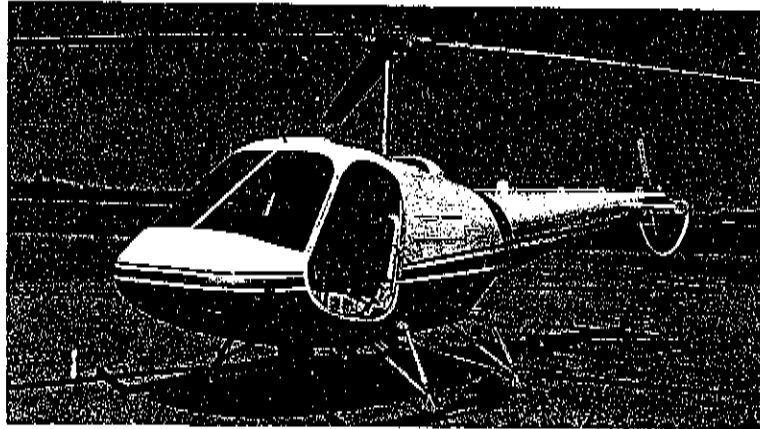


MAINTENANCE MANUAL

THIS IS THE F-28A



Manufactured by The Enstrom Corporation, Menominee, Michigan

Ownership of the F-28A Helicopter will provide you with a smooth, distinctive, and comfortable mode of flight geared to the concept of modern transportation. For business or pleasure, the field of operations is practically unlimited, as point-to-point travel can be accomplished from either prepared or unprepared areas. The distinctive appearance of the F-28A is symbolic of prestige and its high performance capabilities. Under the graceful lines of the F-28A is a ruggedly constructed helicopter designed for easy servicing, minimum maintenance, dependability and economical operation.

This Reissue Replaces All Previous Issues

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Revised 8/18/72

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INTRODUCTION

This Maintenance Manual is one of the group of publications that comprise a complete information file for the Enstrom F-28A Helicopter manufactured by the Enstrom Corporation, Menominee, Michigan. The information presented is intended to provide maintenance personnel with information and procedures necessary to repair and maintain the aircraft in flying commission.

TABLE OF CONTENTS

The table of contents at the beginning of the Manual presents, in sequence, the principal text headings within each section, a complete list of illustrations, also in numerical order.

MANUAL ARRANGEMENT

Information is presented by text and illustrations under section heading. The descriptive text for the major systems defines the function, location, and physical characteristics.

Operating instructions are included when required to perform specific maintenance tasks. Instructions identify and locate switches, lights, and indicators and give normal sequence of operation.

Maintenance procedures are presented as a group in continuous sequence; a general statement of the type of maintenance that can be performed is made at the beginning of each group. Procedural groups contain all or part of the following, as applicable:

- Testing or operational check
- Troubleshooting
- Adjustment
- Removal
- Cleaning
- Inspection
- Repair, parts replacement, or fabrication
- Part repair, testing, and adjustment
- Installation

Under each type of maintenance heading the following information is provided, if applicable:

- Tools and equipment
- Materials
- Maintenance procedures

AIRCRAFT EFFECTIVITY

The Manual is written to include all configurations applicable to the Enstrom F-28A Helicopter. Aircraft differences are determined by serial number and appear as effectivity notes on affected illustrations and in related text. Where no effectivity notes appear, it may be

assumed that the configuration shown or discussed is applicable to all aircraft.

MANUAL CHANGES AND REVISIONS

Subsequent to the publication of the initial issue of the Enstrom F-28A Helicopter Maintenance Manual, changes in aircraft and equipment, in support concepts and in procedures, as well as information developed by experience, affect the contents of the Manual. To ensure that coverage in the Manual continues to reflect such changes, revised information is released by one of the following methods:

- A. Revision — An alteration of portions of the Manual accomplished by the replacement, addition and/or deletion of pages.

CAUTION: Do not discard the present Manual when a revision is received. Consult the "A" page to determine usability of old pages to prevent having a publication with missing pages.

The "A" page that accompanies each revision lists all pages replaced, added, or deleted. The Manual should be disassembled and all affected pages removed and destroyed. The replacing and added pages should then be inserted and checked against the "A" page listing.

- B. Reissue — In cases where large numbers of changes are involved, a complete reissue of the Manual is warranted. Preceding issues of the Manual then becomes obsolete and should be discarded.
- C. Service Information Notices and Letters — Service information is to be considered as part of the Manual.

C.1 Service Letter

To be used to transmit information, recommendations and general service instructions to the customer.

C.2 Service Note

To be used to direct the customer to make mandatory changes, improvements or inspections to his aircraft.

- C.3 Physical incorporation in the Manual of the service information will be accomplished at the next revision date and listed on the Service Information Summary page.

ALPHABETICAL INDEX

The alphabetical index at the end of the Manual is the user's primary guide for locating information. As such, it is arranged to provide ready access to specific procedures. Subjects are listed alphabetically.

LOG OF REVISIONS

Revision Date	Pages Revised	
	Inserted	Removed
12-20-73	MM 9-11	
5-22-74	MM 10-10	
5-22-74	MM 11-7	
5-22-74	MM 11-21	
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8-1-74	MM 2-4	
8-1-74	MM 3-6	
9-1-75	MM 5-15	
9-1-75	MM 5-16	
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NOTE: Revised text is indicated by a black vertical line. |

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F-28A DESCRIPTION

One of the first steps in obtaining the utmost performance, service, and flying enjoyment from your F-28A is to familiarize yourself with its equipment, systems, and controls.

THE HELICOPTER

The Enstrom F-28A Helicopter is designed for high performance, mechanical simplicity, and maximum versatility. By virtue of component longevity and minimum maintenance requirements, the F-28A enjoys the lowest operating cost of any helicopter. The rugged, rotor head, combined with the (51 lbs.) rotor blades, give unheard-of stability and excellent autorotational characteristics.

INTERIOR ARRANGEMENT

The cabin interior is a full, three-place, side-by-side seating arrangement with a spacious 61" width for maximum pilot and passenger comfort and safety. The wide choice of interior color styling is available to complement any exterior combination. The instrument panel is on the horizontal plane for more natural scanning and is conveniently located for dual pilot viewing. Simple, clean controls blend tastefully into the interior. Excellent visibility is offered through the clear view tinted Plexiglas wrap-around windshield and doors to overhead and lower deck windows. Extra-width, swing-open doors close securely with simple-to-operate safety lock handles.

AIRFRAME

The airframe is composed of three main sections: the tail cone assembly, cabin assembly, and pylon assembly.

The tail cone assembly is a semi-monocoque structure and attaches to the pylon assembly with three bolts for easy removal and installation. The rear of the tail cone supports the horizontal stabilizer, tail rotor gear box, tail rotor, and tail rotor skid.

The cabin is fabricated from molded fiberglass and is an integral unit. It is attached to the forward side of the pylon assembly by six bolts and encompasses the structural aluminum seat portion plus instrument panel, cyclic, collective, and tail rotor controls. The wrap-around, tinted Plexiglas windshield and full glass doors, plus upper and lower deck windows, provide for excellent visibility. The extra-width, swing-open doors close securely with simple-to-operate safety lock handles. The helicopter can be flown with either left, right, or both doors off.

The pylon structure assembly is fabricated from steel tubing and houses the engine, the belt engagement and idler assembly, clutch, cooling fan, fuel tanks, and main rotor drive system. A skid-type landing gear attaches to the lower section at four points. Ground handling wheels are provided for moving the helicopter, or can be easily removed. Four air-oil struts soften landing loads and aid

in leveling the helicopter while on the ground.

AIR INDUCTION SYSTEM

The air induction system consists of a filtered non-ram carburetor air intake located beneath the engine compartment. It incorporates a spring-loaded, automatic alternate air source.

POWER PLANT

A Lycoming H10-360-C1A-205 HP four cylinder opposed engine is used in the F-28A Helicopter. The engine is delivered with platinum spark plugs.

NOTE: It is recommended that the appropriate Lycoming Operator's Manual be consulted prior to any adjustment or repair to the engine.

OIL SYSTEM

The Lycoming engine employs a wet sump lubrication system. It has a capacity of 8 quarts. A bayonet-type oil quantity gauge with graduated markings is part of the oil tank filler cap and is accessible through the left-hand side cowling of the engine. Engine oil cooling is accomplished by an oil cooler with thermostatic valves and by-pass provisions. It is located on the right-hand side of the engine compartment.

Oil System Indicators - Oil Temperature and Pressure Gauges. Standard type gauges are provided for both the engine oil temperature and oil pressure indications. Both gauges are marked to provide visual engine operating limitations and are located on the instrument panel.

ENGINE CONTROLS

Throttle. A twist-grip type throttle is located on the collective pitch control stick for direct control of engine power. It is manually connected to the fuel servo-throttle valve on the engine.

Mixture Control. A mixture control push-pull control knob is provided on the center of the console. It is pushed in during all flight operations. Shutting off the engine is accomplished by placing the mixture control in the **Idle Cut Off** position.

Magneto Switch. The magneto switch is a key-operated switch located in the center of the instrument panel. For starting, place the switch in the **Both** position.

Starter Button. The starter button is located on the end of the collective control. Push to engage.

Master Switch. The master switch is located on the instrument panel next to the master switch circuit breaker. It is a single-throw, two-position switch.

CABIN HEAT

The cabin heat control is located at the left-hand side of the pilot's seat, on the floor. By moving the control in or out, the operator

regulates the amount of cabin heat through the output louvers located in the center of the floor under the instrument panel.

CLUTCH ENGAGING LEVER

The clutch engagement lever is located at the right side of the pilot's seat on the forward face of the seat structure. The clutch lever is provided as a means of engaging and disengaging the rotor drive system.

FUEL SYSTEM

The system consists of two interconnected fuel tanks, which feed simultaneously to the engine. Each tank must be filled individually. They are located on the left and right side of the aircraft over the engine compartments. The tanks are fabricated of fiberglass and have an individual fuel capacity of 15 gallons each. Each fuel tank is gravity fed to a central distributing line which connects to the electric booster pump and engine driven pump. The fuel control valve is an off-on type and is located on the firewall next to the pilot's left shoulder. Each tank has an individual drain valve in the bottom. There is also a main fuel filter located aft of the firewall in the engine compartment. The control is on the right-hand side of the engine compartment and extends beyond the side panel.

Auxiliary Fuel Pump Switch. The fuel booster pump switch and fuel pressure warning lights are located on the instrument panel.

Fuel Quantity Indicator. The fuel quantity gauge continuously indicates the total quantity of fuel. It is hooked up through a simple type liquidometer float located in the right-hand fuel tank.

Fuel Pressure Indicator. The fuel pressure indicator provides PSI pressure readings of the fuel as delivered to the flow divider. The indicator is marked for normal operating range from 0 - 12 PSI.

TRANSMISSION SYSTEM

The main transmission unit provides an 8.7871 reduction ratio between the engine and the main rotor. The transmission incorporates a free-wheeling unit in the upper pulley assembly, which is mounted on the output pinion shaft. The free-wheeling unit provides a disconnect from the engine in the event of a power failure and permits the main and tail rotors to rotate in order to accomplish safe autorotation landings. Five and one-half pints of No. 90 wt. oil are used in the transmission. The main rotor transmission has a sight gauge which is located on the aft right-hand side and is visible through an opening in the baggage compartment. A vent line is located on the forward side of the main rotor transmission. Positive oil pressure is maintained, to the main thrust bearing, by centrifical force of the ring gear. All other bearings are splash fed.

Main Rotor Transmission Temperature Indicator. A main rotor transmission gauge is located on the instrument panel and is redlined at 220°F.

Tail Rotor Transmission. The tail rotor transmission, a right-angle transmission mounted at the aft end of the tail cone, supports and drives the tail rotor. The tail rotor transmission transmits power from the tail rotor drive shaft to the tail rotor assembly through steel spiral beveled gears housed in an aluminum alloy housing. The tail rotor transmission is equipped with a self-contained lubricant supply and level gauge at the rear of the housing and a magnetic plug can be removed to inspect for metal particles. Its capacity is ½ pint of No. 10 oil.

ROTOR SYSTEM

Main Rotor. The main rotor is a three-blade, fully articulated system; that is, the blades are hinge-mounted to be free to lead-lag, flap, and feather. The fully articulated system in the F-28A Helicopter provides smooth control responses in all modes of flight; and due to the kinetic energy stored in the heavy rotor blades, allows for easy-to-perform, safe autorotation landings in the event of power failure. The rotor assembly is mechanically simple and consists of three all-metal bonded blades, upper and lower rotor hub plates, universal blocks, blade grip assemblies, and lead lag hydraulic dampers. The excellent hydraulic dampers govern the lead-lag motion and aid in the dynamic stability of the F-28A.

Tail Rotor. The tail anti-torque rotor counteracts the torque of the main rotor and functions to maintain or change the helicopter heading. The tail rotor is a two-bladed, teetering, delta-hinge type assembly. Each blade is connected to a common hub. Blade pitch change is accomplished by movement of the pilot's directional control pedals that are connected to a pitch control assembly mounted on the tail rotor 90° gear box. This blade pitch provides control of torque and change of directional headings. Power to drive the tail rotor is taken from the input shaft of the main transmission.

Rotor Tachometer. The rotor RPM indicator is part of a dual-purpose tachometer which also reads engine RPM.

Stabilizer. An all-metal, fixed-position stabilizer adjusted to a -4° is installed on the tail cone assembly for longitudinal stability.

FLIGHT CONTROLS

Cyclic Control. The cyclic control stick is similar in appearance to the control stick of a fixed-wing aircraft. The direction of stick movement results in a change of the plane of rotation of the main rotor and will produce a corresponding directional movement of the helicopter through the longitudinal and lateral modes of flight. The stick grip incorporates a trigger-type switch used for radio transmissions. A trim switch is also located on the cyclic stick grip to control the longitudinal and lateral trim forces.

Collective Pitch Control. The collective pitch control lever is located to the left of the pilot's position and controls the vertical mode of flight. The amount of lever movement determines the angle of attack

and the lift developed by the rotor blades and results in an ascent or descent of the helicopter. A rotating, grip-type throttle is located at the end of the collective control.

Directional Control Pedals. The directional control pedals are located in the cabin forward of the pilot and/or co-pilot. When moved, these adjustable pedals change the pitch of the tail rotor blades and thereby provide the method of changing directional heading.

FLIGHT INSTRUMENTS

The standard flight instruments which are installed in the F-28A as basic equipment comply with the requirements under visual flight rules for day or night operation. The panel arrangement provides ease of visual observance and includes space provisions for installation of additional instruments to meet individual requirements.

Airspeed Indicator. The single-scale airspeed indicator is calibrated in MPH and provides an indicated airspeed reading at any time during forward flight. The reading is obtained by measuring the difference between impact air pressure and the static vent. The pitot tube, which provides the impact air pressure source, is located forward of the cabin nose section. Static air pressure for instrument operation is derived from two static vents located on either side of the tail cone assembly. The openings in the pitot tube and static vent ports must be maintained obstruction-free and clean at all times for proper instrument operation.

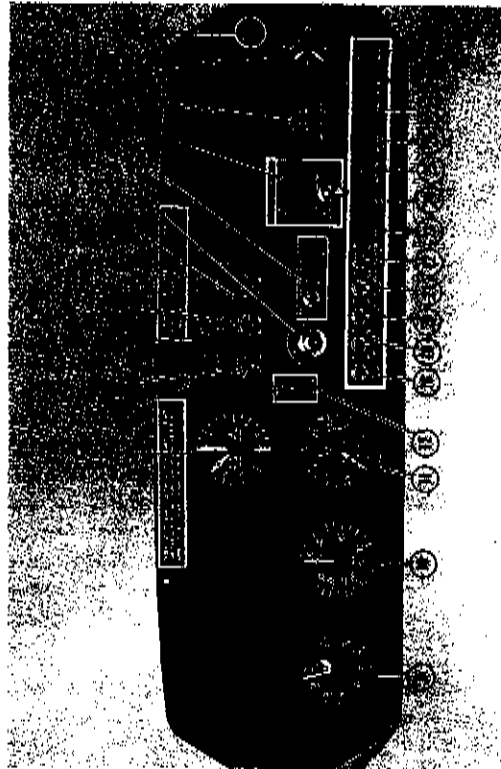
Altimeter. The altimeter is a sensitive type that provides distance-height readings from 0 to 25,000 feet. The long hand in a single complete sweep of the dial totals 1,000 feet, and the short hand totals the thousands of feet altitude. The instrument is vented to the same static port vents as the airspeed indicator.

Compass. A standard aircraft quality magnetic compass is mounted on the front of the cockpit within easy sight of pilot or co-pilot. It is to be used in conjunction with a compass correction card located adjacent to the instrument.

Free Air Temperature Indicator. The free air temperature indicator is a direct reading, bi-metallic instrument with a stainless steel probe. This instrument provides ambient temperature information which, when utilized, will assist in determining performance capabilities of the helicopter at the existing climatic condition. The indicator is located in the top of the canopy.

ELECTRICAL POWER SUPPLY SYSTEM

Direct Current Power System. The basic power supply system is a 12-volt direct current system, with a negative ground to the helicopter structure. A belt-driven alternator is located on the aft part of the engine and is used in place of a generator. One 12-volt battery is located in the right-hand side of the pilot's compartment and serves as a stand-by power source supplying power to the system when the alternator is inoperative.



KEY TO INSTRUMENT PANEL

1	Manifold pressure/fuel pressure	16	Engine hour meter
2	Fuel quantity	17	Clock
3	Oil pressure	18	Panel light
4	Main rotor gear box	19	Running lights
5	Oil temperature	20	Anti-collision light
6	Ammeter	21	Landing light
7	Cylinder temperature	22	Alternator switch
8	Radio circuit breaker	23	Panel light circuit breaker
9	Altimeter	24	Running light circuit breaker
10	Airspeed	25	Anti-collision light circuit breaker
11	Rotor/engine tachometer	26	Landing light circuit breaker
12	Panel light dimmer switch	27	Ignition circuit breaker
13	Ignition switch	28	Instrument CL circuit breaker
14	Master switch and circuit breaker	29	Trim motor circuit breaker
15	Fuel pressure indicator		

Electrical Power Panel. The following switches and circuit-breakers are located on the right-hand side of the instrument console within easy reach of pilot or co-pilot: landing light, navigation light, position light, alternator, instrument light, and master switch.

LIGHTING EQUIPMENT

The basic helicopter is equipped with the required lights necessary for VFR night operation plus additional lighting equipment for utility and convenience purposes. The electrical panel on the right-hand side of the instrument console contains the protective circuit breakers and control panels for the lighting equipment.

Position Lights. Two position lights are located one on either side of the forward cabin structure and two lights are located aft of the stabilizer on the tail cone.

Anti-Collision Lights. The anti-collision lights have a rotating, flashing action that provides for adequate identification of the helicopter. One anti-collision light is located on top of the fuselage aft of the cabin, and the other light is located forward of the cabin structure under the pilot's compartment. They are operated by the anti-collision switch located on the panel.

Landing Light. The landing light is of the permanent extend type and is mounted on the underside of the cabin structure and set in the desired angle for the best forward illumination. The switch for operation of the landing light is located on the instrument panel in the electrical console section.

Instrument Panel Lighting. Three lamps located under the glare shield give maximum visibility with minimum glare.

RADIO

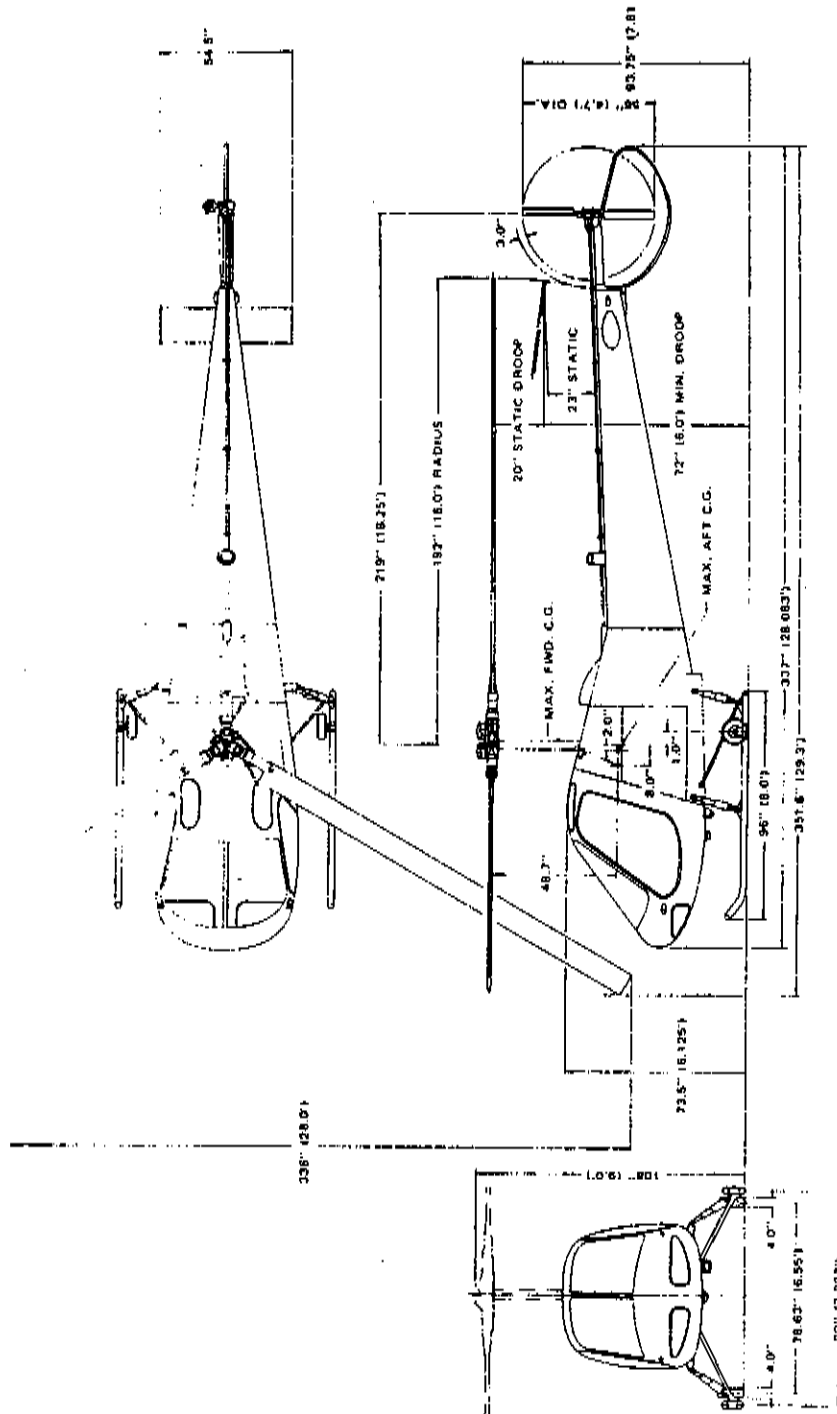
The radio is located on the right-hand side of the instrument panel. A circuit breaker is located to the right of the radio. A transmission switch is located on the cyclic stick. The radio jack box is located on the forward face of the firewall behind the pilot's right-hand shoulder.

GROUND HANDLING WHEELS

Each landing gear skid tube has provisions for easily installed landing gear wheel assemblies. Each assembly has a manually operated over-centering device to lift the skids for installation of the wheels or retracting them for flight. The ground handling wheels should be retracted and the helicopter allowed to rest on the skids when engine run-up is being performed or when helicopter is parked.

BAGGAGE COMPARTMENT

The compartment for storage of baggage is provided in the tail cone assembly aft of the engine compartment. Access to the area is through a single door located on the right-hand side and has a lock for external locking. The capacity of the compartment is approximately 10 cu. ft. and has an allowable loading capacity of 60 lbs.



Principal dimensions of the Enstrom F-28A

F-28A SPECIFICATIONS

Power Plant

Type	Lycoming Opposed
Designation	H10-360-CIA
Cylinders	4
Normal power	205 HP
Normal RPM	2900 RPM
Specific fuel consumption	.5 lbs. hp/hr.
Weight	322 lbs.
Oil	8 qts. @ 15 lbs.

Performance

Maximum speed	112V _{ne}
Best rate of climb	58 m. p. h. - I.A.S.
Normal fuel capacity	30 U.S. gal. @ 176 lbs.
Rate of climb at sea level	950 FPM
Hovering ceiling - IGE ft.	5600

Operating RPM's

Engine	2900
Tail Rotor	2365
Main Rotor	330
Main Rotor Autorotation Range	313 - 385

Ratios

Lower to upper pulley	1:1.226
Main Rotor Gear Box	1:7.154
Tail Rotor Gear Box	1:1
Engine to main rotor	8.7871

Dimensions

Width (overall)	28' 2"
Rotor diameter	32'
Height (overall)	9'
Length (overall)	29' 4"
Cabin width at seat	61"
Tread - Landing Gear	7' 4"

Rotor System

Number of blades	3
Chord - each	9.5"
Disc area	804 sq. ft.
Main rotor RPM	330
Tail rotor diameter	4.67'
Number of blades	2
Chord	3.375"

RELATED PUBLICATIONS AND DIRECTIVES LIST

NOTE: Listed are publications and directives considered helpful when used in conjunction with this manual.

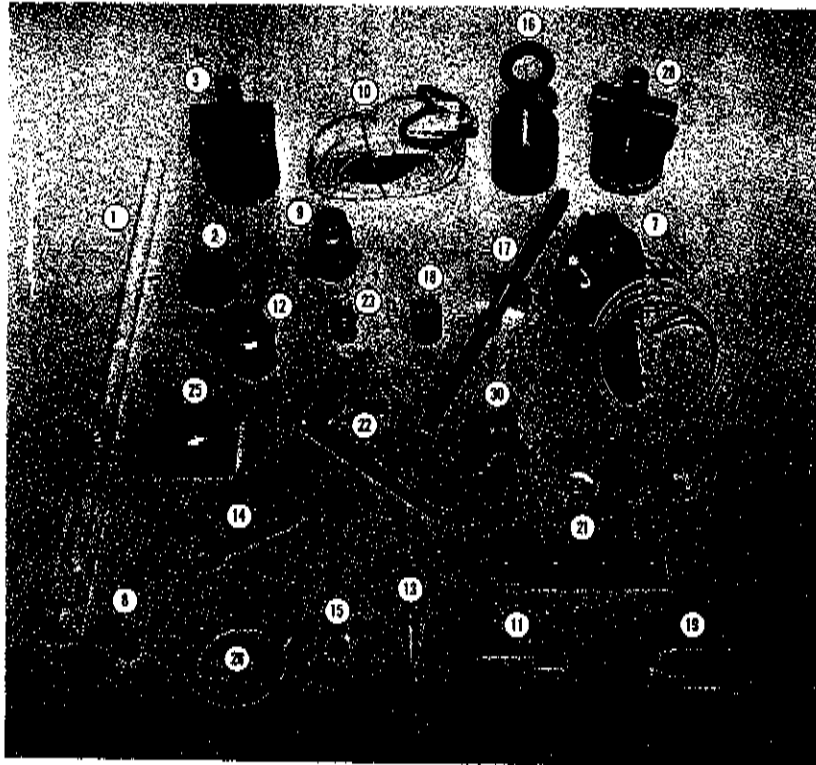
UNIT	NUMBER	TITLE	ADDRESS
Engine	60297-12	Operator's Manual H10-360	Lycoming Division Williamsport, Penn.
Fuel Injection System	15-338B	Fuel Injection Systems	The Bendix Corporation Bendix Product Aerospace Division South Bend 20, Indiana
Fuel Pump Boost	8110	Maintenance and Overhaul of Weidon Pumps	Weidon Tool Co. 3000 Woodhill Road Cleveland, Ohio 44104
Ignition		The ABC's of the Bendix Shower of Spark	The Bendix Corporation Syntilla Division Sydney, New York
Vibrator	L-557	Overhaul and Maintenance of Vibrator	The Bendix Corporation Syntilla Division Sydney, New York

UNIT	NUMBER	TITLE	ADDRESS
Magnetos	L-609-1	Installation, Operation, and Maintenance Instructions for the S-1200 Series and S-200 Magnetos	The Bendix Corporation Syntilla Division Sydney, New York
Voltage Regulator	ASF-7201		
Alternator	ALY-8403		
Starter	MZ-4206	Test Specifications	Prestolite P. O. Box 931 Toledo, Ohio 43601
Battery (OPS)	CA-15	Instruction Manual	Sonotone Corporation Battery Division Elmsford, N. Y. 10523
Battery (STD)	AC78M		Exide Power Systems P. O. Box 5723-C Philadelphia, Pa. 19120

SERVICE SUPPORT ITEMS

Specification	Item	Available from Enstrom Corp.	Source
Aeroshell 14	Grease	5 lb. can 1 lb. can	Shell Oil Company P. O. Box 120 Tulsa, Oklahoma 74100
Aeroshell 16 MIL E-25760	Grease	5 lb. can 1 lb. can	Shell Oil Company P. O. Box 120 Tulsa, Oklahoma 74100
Aeroshell "W" Aviation gr. 80 Aviation gr. 100	Engine Oil Winter Summer	Quart or case	Shell Oil Company P. O. Box 120 Tulsa, Oklahoma 74100
SAE 10W	Oil	Quarts	Shell or Texaco Oil Co.
MIL H5606A	Hydraulic Oil	Gallon	Texaco Oil Company
HD-SAE80-90	Gear Oil	38 lb. can	Mobil Oil Company
DTE-Summer	Clutch Oil	1 pt.	1547 S. 38th Street Milwaukee, Wisconsin 53215
Arctic 'C'-Winter	Clutch Oil	1 pt.	
L-45 Grade 20	Damper Silicone Oil	1/2 pt.	Union Carbide 10421 W. Seven Mile Rd. Detroit, Michigan

Specification	Item	Available from	Source
MGH 10 Mirror Glaze	Plastic Polish	Enstrom Corp. 8 oz. bottle ½ gal. can	Van Duzen Company A/C Supplies
CA 151 PL	Carburetor Air Filter	1 each	
AC-A53C AFD-5			AC Purolater Automotive Supply
Andok 'B'	Grease	½ lb. can	Humble Oil Company P. O. Box 1353 Houston, Texas 77001



SPECIAL TOOLS

SPECIAL TOOLS LIST

NOTE: Special tools may be purchased from The Enstrom Corporation, Menominee, Michigan, Attn: Parts Department.

Item	Nomenclature	Part No.
1	Wheel Bar, ground handling	T-0001
2	Wrench, 28-14256 thrust nut	T-0003
3	Wrench, 28-14001 retention nut	T-0004
7	M/R Track Kit, 3 reflectors	T-0008
8	Pin Guide, M/R Blade	T-0009
9	Wrench, Trans Pinion Nut	T-0010
10	Hoisting Sling, 3,000 lb. capacity	T-0011
11	Tail Rotor Rigging Tool	T-0012
12	Socket, retention thrust nut	T-0013
13	Grease Injector Adapter	T-0014
14	Wrench Damper Shaft	T-0015
15	Wrench Swash Plate Gimbal	T-0016
16	Hoisting Eye	T-0017
17	Mandril Assembly T/R Balancing	T-0019
18	Wrench T/R Box Input Nut	T-0020
19	Retainer - Collective Spring Capsule	T-0022
21	Tab Bender	T-0026
22	Gage, Tab Angle	T-0027
23	Wrench, Tail Rotor Spindle	T-0033
25	M/R Spindle Sleeve Bonding	T-0035
26	Blade Grip Seal Tool	T-0036
28	Wrench Retention Nut (new type)	T-0048
30	Pinion Nut Wrench	T-0053

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PREFLIGHT INSPECTION

This checklist is designed to be used as a reference guide while performing the preflight inspection. Thoroughly familiarize yourself with this Manual before utilizing this checklist. Prior to starting the complete preflight inspection, check the following items in the cockpit: battery switch OFF, magneto switch OFF, all other switches OFF, fuel valve ON.

F-28A Exterior

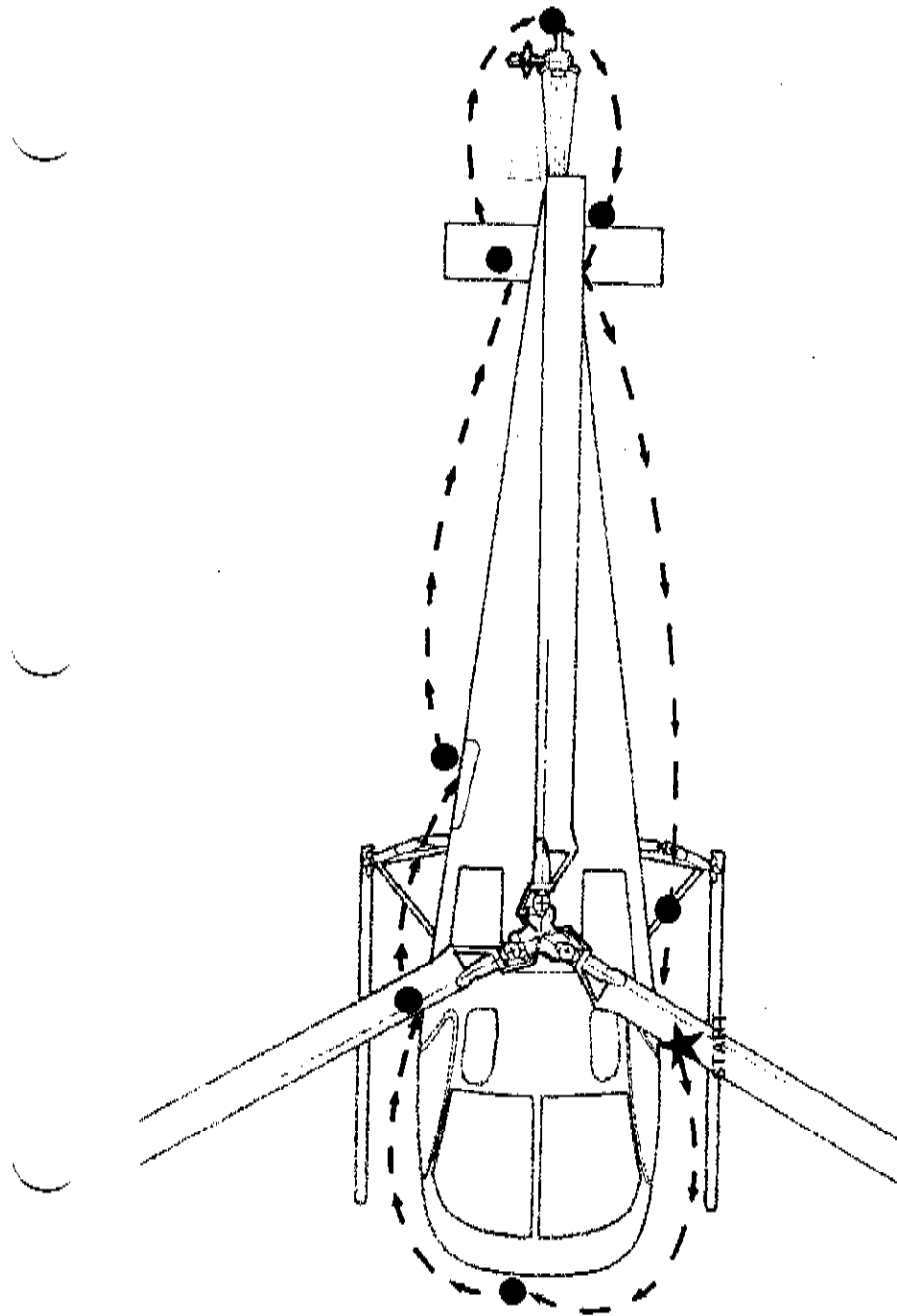
CAUTION: Remove all covers and locking devices

1. Check left hand door for security.
2. Check windshield for cracks.
3. Check pitot tube for obstructions.
4. Check landing lights, beacon and navigational lights for operation and security.
5. Check induction intake scoop for obstructions.
6. Check right hand shock strut—piston extension should be $\frac{3}{4}$ " to $1\frac{1}{4}$ " from red line—struts clean and tires properly inflated.
7. Check right hand landing gear for security.
8. Check right hand door for security.
9. Drain fuel sump.
10. Check right hand engine compartment.
11. Check air intake scoop for obstructions.
12. Check right hand fuel tank - FULL - 100/130 octane - cap secured.
13. Check main gear box oil level.
14. Check baggage door - locked.
15. Check right hand static port - opening unobstructed.
16. Check tail cone for general condition.
17. Check tail rotor drive shaft for security.
18. Check stabilizer for security.
19. Check left and right position lights for operation and security.
20. Check tail rotor pitch links for binding or looseness. Check tail rotor blade for security and leading edge for nicks, bonding separation and general security.
21. Check tail rotor guard for damage and security.
22. Check left hand static port - opening unobstructed.
23. Check main rotor blades for nicks, bonding separation or looseness.
24. Check main rotor pitch links for binding or looseness.
25. Check cyclic and collective walking beams for security.
26. Check blade dampers for proper security and oil level.
27. Check left hand fuel tank - FULL - 100/130 octane - cap secured.

28. Check engine oil - 6 quarts minimum, 8 quarts maximum.
29. Check fuel system for leaks.
30. Check exhaust manifold for cracks and looseness.
31. Check engine for oil leaks.
32. Check belt drive system.
33. Check left hand shock struts--piston extension should be $\frac{3}{4}$ " to $1\frac{1}{4}$ " from red line--struts clean and tires properly inflated.
34. Check left hand landing gear for security.

F-28A Interior

1. Check and adjust rudder pedals.
2. Check seat belts fastened or stowed.
3. Doors latched.
4. Set collective full down.
5. Check clutch disengaged.
6. Check throttle CLOSED.
7. Check mixture IDLE CUT OFF.
8. Check fuel valve ON.
9. Check magneto switch OFF.
10. Radio switches OFF.
11. Set master switch ON.
12. Check fuel quantity.
13. Check fuel pressure warning light (press to test).
14. Check trim motors for operation.
15. Check controls for freedom of operation.
16. Set altimeter.



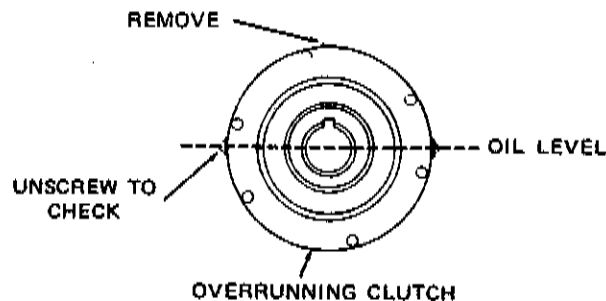
EXTERIOR INSPECTION

HELICOPTER INSPECTION AND LUBRICATION CHECK SHEET INSTRUCTIONS

These check sheets are designed to be used as a "Reference Guide" when performing inspections; the sheets when completed may be kept as a permanent part of the helicopter's records. Adherence to Maintenance Manual information is mandatory and should be consulted when utilizing this check sheet. Each periodic inspection includes every preceeding inspection; the 100 hour periodic inspection includes all 50 and 100 hour items. A complete lubrication check sheet must accompany the signed inspection check sheet.

OVERRUNNING CLUTCH SERVICE INSTRUCTIONS

Three screws are provided in the flange of the overrunning clutch. Turn clutch until two screws are horizontal and the third screw is above. Remove the top and one of the bottom screws. Oil should seep out of lower hole. If oil does not seep out, add oil through top hole with a spring-type oiler. Reference lubrication chart page MM-3-6.



ENSTROM HELICOPTER INSPECTION GUIDE			
Serial No. _____	Owner _____		
N _____	Address _____		
Total Time: _____			
Engine _____	Circle type of inspection:		
Airframe _____	50	100	Periodic Special

NATURE OF INSPECTION	Inspection frequency (hours)	Mechanical check-off	Mechanical check-off	NATURE OF INSPECTION	Inspection frequency (hours)	Mechanical check-off	Mechanical check-off
MAIN ROTOR GROUP				Record compression check: (1) (2) (3) (4)	100		
Inspect rotor head for freedom...cracks or other damage.	100			Check alternator drive belt tensions – 1/2" deflections.	50		
Inspect swash plate for excessive wear.	100			Check cooling fan for loose or bent blades.	100		
Inspect drive system components for cracks or other damage.	100			Check fan hub for cracks.	100		
Inspect main rotor blades for scratches, vent holes at tip obstruction...leading edge for excessive wear and abrasion.	50			Check oil cooler and lines for cracks, leaks and looseness and debris and obstruction.	50		
Dampers: Check for evidence for loss of fluid and attach points for security.	100			Check engine cooling shroud for cracks and looseness.	100		
Check rotor blade track, if necessary.	100			Check air filter assembly, clean and replace filter cartridge.	100		
Check drag links for looseness.	100			Check engine breather for obstruction.	100		
Check pitch arms for looseness and security.	100			CABIN GROUP			
Check push - pull rods for clearance.	100			Check seat belts for attachment and wear.	100		
Check main rotor pitch links for binding and looseness.	100			Check clutch engagement (see Maintenance Manual).	100		
Check main drive clutch control system.	100			Check all controls for freedom.	100		
Check main collective transfer bearing for freedom (Sealed Bearing).	100			Inspect windshield for crack, deterioration.	50		
Check Dynaflex Bushings (rod end in lower push pull dog leg for deterioration.)	100			Inspect door hardware, attachments and cracks.	100		
POWER PLANT GROUP				EXTERIOR FUSELAGE GROUP			
Check baffles for cracks and tight fit to cylinders.	100			Check pitot tube for obstruction and security.	100		
Check cylinders for cracked or broken fins.	100			Check T/R cables for wear and proper tension.	100		
Check air entrances and exits for deformity.	100			Check operation of navigation lights, landing lights and beacons.	50		
Remove and clean fuel screen, fuel servo.	100			Inspect all welded tube structures for local corrosion and cracks.	100		
Check magnetos for timing and sync, check point openings. Check retard for operation.	100			Check tail rotor guard attachment and tube for cracks and looseness.	100		
Check engine mounting bolts and bushings for security.	100			Check tail cone and stabilizer assembly for security and safety.	100		
Check spark plug elbows and shielding nuts for looseness.	100			Inspect all cowling for attachments, inspect air scoops.	100		
Drain and refill oil sump.	50			TAIL ROTOR GROUP			
Remove and clean oil screens.	50			Check tail rotor drive shaft spline couplings for excessive grease leaks.	50		
Drain and clean main fuel strainer, and check fuel vents.	50			Pull and inspect magnetic plug in tail rotor transmission.	100		
Check intake and exhaust systems for security and leaks.	50			Check teetering bearings for roughness.	50		
Check muffler for cracks.	50			Check blade condition for damage, cracks and bonding.	50		
Inspect engine for oil leakage.	50			Check hub for security to shaft.	50		
Inspect safety wire of all drain plugs and covers.	50			To inspect feathering bearings for brinelling and lubrication, disconnect pitch links and rotate blade 2 or 3 turns.	50		
Inspect injector unit and fuel line connections.	50						
Check engine controls for travel and free operation.	50						
Replace or clean spark plugs.	100						
Check ignition harness for breaks.	100						

*Check spherical bearings, rod end in lower push pull dog leg for clearance on spherical diameter.

	NATURE OF INSPECTION	Inspection Frequency (hours)	Mechanical check-off	Mechanical check-off		NATURE OF INSPECTION	Inspection Frequency (hours)	Mechanical check-off	Mechanical check-off
	TAIL ROTOR GROUP (continued) Check tail rotor track if necessary. Check tail rotor control for rigging if necessary. Inspect transfer bearings on control yoke for ease of movement.	100 100 50				Check tail rotor gear box oil level. Check main gear box oil level. Inspect for oil leakage on lower seal (swashplate area). Inspect input pinion drive seal for leakage.	Daily Daily 100 100		
	ELECTRICAL GROUP Inspect all electrical wiring for general condition and proper anchorage. Check radio and instruments for proper operation. Check battery for security. Check battery terminals. Check battery for electrolyte and specific gravity only if lead acid battery is installed. *For Nicad Batteries See Manufacture instructions.	100 100 50 50 50 50				LANDING GEAR GROUP Check landing gear for cracks in weld areas, bolts at all attach and pivot points for excessive wear. Inspect wear plate on skids for excessive wear – replace as necessary. Inspect landing gear oleos, attach points, oil leakage, corrosion and proper extension. (See Maintenance Manual)	100 100 100		
	TRANSMISSION GROUP Check magnetic plug in main rotor transmission. Check condition of gear teeth in main rotor transmission. (See Maintenance Manual)	100 100				BELT DRIVE GROUP ASSEMBLY Check free wheeling clutch for smooth operation. Check condition of drive belt and set proper tension. Check belt roller for proper clearance. Check jack strut for separation of bond and weld areas. Replace if separated or cracked.	100 100 50 100		

NOTES: (1) Each progressive inspection includes every preceding inspection (example: the 100 hour inspection includes all 50 and 100 hour items). (2) A completed lubrication check-off sheet must accompany the signed inspection form.

It is certified that this helicopter has been thoroughly inspected per handbook of maintenance instructions and found to be airworthy, and appropriate entries made in the helicopter's logbook. It is further certified that the helicopter conforms to FAA specification, that all FAA airworthiness directives and manufacturer's service bulletins have been complied with, and the helicopter's papers are in proper order.

MECH. SIG. _____ RATING _____

DATE _____ PILOT SIG. (if required) _____

SPECIAL INSPECTIONS
F-28A Helicopter

Item

Paragraph

NOTE: Prior to overhaul of any vendor component, it is suggested that an up-to-date manufacturer's manual be obtained.

SPECIAL INSPECTIONS -- POWER PLANT

INSPECTION RECOMMENDATIONS FOLLOWING OVERSPEED OF AVCO LYCOMING ENGINES (Ref. Service Instruction No. 1023C, May 19, 1967.)

The engine Model H10-360-C1B overspeed limitation is 3200 RPM, and it is recommended that the following inspections be performed.

For engines that have not exceeded the overspeed limitation, no inspection is required.

Engines that have exceeded the overspeed limitation should be removed from the aircraft, disassembled and the parts completely inspected. Replace all parts that are not within maximum service limits as shown in Avco Lycoming Service Bulletin No. 268. In engines that employ dynamic counterweights, the bushings must be replaced in both the counterweights and the crankshaft. Engine must have connecting rod bolts and nuts replaced.

LYCOMING 400 HOUR INSPECTION

In addition to the items listed for daily pre-flight, 50 hour and 100 hour inspections, the following maintenance check should be made after every 400 hours of operation.

Valve Inspection. Remove rocker box covers and check for freedom of valve rockers when valves are closed. Look for evidence of abnormal wear or broken parts in the area of the valve tips, valve keeper, springs and spring seats. If any indications are found, the cylinder and all of its components should be removed (including the piston and connecting rod assembly) and inspected for further damage. Replace any parts that do not conform with limits shown in the latest revision of Service Bulletin No. 268.

OVERHAUL CYCLES POWER PLANT

Component	Overhaul At
Lycoming Engine (Ref. Lycoming letter 1009M dated 9/6/68)	1000 hrs.

LIMITED LIFE AND COMPONENT OVERHAUL LIST

NOTE: Components listed shall be removed from the helicopter at the periods specified, in accordance with FAA requirements as they are limited life items. Overhaul of components must be accomplished in accordance with the manufacturer's instructions.

Nomenclature	Part No.	Part Life (hours)	Overhaul Cycle (hours)
Main Drive Belt	675-L35 or LD-719	1200	
Belt Idler Pulley Bearing	(MRC-202ZZ)	600	
Swash Plate Bearings	MRC5201SBKZZ New Departure Z993L13X3B	1200 1200	
Damper Assembly	28-14264	500	
Tail Rotor Blade Assembly	28-15120	4500	
Belt Strut Bearings (upper)	99608X3B	600	
Lycoming engine			1000 (Ref. Lycoming letter 1009 M dated 9/6/68)

NOTE: Prior to overhaul of any vendor component, it is suggested that an up-to-date manufacturer's manual be obtained.

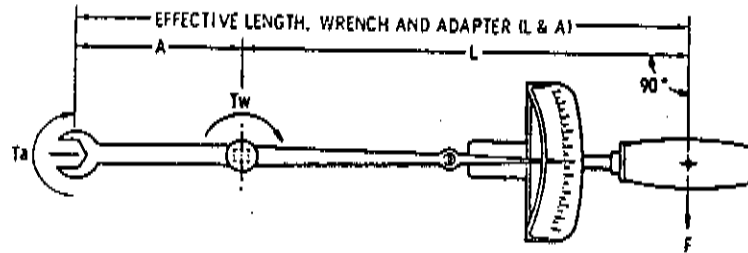
SHIMS COLOR IDENTIFICATION CHART

INFORMATION: The following color coding is used on all plastic shims used on the F-28A Helicopter.

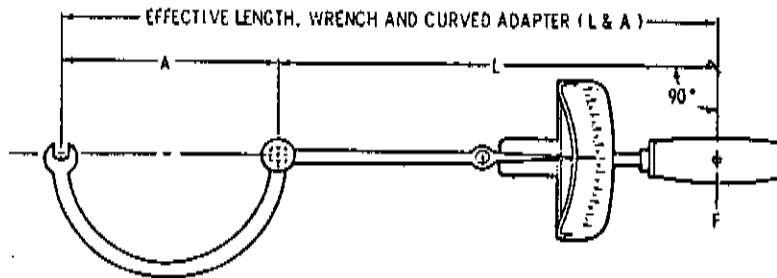
.0005 Silver	.001 Amber	.0015 Purple
.002 Red	.003 Green	.004 Tan
.005 Blue	.0075 Transmatte	.010 Brown
.0125 Black	.015 Pink	.020 Yellow
.025 Solid White	.030 Coral	

The following information defines the formulas and methods used to calculate torque when an adapter is used on the wrench. Methods of physically applying force to the wrench are discussed with the aim of eliminating erroneous reading and torque.

When adapters or extensions are to be utilized, do not use a torque wrench constructed so that the position of the applied load can be varied on the frame or handle.



Effective length, wrench and adapter



Effective length, wrench with curved adapter (L + A)

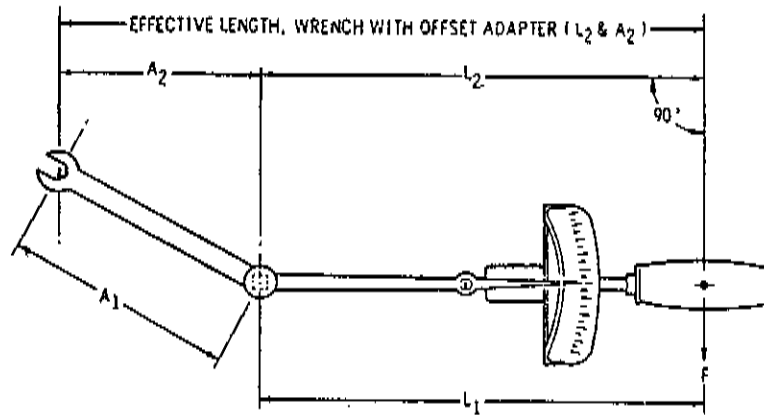
- TW: Scale reading on wrench.
 Ta: Torque (force at end of adapter).
 A: Length of adapter.
 L: Length of wrench lever.
 F: Force
 C: Conversion constant

to obtain— Torque produced at the end of adapter, calculate as follows:
 $Ta = (L+A) \times F$

to obtain— Force required on wrench handle, calculate as follows: $F = \frac{TW}{L}$

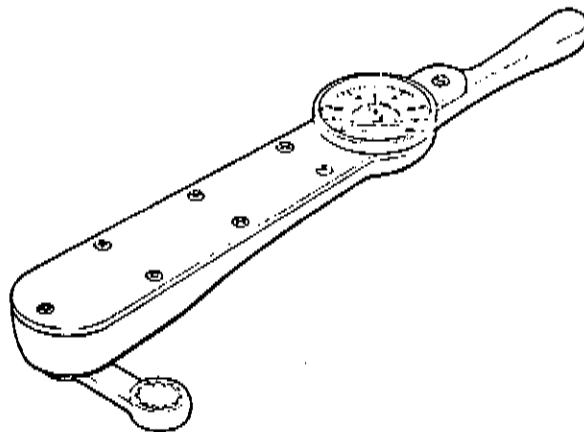
to obtain— Torque at end of the adapter, calculate as follows: $Ta = TW \times (L+A)$

NOTE: The length of the adapter will increase the capacity of the wrench in direct proportion to its relation to the fixed length of the wrench.

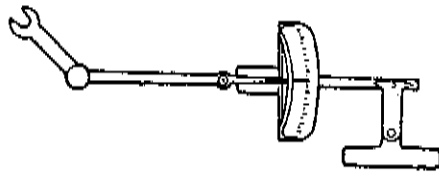


Effective length, wrench with offset adapter ($L_2 + A_2$)

1. Values listed apply only to cadmium plated bolts and nuts coated with molydisulphide.
2. Bolts, washers, and the surfaces they bear on shall be clean, dry, and free of lubricant. Parts lubricated at the factory need not be cleaned before installation.
3. In some cases, when tightening castellated nuts, the cotter pin holes will not line up with the slots in the nuts. In such cases, the nut may be overtightened enough to line up the nearest slot with the cotter pin hole, but the maximum applied torque must not exceed the values listed.
4. Bolts and screws with strength of less than 125,000 psi do not require a mandatory torque value. The nut-bolt combination shall be tightened to make satisfactory joint.
5. Bolts and screws with strength of 160,000 psi minimum or higher shall be per No. 1, unless otherwise specified standard torque values.

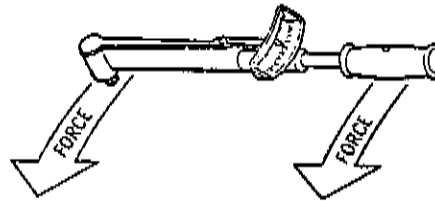


Wrench with adapter at right angle



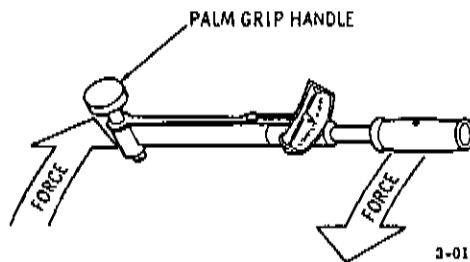
3-009

Wrench with stirrup-type handle



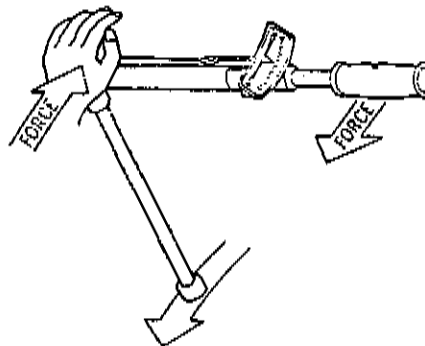
3-010

Incorrect force application



3-011

Wrench with palm grip



3-012

Wrench with palm grip and extension

To obtain— Adapter length when the desired torque is known, calculate as follows:

$$A = \frac{(T_a \cdot T_w) \times L}{T_w}$$

To obtain— Scale reading on the wrench when the desired torque is known, calculate as follows:

$$T_w = \frac{T_a \times L}{L + A}$$

To obtain— Conversion constant which is a ratio of the lever length of the wrench to the total length of the wrench and adapter, calculate as follows:

$$C = \frac{L}{L + A}$$

To obtain— Actual torque at the adapter using the constant, calculate as follows:

$$T_a = \frac{T_w}{C}$$

To obtain— Actual torque reading of the scale when the torque at the adapter is known, calculate as follows:

$$T_w = T_a \times C$$

CAUTION: Torque readings will be inaccurate if the formulas are applied when using a torque wrench with a rigid handle.

Adaptors which conform to the aforementioned sentence above in no way affect the calculations previously described.

TABLE 3 - 4 -- TORQUE DATA

SPECIAL TORQUE DATA PECULIAR TO F-28A ROTORCRAFT

Nomenclature	Part No.	Torque
Tail Rotor Output Shaft Retention Bolt	AN7-H8A	300"/lbs.
Tail Rotor Spindle Nuts	SL61N-4	50'/lbs.
Tail Rotor Input Shaft	NO4	50'/lbs.
Main Rotor Gear Box Pinion Nut	SLW3045	2000 PSI"/lbs. +100"/" - 0 "
Upper Main Rotor Shaft Hub Retention Nut	28-14001	400'/lbs.
Lower Main Rotor Shaft Carrier Nut	28-13121	333'/lbs.
Blade Spindles Retention Nut	28-14335	12'/lbs.

STANDARD TORQUE VALUES

This table covers standard torque values for National Fine and National Coarse nuts and bolts and tube nuts. All special torque values will be defined on applicable drawings and as noted on parts pages.

Torque Values for Nuts and Bolts (inch pounds) - National Fine*

Column 1 Tap Size	Column 2 Tension Nuts AN 365, AN 310	Column 3 Shear Nuts AN 364, AN 320	Column 4 90,000 PSI in Bolts, AN 365 and AN 310 Nuts	Column 5 160% of Column 4) AN 364 and AN 320 Nuts
8-36	12-15	7-9	20	12
10-32	20-25	12-15	40	25
1/4-28	50-70	30-40	100	60
5/16-24	100-140	60-85	225	140
3/8-24	160-190	95-110	390	240
7/16-20	450-500	270-300	840	500
1/2-20	480-690	290-410	1100	660
9/16-18	800-1000	480-600	1600	960
5/8-18	1100-1300	600-780	2400	1400
3/4-16	2300-2500	1300-1500	5000	3000
7/8-14	2500-3000	1500-1800	7000	4200
1-14	3700-5500	2200-3300	10000	6000
1-1/8-12	5000-7000	3000-4200	15000	9000
1-1/4-12	9000-11000	5400-6600	25000	15000

*Torque Values are derived for oil free cadmium-plated steel threads.

Standard Torque Values (Continued)

National Coarse*

Column 1 Tap Size	Column 2 Tension Nuts AN 365, AN 310	Column 3 Shear Nuts AN 364, AN 320	Column 4 90,000 PSI in Bolts, AN 365 and AN 310 Nuts	Column 5 (60% of Column 4) AN 364 and AN 320 Nuts
8-32	12-15	7-9	20	12
10-24	20-25	12-15	35	21
1/4-20	40-50	25-30	75	45
5/16-18	80-90	48-55	160	100
3/8-16	160-185	95-100	275	170
7/16-14	235-255	140-155	475	280
1/2-13	400-480	240-290	880	520
9/16-12	500-700	300-420	1100	650
5/8-11	700-900	420-540	1500	900
3/4-10	1150-1600	700-950	2500	1500
7/8-9	2200-3000	1300-1800	4600	2700

*Torque Values are derived for oil free cadmium-plated steel threads.

Standard Torque Values (Continued)

Tube O. D. (inches)	Wrench Torque Range for Tightening Tube Nuts (inch pounds)	Alum. Alloy 2S1/2H.5280	Steel	Tube O. D. (inches)	Wrench Torque Range for Tightening Tube Nuts (inch pounds)	Alum. Alloy 2S1/2H.5280	Steel
1/8	.....	.....	.....	3/4	300-500	430-575	
3/16	.....	30-70	.....	1	500-700	550-750	
1/4	40-65	50-90	.....	1-1/4	600-900	.....
5/16	60-80	70-120	1-1/2	600-900	
3/8	75-125	90-150	1-3/4	
1/2	150-250	155-250	2	
5/8	200-350	300-400	

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WEIGHT AND BALANCE

INFORMATION

All helicopters are designed for certain limit loads and balance conditions. Changes in equipment which affect the empty weight center of gravity must be recorded in the aircraft and engine log book. It is the responsibility of the helicopter pilot to ensure that the helicopter is loaded properly. The empty weight, empty weight C.G. and useful loads are noted on the weight-balance sheet included in this Manual for this particular helicopter.

NOTE: The C.G. range for the F-28A Helicopter is 92.0" to 98.0" from datum line at a maximum gross weight of 2150 lbs. Listed on page FM-3-5 is a typical loading condition of the F-28A Helicopter, both rearward C.G. and forward C.G. condition.

WEIGHT AND BALANCE

The removal or addition of fuel or equipment results in changes to the center of gravity and weight of the aircraft, and the permissible useful load is affected accordingly. The effects of these changes must be investigated in all cases to eliminate possible adverse effects on the aircraft's flight characteristics. The horizontal reference weighing point is located 20 inches forward of the center bolt in rear skid attachment.

Maximum Gross Weight	2150 lbs.
Empty Weight (no accessories, fuel or Oil)	1450 lbs.
Useful Load	700 lbs.
Approved Forward C.G. Limit	Station 92
Approved Aft C.G. Limit	Station 98

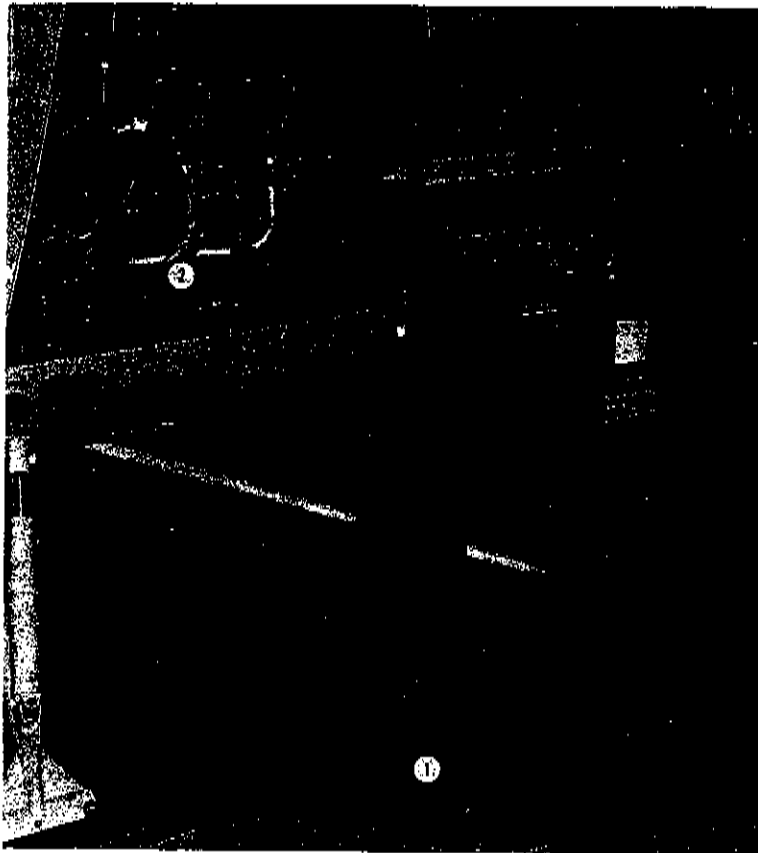
TOOLS AND EQUIPMENT

Tape Measure	Commercial
Scale (two)	1000 lbs. capacity
Scale - tail (one)	100 lbs. capacity
Level - bubble-type	Commercial
Work stand	As required

DETAILED PROCEDURE FOR WEIGHING F-28A SERIES HELICOPTER

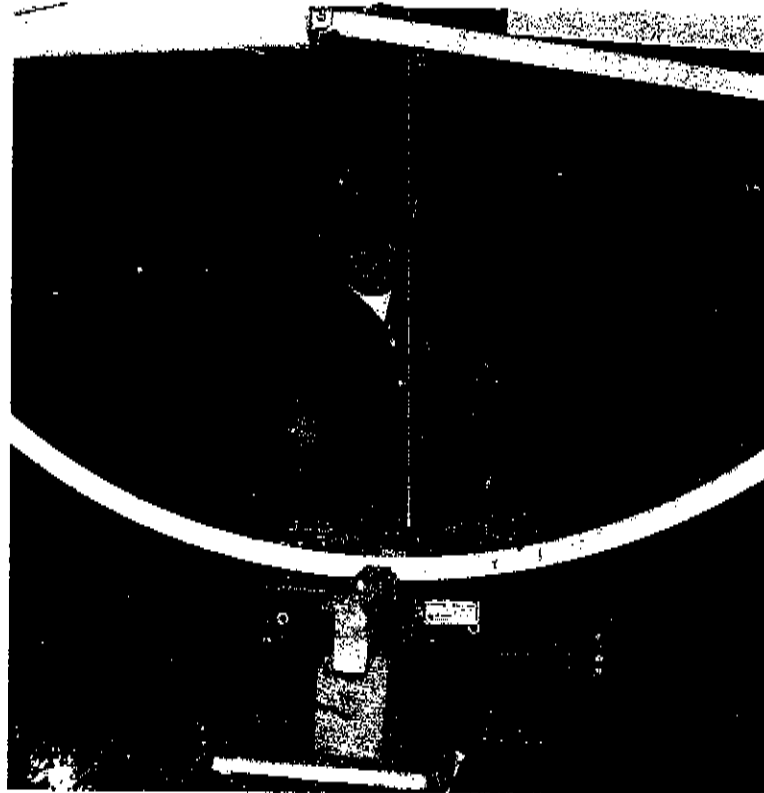
- Thoroughly clean helicopter.
- Helicopter will be weighed inside a closed building to prevent errors in scale readings due to wind. Helicopter will be placed in a level flight attitude.
- Check for proper installation of all accessory items. Check to determine if the scales that are being used have been calibrated recently, and check to see that the scales will zero out before weighing helicopter.

- d. The helicopter will be weighed without fuel, but the weight and balance record will reflect corrections to indicate the amount of unusable fuel required by the helicopter configuration. The helicopter may be weighed with full oil or without oil, but the weight and balance report should be corrected accordingly.
- e. Tare will be noted when helicopter is removed from the scales.
 - **NOTE:** Check oil level of main transmission and tail rotor transmission. Check to see that the main rotor blades are in uniform position, 120° apart.
- f. Close and secure both doors, left and right hand sides.
- g. Hoist or jack helicopter clear of ground.
- h. Position two main scales beneath the skids.
- i. Position a pipe nipple in the center of left and right hand scales at 20 inches forward of center bolt in rear skid attachment (Detail No. 1)



NOTE: Side panels must be removed for leveling. After leveling, temporarily install for weighing.

- j. Height of tail to be adjusted for level.
- k. Level fore and aft to be taken at lower pylon tube, left side, so identified. (Detail No. 2)
- l. Lateral level taken at lower forward pylon tube.



- m. Small scale will be located under tail rotor guard at the center line of the tail rotor output shaft, shown above.

CAUTION: Exercise care to maintain scale alignment during lowering operation of helicopter on scale. No part of skid should touch scale. If helicopter doesn't balance on pipe nipples, move skids as necessary to obtain balance, and measure from rear skid attachment center bolt to center of pipe nipple. Record measurement on weight sheet.

- n. Using jack, raise or lower tail as required to level the aircraft along the longitudinal axis, paying attention to the level on the longitudinal and lateral pylon tubes.

- o. Read and record weight from each of three scales.
- p. Calculate weight and center gravity on attached form, with weight data. Empty weight will be "dry weight."
- q. All items added or subtracted will be listed on the attached form with weight, arm, and moment.

CAUTION: Weight and measurement readings are critical. Double check results.

- r. Remove helicopter from scales.

CAUTION: Do not remove curbing, jack, nipples, blocks, etc., from scales. These items constitute tare weight.

- s. Read and record tare weight from each of the three scales. An official weight and balance report is prepared in connection with each helicopter presented for airworthiness certification at the Enstrom Corporation. All these reports are marked "actual weight."
- t. This weight and balance report, and equipment list will be prepared and supplied with each helicopter.
- u. Use Form No. F-165 Basic Weight and Balance Report to give you a continuous history of weight changes throughout the life of your helicopter.

NOTE: Under normal operating conditions, ballasting is not necessary.

SAMPLE WEIGHT AND BALANCE COMPUTATION

Approved CG Range:
92.0 to 98.0

Maximum Gross Weight:
2150 lbs.

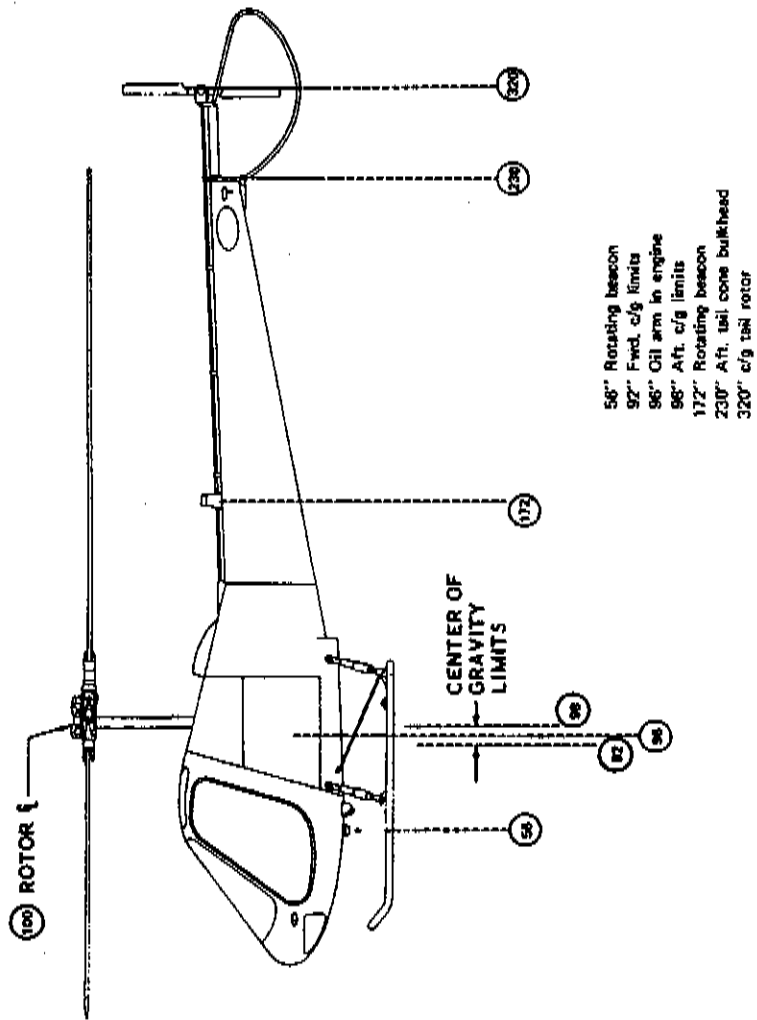
TYPICAL LOADING

Approved Rearward C. G.

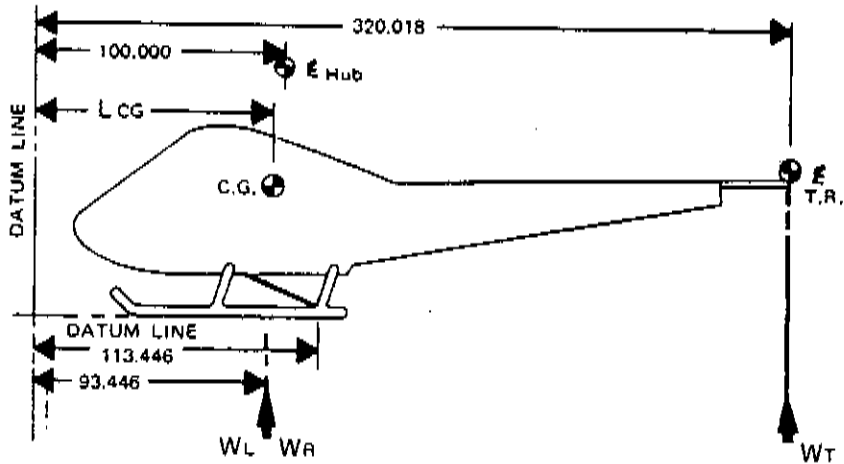
	Weight	Arm	Moment
Basic Empty Weight (including undrainable engine oil, gear box oil and unusable fuel)	1450.0	100.8	146160.00
Engine Oil	15.0	96.0	1440.00
Fuel, 30 gal.	180.0	98.0	17640.00
Pilot	140.0	68.5	9590.00
	<u>1785.</u>	<u>97.9</u>	<u>174830.00</u>

Approved Forward C. G.

Basic Empty Weight (including undrainable engine oil, gear box oil and unusable fuel)	1450.0	100.8	146160.00
Engine Oil	15.0	96.0	1440.00
Fuel, 29.2 gal.	175.0	98.0	17150.00
Pilot and Passengers	510.0	68.5	34935.00
	<u>2150.</u>	<u>92.9</u>	<u>199685.00</u>



WEIGHT AND BALANCE REPORT



Model _____ Serial No. _____ Registration No. _____

FWD. c/g limit 92.0"

AFT. c/g limit 98.0"

Weigh point	Scale—lbs.	Tare	Net wt.	Arm	Moment x 1000
Left gear			(W _L)		
Right gear			(W _R)		
Tail			(W _T)		
Total				X	

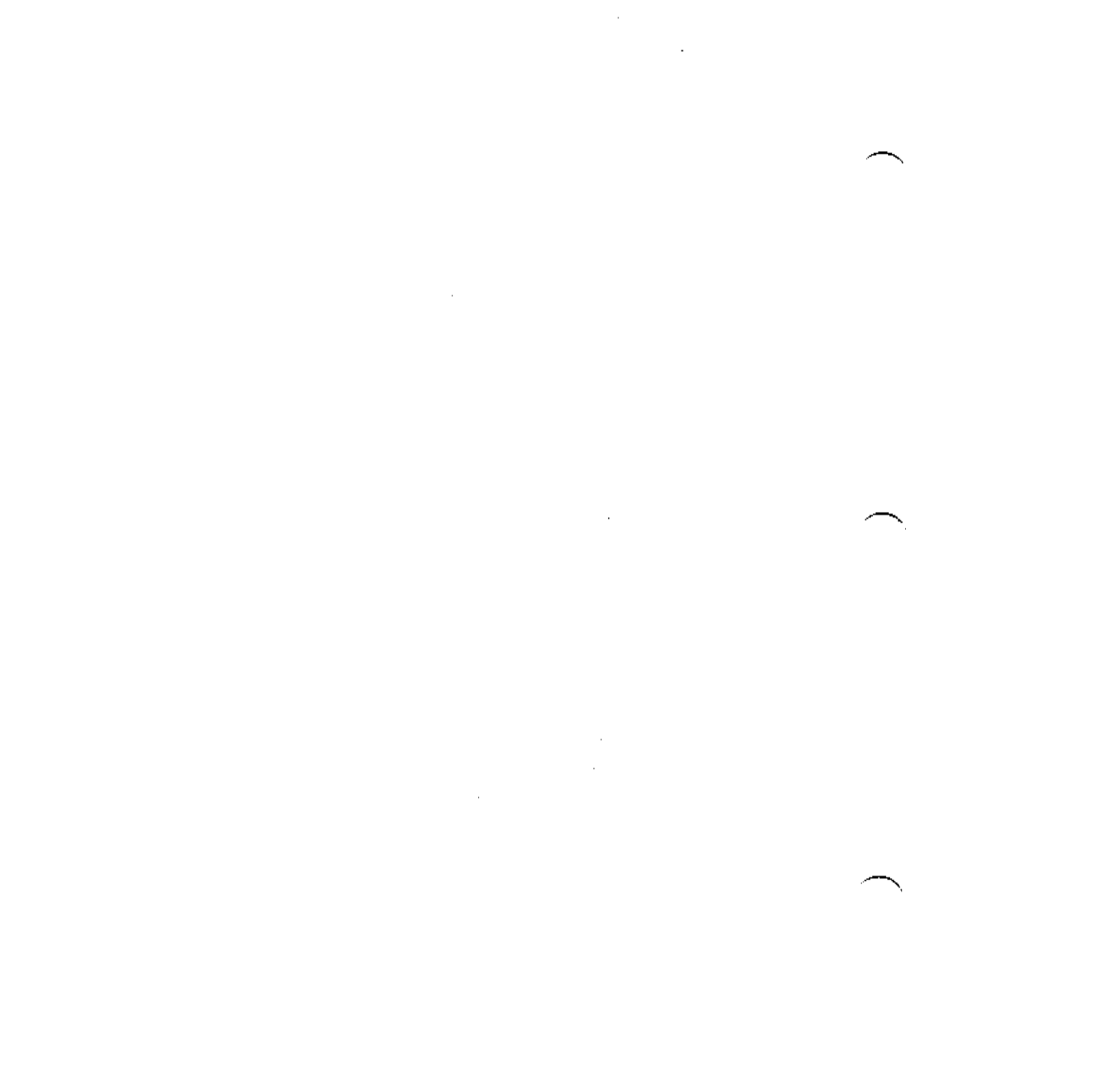
$$LCG = \frac{W_T(320.018) + (W_L + W_R)(93.446)}{W_T + W_L + W_R}$$

Date _____ Weighed by _____

1

2

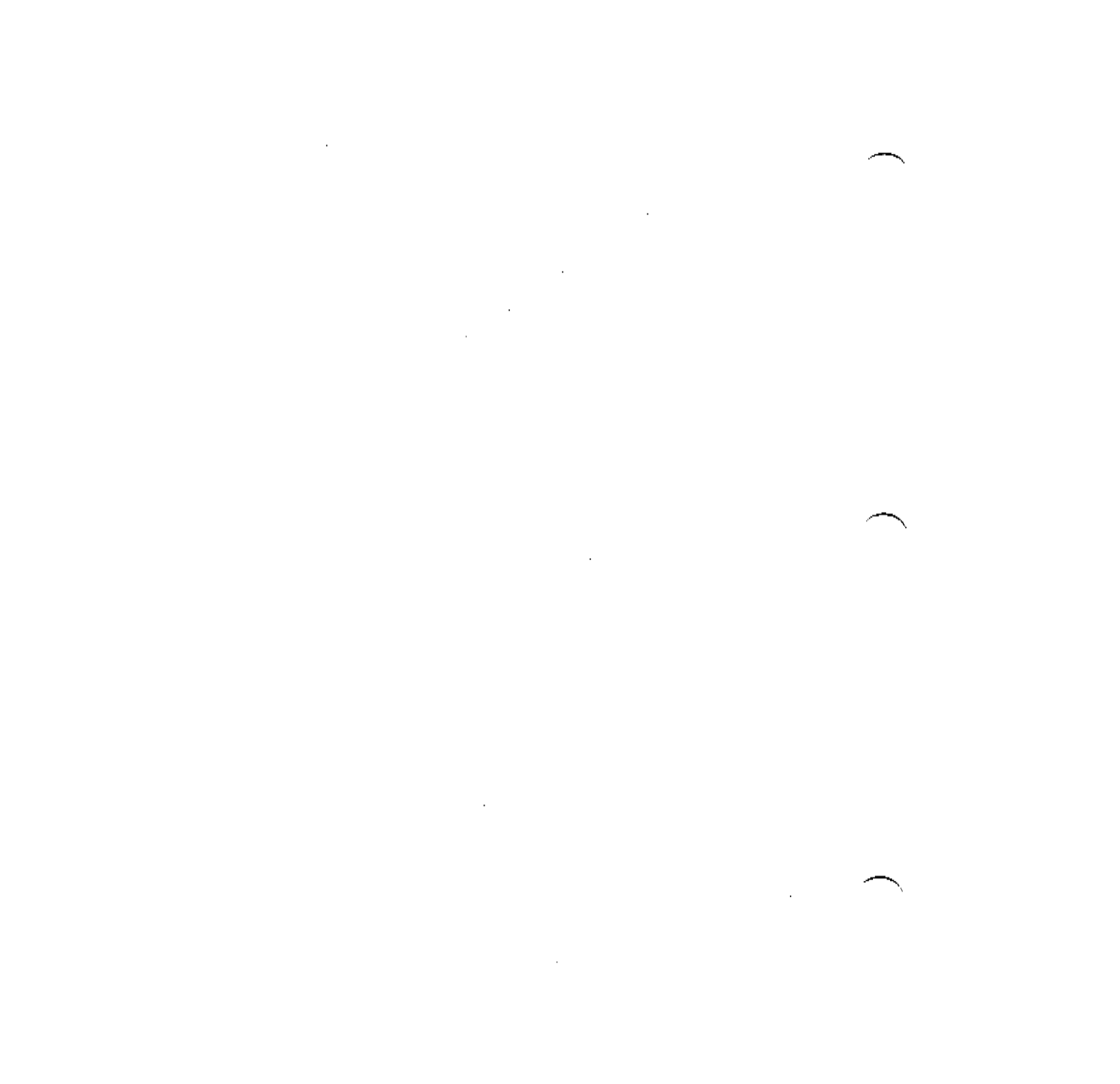
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AIRCRAFT WEIGHT AND C. G. CALCULATION

Model No. _____ Serial No. _____ Reg. No. _____

	Weight lbs.	Arm in.	Moment 1000 in./lbs.
Weight (as weighed)			
Less: optional & surplus weight			
Plus: missing std. equipment			
Total - weight empty - std. aircraft	Computed		
	Actual		
Plus: engine oil			
Plus: optional equipment & kits			
Total basic weight			



POWER PLANT

DESCRIPTION

The HIO 360 series are four cylinder, direct drive, horizontally opposed, air cooled engines.

In referring to the location of the various engine components, the parts are described in their relationship to the engine as installed in the airframe. Thus, the power take-off end is considered the front and the accessory drive end the rear. The sump section is considered the bottom and the opposite side of the engine where the shroud tubes are located the top. Reference to the left and right side is made with the observer facing the rear of the engine. The cylinders are numbered from front to rear, odd numbers on the right, even numbers on the left. The direction of rotation of the crankshaft, viewed from the rear, is clockwise. The direction of rotation for accessory drives is determined with the observer facing the drive pad.

Cylinders. The cylinders are of conventional air cooled construction with the two major parts, head and barrel, screwed and shrunk together. The heads are made from an aluminum alloy casting with a fully machined combustion chamber. Rocker shaft bearing supports are cast integral with the head along with housings to form the rocker boxes for both valve rockers. The cylinder barrels, which are machined from chrome nickel molybdenum steel forgings, have deep integral cooling fins and the inside of the barrels are ground and honed to a specified finish.

