ENSTROM HELICOPTER CORPORATION
2209 22nd Street | Menominee, MI 49858
EnstromHelicopter.com | 906.863.1200

ENSTROM F-28F/280F SERIES MAINTENANCE MANUAL

Revision 15, dated September 26, 2024, applies to the Enstrom F-28F/280F Series Maintenance Manual, 1985 Edition/1990 2nd Edition. Place this cover sheet behind the "Record of Revisions" card after removing and inserting the pages listed below.

Remove Pages	**Insert Pages**
Cover through xiv	i (Cover) through viii
MM-1-1 through MM-1-6	MM-1-1 through MM-1-8
MM-2-1 through MM-2-22	MM-2-1 through MM-2-26
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MM-7-1 through MM-7-15	MM-7-1 through MM-7-28
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MM-9-69 through MM-9-72 MM-9-81 through MM-9-82	MM-9-69 through MM-9-72 MM-9-81 through MM-9-82
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MM-11-71 through MM-11-72 MM-11-75 through MM-11-76	MM-11-71 through MM-11-72 MM-11-75 through MM-11-76
MM-13-0.1 through MM-13-108	MM-13-1 through MM-13-134
MM-14-1 through MM-14-4	MM-14-1 through MM-14-6
MM-15-1 through MM-15-2	MM-15-1 through MM-15-2
MM-16-1 through MM-16-2*	None
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MM-18-1*	None
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MM-21-1 through MM-21-4	MM-21-0.1 through MM-21-4
MM-22-1 through MM-22-2*	None
MM-23-1 through MM-23-2*	None
MM-24-0.1 through MM-24-10*	None
MM-25-1 through MM-25-2*	None

* Tab divider may be discarded.

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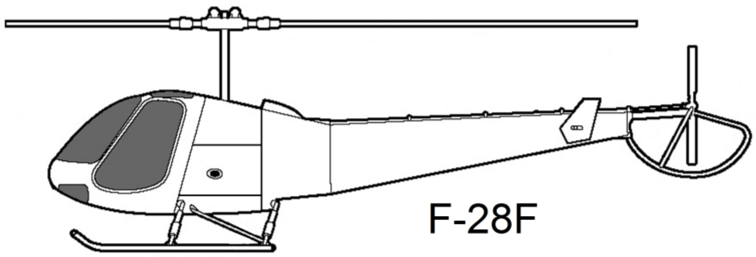
ENSTROM F-28F AND 280F SERIES MAINTENANCE MANUAL



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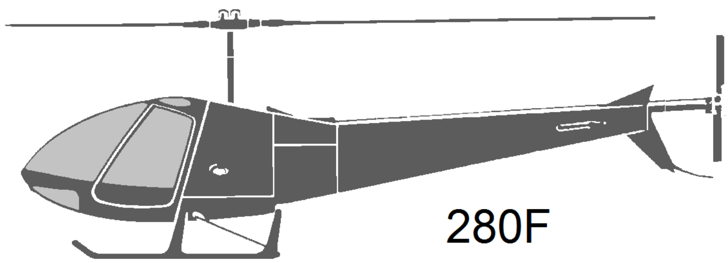

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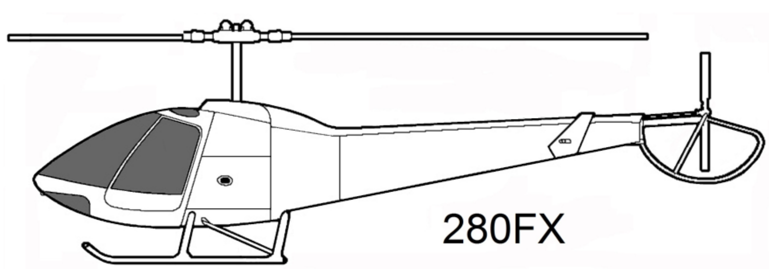

280FX

The Enstrom Helicopter Corporation
2209 22nd Street
Menominee, Michigan 49858-3515

Telephone: 906-863-1200
Fax: 906-863-6821
www.enstromhelicopter.com

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RECOMMENDED CHANGE REPORT

This maintenance manual is prepared and distributed by The Enstrom Helicopter Corporation and is intended for use by personnel responsible for maintaining Enstrom F-28F, 280F, and 280FX helicopters. This manual is periodically revised. If, in the opinion of the user, any information has been omitted or requires clarification, please direct your comments to Enstrom via this form (duplicate of this page), or via the Enstrom Helicopter website, or other similar form.

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Manual Identification: Enstrom F-28F/280F Series Maintenance Manual, dated 1985

Revision Number and Date: ______________________________

Aircraft Model: ______________________________

Recommended Change:

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1	Apr 3/86	vi, vii, viii and ix MM-3-1 Added Sections 15 through 25 inclusively. Section 17 Supplemental Airworthiness Limitations	Apr 3/86	W. F. Horn ACE 115C
2	Nov 18/88	ix MM-2-10, 2-14 & 2-15 MM-3-13 & 3-20, 4-1 & 4-6 MM-6-1, 6-2, 6-5, 6-9, 6-21, 6-23, 6-24, 6-26, 6-28, 6-29 MM-9-14 & 9-47 MM-11-32 & 11-63 MM-12-43 MM-13-19, 13-22, 13-23, 13-94, 13-95, 13-96 MM-21-3, 21-4, 21-7, 21-10, 21-11, 21-12, 21-13	Nov 18/88	W. F. Horn ACE 115C
3	Mar 94	MM-4-1, MM-4-2	N/A	N/A
4	Jun 21/12	iii through xii MM-3-1 through MM-3-6 (MM-3-7 through MM-3-30 deleted) MM-4-1 through MM-4-76 MM-9-49 through MM-9-76 MM-10-1, 10-2, 10-13, 10-14, 10-14.1, 10-14.2, 10-15, 10-16 MM-17-1, 17-2 MM-21-1 through MM-21-30	N/A	G. Michalik ACE 116C
5	Nov 5/13	Cover i through xii MM-1-1 through MM-1-4 MM-2-1 through MM-2-20 MM-4-50, MM-4-55, MM-4-61 MM-4-62, MM-4-64, MM-4-67 MM-6-5, MM-6-6 MM-10-14.1 MM-11-21, MM-11-46 MM-13-33, MM-13-71 MM-13-101, MM-13-103, MM-13-105 MM-13-107, MM-13-108 MM-21-1, MM-21-8, MM-21-11 MM-21-14, MM-21-19 MM-21-21 through MM-21-30 MM-24-1 through MM-24-6	N/A	N/A

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6	Apr 7/15	Cover xi, xii MM-2-13 & 2-14 MM-2-16 through MM-2-19 MM-4-43, MM-4-45 through MM-4-48, MM-4-51, MM-4-63 MM-6-4, 6-5 & 6-6 MM-9-27, MM-9-29 MM-10-13 & 10-14, MM-10-14.2 MM-11-32, MM-11-52, MM-11-65 MM-13-11 & 13-12, MM-13-14, MM-13-16, MM-13-40, MM-13-48, MM-13-62, MM-13-77 & 13-78	N/A	N/A
7	Aug 22/16	Cover xii MM-1-3, MM-1-4 MM-2-11, MM-2-16 MM-3-2 through MM-3-4 MM-4-10 through MM-4-12, MM-4-27 MM-4-32, MM-4-41, MM-4-42, MM-4-57 MM-4-58, MM-4-59, MM-4-69 MM-8-27, MM-8-29, MM-8-30, MM-8-33 MM-8-34, MM-8-36 MM-9-1 through MM-9-30, MM-9-62, MM-9-64, MM-9-75 MM-10-14.1, MM-10-26 through MM-10-30 MM-10-41, MM-10-42, MM-10-45 MM-10-48 through MM-10-50 MM-11-25, MM-11-26 MM-13-14, MM-13-17, MM-13-19, MM-13-20, MM-13-22, MM-13-23, MM-13-33, MM-13-38 MM-13-40, MM-13-78, MM-13-79	N/A	N/A
8	Sep 20/17	Cover iii through ix, xii MM-1-1, MM-1-3, MM-1-4 through MM-1-6 MM-2-18, MM-2-20 MM-3-2, MM-3-3 MM-4-1, MM-4-29 through MM-4-34.2 MM-4-41, MM-4-44, MM-4-46, MM-4-51 MM-4-53 , MM-4-54, MM-4-59, MM-4-63 MM-4-65 MM-8-0 through MM-8-60 MM-13-11, MM-13-14, MM-13-17, MM-13-49 MM-13-50, MM-13-61, MM-13-62 MM-15-1, MM-15-2 (MM-15-A and MM-15-B removed) MM-16-1, MM-16-2 (MM-16-2 through MM-16-6 removed) MM-21-6, MM-21-8, MM-21-9, MM-21-10 MM-21-14, MM-21-21 through MM-21-32 MM-22-1, MM-22-2 (MM-22-2 through MM-22-14 removed)	N/A	N/A
9	Dec 14/17	xii, MM-4-31	N/A	N/A

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10	Feb 7/19	Cover ix, xiii, xiv MM-4-40, MM-4-42 MM-8-0 through MM-8-0.2 MM-8-12 through MM-8-16.2 MM-12-18 through MM-12-22 MM-21-1 through MM-21-4 MM-21-6 through MM-21-8, MM-21-14 MM-21-33 through MM-21-58 MM-24-7 through MM-24-8	N/A	N/A
11	Oct 25/19	Cover iv through vii, ix, xiii MM-1-3 MM-2-11, MM-2-12 MM-2-14 through MM-2-20 MM-4-3, MM-4-9, MM-4-11 MM-4-22, MM-4-32 MM-4-47, MM-4-51 through MM-4-56 MM-4-65, MM-4-66, MM-4-77, MM-4-78 MM-6-0.1, MM-6-0.2 MM-6-1 through MM-6-8 MM-8-36 MM-9-1 through MM-9-48 MM-10-1 through MM-10-68 MM-12-1 through MM-12-80 MM-13-0.1, MM-13-0.2, MM-13-31 MM-13-35, MM-13-37, MM-13-49 MM-13-67 through MM-13-71 MM-13-93 through MM-13-100 MM-21-15, MM-21-16 MM-24-0.1, MM-24-0.2 MM-24-8 through MM-24-10	N/A	N/A
12	Jul 16/2020	Cover vi, xiii, MM-1-1, MM-1-4, MM-1-5 MM-2-1, MM-2-12, MM-2-21, MM-2-22 MM-8-0, MM-8-0.2, MM-8-17, MM-8-18 MM-8-19, MM-8-20, MM-8-61, MM-8-62 MM-21-2 MM-23-1, MM-23-2	N/A	N/A
13	Jan 5/24	Cover i, vii, viii, ix, xiii MM-10-1 through MM-10-74 MM-11-1 through MM-11-84 MM-20-1 through MM-20-2 MM-25-1 through MM-25-2	N/A	N/A
14	Jul 30/24	vi through ix, xiii MM-8-1 through MM-8-76 MM-9-1 through MM-9-78 MM-12-1 through MM-12-86	N/A	N/A

REV. NO	REV DATE	DESCRIPTION	DATE	FAA APPROVED
15	Sep 26/24	Cover i through viii MM-1-1 through MM-1-8 MM-2-1 through MM-2-26 MM-3-1 through MM-3-6 MM-4-1 through MM-4-84 MM-5-1 through MM-5-20 MM-6-1 through MM-6-30 MM-7-1 through MM-7-28 MM-8-34 MM-9-69 through MM-9-71, MM-9-81 MM-10-63, MM-10-64 MM-11-72, MM-11-76 MM-13-1 through MM-13-134 MM-14-1 through MM-14-6 MM-15-1 through MM-15-2 MM-21-0.1, MM-21-0.2, MM-21-1, MM-21-4	Oct 28/2024	B. Diakhite AIR-765

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INTRODUCTION
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SECTION 1

INTRODUCTION

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SECTION 1

INTRODUCTION

1-1 MAINTENANCE MANUAL ARRANGEMENT

The maintenance manual sections divide the aircraft into major systems and related subsystems to provide maintenance procedures required for proper system function and optimum component service life. Each section details the following maintenance functions for the associated subsystems and components, if applicable:

General Description
Troubleshooting
Adjustment/Rigging
Removal
Disassembly
Inspections (other than Periodic Inspections)
Repair
Assembly
Installation

1-2 AIRCRAFT EFFECTIVITY

The maintenance data presented in this manual is applicable to all F-28F, 280F, and 280FX model Enstrom helicopters with standard equipment. Optional equipment maintenance procedures are included in the F-28F/280F Series Maintenance Manual for common optional equipment that is installed before aircraft delivery (This does not include avionics installations).

1-3 MAINTENANCE MANUAL SUPPLEMENTS

Maintenance procedures for optional equipment may be provided in maintenance manual supplements. These supplements are part of the F-28F/280F Series Maintenance Manual when an aircraft is equipped with optional equipment which requires a maintenance manual supplement. The following optional equipment supplements are applicable to the F-28F/280F Series Maintenance Manual.

Supplement 1: Avionic Systems, Revision 9, Dated: Apr 30/20.

1-4 MAINTENANCE MANUAL CHANGES AND REVISIONS

Subsequent to the publication of the initial issue of the Enstrom F-28F/280F Series Maintenance Manual, changes in aircraft equipment, support concepts and procedures, as well as information developed by experience, may 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:

(1) Revision - A revision alters portions of the manual by replacement, addition, and/or deletion of pages. A revision cover page lists the page(s) to be removed and/or inserted.

(2) Reissue - Where large numbers of changes are involved, a complete reissue of the manual is warranted. Preceding issues of the manual then become obsolete and should be discarded.

(3) Service Directive Bulletins - Used to direct the owner/operator and/or maintenance personnel to make mandatory changes, improvements, or inspections to the aircraft applicable to the entire fleet or a segment of the fleet that are typically safety/airworthiness related. The information provided in the Service Directive Bulletins will be incorporated in the maintenance manual as needed at a later date. At the time of incorporation, the Service Directive Bulletin is superseded by the maintenance manual, and accomplishment or sign-off of the Service Directive Bulletin in the maintenance records book is no longer required. A detailed entry should be made in the maintenance records to indicate that the Service Directive Bulletin is superseded by the maintenance manual.

(4) Service Information Letters - Used to transmit information, recommendations, and general service instructions to the aircraft owner/operator and/or maintenance personnel applicable to the entire fleet or a segment of the fleet. The information provided in the Service Information Letters will be incorporated into the maintenance manual as needed at a later date.

(5) Service Instructions – Used to provide the owner/operator and/or maintenance personnel with information that is applicable to specific aircraft and does not meet the criteria of a Service Information Letter or Service Directive Bulletin. Service Instructions will not be distributed to the entire fleet.

Enstrom distributes maintenance manual revisions and reissues in electronic form via the Enstrom Helicopter website: www.enstromhelicopter.com (follow the applicable link under the Technical Publications section of the Technical Support page). Revision update notices are sent via email to owners and operators who are registered with Enstrom. Registration to receive publication mailing notifications can be coordinated through the Enstrom Technical Publications Administrator. A complete manual hardcopy may be ordered through Enstrom Customer Service.

Service Information Letters and Service Directive Bulletins incorporated into the maintenance manual are logged in the Service Information Letter Index or the Service Directive Bulletin Index (as appropriate) located on the Enstrom Helicopter website: www.enstromhelicopter.com (follow the applicable link under the Technical Publications section of the Technical Support page). Each index numerically lists all Service Information Letters and Service Directive Bulletins, respectively, and identifies those which have been incorporated into the maintenance manual. All Service Information Letters and Service Directive Bulletins are also located under the Technical Publications section of the website.

Notice of recently released Service Information Letters and Service Directive Bulletins is provided via email notification. Registration to receive publication mailing notifications can be coordinated through the Enstrom Technical Publications Administrator.

1-5 APPLICATION OF WARNINGS, CAUTIONS, AND NOTES

Warnings, Cautions, and Notes emphasize important and critical instructions and are used for the following conditions.

WARNING: CALLS ATTENTION TO USE OF MATERIALS, PROCESSES, METHODS, OR PROCEDURES THAT MUST BE FOLLOWED TO AVOID PERSONAL INJURY OR LOSS OF LIFE.

CAUTION: CALLS ATTENTION TO METHODS AND PROCEDURES WHICH MUST BE FOLLOWED TO AVOID DAMAGE TO THE AIRCRAFT OR EQUIPMENT.

NOTE: Calls attention to information essential to highlight for clarification of procedures.

1-6 DEFINITIONS AND ABBREVIATIONS

Table 1-1. List of Definitions

Airframe	Means the fuselage, stabilizers, tailcone, cowlings, fairings, rotors, and landing gear of the helicopter and their accessories and controls.
Annually	With respect to an annual inspection, annually means within the preceding 12 calendar months.
Approved	Unless used with reference to another person, means approved by the FAA or any person to whom the FAA has delegated its authority in the matter concerned, or approved under the provisions of a bilateral agreement between the United States and a foreign country or jurisdiction.
Empty Weight	Standard empty weight of a standard helicopter including unusable fuel, full operating fluids, and full engine oil. Basic empty weight is standard empty weight plus weight of installed optional equipment.
FAR	Means the Federal Aviation Regulations (FARs) prescribed by the Federal Aviation Administration (FAA). The FARs comprise Title 14 of the Code of Federal Regulations (14 CFR).
Life-Limited Component	Any part for which a mandatory replacement limit is specified in the type design, the Instructions for Continued Airworthiness, or the maintenance manual. (Refer to Section 3, *Airworthiness Limitations*, Table 3-1.)

Table 1-2. List of Abbreviations

A/R	As Required
AC	Advisory Circular
AGL	Above Ground Level
ALT	Altitude
APU	Auxiliary Power Unit
ASTM	American Society for Testing and Materials
B.L.	Butt Line
C	Celsius
CAS	Calibrated Airspeed
cc	Cubic centimeter
CCW	Counterclockwise
CFR	Code of Federal Regulations
CHT	Cylinder Head Temperature
C.G.	Center of Gravity
C.L.	Center Line
cm	Centimeter
CPC	Corrosion Prevention Compound
COM	Communication
°	Degree
EA	Each
EASA	European Union Aviation Safety Agency
EGT	Exhaust Gas Temperature
EMI	Electromagnetic Interference
F	Fahrenheit
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulations
Fig.	Figure
FIM	Full Indicator Movement
FLT	Flight
FPM	Feet per Minute
ft	Foot/Feet
ft^2	Cubic Feet
ft-lb or *ft-lbs*	Foot-Pound (Force)
ft/min	Feet per Minute
FWD	Forward
g	Gram
gal	Gallon
gal/hr	Gallon per Hour

Table 1-2. List of Abbreviations - Continued

GW	Gross Weight
h or hr(s)	Hour(s)
hp	Horsepower
Hz	Hertz (Cycles per Second)
I/A/W or *IAW*	In Accordance With
IAS	Indicated Airspeed
IPC	Illustrated Parts Catalog
I.D.	Inner Diameter
in or ”	Inch
in-lb or *in-lbs*	Inch-Pound (Force)
in Hg	Inches of Mercury
IVSI	Instantaneous Vertical Speed Indicator
kg	Kilogram
km	Kilometer
kW	Kilowatt
l or L	Liter
LH	Left Hand
lb	Pound
lb/hr	Pound per Hour
LED	Light Emitting Diode
m	Meter
m^2	Cubic Meter
MAX	Maximum
MB	Millibars
ml or *mL*	Milliliter
MIN	Minimum
MIN	Minute
MM	Maintenance Manual
mm	Millimeter
mv	Millivolt
NO.	Number
NM	Nautical Mile
Nm	Newton Meter
OAT	Outside Air Temperature
O.D.	Outer Diameter
ORC	Overrunning Clutch
oz	Ounce
P/N	Part Number

Table 1-2. List of Abbreviations - Continued

Para.	Paragraph
pt	Pint
PTO	Power Take-Off
PRESS	Pressure
psi	Pounds per Square Inch
psig	Pounds per Square Inch Gauge
R/S	Right Side
Ref.	Reference
Rev.	Revision
RFI	Radio Frequency Interference
RFM	Rotorcraft Flight Manual
RH	Right Hand
RPM	Revolutions per Minute
S/N	Serial Number
SDB	Service Directive Bulletin
SIL	Service Information Letter
STA	Station
sq ft	Square Feet
STC	Supplemental Type Certificate
TEMP	Temperature
TIT	Turbine Inlet Temperature
TIS	Time In Service
TT or *T-T*	Tension-Torsion
VDC	Volts, Direct Current
V_H	Velocity Maximum Speed (Level Flying Condition under Maximum Power)
V_{NE}	Velocity Never Exceed (Airspeed Limitation)
W	Watt
WT	Weight
XMSN	Transmission

SECTION 2
GENERAL INFORMATION
TABLE OF CONTENTS

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2-1 GENERAL DESCRIPTION

The F-28F, 280F, and 280FX helicopters are a 3 bladed, single engine helicopter manufactured by the Enstrom Helicopter Corporation and certificated by the FAA under CAR 6. Additionally, the F-28F, 280F, and 280FX models have demonstrated compliance with 14 CFR 36, amendment 20 (Appendix J), effective September 11, 1992.

