bolt threads. Tighten bolts evenly until a final torque of 50 to 70 inch-pounds is attained.

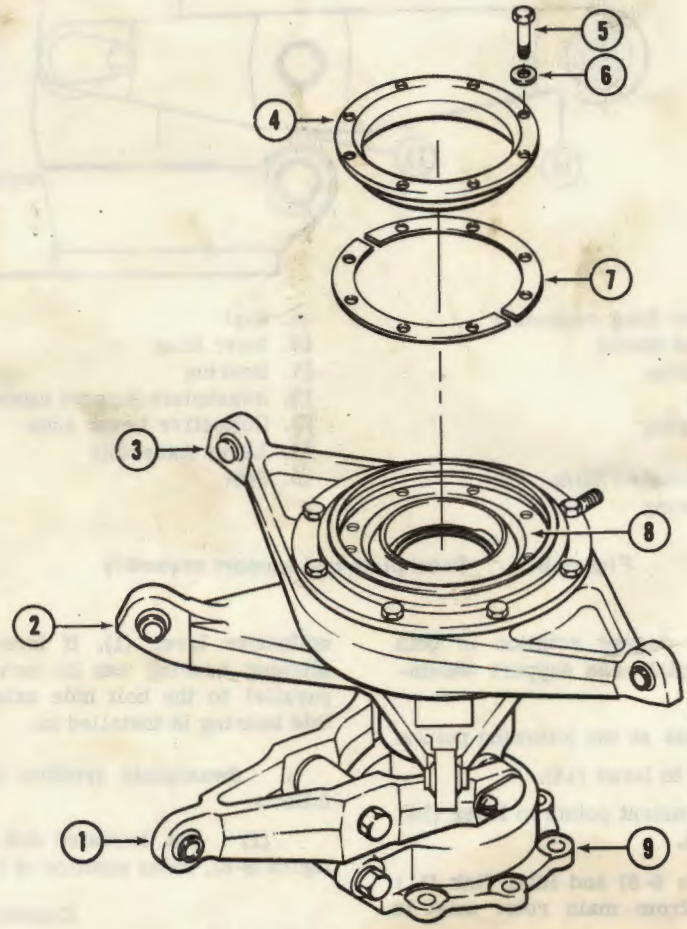
(5) Recheck friction adjustment. Refer to step c. If required, repeat shim adjustment procedure.

(6) Lockwire heads of bolts (5) in pairs.

j. Install all control linkage disconnected to perform inspection. Ensure that cotter pins are replaced where applicable.

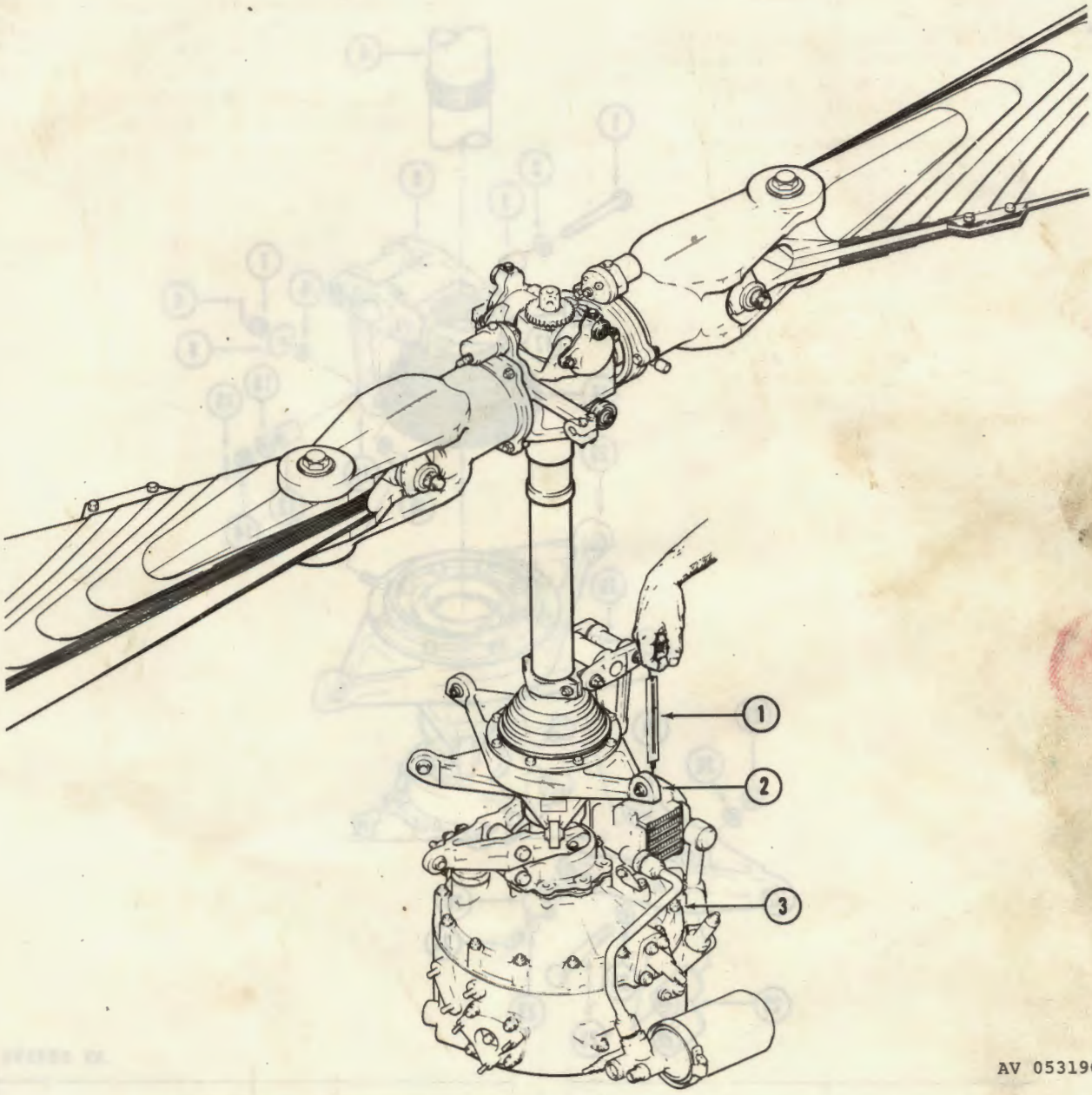
8-26. PITCH LINK ASSEMBLY.

8-27. Pitch link assemblies are used to transmit changes of pitch from the swashplate assembly to each individual blade.



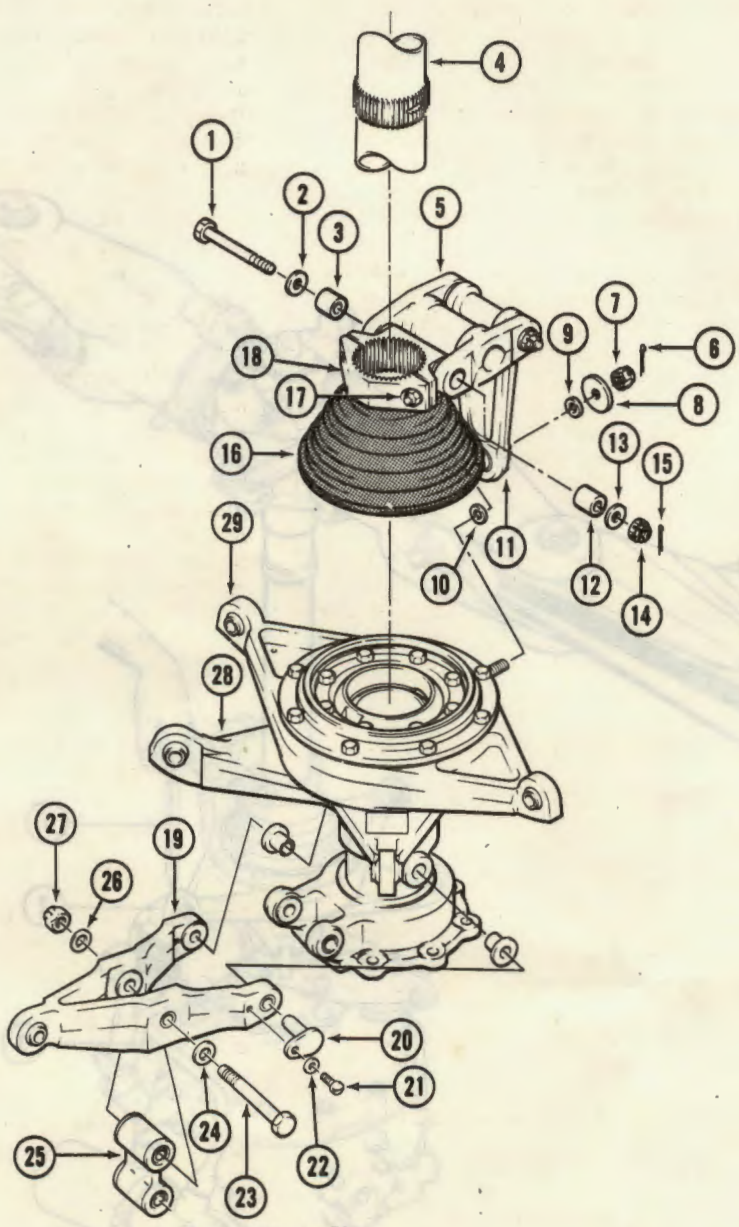
1. Collective Lever
2. Inner Ring
3. Outer Ring
4. Bearing
5. Bolt
6. Washer
7. Shim
8. Inner Cap
9. Support

Figure 8-6. Swashplate friction adjustment



1. Spring Scale
2. Swashplate Outer Ring
3. Transmission

Figure 8-7. Swashplate friction measurement



1. Bolt
2. Washer
3. Spacer
4. Mast
5. Lever
6. Cotter Pin
7. Nut
8. Washer
9. Washer
10. Washer
11. Idler Link
12. Spacer
13. Washer
14. Nut
15. Cotter Pin
16. Boot
17. Nut
18. Collar Set
19. Collective Lever
20. Pin
21. Screw
22. Washer
23. Bolt
24. Washer
25. Link
26. Washer
27. Nut
28. Inner Ring
29. Outer Ring

Figure 8-8. Collective lever, idler link, and collar set installation

8-28. REMOVAL - PITCH LINK ASSEMBLY.

Caution

Do not allow main rotor blades to rotate on pitch change axis. If blade is inadvertently allowed to rotate on the pitch change axis beyond 90°, the main rotor retention strap may be damaged.

a. Index pitch links (8, figure 8-1) for reinstallation in same position. Secure main rotor blade pitch horns to yoke with T-handle work aid in figure 8-9. Lockwire handle to trunnion bearing to prevent backing out.

b. Remove bolts, washers, and nuts securing clevis ends of pitch link assemblies to main rotor pitch horn trunnion and swashplate outer ring (3, figure 8-6).

8-29. INSPECTION - PITCH LINK ASSEMBLY.

a. Check pitch link tubes for damage. Minor damage in the form of scratches not in excess of 0.005 inch in depth may be polished out. No limitations apply to length or direction of scratches.

b. Check holes in clevis ends for elongation.

8-30. REPAIR OR REPLACEMENT - PITCH LINK ASSEMBLY.

a. Remove all scratches that are within limitations with wet or dry type sandpaper (item 501, table 1-1) or finer to obtain a smooth scratch free surface. Apply two coats of zinc chromate primer (item 100, table 1-1) to repaired area.

b. Replace pitch link tubes with scratches in excess of 0.005 inch in depth.

c. Replace clevis ends with elongated holes.

8-31. INSTALLATION - PITCH LINK ASSEMBLY.

a. Remove T-handle work aid.

b. Secure each pitch link assembly (8, figure 8-1) which meets inspection requirement to pitch horn trunnion assembly and to swashplate outer ring (3, figure 8-6). Refer to index marks for reinstallation of pitch link assemblies in same position.

c. If pitch link tubes, clevis ends, or complete assemblies are being replaced, proceed as follows:

(1) Adjust length of swashplate to main rotor blade pitch links to 26.510 inches measured from center of holes in clevis fittings. Set lower clevis (7, figure 8-4) to 0.94 inch dimension as shown and adjust upper clevis (1) to obtain 26.510 inch dimension. Install pitch links (9, figure 8-1) to swashplate and main rotor blade pitch horns with pitch link adjustment locking nut at bottom. Observe color code dots and install pitch links as indicated. Install bolts, washers, and nuts with heads inboard and in direction of rotation. Use two washers under nuts if required for correct cotter pin installation.

(2) Adjust main rotor blade minimum pitch angle to minus 3/4 degree as follows:

(a) Place collective in full down position.

(b) Adjust upper clevis (1, figure 8-4) to minus 3/4 degree main rotor blade pitch angle measured at the grip. Maintain 0.940 inch dimension on the lower clevis (7). Align clevis (1 and 7) to center on self aligning bearings in swashplate and main rotor blade pitch horn and tighten nut (2). Check that dimension on upper clevis (1) does not exceed 1.380 inch. Repeat for opposite blade and install cotter pins in four bolts which attach pitch link assemblies to swashplate and main rotor blade pitch horns.

d. Track main rotor blades. (Refer to paragraph 8-16.)

e. After tracking main rotor blades, torque nuts (2 and 6, figure 8-4) to 150-200 inch-pounds and lockwire nuts (6).

8-32. REMOVAL - IDLER LINK ASSEMBLY AND COLLAR SET.

a. Disconnect lever (5, figure 8-8) from collar set (18) by removing cotter pin (15), nut (14), washer (13), spacer (12), bolt (1), spacer (3) and washer (2).

b. Remove cotter pin (6), nut (7), washer (8), and washer (9), securing idler link (11) to swashplate outer ring (29). Remove lever and link assembly.

c. Remove nuts (17) and attaching hardware securing collar set to mast. Remove collar set (18).

d. Remove hardware securing lever (5) to link (11).

8-33. INSPECTION - IDLER LINK ASSEMBLY. Visually inspect all parts for evidence of physical damage or excessive wear.

8-34. REPAIR OR REPLACEMENT - IDLER LINK ASSEMBLY. Check self aligning bearing in idler link (11, figure 8-8). If inner ball portion of bearing can be moved, 0.010 inch or more parallel to the bolt hole axis, replace idler link.

8-35. INSPECTION - COLLAR SET. Visually inspect splines of collar set for chips and physical damage.

8-36. INSPECTION - BOOT. Inspect boot (16, figure 8-8) for cuts, tears, and deterioration.

8-37. INSTALLATION - IDLER LINK ASSEMBLY AND COLLAR SET.

a. Position collar set (18, figure 8-8) on mast (4) and secure with bolts, washers, and nuts (17). Torque nuts 50 to 70 inch-pounds.

b. Position washer (2) and spacer (3) on bolt (1). Insert bolt through lever (5) and collar set. Ensure that bolt (1) is properly positioned in groove provided in mast. Secure with spacer (12), washer (13), and nut (14). Torque nut (14), 100 to 140 inch-pounds. Install cotter pin (15).

c. Install bolt to connect lever (5) and idler link (11). Spacers, washers, torque, and cotter pin requirements are the same as the callout for bolt (1) in step b.

d. Attach idler link (11) to outer ring of swashplate. Install washers (8, 9, and 10) and torque nut (7) to 60-85 inch-pounds. Install cotter pin (6).

8-38. REMOVAL - COLLECTIVE LEVER AND LINK ASSEMBLY.

a. Remove screw (21, figure 8-8), washer (22), and pin (20) attaching collective lever (19) to pivot sleeve.

b. Remove bolt (23), washers (24 and 26), and nut (27) securing collective lever to link. Remove collective lever.

c. Remove hardware (same as step b. above) securing link (25) to swashplate support. Remove link.

8-39. INSPECTION - COLLECTIVE LEVER AND LINK ASSEMBLY.

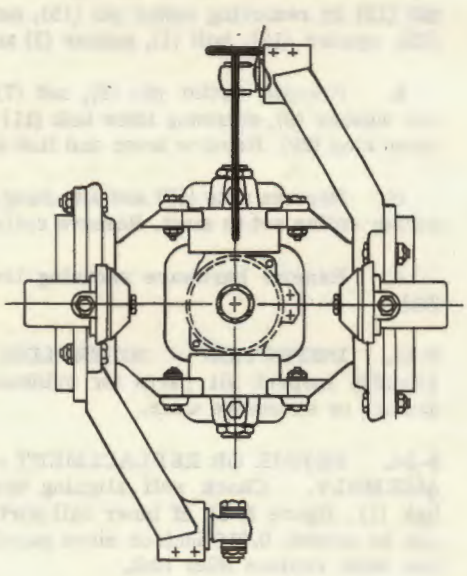
a. Visually inspect all parts for evidence of physical damage and excessive wear.

b. Check self aligning bearing in collective lever (19). If inner ball portion of bearing can be moved 0.010 inch or more parallel to the bolt hole axis, replace collective lever.

8-40. INSTALLATION - COLLECTIVE LEVER AND LINK ASSEMBLY.

a. Install lever assembly (19) to support assembly with link (25) and two bolts (23). The word top is embossed on the lever assembly to indicate proper position. Ensure that two spacers are installed with link (25). Torque bolts to 95-110 inch-pounds and install cotter pins.

b. Check that bushings are installed in lever (19) and support at point where pins (20) are installed. Attach lever to support with two pins (20), two washers (22) and two screws (21). Lockwire screws to lever.



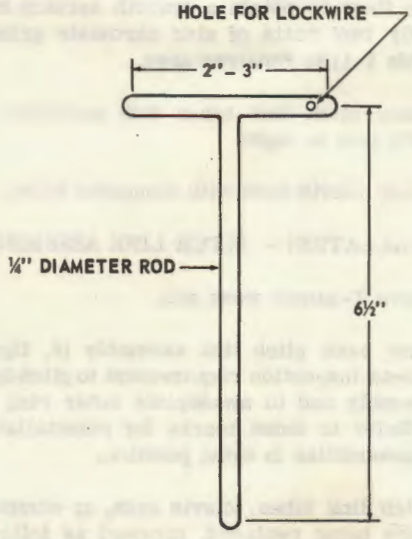


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Figure 8-9. T-Handle work aid

SECTION III TAIL ROTOR HUB AND BLADE

8-41. DESCRIPTION.

8-42. The tail rotor hub and blade assembly consists of an aluminum alloy forged yoke and aluminum alloy blades. The blades are mounted in the yoke by means of spherical bearings which are mounted in the grip plates on the pitch change axis. The spherical bearings provide for pitch change of the blades. The yoke and blade assembly is mounted on the 90 degree gearbox shaft by means of a splined trunnion, mounted in bearings in the yoke, to provide a flapping axis for the assembly. Ballast stations located at the inboard trailing edge and at the tip of the blades are provided for mass balance of the blades; weights used in these locations are determined when the blade is manufactured. At time of assembly, spanwise balance is accomplished by use of washers on the blade retention bolts, and chordwise balance is attained by adjustment of set screws or nuts to shift the position of the trunnion in the yoke.

8-43. TROUBLESHOOTING - TAIL ROTOR. The following information is furnished for tail rotor troubleshooting.

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
High frequency vibration felt through rudder pedals	Blade out of balance	Balance hub and blade assembly
	Worn or loose blade bearing	Replace bearings and/or blades
	Bent pitch change link	Replace link
	Loose retaining nut	Tighten nut
	Loose pitch change link bearing	Replace bearing
	Worn loose pitch change slider	Replace slider
	Worn tail rotor flapping bumper	Replace bumper
Inability to make normal right and left turns in flight	Blade angle not properly set	Check pitch setting and system rigging

8-44. OPERATIONAL CHECK - TAIL ROTOR. After replacement or installation of tail rotor hub and blade assembly, rig assembly as outlined in paragraph 9-70.

8-45. REMOVAL - TAIL ROTOR HUB AND BLADE ASSEMBLY.

a. Disconnect pitch change links (1, figure 8-10) at crosshead by removing nut (20), bolt (22), and washer (21) and at pitch horn (2) by removing nut (23) and cupped washer (24). Remove nut (3) and washer (4) from end of pitch control tube (7). Using a suitable puller remove crosshead (5) from control tube and lift pin (6).

b. Cut lockwire and remove knurled nut (8) and liner (9).

c. Straighten washer (10) where it is bent over nut (11) and remove nut.

d. Remove washer (10), static stop (12), bumper (13) and shim (14).

e. Slide tail rotor assembly off shaft (18) and remove pin (15), key (16) and spacer (17).

Note

Shim (14) serves to position static stop (12) and in turn the tail rotor blade-to-boom clearance. If the hub and blade assembly is to be reinstalled, identify the shim for re-use in the assembly.

8-46. INSPECTION - TAIL ROTOR BLADES. Inspect tail rotor blades for nicks, scratches, dents, and voids. (In the event blades are damaged, refer to next higher category of maintenance.)

8-47. INSPECTION - TAIL ROTOR HUB. Inspect hub for scratches, nicks, dents, burrs, cracks, corrosion and similar surface defects. Scratches and nicks requiring no more than 0.005 inch removal of material in cleanup are permissible. Blend edges of repaired area into surrounding surface to form a smooth contour.

8-48. INSTALLATION - TAIL ROTOR HUB AND BLADE ASSEMBLY.

a. Install spacer (17, figure 8-10) against shoulder on tail rotor drive shaft. Align pin hole in

drive shaft, slot in control tube (7) and hole in key (16). Install pin (15).

Caution

Ensure that pin (15) goes through hole in key (16) and remains in position until tail rotor assembly and static stop are positioned on drive shaft.

Note

Do not bend lock-washer (10) or install lockwire or cotter keys in steps b., c., and g., until completion of step i.

b. Align splines and position tail rotor assembly on ninety degree gearbox shaft with leading edge of top blade (19) facing aft. Install shim (14) rubber bumper (13), static stop (12), new washer (10) and nut (11). Torque nut 45 to 50 foot-pounds.

c. Install liner (9) and knurled nut (8). Tighten hand tight.

d. Check pitch change mechanism for freedom of movement through operating range.

e. Check tail rotor assembly for freedom of movement on flapping axis. Check rotor blades for freedom of movement on spherical bearings.

f. Install pin (6) in pitch control tube and install crosshead (5) over control tube and pin. Check for proper location of pin by inserting piece of lockwire into groove at back of crosshead. Secure crosshead with washer (4) and nut (3). Torque nut 100 to 150 inch-pounds.

g. Install pitch change links between blade pitch horns and crosshead. Secure with washers and nuts. Install cupped washers (24) between nut and pitch link at blade pitch horn. Torque nut (23) 50 to 60 inch-pounds. Check pitch links for freedom of movement on bearings.

h. Check rigging of anti-torque control system. Refer to paragraph 9-70.

i. After tail rotor has been rigged, check for correct rotor flapping angle and tail rotor boom clearance as follows:

(1) Place tail rotor blades in vertical position, move rubber bumper (13, figure 8-9) outboard over static stop, and check flapping angle along pitch change axis. The pitch change axis is an extension of a line through the centers, of the blade to yoke attachment bolts. Flap tail rotor to one extreme position until yoke contacts stop (12, figure 8-10). Place protractor on blade-to-yoke attachment bolts and record angle. Flap tail rotor to opposite extreme position until yoke contacts static stop; measure and record angle. The total flapping angle must be 12 degree plus or minus 1 degree. If angle is not within tolerance, refer to step (3).

(2) Turn tail rotor to position one blde tip adjacent to tail boom. Hold right anti-torque pedal forward against stop. Flap tail rotor blade toward tail boom and against static stop (12). The trailing edge of tail rotor blade must clear tail boom at closest point at least 1.5 inches. If clearance is not within tolerance, refer to step (3).

(3) If necessary to obtain 12 degrees plus or minus 1 degree and 1.5 inch tolerance noted in steps (1) and (2), adjust thickness of shim (14, figure 8-10).

Note

Use only bonded laminates of shim (14). If a thicker shim is required, use a new shim.

j. When 12 degrees plus or minus 1 degree and 1.5 inch tolerances noted in step i. have been attained, lockwire the installation. Bend edge of washer (10) inboard over one flat of static stop (12). Bend edge of washer (10), at another location, outboard over two flats of nuts (11). (See figure 8-10, detail A.) Lockwire nut (11) to washer (10). Install cotter pins in castellated nuts (20 and 23) used to secure pitch links (1).

1. Link
2. Pitch Horn
3. Nut
4. Washer
5. Crosshead
6. Pin
7. Control Tube
8. Knurled Nut
9. Liner
10. Washer
11. Nut
12. Static Stop
13. Bumper
14. Shim
15. Pin
16. Key
17. Spacer
18. Gearbox Shaft
19. Tail Rotor Blade
20. Nut
21. Washer
22. Bolt
23. Nut
24. Cupped Washer

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Figure 8-10. Tail rotor removal/installation (Sheet 1 of 2)

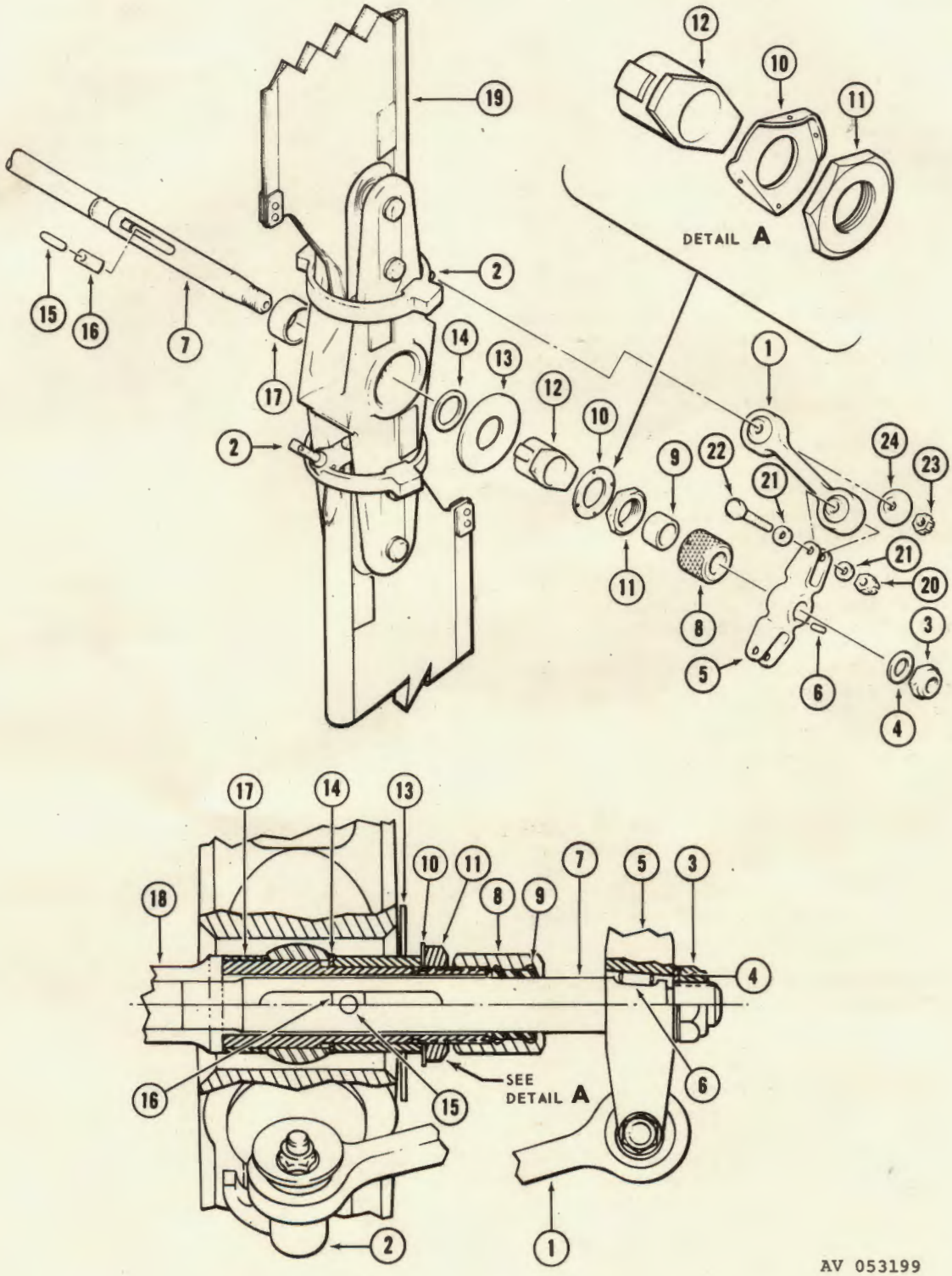

Figure 8-10. Tail rotor removal/installation (Sheet 2 of 2)

CHAPTER 9

FLIGHT CONTROLS

SECTION I SCOPE

9-1. SCOPE.

9-2. The purpose of this chapter is to provide all the essential information for maintenance personnel to accomplish organizational maintenance on the complete flight controls. This information includes a detail description and chronological instructions as to methods and procedures. It also includes special tools and equipment required for accomplishment of these maintenance phases as are applicable in accordance with the Maintenance Allocation Chart. Special tools required for performance of organizational maintenance will be found in TM 55-1520-228-20P Organizational Maintenance Repair Parts and Special Tool Lists Manual.

SECTION II CONTROL SURFACES

(Not Applicable)

SECTION III FLIGHT CONTROLS

9-3. COLLECTIVE PITCH CONTROL SYSTEM.

9-4. Collective pitch control system consists of a jackshaft assembly with dual control sticks, push pull tubes and bellcranks, and a hydraulic servo actuator connected to a control lever on swashplate support. Movement of either control stick is transmitted through linkage and servo actuator to main rotor pitch control mechanism, causing helicopter to ascend or descend or to remain at constant altitude. Servo actuator has an irreversible valve to reduce feedback forces and to provide for use of controls in event of hydraulic boost failures. (Figure 9-1.)

9-5. COLLECTIVE STICKS.

9-6. Pilot and copilot's collective pitch control sticks extend up and forward through flexible boots in floor at left side of each seat. Each stick incorporates a twist grip type power control for positive engine operation in cutoff, ground idle and full open position. Switch boxes on top of pilot's collective stick only, contain control switches for engine starter, governor RPM, landing lights, and idle stop release.

9-7. REMOVAL - COLLECTIVE STICKS.

a. Remove boot around stick shaft.

b. Disconnect electrical cable from terminal (pilot stick only).

c. Remove two bolts, nuts and washers that secure stick in elbow on control assembly. Remove stick. (Pilot's stick only.)

d. Remove knurled screw at base of copilot's stick. Remove stick.

9-8. INSPECTION - COLLECTIVE STICKS. Inspect tubes for nicks, scratches, cracks and security of attached parts.

9-9. INSTALLATION - COLLECTIVE STICKS.

a. Insert stick in elbow, assuring engagement of throttle tube.

b. Install bolts, nuts, and washers to clamp stick in place. (Pilot's stick only.)

c. Install knurled screw on copilot's stick.

d. Connect electrical cable at terminal (pilot's stick only). Install boot.

9-10. JACKSHAFT.

9-11. Collective control sticks are connected under the seats by a jackshaft assembly. The jackshaft is mounted laterally under the seat section and incorporates a friction device between the pilot and copilot seats to adjust drag on the stick operation and a clamp for minimum (ground adjustable) friction.

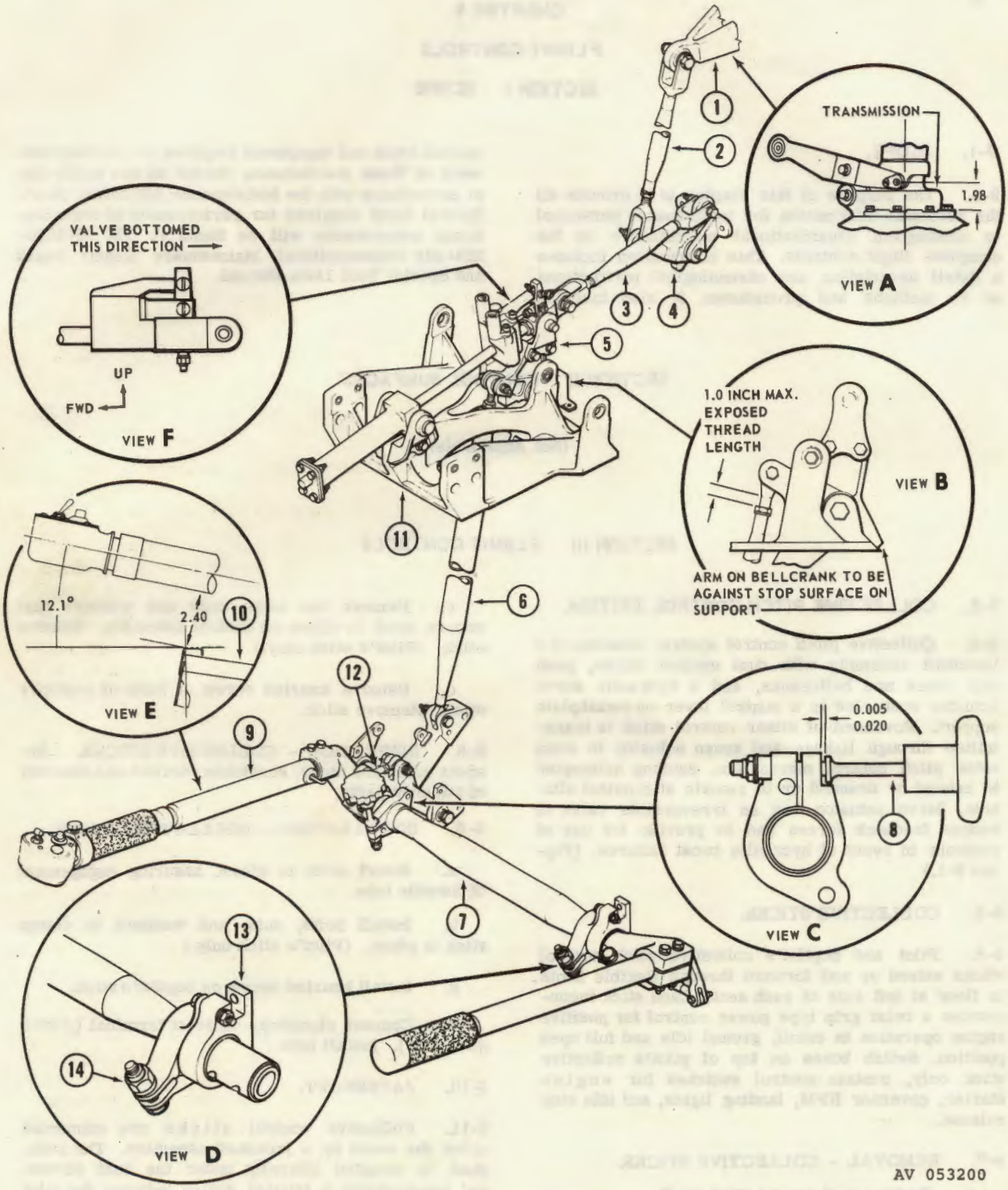

Figure 9-1. Collective controls (Sheet 1 of 2)

1. Collective Lever Assembly
2. Control Tube
3. Cylinder Extension Tube
4. Bellcrank
5. Bellcrank
6. Control Tube
7. Torque Tube
8. Friction Adjuster
9. Collective Lever - Pilot
10. Seat
11. Cylinder Support Assembly
12. Link Assembly
13. Support
14. Nut

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Figure 9-1. Collective controls (Sheet 2 of 2)

9-12. REMOVAL - JACKSHAFT.

a. Remove forward seat panels.

b. Remove friction adjuster knob (8, figure 9-1).

c. Remove center panel.

d. Disconnect NI fuel control linkage on right end of jackshaft.

e. Disconnect link assembly (12, figure 9-1).

f. Remove bolts attaching support (13) and friction casting to airframe. Remove jackshaft.

9-13. INSPECTION - JACKSHAFT.

a. Inspect bearings for smoothness of operation and security in assemblies.

b. Inspect both friction adjustment surfaces for smooth surface and freedom of galling.

c. Inspect jackshaft tube for cracks, nicks, and damage.

9-14. INSTALLATION - JACKSHAFT.

a. Position assembly in airframe and attach support (13, figure 9-1) and friction casting to airframe.

b. Connect link assembly (12) and gas generator control on right end of jackshaft.

c. Install friction adjustor knob (8, figure 9-1) with center panel.

d. Install seat panels and seats.

9-15. ADJUSTMENT - JACKSHAFT FRICTION.

a. Remove pedestal cover, seats and seat panels to expose collective control friction adjuster (8, figure 9-1). Remove copilot's seat and panel to expose left outboard end of tube (7, view D).

b. Release friction on adjuster knob (8) and check for 0.005 to 0.020 inch clearance as illustrated in view C. Disconnect link (12).

c. Check for 2 to 4 pound break-out force, measured at the center of throttle grip. Adjust nut (14) if required.

d. Connect link (12), ensure that cotter pins are installed.

e. Install cover, panels and seats.

9-16. COLLECTIVE PITCH LINKAGE.

9-17. Linkage between collective pitch control jackshaft and collective sleeve lever on swashplate support consists of push-pull tubes, bellcranks, and hydraulic actuator assembly.

9-18. REMOVAL - COLLECTIVE PITCH LINKAGE. Remove control tubes (2, 3, and 6, figure 9-1) and bellcranks as required for inspection and replacement.

9-19. INSPECTION - COLLECTIVE PITCH LINKAGE. Inspect linkage parts for wear, elongated bolt holes, cracks, nicks, or damage. Inspect bearings for wear or roughness.

9-20. INSTALLATION - COLLECTIVE PITCH LINKAGE. Install control tubes and bellcranks (figure 9-1) as required after inspection and replacement.

9-21. CYCLIC CONTROL SYSTEM.

9-22. A system of linkage transmits movement from cyclic control sticks to swashplate which actuates rotating controls to main rotor, controlling direction of helicopter. Fore-aft lateral control are independent linkages from control stick to an intermixing bellcrank. From this point on to swashplate horns, linkage cannot be considered separately as to effect. Two hydraulic servo actuators are incorporated to reduce effort required for control and to reduce feedback of forces from main rotor. Two force gradient units, with magnetic brakes, are incorporated for artificial control feel and stabilization of controls. (Figure 9-2.)

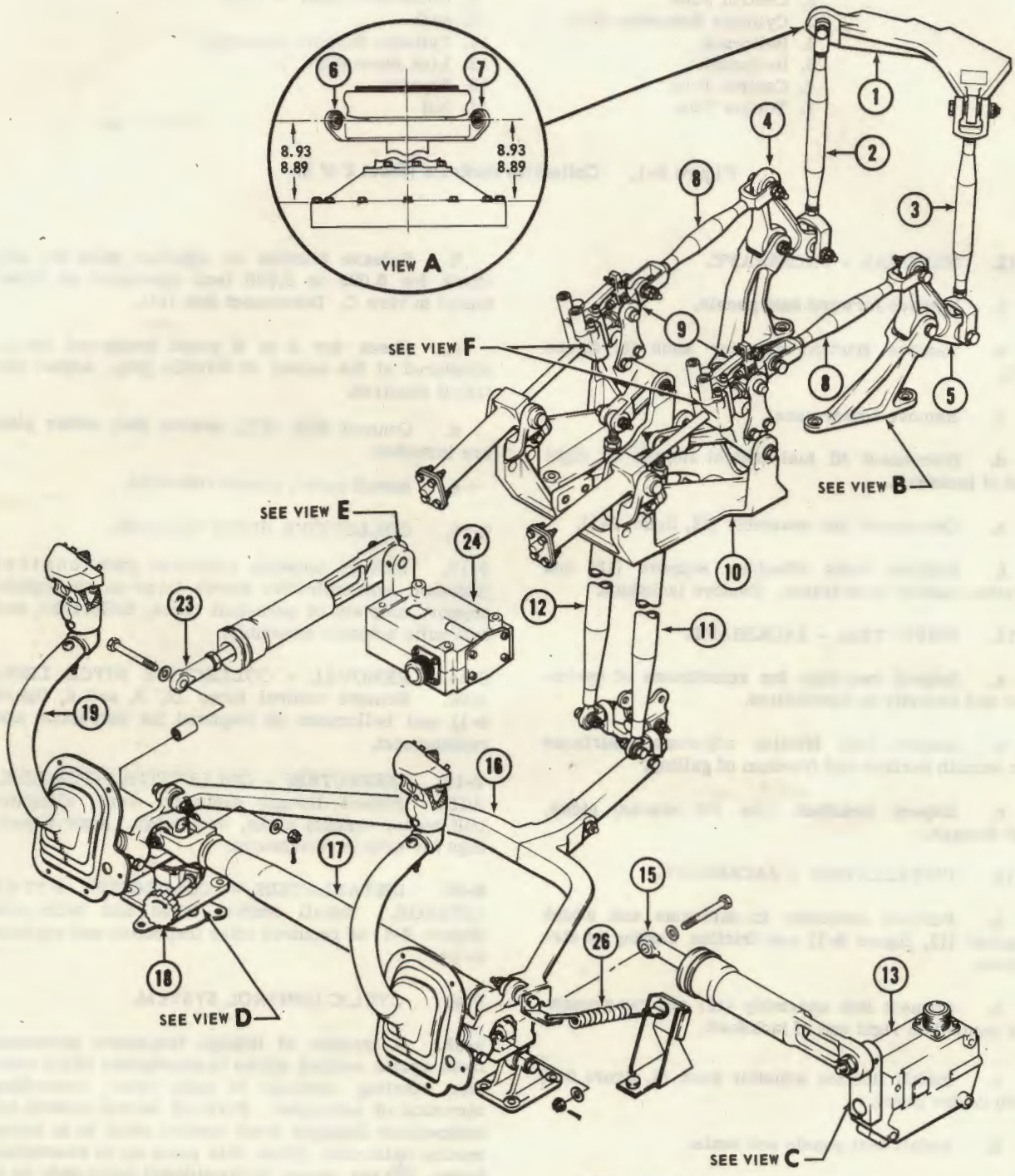
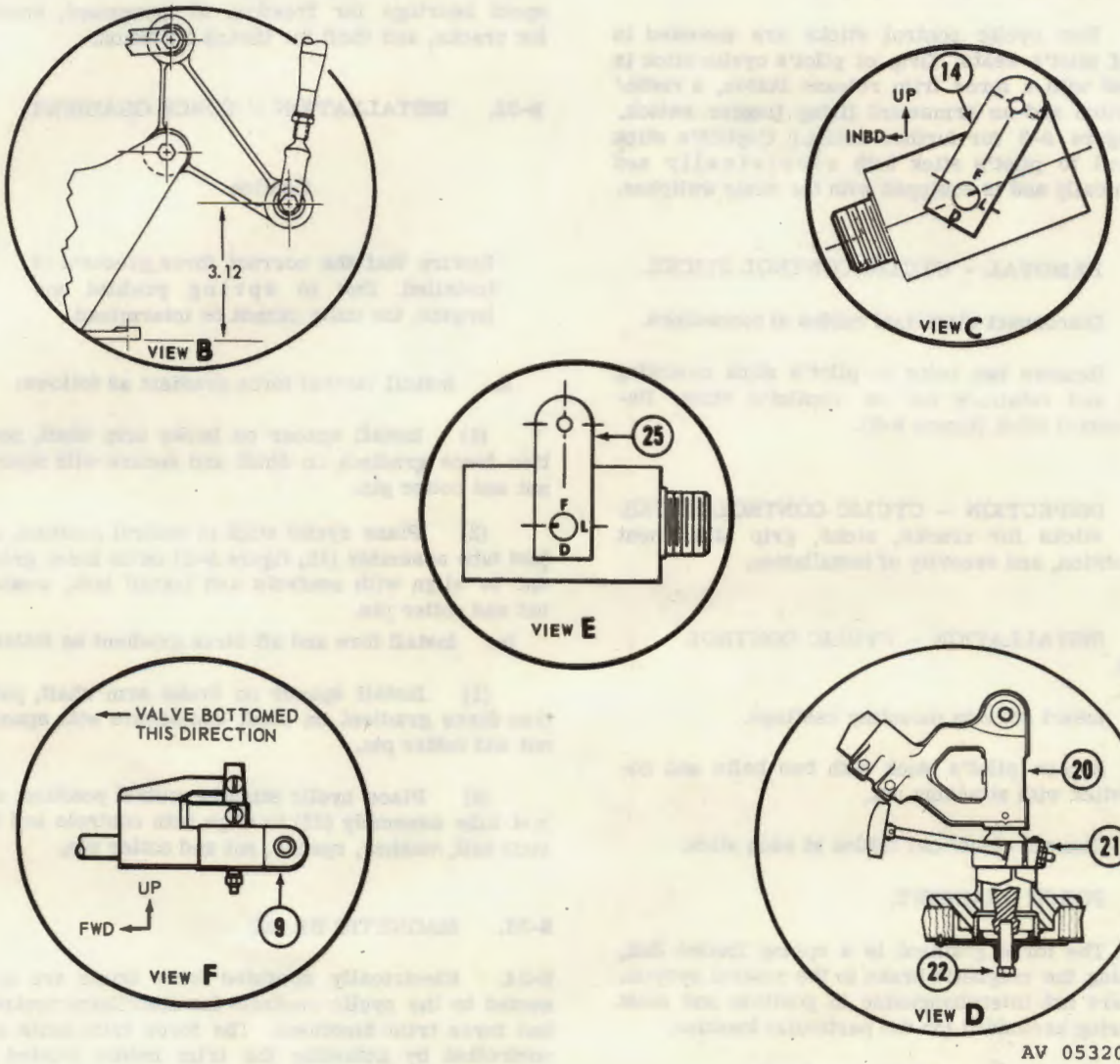


Figure 9-2. Cyclic controls (Sheet 1 of 2)



1. Swashplate Inner Ring
2. Control Tube
3. Control Tube
4. Bellcrank
5. Bellcrank
6. Right Horn
7. Left Horn
8. Cylinder Extension Tube
9. Cylinder Valve
10. Cylinder Support Assembly
11. Control Tube
12. Control Tube
13. Magnetic Brake
14. Arm
15. Tube
16. Yoke
17. Torque Tube
18. Cyclic Friction Adjuster
19. Pilot's Cyclic Control
20. Pivot Assembly
21. Nut
22. Bolt, Rigging
23. Tube
24. Magnetic Brake
25. Arm
26. Spring Assembly

Figure 9-2. Cyclic controls (Sheet 2 of 2)

9-23. CYCLIC CONTROL STICKS.