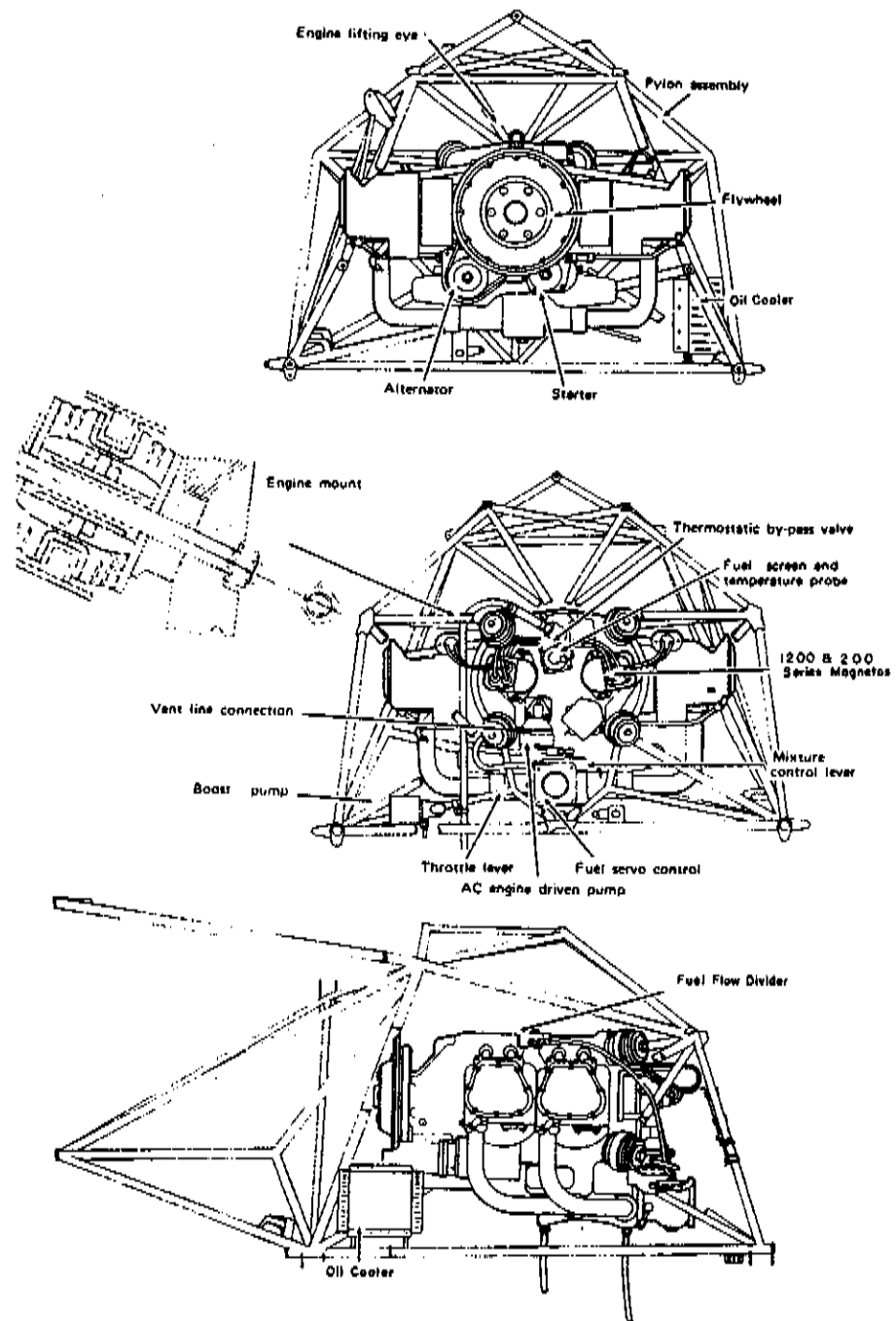
Valve Operating Mechanism. A conventional type camshaft is located above and parallel to the crankshaft. The camshaft actuates hydraulic tappets which operate the valves through push rods and valve rockers. The valve rockers are supported on full floating steel shafts. The valve springs bear against hardened steel seats and are retained on the valve stems by means of split keys.

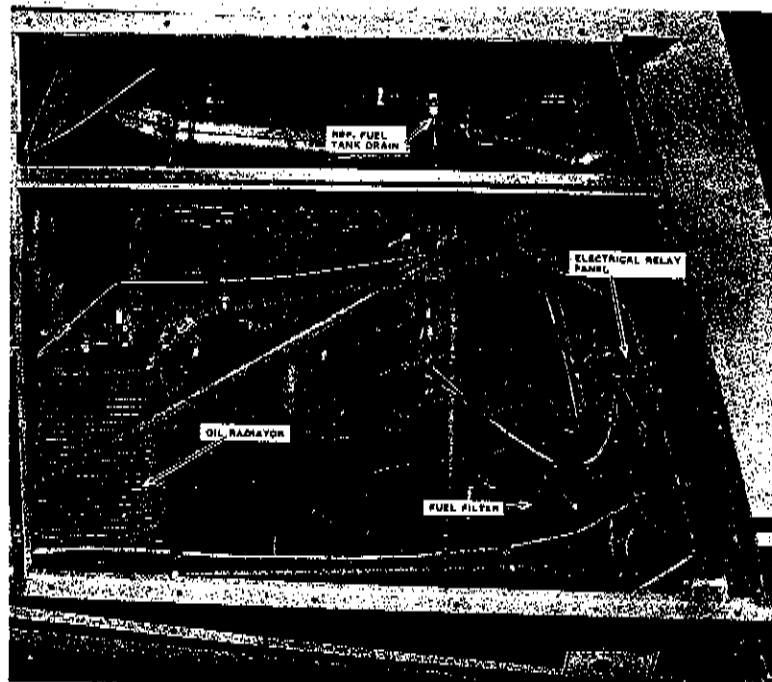
Crankcase. The crankcase assembly consists of two reinforced aluminum alloy castings, fastened together by means of studs, bolts and nuts. The mating surfaces of the two castings are joined without the use of a gasket, and the main bearing bores are machined for use of precision type main bearing inserts.

Crankshaft. The crankshaft is made from a chrome nickel molybdenum steel forging. All bearing journal surfaces are nitrided.

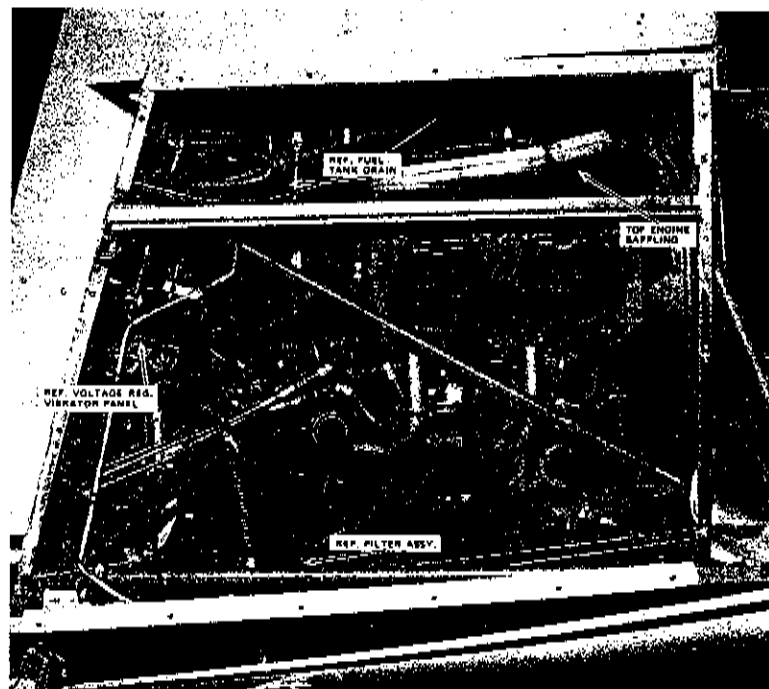
Connecting Rods. The connecting rods are made in the form of "H" sections from alloy steel forgings. They have replaceable bearing inserts in the crankshaft ends and bronze bushings in the piston ends. The bearing caps on the crankshaft ends are retained by two bolts and nuts through each cap.

NOTE: Remove cowling as required for access to engine compartment.





ENGINE COMPARTMENT - RIGHT SIDE



ENGINE COMPARTMENT - LEFT SIDE

Pistons. The pistons are machined from an aluminum alloy. The piston pin is of a full floating type with a plug located in each end of the pin. Depending on the cylinder assembly, pistons may be machined for either three or four rings and may employ either half wedge or full wedge rings.

Accessory Housing. The accessory housing is made from an aluminum casting and is fastened to the rear of the crankcase and the top rear of the sump. It forms a housing for the oil pump and the various accessory drives.

Oil Sump. The sump incorporates an oil drain plug, oil suction screen, mounting pad for carburetor or fuel injector, the intake riser and intake pipe connections.

Cooling System. These engines are designed to be cooled by air flow. Baffles are provided to build up a pressure and force the air through the cylinder fins. The air is then exhausted to the atmosphere.

Induction System. The Avco Lycoming HIO-360 series engines are equipped with a Bendix type RSA fuel injector. The fuel injection system schedules fuel flow in proportion to air flow and fuel vaporization takes place at the intake ports.

The Bendix RSA type fuel injection system is based on the principle of measuring air flow and using the air flow signal in a stem type regulator to convert the air force into a fuel force. This fuel force (fuel pressure differential) when applied across the fuel metering section (jetting system) makes fuel flow proportional to air flow.

Lubrication System. (All models except AIO-360 series.) The full pressure wet sump lubrication system is actuated by an impeller type pump contained within the accessory housing.

Priming System. Fuel injected engines do not require a priming system.

SPECIFICATIONS HIO-360-C SERIES

FAA Type Certificate	1E10
Rated horsepower	205
Rated speed, RPM	2900
Bore, inches	5.125
Stroke, inches	4.375
Displacement, cubic inches	361.0
Compression ratio	8.7:1
Firing order	1-3-2-4
Spark occurs, degrees BTC	25
Valve rocker clearance (hydraulic tappets collapsed)	028-.080
Propeller drive ratio	1:1
Propeller drive rotation (viewed from rear)	Clockwise

POWERPLANT OPERATIONS**F-28A Normal Engine Starting Procedures.**

- a. Mixture control **IDLE CUT OFF**.
- b. Fuel valve ON.
- c. Master switch ON.
- d. Throttle--crack slightly.

CAUTION: Do not open throttle during starting engine; overspeed can result.

NOTE: Check for clutch disengagement.

- e. Mixture **FULL RICH**.
- f. Fuel boost ON, check pressure for slight increase 1 to 3 seconds, then return fuel boost to OFF.
- g. Mixture OFF.
- h. Ignition switch, **BOTH**.
- i. Engage starter.
- j. When engine starts, advance mixture slowly.
- k. Set engine RPM to 1500 - 1600 RPM.
- l. Fuel booster pump ON. Pump must be on at all times in flight.
- m. Check engine oil pressure, 25 PSI minimum.

CAUTION: Shut down engine if minimum oil pressure is not reached within 30 seconds.

- n. Disconnect external power (if used).
- o. Alternator switch ON.

F-28A Engine Starting Procedures, Hot Condition.

Repeat steps a, b, c, d, and e as noted above.

- f. Turn on fuel boost pump 5 to 6 seconds.
- g. Turn booster pump off.
- h. Mixture control OFF.
- i. Throttle--**FULL OPEN**.
- j. Engage starter 5 to 6 seconds to clear engine.
- k. Close throttle and crack slightly.
- l. Magneto switch **BOTH**.
- m. Engage starter until engine fires and advance mixture slowly.
- n. Fuel booster pump ON. Pump must be on at all times in flight.

NOTE: It is important to follow this procedure on hot starts so that the prolonged fuel flow in the lines will eliminate the vapor locks and cool the lines for a proper start.

F-28A Rotor Engagement.

- a. Check collective full down.
- b. Rudder pedals neutral.
- c. Set longitudinal and lateral trim to center cyclic.

- d. Check aircraft vicinity for personnel and equipment.
- e. Set engine to 1400 - 1500 RPM.

NOTE: Maintain fixed throttle during rotor engagement.

- f. Slowly engage clutch handle at 1400 - 1500 engine RPM until rotor RPM reaches 100 RPM.
- g. Close throttle.
- h. Fully engage clutch when engine/rotor needles are superimposed (marry).
- i. Advance throttle to 1800 RPM.

CAUTION: Never apply full power until rotor and engine RPM needles are superimposed and clutch is fully engaged.

F-28A Engine Warmup and Ground Check.

- a. Warm engine at 1800 RPM until cylinder head temperature reaches 200° F.
- b. Check engine oil temperatures and pressures to ascertain whether they are within the green arcs.

NOTE: For faster oil warmup in cold weather, 2300 RPM may be used after cylinder temperature has reached 200° F.

- c. Increase engine RPM to 2750 to 2900 RPM and check for RPM drop on left and right magnetos. 100 RPM is permissible on either magneto.

NOTE: No engine roughness should be apparent when operating on either left or right magneto.

- d. Check ammeter charging indication.
- e. Gently move cyclic, observe rotor tip path plane for control response.
- f. Close throttle, observe engine and rotor needles for separation.

NOTE: Needle separation indicates proper operation of over-running clutch.

- g. Check following before take-off:
 1. Check all instruments for proper indication.
 2. Seat belts and doors latched.
 3. Fuel booster pump ON. Pump must be on at all times in flight.
 4. Mixture FULL RICH.
 5. Fuel pressure warning-green indication.
 6. Set collective and throttle friction.

F-28A Engine Cooling and Shut Down Procedure.

- a. Stabilize temperatures at 1800 RPM until cylinder temperatures drop to 350° F.
- b. Cyclic trim, neutral.
- c. Tighten collective friction.

- d. Set engine FULL IDLE.
- e. Disengage clutch.

CAUTION; Do not disengage clutch unless engine is at FULL IDLE; engine overspeed may result.

- f. Fuel boost pump OFF.
- g. Mixture IDLE CUT OFF.
- h. Magneto switch OFF.
- i. Alternator switch OFF.
- j. Master switch OFF.
- k. All switches OFF.
- l. Fuel valve CLOSED.

OPERATING LIMITATIONS

Powerplant Limitations:

Engine:	Lycoming Model HIO-360-C1B
Fuel:	100/130 minimum grade
Oil Viscosity:	Above 60° F SAE 50 30-90° F SAE 40 0-70° F SAE 30 Below 10° F SAE 20
Horsepower:	205 HP all operations @ 2900 RPM
Operating Engine RPM:	2900 maximum 2750 minimum
Engine Idling RPM:	1400 minimum (clutch disengaged)
Manifold Pressure:	Full throttle, sea level engine
Oil Temperature:	245° F maximum
Oil Pressure:	60-90 PSI, normal operation 25 PSI, idling minimum 100 PSI, starting-warmup
Transmission Oil Temperature:	220° F maximum
Cylinder Head Temperature:	475° F maximum

Rotor--Flight Limitations (Power Off):

Maximum:	385 RPM
Minimum:	313 RPM

Instrument Markings:

Rotor Tachometer	Red Line	385 RPM
	Red Line	313 RPM
	Green Arc	313-385 RPM
Engine Tachometer	Red Line	2750 RPM
	Red Line	2900 RPM
	Green Arc	2750-2900 RPM
Airspeed Indicator	Red Line	112 MPH
Oil Temperature	Red Line	245° F
	Green Arc	120°-245° F
	Yellow Arc	60°-120° F
Oil Pressure	Red Line	100 PSI
	Yellow Arc	90-100 PSI
	Green Arc	60-90 PSI
	Yellow Arc	25-60 PSI
	Red Line	25 PSI
Cylinder Head Temperatures	Red Line	475° F
	Green Arc	200°-475° F
Transmission Oil Temperature	Red Line	220° F
	Green Arc	0°-220° F

FUEL INJECTION SYSTEM

Description. All RSA type fuel injection systems are based on the principle of measuring engine air consumption by use of a venturi tube and using the airflow forces to control fuel flow to the engine. Fuel distribution to the individual cylinders is obtained by the use of a fuel flow divider and air bleed nozzles.

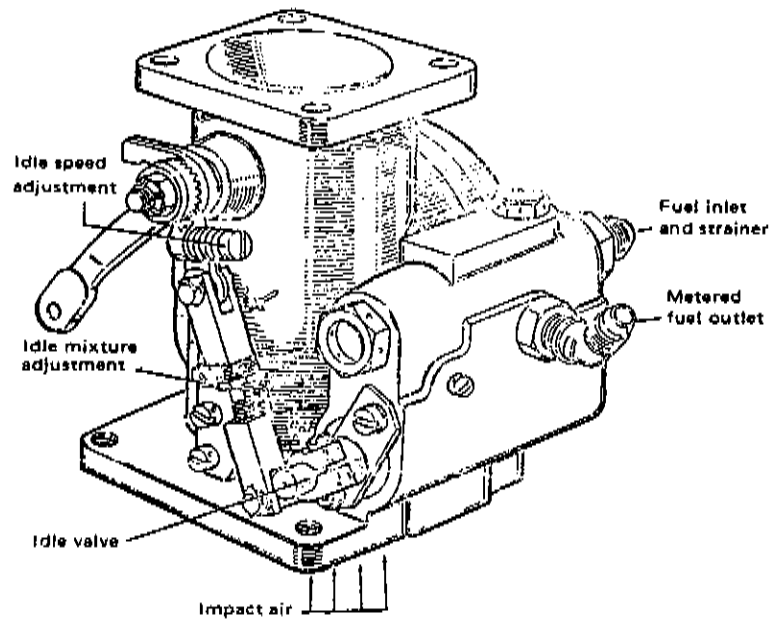
It is suggested that all adjustments and overhaul to the RSA-5 Fuel Injection System be performed with the use of the Operation and Service Manual, Form 15-338B, published by the Bendix Corporation.

Field Adjustments.**Idle Speed and Mixture Adjustment.**

- a. Check magnetos in accordance with instructions furnished in the aircraft operational manual. If the "mag-drop" is not more than 100 RPM Max., proceed with idle adjustment.
- b. Close the throttle to idle (approximately 1400 - 1500 RPM). If the RPM changes appreciably after making idle mixture adjustment during the succeeding steps, readjust the idle speed to the desired RPM.
- c. When the idling speed has been stabilized, move the cockpit mixture control lever with a smooth, steady pull, into the IDLE

CUT-OFF position and observe the tachometer for any change during the leaning out process. Caution must be exercised to return the mixture control to the FULL-RICH position before the RPM can drop to a point where the engine cuts out. An increase in RPM while leaning out indicates the idle mixture is on the rich side of best power. An immediate decrease in RPM (if not preceded by a momentary increase) indicates that the idle mixture is on the lean side of best power.

- d. The desired idle setting is a compromise between one that is rich enough to provide a satisfactory acceleration under all conditions and lean enough to prevent spark plug fouling or rough operation. A rise of 25-50 RPM will usually satisfy both of these conditions.
- e. If Step B indicates that the idle adjustment is too rich or too lean, turn the idle mixture adjustment one or two notches in the direction required for correction, and check this new position by repeating Step B. Make additional adjustments as necessary.
- f. Each time an adjustment is changed, clear the engine by running it up to approximately 2000 RPM before making mixture check.
- g. The actual idle mixture adjustment is made by the lengthening (richening) or shortening (leaning) of the linkage between the throttle lever and idle valve lever. The center screw assembly has right hand threads on both ends but one end has a No. 10-24 thread and the other end has a No. 10-32 thread. For easy reference, consider only the coarse thread end. When it is turned out of its block, the linkage becomes longer and a richer mixture is provided. When it is turned into its block, the linkage becomes longer and a richer mixture is provided. When it is turned into its block, the linkage is shortened and a leaner mixture is provided.
- h. A major adjustment is available for use when the center screw bottoms out on either of the blocks. If the idle adjustment is almost satisfactory, measure the distance between the two blocks. Disconnect the spring from the most accessible linkage pin and remove the pin. Turn the block and adjustment screw until the adjusting wheel is centered and the distance between blocks is as previously measured. There is now additional adjustment range and the reference point is retained.
- i. Make the final idle speed adjustment to obtain the desired idling RPM with closed throttle.
- j. If the setting does not remain stable, check the idle linkage; any looseness in this linkage will cause erratic idling. In all cases, allowance should be made for the effect of weather conditions upon idling adjustment.
- k. Idle speed and mixture adjustments made according to this method should require very little further attention except for extreme variations in temperature and altitude.



Injector, external view

Since the air differential pressure is a function of the airflow, and the fuel differential pressure is a function of the fuel flow, the correct fuel-to-air ratio is always maintained with this system, regardless of the quantity of air being consumed by the engine.

Consideration has been made for the low air forces experienced in the idle range by the incorporation of the constant head idle spring. This spring provides a constant fuel differential pressure that will allow adequate fuel supply for the idle range. As the air forces increase, the spring compresses until the spring retainer touches the air diaphragm and acts as a solid member.

FUEL INJECTION SYSTEM TROUBLESHOOTING CHART

PROBABLE CAUSE	REQUIRED ACTION
<p>Hard Starting:</p> <p>Technique.</p>	Refer to aircraft manufacturer's recommended starting procedure.
Flooded.	Clear engine by cranking with throttle open and mixture control in ICO.
<p>Insufficient prime. (Usually accompanied by a backfire.)</p>	Increase amount of priming.
<p>Rough Idle:</p> <p>Mixture too rich or too lean.</p>	Confirm with mixture control. A too rich mixture will be corrected and roughness decreased during lean-out while a too lean mixture will be aggravated and roughness increased. Adjust idle to give a 25-50 RPM rise at 1400-1500 RPM.
<p>Plugged nozzle(s). (Usually accompanied by high take-off fuel flow readings.</p>	Clean nozzles.
<p>Slight air leak into induction system through manifold drain check valve. (Usually able to adjust initial idle but rough in 1000-1500 RPM range.)</p>	Confirm by temporarily plugging drain line. Replace check valves as necessary.
<p>Slight air leak into induction system through loose intake pipes or damaged "O" rings. (Usually able to adjust initial idle but rough in 1000-1500 RPM range.)</p>	Repair as necessary.
<p>Large air leak into induction system. Several cases of 1/8" pipe plugs dropping out.</p>	Repair as necessary.
<p>Internal leak in injector. (Usually unable to lean-out idle range.)</p>	Replace injector.

FUEL INJECTION SYSTEM TROUBLESHOOTING CHART (Con't)

PROBABLE CAUSE	REQUIRED ACTION
Fuel vaporizing in fuel lines or distributor. (Encountered only under high ambient temperature conditions or following prolonged operation at low idle RPM's.)	See service notes under Idling (A).
Low Take-Off Fuel Flow:	
Strainer plugged.	Remove strainer and clean in a suitable solvent. Acetone or MEK is recommended.
Injector out of adjustment.	Replace injector.
Faulty gage.	Replace as necessary.
Poor Cut-Off:	
Improper rigging of aircraft linkage to mixture control.	Adjust.
Mixture control valve scored or not seating properly.	Eliminate cause of scoring (usually burr or dirt) and lap mixture control valve and plug on surface plate.
Vapor in lines.	Refer to following service notes.

INJECTION SYSTEM SERVICE NOTES

General. Several phases of ground operation are adversely affected by fuel vaporization in the lines. Fuel vaporization is experienced under extreme conditions of ambient and/or nacelle temperatures. Starting, idle operating, and engine shutdown procedures must all be modified to obtain optimum results under these conditions.

Starting. In cold weather, the engine compartment (nacelle) temperature drops off rapidly following engine shutdown and the nozzle lines remain nearly full of fuel. Cold weather starting procedures are therefore simple with highly predictable results. However, in extremely hot weather, nacelle temperatures increase rapidly following engine shutdown, and fuel in the lines vaporizes and escapes out into the manifold. Hot weather starting procedures therefore depend considerably on how soon the next start is attempted. Within the first 20-30 minutes, the manifold is nicely primed and the empty nozzle lines will fill before the engine dies. After a 20-30 minute wait, the vaporized fuel in the manifold will have nearly disappeared and some slight "priming" could be required to refill the nozzle lines and keep the engine running

Idling. During ground operation every precaution should be taken to keep nacelle temperatures from increasing to the extent that fuel will vaporize in the lines. The following suggestions are aimed at minimizing this problem:

- A. Keep nacelle temperatures as low as possible by:
 - 1. Avoiding excessive ground operation.
 - 2. Keeping cooling airflow up by keeping engine RPM's as high as practical.
 - 3. Upon restarting of a hot engine, operating engine at 1,200-1,500 RPM for several minutes to reduce the residual heat in the engine compartment.
- B. Keep fuel temperatures as low as possible. Higher RPM's with the accompanying higher line pressure and flow will help to dissipate some of the heat within the lines.
- C. Make an idle speed and mixture adjustment that is a compromise between the engine's requirement during the cool of the morning and the heat of the day.
 - 1. Adjust idle speed stop to provide RPM as high as practical.
 - 2. Adjust mixture in the cool of the morning to provide a 50 RPM rise when the mixture control is pulled slowly into cut-off.
 - 3. The higher than normal temperature encountered during the heat of the day results in the engine preferring a considerably leaner idle mixture. However, with fuel injection, this richer setting at the heat of the day will help dissipate vapor that still may occur.

Shutdown (Cut-Off). The idling procedure practiced just prior to engine shutdown has considerable bearing on the "cleanness" or smoothness with which the engine stops. If the idling procedures suggested above are not followed and fuel is vaporizing and emptying the lines, the engine will continue to idle very rough for several seconds. This is despite a 100% cut-off of fuel supply by the mixture control.

POWERPLANT

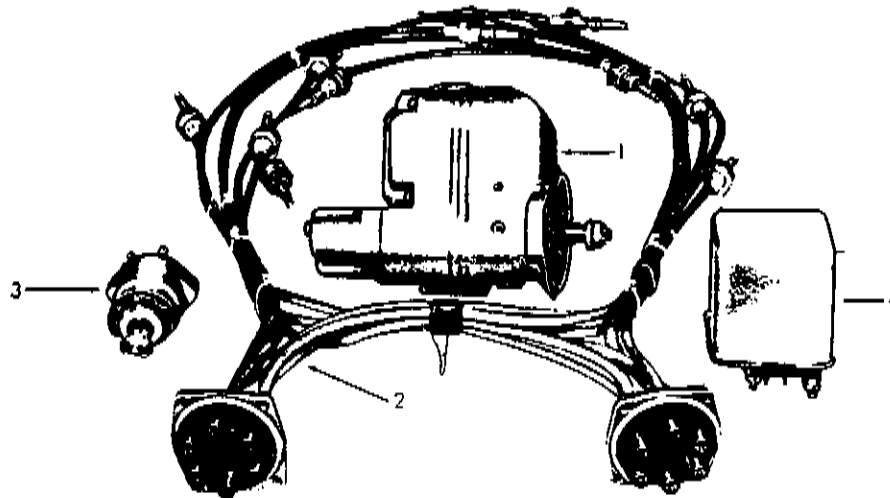
IGNITION SYSTEM

General. The Bendix S-200 Series Magnetos are designed to provide ignition for four and six cylinder aircraft engines. The magnetos generate and distribute high tension current through high tension leads to the spark plugs. Because of the design of the distributor section, these high tension magnetos are capable of providing dependable performance at altitudes of 30,000 feet or above.

To obtain the retard spark necessary for starting, the four and six cylinder magnetos may either employ an impulse coupling or an additional contact assembly used in conjunction with a starting

IGNITION SYSTEM (Con't)

vibrator. Figure below shows the components used in a typical S-200 Ignition System incorporating a starting vibrator. This system consists of a single contact assembly magneto, a dual contact assembly magneto, a starting vibrator and a combination ignition and starter switch.



S-200 MAGNETO AND ASSOCIATED COMPONENTS

1. Magneto
2. Harness Assembly
3. Combination Ignition and Starter Switch
4. Vibrator

NOTE: See latest AVCO Lycoming Operators Manual 60297-12 and Bendix Maintenance Instructions for further pertinent details on magneto and associate components.

IGNITION SYSTEM TROUBLE SHOOTING CHART

PROBABLE CAUSE	REQUIRED ACTION
Hard Starting: Low voltage at vibrator input.	Measure voltage between vibrator terminal marked "in" and the ground terminal while operating starter. Must be at least 8 volts on 12 volt systems, or 13 volts on 24 volt systems.

IGNITION SYSTEM TROUBLESHOOTING CHART (Con't)

PROBABLE CAUSE	REQUIRED ACTION
Inoperative or defective vibrator.	If voltage is adequate, listen for buzzing of vibrator during starting. If no buzzing is heard, either the vibrator is defective or the circuit from the "Output" terminal on the vibrator to the retard (dual contact assembly) magneto is open. Check both "Switch and Retard" circuits. Also check for good electrical ground.
Retard contact assembly in retard (dual contact) magneto not operating electrically. Engine may kick back during cranking due to advance timing of ignition.	Retard points may not be closing due to wrong adjustment, or may not be electrically connected in the circuit due to a poor connection. Inspect retard points to see if they close. Check for proper contact at the "SWITCH" and "RETARD" terminals of retard (dual contact assembly) magneto and at the vibrator. Check wiring.
Vibrator-magneto combination not "putting-out" electrically.	Turn engine in proper direction of rotation until retard points just open on No. 1 cylinder position. Remove input connection from starter to prevent engine turning and while holding No. 1 plug lead 5/16 inch from ground, energize vibrator by turning switch to start. Plug lead should throw a 5/16 inch spark. If spark is weak or missing try new vibrator. If this does not correct trouble, remove magneto and check for improper internal timing or improperly meshed distributor gears.
Advance breaker out of adjustment. (Internal timing off.)	If internal timing is suspected to be off, magneto must be removed. Corrective action should be performed in accordance with current Bendix S-200 series installation and manual instructions.

This page of the manual has intentionally been left blank, please
continue on to page MM-5-17 for additional information.

IGNITION SYSTEM TROUBLESHOOTING CHART (Con't)

PROBABLE CAUSE	REQUIRED ACTION
Engine Roughness:	<p>Try new spark plugs.</p> <p>Check plug leads for continuity and breakdown.</p> <p>Check magneto contact assemblies for burning or dirt. (Main and Retard)</p>
Magneto Check-Out-Of-Limits:	<p>Inspect contact assemblies for proper opening.</p>
IGNITION	<p>Check plugs and leads.</p>

TIMING CHECK F-28A**RUNNING POINTS**

NOTE: Magneto switch OFF, master switch OFF.

- a. Open engine compartment panels.
- b. Remove lower plug from each cylinder.
- c. Open lower seam of wrap-around cowl.
- d. Rotate crankshaft to bring No. 1 piston on compression stroke.
- e. Check timing mark located on starter ring gear support assembly through timing holes in cooling fan with index mark on starter housing. (Ref. Page 5 - 39)
- f. Set timing at 25° B.T.D.C. No. 1 cylinder.

NOTE: Remove timing plug from either magneto and check to see if red index mark is in window.

- g. Attach magneto timing indicator to each "P" lead.
- h. Rotate crankshaft in direction of rotation and check the point opening of both magnetos (25° B.T.D.C.) to engine and both magnetos to each other for proper sync.

RETARD POINTS

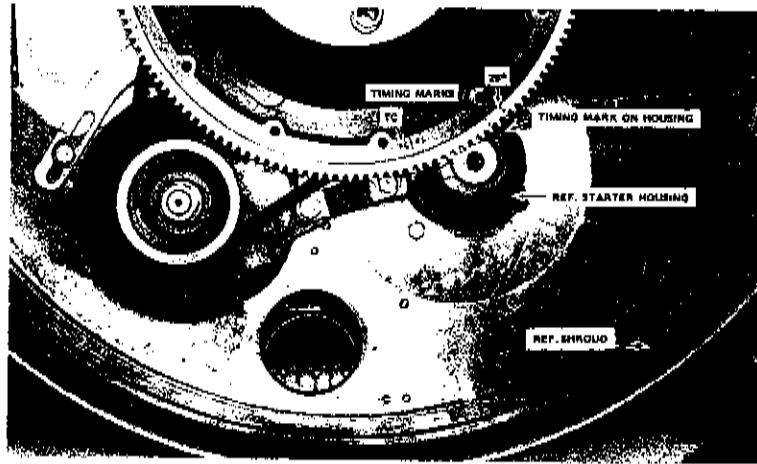
- a. With timing indicator attached to left mag. retard lead, set T.D.C. of No. 1 cylinder, check timing mark on ring gear support assembly through timing hole in cooling fan with index mark on starter housing. (Ref. Page 5 - 39)
- b. Rotate crankshaft in direction of rotation and check point opening.

- c. Retard points to open 25° after running points or at T.D.C. mark on support assembly.

- NOTE:** 1. Each tooth on ring gear is approximately $2\ 1/3^{\circ}$.
2. It is recommended that the retard points be set so that they open when the piston is started down on the power stroke approximately 1° to 3° beyond T.D.C. This will keep the engine from kicking back during the starting sequence.

POWERPLANT TROUBLESHOOTING

Experience has proven that the best method of troubleshooting is to decide on the various causes of a given trouble and then to eliminate causes one by one, beginning with the most probable. The following charts list some of the more common troubles, which may be encountered in maintaining engines and turbochargers; their probable causes and remedies.



ENGINE TIMING LOCATION

1. TROUBLESHOOTING – ENGINE

TROUBLE	CAUSE	REMEDY
Failure of Engine to Start	Lack of fuel	Check fuel system for leaks. Fill fuel tank. Clean dirty lines, strainers or fuel valves.
	Overpriming	Leave ignition "Off" and mixture control in "Idle-Cut-Off", open throttle and "unload" engine by cranking for a few seconds. Turn ignition switch on and proceed

TROUBLESHOOTING – ENGINE (Con't)

TROUBLE	CAUSE	REMEDY
	Defective spark plugs	Clean and adjust or replace spark plugs.
	Defective ignition wire	Check with electric tester, and replace any defective wires.
	Defective battery.	Replace with charged battery.
	Improper operation of magneto breaker	Clean points. Check internal timing of magnetos.
	Lack of sufficient fuel flow	Disconnect fuel line and check fuel flow.
	Water in fuel injector or carburetor	Drain fuel injector or carburetor and fuel lines.
	Internal failure	Check oil screens for metal particles. If found, complete overhaul of the engine may be indicated.
Failure of Engine to Idle Properly	Incorrect idle mixture	Adjust mixture.
	Leak in the induction system	Tighten all connections in the induction system. Replace any parts that are defective.
	Incorrect idle adjustment	Adjust throttle stop to obtain correct idle.
	Uneven cylinder compression	Check condition of piston rings and valve seats.
	Faulty ignition system	Check entire ignition system.
	Insufficient fuel pressure	Adjust fuel pressure.
Low Power and Uneven Running	Mixture too rich indicated by sluggish engine operation, red exhaust flame at night. Extreme cases indicated by black smoke from exhaust.	Readjustment of fuel injector or carburetor by authorized personnel is indicated.

TROUBLESHOOTING – ENGINE (Con't)

TROUBLE	CAUSE	REMEDY
	Mixture too lean; indicated by overheating or backfiring	Check fuel lines for dirt or other restrictions. Readjustment of fuel injector or carburetor by authorized personnel is indicated.
	Leaks in induction system	Tighten all connections. Replace defective parts.
	Defective spark plugs	Clean and gap or replace spark plugs.
	Improper fuel	Fill tank with fuel of recommended grade.
	Magneto breaker points not working properly	Clean points. Check internal timing of magnetos.
	Defective ignition wire	Check wire with electric tester. Replace defective wire.
Failure of Engine to Develop Full Power	Leak in the induction system	Tighten all connections and replace defective parts.
	Throttle lever out of adjustment	Adjust throttle lever.
	Improper fuel flow	Check strainer, gage and flow at the fuel inlet.
	Restriction in air scoop	Examine air scoop and remove restrictions.
	Improper fuel	Drain and refill tank with recommended fuel.
	Faulty ignition	Tighten all connections. Check system with tester. Check ignition timing.
Rough Engine	Cracked engine mount	Replace or repair mount.
	Defective mounting bushings	Install new mounting bushings.
	Uneven compression	Check compression.
Low Oil Pressure	Insufficient oil	Fill to proper level with recommended oil.

TROUBLESHOOTING — ENGINE (Con't)

TROUBLE	CAUSE	REMEDY
	Air lock or dirt in relief valve	Remove and clean oil pressure.
	Leak in suction line or pressure line	Check gasket between accessory housing and crankcase.
	High oil temperature	See "High Oil Temperature" in "Trouble" column.
	Defective pressure gage	Replace.
	Stoppage in oil pump intake passage	Check line for obstruction. Clean suction strainer.
High Oil Temperature	Insufficient air cooling	Check air inlet and outlet for deformation or obstruction.
	Insufficient oil supply	Fill to proper level with specified oil.
	Low grade of oil	Replace with oil conforming to specifications.
	Clogged oil lines or strainers	Remove and clean oil strainers.
	Excessive blow-by	Usually caused by worn or stuck rings.
	Failing or failed bearing	Examine sump for metal particles. If found, overhaul of engine is indicated.
	Defective temperature gage	Replace gage.
Excessive Oil Consumption	Low grade of oil	Fill tank with oil conforming to specifications.
	Failing or failed bearings	Check sump for metal particles.
	Worn piston rings	Install new rings.
	Incorrect installation of piston rings	Install new rings.
	Failure of rings to seat (new nitrided cylinders)	Use mineral base oil. Climb to cruise altitude at full power and operate at 75% cruise power setting until oil consumption stabilizes.

INSPECTION OF FUEL SERVO SCREEN

100 HOUR INSPECTION

1. Disconnect throttle and mixture control at servo unit.
2. Remove fuel pressure line to servo.
3. Remove (4) servo mounting nuts and position servo in order to remove fuel screen.

NOTE: Crack nut on screen before disconnecting servo unit from engine.

4. After inspecting screen for residue, reinstall in servo.
5. Place servo on engine and attach four nuts. Hook up throttle and mixture controls.
6. Run engine and check for leaks and proper operation.

POWERPLANT

FUEL DISTRIBUTOR VALVE

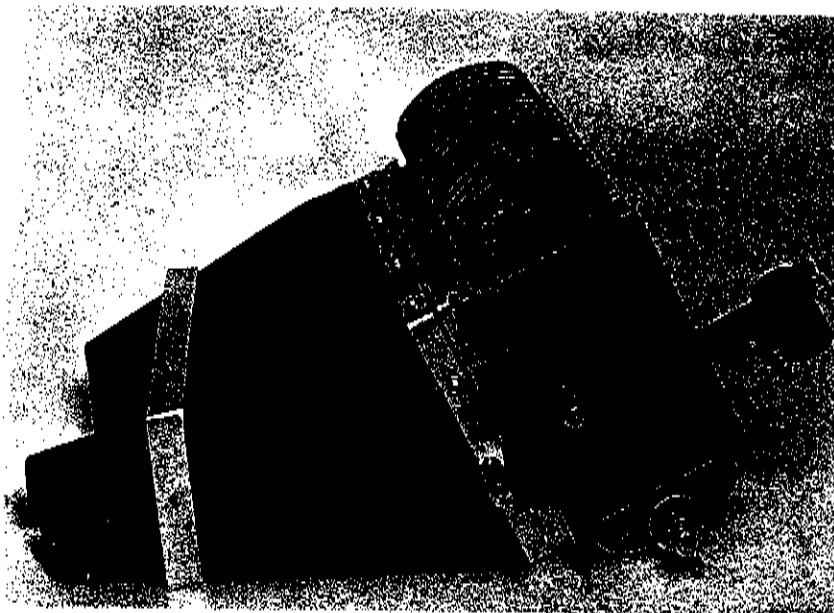
Removal. To remove the fuel distributor valve located on top of the Lycoming engine, the following must be removed: (Ref. Page 5 - 39.)

- a. Remove the 28-12615 left and right baffles that are secured by nine fasteners on each side.
- b. Remove the 28-12614 baffle (center) by removing 17 AN515-8-7 screws.
- c. This will allow access to the distributor valve for removal and/or installation.
- d. After installation of unit, run engine and check for leaks to each cylinder before installing baffles.

POWERPLANT

OIL COOLER

The oil cooler is of the standard radiator type relying on air flow for cooling effect. Cooling air is directed from the fan through the cooler core and exhausted into the atmosphere. Regulation of oil flow through the cooler is accomplished by a temperature and pressure-sensitive valve located in the engine accessory case in line with the oil filter screen. Maintenance which may be performed consists of removal, cleaning, testing, and installation.



OIL COOLER AND DUCT INSTALLATION

Removal of Oil Cooler. The oil cooler is mounted on the right hand side of the engine compartment.

- a. Open or remove right side cowl.

CAUTION: Pay particular attention to magneto switch OFF position.

- b. Drain approximately 1 quart of oil from the drain valve in the lower portion of the radiator.
- c. Disconnect the inlet line and outlet line to the radiator, paying particular attention that they are plugged to keep residue oil from draining on the floor.
- d. Place container beneath the radiator when disconnecting lines to collect any drain oil from cooler and from the lines.
- e. Remove seven 8-32 screws holding cooler boot to fan shroud.
- f. Remove the four base AN-3 bolts from lower bracket. This will allow the radiator to be removed easily.

NOTE: Upon removal of cooler, visually inspect rubber flex boot for rips. Replace the boot assembly if necessary.

OIL COOLER (Con't)**Inspection of Oil Cooler.**

- a. Inspect oil cooler for:
 1. Integrity of finish.
 2. Bent, broken or dirty core fins.
 3. Nicked, burred, or deformed plumbing fittings.
 4. Deformed screw holes.
 5. Loose boot attachment to radiator inlet.
- b. Inspect oil cooler air duct for:
 1. Cleanliness.
 2. Cracks, checking, tears, dents.
 3. Integrity of mounting flanges.
- c. Inspect oil inlet and return line for:
 1. Cleanliness and freedom from obstructions.
 2. Cracks, checking, swelling, and kinks.
 3. Integrity of wire shield.
 4. Plumbing fitting for nicks, burrs, and deformity.

Leakage Check of Oil Cooler.

- a. Perform a hydrostatic test on the radiator. Operate test set in accordance with manufacturer's instructions, or take radiator to certified radiator shop and have it pressure tested for leakage.
- b. Install pressure cap on one oil cooler fitting.
- c. Connect test set to remaining oil cooler fitting.
- d. Regulate test set pressure to 150 PSI.
- e. Check for leakage.

NOTE: Leakage is indicated by escaping fluid and a drop in regulator pressure.

- f. Locate and mark source of leak if any.

NOTE: Use standard procedure to repair leaks. If required repairs are inaccessible or extensive, replace oil cooler with a new unit. After repairs are completed, repeat Steps a through e.

- g. Remove oil cooler from test set.

Installation of Oil Cooler. Oil cooler assembly and components installation may be accomplished as required without having to remove any additional equipment.

OIL COOLER (Con't)

- a. Secure radiator on pylon with four AN-3 bolts.
- b. Position oil cooler boot on scroll mounting flange. Secure with seven 8-32 screws.
- c. Secure oil cooler inlet and return lines to engine accessory case.
- d. Thoroughly inspect oil cooler assembly installation, torque on fittings, security of lock wire, routing of lines, and ducting.
- e. Perform preflight inspection; service engine as required.
- f. Perform operational check of engine prior to flight.
- g. Inspect assembly, following engine run up, for oil leaks.
- h. Replace or secure right side cowl.

REMOVAL OF OIL SCREEN ASSEMBLY

- a. Open side cowl.
- b. Remove safety wire on oil temperature bulb cannon plug and disconnect.
- c. Remove four ¼-20 screws from oil screen housing.
- d. Remove housing by pulling forward.
- e. Remove screen from the housing.

INSPECTION OF OIL FILTER ASSEMBLY

- a. Inspect oil filter screen housing for:
 1. Integrity of finish and cleanliness.
 2. Cracks, nicks, burrs and corrosion.
 3. Stud hole deformity.
 4. Security of temperature bulb.
- b. Inspect oil filter screen for:
 1. Cleanliness.
 2. Dents and broken mesh.
- c. Inspect temperature sensitive bulb for:
 1. Cleanliness and security of attaching parts.
 2. Cracks, nicks, burrs, corrosion, dents and deformed threads.
- d. Inspect attached hardware.
- e. Assemble and install oil filter assembly in reverse of disassembly.
- f. Secure cowl, run engine, check for leaks, secure compartment.

POWERPLANT

ENGINE EXHAUST SYSTEM

Description. The exhaust system utilized on the engine consists of two manifolds which route engine exhaust to the heater-muffler and single discharge pipe.

Removal of Exhaust System.

- a. Remove right hand and left hand side cowling.
- b. Remove the engine exhaust stacks from cylinders.
- c. Remove heater ducting from fan shroud.
- d. Remove duct from cabin heat outlet.
- e. Disconnect three bolts from each exhaust flex coupling.
- f. This will allow the complete manifold assembly to be removed as a unit.

Inspection of Exhaust System.

- a. Upon removal of the complete exhaust system, check the flange mounting of each exhaust stack for cracks, distortion of the flange and proper gaskets.
- b. Pull bottom cowl.

NOTE: At the 100-hour inspection it will be necessary to remove the muffler cover to inspect for any cracks internally which could cause carbon monoxide entering the cabin.

Installation of Exhaust System.

- a. Assemble the muffler cuff.
- b. Attach each exhaust stack to the existing cylinder exhaust flange.
- c. Install manifold assembly and attach flexible coupling to each individual exhaust stack.
- d. Install all cowling.
- e. Run engine and check for leaks.

COLD WEATHER OPERATION - INFORMATION

The overrunning clutch to be serviced with Mobil Artic "C" oil. A small fan may be used for circulating the air to keep the windshield clear of fog. Cabin heater is of sufficient capacity to deliver adequate heat.

Preheating of engine is highly recommended to avoid excess wear or damage to the engine and engine oil system. Oil is near solid state at 0° F. and lower.

Use proper grade oil for the temperature range as recommended by engine manufacturer.

Oil in the reservoir needs most of the heat; therefore, direct the heat to the oil sump, lines and oil cooler and then also to the cylinders.

Too rapid a pre-heating is not good either, as the magnetos will get wet. Engines cooled in sub-freezing temperatures will sweat inside and out. This is evident by a coat of frost on engine after preheating is commenced. Pre-heat until engine is dry and oil temperature is in the high operating range.

Small capacity, 2,500 to 5,000 BTU Catalytic Safety Heaters can be best used as soon as aircraft is shut down for the day. Position heater preferably in engine compartment, keeping it clear of fuel lines, the sediment bowl, and low enough to prevent scorching. Air must be able to move and breathe so do not make the compartment air tight. Where electric power is available, use of a couple 200 Watt light bulbs under the engine can do the job. Most important item is to keep off any cold blast of air over the engine.

At almost any cold temperature, if the engine compartment is covered with an insulated type blanket, the engine and oil temperature will retain its own heat satisfactorily for several hours.

Once the engine is pre-heated, use a regular start procedure as excess priming can cause wet plugs.

Engine run down cooling is desirable to reduce possibility of cracks in exhaust stacks.

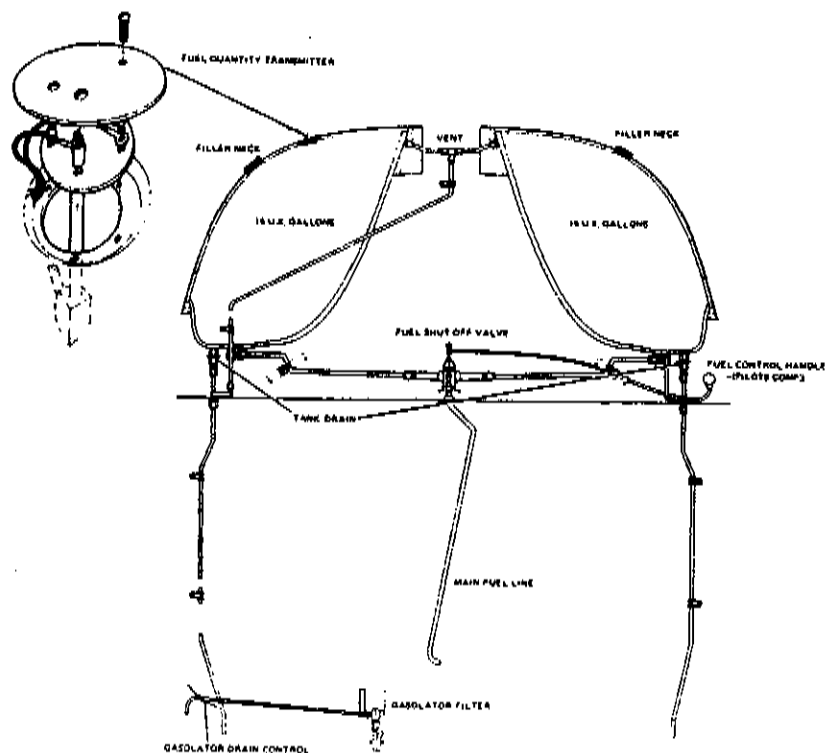
An average battery can be run down in approximately two minutes of attempted starts at 22° F. Thus, pre-heating engine and oil is desirable. Make sure your battery is in good condition and fully charged.

If two or three attempts are made to start a cold engine and there is only feeble firing impulses, remove a couple spark plugs, inspect for ice. If there is icing, change the plugs or preheat the engine before further attempts to start are made.

POWERPLANT

FUEL SYSTEM

Description. The fuel system consists of the fuel tanks, left and right, fuel booster pump, valves and strainer, plumbing lines, engine driven fuel pump, and induction system. Fuel is gravity-fed from the tanks through the auxilliary fuel pump, valves, filter, and plumbing lines to the inlet side of the engine driven fuel pump. This fuel pump functions whenever the engine is operating and delivers a constant flow of fuel under a regulated pressure to the servo-control. The servo-control system operates by measuring the air flow through the throttle body of the servo-valve regulator control, and uses this measurement to operate a servo-valve within the control. The accurately regulated fuel pressure established by the servo-valve is used to control the distributor valve assemblage, which then schedules a fuel flow in proportion to airflow. Components of the fuel system are located throughout the helicopter. These items may be removed individually or in groups as required to perform necessary maintenance. Maintenance which may be performed consists of removal, cleaning, trouble shooting, adjustment, inspection and/or parts replacement, and installation.



MAIN FUEL SYSTEM

FUEL SYSTEM

REMOVAL OF EXTERNAL FUEL BOOSTER PUMP

- a. Turn fuel and master switch OFF.
- b. Remove drain line from bottom of pump.
- c. Remove four NK 500 Nylock screws attaching pump to pylon assembly.
- d. Remove inlet line from fuel tank and outlet line to fuel strainer.
- e. Disconnect the positive wire at junction below right hand relay panel.
- f. Disconnect the ground electrical connection on right hand relay panel.

INSTALLATION OF EXTERNAL FUEL PUMP

- a. Be sure that fuel position valve is OFF and master switch is OFF.
- b. Install fuel booster pump and attach with four NK 500 Nylock screws.
- c. Install the inlet and outlet lines, making sure that the lines are in the correct position and tagged as they were removed.
- d. Hook up the electrical wiring, one to ground, one to positive.
- e. Attach the drain line to the bottom of the pump.
- f. Turn on fuel system, activate fuel booster pump and check for leaks prior to flight.
- g. Mixture control in idle cut-off.

Engine Driven Fuel Pump.

Removal of Engine Driven Fuel Pump.

WARNING: Make certain fuel control is in the OFF position.

- a. Remove nut, securing fuel inlet line to right hand side of fuel pump.
- b. Remove nut, securing fuel outlet line to left hand side of pump.
- c. Remove lockwire, two mounting bolts, flat washers, and lock washers, securing fuel pump to engine accessory case mounting pad.

CAUTION: Withdraw pump straightaway from engine or damage may occur to pump actuating arm.

Inspection of Engine Driven Fuel Pump.

Perform an inspection and operational check on the engine driven fuel pump in accordance with manufacturer's overhaul instructions.

Installation of Engine Driven Fuel Pump.

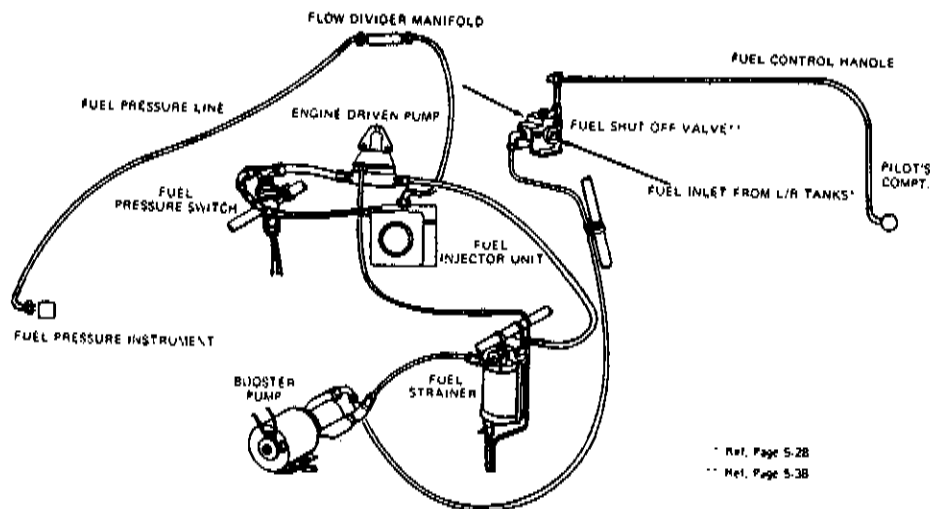
INSTALLATION OF ENGINE DRIVEN FUEL PUMP

- a. Install lock washers and flat washers on two mounting bolts in pump mounting holes.
- b. Install gasket on pump base over mounting bolts.
- c. Position pump over engine accessory mounting pad and slide pump gently toward engine until the pump base is flush against mounting pad.

CAUTION: Install pump by moving straight into engine or damage to pump actuating arm may occur.

- d. Secure pump with mounting hardware.
- e. Secure bolts with lock wire.
- f. Position fuel inlet line on right hand side of pump and secure with nut.
- g. Position fuel outlet line on left hand side of pump and secure with nut.

NOTE: On the removal and overhaul of any engine component part, turn fuel ON and check operation of fuel system.



DISASSEMBLY OF FUEL STRAINER

WARNING: Make certain fuel control is in the OFF position.

- a. Open drain valve located on bottom of fuel strainer assembly and drain residual fuel.
- b. Remove drain line.
- c. Cut lock wire, loosen nut securing swivel bracket at bottom of fuel strainer assembly.
- d. Rotate bracket.
- e. Remove base, screen, outside barrel, and the top and bottom gaskets from strainer assembly.
- f. Release spring catch, securing filter screen to inlet tube at top of fuel strainer assembly.

CLEANING FUEL STRAINER ASSEMBLY

- a. Using solvent or MEK, thoroughly clean all portions of fuel strainer housing.

NOTE: Pay particular attention to fittings and passageways within housing body.

- b. Using solvent and fine bristle brush, thoroughly clean exterior and interior surfaces of filter screen.

CAUTION: Damage to filter screen will occur if excessive force is used during cleaning.

- c. Air dry all parts of fuel strainer assembly.

INSPECTION OF FUEL STRAINER ASSEMBLY

- a. Inspect fuel strainer assembly for:
 1. Nicks, scratches, burrs, cracks and evidence of corrosion.
 2. Deformed mounting holes.
 3. Loose or damaged plumbing fittings.
 4. Worn or damaged gaskets.
- b. In addition to defects described in Step a, check fuel strainer filter screen for:
 1. Rips, dents, and deformities.
 2. Dirty mesh.
 3. Security of spring retainer clip

ASSEMBLY OF FUEL STRAINER

- a. Install upper gasket, wire mesh screen, discharge tube, outer barrel and lower gasket.

- b. Rotate clamp. Align lock nut with pad on base of fuel strainer assembly housing.
- c. Tighten nut to seat strainer parts. Rotate nut one-half turn farther, secure with lock wire.
- d. Close low point drain valve.
- e. Install drain line.
- f. Position fuel valve ON.
- g. Check booster pump ON.
- h. Mixture - idle cut-off.
- i. Check for leaks.

REMOVAL OF FUEL TANKS

- a. Drain fuel through fuel sump drain located on the underside of the left and right fuel tanks.
- b. After fuel tanks have been drained thoroughly, disconnect fuel outlet line at tank.

NOTE: Cap lines.

- c. Remove 16 each AN525-8-10 screws from each tank assembly.
- d. Disconnect left and right fuel vent lines at top inboard side of tanks and lower 'T' fittings.
- e. Disconnect scupper bag drain lines.
- f. Disconnect wire lead to fuel float indicator on top of right hand tank.

INSTALLATION OF FUEL TANKS

- a. Place left and/or right tank in position on top of bulkheads.
- b. Attach left and/or right tank with the 16 each AN525-8-10 screws.
- c. Assemble left and right fuel vent lines at top inboard side of fuel tanks and also at lower 'T' fittings on bottom side of tank.
- d. Assemble fuel outlet lines to fuel control valve located on center top pylon assembly.
- e. Install and hook up fuel drain lines for both left and right tanks.
- f. Hook up electrical connection on liquidometer, located on top of right hand tank.

FUEL SYSTEM

PROCEDURE FOR CALIBRATION OF FUEL TANK GAGE

1. Place ship in approximate normal flight attitude.
2. Add approximately 1/3 gallon of fuel to tank. Zero gage for unusable fuel.
3. Gage should be adjusted to zero by bending float arm.
4. Add fuel until gage reads 1/4. (Allow time for tanks to equalize.) Record amount on calibration card.
5. Repeat Step 4 for 1/2, 3/4 Full, and "Topped" tank. Gage should be linear ± 1 (one) gallon on each reading, except "Topped" (full tank).

FUEL SYSTEM

LEAK REPAIR FOR F-28A FIBERGLASS TANKS

Remove tanks from the helicopter and follow the instructions as stated.

- a. Remove all fuel transmitter components and main fuel outlet and strainer from the bottom of the tank.

NOTE: Caution should be used when removing the fuel outlet as it is bonded to the tank.

- b. Plug all fitting holes.
- c. Fill tanks with one gallon of slushing compound and plug fuel cap opening.
- d. Slowly roll tank to assure that all surfaces have been completely covered with compound.
- e. Place tank so bottom is parallel to floor and remove plug from main fuel outlet. Allow all excess compound to drain from the tank.
- f. Open all holes and force-ventilate tank to cure slushing compound. Allow a minimum of eight hours. Check tank to assure that the slushing compound is tack-free.
- g. Replace main fuel outlet and strainer using EC 801, fuel transmitter components, and check sump drain to assure it is not blocked. Remove excess slushing if required.

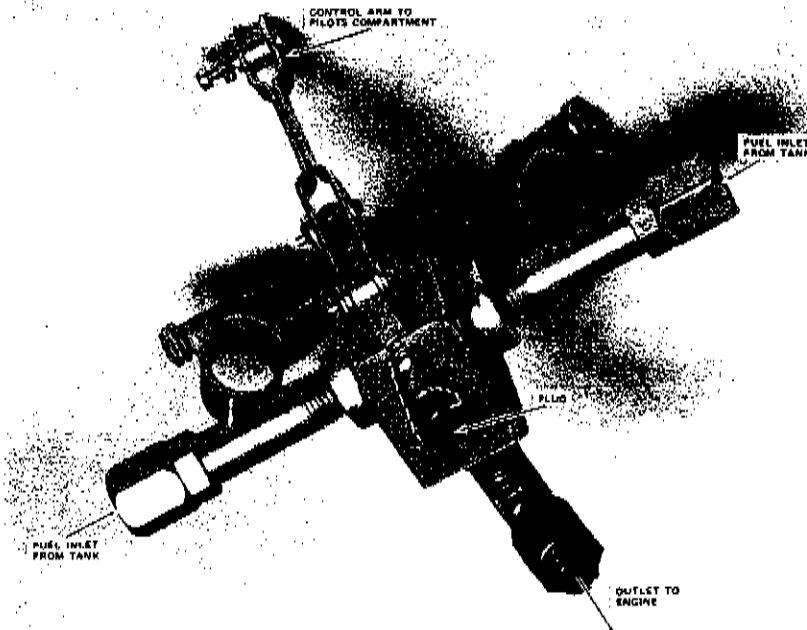
NOTE: Allow EC 801 to dry tack-free.

- h. Place approximately five gallons of fuel in the tank and check for leaks before replacing tank on aircraft.

REMOVAL OF FUEL CONTROL VALVE

NOTE: Pull right hand tank - Ref. Page 5 - 33.

- a. Disconnect left and right fuel inlet lines at fuel control valve.
- b. Disconnect fuel outlet line from booster pump.
- c. Disconnect flex cable at fuel control valve on pylon.
- d. Remove four AN-3 bolts attaching fuel control valve to pylon assembly and remove unit.



FUEL CONTROL VALVE

ASSEMBLY OF FUEL CONTROL VALVE

- a. Install valve at apex of upper pylon assembly and attach with four AN-3 bolts and nuts.
- b. Connect flex control cable to fuel control valve.
- c. Connect fuel outlet line to booster pump.
- d. Connect left and right fuel inlet lines.
- e. Push in fuel control handle to ON position.
- f. Turn on fuel booster pump on instrument panel.
- g. Check fuel system for leaks prior to engine run up. If no leaks are noted, start engine and check powerplant compartment for fuel leaks prior to flight.

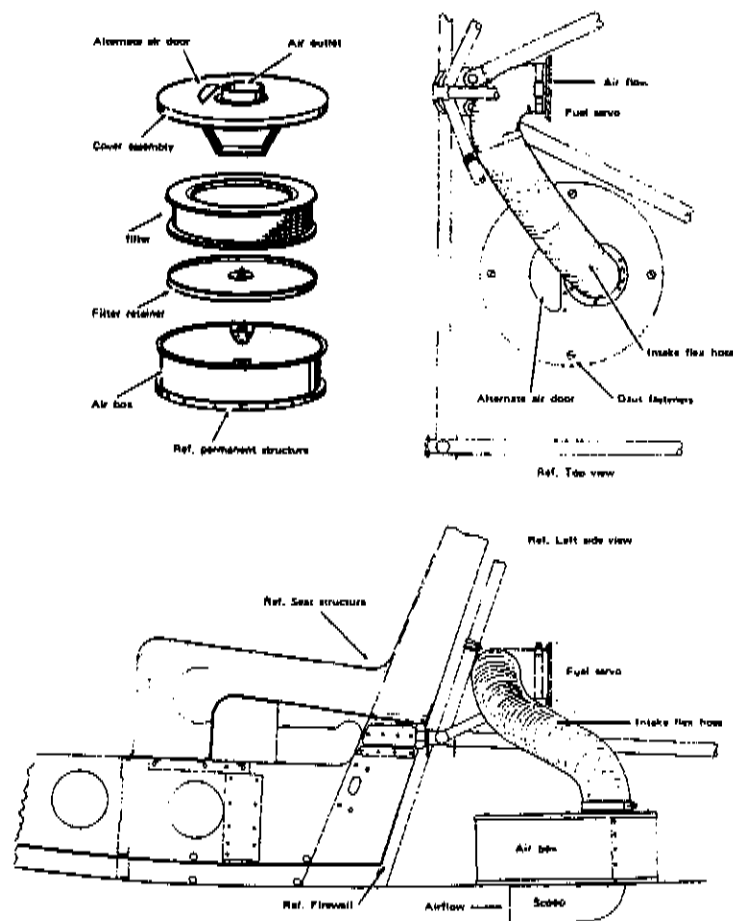
NOTE: Install right hand fuel tank - Ref. Page 5 - 33.

POWERPLANT

FILTER INDUCTION SYSTEM

Description. A porous paper filter Fram No. CA-151 PL or ACA53C or Purolator AFP-5 is utilized to remove all foreign material from the air before it enters the induction system. The filter is installed in the induction plenum chamber which is located in the bottom of the lower cowling below the engine.

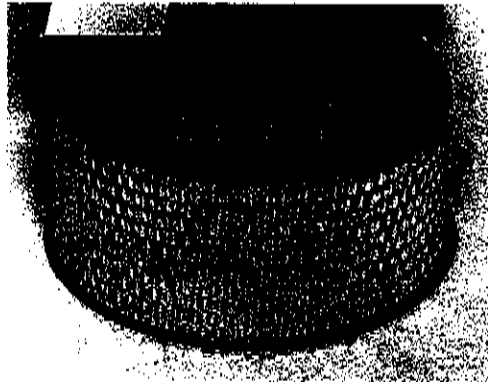
The fuel injector requires an alternate air source in the event the air filter becomes ice covered or plugged. A spring-loaded door between the engine compartment and the air filter housing is designed to open as pressure builds up due to a clogged filter. This provides warm air from the engine compartment to the fuel injector.



Servicing the filter consists of removal, cleaning, inspection of the filter, plenum chamber, valve, and components, and replacement of same.

To inspect and service the filter in the induction system, proceed as follows:

- a. Open left-hand engine cowl.
- b. Remove four DZUS fasteners which will allow the cover assembly and intake flex hose to be lifted easily from the filter air box.
- c. Remove filter from induction air box and clean interior of air box, either by the use of compressed air, tire pump or other suitable means.



TYPICAL AIR FILTER CARTRIDGE

- d. Make a thorough check of the air filter induction system including the flexible hose to see that there are no breaks in the system and that all clamps at the top where the flexible hose goes into the servo unit and attachments to the air box are tight.
- e. Check to see that there are no obstructions in the air scoop which is located on the bottom of the fuselage.
- f. Frequency of inspection is determined by the conditions under which the helicopter is operated. A daily inspection is recommended when the helicopter is used for agricultural dusting and spraying or is operated in extremely dusty areas.
- g. Visually inspect filter element for dents, tears, or other physical damage.
- h. It is recommended that a new filter be installed every 100 hours or, as mentioned above, when conditions warrant changing it. Upon

To inspect and service the filter in the inductor system, (Con't)

installation of the filter unit, be sure that the four DZUS fasteners are locked securely before installing the left hand side cowl and proceeding with an engine run up to check for security of all parts.

- i. Check operation of alternate air door - by applying pressure.

POWERPLANT**COOLING SYSTEM**

Description. The cooling shroud system consists of a fan assembly, a shroud assembly, oil cooler, and ducting. Air is drawn by the fan and forced through the shroud into the cylinder baffles for engine cooling. A portion of the cooling air is ducted to the oil cooler. Components of the cooling system are attached to the engine and form part of the powerplant assembly. The shroud, fan, oil cooler and ducting may be removed while the powerplant is installed in the aircraft. Complete disassembly of the cooling system is necessary for engine removal. Maintenance which may be performed consists of removal, cleaning, and/or replacement.

Fan Assembly. The fan assembly draws in outside air and forces it through the shroud assembly, providing cooling air to the engine and other components.

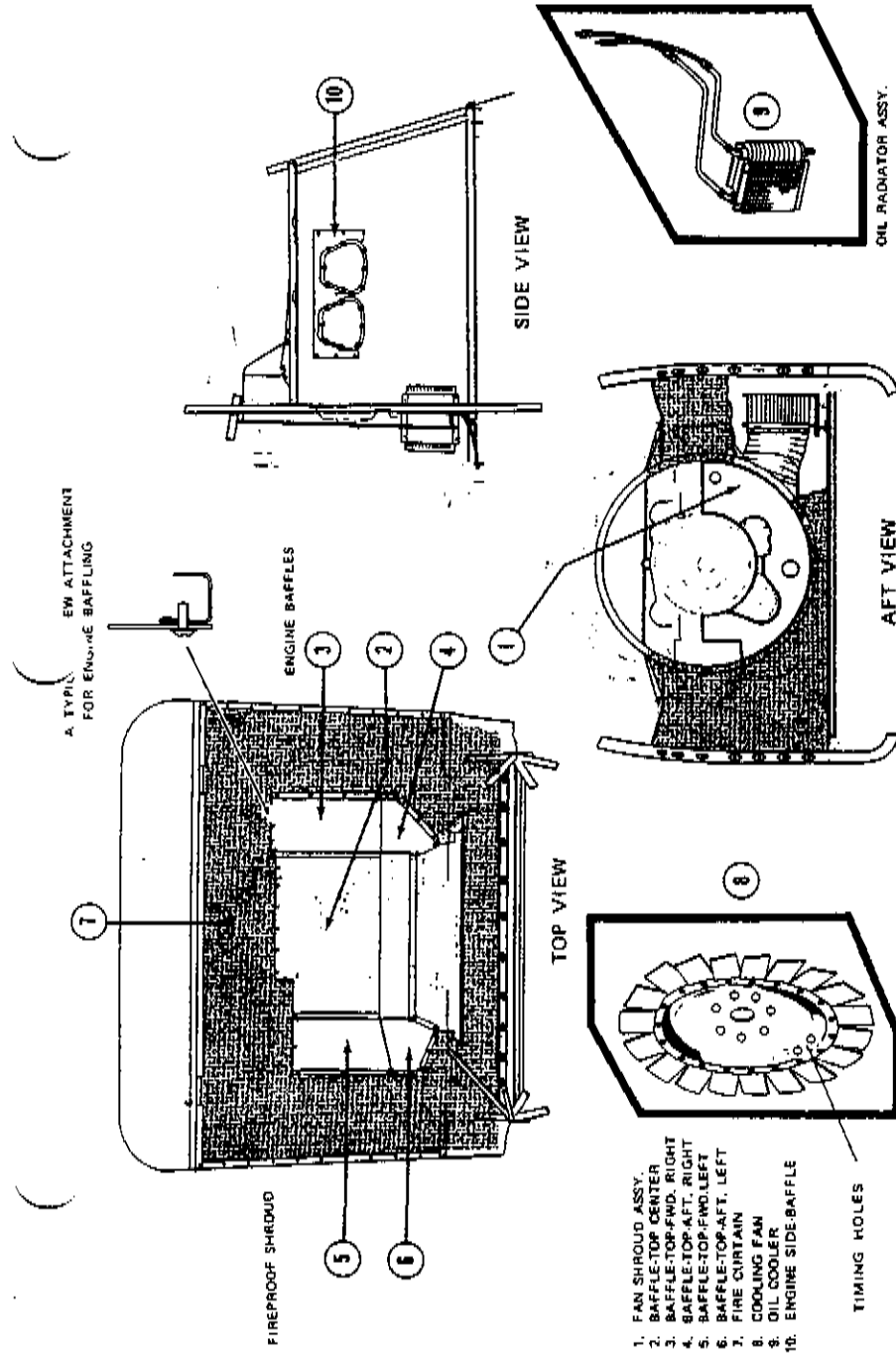
Removal. To remove the fan assembly, proceed as follows:

- a. Remove outer cowling assembly.
- b. Remove baggage compartment.
- c. Remove jack strut and lower pulley assembly. Ref. Sect. 8-9.
- d. Remove forward tail rotor drive shaft coupling. Ref. Sect. 15-16 thru 20.
- e. Remove fan from lower pulley assembly. Ref. Sect. 8-9 - 8-10.

Inspection.

- a. Inspect blades for cracks and nicks.
- b. Replace individual blades if cracks are evident, and rebalance fan.

Installation. Replace above units in reverse order and run engine before replacing outer cowling.



POWER PLANT COOLING SYSTEM

POWERPLANT

REMOVAL

- a. Remove aft wrap-around cowl, side panels, and bottom cowl.
- b. Loosen lower side cowl and allow to swing downward.
- c. Remove exhaust muffler and exhaust pipes.
- d. Remove jack strut and drive pulley. Ref. Page 8 - 9, 8 - 10.
- e. Remove fan.
- f. Remove the following baffling from engine: Ref. Page 5 - 31.
 1. Remove the 12612 oil cooler air duct.
 2. Remove the 12611 fan shroud baffle.
 3. Remove the 12610 fan shroud, baffle, and support bracket assembly.
 4. Remove the top engine baffles, No. 2, 3, 4, 5, 6.
- g. Pull fan shroud away from engine.
- h. Remove oil cooler and oil cooler lines. Ref. Page 5 - 23.
- i. Disconnect clutch cable clamp at lower bay cross tube.
- j. Remove lower bay cross tubes.
- k. Disconnect fuel, electrical lines and engine controls.
- l. Remove aft fan shroud brace from lower engine crankcase.
- m. Tilt engine aft and down to allow magneto to clear pylon.
- n. Remove oil breather line from engine.
- o. Place support under engine and remove the four engine mount bolts.
- p. Slowly allow engine to settle on engine support.

NOTE: Attach all existing hardware to controls to facilitate reinstallation.

INSTALLATION

Replace above units in reverse order and run engine before replacing outer cowling.

POWERPLANT

MIXTURE CONTROL RIGGING

To rig the mixture control, proceed as follows:

- a. Remove left-hand side engine cowl.
- b. Pull mixture control (1) to a full lean position and check for full stop on injector unit (2).
- c. Push mixture control (1) to full rich and check stop on injector unit (2).

NOTE: Should have approximately 1/16" cushion.

- d. Make adjustments as necessary at either rod end nearest mixture control lever (3) or at nut (4) on pylon attachment.
- e. Idle engine at between 1400 - 1450 RPM and check for proper mixture adjustment.

NOTE: 1. Ref. Page 5 - 9 for adjustments.

2. Rotor should be disengaged for this check.

- f. Recheck idle setting if necessary following mixture adjustment.
- g. Inspect all areas where adjustments have been made prior to closure of engine compartment and flight check.

MIXTURE CONTROL REMOVAL

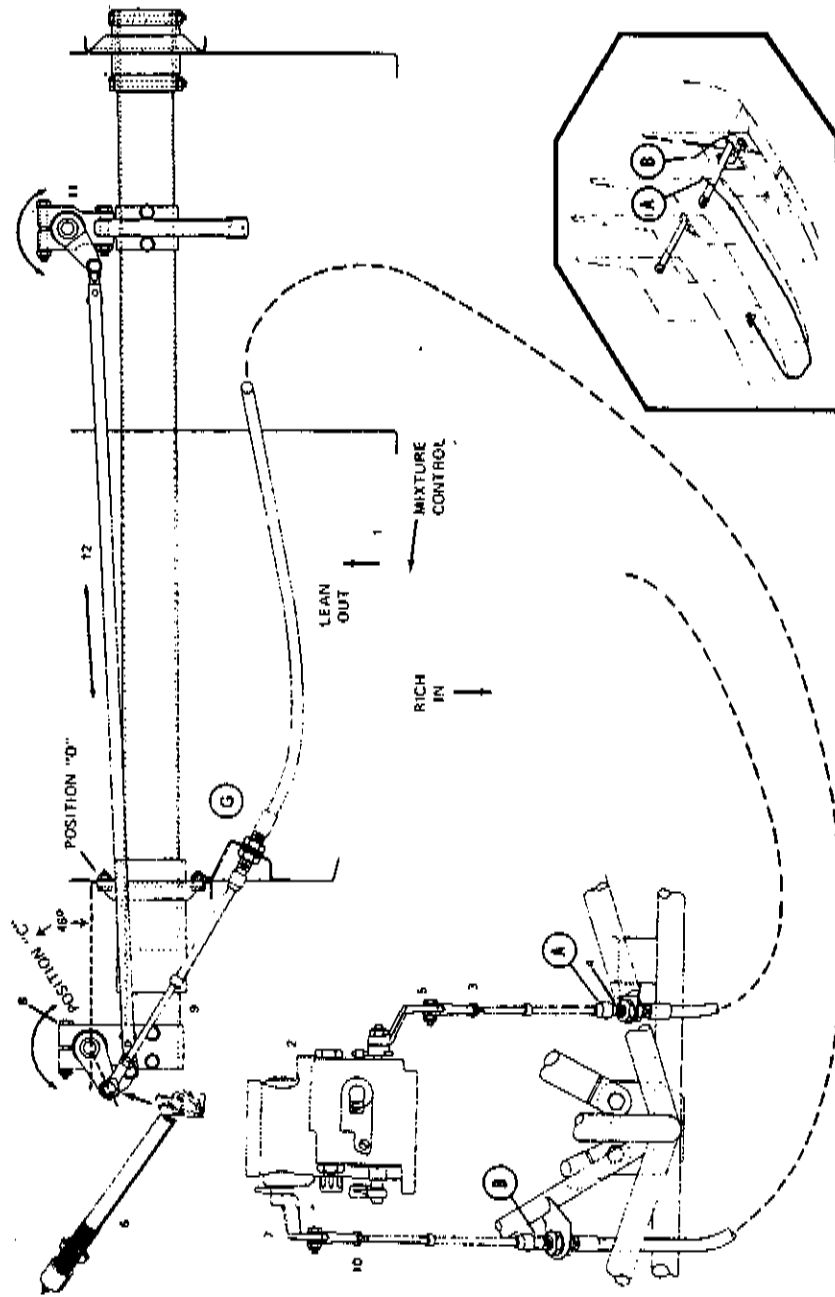
To remove the mixture control unit, proceed as follows: Ref. Pages 5-42 5-44.

- a. Remove fiberglass seat cover, center floor panel and nose tunnel.
- b. Disconnect mixture control from injector bellcrank (5).
- c. Disconnect nut (4) from pylon attachment bracket.
- d. Remove all clamps attaching mixture control to structure and pull mixture control through firewall for removal.
- e. Reinstall mixture control in reverse order and rig the control per above instructions.

THROTTLE CONTROL RIGGING

To rig the throttle control, proceed as follows:

- a. Remove cowling and fiberglass seat cover.
- b. For proper throttle rigging, locate collective stick as indicated "Position C" with collective stick in full down position against low RPM "Stop" then pull collecting stick full up "Position D" roll throttle back to low RPM Stop. If not able to come back to low RPM Stop reposition actuator mount nuts for proper travel required.



THROTTLE AND MIXTURE CONTROL

- c. Check throttle arm on injector unit to see that when fully OFF (hits idle stop) (2).
- d. Check for full throttle at $\frac{1}{4}$ up collective position. (Reference position)

NOTE: If control is properly rigged, you should obtain full throttle at or before $\frac{1}{3}$ collective up position.

- e. Adjustments may be made by any of the following methods:
 - 1. Loosening of four attach bolts (8) holding pilot's collective stick (6) and rotating collective control to set stops located on bottom of collective control.
 - 2. Adjustment of push-pull cable at "B" nuts under pilot's seat and on pylon firewall attach bracket.
 - 3. Adjust rod end at collective (9) or at clevis arm at injector unit (10).

NOTE: 1. Check copilot's throttle stop (11) with pilot's throttle in idle or stop position. Both should hit stops simultaneously.

2. Check for full idle on copilot's collective.

3. Check for any interference on interconnecting rod (12) between collective controls.

4. Check to see that bottom of copilot's collective stick does not hit collective push-pull tube when collective control is in the full up position.

5. The distance between the aft side of the attaching copilot's collective stick bracket and aft end of collective stick should have approximately $\frac{1}{2}$ " maximum exposure.

6. The distance between the aft end of the attaching pilot's collective stick bracket and the aft end of the collective stick should have approximately $\frac{3}{4}$ " exposure.

- f. Following the completion of rigging of the throttle control, check mixture control and readjust as necessary.
- g. Make complete inspection of entire system prior to ground run and check flight.
- h. Reinstall all cowling and fiberglass seat.
- i. Make final inspection prior to flight.

THROTTLE CONTROL REMOVAL

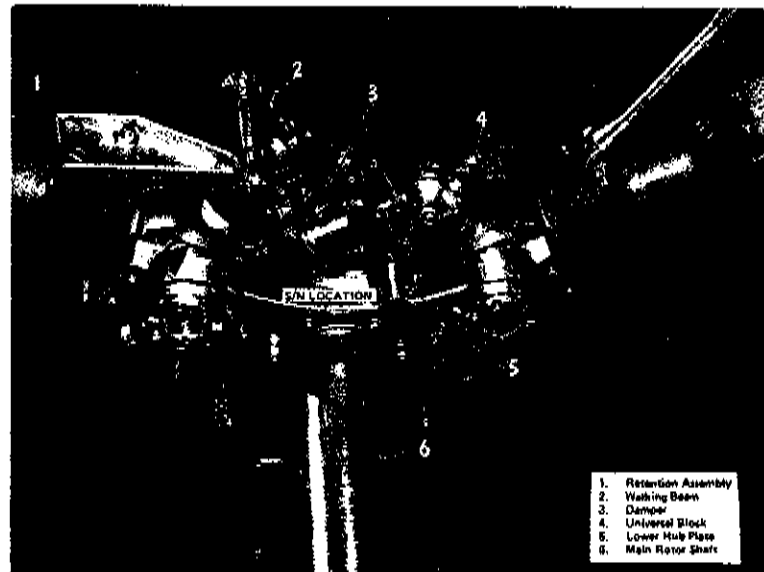
To remove throttle control, proceed as follows:

- a. Remove cowling and fiberglass seat.
- b. Disconnect throttle control at injector unit.
- c. Disconnect "B" nut at pylon attach fitting.
- d. Disconnect throttle control at pilot's collective control stick and pull control through seat structure.
- e. Reinstall new throttle control in reverse order and check rigging per above instructions.
- f. Inspect all work performed in engine compartment and under seat structure prior to installing fiberglass seat cover and closure of engine compartment.
- g. Check engine operation prior to flight.

MAIN ROTOR HUB ASSEMBLY

Description.

The three bladed main rotor is a simplified design with a minimum of bearings and moving parts. The main rotor head consists of two outer hub plates placed together with a spacer and three universal blocks placed between them. Two spline adapters attach to the outer sides of the hub plates and complete the assembly. Three hydraulic dampers attach to the hub assembly and connect to the universal blocks, they dampen the lead-lag movement. Three blade retention assemblies attach to the universal blocks. The three main rotor blades connect to the retention assemblies by a vertical bolt and drag link.



MAIN ROTOR HUB ASSEMBLY

Removal.

- a. Remove the three bellcrank assemblies (1).
- b. With the use of main rotor shaft wrench adapter, remove hub nut (2) and washer (3).
- c. Remove main rotor blades (4). Ref. Page 6 - 7.

NOTE: Hold tip of blade up off down stop to keep from spreading blade grip.