The F-28F, 280F, and 280FX models are powered by a turbocharged, fuel injected Textron-Lycoming piston engine. The turbocharger system is equipped with a variable waste gate assembly, and the throttle is equipped with a correlator.

2-2 PRINCIPAL DIMENSIONS

Figure 2-1 depicts the general arrangement.

2-3 PRINCIPAL SPECIFICATIONS

Table 2-1 lists the principal specifications of the different model aircraft.

2-4 AIRFRAME

The airframe is comprised of three sections: cabin assembly, pylon assembly, and tail cone assembly.

A. Cabin Assembly: The cabin assembly is fabricated from molded fiberglass and is an integral unit. It is attached to the pylon by six bolts and contains the aluminum seat structure, plus the instrument panel, cyclic, collective, and tail rotor controls. The windshield and upper and lower windows provide excellent visibility. The swing-open style doors provide access to the cabin.

B. Pylon Assembly: The pylon assembly is fabricated from steel tubing, houses the engine, and supports the landing gear, cabin, main transmission, and tail cone.

C. Tail Cone Assembly: The tail cone assembly is a semi-monocoque type and attaches to the pylon assembly with three bolts for easy removal and installation. The tail cone supports the horizontal stabilizers, tail rotor driveshaft, tail rotor gearbox, tail rotor, and tail rotor guard.

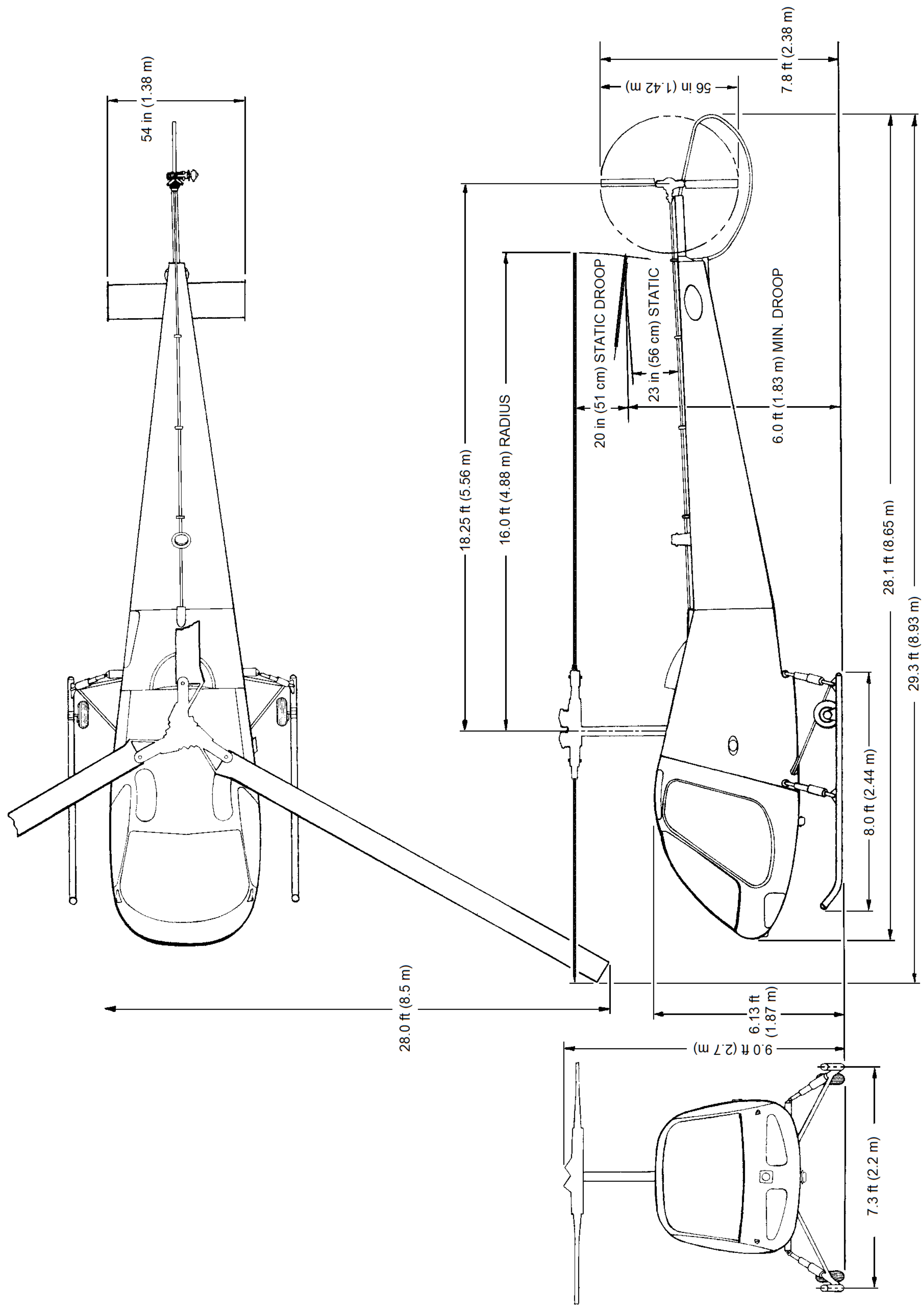

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Figure 2-1. Principal Dimensions - F-28F Pre-1986 (S/N 743 and Prior)

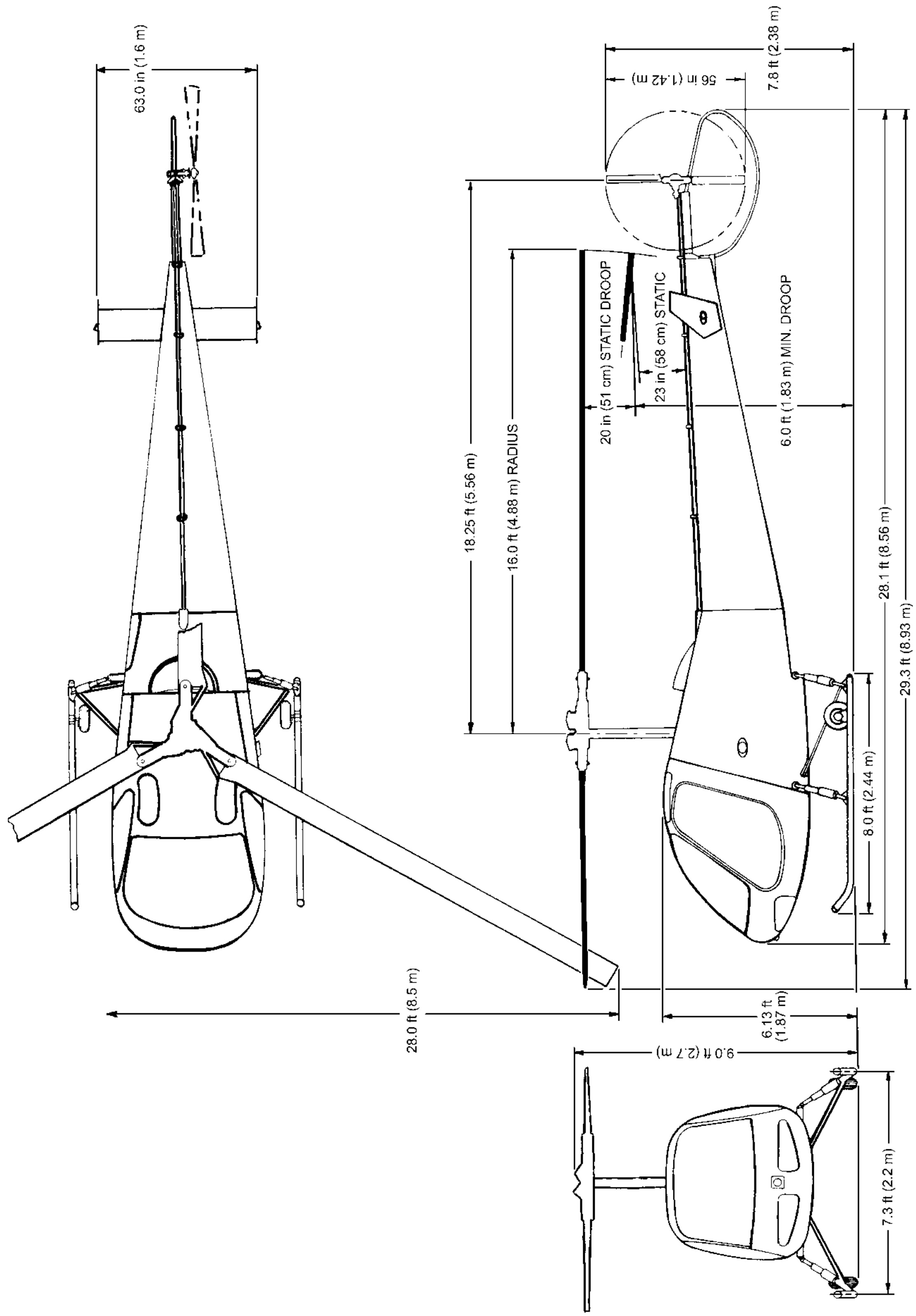

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Figure 2-1. Principal Dimensions - F-28F Post-1986 (S/N 744 and Subsequent)

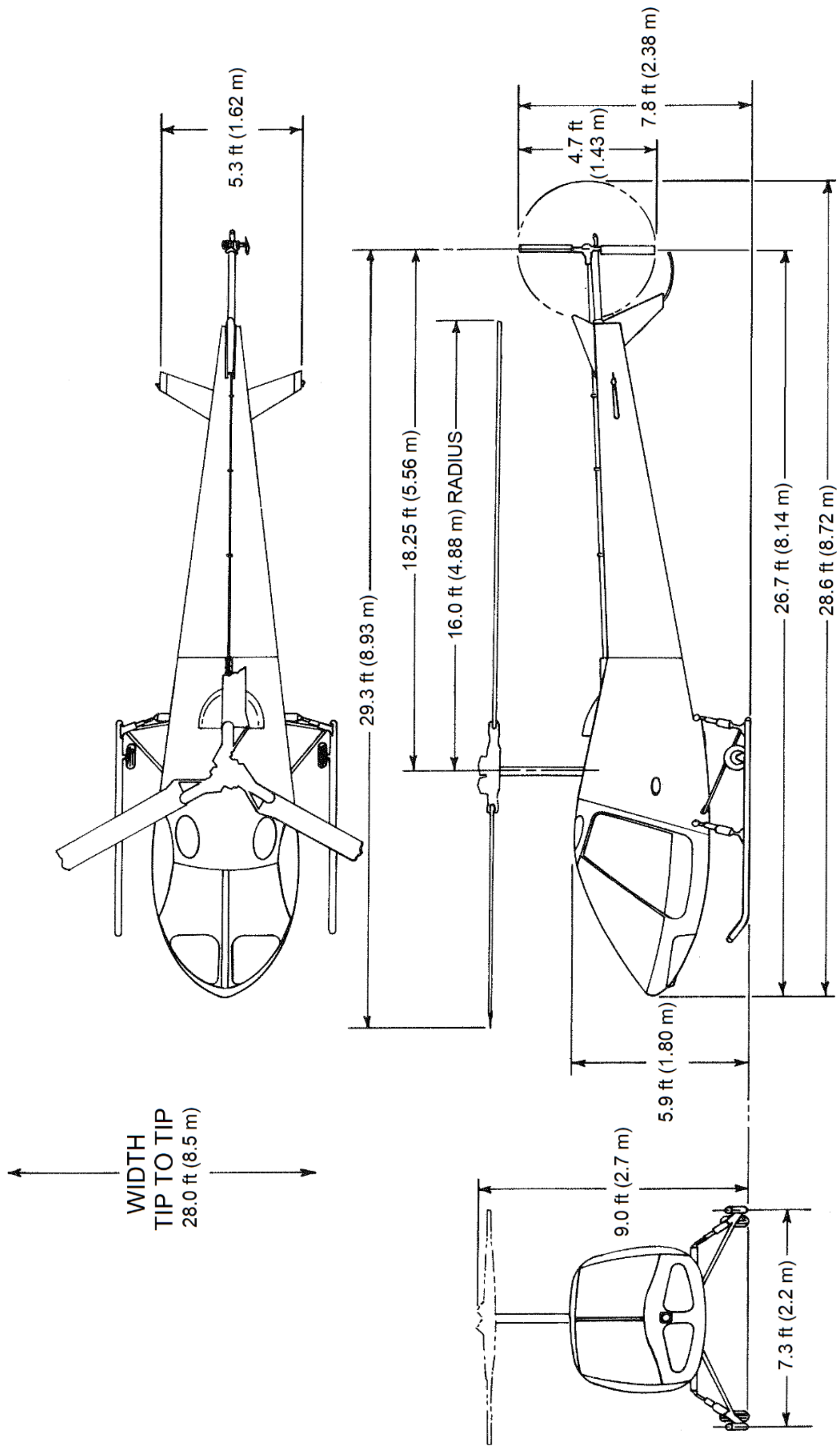

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Figure 2-1. Principal Dimensions - 280F

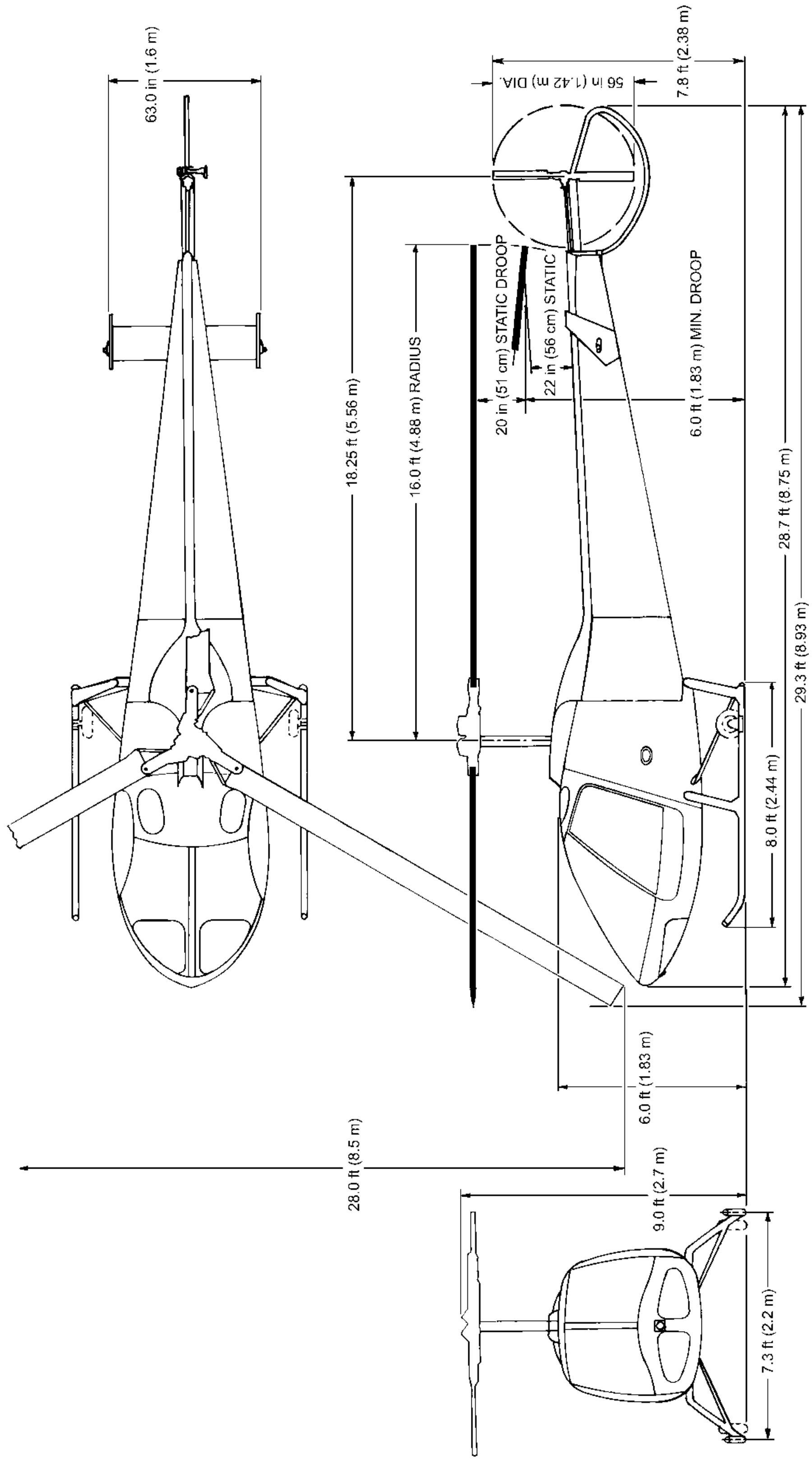

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Figure 2-1. Principal Dimensions - 280FX

Table 2-1. F-28F/280F/FX Specifications

	Model	
	F-28F	**280F/FX**
Power Plant:		
Designation	HIO-360-F1AD	HIO-360-F1AD
Cylinders	4	4
Normal Power	225 (168 kW)	225 (168 kW)
Normal RPM	3050	3050
Specific Fuel Consumption	.69 lb/hp-hr (.42 g/W-h)	.69 lb/hp-hr (.42 g/W-h)
Weight	324 lb (147 kg)	324 lb (147 kg)
Oil	10 qt (9.5 l)	10 qt (9.5 l)
Turbocharger:		
Designation	3BT5EE10J2	3BT5EE10J2
Operating RPMs:		
Engine	2900-3050	2900-3050
Main Rotor	351 @ 3050	351 @ 3050
Tail Rotor	2514 @ 3050	2514 @ 3050
Autorotation (Main Rotor)	334-385	334-385
Ratios:		
Lower Pulley to Upper Pulley	1.213:1	1.213:1
Upper Pulley to Main Rotor	7.154:1	7.154:1
Engine to Main Rotor	8.6781:1	8.6781:1
Upper Pulley to Tail Rotor	1:1	1:1
Main Rotor System:		
Number of Blades	3	3
Blade Cord - Each	9.5 in (24.1 cm)	9.5 in (24.1 cm)
Diameter	32 ft (9.75 m)	32 ft (9.75 m)
Disc Area	804 ft^2 (74.7 m^2)	804 ft^2 (74.7 m^2)
Tail Rotor System:		
Number of Blades	2	2
Blade Cord - Each	4.4 in (11.2 cm)	4.4 in (11.2 cm)
Diameter	4.67 ft (1.42 m)	4.67 ft (1.42 m)
Disc Area	17 ft^2 (1.58 m^2)	17 ft^2 (1.58 m^2)
Miscellaneous:		
Maximum Speed - V_{NE}	112 mph	117 mph
Maximum Gross Weight	2600 lb (1179 kg)	2600 lb (1179 kg)
Fuel Capacity (Useable)	40 gal (151.4 l)	40 gal (151.4 l)

2-5 LANDING GEAR

A. Main Landing Gear: The main landing gear consists of two tubular aluminum skids attached to the airframe by means of the forward and aft cross tubes through four air-oil oleo struts. The struts cushion ground contact during landing. Drag struts give the gear stability and strength and prevent fore and aft movement during ground contact maneuvers. Replaceable hardened steel skid shoes are installed on each skid to resist skid wear on hard surfaces.

B. Tail Rotor Guard: A tubular aluminum tail rotor guard is installed on the aft end of the tailcone. It acts as a warning to the pilot upon an inadvertent tail-low landing and aids in protecting the tail rotor from damage.

WARNING: ENSURE THE LOCKING PIN IS INSTALLED IN GROUND HANDLING WHEEL BEFORE REMOVING THE WHEEL BAR FROM THE WHEEL ASSEMBLY AND MOVING THE AIRCRAFT.

C. Ground Handling Wheels: Each landing gear skid tube has ground handling wheels or provisions for installing removable ground handling wheel assemblies. Each assembly has a manually operated over-centering device to lift the skids clear of the ground. The ground handling wheels should be retracted for engine run-up. If the aircraft has optional removable Brackett® wheels, they should be removed before engine run-up.