9-24. Two cyclic control sticks are mounted in front of pilot's seats. Grip of pilot's cyclic stick is equipped with a force trim release button, a radio/ICS switch and an armament firing trigger switch. (See figure 9-3 for further detail.) Copilot's stick is linked to pilot's stick both electrically and mechanically and is equipped with the same switches.

9-25. REMOVAL - CYCLIC CONTROL STICKS.

a. Disconnect electrical cables at connectors.

b. Remove two bolts on pilot's stick mounting casting and retaining nut on copilot's stick. Remove control stick (figure 9-2).

9-26. INSPECTION - CYCLIC CONTROL STICKS. Inspect sticks for cracks, nicks, grip attachment and condition, and security of installation.

9-27. INSTALLATION - CYCLIC CONTROL STICKS.

a. Insert stick in mounting castings.

b. Secure pilot's stick with two bolts and copilot's stick with attaching nut.

c. Connect electrical cables at each stick.

9-28. FORCE GRADIENT.

9-29. The force gradient is a spring loaded link, connecting the magnetic brake to the control system. These are not interchangeable in position and must have spring preloaded for the particular location.

9-30. REMOVAL - FORCE GRADIENT.

Caution

Do not inter-mix force gradient assemblies. Replace with a like serviceable item.

a. Remove forward seats and panels to gain access to cyclic system.

b. Remove bolts, nuts and spacers from each end of force gradient. Remove force gradient.

9-31. INSPECTION - FORCE GRADIENT. Inspect bearings for freedom of movement, housing for cracks, and shaft for thread condition.

9-32. INSTALLATION - FORCE GRADIENT.

Caution

Ensure that the correct force gradient is installed. Due to spring preload and lengths, the units cannot be intermixed.

a. Install lateral force gradient as follows:

(1) Install spacer on brake arm shaft, position force gradient on shaft and secure with spacer, nut and cotter pin.

(2) Place cyclic stick in neutral position, adjust tube assembly (15, figure 9-2) on the force gradient to align with controls and install bolt, washer, nut and cotter pin.

b. Install fore and aft force gradient as follows:

(1) Install spacer on brake arm shaft, position force gradient on shaft and secure with spacer, nut and cotter pin.

(2) Place cyclic stick in neutral position, adjust tube assembly (23) to align with controls and install bolt, washer, spacer, nut and cotter pin.

9-33. MAGNETIC BRAKE.

9-34. Electrically operated force trims are connected to the cyclic controls for stabilizing controls and force trim functions. The force trim units are controlled by actuating the trim button located on the cyclic sticks. The magnetic brakes are identical assemblies except for the positioning of the arm on the brake shaft illustrated in figure 9-2, views C and E.

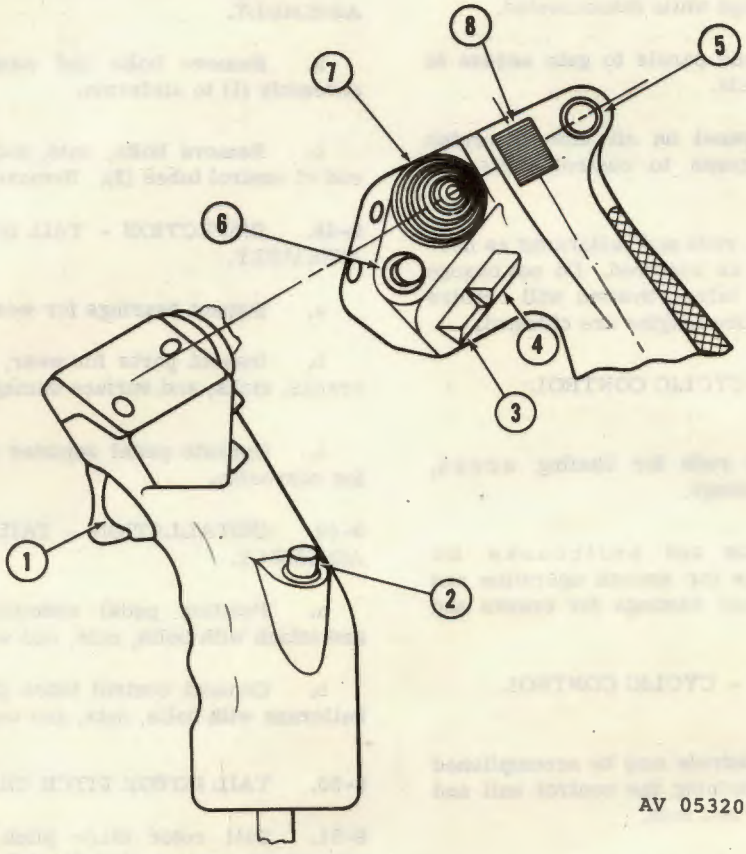
9-35. REMOVAL - MAGNETIC BRAKE.

a. Remove forward seats and access panels.

b. Disconnect electrical connection.

c. Disconnect force gradient from brake arm and remove bolts and washers attaching brake (13 or 24, figure 9-2) to airframe.

9-36. INSPECTION - MAGNETIC BRAKE. Inspect brake for corrosion, unobstructed travel, security of electrical connector and security of mounting.



1. Trigger Switch
2. Not Used
3. Radio ICS
4. Radio Transmit
5. Force Trim
6. Not Used
7. Not Used
8. Depress Elevate Gun Switch

Figure 9-3. Cyclic stick grip

9-37. INSTALLATION - MAGNETIC BRAKE.

a. Install arm on magnetic brake in the relation to marks as shown in figure 9-2 for each position.

b. Position magnetic brake over mounting holes on airframe and install four bolts and washers.

c. Connect brake arm to force gradient by installing spacer on arm shaft, position force gradient on arm shaft and secure with spacer, nut and cotter pin.

d. Connect electrical lead to brake and lockwire.

e. Apply electrical power to brake and check operation.

f. Replace access covers.

9-38. CYCLIC CONTROL LINKAGE.

9-39. Linkage between the cyclic control sticks and swashplate control horns includes control tubes, bellcranks, jackshaft, force gradients with magnetic brakes, and hydraulic servo actuators.

9-40. REMOVAL - CYCLIC CONTROL LINKAGE.

a. Parts of control system can be removed separately as need occurs, or completely in practical

sequence. Take precautions against damage by accidental movement of linkage while disconnected.

b. Remove seats and panels to gain access to forward section of controls.

c. Open vertical panel on aft side of center support column for access to control tubes and bellcranks.

d. Remove control rods and bellcranks as necessary for replacement as required. Do not change length of any adjustable tubes. System will require rigging if any tubes or tube lengths are changed.

9-41. INSPECTION - CYCLIC CONTROL LINKAGE.

a. Inspect control rods for chafing areas, cracks, scratches and damage.

b. Inspect rod ends and bellcranks for elongated holes, bearings for smooth operation and security of mounting, and castings for cracks and wear.

9-42. INSTALLATION - CYCLIC CONTROL LINKAGE.

a. Installation of controls may be accomplished in any sequence by positioning the control unit and installing bolts, washers, and nuts.

b. Install bolts in same direction as removed and move controls through full range to ensure proper clearance.

c. Install control rods and bellcranks as removal required.

d. Install seats and panels which were removed for access.

9-43. TAIL ROTOR CONTROL SYSTEM.

9-44. Tail rotor control system includes control pedals, pedal adjusters, push pull tubes, bellcranks, and a pitch control mechanism mounted through the tail rotor shaft. Actuation of pedals causes pitch change of tail rotor blades to offset main rotor torque and control directional heading of helicopter.

9-45. TAIL ROTOR PEDAL ASSEMBLY.

9-46. Two sets of control pedals (1, figure 9-4) mounted on the pilot's compartment deck are connected under the center console to a bellcrank. Each pedal set has an adjuster knob (3) for manual adjustment of pedal position according to pilot's need.

9-47. REMOVAL - TAIL ROTOR PEDAL ASSEMBLY.

a. Remove bolts and washers attaching pedal assembly (1) to airframe.

b. Remove bolts, nuts, and washers from pedal end of control tubes (2). Remove pedals.

9-48. INSPECTION - TAIL ROTOR PEDAL ASSEMBLY.

a. Inspect bearings for wear and roughness.

b. Inspect parts for wear, elongated bolt holes, cracks, nicks, and surface damage.

c. Operate pedal adjuster full travel and check for corrosion.

9-49. INSTALLATION - TAIL ROTOR PEDAL ASSEMBLY.

a. Position pedal assembly (1) in airframe and attach with bolts, nuts, and washers.

b. Connect control tubes (2) to pedal assembly bellcrank with bolts, nuts, and washers.

9-50. TAIL ROTOR PITCH CHANGE MECHANISM.

9-51. Tail rotor blade pitch control is accomplished by means of bellcrank, rod, and lever assembly mounted on the gearbox, actuating a control tube through the hollow rotor drive shaft to a pitch control crosshead and blade links.

9-52. REMOVAL - TAIL ROTOR PITCH CHANGE MECHANISM.

a. Remove rod assembly (4) at the pitch change lever.

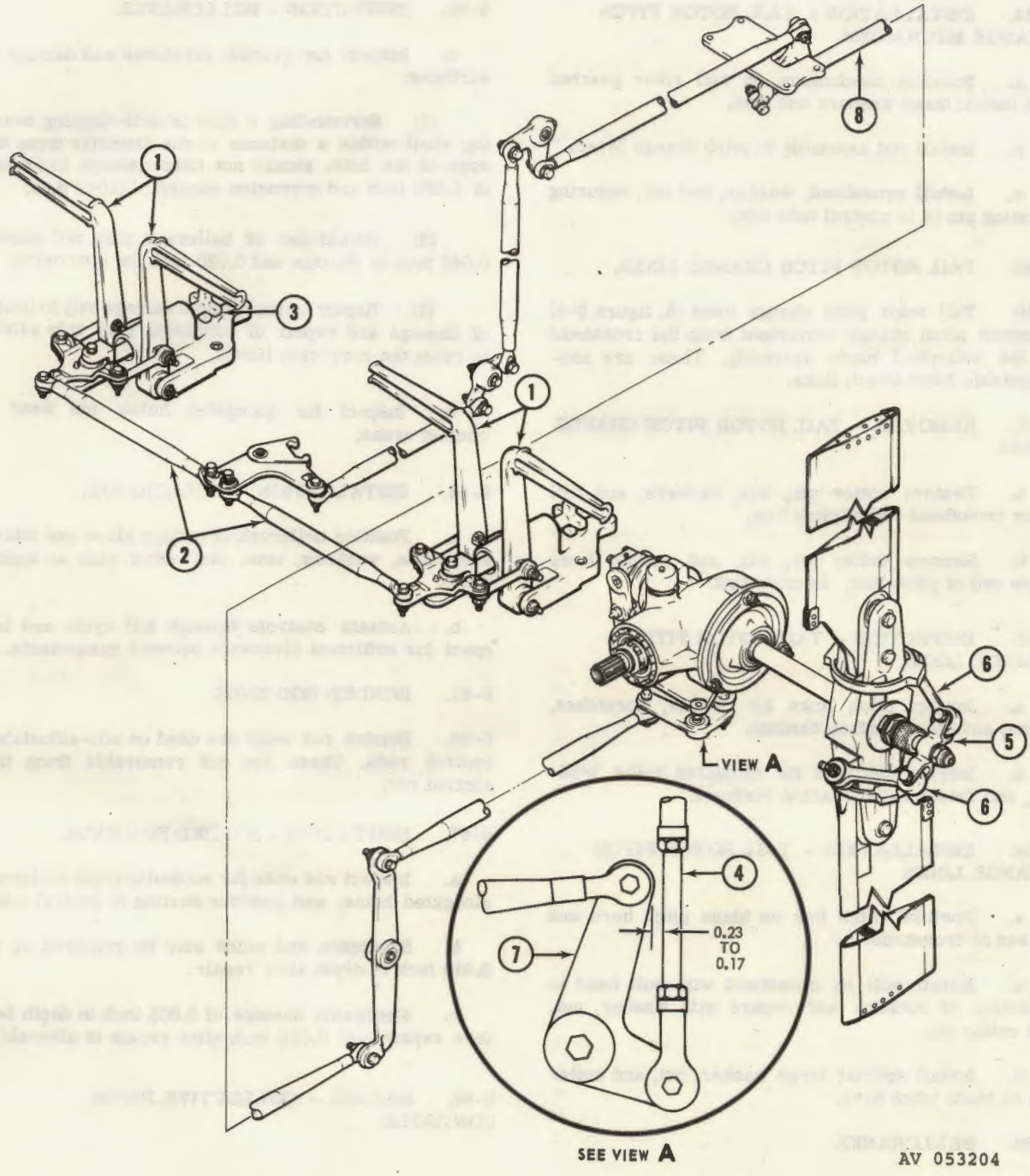
b. Remove nut, washer, and crosshead (5) from control tube.

c. Remove three nuts and washers attaching trunnion housing to tail rotor gearbox. Remove pitch change mechanism.

9-53. INSPECTION - TAIL ROTOR PITCH CHANGE MECHANISM.

a. Inspect for oil leakage around boot and housing to gearbox seal.

b. Inspect bearings for smooth operation, linkage for ease of operation and mechanism for damage.



1. Pedal Assembly
2. Control Tubes
3. Adjuster Knob
4. Rod Assembly
5. Crosshead
6. Pitch Links
7. Bellcrank
8. Control Tube

Figure 9-4. Tail rotor control system

9-54. INSTALLATION - TAIL ROTOR PITCH CHANGE MECHANISM.

a. Position mechanism on tail rotor gearbox and install three washers and nuts.

b. Install rod assembly to pitch change lever.

c. Install crosshead, washer, and nut, ensuring locating pin is in control tube slot.

9-55. TAIL ROTOR PITCH CHANGE LINKS.

9-56. Tail rotor pitch change links (6, figure 9-4) transmit pitch change movement from the crosshead to the individual blade assembly. These are non-adjustable fixed length links.

9-57. REMOVAL - TAIL ROTOR PITCH CHANGE LINKS.

a. Remove cotter pin, nut, washers, and bolt from crosshead end of pitch link.

b. Remove cotter pin, nut, and washer from blade end of pitch link. Remove link.

9-58. INSPECTION - TAIL ROTOR PITCH CHANGE LINKS.

a. Inspect pitch links for cracks, scratches, nicks, and other surface damage.

b. Inspect bearings for elongated holes, binding, and deteriorated bearing surfaces.

9-59. INSTALLATION - TAIL ROTOR PITCH CHANGE LINKS.

a. Position pitch link on blade pitch horn and on end of crosshead.

b. Install bolt in crosshead with bolt head in direction of rotation and secure with washer, nut, and cotter pin.

c. Install special large washer, nut, and cotter pin on blade pitch horn.

9-60. BELLCRANKS.

9-61. Bellcranks are used throughout the collective, cyclic, and tail rotor control systems. These transmit or change movement in the particular system in which they are installed.

9-62. REMOVAL - BELLCRANKS. Bellcranks may be removed by removing attaching bolts, washers, nuts, and cotter pins (retain for reuse or replace as necessary all attaching hardware).

9-63. INSPECTION - BELLCRANKS.

a. Inspect for cracks, scratches and damage to surfaces:

(1) Surrounding a hole or self-aligning bearing shell within a distance of one diameter from the edge of the hole, should not have damage in excess of 0.020 inch and corrosion excess of 0.010 inch.

(2) Remainder of bellcrank may not exceed 0.040 inch in damage and 0.020 inch for corrosion.

(3) Repair of mechanical damage only to limits of damage and repair of corrosion may only extend to twice the corrosion limits.

b. Inspect for elongated holes and wear in contact areas.

9-64. INSTALLATION - BELLCRANKS.

a. Position bellcrank in proper place and attach with bolts, washers, nuts, and cotter pins as applicable.

b. Actuate controls through full cycle and inspect for sufficient clearance between components.

9-65. BONDED ROD ENDS.

9-66. Bonded rod ends are used on non-adjustable control rods. These are not removable from the control rod.

9-67. INSPECTION - BONDED ROD ENDS.

a. Inspect rod ends for scored bearing surfaces, elongated holes, and positive seating in control tube.

b. Scratches and nicks may be repaired up to 0.010 inch in depth after repair.

c. Corrosion damage of 0.005 inch in depth before repair and 0.010 inch after repair is allowable.

9-68. RIGGING - COLLECTIVE PITCH CONTROLS.

Note

Rig collective pitch controls with hydraulic boost OFF.

a. Install all fixed control tubes and links in the collective pitch control system.

b. Adjust collective friction. (Refer to paragraph 9-15.)

c. Adjust cyclic friction to minimum with adjuster (18, figure 9-2, view D). Slide rigging bolt AN5 into position and apply maximum cyclic friction. Remove AN5 bolt and be careful not to displace cyclic stick while rigging procedure is being accomplished.

d. Position the pilot's collective lever 2.40 inches above front seat support (refer to figure 9-1, view E) and position bellcrank (5, view B).

e. Adjust and install control tube (6).

f. Hold the pilot's collective lever against the low pitch stop and bottom the servo actuator valve; refer to view F. Adjust and connect tube (3, figure 9-1).

g. Position the collective lever assembly (1) to position shown in view A, adjust and connect control tube (2).

Caution

Maximum allowable exposed thread area on rod end fitting on control tubes (6, 3, and 2) is 1.0 inches. (Refer to view B.)

h. Refer to paragraph 9-69 step g. for completion of rigging.

Caution

Ensure that AN5 rigging bolt is removed when rigging is completed.

9-69. RIGGING - CYCLIC PITCH CONTROLS.

Note

Rig cyclic pitch control with hydraulic boost OFF.

a. Install all fixed control tubes and links in the cyclic pitch control system.

b. Rig collective controls prior to rigging cyclic controls. (Refer to paragraph 9-68.)

c. Reduce cyclic friction to minimum. Install AN5 rigging bolt (22, view D, figure 9-2) and apply maximum friction to keep stick from being moved. Remove rigging bolt (22). Place collective control lever in full down position.

Caution

Ensure that AN5 rigging bolt has been removed when rigging is completed.

d. Position two bellcranks (4 and 5) to 3.12 inches from deck, refer to view B.

e. Bottom the two servo actuator valves (9), refer to view F. Adjust and connect control tubes (11 and 12).

Caution

Maximum allowable exposed thread area on adjustable rod end fittings on control tubes (11, 12, 2, and 3) is 1.0 inches.

f. Keep the two servo actuators valves bottomed as accomplished in step e. Position the swashplate inner ring (1) as shown in view A. Adjust and connect control tubes (2 and 3).

g. After rigging cyclic and collective systems check clearance between inner ring and sleeve assembly at extreme control positions with boost ON.

(1) If contact between inner ring and pivot sleeve is made on aft side, shorten tubes (2 and 3, figure 9-2) the same amount to obtain 0.010 to 0.030 inch clearance between parts.

(2) Actuate control to extreme position and check the forward side for contact. If contact is made, lengthen tubes (2 and 3) the same amount to obtain 0.010 and 0.030 inch clearance on the forward side of sleeve or until the minimum clearance on aft side is reduced to 0.010 inch.

h. Rig cyclic stick centering as follows:

(1) For lateral system place cyclic stick in neutral position, with arm (14, view C) adjust tube assembly (23) to fit and install nut and cotter pin.

(2) For fore and aft system place cyclic stick in neutral position, with arm (25, view E) adjust tube assembly (15) to fit and install nut and cotter pin.

i. Check for full cyclic travel by removing cover plate under fuselage pilots area and rotating cyclic stick through extreme travels. Cyclic stop surfaces must touch in all extreme positions.

9-70. RIGGING - TAIL ROTOR CONTROLS.

a. Install all fixed control tubes and links in the tail rotor control system.

b. Depress tail rotor crosshead (5, figure 9-4) toward tail boom until the tail rotor blade pitch horn bottoms in the tail rotor yoke.

c. With bellcrank (7) oriented as shown in view A, adjust rod assembly (4) to fit and secure lock nuts.

d. With tail rotor blade pitch horns still bottomed in the tail rotor yoke, depress and hold left pedal against stop. Adjust control tube (8) to fit and then lengthen control tube (8) one-half turn. Install with bolt, washers and nut.

Caution

Maximum allowable exposed thread area on adjustable end of tube (8) is 1.00 inch.

e. Check for freedom of operation of each pitch link with blade flapped to both extreme positions. Check with left pedal full forward and then with right pedal full forward.

f. A friction clamp is installed in the controls between the pedal assemblies. This can be adjusted by removing a cover plate under the forward fuselage below the instrument console. Adjust as desired by the pilot not to exceed 15 inch-pounds torque on the clamp nut.

CHAPTER 10

INSTRUMENTS

SECTION I SCOPE

10-1. PURPOSE.

10-2. This Chapter provides the instructions and information required by organizational maintenance personnel to perform maintenance on OH-58A helicopter instruments. All flight, navigation, engine and miscellaneous instruments are mounted in instrument panel attached to console.

Note

For instrument piping installation see figure 10-1; additional illustrations, pertaining to instrument location and marking, circuit breaker location, and control switch information are contained in TM 55-1520-228-10.

10-3. INSTRUMENTS AND INSTRUMENT PANEL.

10-4. INSTRUMENTS.

10-5. REMOVAL - INSTRUMENTS. Remove any instrument from panel by following general procedure:

a. Be sure all electrical power is OFF.

b. Disconnect electrical leads or instrument piping from back of instrument. Necessary access may be through side panels and console.

c. Protect ends of electrical leads, with electrical tape and cap open piping and openings on instrument.

d. Remove mounting screws. Remove instrument.

10-6. CLEANING - INSTRUMENTS. Clean panel and instrument cover glasses with a suitable soft, lint-free cloth.

10-7. INSPECTION - INSTRUMENTS.

a. Inspect instruments for loose or cracked glasses.

b. Inspect for legibility of range markings.

c. Inspect for faulty decals.

10-8. REPAIR OR REPLACEMENT - INSTRUMENTS. Replace any missing or damaged limit or index markings on cover glasses of instruments. Also replace any required decals which are not clearly legible. Replace any instrument if cover glass is loose or broken, or when found to be unserviceable.

Note

When replacing instrument range markings (see Flight Manual for ranges) use a suitable lacquer, scotch tape, or prepared decals. Protect markings by applying a light coat of clear adhesive varnish or lacquer. Apply range markings accurately on cover glass.

10-9. INSTALLATION - INSTRUMENTS. Install any instrument in panel by the following general procedures:

a. Make certain battery switch is "OFF".

b. Check instrument for correct markings on cover glass.

c. Position instrument in panel. Install mounting screws.

Caution

Do not tighten mounting screws more than necessary to hold instrument as excessive tension may deform instrument case.

d. Remove protective caps or covers as necessary. Connect electrical leads and instrument piping.

e. Check operation of instrument.

10-10. INSTRUMENT PANEL.

10-11. The instrument panel is mounted on the respective console and contains all instruments for the pilot and copilot. The instrument panel is mounted by mounting screws located around edge of panel.

10-12. ADJUSTMENT - INSTRUMENT PANEL. The instrument panel is rigidly mounted and no adjustments are required.

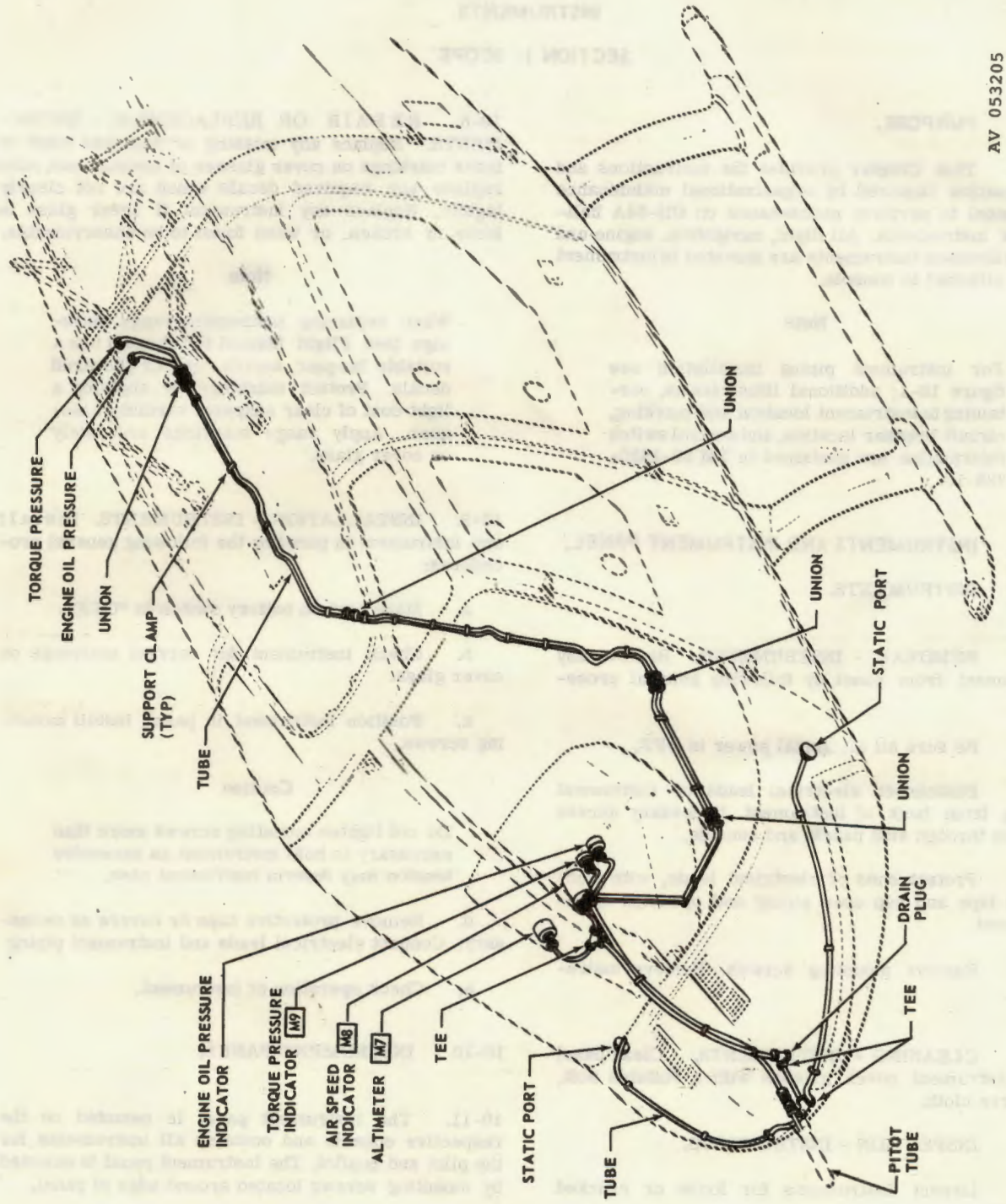


Figure 10-1. Instrument piping installation

SECTION II FLIGHT INSTRUMENTS

10-13. FLIGHT INSTRUMENTS.

10-14. AIRSPEED INDICATOR.

10-15. The airspeed indicator is a standard pitot-static instrument. This single scale indicator provides an airspeed reading in knots by measuring the difference between the impact air pressure from the pitot tube and the static air pressure from the static vents.

10-16. TROUBLESHOOTING - AIRSPEED INDICATOR.

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
Pointer fails to respond	Pressure line not connected	Connect line
	Obstruction in line	Disconnect lines and blow lines clear
Pointer indicates incorrectly	Leak in line	Repair or replace line
	Defective or leaking indicator	Replace indicator
	Vent obstructed or baffle bent	Drain moisture or clean obstruction from static line. Straighten baffle.
Pointer vibrates	Instrument loose on panel	Tighten instrument mounting screws
Pointer oscillates	Leak in line	Repair or replace line
	Defective instrument	Replace instrument

10-17. MAINTENANCE - AIRSPEED INDICATOR. (Refer to paragraphs 10-5 through 10-9.)

10-18. ALTIMETER.

10-19. The altimeter furnishes a direct reading of helicopter height in feet above sea level. This instrument is vented to the static air system. (See figure 10-1.)

10-20. TROUBLESHOOTING - ALTIMETER.

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
Pointer indicates incorrectly	Leak in static line	Repair or replace line
	Static vent plugged	Clean static vent
	Defective instrument	Replace instrument

10-21. MAINTENANCE - ALTIMETER. Refer to paragraphs 10-5 through 10-9.

10-22. PITOT - STATIC SYSTEM.

10-23. The electrically heated pitot tube is mounted on a support located in the most forward part of the cabin nose bubble just right of helicopter centerline. This tube supplies impact air to the airspeed indicator. Static air pressure for instrument operation is obtained from two static vents which are located, one each, on the aft edge of the left and right lower plastic panels of the cabin nose bubble. (See figure 10-1.)

10-24. REMOVAL - PITOT TUBE.

a. Check that all electrical power is "OFF".

b. Remove screws and lock-washers attaching pitot head sleeve to pitot head and pitot tube support.

c. Hold pitot head and slide sleeve forward until coupling in pitot pressure line is exposed. Disconnect pressure line and cap or cover opening in line and in pitot head to prevent entrance of foreign particles.

d. Disconnect electrical wiring, if existing, and cover wire ends with tape. Remove pitot head and sleeve from helicopter.

10-25. CLEANING PITOT TUBE. Clean pitot tube head and sleeve with a clean, lint-free cloth dampened with approved cleaning solvent (item 300, table 1-1).

10-26. CLEANING - PITOT STATIC SYSTEM. Remove drain plug and allow any moisture to drain out.

10-27. INSPECTION - PITOT STATIC SYSTEM.

Note

To be performed by qualified instrument personnel only.

a. Visually inspect parts, plumbing, accessories and instruments to the static system and replace only defective components.

b. Remove drain plugs and check for moisture.

10-28. INSTALLATION - PITOT TUBE.

a. Position pitot head sleeve on pitot head. Remove tape from wire ends, and connect electrical wiring to pitot head.

b. Remove caps or covers from openings in pitot head and pressure line and connect pressure line to pitot head.

c. Align holes in pitot head sleeve with holes in pitot head and in pitot tube support and install attaching lock-washers and screws.

10-29. REMOVAL - STATIC VENT.

Note

The static vent is riveted to fuselage skin and not easily removable. For cleaning and inspection purposes perform the following steps.

a. Disconnect static line from elbow.

b. Remove elbow from static vent.

10-30. INSTALLATION - STATIC VENTS.

a. Install elbow into static vent.

b. Connect static line to elbow.

10-31. TURN AND SLIP INDICATOR.

10-32. The turn and slip indicator (M14) is controlled by an electrically actuated gyro. This instrument has a needle (turn indicator) and a ball (slip indicator). Although needle and ball are combined in one instrument and are normally read and interpreted together each has its own specific function and operates independently of the other. The ball indicates when helicopter is in directional balance, either in a turn or in straight and level flight. If helicopter is yawing or slipping, ball will be off center. The needle indicates in which direction and at what rate helicopter is turning. (See figure 13-4.)

10-33. TROUBLESHOOTING - TURN AND SLIP INDICATOR. (See figure 13-4.)

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
Pointer remains centered, either constantly or intermittently	Sticky gyro	Replace indicator
	No electrical power to indicator	Check circuit connections; repair faulty wiring
Ball too sensitive	Dampening fluid leaked out	Replace indicator

10-34. MAINTENANCE - TURN AND SLIP INDICATOR. (Refer to paragraphs 10-5 through 10-9.)

10-35. GYRO HORIZON INDICATOR.

10-36. This indicator (M10) displays flight attitude of the helicopter relative to the earth. The indicator is self-contained and requires connection through a 1/2 ampere circuit breaker (GYRO HORIZON) to the 115 vac bus. (See figure 13-4.)

10-37. TROUBLESHOOTING - GYRO HORIZON INDICATOR. (See figure 13-4.)

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
Indicator does not operate	AC power failure (INST INVERTER light illuminated)	Check wiring, plugs, circuit breakers and inverter switch
Indicator does not indicate within plus or minus one degree	Defective indicator	Replace indicator
	Plug loose at indicator	Check for proper plug installation
	Faulty wiring	Check system circuit and correct wiring

10-38. OPERATIONAL CHECK - GYRO HORIZON INDICATOR.

a. Place INVERTER switch (S82) to ON. Close GYRO HORIZON circuit breaker. Check that OFF flag on the indicator disappears within three minutes.

b. Cage the gyro by pulling CAGE knob located on lower left-hand corner of indicator. Check that display erects properly and remains stable in both pitch and roll.

c. Rotate the pitch trim knob (on lower left-hand corner of the indicator) clockwise. Check that pitch trim indicator moves upward.

d. Rotate pitch trim knob counterclockwise. Check that pitch-trim indicator moves downward.

e. Return pitch trim knob to zero trim. Check that both pitch and roll axes remain stable.

f. Open GYRO HORIZON circuit breaker. Check that OFF flag appears and that gyro begins to lose speed and stops after several minutes.

g. Place INVERTER switch to OFF.

10-39. MAINTENANCE - GYRO HORIZON INDICATOR. (Refer to paragraphs 10-5 through 10-9.)

10-40. CLOCK.

10-41. The clock, in instrument panel, has a sweep-second pointer and a minute totalizer hand to indicate elapsed time. The control knob on case stops pointers when pressed and returns pointers when pressed again.

10-42. MAINTENANCE - CLOCK. (Refer to paragraphs 10-5 through 10-8.)

10-43. THERMOMETER.

10-44. Outside ambient air temperature may be determined by means of a free air temperature indicator mounted in the upper center of cabin bubble. (See figure 12-1.)

10-45. REMOVAL - THERMOMETER.

a. Unscrew and remove sunshield, dished washer, and one case washer from outer end of thermometer.

b. Remove thermometer and other case washer from inside of windshield.

10-46. MAINTENANCE - THERMOMETER. (Refer to paragraphs 10-6 through 10-8.)

10-47. INSTALLATION - THERMOMETER.

a. Place a case washer over probe of thermometer with flat side of washer next to case. Insert probe through mounting hole from inside windshield.

b. Place another case washer, flat side out, on thermometer probe outside windshield. Seat washer shoulders in mounting hole. Install dished washer, with outside edge curving toward windshield. Position thermometer scale correctly before tightening.

c. Place sunshield over thermometer probe, and tighten securely.

SECTION III NAVIGATION INSTRUMENTS

10-48. NAVIGATION INSTRUMENTS.

10-49. MAGNETIC COMPASS (Standby).

10-50. The magnetic compass is a standard, non-stabilized, magnetic type instrument mounted on a support which is attached to the forward cabin, right side. The compass is used in conjunction with a compass correction card that is located on the left side of the compass.

10-51. TROUBLESHOOTING - MAGNETIC COMPASS.

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
Excessive card error	Improper compensation	Compensate compass
	External magnetic interference	Locate and eliminate magnetic interference if possible
	Air in bowl	Replace compass
Excessive card oscillation	Insufficient liquid in bowl	Replace compass
Card element not level	Leaking float chamber	Replace compass
	Card magnet is detached	Replace compass
Card sluggish	Dirty pivots or jewels restricting rotation	Replace compass
	Weak magnetic card	Replace compass

10-52. MAINTENANCE - MAGNETIC COMPASS. (Refer to paragraphs 10-5 through 10-9.)

10-53. CALIBRATION - MAGNETIC COMPASS.

a. Check condition of compass before positioning helicopter on compass rose. (Refer to paragraph 10-7.)

b. Position helicopter on compass rose. Observe the following precautions prior to start of swinging procedure:

(1) Make sure that all magnetic material and equipment in helicopter is secured in normal flight position.

(2) Check all controls and levers are set in normal position.

(3) Check all observers or personnel near or in the helicopters have no magnetic materials on their person.

(4) Check any magnetic objects, such as trucks automobiles or other aircraft, are removed from the compass rose swing area to a distance at which they will have no magnetic effect on the compass.

c. Position helicopter on compass rose turntable and radial lines. Secure helicopter right-hand skid to compass rose holding fixture. Use helicopter ground handling wheels, or equivalent, to support helicopter when rotating to different headings.

d. Start helicopter power plant according to standard procedures. (Refer to TM 55-1520-228-10.) Turn on power to all equipment, except landing light. Allow helicopter to rest, facing east, for approximately three minutes to permit equipment functions to stabilize.

Note

Rotate helicopter under engine power to accomplish steps e. through i.

Note

Use non-magnetic screwdriver to adjust "N-S" and "E-W" degree compensators on face of compass. Purpose of compensators is to adjust standby compass indicator, as nearly as possible to agree with helicopter heading on compass rose.

e. Rotate helicopter to south magnetic heading and observe compass indication. Adjust "N-S" compensator as necessary.

f. Rotate helicopter to west magnetic heading and observe compass indication. Adjust "E-W" compensator as necessary.

g. Rotate helicopter to north magnetic heading and observe compass indication. Adjust "N-S" compensator as necessary.

h. Rotate helicopter to east magnetic heading and observe compass indication. Adjust "E-W" compensator as necessary.

i. Repeat steps e. through h. two times to establish closest possible degree of compensation.

j. Record S, W, N and E degree deviations on standby compass correction card. Secure compass compensator screws with sealing compound (item 201, table 1-1).

k. Shut down helicopter power plant and electrical power. Remove helicopter from compass rose.

SECTION IV ENGINE INSTRUMENTS

10-54. ENGINE INSTRUMENTS.

10-55. ENGINE OIL PRESSURE INDICATOR.

10-56. The engine oil pressure indicator, precalibrated in pounds per square inch against a standard, is located in cluster with instruments, and is included in piping circuit from engine oil pressure disconnects. No installation calibration is required.

10-57. TROUBLESHOOTING - ENGINE OIL PRESSURE INDICATOR.

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
Low reading on pressure indicator	Obstructed pressure and/or fitting	Replace or clean line and/or fitting
Inaccurate or sticking pressure indicator	Defective indicator	Replace indicator
Sluggish pressure reading	Sludge in pressure line	Bleed line

10-58. MAINTENANCE - OIL PRESSURE INDICATOR. (Refer to paragraphs 10-5 through 10-9.)

10-59. ENGINE TORQUEMETER.

10-60. The engine torque meter (M9) located in instrument panel, is precalibrated in psi against a standard. This instrument is included in piping circuit to lower firewall disconnect which continues to engine accessory drive gearbox (forward side of engine). No calibration of the torque meter is required when installed.

10-61. TROUBLESHOOTING - ENGINE TORQUEMETER. (Refer to paragraph 10-57, procedures are the same.)

10-62. MAINTENANCE - ENGINE TORQUEMETER. (Refer to paragraphs 10-5 through 10-9.)

10-63. BLEEDING PRESSURE GAGE LINE.

a. Disconnect pressure gage line at engine inlet and place end of line in a receptacle so that end will be covered by accumulated fluid in receptacle. Station a man at the receptacle to observe when a bubble free flow has been established.

b. Gain access to rear of instrument. Disconnect pressure gage line at the instrument and connect a low pressure filler gun, filled with light lubricating oil, to gage line. Apply pressure slowly so line will be filled with light oil, displacing fluid in line. Continue to force light oil into line until a steady flow is established at the aft end.

c. When bleeding has been satisfactorily completed, remove filler gun and connect gage line to instrument. Take precaution to hold fluid loss to a minimum while connecting line. Ensure that line is full at aft end connection then connect aft end of gage line at engine inlet.

10-64. TACHOMETER INDICATOR SYSTEM.

10-65. The rotary self generating tachometer indicator system includes gas producer tachometer generator (G4), gas producer tachometer indicator (M3), and interconnecting wiring; power turbine tachometer generator (G3), power turbine tachometer indicator (part of M1) and innerconnecting wiring; and rotor tachometer generator (G2), indicator (part of M1) and innerconnecting wiring. (See figures 12-1 and 13-5.)

10-66. TROUBLESHOOTING - TACHOMETER INDICATOR SYSTEM. (See figure 13-5.)

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
Excessive scale error	Weak magnet in tachometer-generator	Replace tachometer-generator
Pointer moves backward	Leads reversed at generator	Check leads at generator
No reading on indicator	Break or short circuit	Repair or replace wiring

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
High or low reading on indicator, either constant or intermittent	Poor connections at indicator or generator	Clean and tighten connections

10-67. MAINTENANCE INDICATORS - DUAL AND GAS PRODUCER TACHOMETERS. (Refer to paragraphs 10-5 through 10-9.)