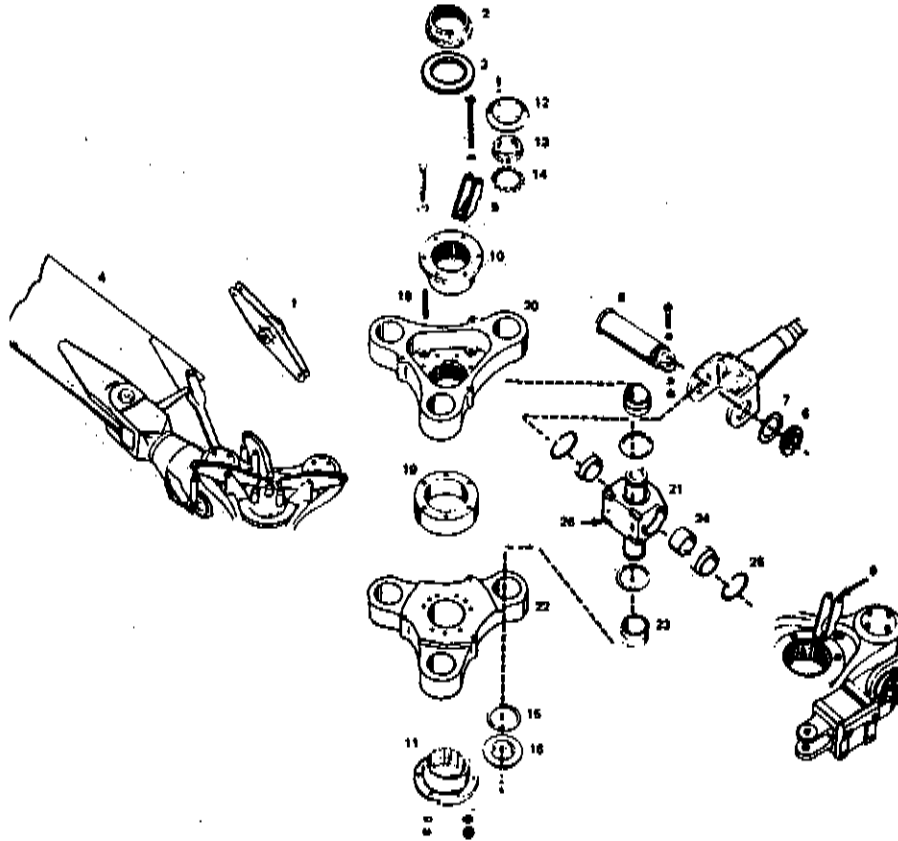
- d. With the use of a strap around hub, lift from rotor shaft.

Disassembly.

- a. Remove blade damper assemblies (5).
- b. Remove nut (6) and washer (7) from hinge pin (8).

NOTE: Care should be taken so as not to shear the 23-194-0625 split pin on other side of hinge pin.

- c. Remove hing pins (8) from spindles and universal blocks (21).
- d. Remove brackets and hardware from upper hub assembly (9).
- e. Remove spline adapters (10 & 11).



- f. Remove dust cap (12) and attaching screws.
- g. Remove nuts (13) and washers (14).
- h. Remove DU washers (15).
- i. Remove nuts (16).
- j. Remove locking keys, nuts and screws (17).
- k. Press out bearings (18) and remove spacer (19).

- l. Heat up bearing bosses on upper hub plate (20) and remove from universal blocks (21).
- m. Heat up bearing bosses on lower hub plate (22) and remove from universal blocks (21).
- n. Remove bearings (23) from universal blocks (21) including spacer (24).
- o. Remove four DU washers (25) and shims if used.
- p. Inspect -1 and -2 lead and lag stop pads (26).

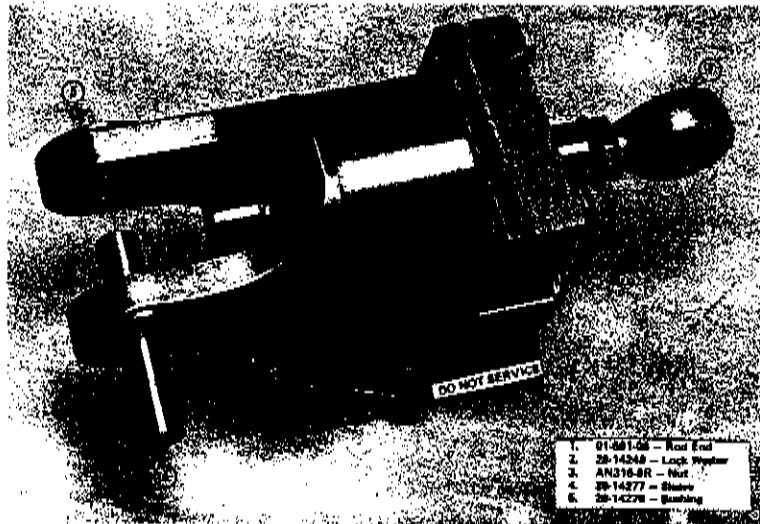
Inspection.

- a. Inspect 28-14241 bellcrank assemblies for any excessive play and need of bushing replacements.
- b. Inspect main rotor shaft threads at top of shaft.
- c. While main rotor blades are off helicopter, inspect leading edge for any defects, dents, and for security of attach fittings.

NOTE: Suggest cleaning blades with soap and water and waxing blades occasionally.

- d. While blade damper assemblies are removed from hub, check for leakage.

NOTE: The main rotor hydraulic dampers are factory adjusted and field maintenance is not necessary. If leakage is detected or no dampening action is noted while moving blade through lead lag phase, return damper to factory for overhaul as necessary.



1. Check to see that lockwasher 28-14248 (2) is installed and peened over jam nut (3) and flat on piston.
2. If excessive play is noted in hydraulic damper rod ends (1) remove and replace.
3. If necessary replace bushing (4).
4. If necessary replace bushing (5).

NOTE: Line ream to .5005 after installation of bushing (5).
.500

- e. Inspect 28-14233 hinge pins for excessive play or scoring that may incur.
- f. Inspect all hardware on rotor systems, including bolts, nuts, washers, and all threaded areas.
- g. Inspect all DU washers if any excessive looseness has incurred in any of the attaching parts.
- h. Inspect all bearings for any roughness or galling and replace as necessary.
- i. Inspect the lead and lag stop pads and replace if necessary.
- j. Inspect damper retention bushings 28-14252 (6) upper and lower hub plates.

Assembly.

- a. Press bearings (23) on universal blocks (21).
- b. Press bearings (23) in universal blocks (21) with spacer (24) in the center of the two bearings.
- c. Place DU washers (25) over bearings (23) with the DU facing down on the universal blocks (21). Replace shims if used.

NOTE: Blocks with castalated part down.

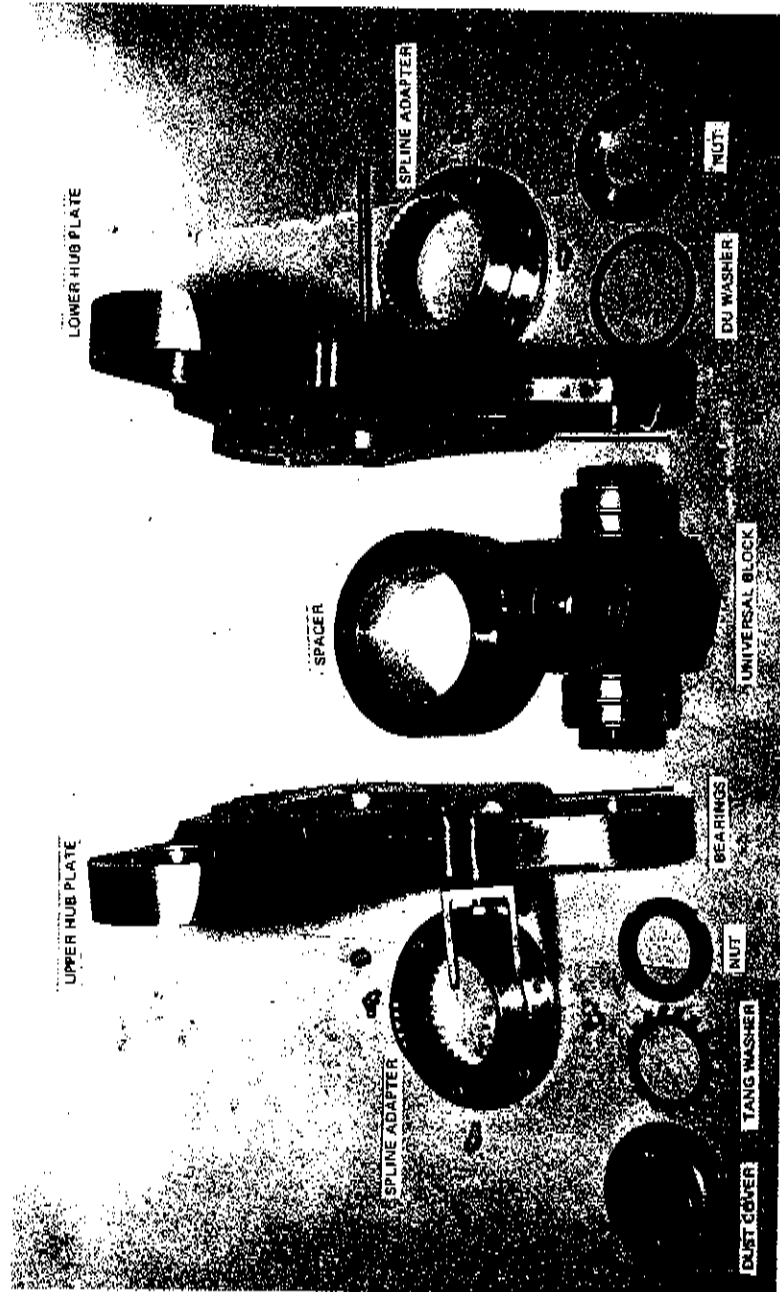
- d. Heat up upper hub plate (20) and insert universal blocks (21).

NOTE: DU washer to fit into slots in hub plate.

- e. Heat up lower hub (22) and tap onto universal blocks (21).

NOTE: DU washers to fit into slots in hub plate with DU washer (15) facing down on universal blocks (21).

- f. Install nuts (16) and secure locking keys (17) with NK500-8-6 screws.
- g. Install nuts (13) and lock washer (14) and secure with tang. Install the dust cover (12) and secure with NK500-8-6 screws.
- h. Install spacer (19) between hug plate and press in pins (18).
- i. Install spline adapters (10 & 11).



- j. Install brackets (9) and attaching hardware.
- k. Put into place two DU washers (25) on universal block (21).
NOTE: DU washers to face outboard of universal blocks.
- l. Slide spindle assembly into place.
- m. Insert hinge pin (8).
NOTE: Line up 23-094-0625 split pin.
- n. Place washer (7) and nut (6) on hinge pin (8). Nut to be torqued sufficiently so that 20 to 25 in./lbs. is required at the blade retention bolt to move the retention assembly 28-14234.
NOTE: Secure tang washers.
- o. Install blade dampers (5). Torque pivot bolt to 190 in./lbs.
NOTE: Check retention bolt for tightness

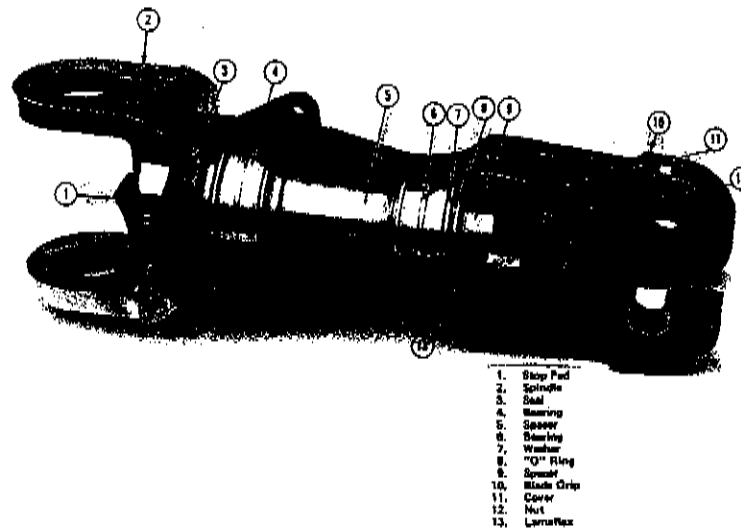
Installation of Main Rotor Hub on Shaft.

- a. With the use of a strap, install hub on rotor shaft.
NOTE: Ref. WATCH HUB PHASING. Move dog leg 28-16128 over top of 28-16198 push-pull rod. Have one blade 90° to right of ship. Assemble hub to shaft so punch marks on hub spline teeth straddle punch marked spline on shaft.
- b. Place washer (3) and nut (2) on main rotor shaft.
- c. Install three main rotor blades (4).
- d. With the use of main rotor shaft wrench adapter, torque nut (2) to 400 ft./lbs.
- e. After torquing nut to required torque, safety wire in 2 places with .040 wire.
- f. Install the three bellcrank assemblies (1).
NOTE: Inspect entire assembly and run engine and engage rotor system prior to flight.

MAIN ROTOR BLADE RETENTION ASSEMBLY

Description. The main rotor retention assembly is composed of a machined aluminum grip bearing case and a spindle bearing shaft on which is positioned two bearings and a sleeve spacer. This assembly is held on the pinion shaft with a thrust nut. Each of the three main rotor blade assemblies is attached to the outboard blade retention assembly by a high-strength vertical bolt. By actuating the cyclic or collective controls, the pilot changes the tilt of the fixed swashplate assembly which is beneath the pitch bearing assembly located above the engine compartment. A rotating swashplate follows the tilt of the fixed, non-rotating swashplate. Three pitch arm control assemblies

that are enclosed in the mast assembly link the walking beams on top of the rotor hub to the rotating swashplate, and vary the pitch angle of the main rotor blades.



1. Stop Pad
2. Spindle
3. Seal
4. Bearing
5. Spacer
6. Bearing
7. Washer
8. "O" Ring
9. Spacer
10. Blade Grip
11. Cover
12. Nut
13. Laminflex

Removal. To remove retention assembly, proceed as follows:

- a. Remove blades by pulling bolt (19), washer (20), nut (21) and disconnecting hardware (22) from trailing edge of blade.

NOTE 1: Hold tip of blade up off down stop to keep from spreading blade grip.

- b. Remove damper assembly.

- c. Remove nut and washer (17 & 18) from hinge pin (16).

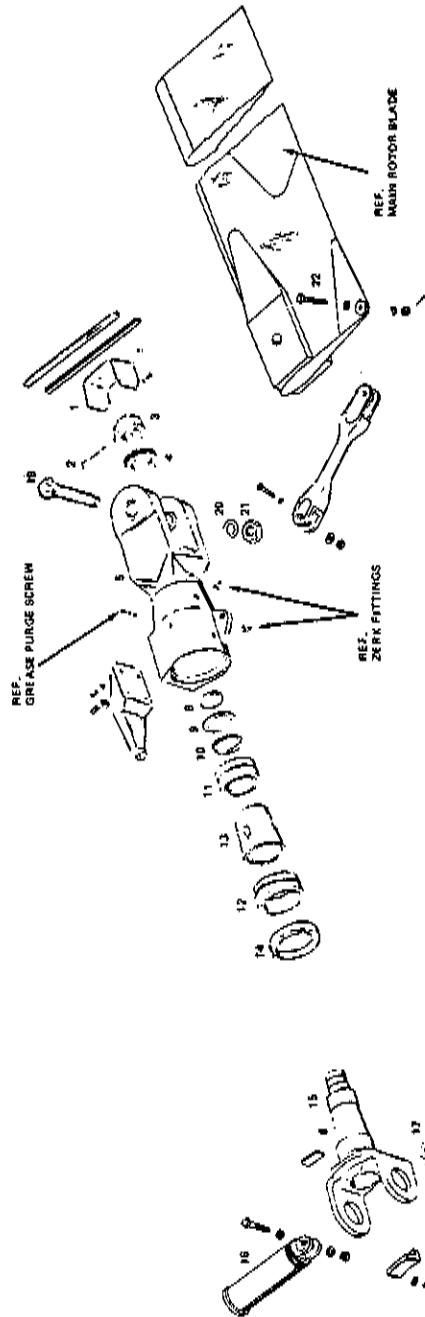
NOTE 2: When removing damper rod end retention bolt, do not loose the two spacer washers on upper and lower surface of rod end.

NOTE 3: Care should be taken so as not to shear roll pin on lip side of hing pin (16).

- d. Remove hinge pins (16) from spindle assemblies (6) and universal blocks.

Disassembly. To disassemble blade retention assembly, proceed as follows:

- a. Remove dust covers (1).
- b. Remove cotter pins (2).



RETENSION ASSEMBLY



- c. Remove retention nuts (3).

NOTE: This nut is not interchangeable and is drilled on assembly.

- d. Remove Lamiflex bearing (4).
- e. Heat up blade grip (5) and remove from spindle (6).
- f. Inspect droop stops (7). Remove and replace as necessary.
- g. Remove "O" ring (8) and DU washer (9).
- h. Remove snap ring (10).
- i. Remove bearings (11 & 13) with spacer (12).
- j. Remove seal (14).
- k. Inspect and replace all parts as necessary.

Inspection.

- a. Inspect all bearing surfaces for scoring, scratches, and galling.
- b. Inspect and replace if necessary the Teflon sleeve (15) on outboard end of spindle assembly.
- c. Inspect threads on spindle assembly and on all attaching bolts.
- d. Suggest replacing all bearings and seals on overhaul.

Assemble. To assemble main rotor blade retention assembly, proceed as follows:

- a. Place seal (14) on spindle (6).
- b. Press bearing (12) and spacer (13) on spindle (6).
- c. Press bearing (11) on spindle (6) and install snap ring (10) in slot in spindle (6).
- d. Install DU washer (9) with champhor down toward bearing.
- e. Install "O" ring (8).

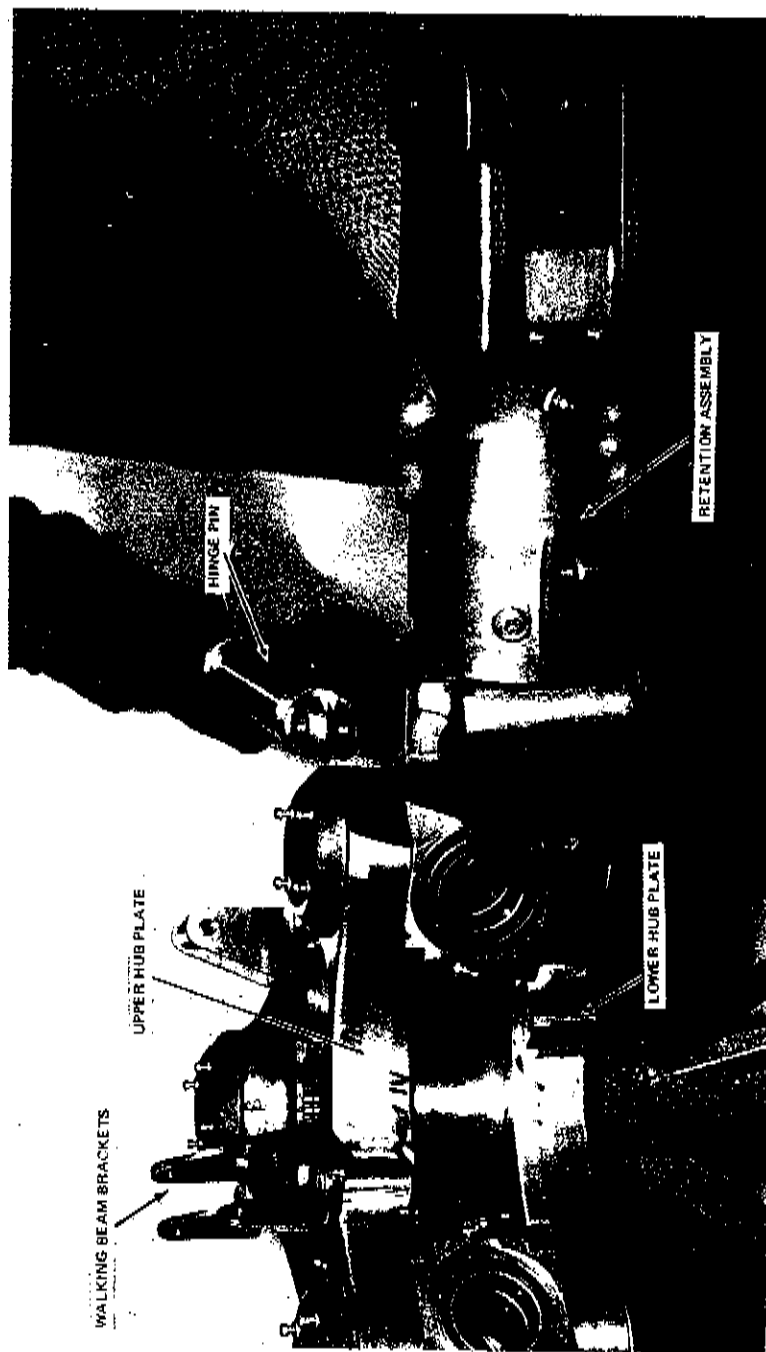
NOTE: Install special tool spacer on the underside of seal (14).

- f. Heat blade grip and install over spindle assembly (6), placing on top of special tool.

NOTE: Allow assembly to cool slightly and remove special tool.

- g. Complete tapping grip (5) onto spindle (6) and be sure it is down and secured.

NOTE: Check the dimension from the rear of the blade grip (5) to foot of spindle (6). This dimension should be .125". This is an inspection to check to see whether the "O" ring (8) or DU washer (9) has been left out on assembly.



WALKING BEAM BRACKETS

UPPER HUB PLATE

HINGE PIN

LOWER HUB PLATE

RETENTION ASSEMBLY

- h. Install Lamiflex bearing (4) with blade grips set at approximately 12° positive pitch. Install Lamiflex bearings carefully so as not to break tangs.

NOTE: Cool down assembly completely prior to torquing nut to 15 to 20 in./lbs.

- i. Install cotter pin (2).

NOTE: If cotter pin hole doesn't align after nut has been torqued, shim behind bearing as necessary.

- j. Replace cap with four screws (1).

NOTES ON LUBRICATION: Remove top screw (17) in cover assembly (1) and grease blade grip until grease comes out of this hole in a steady stream free from air. This shows that the grip has been properly purged. Reinstall screw (17) in cover assembly (1) and remove screw (18) in the grip assembly (5). Again purge through ZERK fitting until grease exudes from this hole. Reinstall screw (18). This completes the purging of the grip assembly.

NOTE: Main rotor attach bolt to be torqued to 600 in./lbs., drag link bolt to be torqued to 150 in./lbs.

Installation. To install main rotor blade retention assembly, proceed as follows:

Reinstall in reverse of removal procedure.

MAIN ROTOR RETENTION SYSTEM

Lamiflex Bearing Change.

- a. Remove main rotor blades or blade as required.
- b. Remove cover (1).
- c. Remove cotter key (2).
- d. With special 1-13/16" socket, remove nut (3).
- e. Remove Lamiflex bearing (4) and shims if used.
- f. Measure thickness of old Lamiflex.
- g. Measure thickness of new Lamiflex.
- h. Shim as required to old Lamiflex bearing thickness.
- i. Should new Lamiflex bearing be thicker, remove shims, if any, or grind bearing surface of nut on surface plate to give 15-20 in./lbs. torque and line up with cotter key hole (2).
- j. Nut (3) and spindle (1) drilled as assembly. Keep together.

CAUTION: Excessive torque will cause stiff cyclic control.

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MAIN ROTOR TRANSMISSION

DESCRIPTION

The main rotor gear box drive assembly is a spiral bevel gear set with a shaft angle of 90°. The ring and pinion gears are manufactured from forged alloy steel for proper grain flow and structure. They are carburized, case-hardened and machined to precision tolerances. Because of the high contact ratio which can be obtained by the spiral angle, the overlap of contact contributes to smooth and quiet operation as well as added strength. The pinion is straddle-mounted, using tapered roller bearings for carrying both radial and thrust loading. The main gear housing is made of cast aluminum alloy and is designed to provide the rigidity necessary to react to the gear loads. A wet sump splash system is utilized to provide adequate lubrication to the ring and pinion gears. This eliminates the need for a gear pump. The centrifugal force of the oil on the ring gear forces the oil through an external tube which lubricates the lower tapered main shaft roller bearing. Also, due to the centrifugal force of the oil outwardly, the oil is controlled to the outer two pinion tapered roller bearings by an oil slinger and conducted back into the transmission by passageways. The gear box capacity is 5½ pints of Mobil extreme pressure oil SAE 80-90. A magnetic plug chip detector is located in the sump, and can be removed to inspect for metallic particles. An oil temperature sensor is also mounted in the sump and is connected to a temperature gage on the instrument panel which is redlined at 220°F. Periodic inspections of the pinion gear may be made by removing the screen on top of the gear case adjacent to the pinion housing. A screen in the oil filler cup prevents large foreign particles from being deposited into the gear case when adding oil. Breather is attached to the upper gear case to provide ventilation for the case. A sight gage is located on the lower right hand side of the transmission to check for oil level, normal level is ½ window with ship level. Transmission should be kept free from abrasive particles to prolong the life of the gears and bearings. A magnetic chip detector is located on the right hand lower side of transmission. The ring and pinion gears are serialized as a matched pair. The main rotor gear box drive shaft is made of 4130 steel tubing.

MAIN ROTOR DRIVE ASSEMBLY

REMOVAL OF MAIN ROTOR SHAFT AND TRANSMISSION ASSEMBLY

To remove the transmission assembly:

- a. Remove blades and hub assembly. (Ref. Sect. 6-7)
- b. Drain fuel from left and right hand tanks.
- c. Remove fuel tanks. (Ref. Sect. 5-33)

- d. Remove wrap-around cowl.
- e. Remove belt assembly. (Ref. Sect. 8-1)
- f. Disconnect the two push-pull tubes at lower swashplate attachment.
- g. Disconnect tachometer and temperature pick up wiring.
- h. Disconnect push rod tube from collective bellcrank.
- i. Remove four mounting bolts and nuts from transmission housing.
- j. Install special tool T-0017 on top of mast.
- k. Use hoist and lift transmission assembly from pylon.

CAUTION: When lifting transmission from pylon, do not allow pulley to strike cowl frame.

NOTE: In the event complete overhaul of the gear box is required, the unit must be returned to the factory.

MAIN ROTOR TRANSMISSION

DISASSEMBLY OF MAIN ROTOR SHAFT ASSEMBLY

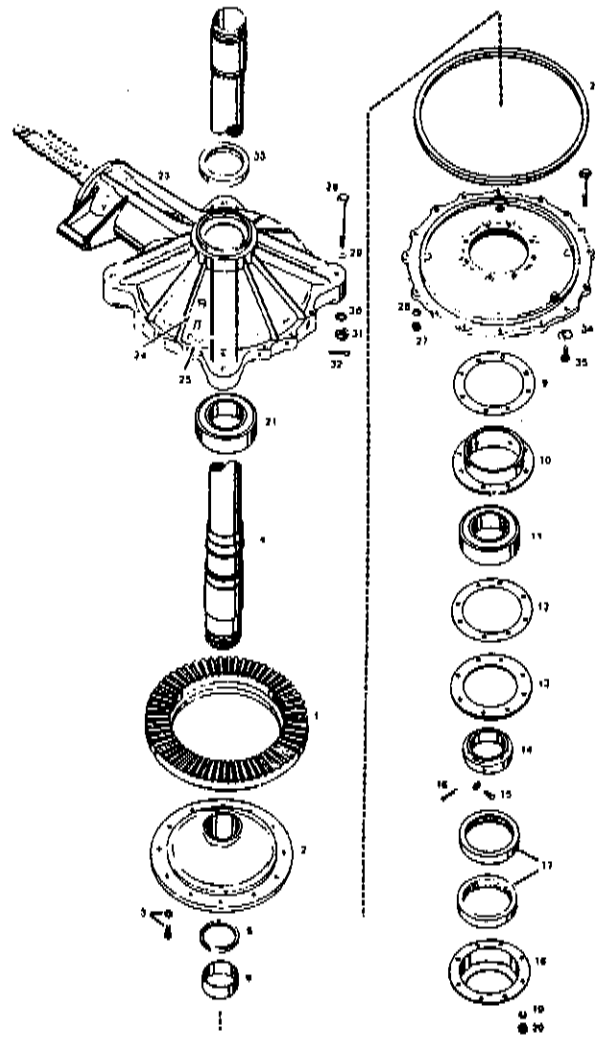
To disassemble the main rotor shaft assembly, proceed as follows:

- a. Drain oil from main rotor transmission by removing plug on lower left side of transmission and attaching drain line to allow oil to drain into a container.
- b. Remove temperature bulb from lower side of transmission.
- c. Remove magnetic chip detector from lower right side of transmission and check for metal particles.
- d. Remove the bolts (24), washers (25) and nuts (26) that secure the upper and lower case halves together.
- e. Stand transmission on floor with shaft upside down and give a sharp blow on piece of hardwood or rubber on floor. This will allow the top case to be removed.
- f. Remove thrust bearing (21) from shaft (4).
- g. Remove seal housing (18) from bottom of ring gear carrier assembly (2) by removing the eight nuts and washers (19 and 20) assembly.
- h. Install special tool ring T0028 to take up spacing after removal of seal housing (19).

NOTE: This tool to be used as a puller adapter.

- i. Install special tool T0006 on bottom side of tapered spacer (5).
- j. Install special tool T0005 on bottom of thrust nut (14) and snug up.

- k. Install a puller over rim of special tool T0028 and attach to bottom of special tool T-0005. This will remove the bottom cover (8).
- l. Inspect ring and pinion gears for excessive wear.
- m. Replace bearings (11 and 21) if necessary.
- n. Replace seal (32) and "O" ring (22).
- o. Check all gaskets. Color denotes thickness and if necessary to replace, use same thickness gaskets.



MAIN ROTOR TRANSMISSION

ASSEMBLY OF MAIN ROTOR SHAFT ASSEMBLY

To assemble the main rotor shaft assembly, follow this procedure:

- a. Assemble the ring gear (1) to carrier (2) by installing bolts and washers to secure the assembly.
- b. Torque the bolts to 240 in./lbs. and safety wire bolts in pairs with .041 safety wire.

NOTE: The ring gears and carriers are matched and are to remain as a set.

- c. Clean mast splines prior to assembly on carrier.
- d. Clean splines on carrier, assemble to mast, apply Loctite to splines.

CAUTION: Apply Loctite sparingly.

- e. Install carrier assembly, composed of ring gear and carrier (1 and 2) on rotor shaft (4), aligning the index mark on carrier assembly to index mark on rotor shaft.
- f. Install spacer (5) on shaft (4) with champhored end toward carrier assembly (2).
- g. Install tapered sleeve (6) on shaft (4).

CAUTION: Small end of taper must face away from carrier assembly (2) to allow bearing to seat properly.

- h. Install the eight bolts (7) and washers in cover assembly (8).
- i. Install shims (9). These shims should be the same thickness as removed on the dis-assembly, as they assist in the pre-loading of the matched gear set.
- j. Install bearing (11) in bearing housing (10). Permatex the bottom of the housing before installation.
- k. Install bearing shim (12).

l. Apply Permatex to retainer (13), and install.

m. Temporarily install hardware (7, 19, and 20).

- n. Install cover assembly (8) over taper sleeve (6) and install four bolts and washers (34 and 33).
- o. Install and torque nut to 4,000 in./lbs. or 333 ft./lgs.

NOTE: This nut has been pre-drilled at the factory and will only match one way.

- p. Install pin (15) and cotter pin (16) securing the nut (14) to the shaft (4).
- q. Remove temporary hardware (19 and 20).

- r. Apply STP to seals (17) and install in seal housing (18).
- s. Apply Permatex 3H to top of seal housing (18).
- t. Assemble housing (18) to bottom of ring gear carrier assembly (8) and attach the washers (19) and nuts (20) to bolt (7).
- u. This completes the installation of the bottom case cover build-up.
- v. Clean pinion gear with Acetone to remove foreign matter.
- w. Apply blueing to pinion gear and ring gear.

NOTE: A light, even coat of blueing is recommended, as a heavy, uneven coat will affect gear backlash readings.

- x. Heat upper bearing (21).

NOTE: Do not heat bearing hot, as grease will melt and flow from bearing.

- y. Install bearing (21) on rotor shaft (4) with seal side of bearing facing top of mast.

CAUTION: Be sure bearing is seated properly on rotor shaft.

- z. Install case housing seal (22), linear "O" ring on lower cover (8).

aa. Check ring gear (1) for any foreign matter.

bb. Heat upper bearing seat in upper transmission housing.

cc. Set rotor shaft in vertical position. Lower upper transmission housing (23) over mast (4).

NOTE: As you match upper and lower cases, rotate pinion for proper mesh. Before seating upper and lower transmission cases, make certain collective yoke pivot point on lower case (8) is 180° from pinion shaft on upper case (23).

dd. Install seal (32) over shaft (4) and seat in upper transmission housing.

ee. Install 11 each bolts (24), washer (25) and nuts (26) and 4 each (27), washer (28), washer (29), nut (30) and cotter pin (31) to secure upper and lower case halves together.

ff. Torque bolts to 70 in./lbs.

MAIN ROTOR TRANSMISSION

PINION SHAFT

Removal and Disassembly. Prior to disassembly of the main rotor pinion shaft, it will be necessary to remove the jack strut and pulley assembly. (Ref. Section 6.) To disassemble pinion shaft, proceed as follows:

- a. Remove the six bearing retainer bolts (1).
- b. Remove bearing retainer (2).
- c. Remove retainer seal (3), followed by removal of the shim (4) located between the bearing retainer (2) and hat section (11).
- d. Heat transmission housing (13) and remove the oil slinger (8), bearing (9), spacer (7), bearing (6), spacer (5) as an assembly.

NOTE 1: If necessary, remove shim (10) and hat section (11) located in transmission housing.

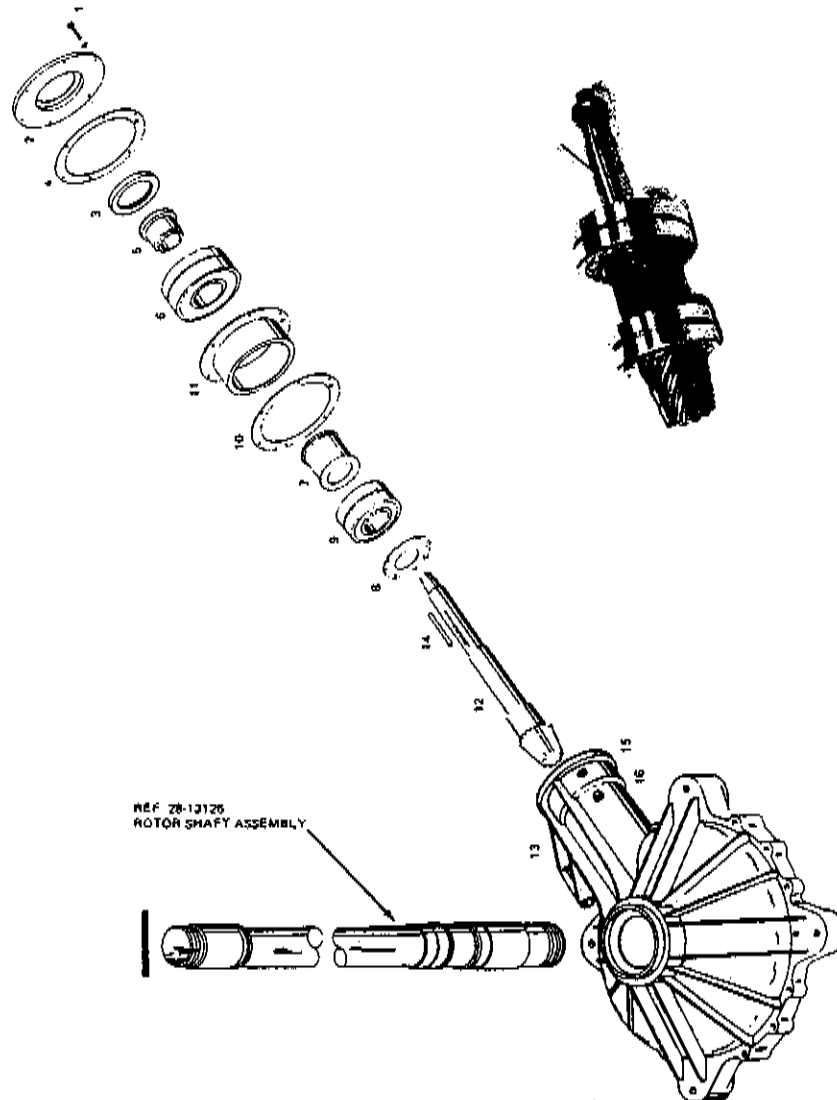
NOTE 2: Keep shims (11 & 4) in proper order for reinstallation ease.

- e. Following the removal of the above assembly, heat bearing (6) and remove spacer (5).
- f. Inspect bearings for roughness and galling; replace if necessary.
- g. Inspect pinion shaft and threads for defects. Check woodruff key way for excessive play and replace key if necessary.
- h. Suggest replacing retainer seal (3) on installation of pinion assembly.

Build-Up and Installation.

- a. Clean pinion shaft (12).
 - b. Install oil slinger (8) on pinion shaft (12) with lip facing pinion gear.
 - c. Heat bearing (9) and install on pinion shaft (12) with bearing numbers facing aft.
 - d. Install spacer (7) on pinion shaft (12).
- NOTE:** Make certain spacer (7) seats on shaft lip (12).
- e. Heat outboard bearing (6) and install spacer (5) into bearing with spacer lip on numbered side of bearing.
 - f. Reheat bearing housing and install bearing (6) and spacer (5) with sleeve lip and bearing numbers facing aft, outboard.
 - g. Allow shaft to cool.
 - h. Measure distance from oil slinger (8) inboard side to inner race of outside bearing (6).
 - i. Calculate shims required if this is a new installation of bearing, shims, etc.
 - j. Heat housing assembly and install shims (10), hat section (11) into case (13).
 - k. Install retainer seal (3) into bearing retainer (2) and place the .001 shim (4) between bearing hat (11) and bearing retainer (2).
 - l. Heat housing (13) and insert pinion assembly build-up.
 - m. Install bolts and nuts (1) attaching bearing retainer (2) to transmission housing (13) and torque bolts to 70 in./lbs.

- NOTE 1:** Refer to jack strut and pulley assembly information for completion of upper pulley assembly on output pinion shaft.
- NOTE 2:** Upon completion of upper pulley and jack strut installation, run up engine and engage rotor system to check for runout and proper operation of system.



INSTALLATION OF TRANSMISSION ASSEMBLY

To install main rotor transmission:

- a. Place special tool T-0017 on top of mast.
- b. Using hoist, place shaft and transmission on top of pylon mount. Attach with the four bolts, washers, and nuts. Torque to 100 in./lbs., up to key slot.
- c. Connect the two push-pull tubes at lower swashplate attachment.
- d. Install belt assembly. (Ref. Sect. 8-1, 8-2).
- e. Install wrap-around cowl.
- f. Install fuel tanks. (Ref. Sec. 5-33).
- g. Install blades and hub assembly. (Ref. Sec. 6-2 and 6-7).

MAIN ROTOR TRANSMISSION

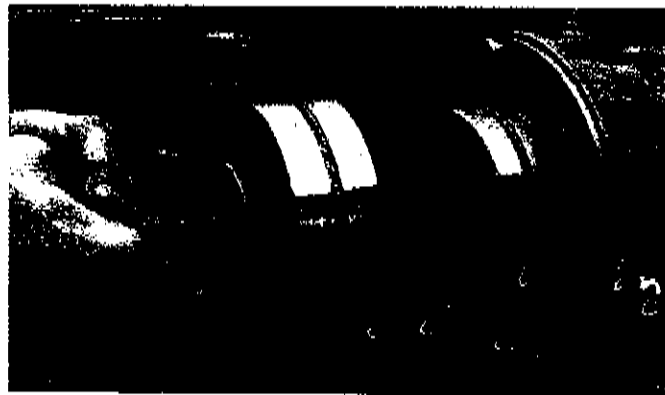
PROCEDURE FOR CHECKING RING AND PINION BACKLASH AND ROTOR MAST RUN-OUT

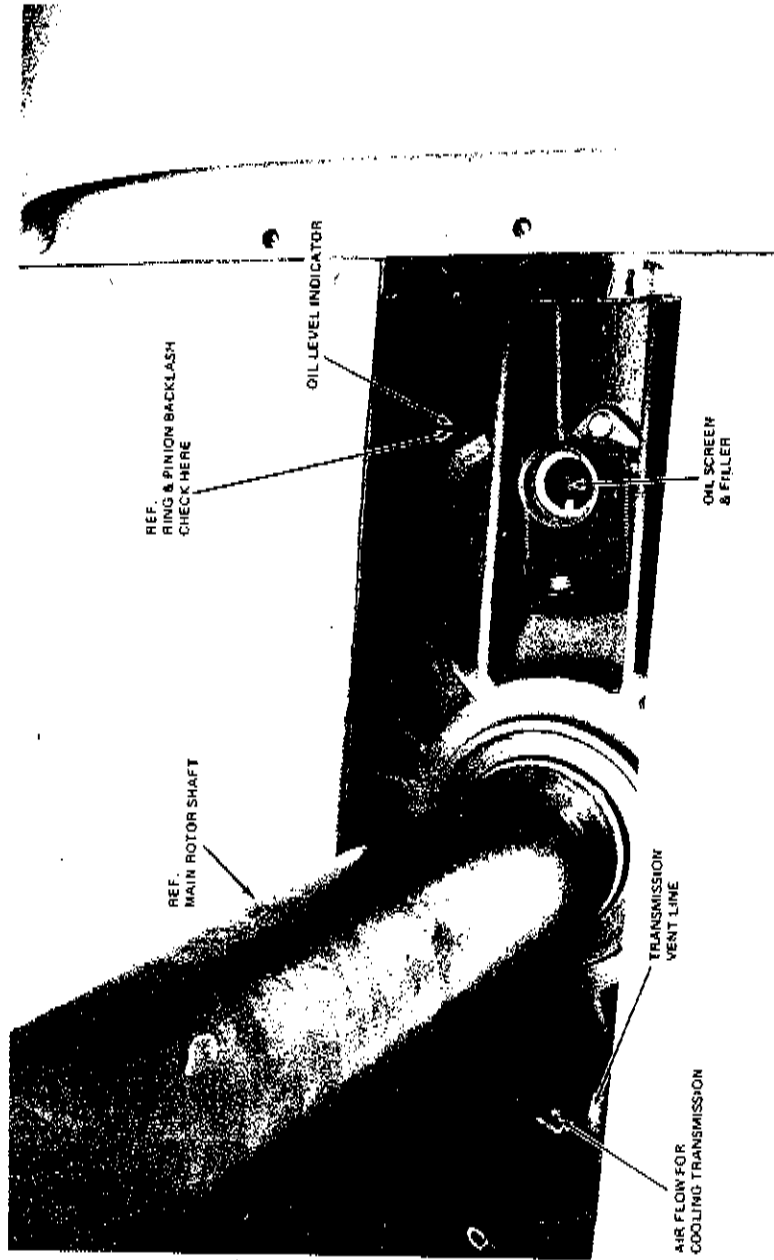
- a. Remove transmission oil level sight gage plug.
- b. Insert dial indicator probe through hole so probe rests on center of gear. Attach dial indicator to transmission case securely.
- c. Hold transmission pinion shaft and turn main rotor shaft in direction of rotation until backlash is taken up. Repeat and record reading on dial indicator. Check at four places approximately 90° from each other. (.004 to .006 required limits.)

NOTE 1: Readings may be recorded on rotor shaft to assist in locating high spots or low spots on gear run-out.

NOTE 2: Thickness of blueing applied to gear teeth will affect backlash.

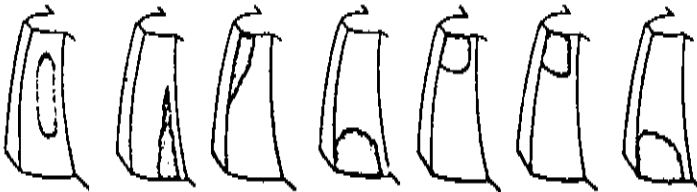
- d. Measure run-out of mast at surface just below hub splines. (Maximum total limit .010.)





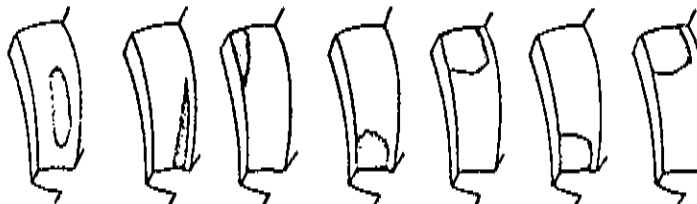
MAIN TRANSMISSION SERVICING POINTS

CONCAVE SIDE



TOOTH BEARINGS ON DRIVEN GEAR

CONVEX SIDE



Correct tooth bearing position with accurate and rigid mounting.

Out of Position Bearing

Cause: Pinion too close to cone center.
Remedy: Move pinion away from cone center.

Out of Position Bearing

Cause: Pinion too far from cone center.
Remedy: Move pinion toward cone center.

Cross Bearing

Cause: Shafts do not intersect.
Remedy: Line up shafts.

Cross Bearing

Cause: Shafts do not intersect.
Remedy: Line up shafts.

Toe Bearing

Cause: Shaft angle too large.
Remedy: Correct the shaft angle.

Heel Bearing

Cause: Shaft angle too small.
Remedy: Correct the shaft angle.

TOOTH PATTERNS

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BELT DRIVE SYSTEM

CLUTCH ENGAGEMENT SYSTEM (Ref. 8-13)

Description. The clutch engagement system is controlled from the cabin by means of a clutch engagement lever. The lever is connected to a push-pull control cable that in turn pulls an idler pulley against the main drive polly "V" belt. The position of the idler pulley is determined by the proper adjustment of the spring tension capsule and the over-centering device. Once engaged, the control lever can be lowered to the cabin floor in a stowed position. **The push-pull control cable has two lube points, one located aft of the main cabin firewall at the support bracket and the other just below the support bracket mounted to the left rear pylon structure. These are greased with Aero-shell 14.**

BELT REMOVAL PROCEDURE

To remove the drive belt assembly, proceed as follows:

- a. Remove wrap-around cowl and baggage compartment.
- b. Remove the four bolts (2) connecting the upper end of jack strut (4) to the bearing housing (6-a).

NOTE: Keep shims (3) together.

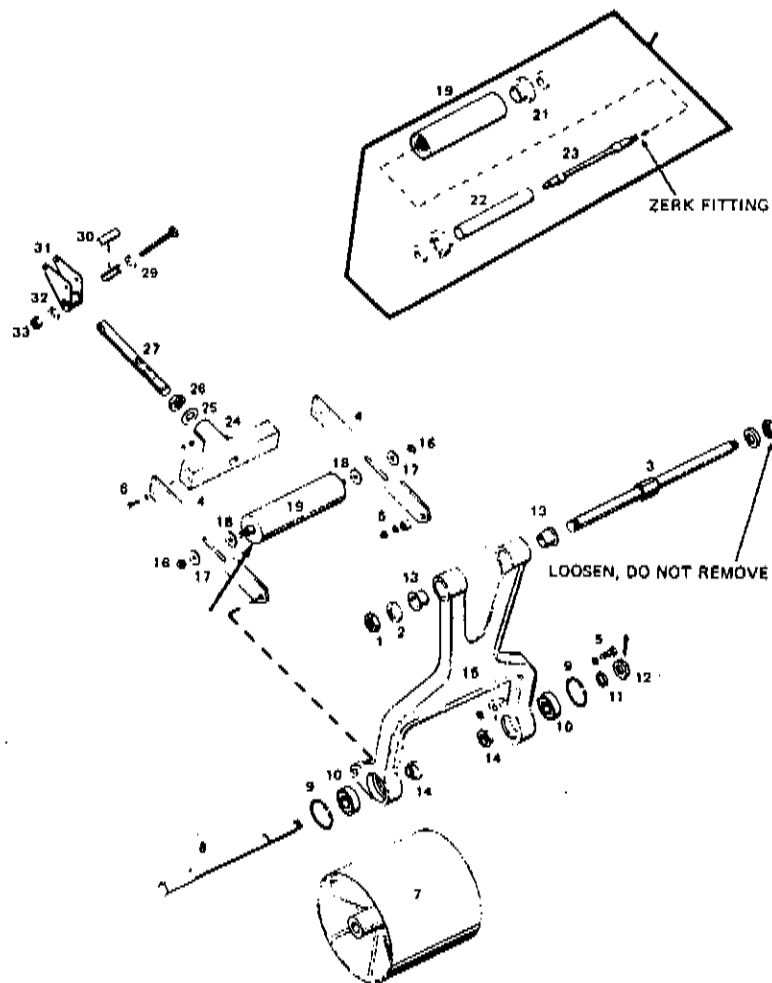
CAUTION: Temporarily safety wire strut assembly (4) to the bearing housing (6-a) to keep it from falling and cocking the bearing (10) in lower drive pulley (9).

- c. Cut safety wire and with $\frac{3}{4}$ " socket remove the six bolts (1) from lower drive pulley (9).
- d. Carefully pull drive pulley (9) and strut assembly (4) from the prop flange end and lift free of the belt.

NOTE: Keep shims together with pulley (9).

CAUTION: Exercise care not to cock the self-aligning bearing (10) in the pulley (9) by letting the jack strut (4) deflect. If bearing should get cocked, don't force it to straighten; just slowly rotate the pulley until it aligns itself.

- e. Remove the four Allen screws or zurn with spiral lock coupling from tail rotor forward drive shaft coupling and remove the aft taper pin in the coupling. (Sect. 15 - 16.)
- f. Separate coupler and slide it aft on tail rotor drive shaft. This exposes a gap of approximately $\frac{1}{2}$ ".
- g. Remove rear actuator arm (4) from idler pulley (7) and position, leaving roller (19) connected on one side. (Ref. 8-2)
- h. Loosen nut on forward end of idler support shaft (3) and rotate the eccentric shaft to maximum clearance from top pulley. (Ref. Sect. 8-3)



NOTE: Suggest index marking shaft position before loosening.

- i. Carefully ease the belt off the top pulley and then slowly and carefully slide the belt vertically between the tail rotor drive shaft and the forward coupling.

BELT INSTALLATION PROCEDURE (Ref. Section 8-2.)

To install the belt assembly, proceed as follows:

- a. Slide the belt vertically between the tail shaft and forward coupling, and then slowly and carefully ease the belt on top of the upper pulley (9-a).
- b. Install rear actuator arm (4) on idler pulley (15) and roller (19).
- c. Attach forward tail rotor drive shaft coupling between output pinion shaft and tail rotor shaft, and install the aft taper pin.
- d. Carefully install the drive pulley (9-a) and strut assembly (4) on the prop flange. Pay particular attention to install the shims attached between pulley and prop flange. (Ref. Section 8-8.)
- e. Install the six bolts (1) that attach the lower drive pulley (9) to fan assembly and safety. (Ref. Figure 30.)
- f. Connect or install the four bolts (2) connecting the upper end of jack strut (4) to the bearing housing (6-a). (Ref. Figure 30.)

NOTE: Keep the shims together (3).

- g. Engage clutch and check for proper rigging. (Ref. Section 8-11.)
- h. Adjust belt roller (19) to $\frac{1}{4}$ " clearance between belt surface and roller. Lube roller (19) with Aero-shell 16 grease. (Ref. Figure 28.)
- i. Track idler pulley.
 1. Remove wrap-around cowl if baggage compartment is installed.
 2. Loosen 15/16" nut on forward side of idler adjusting shaft (3). (Do Not Remove.)
 3. Start engine and slowly engage rotor system while observing idler pulley track on belt.
 4. With 7/8" wrench, turn idler shaft (3) until pulley tracks on belt.
 5. Tighten 15/16" nut on forward end of idler shaft (3). shaft (3).

NOTE: When pulley is tracked, it will be centered on belt.

6. Hover aircraft and check idler pulley track. (Ref. Section 8-10.)
- j. Inspect assembly completely before installing wrap-around cowl and baggage compartment.

REMOVAL OF IDLER ASSEMBLY FROM HELICOPTER (Ref. 8-4)

- a. Remove nut and washer (1 & 2) from shaft (3).
- b. Remove bolts and washers (5) nut (16) and washer (17) from 28-13236 arm (4) in two places.
- c. Remove yoke assembly (15) from shaft (3).

INSTALLATION OF IDLER ASSEMBLY

Install idler assembly in reverse procedure.

DISASSEMBLY OF IDLER PULLEY FROM YOKE

- a. Remove cotter pin.
- b. Remove nut (12).
- c. Remove washer (11) from shaft (8).
- d. Press shaft (8) from pulley (7).
- e. Remove snap rings (9), bearings (10) from yoke (15) and bushings (14).

- NOTE:**
1. If bushings (13) need to be replaced, heat yoke (15) and press bushing (13) out.
 2. Install bearings (10) 28-13200 at 600 hours.

ASSEMBLY OF IDLER PULLEY TO YOKE

Assemble idler pulley in reverse procedure.

REMOVAL, DISASSEMBLY AND INSPECTION OF BELT ROLLER ASSEMBLY

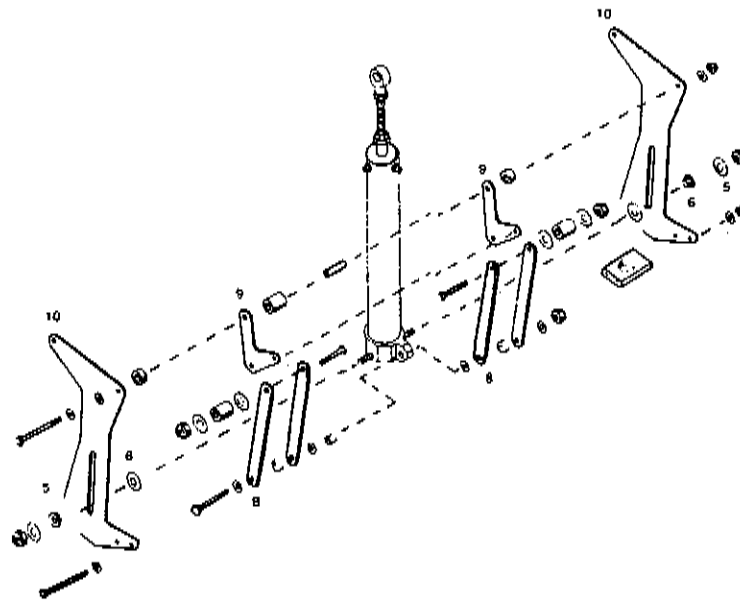
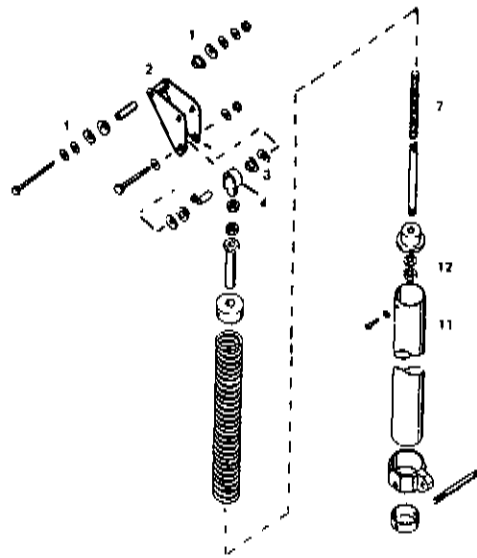
- a. Remove nut and washer (16 & 17) from roller (19) (two places).
- b. Remove three bolts (6) from aft arm (4).
- c. Remove roller assembly (19).

NOTE: Spacers (18) installed between arm (4) and roller (19).

- d. Remove spacers (18) (two places) from shaft (23) and press shaft (23) from roller assembly (19).
- e. Remove bearings (20) from bearing retainers (21).
- f. Remove Zerk fitting from shaft (23).

PART REPLACEMENT, ASSEMBLY AND INSTALLATION OF BELT ROLLER ASSEMBLY

- a. Replace bearings as necessary.
- b. Install belt roller in reverse procedure.
- c. Check track of idler pulley.



REMOVAL OF BELT ENGAGEMENT MECHANISM FROM PYLON (Ref. Section 8-11.)

To remove belt engagement mechanism from pylon, proceed as follows:

- a. Remove bolt assembly (6).
- b. Remove bolt assembly (7).
- c. Remove bolt assembly (8).
- d. Remove Arens cable assembly from clutch engagement mechanism.

INSPECTION OF BELT TENSIONING UNIT (Ref. Section 8-5.)

Inspect belt tensioning unit for the following and replace as required:

- a. "DU" Bushings (1) in over-centering bellcrank (2).
- b. "DU" Bushings (3) in rod end (4).
- c. Nylon guides (5) and washers (6).
- d. Shaft (7) for straightness.
- e. Straps (8), bellcrank sides (9), brackets (10), for cracks and excessive wear.

INSTALLATION OF BELT ENGAGEMENT MECHANISM

- a. Install belt engagement mechanism to pylon in the reverse procedure.

CLUTCH CONTROL HANDLE (Ref. Section 8-11.)

To remove clutch control handle (11), proceed as follows:

- a. Remove fiberglass seat assembly.
- b. Loosen upper and lower jam nuts (12) on turnbuckle located below seat assembly.

NOTE: Mark nuts of turnbuckle for ease in assembly.

- c. Remove AN hardware (13) that attaches handle to bracket (14).
- d. Remove clevis pin (15).
- e. Reinstall handle and attaching hardware in reverse order, paying particular attention to adjusting the turnbuckle (12) as it was removed.
- f. Inspect installation before operating engagement handle and installation of seat assembly.

JACK STRUT AND PULLEY ASSEMBLY

Removal of Upper Pulley Assembly. To remove the upper driven pulley assembly from the output pinion shaft, proceed as follows:

NOTE: Remove tail rotor drive shaft coupling. (Ref. Sect. 15-16)

- a. Remove the four housing bolts (2) that attach housing assembly (6-a) to upper jack strut (4).

NOTE: Remove tail rotor drive shaft coupling. (Ref. Section 15-16.)

NOTE: Keep shims (3) together.

CAUTION: Temporarily safety wire strut assembly (4) to the bearing housing (6-a) to keep it from falling and cocking the bearing (10) in lower drive pulley (9).

NOTE: Keep shims together with pulley (9).

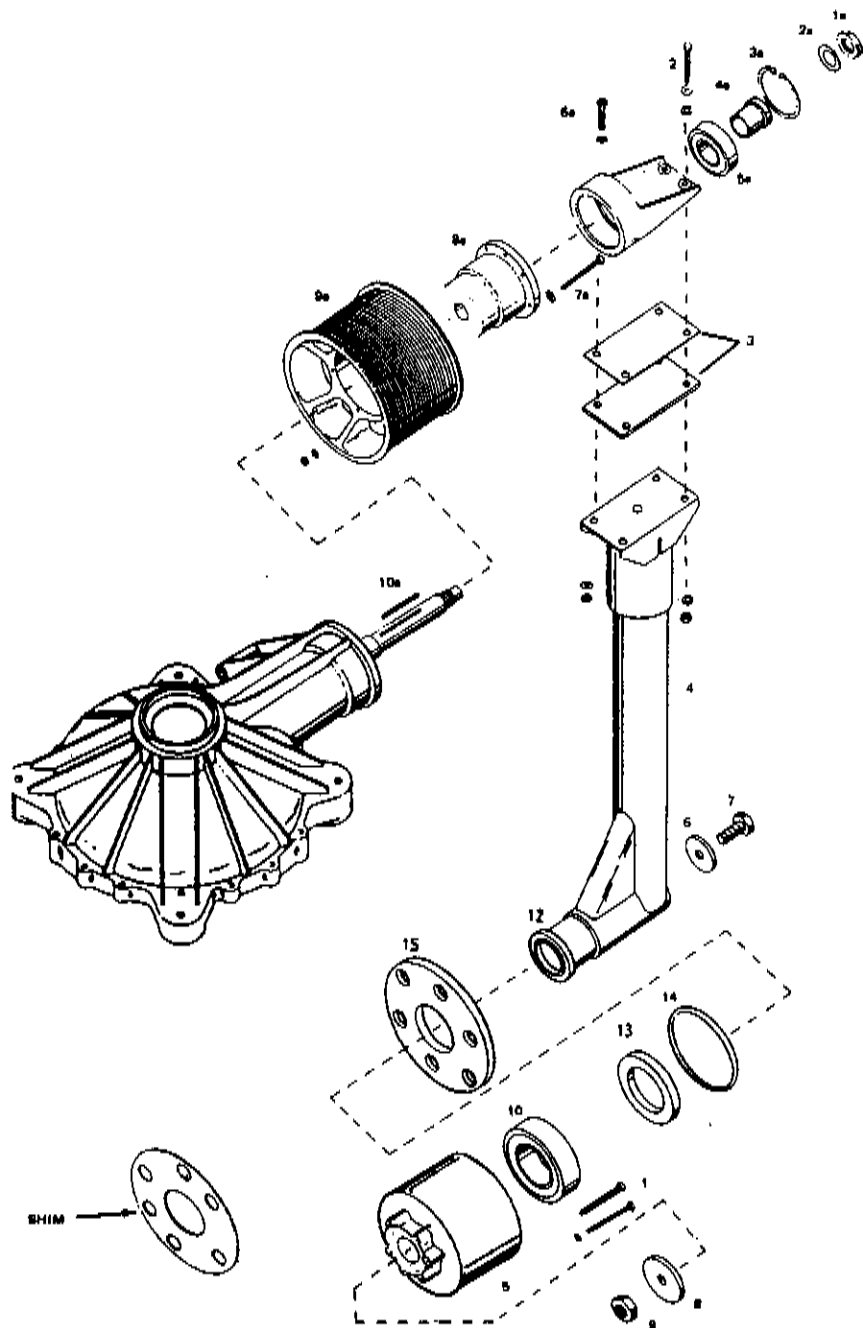
CAUTION: Exercise care not to cock the self-aligning bearing (10) in the pulley (9) by letting the jack strut (4) deflect. If bearing should get cocked, don't force it to straighten; just slowly rotate the pulley until it aligns itself.

- b. Remove the nut (1-a) followed by the tang washer or shure lock (2-a).
- c. Remove housing assembly (6-a).
- d. Remove pulley and clutch assembly (8a & 9a) from pinion shaft by use of puller.
- e. Remove woodruff key (10-a) from pinion shaft.
- f. Remove the tru-lock snap ring (3a) from the outboard side of the bearing (5-a).
- g. Heat the housing (6-a) and remove the bearing (5-a) and adapter (4-a).
- h. To remove the sprag clutch, first remove the retaining bolts and nuts (7a) then heat pulley (7a) and remove clutch.

NOTE 1: Inspect the woodruff key-way and key for signs of distortion and wear before replacing assembly.

NOTE 2: Replace bearing (5a) at 600 hours.

NOTE 3: Replace tang washer or shure lock (2a) upon installation.



Removal of Jack Strut. To remove the jack strut, proceed as follows:

- a. Remove the six lower pulley bolts (1) that attach lower pulley assembly to engine.
- b. Remove the four bolts (2) that attach the housing assembly (6-a) to the shims (3) and jack strut (4).

NOTE: Keep shims (3) together.

CAUTION: Temporarily safety wire strut assembly (4) to the bearing housing (6-a) to keep it from falling and cocking the bearing (10) in lower drive pulley (9).

NOTE: Keep shims together with pulley (9).

CAUTION: Exercise care not to cock the self-aligning bearing (10) in the pulley (9) by letting the jack strut (4) deflect. If bearing should get cocked, don't force it to straighten; just slowly rotate the pulley until it aligns itself.

- c. Remove assembly from helicopter.
- d. Heat up pulley (5) and remove from jack strut assembly (4).
- e. Remove the bolt and washer (6 & 7) washer and nut (8 & 9).
- f. Press off bearing (10).
- g. Remove retainer (15), seal (13), and "O" ring (14).

Inspection of Jack Strut and Lower Pulley Assembly.

- a. Inspect lower pulley grooves for roughness and corrosion.
- b. Install new bearing (10) if necessary.
- c. Inspect shims (3) and install new ones if damaged; otherwise, assemble original shims upon installation of jack strut.
- d. Suggest installing the following new parts when removing the above assembly: seal (13), "O" ring (14).

Installation of Upper Pulley Assembly. To install the upper pulley assembly, proceed as follows:

- a. Be sure output pinion shaft is clean and woodruff key (10a) is installed in slot.
- b. Heat driven pulley assembly (9-a) and install sprag clutch (8-a) into driven pulley assembly. Secure with bolts and nuts (7-a).
- c. Install sprag clutch (8-a) and driven pulley assembly (9-a) on output pinion shaft.

- d. Heat housing (6-a) and install bearing (5a) and adapter (4a) into housing assembly. Secure with tru-lock snap ring (3-a).
- e. Install washer (2-a) and nut (1-a) securing upper driven pulley installation on pinion shaft. Torque to 2000 in./lbs.

Installation of Jack Strut and Lower Pulley. To assemble lower pulley and jack strut, proceed as follows:

- a. Install spacer (12) on jack strut (4) followed by the installation of retainer (15) and seal (13).
- b. Install bearing (10).
- c. Install bolt (6) and washer (7) in jack strut (4) and secure at opposite end of installation by washer (8) followed by nut (9).
- d. Install "O" ring (14).
- e. Heat lower pulley assembly (5) and install on jack strut (4).
- f. Following completion of the upper assembly, attach the six bolts, three long and three short (1) attaching lower pulley to cooling fan assembly and engine, torque to 50 ft./lbs.
- g. Secure the four bolts (2) that attach the housing (6-a) to the two shims (3) to jack strut (4).

NOTE 1: Be sure and install shim between lower pulley and fan assembly.

NOTE 2: Safety wire all six bolts in pairs on lower pulley assembly, with .040 wire.

NOTE 3: Install tail rotor drive shaft assembly and forward flex coupling.

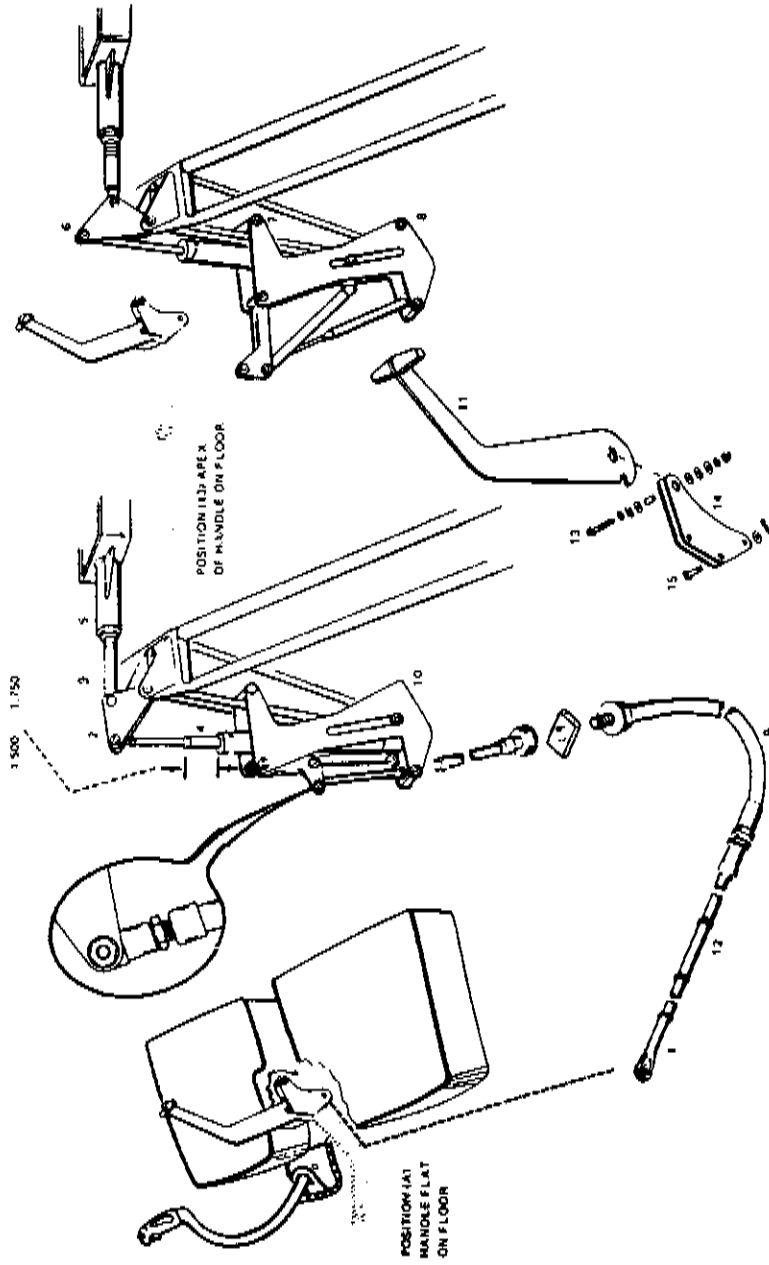
NOTE 4: Service clutch (Ref. Page MM-3-4).

NOTE 5: After installation of jack strut and pulley assembly of belt and engaging mechanism, run engine and engage rotor system and check for proper operation of system before flight. Check track of idler pulley.

ADJUSTMENT PROCEDURE (Ref. Section 8-11.)

The position of the clutch control lever can be adjusted under the main seat structure by adjusting the control cable turnbuckle (1). This adjustment will determine the control lever travel and position.

- a. To adjust the over-centering device, engage the clutch, engine not running, and adjust rod (3) to allow bellcrank (2) to extend beyond the vertical position.
- b. To adjust the spring capsule, engage clutch, engine not running, and screw rod (4) in or out of capsule to allow 1½" to 1¾" of piston, measured from jam nuts to top of capsule, to be exposed. This adjustment allows for proper tension on drive belt.



- NOTE:**
1. When clutch is engaged and handle released, position of handle should be as indicated on Page Reference Position A.
 2. When clutch is disengaged and handle released, position of handle should be as indicated on Page Reference Position B.
 3. With clutch engaged and handle disengaged, handle must lay flat on floor in cockpit.
- c. Adjust belt roller (27) to $\frac{1}{4}$ " clearance between belt surface and roller. Lube roller (34) with Aero-shell 16 grease. (Ref. Sect 8-2.)
- d. With proper adjustment, guides will touch brackets.

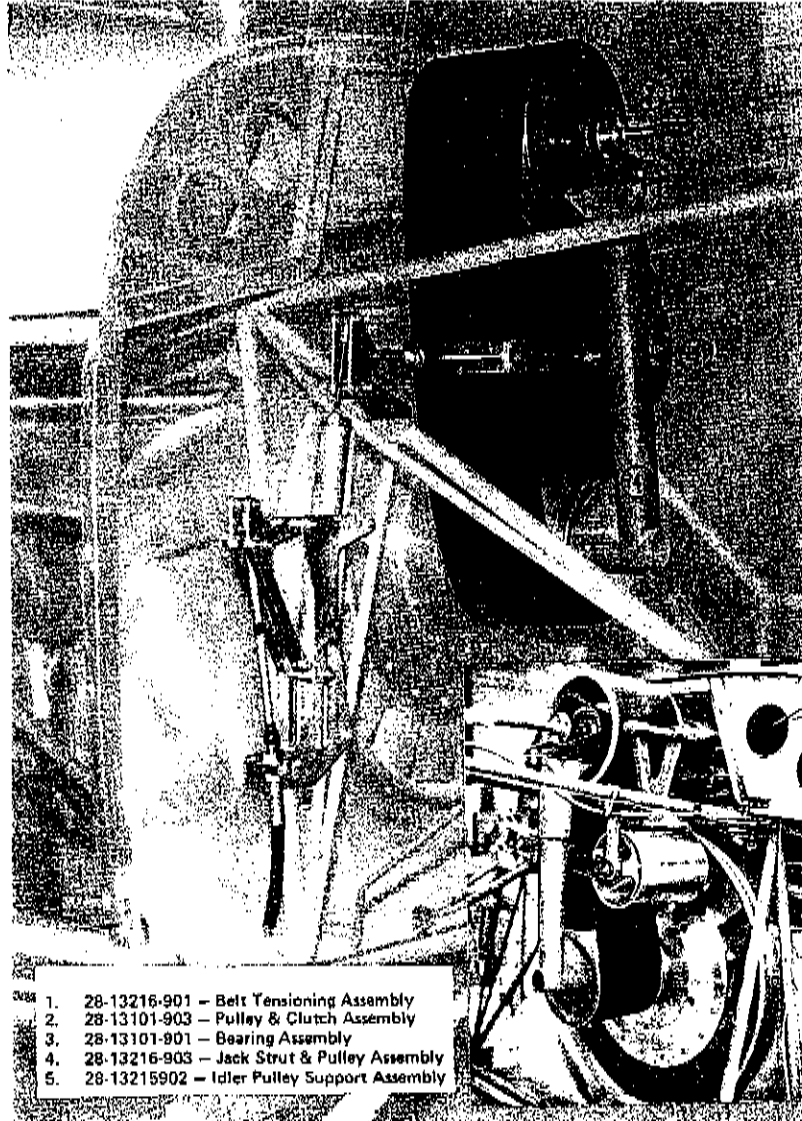
- NOTE:**
1. To further aid in adjustment of over-centering device, shaft (5) may be extended in or out as required.
 2. On new aircraft or after a new belt has been installed, the belt may drag, causing the rotor to turn slowly during engine idle. As belt stretches, adjustments may be required.

TRACKING IDLER PULLEY (Ref. Page 8-2)

- a. Remove wrap-around cowl if baggage compartment is installed.
- b. Loosen 15/16" nut (1) on forward side of idler adjusting shaft (2).
- c. Start engine and slowly engage rotor system while observing idler pulley track on belt.
- d. With 7/8" wrench turn idler shaft (2) until pulley tracks on belt.
- e. Tighten 15/16" nut (1) on forward end of idler shaft (2).

NOTE: When pulley is tracked, it will be centered on belt.

- f. Hover helicopter and check idler pulley track.



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ELECTRICAL SYSTEMS AND COMPONENTS

DESCRIPTION

The electrical system of the helicopter is a 12-volt, direct current system with a negative ground to the helicopter structure. The main source of power is a 12-volt battery. In-flight power is supplied to the system through a voltage regulator from a 12-volt alternator, belt-driven by the engine. The 12-volt battery is located in the right hand side of the cabin compartment and is conveniently located for servicing.

NOTE: Consult the manufacturer's handbook of maintenance instructions for servicing.

The main components of the electrical power system are the battery, starter, alternator and voltage regulator and their associated switches and circuit breakers. Maintenance of the electrical system consists of trouble shooting, removal, and installation.

BATTERY

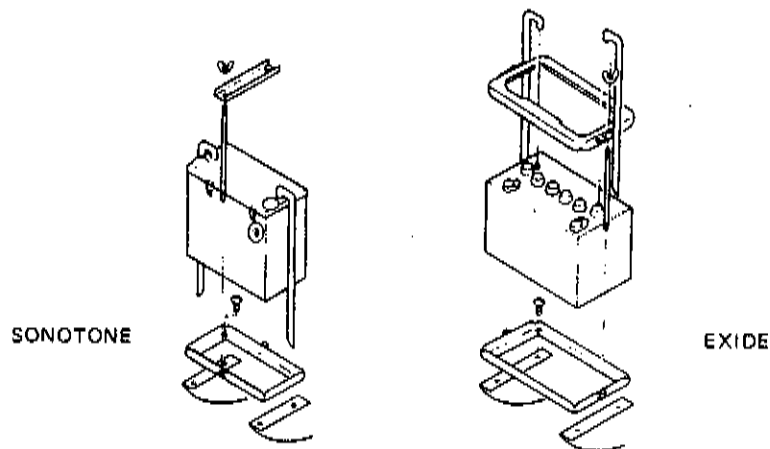
The 12-volt battery is secured in a receptacle on the right hand side of the cabin section which is internally accessible. The battery provides starting power and electrical power for instruments and pumps when the battery switch is turned on.

ELECTRICAL SYSTEM

REMOVAL OF BATTERY

To remove the battery from the helicopter, proceed as follows:

- a. Unsnap the right hand seat cushion from the fiberglass seat unit and remove the entire cushion.
- b. Remove the small metal cover from the seat structure by removing two sheet metal screws; this will give access to the top of the battery.
- c. Remove the two vent lines (red).
- d. Remove the two wing nuts holding the battery support clamp.
- e. Remove cover from top of battery (if used).
- f. Disconnect positive and negative leads from battery.
- g. Remove battery from compartment.
- h. Reinstall battery in reverse order.
- i. Check for proper operation by placing master switch to the ON position.



BATTERY INSTALLATION

ELECTRICAL SYSTEM

ALTERNATOR AND VOLTAGE REGULATOR

A 12-volt, 60-amp alternator is located on the right hand side of the engine and is belt-driven by the engine. The purpose of the alternator is to return charge to the battery. A voltage regulator is mounted on the left hand side of the firewall. It controls the alternator output at the designated level and at the specific RPM and transfers the electrical system from battery to alternator.

ELECTRICAL SYSTEM

REMOVAL OF ALTERNATOR

To remove alternator, proceed as follows:

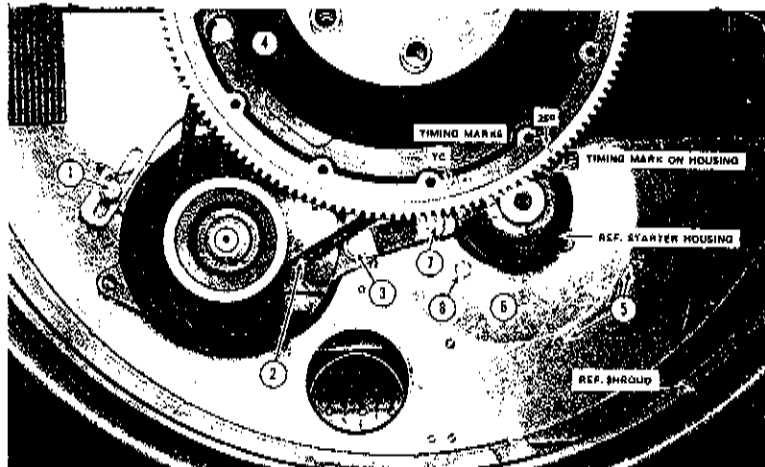
- a. Remove outside cowl assembly and baggage compartment.
- b. Remove cooling fan assembly and lower jack strut pulley assembly. (Ref. Section 8.)
- c. Disengage $\frac{1}{2}$ " (1) bolt that attaches alternator to adjustment arm.
- d. Slacken belt and remove (2).
- e. Remove bolt (3) that attaches arm to starter.
- f. Remove ring gear from rear of engine (4).
- g. Remove the left and right side cowls from powerplant section.
- h. Remove the four wires that attach to the rear of the alternator. Remove 2 ea. Attach bolts.
- i. Alternator may be removed from the aft side of the engine.
- i. Install alternator following above procedure.

- k. After installing and hooking up electrical wiring start engine and check out charge rate.

REMOVAL OF STARTER

To remove starter, repeat Items a. and b. (Ref. Page 9-2), proceed as follows:

- a. Remove six AN515-8-8 (5) screws from the 12611-8 plate (6) on rear of shroud.
- b. Remove attaching arm bolt (7) between the alternator and starter.
- c. Remove the three AN4-20A bolts (8) and 12600-4 spacers that are attached on the rear side of the starter.
- d. Disconnect wiring to starter, designating each respective terminal. Starter may then be removed aft.
- e. Install starter following above procedures.
- f. Following installation and electrical hook-up, start engine and check starter operations.



ALTERNATOR AND STARTER LOCATION

Removal of Voltage Regulator. The voltage regulator, which is located on the left hand side of pylon aft of the firewall, is removed as follows:

- a. Remove ground wire, field switch and master relay, and alternator wire from voltage regulator.
- b. Remove the four screws that attach the voltage regulator to the electrical panel.
- c. Reinstall voltage regulator on electrical panel in the reverse order.

NOTE: Pay particular attention to the coding on each of the wires for proper assembly.

VOLTAGE REGULATOR ADJUSTMENT (LEAD ACID BATTERY)

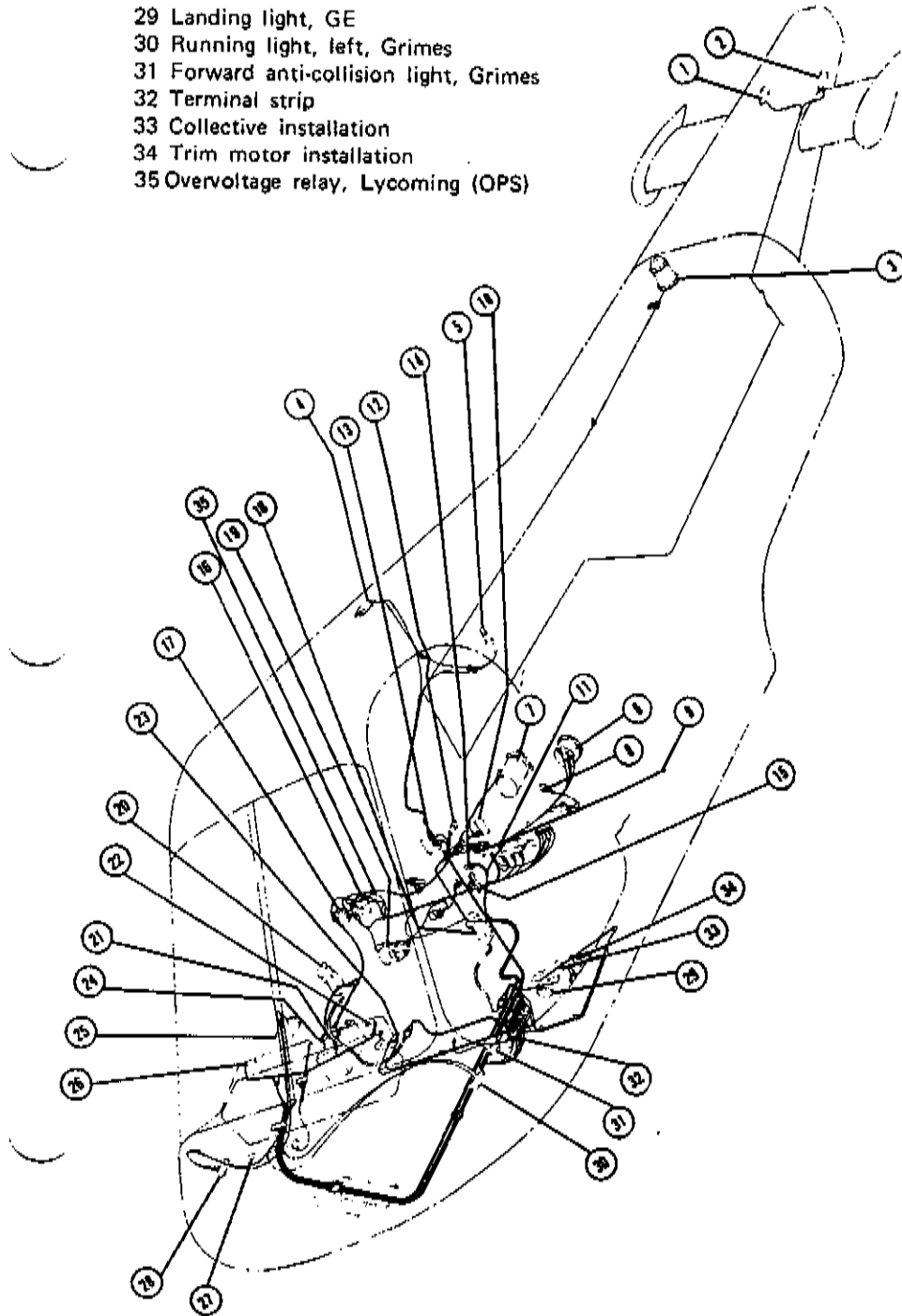
1. Open left hand engine cowl.
2. Start engine and run for approximately 5 minutes at 1500 RPM.
3. Induce load on system.
4. Remove adjustment cap in regulator.
5. Connect plus lead of meter to "F" terminal of regulator and black lead of meter to ground.
- *6. Adjust regulator as required to obtain 12.5 - 13 volts.
7. Re-install cap in regulator, remove meter leads and close engine cowl prior to flight.