2-6 ENGINE

The F-28F/280F series helicopters are powered by a Textron-Lycoming HIO-360 series piston engine. The Textron-Lycoming HIO-360 series engine is a four cylinder, direct drive, horizontally opposed, air cooled, fuel injected engine. The F-28F/280F series helicopters are equipped with an Enstrom installed turbocharger system which allows the engine to produce its rated horsepower up to the certified altitude limit.

2-7 ENGINE COOLING

A fan mounted on the engine crankshaft flange forces cooling air through a shroud assembly and baffles onto the engine cylinders. A portion of the cooling air is diverted through ducting to the engine oil cooler(s). If the optional cabin heating system is installed, a portion of the cooling air is directed to the heater shroud.

2-8 FLIGHT CONTROLS

The flight controls include three primary systems: the collective, cyclic, and anti-torque/directional controls. The flight control systems are not hydraulically boosted. The collective flight control system incorporates a spring capsule that balances the steady collective forces from the main rotor system. The cyclic control system also incorporates spring capsules used to trim out the control system forces produced by the mail rotor system. The spring capsules are part of electrical trim assemblies that are controlled by a switch located on the cyclic stick grip. The aircraft also has fixed horizontal and vertical stabilizers mounted on the tailcone to provide additional stability during forward flight.

2-9 POWER TRAIN

The power train includes the main rotor transmission, upper pulley/overrunning clutch assembly, drive belt, belt drive system, tail rotor drive shaft, and the tail rotor transmission.

A. Main Rotor Transmission: The main rotor transmission provides a 7.154:1 reduction ratio between the upper pulley and main rotor system. The transmission incorporates an over-running clutch in the upper pulley which allows the main and tail rotors to over-run when the engine is throttled back for autorotations. The transmission has a sight gauge which is located on the aft right side and is visible through a panel in the baggage compartment or through the upper access step. Refer to Table 4-1 for system capacity and approved oils and Refer to Table 4-2 for servicing intervals. A magnetic drain plug located on the bottom left aft side of the transmission can be checked for metal particle contamination. All 280FX aircraft are equipped with chip detector annunciator in the instrument panel. Starting with serial number 744, F-28F aircraft may be equipped with the chip detector annunciator as optional equipment. The chip detector is standard equipment on all later production F-28F aircraft.

B. Tail Rotor Transmission: The tail rotor transmission supports and drives the tail rotor assembly. The transmission utilizes a splash lubricated, non-vented, closed oil system. A filler port and a sight gauge are located in the aft end of the transmission. A magnetic drain plug located on the bottom aft side of the transmission can be checked for metal particle contamination. All 280FX aircraft are equipped with chip detector annunciator in the instrument panel. Starting with serial number 744, F-28F aircraft may be equipped with the chip detector annunciator as optional equipment. The chip detector is standard equipment on all later production F-28F aircraft. Refer to Table 4-1 for system capacity and approved oils and refer to Table 4-2 for servicing intervals. An inspection plug, used to visually inspect the transmission gears, is located on the top right side of the transmission. The tail rotor transmission reduction ratio is 1:1.

2-10 MAIN ROTOR ASSEMBLY

The main rotor assembly is a three bladed, high inertia, fully articulated rotor system. Three hydraulic dampers are incorporated to control the lead-lag motions of the blades.

2-11 TAIL ROTOR ASSEMBLY

The tail rotor assembly is a two bladed, teetering, delta hinged rotor assembly.

2-12 OPERATING LIMITATIONS AND RESTRICTIONS

Refer to the applicable F-28F/280F/280FX Rotorcraft Flight Manual for the aircraft operating limitations and restrictions.

2-13 PLACARDS

Refer to the applicable F-28F/280F/280FX Rotorcraft Flight Manual for the required placards.

2-14 VENDOR INFORMATION

The following components listed in Table 2-2 are to be maintained I/A/W the manufacturer's instructions to ensure the continued airworthiness of the aircraft. The owner/operator is responsible for ensuring that current maintenance publications are available to ensure continued airworthiness of the aircraft.

Table 2-2. Vendor Contact Information

Component	**Part Number** (Note 1)	**Manufacturer** (Note 1)	
Engine	M/N HIO-360-F1AD	Textron-Lycoming 625 Oliver Street Williamsport, PA 17701	(570) 327-7049 www.lycoming.com
Magneto	SYS P/N 66E21585-70	Hartzell Engine Technologies 2900 Selma Highway Montgomery, AL 36116	(877) 359-5355 www.hartzell.aero
	P/N 10-682605-13		
Alternator	P/N 32C19553 (24V) P/N ALX-8521LS (12V) P/N ALU8521LS (24V)		
Fuel Pump	P/N 62D26035		
Turbocharger (Note 2)	M/N 3BT5EE10J2 P/N 600700-0000		
Starter Vibrator	P/N 10-382780-123 (12V) P/N 10-400608-243 (24V)	Teledyne Continental Motors 2039 Broad Street Mobile, AL 36615	(630) 513-9599 www.aviall.com
Fuel Servo	M/N RSA-5AB1 P/N 2524858-5	Precision Airmotive Corporation 14800 40th Avenue, North East Marysville, WA. 98271	(360) 651-8282 www.precisionairmotive.com
Fuel Boost Pump	P/N A-10019-D (12V) P/N A-10019-E (24V)	Weldon Pump 640 Golden Oak Parkway Oakwood Village, Ohio 44146	(440) 232-2282 www.weldonpumps.com
Scavenge Oil Pump	P/N 101678-0002	Kelly Aerospace Power Systems 1404 E. South Blvd. Montgomery, AL 36116	(877) 359-5355 www.hartzell.aero
Starter	P/N 149-12HT (12V) P/N 149-24HT (24V)	Sky-Tec 350 Howard Clemmons Road Granbury, TX 78230	(877) 359-5355 www.hartzell.aero
Battery	P/N RG-35A (12V) P/N RG24-11M (24V)	Concorde Battery Corporation 2009 San Bernardino Road West Covina, CA 91790	(800)757-0303 www.concordebattery.com
EGT Indicator	P/N 45817	Alcor 300 Breesport San Antonio, TX 78216	(800) 354-7233 www.alcorinc.com
Graphic Engine Monitor (Note 3)	M/N GEM 603 M/N GEM 610 M/N GEM 610C (P/N GEM-610C-266)	Insight Instrument Corporation 599 Industrial Drive Fort Erie, Ontario, Canada L2A 5M4	(905) 871-0733 techsupport@insightavionics.com
	M/N EDM-700	J. P. Instruments Inc. P.O. Box 7033 Huntington Beach, CA 92646	(800) 345-4574 www.jpinstruments.com

Table 2-2. Vendor Contact Information

Component	**Part Number** (Note 1)	**Manufacturer** (Note 1)	
Tension-Torson (TT) Straps	P/N AA-ECD-084-280	Airwolf Aerospace LLC 15369 Madison Rd. Middlefield, OH 44062-8404	(440) 632-1687 (440) 632-1685 Fax www.airwolfaerospace.com info@airwolfaerospace.com
Anti-Collision Strobe Landing Light	P/N 02-0250276-00 P/N 36-0050626-01 P/N 01-0790340-03 P/N 01-0790340-04 P/N 01-0771833-20	Whelen Aerospace Technologies 210 Airport Drive East Sebastian, FL 32958	(860) 526-9504 www.flyWAT.com info@flyWAT.com
Landing Light	P/N 01-1030-H-A( )	AeroLEDs, LLC 8475 W. Elisa St. Boise, ID 83709	(208) 850-3297 https://aeroleds.com/contact sales@AeroLEDs.com
Clock	M800	Davtron 427 Hillcrest Way Emerald Hills, CA 94062	Tel: 1-866-369-5588; Fax: 650-369-9988 www.davtron.com info@davtron.com
Magnetic Compass	NV2C-28V( )	SIRS Navigation Ltd. Compass House – Bowes Estate Wrotham Road, Meopham Kent DA13 OQB England	Tel: +44 (0) 1474-816320 Fax: +44 (0) 1474-816321 sales@sirs.co.uk https://www.sirs.co.uk/contact

Notes:

1. The manufacturer of the component may differ depending on the time the aircraft was manufactured or overhauled. Refer to the manufacturer's data plate affixed to the component for accurate part number information.
2. Turbocharger 3BT5EE10J2 installation per STC SE484GL.
3. Graphic Engine Monitor GEM 610C installation per STC SH13-45.

2-15 SPECIAL TOOLS

The special tools listed in Table 2-2 are used for removal, installation, and overhaul of components used on the F-28F/280F series aircraft:

NOTE: The special tools listed in Table 2-2 are available through Enstrom's Tool Rental program. Contact Enstrom Helicopter Product Support for details.

Table 2-3. Special Tools

Part Number	Nomenclature
T-0003	Main Rotor Lead/Lag Lower Nut Tool
T-0005	Damper Rod End Removal Tool
T-0009	Main Rotor Blade Bolt Guide Bullet
T-0011	Main Rotor Hoist Sling
T-0013	Main Rotor Lamiflex Nut Socket
T-0014	Needle Point Grease Adapter
T-0016	Lower Swashplate Gimbal Tool
T-0017	Transmission Hoist Eye
T-0022	Collective Spring Capsule Retainer Tool
T-0026	Main Rotor Blade Tab Bending Tool
T-0027	Main Rotor Blade Tab Angle Tool
T-0029-SET	Idler Assembly/Disassembly Tool
T-0035	Oleo Disassembly Tool
T-0036	Blade Grip Seal Installation Tool
T-0044	Pulley Alignment Tool
T-0045-1	Lower Swashplate Dogleg Puller
T-0048	Main Rotor Mast Nut Tool
T-0051-1, -3	Main Rotor Flapping Nut Tool
T-0054	Swashplate Dogleg Alignment Tool
T-0056-3	Tail Rotor Thrust Bearing Retention Nut Tool
T-0057	Damper Bleeding Fixture
T-0068-3	Tail Rotor Transmission Output Shaft Runout Tools
T-0078	Engine Adapter Installation Tool
T-0079-1	Bearing Swagging Tool

Table 2-3. Special Tools - Continued

Part Number	Nomenclature
T-0080	Tail Rotor Rigging Tool
T-0086	Upper Guidetube Nut Tool
T-0087-15	Tail Rotor Assembly Static Balance Mandrel
T-0088	Tail Rotor Driveshaft Alignment Tool
T-0092-5	Taper Pin Removal Tool
T-0095	Damper Tool
T-0100-1	Swashplate DU Bushing Removal Tool
T-0102-1-SET	Guidetube Disassembly Tool
T-0104-1	Swashplate Bushing Installation Tool
T-0111-SET	Correlator Rigging Tool
T-0121-1	Tail Rotor Static Balance Stand
T-0127	Magnetic Pickup Bracket
T-0133-1	Pulley Restraint Tool Assembly
T-0134	Plate Assembly (Lower Swashplate Assembly)
T-0135-1-SET	Main Rotor Transmission Pinion Crows Foot
T-0140	Tail Rotor Rigging Tool
T-0151-1	Universal Block Bearing Tool Set (Grease Lubricated)
T-0152	Tail Rotor Balance Tool (Photo Cell Bracket)
T-0156	Oil Filler Tube Adapter Wrench
T-0160-1	Damper Ring Seal Installation Tools
T-0168-1	Tail Rotor Assembly Holder
T-0169-1	Oleo Disassembly Tool
T-0174-1	Hub Puller
T-0179	Magneto Spring Installation Tool
T-0197-7	MR Hub Nut Torque Multiplier Wrench
T-0198-11	Enabler, Oil Drain MRGB
T-0204	Fan Shroud Alignment Tool

Table 2-3. Special Tools - Continued

Part Number	Nomenclature
T-1575	Swashplate Centering Tool
T-1709	Guidetube Bearing Collar Tool
T-1758	Guidetube Clamps
T-1775	Cyclic Centering Rigging Tool
T-1794	Weight and Balance Datum Tool
T-28-16101	Swashplate Lock
T-2893	Tail Rotor Needle Teeter Bearing Removal/Installation Tool Kit
T-2896-1	Damper Bleeding/Servicing Tool (2 Required)
*	Main Rotor Transmission Stand
*	Main Rotor Hub Stand
*	Sprag Clutch Purge Tool
ATP761	Digital Mast Torque Multiplier

* Contact the Enstrom Helicopter Product Support for assistance in obtaining these tools.

2-16 TORQUE DATA

Unless specified in Table 2-4 and/or in this manual's maintenance procedures or as called out in the component manufacturer's specifications, all hardware should be torqued to standard torque values listed in Tables 2-5 through 2-13.

Table 2-4. Special Torque Values

	Location	Torque Value
1.	Main rotor mast nut	400 ft-lb/542.3 Nm
2.	Main rotor transmission pinion nut	250 ft-lb/339 Nm
3.	Main rotor blade attachment nuts	50 ft-lb/68.2 Nm
4.	Main rotor blade drag link nuts	140 in-lb/15.9 Nm
5.	Main rotor damper pivot nut	190 in-lb/21.6 Nm
6.	Main rotor hub U-block lower nut	50 ft-lb/67.8 Nm
7.	Main rotor hub U-block upper nut	20 ft-lb/27.1 Nm
8.	Lamiflex bearing retention nut	12-15 in-lb/1.4-1.7 Nm
9.	Upper swashplate guidetube nuts	240 in-lb/27.1 Nm
10.	Engine mount nut	460-500 in-lb/52-56.5 Nm
11.	Tailcone attachment bolts	240 in-lb/27.3 Nm
12.	Tail rotor assembly retention bolt	300 in-lb/34.1 Nm
13.	Tail rotor blade grip nuts[1]	75 in-lb/8.5 Nm
14.	Tail rotor thrust bearing retention nut	80-90 ft-lb/108.5-122.0 Nm
15.	Lower engine pulley to crankshaft bolts	50 ft-lb/67.8 Nm
16.	Pitch change bellcranks	
	a. Push/pull rod bolt	40 in-lb/4.5 Nm
	b. Push/pull rod bolt with floating bushing	75 in-lb/8.5Nm
17.	Landing gear pivot points (all)	40-60 in-lb/4.5-6.8 Nm
18.	Landing gear oleo pivots points (all)	2 lb/0.9 kg drag ([2])
19.	Tail rotor driveshaft taper pins	25 in-lb/2.8 Nm
20.	Dogleg nut	130-140 in-lb/14.7-15.9 Nm
21.	Dogleg to swashplate nut	40-60 in-lb/4.5-6.8 Nm
22.	Idler yoke/shaft jam nut	40-45 in-lb/4.5-5.1 Nm
23.	Fuel pump and fuel injector attach nuts	204 in-lb/23.1 Nm
24.	Main Rotor Transmission Magnetic Pick-up	60-65 in-lb/6.8-7.3 Nm
25.	Clutch Cable Jam Nut	175-200 in-lb/19.8-22.6 Nm
26.	Clutch Cable Rod End Jam Nut	80 in-lb/9 Nm
27.	Throttle and Mixture Cable Jam Nuts	80 in-lb/9 Nm
28.	Lycoming STD-2043 Exhaust Self-Locking Nuts	204 in-lb/23 Nm
29.	Tail rotor gearbox sight glass	60 in-lb/6.8 Nm
30.	Spark plugs[3]	35 ft-lb/47.5 Nm

[1] Torque for oversize bolts: 140 in-lb/15.9 Nm maximum.
[2] Refer to Paragraph 8-9, D, (5).
[3] Lycoming Service Instruction No. 1042

Table 2-4. Special Torque Values - Continued

Location	Torque Value

1 Foot-Pound (ft-lb) = 1.3558 Newton Meter (Nm)
1 Inch-Pound (in-lb) = 0.113 Newton Meter (Nm)
1 Nm = 0.7376 ft-lb
1 Nm = 8.851 in-lb

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Table 2-5. Torque Values for Nuts and Bolts

CAUTION THE FOLLOWING TORQUE VALUES ARE DERIVED FROM OIL FREE CADMIUM PLATED THREADS.				
	TORQUE LIMITS RECOMMENDED FOR INSTALLATION (BOLTS LOADED PRIMARILY IN SHEAR) (inch-pounds)		MAXIMUM ALLOWABLE TIGHTENING TORQUE LIMITS (inch-pounds)	
Thread Size	Tension type nuts MS20365 and AN310 (40,000 psi in bolts)	Shear type nuts MS20364 and AN320 (24,000 psi in bolts)	Nuts MS20365 and AN310 (90,000 psi in bolts)	Nuts MS20364 and AN320 (54,000 psi in bolts)
FINE THREAD SERIES				
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*	10,000	6000
1-1/8-12	5000-7000	3000-4200*	15,000	9000
1-1/4-12	9000-11,000	5400-6600*	25,000	15,000
COARSE THREAD SERIES				
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
The above torque values may be used for all cadmium-plated steel nuts of the fine or coarse thread series which have approximately equal number of threads and equal face bearing areas. * Estimated corresponding values.				

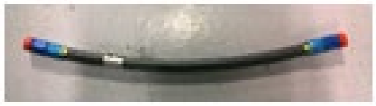
Table 2-6. Fittings, Tubing

Aluminum Alloy Tubing

Steel Tubing

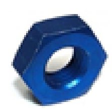
Fitting Size	Tubing OD (inches)	6061-O & 5052-O Aluminum-Alloy Tube: Fitting or Nut Torque (in-lb)	Steel Tube: Fitting or Nut Torque (in-lb)
-2	1/8	20-30	75-85
-3	3/16	25-35	95-105
-4	1/4	50-65	135-150
-5	5/16	70-90	170-200
-6	3/8	110-130	270-300
-8	1/2	230-260	450-500
-10	5/8	330-360	650-700
-12	3/4	460-500	900-1000

Table 2-7. Fittings, Hose Assemblies




Flexible Hose or Tube Fittings (excluding nylon pitot static lines) Measurements based on Hose Inside Diameter or Fitting Size						
Fitting Size	Tube Size (inches)	Thread	Flex Hose and 6061-T6 Aluminum Alloy Torque Limits (in-lb)		Steel (Torque Limits (in-lb)	
			Min	Max	Min	Max
-3	3/16	3/8-24	30	70	90	140
-4	1/4	7/16-20	70	120	135	185
-5	5/16	1/2-20	70	120	180	230
-6	3/8	3/4-16	130	180	270	345
-8	1/2	3/4-16	300	400	450	525
-10	5/8	7/8-14	430	550	650	750
-12	3/4	1-1/6-12	650	800	900	1,100

Table 2-7.1. Fittings


AN924 Nut
Flared Tube


AN814
Plug and Bleeder

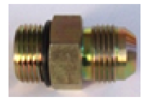

AN6289 Nut (Undercut)
Flared Tube

Nominal Tube O.D. (inches)	Fitting Thread Size	Torque Limits (inch-pounds)									
		For Gasketed Aluminum or Steel Fittings*						For Jamnuts and Fittings Without Gaskets* *			
		AN924 Nut AN815 Union		AN814 Plug		AN6289 Nut		Aluminum		Steel	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
1/8	5/16-24	25	35	10	16	25	35	35	50	-	-
3/16	3/8-24	50	75	30	40	50	75	65	80	70	90
1/4	7/16-20	55	80	40	65	75	100	90	105	110	130
5/16	1/2-20	75	100	60	80	90	120	105	125	140	160
3/8	9/16-18	100	150	80	120	150	200	125	145	225	275
1/2	3/4-16	180	230	150	200	200	250	240	280	400	450
5/8	7/8-14	250	350	200	350	275	400	330	370	550	650
3/4	1-1/6-12	420	600	300	500	450	650	540	660	800	960

* For use with O-rings and aluminum, asbestos, leather, Teflon, gaskets, or washers.
* * For combinations of materials (either jamnut, fittings, or boss), use the lowest applicable values shown.