10-68. POWER TURBINE TACHOMETER GENERATOR.

10-69. The power turbine tachometer generator (G3) is mounted on the forward left-side of the power and accessory gearbox, and connected to the dual tachometer indicator on the instrument panel to indicate engine output shaft RPM. (See figure 12-1.)

10-70. REMOVAL - POWER TURBINE TACHOMETER GENERATOR. (Refer to Chapter 5.)

10-71. INSPECTION, REPAIR OR REPLACEMENT - POWER TURBINE TACHOMETER GENERATOR. Inspect generator case for cracks, excessive wear or any visible damage. Check connector for damaged or bent pins and cracked inserts. Check that rotor turns freely and there is no visible indication of excessive wear to bearings. Replace item if inspection requirements are not met.

10-72. INSTALLATION - POWER TURBINE TACHOMETER GENERATOR. (Refer to Chapter 5.)

10-73. ROTOR TACHOMETER GENERATOR.

10-74. The rotor tachometer generator (G2) is located on the forward left side of the transmission and connected to the dual tachometer indicator on the instrument panel to indicate rotor RPM. (See figure 12-1.)

10-75. REMOVAL - ROTOR TACHOMETER GENERATOR.

a. Disconnect electrical connector and protect end.

b. Remove nuts and washers from mounting studs and remove generator and gasket from adapter.

10-76. INSPECTION, REPAIR OR REPLACEMENT - ROTOR TACHOMETER GENERATOR. (Refer to paragraph 10-71, procedure is the same.)

10-77. INSTALLATION - ROTOR TACHOMETER GENERATOR.

a. Position gasket and generator on adapter studs and secure with washers and nuts.

b. Remove protection from plug and connect to generator.

10-78. FUEL QUANTITY SYSTEM.

10-79. This fuel quantity gaging system is designed specifically to measure the mass or weight of fuel in the helicopter fuel cell. The operation of the system is based on the principle that the capacitance of a capacitor in an electrical circuit is determined by the dielectric constant of the insulating medium between the capacitor plates. When the fuel cell is empty, air is the insulating medium, and when there is fuel in the cell, fuel is the insulating medium. The tank unit assembly (Z5) acts as the variable capacitor in the circuit. The capacitance of the tank unit will vary in direct proportion to the mass of the fuel in the tank. The tank unit is a flange mounted unit with the system electronics housed in the flange head. The indicator (part of cluster M4) is a milliamp meter which receives a rectified DC signal in proportion to the level sensed by the tank unit. The signal is generated by a small transistorized oscillator which applies its signal to a bridge circuit. A sensitive amplifier amplifies the unbalance signal in the bridge and applies it to a stage of rectification to allow adaptation to a calibrated milliamp meter.

10-80. TROUBLESHOOTING - FUEL QUANTITY SYSTEM. (See figure 13-6.)

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
Indicator reads low	System out of adjustment	Perform adjustment procedure. (Refer to General Support for additional information)
	Tank unit has low capacitance	Change tank unit
	Indicator movement defective	Replace indicator

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
	Signal conditioner defective	Replace tank unit
Indicator reads high	System out of adjustment	Perform adjustment procedure. (Refer to General Support for additional information)
	Tank unit has high capacitance	Change tank unit
	Indicator movement defective	Replace indicator
	Signal conditioner defective	Replace tank unit
	Tank unit shorted	Change tank unit
Indicator remains at one point on scale	No power	Check 115 volts 400 Hz power system
	Defective indicator	Replace indicator
	Coaxial lead grounded	Check wiring and repair or replace as necessary
Indicator remains at zero or below	Open wiring	Check wiring

10-81. MAINTENANCE - FUEL QUANTITY INDICATOR. (Refer to paragraphs 10-3 through 10-9.)

10-82. MAINTENANCE - FUEL QUANTITY TRANSMITTER. (Refer to Chapter 5.)

10-83. ENGINE OIL TEMPERATURE SYSTEM.

10-84. The temperature system includes engine oil temperature indicator (part of instrument cluster M4), engine oil temperature bulb (Z2), and interconnecting wiring. The bulb, connected to an electrical resistance temperature indicator on the instrument panel, indicates an increase of temperature as the resistance in the bulb circuit is increased by rise of temperature in the bulb core. The resistance element of the bulb is hermetically sealed in a metal well.

10-85. TROUBLESHOOTING ENGINE OIL TEMPERATURE SYSTEM. (See figure 13-7.)

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
Indicator fails to operate	Open or defective INST. CLUSTER circuit	Check and replace faulty breaker
	Faulty wiring or loose connections	Replace wiring and tighten connections
	Defective temperature bulb	Replace bulb
	Defective indicator	Replace indicator

10-86. MAINTENANCE - ENGINE OIL TEMPERATURE INDICATOR. (Refer to paragraphs 10-5 through 10-9.)

10-87. REMOVAL - ENGINE OIL TEMPERATURE BULB. (Refer to Chapter 5.)

10-88. INSPECTION, REPAIR AND REPLACEMENT - ENGINE OIL TEMPERATURE BULB.

a. Inspect connector for damaged, bent or broken contact pins, insert cracks and faulty insulation.

b. Visually inspect bulb for damage to case that could impair normal efficient operation of the unit.

c. Replace item if it fails to meet inspection requirements.

10-89. INSTALLATION - ENGINE OIL TEMPERATURE BULB. (Refer to Chapter 5.)

10-90. TURBINE OUTLET TEMPERATURE SYSTEM.

10-91. The turbine outlet temperature system is thermocouple self generating and consist of three bayonet type thermocouples mounted in turbine outlet, one turbine outlet temperature resistor (R1), one turbine outlet temperature indicator (M2), one terminal board (TB3) and interconnecting wiring. (See figures 12-1 and 13-7.)

10-92. TROUBLESHOOTING - TURBINE OUTLET TEMPERATURE SYSTEM. (See figure 13-7.)

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
Indicator shows excessive temperature (incorrect reading)	Incorrect circuit resistance	Check and set resistance
No reading on indicator	Loose connections on indicator lead spool resistor or terminal block	Clean and tighten connections
	Open circuit in indicator	Replace indicator
Incorrect reading	Harness not calibrated to 8 ohms	Calibrate harness to 8 ohms

10-93. THERMOCOUPLE RESISTOR.

10-94. The thermocouple resistor spool (R1) located forward of the instrument panel is used in conjunction with the turbine outlet temperature indicator and enables selection of the proper operating resistance of the indicator circuit.

10-95. REMOVAL - THERMOCOUPLE RESISTOR.

a. Remove safetywire.

b. Unlatch and remove resistor cover.

c. Remove thermocouple leads.

d. Remove attachment screws, nuts and washers. Remove resistor.

10-96. INSTALLATION - THERMOCOUPLE RESISTOR.

a. Position resistor in helicopter and install two attaching screws, nuts and washers.

b. Connect thermocouple leads to resistor terminals.

c. Install resistor cover.

d. Safetywire cover fasteners.

10-97. TURBINE OUTLET TEMPERATURE INDICATOR.

10-98. The turbine outlet temperature indicator (M2) receives temperature indications from bayonet type thermocouples mounted in the turbine outlet. The indicator is graduated in degrees centigrade and electrical power is not required as the system is self generating.

10-99. MAINTENANCE - TURBINE OUTLET TEMPERATURE INDICATOR. (Refer to paragraphs 10-5 through 10-9.)

SECTION V MISCELLANEOUS INSTRUMENTS

10-100. MISCELLANEOUS INSTRUMENTS.

10-101. AMMETER - DC.

10-102. The DC ammeter mounted in the instrument cluster (M4), measures and indicates the output of the generator in amperes.

10-103. TROUBLESHOOTING - AMMETER. (See figure 13-8.)

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
No reading or erratic reading	Defective generator	Replace generator
	Open or short circuit in ammeter	Replace ammeter
	Dirty or worn mechanism in ammeter	Replace ammeter
	Voltage regulator faulty	Replace voltage regulator
	Open or defective circuit breakers (located in aft electrical compartment)	Check and replace circuit breakers as required

Note

Refer to Chapter 12 for additional Trouble-shooting of circuits.

10-104. MAINTENANCE - AMMETER. (Refer to paragraphs 10-5 through 10-9.)

CHAPTER 11

UTILITY SYSTEMS

SECTION I SCOPE

11-1. PURPOSE.

11-2. The purpose of this chapter is to provide information for maintenance personnel to accomplish organizational maintenance on the utility systems.

SECTION II HEATING AND VENTILATING SYSTEMS

11-3. DESCRIPTION.

11-4. The bleed air heating system and the ventilating and defogging system (figures 11-1 and 11-2) are interconnected with ducts. The bleed air heater is installed in the equipment compartment aft of the passenger seats. It consists of a bleed air mixing valve, remote temperature sensor with manual control, connecting ducts and tubing. The bleed air system is turned on or off by a solenoid valve which is actuated by a circuit breaker switch in the overhead console. When the heater switch is in the on position, air from the engine compressor section passes through the bleed air nozzle. A venturi working in conjunction with the bleed air nozzle draws in outside air through the outside air vent. Bleed air and outside air are fed into the mixing valve where a sensor determines the mixing ratio to produce the desired temperature. The force of the bleed air forces heated air through the duct system to air distribution valves under the seat and/or to defroster nozzles under windshields. Temperature is regulated by a manual control knob and flexible cable connected to a remote sensor in the heater compartment. The variable sensor has a bi-metalic element which regulates the mixing valve. The ventilating and defogging system is installed in the nose and consists of a ram air intake, two blower fans, defroster nozzles and ducts. The bleed air system is also connected to the ventilating and defogging system. Outside air flow to the cabin and defogging nozzles is controlled by manual push-pull type controls located below the instrument panel. The blowers direct air to the defogging nozzles and are controlled by an ON-OFF switch in the overhead console.

11-5. TROUBLE SHOOTING - HEATING AND VENTILATING SYSTEM. Trouble shoot heating and ventilating system in accordance with the following table.

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
No heated air	Heat switch defective	Replace switch
	Temperature selection switch set at lowest position	Turn knob clockwise to increase temperature
	Bleed air line not connected	Connect line
	Defective solenoid on mixing valve or electrical lead not connected	Replace valve or connect lead
	Remote sensor inoperative or control cable not connected	Replace remote sensor or connect control cable
Restricted warm air supply	Leaks or obstruction in ducts	Repair or replace ducts
	Mixing valve malfunction	Replace valve
	Heat outlet valve incorrectly set	Adjust valve

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
Outlet temperature too high	Temperature selection incorrectly set	Reset dial counterclockwise
	Defective remote sensor or mixing valve	Replace valve or sensor
Heater cycles from hot to no heat and back to hot	Remote sensor malfunction	Replace sensor
	Air mixing valve malfunction	Replace valve

11-6. INSPECTION - HEATING AND DEFOGGING SYSTEM.

a. Check heater ducts for cracks, fraying and wear.

b. Check clamps for security and condition.

c. Check defroster nozzles, and under seat air distribution valves for cleanliness and freedom from obstructions.

d. Check manual control push-pull levers below instrument panel for operation and freedom of movement. Check manually controlled heat selector switch on center column for operation and freedom of movement.

e. Check electrical connections on all switches and connectors for security.

f. Check remote sensor (7) for security of attachment.

g. Functional test bleed air mixing valve while installed on helicopter by charging temperature sensor setting from low to high and back to low. Valve should move back and forth.

h. Check solenoid on mixing valve for operation while installed on helicopter.

i. Check bleed air tube and remote sensor tube for security.

j. Check blower fans for operation and security of attachment.

k. Check plenums for damage and security of mounting.

11-7. REMOVAL - AIR MIXING VALVE.

a. Remove access cover in aft cabin above passenger seats to gain access to mixing valve.

b. Disconnect ambient air duct and coupling including outlet end support clamp, connecting air mixing valve (5, figure 11-1) to plenum (6).

c. Disconnect bleed air tube (4) and remove mounting nut; remove air mixing valve.

11-8. INSTALLATION - AIR MIXING VALVE.

a. Position air mixing valve (5) on plenum intake and install coupling.

b. Install bleed air tube.

c. Install electrical connector and connect tube to sense port.

d. Install ambient air duct.

11-9. REMOVAL - REMOTE SENSOR.

a. Disconnect control cable (3, figure 11-1) and tube from sensor (7).

1. Vent and Defog Control
2. Heat Control
3. Heat Control Cable
4. Bleed Air Tube
5. Mixing Valve
6. Plenum
7. Remote Sensor
8. Fresh Air Inlet
9. Post Plenum
10. Air Distribution Valves
11. Windshield Defog Nozzle
12. Plenum Rain Drain
13. Plenum Valve Assembly
14. Ventilating and Defogging Blower
15. Ram Air Intake Grill

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Figure 11-1. Heating and ventilating system (Sheet 1 of 2)

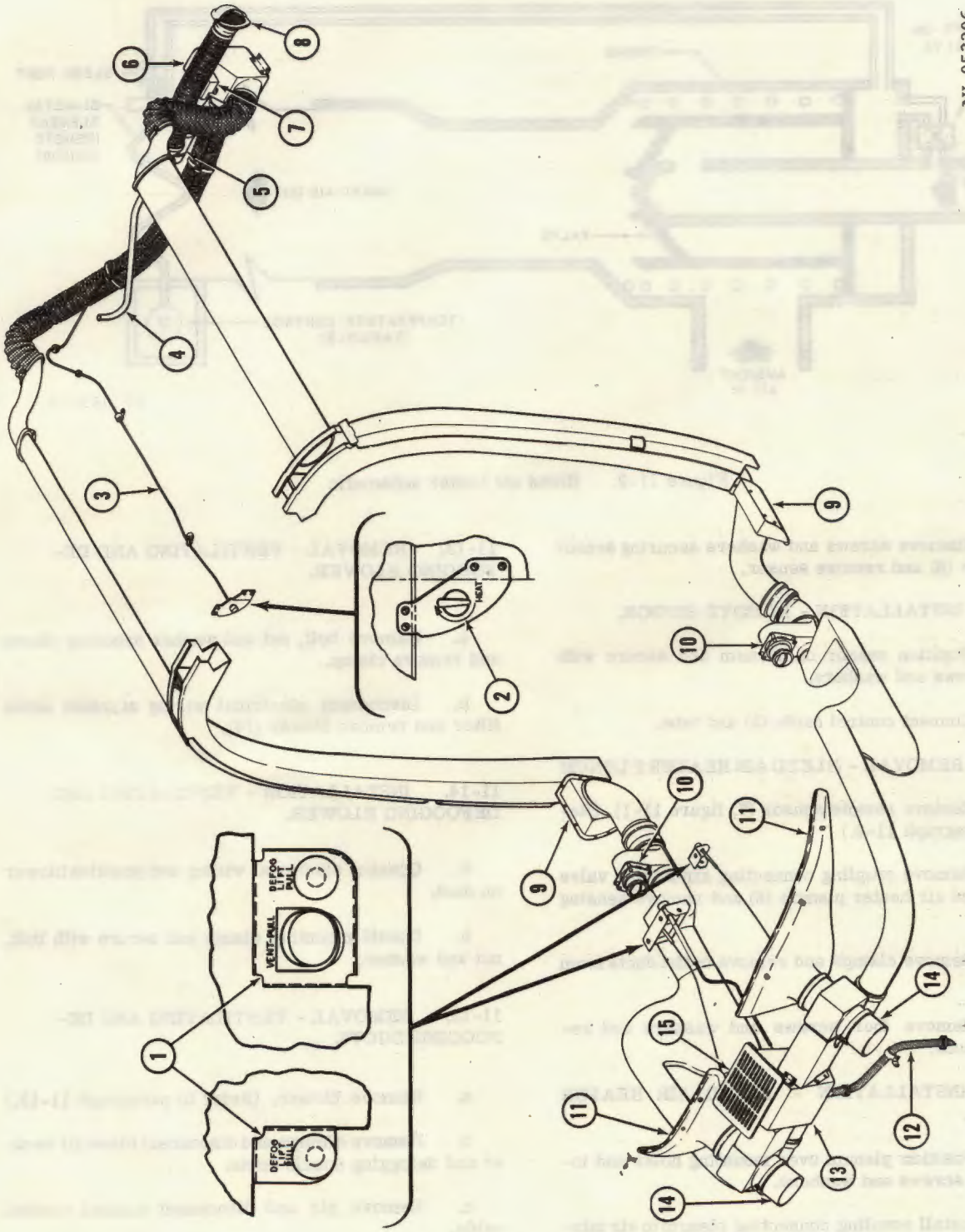

Figure 11-1. Heating and ventilating system (Sheet 2 of 2)

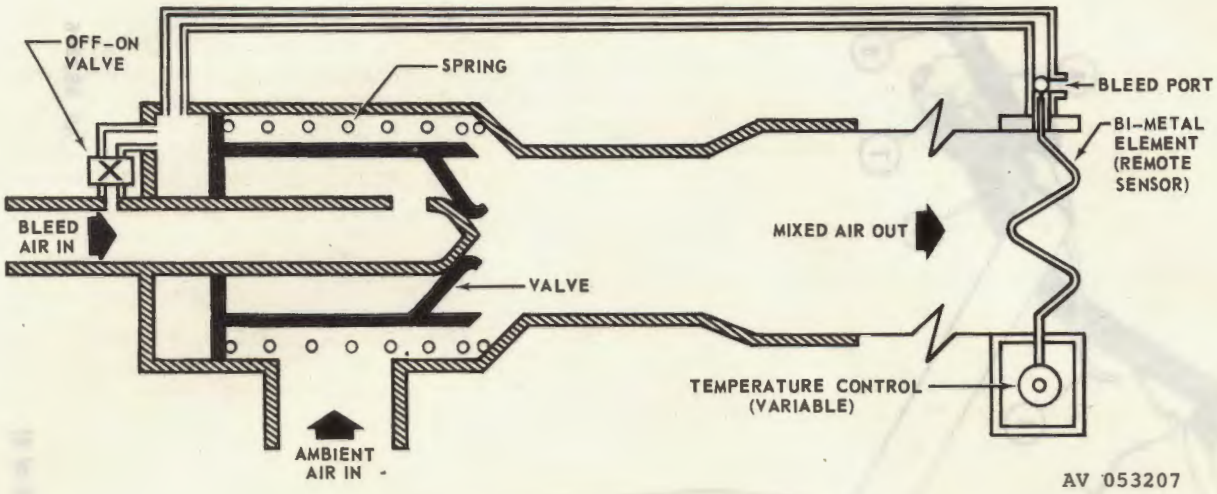

Figure 11-2. Bleed air heater schematic

b. Remove screws and washers securing sensor to plenum (6) and remove sensor.

11-10. INSTALLATION - REMOTE SENSOR.

a. Position sensor on plenum and secure with three screws and washers.

b. Connect control cable (3) and tube.

11-11. REMOVAL - BLEED AIR HEATER PLENUM

a. Remove remote sensor (7, figure 11-1). (Refer to paragraph 11-9.)

b. Remove coupling connecting air mixing valve (5) to bleed air heater plenum (6) and remove sensing tube.

c. Remove clamps and remove outlet ducts from plenum.

d. Remove four screws and washers and remove plenum.

11-12. INSTALLATION - BLEED AIR HEATER PLENUM.

a. Position plenum over mounting holes and install four screws and washers.

b. Install coupling connecting plenum to air mixing valve.

c. Install remote sensor. (Refer to paragraph 11-10.)

11-13. REMOVAL - VENTILATING AND DEFOGGING BLOWER.

a. Remove bolt, nut and washer securing clamp and remove clamp.

b. Disconnect electrical wiring at radio noise filter and remove blower (14).

11-14. INSTALLATION - VENTILATING AND DEFOGGING BLOWER.

a. Connect electrical wiring and position blower on duct.

b. Install mounting clamp and secure with bolt, nut and washer.

11-15. REMOVAL - VENTILATING AND DEFOGGING DUCTS.

a. Remove blower. (Refer to paragraph 11-13.)

b. Remove clamps and disconnect bleed air heater and defogging nozzle ducts.

c. Remove pin and disconnect manual control cable.

d. Remove six screws and washers securing each inboard duct to center plenum (13) and remove duct assemblies.

11-16. INSTALLATION - VENTILATING AND DEFOGGING DUCTS.

a. Secure each inboard duct to center plenum with six screws and washers.

b. Secure bleed air ducts to defogging nozzle ducts with clamps and attaching hardware.

c. Install blower. (Refer to paragraph 11-14.)

d. Connect manual control cable to center plenum (13) with pin.

11-17. DUCTS, NOZZLES, AND MISCELLANEOUS EQUIPMENT. Maintain heater miscellaneous equipment in accordance with the following paragraphs.

11-18. REMOVE - DUCTS, NOZZLES AND MISCELLANEOUS EQUIPMENT. Remove attaching hardware and/or clamps and remove component.

11-19. REPAIR OR REPLACEMENT - DUCTS, NOZZLES, AND MISCELLANEOUS EQUIPMENT.

a. Replace damaged, frayed or cracked ducting.

b. Replace damaged or unserviceable nozzles, valves, and miscellaneous components.

11-20. INSTALLATION - DUCTS, NOZZLES AND MISCELLANEOUS EQUIPMENT. Install components and secure with attaching hardware and/or clamps.

CHAPTER 12

ELECTRICAL SYSTEMS

SECTION I SCOPE

12-1. PURPOSE

12-2. This chapter provides the instructions and information required by organizational maintenance personnel to perform maintenance on OH-58A helicopter electrical systems and components.

12-3. ELECTRICAL SYSTEM - GENERAL.

12-4. ASSOCIATED ILLUSTRATIONS.

12-5. See figure 12-1 for electrical equipment locations, figures 13-4 through 13-15 for systems diagrams, table 13-1 for equipment listing and table 13-2 for connector replacement chart.

12-6. DESCRIPTION - DIRECT CURRENT PRIMARY POWER.

12-7. The OH-58 helicopter is equipped with a 28 volt direct current dual-bus (essential and non-essential) system supplied by a starter-generator and battery. Major components of the DC power system include battery, starter-generator, voltage regulator, relays, switches and circuit breakers. All circuits in the electrical system are single wire with common ground return. The negative terminals of the starter-generator and the battery are grounded to the helicopter structure. In the event of generator failure, the non-essential bus is automatically dropped from the generator and battery bus with the battery then supplying power to the essential bus load. The non-essential bus may be manually reactivated.

12-8. ALTERNATING CURRENT POWER.

12-9. The OH-58A helicopter is equipped with a 65 volt-ampere solid state inverter powered from the non-essential 28 vdc bus through a 5 ampere INVERTER circuit breaker and is manually controlled by an INVERTER switch. The inverter delivers 115 vac 400 Hz single phase power to the 115 vac bus.

Note

1. Illustrations pertaining to circuit breakers, control panel arrangement and face identification are contained in TM 55-1520-228-10.

2. Throughout this chapter when performing operational checks external power should be utilized whenever possible. Perform operational checks to make certain that circuits are free of possible potential malfunction when equipment is replaced or airframe wiring is repaired or replaced.

3. Words "cycles" or "hertz" are used to designate frequency; either word has the same meaning. The abbreviation "cps" carries the same meaning as "Hz".

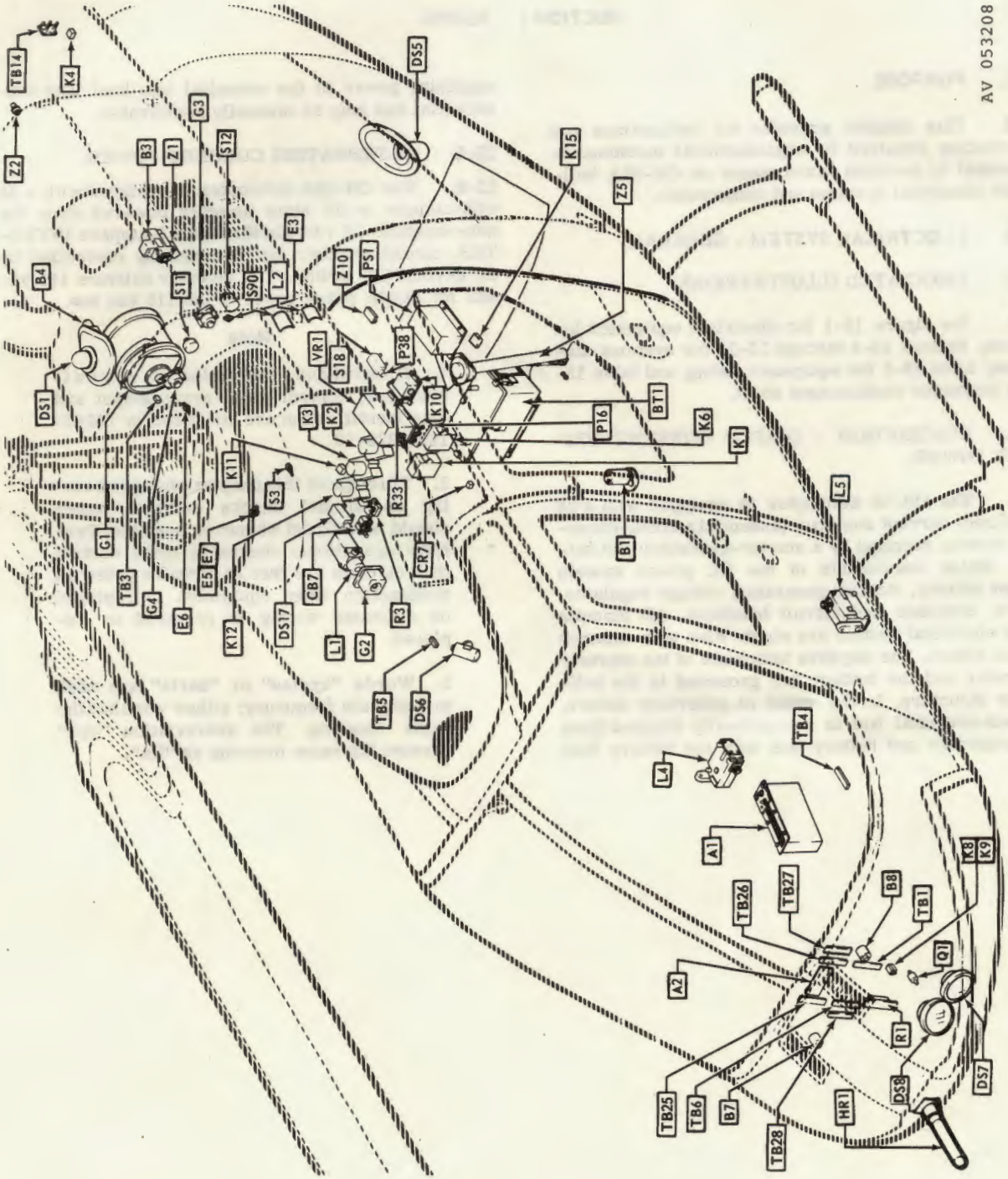

Figure 12-1. Equipment location (Sheet 1 of 3)

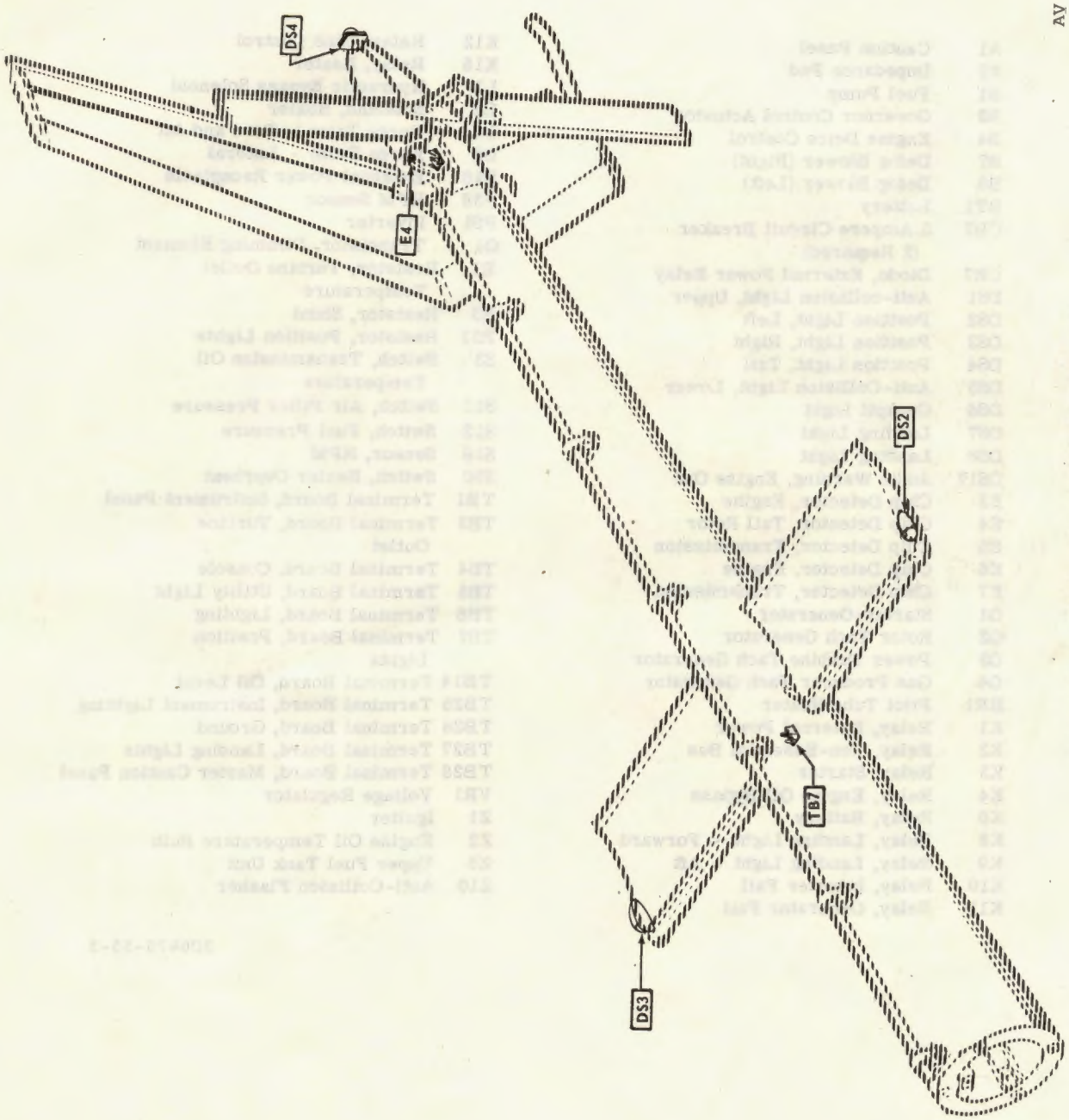

Figure 12-1. Equipment location (Sheet 2 of 3)

A1	Caution Panel
A2	Impedance Pad
B1	Fuel Pump
B3	Governor Control Actuator
B4	Engine Deice Control
B7	Defog Blower (Right)
B8	Defog Blower (Left)
BT1	Battery
CB7	5 Ampere Circuit Breaker (2 Required)
CR7	Diode, External Power Relay
DS1	Anti-collision Light, Upper
DS2	Position Light, Left
DS3	Position Light, Right
DS4	Position Light, Tail
DS5	Anti-Collision Light, Lower
DS6	Cockpit Light
DS7	Landing Light
DS8	Landing Light
DS17	Audio Warning, Engine Out
E3	Chip Detector, Engine
E4	Chip Detector, Tail Rotor
E5	Chip Detector, Transmission
E6	Chip Detector, Engine
E7	Chip Detector, Transmission
G1	Starter-Generator
G2	Rotor Tach Generator
G3	Power Turbine Tach Generator
G4	Gas Producer Tach Generator
HR1	Pitot Tube Heater
K1	Relay, External Power
K2	Relay, Non-Essential Bus
K3	Relay, Starter
K4	Relay, Engine Oil Bypass
K6	Relay, Battery
K8	Relay, Landing Light - Forward
K9	Relay, Landing Light - Aft
K10	Relay, Inverter Fail
K11	Relay, Generator Fail
K12	Relay, Line Control
K15	Relay, Heater
L1	Hydraulic Bypass Solenoid
L2	Solenoid, Heater
L4	Force Trim - Fore and Aft
L5	Force Trim - Lateral
P16	External Power Receptacle
P38	RPM Sensor
PS1	Inverter
Q1	Transistor, Dimming Element
R1	Resistor, Turbine Outlet Temperature
R3	Resistor, Shunt
R33	Resistor, Position Lights
S3	Switch, Transmission Oil Temperature
S11	Switch, Air Filter Pressure
S12	Switch, Fuel Pressure
S18	Sensor, RPM
S90	Switch, Heater Overheat
TB1	Terminal Board, Instrument Panel
TB3	Terminal Board, Turbine Outlet
TB4	Terminal Board, Console
TB5	Terminal Board, Utility Light
TB6	Terminal Board, Lighting
TB7	Terminal Board, Position Lights
TB14	Terminal Board, Oil Level
TB25	Terminal Board, Instrument Lighting
TB26	Terminal Board, Ground
TB27	Terminal Board, Landing Lights
TB28	Terminal Board, Master Caution Panel
VR1	Voltage Regulator
Z1	Igniter
Z2	Engine Oil Temperature Bulb
Z5	Upper Fuel Tank Unit
Z10	Anti-Collision Flasher

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Figure 12-1. Equipment location (Sheet 3 of 3)

SECTION II DIRECT CURRENT DISTRIBUTION SYSTEM

12-10. DESCRIPTION.

12-11. The direct power distribution system provides all basic power for operation of the electrical components as installed in the OH-58A helicopter.

12-12. MISCELLANEOUS ELECTRICAL COMPONENTS.

12-13. Included in this category are relays, rheostats, switches, circuit breakers, plugs, leads, connectors, wiring, conduits, receptacles, shunts and shock mounts.

12-14. REMOVAL - MISCELLANEOUS ELECTRICAL COMPONENTS. Remove attaching hardware, clamps and/or connectors and remove component.

Note

Before attempting to remove or adjust any electrical component, disconnect battery.

12-15. INSPECTION - MISCELLANEOUS ELECTRICAL COMPONENTS.

a. Inspect rheostats for security, corrosion, burned element, damaged wiper, cracks and correct resistance.

b. Inspect switches for weak detents, security, corrosion, continuity in ON and OFF position.

c. Inspect circuit breakers for security, corrosion, actuation for circuit power on and power off and reset retentions.

d. Inspect plugs, connectors and receptacles for security, contact corrosion, damaged contacts, broken wires, faulty contacts, insert cracks and faulty insulation.

e. Inspect leads and wiring for loose terminals, chafing, corrosion or deteriorated conditions, faulty or damaged insulation, excessive mechanical stress, broken strands, damaged shielding, shorted shielding, routing and mounting condition.

f. Inspect conduits for security, surface damage, cracks, corrosion and deterioration.

g. Inspect shunts for corrosion, security, deep scratches, physical damage and discoloration (indicating excessive overloading).

h. Inspect shock mounts for retention, security, cracks, distortion, corrosion and bonding.

i. Inspect solenoids and relays for loose connections, damaged or broken contact pins or terminals, physical damage to case or insulation between contact pins, and discoloration that would indicate internal shorting or excessive overload.

12-16. REPAIR OR REPLACEMENT - MISCELLANEOUS ELECTRICAL COMPONENTS.

a. Tighten loose terminal connectors, mounting and attachment of electrical components.

b. Replace miscellaneous electrical components that fail to meet inspection requirements.

12-17. INSTALLATION - MISCELLANEOUS ELECTRICAL COMPONENTS.

a. Install component and secure with attaching hardware or clamps.

b. Attach terminals and/or connectors.

12-18. CONTROL PANELS. (Figure 12-1.)

12-19. Refer to TM 55-1520-228-10 for additional illustrations pertaining to location and identification of control panels.

12-20. REMOVAL - CONTROL PANELS.

Note

The removal procedure for all panels is relatively the same. A single removal procedure may be used for any panel.

a. Be sure all electrical power is OFF. Physically disconnect battery (BT1).

b. Disengage fasteners or mounting screws holding panel to instrument panels or consoles. Carefully lift panel from mount and disconnect electrical connector.

12-21. INSPECTION - CONTROL PANELS. Visually inspect for scratches, chipped, broken edge light panels, loose wiring connections, damaged or faulty edge light bulbs, damaged connectors and broken or missing mounting fasteners or screws.

12-22. REPAIR OR REPLACEMENT - CONTROL PANEL. Replace items that fail to meet inspection requirements.

12-23. INSTALLATION - CONTROL PANEL. Connect electrical connector. Position panel in mount

being careful not to damage wiring. Engage fasteners. Apply power and check components for proper operation.

12-24. DC CIRCUIT BREAKERS.

12-25. The DC circuit breakers are mounted in the overhead console.

12-26. REMOVAL - DC CIRCUIT BREAKERS.

a. Be sure all electrical power is OFF. Disconnect battery.

b. Disengage fasteners and lift panel assembly to gain access to wiring.

c. Disconnect wiring to appropriate breaker and cover wire ends with electrical tape.

d. Remove mounting nut and lift breaker from panel assembly.

12-27. INSPECTION, REPAIR OR REPLACEMENT-DC CIRCUIT BREAKERS. (Refer to paragraphs 12-15 and 12-16.)

12-28. INSTALLATION - DC CIRCUIT BREAKERS.

a. Position breaker in panel assembly and install mounting nut.

b. Remove cover from wire ends and connect to breaker.

c. Close panel assembly and engage fasteners.

12-29. EXTERNAL POWER SYSTEM.

12-30. During ground operations, external power may be connected to the systems through an external power receptacle (J16) located on helicopter fuselage, lower right side of baggage compartment. No special action or switching is necessary to connect external power. If the external power connections are of correct polarity the external power relay (K1), mounted on the forward bulkhead of the baggage compartment, closes automatically and connects the ground unit to the main power cables serving the direct current bus in baggage compartment. (See figures 12-1 and 13-8.)

12-31. TROUBLESHOOTING - EXTERNAL POWER SYSTEM. (See figure 13-8.)

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
Lack of power when external power plug is inserted into (J16)	Reverse polarity in plug	Check connectors at attachment points on APU for proper installation
	Relay (K1) is inoperative	Replace relay
	Power supply voltage from external source too low	Increase voltage output of external power source to 28 plus or minus 0.5 volts
External power relay (K1) is energized with reverse polarity voltage applied to EXT PWR receptacle	Defective diode (CR7)	Replace diode
	Defective wiring	Repair wiring

12-32. OPERATIONAL CHECK - EXTERNAL POWER SYSTEM. Before connecting external power for the first time, check wiring for correct polarity and terminations at external power receptacle (J16).

a. Apply 28 vdc reverse polarity between the small pin on external power receptacle (J16) and ground. Check that external power relay (K1) does not close. Remove 28 vdc reverse polarity.

b. Connect an external 28 vdc power source to external power receptacle (J16). Energize the power source. Measure voltage on main DC bus in the overhead console. Check that bus voltage is with one volt of the external power source voltage.

c. Place NON-ESS BUS switch (S81) to MAN. Check that voltage on the non-essential DC bus in the overhead console is within one volt of the external power source voltage.

d. Place NON-ESS BUS switch to NORM. Check that there is voltage on the non-essential bus.

e. De-energize external power source. Check that there is no voltage on the essential DC bus.

12-33. EXTERNAL POWER RECEPTACLE.

12-34. The external power receptacle (J16) is a polarized receptacle used as contact point for external power plug-in.

12-35. REMOVAL - EXTERNAL POWER RECEPTACLE.

a. Set (battery) switch to OFF position.

b. Remove attachment screws and extract receptacle enough to gain access to power cables.

c. Disconnect power cables and wrap terminals with electrical tape.

12-36. INSPECTION, REPAIR OR REPLACEMENT EXTERNAL POWER RECEPTACLE. (Refer to paragraphs 12-15 through 12-16.)

12-37. INSTALLATION - EXTERNAL POWER RECEPTACLE.

a. Remove tape from wire ends and connect cables to receptacle.

b. Position receptacle in helicopter and install attachment screws.

12-38. EXTERNAL POWER RELAY.

12-39. The external power relay, (K1) is an electrically operated switch between the external power receptacle and main bus bar. It is controlled through the small positive pin from the external power source which energizes the circuit to the activating coil of the relay only when the external applied voltage is of proper polarity.

12-40. REMOVAL - EXTERNAL POWER RELAY.

a. Place (battery) switch to OFF. Remove external power.

b. Remove attaching hardware and remove bus bar.

c. Disconnect wires from relay and tape ends.

d. Remove attachment bolts and lift relay free from compartment.

12-41. INSPECTION, REPAIR OR REPLACEMENT EXTERNAL POWER RELAY. (Refer to paragraphs 12-15 and 12-16, procedure is the same.)

12-42. INSTALLATION - EXTERNAL POWER RELAY.

a. Position relay and install mounting hardware.

b. Remove tape and connect relay wires.

c. Install and secure bus bar.

12-43. BATTERY AND GENERATOR SYSTEM.

12-44. The battery (BT1) is controlled by relay (K6) and one starter-generator (G1) furnish regulated power for all DC electrical components of the helicopter. The battery is capable of supplying electrical power for four consecutive engine starts, with 30 seconds elapsed time between starting cycles. In the event the starter-generator fails the battery supplies all loads essential to flight. The starter-generator, which is self excited, normally switches onto the main power cables after engine start procedure when the generated voltage exceeds the voltage on the bus by 0.30 to 0.42 volt. The application and regulation of power to the bus is controlled by the generator shunt (R3), line control relay (K12), generator fail relay (K11), non-essential bus relay (K2), voltage regulator (VR1), and associated wiring. (See figures 12-1 and 13-8.)

12-45. TROUBLESHOOTING - BATTERY AND GENERATOR SYSTEM. (See figure 13-7.)