*NOTE: NI-CAD battery regulator should be adjusted to 15 to 15.5 volts.

ELECTRICAL INSTALLATION SYSTEM

- 1 Grimes right hand tail running light
- 2 Grimes left hand running light
- 3 Grimes anti-collision light
- 4 Fuel pick-up
- 5 Temperature pick-up main rotor transmission
- 6 Alternator, 12-volt Prestolite
- 7 Starter, Prestolite
- 8 Cylinder head temperature
- 9 Starter vibrator, Bendix
- 10 Right magneto, Bendix S4LN-1209 or SL4N-204
- 11 Prestolite regulator
- 12 Oli temperature connector
- 13 Left magneto, Bendix S4LN-1208 or S4LN-200
- 14 Fuel pressure switch
- 15 Terminal strip
- 16 Master relay
- 17 Starter relay, 3 amp.
- 18 Cyclic installation, Pilot
- 19 Boost pump, Weldon Tool
- 20 Cyclic installation, co-pilot
- 21 Battery, 12 v. D.C.
- 22 Instrument light, Grimes
- 23 Trim motor assembly
- 24 Instrument light, Grimes
- 25 Airpath compass
- 26 Instrument light, Grimes
- 27 Terminal strip
- 28 Right running light, Grimes

- 29 Landing light, GE
- 30 Running light, left, Grimes
- 31 Forward anti-collision light, Grimes
- 32 Terminal strip
- 33 Collective installation
- 34 Trim motor installation
- 35 Overvoltage relay, Lycoming (OPS)



ELECTRICAL INSTALLATION SYSTEM LOCATIONS

ELECTRICAL SYSTEM

STARTER BUTTON

The starter button is located at the end of the collective pitch stick. If a defective switch is suspected, it can be removed as follows:

- a. Turn battery switch to the OFF position.
- b. Remove seat cover and run a continuity check between the two wires that extend from the bottom of the collective pitch stick. If the trouble is found to be in the switch itself, proceed further.
- c. Remove quick-disconnect wires at lower side of collective pitch stick.
- d. Remove throttle bellcrank by removing the bolt and nut.
- e. Remove the four counter-sunk screws on the top of the collective pitch stick; the assembly can be removed as a unit.
- f. Remove the starter button cap from end of stick by loosening the attaching nut; this will allow the inner tube assembly to slide out.
- g. After installation of new switch, feed wiring through inner tube assembly and connect wires to respective quick-disconnects at firewall.
- h. Connect collective pitch stick and button in reverse order and check operation of starter button.
 1. Check engine operation prior to flight.

ELECTRICAL SYSTEM TROUBLESHOOTING CHART

PROBABLE CAUSE	REQUIRED ACTION
Starter Does Not Crank Engine (Battery Switch On, Alternator Switch On, Clutch Disengaged):	
Weak or dead battery.	Check or replace battery.
Circuit breaker open.	Reset circuit breaker.
Broken wire or open connection.	Check continuity of circuits. Repair or replace wires; tighten and clean connections.
Defective starter relay.	Replace relay.
Defective starter.	Replace starter.
Defective starter switch.	Check, clean or replace switch.
Battery Does Not Supply Power When Battery Switch Is Turned On. (No Indication on Ammeter):	
Dead battery.	Check specific gravity of battery, recharge or replace battery.

Electrical System Troubleshooting Chart (Cont.)

PROBABLE CAUSE	REQUIRED ACTION
Broken wire or open connection.	Check continuity of circuits. Repair or replace wires; tighten and clean connections.
Defective starter relay.	Replace relay.
Defective starter.	Replace starter.
Battery Does Not Supply Power When Battery Switch Is Turned On. (No Indication on Ammeter):	
Dead battery.	Check specific gravity of battery, recharge or replace battery.
Faulty connections.	Check continuity of wiring and tighten or replace broken connections.
Faulty switch.	Replace switch.
Faulty ammeter.	Check ammeter; replace if defective.
Faulty master relay	Check and replace
Starter Clutch Housing Breaks During Attempted Engine Start:	
Retard P-lead not making contact.	Check/secure lead.
Retard timing incorrect.	Check/retime ignition.
Starting vibrator imperative.	Check/replace vibrator.
Low battery voltage.	Check/charge battery.
Loose wiring.	Check/secure clean wiring.
Damaged starter drive gear.	Inspect/replace gear.
Faulty starter clutch.	Check/replace clutch.
Improper installation.	Inspect/reinstall correctly.
Starter solenoid mal-functioning.	Check/replace solenoid.
High Charging Rate When Batteries Are Fully Charged:	
Defective voltage regulator.	Check/replace.
Low Charging Rate With Batteries Not Fully Charged:	
Loose connections on alternator or regulator terminals.	Check/tighten.
Defective voltage regulator.	Check/replace.

Electrical System Troubleshooting Chart (Cont.)

PROBABLE CAUSE	REQUIRED ACTION
Faulty alternator.	Check/repair.
Loose belt.	Adjust belt tension.

Ammeter Shows Heavy Discharge When Engine Is At Slow Idle

Voltage regulator malfunctioning. Check/repair/replace regulator, or loosen belt, loosen mounting.

Erratic Operation of Alternator System:

Defective voltage regulator.

Check/replace.

Dirty or pitted alternator commutator.

Clean and polish commutator.

Faulty wiring in alternator system.

Check/repair.

Worn brushes.

Check/replace.

NIGHT FLYING LIGHTING SYSTEM

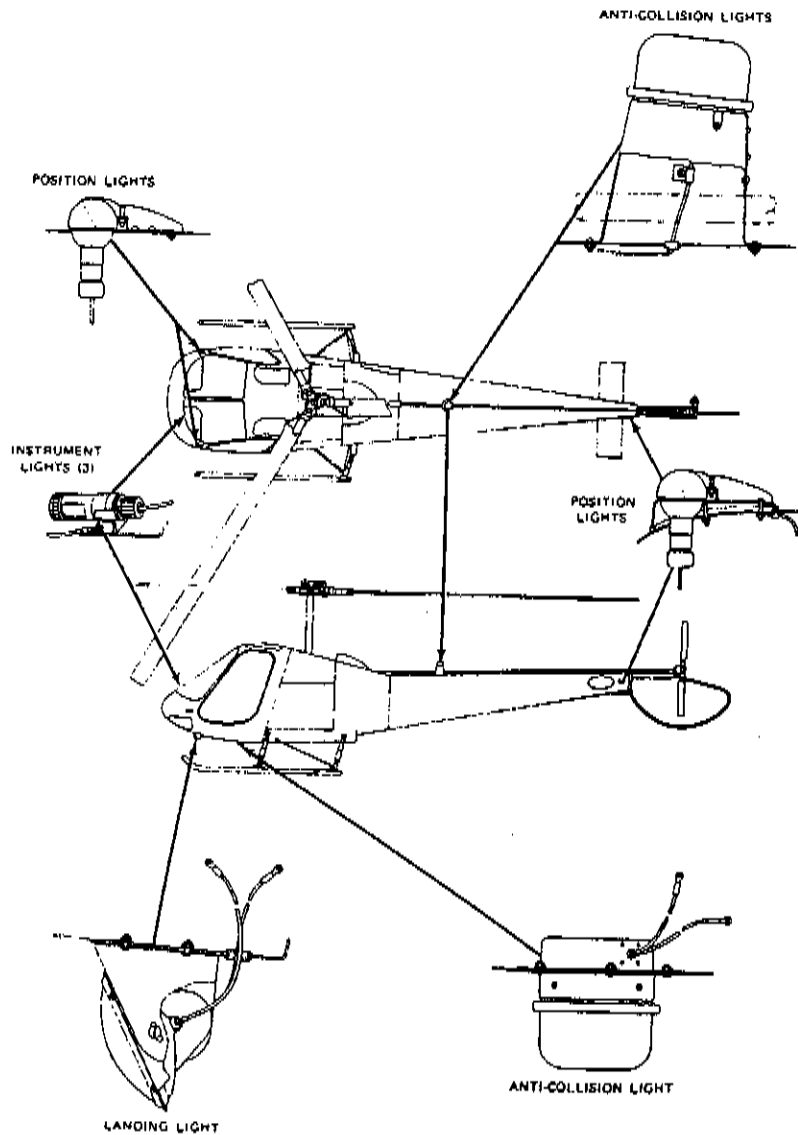
The night flying lighting system, although an optional accessory to the helicopter, is installed on the majority of units. The night flying system consists of the following:

- a. Rotating anti-collision lights on the lower side of the cabin and on topside of the tail cone assembly.
- b. Landing lights on the lower side of the cabin section.
- c. Position lights on the left and right side of the cabin assembly and on the left and right side rear of the tail cone assembly.
- d. Instrument lights.
- e. Control switches and instrument console indicator light.

Maintenance of this system consists of installation, removal and trouble shooting.

INSTRUMENT LIGHTS

The instrument lights are located above the instruments on the underside of the top of the instrument console. The instrument panel lights are controlled by a toggle switch and circuit breaker. A reostat is also installed for intensity control.



NIGHT LIGHTING KIT INSTALLATION

NIGHT FLYING LIGHTING INSTALLATION TROUBLESHOOTING CHART

PROBABLE CAUSE	REQUIRED ACTION
Landing Light Out With Landing Light On Switch Turned On, And Battery Switch On:	
Burned out lamp.	Replace lamp.
Circuit breaker tripped.	Reset circuit breaker.
Defective switch.	Replace switch.
Open circuit.	Check all connections and continuity of wiring.
Position Lights All Out, Battery Switch On, Position Switch On:	
Circuit breaker tripped.	Reset circuit breaker.
Defective switch.	Replace switch.
Position Light Wire Harness	Shorted to Ground.
Any One Position Light Out:	
Burned out bulb.	Replace bulb.
Anti-Collision Lights Out, Motor Rotating:	
Burned out bulbs.	Replace bulbs.
Anti-Collision Lights Out, Motor Not Rotating:	
Circuit breaker tripped.	Reset circuit breaker.
Motors shorting to ground.	Replace assembly.

LAMP REPLACEMENT GUIDE CHART

AMOUNT	LOCATION	MANUF.	NUMBER
3	Panel Light	Grimes	8-H555
1	Anti-Collision (Forward)	Grimes	D-7080-A12
1	Anti-Collision (Aft)	Grimes	D-7080
1	Landing Light (Sealed)	GE	4313-250 Watt
2	Tail Light	Grimes	A-1285-C-12
2	Forward Running Lights	Grimes	21W

FLIGHT AMPERE LOAD CONDITIONS TABLE

ELECTRICAL APPLIANCE	A	B	C	D	E	F	G	H	I	J	K	L
Boost Pump	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Long. Trim*	6.0	6.0		6.0			6.0		6.0			
Lat. Trim*			6.0		6.0			6.0		6.0		
Radio-Transmit*	6.0	6.0					6.0	6.0			6.0	
Radio-Receive	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Instruments	.14	.14	.14	.14	.14	.14	.14	.14	.14	.14	.14	.14
Master Relay	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5
Anti-Coil. Lts.	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2
Panel Lts.						.6	.6	.6	.6	.6	.6	.6
Nav. Lts.						6.4	6.4	6.4	6.4	6.4	6.4	6.4
Landing Lts.○											19.5	19.5
Amps.	20.94	32.94		26.94		29.94	39.94		33.94		53.44	47.44

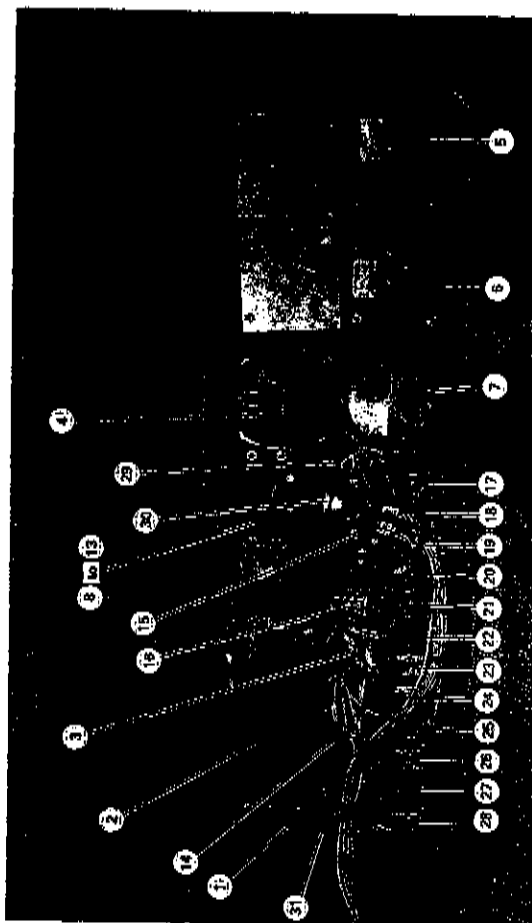
NOTE: Flight Condition A is Day Normal Cruise.

Flight Condition F is Night Normal Cruise.

* Denotes Intermittent Use.

○ Denotes Short Duration Use (5 min.).

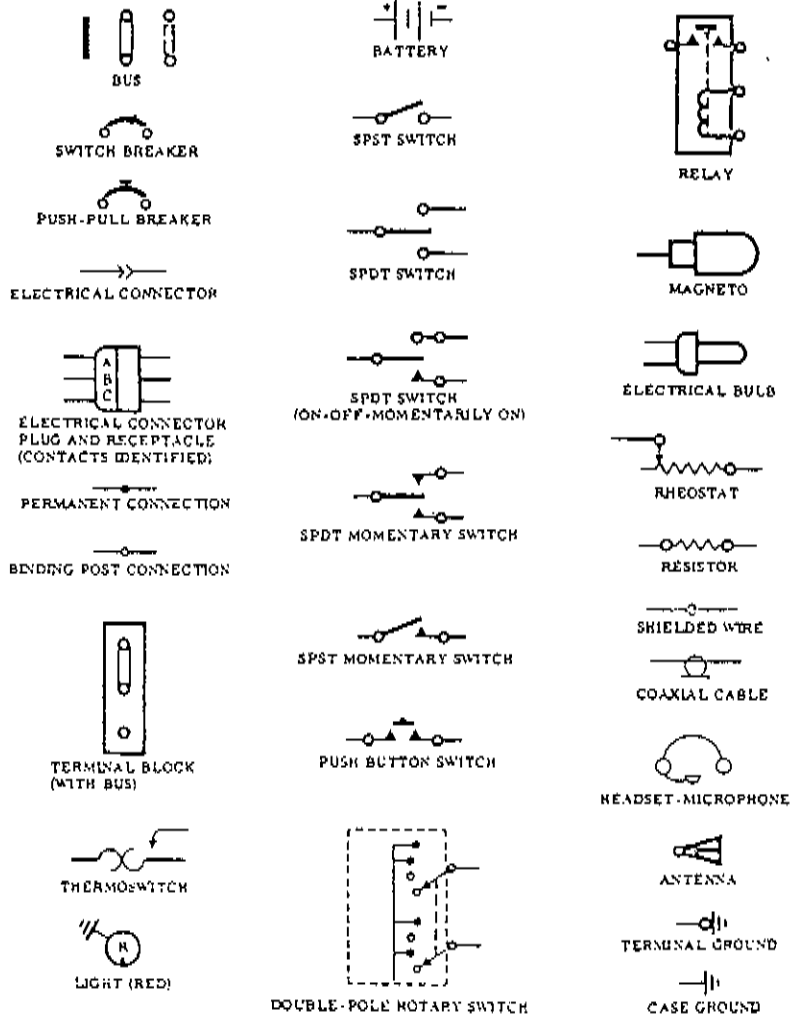
The above load conditions include all electrical appliances that will be available for the F-28 series helicopters, thus indicating the most severe electrical loads that may be encountered.



ELECTRICAL WIRING INSTALLATION PANEL (Rear View)

KEY TO INSTRUMENT PANEL

- | | |
|---|---|
| 1 Mount hole for radio circuit breaker | 17 Panel light |
| 2 Radio mount hole | 18 Running light |
| 3 Fuel pressure indicator and boost pump switch | 19 Anti-collision light |
| 4 Manifold pressure/fuel pressure | 20 Landing light |
| 5 Altimeter | 21 Alternator switch |
| 6 Airspeed | 22 Panel light circuit breaker |
| 7 Rotor/engine tachometer | 23 Running light circuit breaker |
| 8 Fuel quantity | 24 Anti-collision light circuit breaker |
| 9 Oil pressure | 25 Landing light circuit breaker |
| 10 Main rotor gear box temperature | 26 Ignition circuit breaker |
| 11 Oil temperature | 27 Instrument CL. circuit breaker |
| 12 Ammeter | 28 Trim motor circuit breaker |
| 13 Cylinder temperature | 29 Panel light dimmer |
| 14 Engine hour meter | 30 Hobbs pressure switch |
| 15 Ignition switch | 31 Clock |
| 16 Master Switch and Circuit Breaker 50 amp. For Generator, 60 amps, Alter. | |

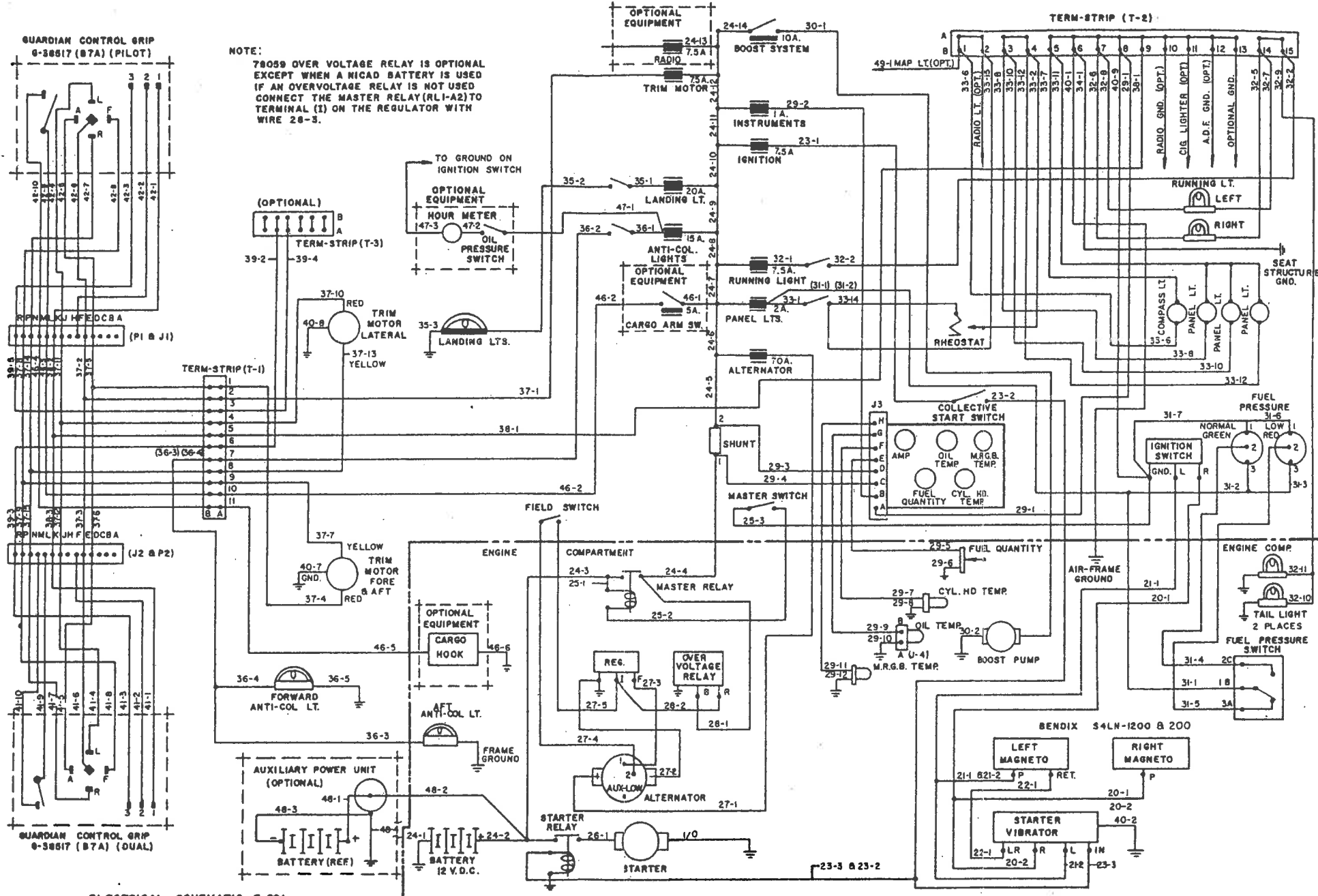


ELECTRICAL SYMBOLS

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NOTE:
78059 OVER VOLTAGE RELAY IS OPTIONAL EXCEPT WHEN A NICAD BATTERY IS USED IF AN OVERVOLTAGE RELAY IS NOT USED CONNECT THE MASTER RELAY (RL-1A2) TO TERMINAL (I) ON THE REGULATOR WITH WIRE 28-3.

ELECTRICAL SCHEMATIC F-28A

STRUCTURE

DESCRIPTION

The structure section of the F-28A Helicopter is composed of the tail cone assembly, cabin assembly, pylon assembly, and landing gear.

PYLON ASSEMBLY

The pylon assembly is a tubular 4130 steel frame type construction member. The frame supports all major structural and drive train components of the helicopter. Maintenance of the frame consists of inspection and repair.

Inspection of Pylon Assembly. Inspection is limited to a field survey of the pylon condition. Visually inspect all members of the pylon for the following:

- a. Cracks and dents.
- b. Integrity of finish.
- c. Evidence of corrosion.
- d. Security of welded points.
- e. Scuffing and abrasion.
- f. Worn and enlarged mounting bolts.

Repair of Pylon Assembly. Damage to the pylon section tubes other than cracks are to be repaired in accordance with FAR 43. Corrosion damage may be repaired in accordance with the procedures defined in this Section.

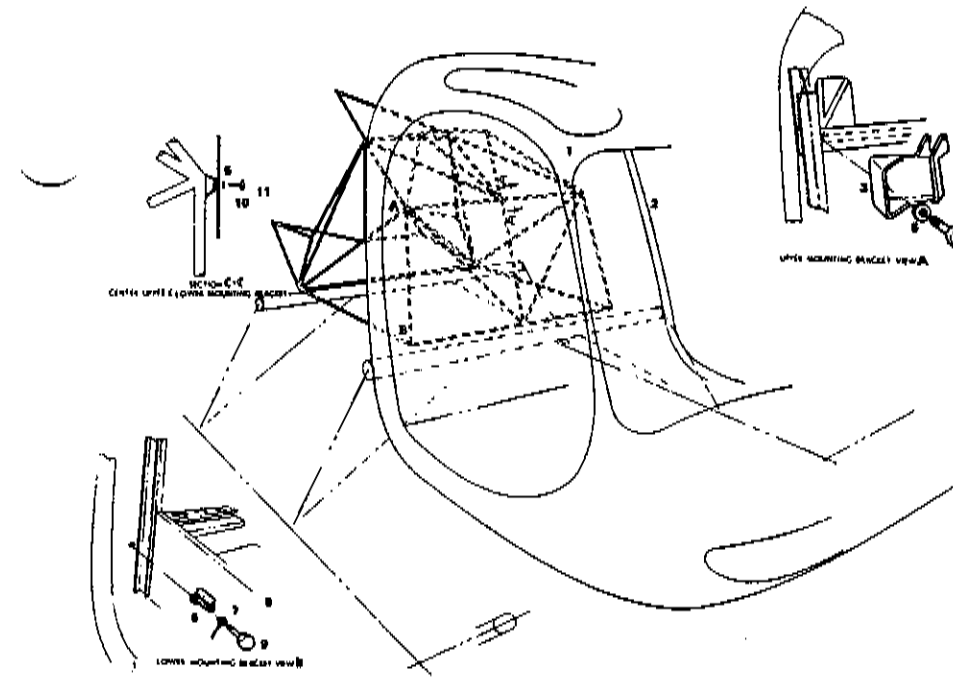
STRUCTURE

CABIN ASSEMBLY

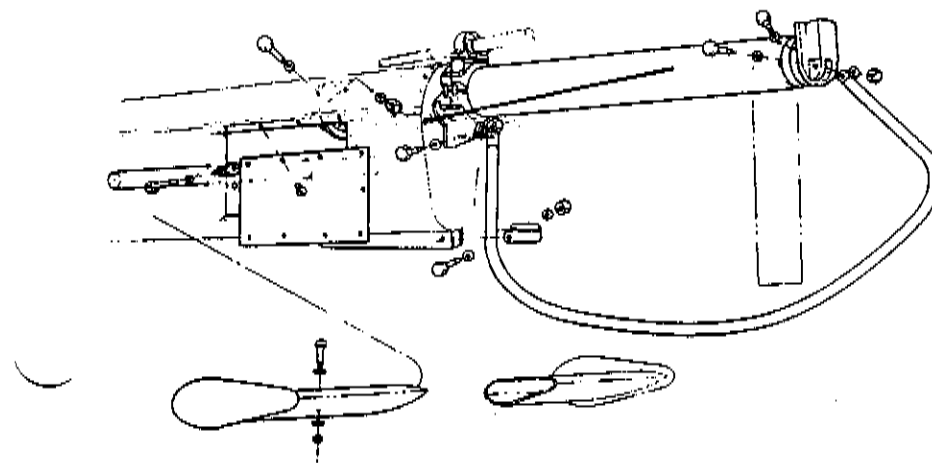
Description. The cabin assembly is constructed of fiber-glass reinforced plastic and is held to the pylon section by six attaching bolts. The entire cabin section can be removed as a unit.

Removal.

- a. Disconnect collective push rod at the point where it attaches to collective walking beam. (Ref. Section 11-2.)
- b. Disconnect the lateral and longitudinal push rods at the bellcranks at either side of the rear cabin wall.
- c. Disconnect the main battery cable at the relay inside of the engine compartment. (Ref. Section 9-3.)
- d. Drain fuel from both fuel tanks and remove tanks and clamps holding vent tubes to the forward firewall.
- e. Remove rudder cables at turnbuckle in engine compartment. (Ref. Section 15-12.)
- f. Disconnect all oil lines, fuel lines, and air speed static tube at firewall.
- g. Disconnect electrical wiring in the engine compartment.
- h. Disconnect clutch control at junction of flexible cable and cabin adjacent to forward firewall. (Ref. Section 8-6.)
- i. Disconnect throttle control inside engine compartment. (Ref. Section 5-41.)
- j. Remove firewall curtain.
- k. Disconnect fuel shut-off control.
- l. Remove six attaching bolts from inside cabin and lift cabin free of aircraft.



CABIN ATTACHMENT TO PYLON



STABILIZER AND TAIL CONE EXTENSION

STRUCTURE

REMOVAL OF LEFT AND RIGHT DOOR ASSEMBLY

- a. Disconnect lower bungee at forward part of door at frame.
- b. Remove hinge pins at top and bottom of doors and remove doors.

TO REPLACE GLASS IN DOORS

- a. Remove lock assembly and handle.
- b. Remove trim from inside of doors.
- c. Remove glass.
- d. Fit glass to door and trim as necessary, and pick up all existing holes.
- e. Install glass using EC-801 bonding compound, trim, door handles, and locking assembly.

INSTALLATION OF DOOR ASSEMBLY

- a. Install hinge pins, top and bottom.
- b. Hook up lower bungee to frame assembly.

OVERHEAD AND LOWER BAY WINDOWS

Removal.

- a. Drill out cherry rivets in frame assembly.
- b. Remove frame and glass assembly.
- c. Clean area.

Installation.

- a. Position frame and match drill to existing rivet pattern.
- b. Apply silicone compound bonding agent and install frame and glass assembly using cherry rivets.
- c. Clean excess bonding material from area.

WINDSHIELDS

Removal.

- a. Remove center retainer strip and filler along bottom side of glass and from top of all screw heads.
- b. Remove all attaching screws.
- c. Remove glass.
- d. Clean recess of window frame.

Installation.

- a. Trim window to fit.
- b. Match drill all holes and countersink.
- c. Install glass using EC801 compound.
- d. Install screws and fill and smooth to contour.
- e. Install trim and repaint.

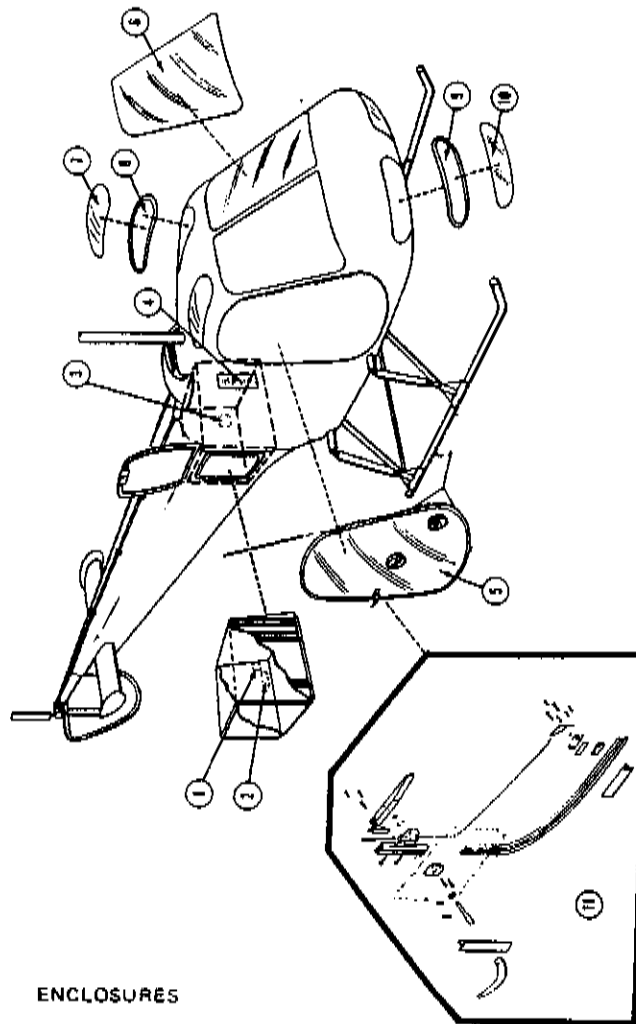
BAGGAGE COMPARTMENT**Removal.**

- a. Remove wrap-around cowling.
- b. Remove mounting bolts from baggage compartment and slide out.

Installation.

- a. Install baggage compartment and secure.
- b. Install wrap-around cowling.

NOTE: Check all hardware for security prior to flight.



ENCLOSURES

TAIL CONE ASSEMBLY

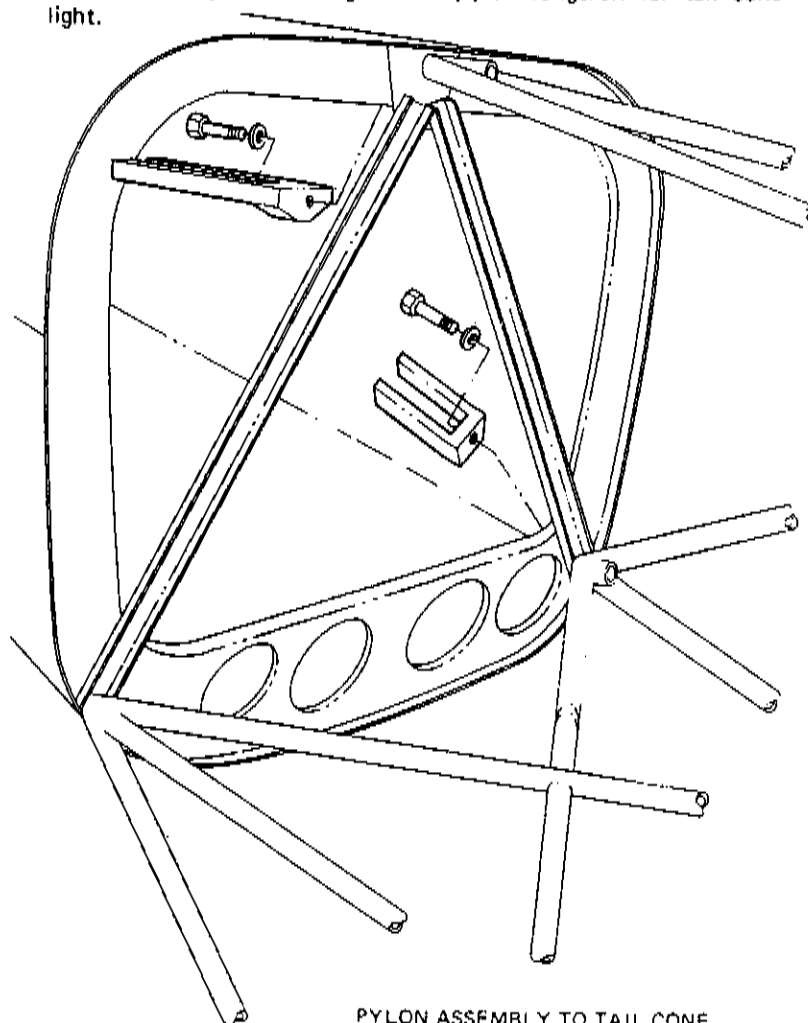
DESCRIPTION

The tail cone assembly is aluminum monocoque structure with formed sheet metal bulkheads and sheet metal skin.

REMOVAL OF TAIL CONE ASSEMBLY

Remove the tail cone assembly by the following procedure:

- a. Disconnect static line at bulkhead fitting.
- b. Disconnect antenna wire at fitting on lower portion of fuselage tail cone.
- c. Disconnect bayonet on right-hand pylon longeron for tail cone light.



PYLON ASSEMBLY TO TAIL CONE

REMOVAL OF TAIL CONE ASSEMBLY (Con't)

- d. Disconnect bayonet fitting at top of fuselage for rotating beacon assembly.
- e. Disconnect flexible coupling at forward end of tail rotor drive shaft.
- f. Remove tachometer cover and "O" ring drive.
- g. Disconnect rudder cables at tail rotor yoke and feed the cables through fair leads to forward portion of tail cone assembly.

NOTE:

- 1. Before pulling rudder cables through fuselage, attach two separate strings to facilitate installation upon assembly of tail cone assembly to mount.
- 2. Before removing the three pylon bolts, place two supporting fixtures under fuselage or tail cone to support same.

- h. Remove the three bolts and washers attaching the tail cone assembly to the pylon mount.

INSTALLATION OF TAIL CONE ASSEMBLY

Install the tail cone assembly as follows:

- a. Support tail cone assembly on two supporting fixtures prior to mating to pylon mount. Install three mounting bolts securing pylon mount to tail cone assembly, torque to 240 in./lbs. and safety wire with .032 wire.
- b. Connect forward flex-coupling, tail rotor drive shaft.
- c. Install rotor tachometer, "O" rings, and cover assembly.
- d. Pull rudder cables through aft tail cone assembly by the use of strings which will guide the cable assembly through the fair leads to the tail rotor yoke control.
- e. Connect the rudder cables at tail rotor yoke.
- f. Connect the static line at bulkhead fitting.
- g. Connect antenna at fitting on bottom of fuselage, bayonet fitting for tail light on right-hand longeron and bayonet fitting at top of fuselage for rotating beacon.
- h. Inspect the installation of all electrical connections, rudder cable attachment, proper rudder control, and pylon connecting bolts and forward coupling prior to starting engine and running ground check on tail rotor operation.

NOTE: Structural repairs to the tail cone assembly can be accomplished by utilizing Part FAR 43 Manual for typical sheet metal repairs.

Description. The stabilizer is a dual, all-metal airfoil mounted near the aft end of the tail boom and protruding on each side of the helicopter. The stabilizer is a symmetrical airfoil section and is rigidly attached to the boom. Drain holes are provided at the lowest point, and small end plates are attached to outboard ends of the stabilizer. Any nose-down tendency of the helicopter at high forward speeds with forward-most CG loadings is compensated for by the stabilizer.

Removal of Horizontal Stabilizer. Remove horizontal stabilizer by the following procedure:

- a. Disconnect the two AN-bolts on the left-hand stabilizer.
- b. Pull left-hand stabilizer from attaching carry-through spar.
- c. Through inspection hole on aft tail cone under left-hand horizontal stabilizer, remove bolt which attaches the spar to the spar fitting.
- d. Remove stabilizer from right-hand side of tail cone assembly.

Inspection of Horizontal Stabilizer.

- a. Inspect the left and right horizontal stabilizer bushings on the inside of the aft tail cone assembly. Check for excessive looseness that could occur from improper ground handling. If horizontal stabilizer is found excessively loose replace stabilizer bushing assembly. Check spar for excessive wear, cracks or elongated holes.

NOTE: This will necessitate installing the stabilizer and redrilling the holes from the carry-through spar.

- b. It is important that the two bolts that hold the stabilizer to the bracket or spar fitting are kept tight to prevent any movement.

NOTE: Structural repairs to the tail cone stabilizer assembly can be accomplished by utilizing Part FAR 43 Manual for typical sheet metal repairs.

Installation of Horizontal Stabilizer.

Install the horizontal stabilizer by the following procedure:

- a. Install the right-hand stabilizer with the carry through spar into the tail cone assembly.
- b. Install the right-hand bolt which attaches the spar to the spar fitting.
- c. Install the left-hand bolt that attaches the carry-through spar to the left-hand spar fitting.
- d. Install left-hand inspection plate.
- e. Install the left-hand stabilizer and install the two AN- bolts through the top side of the stabilizer and secure with AN-365 nuts on the bottom.
- f. Re-check the entire assembly prior to flight.

Removal of Tail Cone Torque Tube Extension.

- a. Disassemble aft universal joint.
- b. Disassemble rudder cables.
- c. Remove tail rotor guard.
- d. Remove tail rotor gear box assembly as a unit.
- e. Remove bolts from aft pillow block. (Leave on tail rotor shaft.)
- f. Remove bolts from left horizontal stabilizer and remove.
- g. Remove left-hand inspection plate on tail cone under stabilizer.
- h. Remove three bolts from forward torque tube bulkhead.
- i. Remove tube to the rear with a slight oscillating action.

Assembly. Assemble torque tube extension in reverse order, torque all bolts and safety wire where required. Check tail rotor controls prior to flight.

NOTE: When installing tail rotor guard bolts, do not over tighten. Observe torque value.

LANDING GEAR ASSEMBLY

LANDING GEAR REMOVAL (Ref. Page 10 - 10 and 10 - 12)

The landing gear assembly may be removed from the pylon assembly as follows:

- a. Hoist helicopter by placing nylon sling around hub assembly.
- b. Remove left, right, and bottom cowling.
- c. Remove the four bolts (2) that attach the front and rear strut members (3) to the forward and aft cross tube clamp assemblies (4).

NOTE: Forward strut bolts are installed head aft.

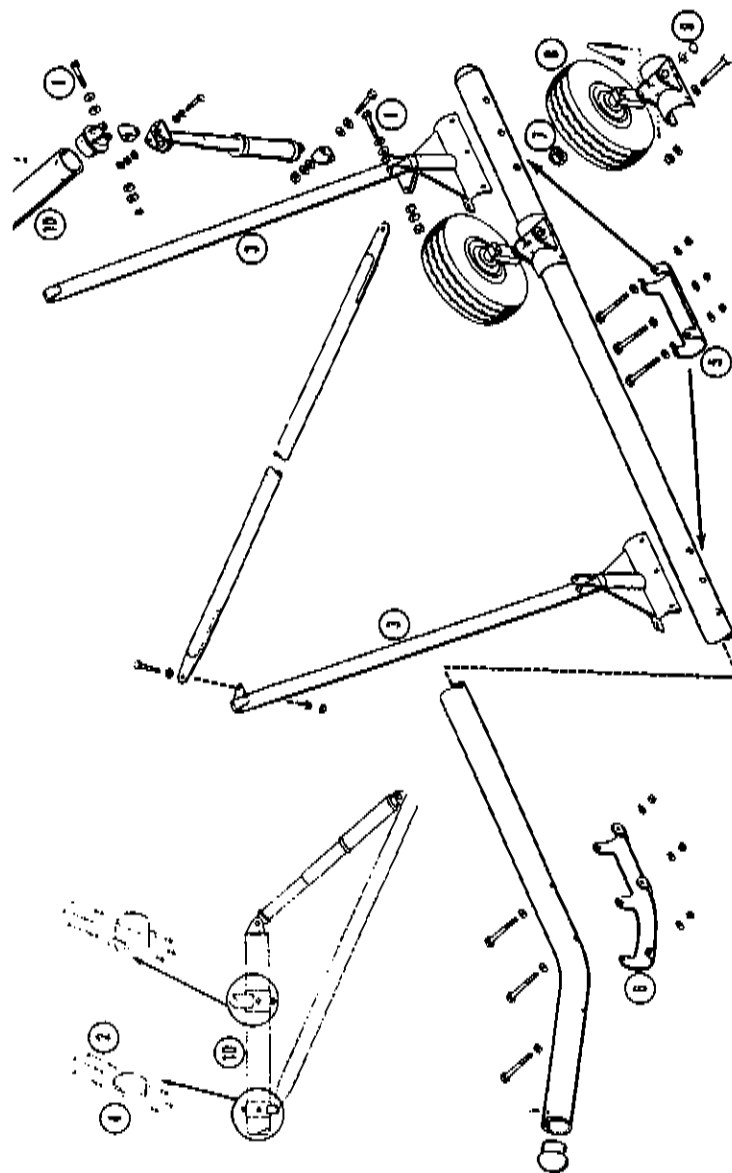
- d. Remove upper oleo strut hardware (1) and temporarily support oleos to strut assemblies.

LANDING GEAR INSTALLATION

The landing gear assembly may be installed as a unit on the pylon assembly as follows:

- a. Hoist helicopter by placing nylon sling around hub assembly.
- b. Place landing gear assembly beneath the pylon and lower pylon assembly, attaching the forward and aft struts (3) to the forward and aft cross tube clamps with four bolts (2).
- c. Install the four upper oleo struts hardware (1), attaching oleos to fore and aft cross tubes (10).
- d. Inspect all attach points, then rock ship and check for proper oleo extension.

NOTE: Tire inflation pressure is 75 psi. |



LANDING GEAR ASSEMBLY

NOTE: Landing gear bolts at pivot points are to be torqued to 40 - 50 in./lbs. to allow gear to flex.

LANDING GEAR

SKID SHOES

Description: (ref. page 10-9 & 10-10). Three skid shoes (5), (6) are installed on each landing gear skid by means of AN hardware. It is important that the operator inspect the bottom of the shoes periodically, depending on the particular types of operations. If the helicopter is used for training and landing on hard surfaces, the shoes will wear down faster than operating on soft ground.

Removal. The shoes may be removed by one of the following methods:

- a. Jacking up landing gear.
- b. Hoisting entire ship with sling.
- c. Placing ground handling wheels in movable position.
- d. Remove AN hardware on respective skid shoes and either replace entire skid shoe or weld new bead of tungsten on bottom of shoe if welding equipment is available to do so.

Installation.

- a. Replace skid shoes on skids by inserting AN hardware.
- b. Lower helicopter.
- c. Inspect installation prior to flight.

GROUND HANDLING WHEELS

Description. Each landing gear skid tube has provisions for easily installed landing gear wheel assemblies. Each assembly has a manually operated over centering device to lift the skids for installation of the wheels or retract them for flight. The ground handling wheels should be retracted and the helicopter allowed to rest on the skids when the engine run-up is being performed or when helicopter is parked. To facilitate moving the helicopter on a hard surface, insert the slotted handle facing forward. While applying a constant pressure to handle, release pin. Pull up and aft with a lifting motion until the hole lines up. Insert the locking pin.

CAUTION:

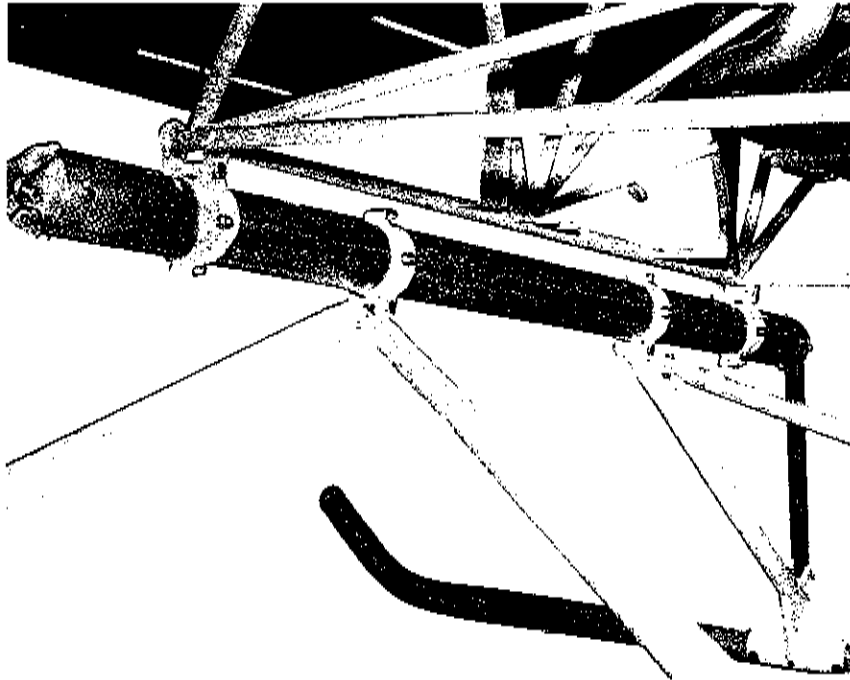
1. Keep your feet from under the skids.
2. Stay on outside of skid, do not straddle.

NOTE: Carry slotted handle with helicopter.

Removal. To remove wheel assembly to repair tire or inspect wheel assembly, proceed as follows:

- a. Place helicopter on skids.
- b. Remove wheel nut, (7)
- c. Remove wheel. (8)
Or:
- d. Remove snap ring from outboard end of axle and remove entire assembly. (9)

Installation: To install wheel assembly proceed in reverse order of removal.

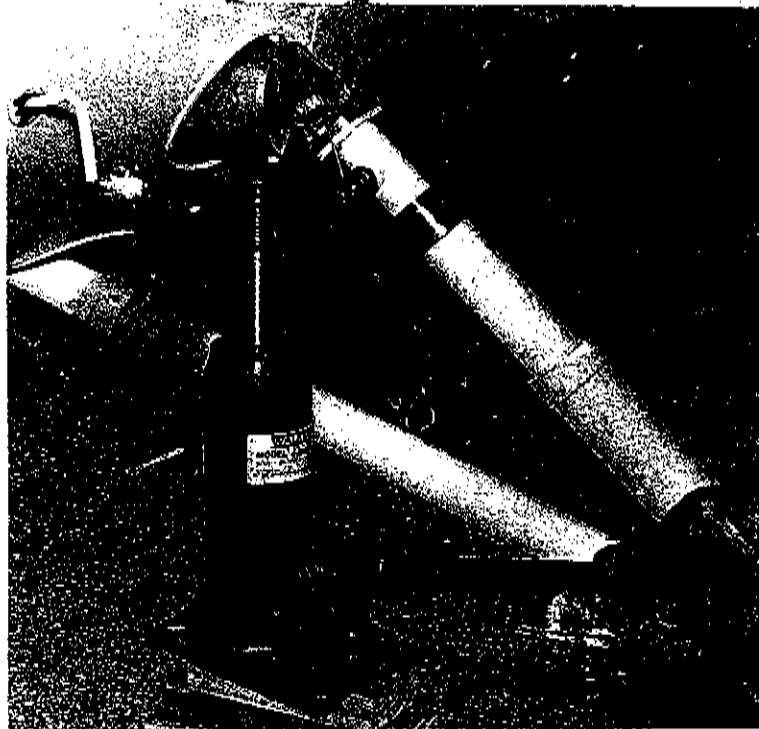


WHFFI BAR AND GROUND HANDLING (LOWERED POSITION)

LANDING GEAR ASSEMBLY

OLEO STRUTS

Description. The landing gear assembly is a skid-type gear of welded tubular construction. It uses air-oil struts to absorb landing shocks and to provide the dampening required to eliminate ground resonance.



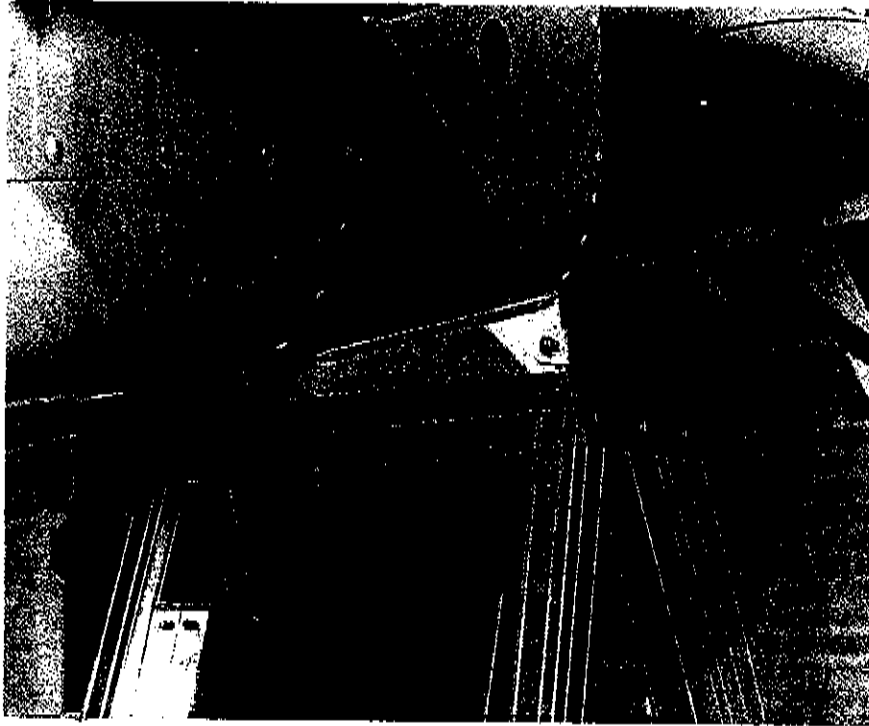
PROPER PLACEMENT OF JACK UNDER VERTICAL BOLT HEAD

Removal from Helicopter.

- a. Use a hoist attached to the main rotor hub and lift helicopter as a unit or jack landing gear at outer ends of cross tube members, placing jack under vertical bolt head.

CAUTION: When jacking helicopter, place support under tail cone assembly at aft end. (Ref. 10-14.)

- b. Remove all air from strut by opening strut valve slowly.
- c. Remove strut from landing gear by disconnecting and removing upper and lower attach hardware (1).



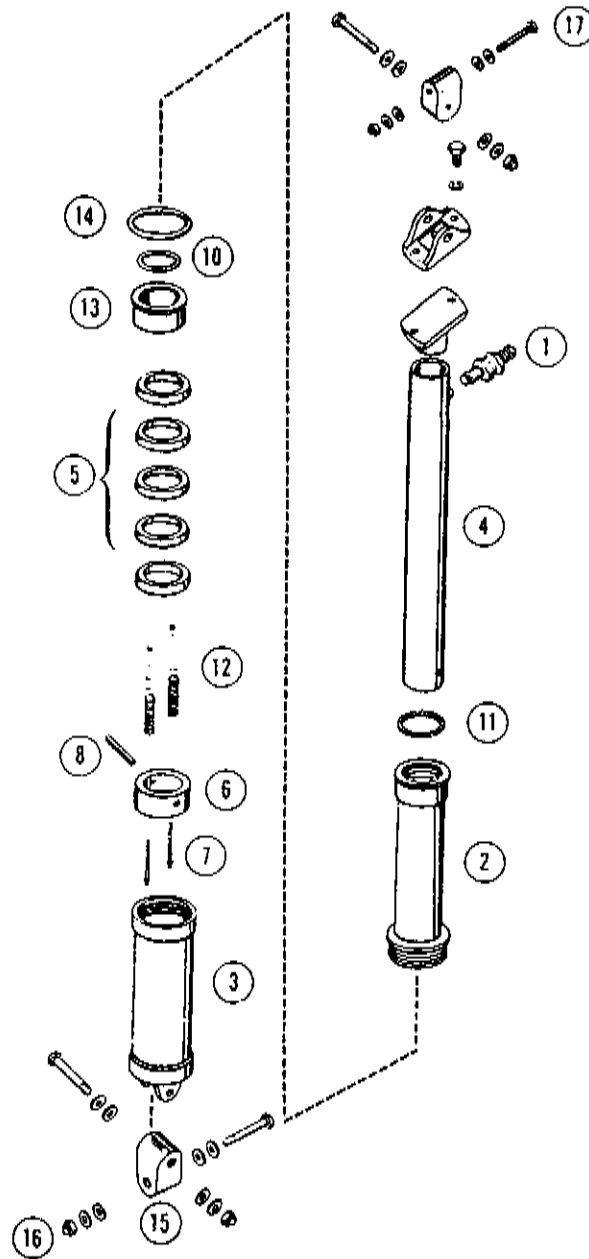
SUPPORT IN PROPER PLACE WHEN JACKING HELICOPTER FOR REMOVAL OF LANDING GEAR

Disassembly.

- a. Remove strut valve (1) from strut.
- b. Drain fluid from strut into pan.
- c. Unscrew seal housing (2) from cylinder (3) by using a strap wrench on the seal housing.

- NOTE:**
1. Place cylinder end of strut assembly in vise.
 2. When removing seal housing guide shaft from cylinder assembly, place strap wrench as close to threaded portion as possible.

Disassembly of Oleo Struts (Con't)



OLEO STRUT ASSEMBLY

Disassembly of Oleo Struts (Con't)

- d. Slowly pull piston shaft assembly (4) from the cylinder (3).
- e. Inspect rebound rings (5) for wear and piston (6) for wear.
- f. Check relief valve (7) and orifice holes for blockage.
- g. Remove pin (8), piston (6) and spacer (13). Then index mark by use of paint for reassembly.
- h. Remove seal housing guide shaft (2).
- i. Inspect the linear backup ring, linear "O" ring (10) and Victor "O" ring (14). Check the dry felt wiper (11). (Replace as necessary.)

NOTE: Replace piston shaft assembly (4) if chrome is pitted or scored.

- j. Check relief valve spring (12). Compression length should be 1.48" on the piston (6).

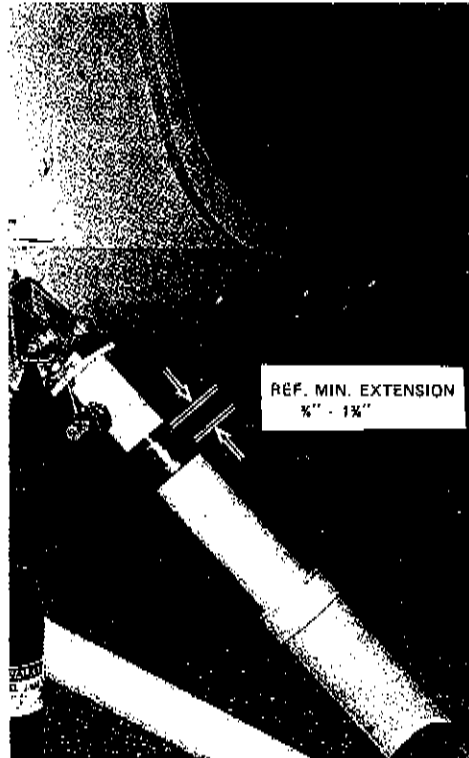
NOTE: Relief valve preadjusted at factory, do not field adjust.

Assembly.

- a. Assemble seal housing (2) with "O" ring, linear backup rings (10) and dry felt wiper (11).
- b. Place seal housing (2) on piston shaft (4) with wiper end first.
- c. Install spacer (13) with large shoulder end toward threaded portion of seal housing (2).
- d. Place five rebound rings (5) on, making sure to stagger the notches.
- e. Install piston assembly (6) per index mark, and insert pin (8).
- f. Install new Victor "O" rings (14) on seal housing (2) above the threads.
- g. Fill the cylinder (3) with MIL-H5606A hydraulic fluid (red).
- h. Slowly insert seal housing (2) and piston assembly into cylinder (3).
- i. Observe that the rebound rings (5) are staggered while inserting.
- j. Place strap on seal housing assembly (2) and tighten.
- k. Fully extend the strut and lay horizontal with valve boss (1) upwards.
- l. Fill strut through valve boss with hydraulic fluid MIL-H5606A.
- m. Slowly fully collapse the strut assembly while horizontal, allowing excess fluid to drain out of strut while air valve boss is upward.
- n. With strut in collapsed position, install strut valve and safety.
- o. Pressurize with air approximately 325-375 PSI.

Installation. Install oleo strut on landing gear and secure at upper and lower attach points. Lower helicopter on skids.

NOTE: Rock the helicopter to distribute the weight evenly between the struts. Check the oleo extension for $\frac{3}{4}$ " to $1\frac{1}{4}$ " from red line; if the extension is within this range the pressure is correct.



Servicing.

NOTE: It is imperative that the air pressure be maintained at a level sufficient to prevent the struts from bottoming when the helicopter is run up on the ground.

Inspections. Inspection of the oleo extension is mandatory on all preflights. Wiping the exposed oleo extension daily will extend the service life of the external "O" rings.

STRUCTURE

CORROSION CONTROL

INFORMATION

The airframe is fabricated of aluminum alloys and steel and should be checked regularly for any signs of corrosion, especially at the points of dissimilar metal contacts. Corrosion of dissimilar metals is the result of several conditions: lack of proper insulation at the point of metal contact, tears or punctures of the metal itself, and areas where the protective finishes have been scuffed, scratched, chipped, or worn off. To prevent corrosion resulting from action between the mating surfaces of dissimilar metals, certain precautions must be observed.

CORROSION PREVENTION--SALT WATER/HIGH HUMIDITY

The rotor craft should be washed every day when operating over salt water or when coming in contact with salt water. Washing should be accomplished at least twice a week in areas of high humidity. A constant watch for corrosion damage must be maintained.

CORROSION PROBLEMS IN AGRICULTURAL APPLICATION

Liquid fertilizer coming in contact with brass causes a chemical reaction that results in corrosion and rapid decomposition of the material. Further study indicates that the normal procedures used to retard or eliminate corrosion have little or no effect once the condition has started. Since control turnbuckles are made primarily of brass, this condition could prove extremely dangerous. A weekly inspection of turnbuckles is recommended, using at least a 10-power magnifying glass.

Any evidence of corrosion, no matter how small, is reason for replacement of the part.

Many agricultural chemicals are quite corrosive to most metals. Fortunately, however, only a few severely attack the lightweight metals on aircraft, and this occurs primarily when inadequate care is taken in cleaning the aircraft and equipment daily.

The helicopter and the agricultural spray kit are designed and protected to minimize corrosion. However, it is emphasized that the prevention of corrosion rests with the operator of the equipment. The equipment should be completely cleaned after each day of work by washing with a pressure washer, using a cleaning and neutralizing agent, and then flushing with clear water.

NOTE: Most fertilizers need more than the usual attention, because of highly corrosive nature. Know the chemical makeup of material and clean equipment with necessary neutralizing agent.

Exterior Surface Touchup Treatment (Con't)

- d. Allow solution to remain on surface for approximately five minutes. Keep surfaces wet.
- e. Rinse thoroughly with clean water. Dry with a clean lintless cloth and air-dry completely.

Aluminum Alloy. Touch up surface as follows:

CAUTION: Do not use steel wool or emery cloth on aluminum surfaces.

- a. Wash affected area with a solution of mild soap and fresh water. Rinse area with clean water and wipe dry with a clean, soft lintless cloth.
- b. Apply chemical treatment, such as Alodine, Chromicoat, or Iridite, liberally with swab.
- c. Allow solution to remain on surface for not less than three minutes and not more than five minutes, or until surface changes to an amber to brown color.

NOTE: Avoid letting the chemical mixture dry on the surface. If it has dried, rewet the surface with the solution.

- d. Rinse treated surface with clean water. After rinsing, wipe off excess moisture with a clean, lintless cloth. Blow any moisture from joints or crevices with dry compressed air and allow to dry completely in open air.
- e. When area is completely dry, apply two coats of zinc chromate primer, allowing approximately 30 minutes between each coat.
- f. When second coat of zinc chromate primer is dry, apply one coat of matching finish.

NOTE: If the solution in Step B above, Specification MIL-C-5541, cannot be obtained, the procedures outlined in Steps E and F will serve as a temporary finish.

SURFACE TOUCHUP

Limited Anticorrosion Measures. The limited anticorrosion measures outlined here are to be used only in cases where the proper materials or equipment are not available.

WARNING: The limited anticorrosion measures apply to the airframe of the helicopter only. If a part is corroded too far to withstand normal loads before the aircraft can reach a major overhaul base, metal patchings will have to be performed on this part before the aircraft is in condition for flight.

Corrosion problems in Agricultural Application (Con't)

To prevent corrosion, it is essential that all metallic components of the helicopter be kept coated with paint. Particular care should be exercised to recoat areas in which the paint has been scratched or chipped off during maintenance procedures or the operation of the helicopter.

CORROSION ON ALUMINUM ALLOYS

Corrosion will not be present on aluminum surfaces that have a protective finish; however, corrosion will attack metal through cracks, scratches, etc., in paint. In such cases, the affected areas will generally be characterized by:

- a. A scaly or blistered appearance of the finish surface.
- b. A dulling and pitting of the area.
- c. Whitish powdered deposits.

NOTE: To differentiate between aluminum and magnesium alloy, apply one drop of ordinary battery acid to the surface of the metal being tested. (Apply by allowing to drop from a glass rod.) If the alloy is magnesium, a foaming or boiling action of the liquid, accompanied by a black discoloration of the metal, will immediately occur. If the alloy is aluminum, no reaction to the acid will be evidenced.

CAUTION: Do not apply battery acid to or near bolts, fasteners, seams, or flying surfaces. Immediately after completing the magnesium and aluminum test, wash the tested area with water to prevent burns and continued acid action on the magnesium.

CORROSION ON ALLOY STEELS

Corrosion will not normally be present on steel surfaces that have been painted; however, surfaces may corrode where moisture enters through cracks, scratches, etc., in the paint. Such corrosion will be characterized by:

- a. A reddish or brownish blistered appearance in the corroded area.
- b. Blistering of the painted surfaces.

EXTERIOR SURFACE TOUCHUP TREATMENT

Steel Alloy. Touch up surfaces as follows:

- a. Remove loosely adherent paint and corrosion product by scraping area with a sharp phenolic scraper or heavy fiber brush.
- b. Wash area with mild soap and clean fresh water; rinse thoroughly.
- c. Treat surface with Turco WO-1, Pre-paint, or equivalent.

Surface Touchup (Con't)

- a. Examine part or area in question for extent of corrosion.
- b. Remove loosely adherent paint and powdery products of corrosion by scraping or brushing area.
NOTE: Use a sharp phenolic scraper or a heavy fiber brush to clean affected areas.
- c. Wash off the areas with mild soap and clean fresh water; rinse thoroughly.
- d. Dry surface and paint it with two coats of zinc chromate primer.
- e. Apply finish coat of enamel, if available.
- f. If none of the above protective coatings are available, apply corrosion-preventive compound, or apply grease liberally to affected areas.

NOTE: All new ships are provided with an alumagrip finish. Contact factory for primer and touch up kits.

1

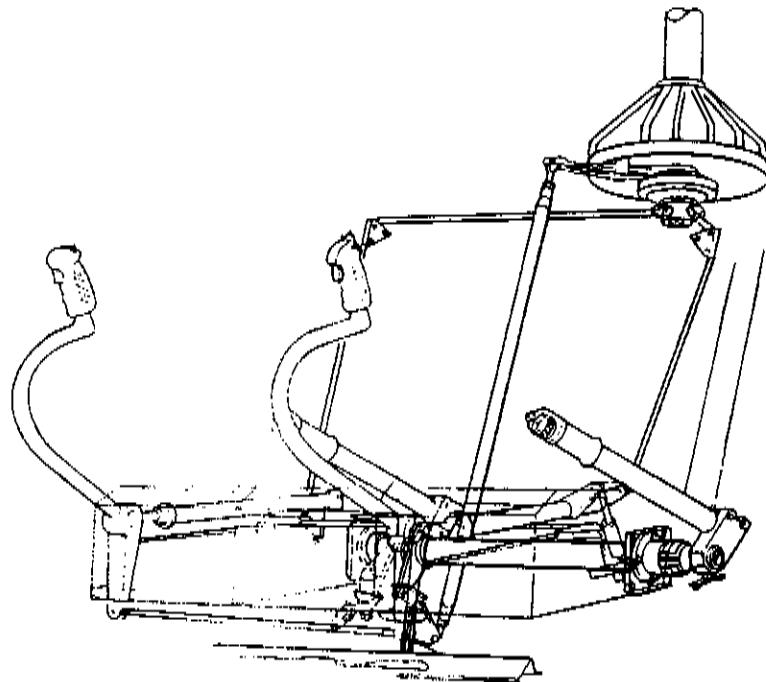
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3

FLIGHT CONTROLS

DESCRIPTION

The F-28A Helicopter is controlled in flight by the collective pitch control stick, throttle, cyclic pitch control stick and tail rotor pitch control foot pedals. (See below) These controls are installed for operation from the left-hand pilot seat. A dual control kit (optional) permits co-pilot's operation from the right-hand seat. The collective pitch control stick causes the helicopter to climb or descend as the stick is raised or lowered. The throttle is used independently by turning the grip. The cyclic pitch control stick controls forward, aft, left and right motion of the helicopter. Longitudinal control is obtained by moving the cyclic stick in a forward or aft direction; lateral motion is obtained by displacement of the stick to the left or right. Longitudinal and lateral trim is electrically controlled from a switch on the cyclic stick. The tail rotor pitch control foot pedals vary the thrust of the tail rotor, which results in a change of heading of the helicopter by increasing or decreasing the anti-torque effect of the tail rotor.

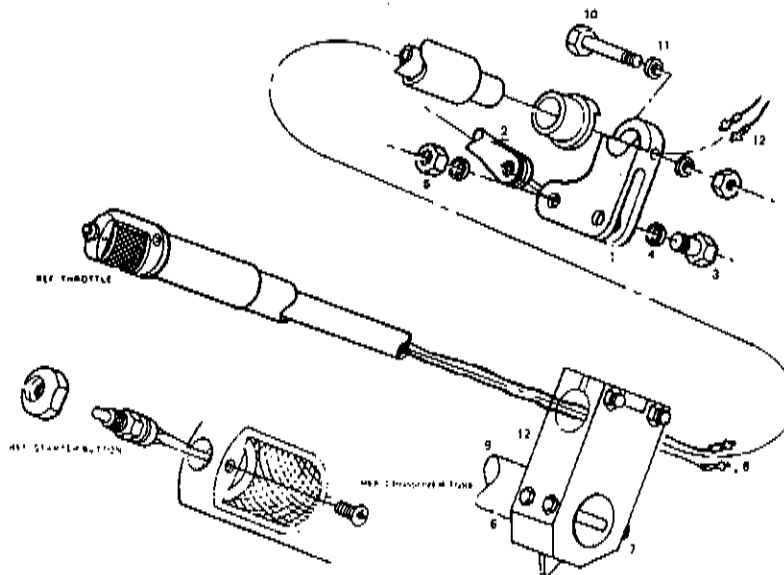


PILOT'S COLLECTIVE CONTROL STICK

Removal. (Ref. Section 5-42 and Page 11-2.)

- a. Remove seat assembly.
- b. Disconnect throttle flex cable from collective bellcrank (1) by removing bolt and nut.
- c. Disconnect co-pilot's throttle rod (2) from pilot's collective bellcrank by removing one bolt (3), nuts (4) and washers (5).
- d. Remove bolt (10), washers (11) and nut (12) from bellcrank (1).
- e. Disconnect two bolts (6) and nuts (7) which secure collective bracket and stick assembly to crossover tube (9).
- f. Disconnect two electrical terminals (8).
- g. Remove collective assembly outboard (12).

NOTE: Do not disturb jam nut on throttle clevis as this will alter throttle adjustment.



Installation.

- a. Install collective assembly inboard (12).
- b. Connect two electrical terminals (8).
- c. Connect two bolts (6) and nuts (7) which secure collective bracket and stick assembly to crossover tube (9).

- d. Connect co-pilot's throttle rod (2) to pilot's collective bellcrank (1) by installing one bolt (3), nut (4) and washers (5).
- e. Connect throttle flex cable to collective bellcrank by installing bolt and nut.
- f. Reinstall bolt (10), washers (11) and nut (12) in bellcrank (1).
- g. Install seat assembly.

NOTE: Run up engine after installation of collective stick and check for proper throttle operation prior to flight.

COLLECTIVE PITCH CONTROL STICK

The collective pitch control stick, when moved upward, increases the pitch of all three main rotor blades simultaneously and to the same degree. Movement of the stick in the downward direction decreases the pitch. Increasing the collective pitch increases the lift of the rotor blades; and, consequently, the helicopter climbs. Decreasing the pitch decreases the lift of the rotor and permits control descend. The throttle control is incorporated into the collective pitch control stick. Operating friction of the collective stick may be varied to suit the individual pilot by means of a friction control device. Friction of the throttle grip is also adjustable. The engine starter button is located on the end of the pilot's collective stick. The co-pilot's collective stick, when installed, does not have a starter button. For quick removal pull pin "A" and pull stick from socket.

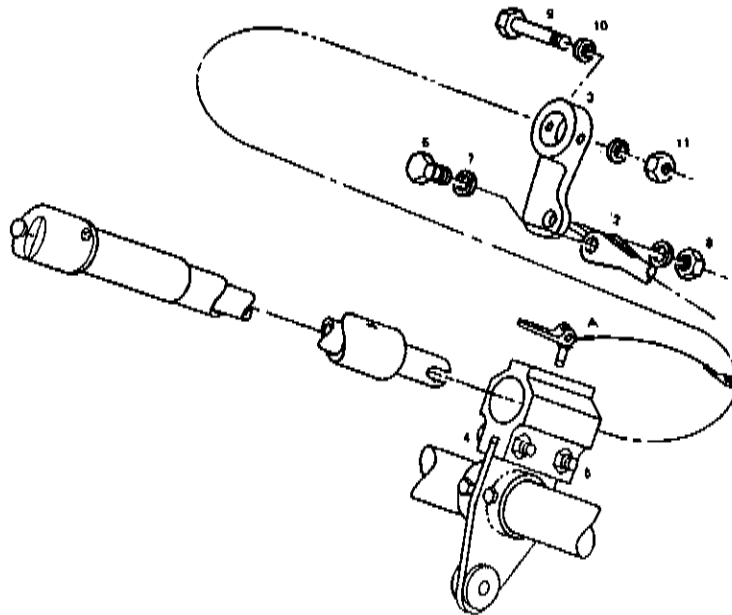
CO-PILOT'S COLLECTIVE CONTROL STICK

Removal. (Ref. Section 5-42 and Page 11-4 .)

- a. Disconnect throttle rod (2) between pilot's (1) and co-pilot's collective bellcrank (3) by removing bolt (6), washers (7) and nut (8).
- b. Remove two bolts (4) and nuts (5) from lower co-pilot's collective bracket and remove stick assembly.
- c. Remove bolt (9), washers (10) and nut (11) from bellcrank (3).
- d. Reinstall in reverse order.
- e. Install seat assembly.

NOTE: When removing hardware, attach to removable parts for ease of reinstallation.

NOTE: Inspect controls prior to flight.

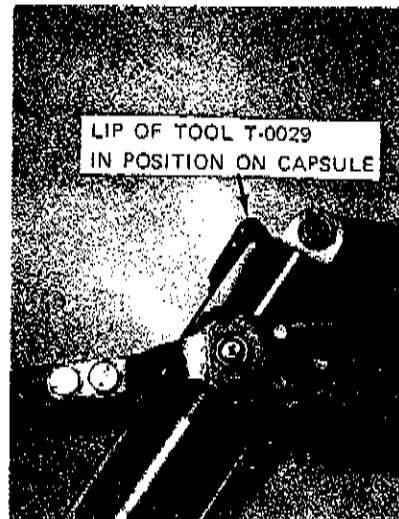
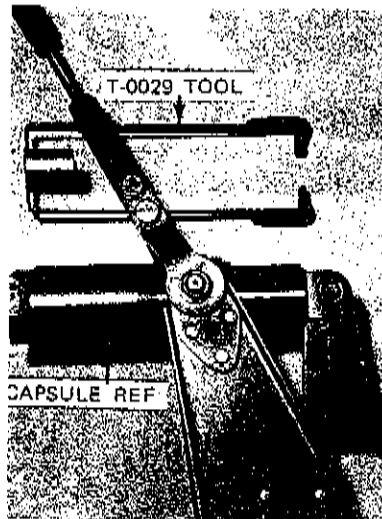


FLIGHT CONTROL SYSTEM

COLLECTIVE TRIM SYSTEM

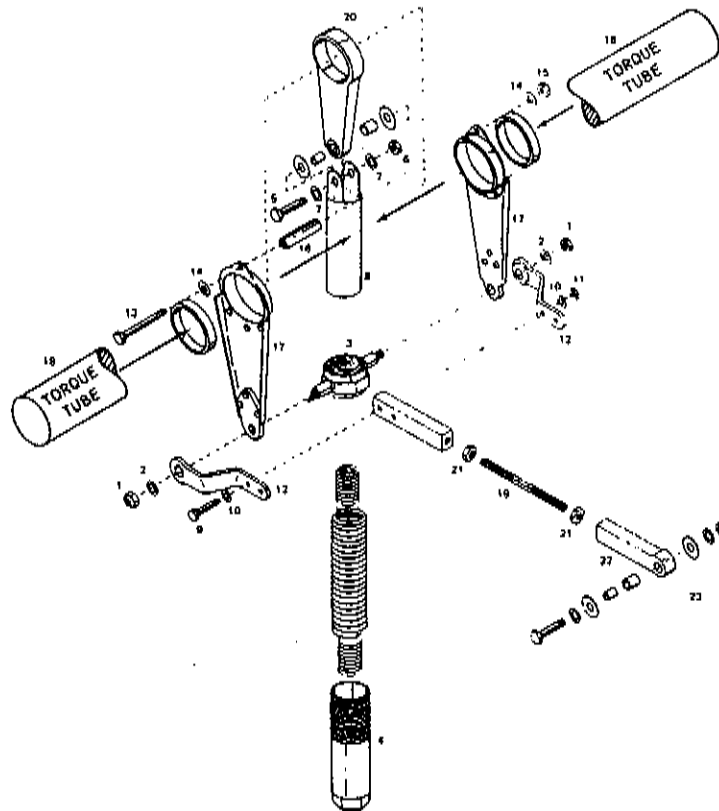
Removal.

- Remove seat deck and back fiberglass structure.
- Remove nuts (1), washers (2) from spring housing retainer (3).
- Using special tool No. T-0029, secure spring housing (4) in the compressed position between bottom of hex nut and top of piston.



CAUTION: Make sure it is secure, as spring is highly loaded. Place safety wire around top to hold in position.

- d. Remove bolt (5), nuts (6) and washer (7) from the top capsule (8).
- e. Remove bolts (9), washers (10) and nut (11) from brackets (12) and disassemble.
- f. Remove top retaining bolt (13), washers (14), nut (15) and spacer (16).
- g. Slide both pivot retainer straps (17) along the torque tube (18) and off the capsule pivots (3) as far as they will move and remove.
- h. Carefully remove spring housing capsule assembly.
- i. Place capsule assembly into vise in the compressed state and cut safety wire off (special tool) and slowly release the springs.
- j. Inspect and replace parts as necessary. Re-assemble and re-install in reverse order.
- k. To remove tie rod assembly (22) from seat structure, remove hardware (23).



Rigging.

- a. Remove seat deck and back fiberglass structure.
- b. Adjust tie rod (20) so that bellcrank (21) and pivot point of spring capsule (3) just go over center when collective stick is full down (static position).

NOTE: The adjustment in (b) acts as an over center lock to hold collective in down position.

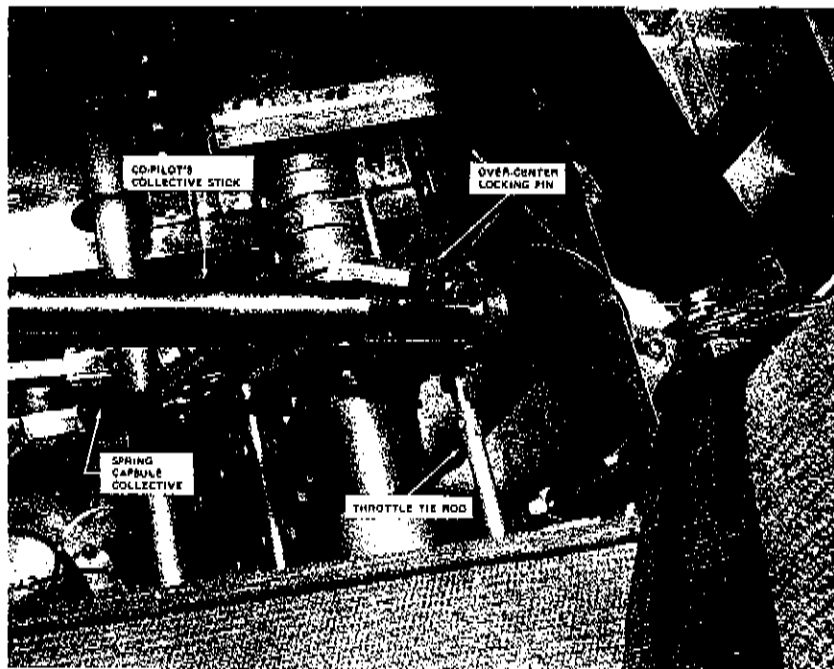
- c. Adjust spring retainer cylinder (4) in or out to balance out pilot's collective force load.
- d. Secure jam nuts (22) on tie rod (10).

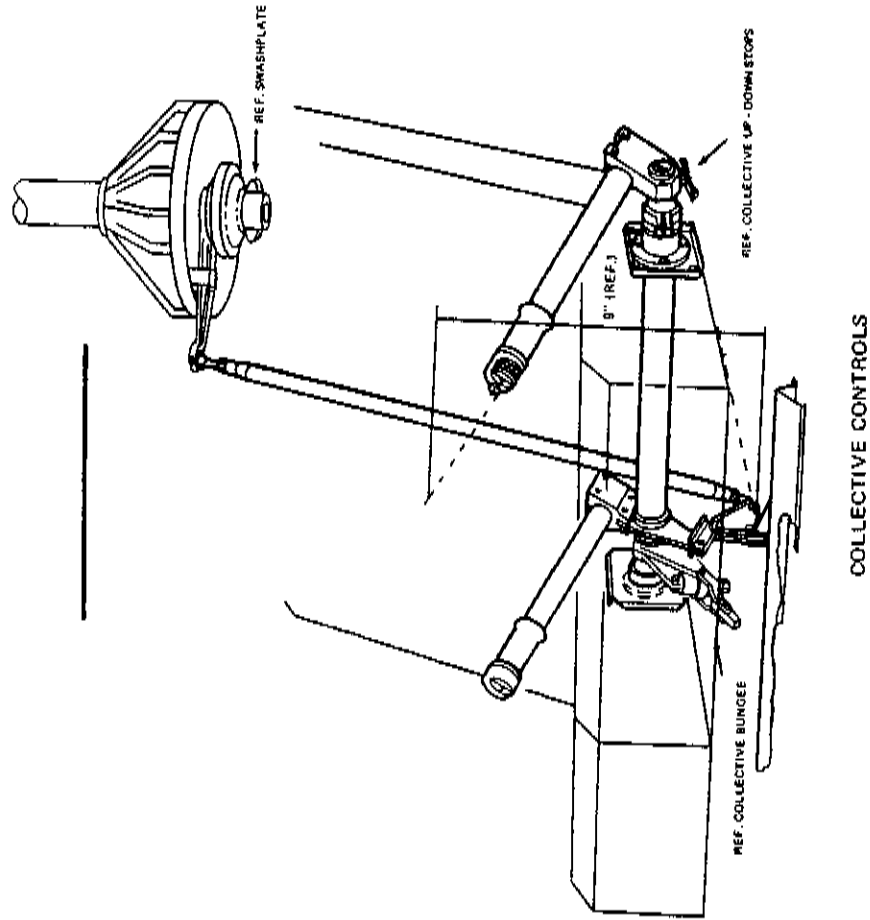
NOTE: Shorten tie rod (20) to achieve over center condition.