Table 2-8. Steel Fittings Using Jam Nuts or Straight Thread O-Ring Boss

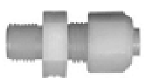
AN814
Plug and Bleeder
(Steel)



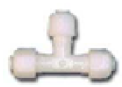
MS51525
Flared AN to Straight Pipe
Thread Male Adapter

Tube Size	Thread Size (inches)	Torque Limits (inch-pounds)	
		Min	Max
-02	5/16-24	72	84
-03	3/8-24	95	105
-04	7/16-20	155	180
-05	1/2-20	170	180
-06	9/16-18	275	290
-08	3/4-16	480	515
-10	7/8-14	515	575

Table 2-9. Pitot Static System Nylon Fittings



268N04X02: Adapter



264N04: Union Tee

269N04X02: Male Elbow

Nominal Tube O.D. (inches)	Thread Size (inches)	Torque Limits (inch-pounds)	
		Min	Max
1/4	7/16-20	7	10

Table 2-10. Pipe Plugs

MS20822
90° AN to Pipe
Fitting

MS20823
45° AN to
Pipe Fitting

AN816
Nipple, Flared
Tube and Pipe
Thread

AN932 Plug

MS20913
Plug, Square
Head

Thread Size (inches)	Torque Limits (inch-pounds)
1/16-27 NPT	40 to 44
1/8-27 NPT	40 to 44
1/4-18 NPT	85 to 94
3/8-18 NPT	110 to 121
1/2-14 NPT	160 to 176
3/4-14 NPT	230 to 252
1-11-1/2 NPT	315 to 347

Table 2-11. Crush Type Gaskets

NOTE

Turn the part until the sealing surfaces are in contact and then tighten to the angle of turn listed for the appropriate thread size.

Thread Pitch On Part to be Tightened (Threads per Inch)	Angle of Turn	
	Aluminum	Copper
8	135°	67°
10	135°	67°
12	180°	90°
14	180°	90°
16	270°	135°
18	270°	135°
20	270°	135°
24	360°	180°
28	360°	180°

Table 2-12. Prevailing Torque Values for Re-used Self-Locking Nuts

Bolt, or Screw Thread Size (inches)	Seating Torque (in-lb ±10%)	Prevailing Torque Max. On or Off (in-lb)	Prevailing Torque Min. On or Off (in-lb)
4-40	8	5	0.5
6-32	15	8	1.0
8-32	28	12	1.5
AN3	45	18	2.0
AN4	110	40	3.0
AN5	190	85	5.0
AN6	345	110	9.0
AN7	545	150	12.0
AN8	850	220	16.0

If not listed in Table 2-12, a self-locking nut can be reused as long as a wrench is required to turn it on the bolt.

Table 2-13. Brass Bolts

Bolt Thread Size (Inch)	Coarse Thread	Bolt Thread Size (Inch)	Fine Thread
2-56	2 in-lb	2-64	2.5 in-lb
4-40	4.3 in-lb	4-48	5.4 in-lb
5-40	6.3 in-lb	5-44	7.7 in-lb
6-32	7.9 in-lb	6-40	9.9 in-lb
8-32	16.2 in-lb	8-36	18.0 in-lb
10-24	18.6 in-lb	10-32	25.9 in-lb
1/4”-20	61.5 in-lb	1/4"-28	77 in-lb
5/16”-18	107 in-lb	5/16”-24	116 in-lb
3/8”-16	16.0 ft-lb	3/8”-24	17.7 ft-lb
7/16”-14	26.4 ft-lb	7/16”-20	27.3 ft-lb
1/2”-13	35.2 ft-lb	1/2"-20	37 ft-lb
5/8”-11	76 ft-lb	5/8”-18	85 ft-lb
3/4”-10	104 ft-lb	3/4”-16	102 ft-lb
7/8”-9	159 ft-lb	7/8”-14	158 ft-lb
1”-8	235 ft-lb	1”-14	212 ft-lb

2-17 CONSUMABLE PARTS LIST

Table 2-14 lists the consumable parts and lubricants that are normally used during servicing or periodic inspection of the aircraft. The quantities listed reflect normal inspection intervals; however, they may need to be adjusted if adverse operating conditions require more frequent servicing or inspections.

Refer to the Lycoming Operator's Manual (Document 60297-12) and the Lycoming Parts Catalog (Document PC-406-2) for the consumable parts required for servicing or periodic inspection of the engine.

NOTE: Enstrom does not stock engine parts for customer service use. Obtain engine parts through Lycoming Engines Distribution Partners. For assistance, refer to the Genuine Parts tab on the Lycoming Products web page to find distributors near you (www.lycoming.com).

Table 2-14. Consumable Parts List

	Item	**Part Number** (Note 1, 3)	**Quantity**
50 Hour Service			
1.	Grease	C008 and C011	As Required
2.	Silicon Oil	C007	As Required
3.	Oil	C005	As Required
4.	O-ring	NAS1612-2	6 EA (Note 2)
5.	Oil Filter	CH48103	1 EA
100 Hour Service/Inspection			
1.	Same as 50 hour Requirements		
2.	Crush Washer	AN900-8 or MS35769-9	1 EA
3.	Crush Washer	AN900-10 or MS35769-11	1 EA
4.	Oil	C005	1 FL OZ (US)
5.	Oil	C006	7 PT (US)
6.	Air Filter Element	BA-15	1 EA
7.	O-ring	MS28775-2	1 EA (Note 2)
8.	Lockwire	MS20995C25	As Required
9.	Lockwire	MS20995C32	As Required
200 Hour Service/Inspection			
1.	Same as 100 hour requirements		
300 Hour Service/Inspection			
1.	Same as 100 hour requirements		

NOTES:

1 Refer to Table 4-1 C-### index listing
2 Replace on condition
3 Verify configuration, part number and quantity with latest revision of illustrated parts catalog, service letters, and service bulletins as required.

2-18 TAPER PIN SIZE CHART

Table 2-15 lists information pertaining to taper pin part numbers and physical properties.

NOTE: Always check the condition and security of taper pins at every inspection.

NOTE: The dash number of the 28-16323 series taper pins is vibro-etched on the head of the taper pin.

Table 2-15. Taper Pin List

Old Enstrom P/N	Current Enstrom P/N	Head Diameter	Grip Length
AN386-2-7A [1]	AN386-2-7A [1]	0.296 in / 7.5 mm	1.00 in / 25.4 mm
AN386-2-8A [1]	AN386-2-8A [1]	0.302 in / 7.6 mm	1.12 in / 28.4 mm
AN386-2-9A [1]	AN386-2-9A [1]	0.308 in / 7.8 mm	1.26 in / 32 mm
28-13600-3 [2]	28-13623-25 [2]	0.302 in / 7.6 mm	1.00 in / 25.4 mm
28-13600-4 [2]	28-13623-27 [2]	0.307 in / 7.7 mm	1.00 in / 25.4 mm
28-13600-5 [2]	28-13623-29 [2]	0.314 in / 7.9 mm	1.00 in / 25.4 mm
NA	28-13623-31 [2]	0.316 in / 8 mm	1.00 in / 25.4 mm
28-13600-7 [3]	28-13623-13 [3]	0.310 in / 7.8 mm	1.12 in / 28.4 mm
28-13600-8 [3]	28-13623-17 [3]	0.318 in / 8 mm	1.12 in / 28.4 mm
NA	28-13623-15 [3]	0.315 in / 8 mm	1.12 in / 28.4 mm
28-13600-6 [3]	28-13623-11 [3]	0.305 in / 7.7 mm	1.12 in / 28.4 mm

[1] Standard
[2] Tail Rotor Transmission
[3] Main Rotor Transmission

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SECTION 3

AIRWORTHINESS LIMITATIONS

The Airworthiness Limitations Section is FAA approved and specifies inspections and other maintenance required under 14 CFR §§ 43.16 and 91.403 of the Federal Aviation Regulations unless an alternative program has been FAA approved.

For EASA approval, this Airworthiness Limitations section is approved, and variations must also be approved.

FAA APPROVED BY ______________________ DATE 7/2/12

MANAGER
CHICAGO AIRCRAFT CERTIFICATION OFFICE
CENTRAL REGION
FEDERAL AVIATION ADMINISTRATION

SECTION 3

LOG OF REVISIONS

Rev. Num.	Rev. Date	Pages Affected	Approval Date	FAA Approved
1	4/3/86	MM-3-1	4/3/86	W. F. Horn
2	11/18/88	MM-3-13 and MM-3-20	11/18/88	W. F. Horn
3	N/A	None	N/A	N/A
4	6/21/12	MM-3-1 through MM-3-6	Jul 2/12	G. Michalik
5	Nov 5/13	None	N/A	N/A
6	Apr 7/15	None	N/A	N/A
7	Aug 22/16	MM-3-2 through MM-3-4	Aug 26/16	G. Michalik
8	Sep 20/17	MM-3-2, MM-3-3	Oct 10/17	M. Javed
9	Dec 14/17	None	N/A	N/A
10	Feb 7/19	None	N/A	N/A
11	Oct 25/19	None	N/A	N/A
12	Jul 16/20	None	N/A	N/A
13	Jan 5/24	None	N/A	N/A
14	Jul 23/24	None	N/A	N/A
15	Sep 26/24	MM-3-1 through MM-3-6	Oct 28/2024	B. Diakhite AIR-765

SECTION 3

EASA LOG OF REVISIONS

Rev. Num.	Date	EASA Approved
1	9/28/03	Article 3, Commission Regulation (EU) 748/2012
2	9/28/03	Article 3, Commission Regulation (EU) 748/2012
3	N/A	N/A
4	7/9/15	FAA/EASA T.I.P.; FAA Approved on Behalf of EASA by G. Michalik*
5	N/A	N/A
6	N/A	N/A
7	9/9/16	FAA/EASA T.I.P.; FAA Approved on Behalf of EASA by G. Michalik♦
8	10/23/17	N/A
9	N/A	N/A
10	N/A	N/A
11	N/A	N/A
12	N/A	N/A
13	N/A	N/A
14	8/12/24	FAA/EASA T.I.P.▼

* T.I.P., Rev. 4 dated September 22, 2014, Section 3.2.11

♦ T.I.P., Rev. 5 dated September 15, 2015, Section 3.2.11

▼ T.I.P., Rev. 7 dated October 19, 2023, Sections 3.3 and 3.5.12.4

SECTION 3

AIRWORTHINESS LIMITATIONS

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SECTION 3

AIRWORTHINESS LIMITATIONS

3-1. RETIREMENT LIFE ITEMS

A. The items listed in Table 3-1 require mandatory retirement at the hours or calendar time established by Enstrom Helicopter Corporation and other component manufacturers.

B. Retirement life components authorized for installation on the F-28F and 280F Series must use the shorter retirement life limit for the life of the component if the component is removed from one model of aircraft and installed on a model with a different retirement life.

3-2. MANDATORY INSPECTION ITEMS

The Enstrom F-28F and 280F Series helicopters have no mandatory inspection items.

Table 3-1. Retirement Life Items

ITEM	PART NUMBER	RETIREMENT LIFE		
		F-28F	280F	280FX
Bearing, Idler Pulley	ECD018-11 (202SZZ)	600 Hrs	600 Hrs	600 Hrs
Bearing, Lower Swashplate	ECD009-11, -13 (5201SBKZZ)	1,200 Hrs+	1,200 Hrs+	On Condition
Bearing, Upper Swashplate	ECD013-11, -13 (Z993L13XR3B)	1,200 Hrs+	1,200 Hrs+	On Condition
Housing, Lower Swashplate	28-16119-1, -3	17,700 Hrs	17,700 Hrs	17,700 Hrs
Main Rotor Drag Link	28-14283-1	13,750 Hrs++	13,750 Hrs++	13,750 Hrs
Tail Rotor Blade	28-150002-1	3,100 Hrs	3,100 Hrs	3,100 Hrs
Tail Rotor Blade Grip	28-150044-1, -3	6,200 Hrs	6,200 Hrs	6,200 Hrs
Tail Rotor Driveshaft Coupling	28-13609-1	1,200 Hrs	1,200 Hrs	N/A
Tail Rotor Driveshaft Flex Pack	28-01041-3	1,200 Hrs	1,200 Hrs	1,200 Hrs
Tail Rotor Gear Set	ECD074-1, -2 (XR-137-2YL, -2R) ECD100* ECD101-1, -2	1,200 Hrs 1,200 Hrs 1,200 Hrs	1,200 Hrs 1,200 Hrs 1,200 Hrs	1,200 Hrs 1,200 Hrs 1,200 Hrs
Tail Rotor Spindle	28-150064-11, -13	1,200 Hrs	1,200 Hrs	1,200 Hrs
Tail Rotor Spindle	28-150074-11, -13	1,200 Hrs	1,200 Hrs	1,200 Hrs
Turbocharger	RJ0332 (325E10-2) 103574-00 (3BT2EE10J2) 600700-0000 (3BT5EE10J2)	2,000 Hrs 2,000 Hrs 2,000 Hrs	2,000 Hrs 2,000 Hrs 2,000 Hrs	2,000 Hrs 2,000 Hrs 2,000 Hrs
Thrust Bearing	28-14320-12, -15	**	**	**
Tachometer Drive Belt (O-Ring)	NAS1611-333	***	***	***
V-band Coupling	LW-13464	500 Hrs♦	500 Hrs♦	500 Hrs♦

* Applies to all dash numbers.

** Retire from service 5 calendar years from date of manufacture all Lamiflex bearings serial number 5997 and prior. Retire from service 5 calendar years from date of installation (defined as the date the Lamiflex bearing packaging is opened) or 8 calendar years from date of manufacture, whichever occurs first, all Lamiflex bearings serial numbers 5998 and subsequent.

*** Retire from service 5 calendar years from date of installation or package opening, or 8 years from date of manufacture, whichever occurs first.

\+ On condition when used with grease fitting.

++ For aircraft certified to 2350 lb maximum weight, component has no time limit. Remove component on condition per maintenance manual inspection criteria.

♦ Effective date July 17, 2023, for new v-band coupling as installed per AD 2023-09-09.

For a v-band coupling in service prior to July 17, 2023, refer to AD 2023-09-09 paragraph (i)(1) for removing and installing a new v-band coupling within the compliance times stated.

Note: Per AD 2023-09-09 paragraph (i)(2), as an alternative to removing the v-band coupling from service, inspections of the v-band coupling may be performed according to the requirements stated in AD 2023-09-09 for a period not to exceed 2 years after the effective date of AD 2023-09-09.

SECTION 4

SERVICING, RECOMMENDED OVERHAULS, INSPECTIONS, AND GENERAL MAINTENANCE

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SECTION 4

SERVICING, RECOMMENDED OVERHAULS, INSPECTIONS, AND GENERAL MAINTENANCE

TABLE OF CONTENTS (CONTINUED PAGE MM-4-2)

SECTION 4

SERVICING, RECOMMENDED OVERHAULS, INSPECTIONS, AND GENERAL MAINTENANCE

TABLE OF CONTENTS (CONTINUED PAGE MM-4-3)

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4-1 SERVICING

4-2 Description – Servicing

A. Servicing of the F-28/280F series helicopter is normally accomplished at specified hourly intervals. Operators should take into consideration the environmental conditions and determine whether more frequent servicing intervals are necessary. Refer to Tables 4-1 through 4-2 and Figure 4-1 for approved fuels, oils, lubricants, intervals, and locations.

Table 4-1. Index - Fuels, Lubricants, Specification, and Capacities

Code	Nomenclature	Specification	Commercial Description	Notes
C001	Fuel	100/130 Aviation Gasoline 100 Aviation Gasoline 100LL Aviation Gasoline		(1)
C002	Lubricating Oil, Piston Engine	MIL-L-22851/SAE-J1899 MIL-L-6082, SAE-J1966		(2, 3)
C003	Fuel, Emergency Use			
C004	Lubricating Oil, Aircraft Turbine Engine, Synthetic Base	MIL-PRF-7808	American PQ Lubricant 689 Brayco 880 Eastman Chemical ETO 2389 Exxon Turbo Oil 2389 Mobil Avrex S Turbo 256 Mobil RM-201A Mobil RM-184A Stauffer Jet I	
C005	Lubricating Oil, Aircraft Turbine Engine, Synthetic Base	MIL-PRF-23699 STD MIL-PRF-23699 HTS	Aeroshell Turbine Oil 500 Royco Turbine Oil 500 American PQ Lubricant 6700 BPTO 2380 Caltex RPM Jet Engine Oil 5 Castrol 5050 Chevron Jet Engine Oil 5 Eastman Chemical ETO 2380 ExxonMobil MJO II Mobil Jet Oil II Stauffer Jet II (Castrol 205) Turbonycoil 600 Mobil Jet Oil 254 and Mobil Jet Oil 291 (HTS Oil) Royco 560 (HTS Oil) Aeroshell Turbine Oil 560 (HTS Oil) Eastman Chemical ETO 2197 BPTO 2197	

Code	Nomenclature	Specification	Commercial Description	Notes
C006	Lubricant, Gear	MIL-PRF-2105/SAE-J2360 API GL-5	Mobil 1 Synthetic Gear Lubricant LS 75W-90 Mobil Delvac 1 Synthetic Gear Oil 75W-90 Mobilube HD LS 80W-90 Mobilube HD Plus 80W-90 Shell Helix Racing Gear Oil 75W-90 Shell Spirax HD 80W90 Castrol Syntrax Limited Slip 75W-90 (Syntec Gear Oil)	
C007	Lubricant	Silicone Oil/Fluid	SF96-20	
C008	Grease, general purpose	MIL-PRF-81322	Royco 22CF Aeroshell 22 Aeroshell 22CF	(4)
C009	Engine oil			(5)
C010	Hydraulic fluid	MIL-PRF-5606	Aeroshell Fluid 41	
C011	Grease	MIL-G-25537	Aeroshell Grease 14	
C012	Corrosion inhibitor	MIL-PRF-81309, Type II or III	ACF-50, Lear Chemical Research Brand Corrosion X – Aviation, Corrosion Technologies Corporation	
C013	Lubricant		Tri-Flow Lubricant, Tri-Flow Brand	

NOTES

1. Refer to Textron-Lycoming Service Instruction 1070 (latest revision) for fuel recommendations.
2. Refer to Textron-Lycoming Service Instruction 1014 (latest revision) for lubricating oil recommendations and seasonal oil grade recommendations.
3. Textron-Lycoming recommends using the following engine oil for the specified average ambient air temperatures (See Note 2):

Textron-Lycoming Lubricating Oil Recommendations		
Average Ambient Air Temperature	**MIL-L-6082 or SAE-J1966**	**MIL-L-22851 or SAE-J1899**
All temperature		SAE 15W-50 or SAE 20W-50
Above 80°F (27°C)	SAE 60	SAE 60
Above 60°F (16°C)	SAE 50	SAE 40 or SAE 50
30°F to 90°F (-1°C to 32°C)	SAE 40	SAE 40
0°F to 70°F (-18°C to 21°C)	SAE 30	SAE 30, SAE 40, or SAE 20W-40
0°F to 90°F (-18°C to 32°C)	SAE 20W-50	SAE 20W-50 or SAE 15W-50
Below 10°F (-12°C)	SAE 20	SAE 30 or SAE 20W-30

4. Enstrom advises against using Mobilgrease 28 for most components except for the idler pulley bearings. Refer to Table 4-2.
5. Any grade internal combustion engine motor oil.