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
Battery (BT1) will not hold charge	Demand too great	Use external power source whenever possible
	Charging rate too low	Adjust voltage regulator
	Broken cell partitions	Replace battery
	Shorted or grounded wire	Repair wiring
	Unbalanced cells	Replace battery
Short battery life	Level of electrolyte below of plate	Replace battery

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
Excessive loss of electrolyte	Charging rate too high, if loss is in individual cells only, cell is faulty	Reduce charging rate
	Cracked battery case	Check battery case for leaks; replace battery
Battery terminals corroded	Excessive charging or discharing rate	Adjust charing rate or load and clean terminals
Polarity reversed	Battery connections reversed	Check wiring to battery plug; reverse wiring if necessary
Actuation of battery toggle switch fails to turn on power	Battery relay points corroded or burned	Replace relay
	Faulty wiring between relay and battery switch	Check and repair wiring
Starter-generator produces voltage, but ammeter reads zero	Circuit breakers open	Close circuit breakers
	Defective ammeter or ammeter circuit	Check wiring continuity between ammeter and ammeter shunt. Replace wiring or defective ammeter. Tighten connections.
	Defective circuit breakers in ammeter circuit	Check and replace circuit breakers
No starter-generator output	No residual magnetism (Faulty voltage regulator)	Check and replace regulator
	Open circuit in voltage regulator	Check continuity between terminals of regulator; if circuit is open, replace regulator
	Open generator field circuit	Check continuity of wiring and of field winding; repair wiring or replace starter-generator
	Amature burned out or shaft sheared	Replace starter-generator
	Brushes excessively worn	Visually check brushes and replace as required
	Faulty connections	Tighten connections
	Armature or field winding short circuited	Replace starter-generator
	Brushes binding in holders	Remove, clean and reset brushes
	Commutator dirty, rough or pitted	Visually check commutator if dirty clean; if rough or pitted, replace starter-generator
Movement of regulator adjustment does not alter voltage within normal range	Defective regulator	Replace regulator
	Faulty wiring	Repair wiring

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
Ammeter fluctuates rapidly under steady load conditions	Voltage regulator unstable	Replace regulator
Voltage varies excessively with changes in engine speed or electrical load	Defective regulator	Replace regulator

12-46. OPERATIONAL CHECK - BATTERY CIRCUITS. The battery circuitry test shall be performed using the installed 24 vdc battery as power source connected at the battery connector as indicated in the following steps:

a. Before connecting power to the battery circuitry for the first time, open all circuit breakers, and place all switches in their open positions. Check that an open circuit exists between the positive terminal of the battery quick-disconnect and ground.

b. Check all battery circuitry connections for tightness and correct polarity.

c. Connect the battery, or external power source, to power cables at the quick-disconnect at the battery location. Place BATTERY switch (S1) to BATT. Check that battery voltage (approximately 24 volts) is present on main DC bus in the overhead console.

d. Position BATTERY switch (S1) to OFF. Check that there is no voltage present on main DC bus.

e. Disconnect the external power source, if used, and connect the battery to the battery power cables at the quick-disconnect in the battery location. Check that connection is tight and secure.

12-47. OPERATIONAL CHECK GENERATOR CIRCUITRY. Disconnect wires (P19C8 and P19D8) from positive terminal B on the starter-generator. Disconnect wires (K5A8N and K5C8N) from negative terminal E on the starter-generator. Connect these wires to a 28 vdc external power source observing correct polarity, but do not energize the power source until specified in the procedure below.

a. Close CAUTION LTS circuit breaker. Place BATTERY switch (S1) to BATT. Check that DC GENERATOR caution light is illuminated.

b. Close GEN BUS RESET, and GEN FIELD circuit breaker; place MAIN GEN switch to ON, NON-ESS BUS switch (S81) to NORM. Energize the external power source and adjust to 28 plus or minus 1 vdc. Check that DC GENERATOR caution light is extinguished and that voltage on the essential and non-essential DC buses is within one volt of the external power source voltage.

c. Close LOADMETER circuit breakers. Momentarily turn on a load such as the main inverter and check that ammeter reads upscale.

d. Open GEN FIELD circuit breaker. Check that (1) the non-essential bus voltage is zero, (2) the essential bus voltage is within one volt of battery voltage, and (3) the DC GENERATOR caution light is illuminated.

e. Open all circuit breakers. De-energize external power source. Disconnect wires (P19C8 and P19D8) from the power source and connect them to positive terminal B of the starter-generator. Disconnect wires (K5A8N and K5C8N) from the external source and reconnect them to negative terminal E of the starter-generator. Check that connections are correctly polarized, tight, and secure.

12-48. BATTERY.

12-49. The battery installation on the OH-58A helicopter consist of a vented 24 volt 13 ampere hour (or AH) nickel-cadmium battery; (BT1) located in the baggage compartment. (See figure 12-1.)

12-50. BATTERY CONDITION. Batteries may be checked during normal helicopter operations as follows: A fully charged battery can be determined only by moving the battery switch from BATT to OFF and observing the effect on the generator ammeter. If the change in indication is less than 5.0 amperes the battery is fully charged.

12-51. REMOVAL - BATTERY.

a. Check that BAT switch is OFF, and external power is not applied. Open compartment door.

b. Disconnect battery cable connector by turning knob counterclockwise.

c. Disconnect two vent tubes from battery case.

d. Remove mounting bolts and washers and lift battery from compartment.

e. Close compartment door.

12-52. INSPECTION - BATTERY. Inspect battery for the following conditions.

a. Loose connections at disconnect or between cells.

b. Electrolyte for proper level (refer to TM 11-1520-228-20.)

c. Clogged vent plug or vent tubes.

d. Damage to indivudual cell cases (distortion due to overcharge, cracks, or leaks).

12-53. REPAIR OR REPLACEMENT - BATTERY. Refer to general support for battery servicing procedures. Repair of battery should be accomplished in an authorized battery repair station.

12-54. INSTALLATION - BATTERY.

a. Open compartment door.

b. Place battery on shelf aligned for connections. Install mounting bolts and washers, tighten securely.

c. Connect two vent tubes to battery case and tighten clamps.

d. Insert cable connector in battery receptable and secure by turning knob clockwise.

12-55. CHARGING BATTERY IN HELICOPTER (EXTERNAL POWER).

a. Check that all electrical power is OFF.

b. Plug external power into helicopter.

c. Turn external power unit ON and note APU ammeter reading.

Note

Check and set voltage on external power for 27.5 to 28.5 volts.

d. Turn battery switch to BATT and note rise in ammeter reading on external power unit (approximately 10 to 120 amperes) depending upon state of charge of battery.

e. Continue charging until ammeter has dropped to about the same reading recorded before the helicopter battery switch was actuated to BATT. This time will vary from about 10 minutes to approximately 30 minutes depending upon state of charge of the battery.

f. When current has dropped the battery is charged and ready for service. Turn BATtery switch OFF; turn external power OFF and disconnect power unit.

12-56. CHARGING BATTERY OUT OF HELICOPTER (APU CHARGE).

a. Use the same procedure as outlined in paragraph 12-55 except that the battery is not installed in the helicopter.

b. With this method the proper connector must be used to interconnect the battery and APU.

c. Make certain that connections and cables are capable of carrying at least 100 amperes. DO NOT ATTEMPT TO USE BATTERY CABLE CLIPS. Cable clips are unsatisfactory and will result in severe damage to battery terminals.

d. Charge the battery as outlined in paragraph 12-55 recording first the current required by the APU, then closing generator power switch and continuing charge until current has dropped down to the value first recorded on the APU.

e. When current has dropped, the battery is charged and ready for installation in the helicopter.

12-57. CHARGING BATTERY (SLOW CHARGE). Set battery charger on 24 volts slow rate. If battery is known to require a complete recharge, due to accidental discharge or because battery has been stored for exceptionally long periods of time (particularly at high temperatures), charging time should be approximately nine hours at approximately three amperes.

Note

The battery is sufficiently vented when installed in the helicopter to expell accumulated gases during charging or discharging.

12-58. BATTERY RELAY.

12-59. The battery relay (K6) located on forward bulkhead of baggage compartment is an electrically operated switch controlling battery power to distribution points on essential BUS.

12-60. REMOVAL - BATTERY RELAY.

a. Disconnect battery (paragraph 12-51).

b. Remove attaching hardware and remove bus bar from relay.

c. Disconnect wires from relay and tape ends using electrical tape.

d. Remove attachment screws and lift relay free.

12-61. INSPECTION, REPAIR OR REPLACEMENT BATTERY RELAY. (Refer to paragraphs 12-13 and 12-14.)

12-62. INSTALLATION - BATTERY RELAY.

a. Position relay and install attaching screws.

b. Remove protective tap and connect wire to relay.

c. Position bus bar on relay and secure with attaching hardware.

d. Connect battery. (Paragraph 12-55.)

12-63. STARTER GENERATOR.

12-64. The starter-generator (G1) is located on the underside of the engine to the right of the helicopter center line. This unit is used to start the engine, charge the battery and supply power for the operation of DC equipment. (See figure 12-1.)

12-65. REMOVAL STARTER-GENERATOR. Disconnect all electrical power from helicopter. Disconnect electrical connectors from starter-generator. Protect ends of wires with electrical tape. Refer to Chapter 5 for starter-generator removal.

12-66. INSPECTION - STARTER-GENERATOR. Inspect for cracks, excessive wear or any visible damage. Check for warped or cracked terminal board or terminal damage. Check brush cover for dents, loose or bent pins, broken spring or damaged insulation.

12-67. REPAIR OR REPLACEMENT - STARTER-GENERATOR. Replace starter-generator if it does not meet inspection requirements.

Note

LEAR-SEIGLER STARTER-GENERATOR. Part No. 23032-020. Replace brushes when the overall length is less than 0.79 inch. This is indicated when the diagonal line extends less than one third the length across the brush.

12-68. INSTALLATION - STARTER-GENERATOR. Refer to Chapter 5 for starter-generator installation. Remove electrical tape, connect electrical wires, and secure installation hardware. Restore electrical power to helicopter.

12-69. GENERATOR SHUNT.

12-70. The generator shunt (R3) is located on the equipment shelf above the baggage compartment and provides a small voltage drop, proportional to the current, to operate the ammeter.

12-71. REMOVAL - GENERATOR SHUNT.

a. Check that all electrical power is OFF.

b. Remove upholstered panel, located aft of rear seat, to gain access to generator shunt.

c. Disconnect electrical wiring and cover ends with tape.

d. Remove mounting screws and washers; remove shunt.

12-72. INSPECTION, REPAIR OR REPLACEMENT - GENERATOR SHUNT. (Refer to paragraphs 12-15 and 12-16.)

12-73. INSTALLATION - GENERATOR SHUNT.

a. Position shunt and install mounting hardware.

b. Remove tape and connect wiring.

c. Replace upholstered panel.

12-74. LOADMETER CIRCUIT BREAKERS (CB7).

12-75. Two 5 ampere circuit breakers are mounted on a bracket on equipment shelf above baggage compartment and are connected in the positive and negative ammeter lines to prevent possible damage to ammeter.

12-76. VOLTAGE REGULATOR.

12-77. A static type voltage regulator (VR1) is located on equipment shelf above baggage compartment and is adjustable for 26.0 to 29.0 volt generator output by adjustment screw located on end of regulator adjacent to connector. The regulator is a component of the basic DC power system and functions in conjunction with the other components of the system to accomplish the following:

a. Prevent the generator from being connected to the line until operating voltage is attained, protects the generator against overload, prevents reverse current flow and hold the generator connected to line unless voltage drops to a point where continued operation would be detrimental to the electrical equipment.

b. Provides increased resistance in the shunt field circuit to weaken the shunt field of the starter-generator during start operation, and maintains approximately 1.0 volt positive applied to generator terminal A during start operation to maintain generator residual magnetism.

12-78. REMOVAL - VOLTAGE REGULATOR.

a. Set battery and GEN switches to OFF position.

b. Disconnect electrical connector and protect with cap or tape.

c. Remove four mounting screws and washers.

d. Lift regulator from shelf.

12-79. INSPECTION - VOLTAGE REGULATOR. Visually inspect regulator case for physical damage that could impair normal efficient operation of the unit, (cracked case, damaged contact pins). Check for secure mounting of regulator.

12-80. REPAIR OR REPLACEMENT - VOLTAGE REGULATOR. Replace item if inspection requirements are not met.

12-81. INSTALLATION - VOLTAGE REGULATOR.

a. Position regulator and install four mounting screws and washers.

b. Remove cover and connect electrical connector to regulator.

12-82. ADJUSTING - VOLTAGE REGULATOR (IN SHIP). Adjust the voltage regulator by turning the adjustment screw on the face clockwise to increase voltage and counterclockwise to decrease voltage. Set regulator as follows:

CONDITION		GENERATOR SETTING
Winter:	32°F or lower	28.5 volts
Summer:	90°F or higher	27.0 volts
Fall and Spring:	32°F to 94°F	27.5 volts

12-83. LINE CONTROL RELAY (K12).

12-84. The line control relay, located on equipment shelf above the baggage compartment is a component of the basic DC power system and functions in conjunction with the other power system components to prevent the generator from being connected to the line until operating voltage is attained, protect the generator against overload, prevent reverse current flow and hold the generator connected to line unless voltage drops to a point where continued operation would be detrimental to the electrical equipment.

12-85. REMOVAL - LINE CONTROL RELAY.

a. Set battery switch to OFF.

b. Remove bus bar from relays (K2), (K3) and (K12).

c. Disconnect wires and tape ends.

d. Remove mounting screws and washers and lift relay from shelf.

12-86. INSPECTION, REPAIR OR REPLACEMENT LINE CONTROL RELAY. (Refer to paragraphs 12-15 and 12-16.)

12-87. INSTALLATION - LINE CONTROL RELAY.

a. Position relay on shelf and install mounting hardware.

b. Remove tape and connect wires.

c. Install bus bar on relays (K2), (K3) and (K12).

12-88. GENERATOR FAIL RELAY.

12-89. The generator fail relay (K11) located on the equipment shelf above the baggage compartment, is actuated from pin H of the voltage regulator and provides the necessary switching action to energize the non-essential bus relay and allow power to be supplied to the non-essential bus from either external power or generator. In the event of a generator failure, the non-essential bus is automatically dropped from the generator and battery bus with the battery then supplying power for the essential bus load.

12-90. REMOVAL - GENERATOR FAIL RELAY.

a. Check that all electrical power is OFF.

b. Disconnect wires from relay, identify and tape ends.

c. Remove screws, spacers and washers and remove relay.

12-91. INSPECTION, REPAIR OR REPLACEMENT - GENERATOR FAIL RELAY. (Refer to paragraphs 12-15 and 12-16.)

12-92. INSTALLATION - GENERATOR FAIL RELAY.

a. Position relay on shelf and install spacers, washers and screws.

b. Remove covers from wire ends and connect wires to proper terminals.

12-93. NON-ESSENTIAL BUS RELAY.

12-94. The non-essential bus relay (K2) is an electrically operated switch between the main bus and the non-essential bus and is controlled by either the generator fail relay or the non-essential bus switch (S1).

12-95. REMOVAL - NON-ESSENTIAL BUS RELAY.

a. Check that all electrical power is OFF.

b. Remove bus bar from relays (K2), (K3) and (K12).

c. Disconnect wires from relay, identify and tape ends.

d. Remove mounting bolts and washers and remove relay from shelf.

12-96. INSPECTION, REPAIR OR REPLACEMENT - NON-ESSENTIAL BUS RELAY. (Refer to paragraphs 12-5 and 12-16.)

12-97. INSTALLATION - NON-ESSENTIAL BUS RELAY.

a. Position relay on shelf and install attaching bolts and washers.

b. Remove tape from wires and connect to proper terminal.

c. Install bus bar on relays (K2), (K3) and (K12).

12-98. DC STARTER SYSTEM.

12-99. The starter-generator (G1) is located on the underside of the engine. This unit is used to start the engine, charge the battery and supply power for operation of DC equipment. The starter is energized by the starter-relay (K3) located in the aft electrical compartment. This relay is actuated by the starter switch (S6) located on the pilot's collective stick. (See figures 12-1 and 13-8.)

Note

Refer to paragraph 12-43 for coverage of generator portion of starter-generator.

12-100. TROUBLE SHOOTING - STARTER SYSTEM. (See figure 13-8.)

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
Starter fails to operate when START switch is depressed	Defective starter circuit breaker	Replace circuit breaker
	Defective battery (BT1)	Replace battery
	Switch contacts corroded or burned	Replace switch
	Faulty wiring or loose connections	Replace wiring, tighten connections
	Defective starter relay (K3)	Replace relay
	Brushes excessively worn	Replace as required
	Armature burned out	Replace starter-generator
Starter fails to produce sufficient RPM during start cycle (15% as indicated on gas producer tachometer)	Excessive wear to bearing	Replace starter-generator
	Battery terminal voltage low	Use power cart

12-101. OPERATIONAL CHECK - STARTER AND IGNITER CIRCUITRY. Disconnect wires (K4B8 and (4D8) from terminal C on the starter-generator and isolate them from ground. Connect the external power source at external power receptacle (J16).

a. Energize external power source. Close START ENG circuit breaker. Depress starter switch on pilot's collective stick. Check that power source voltage (approximately 28 vdc) is present at end of wires (K4B8 and K4D8) while starter switch is depressed.

b. Release pilot's starter switch. Check for no voltage at open end of wires (K4B8 and K4D8).

c. Close IGN ENG circuit breaker. Depress pilot's starter switch. Check that igniter unit operates.

d. Open IGN ENG and START ENG circuit breakers. Disconnect external power source. Reconnect wires (K4B8 and K4D8) to terminal C on the starter-generator. Check that connections are tight and secure.

12-102. STARTER RELAY.

12-103. The starter relay (K3) is located on equipment shelf above baggage compartment and supplies direct current to the starter when the starter switch is depressed.

12-104. REMOVAL - STARTER RELAY.

a. Be sure all electrical power is OFF.

b. Remove bus bar from relays (K2), (K3) and (K12).

c. Disconnect and tape wire ends.

d. Remove mounting bolts and washers.

12-105. INSPECTION, REPAIR OR REPLACEMENT - STARTER RELAY. (Refer to paragraphs 12-15 and 12-16.)

12-106. INSTALLATION - STARTER RELAY.

a. Position relay and install mounting hardware.

b. Remove tape and connect wires.

c. Install bus bar on relays (K2), (K3) and (K12).

12-107. STARTER SWITCH.

12-108. The starter switch (S6), located in the collective stick switch box, is a double-pole, single-throw, push-button type switch. When switch is pressed to START position, the circuit to starter relay actuating coil is energized.

12-109. REMOVAL - STARTER SWITCH.

a. Set BATtery switch to OFF.

b. Remove switch plate mounting screws and lift plate sufficiently to gain access to switch wires.

c. Disconnect switch wires.

d. Remove switch from panel.

Note

Utilize caution in switch removal to prevent chafing or damage to wires.

12-110. INSPECTION, REPAIR OR REPLACEMENT - STARTER SWITCH. (Refer to paragraphs 12-15 and 12-16.)

12-111. INSTALLATION - STARTER SWITCH.

a. Install switch to plate observing that indexing key is in proper position.

b. Connect wires to switch.

c. Position plate on switch box and install mounting screws.

12-112. IGNITER SYSTEM.

12-113. The igniter (Z1), furnished with the power turbine, is located below the tachometer generator on the lower left section of engine and consists of a low tension capacitor discharge ignition exciter. This unit provides a continuous ignition arc during engine start cycle. (See figures 12-1 and 13-8.)

12-114. TROUBLESHOOTING - IGNITER SYSTEM. (See figure 13-8.)

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
Ignition fails to operate when starter switch is depressed	Starter or ignition circuit breaker open or defective	Check and replace faulty breakers
	Starter switch contact corroded or burned	Replace switch
	Loose connections or defective wiring	Repair wiring and tighten connections
	Defective igniter	Replace igniter

12-115. OPERATIONAL CHECK - IGNITER SYSTEM. (See Starter-Igniter paragraph 12-101.)

12-116. FUEL PUMP SYSTEM.

12-117. The fuel pump system consists of one electrically operated fuel boost pump (B1) submerged in the fuel cell and is accessable from the bottom of the fuselage. The pump is energized from a circuit breaker in the overhead console. (See figures 12-1 and 13-9.)

12-118. TROUBLESHOOTING - FUEL PUMP SYSTEM. (See figure 13-9.)

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
Fuel pump fails to operate when breaker is closed	Defective breaker in pump circuit	Check and replace as necessary
	Faulty wiring or loose contions	Repair wiring and tighten connections
	Defective pump	Replace pump
Circuit breaker trips	Wiring shorted	Check and repair wirng as necessary
	Shorted or defective pump	Replace pump

Note

For maintenance of fuel boost pump (refer to Chapter 5).

12-119. OPERATIONAL CHECK - FUEL PUMP.

a. Close FUEL PUMP circuit breaker. Check that the fuel pump operates.

b. Open FUEL PUMP circuit breaker. Check that the fuel pump stops operating.

12-120. GOVERNOR CONTROL SYSTEM.

12-121. The Governor control system allows pilot control of the governor setting and consists of a GOV CONT 5 ampere circuit breaker (CB7), a governor control switch (S5), and a governor control actuator (B3). (See figures 12-1 and 13-9.)

12-122. TROUBLESHOOTING - GOVERNOR CONTROL SYSTEM. (See figure 13-9.)

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
Governor actuator fails to respond when governor RPM switch is placed to INCR or DECR positions	Defective or open circuit breaker in overhead console	Check and replace faulty circuit breaker
	Faulty wiring or loose connections	Repair wiring and tighten connections
	Switch contacts corroded or burned	Replace switch
	Defective governor control actuator	Replace actuator
	Leads connected to wrong terminals on actuator	Refer to wiring diagram for correct terminals
Actuator moves in opposite direction to increase/decrease selection	Leads connected to wrong terminals on actuator	Refer to wiring diagram for correct terminals

12-123. OPERATIONAL CHECK - GOVERNOR CONTROL.

a. Close GOV CONT circuit breaker. Press GOV RPM switch to INCR. Check that governor control actuator retracts.

b. Press GOV RPM switch to DECR. Check that governor control actuator extends.

12-124. GOVERNOR CONTROL SWITCH.

12-125. The governor control switch (S5), located in the pilot's collective switch box, is a double-pole,

double-throw, spring loaded, momentary contact switch that enables the pilot to increase or decrease the governor RPM actuator setting. With the switch in INCR position, the circuit to the actuator motor is completed and allows motor to move arm in one given direction. With the switch in DECR position the polarity to the actuator motor is reversed, allowing the actuator arm to move in the opposite direction. When the switch is in rest position, circuit is de-energized. (See figure 13-9.)

12-126. REMOVAL - GOVERNOR CONTROL SWITCH. (Refer to paragraph 12-109, procedure is the same.)

12-127. INSPECTION, REPAIR OR REPLACEMENT - GOVERNOR CONTROL SWITCH. (Refer to paragraphs 12-15 and 12-16.)

12-128. INSTALLATION - GOVERNOR CONTROL SWITCH. (Refer to paragraph 12-111, procedure is the same.)

12-129. GOVERNOR ACTUATOR.

12-130. The governor actuator (B3) is located on the forward left side of engine and is a reversible motor that provides increase or decrease of the governor setting. The unit is controlled by the governor switch on the collective stick.

Note

For maintenance of governor actuator (refer to Chapter 5.)

12-131. ENGINE ANTI-ICE SYSTEM.

12-132. The Engine Anti-Ice system provides distribution of heated air to prevent engine icing and is comprised of: the Engine De-Ice switch (S8), the Engine De-Ice Control (B4), and is protected by a 5 ampere ENG DE-ICE circuit breaker. (See figures 12-1 and 12-10.)

12-133. TROUBLESHOOTING - ENGINE ANTI-ICE SYSTEM. (See figure 13-10.)

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
Actuation of ENG DE-ICE toggle switch fails to operate control	Defective or open circuit breaker in engine de-ice control circuit	Check and replace breaker
	Defective ENG DE-ICE toggle switch	Replace switch
	Loose connections or faulty wiring	Tighten connections repair wiring
	Defective DE-ICE control	Replace control
DE-ICE control operates in reverse order	Wiring reversed between switch and control	Refer to wiring diagram and correct as necessary
Circuit breaker trips	Shorted wiring	Repair wiring
	Shorted control	Replace control

12-134. OPERATIONAL CHECK - ENGINE DE-ICING CONTROL.

a. Close ENG DE-ICE circuit breaker. Set ENG DE-ICE switch (S8) to DE-ICE. Check that the de-ice valve actuator arm moves aft, opening the de-ice valve.

b. Place ENG DE-ICE switch (S8) to OFF. Check that the de-ice valve actuator arm moves forward closing the de-ice valve.

12-135. ENGINE HEAT ACTUATOR.

12-136. The engine heat actuator (B4), located on upper forward section of engine, provides electrical remote control of the engine heat control valve and is energized through the engine heater switch on the overhead console.

Note

For maintenance of Engine Heat Actuator (refer to Chapter 5.)

12-137. HYDRAULIC CONTROL SYSTEM.

12-138. The electrical circuitry for control of the hydraulic system consists of a hydraulic by-pass solenoid valve (L1), a HYD BOOST switch (S7), and is protected by a 5 ampere HYD BOOST circuit breaker. The valve is normally energized to prevent hydraulic fluid flow and may be de-energized to permit fluid

flow by setting switch (S7) to ON position. (See figures 12-1 and 13-11.)

12-139. TROUBLESHOOTING - HYDRAULIC CONTROL SYSTEM. (See figure 13-11.)

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
Actuation of hydraulic bypass toggle switch to OFF fails to operate solenoid and hydraulic pressure continues to exist	Defective or open circuit breaker	Check and replace faulty circuit breaker
	Bypass switch contacts corroded or burned	Replace switch
	Faulty wiring or loose connections	Repair wiring and tighten connections
	Defective solenoid	Replace solenoid
Circuit breaker trips	Wiring shorted	Repair wiring
	Solenoid shorted	Replace solenoid

12-140. OPERATIONAL CHECK - ELECTRIC CONTROL OF HYDRAULIC SYSTEM.

a. Set HYD BOOST switch to ON. Close HYD BOOST and CAUTION LIGHT circuit breakers. Apply hydraulic pressure to aircraft from the external source. Check that the HYD BOOST caution light is extinguished and that cyclic, collective, and tail rotor controls move easily.

b. Set HYD BOOST switch to OFF. Check that HYD BOOST caution light is illuminated and that cyclic, collective, and tail rotor controls are harder to move than in step a.

c. Set HYD BOOST switch to ON. Check that HYD BOOST caution light is extinguished and that the cyclic, collective, and tail rotor controls move easily.

12-141. HYDRAULIC BYPASS SOLENOID.

12-142. The hydraulic bypass solenoid (L1) located on the service deck forward of the transmission is controlled by the HYD BOOST switch. (Figure 12-1.) With the switch in OFF position, the solenoid is energized, allowing the boost system to be bypassed.

12-143. REMOVAL - HYDRAULIC BYPASS SOLENOID. (Refer to Chapter 6.)

12-144. INSPECTION, REPAIR OR REPLACEMENT - HYDRAULIC BYPASS SOLENOID. (Refer to paragraphs 12-15 and 12-16.)

12-145. INSTALLATION - HYDRAULIC BYPASS SOLENOID. (Refer to Chapter 6.)

12-146. FORCE TRIM SYSTEM.

12-147. The force trim system consists of a fore and aft force trim magnetic brake (L4), and a lateral force trim magnetic brake (L5). The magnetic brakes are wired in parallel and are protected by a 5 ampere FORCE TRIM circuit breaker. FORCE TRIM switches (S60), (S58), and (59) are all series wired. The entire system serves to return pilot's and copilot's cyclic stick to desired initial position when (S60) is set to ON position. Switch (S58) or (S59) may be triggered to de-energize brakes and eliminate centering force. With (S60) set to OFF position, automatic trim force is de-energized. (See figures 12-1 and 13-11.)

12-148. TROUBLESHOOTING - FORCE TRIM SYSTEM. (See figure 13-11.)

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
All magnetic brakes fail to energize with FORCE TRIM switch (S60) to ON position	Faulty wiring or loose connections	Repair wiring and tighten connections
	Defective switch (S60), (S58), or (S59)	Replace defective switch
Any magnetic brake fails to energize with FORCE TRIM switch (S60) to ON position	Defective magnetic brake	Replace defective brake

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
Magnetic brakes fail to de-energize when FORCE TRIM switch (S58) or (S59) is de-pressed	Defective switch or shorted wiring	Replace switch or repair wiring

12-149. OPERATIONAL CHECK - FORCE TRIM SYSTEM.

a. Close FORCE TRIM circuit breaker. Place FORCE TRIM switch to ON. Check that the cyclic controls have a holding force in fore and aft and lateral directions.

b. Press FORCE TRIM switch on pilot's cyclic stick. Check that holding forces noted in step a., are not present.

c. Release FORCE TRIM switch on pilot's cyclic stick. Check that the holding forces noted in step a., are present.

d. Repeat steps b., and c., except use FORCE TRIM switch on copilot's cyclic stick.

e. Place FORCE TRIM switch to OFF. Check that holding forces are not present.

12-150. MAGNETIC BRAKES (L4, L5).

12-151. Refer to Chapter 9, for removal, installation and rigging procedures.

12-152. CYCLIC BUTTON SWITCH (S58 and S59).

12-153. The cyclic button switch is a single-pole, single-throw, press contact switch furnished as a part of the cyclic stick grip assembly and enables pilot or copilot to de-energize force trim system.

12-154. REMOVAL - CYCLIC BUTTON SWITCH.

a. Set battery switch to OFF.

b. Unscrew and remove two attachment screws from grip cap.

c. Remove cap, release and lift switch sufficiently to gain access to switch wires.

d. Disconnect wires from switch, identify and tape wire ends.

Note

Utilize caution in switch removal and installation to prevent chafing or damage to wires.

12-155. INSPECTION, REPAIR OR REPLACEMENT - CYCLIC BUTTON SWITCH. Inspect switch for cracks, discoloration, faulty contacts and looseness of the assembly; if any of these conditions exist, replace switch.

12-156. INSTALLATION - CYCLIC BUTTON SWITCH.

a. Remove tape and attach wires to switch.

b. Carefully position switch in grip assembly observing that wires are free of obstruction.

c. Place cap on grip assembly and install two attachment screws.

12-157. CAUTION AND WARNING LIGHTS SYSTEM.

12-158. The caution and warning lights system includes a master caution panel (A1), caution lights (DS 12) (DS13) (DS14)and (DS15), caution light test switch (S86), and engine out tone generator (DS17). The caution panel contains a number of internally lighted capsules that illuminate when associated switches, (Sensors) located at different places in the helicopter, actuate to complete circuits thus indicating malfunctions in the systems being monitored by the sensors. The panel is energized from 28vdc bus and protected by a 5 ampere circuit breaker (CB7). (See figures 12-1 and 13-12.)

12-159. TROUBLESHOOTING - CAUTION AND WARNING LIGHTS SYSTEM. Refer to circuit diagram and trace malfunctioning circuit or loop, using standard electronic troubleshooting procedures and standard test equipment. Localize malfunctioning switch components, and repair or replace as required. (See figure 13-12.)

12-160. OPERATIONAL CHECK - CAUTION AND WARNING LIGHTS SYSTEM. During the following tests, the MASTER CAUTION light shall illuminate each time a caution panel segment illuminates and shall extinguish when reset. A caution panel segment will illuminate each time a fault exists and will remain illuminated until fault is cleared. Each time a caution panel segment becomes illuminated, it shall flash at a rate of 3 to 5 times per second until system is reset, then segment shall remain steady on, until fault is cleared, the system shall be reset after each check in readiness for the next fault indication.

a. Caution Light Panel.

(1) Close CAUTION LTS circuit breaker. Check that the MASTER CAUTION light and each caution panel segment listed as ON are illuminated and flashing at a rate of 3 to 5 times per second. The following conditions exist.

CAUTION LIGHT	ON/OFF CONDITION
FUEL BOOST	ON
20 MIN FUEL	ON OR OFF
FUEL FILTER	OFF
ENG OIL BYPASS	ON OR OFF
ENG CHIP DET	OFF
XMSN CHIP DET	OFF
T/R CHIP DET	OFF
INST INVERTER	ON
DC GENERATOR	ON
HYD PRESS	ON

(2) Reset MASTER CAUTION light by placing RESET/TEST switch momentarily to RESET. Check that the first caution light listed as ON is steadily illuminated but that the MASTER CAUTION and the remaining caution lights listed as ON continue to flash.

(3) Continue to reset the MASTER CAUTION light until all the caution lights listed as ON are steadily illuminated. Check that the MASTER CAUTION light is extinguished.

(4) Place RESET/TEST switch to test. Check that all the caution lights and the MASTER CAUTION are flashing and continue flashing as long as the switch is held to TEST.

(5) Release the RESET/TEST switch. Check that the MASTER CAUTION light is extinguished and the caution lights listed as ON are steadily illuminated.

(6) Depress the BRIGHT/DIM switch momentarily to DIM. Check that the caution lights do not dim.

(7) Rotate the instrument lights dimmer control clockwise from OFF. Depress the BRIGHT/DIM switch momentarily to DIM. Check that the caution lights dim and remain dimly illuminated.

(8) Momentarily depress the BRIGHT/DIM switch to BRIGHT. Check that the caution lights become brightly illuminated.

b. Fuel Boost Caution Light. Disconnect plug P172 from the fuel pressure switch and check that FUEL BOOST caution light is extinguished.

c. Twenty-Minute Fuel Caution Light. The 20-MIN FUEL caution light shall be tested in accordance with either of the following, as applicable.

(1) Procedure for less than twenty minutes fuel.

(a) Disconnect wire (E40A22) at splice near fuel tank. Check that 20-MIN FUEL caution light extinguishes.

(b) Reconnect wire (E40A22) at splice. Check that 20-MIN FUEL caution light is illuminated.

(2) Procedure for more than twenty minutes fuel.

(a) Disconnect wire (E40A22) at splice near fuel tank and connect to ground. Check that 20-MIN FUEL caution light is illuminated.

(b) Remove wire (E40A22) from ground. Check that 20-MIN FUEL light is extinguished.

(c) Reconnect wire (E40A22) at splice. Check that the 20-MIN FUEL caution light remains extinguished.

d. Fuel Filter Caution Light.

(1) Disconnect plug (P23) from the fuel filter pressure switch. Temporarily short pins B and C on plug (P23). Check that FUEL FILTER caution light is illuminated.

(2) Remove temporary short between pins B and C of plug (P23). Check that FUEL FILTER caution light is extinguished.

(3) Reconnect plug (P23) to the fuel filter pressure switch. Check that the connection is properly mated (tight and secure) and that FUEL FILTER caution light is extinguished.

e. Engine Oil Bypass Caution Light. With the ENGINE OIL bypass light illuminated (low oil level) perform the following:

(1) Disconnect ground wire from oil level float switch (S52). Check that ENG OIL BYPASS caution light is extinguished.

(2) Reconnect ground wire to oil level float switch (S52). Check that ENG OIL BYPASS caution light is illuminated.

(3) If ENG OIL BYPASS caution light is extinguished (indicating safe oil level), temporarily jumper terminal 2 of TB14 and ground wire and check that ENG OIL BYPASS caution light illuminates.

(4) Remove jumper from terminal 2 of (TB14) and ground wire and observe that ENG OIL BYPASS caution light extinguishes.

f. Engine Chip Detector Caution Light.

(1) Remove plug (P113) from the upper engine chip detector. Connect a temporary short between pin A of plug (P113) and aircraft structure. Check that ENG CHIP DET caution light is illuminated.

(2) Remove temporary short installed in step a. Check that ENG CHIP DET cuation light is extinguished.

(3) Reconnect plug (P113) to its engine chip detector. Check that connection is properly made and that the ENG CHIP DET caution light remains extinguished.

(4) Remove plug (P126) from the lower engine chip detector. Connect a temporary short between pin A of plug (P126) and aircraft structure. Check that ENG CHIP DET caution light is illuminated.

(5) Remove temporary short. Check that ENG CHIP DET caution light is extinguished.

(6) Reconnect plug (P126) to its engine chip detector. Check that connection is properly made and that ENG CHIP DET caution light remains extinguished.

g. Transmission Chip Detector Caution Light.

(1) Connect a temporary short between the stud on one of the transmission chip detectors and aircraft structure. Check that XMSN CHIP DET caution light is illuminated.

(2) Remove termporary short. Check that XMSN CHIP DET caution light is extinguished.

(3) Connect a temporary short between the stud on the other transmission chip detector and aircraft structure. Check that XMSN CHIP DET caution light is illuminated.

(4) Remove temporary short. Check that XMSN CHIP DET caution light is extinguished.

h. Tail Rotor Chip Detector Caution Light.

(1) Connect a temporary short between the stud on the chip detector in the tail rotor gearbox and aircraft structure. Check that T/R CHIP DET caution light is illuminated.

(2) Remove temporary short. Check that T/R CHIP DET caution light is extinguished.

i. Instrument Inverter Caution Light. The INST INVERTER caution light is tested as a part of the inverter circuitry.

j. DC Generator Caution Light. The DC GENERATOR caution light is tested as a part of the generator circuitry.

k. Hydraulic Pressure Caution Light.

(1) Connect ship's hydraulic system to the hydraulic power cart. Gradually increase pressure to the point where the HYD PRESS caution light extinguishes. Check that HYD PRESS caution light extinguishes at 400 psig increasing pressure.

(2) Gradually reduce pressure to the point where the HYD PRESS caution light illuminates. Check that HYD PRESS caution light illuminates at 300 psig decreasing pressure.

(3) Relieve pressure and disconnect the hydraulic power cart. Check that HYD PRESS caution light remains illuminated.

l. Master Caution Light. The MASTER CAUTION light is tested in conjunction with the caution lights panel.

m. Engine Out Warning (Visual and Audio).

(1) Close CAUTION LTS circuit breaker Check that ENG OUT warning light is illuminated and the engine out warning alarm is audible.

(2) Start helicopter engine, using procedures as outlined in TM 55-1520-228-10 operators manual, and observe that engine out light extinguishes and audio signal is silenced as nI tachometer indicator reaches 58 percent increasing rpm indication.

(3) Secure engine and observe that engine out warning light is again illuminated and audio is present in the headset, as nI tachometer indicator reading falls below 52 percent rpm indication.

n. Transmission Oil Pressure Warning Light.

(1) Check that XMSN OIL PRESS warning light is illuminated.

(2) Disconnect wires (D4C20 and D16A20) from stud on the lower transmission oil pressure switch (S13). Separate the two wires from each other and from aircraft structure. Check that XMSN OIL PRESS warning light is extinguished.

(3) Depress warning light TEST switch. Check that XMSN OIL PRESS light is illuminated while switch is depressed and extinguished when switch is released.

(4) Temporarily connect wire D4C20 to wire D16A20. Check that XMSN OIL PRESS warning light is illuminated.

(5) Separate the two wires. Do not permit the wires to contact aircraft structure. Check that XMSN OIL PRESS warning light is extinguished.

(6) Connect wire D4C20 to lower transmission oil pressure switch. Check that XMSN OIL PRESS warning light is illuminated.

(7) Reconnect wires D4C20 and D16A20 to lower transmission oil pressure switch. Check that connections are properly and permanently made and that XMSN OIL PRESS switch light remains illuminated.

o. Transmission Oil Hot Warning Light.

(1) Check that XMSN OIL HOT warning light is extinguished.

(2) Depress warning light TEST switch. Check that the XMSN OIL HOT warning light is illuminated when switch is depressed and extinguished when switch is released.

(3) Connect a temporary short from stud on transmission oil temperature switch (S3) and aircraft structure. Check that XMSN OIL HOT warning light is illuminated.

(4) Remove temporary short. Check that XMSN OIL HOT warning light is extinguished.

12-161. TRANSMISSION OIL TEMPERATURE SWITCH.

12-162. The transmission oil temperature switch (S3), located adjacent to temperature bulb left side of transmission, is a hermetically sealed, temperature operated, single-pole switch, that closes when temperature of transmission oil rises above safe operating range; this energizes a XMSN OIL HOT caution light on the caution panel.

12-163. REMOVAL - TRANSMISSION TEMPERATURE SWITCH. (Refer to Chapter 6.)

12-164. INSPECTION, REPAIR OR REPLACEMENT - TRANSMISSION OIL TEMPERATURE SWITCH. (Refer to paragraphs 12-15 and 12-16.)

12-165. INSTALLATION - TRANSMISSION OIL TEMPERATURE SWITCH . (Refer to Chapter 6.)

12-166. FUEL PRESSURE SWITCH.

12-167. A pressure operated switch (S12), located in the discharge port of the fuel boost pump provides an indication of pump failure, should the pressure drop on the pump the switch closes energizing fuel boost caution light on the caution panel.

12-168. REMOVAL - FUEL PRESSURE SWITCH. (Refer to Chapter 5.)

12-169. INSPECTION, REPAIR OR REPLACEMENT - FUEL PRESSURE SWITCH.

a. Inspect switch for clogged pressure port.

b. Using a source of controlled and monitored pressure and a test light connected across pins A and B of switch receptacle slowly apply increasing pressure to the pressure port of the switch. At 8 psig the switch should actuate to open, extinguishing the test light. On decreasing pressure the switch should close at 4.5 plus or minus 0.5 psig and illuminate the test lamp.

Note

The switch is pre-set at the factory, no adjustment is provided. Should the switch fail to operate at this prescribed range replacement of the switch is necessary.

12-170. INSTALLATION - FUEL PRESSURE SWITCH. (Refer to Chapter 5.)

12-171. FUEL FILTER PRESSURE SWITCH.

12-172. The filter pressure switch (S10), attached to lower firewall beneath the engine, is a pressure operated switch connected to the fuel filter caution light. Should the fuel filter pressure drop below safe operating limit, the switch closes and energizes the fuel filter caution light alerting the pilot of clogged fuel filter. Fuel is by-passing filter at this time.

12-173. REMOVAL - FUEL FILTER PRESSURE SWITCH. (Refer to Chapter 5.)

12-174. INSPECTION, REPAIR OR REPLACEMENT - FUEL FILTER PRESSURE SWITCH.

a. Inspect switch for clogged pressure port.

b. Using a source of controlled and monitored pressure and a test light connected across pins B and C of switch receptacle slowly apply increasing pressure to the pressure port of the switch. The switch should actuate at approximately 1.15 psig.

Note

The switch is pre-set at the factory, no adjustment is provided. Should the switch fail to operate at this prescribed range replacement of the switch is necessary.

12-175. INSTALLATION - FUEL PRESSURE SWITCH. (Refer to Chapter 5.)

12-176. TRANSMISSION OIL PRESSURE SWITCHES.

12-177. Two transmission pressure switches (S4 and S13), located on upper and lower left side of transmission are pressure operated switches and serve to energize XMSN OIL PRESS caution light on the instrument panel, warning the pilot of high or low oil pressure.

12-178. REMOVAL - TRANSMISSION OIL PRESSURE SWITCH. (Refer to Chapter 7.)

12-179. INSPECTION, REPAIR OR REPLACEMENT - TRANSMISSION OIL PRESSURE SWITCHES. (S4 AND S13).

a. Inspect switch for clogged pressure port.

Note

Determine the manufactures part number and inspect the switch in accordance with the following step, (b or c) as applicable.

b. Switch (part number 7G198); using a source of controlled and monitored pressure and a test light connected across the 6.32 stud and case; slowly apply increasing pressure to the pressure port of the switch. At 36 psig the switch should actuate to open, extinguishing the test light. On decreasing pressure the switch should close at 30 plus or minus 2 psig and illuminate the test lamp.

c. Switch (part number 7G199); using a source of controlled and monitored pressure and a test light connected across the 6.32 stud and case, slowly apply increasing pressure to the pressure port of the switch. Upon reading 80 plus or minus 3 psig the switch should close illuminating the test light. On decreasing pressure the switch should open by 70 psig and extinguish the test lamp.

Note

The switch is pre-set at the factory, no adjustment is provided. Should the switch fail to operate at this prescribed range replacement of the switch is necessary.

12-180. INSTALLATION - TRANSMISSION OIL PRESSURE SWITCH. (Refer to Chapter 7.)

12-181. ENGINE TRANSMISSION AND TAIL ROTOR GEARBOX CHIP DETECTORS.

12-182. Chip detectors (E3 and E6) installed on the engine provide an indication of the presence of metal particles in the engine lubrication system on the ENG CHIP DET caution panel segment. The transmission is equipped with chip detectors (E5) and (E7) and provide illumination of XMSN CHIP DET caution panel segment. The tail rotor gearbox is equipped with chip detector (E4) and provides illumination of T/R CHIP DET caution panel segment. The lights are illuminated when metal particles are present in sufficient quantity on the magnetic pole of the detector element to bridge the element. (See figure 12-1.)