Installation. Installation of the trim mechanism is in reverse order of the removal. Lube springs before reassembly.

SPECIAL

CAUTION: When installing the spring retainer capsule assembly, while compressed, capsule is potentially dangerous. Handle with **EXTREME** care. There is approximately 180 lbs. of force exerted by the springs.





CYCLIC PITCH CONTROL STICK

The cyclic pitch control stick controls movement of the helicopter forward, aft, left and right while in flight. Longitudinal control is obtained by the forward or aft motion of the cyclic pitch stick, which causes the swash plate to tilt forward or aft, causing one complete cyclic pitch change of the rotor blades per rotor revolution. With the swash plate tilted forward, the rotor blades assume a higher pitch angle in the retreating sector of the plane of rotation of the blades, and a lower pitch angle to the advancing sector. This causes the blades to fly low in front and high in back, thus inducing a forward thrust component in the rotor system. This will cause forward flight at the desired speed when coordinated with the proper application of collective pitch and throttle. Rearward flight is similarly accomplished by moving the cyclic pitch stick in an aft direction. The cyclic pitch control stick has a grip that contains a cyclic trim switch.

Lateral control is obtained by displacement of the cyclic stick in a lateral direction, which inclines the swash plate laterally and brings about flight in a lateral direction. Displacement of the cyclic control stick to the right causes the helicopter to fly to the right and vice versa.

FLIGHT CONTROL SYSTEM

CYCLIC STICKS

Removal.

- a. Disconnect snap fasteners on stick boots.
- b. Remove cannon plugs from seat structure receptacle.
- c. Remove two each bolts (1) and nuts (2) from control stick.
- d. Remove stick assembly.

Installation.

- a. Install stick assembly.
- b. Install two each bolts (1) and nuts (2) to control stick.
- c. Install cannon plugs to seat structure receptacle.
- d. Connect snap fasteners on stick boots.

NOTE: Inspect all controls for security prior to flight.

CONTROL SYSTEMS

CYCLIC CONTROLS

Lateral and Longitudinal Trim Motors Removal.

To remove the lateral trim motor:

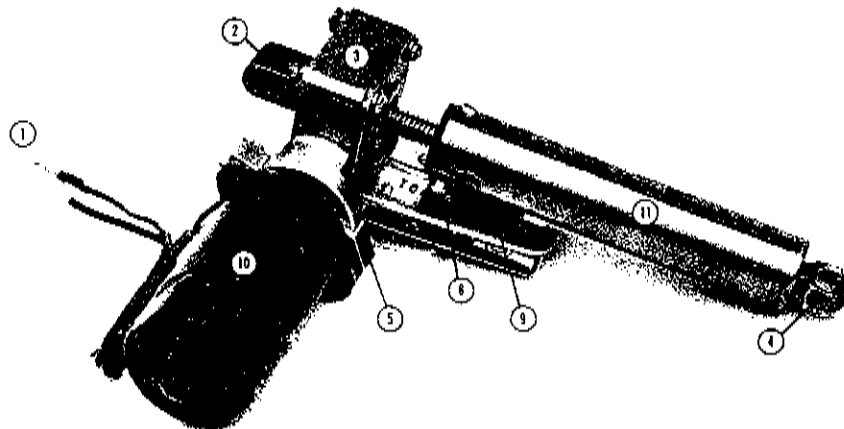
- a. Remove fiberglass seat cover to gain access to top of trim motor.
- b. Disconnect the two wires from the trim motor to ship's system (black and green) (1).
- c. Disconnect the hardware (2) from the fixed end of the trim motor housing (3).
- d. Disconnect the hardware from the piston end of the trim motor assembly (4).
- e. Remove lateral trim motor assembly.

To remove the longitudinal trim motor assembly:

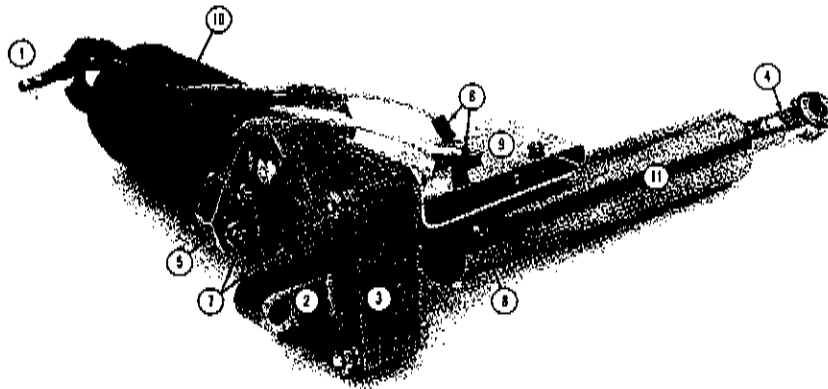
- a. Remove fiberglass seat cover to gain access to top of trim motor.
- b. Disconnect the two wires from the trim motor to ship's system (black and green) (1).
- c. Disconnect the hardware (2) from the fixed end of the trim motor housing (3).
- d. Disconnect the hardware from the piston end of trim motor assembly (4).
- e. Remove trim motor assembly.

If trouble-shooting proves trim motor is inoperative, remove trim actuator assembly and remove and replace motor as follows:

- a. Disconnect hardware (5) in two places.



LATERAL AND LONGITUDINAL TRIM MOTOR ASSEMBLY



LATERAL AND LONGITUDINAL TRIM MOTOR ASSEMBLY

- b. Disconnect wires (6).
- c. Remove the trim motor (10).

If trouble-shooting indicates the problem is with the microswitch operation, remove actuator assembly as described above, and:

- a. Remove microswitch assembly (9) from housing assembly (3) by removing two screws (7), two screws (8) and electrical connection (6).
- b. Re-install microswitch assembly (9) on housing assembly (3) by installing the two screws (7), two screws (8) and hooking up (Red and Yellow) wire (6) from microswitch assembly to motor (10).

If trouble-shooting indicates the problem is with the cyclic grip lateral and longitudinal trim switch, remove the stick grip assembly and wiring as follows: (Ref. page 11-12).

- a. Remove cannon plug from seat structure.
- b. Remove bolt that attaches stick grip and switch assembly to cyclic stick.
- c. Remove grip from top of cyclic stick to expose electrical connections. It will be necessary to lift and rotate the stick grip upward while feeding the electrical wiring bundle through the lower portion of the cyclic stick.
- d. Break the electrical connections on all wires and remove grip.

NOTE: Identify each wire as it is separated as this will aid in reconnecting the electrical wires from the bundle to the new cyclic stick grip.

- e. Reinstall in reverse order.

- f. Turn master switch ON and check the operation of the lateral and longitudinal trim actuators prior to assembling seat structure and flight test.

If trouble-shooting indicates a mechanical malfunction in the trim motor assembly, remove the assembly and:

- a. Remove the following:
 - Trim motor (10).
 - Electrical microswitch assembly (9).
- b. Replace trim motor housing (3) and spring housing assembly (11) as a unit.
- c. Assemble trim motor (10) electrical microswitch assembly (9) to trim housing assembly (3) and hook up wiring as removed. (Ref. Electrical Diagram in ELECTRICAL SECTION (9) page 14.
- d. Install lateral or longitudinal trim motor assembly in reverse procedure as removed.
- e. After installation of either of the trim motor assemblies and prior to installing seats, make complete final inspection of trim motor area, inspecting for any loose bolts, or washers that may have dropped in the area. Turn master switch ON, and activate switch on cyclic stick to see that the trim motors operate in all modes prior to flight test.

FLIGHT CONTROL SYSTEMS

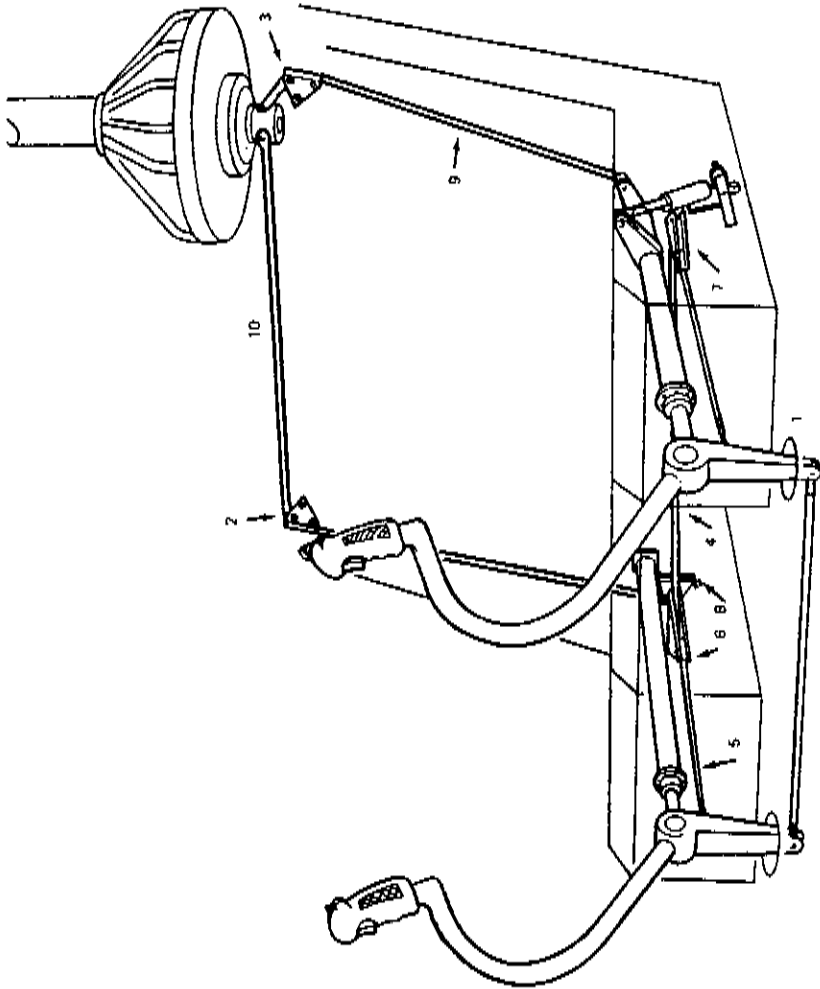
CYCLIC AND COLLECTIVE CONTROL RIGGING PROCEDURE

Ship level with reference to bottom bay of pylon, blades at 0° lag. Main rotor shaft 2° forward and 2° left.

To check the rigging on the F-28A Helicopter or to alter the rigging, proceed as follows:

- a. Remove seat back, back molding and side cowl panels.
- b. Install pilot's cyclic rigging fixture tool No. T-0030 to establish neutral position (1).
- c. Disconnect bellcranks (2 and 3) on top of firewall at swashplate side.
- d. Adjust lateral rod (4) and fore and aft push rods (5) so that bellcranks (6 and 7) are parallel to center line of ship, and adjust bellcrank (8) in a vertical position. (Use longitudinal bulkhead for reference line.) (Basic setting at factory)
- e. Adjust the two vertical rods (9) so as to position the back side of the bellcranks (2 and 3) parallel to back of cabin.

NOTE: Bellcranks 2 and 3 should not hit mounting bracket located on firewall.



CYCLIC CONTROL SYSTEM

- f. Remove cyclic rigging fixtures and cycle sticks in forward, aft, and lateral positions and check for freedom of travel.

NOTE: If no further adjustment is necessary, secure all jam nuts on control rods, and check for proper rod and thread extension.

- g. Reinstall pilot's cyclic rigging jig.
- h. Install swashplate rigging jig, Tool No. T-0031.
- i. Adjust rods (10) so as to connect to bellcranks (2 and 3) and secure with bolts and nuts.

NOTE: Check the three vertical rods in mast to see that they are the same length at top of hub. (Ref. Pg. 11-14.)

- j. Hook up the three vertical rods (32) to walking beams (35) at top of rotor head. (Ref. Pg. 11-16.)

NOTE: When working on rotor head, place rag (red) in top of main rotor shaft to preclude the possibility of dropping hardware in shaft.

- k. Recheck level of helicopter with use of protractor on left-hand lower pylon longeron.

- l. Set down stop of pilot collective control to approximately 9" from center line of starter button on end of collective to floor line.

NOTE: By the use of a protractor placed on top of the pilot's collective, you should obtain a reading of approximately 20° pitch with reference to floor line. (Ref. Pg. 11- 2.)

- m. Hook up the three link rods between the walking beams and the bracket attached to the retention assemblies.

- n. Position each retention assembly at right angles to the mast (3 o'clock position) 90° to right side of ship.

- o. Place protractor on blade retention assembly.

NOTE: Always position at same spot on all retention assemblies and adjust pitch links to achieve the position +6.25° ±.75° angle of incidence on the retention assembly.

- p. Repeat this procedure on each retention assembly.

- q. Lift pilot collective stick and adjust the up stop to a positive +17.25° ±.75° on retention assembly to achieve a total travel of between 10° and 11°.

NOTE: Remove rigging fixtures. Check rods (10) for pylon clearance, and check distance between bottom of swashplate and top of engine baffle for clearance.

- r. Rotate cyclic control through a 360° azimuth with collective up and down position and check for freedom of movement.

- s. Reinspect entire system for security.

CYCLIC AZIMUTH CHECK – VERIFICATION OF RIGGING

- a. Position collective down against stop and cyclic forward against stop.
- b. Check blade pitch at root retention plates with blade to right at right angles to ship (3 o'clock position) fore and aft centerline
90° azimuth = $-2.5^\circ \pm .75^\circ$.
- c. Position cyclic AFT against stop.
- d. Check blade pitch at root retention plates with blade to right at right angles to ship (3 o'clock position) fore and aft centerline
(90° azimuth) = $+14.25^\circ \pm 1^\circ$.
- e. Position cyclic right against stop.
- f. Check blade pitch at root retention plate with blade positioned approximately 7° to right of forward centerline position (173° azimuth) = $+14.25^\circ \pm 1^\circ$.
- g. Position cyclic left against stop.
- h. Check blade pitch at root retention plate with blade forward and 7° to right as before = $-2^\circ \pm 1^\circ$.

NOTE: Track the helicopter per following information.

NOTE: When working on rotor head, place rag (red) in top of main rotor shaft to prevent the possibility of dropping hardware down shaft.

SWASHPLATE ASSEMBLY**DESCRIPTION**

Each of the three main rotor blade assemblies is attached to the outboard blade retention assembly by a high-strength vertical bolt. By actuating the cyclic or collective controls, the pilot changes the tilt of the non-rotating plate assembly, which is located above the engine compartment. A rotating swashplate follows the tilt of the non-rotating swashplate. Three push-pull rods are enclosed in the mast assembly, and link the walking beams on top of the rotor hub to the rotating swashplate and vary the pitch angle of the main rotor blades.

REMOVAL

To remove the swashplate assembly with main rotor transmission installed, first remove the lower swashplate assembly to inspect and replace bearings as necessary. Proceed as follows:

NOTE: Index mark all parts before separating to aid in reassembly of swashplate.

- a. Remove both side panel cowls.
- b. Drain fuel tanks.
- c. Remove one fuel tank.
- d. Disconnect the longitudinal and lateral cyclic rods (1) from bearing housing (2) on swashplate (7).
- e. Remove the three special bolts (3) and nuts (4) from dog legs (5).
CAUTION: Do not lose washers or spacers (6) on bolts (3) between dog leg (5) and swashplate, as they must be in the same location on installation.
- f. Cut safety wire and remove the six screws (8) and washers (9) from the upper universal half of swashplate (10).
NOTE: When removing, note alignment marks ("V") on upper and lower swashplate halves. This aids in reassembly.
- g. Lower and remove lower universal housing (7).
- h. Following the removal of the lower universal housing (7), disassemble as follows:
 - i. Disconnect the following hardware: cotter pin (11) and nut (12), washer (16) from tie rod (13). Remove tie rod (13) from housing (10). When removing tie rod (13) the following parts should be removed: spacer (14) and washer (15).
 - j. Remove shaft (17) from universal housing (7) by first removing cotter pin (18) and nut (19), washers (20 and 21) and one sleeve (22) and bearing (23).
 - k. Remove hardware, consisting of cotter pin (24), washer (25), and nut (26) from bolt (27) that secures the lower bearing housing (10). Remove bolt (27) and washer (30).
 - l. Remove retaining ring (28) from lower bearing housing (2).
- m. Press bearing (29) out of bearing housing (2).

IMPORTANT

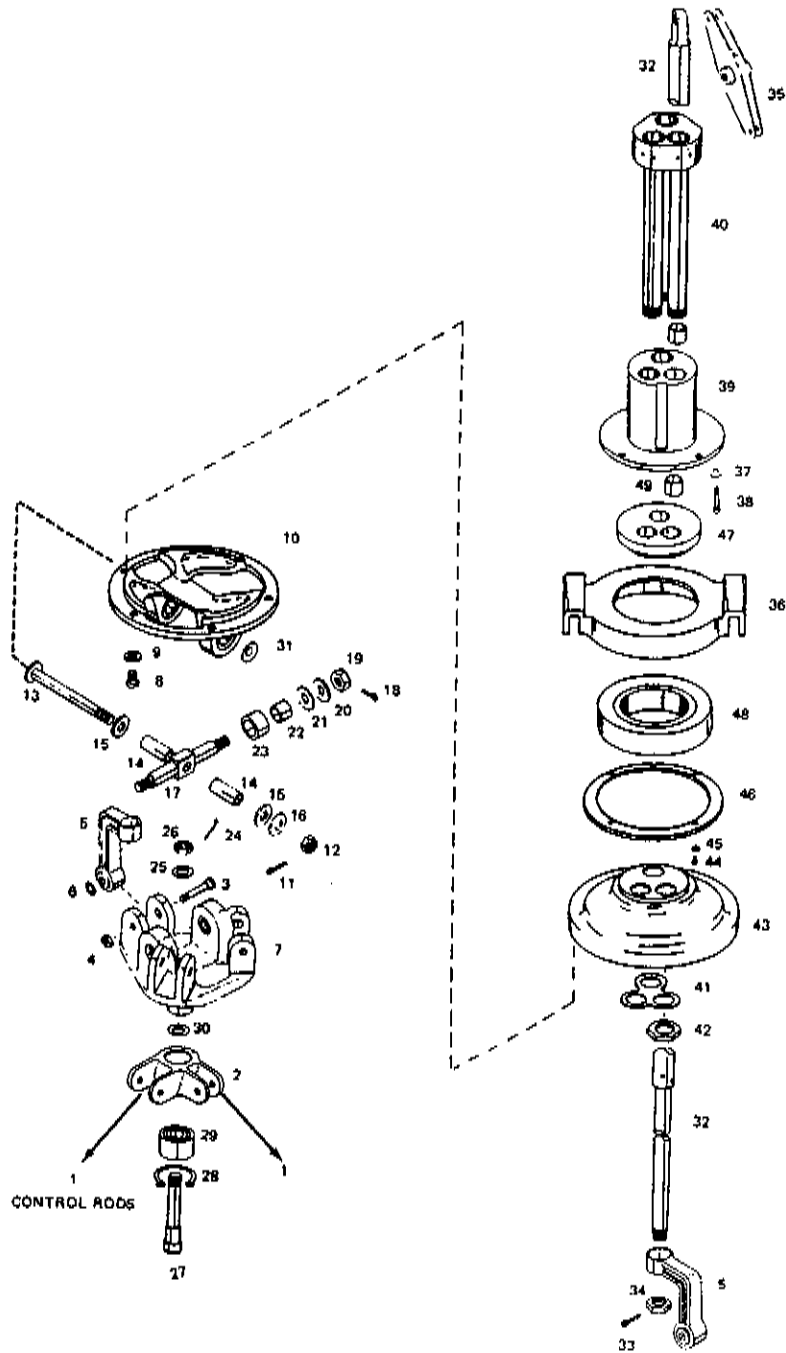
NOTE: The bearing (19) must be replaced at 1200 hours.

INSPECTION OF LOWER SWASHPLATE ASSEMBLY

Following disassembly of the lower swashplate unit, perform the following inspections and replace all parts as necessary.

- a. Check the four DU bearings (23 and 31) for galling, excessive looseness or roughness. Replace as necessary.

NOTE: If it is necessary to replace DU bearings, press sleeves (22) out of housing assembly (7) and press DU bearings (23) out of sleeve (22).



- b. Inspect tie rod (13) and shaft (17) to see that they move easily in the DU bearings without any excessive binding before assembly.
- c. Check the lower bearing (29) for galling or roughness and replace if necessary. See NOTE Page 11-15.

ASSEMBLY OF LOWER SWASHPLATE UNIT

- a. After inspection of lower universal housing unit for cracks and a check of all attaching hardware, proceed to assemble in the reverse order or removal, paying particular attention to inspection notes as stated above for ease in reassembly.
- b. After assembly of tie rod (13) and shaft (17), check for freedom of operation and rotational movement.
- c. Following final inspection of this unit, set aside until the upper universal housing assembly (10) is removed, disassembled, inspected and reinstalled, after which the lower universal housing (7) may be installed.

REMOVAL AND DISASSEMBLY OF UPPER SWASHPLATE UNIT

NOTE: Index each dog leg (5) to its respective push rod assembly (32) before removal.

- a. Remove cotter pins (33) and shear castle nuts (34) from bottom of push-pull tube (32) and remove the three respective dog legs (5) with the use of special tool No. T-0045.
- b. Disconnect walking beams (35) from push-pull tubes (32) at top of mast and remove push-pull rods (32) from the top of mast.

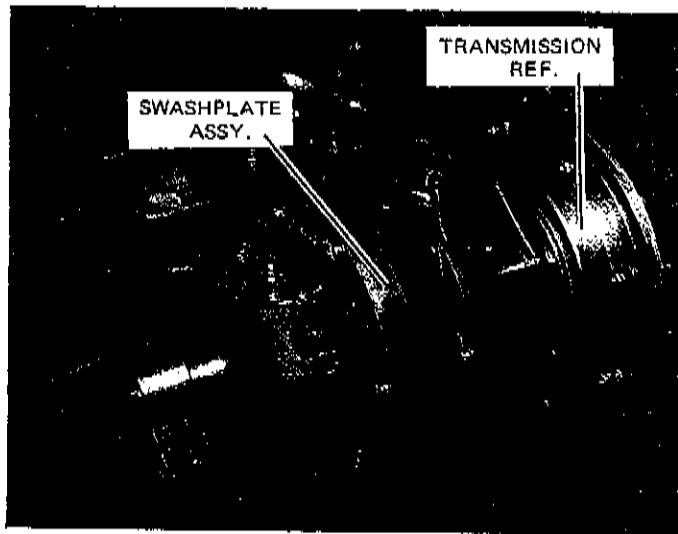
NOTE: Index mark walking beams to respective push-pull rods for ease in installation.

After removal of push-pull tubes (32), attach each respective dog leg (5) and nuts (34) to push-pull tubes (32) for ease in reassembly.

- c. Disconnect collective walking beam (35) at transmission pivot point, at firewall push-pull tube and at bearing housing (36).
- d. Remove the three bolts (37) and washers (38) from housing and bearing assembly (39). This will allow retainer guide shaft assembly (40) and bearing housing assembly (39) to be removed as a unit. Following removal of this unit from lower mast assembly, continue process of disassembly.
- e. Disengage the lock plate (41) that holds the three nuts (42) in place on the underside of the bell housing (43).
- f. Remove guide shaft (40), housing (39), and bearing housing (36).
- g. Cut safety wire and remove the six bolts (44) and washers (45) attaching retainer plate (46) to collective yoke bearing housing (36).

- h. Press out spacer (47) from bearing inter-race.
- i. Press bearing (48) out. This is a 1200 hour bearing.

NOTE: Be sure the same shim thickness is maintained upon reinstallation, 28-16125-3 or -4 or -5. A shim chart is part of the Maintenance Manual and all shims are color codes for thickness identification.



INSPECTION OF UPPER SWASHPLATE UNIT

- a. Inspect the six DU bearings (49) that are installed in the housing and bearing assembly (39). Check for looseness, galling, and replace if necessary.
- b. Inspect bearing (48) for any evidence of galling or roughness.
- c. Inspect entire housing assemblies for any cracks prior to reassembly.
- d. Check rivets in retainer and guide shaft assembly (40) for security.
- e. Inspect push-pull rods (32) for any evidence of scoring.
- f. Inspect bottom taper of push-pull rod for any evidence of pitting, fretting, or looseness between dog leg and rod.
- g. Inspect dog leg (5) rubber inserts, and replace if necessary.
- h. Check the four oilite bearings in support link assembly at walking beam attach point for excessive wear.
- i. Check the two bushings in walking beam for galling and fretting.

ASSEMBLY OF UPPER SWASHPLATE UNIT

- a. Following inspection of entire swashplate assembly and replacement of parts as necessary, reassemble upper swashplate unit in reverse order of disassembly and reinstall in lower part of mast.

NOTE: Reference standard torque values except for dog leg taper 140 in./lbs, and walking beam Push-Pull Rod End 40 in./lbs., Pitch Change Link 70 in./lbs., Pivot Point 40 in./lbs.

- b. Assemble lower universal housing assembly (7) to upper universal housing assembly (10).
- c. Following installation of push rods (32) from the top of mast down and after hooking up dog legs (5) in respective position as noted by alignment marks made on disassembly, check to see that there is no rubbing or cocking of the push-pull tubes at the dog leg attach points or at the upper walking beam attach points.
- d. After installation and inspection of main rotor control system for freedom of motion and proper travel, and all safety devices, that is, cotter keys and safety wire, are installed, install gas tank and hook up.
- e. After installation of fuel tank, turn on fuel valve and check for any leaks prior to starting ground run.
- f. After completing satisfactory ground run, reinstall left and right hand cowl, fill gas tanks to proper capacity, pre-flight helicopter and flight check.

MAIN ROTOR BLADE TRACKING PROCEDURE

Description. The three main rotor blades are tracked to each other before the helicopter starts its production flight test. Normally, it is necessary to track blades in service after a new part has been installed and the basic dimensions have been altered. If it is necessary to track the blades, proceed as follows:

- a. Install a tracking light (250 W) to ship's power source.
- b. Install reflectors on bottom of rotor blades at outboard end. Put reflector with bar on red blade facing inboard. This will be the master blade to which you will track the other two blades.
- c. Place one clear reflector facing inboard.
- d. Place one clear reflector facing outboard.

NOTE: Install reflectors parallel to blade tip.

- e. Start engine and with rotor engaged pull helicopter to a hover. Observe track of the one blade against the bar or master blade.
- f. Reverse the clear reflectors, hover helicopter and check track of the clear against the bar or master blade.

NOTE: If it is obvious that only one blade is out of track, land and correct the condition immediately by adjusting the pitch link of that blade. Reverse clear reflectors as necessary in order to observe the blade you are trying to adjust.

- g. Again hover helicopter and observe the tracking path.
- h. If the two clear blades are high or low compared to master blade, correct by adjusting master blade.

This would normally be the first adjustment made when starting the tracking procedure.

- CAUTION:**
1. It is important in tracking for hover condition that the blades be brought into track by utilizing the pitch link.
 2. If the helicopter has had maintenance that disturbed the rigging or a change of rotor or control parts, it may be advisable to zero out the trim tab settings before starting tracking procedure.
 3. Trim tabs are normally used to correct for out of track condition at cruise airspeed. Tab adjustment will primarily effect the track at the forward end of the tip path plane. Therefore the track condition in cruise should be viewed straight forward from the cabin.
- i. When hover track is satisfactory, fly the helicopter in a fast cruise and observe the track straight forward (12 o'clock position).
 - j. Complete flight and adjust track using trim tab only. Adjusting trim tab may tend to throw out track reading at hover. In this case, readjust with pitch link before readjusting tab again.

NOTE: Bending tab up causes blade to come up, and the reverse for down.

CAUTION: Use only 1° or 2° increments for tab bending. If more than 8° is necessary, check main rotor damper, binding in main rotor feathering axis, or deteriorated rubber in swashplate dog legs.

- k. Following completion of tracking procedure, all pitch links should be checked for tightness.
- l. Remove three reflectors.
- m. Rig helicopter for autorotation. Fly at 55 MPH indicated airspeed and approximately 2000 pounds gross weight (two persons plus fuel).

FLIGHT CONTROL SYSTEM

PROCEDURE FOR SETTING AUTOROTATIVE RPM

- a. Load helicopter with two people and full fuel. (2,000 lbs. gross wt. approx.)
- b. Enter autorotation at altitude adequate for stabilized autorotation at 58 MPH.
- c. Acceptable rotor RPM is 345 to 355; 350 to 360 with leading edge tape (standard day - sea level). For other than standard conditions the following corrections can be made:
 - 1,000 ft. increase in density altitude will increase the autorotative RPM by 5.
 - 1,000 ft. decrease in density altitude will decrease the autorotative RPM by 5.
 - 100 lbs. increase in gross weight will increase the autorotative RPM by 10.
 - 100 lbs. decrease in gross weight will decrease the autorotative RPM by 10.
- d. Adjust rotor RPM (if out of range) by turning rod end in pitch links (main rotor hub) in or out. One full (360°) turn of rod end (not pitch link barrel) will change autorotative rotor speed by 10 RPM.

MAIN ROTOR DRIVE SYSTEM

MAIN ROTOR DRIVE SYSTEM VIBRATION TROUBLESHOOTING CHART

- | | |
|--|--|
| a. Vertical Vibration | <ol style="list-style-type: none"> 1. Track 2. Tab out of adjustment 3. Worn dog legs 4. Damper 5. Grip binding - grease 6. Worn rod ends 7. Lamiflex bearing bad |
| b. Lateral Cyclic Feedback | <ol style="list-style-type: none"> 1. Excessive tab 2. Grip binding 3. Lamiflex bearing bad 4. Binding in swashplate "U" joint 5. Bad pitching moment in blade |
| c. Cyclic Whirl When Released - Flat Pitch | <ol style="list-style-type: none"> 1. Grip binding 2. Lamiflex bearing bad 3. Track 4. Blade pitching moment |
| d. Shuffle, 1-1 Fore and Aft | <ol style="list-style-type: none"> 1. Damper |

MAIN ROTOR DRIVE SYSTEM VIBRATION TROUBLESHOOTING CHART (Con't)

- | | |
|--|---|
| e. Medium Frequency
Vibration (2365RPM) | <ol style="list-style-type: none"> 1. Tail rotor gimble bearings 2. Tail rotor pillow block bearing or rubber insert 3. Tail rotor shaft alignment 4. Tail rotor balance |
| f. High Frequency
Vibration | <ol style="list-style-type: none"> 1. Belt roller too far away from belt 2. Idler pulley bearing 3. Cracked or missing belt material (irregular rumbling sound) 4. Jack strut bearings 5. Damaged or missing fan blade 6. Engine mounts bottoming or age hardened |
| g. Ground Bounce —
Flat pitch | <ol style="list-style-type: none"> 1. Damper rod end bad 2. Damper mounting bolts 3. Out of track 4. Hub plate bushing 5. Flat oleo strut |

Frequency Rates

Low	0-400 RPM
Medium	400-2500 RPM
High	2500-up RPM

FURNISHINGS

DESCRIPTION

The F-28A Helicopter is a three-place helicopter. The left hand seat is the pilot's seat; the right hand seats can be used by the copilot or passengers. The cabin section is constructed of molded fiberglass with an aluminum seat structure attached. A stainless steel firewall separates the engine compartment from the cabin section.

Rugs. Rugs are fabricated from a combination of nylon and wool and sprayed with fire retardant material, and secured to the floor by scuff plates and cyclic boot covers.

Scuff Plates. Scuff plates are fabricated of aluminum alloy and attached by six screws at each pedal assembly.

Cyclic Boot Covers. Cyclic boot covers are fabricated from nylon and wool material and attached by 13 snap fasteners on each stick.

Firewall Soundproofing. The firewall soundproofing is fabricated from nylon and wool accoustical material for sound suppression.

Collective Housing. The collective housing is fabricated from fiberglass and attached to firewall and floor by screws.

Seat Belts. One seat belt is supplied for the pilot and the other for the two passengers.

Seat Cushions. The foam seat cushions are covered with nylon and wool material and snapped onto the fiberglass seat structure.

Head Set Attachments. Head set attachments are two hooks secured to the firewall.

Head Set Jack Box. The dual jack box is located in the center of the firewall.

Document Holders. Document holders are provided by the manufacturer for necessary FAA documents.

Door Latching Mechanism. A flexible cable is attached to handles and an over center locking device latches door at lower door frame.

Cyclic Grip. The following controls are located on the grip:

A fore, aft, and lateral trim switch.

A two-position radio transmitter switch on the forward side of the grip.

Collective Stick. A starter button is located on the forward end of the stick.

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UTILITY SYSTEMS

CABIN HEATING SYSTEM

Warm air used for heating the cabin is derived from a heater shroud mounted on the collective exhaust stack muffler. The air enters this system from the engine cooling shroud and is conducted by a flexible hose to the heater shroud. From here, the air is directed to a heater valve mounted on the aft side of the firewall. This valve is connected to the cabin heat control and is used to regulate the airflow into the cabin area. A diffuser outlet is located in the center of the cabin floor just forward of both pilot and passengers, and gives adequate heat for all kinds of weather. The control is located on the left-hand side of the pilot's seat. The pilot may vary the temperature by pushing in to the OFF position or out to the ON position. When the control is in the OFF position, the hot air is discharged through a hot air deflector on the bottom cowl of the helicopter.

Heater Shroud. The muffler is enclosed by a heater shroud. Air flowing through the heater shroud is warmed by its passage around the muffler.

Remove the shroud cover assembly from the muffler, and inspect for any cracks that are evident in either the muffler or the shroud, either weld the exhaust stacks in an approved manner as certified by FAA or repair the muffler assembly under standard FAA regulations.

NOTE: See F-28A INSPECTION SHEET.

At the same time, it is important to check the inlet and outlet flex lines for cracks.

Valve Assembly. To remove the heater valve assembly in case of malfunction of the control valve, use the following procedure:

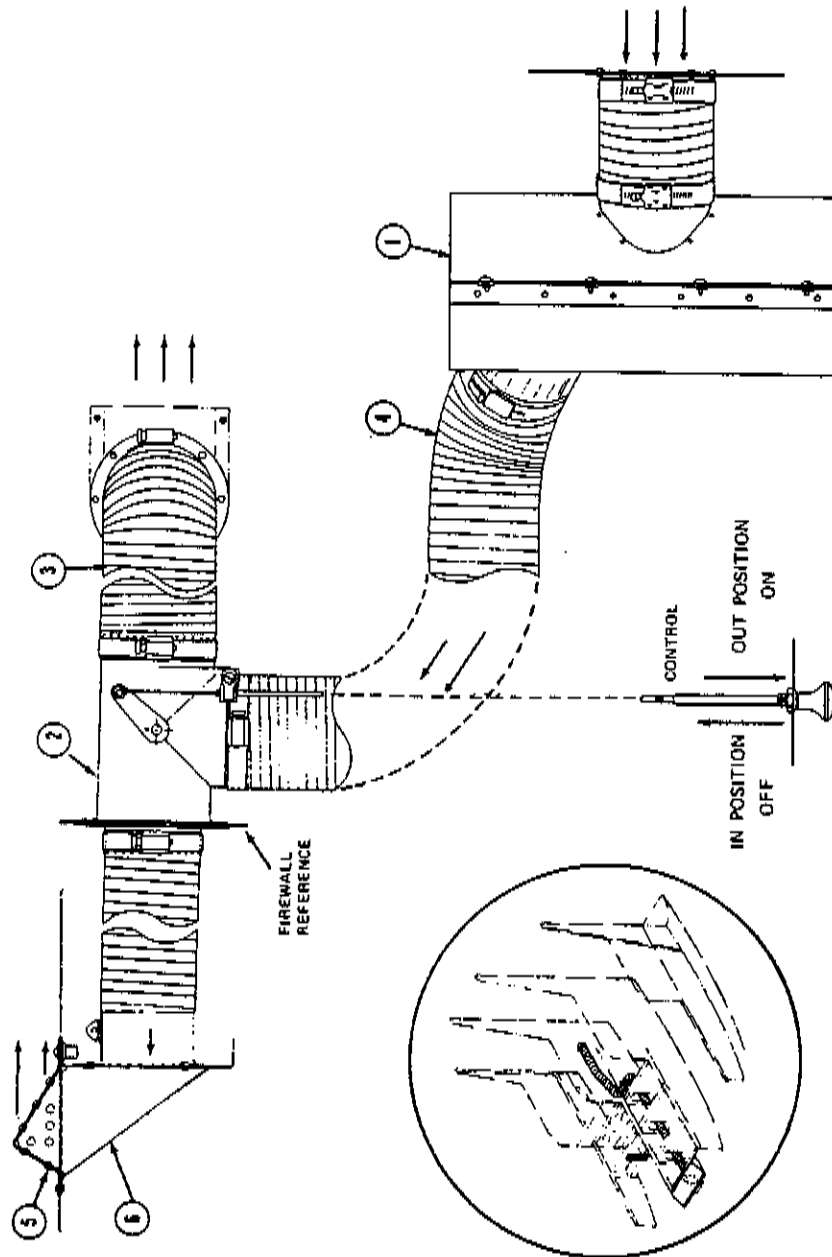
- a. Open the right side panel and lower cowl to gain access to the control valve located on the firewall (4).
- b. Disconnect the flex line (5) attaching to the valve assembly, and disconnect the flex line (3) on the inlet side of the valve.
- c. Operate control through full range and observe the travel of valve by looking in exit hole with hose (5) removed.
- d. If control does not move through its full close and open range, disconnect control valve flex line at heater valve, and replace unit or repair as necessary.
- e. If it is necessary to remove the diffuser outlet (7) in the cabin, you may do so by removing the screws that attach it to the cabin floor and to the duct assembly (8).

CAUTION: It is important that during cold weather a thorough pre-flight be given of the heater system for any leaks.

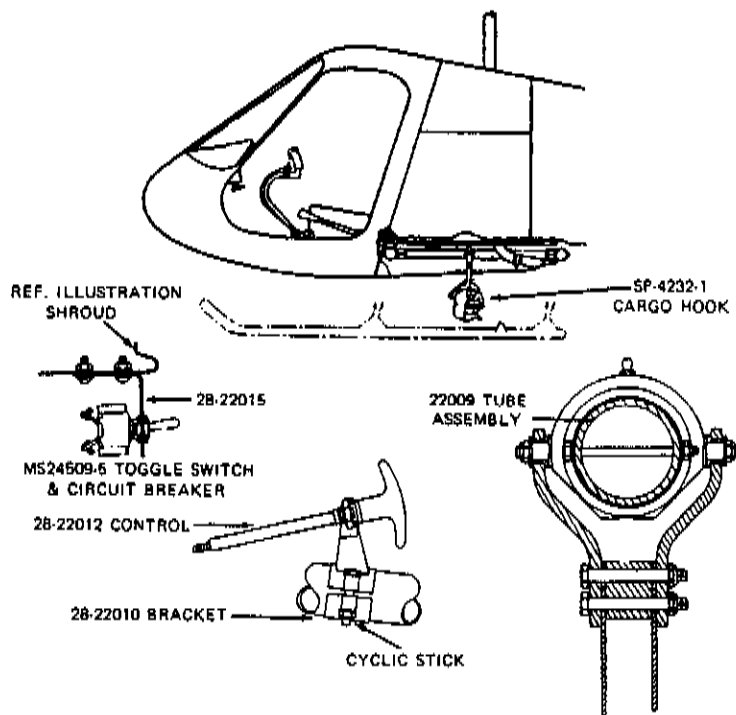
NOTE: See Trouble Shooting Guide.

TROUBLE-SHOOTING CABIN HEATING SYSTEM

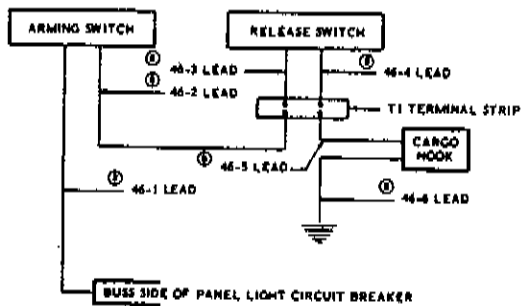
TROUBLE	PROBABLE CAUSE	CORRECTION
Exhaust fumes enter cabin when cabin heat is applied. Insufficient heat.	Hole in exhaust stack or muffler. Flexible hoses forward of firewall off or loose. Control linkage disconnected or loose. Defective heater shroud.	Replace stack muffler or weld. Connect hoses and secure with clamps. Connect linkage properly. Replace or repair heater shroud.
	Defective valve assembly.	Replace or repair valve assembly.



CABIN HEATING



WIRING DIAGRAM



NOTE: WIRING TO BE DONE IN ACCORDANCE WITH AC43.13-1
(FAA ADVISORY CIRCULAR) - CHAPTER II.

LEAD WIRE TO MEET MIL-W-5086

INSTRUMENTS

INSTRUMENT PANEL

Description. The horizontal instrument panel is centrally located in the front of the cabin for optimum visibility by either pilot or copilot. Instruments and switches located on the instrument panel are as follows:

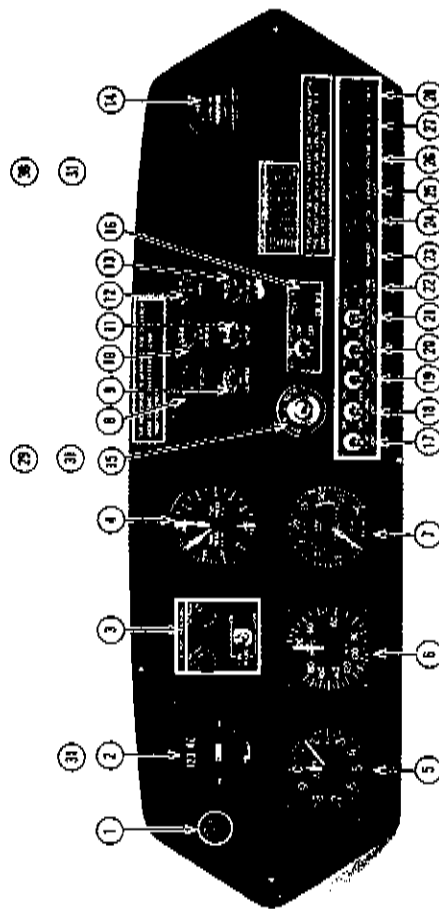
1. **Radio Circuit Breaker.**
2. **Radio.**
3. **Auxilliary Fuel Pump Switch.** The fuel booster pump switch and fuel pressure warning lights are located adjacent to the manifold pressure and fuel pressure gages.
4. **Combination Fuel Pressure and Manifold Pressure Gage.** The fuel pressure gage is connected to the flow divider and indicates the pressure in the fuel lines in pounds per square inch. The manifold pressure gage is connected to No. 3 cylinder, and indicates power being used.
5. **Altimeter.** The altimeter indicates the height of the helicopter above sea level. The altimeter is operated by static air pressure derived from the airspeed pitot-static system. The altimeter is of the sensitive type that provides a distance-height reading from 0 to 25,000 feet. The long hand in a single complete sweep of the dial totals 1,000 feet, and the short hand totals the thousands of the feet altitude.
6. **Airspeed Indicator.** The single scale airspeed indicator is calibrated in miles per hour and provides an indicated airspeed reading at any time during forward flight. The reading is obtained by measuring the difference between impact air pressure and the static vent. The pitot tube, which provides the impact air pressure source, is located forward of the cabin nose section. Static air pressure for instrument operation is derived from two static vents located on either side of the tail cone assembly. The openings in the pitot tube and static vent ports must be maintained obstruction-free and clean at all times for proper instrument operation.
7. **Engine and Rotor Tachometer.** The engine and rotor tachometers are combined on a single indicator with concentric scales calibrated in engine RPM and rotor RPM. One needle marked "E" indicates engine RPM, while a second needle marked "R" indicates rotor RPM. The indicator is mechanically connected to the rotor assembly and engine assembly through flexible cables.
8. **Fuel Quantity Indicator.** The fuel quantity gage continuously indicates the total quantity of fuel. It is hooked up through a simple type liquidometer float located in the right hand fuel tank.

9. **Engine Oil Pressure Gage.** The engine oil pressure gage indicates the pressure in the engine oil lines in pounds per square inch.
10. **Main Rotor Transmission Temperature Indicator.** A main rotor transmission temperature gage is located on the instrument panel and is redlined at 220°F.
11. **Engine Oil Temperature Indicator.** The engine oil temperature indicator measures engine oil temperature electrically by means of a thermocouple installed in the engine oil screen housing.
12. **Ammeter.** The ammeter indicates the amount of electric current supplied by the battery and the amount of the current supplied by the alternator to the battery.
13. **Cylinder Head Temperature Indicator.** The cylinder head temperature indicator measures the cylinder head temperature by means of electric current from a thermocouple located in the bottom of No. 3 cylinder head.
14. **Hour Meter.**
15. **Magneto Switch.** The magneto switch is a key-operated switch located in the center of the instrument panel. For starting, place the switch in the BOTH position.
16. **Master Switch.** The master switch is located on the instrument panel next to the master switch circuit breaker. It is a single-throw, two-position switch.
17. **Panel Light Switch.**
18. **Running Lights Switch.**
19. **Anti-Collision Light Switch.**
20. **Landing Light Switch.**
21. **Alternator Switch.**
22. **Panel Light Circuit Breaker.**
23. **Running Light Circuit Breaker.**
24. **Anti-Collision Light Circuit Breaker.**
25. **Landing Light Circuit Breaker**
26. **Ignition Circuit Breaker.**
27. **Instrument C1. Circuit Breaker.**
28. **Trim Motor Circuit Breaker.**
29. **Magnetic Compass.** The magnetic compass indicates the heading of the helicopter in relation to magnetic North. It is a direct indicating compass and indicates the heading by means of a floating card element that is read against a fixed reference line. The liquid used in the compass dampens the card oscillation. A compass light is furnished for night flying. A compass correction card and card holder is furnished adjacent to the instrument.
30. **Free Air Temperature Indicator.** The free air temperature indicator is a direct reading, bi-metallic instrument with a stainless

steel probe. This instrument provides ambient temperature information which, when utilized, will assist in determining performance capabilities of the helicopter at the existing climatic condition. The indicator is located in the top of the canopy.

31. Instrument Lights.

32. Mixture Control. The mixture control is located in center lower portion of instrument panel.



KEY TO INSTRUMENT PANEL

1	Manifold pressure/fuel pressure	16	Engine hour meter
2	Fuel quantity	17	Clock
3	Oil pressure	18	Panel light
4	Main rotor gear box	19	Running lights
5	Oil temperature	20	Anti-collision light
6	Ammeter	21	Landing light
7	Cylinder temperature	22	Alternator switch
8	Radio circuit breaker	23	Panel light circuit breaker
9	Altimeter	24	Running light circuit breaker
10	Airspeed	25	Anti-collision light circuit breaker
11	Rotor/engine tachometer	26	Landing light circuit breaker
12	Panel light dimmer switch	27	Ignition circuit breaker
13	Ignition switch	28	Instrument CL circuit breaker
14	Master switch and circuit breaker	29	Trim motor circuit breaker
15	Fuel pressure indicator		

INSTRUMENTS AND SYSTEMS TROUBLESHOOTING CHART

AIRSPEED INDICATOR

PROBABLE CAUSE	REQUIRED ACTION
Airspeed Indicator Needle Fails to Respond:	
Incorrect pitot tube hookup.	Check tubing connection and make necessary corrections.
Obstructions in pitot lines.	Disconnect pitot line from pitot head and instruments and static line from fuselage and instrument; clear lines with compressed air. Check pitot tube drain hole.

CAUTION: Never apply positive pressure to static lines with the instruments connected; this will damage the instrument mechanism.

Oscillation of Airspeed Indicator:

Leak in pitot or static lines.	Check all connections and check flexible hoses at back of instrument for leakage.
Moisture in pitot or static lines.	Disconnect pitot line from instrument and static line from fuselage flanges and instruments; clear lines with compressed air. Check pitot tube drain hole.

COMPASS

PROBABLE CAUSE	REQUIRED ACTION
Excessive Card Element Error:	
Improper compensation.	Compensate compass.
External magnetic interference.	Locate magnetic interference and eliminate.
Air in bowl.	Replace compass.
Excessive Card Element Oscillation:	
Insufficient liquid in bowl.	Replace compass.

Card Element Not Level:

Leaking float chamber. Replace compass.
 Card magnets detached from card. Replace compass.

Card Element Is Sluggish:

Dirty jewels or pivots. Replace compass.
 Weak card magnets. Replace compass.
 Instrument heavily
 compensated. Compensate compass.

Compensator Does Not Have Sufficient Effect:

Weak magnets in compensator. Replace compensator.

Liquid Leakage:

Leaking gaskets. Replace gaskets.
 Broken case. Replace compass.

Defective Light (Battery Switch On, Instrument Switch On):

Burnt out bulb or fuse. Replace bulb or fuse.
 Broken Circuit. Check continuity of wiring.
 Broken Switch. Check/replace instrument switch.

ALTIMETER**PROBABLE CAUSE****REQUIRED ACTION****Indicating Hands Fail To Respond:**

Static pressure line obstructed. Disconnect static pressure line from
 instruments and blow out with
 compressed air.

CAUTION: Never apply positive pressure to static lines with
 the instruments connected; this will damage the
 instrument mechanism.

Static pressure connection Check static pressure lines and
 improperly made. connect correctly.

Indications Are Obviously Incorrect:

Leaks in static pressure line Replace damaged tubing and/or
 and/or leaks in cases of check instruments for leaks.
 instruments in same system.
 Defective instrument. Replace altimeter.

Indicator Hands Vibrate:

Excessive vibration of static pressure tubing. Anchor tubing with tube clamps.

ENGINE AND MAIN ROTOR TACHOMETER INDICATOR**PROBABLE CAUSE****REQUIRED ACTION****Fluctuating Needle(s):**

Binding cable.

Lubricate cable.

Defective instrument.

Replace instrument.

No Reading on Indicator, Either Permanent or Intermittent:

Twisted or broken cable.

Replace cable.

Defective instrument

Replace instrument.

Reverse installation of cables.

Install cables in correct position.

Needles Do Not Superimpose:

Instrument out of tolerance.

Check tolerance, 2600 \pm 25 RPM, 2800 \pm 25 RPM, spread between needles $\frac{1}{4}$ of needle width maximum.

MANIFOLD PRESSURE**Excessive Error at Existing Barometer Pressure:**

Water or restriction in line between instrument and engine.

Disconnect and blow out line.

Sluggish Operation of Needle:

Damaged or restricted line.

Remove line and blow out restriction. Replace line if damaged.

Defective instrument.

Replace instrument.

FUEL QUANTITY GAGE**PROBABLE CAUSE****REQUIRED ACTION**

Indicator Registers F, or Consistently High Reading (Battery Switch On):

Poor connections or sender ground.

Clean and tighten connection.

Indicator Registers O At All Times:

Grounded lead wire.	Replace or repair wire.
Defective indicator.	Replace indicator.
Defective sender.	Replace sender.
Float jammed or broken off arm.	Replace float.
Fuse blown.	Replace fuse.

Erratic and Inconsistent Readings:

Corrosion on movable contact arm or resistance coil.	Clean contacting surface or replace sender.
Defective indicator.	Replace indicator.
Loose connection; partially broken lead.	Tighten connection or replace lead.

Indicator Reading Not At O With Empty Fuel Tank:

Resistance out of adjustment.	Adjust or replace sender.
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Indicator Reading Not At F With Full Fuel Tank:

Resistance out of adjustment.	Adjust or replace sender.
Float jammed.	Free float and remove obstruction.

ENGINE OIL TEMPERATURE INDICATOR**PROBABLE CAUSE****REQUIRED ACTION****No Reading on Oil Temperature Indicator With Battery Switch On, Either Constant or Intermittent:**

Break in power leads.	Repair or replace leads.
Poor ground at panel.	Replace indicator.
Open or short circuit in indicator.	Replace indicator.

Reading Off Scale at Low Temperature End or Low Reading, Either Constant or Intermittent:

Short circuit in leads from resistance bulb to indicator.	Make continuity check and repair or replace lead.
Short circuit in bulb.	Replace bulb.

(NOTE: Do not use thread lube when installing new bulb.)

Open or short circuit in indicator.	Replace indicator.
-------------------------------------	--------------------

Reading Off Scale at High Temperature End or High Reading, Either Constant or Intermittent:

Open circuit in resistance bulb.	Replace bulb. (NOTE: Do not use thread lube when installing new bulb.)
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Open or short circuit in indicator.	Replace indicator.
-------------------------------------	--------------------

FUEL PRESSURE AND OIL PRESSURE GAGE

PROBABLE CAUSE	REQUIRED ACTION
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Low Reading on Oil or Fuel Pressure Indicator:

Kinked tubing or obstruction in tubing.	Replace or clean tubing.
---	--------------------------

Instrument out of tolerance.	Replace instrument.
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Poor lead connection.	Clean connectors on meter and sender and install securely.
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Inaccurate Fuel or Oil Temperature Indicator:

Defective sender.	Replace defective sender.
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Defective instrument.	Replace a defective instrument.
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Sticking Fuel or Oil Pressure Indicator:

Defective instrument.	Replace instrument.
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Sluggish Oil Pressure Reading:

Sludge or heavy oil in line.	Bleed line and service with engine oil.
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Fluctuating Oil Pressure:

Air in pressure line.	Service oil pressure line with engine oil.
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CYLINDER HEAD TEMPERATURE INDICATOR

Temperature Reading High Throughout Scale:

Poor connections or partial break in leads.	Check continuity of leads. Repair or replace faulty leads.
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Defective instrument.	Remove instrument for overhaul.
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No Reading, Either Permanent or Intermittent:

Break in lead; break in thermocouple.	Repair or replace lead; replace thermal switch.
Faulty indicator.	Remove instrument for overhaul.

Low Reading, Either Permanent or Intermittent:

Poor connection or short circuit.	Clean and tighten connections. Eliminate short circuit.
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AMMETER**No Reading or Erratic Reading, (Battery Switch On, Alternator Switch On):**

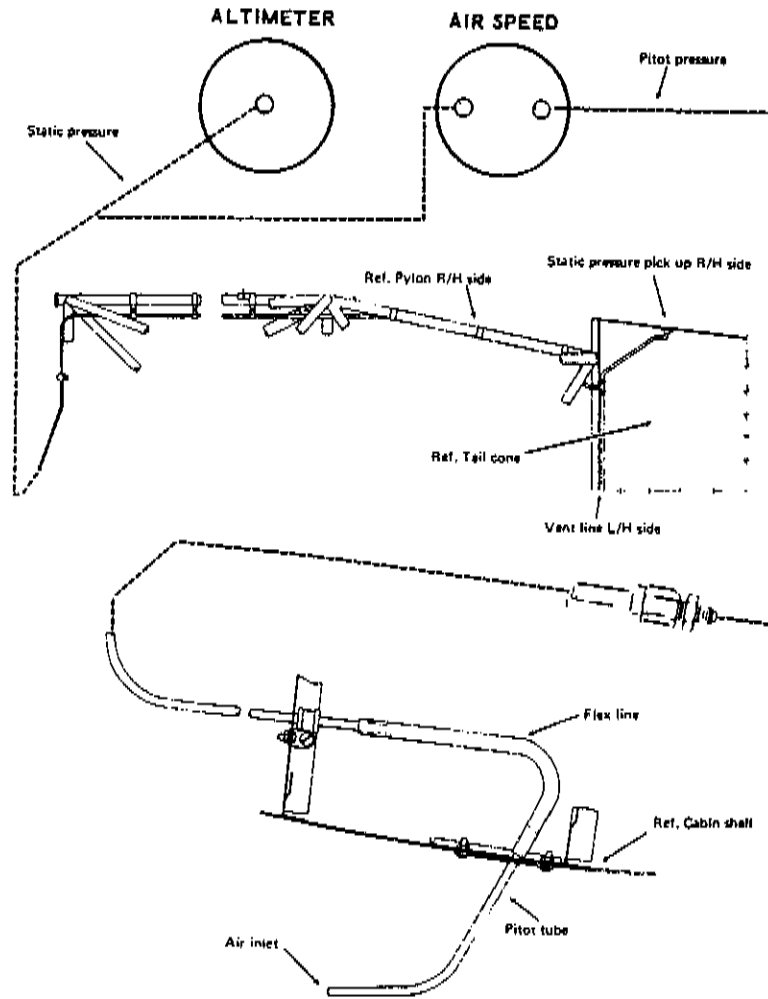
Malfunctioning alternator.	Repair or replace alternator.
Open or short circuit in instrument.	Replace instrument.
Dirty or worn mechanism.	Replace instrument.
Fault in switches.	Replace switches.

GEARBOX OIL TEMPERATURE INDICATOR

Broken circuit.	Check continuity. Clean and tighten ground connection.
Burnt out fuse.	Replace fuse.

PITOT-STATIC SYSTEM

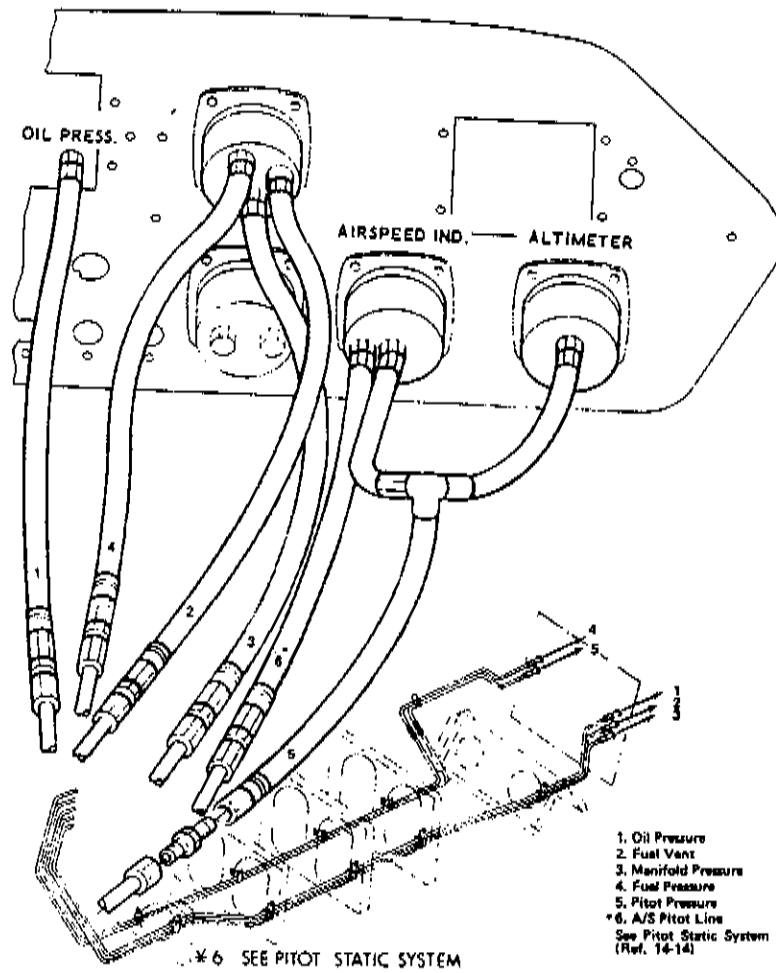
Description. To operate the airspeed indicator and altimeter, it is necessary to have a static source of air pressure. The F-28A Helicopter has two static air pressure ports. One is on the left hand side of the fuselage just aft of the baggage compartment, and the other is on the opposite side of the helicopter. They are interconnected across the fuselage by a ¼" aluminum tubing line. This line is routed along the right hand side of the pylon assembly under the seat and up to the altimeter and airspeed, which are located on the instrument panel. The airspeed indicator measures the differential between ram or impact air pressure taken at the pitot head and static air pressure. The measurement is indicated in miles per hour. The altimeter indicates the height of the helicopter above sea level. The altimeter is operated by static air pressure derived from the pitot-static system. The instrument can be compensated for deviations from standard sea level barometric pressure

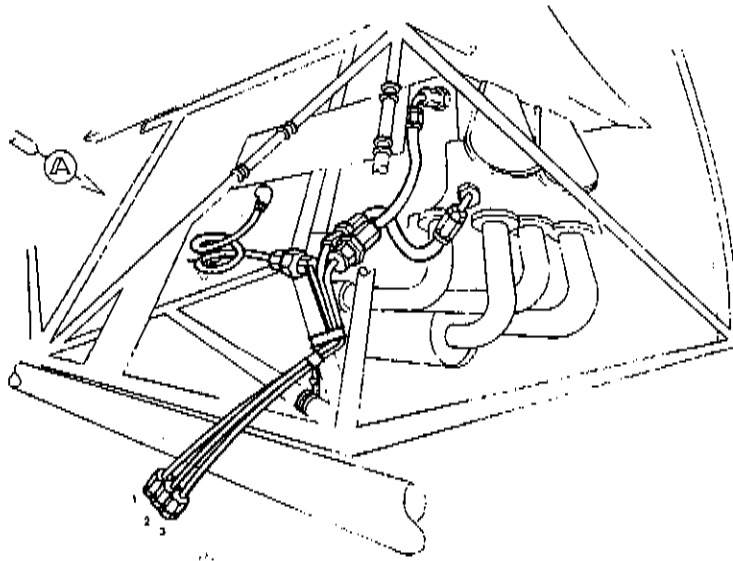
**PITOT STATIC SYSTEM**

manually by a knob on the lower left portion of the instrument case. The barometric pressure scale is graduated in inches of mercury.

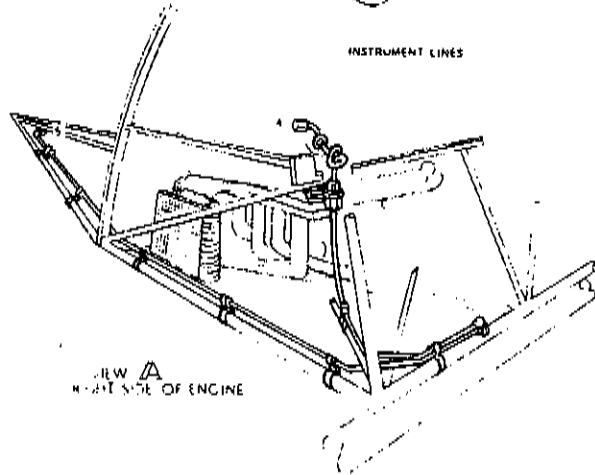
The static ports located on the left and right hand side of the fuselage are included in a preflight inspection guide, and should always be checked prior to flight and also at any time the helicopter is operated in dusty or freezing conditions where the small inlet holes may become clogged, which will cause the instruments to be inoperative and inaccurate.

Pitot Tube. The pitot tube is located on the lower forward side of the cabin structure. It is a curved aluminum tube attached securely at two positions. It is connected to the routing line that goes to the instrument panel by a flex rubber hose above the cabin line. It is important that a cover be kept over the pitot inlet at all times when the aircraft is to be parked for any prolonged period of time as ingestion of dirt or ice will impair the operation of the airspeed indicator. It is important that the cover that is put over the intake of the pitot be a red object so that it will be noticeable and will be removed on the preflight inspection. Both the pitot system and static air system are very readily accessible to the mechanic for inspection both internally and externally of the airframe.





INSTRUMENT LINES



VIEW A
RIGHT SIDE OF ENGINE

TAIL ROTOR DRIVE ASSEMBLY

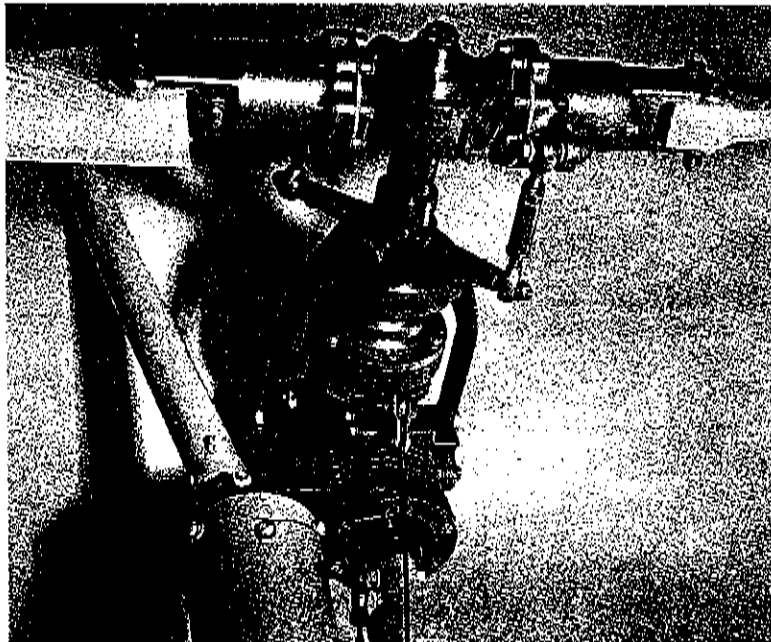
DESCRIPTION

The tail rotor drive assembly consists of a tail rotor assembly, tail rotor torque tube mounted in five bearings and a tail rotor transmission.

NOTE: If possible, the tail rotor assembly and tail rotor gear box should be returned to the factory for inspection and any necessary overhaul work.

TAIL ROTOR ASSEMBLY

The tail rotor assembly consists of a pitch control assembly, two pitch control links and two blade assemblies bolted to a grip assembly. Three bearings are provided in each grip to provide for feathering motion and tail rotor thrust. The hub is splined to the rotating output shaft of the gear box. The rotor pitch control is accomplished through a series of bellcranks and cables, attached to foot pedals in the cockpit.



Removal of Tail Rotor Assembly (Ref. Pg. 15-3)

Remove tail rotor assembly by the following procedure:

- a. Disconnect pitch change links from pitch arms (Ref. 15-9).

NOTE: When removing hardware, Item (A) and (B) (Ref. Pg. 15-8), observe that spacers are provided on outboard side of pitch links. They are factory set for proper clearance, **KEEP TOGETHER** for proper installation.

- b. Remove safety wire from hub retention bolt (1); remove bolt, washer (2), and teetering stop (3).

NOTE: Index hub and shaft splines for installation ease.

- c. Slowly slide hub and blade assembly off shaft.
- d. Use caution in handling and working on assembly.

Disassembly of Tail Rotor Assembly. (Ref. Page 15-3.) Disassemble the tail rotor assembly by performing the following steps:

- a. Remove the blade assembly from the hub assembly by extracting safety wire and removing the bolts and washer (4 & 5) holding the pitch arm (6) to the grip (7). Accomplish by removing one at a time while grip is rotated, aligning that bolt with flat part of spindle (8).

NOTE: 1. There are special champhored washers under the NAS bolts.

2. Index mark the blade to spindle and mark the pitch arm to the grip to aid in reassembly.

3. Remove ZERK fitting (9) in grip assembly (7).

4. Remove bleed screw (10) in grip (7).

- b. Apply heat (with gun or substitute method) to blade grip (7) till it is quite warm. Then pull blade and grip assembly off the spindle assembly.

CAUTION: Do not separate the blade from the grip as these are match-drilled on assembly.

- c. Remove bearing retaining lock nut (11) and lockwasher (12) from spindle (8).
- d. Remove the three thrust bearings (13, 14, 15) along with the spacer (16). Observe that the bearings have closed side towards hub.
- e. Now slide pitch arm (6) and bearing (17) from the spindle (8).
- f. Disengage both retainer rings (18 & 19) that secure the bearings (20 & 21) in the spindle (8).
- g. Use a suitable drift to remove bearings (20 & 21) from hub (22).

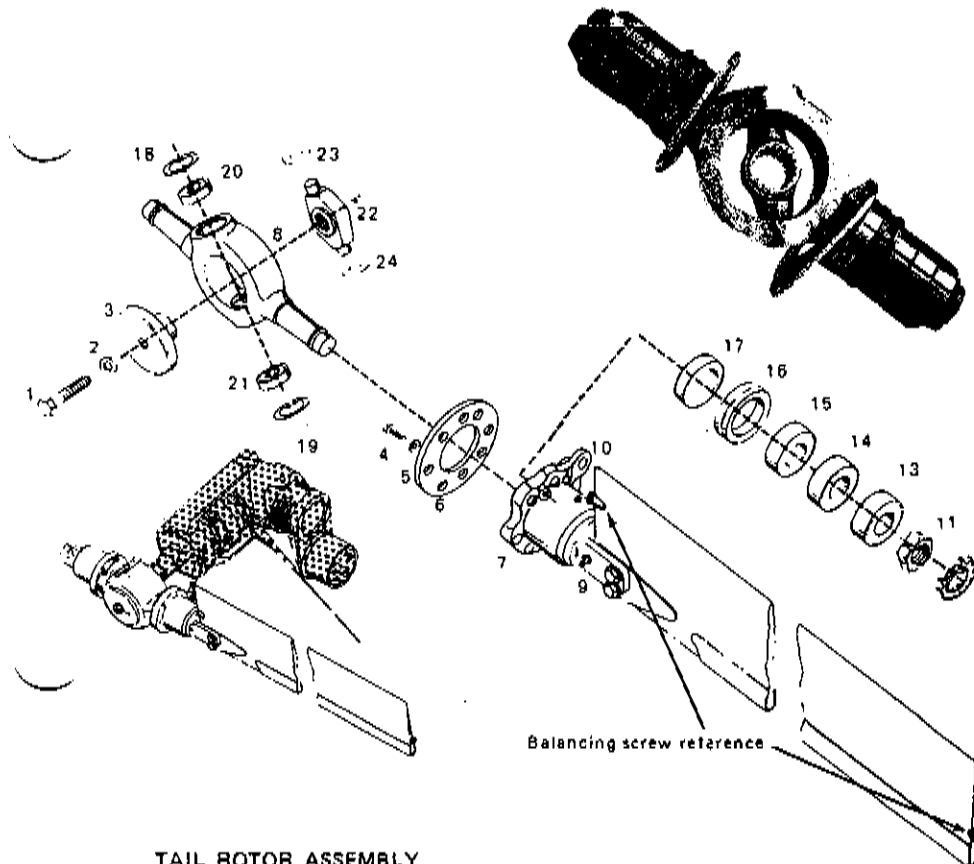
NOTE: Shims (23 & 24) may be used between bearings and hub shoulders. Exercise care not to mix or change their position as this will aid in reassembly and **MAINTAINING THE BALANCE.**

Cleaning Tail Rotor Assembly. Clean the tail rotor assembly as follows:

- a. Clean tail rotor assembly with clean, lint-free cloth dampened with soap and water solution.
- b. Wipe dry with clean, lint-free cloth.
- c. Clean hard-to-clean parts with solvent and dry with compressed air.

Inspection of Tail Rotor Assembly. Inspect the tail rotor assembly as follows:

CAUTION: No cracks or breaks are permissible in tail rotor blade, hub, pitch control assembly. Remove and replace any defective components.



TAIL ROTOR ASSEMBLY

- a. Check all parts for obvious wear or damage.
- b. Check all threaded parts for condition of threads.
- c. Check all bearings and lubrication fittings for condition of operation.
- d. Inspect tail rotor assembly for evidence of binding by hand turning a few turns while listening for unusual sounds.
- e. Inspect pitch control assembly for scratches, dents, nicks, cracks, corrosion and surface defects.
- f. Inspect all nuts and bolts security.
- g. Inspect pitch control links for scratches, nicks, dents, burrs, cracks, corrosion and similar surface defects.
- h. Inspect blade stop for deterioration and security of attachment.
- i. Inspect hub for scratches, nicks, dents, burrs, cracks, corrosion and surface defects.
- j. Inspect blades for visible bond.
- k. Inspect leading edge stainless steel abrasion strips on blade leading edge for separation from blade skin. No voids are permitted in tail rotor blades.
- l. Inspect blades for scratches.
- m. Inspect stainless steel abrasion strip on leading edges for cracks, dents, scratches and nicks.

Assembly of Tail Rotor Assembly. Assemble the tail rotor assembly as follows:

CAUTION: To maintain proper balance, all parts must be returned to their original position prior to disassembly.

- a. Insert hub (22) into spindle (8). Be sure spacers (23 & 24) have been installed as removed. Press bearing (20 & 21) into opposite sides of spindle (8) and insert retainer rings (18 & 19).
 - b. Slide pitch link arm (6) onto spindle.
 - c. Install bearing (17) followed by spacer (16).
 - d. Install the three bearings (13, 14 & 15) onto spindle.
- CAUTION:** Be sure the bearings have closed side towards the hub.
- e. Install lockwasher (12) and retaining nut (11). Torque nut to 40 - 50 lbs.
 - f. Heat blade grip (7) until quite warm and slide over spindle assembly (8).

- g. Install the eight bolts and washers (4 & 5). Assembling the pitch arm (6) to the grip (7).

NOTE: Accomplish by installing one at a time while grip is rotated, aligning that bolt with flat side of spindle (8).

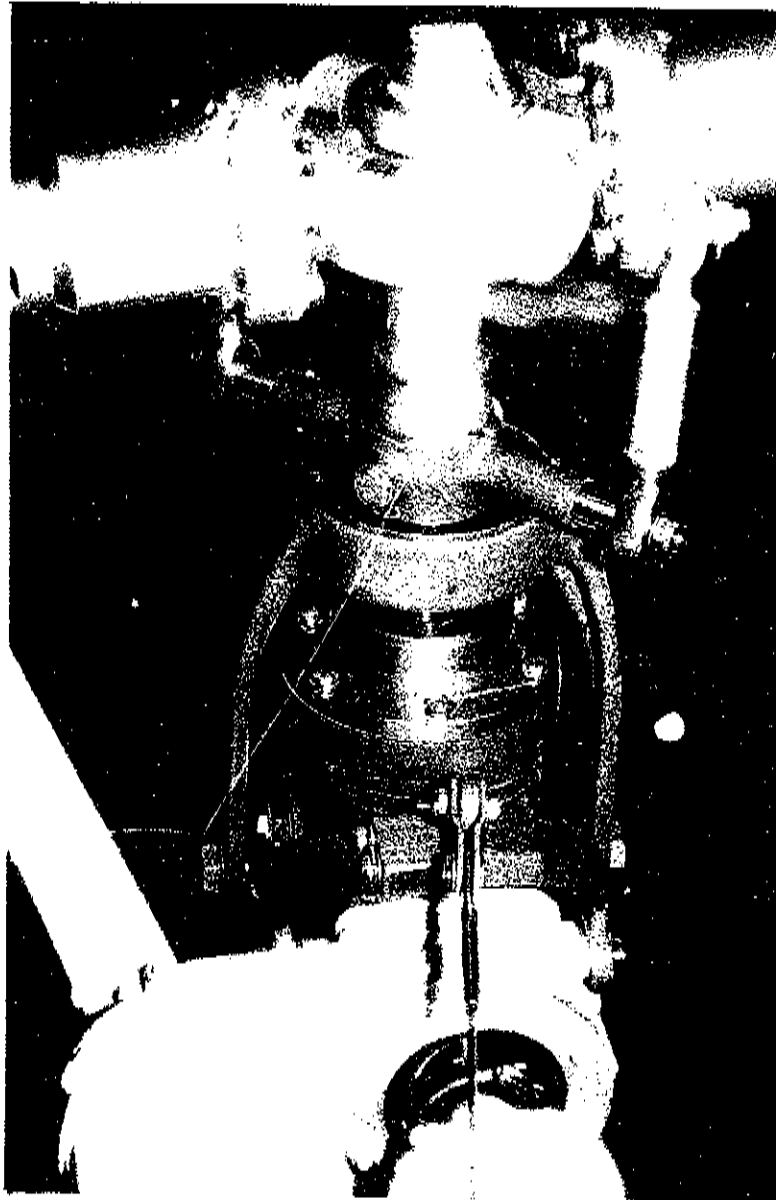
- h. Safety wire bolts in pairs.
- i. Install ZERK fitting (9) in grip (8).
- j. Lubricate with Aero-shell 14 grease. Be sure 10-32 screw (10) is removed to allow purging of grease in grip (8).

NOTE: Reinstall 10-32 purge screw (10).

Removal of Control Assembly. (Ref. Page 15-8.)

- a. Remove safety wire on both guide bolts (4) from pitch link retainer (5).
- b. Remove snap ring (6).
- c. Remove pitch link retainer bolts (4) and remove retainer assembly (5).
- d. Remove both bolts and washers (7) attaching bearing yoke (8) to the control brackets (9 & 10).
- e. Carefully slide yoke (8) off the slotted shaft (11) and spacer (17).
- f. The control brackets may remain on the gear box at this time.
- g. To remove the bracket assembly (9 & 10), remove the safety wire from the four bolts (12).
- h. Separate and remove the upper and the lower brackets (9 & 10).

NOTE: Observe washers on pivot axis of upper and lower brackets.



Disassembly of Bearing Housing. (Ref. Page 15-8.)

- a. Remove the snap nut (13).
- b. Heat the housing assembly (8) and press out bearing (14).
- c. Remove pitch control bearing (16).
- d. Remove seals (15 & 17).

Reassembly of Bearing Housing

- a. Inspect and replace parts as necessary.
- b. Reassemble in reverse order of disassembly.

TAIL ROTOR PEDAL CONTROLS**Removal, Inspection and Installation.**

NOTE: To remove any part of the tail rotor pedal installation, first remove the floor upholstery and floor inspection covers.

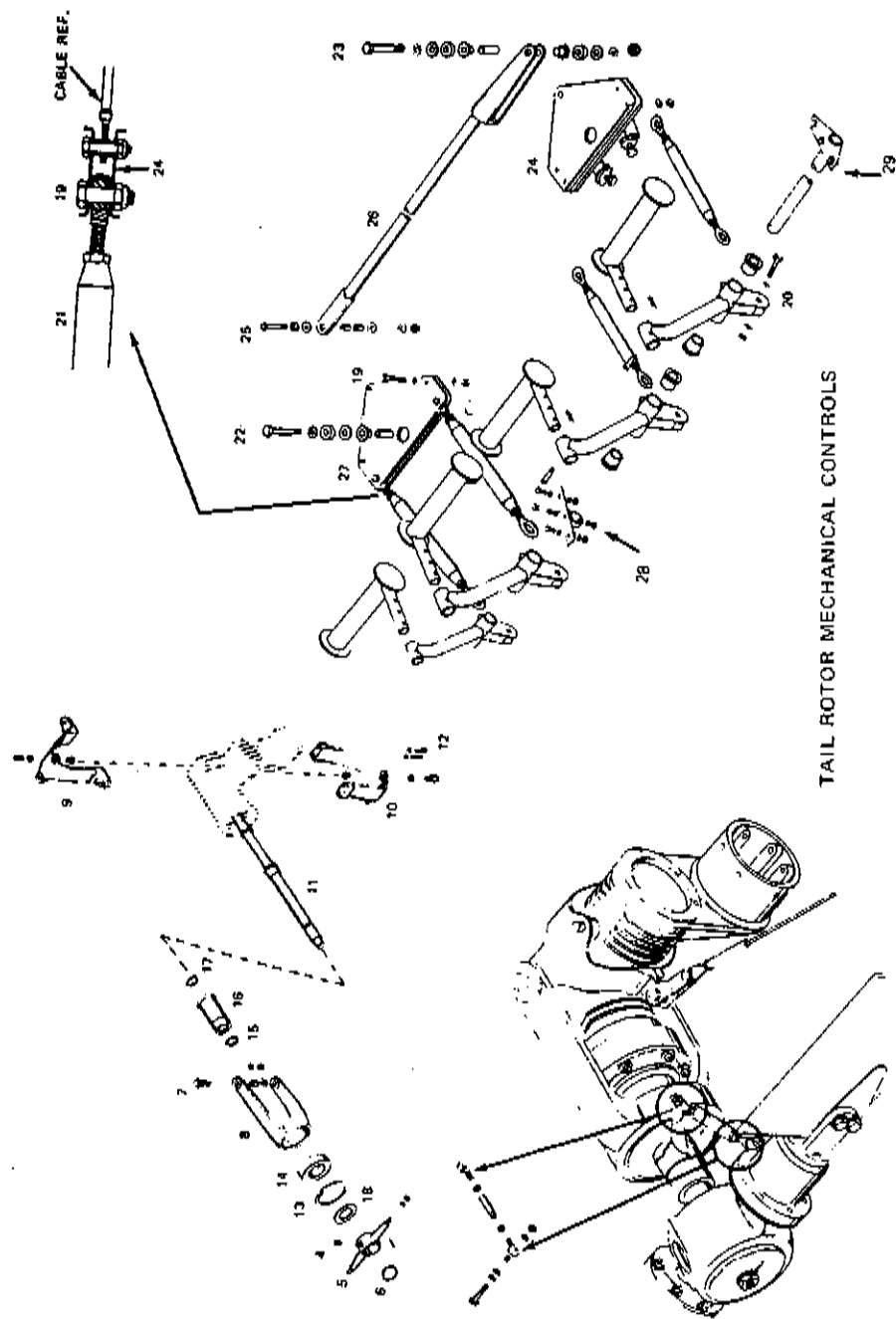
- a. In order to temporarily disconnect the dual pedals, remove the hardware (23 and 25) connecting dual cross over tube (26) between bellcranks (24 and 27).
- b. Remove cross over tube (26) and attach existing hardware to it to assist in reinstallation.
- c. To permanently disconnect and remove the co-pilot's dual pedal installation, proceed as follows: remove cross over tube as stated in 'a' and 'b' above.
- d. Disconnect and remove hardware (19, 20 and 22).
- e. Remove bellcrank (27) and push-pull rods (21).
- f. Disconnect and remove the hardware (28) securing pedal brackets to seat structure.
- g. Remove pedal assembly and attach all hardware to the pedal brackets.
- h. Replace floor inspection covers and upholstery, and check controls for proper operation prior to flight.

TAIL ROTOR PEDAL PUSH-PULL RODS**Removal and Replacement.**

- a. Remove hardware (19 and 20).
- b. Remove turnbuckle (21).

NOTE: Mark for ease in replacement.

- c. Replace in reverse procedure.



TAIL ROTOR MECHANICAL CONTROLS

TAIL ROTOR BELLCRANK

Removal and Replacement.

- a. Loosen tail rotor cables in engine compartment and disconnect cable from bellcrank. (Ref. Page 15-14.)
- b. Remove hardware (19, 22 and 23) from bellcrank (24) and remove.
- c. Reinstall in reverse procedure.