Table 4-2. Servicing Intervals, Methods, and Locations

System	Location (Note 1)	Consumable Identification	Frequency (Note 8) (hr) 25	50	100	Other	As Required	Capacity	Method
Fuel	A-1	C001					X	42.0 gal (US) (40.0 gal (US) usable) 159.0 L (151.4 L usable)	
Engine Oil	A-3	C002		X			X	10.0 Qt (US) (8.0 U.S Qt (US) Engine Sump) 7.6 L (5.7 L Engine Sump)	Filler Can
Main Rotor Transmission	F-14	C006			X		X	3.0 Qt (US) - Dry 2.75 Qt (US) - Servicing 2.84 L - Dry 2.6 L - Servicing	Filler Can
Overrunning Clutch	G-15	C004, C005			X			As Required	Oil Can
Upper Pulley (Jackstrut) Bearing	G-16 (Note 3)	C008			X (3)			As Required	Grease Gun or Hand Pack
Lower Pulley (Jackstrut) Bearing	H-17	C008, C011		X				As Required	Grease gun
Idler Pulley Bearings	I-18	C008 (Note 9)				X		As Required	Syringe
Idler Pulley Actuator Arm Pivots	I-19	C002			X			As required	Oil Can
Snubber Roller Bearings	J-20	C008		X				As Required	Grease Gun
Drive Belt Clutch Cable	K-21	C008, C011		X				As Required	Grease Gun
Main Rotor Tachometer Drive Bearings	L-22	C008			X			As Required	Grease gun
Tail Rotor Drive Shaft Bearings	M-23	C008, C011	X					As Required	Grease gun
Tail Rotor Transmission	N-25	C006			X		X	5 fl oz (US) .15 L	Oil can Syringe
Tail Rotor Rotating Control Pivots	N-27	C002			X			As required	Oil Can
Tail Rotor Feathering Bearings	N-28	C008, C011	X					As Required	Grease Gun
Tail Rotor Teeter Bearings	N-29 (Note 4)	C008, C011	X					As required	Grease Gun

System	Location (Note 1)	Consumable Identification	Frequency (Note 8) (hr) 25	50	100	Other	As Required	Capacity	Method
Tail Rotor Pitch Control Bearing	N-30	C008			X			As Required	Syringe
Collective Guidetube Bearing	O-31 (Note 3, 6)	C008		X				As required	Grease Gun or Hand Pack
Cyclic Swashplate Bearing	O-32 (Note 3, 7)	C008		X				As required	Grease Gun or Hand Pack
Cyclic Swashplate Control Rod Pivot	O-33	C002		X				As required	Oil Can
Pitch Change Bellcrank Pivot Bearings	P-34	C008, C011		X				As Required	Grease Gun
Pitch Change Bellcrank Inboard Pivot Points	P-35	C002		X				As required	Grease Gun
Main Rotor Blade Grips	P-37 (Note 2)	C008		X				As Required	Grease Gun
Main Rotor Dampers	P-38	C007		X			X	As Required	Tool T-2896
Main Rotor Lead-Lag Bearings	Q-39	C008, C011		X				As Required	Grease Gun
Main Rotor Flapping Bearings	Q-40	C008, C011		X				As Required	Grease Gun
Landing Gear Oleos	R-41	C010			X		X	As required	Filler Can
Ground Handling Wheels	R-42	C008, C011					X	As required	Hand Pack
Battery	S-43					(See Note 5)			
Tail Rotor Pedal Pivot Bushings	T-44/45	C002			X			As required	Oil Can
Cabin Flight Control Bellcrank Bushings	U-46	C002			X			As required	Oil Can
Trim Motor Attachment Points	U-46	C002			X			As required	Oil Can

NOTES

1. Refer to the Figure 4-1 illustrations for the lubrication/servicing locations.
2. Refer to Paragraph 4-28 for lubrication procedure.
3. Hand pack the bearing if the bearing housing is not equipped with a grease fitting.
4. Only applies to 28-150050 and 28-150079 series tail rotor assemblies.
5. Service in accordance with manufacturer’s instructions.
6. Also referred to as Upper Swashplate Bearing.
7. Also referred to as Lower Swashplate Bearing.
8. Refer to Paragraph 4-49 for additional guidance pertaining to servicing frequency.
9. Lubricate the idler pulley bearings if experiencing RFI/EMI in the COM system.

Table 4-3. Qualified Domestic Commercial Oils for MIL-PRF-7808

NOTE: Content previously contained in Table 4-3 has been incorporated into Table 4-1.

Table 4-4. Qualified Domestic Commercial Oils for MIL-PRF-23699

NOTE: Content previously contained in Table 4-4 has been incorporated into Table 4-1.

Table 4-5. Qualified Domestic Commercial Oils for SAE-J2360/API GL-5/MIL-PRF-2105

NOTE: Content previously contained in Table 4-5 has been incorporated into Table 4-1.

Table 4-6. Qualified Domestic Commercial Greases for MIL-G-25537

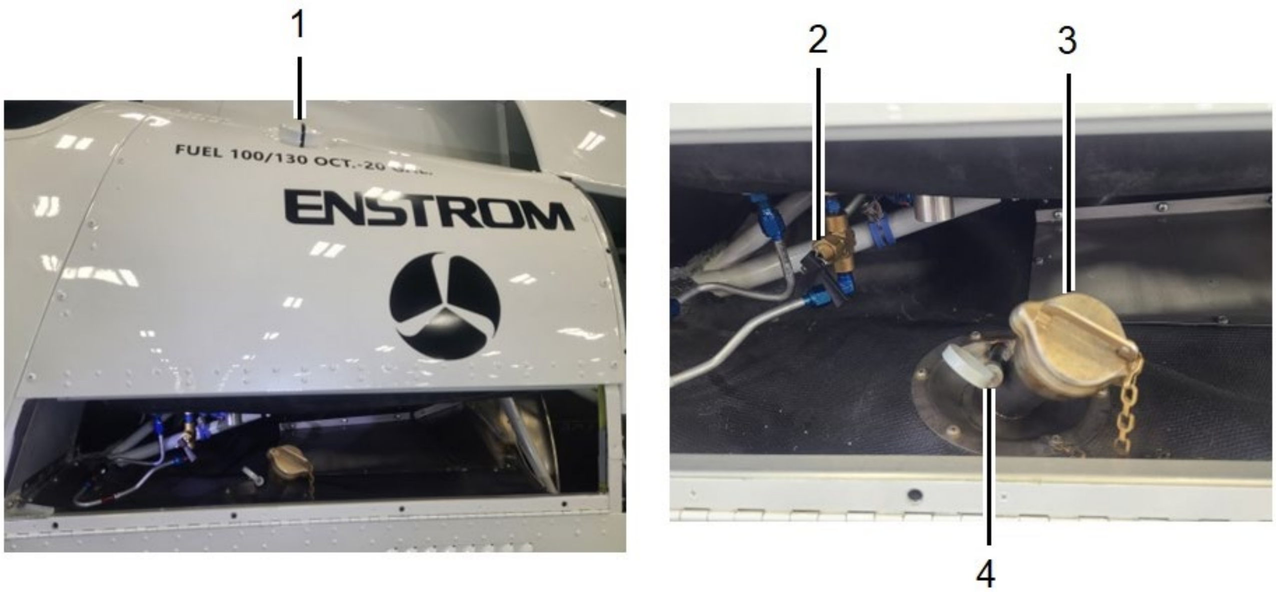
NOTE: Content previously contained in Table 4-6 has been incorporated into Table 4-1.

Table 4-7. Qualified Domestic Commercial Greases for MIL-PRF-81322

NOTE: Content previously contained in Table 4-7 has been incorporated into Table 4-1.

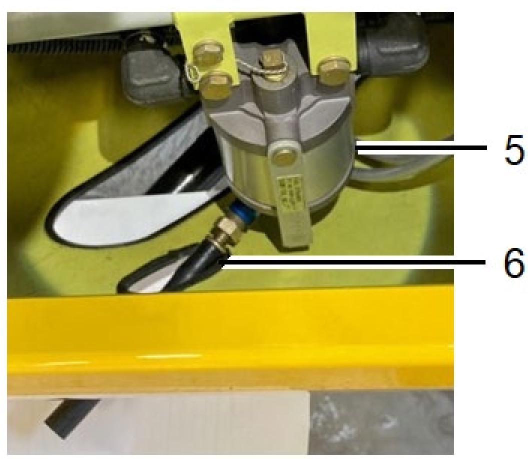
Table 4-8. Qualified Domestic Commercial Greases for MIL-PRF-23827

NOTE: Content previously contained in Table 4-8 has been incorporated into Table 4-1.



View A

1. Fuel Tanks (2 places)
2. Fuel Tank Sump Drain (2 places)
3. Engine Oil Filler
4. Engine Oil Dipstick

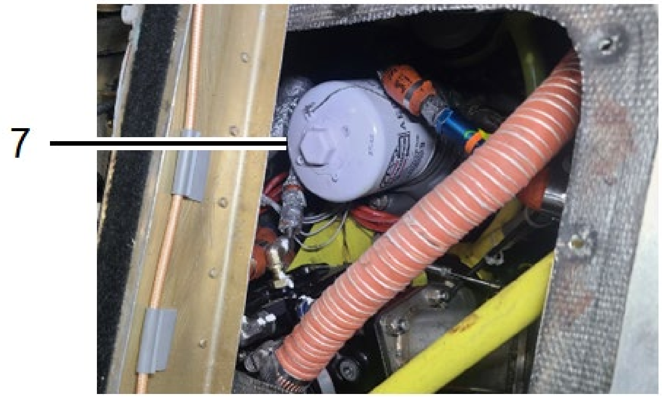


View B

5. Main Fuel Filter (P/N 33-199-916)
6. Main Fuel Filter Drain

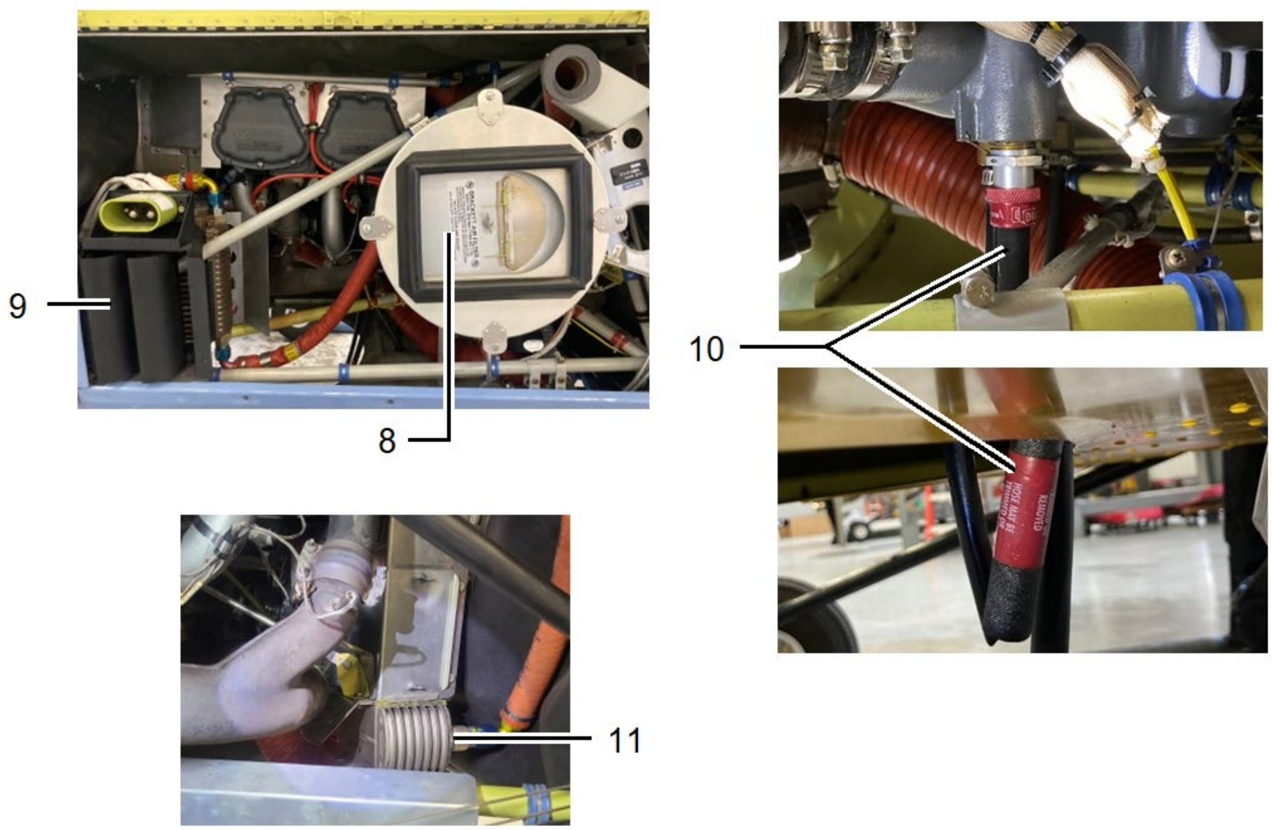
Sheet 1 of 12

Figure 4-1. Servicing Locations



View C

7. Engine Oil Filter

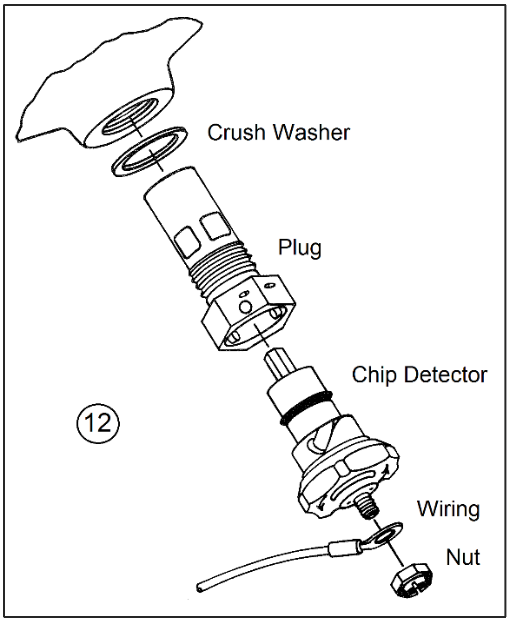


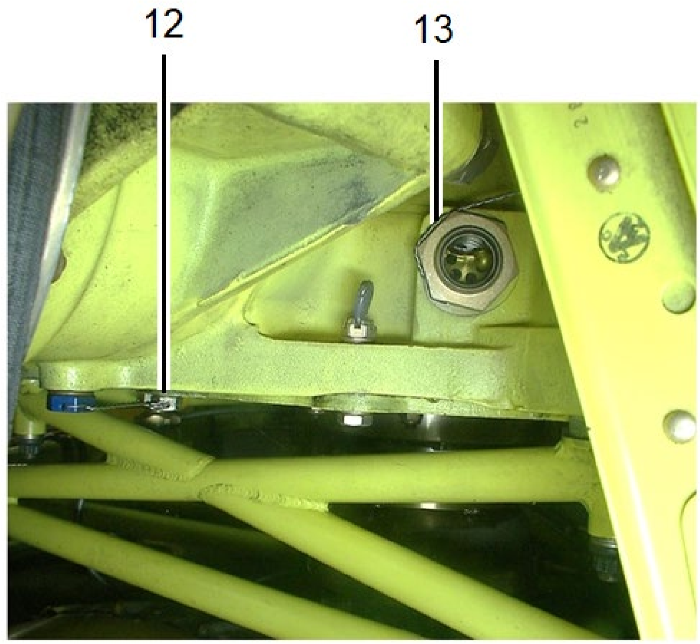
View D

8. Engine Air Filter	10. Engine Oil Sump Drain
9. Engine Main Oil Cooler	11. Aux. Engine Oil Cooler

Sheet 2 of 12

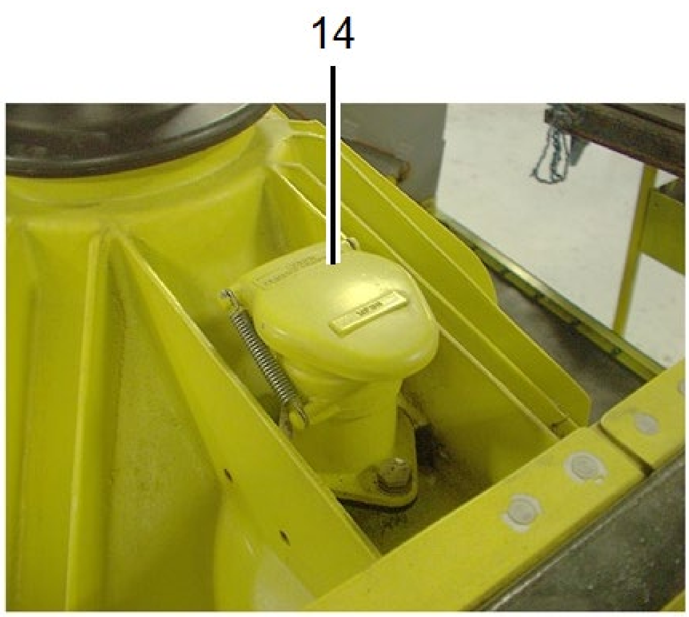
Figure 4-1. Servicing Locations





View E

12. Main Rotor Gearbox Plug and Magnetic Chip Detector
13. Main Rotor Gearbox Oil Level Sight Gauge

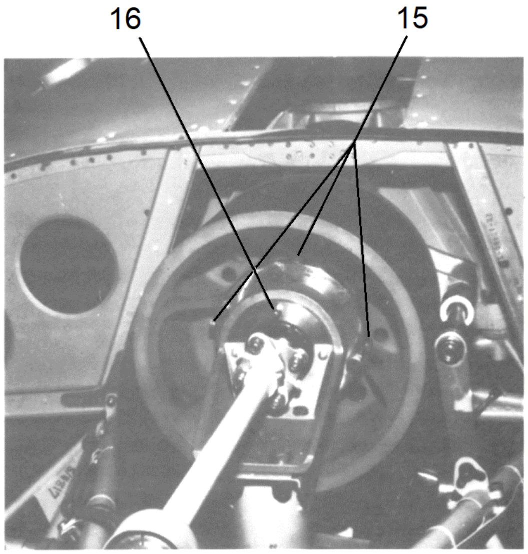


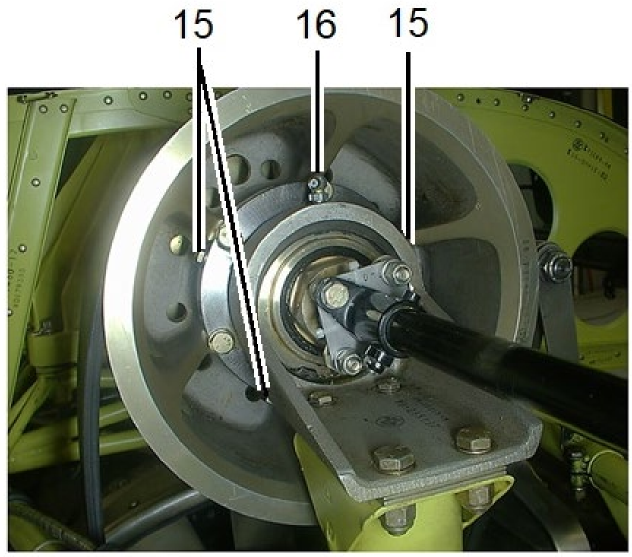
View F

14. Main Rotor Gearbox Filler and Screen

Sheet 3 of 12

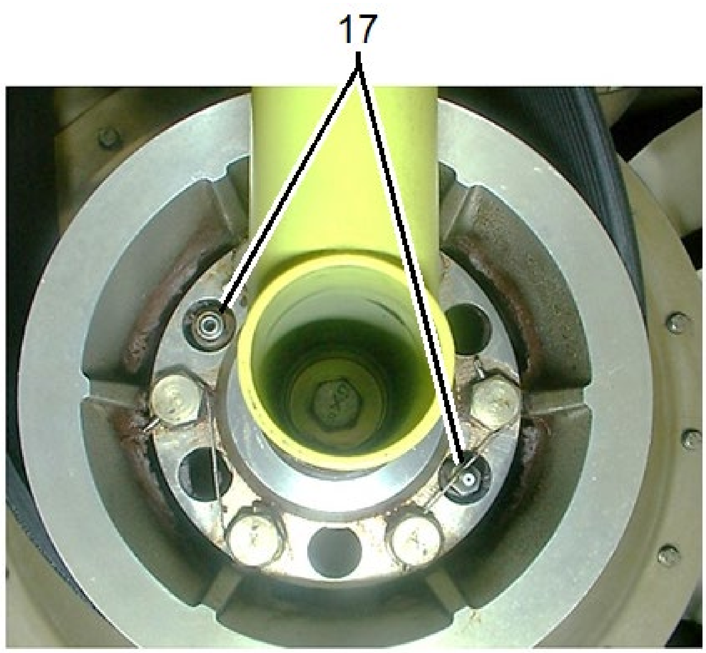
Figure 4-1. Servicing Locations





View G

15. Main Rotor Gearbox Overrunning Clutch Drain and Filler Plugs
16. Upper Jackstrut Bearing Grease Fitting (early housing to the left; current housing to the right)