12-183. REMOVAL - CHIP DETECTORS. (Refer to Chapter 5 or 7 as applicable.)

12-184. CLEANING - CHIP DETECTORS. Clean detector with dry cleaning solvent (item 300, table 1-1).

12-185. INSPECTION - CHIP DETECTORS.

a. Inspect detector for stripped or damaged threads or bayonet pins.

b. Check for accumulation of metal particles on magnet. Presence of metal may indicate need for further investigation and corrective action.

Note

Refer to Chapters 5 and 7 for additional information.

c. Inspect seals for damage or distortion.

12-186. REPAIR OR REPLACEMENT - CHIP DETECTORS. Remove packing. Replace detector if threads or bayonet pins are damaged.

12-187. INSTALLATION - CHIP DETECTORS. (Refer to Chapter 5 or 7 as applicable.)

12-188. HYDRAULIC PRESSURE SWITCH.

12-189. The hydraulic pressure switch (S67), located on the workdeck right side of transmission adjacent to the filter, is a pressure operated switch that actuates upon low hydraulic pressure to illuminate HYD PRESS module of the caution panel. (See figure 12-1.)

Note

For additional description and maintenance (refer to Chapter 6).

12-190. DC GENERATOR FAIL RELAY.

12-191. A relay (K11) located on the equipment shelf in the baggage compartment, is actuated from pin H of voltage regulator (VR1) to illuminate DC GEN segment of the caution panel in the event of a generator failure.

12-192. REMOVAL - DC GENERATOR FAIL RELAY. (Refer to paragraph 12-14.)

12-193. INSPECTION, REPAIR OR REPLACEMENT - DC GENERATOR FAIL RELAY. (Refer to paragraphs 12-15 and 12-16.)

12-194. INSTALLATION - DC GENERATOR FAIL RELAY. (Refer to paragraph 12-17.)

12-195. SENSOR - RPM.

12-196. The RPM sensor (S18), located on equipment shelf right side, just aft of the engine out audio generator, receives and interprets output signal from the nI tachometer generator. Should the gas producer speed fall below 52 plus or minus 3 percent, the sensor serves to complete circuits to the engine out audio generator and engine out warning light simultaneously to alert pilot of engine failure. An engine OUT warning switch (S70) enables pilot to prevent audio warning in the headset while helicopter is in a non-flight status.

12-197. REMOVAL - SENSOR RPM.

a. Check that all electrical power is OFF.

b. Disconnect electrical connector and cover plug and receptacle for protection (cap or electrical tape).

c. Remove mounting screws and washers and lift sensor from equipment shelf.

12-198. INSPECTION, REPAIR OR REPLACEMENT - SENSOR - RPM.

a. Visually inspect sensor case for dents or physical damage that could impair normal efficient operation of the unit.

b. Inspect sensor receptacle for bent or broken contacts pins, cracked insert, or damage to connector threads.

c. Replace item if it fails to meet inspection requirements.

12-199. INSTALLATION SENSOR - RPM.

a. Position sensor on equipment shelf and install mounting screws and washers.

b. Remove covers from sensor plug and receptable. Engage and secure connectors.

c. Restore power to helicopter.

SECTION III AUXILIARY POWER SYSTEM

(Not Applicable)

SECTION IV ALTERNATING CURRENT POWER DISTRIBUTION

12-200. ALTERNATING CURRENT SYSTEM.

12-201. Alternating current is supplied to the 115 vac bus in the overhead console by a static inverter. The system includes the inverter (PS1), inverter switch (S82), inverter fail relay (K10), and serves to supply operating power for the gyro compass and attitude gyro.

12-202. INVERTER.

12-203. The 65 volt ampere 115 vac 400 Hz static inverter (PS1) is located on equipment shelf in baggage compartment. (See figure 12-1.)

12-204. TROUBLESHOOTING INVERTER CIRCUITRY. (See figure 13-4.)

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
Inverter (PS1) fails to operate	Open circuit breaker	Reset circuit breaker
	Faulty wiring or connections in switch (S82) or power circuits	Check continuity or wiring. Repair wiring and tighten connections
	Poor bonding to ground	Clean and tighten connections
	Defective inverter	Replace inverter
Improper inverter output voltage or frequency	Low input voltage	Check for proper input voltage to inverter; correct low primary voltage condition

12-205. OPERATIONAL CHECK - INVERTER CIRCUITRY. Open all circuit breakers and energize external power source.

a. Close GEN AND BUS RESET, INVERTER and CAUTION LIGHT circuit breakers. Place NON-ESS switch (S81) to MAN. Close all AC circuit breakers (AC FAIL, ATT., GYRO, and GYRO CMPS). Check that INST INV caution light is illuminated.

b. Position inverter switch (S82) to ON. Check that inverter is energized and that INST INV caution light is extinguished.

c. Check that voltage on the AC bus is 115 plus or minus 3 vac when all AC loads are energized and the non-essential bus voltage is 28 plus or minus 0.5 vdc.

d. Place inverter switch to OFF. Check that voltage on the AC bus decreases to zero and that inverter becomes de-energized.

12-206. REMOVAL - INVERTER.

a. Place battery switch to OFF. Remove external power.

b. Gain access to inverter through baggage compartment door.

c. Disengage connector and protect with cap.

d. Remove attaching hardware.

e. Lift inverter from compartment.

12-207. INSPECTION - INVERTER. Inspect inverter for cracked or damaged case, proper bonding and security of mounting, broken connector pins or cracked connector inserts and proper operation.

12-208. REPAIR, OR REPLACEMENT - INVERTER. Replace item if inspection requirements are not met.

12-209. INSTALLATION - INVERTER.

a. Position inverter.

b. Remove protective cap from connector and engage with inverter.

c. Install attaching hardware and secure same.

SECTION V LIGHTING PROVISIONS

12-210. DESCRIPTION.

12-211. Lighting provisions include the equipment necessary for the illumination of instruments and switches; also interior and exterior lighting used for night operation of the helicopter. (See figure 12-1.)

12-212. INTERIOR LIGHTS SYSTEM.

12-213. The interior light system consists of internal lighting of the instruments, panel edge lights, dimming rheostats (R7) and (R25), one transistorized dimming element (Q1), lighting terminal boards (TB6) and (TB25), one cockpit light, signal light receptacle (J169), and associated wiring as shown in figure 13-13.

12-214. TROUBLESHOOTING - INTERIOR LIGHTS SYSTEM. (See figure 13-13.)

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
Any light fails to burn when circuit is energized	Open lamp filament	Replace lamp
	Light improperly bonded to structure	Bond as necessary to provide good electrical connection
Circuit breaker trips	Shorted wiring	Replace as necessary
Instrument or console lights fail to brighten as INST LT or CONSOLE LTS knob is rotated clockwise	Faulty rheostat	Replace rheostat
	Defective transsistor dimmer element (Q1).	Replace dimmer element

12-215. OPERATIONAL CHECK - INTERIOR LIGHTING SYSTEM.

a. Instrument Lights. Rotate instrument light control (R7) and console lights control (R25) to their counterclockwise extremes.

(1) Close CONSOLE LTS circuit breaker. Rotate instrument lights control clockwise until switch closes. Check that instrument lights illuminate dimly.

(2) Continue clockwise rotation of the instrument lights control. Check that the instrument lights increase in brightness as the control is rotated clockwise.

(3) Rotate the instrument lights control counterclockwise. Check that the instrument lights decrease in brightness as the control is rotated counterclockwise and extinguish when control reaches counterclockwise extreme.

b. Console Lights.

(1) Rotate console lights control (R25) clockwise until the switch closes. Check that console lights (including all avionic equipment lights) and control panel lights illuminate dimly.

(2) Continue clockwise rotation of the console lights control. Check that the lights which are illuminated in step (1), increase in brightness as the control is rotated clockwise.

(3) Rotate console lights control counterclockwise. Check that the lights which were illuminated in step (1) decrease in brightness as control is rotated counterclockwise and extinguish when control reaches counterclockwise extreme.

c. Cockpit Light.

(1) Place NON-ESS bus switch to MAN. Close COCKPIT LT and GEN and BUS RESET circuit breakers. Check that the cockpit light is operational in each mode (ON/OFF, DIM/BRIGHT, and SPOT/FLOOD on both red and white).

(2) Check that the cockpit light is left in the OFF position.

d. Signal Light Receptacle. Close SIGNAL LT circuit breaker. Check that 28 vdc is available at the signal light receptacle.

12-216. COCKPIT LIGHT.

12-217. This light has an ON-OFF switch and rheostat incorporated into the lamp body.

12-218. REMOVAL - COCKPIT LIGHT.

a. Check that all electrical power is OFF.

b. Disconnect light wire from (TB5) and cover terminal for protection.

c. Disconnect ground lead from ground stud and remove cable from grommet.

d. Remove mounting nuts, washers, screws, and spacer holding light base.

12-219. INSTALLATION - COCKPIT LIGHT.

a. Place light and spacer in position and install screws, washers and nuts.

b. Connect light by inserting cable through grommet, install and secure ground lead. Check for proper bonding to airframe structure.

c. Remove protective cover and connect light wire to (TB5).

12-220. EXTERIOR LIGHTS SYSTEM.

12-221. The exterior lights system consist of: two landing lights (DS7 and DS8), two landing light relays (K8 and K9), one landing light switch (S49), located in the pilot's collective stick switch box; two position lights (DS2 and DS3), located one each on the right and left tip of the horizontal stabilizer; position lights switch (S68), position lights dimming resistor (R33), one anti-collision light flasher (Z10), one upper anti-collision light (DS1), one lower anti-collision light (DS5), and one tail light located on the aft tip of the tail boom fairing. All lighting circuits are energized from the 28 volt bus and protected by circuit breakers located in the overhead console. (See figures 12-1 and 13-14.)

12-222. TROUBLESHOOTING - EXTERIOR LIGHTS SYSTEM. (See figure 13-14.)

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
Landing light fails to operate when landing light switch is closed	Faulty circuit breaker	Check and replace breaker
	Faulty landing light switch (S49)	Replace switch
	Lamp filament open	Replace lamp
Anti-collision light burns constantly	Defective flasher unit (Z10)	Replace flasher unit
Position lights fail to illuminate when position light switch (S68) is placed to BRT	Faulty circuit breaker	Replace breaker
	Faulty switch	Replace switch
	Lamp filament open (one light fails to burn)	Replace lamp
	Defective wiring	Repair wiring
Position lights fail to dim, or fail to burn on dim position	Defective dimming resistor (R33)	Replace resistor

12-223. OPERATIONAL CHECK - EXTERIOR LIGHTING SYSTEM.

a. Position Lights. Place POS LTS switch to OFF. Place NON-ESS BUS switch to MAN. Close POS LTS and GEN and BUS RESET circuit breakers.

(1) Place POS LTS switch (S68) to DIM. Check that right-hand and left-hand position lights and the tail light are dimly illuminated.

(2) Place the POS LTS switch to BRT. Check that both side position lights and the tail light are brightly illuminated.

(3) Place POS LTS switch to OFF. Check that the side position lights and the tail light are extinguished.

b. Anti-collision Lights. Place ANTI-COLL LTS switch to OFF. Close ANTI-COLL LTS circuit breaker.

(1) Place ANTI-COLL LTS switch to ON. Check that the two anti-collision lights illuminate and flash at a rate of 90 plus or minus 10 flashes per minute.

(2) Place ANTI-COLL LTS switch to OFF. Check that the anti-collision lights are extinguished.

c. Landing Lights. Place LDG LTS switch on pilot's collective stick to OFF. Close LDG LTS circuit breaker.

(1) Place LDG LTS switch to FWD position. Check that forward landing light illuminates.

(2) Place LDG LTS switch to BOTH. Check that both landing lights illuminate.

(3) Place LDG LTS switch to OFF. Check that both landing lights extinguish.

12-224. LANDING LIGHTS.

12-225. Two landing lights (DS7-DOWN, DS8-FWD) located in the lower center section of the nose are positioned to provide illumination both forward and downward from the helicopter.

12-226. REMOVAL - LANDING LIGHTS.

a. Check that all electrical power is off.

b. Open or remove light access window.

c. Remove nuts, spacers, washers and bolts attaching landing lights.

d. Disconnect electrical wiring from landing lights and cover wire ends with tape. Remove lights.

12-227. CLEANING - LANDING LIGHTS. Wipe exterior of light with a soft, clean, lint-free cloth.

12-228. INSPECTION, REPAIR OR REPLACEMENT - LANDING LIGHTS. Check light for defective or broken sealed beam unit, loose connections, and damaged or defective components parts. Replace as necessary.

12-229. INSTALLATION - LANDING LIGHTS.

a. Remove tape from wire ends and connect electrical wiring to landing lights.

b. Position light on mounting bracket and install attaching bolts, washers, spacers and nuts.

c. Install or close light access window.

12-230. LANDING LIGHT RELAYS.

12-231. Two relays (K8) and (K9) located in the nose compartment, control illumination of landing lights and are actuated by landing light switch (S49).

12-232. REMOVAL - LANDING LIGHT RELAY.

a. Check that all electrical power is OFF.

b. Disconnect all electrical wiring from the relay, and cover wire ends with tape.

c. Remove screws and washers attaching relay and remove relay.

12-233. INSPECTION, REPAIR OR REPLACEMENT - LANDING LIGHT RELAY. (Refer to paragraphs 12-15 and 12-16.)

12-234. INSTALLATION - LANDING LIGHT RELAY.

a. Position landing light relay and install attaching washers and screws.

b. Remove tape from wire ends and connect all electrical wiring.

12-235. ANTI-COLLISION LIGHTS FLASHER (Z10).

12-236. REMOVAL - ANTI-COLLISION LIGHTS FLASHER.

a. Check that all electrical power is off.

b. Disconnect electrical wires (permanent splices) and tape wire ends.

c. Disconnect ground terminal.

d. Remove attaching screws and washers and remove unit.

12-237. INSPECTION, REPAIR OR REPLACEMENT - ANTI-COLLISION LIGHTS FLASHER. Inspect flasher case for dents or damage that would impair normal operation of the unit. Check connections for proper security. Replace unit as necessary.

12-238. INSTALLATION - ANTI-COLLISION LIGHTS FLASHER.

a. Position flasher unit, install and tighten attachment screws and washers.

b. Remove tape and connect electrical wiring as indicated in figure 13-14.

12-239. ANTI-COLLISION LIGHTS (DS1-UPPER DS5-LOWER).

12-240. REMOVAL - ANTI-COLLISION LIGHT.

a. Check that all electrical power is OFF.

b. Remove mounting screws and lift lamp assembly to gain access to wiring.

c. Disconnect electrical leads and cap ends with tape.

d. Remove light base from helicopter.

12-241. INSPECTION, REPAIR OR REPLACEMENT - ANTI-COLLISION LIGHT. Inspect light for broken cover, lens or open lamp filament, damaged case or lamp socket.

Note

When replacing the bulb in the anti-collision light, take care to avoid touching the glass portion of the bulb with bare fingers. Oil from fingers will shorten life of bulb.

12-242. INSTALLATION - ANTI-COLLISION LIGHT.

a. Remove tape from wire and connect to lamp terminals.

b. Position lamp assembly on fairing and install mounting hardware.

12-243. POSITION LIGHTS (DS2-LH AND DS3-RH).

Note

Position light lens or lamps may be replaced by simply removing one light fairing attachment screw and removing lens or lamp as necessary.

12-244. REMOVAL - POSITION LIGHTS.

a. Check that electrical power is OFF.

b. To remove left or right position lights, remove three attaching screws and remove light from mounting. Back off coupling nut and disconnect electrical wiring from light. Cover wire ends with tape.

12-245. INSPECTION, REPAIR OR REPLACEMENT - POSITION LIGHTS. Inspect lights for corroded lamp socket terminals, shorted or broken wires, cracked lens, burned out lamp bulbs, or improper bonding of light case to airframe. Replace faulty or damaged components parts (lens, lamp bulbs, etc.). If light case is damaged beyond repair complete unit must be replaced.

12-246. INSTALLATION - POSITION LIGHTS. Remove tape from left or right position light wire ends. Thread wires through coupling nut and connect to light. Tighten coupling nut; position light and install three attaching screws.

12-247. TAIL LIGHT (DS4).

12-248. REMOVAL - TAIL LIGHT.

a. Check that all electrical power is OFF.

b. Remove two attaching screws and remove light from shock mounting.

c. Disconnect coupling nut attaching wiring insert to light and cover insert end with tape.

12-249. INSPECTION, REPAIR OR REPLACEMENT - TAIL LIGHT. (Refer to paragraph 12-245, procedure is the same.)

12-250. INSTALLATION - TAIL LIGHT.

a. Remove tape from wiring insert. Place insert in position and tighten coupling nut.

b. Position light on shock mount, install and tighten attaching screws.

SECTION VI MISCELLANEOUS EQUIPMENT

12-251. DESCRIPTION.

12-252. Miscellaneous equipment covered in this section includes the De-fogging Blower System, Bleed Air Heater System, Pitot Heater System, Auxiliary Power Receptable, and Armament Electrical System.

12-253. DEFOGGING BLOWER SYSTEM.

12-254. This system provides air circulation directed on the left and right windshields to dissipate any condensation formation on the windshields, and consists of: right blower motor (B7), left blower motor (B8), wired in parallel and energized by the DEFOG and VENT switch breaker (CB5). The system is fed from the 28 vdc bus in the overhead console. (See figures 12-1 and 13-10.)

12-255. TROUBLESHOOTING - DEFOGGING BLOWER SYSTEM. (See figure 13-10.)

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
Blowers fail to operate when DEFOG and VENT switch breaker is placed to ON	Defective switch, faulty wiring or loose connections	Replace switch, repair wiring or tighten connections
	Defective blower	Replace blower
Switch breaker trips	Shorted wiring	Repair wiring
	Overloaded blower motor	Check blower fans for freedom of operation
	Shorted blower motor	Replace motor

12-256. OPERATIONAL CHECK - DEFOGGING BLOWERS.

a. Close GEN and BUS RESET circuit breaker, place NON-ESS BUS switch to MAN. Place DEFOG and VENT switch breaker to ON. Check that both defogging blowers operate.

b. Place DEFOG and VENT switch breaker to OFF. Check that both defogging blowers stop operating.

12-257. DEFOGGING BLOWER MOTORS (B7 AND B8).

12-258. For description and maintenance refer to Chapter 11.

12-259. BLEED AIR HEATER SYSTEM.

12-260. The electrical portion of the bleed air heater system consists of heater solenoid (L2), heater relay (K15), heater overheat switch (S90), and associated wiring. The system is energized from and protected by a 5 ampere HEATER switch breaker located in the overhead console, which energizes heater solenoid (L2) through heater relay (K15). Should an overheat condition occur (S90) closes to actuate (K15) thus breaking circuit to (L2).

12-261. TROUBLESHOOTING - BLEED AIR HEATER SYSTEM. See figure 13-10 and use standard troubleshooting procedure to isolate trouble in simple circuits.

12-262. OPERATIONAL CHECK - BLEED AIR HEAT SYSTEM.

a. Close GEN and BUS RESET circuit breaker, place NON-ESS bus to MAN. Place HEATER switch breaker to ON. Check that heater solenoid (L2) actuates and cabin bleed-air inlet vent opens.

b. Temporarily jump terminal X1 of heater relay (K15) to ground simulating an overheat condition. Check that relay (K15) operates and removes power from heater solenoid (L2).

c. Remove temporary jumper from terminal X1 of relay (K15). Check that power is restored to (L2).

d. Place HEATER switch to OFF. Check that heater solenoid (L2) actuates and cabin bleed-air inlet vent closes.

Note

For additional information on bleed air heater refer to Chapter 11.

12-263. PITOT HEATER SYSTEM.

12-264. The pitot heating system consists of a pitot tube heater (HR1), located in the nose section. The pitot heating system is energized from and protected

by a 5 ampere PITOT HEATER switch breaker, located in the overhead console.

12-265. TROUBLESHOOTING - PITOT HEATER SYSTEM. See figure 13-10 and use standard troubleshooting procedure to isolate trouble in simple circuit.

12-266. OPERATIONAL CHECK - PITOT TUBE HEATER.

a. Place PITOT HTR switch breaker to ON. Check that pitot tube heater begins to heat.

Warning

Pitot tube heats rapidly. Use extreme care when check operation to avoid serious burns.

b. Place PITOT HTR switch breaker to OFF. Check that pitot heater stops heating.

12-267. REMOVAL - PITOT HEATER. (Refer to paragraph 10-24.)

12-268. INSTALLATION - PITOT HEATER. (Refer to paragraph 10-28.

12-269. AUXILIARY POWER RECEPTACLE.

12-270. The auxiliary power receptacle (J120) is mounted on a bulkhead aft and inboard of the pilot's seat and provides power take off of 28 vdc to operate miscellaneous auxiliary equipment. The circuit is powered from 28 vdc essential bus and protected by a 10 ampere AUX RECP switch breaker (CB5) in the overhead console. (See figure 12-1.)

12-271. TROUBLESHOOTING - AUXILIARY POWER RECEPTACLE. See figure 13-8 and use standard troubleshooting techniques (voltage and continuity checks) to isolate trouble.

12-272. OPERATIONAL CHECK - AUXILIARY POWER RECEPTACLE. Energize essential dc bus. Close AUX RECP switch breaker and check for 28 vdc between pins A and B of auxiliary power receptacle (J120).

12-273. REMOVAL - AUXILIARY POWER RECEPTACLE. (Refer to paragraph 12-14.)

12-274. INSPECTION, REPAIR OR REPLACEMENT - AUXILIARY POWER RECEPTACLE. (Refer to paragraphs 12-15 and 12-16.)

12-275. INSTALLATION - AUXILIARY POWER RECEPTACLE. (Refer to paragraph 12-17.)

12-276. ARMAMENT ELECTRICAL SYSTEM - AIRFRAME.

12-277. The armament airframe system includes the following:

One - Control panel located in instrument panel.

One - Firewall disconnect (gun) with dust cover.

One - Armament control panel disconnect (P301) located in upper portion of pedestal.

One - Terminal junction (TB4) located in right side of lower console.

Part of - Impedance pad network located forward of instrument panel in console.

Part of - Junction terminals (TB1) and (TB6) located in console adjacent to impedance pad network.

12-278. TROUBLESHOOTING - ARMAMENT AIRFRAME ELECTRICAL. (See figure 13-15.)

Warning

In the following troubleshooting chart items "1" through "25" are to be performed without ammunition present in the gun, delinking feeder, ammunition chutes, or container.

Note

The following steps are to be observed when troubleshooting the armament electrical system.

a. Gun operation (dry firing) shall be held to a minimum to avoid damaging firing pins. The gun safing sector must be installed to prevent gun jamming and damage to bolt assemblies.

b. AMMO LOW light will remain illuminated in items "5" through "25" without ammunition and no malfunctions in its circuitry.

c. Press Reset Button on control box to extinguish Gun Not Cleared light after items "13" through "15".

ITEM NO.	INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
1	ARMED, GUN NOT CLEAR, and AMMO LOW lights do not illuminate when PRESS TO TEST switch is pressed.	Defective PRESS TO TEST switch Defective wiring	Replace switch Repair wiring
2	Only the AMMO LOW light doesn't illuminate when PRESS TO TEST switch is pressed	Defective lamp - open filaments Defective diode- (CR24) or (CR603) Defective wiring	Replace lamp Replace diode Repair wiring
3	Only the ARMED light doesn't illuminate when PRESS TO TEST switch is pressed	Defective lamp - open filaments Defective wiring	Replace lamp Repair wiring
4	Only the GUN NOT CLEAR light doesn't illuminate when PRESS TO TEST switch is pressed	Defective lamp - open filaments Defective circuit breaker-ARM Defective diode - (CR602) Defective wiring	Replace lamp Replace circuit breaker Replace diode Repair wiring
5	The ARMED light illuminates with MASTER switch in FIRE TO CLEAR position and ARM/SAFE switch in SAFE position	Defective diode - (CR24) Defective ARM/SAFE switch Defective wiring	Replace diode Replace switch Repair wiring
6	ARMED light doesn't illuminate with MASTER switch in FIRE TO CLEAR position and ARM/SAFE switch in ARM position	Defective MASTER switch Defective ARM/SAFE switch Defective diode (CR604) Defective series resistor (R611) Defective wiring	Replace switch Replace switch Replace diode Replace resistor Replace wiring
7	With controls positioned as described in Item 6, ARMED light only illuminates when dimming switch is set for maximum brightness (closed)	Defective series resistor - (R611) Defective wiring	Replace resistor Replace wiring
8	With controls positioned as described in Item 6, ARMED light will not reach maximum brightness	Defective dimming switch - (S19) Defective dimming relay - (K602) Defective lamp - one filament open Defective wiring	Replace switch Replace relay Replace lamp Replace wiring
9	The AMMO LOW doesn't illuminate with ARM/SAFE switch in SAFE position and MASTER switch in FIRE TO CLEAR position	Defective AMMO LOW switch Defective diode-(CR601) or (CR23) Defective series resistor-(R609) Defective MASTER switch Defective wiring	Replace AMMO LOW switch Replace diode Replace resistor Replace MASTER switch Repair wiring
10	With Controls positioned as described in Item 9, AMMO LOW light only illuminates with dimming set for maximum brightness	Defective series resistor - (R609) Defective wiring	Replace resistor Repair wiring
11	With controls positioned as described in Item 9, AMMO LOW light will not reach maximum brightness	Defective dimming switch-(S19) Defective dimming relay - (K601) Defective lamp - one filament open Defective wiring	Replace dimming switch Replace dimming relay Replace lamp Repair wiring

ITEM NO.	INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
12	GUN NOT CLEAR light illuminates with MASTER switch in FIRE TO CLEAR position and ARM/SAFE switch in ARM position	Defective CONTROL BOX - LOGIC circuit Defective wiring	Replace CONTROL BOX Repair wiring
13	With controls positioned as described in Item 12, except the GUN NOT CLEAR light doesn't illuminate when PILOT or COPILOT TRIGGER is DEPRESSED	Defective series resistor - (R610) Defective control box - LOGIC circuit or Bust Control time delay relay (M2) Defective trigger - PILOTS or COPILOTS (S101 or (S109) Defective wiring	Replace resistor Replace control box Replace trigger Repair wiring
14	With conditions as described in Item 13, GUN NOT CLEARED light will not reach maximum brightness	Defective dimming switch - (S19) Defective dimming relay - (K601) Defective lamp - one filament open Defective wiring	Replace dimming switch Replace dimming relay Replace lamp Repair wiring
15	With MASTER switch in FIRE TO CLEAR position and ARM/SAFE switch in ARM position, gun will not rotate when trigger is depressed	Mechanically jammed Defective circuit breaker - ARM PWR Defective control box - (K1 or K2) Defective speed control unit - (CR2, SCR1, SCR2) Defective trigger - PILOTS or COPILOTS (S101 or 109) Defective wiring	Determine if Mechanically jammed Replace circuit breaker Replace control box Replace speed control unit Replace trigger Repair wiring
16	With controls positioned as described in Item 15, gun rotates at a slow rate but will not change to fast rate.	Defective speed control unit Defective wiring	Replace speed control unit Repair wiring
17	With controls positioned as described in Item 15, gun rotates for excessive length of time after trigger is released during fire to clear	Defective control box - clearing time relay (M1)	Replace control box
18	Gun elevation motor is inoperative for any setting of PILOTS or COPILOTS ELEVATE/DEPRESS switches	Defective elevation motor Defective wiring	Replace motor Repair wiring
19	Gun elevation motor operates with ELEVATE/DEPRESS switches in UP position only	Defective DEPRESS Relay - (K2) Defective elevation motor Defective wiring	Replace depress relay Replace motor Repair wiring
20	Gun elevation motor operates with ELEVATE/DEPRESS switches in DOWN position only	Defective ELEVATE relay - (K3) Defective ELEVATION motor Defective wiring	Replace depress relay Replace elevation motor Repair wiring
21	Gun elevation motor operates through Pilots ELEVATE/DEPRESS switch only	Defective COPILOTS ELEVATE/DEPRESS switch Defective wiring	Replace switch Repair wiring
22	Gun elevation motor operates through COPILOTS ELEVATE/DEPRESS switch only	Defective PILOTS ELEVATE/DEPRESS switch Defective wiring	Replace switch Replace wiring

ITEM NO.	INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
23	Gun sight light doesn't illuminate with MASTER switch in FIRE TO CLEAR position and for any position of filament selector switch	Defective INTENSITY CONTROL	Replace INTENSITY CONTROL
		Defective FILAMENT SELECTOR switch	Replace switch
		Defective lamp - open filaments	Replace lamp
		Defective wiring	Repair wiring
24	Gun sight light will not reach maximum intensity	Defective INTENSITY CONTROL	Replace intensity control
		Defective wiring	Repair wiring
25	Gun sight only illuminates with filament selector in one position	Defective lamp - one filament open	Replace lamp

Warning

The following troubleshooting steps, items "26" and "27" require the use of live ammunition. Take adequate precautionary measures according to army regulations before performing these steps.

26	Gun doesn't fire (ejects live ammunition)	Defective GUN FEED SOLENOID	Replace solenoid
		Defective CONTROL BOX	Replace CONTROL BOX
		Defective TRIGGER - PILOTS and COPILOTS	Replace TRIGGER
		Defective wiring	Repair wiring
27	GUN NOT CLEAR light remains illuminated after firing to clear	Gun not clear - less than seven live rounds ejected	Clear gun - Refer to unloading and clearing procedure (TM 55-1520-228-10). Press reset button on control box to extinguish GUN NOT CLEAR light.
		Defective GUN CLEAR SENSOR	Replace gun clear sensor unit
		Defective wiring	Repair wiring

12-279. OPERATION CHECK - ARMAMENT CONTROL CIRCUITRY. Open ARMT PWR and ARMT circuit breakers. Place ARM/SAFE switch to SAFE and MASTER switch to OFF. Place instrument lights control and console lights control to their OFF positions. Energize the essential DC bus.

Warning

Before performing the following operation checks (steps a. through u.) the armament turret must be disconnected. Make certain that connector (P300) is disconnected from bulkhead connector (J300) before proceeding to step a.

a. Close ARMT PWR circuit breaker. Check that 28 vdc is present at pin A of turret connector (J300). Open ARMT PWR circuit breaker.

b. Close ARMT circuit breaker. Check that 28 vdc is present at pin M of turret connector.

c. Depress the armament press-to-test switch (S86). Check that GUN NOT CLEARED light, ARMED light, and AMMO LOW light all illuminate dimly and remain illuminated until the press-to-test switch is released.

d. Rotate instrument lights control slightly clockwise from OFF. Depress armament press-to-test switch. Check that the three lights listed in step c. are brightly illuminated.

e. Hold the press-to-test switch in depressed position. Rotate instrument lights control to its clockwise extreme. Check that the three lights listed in step c. do not change in brightness.

f. Still holding the press-to-test switch in the depressed position, rotate the instrument lights control to its counterclockwise extreme. Check that the three lights listed in step c. do not change in brightness until the instrument lights control reaches its OFF position, at which time they become dimly illuminated. Release the press-to-test switch.

g. Close CONSOLE LTS circuit breaker. Rotate console lights control (R25) slightly in a clockwise direction until the switch closes. Check that armament control panel edge lights are dimly illuminated.

h. Continue clockwise rotation of the console lights control. Check that armament control panel edge lights increase in brightness with clockwise rotation of the control and are brightest at clockwise extreme.

i. Rotate console lights control in a counterclockwise direction. Check that armament control panel edge lights decrease in brightness as control is rotated counterclockwise and are extinguished as control is rotated to its OFF position.

j. Rotate instrument lights control slightly in a clockwise direction. Connect a temporary short circuit between pin E of turret connector (J300) and aircraft structure. Check that GUN NOT CLEARED light illuminates brightly.

k. Remove temporary short circuit from pin E of the turret connector and connect it between pin D and aircraft structure. Place MASTER switch to FIRE TO CLEAR position. Check that the AMMO LOW light illuminates brightly.

l. Place MASTER switch to FIRE NORM position. Check that AMMO LOW light remains illuminated.

m. Remove the temporary short circuit installed in step k., Check that the AMMO LOW light is extinguished.

n. Connect a temporary short circuit between pins C and L on the turret connector (J300). Place ARM/SAFE switch to ARM. Check that ARMED light is illuminated.

o. Depress trigger switch on pilot's cyclic stick. Check that 28 vdc is present on pin K of turret connector (J300) while the switch is depressed.

p. Repeat step o. except depress the trigger switch on copilot's cyclic stick.

q. Place MASTER switch to FIRE TO CLEAR. Check that ARMED light remains illuminated and both pilot's and copilot's trigger switches have the same effect as described in steps o., and p.

r. Place ARM/SAFE switch to SAFE. Check that ARMED light is extinguished and the pilot's and copilot's trigger switch have no effect. Remove the temporary short circuit installed in step n.

s. Place ELEVATOR/DEPRESS switch on pilot's cyclic stick to UP. Check that 28 vdc is present on pin P of the turret connector (J300) while switch is held in UP.

t. Place pilot's ELEVATOR/DEPRESS switch to DOWN. Check that 28 vdc is present on pin R of the turret connector (J300) while the switch is held to DOWN.

u. Repeat steps s., and t., using the copilot's ELEVATE/DEPRESS switch.

CHAPTER 13

WIRING DIAGRAMS

SECTION I GENERAL

13-1. SCOPE.

13-2. This chapter contains wiring diagrams and essential wiring information for the electrical systems and circuits in the OH-58A helicopter to assist maintenance personnel in understanding the circuits and components installed in the helicopter and in troubleshooting and tracing of inoperative and malfunctioning circuits.

13-3. WIRING DATA.

13-4. All wiring is adequately shielded and wires are marked with identification letters and numbers.

a. Wire Identification. Identification of each wire is accomplished by a combination of letters and numbers. (See figure 13-1.)

b. Abbreviations. Abreviations used are in accordance with MIL-STD-12 except when the abbreviation depicts a marking actually found in the aircraft.

c. Symbols. Diagram components symbols are drawn in accordance with MIL-STD-15-1. (See figure 13-2.)

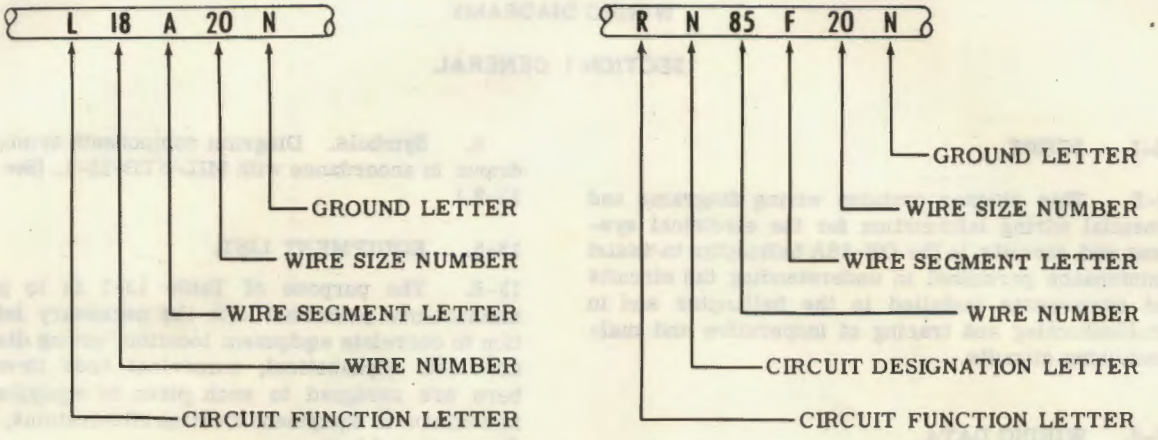
13-5. EQUIPMENT LIST.

13-6. The purpose of Table 13-1 is to provide maintenance personnel with the necessary information to correlate equipment location, wiring diagrams and text. Alphabetical, numerical code item numbers are assigned to each piece of equipment and is common in equipment location illustrations, wiring diagrams and text.

13-7. CONNECTOR REPLACEMENT CHART.

13-8. The purpose of Table 13-2 is to provide maintenance personnel with necessary information to replace (resolder or crimp) a damaged electrical connector. The chart contains the connector code item number, the connector pin letters or numbers, and the wire number that installs in each respective pin. Only those connectors that are not shown in their entirety in one of the system diagrams are presented in table 13-2.

WIRING IDENTIFICATION CODE



CIRCUIT FUNCTIONS

CODE	NOMENCLATURE
A	ARMAMENT
C	CONTROL SURFACES
D	INSTRUMENTS (OTHER THAN FLIGHT OR ENGINE)
E	ENGINE INSTRUMENTS
F	FLIGHT INSTRUMENTS
H	HEATING, VENTILATING AND DE-ICING
J	IGNITION
K	ENGINE CONTROL
L	LIGHTING
M	MISCELLANEOUS ELECTRIC
N	GROUND
P	DC POWER
Q	FUEL AND OIL
R	RADIO (NAVIGATION AND COMMUNICATION)
RC	COMMAND
RF	VHF LIAISON
RL	LIAISON
RM	MARKER BEACON
RN	NAVIGATION
RU	UHF COMMAND
RV	VHF COMMAND
RZ	INTERPHONE AND HEADPHONE
S	RADAR
SX	RECOGNITION (IFF)
TN	TRACKING NAVIGATION
V	DC POWER AND DC CONTROL CABLES FOR AC SYSTEM
W	WARNING AND EMERGENCY
X	AC POWER

AV 053211

Figure 13-1. Wiring identification code

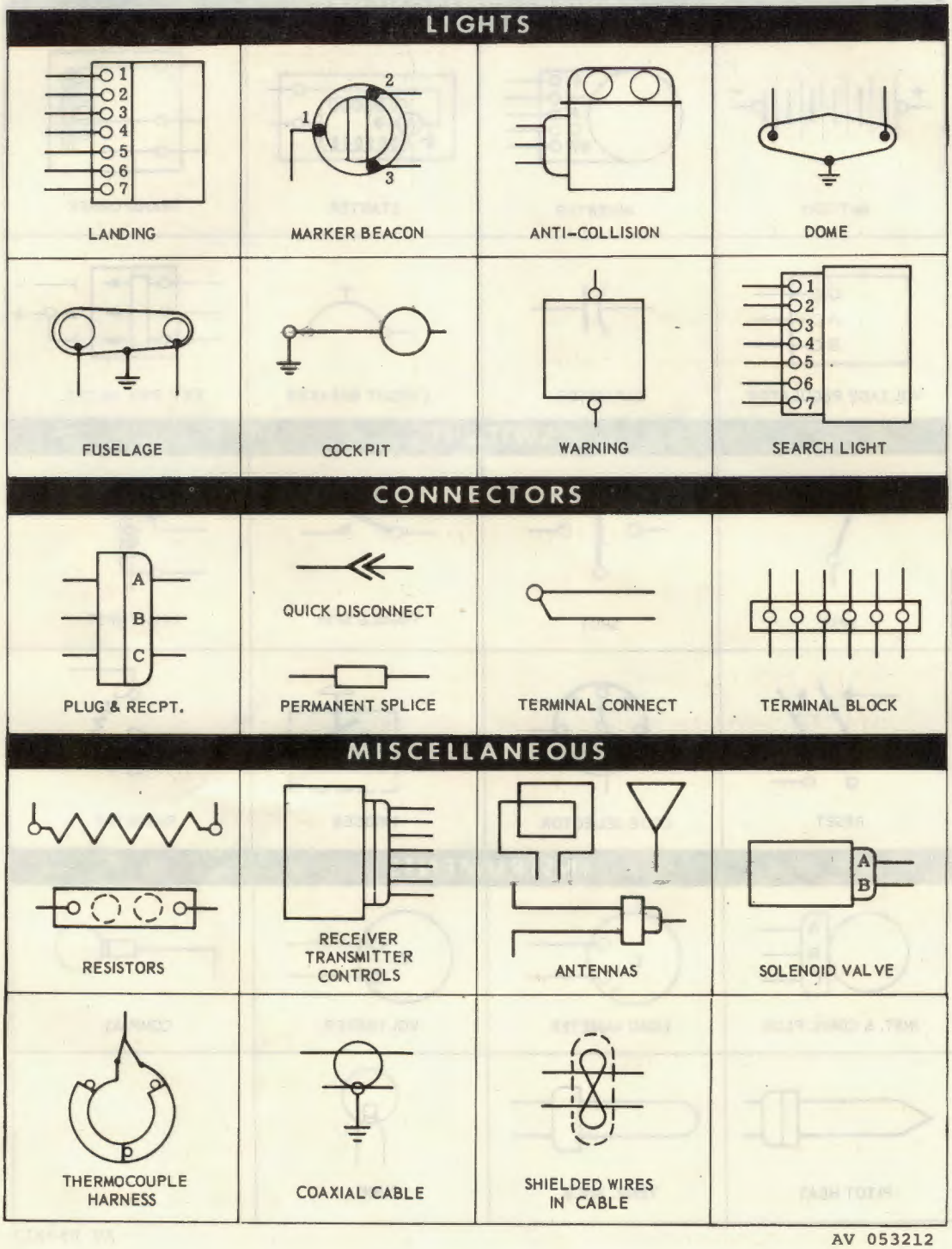


Figure 13-2. Electrical symbol chart (Seet 1 of 2)