TAIL ROTOR GEAR BOX REMOVAL

Removal. To remove the tail rotor gear box, proceed as follows: (Ref. Page 15-10.)

- a. Remove tail rotor assembly. (Ref. Page 15-2.)
- b. Disconnect rudder cables at gear box (1).
- c. Remove the forward taper pin attaching drive coupling to the gear box. (Ref. Page 15-16)
- d. Disconnect or remove tail guard (2).
- e. Remove safety wire and the six screws that attach the gear box (3).
- f. Remove gear box by straight pull aft to release it.

NOTE: Do not pull on the slotted shaft. It can damage the enclosure seal.

Disassembly of Tail Rotor Gear Box. (Ref. Page 15-10.)

Before disassembly of tail rotor gear box, check the run out at the outer end of the output shaft assembly. Run out shall not exceed .005. Field disassembly of the gear box is required only when malfunctions are noted or suspected. Field maintenance is limited to the replacement of seals, packings, bearings, and gears.

- a. Before disassembly of gear box, remove drain valve (1) and magnetic plug (2). Inspect for metal particles.

Removal and Disassembly of Input Shaft.

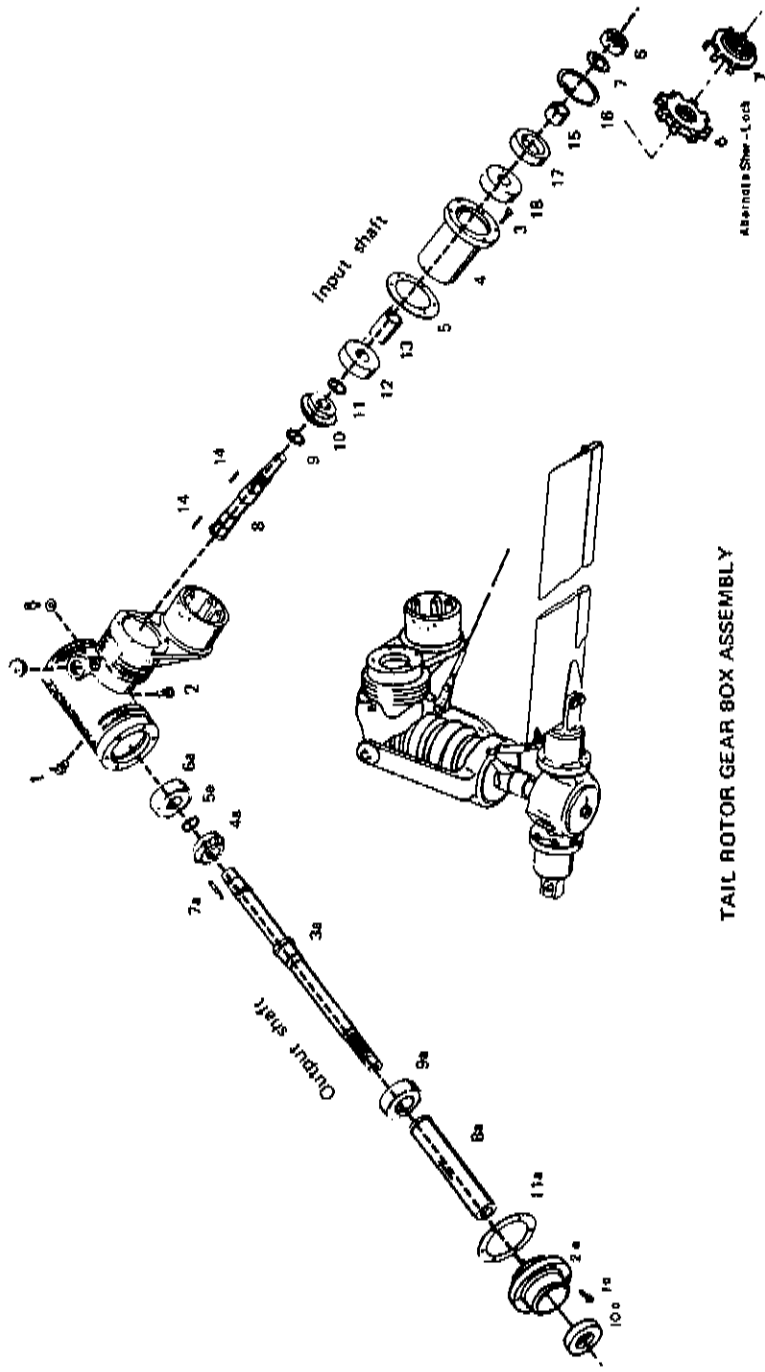
NOTE: Input shaft must be removed and disassembled prior to the removal of the output shaft.

- b. Remove safety wire and six screws (3) from the input capsule assembly (4).

NOTE: Observe the shims (5) and record the dimensions.

- c. Apply heat to the gear box and remove the input capsule assembly (4).

CAUTION: Do not exceed 180° to 200°F. by use of heat gun.

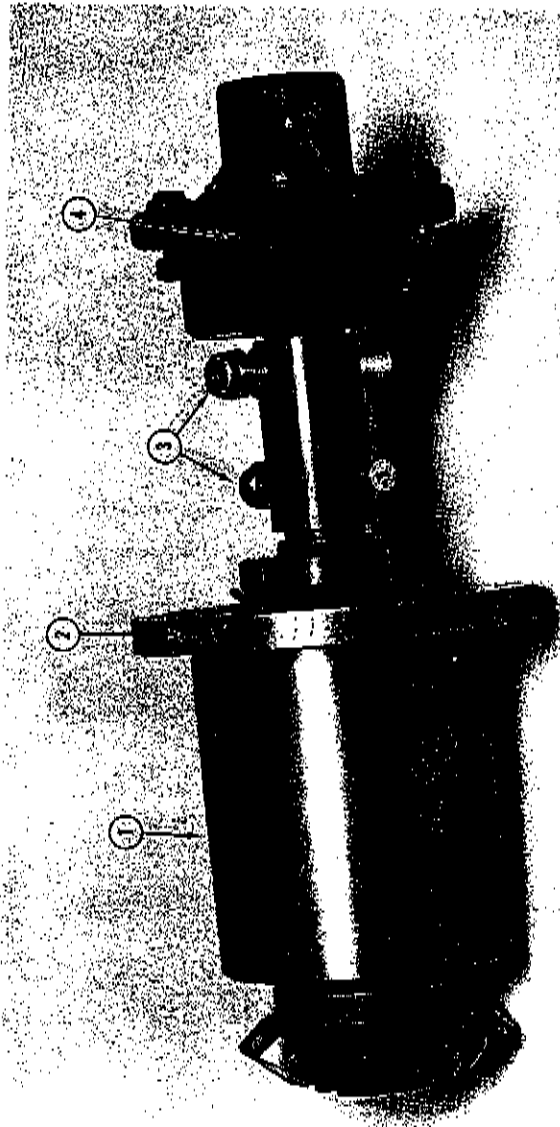


TAIL ROTOR GEAR BOX ASSEMBLY

- d. Remove input shaft assembly from gear box.
 - e. The input shaft capsule assembly (4) is further disassembled by removing nut and washer (6 & 7).
 - f. Place input shaft (8) in press and, pressing on the threaded end of the shaft, remove spacer (9), gear (10), spacer (11), bearing (12) and spacer (13).
 - g. Remove woodruff keys (14) from pinion shaft.
 - h. When the following parts are removed from the pinion shaft, spacer (15) will also slide off the end of the shaft.
 - i. Remove snap ring (16).
 - j. Press seal (17) and bearing (18) from capsule assembly (4).
- SPECIAL** The two bearings (12 & 18) are a matched pair.
NOTE The spacer (13) and the housing (4) are mated and carry matching serial numbers which are etched on the outside of the housing assembly.

Removal and Disassembly of Output Shaft.

- k. Remove safety wire and six screws (1-a) that attach the seal retainer assembly to the output portion of the tail rotor gear box.
 - l. Apply heat to the gear box and remove the output shaft assembly (3-a).
- NOTE:** Observe the shim thicknesses and record the dimensions (11-a).
- m. Install the shaft in the press, and proceed to press the following parts from the shaft in the following sequence: Gear (4-a), spacer (5-a), bearing (6-a) and woodruff keys (7-a).
 - n. Apply heat to seal retainer (2-a) and remove slotted shaft (8-a).
 - o. Press bearing (9-a) from shaft (3-a).
 - p. Remove seal (10-a).
- NOTE:** The gears are not matched sets and can be replaced individually.
- q. Inspect and replace bearings, shims, spacers, seals and hardware as necessary. Assemble tail rotor gear box in reverse order and inspect visually to see that all safety devices have been accomplished prior to installation of gear box on tail cone.



- 1. Input Carcase
- 2. Serial Numbers
- 3. Taper Pin
- 4. Aft Flex Coupling

Tail Rotor Cable Inspection and Replacement

- a. To inspect cables and pulleys it will be necessary to remove aft wrap around cowl, baggage compartment and fiber glass seat cover as required.
- b. Inspect tail rotor cables for excessive wear and strand separation.
- c. If necessary to replace aft cables, proceed as follows:
 1. Remove aft cable links.
 2. Cut cable aft of turnbuckle.
 3. Attach string to cable and pull aft through pulleys and tail cone.
 4. Replace aft cable in reverse order.
 5. Position new cable around eye on turnbuckle.

NOTE: Reposition turnbuckle to allow for future adjustment.

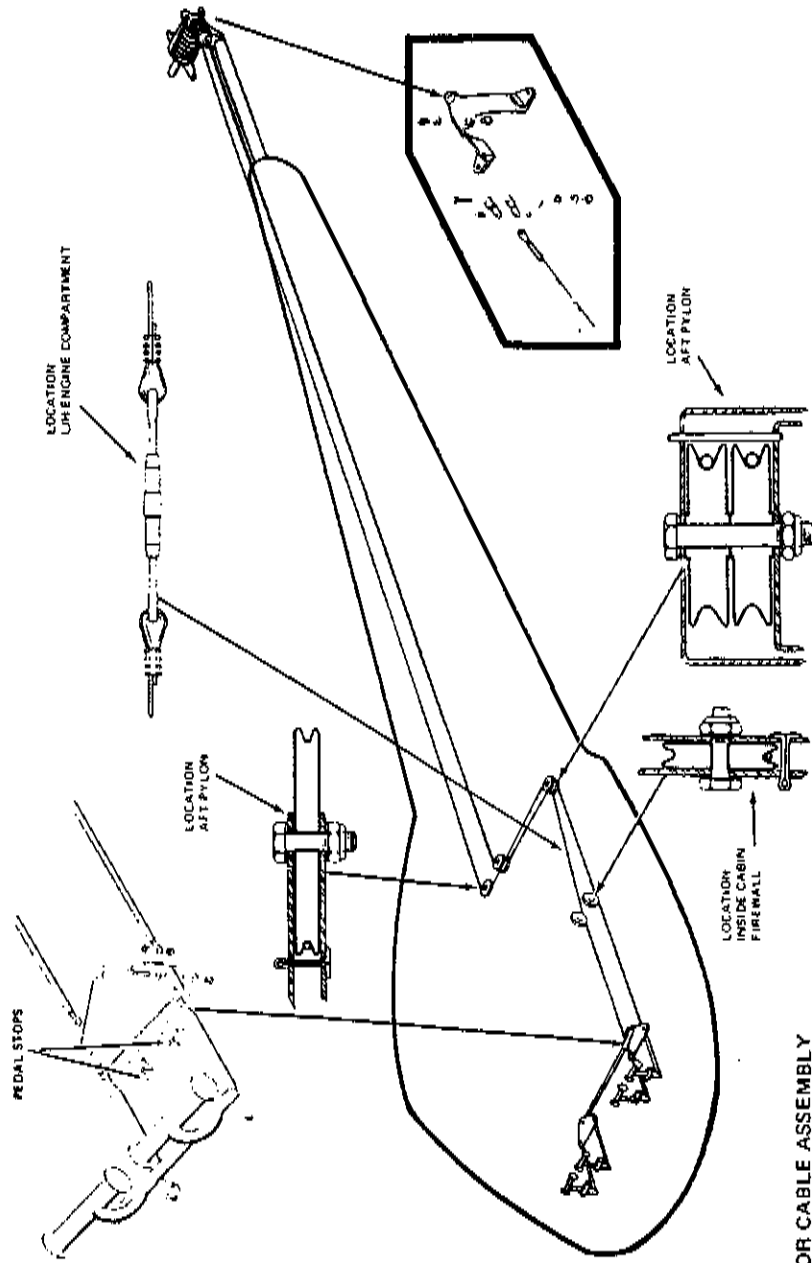
6. Pull cable taut and swedge.
7. Cut excess cable.
8. Re-rig tail rotor. (Ref. Page 15-20).
9. Safety wire turnbuckles upon completion of rigging.
- d. If necessary to replace forward cables, proceed as follows:
 1. Remove seat assembly and floor panels as required.
 2. Disconnect cable at bellcrank under floor.
 3. Cut cable forward of turnbuckle.
 4. Attach string to cable and pull forward through firewall and seat assembly.
 5. Replace forward cable in reverse order.
 6. Position new cable around cable eye on turnbuckle.

NOTE: Readjust turnbuckle to allow for future adjustment.

7. Pull cable taut and reswedge.
8. Cut excess cable.
9. Re-rig tail rotor controls. (Ref. Page 15-20).
10. Safety wire turnbuckles on completion of rigging.

TAIL ROTOR DRIVE SHAFT ASSEMBLY

The tail rotor drive shaft transmits power from the main rotor gear box to the tail rotor gear box. Excessive oscillation of the drive shaft is suppressed by the five bearings on the top of the tail cone. The drive shaft is fabricated from 4130 steel tubing and has forward and aft universal joints that allow $1\frac{1}{2}^{\circ}$ of misalignment. The tail rotor drive shaft alignment must be checked visually with the shaft installed in the helicopter and attached at the fore and aft end.



TAIL ROTOR CABLE ASSEMBLY

Tools and Equipment Necessary to Perform Operation:

Length of piano wire for use in aligning drive shaft assembly.

Removal of Tail Rotor Drive Shaft, Pillow Assemblies, and Mechanical Tachometer. (Ref. Page 15-16)

Remove the drive shaft, pillow assemblies and tachometer as follows:

- a. Remove bolts (1 & 2) in forward and aft universals.
- b. Remove taper pin (3) in forward universal.
- c. Slide universal inboard at both front and aft sections.
- d. Remove the bolts (4) that attach the pillow blocks (12) and shims (5) to top of fuselage.

NOTE: 1. Attach shims (5) with safety wire or tape as the pillow blocks are shimmed upon original installation, and keeping shims together will facilitate alignment of shaft upon installation.

2. Changing main rotor gear box may necessitate reshimming pillow blocks.

Remove the following tachometer parts: (Ref. Page 15-16)

- e. Cap screws (6).
- f. Cover assembly (7).
- g. "O" rings (8).
- h. Drive pulley (9).
- i. Remove rotating beacon (10).

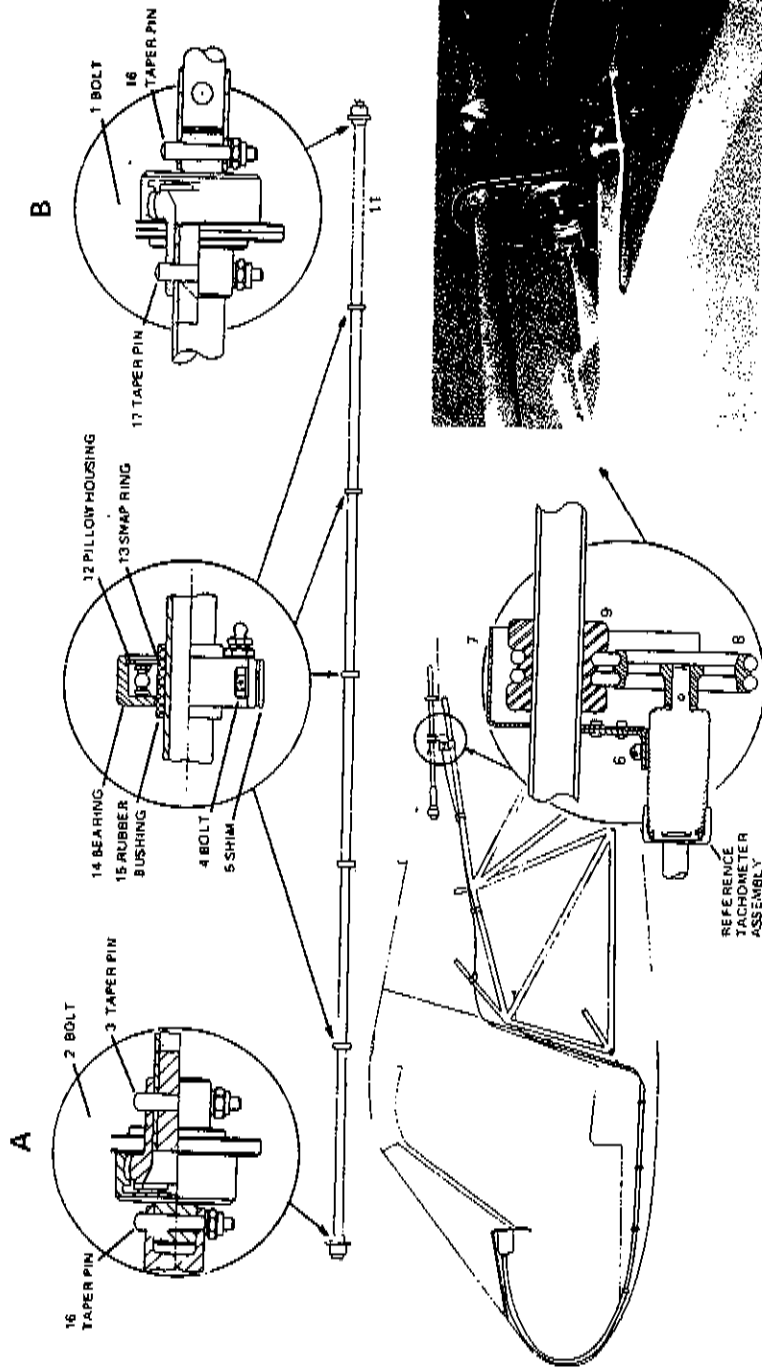
NOTE: Lift complete tail rotor drive shaft assembly (11) from helicopter. Lay drive shaft on flat surface and away from personnel that may step on shaft.

- j. Remove taper pins (16) and remove universals (A and B) from tail rotor drive shaft.
- k. Remove each of the pillow blocks (12) from the tail rotor drive shaft (11) and designate each pillow block by number, starting at the front. This will eliminate errors in reassembly.
- l. If necessary to replace bearings, remove snap ring (13) and remove bearing (14) from pillow blocks.

Inspection of Tail Rotor Drive Shaft Assembly.

Inspect the drive shaft and pillow block assemblies as follows:

- a. Inspect all parts for obvious wear or damage.
- b. Check all threaded parts for condition of threads.
- c. Inspect drive shaft for scratches. Minor scratches are permissible. Round bottom of scratches and touch up with Iridine.



- d. Check for dents and cracks in drive shaft.

NOTE: None permissible.

- e. Inspect each of the five bearings (14) for roughness, indication of overheat and/or lack of lubrication. Replace and/or lubricate all bearings as necessary prior to installation with Aero-shell 14 grease.
- f. Inspect the universal assemblies (A and B) for any excessive wear.
- g. Inspect taper pin holes for elongation or misalignment.

Assembly and Installation of Tail Rotor Drive Shaft and Pillow Block Assembly.

Assemble the tail rotor drive shaft as follows:

- a. Locate fore and aft universal assemblies (A and B) on pinion shafts of main rotor transmission and tail rotor transmission.
- b. Determine length of new undrilled tail rotor drive shaft.
- c. After determining the length of the drive shaft, drill holes for taper pins for the fore and aft couplings.

CAUTION: When drilling for taper pin, determine minimum size of pin to be installed, drill hole and taper ream. Be careful not to taper ream too deep.

- d. Insert rubber bushings (15) inside of bearings (14) prior to installing pillow housing (12) assembly on shaft (11).
- e. Use lubricate (STP) to facilitate installing pillow housing assembly (12) on shaft (11).
- f. Install pillow blocks (12) from front to rear on shaft.
- g. Install taper pins (16) to pinion shafts.
- h. Be sure forward and aft drive couplings are greased prior to reassembly.

CAUTION: When installing the new taper pins in drive shaft assembly both fore and aft, use AN975-3 washer and inspect for proper fit.

- i. Install the shims (5) under each of the five pillow blocks and install the attached bolts (4) to tail boom mount pads.

NOTE: Do not tighten these bolts, as you will have to adjust for alignment of the tail rotor drive shaft.

Installation of Mechanical Tachometer.

Install the following units:

- a. Driven pulley (9) on shaft (11).
- b. "O" rings (8).

NOTE: Align drive pulley with driven pulley and secure four screws.

- c. Cover assembly (7).
- d. Two cap screws (6).

Alignment of Tail Rotor Drive Shaft.

Align the tail rotor drive shaft as follows:

- a. Alignment of the tail rotor drive shaft is accomplished by determining a fixed point at the fore and aft center line of the universal joint.
- b. Stretch a piano wire (.010") fore and aft and align the height of the pillow blocks to the outstretched wire.
- c. Shim as necessary. Tighten to proper torque. Safety wire attaching bolts on pillow block (12).
- d. After this alignment has been achieved, turn the shaft 90° and check for alignment laterally.

Final Inspection of Tail Rotor Drive Assembly.

- a. Inspect the forward and aft universal attachments (A and B) for security.
- b. Check five pillow block bolt attachments for security.
- c. Check each alemite fitting for security and proper amount of lubricant in bearing.

Re-installation of Tail Rotor Drive Assembly

- a. Re-install tail rotor gear box (Ref. Pg. 15-10).
- b. Re-install tail rotor controls and hook-up (Ref. 15- 8).
- c. Re-install tail rotor guard.
- d. Re-installation of tail rotor (Ref. Pg. 15- 3).
 - 1. Position rotor hub assembly (22) on the shaft splines so the axes of the hub is parallel with the pitch link retainer and slide on.
 - 2. Start .041 wrap of safety wire around the hub (22) and feed through the teetering stop (3) as the teetering stop is put in position.
 - 3. Install retention bolt (1), washer (2) and torque to 300 in./lbs. and complete safety with .040 wire.
 - 4. Rotate the blades so that the blade pitch link is opposite the pitch link retainer.
 - 5. Connect pitch link to pitch change arm utilizing AN hardware as shown on Pg. 15-8.)
 - 6. When assembling blade pitch arm to pitch change link, place thin spacer over bolt and install bolt with head inboard into

rod end pitch arm. Assemble large AN760D416 washer thru spacer on bolt followed by pitch arm.

7. Install AN760D416 washer, and AN364-416 nut. (See NOTE on Pg. 15- 2).
8. **NOTE:** Do not remove the pitch link retainer stud as it is a pre-drilled unit.
9. Lubricate tail rotor with Aeroshell 14 grease.
10. Check for freedom of operation and full travel.

After final inspection of tail rotor drive assembly, run up engine, engaging the rotor system, and check each pillow block bearing support for over-heat or noisy bearings that would indicate a dry or angular displacement of the bearing support.

TAIL ROTOR SYSTEM

TAIL ROTOR RIGGING

Procedure.

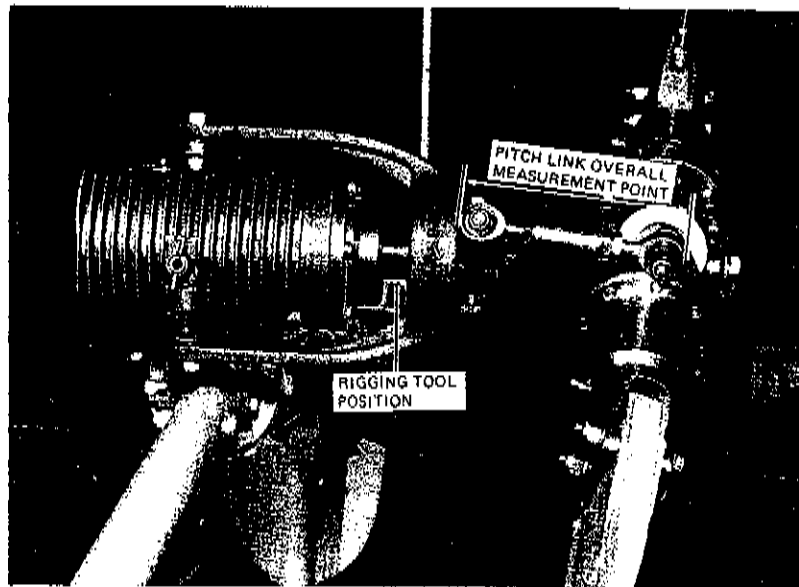
- a. Clamp pedals in line (neutral position).
- b. Insert rigging tool (T-0012, (Ref. Page 15-21), neutral position, at position shown on Page 15-20. If rigging tool can not be inserted cables must be readjusted (35 to 40 lbs.).

NOTE: If special tool is not available, neutral measurement is .590.

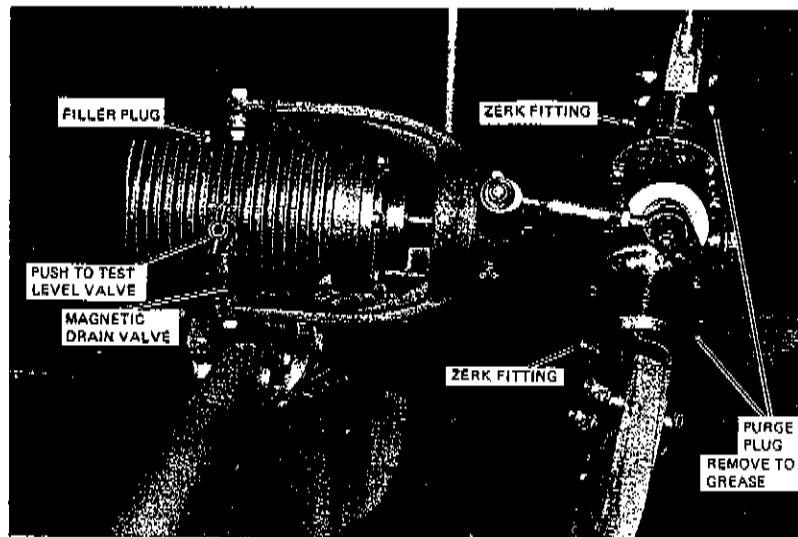
- c. Remove rigging tool and clamps from pedals.
- d. Insert rigging tool as in Step b for correct "right pedal" spacing between fork and adapter plate of tail rotor. Depress right pedal, if spacing is incorrect adjust stop on forward bellcrank assembly under left hand floor in cabin. (Ref. Page 15-8)
- e. Repeat Step d. For correct "Left Pedal" throw and correct as in Step d if necessary.
- f. Check pitch change links for proper overall dimension. Use micrometer or suitable measuring device to set length at 4.124 inches for fiberglide bearings and 4.050 for heim bearings. (Ref. Page 15-20)
- g. Cycle pedals full left and right and check for proper blade travel, for security and freedom of operation. Safety wire turnbuckles using .032 safety wire. Recheck complete system.

NOTE: No more than three threads to be exposed at both ends on turnbuckle.

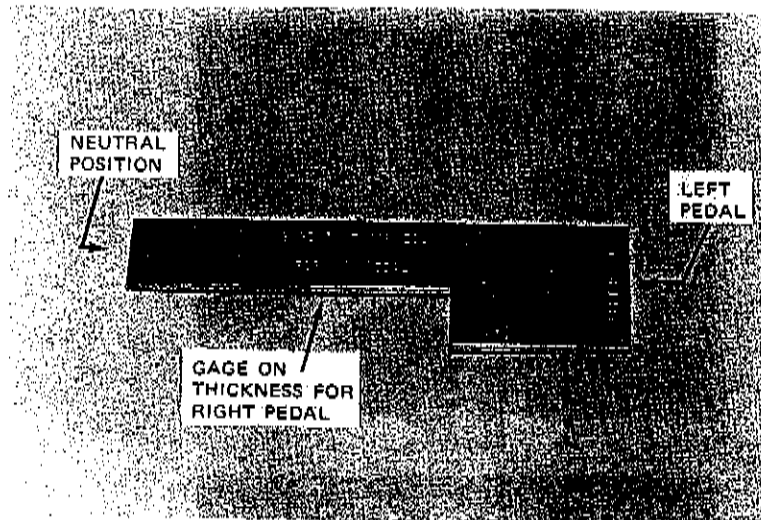
- h. Left pedal travel $26.3^{\circ} \pm 1^{\circ}$ and right pedal $-5.5^{\circ} \pm 1^{\circ}$.



TAIL ROTOR RIGGING



TAIL ROTOR LUBRICATION POINTS



TAIL ROTOR RIGGING TOOL

TAIL ROTOR SYSTEM

TAIL ROTOR BALANCING - STATIC. (Ref. 15-22)

- a. Grease blade grips and wipe assembly free of all foreign matter.
- b. Install balance arbor in tail rotor hub.
- c. Place tail rotor assembly on balance fixture. Ref. Picture A.
- d. Align blades in zero pitch setting.
- e. Check chordwise balance. Ref. Picture B.

NOTE: Add or remove weights as necessary to balance screws located in butt end of blade (1). If excessive weight is required, remove tail rotor from fixture and shift shims in hub. Re-check chordwise balance.

- f. Check spanwise balance. Ref. Picture C.
- g. Add or remove weights as necessary to balance screws located in tip end of blade (2).
- h. Re-check chordwise balance.
- i. If desired, a check may be made at 45° intervals to determine if tail rotor assembly is properly balanced.

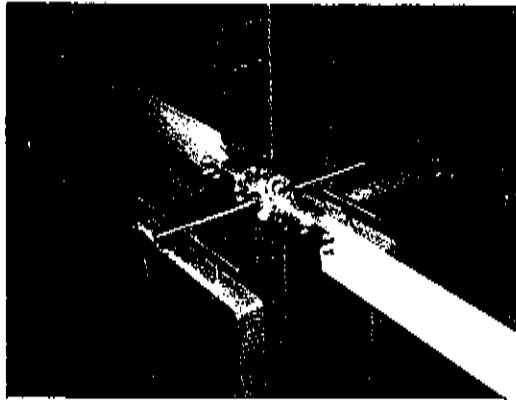


FIGURE A

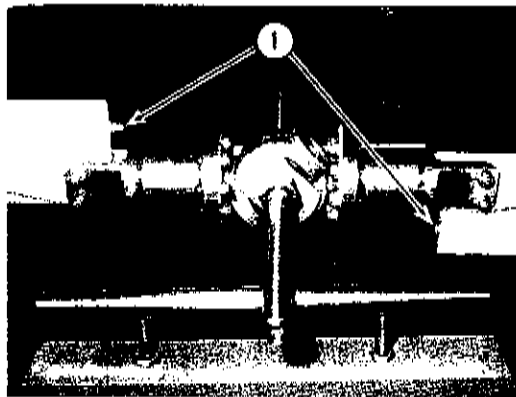


FIGURE B

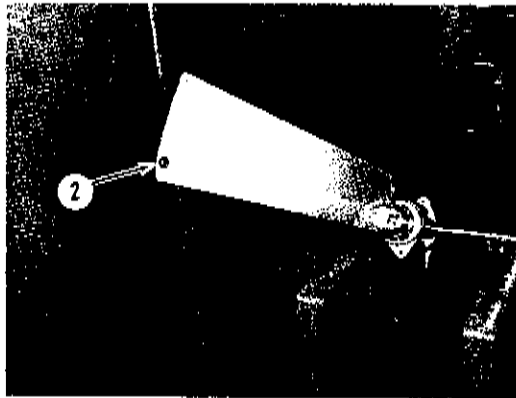


FIGURE C

TAIL ROTOR BALANCE

INTRODUCTION

This maintenance manual supplement is issued to set forth the recommendations and procedures for maintaining and servicing the model F-28C helicopter, manufactured by the Enstrom Helicopter Corporation, P.O. Box 277, Menominee, Michigan. The F-28C supplement chapters are to be used in addition to the basic model F-28A and 280 maintenance manual.

TABLE OF CONTENTS

The table of contents at the beginning of the supplement presents, in sequence, the principal text headings within each section and a complete list of illustrations.

MANUAL CHANGES AND REVISIONS

Subsequent to the publication of the initial issue of the Enstrom 280C Helicopter Maintenance Manual, changes in aircraft and equipment, in support concepts and in procedures, as well as information developed by experience, affect the contents of the Manual. To ensure that coverage in the Manual continues to reflect such changes, revised information is released by one of the following methods:

- A. Revision — An alteration of portions of the Manual accomplished by the replacement, addition and/or deletion of pages.

CAUTION: Do not discard the present Manual when a revision is received. Consult the "A" page to determine usability of old pages to prevent having a publication with missing pages.

The "A" page that accompanies each revision lists all pages replaced, added, or deleted. The Manual should be disassembled and all affected pages removed and destroyed. The replacing and added pages should then be inserted and checked against the "A" page listing.

- B. Reissue — In cases where large numbers of changes are involved, a complete reissue of the Manual is warranted. Preceding issues of the Manual then becomes obsolete and should be discarded.
- C. Service Information Letters and Directive Bulletins — Service information is to be considered as part of the Manual.

C.-1 Service Information Letter

To be used to transmit information, recommen-

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datations and general service instructions to the customer.

C.-2 Service Directive Bulletin

To be used to direct the customer to make mandatory changes, improvements or inspections to his aircraft.

C.-3 Physical incorporation In the Manual of the service information will be accomplished at the next revision date and listed on the Service Information Summary page.

TURBOCHARGER SUPPLEMENT

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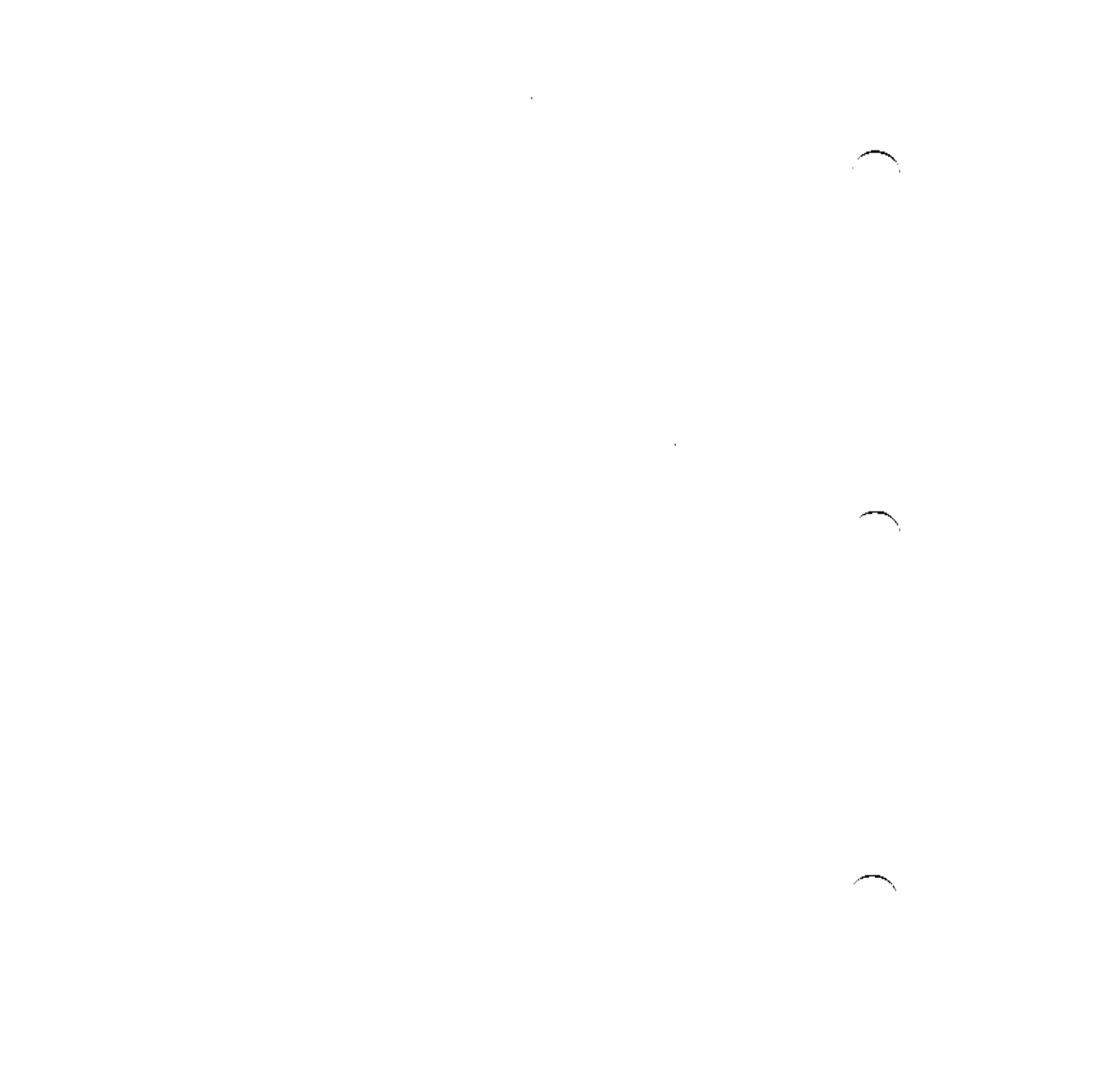
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SERVICE INFORMATION SUMMARY

The following service information has been incorporated in this Manual:

Number	Date	Number	Date
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SECTION 17 — GENERAL INFORMATION

DESCRIPTION

The C-Model helicopter incorporates an increase in performance which is attained by a turbocharged engine installation. The various individual system features are defined in this chapter.

INDUCTION AIRFLOW SYSTEM

The air induction consists of a filtered non-ram air intake located on the right side of the engine compartment. The air filter container assembly incorporates a spring-loaded, automatic alternate air source. The filtered intake air passes through the container assembly and into the fuel injector unit.

POWER PLANT

A Lycoming HIO-360-E1AD four-cylinder opposed engine is used in the 280C helicopter. This engine incorporates features making it suitable for turbocharging.

NOTE: It is recommended that the appropriate Lycoming Operator's Manual be consulted prior to any adjustment or repair to the engine.

OIL SYSTEM

The Lycoming engine is provided with a wet sump pressure oil system having a capacity of eight (8) quarts. The total oil system has a capacity of ten (10) quarts. This includes all oil in the lines, engine, oil cooler, and oil filter. An engine-driven gear scavenge pump returns the oil from the turbocharger back to the engine sump. There is a restrictor that is supplied with the engine which restricts the oil pressure to the turbocharger. The restrictor valve is rated at 27 psi. Another restrictor valve is located in the oil line at the turbocharger inlet. This is a one way valve which prevents oil leakage from the turbocharger after shutdown.

A bayonet-type oil quantity gauge with graduated markings is part of the oil tank filler cap and is accessible through the left-hand side cowling of the engine. Engine oil cooling is accomplished by the use of a reverse-flow oil cooler with thermostatic valves and bypass provisions. It is located on the right-hand side of the engine compartment.

Oil System Indicators — Oil Temperature and Pressure Gauges. Standard type gauges are provided for both the

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engine oil temperature and oil pressure indications. Both gauges are marked to provide visual engine operating limitations and are located on the instrument panel.

ENGINE CONTROLS

Mixture Control. A vernier mixture control knob is provided on the instrument console. This vernier control incorporates the features of a standard push-pull cable. Full rich is in the "in" position. Full lean is in the "out" position. The vernier feature allows a screw type of adjustment to fine tune any preset mixture position.

TURBOCHARGER

The turbo unit has only one moving part, a rotating shaft with a turbine wheel on one end, a compressor impeller on the other, all precision balanced and each contained in its own housing. The turbine wheel, driven by exhaust gas energy, drives the impeller which compresses intake air to a density equivalent of near sea level and delivers it to the engine intake. This increased volume of air allows the engine to "breathe" with the same volumetric efficiency that it does at low levels. The engine can produce the equivalent power at all altitudes up to 12,000 feet density altitude.

SECONDARY STATIC SYSTEM

The turbocharged static air system insures positive ambient pressures at the engine injector nozzles for all operating environments. Two check valves are installed in this static system. One check valve is vented to ambient pressure on the filtered side of the air induction container. The other valve is installed in the static line which is connected to the induction tube downstream of the turbocharger. The ambient air valve is open during starting, idling and engine manifold pressures up to barometric. The induction valve is closed at this time. As the manifold pressure exceeds barometric, the ambient valve closes and the induction valve opens. Both valves function automatically during this process. The engine-driven fuel pump is vented to the inlet air induction tube. This vent line provides the fuel pump with the same atmospheric pressure at which the turbocharger system is operating.

EXHAUST GAS TEMPERATURE SYSTEM

The exhaust gas temperature, as shown on the panel-

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mounted indicator, is used as an aid for fuel mixture leaning in cruising flight. The panel indicator is red lined at 1650°F. The exhaust temperature probe is located on the exhaust stack just before the inlet to the turbocharger. This allows an actual temperature measurement of the exhaust gases that are delivered into the turbocharger unit.

PRIMARY AIRFLOW SYSTEM

The primary air system consists of an inlet filter assembly, a fuel injector, a turbocharger, and an induction inlet tube. The filtered outside air passes into the fuel injector where it is metered. The air from the injector is drawn into the turbocharger impeller. The inlet air is compressed and delivered to the engine intake sump.

INDUCTION PRESSURE RELIEF VALVE

The turbocharged engines are equipped with a pop-off valve to limit manifold pressures to the engine. This valve normally starts to crack open at 36.5" to 37.0" of M.A.P. and is fully open at approximately 40.0" of M.A.P. This will vary slightly between individual engines. When this valve opens in the overboost condition, it dumps airflow overboard. Since the fuel injector or servo meters fuel partially based on mass airflow, but cannot recognize that the pop-off valve is open, the fuel/air mixture will become increasingly rich with an attendant loss of net horsepower. This is also evidenced by a drop in E.G.T. and an increase in fuel flow which is responsive to the rate of change of the pop-off valve opening (i.e. slow throttle movement causing small rates of change of pop-off valve opening will cause slow rates of change of E.G.T. and fuel flow, etc.). This normally can be observed at or below 6,000 feet density altitude.

To recover higher powers, the M.A.P. must be reduced toward normal limits (36.5" M.A.P.) to permit the pop-off valve to close, resulting in a proper fuel/air mixture for maximum power output.

FUEL SYSTEM

The system consists of two interconnected 20 U.S. gallon fuel tanks which feed simultaneously to the engine. The tanks are located on the left and right side of the aircraft over the engine compartment. The tanks have a total fuel capacity of 40 U.S. gallons, with a total of 2 gallons unusable fuel, one gallon unusable fuel in each tank.

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Fuel Pressure Indicator. The fuel pressure indicator provides psi pressure readings of the fuel as delivered to the flow divider. The indicator is marked for normal operating range from 0 to 160 pounds per hour and 0 to 25 psi index lines in 5 psi increments.

TRANSMISSION SYSTEM

The main transmission unit provides an 8.277 reduction ratio between the engine and the main rotor. The transmission incorporates a free-wheeling unit in the upper pulley assembly which is mounted on the pinion input shaft. The free-wheeling unit provides a disconnect from the engine in the event of a power failure and permits the main and tail rotors to rotate in order to accomplish safe autorotation landings. Six pints of Mobil HD 80-90 gear oil are used in the transmission. The main rotor transmission has a sight gauge which is located on the aft right-hand side and is visible through an opening in the baggage compartment or the right access panel.

Main Rotor Transmission Temperature Indicator. A main rotor transmission gauge is located on the instrument panel and is red lined at 220°F.

Tail Rotor Transmission. The tail rotor transmission, mounted at the aft end of the tail cone, supports and drives the tail rotor. The tail rotor transmission is equipped with a self-contained lubricant supply and level gauge at the rear of the housing and magnetic plug can be removed to inspect for metal particles. Its capacity is 5 ounces of S.A.E. 10 wt. non-detergent motor oil.

MODEL SPECIFICATIONS

Power Plant

Type	Lycoming
Designation	HIO-360-E1AD
Cylinders	4
Normal Power	205 hp
Normal RPM	2900 RPM
Specific Fuel Consumption	.69 lbs. hp/hr.
Weight	322 lbs.
Oil	8 qts. or 15 lbs.

Turbocharger

Type	Rajay
Designation	301 E-10-2

Performance

Refer to Flight Manual.

Operating RPM's

Engine	2750-2900
Tail Rotor	2504 (at 2900 engine RPM)
Main Rotor	350 (at 2900 engine RPM)
Main Rotor Autorotation Range	332-385

Ratios

Lower to Upper Pulley	1:1.157
Main Rotor Gearbox	1:7.154
Tail Rotor Gearbox	1:1
Engine to Main Rotor	8.277

Dimensions

Width (overall)	28'2"
Rotor Diameter	32'
Height (overall)	9'
Length (overall)	27'8" (280C) 29'4" (F-28C)
Cabin Width at Seat	58" (280C) 61" (F-28C)
Tread-Landing Gear	7'4"

**F-28C — 280C MAINTENANCE
MANUAL SUPPLEMENT****Rotor System**

Number of Blades	3
Chord - Each	9.5"
Disc Area	804 sq. ft.
Main Rotor RPM	350
Tail Rotor Diameter	4.67'
Number of Blades	2
Chord	4.4"

NOTE: Listed are publications and directives considered helpful when used in conjunction with this manual.

Unit	Number	Title	Address
Engine	60297-12	Operator's Manual H10-360	Lycoming Division, Williamsport, Pa.
Fuel Injection System	15-338C	Fuel Injection Systems	The Bendix Corp., Bendix Product Aerospace Div., South Bend 20, Ind.
Fuel Pump, Boost	10019	Maintenance & Overhaul of Weldon Pumps	Weldon Tool Co. 3000 Woodhill Road Cleveland, Ohio 44104
Ignition		The ABC's of the Bendix Shower of Spark	The Bendix Corp. Electrical Components Division Sidney, New York 13838
Magnetos	D-2000	Installation, Operation & Maintenance Instructions for the D-2000 & D-2200 Series Magnetos	The Bendix Corp. Electrical Components Division Sidney, New York 13838

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MM-17-9

Unit	Number	Title	Address
Voltage Regulator	VSF-7200	Prestolite Service Information	Prestolite P.O. Box 931 Toledo, Ohio 43601
Alternator	ALX-8421		Prestolite P.O. Box 931 Toledo, Ohio 43601
Starter	MZ-4218	Test Specifications	Prestolite P.O. Box 931 Toledo, Ohio 43601
Battery (Std.)	AC78M		Exide Power Systems P.O. Box 5723-C Philadelphia, Pa. 19120
Turbocharger	301 E-10-2		Rajay Industries, Inc. P.O. Box 207 Long Beach, Calif. 90801

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MM-17-10

Unit	Number	Title	Address
Pressure Relief Valve	No. TP21-0115	Overhaul Instructions	Garrett Corp. Airresearch Industrial Division 9225 Aviation Blvd. Los Angeles, Calif. 90009
Exhaust Gas Temp. Gauge	Report 65-112	Installation and Operating Instructions	Alcor Aviation Inc. P.O. Box 28299 San Antonio, Texas 78228

SERVICE SUPPORT ITEMS

MIL Spec	Product	Item	Available From Enstrom Corp.	Source
MIL-G-18709A	Andock "B" Regal AFB No. 2 Marfax 0 or 00	General Purpose Grease " "		EXXON or Humble Oil Co. Texaco Oil Co. Texaco Oil Co.
MIL-G-22537A	Aeroshell 14	Grease	5 Lb. Can 1 Lb. Can	Shell Oil Co. P.O. Box 120 Tulsa, Okla. 74100
Alternate MIL-G-23827A	Mobil No. 22 Enco Beacon No. 325 EXXON No. 5114 EP	" " "		Mobil Oil Co. Enco Oil Co. EXXON Oil Co.
MIL-G-25760A	Aeroshell No. 16 Mobil No. 28	" "	1 & 5 Lb. Can	Shell Oil Co. Mobil Oil Co.
MIL-L-228518 (Ashless disper- sant aviation oil)	Aeroshell "W" Texaco Premium AD Enco Aviation Oil-E Paranox Oil (EXXON) AMOCO Premium	Engine Oil " " " "	Quart or Case	Shell Oil Co. Texaco Oil Co. Enco Oil Co. EXXON Oil Co. AMOCO Oil Co.

SERVICE SUPPORT ITEMS

MIL Spec	Product	Item	Available From Enstrom Corp.	Source
MIL-L-60828 (Standard Aviation Oil)	Aeroshell Texaco Aviation Oil Enco Aviation Oil EXXON Aviation Oil AMOCO Aviation Oil	" " " " "		Shell Oil Co. Texaco Oil Co. Enco Oil Co. EXXON Oil Co. AMOCO Oil Co.

SERVICE SUPPORT ITEMS

MIL Spec	Product	Item	Available from Enstrom Corp.	Source
MIL-L-6082B SAE 10W	Aeroshell	Tail Rotor Gearbox	Quarts	Shell Oil Co. Texaco Oil Co. Enco Oil Co. EXXON Oil Co. Mobil Oil Co. AMOCO Oil Co.
	Texaco Aviation Oil	" "		
	Enco Aviation Oil	" "		
	EXXON Aviation Oil	" "		
	Mobil Aviation Oil	" "		
MIL-H-5606A	AMOCO Aviation Oil	" "	Gallon	Texaco Oil Co. Shell Oil Co. EXXON Oil Co. Enco Oil Co. Mobil Oil Co. AMOCO Oil Co.
	Hydraulic Oil	Landing Gear Struts		
	Hydraulic Oil	" "		
	Hydraulic Oil	" "		
	Hydraulic Oil	" "		
	Hydraulic Oil	" "		
	Hydraulic Oil	" "		

LYCOMING ENGINE OIL SPECIFICATIONS

Average Ambient Temperature MIL-L-6082B SAE Grade MIL-L-22851 Ashless Dispersant SAE Grades

Above 60°F. 50
30°F. to 90°F. 40
0°F. to 70°F. 30
Below 10°F. 20

40 or 50
40
30
20

SERVICE SUPPORT ITEMS

MIL Spec	Product	Item	Available from Enstrom Corp.	Source	
MIL-L-2105B	Mobilube HD 80-90	Main Rotor Gearbox	38 Lb. Can	Mobil Oil Co.	
	Shell Spirex HD 90 and EP 90	" "			Shell Oil Co.
	EXXON Gear Oil GX90	" "			EXXON Oil Co.
	Pennzoil No. 4096	" "			
	MIL-L-7808	L-45 Grade 20	Damper Silicone Oil	1 Pint	Union Carbide
		D.T.E. Heavy Medium Oil	Clutch Oil	1 Pint	Mobil Oil Co.
		Arctic "C"	" "	1 Pint	Mobil Oil Co.
		Arctic Light Oil	" "	1 Pint	Mobil Oil Co.
	MIL-L-23699	Turbo Oil EXXON No. 15	" "		EXXON Oil Co.
		Turbo Oil EXXON No. 2380	" "		EXXON Oil Co.
No. F-50 Versilube		" "		General Electric	
No. 220ATF Fluid Enco No. B-10103		" "		Mobil Oil Co. Enco Oil Co.	

FORMSPRAG CLUTCH OIL SPECIFICATIONS

- +20°F. to +120°F. — D.T.E. Heavy Medium Oil — Mobil
- 10°F. to + 20°F. — Arctic "C" Mobil
- 10°F. to - 30°F. — Arctic Light Oil — Mobil
- 40°F. to +120°F. — MIL-L-7808 Turbo Oil EXXON No. 15
MIL-L-23699 Turbo Oil EXXON No. 2380
- 30°F. to +120°F. — G.E. No. F-50 Versilube
Mobil No. 220 ATF Fluid
Enco No. b-10103

SERVICE SUPPORT ITEMS

Product	Item	Available From Enstrom Corp.	Source
MGH 10 Mirror Glaze	Plastic Polish	8 oz. bottle ½ gal. can	Van Duzen Company A/C Supplies
6487894 (AAF-115)	Filter	1 each	AC Spark Plug
Andok 'B'	Grease	½ lb. can	Humble Oil Company P.O. Box 1353 Houston, Texas 77001
CH48103	Oil Filter	1 each	Champion Spark Plug P.O. Box 910 Toledo, Ohio

SECTION 18 — INSPECTIONS

PREFLIGHT INSPECTION

This checklist is designed to be used as a reference guide while performing the preflight inspection. Thoroughly familiarize yourself with this Manual before utilizing this checklist. Prior to starting the complete preflight inspection, check the following items in the cockpit: master switch OFF, magneto switch OFF, all other switches OFF, fuel valve ON

Exterior — Check the following:

CAUTION: Remove all covers and locking devices.

1. Left-hand door for security.
2. Windshield for cracks.
3. Pitot tube for obstruction.
4. Landing lights for operation and security.
5. Induction intake scoop for obstructions.
6. Right-hand shock strut—plston extension should be $\frac{3}{4}$ " to $1-\frac{3}{4}$ " from red line; struts clean.
7. Right-hand landing gear for security. (Ground handling wheels secured.)
8. Right-hand door for security.
9. Drain fuel sump.
10. Right-hand engine compartment.
11. Induction hose clamps on the air filter and fuel injector for security.
12. Air intake scoop for obstructions.
13. Right-hand fuel tank full — 100/130 octane, cap secured. Drain tank sump.
14. Main gearbox oil level.
15. Baggage door locked.
16. Right-hand static port opening unobstructed.
17. Tail cone for general condition.
18. Tail rotor drive shaft for security. Check stabilizer for security.
19. Navigation and strobe lights for operation and security.
20. Tail rotor pitch links for binding or looseness. Tail rotor blade for security and leading edge for nicks, bonding separation and general security. Tail rotor strike tabs for security and damage.
21. Tail rotor guard for damage and security. Also check tail rotor gearbox for oil quantity.
22. Left-hand static port opening unobstructed.
23. Main rotor blades for nicks, bonding separation or

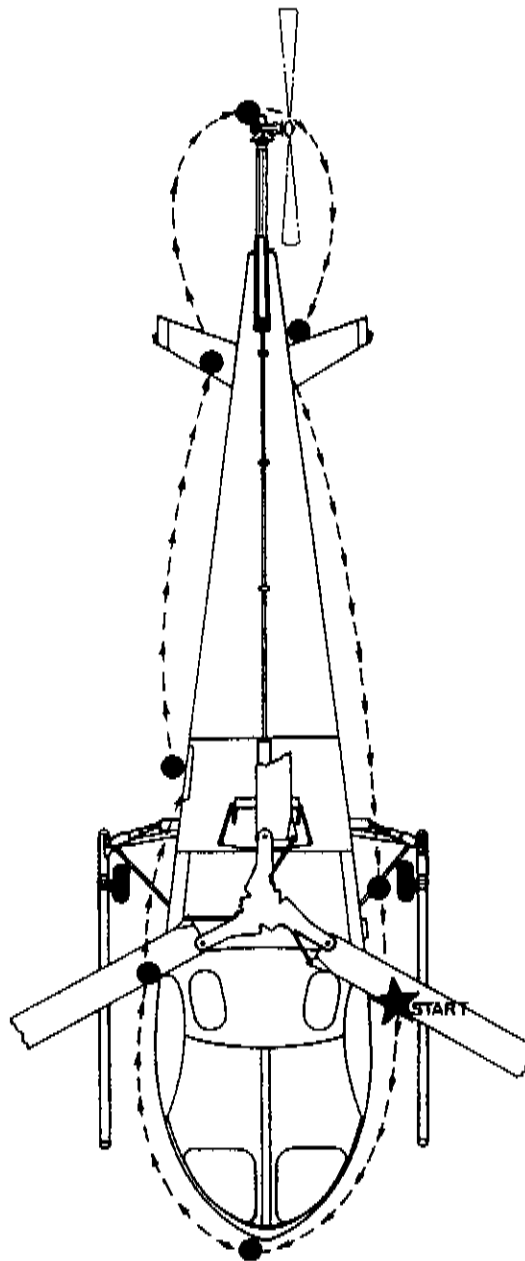
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looseness.

24. Main rotor pitch links for binding or looseness.
25. Cyclic and collective walking beams for security.
26. Blade dampers for proper security.
27. Left-hand fuel tank full—100/130 octane cap secured.
Drain tank sump.
28. Engine oil—6 quarts minimum, 8 quarts maximum.
29. Fuel system for leaks.
30. Exhaust manifold for cracks and looseness.
31. Engine for oil leaks.
32. Turbocharger exhaust inlet and outlet clamps for security.
33. Turbocharger air inlet clamps for security.
34. Turbocharger oil lines for leaks.
35. Turbocharger mount bracket for security.
36. Belt drive system.
37. Left-hand shock struts—piston extension should be $\frac{3}{4}$ " to $1\text{-}\frac{3}{4}$ " from red line; struts clean.
38. Left-hand landing gear for security. (Ground handling wheel secure.)
39. Check operation of all lighting for night flight.

Interior — Check the following:

1. Check and adjust tail rotor pedals.
2. Seat belts fastened.
3. Doors latched.
4. Collective full down and friction on.
5. Clutch disengaged.
6. Throttle CLOSED.
7. Mixture IDLE CUT OFF.
8. Fuel valve ON.
9. Magneto switch OFF.
10. Radio switches OFF.
11. Set master switch ON.
12. Fuel quantity.
13. Fuel pressure warning light (press to test).
14. Trim motors for operation.
15. Controls for freedom of operation.
16. Altimeter setting.



EXTERIOR INSPECTION

1

2

3

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MM-18-4

ENSTROM HELICOPTER INSPECTION SHEET			
Serial No. _____	Owner _____		
N _____	Address _____		
Total Time: _____			
Engine _____			
Airframe _____			
Circle type of inspection:			
50	100		
Periodic	Special		

Nature of Inspection	Inspection Frequency (hours)	Mechanical Check-off	Mechanical Check-off	Nature of Inspection	Inspection Frequency (hours)	Mechanical Check-off	Mechanical Check-off
		75	100			75	100
POWER PLANT GROUP				H. Inspect accessory section for:			
Engine Compartment				1. Evidence of leakage	50		
Turbocharger				2. Security of mounting of accessories	50		
A. Inspect all air inlet ducting and compressor discharge ducting for:				3. Chafing of lines	50		
1. Worn Spots	50			4. Proper security of lines	50		
2. Loose Clamps	50			I. Inspect injector for:			
3. Leaks	50			1. Security of mounting	50		
B. Inspect engine air inlet assembly for:				2. Evidence of leakage	50		
1. Checks and Chafing	50			3. Cleanliness of finger strainer	50		
2. Security of Clamps	50			4. Proper security of fittings	50		
C. Check all turbo support brackets and struts for:				5. Proper operation, travel of mixture and throttle control	50		
1. Breakage	100			6. Proper safetying of controls	50		
2. Sagging	100			7. Proper location of blast tube	100		
3. Wear	100			J. Inspect injector air ducting for:			
D. Check all oil lines, fuel lines and fittings for:				1. Proper security	50		
1. Wear	50			2. Cracks or damage	50		
2. Chafing	50			3. Cleanliness of air filter	100		
3. Leakage	50			4. Torn or deteriorated hose	50		
4. Heat Damage	50			5. Proper operation of blow-in door	50		
5. Fatigue	50			6. Security of hose	50		
E. Inspect injector system for signs of fuel dye indicating leaks.	50			K. Inspect engine mounts for:			
NOTE: If dye stains are present, check for loose connections and proper installation of air bleed nozzle shrouds.				1. Deteriorated rubber	100		
F. Check turbocharger system static vent lines for:				2. Proper safetying	100		
1. Internal cleanliness—disconnect and blow out lines.	100			3. Cracks or damage	100		
2. Security of attachments	100			L. Inspect intake pipes for:			
3. Worn spots	50			1. Dents and cracks	50		
4. Proper operation of check valves	100			2. Evidence of leakage	50		
G. Inspect engine baffling for:				3. Proper security	50		
1. Cracks and chafing	50			M. Inspect exhaust for:			
2. Worn or damaged fasteners	50			1. Cracks	50		
3. Cleanliness	50			2. Heater muff for leaks	50		
				3. Proper security	50		
				4. Check all clamps for tightness	50		
				N. Inspect cylinders for:			
				1. Fins broken or damaged beyond permissible limits	100		
				2. Cracked, broken or damaged air defectors	100		
				3. Security of air defectors	100		

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MANUAL SUPPLEMENT**

MM-18-5

Nature of Inspection	Inspection Frequency (hours)	Mechanical	Mechanical	Nature of Inspection	Inspection Frequency (hours)	Mechanical	Mechanical
		Check-Off	Check-Off			Check-Off	Check-Off
		25	50			25	50
		75	100			75	100
4. Proper security of hold-down nuts	100			(a) Left			
5. Evidence of leakage	100			(b) Right			
6. Damaged rocker box covers	100			(c) Off			
O. Inspect push rod housing for:				(5) Retorque turbocharger inlet oil connection if removed.			
1. Dents, cracks and damage	100			(6) Idle Operation			
2. Evidence of leakage	100			(a) RPM			
3. Proper security	100			(b) Mixture			
P. Inspect firewall and fire curtain for:				(7) Fuel Pressure			
1. Damage or cracks	100			(a) Fuel boost pump			
2. Cleanliness	100			(b) Engine-driven pump			
Q. Inspect engine cooling shroud for:				(c) Fuel shut-off			
1. Damage or cracks	100			(8) Free wheeling unit			
2. Security of mounting	100			(9) Transmission			
R. Inspect magneto for:				(10) Alternator			
1. Security of mounting	100			(11) Radios or avionics			
2. Timing	100						
S. Inspect engine-driven fuel pump for:				2. Inspect rotor blades for:			
1. Security of mounting	100			a. Evidence of blades out of track			
2. Evidence of leakage	50			3. Inspect aircraft for:			
3. Security of lines	50			a. Evidence of leakage			
T. Inspect engine compression for:							
1. No. 1 cylinder _____	100						
No. 2 cylinder _____							
No. 3 cylinder _____							
No. 4 cylinder _____							
U. Change oil and filter	50						
V. Post inspection run-up							
1. Inspect the following for proper operation:							
a. Belt engagement							
b. Engine:							
(1) Oil Pressure							
(2) Oil Temperature							
(3) Cylinder temperature							
(4) Magnetos							

NOTES: (1) Each progressive inspection includes every preceding inspection (e.g., the 100 hour inspection includes all 50 and 100 hour items). (2) A completed lubrication check-off sheet must accompany the signed inspection form.

It is certified that this helicopter has been thoroughly inspected per handbook of maintenance instructions and found to be airworthy, and appropriate entries made in the helicopter's logbook. It is further certified that the helicopter conforms to FAA specification, that all FAA airworthiness directives and manufacturer's service bulletins have been complied with, and the helicopter's papers are in proper order.

Mech 3-g. _____ Rating _____

Date _____ Pilot 3-g. (if required) _____

**F-28C — 280C MAINTENANCE
MANUAL SUPPLEMENT**

SPECIAL INSPECTIONS — POWER PLANT

INSPECTION RECOMMENDATIONS FOLLOWING OVERSPEED OF AVCO LYCOMING ENGINES [Ref. Service Instruction No. 1023C, May 19, 1967.]

The engine Model H10-360-E1AD overspeed limitation is 3200 RPM, and it is recommended that the following inspections be performed.

For engines that have not exceeded the overspeed limitation, no inspection is required.

Engines that have exceeded the overspeed limitation should be removed from the aircraft, disassembled, and the parts completely inspected. Replace all parts that are not within maximum service limits as shown in Avco Lycoming Service Bulletin No. SSP2070. In engines that employ dynamic counterweights, the bushings must be replaced in both the counterweights and the crankshaft. Engine must have connecting rod bolts and nuts replaced.

LYCOMING 400 HOUR INSPECTION

In addition to the items listed for daily preflight, 50 hour and 100 hour inspections, the following maintenance check should be made after every 400 hours of operation.

Valve Inspection. Remove rocker box covers and check for freedom of valve rockers when valves are closed. Look for evidence of abnormal wear or broken parts in the area of the valve tips, valve keeper, springs and spring seats. If any indications are found, the cylinder and all of its components should be removed (including the piston and connecting rod assembly) and inspected for further damage. Replace any parts that do not conform with limits shown in the latest revision of Service Bulletin No. SSP2070.

OVERHAUL CYCLES—POWER PLANT

Component	Overhaul At
Lycoming Engine (Ref. Lycoming letter 1009M dated 9/6/68)	1000 hrs.
Rajay Turbocharger	1000 hrs.

LIMITED LIFE AND COMPONENT OVERHAUL LIST

NOTE: Components listed shall be removed from the helicopter at the periods specified, in accordance with FAA requirements as they are limited life

**F-28C — 280C MAINTENANCE
MANUAL SUPPLEMENT**

items. Overhaul of components must be accomplished in accordance with the manufacturer's instructions.

Part No.	Component	SERVICE LIFE — HOURS											
		F-28		F-28A		280		@ 2200 #		@ 2350 #		@ 2600 #*	
		F-28	F-28A	F-28C	280C	F-28C	280C	F-28C	280C	F-28C	280C	F-28C	280C
695L28	Main Drive Belt	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200
695L35	Main Drive Belt	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200
LO-719	Main Drive Belt	600	600	600	600	600	600	600	600	600	600	600	600
MRC202SZZ	Belt Idler Pulley Bearing	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200
MRC5201S8XZZ	Swash Plate Bearing	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200
Z993L13X3B	Swash Plate Bearing	600	600	600	600	600	600	600	600	600	600	600	600
99508X3B	Belt Strut Bearing	500	500	500	500	500	500	500	500	500	500	500	500
01-691-08	Damper Rod End-												
	Main Rotor Blade												
	Main Rotor Shaft												
28-13104	Main Rotor Blade												
Rev. J or Earlier	Main Rotor Shaft												
28-14100	Main Rotor Blade												
28-14207	Walking Beam												
28-14282-11	Main Rotor Spindle												
28-14283	Main Rotor Drag Link												
28-15100	Tail Rotor Blade												
28-15110	Tail Rotor Blade												
28-15120	Tail Rotor Blade on												
	L-H Inst. 28-163000												
	R-H Inst. 28-16300												
28-15202-13	T.R. Spindle Narrow Chord												
28-16119	Universal Housing												
28-150002	Tail Rotor Blade												
28-150014	T.R. Spindle Wide Chord												

* RESTRICTED CATEGORY: Refer to Flight Manual for specified limitations

N/A - Not an approved installation

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SECTION 19 — WEIGHT AND BALANCE

INFORMATION

All helicopters are designed for certain limit loads and balance conditions. Changes in equipment which affect the empty weight center of gravity must be recorded in the aircraft and engine log book. It is the responsibility of the helicopter pilot to ensure that the helicopter is loaded properly. The empty weight, empty weight C.G. and useful loads are noted on the weight-balance sheet included in this Manual for this particular helicopter.

The longitudinal and lateral c.g. range for the Model F-28C vary with gross weight. Satisfactory aircraft handling qualities have been established throughout the c.g. envelopes shown on pages FM-6-6 through FM-6-10 of this supplement. Although the envelopes presented cover a wide range of typical loading conditions, pilots must calculate any unusual loading conditions to insure that the aircraft c.g. remains in the approved envelope. A sample calculation is shown on page FM-6-5 for reference.

The lateral c.g. limit is defined in terms of lateral moment in that the calculation of lateral c.g. is not part of the primary aircraft weight and balance records. Lateral moment is the algebraic summation of the left and right hand loads times their respective lateral moment arms. A sample calculation is shown on page FM-6-5 for reference. The aircraft centerline is used as the datum reference. Left lateral moment arms considered negative; right lateral moment arms are considered positive.

WEIGHT AND BALANCE

The removal or addition of fuel or equipment results in changes to the center of gravity and weight of the aircraft, and the permissible useful load is affected accordingly. The effects of these changes must be investigated in all cases to eliminate possible adverse effects on the aircraft's flight characteristics. The horizontal reference weight point is located 20 inches forward of the center in rear skid attachment.

Maximum Gross Weight	2200 lbs.
Estimated Empty Weight (no accessories, fuel or oil)	1495 lbs.
Useful Load	705 lbs.
Approved Forward C.G. Limit	2200 lbs. station 92.0
Approved Aft C.G. Limit	2200 lbs. station 94.7
Approved Aft C.G. Limit	2000 lbs. station 98.0
Approved Lateral Offset Moment	at 2200 lbs. -1700 lbs. + 3700 in. lbs.

The total lateral offset moment envelope is shown on Page FM-6-6.

Centerline of aircraft is "O" lateral moment arm.

TOOLS AND EQUIPMENT

Tape Measure	Commercial
Scale (two)	1000 lbs. capacity
Scale — tall (one)	100 lbs. capacity
Level — bubble-type	Commercial
Work stand	As required

DETAILED PROCEDURE FOR WEIGHING F-28C SERIES HELICOPTER

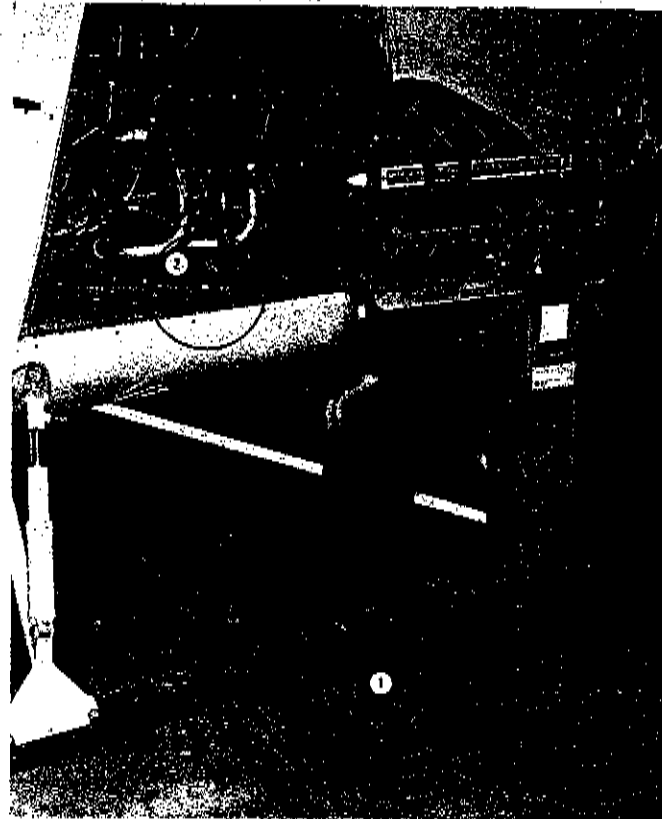
- a. Thoroughly clean helicopter.
- b. Helicopter will be weighed inside a closed building to prevent errors in scale readings due to wind. Helicopter will be placed in a level flight attitude.
- c. Check for proper installation of all accessory items. Check to determine if the scales that are being used have been calibrated recently, and check to see that the scales will zero out before weighing helicopter.
- d. The helicopter will be weighed without fuel, but the weight and balance record will reflect corrections to indicate the amount of unusable fuel 2 U.S. gallons. The helicopter may be weighed with full oil or without oil, but the weight and balance report should be corrected accordingly.
- e. Tare will be noted when helicopter is removed from the scales.

NOTE: Check oil level of main transmission and tail rotor transmission. Check to see that the main rotor blades are in uniform position, 120° apart.

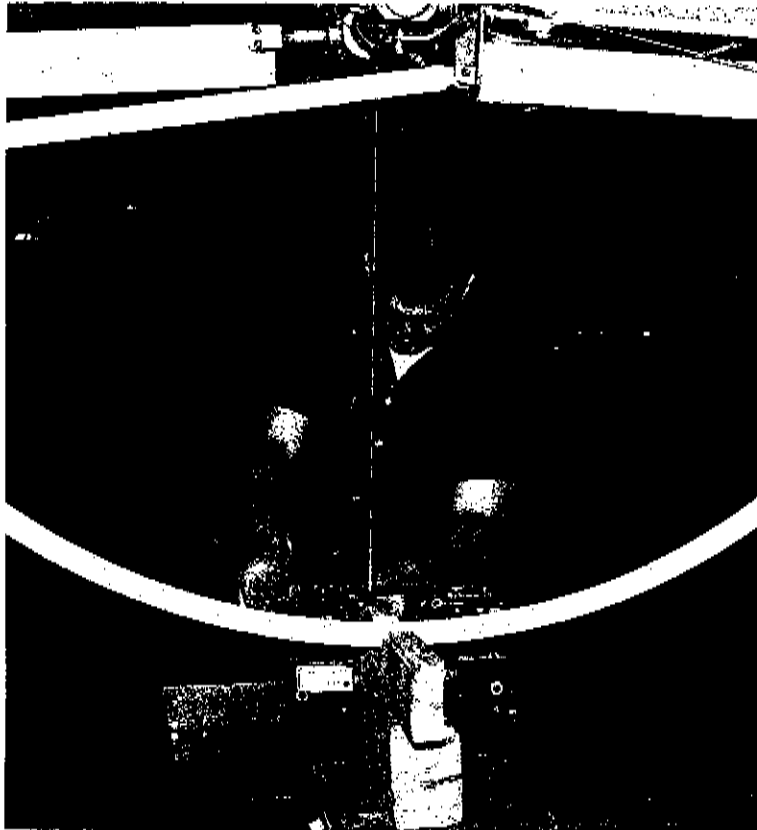
- f. Close and secure both doors, left and right hand sides.

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MANUAL SUPPLEMENT

- g. Hoist or jack helicopter clear of ground.
- h. Position two main scales beneath the skids.
- i. Position a pipe nipple in the center of left and right hand scales at 20 inches forward of center bolt in rear skid attachment. (Detail No. 1).



- j. Height of tail to be adjusted for level.
- k. Level fore and aft to be taken at lower pylon tube, left side, so identified. (Detail No. 2).
- l. Lateral level taken at lower forward pylon tube.
- m. Small scale will be located under tail rotor at the center line of the tail rotor output shaft, shown above.
- n. Using jack, raise or lower tail as required to level the aircraft along the longitudinal axis, paying attention to the level on the longitudinal and lateral pylon tubes.
- o. Read and record weight from each of three scales.
- p. Calculate weight and center of gravity on attached form, with weight data. Empty weight will be "dry weight."

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- q. All items added or subtracted will be listed on the attached form with weight, arm, and moment.
- CAUTION:** Weight and measurement readings are critical. Double check results.
- r. Remove helicopter from scales.
- CAUTION:** Do not remove curbing, jack, nipples, blocks, etc., from scales. These items constitute tare weight.
- s. Read and record tare weight from each of the three scales. An official weight and balance report is prepared in connection with each helicopter presented for airworthiness certification at the Enstrom Corporation. All these reports are marked "actual weight."
- t. This weight and balance report, and equipment list will be prepared and supplied with each helicopter.
- u. Use Form No. F-165 Basic Weight and Balance Report

**F-28C — 280C MAINTENANCE
MANUAL SUPPLEMENT**

to give you a continuous history of weight changes throughout the life of your helicopter.

LOADING INFORMATION

NOTE: It is the responsibility of the helicopter pilot to insure that the helicopter is loaded properly. The empty weight, empty weight c.g. and useful load are noted on the weight and balance sheet included in this manual for this helicopter.

C.G.

Range: Variable with Gross Weight 92.0 to 98.0
Maximum Gross Weight 2200 lbs.

TYPICAL LOADING — 280C

Rearward C.G.	Weight	Arm	Moment
Empty Weight (including undrainable engine oil, gearbox oil and unusable fuel)	1495.0	101.4	151593.0
Engine Oil	15.0	100.5	1507.5
Fuel, 40 Gal.	240.0	96.0	23040.0
Pilot	<u>140.0</u>	<u>64.0</u>	<u>8960.0</u>
	1890.0	97.9	185100

Forward C.G.

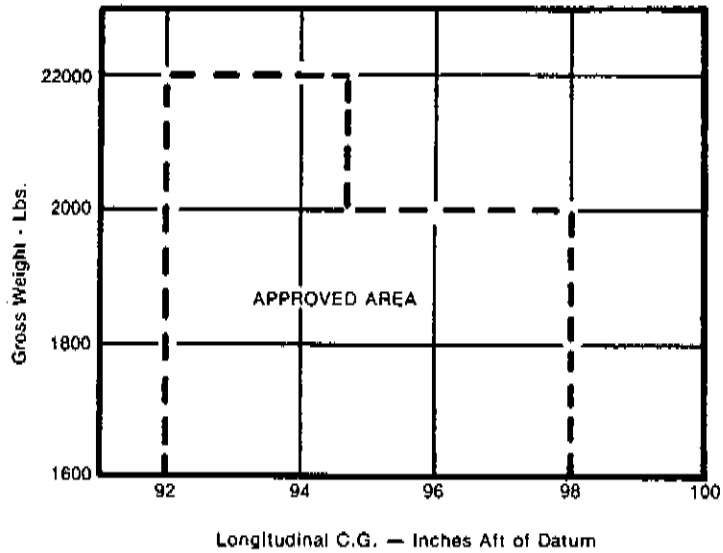
Empty Weight (including undrainable engine oil, gearbox oil and unusable fuel)	1495.0	101.4	151593.0
Engine Oil	15.0	100.5	1507.5
Fuel, 30.0 Gal.	180.0	96.0	17280.0
Pilot & Passengers	<u>510.0</u>	<u>64.0</u>	<u>32640.0</u>
	2200.0	92.2	203020.5

Lateral Offset Moment

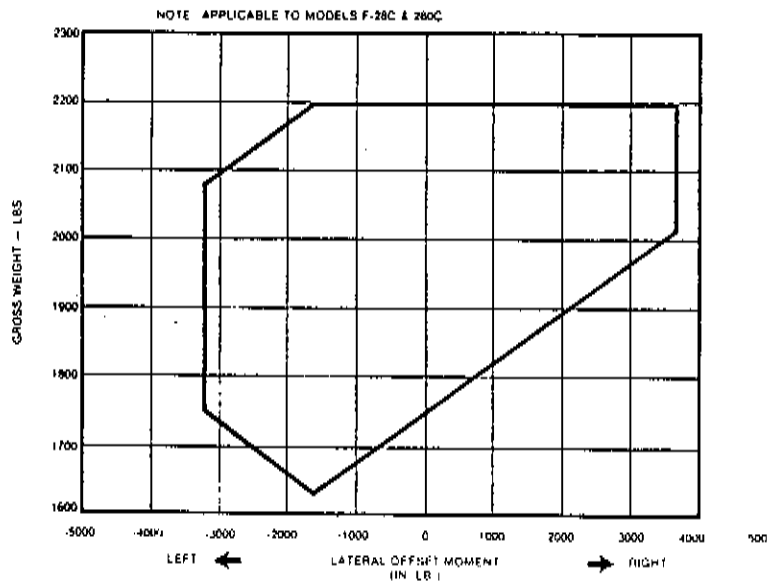
Pilot (left seat)	190	-13.5	-2565
Copilot (right seat)	130	+13.5	<u>+1755</u>
(Centerline of aircraft is "O" moment arm.)			- 810 in. lb.