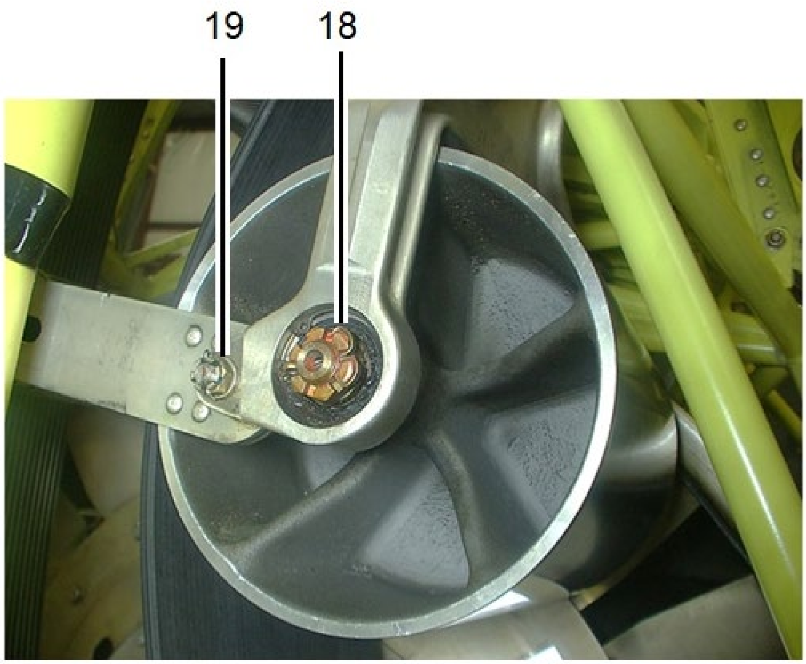


View H

17. Lower Jackstrut Bearing Grease Fitting and Purge Plug

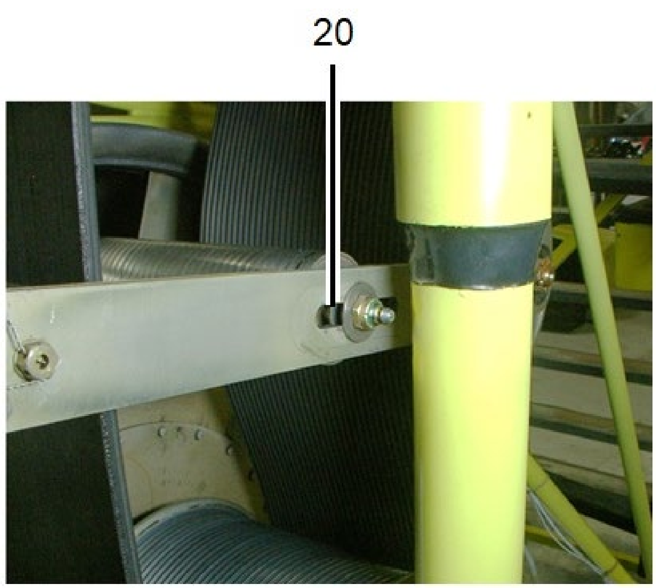
Sheet 4 of 12

Figure 4-1. Servicing Locations



View I

18. Idler Pulley Bearings (2 places)
19. Idler Actuator Arm Assembly Bushings (hidden, 2 places)

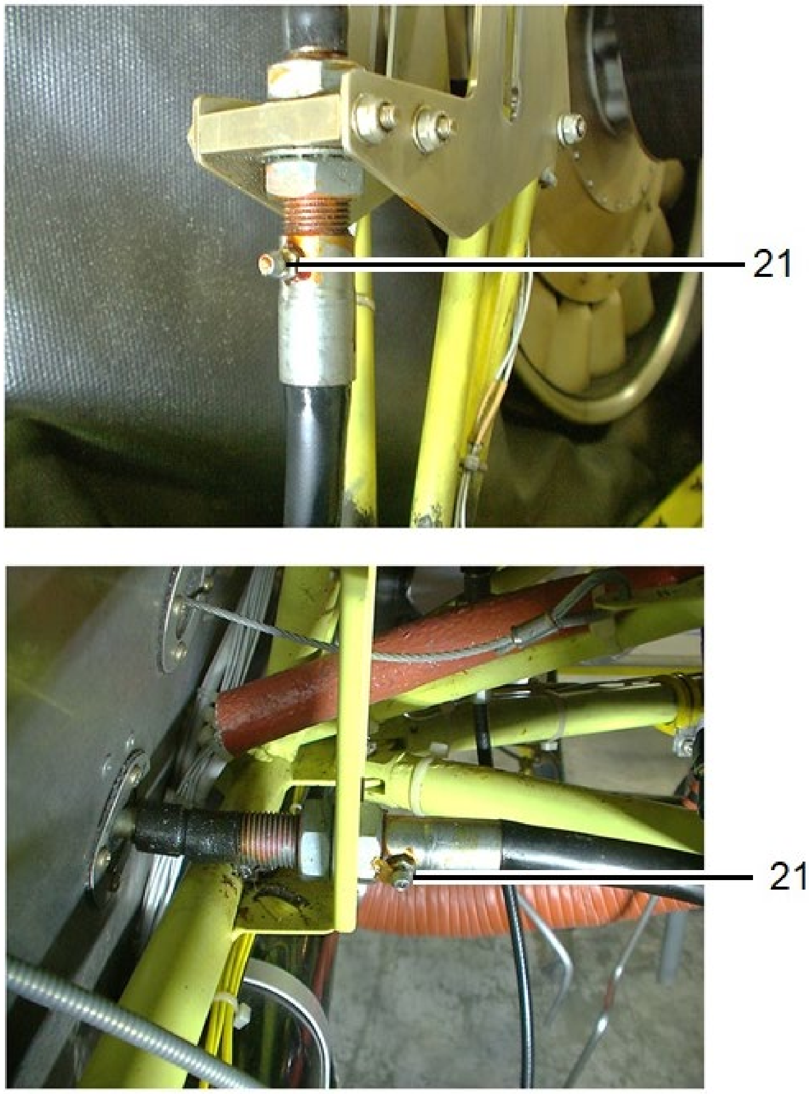


View J

20. Drive Belt Snubber Roller Bearings

Sheet 5 of 12

Figure 4-1. Servicing Locations



View K

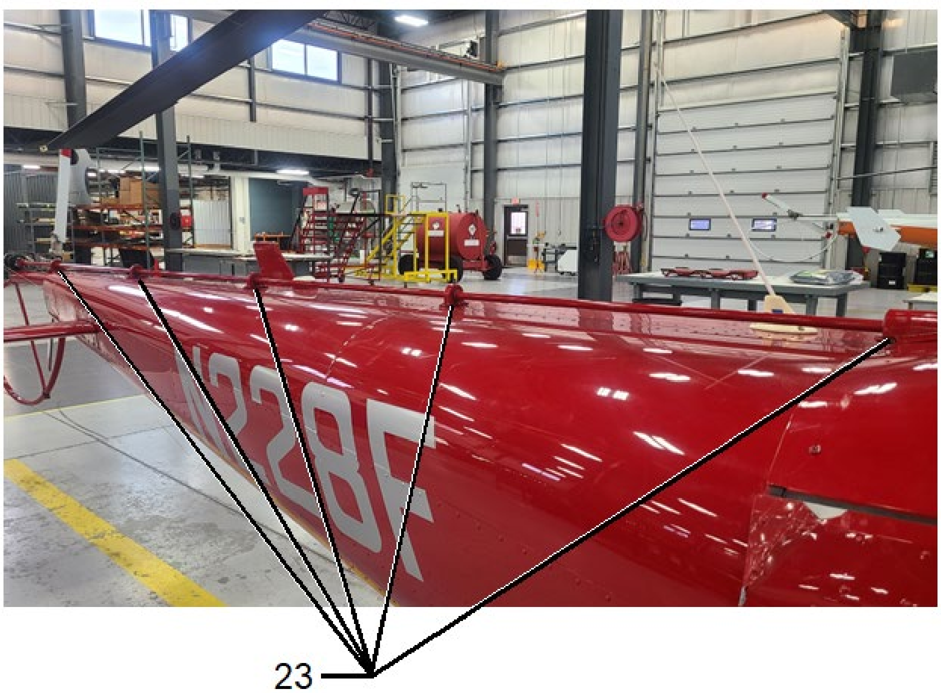
21. Drive Belt Clutch Engagement Cable Grease Fitting
(2 places: Aft, top photo; Forward, bottom photo)

Sheet 6 of 12

Figure 4-1. Servicing Locations

View L

22. Rotor Tach Drive Grease Fitting

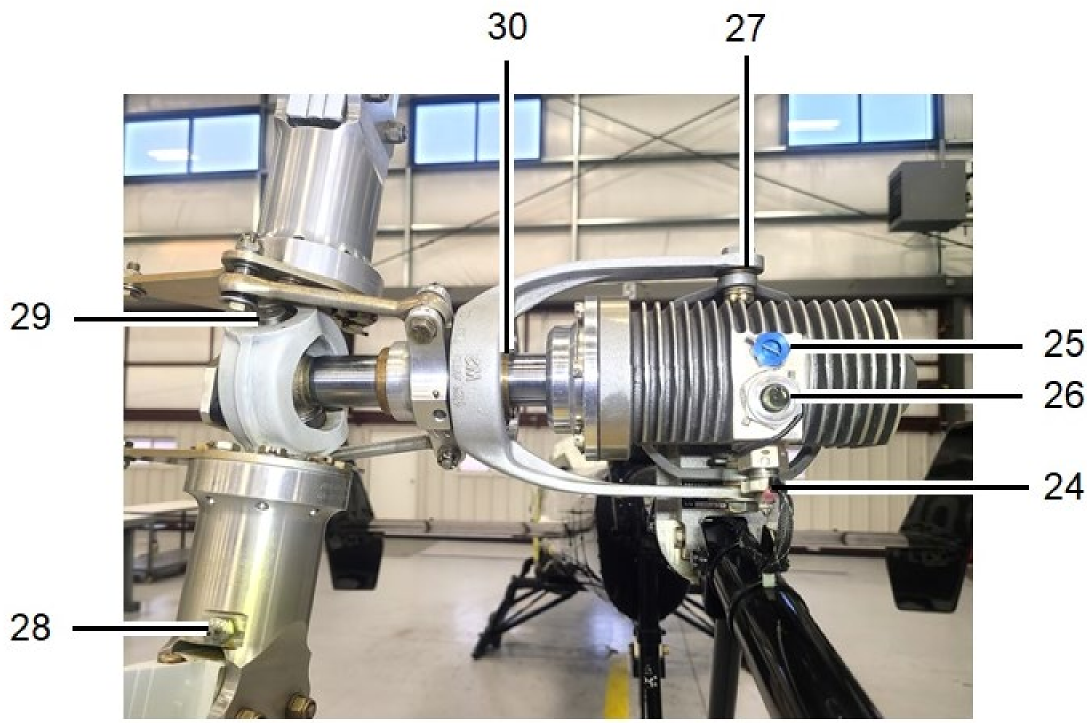


View M

23. Tail Rotor Drive Shaft Bearings (5 places)

Sheet 7 of 12

Figure 4-1. Servicing Locations

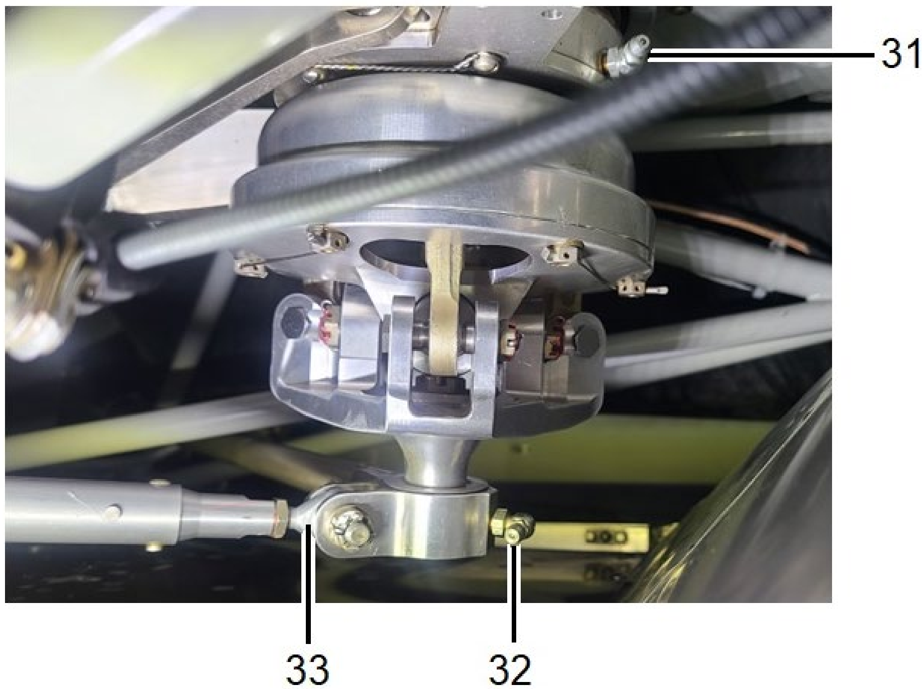


View N

24. Tail Rotor Gearbox Drain and Magnetic Particle Plug
25. Tail Rotor Gearbox Filler Plug
26. Tail Rotor Gearbox Sight Gauge
27. Tail Rotor Control Yoke Pivot Points (4 places)
28. Tail Rotor Feathering Bearings (2 places)
29. Tail Rotor Teetering Bearings (2 places)
30. Tail Rotor Pitch Change Bearing

Sheet 8 of 12

Figure 4-1. Servicing Locations

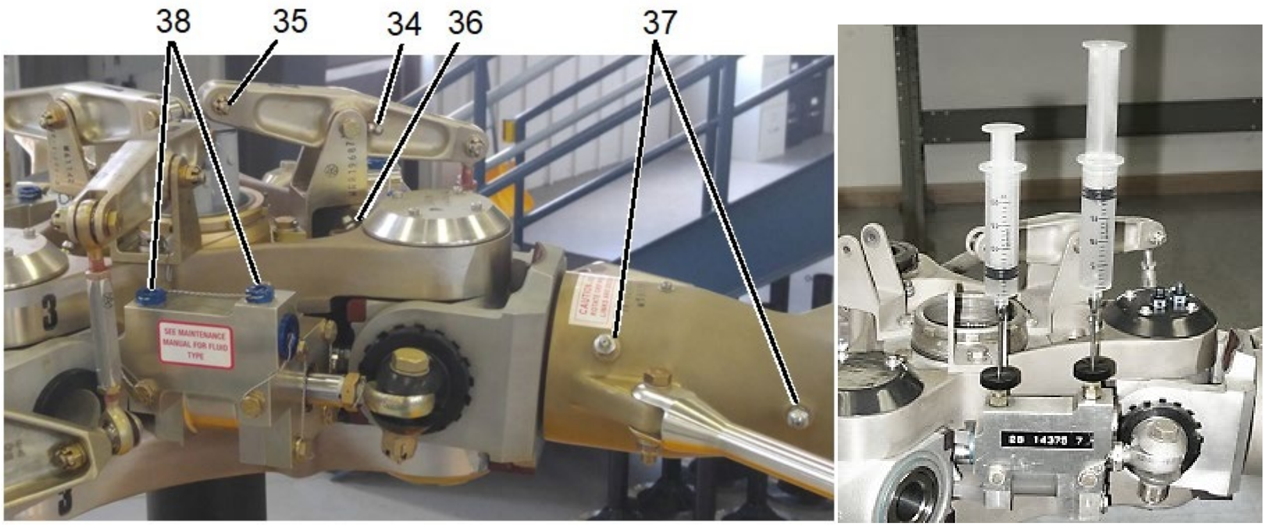


View O

31. Collective Guidetube Bearing Grease Fitting
32. Cyclic Swashplate Bearing Grease Fitting
33. Cyclic Swashplate Control Rod Pivots

Sheet 9 of 12

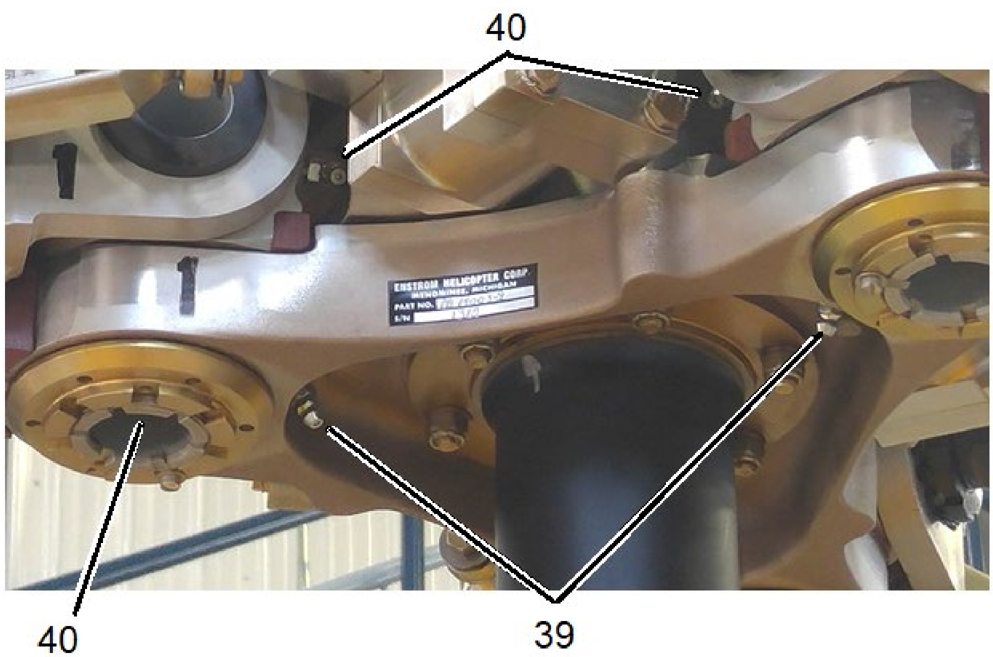
Figure 4-1. Servicing Locations



View P

(Servicing the dampers using Tool T-2896 is shown in the photo to the right.)

34. Pitch Change Bellcrank Pivot Bearings (3 places)
35. Pitch Change Bellcrank Inboard Pivot Points (3 places)
36. Main Rotor Lead/Lag Bearings (3 places)
37. Main Rotor Feathering Bearings (6 places)
38. Main Rotor Damper Service Plugs