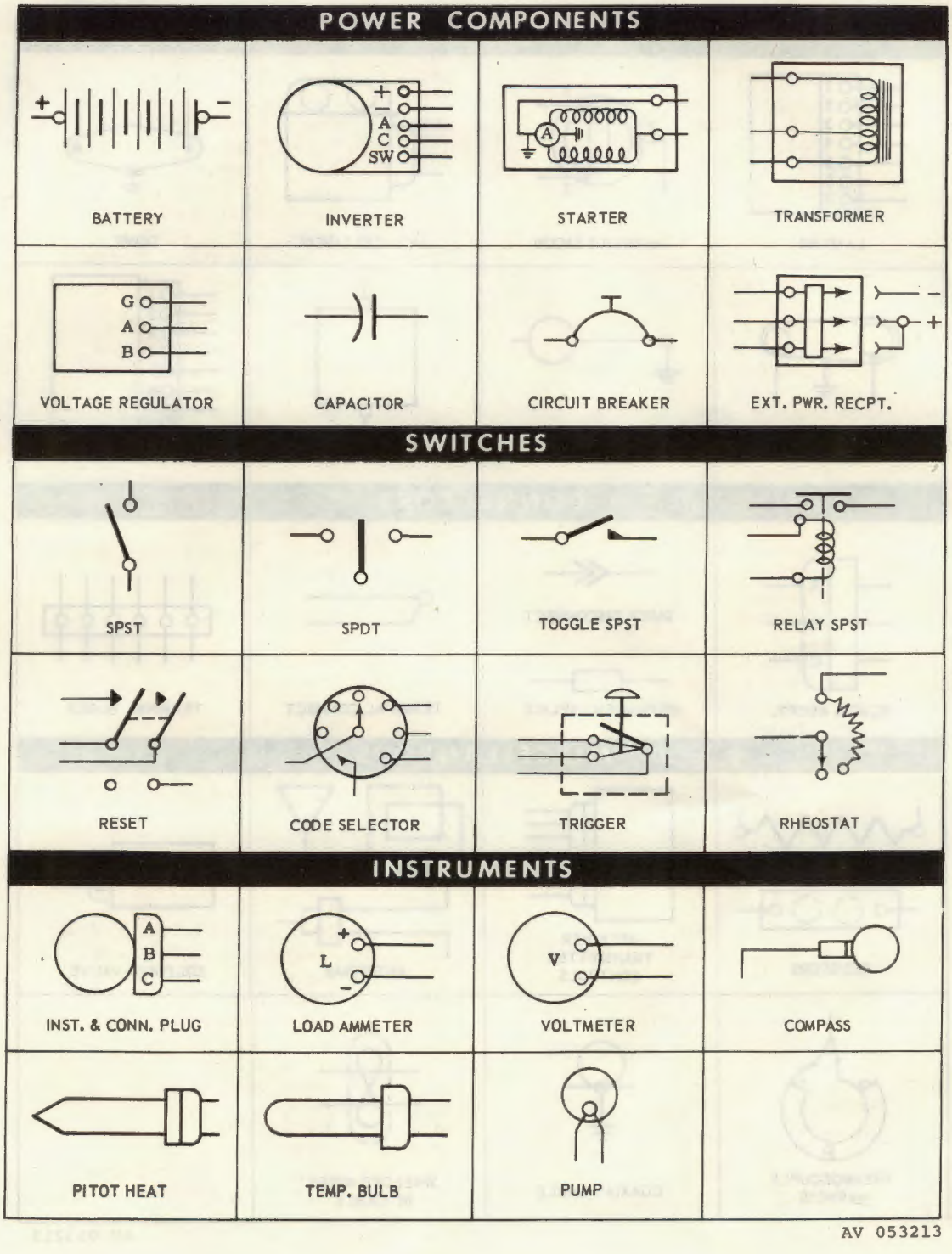


Figure 13-2. Electrical symbol chart (Sheet 2 of 2)

TABLE 13-1. EQUIPMENT LIST

ITEM	DESCRIPTION	ITEM	DESCRIPTION
A1	Panel - Caution	J29	Recep. Pitot Tube Heater
A2	Impedance Pad	J30	Recep. Hyd. Bypass Solenoid
B1	Fuel Pump	J31	Recep. Audio Warning Disc
B3	Gov. Cont. Actuator	J32	Recep. Caution Panel
B4	Eng. De-Ice Cont	J33	Recep. Edge Lt. Panel Cont Boost
B7	Defog Blower R.H.	J34	Recep. Edge Lt Panel
B8	Defog Blower L.H.	J38	Recep. RPM Sensor
BT1	Battery	J39	Recep. Att. Gyro
CB1	Circuit Breaker (7 Amp)	J105	Recep. Turn & Slip Ind.
CB3	Circuit Breaker (10 Amp)	J114	Recep. Hyd. Press. Switch
CB4	Circuit Breaker (20 Amp)	J115	Recep. Standby Compass
CB5	Circuit Breaker (5 Amp)	J119	Recep. Battery
CB6	Circuit Breaker (1/2 Amp)	J120	Recep. Aux. Pwer.
CB7	Circuit Breaker (5 Amp)	J121	Recep. Force Trim Brake
CB8	Circuit Breaker (15 Amp)	J122	Recep. Force Trim Brake
CB9	Circuit Breaker (50 Amp)	J123	Recep. Heater Solenoid
CB10	Circuit Breaker (10 Amp)	J126	Recep. Engine Chip Det
CB11	Circuit Breaker (10 Amp)	J168	Recep. Upper Fuel Tank Unit
CR7	Diode, Ext. Pwr Rel	J169	Recep. Signal Lit. Recep.
DS1	Light, Anti-Coll Lt. Upper	J171	Recep. Voltage Regulator
DS2	Light, Position Lt. L.H.	J172	Recep. Fuel Press Switch
DS3	Light, Position Lt. R.H.	J173	Recep. Inverter
DS4	Light, Position Lt. Tail	J216	Recep. Copilot's Cyclic Stick
DS5	Light, Anti-Coll Lt. Lower	J600	Recep. Imp Pad
DS6	Light, Cockpit	K1	Relay, Ext Pwr
DS7	Light, Landing	K2	Relay, Non-Ess
DS8	Light, Landing	K3	Relay, Starter
DS12	Light, XMSN Oil Hot	K4	Relay, Eng Oil Bypass
DS13	Light, XMSN Oil Press	K6	Relay, Battery
DS14	Light, Eng. Out Warning	K8	Relay, Ldg Light Fwd
DS15	Light, Master Caution	K9	Relay, Ldg Light
DS16	Light, Standby Compass	K10	Relay, Inverter Fail
DS17	Light, Audio Warning	K11	Relay, Gen Fail
E3	Chip Det. Engine Upper	K12	Relay, Line Control
E4	Chip Det. Tail Rotor	K15	Relay, Heater
E5	Chip Det. XMSN	L1	Hyd Bypass Solenoid
E6	Chip Det. Engine Lower	L2	Heater Solenoid
E7	Chip Det. XMSN	L4	Force Trim - Fore & Aft
G1	Starter-Generator	L5	Force Trim - Lateral
G2	Rotor Tach. Generator	M1	Meter, Rotor & Turbine RPM
G3	Power Turbine Tach. Generator	M2	Meter, Turb. Outlet Temp.
G4	Gas Prod. Tach. Generator	M3	Meter, Gas Prod. Tach
HR1	Pitot Tube Heater	M4	Meter, Inst. Cluster
J1	Recep. Pwr Turbine Tach.	M7	Meter, Altimeter
J2	Recep. Rotor & Turbine RPM	M8	Meter, Airspeed
J3	Recep. Gas Prod. Tach.	M9	Meter, Torque
J4	Recep. Inst. Cluster	M10	Meter, Attitude Gyro
J6	Recep. Rotor Tach. Gen.	M11	Meter, Dir. Gyro
J7	Recep. Turb. Tach.	M13	Meter, Clock
J9	Recep. XMSN	M14	Meter, Turn & Slip
J10	Recep. Gas Prod. Tach	P1	Plug, Pwr Turbine Tach Ind
J11	Recep. Eng. Oil Temp. Bulb	P2	Plug, Rotor & Turbine RPM
J12	Recep. Engine	P3	Plug, Gas Producer
J13	Recep. Starter-Generator	P4	Plug, Inst. Cluster
J16	Recep. Ext. Pwr. Recep.	P6	Plug, Rotor Tach Gen
J23	Recep. Fuel Filter Press	P7	Plug, Pwr Turb Tach
J24	Recep. Tailboom Disc	P9	Plug, XMSN

TABLE 13-1. EQUIPMENT LIST (CONT)

ITEM	DESCRIPTION	ITEM	DESCRIPTION
P10	Plug, Gas Prod Tach	S3	Switch, XMSN Oil Temp
P11	Plug, Eng Oil Temp Bulb	S4	Switch, XMSN Oil Press
P12	Plug, Engine	S5	Switch, Gov RPM
P13	Plug, Starter-Generator	S6	Switch, Starter
P16	Plug, Ext Pwr	S7	Switch, Cont Boost
P23	Plug, Fuel Filter Press Switch	S8	Switch, Eng De-Ice
P24	Plug, Tailboom Disc	S10	Switch, Fuel Filter
P29	Plug, Pitot Tube Heater	S12	Switch, Fuel Press
P30	Plug, Hyd Bypass Solenoid	S13	Switch, XMSN Oil Press
P31	Plug, Audio Warning Disc	S18	Switch, RPM
P32	Plug, Caution Panel	S19	Switch, Inst Lights
P33	Plug, Edgelit Panel, Cont Boost	S49	Switch, Landing Lights
P34	Plug, Edgelit Panel	S52	Switch, Oil Level Float
P38	Plug, RPM Sensor	S58	Switch, Force Trim-Pilot
P39	Plug, Attitude Gyro	S59	Switch, Force Trim - Copilot
P43	Plug, Anti-Coll Lt	S60	Switch, Force Trim Pwr
P105	Plug, Turn & Slip Ind	S67	Switch, Hyd Press
P113	Plug, Engine Chip Det	S68	Switch, Position Lts
P114	Plug, Hyd Press Switch	S70	Switch, Eng. Out Warning
P115	Plug, Standby Compass	S81	Switch, Non-Ess Bus
P119	Plug, Battery	S82	Switch, Inverter
P121	Plug, Force Trim Mag Brake	S83	Switch, Anti-Coll Lts
P122	Plug, Force Trim Mag Brake	S84	Switch, Eng Oil Bypass
P123	Plug, Heater Solenoid	S85	Switch, Low Level Fuel
P126	Plug, Engine Chip Det.	S86	Switch, Test Warning Lts
P127	Plug, Eng Oil Bypass	S90	Switch, Heater Overheat
P168	Plug, Upper Fuel Tank Unit	TB1	Term. Board, Inst Panel
P169	Plug, Signal Lt	TB3	Term. Board, Turb Outlet
P171	Plug, Voltage Regulator	TB4	Term. Board, Console
P172	Plug, Fuel Press Switch	TB5	Term. Board, Utility Lt
P173	Plug, Inverter	TB6	Term. Board, Lighting
P216	Plug, Copilot's Cyclic Stick	TB7	Term. Board, Position Lts
P600	Plug, Impedance Pad	TB14	Term. Board, Oil Level
Q1	Transistor, Dimming Element	TB25	Term. Board, Inst Lts
PS1	Inverter	TB26	Term. Board, Ground
R1	Resistor, Turb Outlet Temp	TB27	Term. Board, Landing Lts
R3	Resistor, Shunt	TB28	Term. Board, Master Caution Panel
R7	Resistor, Instrument Lts	VR1	Voltage Regulator
R25	Resistor, Console Lts	Z1	Igniter
R33	Resistor, Positon Lts	Z2	Engine Oil Temp Bulb
S1	Switch, Battery	Z5	Upper Fuel Tank Unit
S2	Switch, Main Generator	Z10	Anti-Coll Flasher

TABLE 13-2. CONNECTOR REPLACEMENT CHART

WIRE NO.	RECEPTACLE	PIN	PLUG	WIRE NO.
(P/O Equipment)	J4	A	P4	E1A22
		B	P4	D6A22N
		C	P4	L100A22
		D	P4	E2A22
		E	P4	D7A22
		F	P4	D8A22
		G	P4	E20A22
		H	P4	E26A22

TABLE 13-2. CONNECTOR REPLACEMENT CHART (CONT)

WIRE NO.	RECEPTACLE	PIN	PLUG	WIRE NO.
D4B22	J9	A	P9	D4C20
C2A22	J9	B	P9	C2B20
	J9	C	P9	
D11A22	J9	D	P9	D11B20
D12A22	J9	E	P9	D12B20
	J9	F	P9	
	J9	G	P9	
D3B22	J9	H	P9	D3C20
C66B22	J9	J	P9	C66A20
W56A22	J9	K	P9	W56B20
E9B-CR	J12	A	P12	E9A-CR
E7B-AL	J12	B	P12	E7A-AL
J2B22	J12	C	P12	J3B18
Q8B22	J12	D	P12	Q8C20
Q9B22	J12	E	P12	Q9C20
E4B22	J12	F	P12	E4A20
E5B22	J12	G	P12	E5A20
E16B16N	J12	H	P12	E16A16N
E15A22	J12	I	P12	E15B20
H2A22	J12	J	P12	H2B20
H3A22	J12	K	P12	H3B20
P26B22	J12	L	P12	P26A20
E13B22	J12	M	P12	E13A20
E12B22	J12	N	P12	E12A20
W41A22	J43	A	P43	W41B18
E43B22	J43	B	P43	E43C20
	J43	C	P43	
L56A18	J43	D	P43	L56B18
P24B16	J43	E	P43	P24A16
	J216	A	P216	(P/O Stick Assembly)
A10C20	J216	B		
C6533B-2B22	J216	C		
C6533B-50B20	J216	D		
C6533B-5B22	J216	E		
	J216	F		
	J216	G		
	J216	H		
	J216	J		
	J216	K		
	J216	L		
	J216	M		
A12B20	J216	N		
A13B20	J216	P		
C75A20	J216	R		
C76A20	J216	S		
A16B20	J216	T		
A8B20	J216	U		
A11B20	J216	V		
A24A20	J600	2	P600	(P/O Equipment)
A19D20	J600	4		
A21A20	J600	6		
A22A20	J600	8		

TABLE 13-2. CONNECTOR REPLACEMENT CHART (CONT)

WIRE NO.	RECEPTACLE	PIN	PLUG	WIRE NO.
A3A20	J600	10		
A18A20	J600	12		
A23A20	J600	14		
A17A20	J600	16		
A4B20	J600	17		
A4A20	J600	22		
E43A20	J600	23		
D4A22	J600	25		
D5A22	J600	26		
D3A22	J600	27		
C6533A-22B20	J600	28		
SX803A22	J600	29		
C6533A-29A22	J600	29		
C6533B-29A22	J600	30		
C6533A-40A22	J600	31		
C6533B-40A22	J600	31		
C6533A-26A22	J600	33		
C6533B-26A22	J600	33		
ARN89-1A22	J600	35		
C6533A-41A22	J600	35		
C6533B-41A22	J600	36		
ARC116-27A22	J600	37		
C6533A-37A22	J600	37		
C6533B-37A22	J600	38		
ARC115-27A22	J600	39		
C6533A-35A22	J600	39		
C6533B-35A22	J600	40		
2ARC114-27A22	J600	41		
C6533A-47A22	J600	41		
C6533B-47A22	J600	42		
1ARC114-52A22	J600	43		
C6533A-31A22	J600	43		
C6533B-31A22	J600	44		

SECTION II LOAD CHARTS AND WIRING DIAGRAMS

13-9. INDEX

13-10. DIAGRAMS.

13-11. The following wiring diagrams are utilized in this section.

FIGURE TITLE

Figure 13-3. Load Analysis Charts

Figure 13-4. Inverter, Attitude Gyro and Turn and Slip Indicator Systems - Wiring Diagrams

Figure 13-5. Tachometer Indicator Systems - Wiring Diagrams

Figure 13-6. Fuel Quantity Indicating System - Wiring Diagram

Figure 13-7. Engine Oil and Turbine Outlet Temperature Systems - Wiring Diagram

Information will be furnished at a later date.

Figure 13-3. Load analysis charts

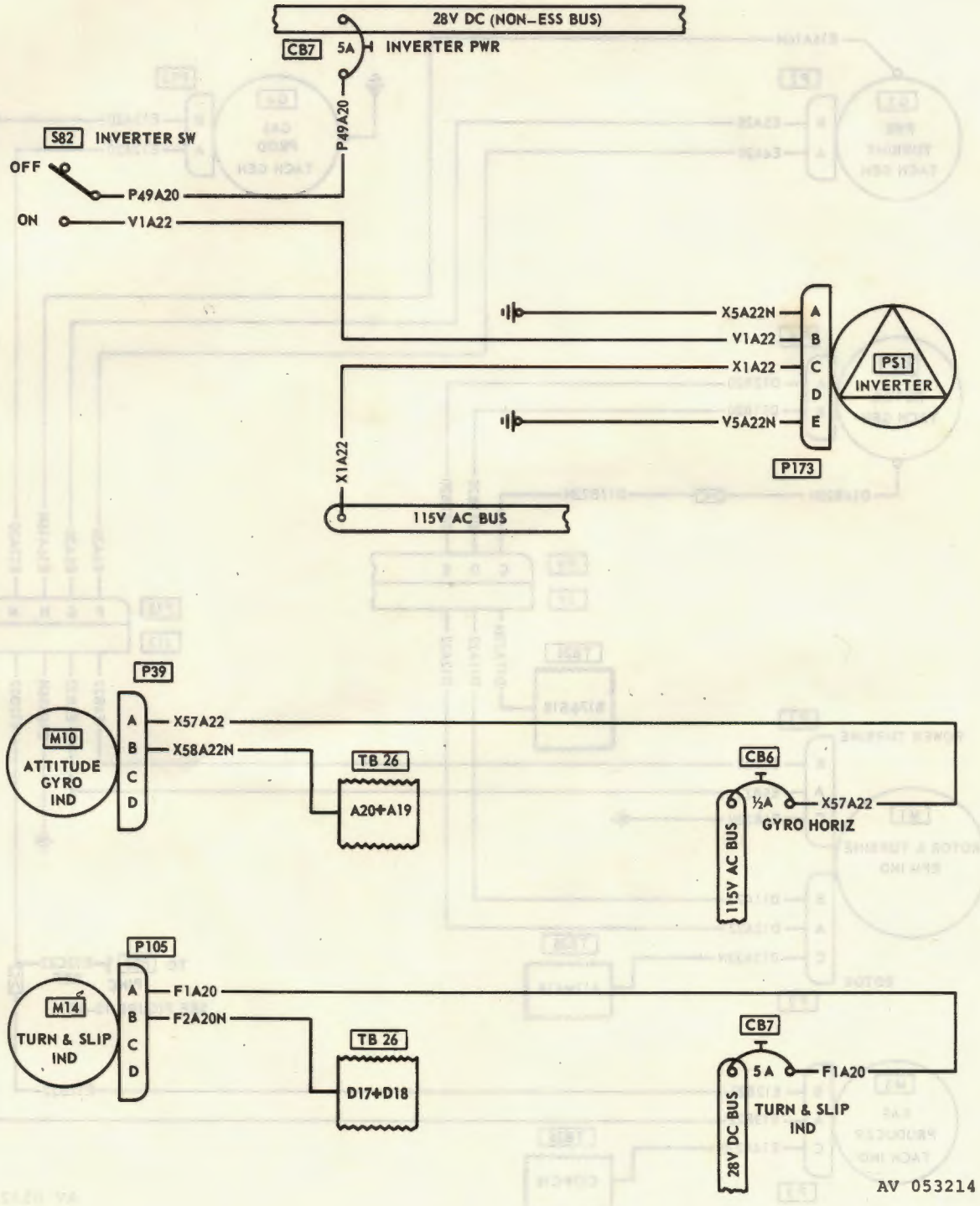


Figure 13-4. Inverter, attitude gyro and turn and slip indicator systems - wiring diagrams

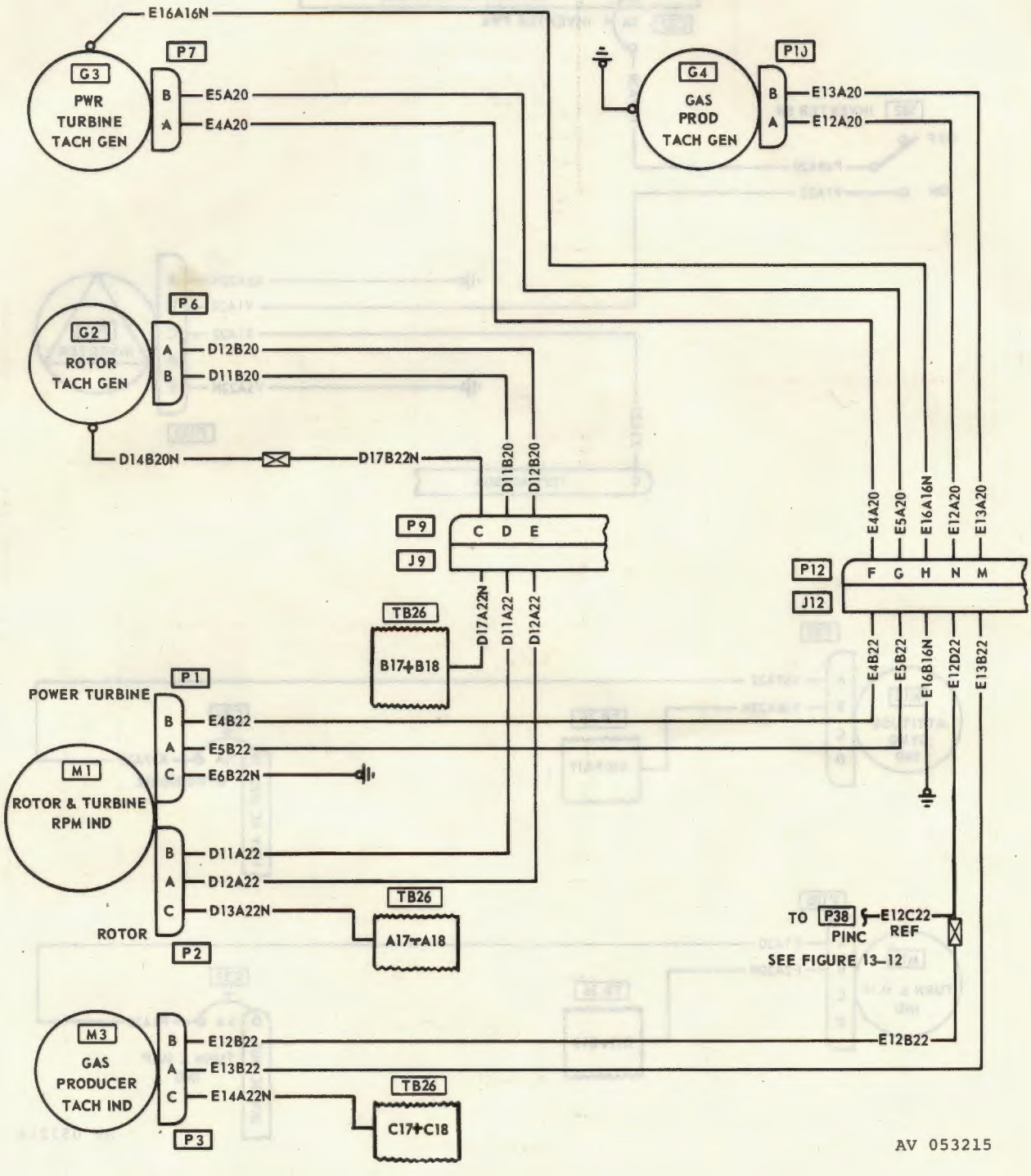


Figure 13-5. Tachometer indicator systems - wiring diagrams

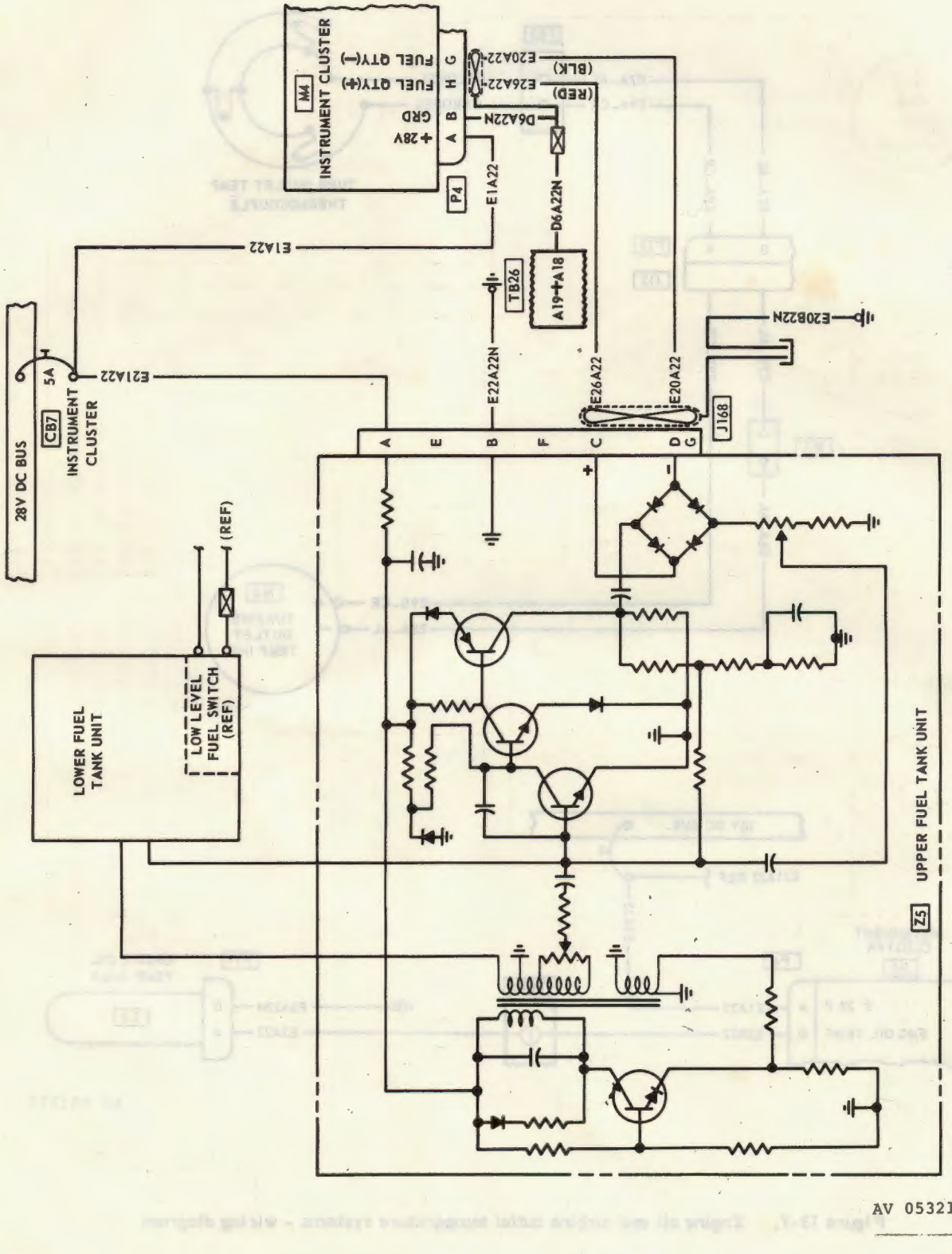


Figure 13-6. Fuel quantity indicating system - wiring diagram

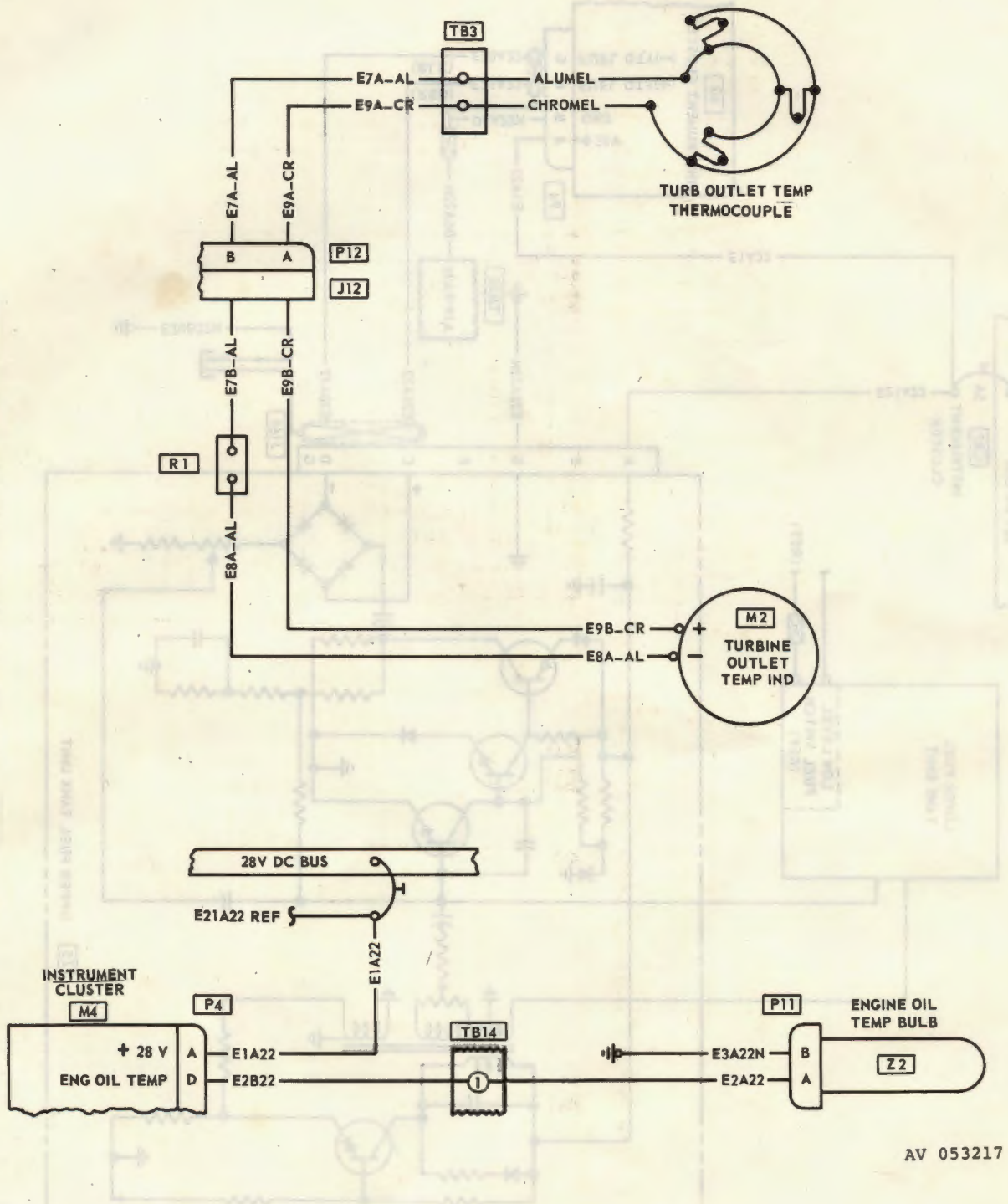


Figure 13-7. Engine oil and turbine outlet temperature systems - wiring diagram

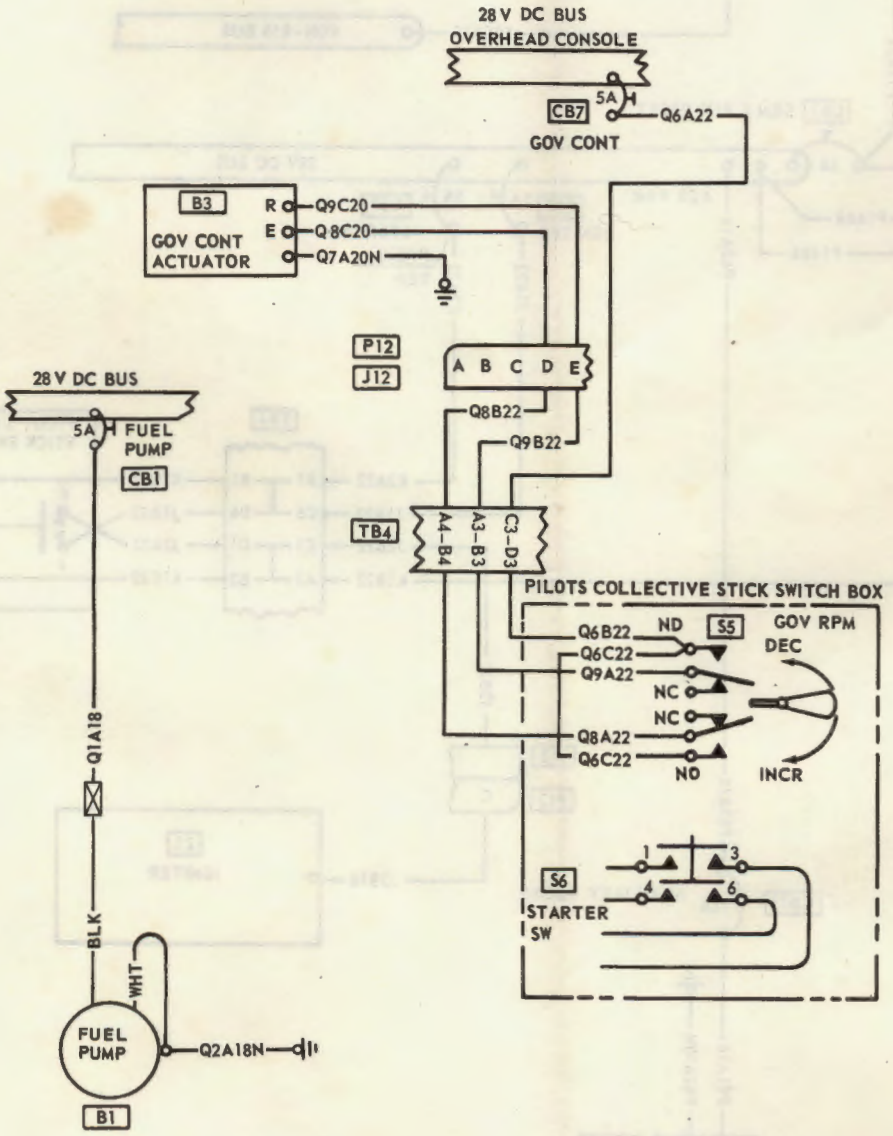


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Figure 13-9. Fuel pump and governor control systems - wiring diagram

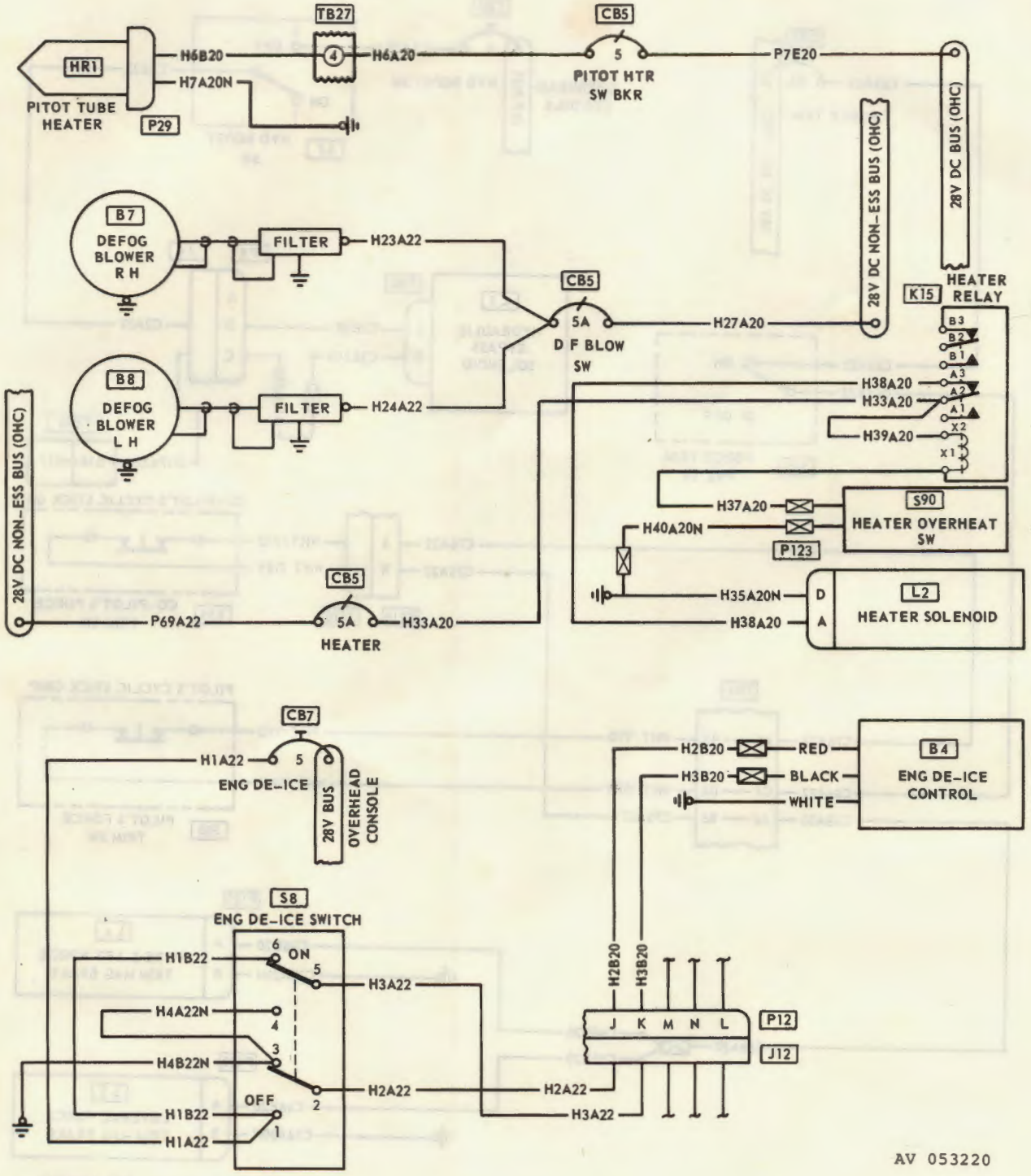


Figure 13-10. Heating, de-fogging blower and engine de-icing systems - wiring diagram

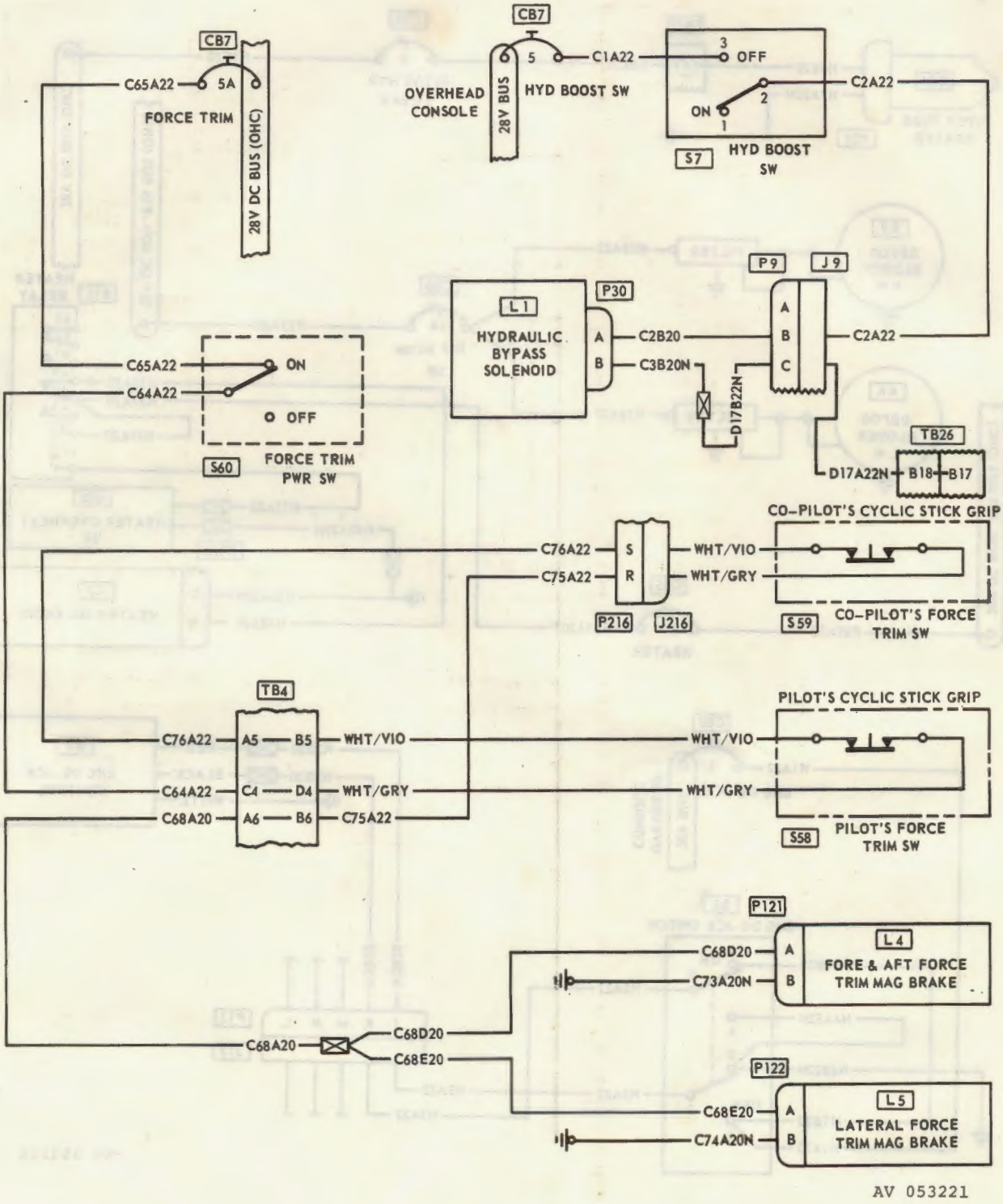
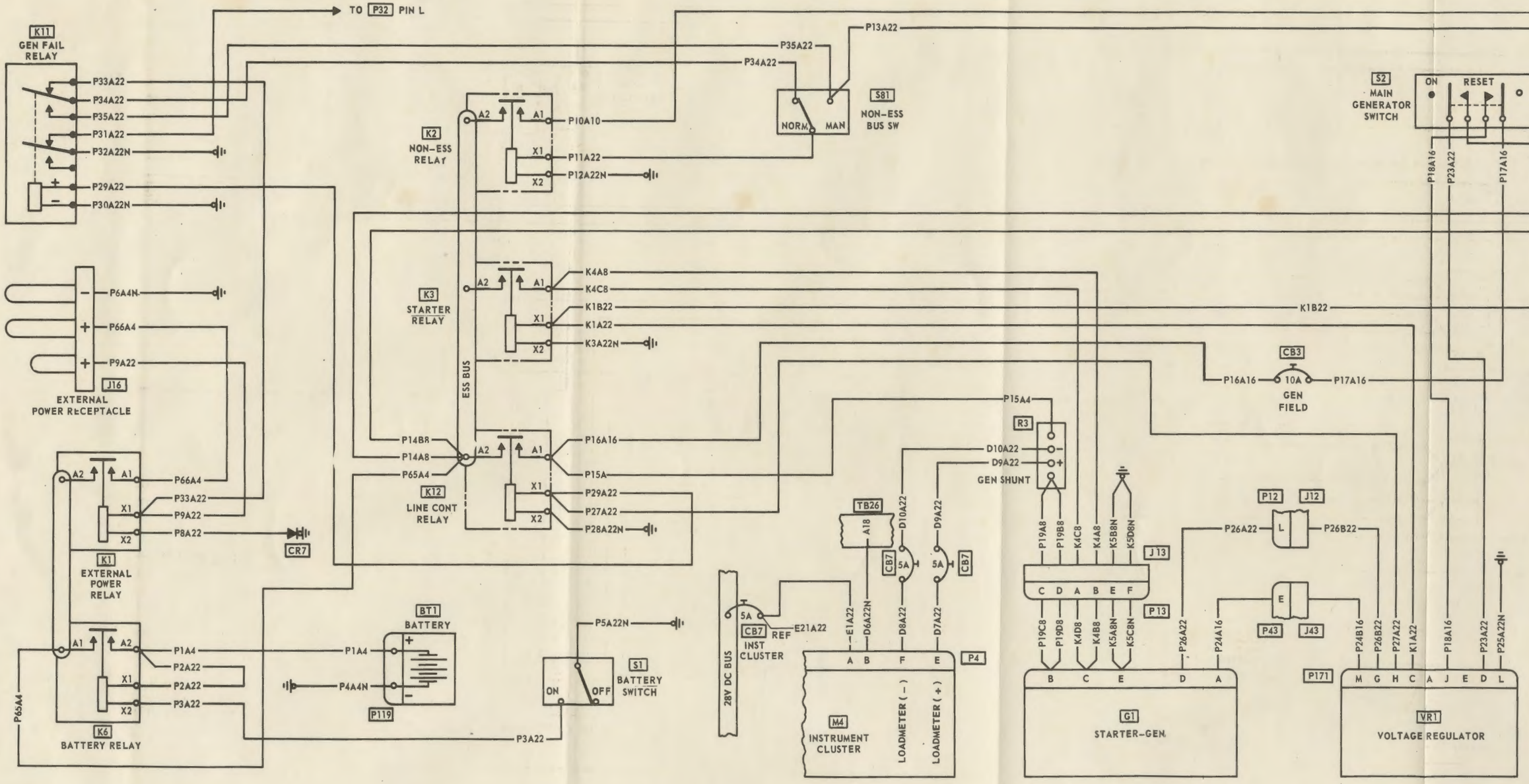