**F-28C — 280C MAINTENANCE
MANUAL SUPPLEMENT**

**APPROVED CENTER OF GRAVITY ENVELOPES
LATERAL AND LONGITUDINAL**



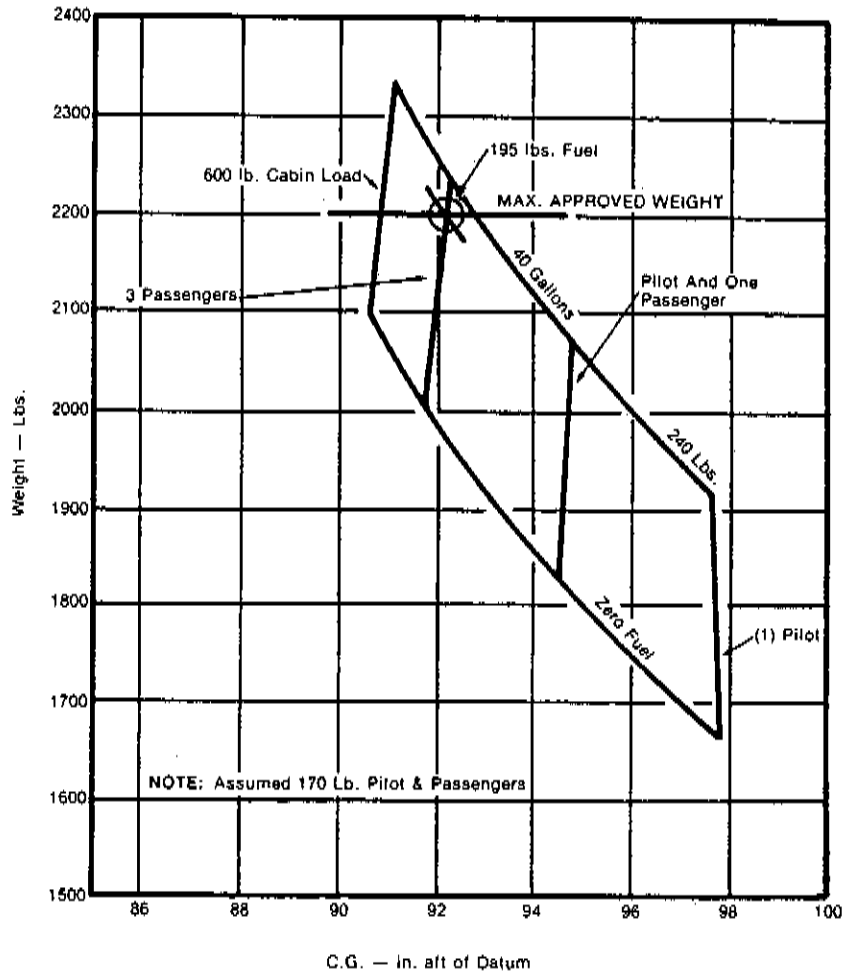
LATERAL OFFSET MOMENT ENVELOPE



F-28C — 280C MAINTENANCE
MANUAL SUPPLEMENT

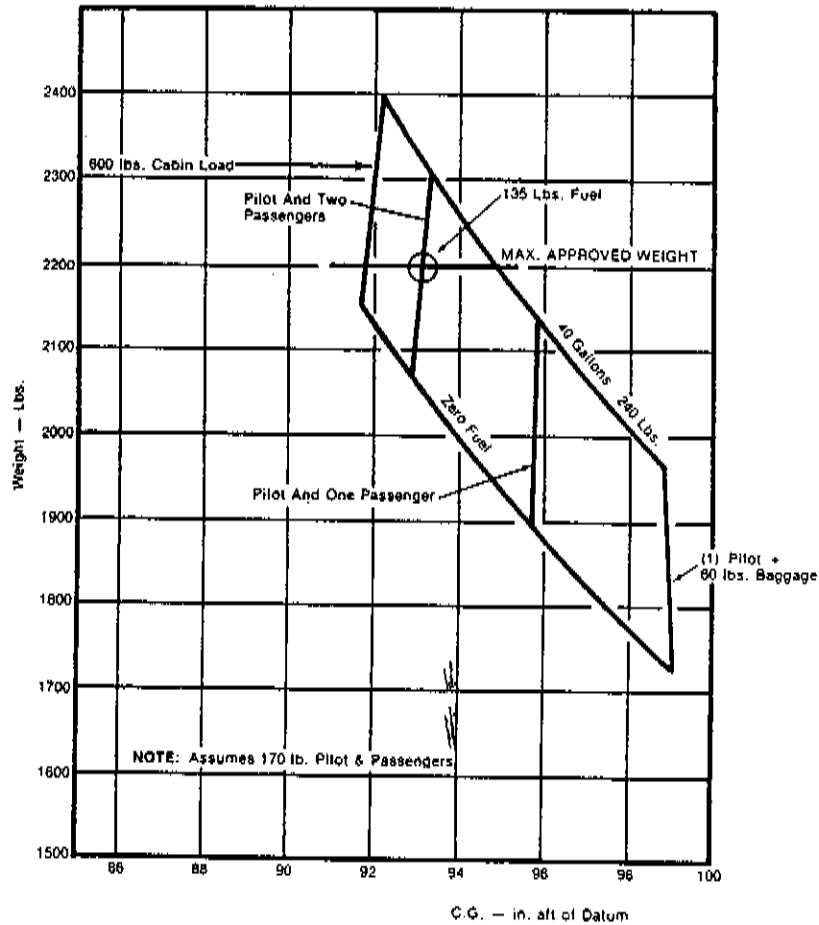
TYPICAL CONFIGURATION

**Basic Aircraft No Baggage
Empty Wt. — 1495 lbs.**



**F-28C — 280C MAINTENANCE
MANUAL SUPPLEMENT**

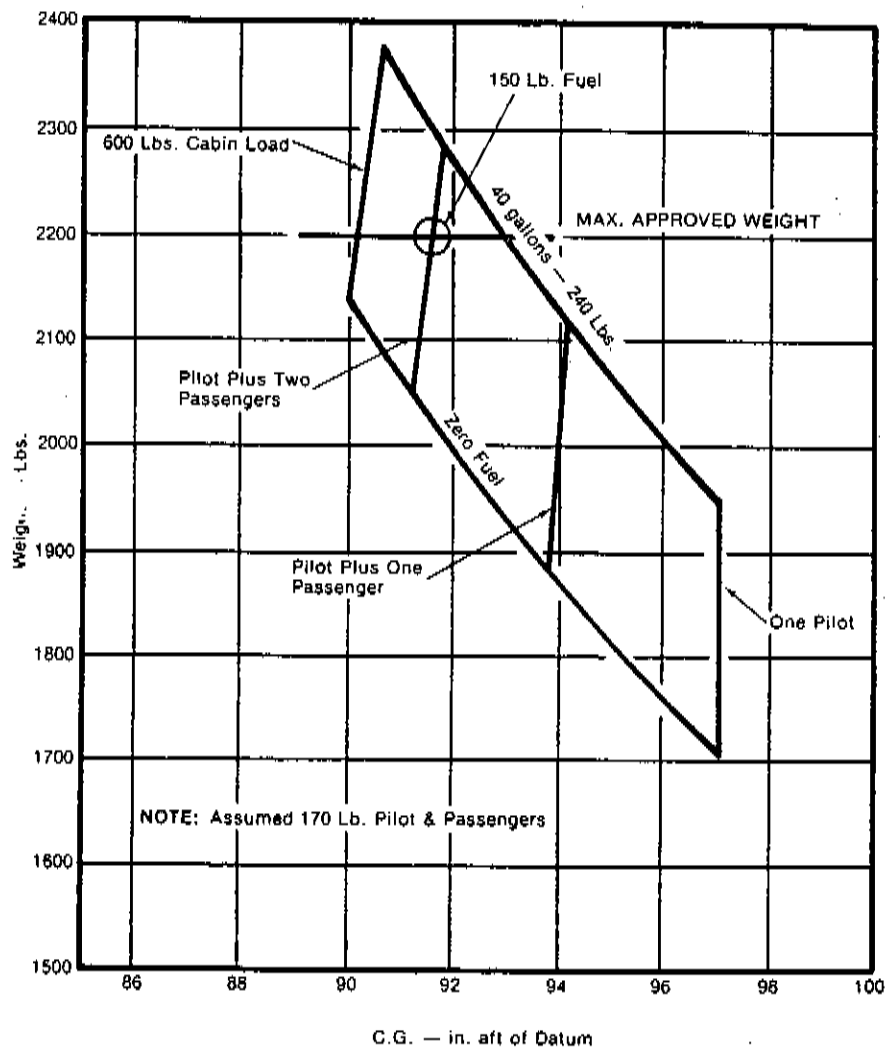
TYPICAL CONFIGURATION
Basic Aircraft with 60 lbs. Baggage
Empty Weight — 1495 lbs.



F-28C — 280C MAINTENANCE
MANUAL SUPPLEMENT

TYPICAL CONFIGURATION

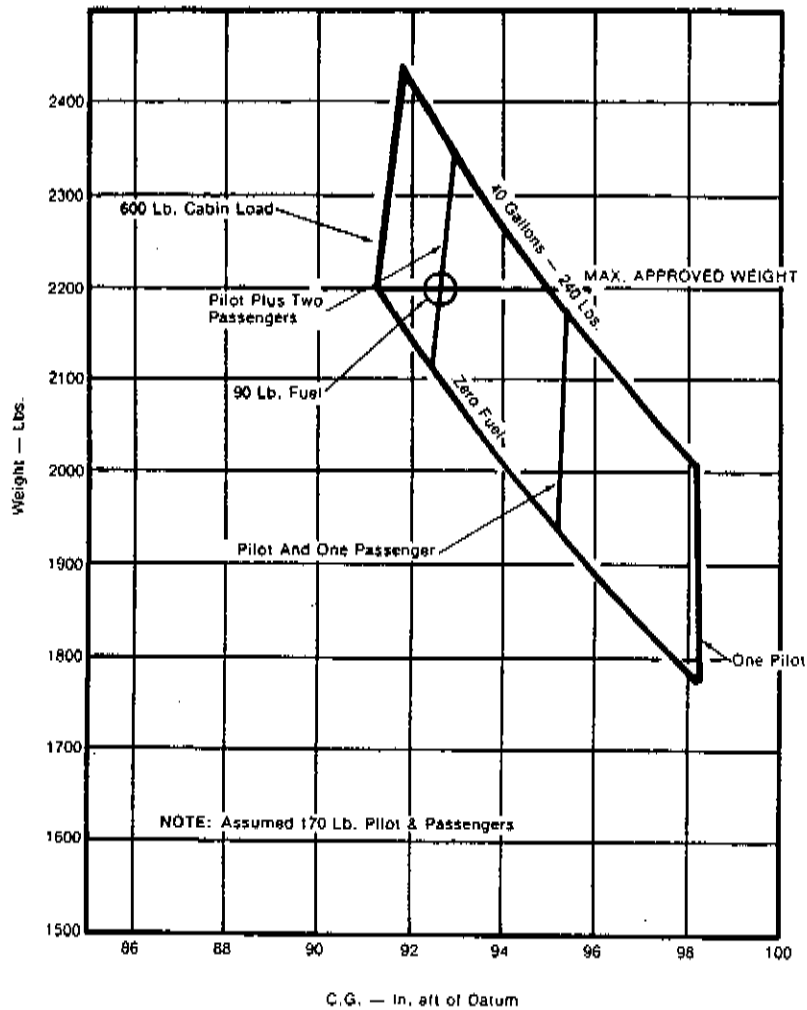
**Basic Aircraft + Typical Accessories + No Baggage
Empty Weight — 1540 Lbs.**



**F-28C — 280C MAINTENANCE
MANUAL SUPPLEMENT**

TYPICAL CONFIGURATION

**Basic Aircraft + Typical Accessories + 60 Lbs. Baggage
Empty Weight — 1540 lbs.**



ENSTROM F-28C EQUIPMENT LIST

Serial No. _____

FAA Approved Registration No. _____

Date _____

Check Date		No.	Item	Wt.	Arm
On	Off				
INSTRUMENTS — REQUIRED					
			Allimeter	1.2	36
			Airspeed	.5	36
			Tachometer	1.3	36
			Manifold — Fuel Pressure	1.5	36
			Instrument Cluster	2.0	36
			Oil Temperature		
			Oil Pressure		
			Gear Box Temperature		
			Cylinder Temperature		
			Fuel Quantity		
			Ammeter		
			Compass	1.0	40
			OAT Gauge	0.5	55
			Ball Bank Indicator*		
			E.G.T. Gauge*	0.5	36
OPTIONAL EQUIPMENT					
		1	Night lighting equipment (includes 2 beacons, 4 running lights, internally lit instrument cluster, and post panel lights).		
		2	Map light (Req'd for night flight)	.5	80
		3	8 day clock	.5	36
		4	Hour meter	.75	88
		5	Soundproofing	4.0	80
		6	Defroster — F28A, F28C	4.0	28
		7	Strobe lights — F28A		
		8	Float build up		
		9	Center radio console (F28A, F28C)	15	100
		10	Cargo Hook	2.5	34
		11	Extra head set	15	96
		12	Cabin heater & defroster combination 280, 280C	2.0	80
		13	Snow shoe installation	3.5	46
		14	Cabin heater (F28A, F28C)	18.0	100.9
		15	Baggage compartment	4.1	36.0
		16	Flotation gear/with hardware	10.0	135.0
		17	Dual controls		
		18	Floor carpet, int. trim & headliner	12.0	50
		19	Fed. 12V. twin speaker—siren	6.0	65.0
		20	Litter kit—single	11.3	79
		21	King KT 76 transponder	24.0	100.0
		22	Shoulder harness w/feet — single	4.0	34.0
		23	Shoulder harness w/real — double	3	82
		24	First aid kit	6	82
		25	Ashtrays & lighter	5.2	135
		26	Fire extinguisher	1.0	32.0
		27	External power unit (APU)	5.7	80.0
		28	Narco com 11 AH w/intercom	1.0	75.0
		29	Narco nav 11	4.0	34.0
		30	Narco ADF — 140	3.5	32.0
		31	Narco DME 180	4.3	33.0
		32	Narco AT50A transponder	6.6	34.0
		33	King KR86 ADF	4.0	34.0
		34	King KR86 ADF	3.9	34.0
		35	Gyro horizon model R.C. Allen — 25	3.4	32.0
		36	RCA-15A-2 directional gyro	2.3	32.0
		37	King KX175B NAV/COM	7.0	34.0
		38	ADF 140 loop & sense antenna	3.1	138.0
		39	Presidential doors (door pockets)	6.0	60.0
		40	Instantaneous vertical speed indicator	1.3	34.0
		41	Aim 200 directional gyro	3.8	34.0
		42	Antenna (vor)	1.3	184.0
		43	Narco DGO-10	4.7	32.0
		44	Dual landing light	3.2	25.0
		45	King KR 85 w/indicator	7.0	34.0
		46	Chadwick tank	40.0	101.3
		47	Ground handling wheel(s)	13.0	104.7
		48	King KI-225-01 indicator	1.3	34.0
		49	Narco NAV 14	2.25	34.0
			Narco ELT	3.3	135

*Standard equipment not required by FAA.

1. The first part of the document discusses the importance of maintaining accurate records of all transactions and activities. It emphasizes that proper record-keeping is essential for transparency and accountability, particularly in the context of public administration and government operations. The text notes that without reliable records, it becomes difficult to track the flow of funds, identify inefficiencies, and ensure that resources are being used as intended.

2. The second part of the document addresses the challenges associated with data collection and analysis. It highlights that while modern technology offers powerful tools for data management, the quality and consistency of the data itself can be a significant barrier. The document suggests that standardized protocols and training for data entry personnel are crucial to overcoming these challenges and ensuring that the information collected is both accurate and actionable.

3. The third part of the document focuses on the role of communication in the implementation of any program or policy. It argues that clear and consistent communication is necessary to ensure that all stakeholders understand their roles and responsibilities. The text also discusses the importance of regular reporting and updates to keep the public and relevant agencies informed about progress and any changes in direction.

4. The final part of the document provides a summary of the key findings and offers recommendations for future work. It stresses the need for a holistic approach that integrates record-keeping, data management, and communication into a cohesive strategy. The document concludes by expressing confidence that with the right resources and commitment, the organization can achieve its goals and improve its overall performance.

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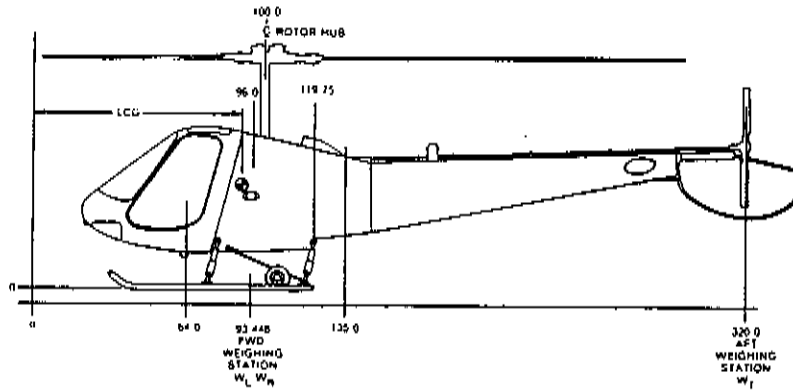
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WEIGHT AND BALANCE REPORT



Model _____ Serial No. _____ Registration No. _____

FWD. c/g limit 92.0"

AFT. c/g limit 98.0"

Weigh point	Scale—lbs.	Tare	Net wt.	Arm	Moment x 1000
Left gear			(W _L)		
Right gear			(W _R)		
Tail			(W _T)		
Total				X	

$$LCG = \frac{W_T (320.0) + (W_L + W_R) (93.448)}{W_T + W_L + W_R} = \underline{\hspace{2cm}}$$

Date _____ Weighed by _____



AIRCRAFT WEIGHT AND C. G. CALCULATION

Model _____ Serial No. _____ Reg. No. _____

		Weight lbs.	Arm in.	Moment 1000 in./lbs.
Weight (as weighed)				
Less: optional & surplus weight				
Plus: missing std. equipment				
Total - weight empty - std. aircraft	Computed			
	Actual			
Plus: engine oil				
Plus: optional equipment & kits				
Total basic weight				

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F-28C — 280C MAINTENANCE
MANUAL SUPPLEMENT**SECTION 20****POWER PLANT****DESCRIPTION**

A Lycoming turbocharged HIO-360-E1AD four cylinder, direct drive, horizontally opposed, air cooled engine is used in the C-Model helicopter.

In referring to the location of the various engine components, the parts are described in their relationship to the engine as installed in the airframe. Thus, the power take-off end is considered the front and the accessory drive end the rear. The sump section is considered the bottom and the opposite side of the engine where the shroud tubes are located the top. Reference to the left and right side is made with the observer facing the rear of the engine. The cylinders are numbered from front to rear, odd numbers on the right, even numbers on the left. The direction of rotation of the crankshaft, viewed from the rear, is clockwise. The direction of rotation for accessory drives is determined with the observer facing the drive pad.

The engine is mounted in the center airframe by four dynafocal mounts with the accessory section or rear of the engine facing forward in the helicopter. Access to the engine by two large hinged side panels and a removable access panel through the cabin fire wall are provided.

Cylinders. The HIO-360 cylinders are of conventional air cooled construction with the two major parts, head and barrel, screwed and shrunk together. The heads are made from an aluminum alloy casting with a fully machined combustion chamber. Rocker shaft bearing supports are cast integral with the head along with housings to form the rocker boxes for both valve rockers. The cylinder barrels, which are machined from chrome nickel molybdenum steel forgings, have deep integral cooling fins and the inside of the barrels are ground and honed to a specified finish.

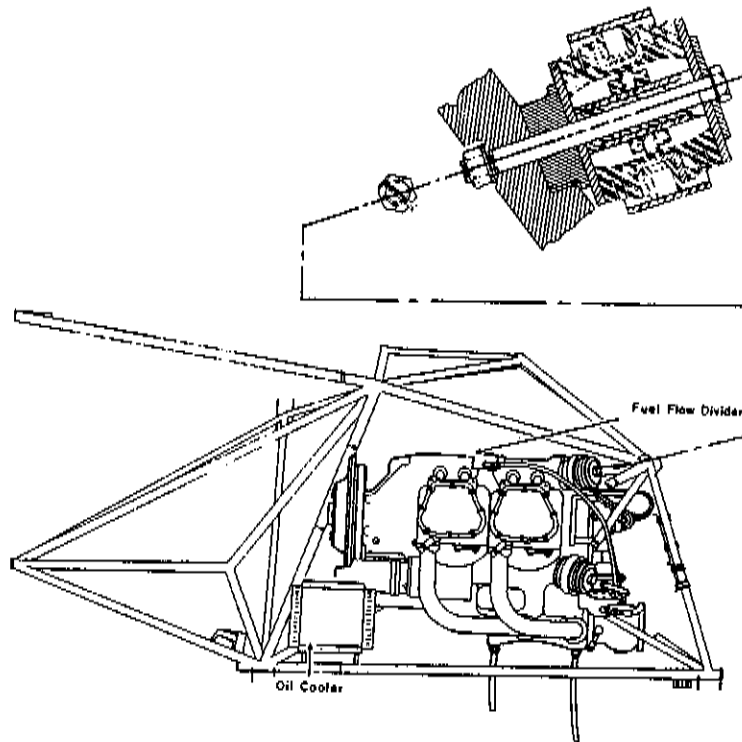
Valve operating mechanism. A conventional type camshaft is located above and parallel to the crankshaft. The camshaft actuates hydraulic tappets which operate the valves through push rods and valve rockers. The valve rockers are supported on full floating steel shafts. The valve springs bear against hardened steel seats and are retained on the valve stems by means of split keys.

**F-28C — 280C MAINTENANCE
MANUAL SUPPLEMENT**

Crankcase. The crankcase assembly consists of two reinforced aluminum alloy castings, fastened together by means of studs, bolts and nuts. The mating surfaces of the two castings are joined without the use of a gasket, and the main bearing bores are machined for use of precision type main bearing inserts.

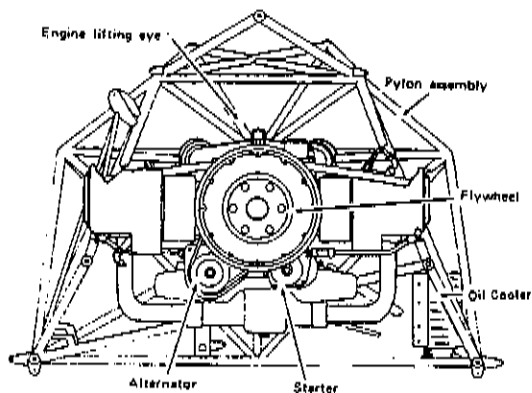
Crankshaft. The crankshaft is made from a chrome nickel molybdenum steel forging. All bearing journal surfaces are nitrided.

Connecting rods. The connecting rods are made in the form of "H" sections from alloy steel forgings. They have replaceable bearing inserts in the crankshaft ends and bronze bushings in the piston ends. The bearing caps on the crankshaft ends are retained by two bolts and nuts through each cap.

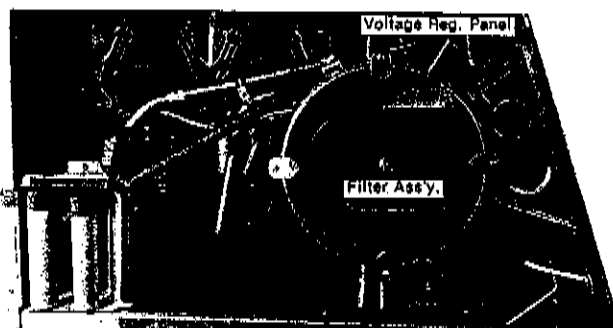


POWERPLANT INSTALLATION AND UNIT LOCATION

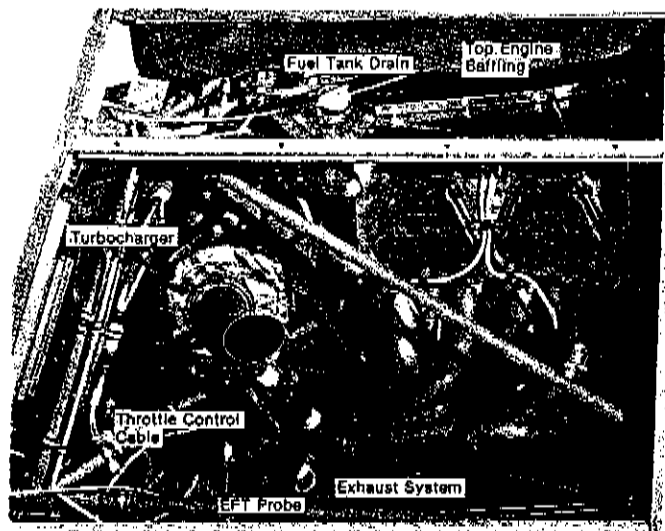
F-28C — 280C MAINTENANCE MANUAL SUPPLEMENT



POWERPLANT INSTALLATION AND UNIT LOCATION



ENGINE COMPARTMENT — RIGHT SIDE



ENGINE COMPARTMENT — LEFT SIDE

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Pistons. The pistons are machined from an aluminum alloy. The piston pin is of a full floating type with a plug located in each end. Depending on cylinder assembly, pistons may have three or four rings and may employ half wedge or full wedge rings. Positive internal piston cooling is provided in this engine by four oil nozzles, one for each piston mounted in the crankcase.

Accessory Housing. The accessory housing is made from an aluminum casting and is fastened to the crankcase and the top rear of the lower engine sump. It provides a housing and drives required for the engine oil pump, magneto mounting and drive, boost pump mounting and drive, and engine oil filter mounting.

Oil Sump. The Lycoming engine employs a wet sump lubrication system. It has a capacity of 8 quarts. A bayonet-type oil quantity gauge with graduated markings is part of the oil tank filler cap and is accessible through the left-hand side cowling of the engine. Engine oil cooling is accomplished by an oil cooler with thermostatic valves and bypass provisions. It is located on the right-hand side of the engine compartment.

Gauges. Standard type gauges are provided for both the engine oil temperature and oil pressure indications. Both gauges are marked to provide visual engine operating limitations and are located on the instrument panel.

Engine Cooling. Engine cooling is provided by a large axial flow fan mounted on the output drive. The air is directed over the cylinders through a cooling shroud and is then exhausted into the atmosphere.

Induction System. The induction system in this turbo-charged installation utilizes a standard RSA fuel injector mounted ahead of the Rajay blower. The fuel injection system schedules fuel flow in proportion to airflow directly into the intake ports through a series of four nozzles. The placement of the fuel injector ahead of the blower utilizes the butterfly valve to throttle the blower. This system is relatively surge-free and lends itself to a fully automatic system. An automatic control valve is installed in the system between the blower and intake sump. This valve limits the MAP to critical altitude to prevent over-boost and possible engine damage.

Turbocharger. The Rajay blower is a self-contained unit that is pressure lubricated from the engine oil system and uses a scavenge return system.

Exhaust System. The exhaust system used in this installation utilizes no waste gates or mechanical controls. This is a tuned system with a fixed exhaust pressure bypass, thus simplifying the cost and maintainability of the overall installation.

Operation. Pilot operation of the Enstrom turbocharged system is the same as a normally aspirated system except the pilot must not exceed 36.5" of manifold pressure and must monitor the total inlet temperature to the turbine by a proper mixture control schedule.

SPECIFICATIONS

HIO-360-E1AD

FAA Type Certificate	1E10
Rated Horsepower	205
Rated Speed, RPM	2900
Bore, Inches	5.125
Stroke, Inches	4.375
Displacement, Cubic Inches	361
Compression Ratio	8.0:1
Firing Order	1-3-2-4
Spark Occurs, Degrees BTC	20°
Valve Rocker Clearance (hydraulic tappets collapsed)	.028-.080
Propeller Drive Rotation (viewed from rear)	Clockwise

POWERPLANT OPERATIONS

NORMAL ENGINE STARTING PROCEDURES

1. Seat belts fastened and doors latched.
2. Fuel valve pushed in to turn on.
3. Collective full down and locked with the friction knob.
4. Heater as desired (in for OFF).
5. Cyclic stick cannon plugs secure.
6. Rotor clutch disengaged.

CAUTION: Although starting the helicopter with the rotor clutch engaged will not damage the rotor system, it will severely overload the starter motor.

7. Check compass full of fluid, no bubbles, and it has a correction card.
8. Altimeter set to field elevation.
9. Radio(s) off.
10. All switches off.

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11. Master switch and alternator on (alternator OFF if using an APU start). Ignition switch on.
12. Throttle cracked open — cracked open is 1/16".
13. Mixture full rich.
14. **Cold Engine Start** — Fuel boost pump on until the fuel pressure gauge shows a rise, then boost pump off.
15. Mixture idle cut off; throttle closed, mags on both; depress starter, when engine fires mixture full rich.
16. Fuel boost on (pump must be on at all times in flight).
17. Check engine oil pressure is off the zero line within 30 seconds.
18. Check amp meter gauge indicates a charge.
19. If APU start disconnect APU cable. Then alternator switch on check for a charge indication on the amp meter.
20. Idle engine at 1450 to 1500 rpm.
21. When oil pressure is 25 psi or above clutch may be engaged.

*Caution: On rare occasion the engine may backfire through the induction system during a start procedure. The backfire will not cause damage to the induction system but it could cause the induction hose between the air filter and the fuel injection servo unit to be disconnected due to the backfire. It is recommended that should a backfire occur during engine starting, a visual inspection be accomplished by the pilot or mechanic to assure that the hose is securely in place before takeoff.

**ENGINE STARTING PROCEDURES, HOT
CONDITION**

Follow normal start procedures, if no start proceed as follows:

1. Master switch ON.
2. Magneto switch OFF.
3. Throttle cracked.
4. Mixture control FULL RICH.
5. Turn on fuel boost pump 5 to 6 seconds.
6. Turn boost pump off.
7. Mixture control FULL LEAN.
8. Throttle — FULL OPEN.
9. Engage starter 5 to 6 seconds to clear engine.
10. Close throttle and crack slightly.

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MANUAL SUPPLEMENT**

11. Magneto switch BOTH. Ignition switch ON.
12. Engage starter until engine fires and advance mixture slowly.
13. Fuel boost ON. (Pump must be on at all times in flight).

NOTE: It is important to follow this procedure on hot starts so that the prolonged fuel flow in the lines will eliminate the vapor locks and cool the lines for a proper start.

ROTOR ENGAGEMENT

1. Check collective pitch full down. Friction ON.
2. Tail rotor pedal neutral position.
3. Center cyclic stick with trim switch.
4. Check aircraft vicinity clear of personnel and equipment.
5. Check engine idle set at 1450 to 1500 rpm, then leave throttle fixed in this position; don't add more throttle during engagement.
6. Slowly and smoothly engage clutch handle at 1450 to 1500 rpm, allowing the engine rpm to bleed no lower than 1200 rpm. When the rotor rpm reaches 100 rpm, fully engage clutch. If required, slowly advance throttle to 1800 R.P.M. so engine runs smoothly.

ENGINE WARMUP AND GROUND CHECK

1. Advance throttle to 1800 rpm and wait for cylinder head temperature to reach low green or 200° F.
2. After reaching 200° F., cylinder head temperature, slowly advance throttle to 2300 rpm until oil temperature reads low green or 120° F.
3. Increase engine RPM to 2900 rpm and check for rpm drop on right and left magnetos. A 100-rpm drop is permissible on either magneto as long as there is no engine roughness when operating on either right or left magneto.
4. Gently close throttle to split tachometer needles to check proper operation of over-running clutch.
5. Check following before take-off:
 - a. Check all instruments for proper indication.
 - b. Seat belts and doors latched.
 - c. Fuel ON.
 - d. Fuel boost ON. (Pump must be on at all times in flight.)
 - e. Mixture FULL RICH.
 - f. Fuel pressure warning — green indication.

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MANUAL SUPPLEMENT**

g. Adjust collective and throttle friction.

NOTE: Keep hand on collective and maintain down position when friction lock is disengaged.

ENGINE COOLING AND SHUT DOWN PROCEDURE

1. Collective pitch full down and friction on.
2. Throttle full off.
3. Fuel boost pump off.
4. Clutch disengaged, engine at full idle only.
5. Cyclic trim centered.
6. Idle engine at 1800 rpm for 2 minutes or until cylinder head temperature cools to 300° F.
7. Radios off.
8. Lights off.
9. Throttle full idle.
10. Mixture Idle cut off.
11. When engine stops turning magnetos off.
12. All switches off.
13. Master switch off.
14. Fuel valve closed (out).
15. Set collective one-half way up in its travel to unload Lamiflex bearings.
16. Tie down main rotor and tail rotor if wind speed is expected to go over 30 mph.

OPERATING LIMITATIONS

POWERPLANT LIMITATIONS:

Engine:	Lycoming Model H10-360-E1AD with Rajay 301 E-10-2 Turbo- charger
Fuel:	100/130 minimum grade
Oil Viscosity:	50 hour breakin period (MIL-L-6082B) Above 60°F. SAE 50 30-90°F. SAE 40 0-70°F. SAE 30 Below 10°F. SAE 20 After breakin MIL-L-22851 Ashless Dispersant SAE Grades Above 60°F. SAE 50 30-90°F. SAE 40 0-70°F. SAE 30 Below 10°F. SAE 20
Horsepower:	205 HP each 2900 RPM, 36.5 in. MP.

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MANUAL SUPPLEMENT**

Operating Engine RPM: 2900 maximum
2750 minimum

Engine Idling RPM: 1500 minimum (clutch disengaged)

Manifold Pressure: 36.5 in Hg S.L. to 13,500 ft. D.A.
E.G.T. 1650° F. Maximum

Oil Temperature: 245° Maximum

Oil Pressure: 60-90 PSI, normal operation
25 PSI, idling minimum
100 PSI, starting-warmup

Transmission Oil
Temperature: 220° F. maximum

Cylinder Head
Temperature: 475° F. maximum

Fuel Mixture: Engine may be leaned at 29" M.P. or below to 1600° F. on rich side of peak. Never exceed 1650° F. E.G.T. Mixture must be full rich for landing and takeoff regardless of power for proper engine cooling.

ROTOR — FLIGHT LIMITATIONS [POWER OFF]

Maximum: 385 RPM
Minimum: 332 RPM

INSTRUMENT MARKINGS:

Rotor	Red Line	385 RPM
Tachometer	Red Line	332 RPM
	Green Arc	332-385 RPM
Engine	Red Line	2750 RPM
Tachometer	Red Line	2900 RPM
	Green Arc	2750-2900 RPM
Airspeed Indicator	Red Line	117 MPH (280C)
		112 MPH (F-28C)
Manifold Press.	Red Line	36.5 in. Hg.
Oil Temperature	Red Line	245° F.
	Green Arc	120°-245° F.
	Yellow Arc	60°-120° F.
Oil Pressure	Red Line	100 PSI
	Green Arc	60-100 PSI
	Yellow Arc	25-60 PSI
	Red Line	25 PSI
EGT Cylinder	Red Line	1650° F.

Cylinder Head	Red Line	475°F.
Temperatures	Green Arc	200°-475°F.
Transmission	Red Line	220°F.
Oil Temperature	Green Arc	0°-220°F.

FUEL INJECTION SYSTEM

Description. All RSA type fuel injection systems are based on the principle of measuring engine air consumption by use of a venturi tube and using the airflow forces to control fuel flow to the engine. Fuel distribution to the individual cylinders is obtained by the use of a fuel flow divider and air bleed nozzles.

It is suggested that all adjustments and overhaul to the RSA-5 Fuel Injection System be performed with the use of the Operation and Service Manual, Form 15-338C, published by the Bendix Corporation.

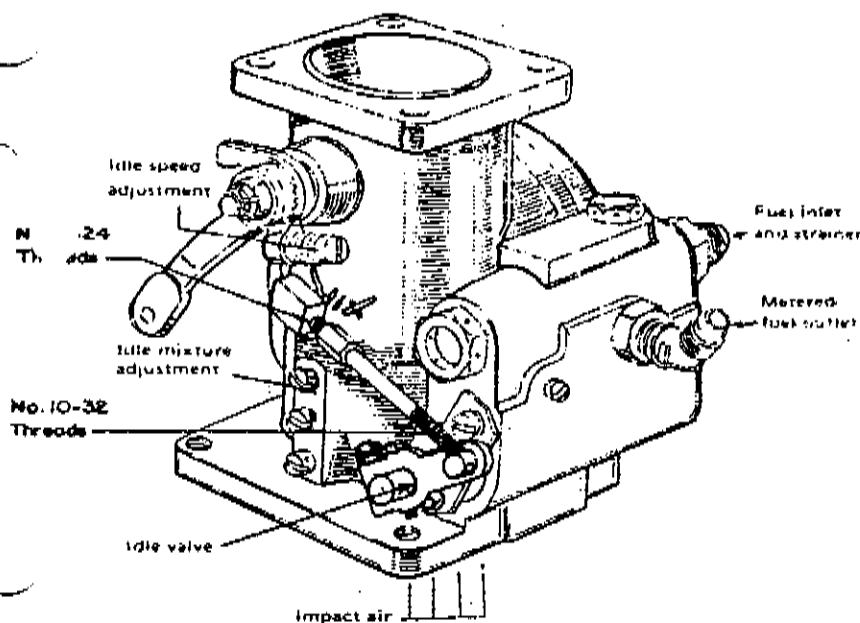
Field Adjustments.

Idle Speed and Mixture Adjustment.

- a. Check magnetos in accordance with instructions furnished in the aircraft operational manual. If the "mag-drop" is not more than 100 RPM Max., proceed with Idle adjustment.
- b. Close the throttle to Idle (approximately 1400-1500 RPM). If the RPM changes appreciably after making idle mixture adjustment during the succeeding steps, readjust the idle speed to the desired RPM.
- c. When the idling speed has been stabilized, move the cockpit mixture control lever with a smooth, steady pull, into the IDLE CUT-OFF position and observe the tachometer for any change during the leaning out process. Caution must be exercised to return the mixture control to the FULL-RICH position before the RPM can drop to a point where the engine cuts out. An increase in RPM while leaning out indicates the idle mixture is on the rich side of best power. An immediate decrease in RPM (if not preceded by a momentary increase) indicates that the idle mixture is on the lean side of best power.
- d. The desired idle setting is a compromise between one that is rich enough to provide a satisfactory acceleration under all conditions and lean enough to prevent spark plug fouling or rough operation. A rise of 25-50 RPM will usually satisfy both of these conditions.
- e. If Step B indicates that the idle adjustment is too rich or

- too lean, turn the idle mixture adjustment one or two notches in the direction required for correction, and check this new position by repeating Step B. Make additional adjustments as necessary.
- f. Each time an adjustment is changed, clear the engine by running it up to approximately 2000 RPM before making mixture check.
 - g. The actual idle mixture adjustment is made by the lengthening (richening) or shortening (leaning) of the linkage between the throttle lever and idle valve lever. The center screw assembly has right hand threads on both ends but one end has a No. 10-24 thread and the other end has a No. 10-32 thread. For easy reference, consider only the coarse thread end. When it is turned out of its block, the linkage becomes longer and a richer mixture is provided. When it is turned into its block, the linkage is shortened and a leaner mixture is provided.
 - h. A major adjustment is available for use when the center screw bottoms out on either of the blocks. If the idle adjustment is almost satisfactory, measure the distance between the two blocks. Disconnect the spring from the most accessible linkage pin and remove the pin. Turn the block and adjustment screw until the adjusting wheel is centered and the distance between blocks is as previously measured. There is now additional adjustment range and the reference point is retained.
 - i. Make the final idle speed adjustment to obtain the desired idling RPM with closed throttle.
 - j. If the setting does not remain stable, check the idle linkage; any looseness in this linkage will cause erratic idling. In all cases, allowance should be made for the effect of weather conditions upon idling adjustment.
 - k. Idle speed and mixture adjustments made according to this method should require very little further attention except for extreme variations in temperature and altitude.





INJECTOR, EXTERNAL VIEW

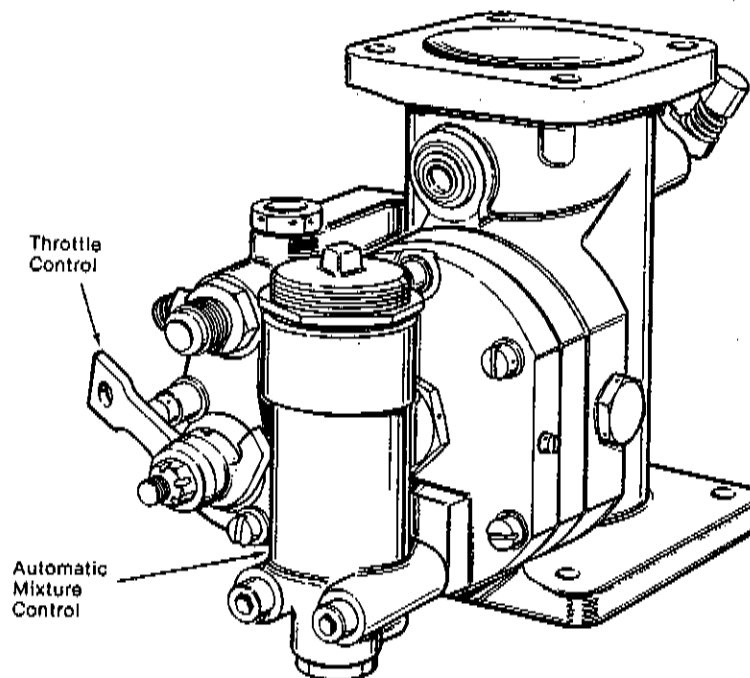
Since the air differential pressure is a function of the airflow, and the fuel differential pressure is a function of the fuel flow, the correct fuel-to-air ratio is always maintained with this system, regardless of the quantity of air being consumed by the engine.

Consideration has been made for the low air forces experienced in the idle range by the incorporation of the constant head idle spring. This spring provides a constant fuel differential pressure that will allow adequate fuel supply for the idle range. As the air forces increase, the spring compresses until the spring retainer touches the air diaphragm and acts as a solid member.

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RSA INJECTOR EXTERNAL VIEW

**AUTOMATIC MIXTURE CONTROL UNIT [USED ONLY ON
RSA]**

This unit provides a variable orifice between impact pressure and venturi throat pressure. It is responsive to both changes in air temperature and pressure (density) and will keep the differential air pressure between the two air chambers constant for any airflow, regardless of changes in the air inlet density.

The automatic mixture control consists of a contoured needle that is moved in or out of an orifice by a bellows assembly. The sealed bellows contains helium gas to sense density variations and also a small quantity of inert oil to help damp vibration. Under high density conditions, the bellows is contracted and positions the needle in the orifice so that the flow of impact pressure into venturi throat pressure is at a minimum. As density decreases, due to either a decrease in pressure or an increase in temperature, the bellows elongates and repositions the needle in the orifice so there is a greater flow of impact

pressure to venturi pressure which decreases the air metering forces to maintain a constant fuel-air ratio.

The automatic mixture control unit is enclosed by an aluminum housing which has a blast tube for cooling. In order to insure proper functioning of the AMC unit, the blast tube must be installed since it is very temperature sensitive.

AUTOMATIC MIXTURE CONTROL MAINTENANCE

Dirt on the AMC needle will cause rich operation. This build-up on the needle can become so severe that the needle will stick, with resultant loss of altitude compensation.

Clean the AMC unit without disturbing the calibration by observing the following instructions.

- A. Carefully remove the AMC unit. If gasket is damaged a new gasket, Bendix P/N 2523555, must be used for replacement.
- B. Remove the 9/16-24 plug and immerse the unit in clean naphtha, invert the unit to fill with fluid. Exercise the AMC needle with a hardwood or plastic rod to facilitate cleaning. Shake the unit vigorously while allowing fluid to drain. Repeat several times to wash out all traces of contaminants.
- C. Drain the unit; allow naphtha to evaporate thoroughly. Do not dry with air pressure.
- D. Replace 9/16-24 plug and reinstall unit on injector. Torque to 55-60 inch pounds.

NOTE: The Bendix model RSA5AB1 fuel injector which is supplied with the HIO-360-E1AD Lycoming engine is internally adjusted specifically for the Enstrom turbocharged installation. The standard [off the shelf] RES5AB1 Bendix injector is NOT an interchangeable item. All replacement injectors must be acquired from the factory or factory designated maintenance facility.

FUEL INJECTION SYSTEM TROUBLESHOOTING CHART

PROBABLE CAUSE REQUIRED ACTION

Hard Starting:

Technique.

Refer to aircraft manufacturer's recommended starting procedure.

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Flooded.	Clear engine by cranking with throttle open and mixture control in ICO.
Insufficient prime. (Usually accompanied by a backfire.)	Increase amount of priming.
Rough Idle:	
Mixture too rich or too lean.	Confirm with mixture control. A too rich mixture will be corrected and roughness decreased during lean-out while a too lean mixture will be aggravated and roughness increased. Adjust idle to give a 25-50 RPM rise at 1400-1500 RPM.
Plugged nozzle(s). (Usually accompanied by high take-off fuel flow readings.)	Clean nozzles.
Slight air leak into induction system through manifold drain check valve. (Usually able to adjust initial idle but rough in 1000-1500 RPM range.)	Confirm by temporarily plugging drain line. Replace check valves as necessary.
Slight air leak into induction system through loose intake pipes or damaged "O" rings. (Usually able to adjust initial idle but rough in 1000-1500 RPM range.)	Repair as necessary.
Large air leak into induction system. Several cases of 1/8" pipe plugs dropping out.	Repair as necessary

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Internal leak in injector. (Usually unable to lean-out idle range.)	Replace injector.
Fuel vaporizing in fuel lines or distributor. (Encountered only under high ambient temperature conditions or following prolonged operation at low idle RPM's.)	See service notes under Idling (A).

Low Take-Off Fuel Flow

Strainer plugged.	Remove strainer and clean in a suitable solvent. Acetone or MEK is recommended.
Injector out of adjustment.	Replace injector.
Faulty gauge.	Replace as necessary.

Poor Cut-Off:

Improper rigging of aircraft linkage to mixture control.	Adjust.
Mixture control valve scored or not seating properly.	Eliminate cause of scoring (usually burr or dirt) and lap mixture control valve and plug on surface plate.
Vapor in lines.	Refer to following service notes.

Rough Engine [Turbocharged] and Poor Cut-Off:

Air bleed hole(s) clogged.	Clean or replace nozzles.
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Erroneous Fuel Flow

Faulty gage.	Replace as necessary.
AMC blast tube disconnected.	Repair as necessary.

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MANUAL SUPPLEMENT

INJECTION SYSTEM SERVICE NOTES

General. Several phases of ground operation are adversely affected by fuel vaporization in the lines. Fuel vaporization is experienced under extreme conditions of ambient and/or nacelle temperatures. Starting, idle operating, and engine shutdown procedures must all be modified to obtain optimum results under these conditions.

Starting. In cold weather, the engine compartment (nacelle) temperature drops off rapidly following engine shutdown and the nozzle lines remain nearly full of fuel. Cold weather starting procedures are therefore simple with highly predictable results. However, in extremely hot weather, nacelle temperatures increase rapidly following engine shutdown, and fuel in the lines vaporizes and escapes out into the manifold. Hot weather starting procedures therefore depend considerably on how soon the next start is attempted. Within the first 20-30 minutes, the manifold is nicely primed and the empty nozzle lines will fill before the engine dies. After a 20-30 minute wait, the vaporized fuel in the manifold will have nearly disappeared and some slight "priming" could be required to refill the nozzle lines and keep the engine running after first firing.

Idling. During ground operation every precaution should be taken to keep nacelle temperatures from increasing to the extent that fuel will vaporize in the lines. The following suggestions are aimed at minimizing this problem:

- A. Keep nacelle temperatures as low as possible by:
 - 1. Avoiding excessive ground operation.
 - 2. Keeping cooling airflow up by keeping engine RPM's as high as practical.
 - 3. Upon restarting of a hot engine, operating engine at 1,200-1,500 RPM for several minutes to reduce the residual heat in the engine compartment.
- B. Keep fuel temperatures as low as possible. Higher RPM's with the accompanying higher line pressure and flow will help to dissipate some of the heat within the lines.
- C. Make an idle speed and mixture adjustment that is a compromise between the engine's requirement during the cool of the morning and the heat of the day.
 - 1. Adjust idle speed stop to provide RPM as high as practical.
 - 2. Adjust mixture in the cool of the morning to provide a 50 RPM rise when the mixture control is pulled

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MANUAL SUPPLEMENT**

slowly into cut-off.

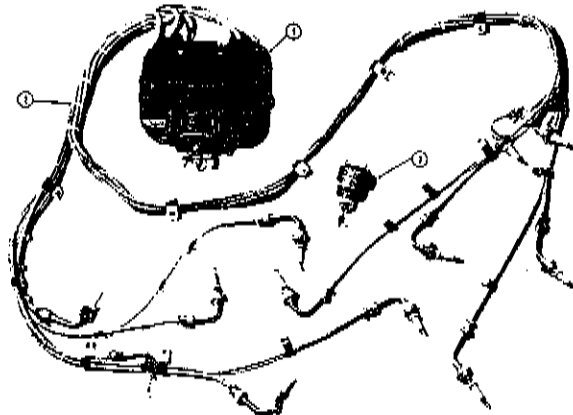
3. The higher than normal temperature encountered during the heat of the day results in the engine preferring a considerably leaner idle mixture. However, with fuel injection, this richer setting at the heat of the day will help dissipate vapor that still may occur.

Shutdown [Cut-Off]. The idling procedure practiced just prior to engine shutdown has considerable bearing on the "cleanness" or smoothness with which the engine stops. If the idling procedures suggested above are not followed and fuel is vaporizing and emptying the lines, the engine will continue to idle very rough for several seconds. This is despite a 100% cut-off of fuel supply by the mixture control.

POWERPLANT

IGNITION SYSTEM

General. The D-2000 Series Magnetos are designed to provide ignition for four, six, and eight cylinder aircraft engines. The magnetos generate and distribute high tension current through high tension leads to the spark plugs. Each magneto system consists of a dual magneto unit, harness assembly, and ignition switch. To obtain the retard spark necessary for starting, the D-2000 magnetos employ an impulse coupling.



D-2000 Magneto and Associated Components

1. Dual magneto
2. Harness assembly
3. Combination ignition and starter switch

IGNITION SYSTEM TROUBLESHOOTING CHART

PROBABLE CAUSE

REQUIRED ACTION

Hard Starting:

Magneto not
"putting out"
electrically.

Turn engine in proper direction to bring No. 1 cylinder on the compression stroke. Remove the input connection from the starter to prevent engine turning and, while holding No. 1 plug lead 3/16 inch from ground, rotate crankshaft until the impulse coupling snaps. Plug lead should throw a 3/16 inch spark. If spark is weak or missing, try a new spark plug wire or magneto.

Magneto improperly
timed to engine.

Check magneto to engine timing per current Bendix D-2000 series operational instructions.

Advance contact
assembly out of
adjustment (internal
timing off).

Check magneto to engine timing per current Bendix D-2000 series operational instructions.

Retard points open-
ing too late.

Check timing of retard points.

Impulse coupling
inoperative.

Remove cover and check impulse coupling action.

Engine roughness.

Try new spark plugs. Check plug leads for continuity and breakdown. Check distributor block for moisture and carbon tracking. Check contact springs in distributor block. Check magneto to contact assemblies for burning or dirt (main and retard). Check distributor timing.

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**F-28C — 280C MAINTENANCE
MANUAL SUPPLEMENT**

Magneto check out-of-limits.	Check magneto-to-engine timing. Inspect contact assemblies for proper opening. Check plugs and leads.
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IGNITION**TIMING CHECK****RUNNING POINTS**

NOTE: Magneto switch OFF, master switch OFF.

- a. Remove seat cushions and fiberglass seat cover.
- b. Remove engine access panels on cabin aft firewall.
- c. Open engine compartment panels.
- d. Remove lower plug from each cylinder.
- e. Open lower seam of wrap-around cowl.
- f. Rotate crankshaft to bring No. 1 piston on compression stroke.
- g. Check timing mark located on starter ring gear support assembly through timing holes in cooling fan with index mark on starter housing. (Ref. Page No. MM-20-22).
- h. Set timing at 20° B.T.D.C.

NOTE: Remove timing plug from either magneto and check to see if red index mark is in window.

- i. Attach magneto timing indicator to each "P" lead.
- j. Rotate crankshaft in direction of rotation and check the point opening of both magnetos (20° B.T.D.C.) to engine and both magnetoes to each other for proper synchronization. Impulse coupling must snap before the timing can be checked at 20° B.T.D.C.

IMPULSE COUPLING ACTION

With the ignition switch off observe breaker cam end of rotor while manually cranking engine through a firing sequence. Rotor should alternately stop and then (with an audible snap) be rotated rapidly through a retard firing position (T.D.C. position).

TURBOCHARGER**DESCRIPTION**

The turbo unit has only one moving part, a rotating shaft with a turbine wheel on one end, a compressor impeller on the other, all precision balanced and each contained in its own housing. The turbine wheel, driven by exhaust gas energy, drives the impeller which compresses intake air to a density equivalent of near sea level and delivers it to the

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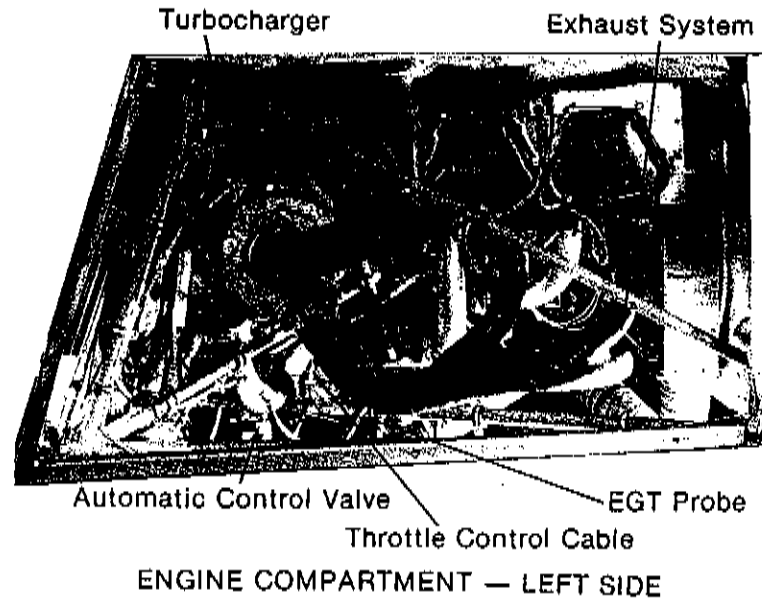
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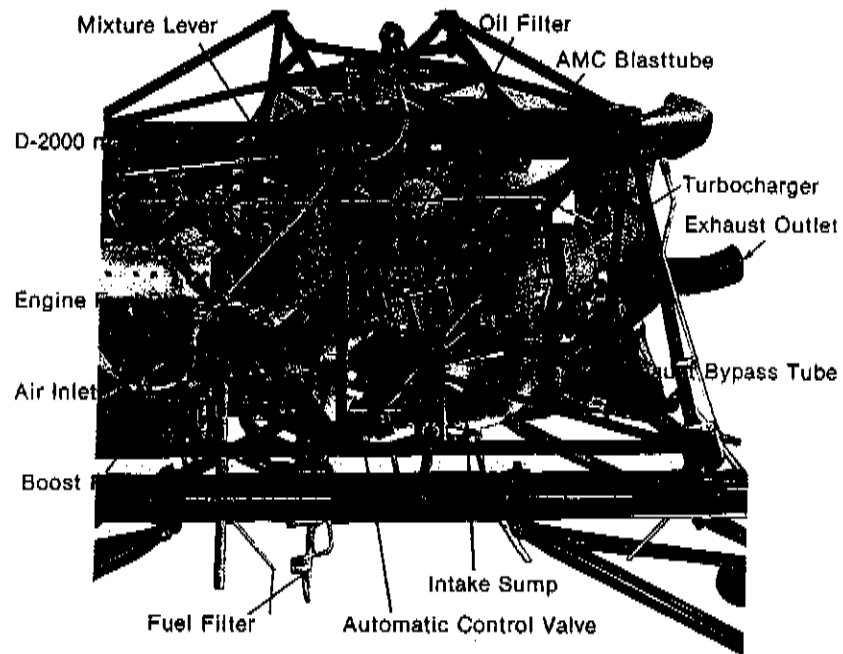
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MANUAL SUPPLEMENT**

engine intake. This increased volume of air allows the engine to "breathe" with the same volumetric efficiency that it does at low levels. The engine can produce the equivalent power at all altitudes up to 12,000 feet density altitude.

When turbocharged, you engine's entire intake system is pressurized. The fuel/air mixture is literally forced into the cylinder the instant the intake valve starts to open — completely filling the entire chamber prior to the start of the compression stroke. This assures a full charge of the fuel/air mixture resulting in more power during each combustion stroke. It also assures a more evenly balanced air/fuel/power cycle between cylinders.



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MANUAL SUPPLEMENT

ENGINE INSTALLATION (FRONT VIEW)

F-28C — 280C MAINTENANCE
MANUAL SUPPLEMENT**TURBOCHARGER****REMOVAL.**

- a. Remove seat cushion and fiberglass seat deck.
- b. Remove firewall access panels from cabin firewall.
- c. Open left-side engine panel.
- d. Remove clamp from exhaust outlet. Remove exhaust outlet, shims and by-pass tube.
- e. Remove turbo heat shield attachments. Remove heat-shield.
- f. Remove exhaust inlet clamp and slide adapter collar down on the exhaust tube. Remove gasket.
- g. Remove induction tube clamps and slide rubber tube down on the induction inlet tube.
- h. Remove inlet and outlet oil line connections.

NOTE: Leave the lower elbow and flexible line attached to the turbocharger.

- i. Remove 4 bolts from the turbo inlet adapter at the injector. Leave inlet adapter mounted on the turbocharger.
- j. Remove 2 bolts which attach the turbocharger to the turbo mount brackets. Identify washer shims for proper re-assembly.
- k. Slide turbocharger up and off the mount brackets. Remove it from the ship. Remove gasket from injector.
- l. Remove safety wire and six screws from the inlet adapter. Identify position for reassembly. Remove the gasket and inlet adapter.

INSPECTION

1. Rotating unit rubbing housing.
2. Distorted housing.
3. Dirt accumulation on impeller.
4. Carbon build-up on turbine.
5. Foreign object damage.

REPAIR OR REPLACEMENT

The limits for repairing or replacement are defined in the turbocharged troubleshooting section. The overhaul life is 1000 hours.

INSTALLATION

- a. Install a new gasket between the turbo inlet and the turbocharger. Secure the turbo inlet adapter with 6 screws and safety wire it to the turbocharger. Position

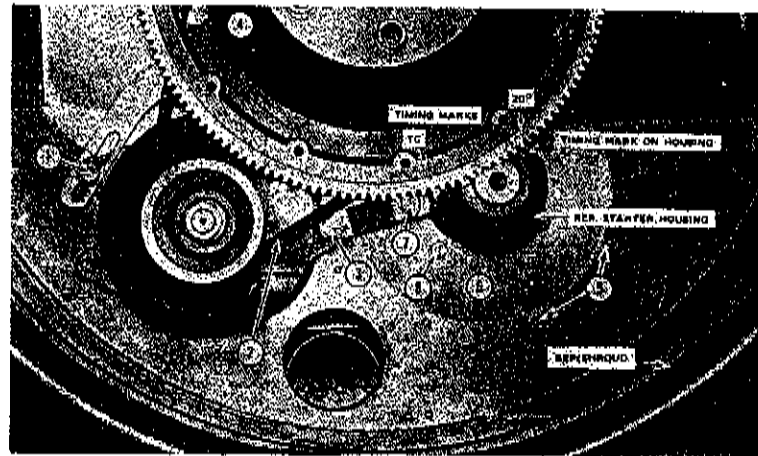
**F-28C — 280C MAINTENANCE
MANUAL SUPPLEMENT**

- per identifying marks.
- b. Install the lower outlet oil elbow, gasket and flexible outlet line to the turbocharger on the bench. Torque and safety. Install inlet oil elbow.
 - c. Install the inlet sleeve on the induction tube.
 - d. Install the turbocharger on the mount brackets. Install the washers (shims) at the proper locations on the turbo mounts. Install (2) bolts (do not torque).
 - e. Install turbocharger head shield. Safety wire 5 places.
 - f. Install a new gasket between the injector and the turbo inlet bracket. Install four bolts (do not torque).
 - g. Connect exhaust collar and steel gasket to the turbocharger exhaust inlet. Rotate the collar for correct alignment. Install exhaust inlet clamp and safety. The clamp torque is 70 to 80 in. lbs.
NOTE: If required, loosen turbo mount brackets on the engine for proper turbocharger alignment.
 - h. Install the clamps on the flexible sleeve between the induction inlet tube and the turbocharger compressor. Torque and safety.
NOTE: The turbocharger center divider clamp may be released to rotate the compressor section for adjustment. Do not break the seal.
 - i. Install metal shim and exhaust outlet. Rotate exhaust outlet for proper alignment of the bypass tube. Torque exhaust outlet clamp to 70 to 80 in. lbs.
 - j. Torque the two main turbocharger mount bolts.
NOTE: If required, torque and resafety the lower engine mount bolts.
 - k. Torque injector outlet mount bolts. If required, torque turbo center divider clamps and safety.
 - l. Connect oil inlet and outlet lines.
 - m. Inspect all areas prior to closure of the engine compartment and flight check.
NOTE: Oil inlet elbow is to retorqued one complete turn while turbo is hot after the first engine run up.

POWERPLANT TROUBLESHOOTING

Experience has proven that the best method of troubleshooting is to decide on the various causes of a given trouble and then to eliminate causes one by one, beginning with the most probable. The following charts list some of the more common troubles, which may be encountered in maintaining engines and turbochargers; their probable causes and remedies.

F-28C — 280C MAINTENANCE
MANUAL SUPPLEMENT



ENGINE TIMING LOCATION

1. TROUBLESHOOTING — ENGINE AND
TURBOCHARGER

TROUBLE	CAUSE	REMEDY
Failure of Engine to Start	Lack of fuel	Check fuel system for leaks. Fill fuel tank. Clean dirty lines, strainers or fuel valves.
	Overpriming	Leave ignition "Off" and mixture control in "Idle-Cut-Off", open throttle and "un-load" engine by cranking for a few seconds. Turn ignition switch on and proceed to start in a normal manner.
	Defective spark plugs	Clean and adjust or replace spark plugs.
	Defective ignition wire	Check with electric tester, and replace any defective wires.
	Defective battery.	Replace with charged battery.
	Improper operation of magneto breaker	Clean points. Check internal timing of magnetos.
Lack of		Disconnect fuel line and

	sufficient fuel flow	check fuel flow.
	Water in fuel injector	Drain fuel injector and fuel lines.
	Internal failure	Check oil screens for metal particles. If found, complete overhaul of the engine may be indicated.
Failure of Engine to Idle Properly	Incorrect idle mixture	Adjust mixture.
	Leak in the induction system	Tighten all connections in the induction system. Replace any parts that are defective.
	Incorrect idle	Adjust throttle stop to obtain correct idle.
	Uneven cylinder compression	Check condition of piston rings and valve seats.
	Faulty ignition system	Check entire ignition system.
	Insufficient fuel pressure	Adjust fuel pressure.
Low Power and Uneven Running	Mixture too rich indicated sluggish engine operation, red exhaust flame at night. Extreme cases indicated by black smoke from exhaust.	Readjustment of fuel injector by authorized personnel is indicated.
	Mixture too lean; indicated by overheating or backfiring	Check fuel lines for dirt or other restrictions. Readjustment of fuel injector or carburetor by authorized personnel is indicated.
	Leaks in induction system	Tighten all connections. Replace defective parts.

**F-28C -- 280C MAINTENANCE
MANUAL SUPPLEMENT**

TROUBLE	CAUSE	REMEDY
	Defective spark plugs	Clean and gap or replace spark plugs.
	Improper fuel	Fill tank with fuel of recommended grade.
	Magneto breaker points not working properly	Clean points. Check internal timing of magnetos.
	Defective ignition wire	Check wire with electric tester. Replace defective wire.
Failure of Engine to Develop Full Power	Leak in the induction system	Tighten all connections and replace defective parts.
	Throttle lever out of adjustment	Adjust throttle lever.
	Improper fuel flow	Check strainer, gage and flow at the fuel inlet.
	Restriction in air scoop	Examine air scoop and remove restrictions.
	Improper fuel	Drain and refill tank with recommended fuel.
	Faulty ignition	Tighten all connections. Check system with tester. Check ignition timing.
Rough Engine	Cracked engine mount	Replace or repair mount.
	Defective mounting bushings	Install new mounting bushings.
	Uneven compression	Check compression.
Low Oil Pressure	Insufficient oil	Fill to proper level with recommended oil.
	Air lock or dirt in relief valve	Remove and clean oil pressure.
	Leak in suction line or pressure line	Check gasket between accessory housing and crankcase.

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	High oil temperature	See "High Oil Temperature" in "Trouble" column.
	Defective pressure gage	Replace.
	Stoppage in oil pump intake passage	Check line for obstruction. Clean suction strainer.
High Oil Temperature	Insufficient air cooling	Check air inlet and outlet for deformation or obstruction.
	Insufficient oil supply	Fill to proper level with specified oil.
	Low grade of oil	Replace with oil conforming to specifications.
	Clogged oil lines or strainers	Remove and clean oil strainers.
	Excessive blow-by	Usually caused by worn or stuck rings.
Excessive Oil Consumption	Failing or failed bearing	Examine sump for metal particles. If found, overhaul of engine is indicated.
	Defective temperature gage	Replace gage.
	Low grade of oil	Fill tank with oil conforming to specifications.
Excessive Noise or Vibration	Failing or failed bearings	Check sump for metal particles.
	Worn piston rings	Install new rings.
	Incorrect installation of piston rings	Install new rings.
	Failure of rings to seat (new nitrided cylinders)	Use mineral base oil. Climb to cruise altitude at full power and operate at 75% cruise power setting until oil consumption stabilizes.
	Improper bearing lubrication	Supply required oil pressure. Clean or replace oil line; clean oil strainer. If trouble

**F-28C — 280C MAINTENANCE
MANUAL SUPPLEMENT**

		persists, overhaul turbo-charger.
	Leak in intake or exhaust manifold	Tighten loose connections or replace manifold gaskets as necessary.
	Dirty impeller blades	Disassemble and clean.
Engine will not Deliver Rated Power	Clogged manifold system	Clear all ducting.
	Foreign material lodged in compressor impeller or turbine	Disassemble and clean.
	Excessive dirt build-up in compressor	Thoroughly clean compressor assembly. Service air cleaner and check for leakage.
	Leak in engine intake or exhaust	Tighten loose connections or replace manifold gaskets as necessary.
	Rotating assembly bearing seizure	Replace turbocharger.
Engine will not Deliver Rated Power (Cont.)	Oil pressure too low	Tighten fittings. Replace lines or hoses. Increase oil pressure to desired pressure.
	Turbocharger impeller binding frozen or fouling housing	Check bearings. Replace turbocharger.
	Piston seal in actuator leaking. (Usually accompanied by oil leakage at drain line)	Remove and replace actuator or disassemble and replace packing.

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MANUAL SUPPLEMENT**

Engine surges Smokes	Air in oil lines	Bleed system.
	Clogged breather	Check breather for restrictions to air flow.
Loss of, reduction of, or fluctuation of manifold pressure when turbo-charging	Malfunctioning manifold pressure gauge due to faulty gauge or possible oil in MAP reference line or gauge.	Repair or replace gauge. NOTE: If the engine changes in power level or the airspeed changes, then actual change in MAP has occurred due to one of the reasons listed below;
	Turbocharger inlet duct blocked.	Check ducting and remove obstruction.
	Turbo-compressor discharge duct ruptured or disconnected.	Connect or replace ducting.
	Severe rupture on exhaust stacks.	Replace defective part.
	Turbocharger rotor jammed.	Replace turbocharger.
	Ruptured manifold gauge line or fitting.	Repair leak.
	Air Inlet check valve not fully or blocked partly open	Inspect, repair or replace as needed.
Loss or reduction of fuel pressure when turbo-charging	Out of fuel.	Refuel.

**F-28C — 280C MAINTENANCE
MANUAL SUPPLEMENT**

	Partial fuel vapor lock at high altitude due to hot fuel and high power settings.	Reduce power.
	Malfunctioning fuel pressure regulating valve or fuel pump.	Reduce power.
	Ruptured fuel line or leaking ftg. or pump shaft seal.	Shut off fuel shut-off valve, full rich mixture until fuel fwd of firewall is consumed by engine. Secure engine.
	Ruptured boost pressure reference line to fuel pressure regulating valve.	Continue operation until next landing if engine is smooth; otherwise, return engine to naturally aspirated power. Ground check fuel system.
Engine runs hot when turbo-charging or naturally aspirated.	May be due to extreme hot weather.	Reduce power.
	Cracked or loose cylinder cooling air baffles.	Repair or replace as required.
	During climb	Reduce power or increase Indicated Air Speed.
	Over-boost or RPM to high	Reduce MAP or RPM.
	Fuel mixture too lean during very hot weather	Enrichen mixture.
	Mis-timed	Check Ignition timing, adjust

**F-28C — 280C MAINTENANCE
MANUAL SUPPLEMENT**

	ignition, either retarded or pre-ignition.	as necessary.
	Detonation due to low octane fuel or Item "f" above	Fuel mixture set too lean or fuel octane too low. Check mixture and fuel grade.
	Faulty cylinder head temperature gauge	Replace instrument.
	Defective oil cooling system	Inspect and repair as required.
	Combination of above	Systematically eliminate by above steps.
	Collapsed hose or twisted fuel line	Replace damaged hose or fuel line.
Per- formance is reduced from normal	May be due to hot weather	Turbo aircraft speed will be reduced according to the rise in temperature above standard day. This is because turbochargers, like turbines, are heat sensitive as to per- formance.
	Out of tune engine	Repair engine as required.
Fuel con- sumption is higher than normal	Mixture set too rich	Improper leaning.
	Leak in fuel system	Locate and repair leak.
	Prolonged high power at full rich mixture	Reduce power and lean for economy.
	Hot weather	Hot weather will naturally increase fuel consumption depending on power, leaning

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MANUAL SUPPLEMENT

		and temperature of the air. This is due to less dense air for the same MAP. Also it has been found from tests that slightly richer mixture should be used for extremely warm weather to maintain a lower head temperature. This will insure good engine life.
Oil leaking in engine area	Failed turbo-charger bearings and compressor seal	Replace turbocharger. NOTE: The turbocharger seal will have to be in very poor condition to permit oil to pass the compressor impeller seal.
Noisy turbo-charger rotating assembly	Damaged bearings	Replace unit.
	Rotating unit rubbing housing, distorted housings, dirt accumulation on impeller, carbon build-up on turbine or foreign object damage	Replace unit. NOTE: allowable shaft radial play is .017 to .028 inch due to semi-floating bearings. Allowable shaft axial play is .004 to .009 inch.

INSPECTION OF FUEL SERVO SCREEN

100 HOUR INSPECTION

1. Disconnect throttle and mixture control at servo unit.
2. Remove fuel pressure line to servo.
3. Remove (4) servo mounting nuts and position servo in order to remove fuel screen.

NOTE: Crack nut on screen before disconnecting servo unit from engine.

4. After inspecting screen for residue, reinstall in servo.
5. Place servo on engine and attach four nuts. Hook up throttle and mixture controls.
6. Run engine and check for leaks and proper operation.

POWERPLANT

FUEL DISTRIBUTOR VALVE

Removal. To remove the fuel distributor valve located on top of the Lycoming engine, the following must be removed:

- a. Remove the left and right baffles that are secured by nine fasteners on each side.
- b. Remove the baffle (center) by removing 17 screws.
- c. This will allow access to the distributor valve for removal and/or installation.
- d. After installation of unit, run engine and check for leaks to each cylinder before installation baffles.

POWERPLANT

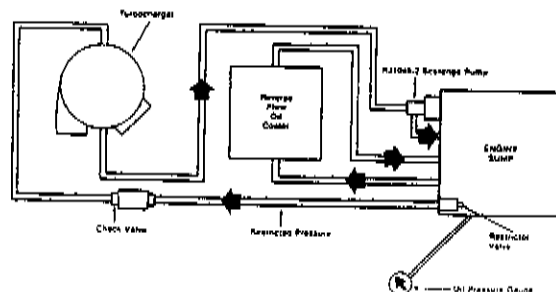
OIL SYSTEM

Description. Engine oil flows to the turbocharger from the engine through an elbow restrictor. On this same line, a valve is located just before the oil inlet to the turbocharger. This check valve prevents an oil build up in the turbocharger after the engine shuts down. An engine driven scavenge pump is utilized to return the turbocharger oil back to the engine sump. The scavenge pump is stamped "in" or "out" and the correct rotation is marked on it. Part Number RJ1045-2 identifies this pump.

A reverse flow oil cooler is used to cool the oil for the entire system. Cooling air is directed from the fan through the cooler core and exhausted into the atmosphere. Regulation of oil flow through the cooler is accomplished by a temperature and pressure-sensitive valve located in the engine accessory case.

The cockpit oil pressure gauge line runs from under the instrument console back to the engine accessory case.

OIL SYSTEM DIAGRAM



**F-28C — 280C MAINTENANCE
MANUAL SUPPLEMENT**

Removal of Oil Cooler. The oil cooler is mounted on the right hand side of the engine compartment.

- a. Open right side cowl.

NOTE: Pay particular attention to magneto off position.

- b. Drain oil out of the lower inlet oil line fitting.
- c. Disconnect the inlet and outlet line to the radiator, paying particular attention that they are plugged to keep residue oil from draining on the floor.
- d. Place container beneath the radiator when disconnecting lines to collect any drain oil from cooler and lines.
- e. Remove 4 AN3 bolts holding the oil cooler boot to the inboard side of the oil cooler.
- f. Remove 4 AN3 bolts holding the oil cooler air exit duct to the outboard side of the oil cooler. This will allow the radiator to be removed easily.

NOTE: Upon removal of cooler, visually inspect rubber flex boot for rips. Replace the boot assembly if necessary.

Inspection of Oil Cooler.

- a. Inspect oil cooler for:
 1. Integrity of finish.
 2. Bent, broken or dirty core fins.
 3. Nicked, burred, or deformed plumbing fittings.
 4. Deformed screw holes.
 5. Loose boot attachment to radiator inlet.
- b. Inspect oil cooler air duct for:
 1. Cleanliness.
 2. Cracks, checking, tears, dents.
 3. Integrity of mounting flanges.
- c. Inspect oil inlet and return line for:
 1. Cleanliness and freedom from obstructions.
 2. Cracks, checking, swelling, and kinks.
 3. Integrity of wire shield.
 4. Plumbing fitting for nicks, burrs, and deformity.

Leakage Check of Oil Cooler.

- a. Perform a hydrostatic test on the radiator. Operate test set in accordance with manufacturer's instructions, or take radiator to certified radiator shop and have it pressure tested for leakage.
- b. Install pressure cap on one oil cooler fitting.

**F-28C — 280C MAINTENANCE
MANUAL SUPPLEMENT****OIL COOLER [Con't]**

- c. Connect test set to remaining oil cooler fitting.
- d. Regulate test set pressure to 150 PSI.
- e. Check for leakage.

NOTE: Leakage is indicated by escaping fluid and a drop in regulator pressure.

- f. Locate and mark source of leak if any.

NOTE: Use standard procedure to repair leaks. If required repairs are inaccessible or extensive, replace oil cooler with a new unit. After repairs are completed, repeat Steps a through e.

- g. Remove oil cooler from test set.

Installation of Oil Cooler. Oil cooler assembly and components installation may be accomplished as required without having to remove any additional equipment.

- a. Secure radiator to the oil cooler boot and lower mount with four AN3 bolts.
- b. Secure oil cooler inlet and return lines.
- c. Secure air inlet duct to oil cooler and lower mount with four AN3 bolts.
- d. Thoroughly inspect the oil cooler assembly installation, torque on fittings, routing of lines, and ducting.
- e. Perform preflight inspection; service engine as required.
- f. Perform operational check of engine prior to flight.
- g. Inspect assembly, after the engine has been run up to operating temperature, for oil leaks.

NOTE: Oil circulates through the entire system only when the engine is at operating temperature.

- h. Secure right side cowl.

POWERPLANT**ENGINE EXHAUST SYSTEM**

Description. The exhaust system utilized on the engine consists of an interconnected manifold with a single outlet into the turbocharger. There is a sleeve joint on the copilots side of the heater muff which separates the two manifolds. The heater muff is located on the exhaust cross over manifold under the center of the engine just forward of the fan shroud.

Removal of Exhaust System.

- a. Open right and left hand side cowling.
- b. Remove ducting from the heater muff.

**F-28C — 280C MAINTENANCE
MANUAL SUPPLEMENT**

- c. Remove exhaust inlet turbocharger clamp and slide the collar down on the exhaust tube. Remove gasket.
- d. Remove clamp from turbocharger outlet. Remove exhaust outlet, shims, and by-pass tube.
- e. Disconnect four bolts from the exhaust couplings on number one and number four cylinders.
- f. Disconnect two nuts on each exhaust flange on number two and number three cylinders.
- g. Break loose the sleeve joint at the heater muff. This will allow the exhaust system to be removed in two pieces.

Inspection of Exhaust System.

- a. Upon removal of the complete exhaust system, check the flange mounting of each exhaust stack for cracks, distortion of the flange and proper gaskets.

NOTE: At the 100-hour inspection it will be necessary to remove the muffler cover to inspect for any cracks internally which could cause carbon monoxide entering the cabin.

Installation of Exhaust System.

- a. Assemble the muffler cuff.
- b. Install the co-pilots side manifold split section. Install new gaskets and hardware. Do not torque.
- c. Insert the heater muff sleeve over the left-side manifold. Install new gaskets and hardware. Do not torque.
- d. Slide the exhaust inlet collar and new fibergasket up to the turbocharger. Rotate collar for proper alignment. Install turbocharger inlet clamp.
- e. Install turbocharger by-pass tube, metal shim(s) and by-pass tube. Install turbocharger outlet clamp.
- f. Inspect turbocharger and engine flange attachments for proper alignment. Torque all attachments. Safety wire turbocharger clamps.
- g. Install ducting from the heater muff.
- h. Run engine and check for leaks.

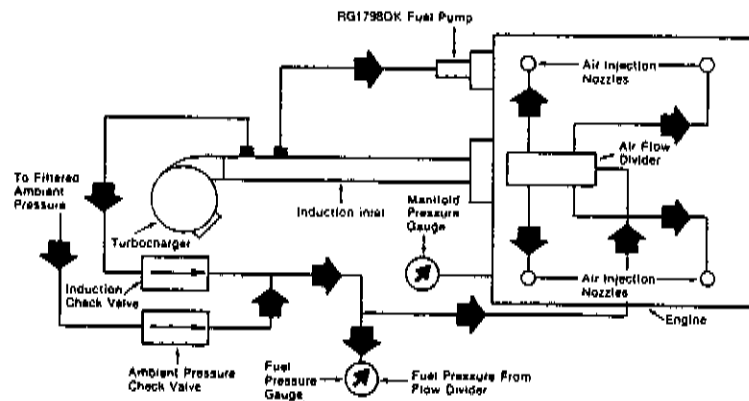
TURBOCHARGER STATIC PRESSURE SYSTEM

Description. In order to attain positive pressure at the injector nozzle for engine starting, idle, and all operating environments, a static system with a series of check valves is required.

One static pressure check valve is vented to ambient pressure on the filtered side of the air inlet container. During starting, idling, and manifold pressures up to

ambient, this check valve is open. The ambient check valve closes automatically when turbocharger compressor inlet pressure exceeds the existing ambient pressure. At this time the induction check valve opens. This check valve is in the static line which is connected to the pressurized side of the air induction tube. Both static pressure lines are interconnected and run to a divider which is located on the top side of the engine. From this divider, the static pressure lines run to each cylinder port injector providing positive system pressure in all operating environments.

TURBOCHARGER STATIC PRESSURE SYSTEM



Static pressure (system pressure) to the engine fuel pump is attained by connecting the fuel pump vent line to the induction inlet tube. This allows the pump to retain its sea level efficiency at all operating altitudes up to 12,000 ft.

INSPECTION OF TURBOCHARGER STATIC PRESSURE SYSTEM

1. At each 100 hour inspection all static pressure lines are to be checked for:
 - a. Internal cleanliness...disconnect and blow out lines.
 - b. Chafing of lines.
 - c. Security of attachments.
 - d. Worn spots.
 - e. Proper operation of check valves.
 - f. Plumbing fittings for nicks, burrs, and deformity.

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MANUAL SUPPLEMENT**

**TROUBLESHOOTING TURBOCHARGER STATIC
PRESSURE SYSTEM**

TROUBLE	CAUSE	REMEDY
Engine Rough Idle	Dirt in nozzle	Clean lines and fittings.
	Ambient check valve sticking	Clean valve.
	Dirt in air flow divider	Disconnect lines and blow out air flow divider.
Engine Low Ambient Pressure w/Power Normally Aspirated	Faulty gauge	Replace gauge.
	Dirty ambient Check valve or dirty lines	Clean or replace valve. Clean dirty lines.
Engine Running Lean Normally Aspirated	Faulty Ambient Check valve	Replace or clean Ambient check valve.
Engine Runs Rough Above Ambient	Faulty or dirty induction check valve	Replace or clean induction check valve.
Engine Quits While In Higher Ambient Range	Faulty induction check valve	Replace induction check valve.

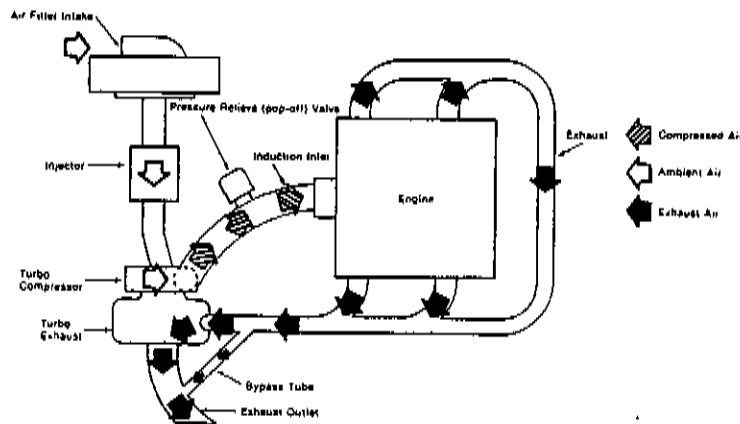
PRIMARY AIR FLOW SYSTEM

Description. Intake air is drawn in through the non-ram air scoop which is sealed to the outer shell of air-filter container. The intake air passes through the air filter on it's way to the injector. At the injector the air volume is metered in proper proportion to the fuel mixture which the engine requires. The metered air is drawn into the impeller section of the turbocharger where it is compressed. This

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compressed air is then forced into the intake manifolds where it is delivered to the various cylinders. It is then forced out the exhaust ports. Exhaust air passes through the exhaust manifolds back to the turbocharger exhaust inlet. The engine exhaust then drives the turbocharger exhaust turbine wheel which is on a fixed shaft with the compressor impeller on the opposite end. It is then pumped overboard through the exhaust outlet. Just before the turbocharger exhaust inlet a mandrel type of exhaust bypass is welded onto the exhaust manifold. A pre-determined exhaust bypass orifice size and bypass tube is an integral part of this system. It is of failsafe design in that if a bypass tube fails the orifice is fixed onto the exhaust manifold.

PRIMARY AIR FLOW SCHEMATIC



INTAKE PRESSURE RELIEF [POP-OFF] VALVE

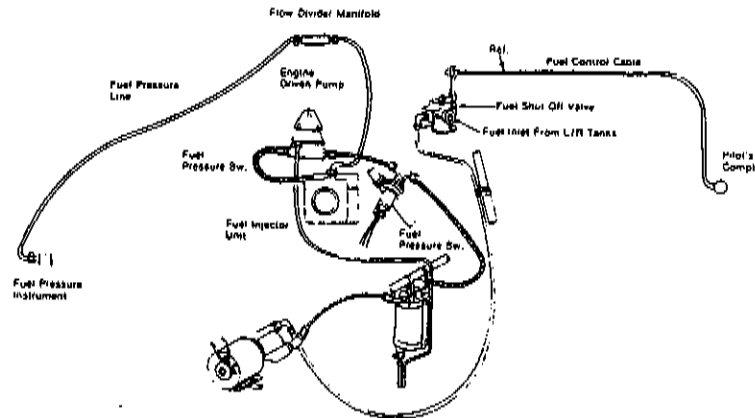
Operation.

The relief valve senses deck pressure directly against the valve face which is held in a closed position by action of the spring and aneroid bellows. The valve face will remain seated under all conditions of normal manifold pressures.