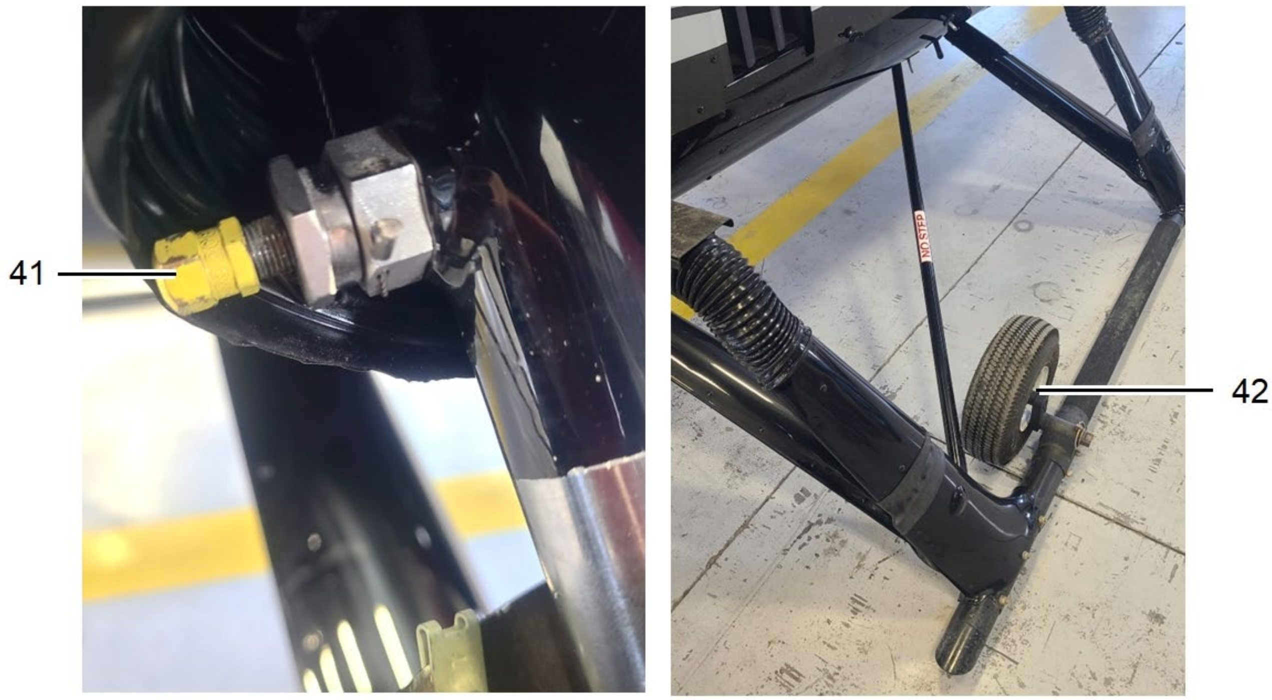


View Q

39. Main Rotor Lead/Lag Bearings (3 places)
40. Main Rotor Flapping Bearings (9 places)

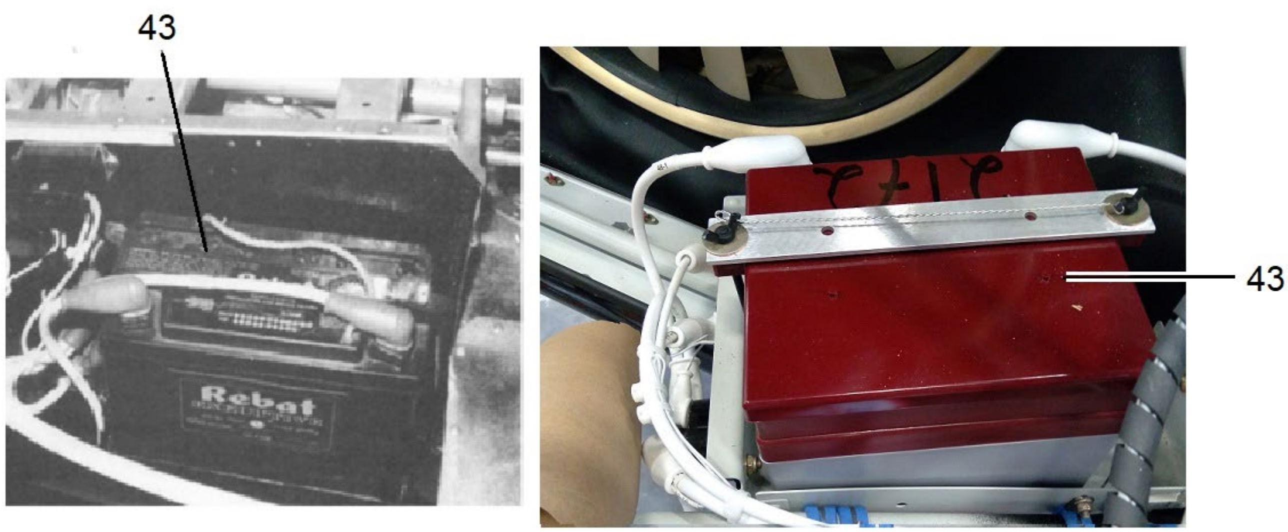
Sheet 10 of 12

Figure 4-1. Servicing Locations



View R

41. Landing Gear Oleo Service Point
42. Ground Handling Wheel Bearing



View S

43. Battery Servicing Points (Forward, left photo, or aft, right photo, installation)

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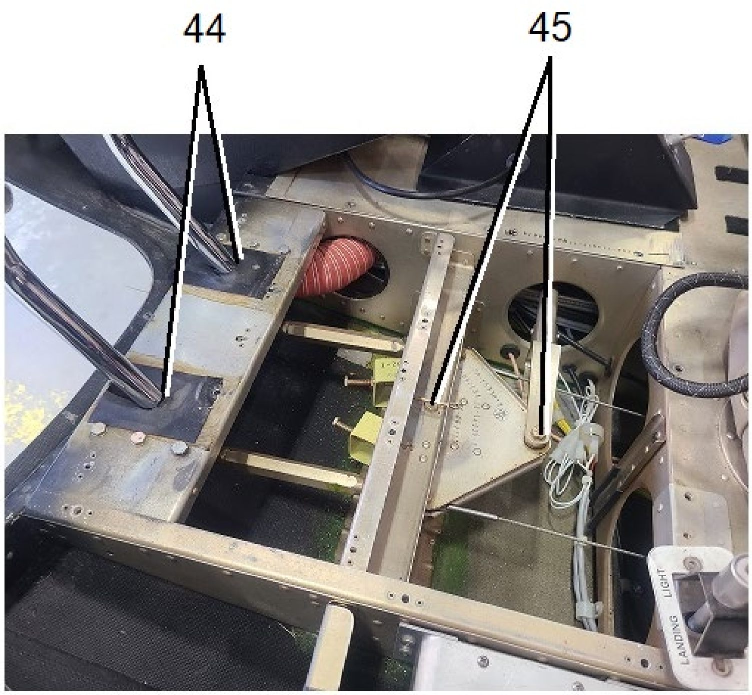
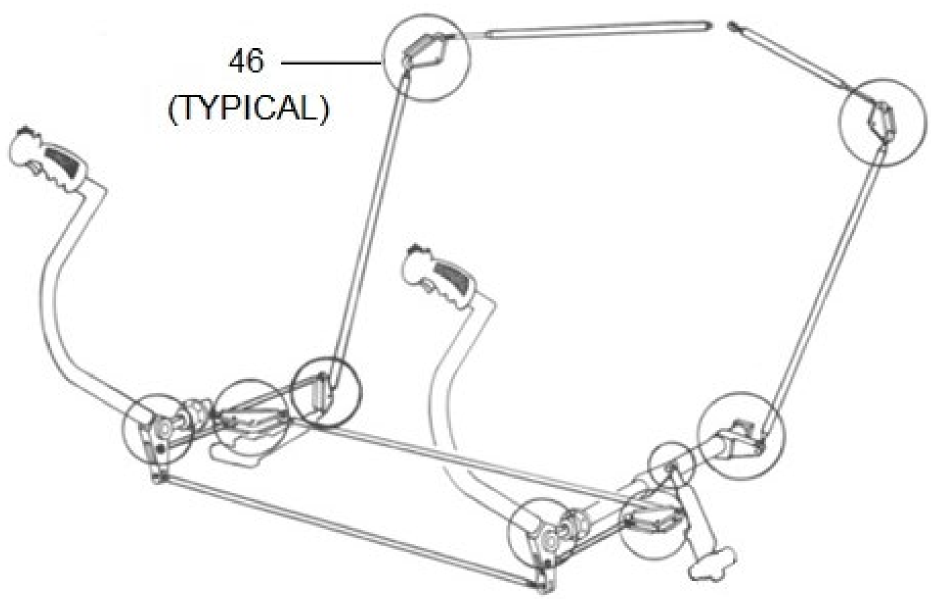
Figure 4-1. Servicing Locations



View T

44. Tail Rotor Pedals Lubricating Points (4 places)
45. Tail Rotor Control Bushings (4 places)



View U

46. Cabin Flight Control Bellcrank Pivot Bushings (16 places)

Sheet 12 of 12

Figure 4-1. Servicing Locations

4-3 FUEL SYSTEM

4-4 Servicing – Fuel System

NOTE: Refer to Figure 4-1, View A and View B.

NOTE: Refer to Table 4-1 for system capacity and approved fuels.

WARNING: IN THE EVENT OF A MAJOR SPILLAGE OF FUEL, ALL POWERED EQUIPMENT MUST BE SHUT DOWN. ALL PERSONNEL SHOULD LEAVE THE VICINITY AND BE POSITIONED TO PREVENT ANY SOURCES OF POSSIBLE IGNITION FROM ENTERING THE AREA. THE APPROPRIATE AUTHORITIES SHOULD BE NOTIFIED TO CONTAIN AND DISPERSE THE SPILL.

A. Attach fuel truck or refueling equipment ground wire to landing gear skids.

CAUTION: TAKE CARE NOT TO BEND FIBERGLASS FUEL TANKS BY NOT ALLOWING NOZZLE TO BEND FILLER NECK.

CAUTION: IF FUELING FROM DRUMS OR ANY QUESTIONABLE SOURCE OF SUPPLY, A CLEAN FUNNEL AND A SCREEN OR FILTER SHOULD BE USED TO REMOVE ANY FOREIGN MATERIALS.

B. Remove fuel cap from one of the fuel tanks and insert fuel nozzle.

NOTE: When aircraft engine is hot, service right tank first.

C. Service fuel tank as required.

D. Remove fuel nozzle and install fuel cap.

E. Remove fuel cap from opposite tank and insert fuel nozzle.

F. Service fuel tank as required.

G. Remove fuel nozzle and install fuel cap.

NOTE: Because of cross-feeding, which occurs during refueling, it may be necessary to add fuel to the first fuel tank refueled to obtain the required fuel quantity.

H. Remove ground wire.

4-5 Draining – Fuel System

WARNING: IN THE EVENT OF A MAJOR SPILLAGE OF FUEL, ALL POWERED EQUIPMENT MUST BE SHUT DOWN. ALL PERSONNEL SHOULD LEAVE THE VICINITY AND BE POSITIONED TO PREVENT ANY SOURCES OF POSSIBLE IGNITION FROM ENTERING THE AREA. THE APPROPRIATE AUTHORITIES SHOULD BE NOTIFIED TO CONTAIN AND DISPERSE THE SPILL.

A. Open filler cap on right fuel tank.

B. Remove fuel from fuel tanks using suitable pump or siphon and containers.

C. Drain remaining fuel from tanks and lines into suitable containers using tank sump drain valves and gascolator drain valve.

D. Reinstall filler cap on right fuel tank.

4-5.1 Servicing – Fuel Filter Screen

WARNING: SHUT OFF FUEL BEFORE DISASSEMBLY AND SERVICING OF THE FUEL FILTER.

A. Shut off fuel.

B. Drain residual fuel from filter (strainer).

C. Disassemble fuel filter (Para. 13-10, E, (2)).

D. Inspect fuel filter screen (Para. 13-10, E, (3), (b)).

E. Clean fuel filter assembly.

(1) Clean all filter housing parts with solvent.

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

(2) Clean interior and exterior surfaces of filter housing with solvent using a fine bristle brush.

CAUTION: DAMAGE TO THE SCREEN CAN OCCUR IF EXCESSIVE FORCE IS USED DURING CLEANING.

(3) Immerse screen in solvent (Naptha or Toluene) for approximately 10 minutes. Use a fine bristle brush to removal of debris.

(4) Dry screen thoroughly with filtered, compressed air.

F. Assemble fuel filter assembly (Para. 13-10, E, (5)).

4-6 ENGINE OIL SYSTEM

NOTE: Refer to Figure 4-1, View C and View D.

4-7 Servicing – Engine Oil System

NOTE: Refer to Table 4-1 for system capacity and approved oils.

A. Visually check oil level on dip stick.

B. Remove filler cap from fill tube.

C. Add oil as required to bring oil level to the 8 quart mark.

NOTE: Normal operating oil level is between 6 and 8 quarts.

D. Secure dip stick and filler cap.

E. If servicing after draining the engine oil system, ground run engine in accordance with applicable rotorcraft flight manual/pilots operating manual. After ground run, check oil level and service as required.

4-8 Draining – Engine Oil System

A. Place a suitable container under drain plug in bottom of engine sump.

B. Remove drain plug or open drain valve and allow oil to drain sump.

C. Reinstall drain plug and safety wire or close drain valve after draining the oil.

D. Place a suitable container under lower oil line connection of engine oil cooler.

E. Disconnect oil line from cooler and drain oil from oil cooler and line.

F. Reconnect oil line.

G. If helicopter is equipped with an auxiliary engine oil cooler, place a suitable container under oil cooler.

H. Disconnect oil line from oil cooler and drain oil from the cooler and oil line.

I. Reconnect oil line.

4-9 OVERRUNNING CLUTCH

NOTE: Refer to Figure 4-1, View G.

4-10 Servicing – Overrunning Clutch

NOTE: Refer to Table 4-1 for system capacity and approved oil. An alternate servicing procedure is described in Step F.

A. Rotate upper pulley/overrunning clutch until the service plugs in clutch are in the horizontal and vertical positions.

B. Continue to rotate upper pulley/overrunning clutch until one of the horizontal filler plugs is slightly above horizontal.

C. Remove filler plugs that are in the above horizontal and beyond vertical positions.

D. Slowly rotate upper pulley/overrunning clutch so that the open filler ports move toward the horizontal and vertical position.

E. The overrunning clutch is properly serviced when oil starts to drain from the open filler port as the port reaches the horizontal position.

F. Add oil to the overrunning clutch until oil starts to drain from the filler port in the horizontal position.

NOTE: Because of the location of the filler passage, it is possible for the filler port to be partially blocked by the clutch sprags. If the filler port is partially blocked, the clutch will take oil very slowly.

G. Alternate Method:

(1) Obtain a ¼-28 right angle Zerk fitting, unscrew the end off, and discard ball and spring.

(2) Perform Steps A and B. Install the modified Zerk fitting in the top hole.

(3) Using a suitable oil pump or syringe, push oil into the clutch until the oil runs clear from the side plug hole.

H. Reinstall filler plugs and wipe up excess oil.

4-11 MAIN ROTOR TRANSMISSION

NOTE: Refer to Figure 4-1, View E and View F.

4-12 Servicing – Main Rotor Transmission

NOTE: Refer to Table 4-1 for system capacity and approved oils.

NOTE: Check the transmission for leaking seals if servicing is required between periodic inspections.

The main transmission oil level is checked by a sight gauge located on the right aft side of the transmission. The sight gauge is visible through the top step in the step access panel on the right side of the helicopter. (On older helicopters, the sight gauge is visible through an access panel in the baggage compartment.) With the helicopter in a relatively level position, the oil level should be at or near the halfway level in the sight gauge. If oil is visible, no additional oil is required. If oil is not visible, add oil until the oil level is halfway up the sight gauge.

A. Servicing the main rotor transmission.

(1) Open cover on transmission filler port.

(2) Add oil as required.

(3) Close cover on transmission filler port.

4-13 Draining – Main Rotor Transmission

A. Remove access panel located below left side fuel tank.

B. Place a trough under chip detector/magnetic plug located by aft left side transmission mount. Use a suitable container to collect oil.

C. If equipped with a chip detector, remove chip detector from the quick disconnect receptacle.

NOTE: Tool T-0198-11 may be inserted in the base of the chip detector to drain the oil.

D. Remove quick disconnect receptacle/magnetic plug from transmission to drain the oil.

E. When transmission is drained, replace crush washer on receptacle/magnetic plug.

F. Reinstall receptacle/magnetic plug finger tight. Tighten an additional 90° and lockwire (MS20995C32) receptacle/magnetic plug.

G. If equipped with chip detector, reinstall chip detector.

4-13.1 Flushing – Main Rotor Transmission

A. Lower ground handling wheels (Para. 4-67, B).

(1) Set 1.5 inch (4 cm) wood blocks under the forward skid shoes and raise the left side ground handling wheel (Para. 4-67, C).

B. Remove left side upper access panel.

C. Drain transmission oil (Para. 4-13).

D. Remove filler cap and tube assembly.

E. Inspect transmission gears.

(1) Using a bright light source, inspect ring and pinion gear teeth for cracks, any pitting, any spalling (frosting), or hard wear lines. Turn the transmission by turning the upper pulley or the tail rotor.

F. Use a syphon sprayer with kerosene, mineral spirits, or equivalent oil-based solvent to spray the interior of the gearbox. Direct the aim of the sprayer around the inside of the gearbox and the ring gear and carrier while turning the gearbox.

(1) Use a sufficient volume of solvent to thoroughly flush out any debris.

G. Allow transmission to drain completely.

H. Loosely install magnetic drain plug or chip detector, as applicable.

I. Add 4 quarts of gear lube currently used in the gearbox (ref. Table 4-1).

J. Manually rotate main rotor hub to spin gearbox 7-10 revolutions.

K. Remove magnetic plug/chip detector and drain gearbox.

L Collect oil to inspect for contamination.

M. Repeat the flushing procedure until it drains free of contamination.

N. Inspect and clean magnetic drain plug or chip detector, if installed.

O. Install receptacle/magnetic plug finger tight. Tighten an additional 90° and lockwire (MS20995C32) receptacle/magnetic plug.

P. Install and secure the filter cap and tube assembly using a new P/N 28-13107-13 gasket.

Q. Torque the bolts to 50-70 in-lb/5.6-7.9 Nm.

R. Service the gearbox (Para. 4-12).

S. Remove blocks from under forward skids and position ground handling wheels, as desired.

T. Install left side upper access panel.

4-14 TAIL ROTOR TRANSMISSION

NOTE: Refer to Figure 4-1, View N.

4-14.1 Oil Level Check – Tail Rotor Transmission

A. Check oil level by using the sight glass located in the aft side of the tail rotor gearbox.

NOTE: The tailcone of the helicopter should be approximately level when servicing the tail rotor gearbox.

NOTE: The sight glass should be transparent and free of any bubbles for the oil level check.

(1) If the sight glass is dirty, opaque, or cloudy:

(a) Drain the oil from the gearbox.

(b) Remove and clean the sight glass.

(c) Reinstall the sight glass (torque 60 in-lb/6.8 Nm).

(d) Service the gearbox (Para. 4-15).

(2) If bubbles are present in the sight glass, raise and lower the tail to change the attitude of the helicopter to clear any bubbles from the sight glass.

(3) The minimum required oil level is when the oil fills half the sight glass.

(a) If the oil level fills half or more than half of the sight glass, the gearbox is adequately filled for operation.

(b) If the oil level fills less than half of the sight glass, proceed to Para. 4-15 to service the gearbox.

4-15 Servicing – Tail Rotor Transmission

NOTE: The tailcone of the helicopter should be approximately level when servicing the tail rotor gearbox.

NOTE: The capacity of the tail rotor gearbox is 5 US fl oz (0.15 L). It may require less than 5 US fl oz (0.15 L) to service the gearbox because the oil might not drain completely. A small amount of residual oil remaining in the gearbox is not a cause for concern.

A. Remove the filler port located directly above sight glass.

B. Add oil until the oil begins to flow from the filler port.

NOTE: The sight glass should be free of any air bubbles.

C. Install a new O-ring (MS28778-2).

D. Install the filler plug (torque 20 in-lb/2.3 Nm).

E. Lockwire (MS20995C32) the filler plug to the magnetic plug/chip detector and the sight glass.

4-16 Draining – Tail Rotor Transmission

NOTE: Draining the tail rotor gearbox is required for the 100 hour/annual inspection, gearbox flushing, and when returning the helicopter to service after a six-month or longer storage period.

A. If equipped with a chip detector, remove chip detector from the quick disconnect receptacle.

B. Place a suitable container under receptacle/magnetic plug.

C. Remove quick disconnect receptacle/magnetic plug and drain transmission.

D. When transmission is drained, replace the crush washer and reinstall the magnetic plug/chip detector.

(1) Tighten magnetic plug/chip detector until turning surfaces are in contact, then tighten an additional 135° (not to exceed 35 in-lb/4 Nm).

(2) Lockwire (MS20995C32) receptacle/magnetic plug to sight glass and filler plug after transmission has been serviced (Para. 4-15).

4-16.1 Flushing – Tail Rotor Transmission

A. Drain oil (Para. 4-16, Steps A through C only).

B. Remove filler plug, sight glass, and top visual inspection plug (if not already removed) from gearbox.

C. Inspect gears closely for cracked or missing teeth and the gearbox for damage.

D. Use a syphon sprayer with kerosene, mineral spirits, or equivalent oil-based solvent to spray down interior of gearbox and flush any debris out of gearbox.

E. Direct aim sprayer around inside of gearbox to flush the input and output bearings, while rotating gearbox.

F. Loosely install bottom drain plug, sight glass, and fill plug.

G. Add one-half quart of the gear lube that is currently used in the gearbox (Table 4-1).

H. Rotate gears at least ten times to circulate oil.

I. Place a container covered with a clean, white cloth or filter under the drain plug.

J. Remove drain plug and drain oil into container while rotating the gears.

K. Allow gearbox to drain completely.

L. Inspect cloth for contamination. If there is contamination, repeat Steps D through L using a new cloth or filter each time the gearbox is drained. Proceed to step M if there is no contamination.

M. Replace O-ring (MS28778-2) and install sight glass. Tighten to 60 in-lb/6.8 Nm.

N. Apply lubricant (MIL-PRF-2105) to the threads the chip detector.

O. Replace crush washer and install the bottom magnetic plug/chip detector. Tighten until turning surfaces contact, then tighten an additional 135° (not to exceed 35 in-lb/4 Nm).

P. Service the gearbox (Para. 4-15).

Q. Lockwire (MS20995C32) receptacle/magnetic plug to sight glass and filler plug after transmission has been serviced (Para. 4-15).

4-17 MAIN ROTOR DAMPERS

NOTE: Refer to Figure 4-1, View P.

4-18 Servicing (Bleeding) – Main Rotor Dampers

NOTE: Refer to Table 4-1 for system capacity and approved oil.

NOTE: Dampers may be serviced whether installed or removed from the aircraft.

A. Servicing the dampers with tools T-2896 (Figure 4-1, View P, right):

(1) Fill tools approximately half full with L-45 Silicone Oil.

(2) Remove reservoir plugs and replace the O-rings as required.

(3) Install tools into reservoir.

(4) Depress one plunger only until bubbles stop entering the other syringe.

(5) Cycle second syringe until plunger is almost at the bottom.

(6) Slowly cycle plungers until all air bubbles are purged from damper.

(7) Remove tool from “lower” port of reservoir and install plug.

(8) Remove tool from “upper” port of reservoir and completely fill reservoir before installing plug.

(9) Tighten and lockwire (.025) the plugs (20 in-lb/2.3 Nm).