Figure 13-11. Force trim and hydraulic control systems - wiring diagram


TO P32 PIN L
K11
GEN FAIL RELAY
P33A22
P34A22
P35A22
P31A22
P32A22N
P29A22
P30A22N
P13A22
P35A22
P34A22
S81
NON-ESS BUS SW
NORM
MAN
K2
NON-ESS RELAY
A2
A1
X1
X2
P10A10
P11A22
P12A22N
S2
MAIN GENERATOR SWITCH
ON
RESET
P18A16
P23A22
P17A16
P6A4N
P66A4
P9A22
J16
EXTERNAL POWER RECEPTACLE
K3
STARTER RELAY
K4A8
K4C8
K1B22
K1A22
K3A22N
ESS BUS
K1B22
CB3
10A
P16A16
P17A16
GEN FIELD
P15A4
R3
D10A22
D9A22
GEN SHUNT
P14B8
P14A8
P65A4
K12
LINE CONT RELAY
P16A16
P15A
P29A22
P27A22
P28A22N
P66A4
P33A22
P9A22
P8A22
CR7
K1
EXTERNAL POWER RELAY
BT1
BATTERY
P1A4
P2A22
P2A22
P3A22
P4A4N
P119
P5A22N
S1
ON
OFF
BATTERY SWITCH
P3A22
P65A4
K6
BATTERY RELAY
TB26
A18
CB7
5A
28V DC BUS
E1A22
D6A22N
D8A22
D7A22
E21A22
REF
INST CLUSTER
A
B
F
E
P4
M4
INSTRUMENT CLUSTER
LOADMETER (-)
LOADMETER (+)
P19A8
P19B8
K4C8
K4A8
K5B8N
K5D8N
J13
C
D
A
B
E
F
P13
P19C8
P19D8
K4D8
K4B8
K5A8N
K5C8N
P26A22
P24A16
B
C
E
D
A
G1
STARTER-GEN
P12
J12
L
P26A22
P26B22
E
P43
J43
P24B16
P26B22
P27A22
K1A22
P18A16
P23A22
P25A22N
P171
M
G
H
C
A
J
E
D
L
VR1
VOLTAGE REGULATOR

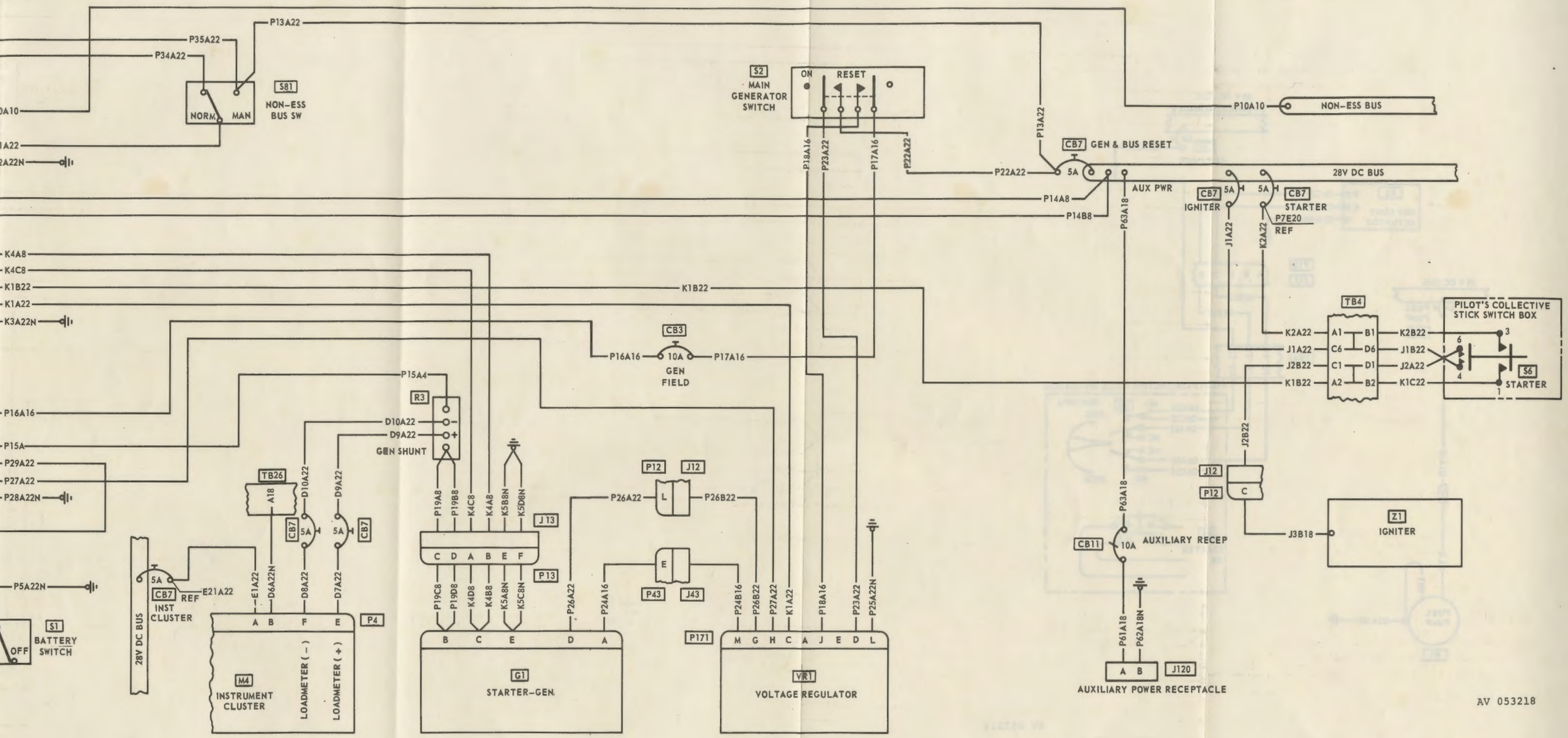


Figure 13-8. DC power and starter systems - wiring diagram

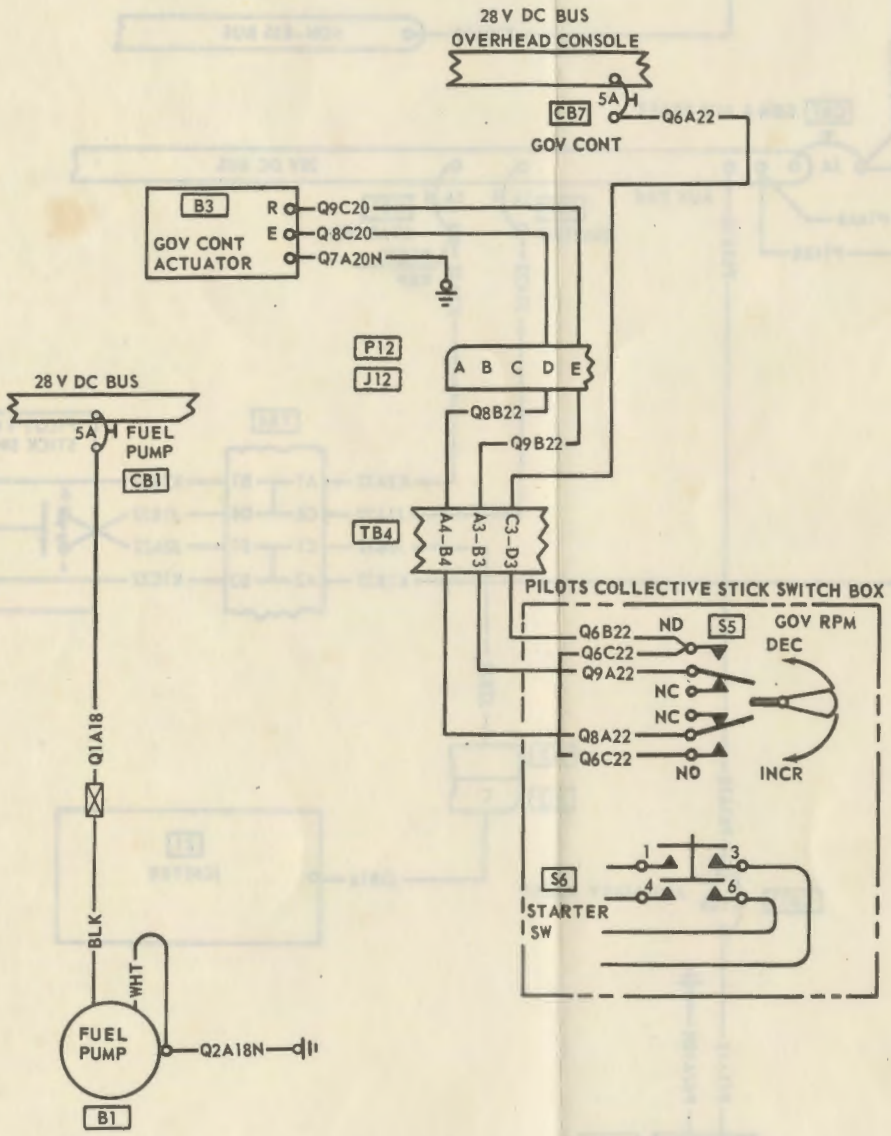


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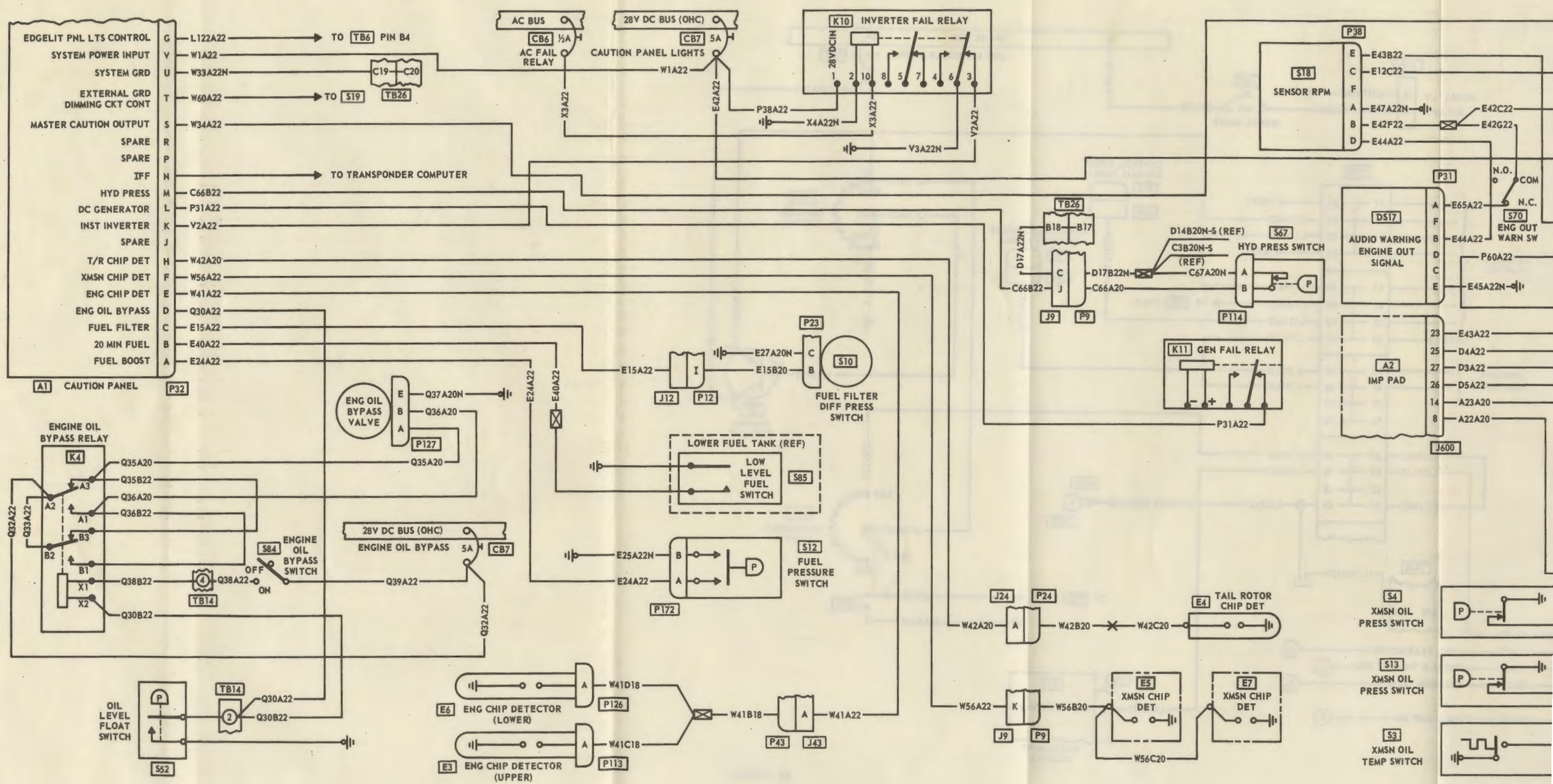
Figure 13-9. Fuel pump and governor control systems - wiring diagram


EDGELIT PNL LTS CONTROL G L122A22 TO TB6 PIN B4
SYSTEM POWER INPUT V W1A22
SYSTEM GRD U W33A22N C19 C20 TB26
EXTERNAL GRD DIMMING CKT CONT T W60A22 TO S19
MASTER CAUTION OUTPUT S W34A22
SPARE R
SPARE P
IFF N TO TRANSPONDER COMPUTER
HYD PRESS M C66B22
DC GENERATOR L P31A22
INST INVERTER K V2A22
SPARE J
T/R CHIP DET H W42A20
XMSN CHIP DET F W56A22
ENG CHIP DET E W41A22
ENG OIL BYPASS D Q30A22
FUEL FILTER C E15A22
20 MIN FUEL B E40A22
FUEL BOOST A E24A22
A1 CAUTION PANEL P32
AC BUS
CB6 ½A
AC FAIL RELAY
28V DC BUS (OHC)
CB7 5A
CAUTION PANEL LIGHTS
W1A22
X3A22
E42A22
K10 INVERTER FAIL RELAY
28VDCIN
1 2 10 8 5 7 4 6 3
P38A22
X4A22N
X3A22
V3A22N
V2A22
P38
S18 SENSOR RPM
E E43B22
C E12C22
F
A E47A22N
B E42F22
D E44A22
E42C22
E42G22
E44A22
P31
DS17 AUDIO WARNING ENGINE OUT SIGNAL
A E65A22
F
B E44A22
D
C
E
N.O. COM N.C.
S70 ENG OUT WARN SW
P60A22
E45A22N
TB26
B18 B17
D17A22N
C66B22
C J
J9 P9
D14B20N-S (REF)
C3B20N-S (REF)
D17B22N
C67A20N
C66A20
S67 HYD PRESS SWITCH
A B P
P114
K11 GEN FAIL RELAY
P31A22
A2 IMP PAD
23 E43A22
25 D4A22
27 D3A22
26 D5A22
14 A23A20
8 A22A20
J600
ENGINE OIL BYPASS RELAY
K4
A3 A2 A1 B3 B2 B1 X1 X2
Q35A20
Q35B22
Q36A20
Q36B22
Q38B22
Q38A22
Q30B22
Q32A22
Q33A22
ENG OIL BYPASS VALVE
E B A
Q37A20N
Q36A20
P127
Q35A20
E24A22
E40A22
E15A22
J12 I P12
E27A20N
E15B20
P23 C B S10
FUEL FILTER DIFF PRESS SWITCH
LOWER FUEL TANK (REF)
LOW LEVEL FUEL SWITCH
S85
28V DC BUS (OHC)
ENGINE OIL BYPASS 5A CB7
S84 ENGINE OIL BYPASS SWITCH
OFF ON
Q39A22
TB14
Q32A22
E25A22N
E24A22
B A P
S12 FUEL PRESSURE SWITCH
P172
OIL LEVEL FLOAT SWITCH
P
TB14
2
Q30A22
Q30B22
S52
E6 ENG CHIP DETECTOR (LOWER)
W41D18
A P126
E3 ENG CHIP DETECTOR (UPPER)
W41C18
A P113
W41B18
A P43 J43
W41A22
J24 P24
W42A20 A W42B20 W42C20
E4 TAIL ROTOR CHIP DET
W56A22 K W56B20
J9 P9
E5 XMSN CHIP DET
E7 XMSN CHIP DET
W56C20
S4 XMSN OIL PRESS SWITCH
S13 XMSN OIL PRESS SWITCH
S3 XMSN OIL TEMP SWITCH

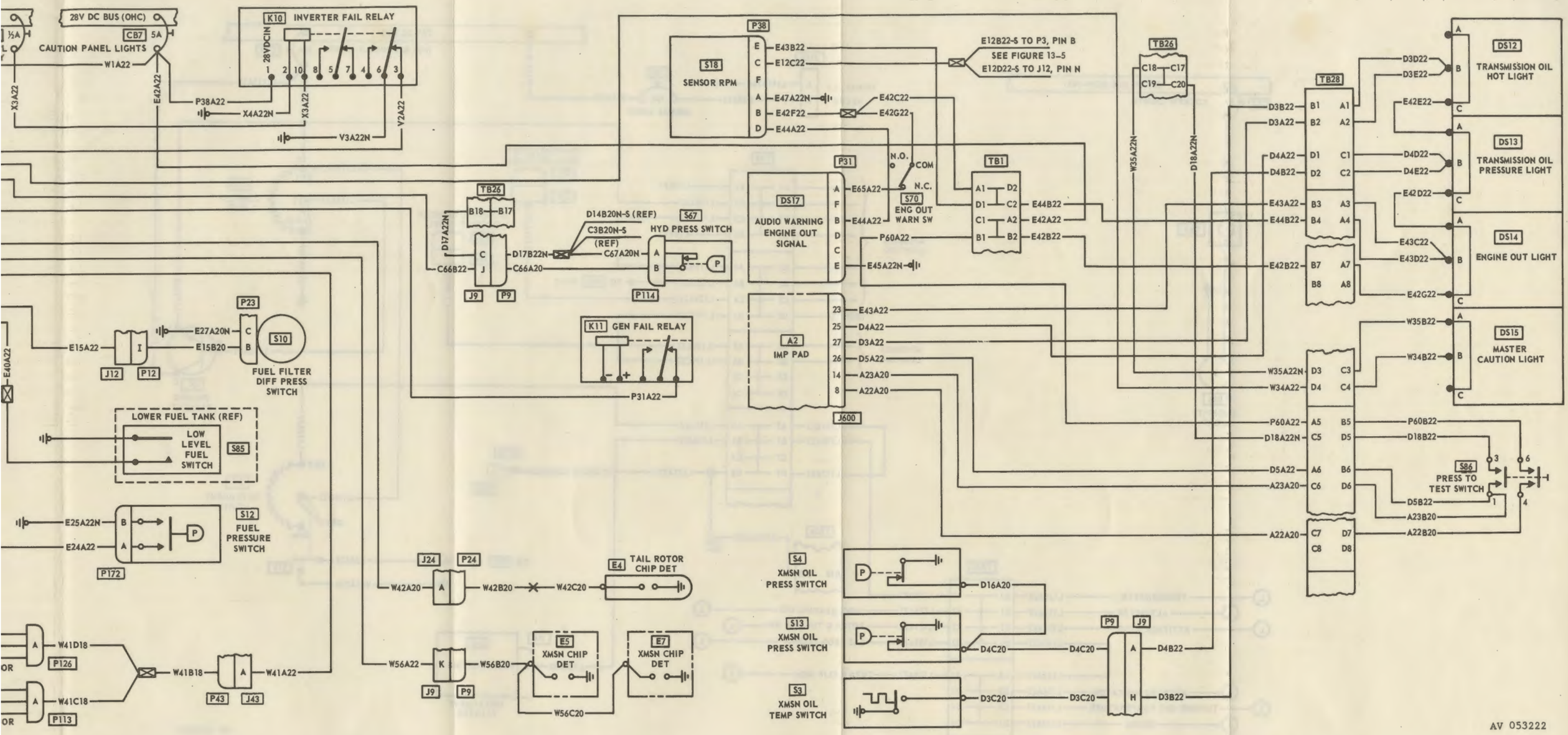


Figure 13-12. Caution and warning lights systems - wiring diagrams

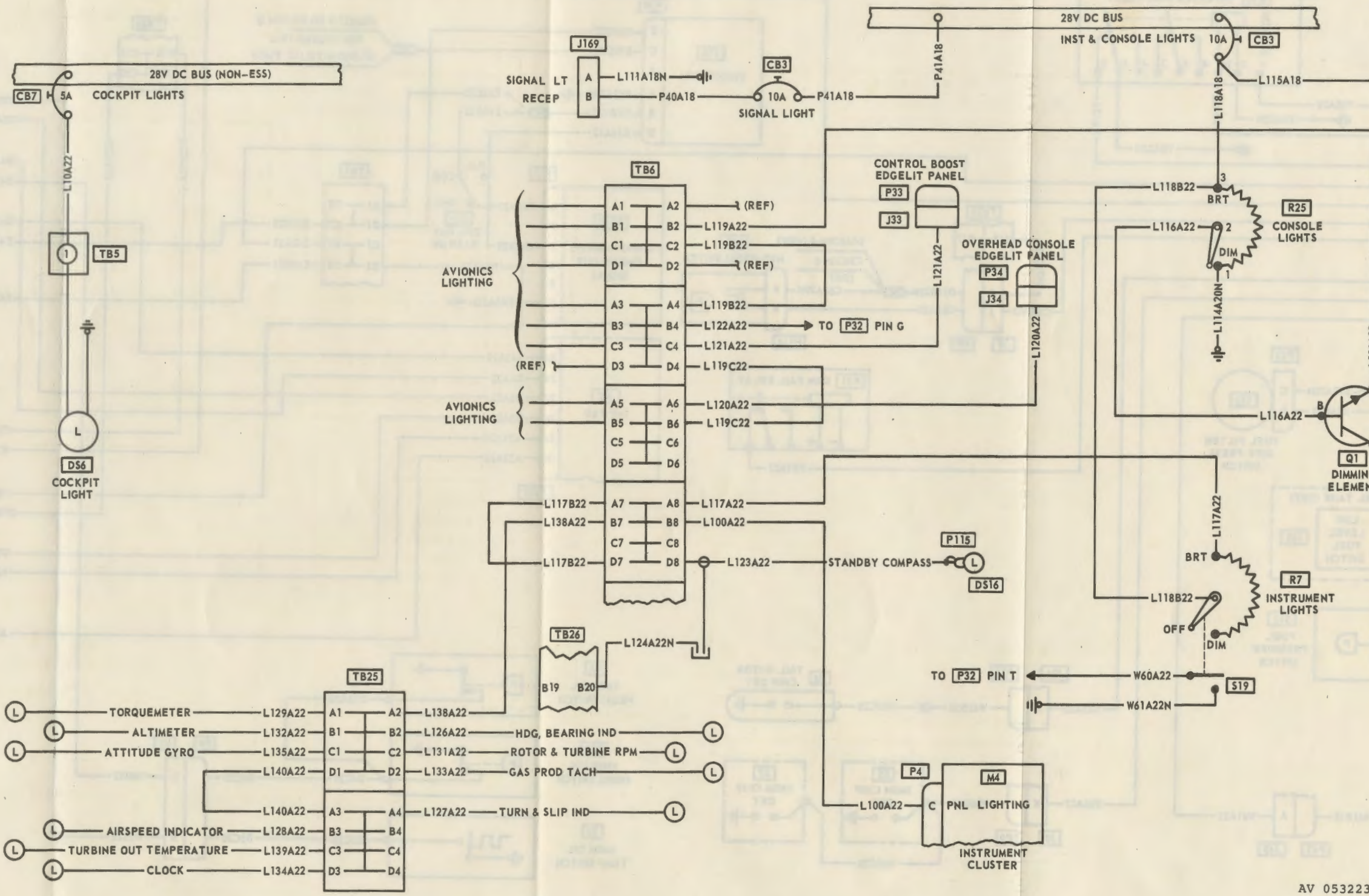


Figure 13-13. Interior lights system - wiring diagram

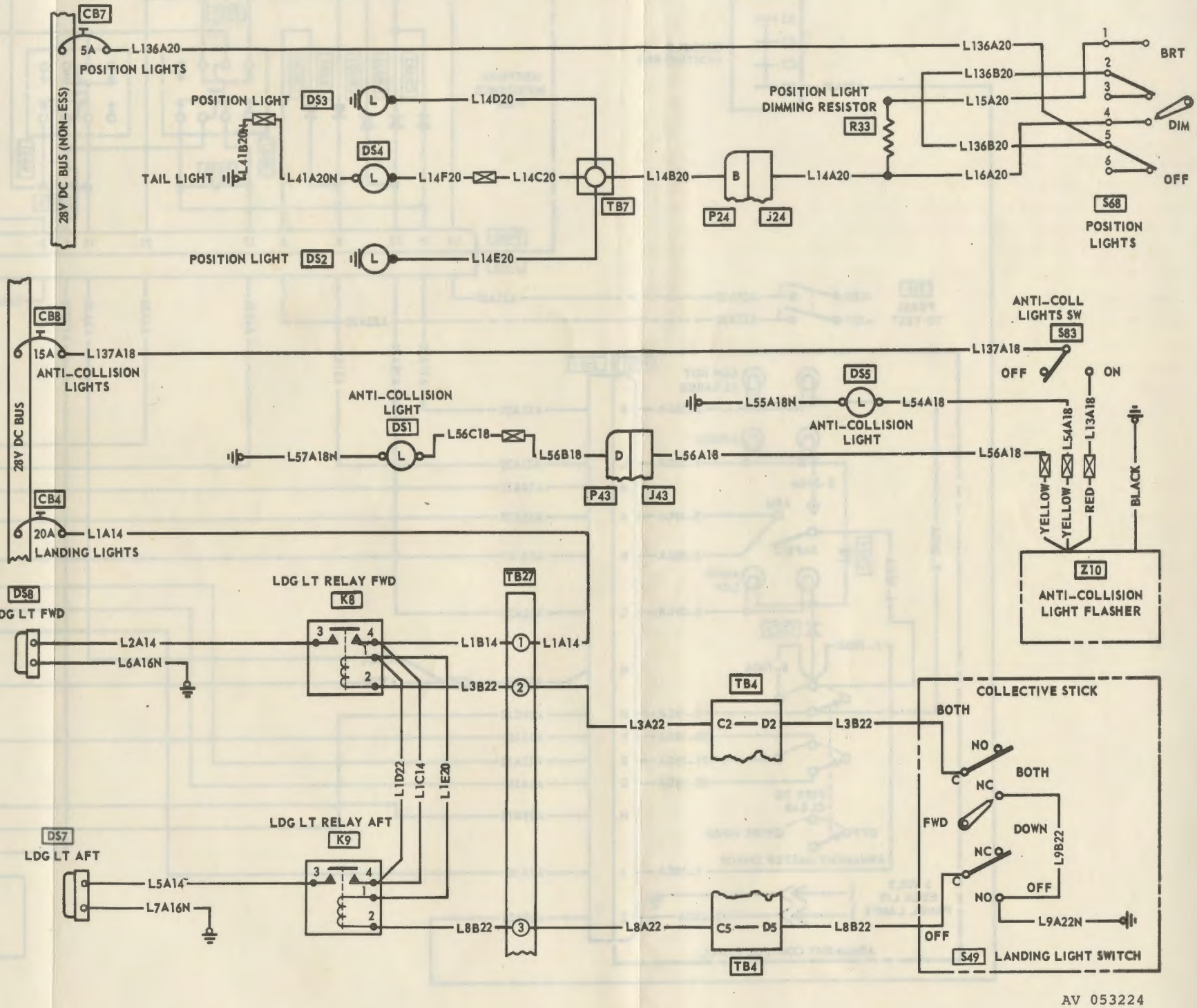


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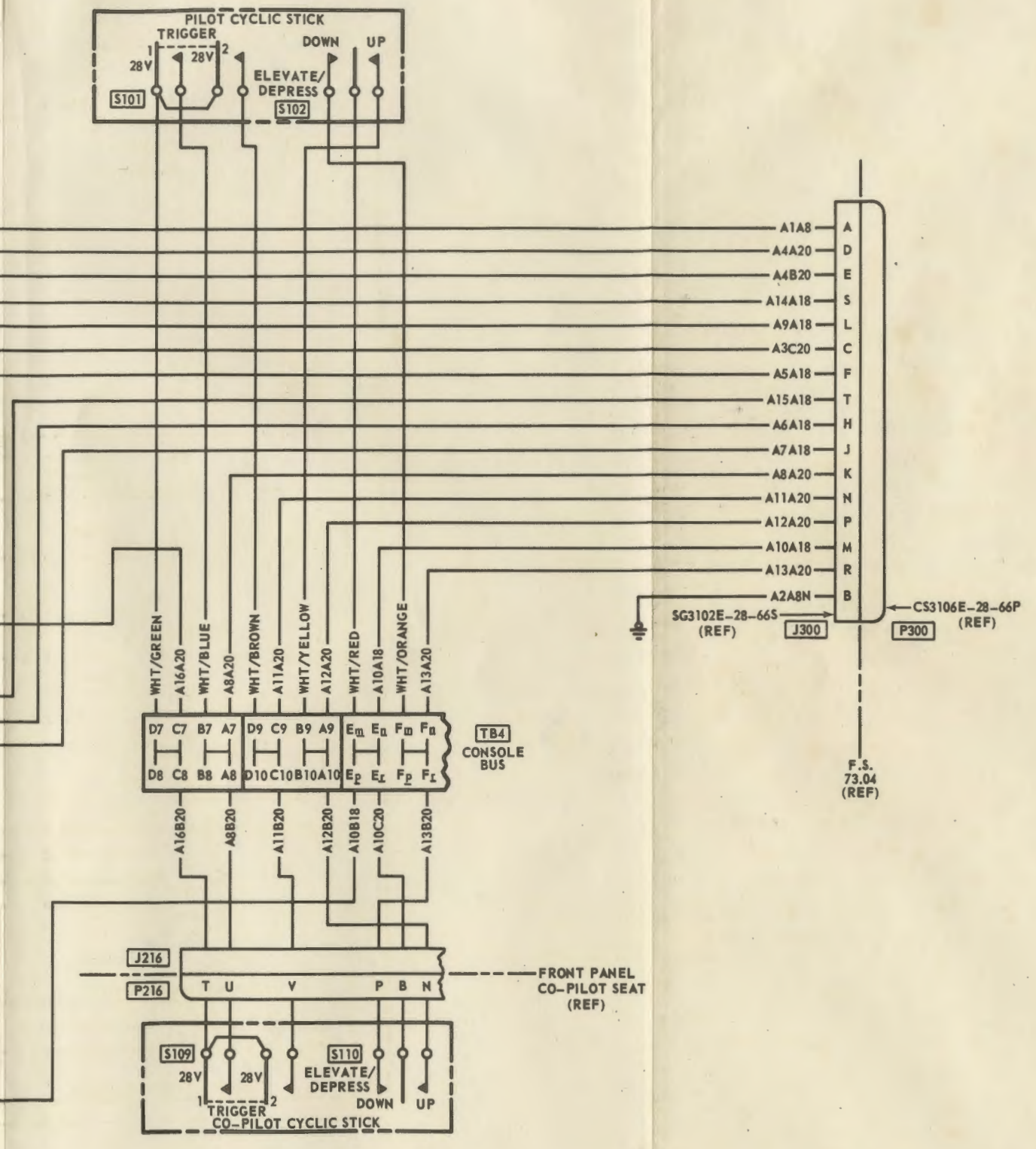
Figure 13-14. Exterior lights system - wiring diagram

TB6
A3
B3
C3
D3
CONSOLE LIGHTING BUS
A20A20
NETWORK IMPEDENCE PAD
R609
CR602
CR603
CR601
CR604
CR605
K601
R610
K602
R611
P600
J600
14 16 12 6 8 17 22 10 4 2
S19
PART OF RIGHT INST LIGHT DIMMING
A24A20
ESS BUSS
CB3 10A ARM.
CB9 50A ARM. PWR.
A19A18
A1A8
PILOT CYCLIC STICK
TRIGGER
1 28V 2 28V
S101
ELEVATE/ DEPRESS
DOWN UP
S102
S86
PRESS TO TEST
GRD
+28V
1
4
A23A20
A22A20
A23A20
A22A20
A17A20
A18A20
A21A20
A4B20
A4A20
A3A20
A19D20
A24A20
P301
J301
GUN NOT CLEARED
2-20GA B A17A20
ARMED
1-20GA L A21A20
0-20GA
ARM
3-18GA A A16A20
M A14A18
SAFE
4-20GA K A9A18
CR24
AMMO LOW
5-20GA C A18A20
CR23
7-18GA
8-18GA
H A3B20 A3A20 A3C20
9-18GA D A19C18
90-18GA F A5A18
91-18GA E A15A18
92-18GA G A6A18
FIRE TO CLEAR
OFF FIRE NORM
N A19B18
ARMAMENT MASTER SWITCH
7-18GA J A7A18
5 VOLT EDGE LIT PANEL LAMPS
93-20GA I A20A20
ARMAMENT CONTROL PANEL
0-20GA
6-18GA
A19B18
A19C18
A19D20
A10B18
E1 F1
Ek Fk
Em Fm
En Fn
A19A18
TB1
INSTRUMENT PANEL BUS
WHT/GREEN A16A20
WHT/BLUE A8A20
WHT/BROWN A11A20
WHT/YELLOW A12A20
WHT/RED A10A18
WHT/ORANGE A13A20
D7 C7 B7 A7
D8 C8 B8 A8
D9 C9 B9 A9
D10 C10 B10 A10
Em En Fm Fn
Ep Er Fp Fr
TB4
CONSOLE BUS
A16B20
A8B20
A11B20
A12B20
A10B18
A10C20
A13B20
J216
P216
T U V P B N
S109
28V 28V
TRIGGER
1 2
CO-PILOT CYCLIC STICK
S110
ELEVATE/ DEPRESS
DOWN UP



EQUIPMENT		
ITEM	DESCRIPTION	
CB3	CIRCUIT BREAKER	(10A)
CB9	CIRCUIT BREAKER	(50A)
CR23	DIODE	
CR24	DIODE	
J216	RECEPTACLE	CYCLIC STICK
J300	↕	ARMAMENT POWER
J301	↕	ARMAMENT CONTROL
J600	RECEPTACLE	IMPEDENCE PAD
P216	PLUG	CYCLIC STICK CO-PILOT
P300	↕	ARMAMENT POWER
P301	↕	ARMAMENT CONTROL
P600	PLUG	IMPEDENCE PAD
S19	SWITCH	INSTRUMENT LIGHT DIMMING
S86	SWITCH	PRESS TO TEST
TB1	TERMINAL JUNCTION	INSTRUMENT PANEL
TB4	TERMINAL JUNCTION	CONSOLE
TB6	TERMINAL JUNCTION	LIGHTING

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Figure 13-15. Armament system - wiring diagram

CHAPTER 14

AVIONICS, PHOTOGRAPHY AND ARMAMENT

SECTION I SCOPE

14-1. PURPOSE.

14-2. This chapter provides all the essential information necessary for maintenance personnel to maintain the XM27E1 Subsystem, 7.62 MM Machine Gun.

SECTION II ARMAMENT SYSTEM

14-3. DESCRIPTION.

14-4. The description, operation, and organizational maintenance of this armament system is covered in TM 9-1005-298-12 Operator and Organizational Maintenance Manual, Armament Subsystem, Helicopter, 7.62 Millimeter Machine Gun: High Rate, XM27E1.

14-5. REMOVAL - ARMAMENT SYSTEM.

a. Remove door seal assembly, retain the 11 screws.

b. Remove door as follows:

(1) Support door and remove bolts, nuts, washer, and spacer. (Refer to paragraph 4-5.)

(2) Install filler door with 11 screws and reinstall door after gun and mount assembly are removed.

(3) Install inside door handle.

c. Remove sight control rod assembly by pulling quick-release pins.

d. Remove sight assembly electrical cable and sight assembly from airframe mount.

e. Remove mount assembly upper support rod by pulling quick-release pins.

f. Remove main electrical connector on bulkhead.

g. Remove mount assembly by pulling quick-release pins at seat hard points and remove assembly.

14-6. INSTALLATION - ARMAMENT SYSTEM.

a. If left passenger door is installed on the aircraft, remove it as follows:

(1) Unlatch and open the left door.

(2) Support the door and remove bolts, nuts, and washers. (Refer to paragraph 4-5.)

(3) Remove the passenger door from the aircraft.

(4) Remove the filler door from the passenger door by removing 11 screws. Retain for reinstallation.

(5) Remove inside door handle and guard.

b. Place the mount assembly in the aircraft and position for attachment to hard point fittings and to the upper support rod.

c. Install two quick-release pins to attach mount to hard points on seat pan. Install quick-release pins to attach upper support rod to seat back shelf bracket.

Note

Insure rod assembly, 206-071-207-1, is used in place of 11697500 tube assembly.

d. Connect electrical cannon plug.

e. Place aircraft door in place and install bolts and nuts to retain door; latch door securely.

f. Install the filler door with 11 screws.

g. Position the gun sight assembly on control tunnel mount at pin mounts.

h. Depress the pushbutton in the knob of the sight retaining pin and insert in the aircraft fitting.

i. Install the sight control rod assembly between the sight and mount assembly using two quick-release pins.

j. Connect sight electrical cable to control box assembly.

Note

Insure rod assembly, 206-071-211-1, is used in place of 11697845 control rod assembly.

k. Route the sight electrical harness to mount assembly box.

14-7. PASSIVE DEFENSE.

14-8. Two pieces of armor plate are located in the forward section of the engine compartment for protection of the engine compressor section. These are mounted on the forward firewall one on each side of the engine compressor.

14-9. REMOVAL - PASSIVE DEFENSE.

a. Open engine cowling on side requiring armor plate removal.

b. At forward firewall remove two nuts, washers, and screws attaching plate to firewall stiffener.

c. Remove two nuts, washers, and screws attaching two brace assemblies to firewall support. Remove armor plate assembly.

14-10. DISASSEMBLY - PASSIVE DEFENSE. Armor plate is removed from angle and brace assemblies by removing two nuts and washers at each brace assembly.

14-11. INSPECTION - PASSIVE DEFENSE. Inspect armor plate for damage from enemy fire and other unserviceable conditions. Replace as necessary.

14-12. REASSEMBLY - PASSIVE DEFENSE. Position brace assembly on serviceable armor plate and secure with two nuts and washers on each brace assembly.

14-13. INSTALLATION - PASSIVE DEFENSE.

a. Position armor plate assembly on firewall mounting supports.

b. Install two screws, washers, and nuts securing brace assemblies to firewall support.

c. Where armor plate assembly seats in firewall support install two screws, nuts, and washers. Close engine cowling.

14-14. ARMOR PANELS.

14-15. The crew is protected against enemy fire by armor panels. The panels are bolted in place on the outboard and back sides of each seat, also a panel is located under each seat support. The outboard section is hinged at the rear for easy entry and exit of the aircraft. A latch is provided to keep this panel in proper position during flight.

14-16. REMOVAL - ARMOR PANELS.

a. Remove four bolts and washers on each seat back panel. Remove panels.

b. Remove four screws and washers which attach armor plate hinge to airframe or five screws, washers, and nuts which attach hinge to armor plate on each panel. Remove panels.

c. Remove seats and honeycomb structure plates under seats. Remove armor panels from under side of structure plates by removing bolts and washers.

14-17. INSPECTION - ARMOR PANELS.

a. Inspect all panels for security of attachment.

b. Visually inspect each panel for surface damage:

(1) Evidence of a hit by any ballistic projectile requires replacement of panel.

(2) Visible cracks longer than 1/4 inch are not acceptable.

(3) Small chips, not more than 1/4 inch diameter, at edges of ceramic faces of panel are acceptable and do not require repair.

14-18. REPAIR OR REPLACEMENT - ARMOR PANELS. Replace any panels that fail inspection.

14-19. INSTALLATION - ARMOR PANELS.

a. Position seat back panels in place and install bolts and washers.

b. Position side panels in airframe and install screws, washers and nuts as were required for removal.

c. Install underseat panels and then install structure plates and seats.

SECTION III PHOTOGRAPHY

(Not Applicable)

SECTION IV AVIONICS

Refer to Appendix A for appropriate organizational maintenance manuals covering avionics systems for Army Model OH-58A aircraft. Refer to TM 11-1520-228-20.

CHAPTER 15

EXTERNAL STORES NONARMAMENT

(Not Applicable)

CHAPTER 16

STORAGE OF AIRCRAFT

SECTION I SCOPE

16-1. INTRODUCTION.

16-2. The storage instructions defined herein apply to limited periods of storage depending on the aircraft status as operational reserve or for reasons of minor repair, modifications, reassignment, or disposition actions. Also activation of aircraft is covered.

16-3. SCOPE.

16-4. Procedures are provided in this chapter for following storage categories.

a. Flyable Storage - No time limit.

b. Short Term Storage - 1 to 45 days.

c. Intermediate Storage - 46 to 180 days.

Note

When selection of a storage category is made, the ground operation, motoring of engines, and other necessary functions for type of storage involved must be considered.

SECTION II PRESERVATION PROCEDURES

16-5. PARKING AND MOORING.

16-6. For parking and mooring procedures refer to paragraphs 1-61 and 1-62.

16-7. GENERAL INSPECTION OF STORED HELICOPTERS.

16-8. The local organizational maintenance officers shall be responsible for establishing a program for periodic inspection of stored helicopters in addition to the following general inspections.

a. Ensure proper preservation and ventilation of helicopters and take immediate action to correct all unsatisfactory conditions.

b. Ensure drainage holes are free of obstructions.

c. When canvas covers are used for protection, they shall be arranged as to prevent the accumulation of water on the surface of the cover.

d. During hot weather, spot checks shall be made of stored helicopters to determine maximum temperature. This shall be accomplished by hanging a standard thermometer in the interior of the helicopter and recording readings during the hottest part of the day. If temperature exceeds 160°F (71°C), action shall be taken to properly ventilate the helicopter.

Note

Forced ventilation shall be employed, if other methods are not adequate to prevent sweating and possible mildew.

e. If average local humidity exceeds 40 percent, all stored helicopters shall be inspected carefully at 14 day intervals and treated for corrosion if necessary. If humidity is less than 40 percent, the above shall be accomplished every 30 days. While inspecting for corrosion, special attention shall be given to areas where moisture deposits will not evaporate rapidly. Normally, corrosion will not be as prevalent on painted surfaces as on unpainted ones; however, under certain conditions, corrosion may attack the metal through the paint, indicated by blisters or scaly appearance on the paint.

f. Inspect ground wires, mooring devices, and rotor tie-down straps every 30 days, and immediately after helicopter has been subjected to high-velocity winds (exceeding 40 mph). Pulled rods, deteriorated ground wires, mooring ropes, and tie-down straps shall be replaced.

g. Check canvas covers for condition and proper drainage.