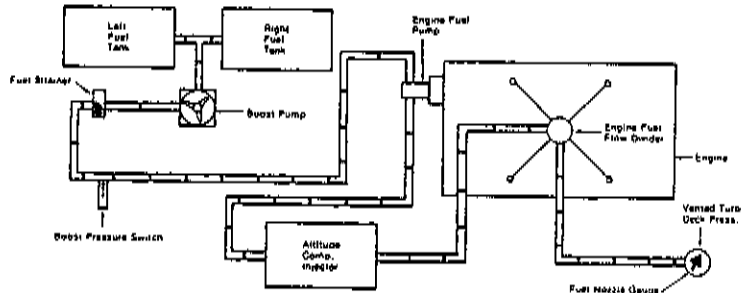
The valve is set to crack open at a pressure slightly above the normal allowable deck pressure. The valve is calibrated to limit the deck pressure to a preset value above the normal allowable pressure. In the event that overboost does occur, the engine is protected against damage, but it is the responsibility of the pilot to correct the throttle

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These items may be removed individually or in groups as required to perform necessary maintenance. Maintenance which may be performed consists of removal, cleaning, trouble shooting, adjustment, inspection and/or parts replacement, and installation.



ENGINE FUEL SYSTEM



FUEL FLOW SCHEMATIC

**F-28C — 280C MAINTENANCE
MANUAL SUPPLEMENT****EXTERNAL FUEL BOOSTER PUMP**

The fuel boost pump is factory set to 40 P.S.I. pressure. A pressure switch monitors the system fuel pressure and activates the panel lights. The green light will come on when the system pressure exceeds 32 to 37 P.S.I. The red light will come on when the system pressure is less than 22 to 30 psi.

NOTE: See section five for installation and removal.

ENGINE DRIVEN FUEL PUMP**Removal of Engine Driven Fuel Pump**

WARNING: Make certain fuel control is in the OFF position.

- a. Remove seat cushions and firewall access panels.
- b. Remove inlet fuel, outlet fuel, fuel drain, and fuel vent lines.
- c. Remove safety wire on 4 bolts. Remove hardware securing fuel pump to engine accessory case mounting pad. Remove fiber gasket.

CAUTION: Withdraw pump straight away from the engine. Oil lubrication case will remain in position with oil lines intact.

INSPECTION OF ENGINE DRIVEN FUEL PUMP

Perform an inspection and operational check on the engine driven fuel pump in accordance with manufacturer's overhaul instructions.

Installation

NOTE: On new pump install elbows in correct location on the bench.

- a. Slide engine pump straight into splines.
- b. Install hardware four places to align engine pump, fiber gasket, oil lubrication case, and engine case gasket.
- c. Secure pump mounting hardware.
- d. Secure bolts with lock wire.

NOTE: On the removal and overhaul of any engine component part, turn fuel ON and check operation of fuel system. Every 25 hours, with the engine running, a visual check of the pump drain should be made. If the engine driven pump fails, there is a possibility that it will pump fuel over board through the drain line.

PROCEDURE FOR CALIBRATION OF FUEL TANK GAUGE

1. Place ship in normal flight attitude — up on wheels.
2. Add six gallons of fuel to each tank. Allow fuel to equalize between tanks.
3. Gauge should be adjusted to the $\frac{1}{4}$ or 60 lb. cockpit reading by bending the float arm. Attach 60 lb. decal to tank at this point.

NOTE: Bending of float arm up will indicate lower reading on gauge.

4. Add additional five gallons of fuel to each tank. Allow time for equalization of fuel. Attach 120 lb. markers at this point.
5. Measure up 10.87 inches from bottom edge of tank along forward side of sight window. Attach 180 lb. decal.
6. Install 240 lb. decal on the top inside corner of sight window decal.

Actual Fuel Quantity

$\frac{1}{4}$	=	60 Lbs. or 12 Gallons
$\frac{1}{2}$	=	120 Lbs. or 22 Gallons
$\frac{3}{4}$	=	180 Lbs. or 32 Gallons
Full	=	240 Lbs. or 40 Gallons

NOTE: Each tank contains one gallon of unusable fuel.

POWERPLANT

FILTER INDUCTION SYSTEM

Description. An A-C sparkplug No. 6487894 (AAF-115) filter is utilized to remove all foreign material from the air before it enters the induction system. The filter is installed in the induction plenum chamber which is located on the right hand side of the engine compartment.

The fuel injector requires an alternate air source in the event the air filter becomes ice covered or plugged. A spring-loaded door between the engine compartment and the air filter housing is designed to open as pressure builds up due to a clogged filter. This provides warm air from the engine compartment to the fuel injector.

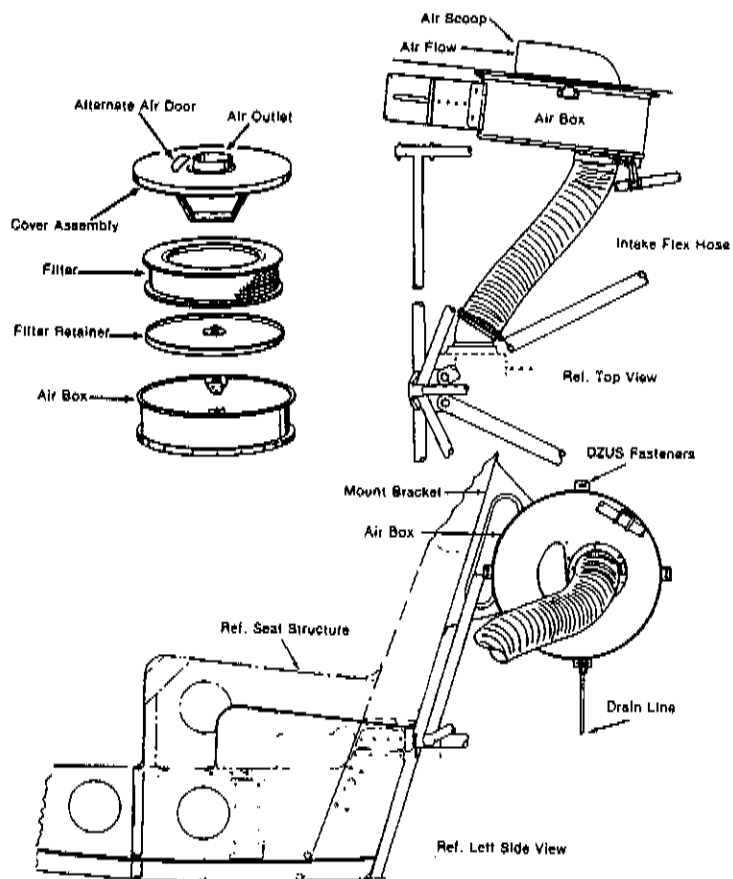
Servicing the filter consists of removal, cleaning, inspection of the filter, plenum chamber, valve, and components, and replacement of same.

To inspect and service the filter in the induction system, proceed as follows:

- a. Open right-hand engine cowl.

F-28C — 280C MAINTENANCE
MANUAL SUPPLEMENT

- b. Remove four DZUS fasteners which will allow the cover assembly to be lifted easily from the filter air box.
- c. Remove inner cover and filter from induction air box. Clean interior of air box, either by the use of compressed air, tire pump or other suitable means.
- d. Make a thorough check of the air filter induction system including the flexible hose to see that there are no breaks in the system and that all clamps at the top where the flexible hose goes into the servo unit and attachments to the air box are tight.
- e. Check to see that there are no obstructions in the air scoop which is located on the right side cowl door.
- f. Frequency of inspection is determined by the conditions under which the helicopter is operated. A daily inspection is recommended when the helicopter is used for agricultural dusting and spraying or is operated in extremely dusty areas.
- g. Visually inspect filter element for dents, tears, or other physical damage.
- h. It is recommended that a new filter be installed every 100 hours or, as mentioned above, when conditions warrant changing it. Upon installation of the filter unit, be sure that all DZUS fasteners are locked before proceeding with an engine run up to check for security of all parts.
- i. Check operation of alternate air door — by applying pressure.
- j. Check drain lines to insure that they are open.



FILTER — INDUCTION SYSTEM

**F-28C — 280C MAINTENANCE
MANUAL SUPPLEMENT****SECTION 21 — ELECTRICAL**

The electrical system utilized on the turbocharged installation is the same basic system as the normally aspirated helicopter. Only the additions or changes are included in this chapter. The total description of the electrical system is illustrated in chapter nine of this manual.

NOTE: Consult the manufacturer's handbook of maintenance instructions for servicing.

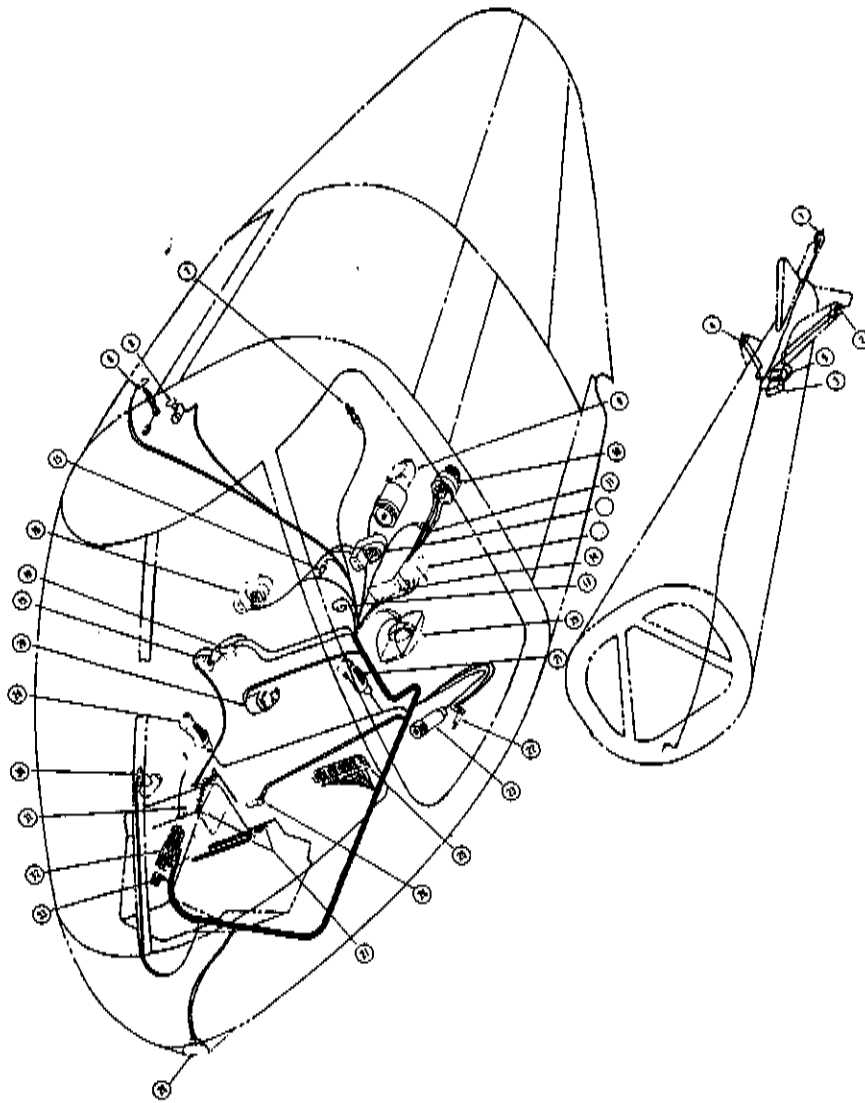
ALTERNATOR

A 12-volt, 70-amp alternator is located on the right hand side of the engine and is belt-driven by the engine. The alternator returns the electrical charge to the battery.

ELECTRICAL INSTALLATION SYSTEM — 280C

1. Whelen Tail Position Light
2. Left Side Whelen Position and Strobe Light Assembly
3. Left Side Power Supply
4. Right Side Whelen Position and Strobe Light Assembly
5. Right Side Power Supply
6. Fuel Quantity Indicator
7. Temperature Thermocouple — Main Rotor Transmission
8. Map Light
9. Starter, Prestolite
10. Alternator, 12-Volt Prestolite
11. Cylinder Head Temperature Thermocouple
14. Prestolite Regulator
15. Oil Temperature Thermocouple
16. Magneto, Bendix D-2000
17. Fuel Pressure Switch
18. Master Relay
19. Starter Relay
20. Boost Pump, Weldon Tool
21. Cyclic Stick Grip, Pilot
22. Left Side Trim Motor Installation
23. Pilot's Collective Stick Grip
24. Cyclic Stick Grip, Co-pilot
25. Terminal Strip
26. Right Side Trim Motor Installation
27. Switch Lights
28. Forward Nose Light Installation
29. Aft Landing Light
30. Air Path Compass Installation

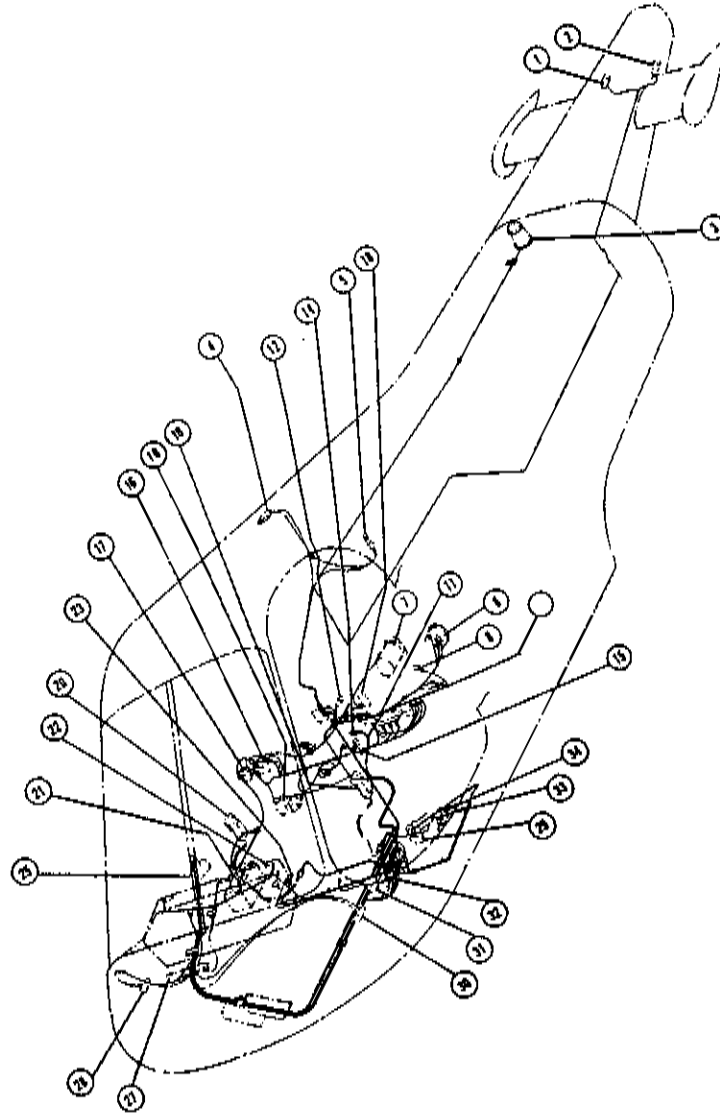
- 31. Battery, 12-Volt DC
- 32. Terminal Strip
- 33. Shunt



ELECTRICAL INSTALLATION SYSTEM — 280C

**F-28C — 280C MAINTENANCE
MANUAL SUPPLEMENT****ELECTRICAL INSTALLATION SYSTEM — F-28C**

1. Grimes right hand tail running light
2. Grimes left hand running light
3. Grimes anti-collision light (Whelen)
4. Fuel pick-up
5. Temperature pick-up main rotor transmission
6. Alternator, 12-volt Prestolite (70 amp.)
7. Starter, Prestolite
8. Cylinder head temperature
10. Magneto, Bendix D-2000
11. Prestolite regulator
12. Oil temperature connector
14. Fuel pressure switch
15. Terminal strip
16. Master relay
17. Starter relay, 3 amp.
18. Cyclic installation, Pilot
19. Boost pump, Weldon Tool
20. Cyclic installation, co-pilot
21. Battery, 12 v. D.C.
22. Instrument light, Grimes
23. Trim motor assembly
25. Airpath compass
27. Terminal strip
28. Right running light, Grimes
29. Landing light, GE
30. Running light, left, Grimes
31. Forward anti-collision light, Grimes or Whelen
32. Terminal strip
33. Collective installation
34. Trim motor installation

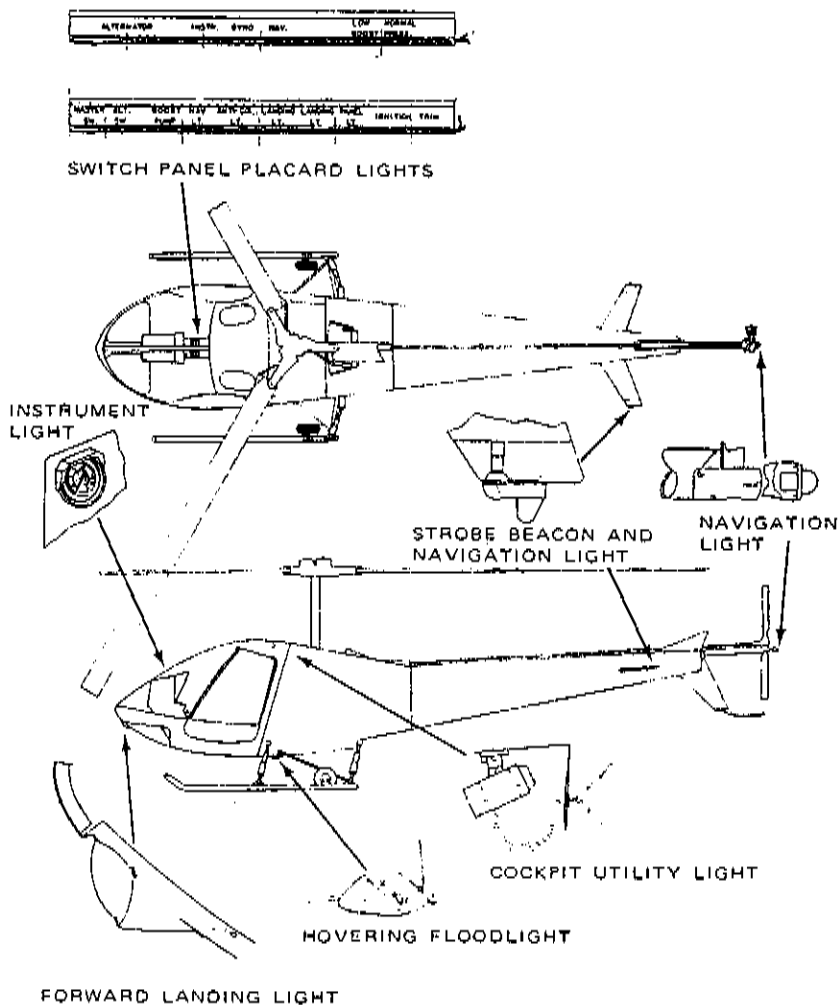


ELECTRICAL INSTALLATION SYSTEM — F-28C

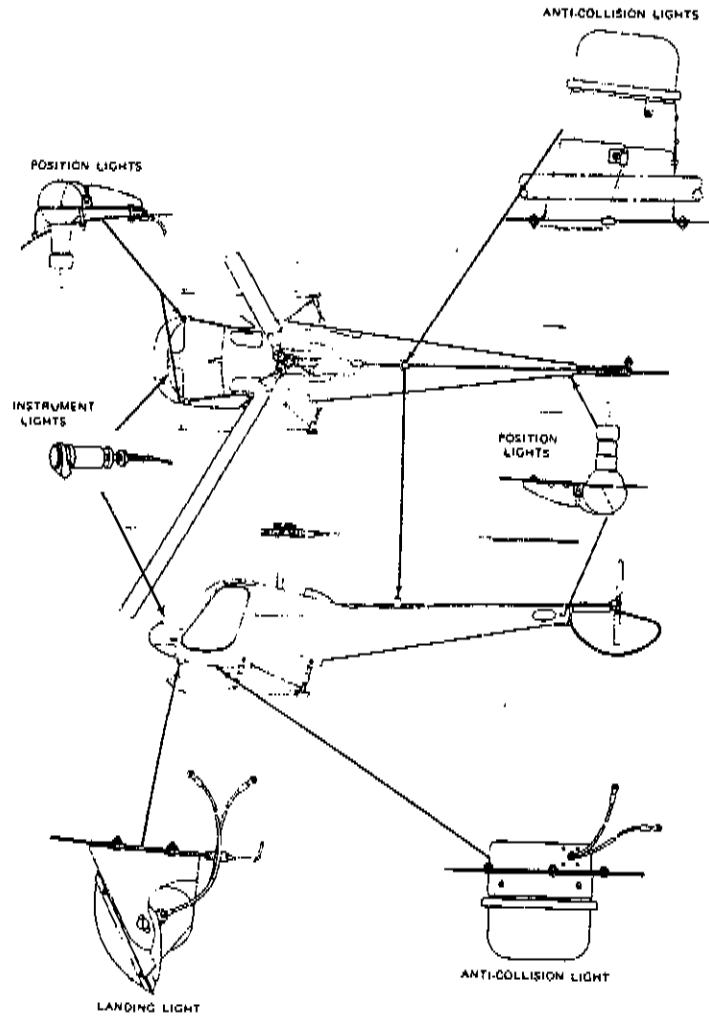
INSTRUMENT LIGHTS

The F-28C instrument post lights are located on the various mount holes on each instrument. The instrument panel lights are controlled by a circuit breaker switch. A reostat is also installed for intensity control.

On the Model 280C, the main instrument lights are lit with eyebrow instrument lights. The circuit breakers and switches are lit with an illuminated placard panel.



NIGHT LIGHTING KIT INSTALLATION — 280C



NIGHT LIGHTING KIT INSTALLATION — F-28C

NIGHT LIGHTING INSTALLATION TROUBLE- SHOOTING CHART

PROBABLE CAUSE REQUIRED ACTION

Landing light out with landing light switch turned on and master switch on:

Burned out lamp	Replace lamp.
Circuit breaker tripped	Reset circuit breaker. Check for wires shorted to ground.
Open circuit	Check all connections and continuity of wiring.

Navigation lights all out, master switch on:

Circuit breaker tripped	Reset circuit breaker.
Position light wire harness	Shorted to ground.

Any one position light out:

Burned out bulb	Replace bulb.
Open circuit	Check all connections and continuity of wiring.

Strobe anti-collision lights all out, master switch on:

Circuit breaker tripped	Reset circuit breaker. Check for wires shorted to ground.
Open circuit	Check all connections and continuity of wiring.

One strobe anti-collision light out:

No audible tone in power supply	Replace power supply.
Burned out bulb	Replace bulb. Check all connections and continuity of wiring.

**F-28C — 280C MAINTENANCE
MANUAL SUPPLEMENT**

LAMP REPLACEMENT GUIDE CHART

Amount	Location	Manuf.	Number
4	Panel Lt.	Grimes	B-4855B-1-24-Y
1	Aft Landing Lt. (sealed)	GE	GE-4406
1	Forward Landing Lt. (sealed)	GE	GE-4313
1	Tail Navigation Lt.	Whelen	A480A
1	Left Side Position and Strobe	Whelen	A429-PR
1	Right Side Position and Strobe	Whelen	A429-PG
2	Switch Panel Placards	Enstrom	-180005
9	Panel Light	Grimes	A-8970B-1-330
1	Navigation Light (red)	Grimes	A-1285-R-12
1	Navigation Light (green)	Grimes	A-1285-G-12
2	Rear Navigation	Grimes	A-1285-C-12
2	Anti-collision	Whelen	WRML
		Grimes	7079B-12

FLIGHT AMPERE LOAD CONDITIONS TABLE — 280C

ELECTRICAL EQUIPMENT	A	B	C	D	E	F	G	H	I	J	K	L
Boost Pump	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Long. Trim*	6.0		6.0				6.0		6.0			
Lat. Trim*			6.0		6.0			6.0		6.0		
Radio-Transmit*	5.0	5.0					5.0	5.0			6.0	
Radio-Receive	.8	.8	.8	.8	.8	.8	.8	.8	.8	.8	.8	.8
Instruments	.12	.12	.12	.12	.12	.12	.12	.12	.12	.12	.12	.12
Master Realy	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5
Strobe Lts.	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4
Panel Lts.							.6	.6	.6	.6	.6	.6
Nav. Lts.						6.2	6.2	6.2	6.2	6.2	6.2	6.2
Fwd. Landing Lt.*											19.5	19.5
Aft Landing Lt.*											3.0	3.0
Amps.	10.82	21.82		16.82		17.62	28.62		23.62		46.12	40.12

note: Flight Condition A is Day Normal Cruise.

Flight Condition F is Night Normal Cruise.

* Denotes Intermittent Use.

° Denotes Short Duration Use (5 min.).

Alternator is 12 volt, 70 amp.

The above load conditions include all standard electrical appliances for 280C series helicopters. If other special equipment is added, the loads for conditions A and F in the above table are to be modified.

FLIGHT AMPERE LOAD CONDITIONS TABLE — F-28C

ELECTRICAL EQUIPMENT	A	B	C	D	E	F	G	H	I	J	K	L
Boost Pump	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Long. Trim*	6.0	6.0		6.0			6.0		6.0			
Lat. Trim*			6.0		6.0			6.0		6.0		
Radio-Transmit*	5.0	5.0					5.0	5.0			6.0	
Radio-Receive	.8	.8	.8	.8	.8	.8	.8	.8	.8	.8	.8	.8
Instruments	.12	.12	.12	.12	.12	.12	.12	.12	.12	.12	.12	.12
Master Relay	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5
Strobe Lts.	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2
Panel Lts.						.6	.6	.6	.6	.6	.6	.6
Nav. Lts.						6.2	6.2	6.2	6.2	6.2	6.2	6.2
Fwd. Landing Lt.*											19.5	19.5
Aft Landing Lt.*											3.0	3.0
Amps.	20.62	31.62		26.62		27.42	38.42		33.42		55.9	49.92

NOTE: Flight Condition A is Day Normal Cruise.

Flight Condition F is Night Normal Cruise.

* Denotes Intermittent Use.

° Denotes Short Duration Use (5 min.).

Alternator is 12 volt, 70 amp.

The above load conditions include all standard electrical appliances for F-28C series helicopters. If other special equipment is added, the loads for conditions A and F in the above table are to be modified.

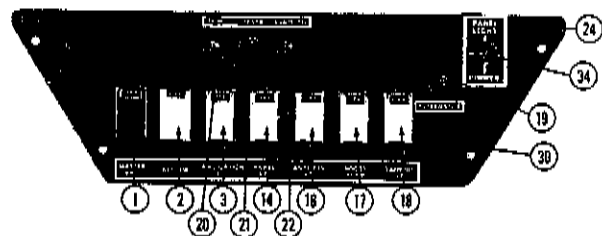
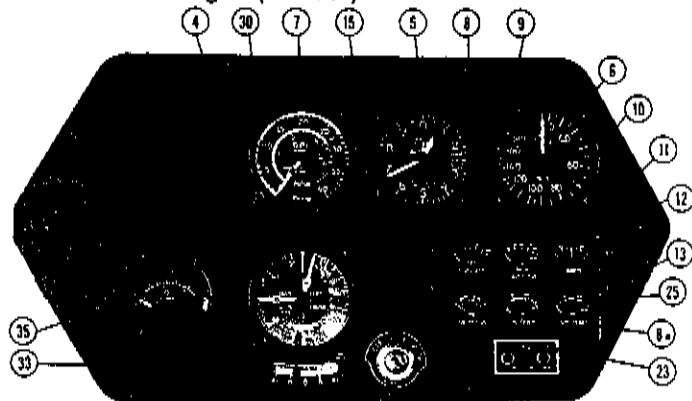
F-28C — 280C MAINTENANCE
MANUAL SUPPLEMENT

Item	Part Name
	Instrument Inst'l.
1	Master Switch
2	Alternator Switch
3	Navigation Lt. Circuit Breaker Switch
4	Manifold Pressure Gage
5	Altimeter
6	Airspeed
7	Tachometer
8a	Engine Instrument Cluster
8	Fuel Quantity Gage
9	Engine Oil Pressure Gage
10	M/R Gear Box Oil Temp.
11	Engine Oil Temp. Gage
12	Ammeter Gage
13	Engine Cyl. Temp. Gage
14	Panel Lt. Circuit Breaker Switch
15	Ignition Switch
16	Anti-Col. Lt. Circuit Breaker Switch
17	Boost Pump Circuit Breaker Switch
18	Landing Lt. Circuit Breaker Switch
19	Alternator Circuit Breaker — 70 Amp.
20	7½ Amp. — Trim Motor Circuit Breaker
21	1 Amp. — Instrument Circuit Breaker
22	7½ Amp. — Ignition Circuit Breaker
23	Fuel Pressure Warning System Indicator Light (Green) Indicator Light (Red)
24	Switch Panel
25	Instrument Panel
26	Filler Plate 3.08 Dia.
27	Kendall Polyken Cloth Tape
28	Airpath Compass (Not Shown) Compass Bulb (Not Shown)
29	Scott Outside Air Temp. Gage (Not Shown)
30	Instrument Lights Instrument Bulbs (Not Shown)
31	Shunt, 50 Millivolt (Not Shown)
32	Pressure Switch
33	Ball Bank Indicator
34	1/8 Knob Rheostat
35	E.G.T. Gauge

F-28C — 280C MAINTENANCE
MANUAL SUPPLEMENT

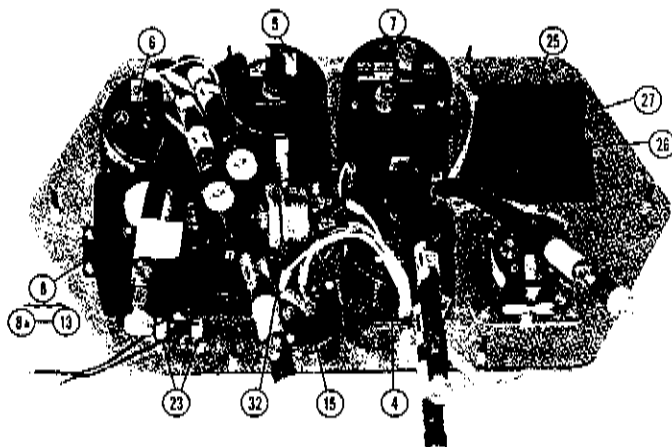
OPTIONAL (Not Shown)

- 1 Starter Engaged Warning Light (Red)
- 2 Alternator Discharge Light (Red)
- 3 Low Fuel Light (Amber)



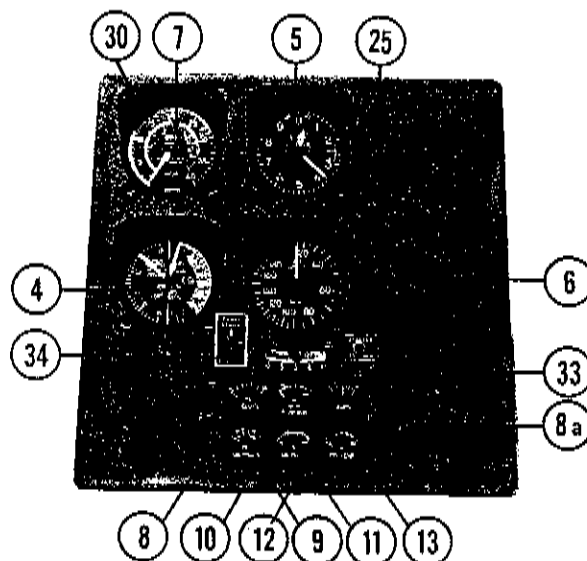
MAIN PANEL — F-28C

SWITCH PANEL — F-28C

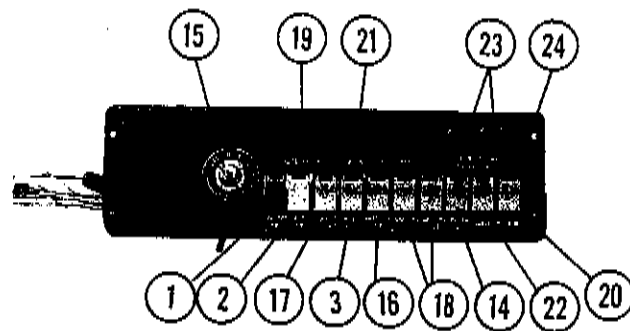


MAIN PANEL — REAR VIEW F-28C

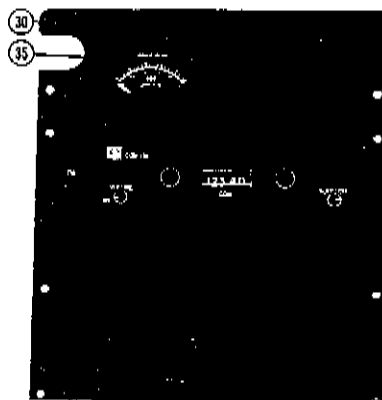
F-28C — 280C MAINTENANCE
MANUAL SUPPLEMENT



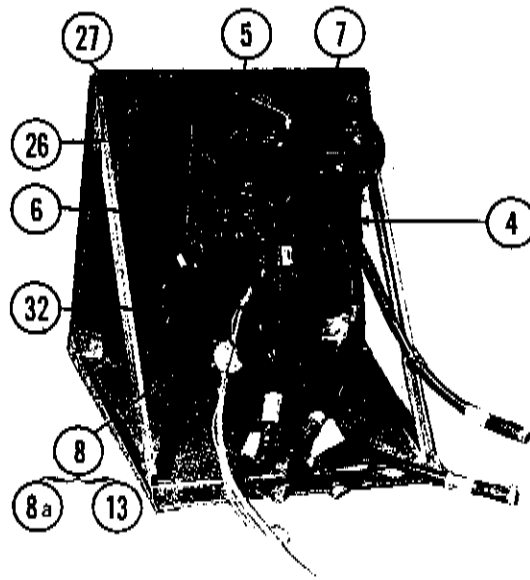
MAIN PANEL — 280C



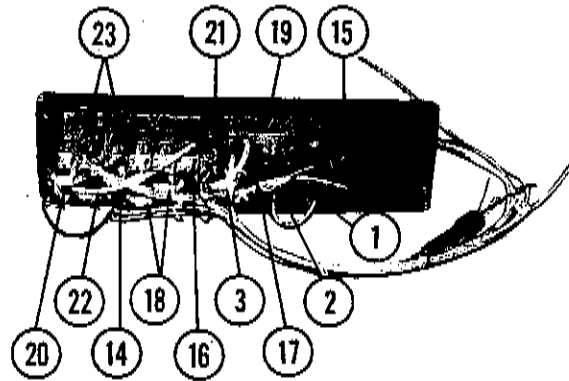
SWITCH PANEL — 280C



LOWER PANEL — 280C



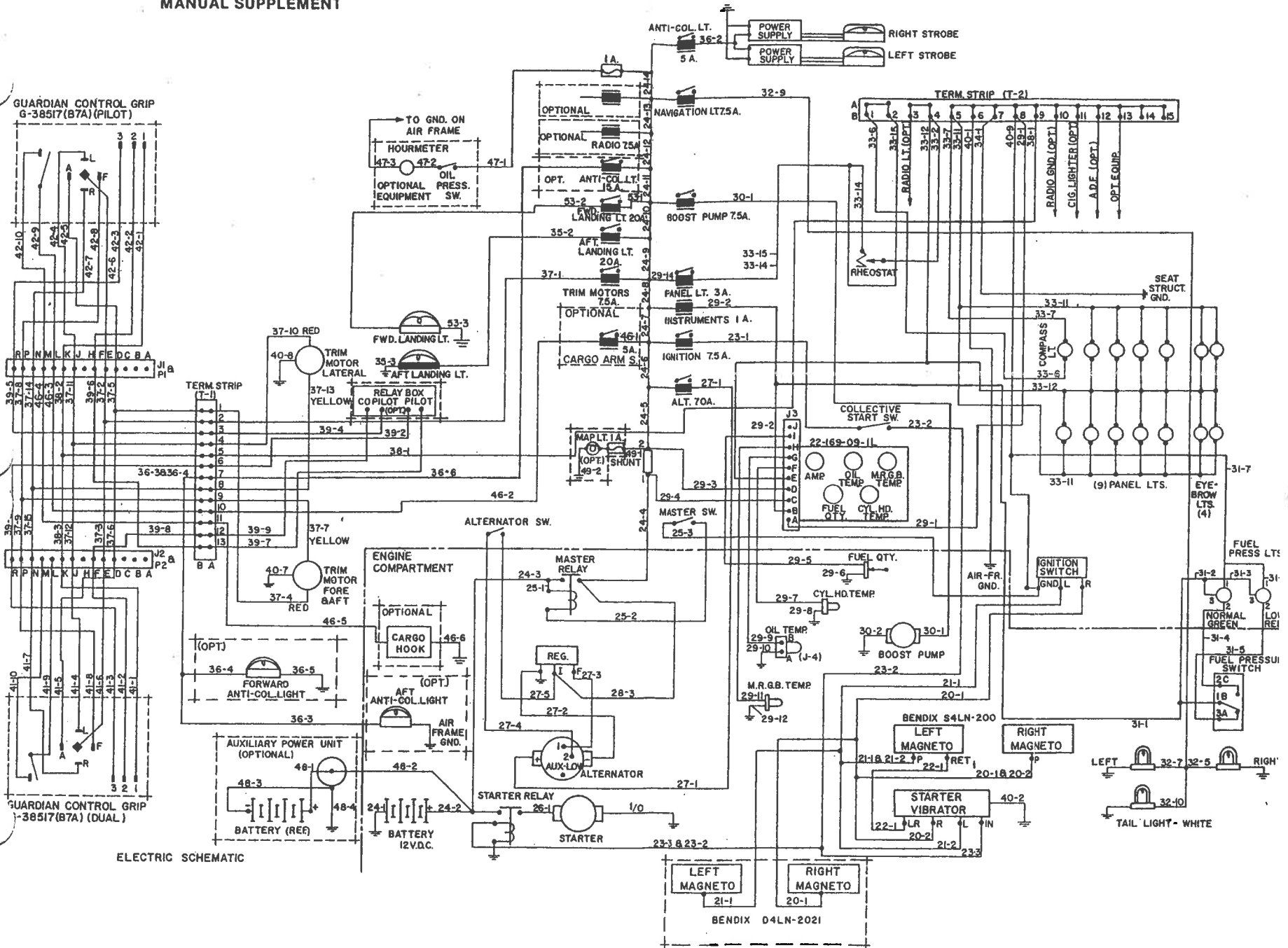
MAIN PANEL — REAR VIEW 280C



SWITCH PANEL — REAR VIEW 280C

F-28C — 280C MAINTENANCE
MANUAL SUPPLEMENT

MM-21-15



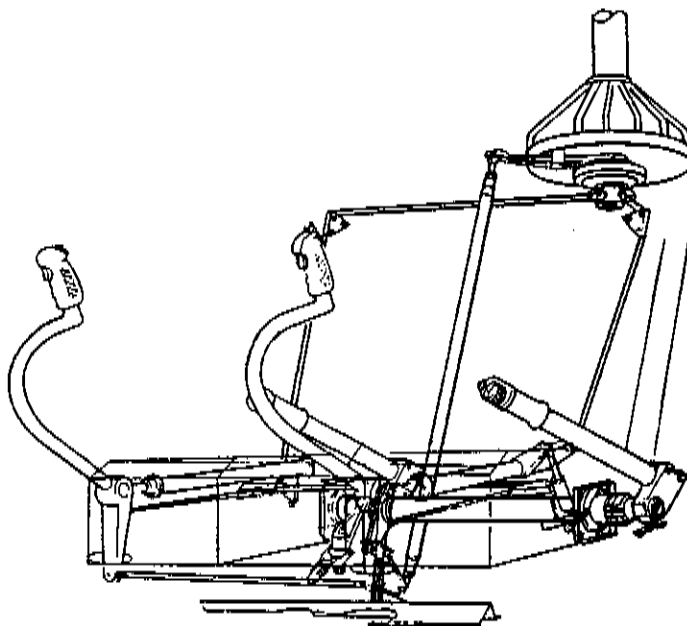
ELECTRIC SCHEMATIC

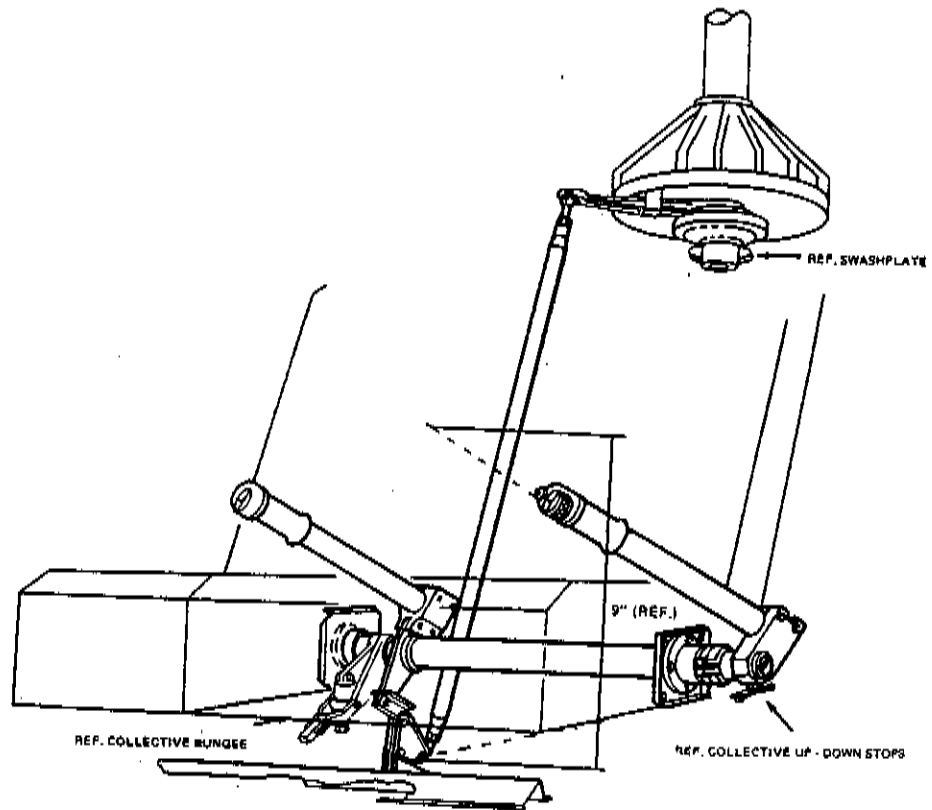
SECTION 22

FLIGHT CONTROLS

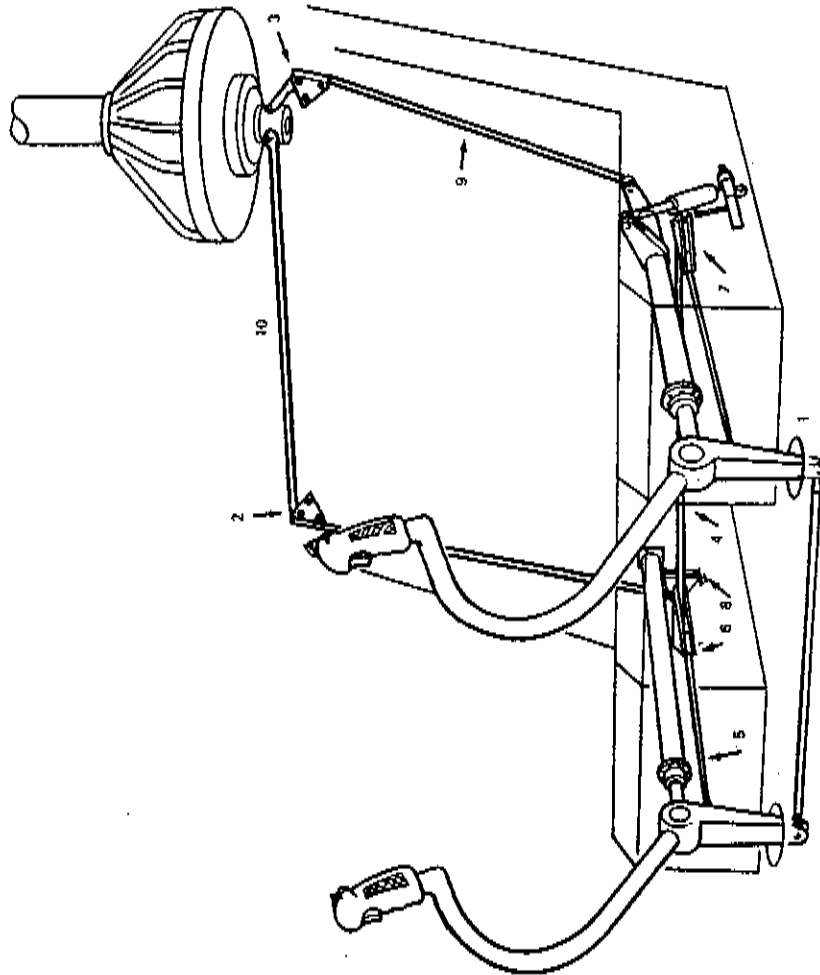
DESCRIPTION

The F-28C Helicopter is controlled in flight by the collective pitch control stick, throttle, cyclic pitch control stick and tail rotor pitch control foot pedals. (See below.) These controls are installed for operation from the left-hand pilot seat. A dual control kit (optional) permits co-pilot's operation from the right-hand seat. The collective pitch control stick causes the helicopter to climb or descend as the stick is raised or lowered. The throttle is used independently by turning the grip. The cyclic pitch control stick controls forward, aft, left and right motion of the helicopter. Longitudinal control is obtained by moving the cyclic stick in a forward or aft direction; lateral motion is obtained by displacement of the stick to the left or right. Longitudinal and lateral trim is electrically controlled from a switch on the cyclic stick. The tail rotor pitch control foot pedals vary the thrust of the tail rotor, which results in a change of heading of the helicopter by increasing or decreasing the anti-torque effect of the tail rotor.



F-28C — 280C MAINTENANCE
MANUAL SUPPLEMENT

COLLECTIVE CONTROLS



CYCLIC CONTROL SYSTEM

CYCLIC AND COLLECTIVE CONTROL RIGGING PROCEDURE

Ship level with reference to bottom bay of pylon, blades at 0° lag. Main rotor shaft 2° forward and 2° left.

To check the rigging on the helicopter or to alter the rigging, proceed as follows:

- a. Remove seat back, seat cover and side cowl upper panels.
- b. Install pilot's cyclic rigging fixture tool no. T-1775 to establish neutral position (1).
- c. Disconnect bellcranks (2 and 3) on top of firewall at swashplate side.
- d. Adjust lateral rod (4) and fore and aft push rods (5) so that bellcranks (6 and 7) are parallel to center line of ship, and adjust bellcrank (8) in a vertical position. (Use longitudinal bulkhead for reference line.) (Basic setting at factory.)
- e. Adjust the two vertical rods (9) so as to position the back side of the bellcranks (2 and 3) parallel to back of the cabin.

NOTE: Bellcranks 2 and 3 should not hit mounting bracket located on firewall.

- f. Remove cyclic rigging fixtures and cyclic sticks in forward, aft, and lateral positions and check for freedom of travel.

NOTE: If no further adjustment is necessary, secure all jam nuts on control rods, and check for proper rod end thread extension.

- g. Reinstall pilot's cyclic rigging jig.
- h. Install swashplate centering tool no. 1575 (3 places). This tool positions the lower swashplate perpendicular to the main rotor shaft.
- i. Adjust rod (10) so as to connect to bellcranks (2 and 3) and secure with bolts and nuts.
- j. Hook up the three vertical rods (32) to walking beams (35) at the top of the rotor head. (Ref. Page 11-16).

NOTE: When working on rotor head, place rag [red] in top of main rotor shaft to preclude the possibility of dropping hardware in shaft.

- k. Recheck level of helicopter with use of a level on the left-hand lower pylon longeron.
- l. Set down stop of pilot collective control to approximately 8" from center line of starter button on end of the collective to the floor line.

**F-28C — 280C MAINTENANCE
MANUAL SUPPLEMENT**

NOTE: By the use of a protractor placed on top of the pilot's collective, you should obtain a reading of approximately $20^{\circ} + .5^{\circ}$ pitch with reference to the floor line.

- m. Hook up the three pitch links between the walking beams and the pitch arm attached to the retention assemblies.
- n. Move the main rotor hub CCW until number one (1) blade grip is at 97° azimuth (center grip with 1" damper piston rod exposed).
- o. Place protractor on blade retention assembly.

NOTE: Always position at the same spot on all retention assemblies and adjust pitch links to achieve the position $+6.50^{\circ} \pm .5^{\circ}$ angle of incidence on the retention assembly.

- p. Repeat this procedure on each retention assembly.
- q. Lift pilot collective stick and adjust the up stop to a positive $+19.0^{\circ} \pm .5^{\circ}$ on retention assembly to achieve a total travel of $13^{\circ} \pm .5^{\circ}$.

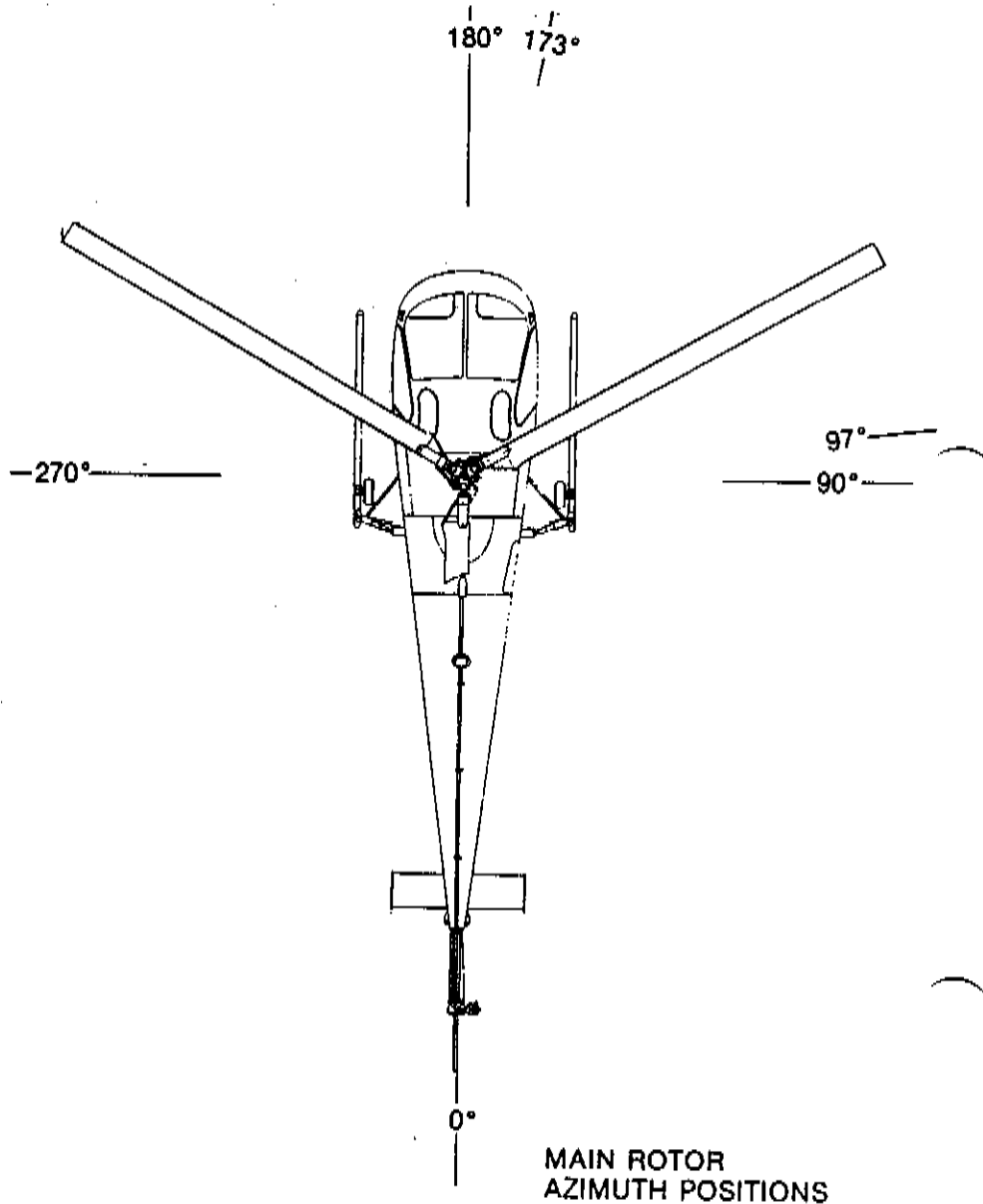
NOTE: Remove rigging fixtures. Check rods [10] for pylon clearance, and check distance between bottom of swashplate and top of engine baffle for clearance.

- r. Rotate cyclic control through a 360° azimuth with collective up and down position and check for freedom of movement.
- s. Reinspect entire system for security.

CYCLIC AZIMUTH CHECK-VERIFICATION OF RIGGING

- a. Position collective down against stop and cyclic forward against stop.
- b. Check blade pitch at root retention plate with blade at right angle to the ship fore and aft centerline 97° azimuth = $-2.5^{\circ} \pm .50^{\circ}$.
- c. Position cyclic aft against stop.
- d. Check blade pitch at root retention plates with blade to right at right angles to the ship fore and aft centerline (97° azimuth) = $+14.5^{\circ} \pm .5^{\circ}$.
- e. Position cyclic right against stop.
- f. Check blade pitch at root retention plate with blade positioned approximately 7° to right of the forward centerline position (173° azimuth) = $14.5^{\circ} \pm .5^{\circ}$.
- g. Position cyclic left against stop.
- h. Check blade pitch at root retention plate with blade forward and 7° to right as before = $-2.5^{\circ} \pm .5^{\circ}$.

NOTE: When working on the rotor head, place a rag [red] in the top of the main rotor shaft to prevent the possibility of dropping hardware down into the shaft.



F-28C - 280C MAINTENANCE
MANUAL SUPPLEMENT

CYCLIC TRIM SPRINGS RIGGING PROCEDURE
P/N 28-16283 Spring (Lateral Trim)

- a. Install 28-16283 spring between 28-16291 plate and outboard hole on 28-16290 bracket.
- b. Flight check helicopter to see if desired lateral trim forces can be obtained.

NOTE: Outboard Hole--will allow maximum left lateral trim force. Maximum left lateral trim required with maximum right lateral c.g. (i. e., 3700 in.-lbs.); hovering with left side into the wind also requires more left lateral trim.

Inboard Hole--will allow maximum right lateral trim force. Flight conditions where this would be required are as follows:

- 1) Forward flight at V_{NE} .
 - 2) Minus 3250 in.-lbs. lateral offset moment.
- c. If more right lateral trim is desired, move spring to next hole inboard and check for sufficient right lateral trim at V_{NE} . Operator should adjust trim for sufficient right lateral trim at V_{NE} with typical solo pilot, thereby insuring maximum left lateral trim in hover.

CYCLIC TRIM SPRINGS RIGGING PROCEDURE
P/N 28-16283 Spring (Longitudinal Trim)

- a. Install 28-16283 longitudinal bias spring between 28-16294 bracket and 28-16284 clip. Bracket 28-16294 may be installed in two positions. Installing the bracket such that the leading edge is parallel with the forward edge of the longitudinal bellcrank and hooking the spring in the bottom hole will result in

1. The first part of the document discusses the importance of maintaining accurate records of all transactions and activities. It emphasizes that this is crucial for ensuring transparency and accountability in the organization's operations.

2. The second part outlines the various methods and tools used to collect and analyze data. This includes both traditional manual methods and modern digital technologies, highlighting the benefits of each approach.

3. The third part focuses on the challenges faced in data collection and analysis, such as data quality, privacy concerns, and the integration of different data sources. It provides strategies to overcome these challenges and ensure the reliability of the data.

4. The fourth part discusses the role of data in decision-making and strategic planning. It explains how data-driven insights can help organizations identify trends, anticipate market changes, and make more informed decisions.

5. The fifth part addresses the ethical implications of data collection and analysis, particularly regarding privacy and the potential for misuse of data. It stresses the need for robust data protection policies and ethical guidelines.

6. The sixth part explores the future of data collection and analysis, including emerging technologies like artificial intelligence and machine learning, and their potential to revolutionize data processing and analysis.

7. The seventh part provides a summary of the key points discussed in the document and offers recommendations for organizations looking to optimize their data collection and analysis processes.

8. The eighth part concludes the document by reiterating the importance of data in driving organizational success and the need for continuous improvement in data management practices.

maximum forward trim force. Moving the spring to a higher hole will result in more aft spring force. Should locating the spring in the top hole provide insufficient aft spring force, the bracket may be rotated aft to the second notch and the choice of hole location repeated.

NOTE: Maximum aft trim force will generally be required hovering tail into the wind and at VNE when ballasted for maximum forward c.g. at gross weight. Due to sensitivity of aft trim to wind velocity, it is recommended that the longitudinal spring be adjusted to provide adequate aft trim at VNE (i. e., 117 mph) when ballasted to maximum forward c.g. (i. e., 92 inches).

1. The first part of the document discusses the importance of maintaining accurate records of all transactions and activities. It emphasizes that this is crucial for ensuring transparency and accountability in the organization's operations.

2. The second part of the document outlines the various methods and tools used to collect and analyze data. It highlights the need for a systematic approach to data collection and the importance of using reliable sources of information.

3. The third part of the document focuses on the analysis of the collected data. It discusses the various techniques used to identify trends, patterns, and anomalies in the data, and how these insights can be used to inform decision-making.

4. The fourth part of the document discusses the importance of communication and reporting. It emphasizes that the results of the data analysis should be clearly and concisely communicated to the relevant stakeholders, and that regular reports should be provided to keep them informed of the organization's performance.

5. The fifth part of the document discusses the importance of continuous improvement. It emphasizes that the organization should regularly review its processes and procedures to identify areas for improvement and implement changes to enhance its performance.

SECTION 23 — INSTRUMENTS

EXHAUST GAS TEMPERATURE INDICATOR

DESCRIPTION

One of the most important factors in flying an aircraft is to maintain the correct fuel/air mixture. Proper mixture to the engine will give maximum range, economical operation, and maximum service life. Improper mixture will prove costly in fuel economy and maintenance costs, as well as shorten the life of the engine. The most accurate method for determining the correct fuel/air ratio is a sensitive and fast-responding exhaust gas temperature indicator.

Cruise. Exhaust gas temperature, as shown on the Enstrom EGT Indicator, should be used as an aid for fuel mixture leaning in cruising flight at 75% power or less, i.e. 28 inches manifold pressure and 2900 RPM in the Model F-28C or 280C.

To obtain a best economy mixture, lean to 1650°F. EGT. To obtain a best power mixture, lean only to 1550°F. EGT. Do not exceed 1650°F. EGT. Operation on the lean side of peak EGT is not approved. Also any change in altitude or power will require a recheck of the EGT indication.

Refer to FM-9-10 of the Flight Manual for the relationship of fuel flow in pounds per hour versus nozzle pressure psi to determine your actual fuel consumption.

Fuel Mixture: Engine may be leaned at 29" M.P. or below to 1600°F. on rich side of peak. Never exceed 1650°F. E.G.T. Mixture must be full rich for landing and takeoff regardless of power for proper engine cooling.

CALIBRATION

Since all mixture settings are made relative to peak exhaust temperature (point of maximum needle deflection) calibration is not necessary. However, when the EGT reading for a given set of conditions changes significantly, the calibration of the indicator should be checked because of the possibility of the change reflecting engine trouble. Calibration can be accomplished with an AICal Calibrator available from ALCOR.

FUNCTIONAL CHECK

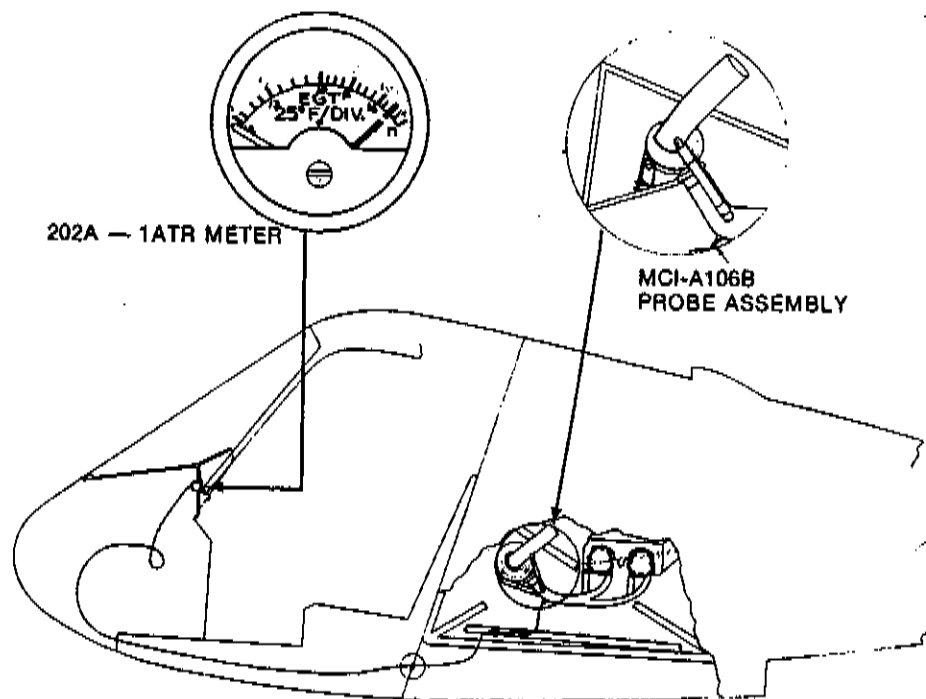
After installation it is recommended that a functional check

be made of the system using an ALCOR AICal Mark V Calibrator in accordance with instructions provided therewith. If this Calibrator is not available then the recommended procedure is as follows:

1. Heat the end of the exhaust probe with a propane torch, or equivalent, to a light red heat (1400° to 1500°F.) and if the indicator pointer does not move into the operating range, check the following:
 - a. Connections between the probe and lead wire.
 - b. Short between two connectors.
 - c. Continuity of circuit at connector and indicator binding posts. The red lead wire should be continuous from probe to the No. 8 size terminal.
 - d. Probe resistance, approximately 0.8 ohms.

OPERATION

See the aircraft pilot's operating manual or consult engine manufacturers for recommended operation. For Lycoming engines see Lycoming Service Instructions 1094B dated May 3, 1968.



EXHAUST GAS TEMPERATURE INSTALLATION

SECTION 24 TAIL ROTOR DRIVE ASSEMBLY

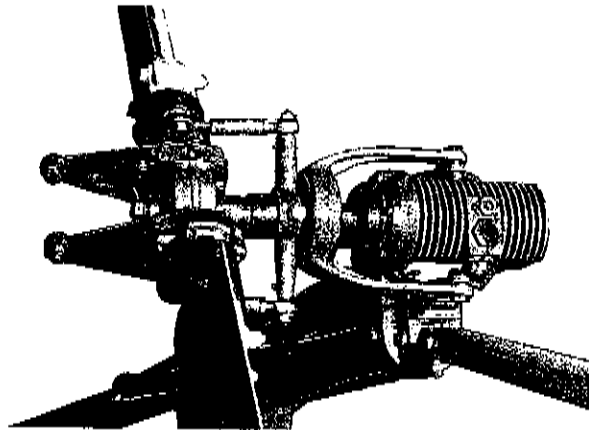
DESCRIPTION

The tail rotor drive assembly consists of a tail rotor assembly, tail rotor torque tube mounted in five bearings and a tail rotor transmission.

NOTE: The tail rotor assembly and tail rotor gear box is to be returned to the factory or factory designated service facility for inspection and any necessary overhaul work.

TAIL ROTOR ASSEMBLY

The tail rotor assembly consist of a pitch control assembly, two pitch control links and two blade assemblies bolted to a grip assembly. Three bearings are provided in each grip to provide for feathering motion and tail rotor thrust. The hub is splined to the rotating output shaft of the gear box. The rotor pitch control is accomplished through a series of bellcranks and cables, attached to foot pedals in the cockpit.



REMOVAL OF THE TAIL ROTOR ASSEMBLY [Ref. Page 24-3]

Remove tail rotor assembly by the following procedure:

- a. Disconnect pitch change links from pitch arms (Ref. Page 24-6).

NOTE: When removing pitch link hardware, observe that spacers are provided on outboard side of the pitch links. They are factory set for proper clearance, keep together for proper installation.

- b. Remove safety wire from hub retention bolt (1); remove bolt, washer (2), and teetering stop (3). (Ref. Page 24-3).

NOTE: Index hub and shaft splines for installation ease.

- c. Slowly slide hub and blade assembly off shaft.
- d. Use caution in handling and working on assembly.

Disassembly of Tail Rotor Assembly. Ref. Page 24-6.)

Disassemble the tail rotor assembly by performing the following steps:

- a. Remove the blade assembly from the hub assembly by extracting safety wire and removing the bolts and washers (4 & 5) holding the plate (6) to the grip (7). Accomplish by removing one at a time while grip is rotated, aligning that bolt with flat part of spindle (8). Identify retention plate (6) for proper installation on each grip.

NOTE: 1. There are special chamfered washers under the NAS bolts.

2. Index mark the blade to spindle and mark the retention plate to the grip to aid in reassembly.

4. Remove bleed screw [10] in grip [7].

5. Do not remove weights 25, 26, 27, 28 from plates [6].

- b. Apply heat (with gun or substitute method) to blade grip (7) till it is quite warm. Then pull blade and grip assembly off the spindle assembly.

CAUTION: Do not separate the blade from the grip as these are match-drilled on assembly.

- c. Remove bearing retaining lock nut (11) and lockwasher (12) from spindle (8).
- d. Remove the two thrust bearings (13, 14) along with the spacers (15 and 16). Observe that the bearings have closed side towards hub.
- e. Now slide retention plate (6) and bearing (17) from the spindle (8).
- f. Disengage both retainer rings (18 & 19) that secure the bearings (20 & 21) in the spindle (8). Identify shims for reassembly.

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- g. Use a suitable drift to remove bearings (20 & 21) from hub (22).
- h. Check bearings for radial clearance. The drag is to be snug fit but still able to turn by hand on the axis.

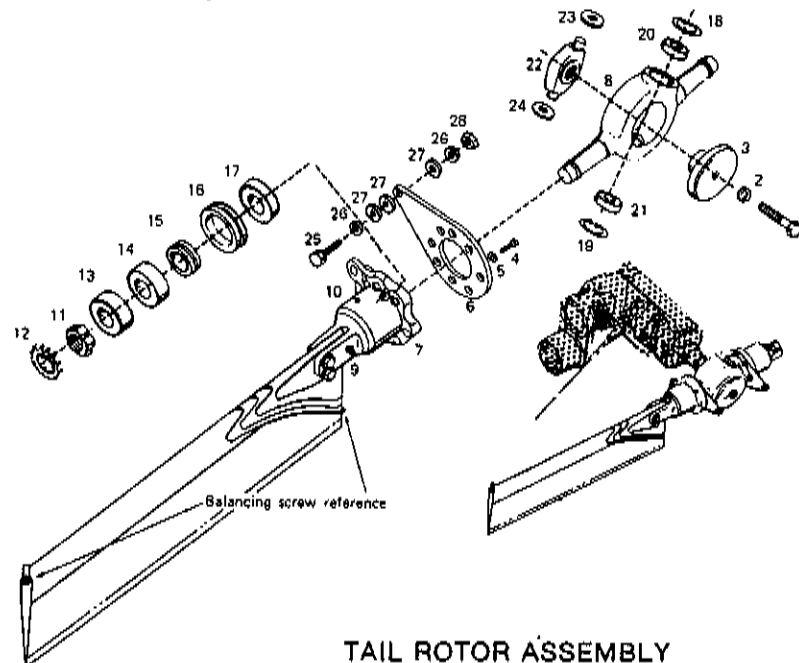
NOTE: Shims [23 & 24] may be used between bearings and hub shoulders. Exercise care not to mix or change their position as this will aid in reassembly and MAINTAINING THE BALANCE.

Cleaning Tail Rotor Assembly. Clean the tail rotor assembly as follows:

- a. Clean tail rotor assembly with clean, lint-free cloth dampened with soap and water solution.
- b. Wipe dry with clean, lint-free cloth.
- c. Clean hard-to-clean parts with solvent and dry with compressed air.

Inspection of Tail Rotor Assembly. Inspect the tail rotor assembly as follows:

CAUTION: No cracks or breaks are permissible in tail rotor blade, hub, pitch control assembly. Remove and replace any defective components.



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- a. Check all parts for obvious wear or damage.
- b. Check all threaded parts for condition of threads.
- c. Check all bearings and lubrication fittings for condition of operation.
- d. Inspect tail rotor assembly for evidence of binding by hand turning a few turns while listening for unusual sounds.
- e. Inspect pitch control assembly for scratches, dents, nicks, cracks, corrosion and surface defects.
- f. Inspect all nuts and bolts security.
- g. Inspect pitch control links for scratches, nicks, dents, burrs, cracks, corrosion and similar surface defects.
- h. Inspect blade stop for deterioration and security of attachment.
- i. Inspect hub for scratches, nicks, dents, burrs, cracks, corrosion and surface defects.
- j. Inspect blades for visible bond.
- k. Inspect leading edge stainless steel abrasion strips on blade leading edge for separation from blade skin. No voids are permitted in tail rotor blades.
- l. Inspect blades for scratches.
- m. Inspect stainless steel abrasion strip on leading edges for cracks, dents, scratches and nicks.

Assembly of Tail Rotor Assembly. Assemble the tail rotor assembly as follows:

CAUTION: To maintain proper balance, all parts must be returned to their original position prior to disassembly.

- a. Insert hub (22) into spindle (8). Be sure shims (23 & 24) have been installed as removed. Press bearing (20 & 21) into opposite sides of spindle (8) and insert retainer rings (18 & 19).
- b. Slide pitch link arm (6) onto spindle.
- c. Install bearing (17) followed by spacers (15 and 16).
- d. Install the two bearings (13 and 14) onto spindle.

CAUTION: Be sure the bearings have closed side towards the hub.

- e. Install lockwasher (12) and retaining nut (11). Torque nut to 35-40 ft. lbs.
- f. Heat blade grip (7) until quite warm and slide over spindle assembly (8).
- g. Install the eight bolts and washers (4 & 5). Assembling the pitch arm (6) to the grip (7).

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NOTE: Accomplish by installing one at a time while grip is rotated, aligning that bolt with flat side of spindle [8].

- h. Safety wire bolts in pairs.
- i. Install ZERK fitting (9) in grip (8).
- j. Lubricate with Aero-shell 14 grease. Be sure 10-32 screw (10) is removed to allow purging of grease in grip (8).

NOTE: Reinstall 10-32 purge screw [10].

Removal of Control Assembly. (Ref. Page 24-6.)

- a. Remove safety wire on both guide bolts (4) from pitch link retainer (5).
- b. Remove snap ring (6).
- c. Remove pitch link retainer bolts (4) and remove retainer assembly (5).
- d. Remove both bolts and washers (7) attaching bearing yoke (8) to the control brackets (9 & 10).
- e. Carefully slide yoke (8) off the slotted shaft and spacer (11).
- f. The control brackets may remain on the gear box at this time.
- g. To remove the bracket assembly (9 & 10), remove the safety wire from the four bolts (12).
- h. Separate and remove the upper and the lower brackets (9 & 10).

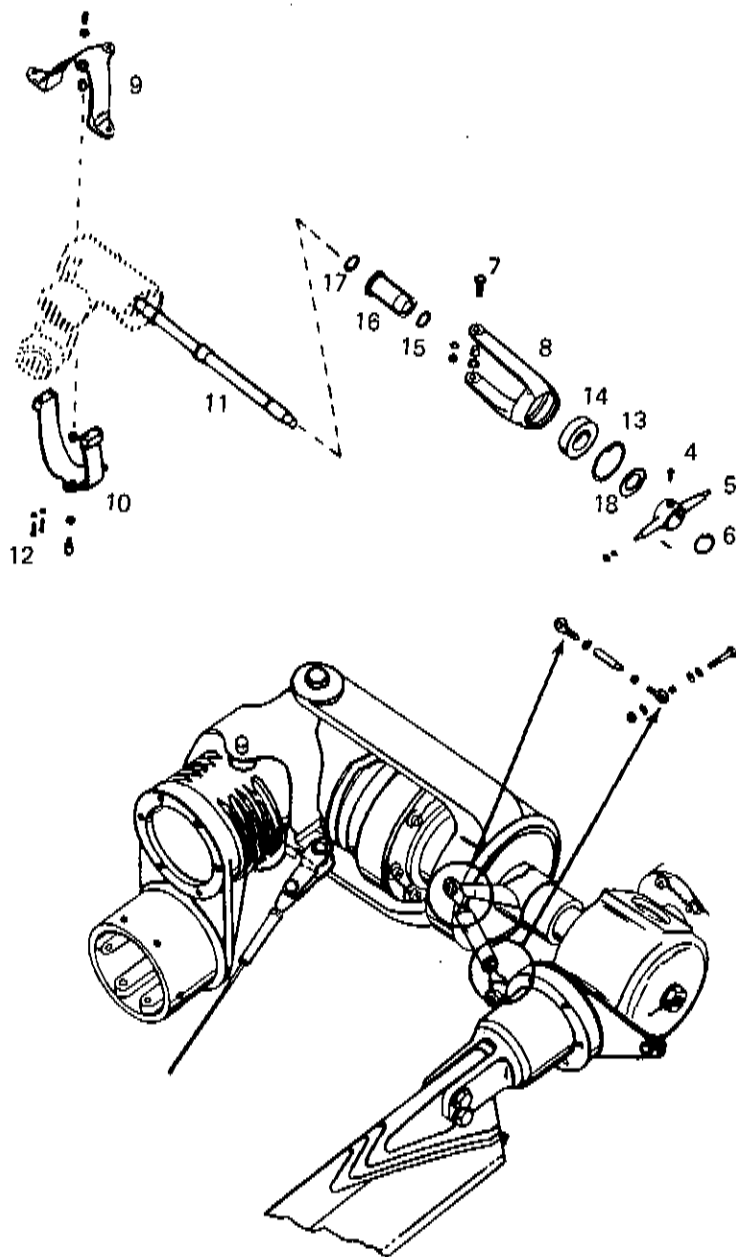
NOTE: Observe washers on pivot axis of upper and lower brackets.

Disassembly of Bearing Housing. (Ref. Page 24-6.)

- a. Remove the snap ring (13).
- b. Heat the housing assembly (8) and press out bearing (14).
- c. Remove pitch control bearing (16).
- d. Remove seals (15 & 17).

Reassembly of Bearing Housing

- a. Inspect and replace parts as necessary.
- b. Reassemble in reverse order of disassembly.



TAIL ROTOR MECHANICAL CONTROLS

TAIL ROTOR TRANSMISSION

The tail rotor transmission is to be returned to the factory or factory designated maintenance facility for overhaul.

TAIL ROTOR GEAR BOX REMOVAL

Removal. To remove the tail rotor gear box, proceed as follows:

- a. Remove tail rotor assembly. (Ref. Page 24-1.)
- b. Disconnect rudder cables at gear box.
- c. Remove the forward taper pin attaching drive coupling to the gear box.
- d. Disconnect or remove tail guard.
- e. Remove safety wire and the six screws that attach the gear box.
- f. Remove gear box by straight pull aft to release it. Check the run out at the outer end of the output shaft assembly. Run out shall not exceed .005 T.I.R.

Final Inspection of Tail Rotor Drive Assembly.

- a. Inspect the forward and aft universal attachments for security.
- b. Check five pillow block bolt attachments for security.
- c. Check each alemite fitting for security and proper amount of lubricant in bearing.

Re-installation of Tail Rotor Drive Assembly

Re-install tail rotor gear box.

- b. Re-install tail rotor guard.
- c. Re-installation of tail rotor (Ref. Page 24-3).
 1. Position rotor hub assembly (22) on the shaft splines so the axes of the hub is parallel with the pitch link retainer and slide on.
 2. Start .041 wrap of safety wire around the hub (22) and feed through the teetering stop (3) as the teetering stop is put in position.
 3. Install retention bolt (1), washer (2) and torque to 300 in./lbs. and complete safety with .040 wire.
 4. Rotate the blades so that the blade pitch link is opposite the pitch link retainer.
 5. Connect pitch link to pitch change arm utilizing AN hardware as shown on Page 24-6).
 6. When assembling blade pitch arm to pitch change link, place thin spacer over bolt and install bolt with head inboard into rod end pitch arm. Assemble large

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AN760D416 washer thru spacer on bolt followed by pitch arm.

7. Install AN960D416 washer, and AN364-416 nut. (See NOTE on Page 24-2).
8. **NOTE: Do not remove the pitch link retainer stud as it is a pre-drilled unit.**
9. Lubricate tail rotor with Aeroshell 14 grease.
10. Check for freedom of operation and full travel.

After final inspection of tail rotor drive assembly, run up engine, engaging the rotor system, and check each pillow block bearing support for over-heat or noisy bearings that would indicate a dry or angular displacement of the bearing support.

TAIL ROTOR SYSTEM

TAIL ROTOR RIGGING

Procedure.

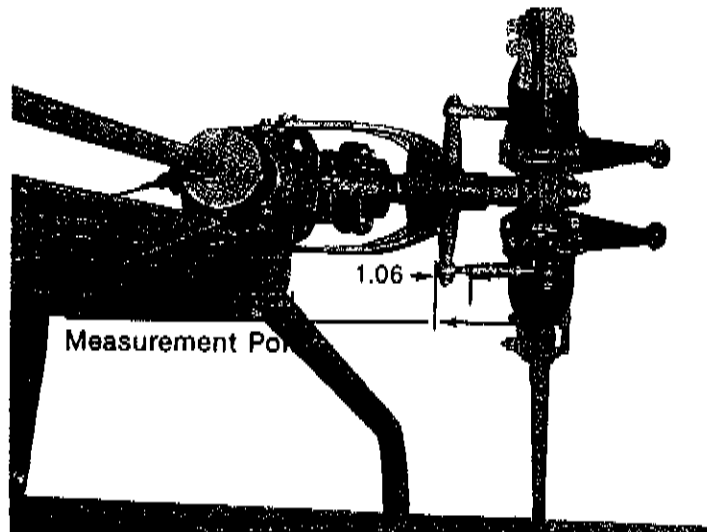
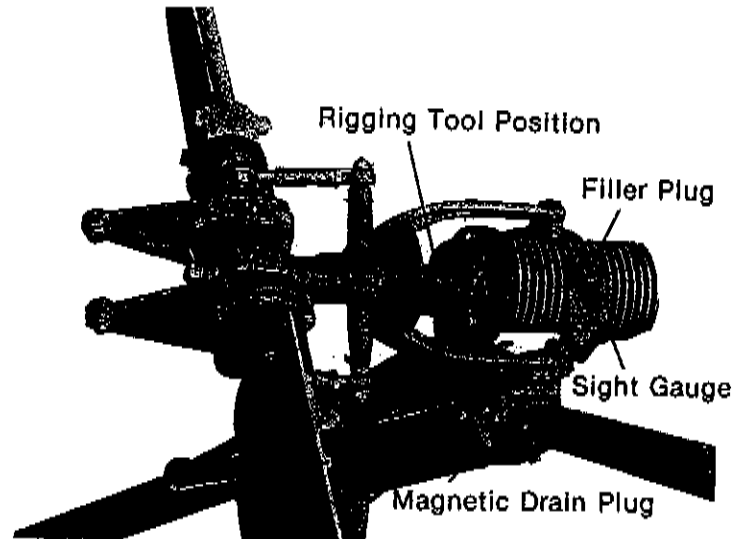
- a. Clamp pedals in line (neutral position).
- b. Insert rigging tool (T-0080, Ref. Page 24-10), neutral position, at position shown on Page 24-9. If rigging tool can not be inserted cables must be readjusted (35 to 40 lbs.).

NOTE: If special tool is not available, neutral measurement is .590 ins.

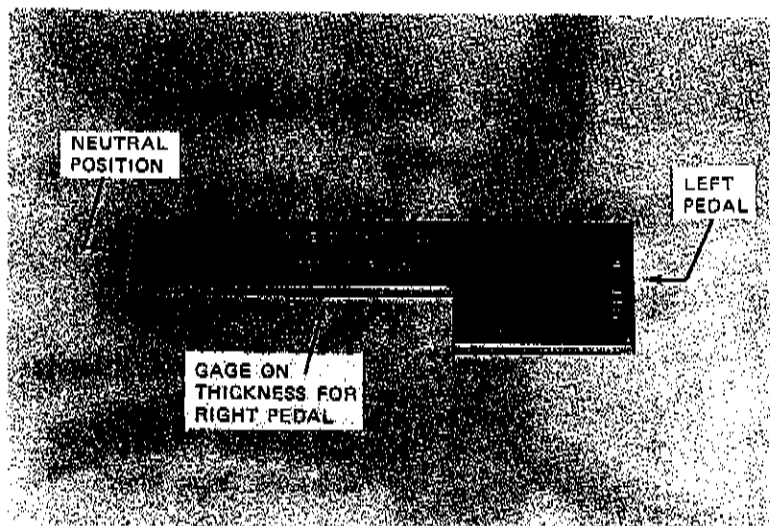
- c. Remove rigging tool and clamps from pedals.
- d. Insert rigging tool as in Step b for correct "right pedal" spacing between fork and adapter plate of tail rotor. Depress right pedal, if spacing is incorrect adjust stop on forward bellcrank assembly under left hand floor in cabin.
- e. Repeat Step d. For correct "Left Pedal" throw and correct as in Step d if necessary.
- f. Check pitch change links for proper overall dimension. Use micrometer or suitable measuring device to set length at 4.2508 inches for fiberglide bearings. Lock inboard lock nut to 1.06 dimension. (Ref. Page 24-9).
- g. Cycle pedals full left and right and check for proper blade travel, for security and freedom of operation. Safety wire turnbuckles using .032 safety wire. Recheck complete system.

NOTE: No more than three threads to be exposed at inboard end on turnbuckle.

- h. Left pedal travel $+32.0^\circ \pm .5^\circ$ and right pedal $-5.0^\circ \pm .5^\circ$.



TAIL ROTOR LUBRICATION
AND
RIGGING POINTS



TAIL ROTOR RIGGING TOOL