16-9. FLYABLE STORAGE.

16-10. An aircraft that will not be flown for a period of at least 72 hours (3 days) shall be preserved and maintained with all components and systems in an operable condition. The aircraft engine

shall be run or motored with the starter on the third day. If the engine is motored with the starter on the third day, it shall subsequently be run on the seventh day.

16-11. PREPARATION - FLYABLE STORAGE.

a. Perform a regular preflight inspection.

b. Run engine at flight idle for 10 minutes with all instruments stabilized.

c. Shut down engine.

d. Service all oil reservoirs and fuel cell.

e. Perform postflight inspection.

f. Ensure all drain holes on aircraft are free of obstructions and clear of covers.

g. Install static ground wire.

h. Remove any objects from vicinity of aircraft that are likely to strike aircraft during high wind conditions.

i. Install all covers and tie down straps.

16-12. INSPECTION - FLYABLE STORAGE.

a. Ensure all cockpit switches in proper position.

b. Drain fuel sump daily.

c. Check fuel and oil lines periodically for leaks and deterioration.

16-13. SHORT TERM STORAGE.

16-14. An aircraft that is not operated in accordance with requirements of flyable storage shall be placed in short term storage for a period not to exceed 45 days. Aircraft normally falling in this category are those undergoing minor repair, modification, awaiting assignment or disposition, being held as an operation reserve, or any other condition which would contribute to grounding the aircraft for a period not to exceed 45 days.

16-15. PREPARATION - SHORT TERM STORAGE.

a. Airframe preparation. Clean the following areas and treat for corrosion in accordance with TM 55-405-3:

(1) Crew and cargo compartment.

(2) Radio compartment.

(3) Electrical compartments.

(4) Tail boom, interior and exterior.

(5) Install tie-downs on main and tail rotors.

(6) Attach a static ground wire.

(7) Close and secure all cowling, inspection panels and covers.

(8) Remove all obstructions from drain holes in fuselage and tail boom.

b. Engine preparation. Preservation of an installed engine for short term storage is the same as for flyable storage. (Refer to paragraph 16-11.)

c. Fuel system preparation.

(1) Defuel and drain fuel system, including strainer and tank sumps.

(2) Purge fumes from fuel cells by slowly discharging carbon dioxide bottles into filler opening.

(3) Fog interior of fuel cells with light engine oil (item 9, table 1-1), through filler opening, vents, and other openings available without extensive disassembly.

Caution

Do not relax precautions against fire and explosion, since purging of fumes does not eliminate these hazards.

d. Power train preparation.

(1) Clean drive shaft and treat for any evident corrosion.

(2) Apply corrosion-preventive compound (item 302, table 1-1) to unplated steel surfaces not in contact with bearings.

(3) Cover breather holes in transmission and gearboxes with grease-proof barrier material (item 303, table 1-1) secured with tape (item 400, table 1-1).

e. Hydraulic system preparation.

(1) Fill hydraulic reservoir with oil (item 3, table 1-1).

(2) Wipe exposed portions of hydraulic boost cylinder actuator pistons with lint-free cloth moistened with hydraulic fluid.

f. Rotors and controls preparation.

(1) Lubricate rotors and controls according to Lubrication Order.

(2) Wipe all parts dry with clean, lint-free cloth, and apply corrosion-preventive compound (item 302, table 1-1) to all unpainted metal surfaces not in contact with bearings.

(3) Clean surfaces of rotor blades with mild soap and water solution. Wipe blade completely dry with clean, lint-free cloth.

(4) Apply a light, even coat of wax (item 500, table 1-1) to entire painted area of rotor blades.

g. Battery preparation.

(1) Disconnect battery and allow to remain in helicopter.

(2) Wrap battery quick-disconnect with barrier material (item 303, table 1-1) secured with tape (item 400, table 1-1).

h. Instruments preparation.

(1) Install cover on airspeed pitot tube.

(2) Cut a piece of barrier material (item 303, table 1-1) to fit over each static vent of airspeed system. Secure material in place with tape (item 400, table 1-1).

i. Avionic equipment preparation.

(1) Remove, attach condition tags, and return all head-sets and microphones to supply.

(2) Leave all other unclassified avionic equipment installed in helicopter.

j. Landing gear preparation.

(1) Place blocks or shoring under skid tubes to provide free air passage.

(2) Remove and clean ground handling wheel assemblies. Inflate tires to normal pressure. Stow wheel assemblies in cabin cargo area.

(3) Clean cross tubes and skid tubes and treat for corrosion in accordance with TM 55-405-3.

16-16. INSPECTION AND SERVICING - SHORT TERM STORAGE.

a. Perform a daily inspection, except for oil servicing of transmission and tail rotor gearbox.

b. Drain the following reservoirs and fill with corrosion preventive oil (item 304, table 1-1).

(1) Transmission sump.

(2) Tail rotor gearbox.

16-17. INTERMEDIATE STORAGE.

16-18. An aircraft that will be inactive for a period of more than 45 days but not exceeding 180 days, will be preserved and maintained in intermediate storage. Normally, this includes aircraft undergoing major repair or modification; aircraft declared surplus and awaiting final disposition; or any other circumstances that would warrant storage for a period of 45 to 180 days.

16-19. PREPARATION - INTERMEDIATE STORAGE.

16-20. A renewal of preservative shall be accomplished at each 45 day interval.

a. Airframe preparation.

Note

Apply the following procedures in addition to those for short term storage.

(1) Install standard covers, or suitable waterproof covering, over any openings which could allow water or other foreign matter to contact equipment or structural parts.

(2) Clean external surfaces of transparent plastic windows. (Refer to TM 55-405-4.)

(3) Allow windows to dry thoroughly. Apply an 0.008 inch minimum dry film of plastic coating compound (item 305, 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.

b. Fuel system preparation. Apply same procedures as for short term storage. (Refer to paragraph 16-13.) Any auxiliary fuel tanks will be removed, preserved, tagged, and returned to stock in accordance with TM 55-405-3.

c. Power train preparation.

(1) 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 (2) through (8) below.

(2) Remove main rotor.

(3) Remove mast assembly.

(4) Spray inside of transmission, through top opening, with approximately one gallon of corrosion-preventive oil (item 304, table 1-1). While spraying, manually rotate internal gears and bearings with input drive quill.

(5) Reinstall mast assembly. Apply dry cleaning solvent (item 300, table 1-1) to all unpainted surfaces of mast assembly. Wipe mast dry with clean lint-free cloth. Apply corrosion-preventive compound (item 302, table 1-1) to all unpainted surfaces.

(6) Reinstall main rotor.

(7) Reinstall main driveshaft.

(8) Be sure intermediate and tail rotor gearboxes have been filled with corrosion-preventive compound.

d. Hydraulic system preparation. Apply same procedures as for short term storage.

e. Rotors and controls preparation. Apply same procedures as for short term storage.

f. Battery preparation.

(1) Remove battery and turn in to higher level maintenance.

(2) Wrap battery quick-disconnect with barrier material (item 303, table 1-1) secured with tape (item 400, table 1-1).

g. Avionic equipment preparation. Apply same procedures as for short term storage. (Refer to paragraph 16-15.)

h. Utility equipment preparation.

(1) Remove fire extinguishers, apply condition tag, and return to local supply.

(2) Remove, apply condition tag, and return to supply such items as first-aid kits and other equipment subject to mildew and deterioration.

i. Landing gear preparation. Apply same procedures as for short term storage. (Refer to paragraph 16-15.)

j. Engine preparation.

(1) Disconnect the exciter input lead and insulate terminal.

(2) Place an oil container under the burner drain valve; supply preservation oil (item 7, table 1-1) to the fuel pump inlet.

(3) Move twist grip to idle detent. Motor engine with starter.

(4) When oil is observed flowing from the burner drain valve into container, move twist grip to Fuel Cutoff position. Remove oil supply to pump inlet.

(5) Connect the exciter input lead.

(6) Seal the inlet to the compressor, engine overboard vent, interstage bleed valve, labyrinth seal vent, and exhaust outlet.

(7) Record the extent of engine preservation in log book.

SECTION III DEPRESERVATION AND ACTIVATION

16-21. HELICOPTER ACTIVATION - AFTER FLYABLE STORAGE.

16-22. Helicopter in flyable storage requires no depreservation and can be returned to active flight status by accomplishing a complete Daily Inspection.

16-23. HELICOPTER ACTIVATION - AFTER SHORT TERM AND INTERMEDIATE STORAGE.

16-24. A helicopter being removed from short term or intermediate storage requires depreservation in accordance with the following instructions.

a. Airframe - depreservation. Clean airframe in accordance with instructions in TM 55-405-4. Remove all protective covers, coatings, and barrier material.

b. Fuel cells - depreservation. Flush fuel cells with jet fuel (item 1, table 1-1). Thoroughly dry inside of cells with filtered compressed air.

Note

Do not exceed three psig pressure during drying operation, as excessive pressure can rupture fuel cell.

c. Power train - depreservation.

(1) Drain preservative compound from transmission and tail rotor gearbox. Flush and fill each unit with oil (item 2, table 1-1).

(2) Check transmission oil filter.

(3) Clean drive shafts as necessary with cleaning solvent (item 300, table 1-1).

d. Rotors and controls - depreservation.

(1) Clean main and tail rotor assemblies with dry cleaning solvent (item 300, table 1-1). Wipe dry with lint-free cloth.

(2) Lubricate in accordance with Lubrication Order.

e. Battery - depreservation. Remove protective material from battery connector. Install and connect battery.

f. Landing gear - depreservation. Remove block from under skid gear. Inflate ground handling wheel tires to normal pressure.

g. Engine activation - after storage.

(1) Remove all temporary caps, plugs, and covers used to seal engine openings.

(2) Service the engine lubrication system with engine oil (item 2 or 10, table 1-1).

(3) Depreserve the engine by making a normal start.

Note

In case of a false start or a start that is not completed in a total time of one minute, return the gas producer lever to FUEL OFF and motor the engine without ignition for 10 seconds.

SECTION IV DEMOLITION

16-25. DESTRUCTION BY EXPLOSIVE.

16-26. Place as many charges as the situation permits at locations listed in following steps b. through e., and detonate them simultaneously with detonating cord and a suitable detonator. If possible, provide for dual method of detonation to minimize the possibility of misfire.

Warning

Observe all appropriate safety precautions to avoid personal injury or loss of life.

a. Remove and empty fire extinguishers.

b. Place one 1-pound TNT charge or equivalent beneath fuel tanks.

c. Place one 2-pound TNT charge or equivalent on the engine as close to the power drive section as possible.

d. Place one 1-pound TNT charge or equivalent behind the instrument panel.

e. Place one 1-pound TNT charge or equivalent in radio compartment.

f. Take cover and ignite charges.

16-27. DESTRUCTION BY MECHANICAL MEANS.

a. Remove access doors to main transmission drive shaft. Break the main drive shaft.

b. Cover instruments with cloth and smash all instruments.

c. When the engine is either removed from, or installed in, the aircraft the most logical manner of destruction is to dent the compressor first-stage rotor blades or smash the combustion section with suitable tools.

d. When the engine is installed in the aircraft, disconnect the turbine oil supply line. (See figure 16-1.) Run the engine at flight idle rpm and lock the collective pitch stick in the down position. Leave the engine running and evacuate all personnel to a safe distance. A mechanical seizure of all rotating parts will occur damaging the engine to an extent that further operation would be impossible.

e. Smash electronic equipment controls, tubes, coils, switches, capacitors, and transformers. Bury or scatter destroyed parts in slit trenches or foxholes, or throw them in a lake, stream, swamp, or other body of water.

f. Permanently bend or break the main rotor blades.

g. Break off pitot tube.

h. Smash the canopy and all windows in the aircraft.

i. If possible, turn aircraft upside down.

16-28. DESTRUCTION BY FIRE.

a. Remove fuel filler cap.

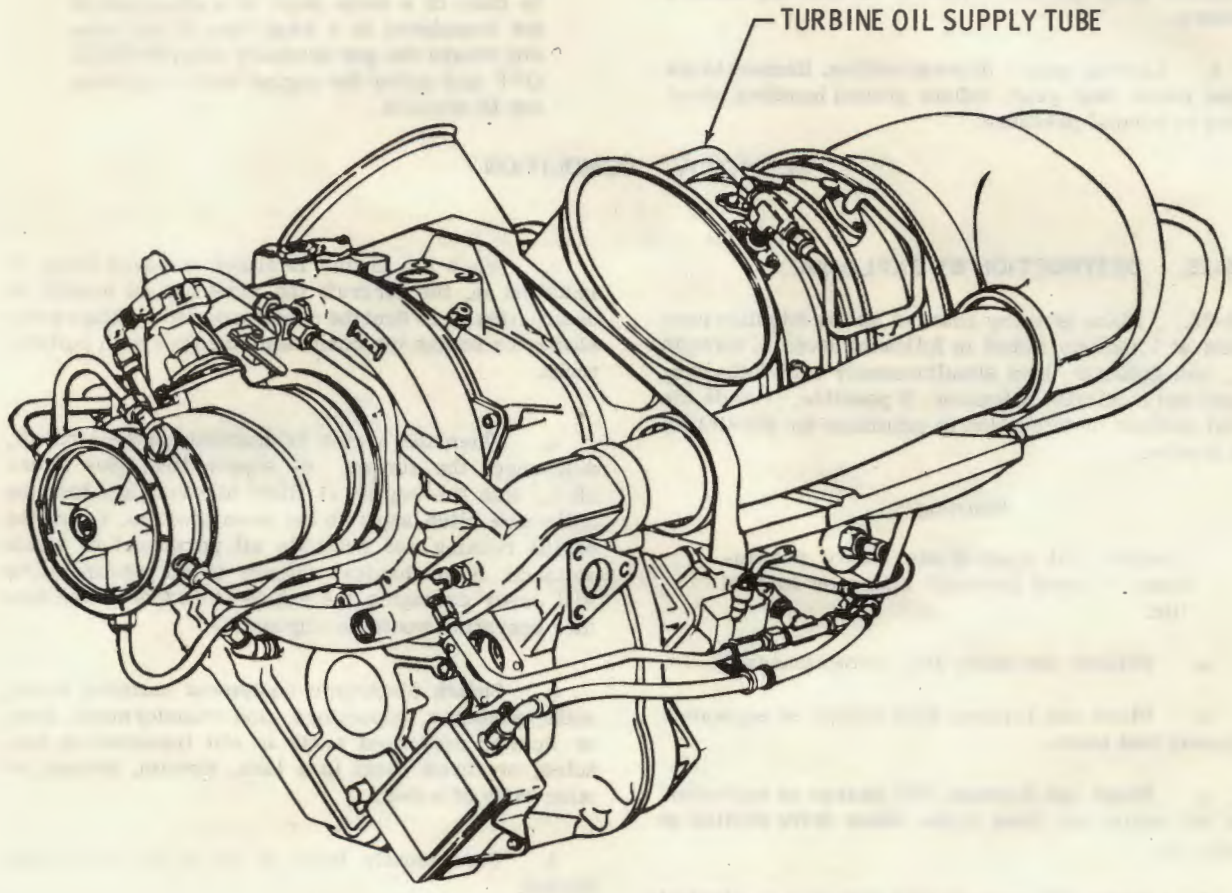
b. Open fuel cell drain valve on underside of fuselage.

c. Fire a signal cartridge into fuel beneath the aircraft.

d. If signal pistol is not available, drain some fuel into a can and lay a fuel trail away from the aircraft. Set end of fuel trail on fire and retire immediately from vicinity of aircraft to seek cover.

Note

The fuel may also be ignited by removing the aircraft battery, ripping two lengths of electrical wiring from the aircraft, connecting each wire to the battery receptacle, then creating a spark by bringing the ends of the wires together in the vapor of a fuel trail.



AV 053306

Figure 16-1. Destruction of engine

APPENDIX A
REFERENCES

The following references, of the issue in effect, in addition to those references contained in TM 55-1520-228-10, Appendix A are required for use by Organizational Maintenance personnel in performance of their duties.

NUMBER	TITLE
AR 95-16	Weight and Balance, Army Aircraft
AR 750-5	Organization, Policies, and Responsibility for Maintenance Operation
AR 750-55	Inspection and Preparation of Army Aircraft for Transfer to Foreign Governments as Grant Aid or Military Sales
AR 755-380	Disposal of Supplies and Equipment
DA Pam 310-4	Index of Technical Manuals, Technical Bulletins, Supply Manuals, Supply Bulletins, Lubrication Orders
TB AVN 23-16	Test Flights and Maintenance Operational Checks for Army Aircraft
TB 55-1500-300-25	Aircraft Accessory Replacement and Reuse Procedures
TB 55-1500-301-25	Army Aircraft Maintenance Inspection Procedures
TB 55-1500-303-25	Reporting Criteria and Instructions for Processing Damaged or Deteriorated Aircraft
TB 55-1500-308-25	First Aid Kit, Aircraft
TB 55-6650-300-15	Spectrometric Oil Analysis
TB 746-93-2	Painting and Marking of Army Aircraft
TM 3-220	Chemical, Biological and Radiological (CBR) Decontamination
TM 9-1005-298-12	Operator and Organizational Maintenance Manual Armament Subsystem, Helicopter, 7.62 Millimeter Machine Gun: High Rate, XM27E1
TM 10-1101	Petroleum Handling and Operations
TM 11-1520-228-20	Operator and Organizational Maintenance Manual: Electronic Equipment Configuration, Army Model OH-58A Helicopter
TM 11-6140-203-12	Operator and Organizational Maintenance Manual: Nickel-cadmium Storage Batteries
TM 38-230	Preservation, Packaging and Packing of Military Supplies and Equipment
TM 38-750	The Army Equipment Record System and Procedures

NUMBER	TITLE
TM 55-403	Fundamentals of Army Helicopter Maintenance
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
TM 55-405-9	Army Aviation Maintenance Engineering Manual: Weight and Balance
TM 55-1500-311-25	Army Aviation Maintenance Engineering Manual: General Practices
TM 55-6600-200-20	Marking of Instruments and Interpretation of Markings
TM 750-134	Procedures for Rapid Deployment, Redeployment and Retrogradation of US Army Rotary Wing Aircraft
TM 750-199	Procedures for Rapid Deployment, Redeployment and Retrogradation of U.S. Army Aircraft Components, Spare Parts, and Support Equipment (Class II (A) and Class IV (A) Supplies)
Technical Index	Index of Specifications and Standards

APPENDIX B

MAINTENANCE ALLOCATION CHART

SECTION I INTRODUCTION

AB-1. MAINTENANCE ALLOCATION CHART.

a. The maintenance allocation chart assigns maintenance functions to the lowest level of maintenance based on past experience and the following consideration:

(1) Skills available.

(2) Time required.

(3) Tools and test equipment required and/or available.

b. Only the lowest level of maintenance authorized to perform a maintenance function is indicated.

c. A maintenance function assigned to a maintenance level will automatically be authorized to be performed at any higher maintenance level.

d. A maintenance function that cannot be performed at the assigned level of maintenance for any reason may be evacuated to the next higher maintenance organization. Higher maintenance levels will perform the maintenance functions of lower maintenance levels when required or directed by the appropriate commander.

e. The assignment of a maintenance function will not be construed as authority to carry the associated repair parts in stock. Authority to requisition, stock, or otherwise secure necessary repair parts will be as specified in the repair parts appendix.

f. Normally there will be no deviation from the assigned level of maintenance. In cases of operational necessity, maintenance functions assigned to a maintenance level may, on a one-time basis at the request of the lower maintenance level, be specifically authorized by the Maintenance Officer of the level of maintenance to which the function is assigned. The special tools, equipment, etc., required by the lower level of maintenance to perform this function will be furnished by the maintenance level to which the function is assigned. This transfer of a maintenance function to a lower maintenance level does not relieve the higher maintenance level of the responsibility of the function. The higher level of maintenance will provide technical supervision and inspection of the function being performed at the lower level.

g. Organizational through depot maintenance of the U.S. Army Electronics Command Equipment will be performed by designated U.S. Army Electronics Command personnel.

h. Changes to the Maintenance Allocation Chart will be based on continuing evaluation and analysis of responsible technical personnel and on reports received from field activities.

AB-2. DEFINITIONS.

a. INSPECTION: To determine serviceability of an item by comparing its physical, mechanical, and electrical characteristics with established standards.

b. TEST: To verify serviceability and to detect electrical or mechanical failure by use of test equipment.

c. SERVICE: To clean, to preserve, to charge, and to add fuel, lubricants, cooling agents and air.

d. ADJUST: To rectify to the extent necessary to bring into proper operating range.

e. ALIGN: To adjust specified variable elements of an item to bring to optimum performance.

f. CALIBRATE: To determine the corrections to be made in the readings of instruments or test equipment used in precise measurement. Consists of the comparison of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument or test equipment being compared with the certified standard.

g. INSTALL: To set up for use in an operational environment such as an emplacement, site or vehicle.

h. REPLACE: To replace unserviceable items with serviceable assemblies, sub-assemblies or parts.

i. REPAIR: To restore an item to serviceable condition through correction of a specific failure or unserviceable condition. This includes, but is not limited to, inspections, cleaning, preserving, adjusting, replacing, welding, riveting and strengthening.

j. OVERHAUL: To restore an item to a completely serviceable condition as prescribed by maintenance serviceability standards prepared and published for the specific item to be overhauled.

k. REBUILD: To restore an item to a standard as nearly as possible to the original or new condition in appearance, performance, and life expectancy. This is accomplished through the maintenance technique of complete disassembly of the item, inspection of all parts or components, repair or replacement of worn or unserviceable elements (items) using original manufacturing tolerance and specifications and subsequent reassembly of the item.

AB-3. SYMBOLS.

a. The symbols "O, F, H and D" represent: Organizational maintenance (O), Direct Support Maintenance (F), General Support Maintenance (H), and Depot Maintenance (D) and when placed on the maintenance allocation chart, indicates the lowest level of maintenance responsible for performing the particular maintenance function. Maintenance levels higher than the level of maintenance marked by the symbol are authorized to perform the indicated function.

b. The symbol "%%" applies to organizational maintenance and indicates that the particular maintenance function may be performed provided it is specifically authorized by the direct support maintenance officer. In no case will the direct support maintenance officer require the accomplishment of a "%%" maintenance function by an organization or unit and in no case will a "%%" function authorize stockage of parts at organization level.

c. The symbol (*) in column 3 and 4 of the MAC denotes that a special tool is required to perform the indicated maintenance function.

d. The symbols (1) through (10) in column 3 of the MAC refer to foot-notes of the MAC.

SECTION II CHARTS

MAINTENANCE ALLOCATION CHART FOR OH-58A

(AR 310-3)

(1) GROUP NO	(2) FUNCTIONAL GROUP	(3) MAINTENANCE FUNCTION											(4) TOOLS AND EQUIPMENT	(5) REMARKS
		INSPECT	TEST	SERVICE	ADJUST	ALIGN	CALIBRATE	INSTALL	REPLACE	REPAIR	OVERHAUL	REBUILD		
		a	b	c	d	e	f	g	h	i	j	k		
00	AIRCRAFT													
	Clean													O
	Moor													O
	Tow													O
	Jack													O
	Preservation													O
	Weight & Balance													F
	Complete Painting													H
01	AIRFRAME													
	Sheetmetal & Structural Members not Requiring Jigs & Fixtures	O							F	F				
	Sheetmetal & Structural Members Requiring Jigs & Fixtures	O							H_5	H_5				
	Engine Mount Adapters	O							F					
	Engine Mount Supports	O							F	F				
	Tail Boom with Jigs & Fixtures	O							F	H_5				
	Tail Boom without Jigs and Fixtures	O							F	F				
	Vertical Stabilizer	O							O	F				
	Tail Skid Assembly	O							O					
	Horizontal Stabilizer Assembly	O							O	F				
	Cockpit and Cargo Doors	O							O	F				
	Jettison Mechanism	O							O					
	Latch Assemblies	O			O				F	F				
	Windows, All	O							F	O				Patch Repair "O" Level
	Windshields	O							F	F				
	Seats	O							O	F				
	Seat Belts & Shoulder Harness	O							O					
	Inertia Reel	O	O_1		O				O	F				
	Soundproofing	O							O	F				
	Cowling and Fairing	O							O	F				
02	ALIGHTING GEAR													
	Cross Tubes	O							O	F				
	Skid Tubes	O							O	F				
	Skid Shoes	O							O	H				
	Tow Rings	O							O					

MAINTENANCE ALLOCATION CHART FOR OH-58A

(AR 310-3)

(1) GROUP NO	(2) FUNCTIONAL GROUP	(3) MAINTENANCE FUNCTION											(4) TOOLS AND EQUIPMENT	(5) REMARKS
		INSPECT	TEST	SERVICE	ADJUST	ALIGN	CALIBRATE	INSTALL	REPLACE	REPAIR	OVERHAUL	REBUILD		
		a	b	c	d	e	f	g	h	i	j	k		
03	ENGINE & RELATED SYSTEMS													
	Engine, Complete Assembly	O	O_1	O	O				F	F	D			"O" adjust IDLE speed only
	Compressor, Air Inlet and Seals	O							F	F				
	Compressor Assembly	O							F	F	D			
	Interstage Bleed Valve	O	O_1						%%	H				
	Anti-Icing Valve	O	O_1						%%	F				
	Stator Vanes and Rotor	F							H_5					
	Diffuser Scroll	O							F	F				
	Combustion Section	O							F	F				
	Outer Case	O							F	F				
	Combustion Liner	F							F	F				
	Fuel Spray Nozzle	O							O	D				
	Drain Valve	O							%%					
	Turbine Assembly	F							F	F	D			
	Seal Assembly, Oil Bellows	F							F					
	1st Stage Nozzle & Shield Assembly	F							F					
	Exhaust Collector	O							F	H				
	Exhaust Stacks	O							O	H				
	Power & Accessory Gearbox Assembly	O								F	D			
	Gearbox Seals, External	O							F					
	Torquemeter System - External	O							F					
	Gearbox Studs	O							F					
	Chip Detectors	O	O						O					
	Starter-Generator	O	F						O	F	H			
	Engine Oil Cooler	O							O					
	Engine Oil Cooler Blower	O							O					
	Oil Pressure Regulator	O	O_1		O				O					
	Ignition & Exciter	O	O_1						O					
	Spark Igniter Lead	O							O					
	Gas Producer Fuel Control	O	F_1		F				F		D			

MAINTENANCE ALLOCATION CHART
FOR
OH-58A

(AR 310-3)

(1) GROUP NO	(2) FUNCTIONAL GROUP	(3) MAINTENANCE FUNCTION											(4) TOOLS AND EQUIPMENT	(5) REMARKS
		INSPECT	TEST	SERVICE	ADJUST	ALIGN	CALIBRATE	INSTALL	REPLACE	REPAIR	OVERHAUL	REBUILD		
03	ENGINE & RELATED SYSTEMS (Cont)	a	b	c	d	e	f	g	h	i	j	k		
	Power Turbine Fuel Governor	O	F_1		F				F		D			
	Fuel Pump	O	O_1	O					F		D			
	Fuel Pump Filter	O	O_1	O					O					
	Double Check Valve	O							%%					
	Oil Tank	O		O					O	F				
	Oil Filter	O		O					O					
	Oil Bypass Valve	O	O_1						O					
	Engine Control Linkage	O			O_3				O	O				
	Droop Compensator Linkage	O			O_3				O	O				
	Linear Actuator	O	O_1		O				O	H				
	Particle Separator	O		O					O	F				
04	ROTORS AND TRANSMISSION SYSTEM													
	Main Rotor Hub and Blade Assembly	O	O_1	O	O_2	F_4			F					
	Main Rotor Hub Assembly	O		O	F				F	F	D			
	Reservoirs & Sight Glass	O			O				O					
	Rod End Bearing, Pitch Change	O							O					
	Latch Assembly	O							F					
	Grip Seals	O							F					
	Bolt, Blade Retention	O							F					
	Split Cone Set	F							F					
	Main Rotor Retain Nut	O							F					

MAINTENANCE ALLOCATION CHART FOR OH-58A

(AR 310-3)

(1) GROUP NO	(2) FUNCTIONAL GROUP	(3) MAINTENANCE FUNCTION											(4) TOOLS AND EQUIPMENT	(5) REMARKS
		INSPECT	TEST	SERVICE	ADJUST	ALIGN	CALIBRATE	INSTALL	REPLACE	REPAIR	OVERHAUL	REBUILD		
		a	b	c	d	e	f	g	h	i	j	k		
04	ROTORS AND TRANSMISSION SYSTEM (Cont)													
	Blade Main Rotor	O							F	H				
	Mast Assembly	O							F	H				
	Seals	O							H					
	Bearing	O							H					
	Pitch Link Assembly	O			O				O	O				
	Link Assembly, Idler	O							O	O				
	Link Drive	O							O	F				
	Idler	O							O	F				
	Collar Set	O							O	F				
	Boot Assembly, Mast	O							F					
	Swashplate & Support Assembly	O	O		O				F	F	H			Uniball Friction Test "O"
	Lever, Collective	O							O	F				
	Link Assembly, Collective	O							O					
	Support Assembly, Collective	F							F	F				
	Transmission Assembly Main	O		O					F	O	D			600 Hr. Insp. at "F" Level
	Oil Pump Assembly	O							F	D				
	Input Drive Quill Seals	O							F					
	Drag Pin Assembly	O							F					
	Pylon Support	O							F	F				
	Oil Jets	F							F					
	Oil Filter Head Assembly	O							O	O				
	Temp Bulb	O							O					
	Thermo Switch	O							O					
	Filter	O							O					
	Screen	O							O					
	Valve Pressure	O							O					

MAINTENANCE ALLOCATION CHART FOR OH-58A

(AR 310-3)

(1) GROUP NO	(2) FUNCTIONAL GROUP	(3) MAINTENANCE FUNCTION											(4) TOOLS AND EQUIPMENT	(5) REMARKS
		INSPECT	TEST	SERVICE	ADJUST	ALIGN	CALIBRATE	INSTALL	REPLACE	REPAIR	OVERHAUL	REBUILD		
		a	b	c	d	e	f	g	h	i	j	k		
04	ROTORS AND TRANSMISSION SYSTEMS (Cont)													
	Chip Detector	O							O					
	Oil Cooler	O							O	H				
	Oil Transfer Tube	O							O					
	Tube, Filter to Cooler	O							O					
	Hoses and Lines	O							O					
	Duct Installation Transmission	O							O					
	Driveshaft Assembly Transmission	O		O					O	O	H			
	Freewheeling Assembly	O							F	F	D			
04	Valve Vent	O		O					%%					
	Tail Rotor Driveshaft Assembly	O							O	O	H			
	Disc Assemblies	O							O					
	Bearings and Hangers	O							O					
	Gear Box, 90°	O		O					O	F	D			
	Seals	O							F					
	Tail Rotor Hub & Blade Assembly	O			F_4				O_3	F				
	Tail Rotor Blades	O							F	F				
	Bearing	F							F					
	Tail Rotor Hub Assembly	O							F	F	H_5			
	Trunnion	F							F					
06	HYDRAULIC SYSTEM													
	Pump Assembly	O	O_1		O				O	F	H			
	Reservoir	O		O					O	O				
	Filter Assemblies	O							O	F				
	Filter Element	O		F_8					O					
	Solenoid Valve	O	O_1						O					
	Servo Actuator Assembly	O	O_1						O	F	H			

MAINTENANCE ALLOCATION CHART FOR OH-58A

(AR 310-3)

(1) GROUP NO	(2) FUNCTIONAL GROUP	(3) MAINTENANCE FUNCTION											(4) TOOLS AND EQUIPMENT	(5) REMARKS
		INSPECT	TEST	SERVICE	ADJUST	ALIGN	CALIBRATE	INSTALL	REPLACE	REPAIR	OVERHAUL	REBUILD		
		a	b	c	d	e	f	g	h	i	j	k		
	HYDRAULIC SYSTEM (Cont)													
	Check Valves	O							O					
	Pressure Switch	O	O_1						O					
	Quick Disconnect Ground Test	O							O					
	Hose and Lines	O							O					
08	INSTRUMENTS													
	Miscellaneous Instruments													
	Clock	O							O					Note 7
	Fuel Quantity Indicator	O							O		H			
	Fuel Quantity Transmitter	O							O					
	D.C. Ammeter	O			O				O					
	Flight Instruments													
	Standby Compass	O					O_6		O	H				
	Airspeed Indicator	O	F						O		H			
	Altimeter	O	F		O				O		H			
	Attitude Indicator	O							O		H			
	Turn & Slip Indicator	O							O		H			
	Free Air Temperature	O							O					
	Pitot/Static System	O	F						O	F				
	Engine Instruments													
	Engine & Rotor Tachometer Generators	O	F						O		H			
	Engine & Rotor Indicator (Dual)	O	F						O		H			
	Exhaust Temperature	O	F						O					
	Oil Temperature Indicator	O							O					
	Oil Pressure Indicator	O							O		H			
	Fuel Pressure Indicator	O							O		H			
	Torquemeter Indicator	O							O		H			
	Gas Producer Indicator	O	F						O		H			
	Transmission Instruments													
	Oil Temperature Indicator	O							O					
	Oil Pressure Indicator	O							O		H			
	Thermocouples & Temperature Bulbs	O	F						O					
09	ELECTRICAL SYSTEM													
	Battery	O		O					O					Note 7
	Voltage Regulator	O	O_1		O				O	H				

MAINTENANCE ALLOCATION CHART FOR OH-58A

(AR 310-3)

(1) GROUP NO	(2) FUNCTIONAL GROUP	(3) MAINTENANCE FUNCTION											(4) TOOLS AND EQUIPMENT	(5) REMARKS
		INSPECT	TEST	SERVICE	ADJUST	ALIGN	CALIBRATE	INSTALL	REPLACE	REPAIR	OVERHAUL	REBUILD		
		a	b	c	d	e	f	g	h	i	j	k		
	ELECTRICAL SYSTEM (Cont)													
	Relays, Rheostats, Switches, Circuit Breaker, Connectors, Wiring Conduits, Receptacles, Shunts and Shock Mounts	O	O						O					
	Flasher Unit	O							O					
	Caution Panel	O	F						O	F				
	Engine Failure Warning Signal	O	O_1		O				O					
	Lights; Landing, Navigation, Instrument, Cabin, Map, Anti-Collision	O							O	O				
	Chip Detector System	O							O	O				
10	FUEL SYSTEM	O					F			F				
	Fuel Cell	O		O					O	F				
	Boost Pump	O	O_1						O		H			
	Valves	O							O					
	Hoses, Lines, and Fittings	O	F						O	F				
	Pressure Switch	O							O					
11	FLIGHT CONTROL SYSTEMS													
	Main Rotor Control Tubes	O			O_3				O	O				
	Force Gradient	O			O_3				O	F				
	Control Stick Collective and Cyclic	O			O_3				O	F				
	Magnetic Brake	O			O_3				O	H				
	Collective and Cyclic Linkage	O			O_3				O	O				
	Jackshaft	O							O					
	Tail Rotor Control Linkage	O			O_3				O	O				
	Tail Rotor Pitch Change Mechanism	O							O	F				
	Tail Rotor Pich Change Links	O							O					
	Pedal Assembly, Tail Rotor	O			O_3				O	F				
	Bellcranks	O							F					
	Bonded Rod Ends	O							F					
12	UTILITY SYSTEMS													
	Bleed Air Heating System	O							O					

MAINTENANCE ALLOCATION CHART FOR OH-58A

(AR 310-3)

(1) GROUP NO	(2) FUNCTIONAL GROUP	(3) MAINTENANCE FUNCTION											(4) TOOLS AND EQUIPMENT	(5) REMARKS
		INSPECT	TEST	SERVICE	ADJUST	ALIGN	CALIBRATE	INSTALL	REPLACE	REPAIR	OVERHAUL	REBUILD		
		a	b	c	d	e	f	g	h	i	j	k		
	UTILITY SYSTEMS (Cont)													
	Ventilating and Defogging	O							O	F				
	Valves, Ducts, Hose and Registers	O							O	F				
	Fan Motors	O							O	H				
19	AVIONICS													Note 7
30	ARMAMENT													Note 7
40	GROUND HANDLING EQUIPMENT	O							O	O				
	Wheel Assemblies	O		O					O	O				
	Actuating Assemblies	O		O					O	F				
70	MAINTENANCE SUPPLIES													
	Dye Penetrant Inspection													O
	Magnaflux and/or Fluorescent Inspection													F
	Hardness Testing													H
	Heat Treat													H_5
	Cleaning													O
	Preservation and Depreservation													O
	Cadmium Plating													H_5
	Chrome Plating													H_5
	Spot Painting													O
	Welding and Brazing													F
	NOTES:													
	1. Maintenance Operational Check, (Reference TB-AVN 23-16)													
	2. Tracking													
	3. Rigging													
	4. Balance													

MAINTENANCE ALLOCATION CHART
FOR
OH-58A

(AR 310-3)

(1) GROUP NO	(2) FUNCTIONAL GROUP	(3) MAINTENANCE FUNCTION											(4) TOOLS AND EQUIPMENT	(5) REMARKS
		INSPECT	TEST	SERVICE	ADJUST	ALIGN	CALIBRATE	INSTALL	REPLACE	REPAIR	OVERHAUL	REBUILD		
	NOTES (Cont) 5. Normally depot function, however, where facilities, skills, equipment and test capabilities are authorized at "H" level, this function is authorized. 6. Compass Swing 7. For all maintenance allocations and functions refer to the maintenance allocation chart in the applicable TM. 8. Sonic Cleaning of Reusable Porous Filters 9. If the transformers and rectifiers are not AVCOM managed items, use Note 7.													

APPENDIX C

AIRCRAFT INVENTORY MASTER GUIDE

AC-1. INTRODUCTION.

AC-2. Appendix C lists those items of installed or loose equipment required by and authorized for using organizations to accomplish their primary or alternate mission. This list will serve to standardize present inventory procedures, using the inventory master guide to determine the inventoriable items of installed and loose equipment. Insofar as possible, items of equipment are listed in the sequence of their physical location within the aircraft area.

AC-3. Aircraft inventory is subject to change as a result of authorized changes (MWO's) and additions or deletions of property for special missions requirements; therefore, the selection of items of inventory from the inventory master guide may or may not provide a complete inventory list. When it is known that the master guide does not provide a complete inventory list, it will be necessary to research authorized changes (MWO's) and local command directives in order to compile an accurate and exact inventory list.

AC-4. Refer to TM 38-750 for applicable forms and records.

AC-5. SECURITY.

AC-6. It is desired that aircraft inventory records be unclassified. Therefore, when equipment bearing a security classification or the installation of unclassified equipment is of a confidential or secret nature, accomplishment of the classification will be in accordance with existing security regulations.

AC-7. PERIODS OF INVENTORY.

AC-8. Inventoriable items will be checked against the Aircraft Inventory Record (DA Form 2408-17) at the following periods:

a. Upon receipt of the aircraft.

b. Prior to transfer of the aircraft to another organization.

c. Upon placing aircraft in storage and upon removing from storage. Aircraft need not be inventoried while in storage.

d. Twelve months elapsed time since last inventory.

e. Loose equipment shipped under separate cover are inventoried upon transfer by the sending activity and immediately upon receipt by the receiving activity.

AC-9. INVENTORY ITEMS LIST. (Refer to figure AC-1.)

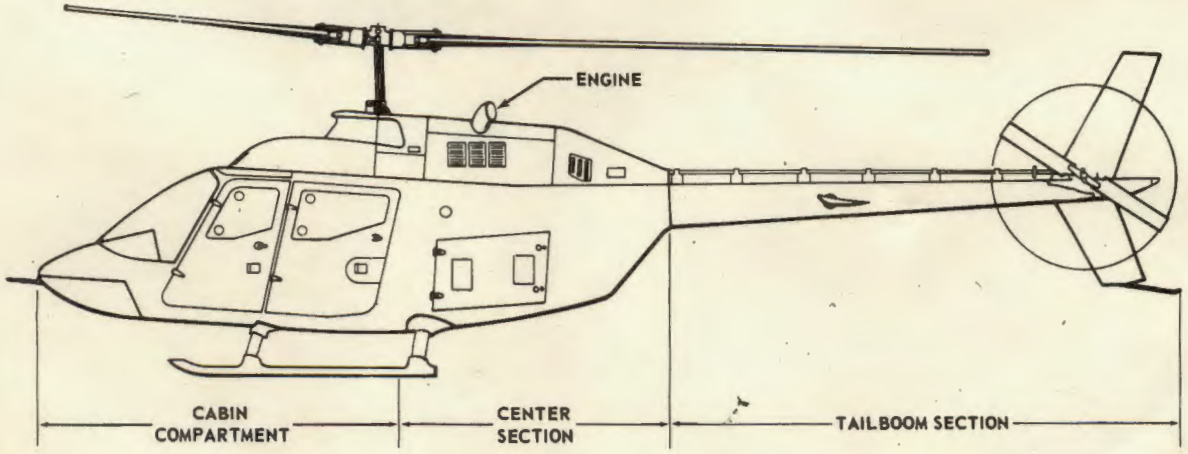


Figure AC-1. Aircraft inventory sections

NOMENCLATURE	WHERE	AMOUNT INSTALLED
First Aid Kit	Cabin Compartment	1
Pilot Seat and Back Cushions	Cabin Compartment	1
Copilot Seat and Back Cushions	Cabin Compartment	1
Pilot Seat Belt and Shoulder Harness	Cabin Compartment	1
Copilot Seat Belt and Shoulder Harness	Cabin Compartment	1
Passenger Seats and Back Cushions	Cabin Compartment	2
Passenger Seat Belts and Shoulder Harness	Cabin Compartment	2
Clock	Cabin Compartment	1
Magnetic Compass	Cabin Compartment	1
Fire Extinguisher	Cabin Compartment	1
AN/ARC-116(XC-2) UHF-AM	Cabin Compartment	1
C6533(XC-2A) Control	Cabin Compartment	2
AN/ARC-114(XC-2) VHF-FM	Cabin Compartment	2
AN/ARC-115(XC-2) VHF-AM	Cabin Compartment	1
AN/ARN-89 (XC-2) ADF	Cabin Compartment	1
C-6280P/APX IFF Control	Cabin Compartment	1
Armament Control Panel	Cabin Compartment	1
ARN-89 Preamp	Center Section	1
APX-72 Transponder	Center Section	1
Exhaust Cover	Exterior	2
Main Rotor Tie Down	Exterior	1
Pitot Cover	Exterior	1
Wheel Assembly	Exterior	2
Engine Inlet Cover	Exterior	2
Hard Point Fittings	Exterior	3
Cargo Platform	Exterior	1
Tow Fittings	Exterior	2

APPENDIX D

WEIGHT AND BALANCE

Note

For general weight and balance information, refer to TM 55-405-9, Army Aviation Maintenance Engineering Manual, Weight and Balance. Appendix B, Maintenance Allocation Chart should be consulted for responsibility of weighing and balancing of the aircraft.

ALPHABETICAL INDEX