B. Alternate method of servicing the dampers:

NOTE: Do not cycle the blades back and forth during this procedure as it will mix any air that is in the reservoirs and distribute it through the damper.

(1) **Slowly** cycle the three blades in one direction until damper piston is fully compressed.

(2) Remove all of caps from reservoirs and fill reservoirs to the top of port. Reinstall caps.

(3) **Slowly** cycle the three blades in the other direction until damper piston is fully extended.

(4) Remove all caps from the reservoirs and fill reservoirs to the top of the port. Reinstall caps.

(5) Perform this procedure three times or until reservoirs show full when caps are removed.

(6) Replace the plug O-rings as required.

(7) Install reservoir plugs and lockwire (.025).

4-19 OLEOS

NOTE: Refer to Figure 4-1, View R.

4-20 Servicing – Oleos

Check the serviceability of the oleos by rocking the aircraft to distribute the weight of the aircraft evenly. The oleos are serviceable if 0.75-1.75 in/19-51 mm of the chromed piston extends past the seal retainer. When protective boots are installed, measure from upper flange of piston assembly to the lower flange on the seal housing assembly; proper length is 8-9 in/20.3-22.9 cm.

On 280FX models with the oleo fairings installed, use the back side of the fuel quantity dip stick, P/N 28-12478-11, to determine if the oleos are properly serviced.

NOTE: If the oleos are not installed on the aircraft or the aircraft is jacked or hoisted off the ground, pressurize the forward and aft oleos to 400 psi.

NOTE: In some circumstances, individual oleo pressures may have to be adjusted to compensate for differences between individual helicopters and environmental factors.

NOTE: The oleo struts should be serviced as pairs such that either both front or both aft oleos are serviced at the same time.

NOTE: The use of nitrogen is recommended for servicing, as it has no moisture content.

A. Service oleos as follows:

(1) (280FX) Remove screws securing lower end of flex boot to oleo fairing, and lift flex boot to gain access to oleo valve.

(2) Sling or hoist helicopter.

(a) An alternative method to sling or hoisting is to use a bottle jack placed under the outboard vertical bolt that secures the end cap to the cross tube.

(4) Remove valve cap and connect servicing equipment pressure line to the oleo valve.

(5) Set nitrogen tank regulator pressure to 400 psi for the forward and aft oleos.

WARNING: OLEO MAY EXTEND WHEN VALVE IS OPENED.

(6) Slowly open oleo valve.

(7) After pressure in oleo has equalized to the regulator pressure, close oleo valve.

(8) Turn off nitrogen tank and set regulator pressure back to zero.

(9) Disconnect the service equipment and install the valve cap.

(10) (280FX) Slide landing gear fairing into position and install retaining screws.

(11) (280FX) Lower flex boot and install screws securing the flex boot to the oleo fairing.

(12) Remove helicopter from sling, as necessary.

4-21 BATTERY

NOTE: Refer to Figure 4-1, View S.

4-22 Servicing – Battery

A. Service battery in accordance with manufacturer's instructions.

4-23 LUBRICATION

4-24 Description – Lubrication

Lubrication of F-28/280 Series helicopters is normally accomplished at specified hourly intervals. Operators should take into consideration the environmental conditions and determine whether more frequent lubrication intervals are necessary.

Refer to Tables 4-1 to 4-2 and Figure 4-1 for approved lubricants, intervals, and locations.

A. Purge lubricate all bearings and remove excess grease before performing post maintenance ground run.

B. Specific bearing lubrication procedures:

(1) Lower pulley (jackstrut) bearing (Para. 4-25); Upper pulley (jackstrut) bearing (Para. 4-35); idler pulley bearings (Para. 4-41); Drive belt roller bearing (Para. 4-44.1)

(2) Main rotor blade grips (Para. 4-27); Main rotor flapping bearings (Para. 4-29)

(3) Collective guide tube bearing (Para. 4-37), Cyclic swashplate bearing (Para. 4-39)

(4) Tail rotor pitch control bearing (Para. 4-31)

C. Lubricate flight control pivot points sparingly to prevent accumulation of dirt.

D. Lubricate the following assemblies where a Teflon (DU) bearing is present using Tri-Flow or equivalent light viscosity lubricant:

(1) Walking beam to control rods in mast (Figure 12-25)

(2) Upper swashplate guide tube bushings (Figure 12-23)

(3) Lower swashplate bushings and DU washers (Figure 12-21)

(4) Collective torque tube, 5 locations

(5) Clutch capsule adapter bushing (Figure 11-19)

4-25 LOWER PULLEY (JACKSTRUT) BEARING

NOTE: Refer to Figure 4-1, View H.

4-26 Lubrication – Lower Pulley (Jackstrut) Bearing

A. Remove purge plug.

B. Purge lubricate lower pulley bearing.

C. Install purge plug.

4-27 MAIN ROTOR BLADE GRIP

NOTE: Refer to Figure 4-1, View P, and Figure 4-2.

4-28 Lubrication - Main Rotor Blade Grip

NOTE: Purge all three blade grips when lubricating the hub to prevent an "out of balance" condition.

CAUTION: DISCONNECT THE PITCH LINKS AND BEFORE ROTATING THE GRIPS. DO NOT OVER-ROTATE.

A. Disconnect pitch links and rotate grips a few degrees up and down to release pressure.

B. Remove purge screw (2) and pump grease into grease fitting (1) until grease purges through the screw hole. Install screw (2).

C. Remove purge screw (3) and pump grease into grease fitting (1) until grease purges through screw hole.

D. Pump grease into fitting (4) until grease purges through screw hole. Install screw (3).

E. Pump grease into grease fitting (4) until grease purges through seal between the end of the grip and spindle.

F. Remove purge screw (3) to relieve any internal pressure against seals. Install screw.

G. Check seal to determine that it has not been displaced.

NOTE: It is necessary to rotate the grip in the feather axis while purge lubricating the retention assembly. This will prevent damage to the seal.

CAUTION: DO NOT OVER ROTATE THE GRIP WHEN THE PITCH LINKS ARE DISCONNECTED (18° MAX).

(1) If the seal has been displaced:

(a) Remove the purge screw from the top of the blade grip.

(b) Insert the blade of a flathead screwdriver between the seal and the spindle.

(c) Carefully work the seal back into the grip.

NOTE: It is normal if grease is displaced out of the purge hole as the seal is pushed back into place.

(d) Reinstall the purge screw.

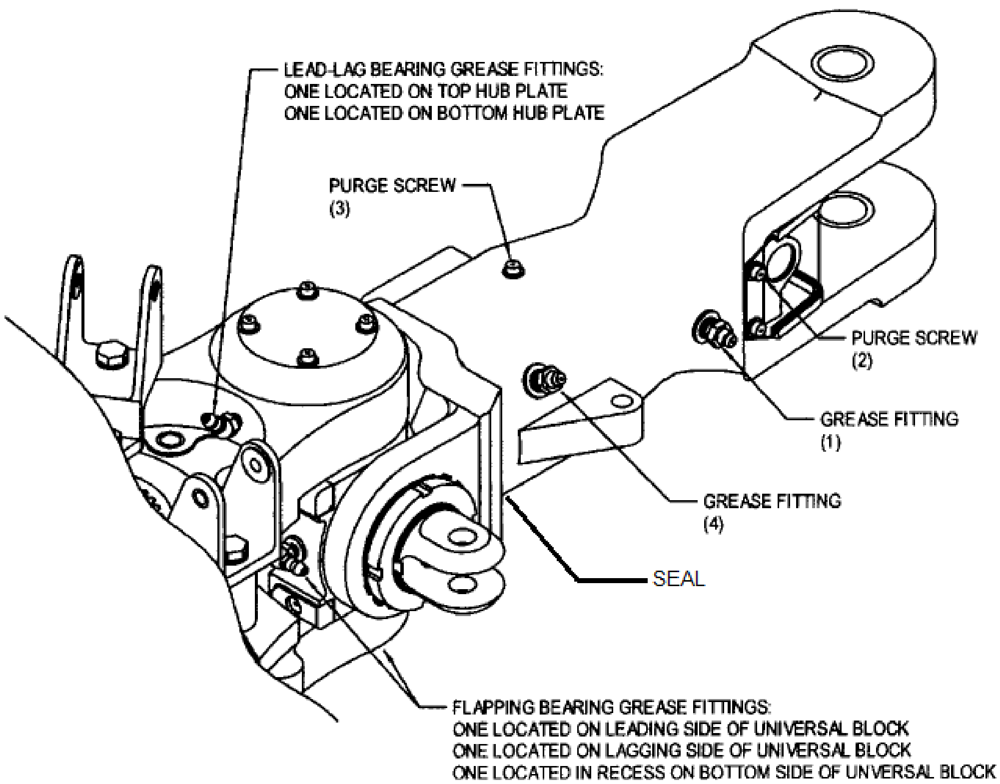


Figure 4-2. Main Rotor Blade Grip, Lead-Lag Bearing, and Flapping Bearing Lubrication

4-29 MAIN ROTOR FLAPPING BEARINGS

NOTE: Refer to Figure 4-1, View Q, and Figure 4-2.

4-30 Lubrication – Main Rotor Flapping Bearings

A. Purge lubricate main rotor flapping bearings using grease fitting located in recess of the bottom of the vertical hinge pin (Figure 4-2).

4-31 TAIL ROTOR PITCH CONTROL BEARING

NOTE: Refer to Figure 4-1, View N.

4-32 Lubrication – Tail Rotor Pitch Control Bearing

4-33 Lubrication, Preferred Method – Tail Rotor Pitch Control Bearing

NOTE: Purge the needle prior to each use and lubricate the external surface of the needle with grease to prevent seal damage.

A. Using a 6 cubic centimeter (cc) medical syringe and an 18 gauge hypodermic needle, inject .5cc of grease into bearing in two places, approximately 180° apart.

NOTE: Carefully insert the tip of the needle under the lip of the seal where it contacts the inner race of the bearing. The tip of the needle can be worked under the lip of the seal and into the bearing between the balls. If the needle does not penetrate between the balls, the needle can be withdrawn and inserted in another position on the bearing.

B. Wipe excess grease from surface of seal as necessary

4-34 Lubrication, Alternate Method – Tail Rotor Pitch Control Bearing

WARNING: USE CAUTION WHEN REMOVING THE SEAL TO PREVENT FROM INJURING YOURSELF.

A. Using a small flat-blade screwdriver or small knife blade, remove seal from inboard side of bearing.

B. Hand pack bearing with grease.

C. Install seal. Ensure it is properly seated.

4-35 UPPER PULLEY (JACKSTRUT) BEARING

NOTE: Refer to Figure 4-1, View G.

4-36 Lubrication – Upper Pulley (Jackstrut) Bearing

A. Purge lubricate bearing via grease fitting.

B. Wipe excess grease from housing as necessary.

4-37 COLLECTIVE GUIDETUBE BEARING

NOTE: Refer to Figure 4-1, View O.

4-38 Lubrication – Collective Guidetube Bearing

A. Purge lubricate bearing via grease fitting.

4-39 CYCLIC SWASHPLATE BEARING

NOTE: Refer to Figure 4-1, View O.

4-40 Lubrication – Cyclic Swashplate Bearing

A. Purge lubricate bearing via grease fitting.

4-41 IDLER PULLEY BEARINGS

NOTE: Refer to Figure 4-1, View I.

4-42 Lubrication – Idler Pulley Bearings

4-43 Lubrication, Preferred Method – Idler Pulley Bearings

NOTE: Purge the needle prior to each use and lubricate the external surface of the needle with grease to prevent seal damage.

A. Using a 6 cubic centimeter (cc) medical syringe and an 18 gauge hypodermic needle, inject .5cc of grease into the bearing in two places, approximately 180° apart.

NOTE: Carefully insert the tip of the needle under the lip of the seal where it contacts the inner race of the bearing. The tip of the needle can be worked under the lip of the seal and into the bearing between the balls. If the needle does not penetrate between the balls, the needle can be withdrawn and inserted in another position on the bearing.

B. Wipe excess grease from surface of seal as necessary.

4-44 Lubrication, Alternate Method – Idler Pulley Bearings

NOTE: The idler pulley/yoke assembly must be removed for this servicing method.

WARNING: USE CAUTION WHEN REMOVING THE SEAL TO PREVENT FROM INJURING YOURSELF.

A. Clean surface of bearing and seal before removing seal.

B. Using a small flat-blade screwdriver or small knife blade, remove seal from aft side of the aft bearing or the front side of bearing.

C. Hand pack bearing with grease.

D. Install seal. Ensure it is properly seated.

4-44.1 DRIVE BELT ROLLER ASSEMBLY

NOTE: Refer to Figure 4-2.1.

4-44.2 Lubrication – Drive Belt Roller

NOTE: When greasing the drive belt "snubber" roller, it is common for the grease to purge through the aft bearing, but not the forward bearing. The following procedure forces grease inside the shaft to purge through the front bearing.

A. Using a 3/16" nylon rope, wind rope around roller shaft between the edge of the roller and the aft actuator arm assembly so as to create a seal against the aft bearing.

B. Tie off ends of rope to the belt tension assembly yoke.

C. Proceed with greasing roller until grease purges from forward roller bearing.

D. Remove rope.

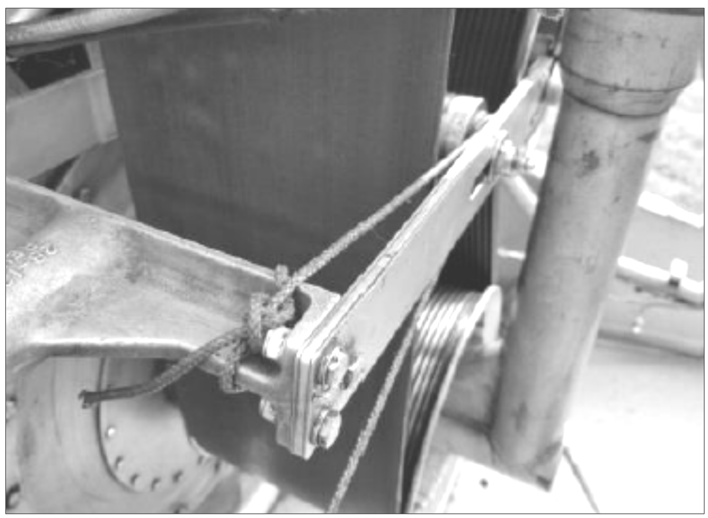


Figure 4-2.1. Roller Grease Purging Procedure

4-45 RECOMMENDED OVERHAUL CYCLES

A. Refer to Table 4-9 for components with recommended overhaul cycles established by Enstrom Helicopter Corporation and other component manufacturers.

NOTE: Refer to the latest revision of Textron-Lycoming Service Instruction No. 1009 for the recommended overhaul cycle for the HIO-360 Series engine.

NOTE: Refer to the latest revision of the *Rayjay Aircraft Turbocharger Overhaul and Test Manual* for the recommended overhaul cycle for the turbocharger.

NOTE: All other components not listed in Table 4-9 are "on condition" items.

B. Overhaul cycle components authorized for installation on the F-28F, 280F, and 280FX must use the shorter overhaul cycle for the duration of the component overhaul cycle if the component is removed from one model of aircraft and installed on a model with a different overhaul cycle.

Table 4-9. Recommended Overhaul Cycles

ITEM	PART NUMBER	OVERHAUL CYCLE (hours)
		F-28F/280F Series
Clutch, Overrunning	28-13401-2, -4	2400
Transmission, Main Rotor	28-13101 (All dash numbers) 28-13170 (All dash numbers)	1200 1200
Transmission, Tail Rotor	28-13520 (All dash numbers) 28-13525 (All dash numbers)	1200 1200

4-46 PERIODIC INSPECTIONS

4-47 General Information

A. Periodic Inspection Checklists are set forth in paragraphs 4-50 through 4-53. These inspection checklists are intended to be used in conjunction with more detailed procedures presented in other sections of this manual, optional equipment maintenance manual supplements, or vendor manuals. Special inspections are set forth in paragraph 4-54. These special inspections are required following such occurrences as a main rotor and/or tail rotor blade strike, a hard landing, or a rotor overspeed.

(1) The time extension for the periodic inspections is as follows:

(a) 50, 100, 200, and 400 hour periodic inspections – 10 hours.

(2) If the extension is used, the next scheduled inspection is due at the time applicable prior to using the extension. For example, if a 100 hour periodic inspection is due at 100 hours, but is performed at 108 hours, the next periodic 100 hour inspection is due at 200 hours not 208 hours.

(3) If the periodic inspection is performed early, the next periodic inspection is due based on when the inspection was performed. For example, if the periodic inspection was performed at 98 hours instead of 100 hours, the next periodic inspection is due at 198 hours, not 200 hours.

(4) The 10 hour extension does not apply to life limited components.

B. Mandatory component replacement times in flight hours are specified in Paragraph 3-2.

C. Recommended component overhaul cycles are specified in Paragraph 4-45.

4-48 Daily Inspection

The Enstrom F-28F, 280F, and 280FX do not require a mandatory daily (maintenance) inspection. Owner/Operators opting to have maintenance personnel check the aircraft should perform a pre-flight check I/A/W the F-28F, 280F, or 280FX Rotorcraft Flight Manual.

4-49 Periodic Inspection Checklists

A. These inspection checklists are intended for aircraft operating under normal condition. More frequent inspections may be required should adverse operations be encountered.

B. For more detailed inspection procedures and tolerance, refer to the appropriate section in the maintenance manual, optional equipment maintenance manual supplements, or vendor manuals.

C. Perform a 100 hour inspection, as a minimum, to meet the requirements for an Annual Inspection as required by 14 CFR Part 91, as applicable.

D. Refer to the Textron-Lycoming O, HO, AIO, HIO, TIO-360 Series Operator's Manual (60297-12) for the specific inspection requirements for continued airworthiness of the engine.

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4-50 50 HOUR INSPECTION GUIDE – PERIODIC INSPECTION

AIRCRAFT REGISTRATION NUMBER:		SIGNATURE:	
AIRCRAFT SERIAL NUMBER:		DATE:	
HOURS: Engine:	Flight:		

50 HOUR INSPECTION GUIDE		
INITIAL EACH ITEM AFTER ACCOMPLISHMENT	**INITIAL**	**REF**
1. GENERAL INSPECTION		
A. Inspect engine records and discrepancy sheets.	________	
B. Check engine records for time remaining TBO.	________	
C. Check for special engine inspections.	________	
D. Check compliance with applicable engine Service Letters, Service Bulletins, and Airworthiness Directives.	________	
E. Remove cowling and access panels as required to inspect the engine and drive system.	________	
2. ENGINE		
A. Inspect engine in accordance with the Textron-Lycoming O, HO, AIO, HIO, TIO-360 Series Operator's Manual (60297-12).	________	
3. FLIGHT CONTROLS		
A. Verify tail rotor pitch change horn/pitch change link installation hardware and torque (55-75 in-lb/6.2-8.5 Nm).	________	Fig. 10-3 Para. 10-1,J
B. (F-28F S/N 814 and prior, and 280F/FX S/N 2087 and prior that have tail rotor cable turnbuckles located in the engine department): Visually inspect the cable ends, turnbuckles, and hardware for evidence of corrosion.	________	Para. 10-8,A SDB 0131
4. DRIVE BELT SYSTEM		
A. Inspect the Belt Engagement (Clutch) Assembly for:		
(1) Proper extension of the piston with the clutch engaged (measurement: 1.63-1.75 in/41.1-44.5 mm).	________	Para. 11-1,A,(2),(e)
(2) Worn or loose nylon guides in the side plate slots.	________	Fig. 11-18, Item 8
(3) Wear notches in the side plate slots.	________	Table 11-7, Item 9
(4) Microswitch for proper operation at the over-center position.	________	Para. 11-1,B
(5) Bushing in the bellcrank at the pylon for looseness.	________	Fig. 11-3, Item 20
(6) Security of the clutch engagement cable.	________	Para. 11-2,B
(7) Security of all attaching hardware.	________	Para. 11-1,A
(8) Cracks in the adjacent pylon structure.	________	Fig. 11-20

50 HOUR INSPECTION GUIDE		
INITIAL EACH ITEM AFTER ACCOMPLISHMENT	**INITIAL**	**REF**
(9) Clutch capsule adapter and bushing for wear. Replace Bushing (P/N 07DU08) as required.	________	Fig. 11-19, Item 5 Table 11-8
(10) Clearance at the bottom of the spring capsule (between the anchor and the pylon).	________	Para. 11-1,A,(2),(f)
B. Inspect the Idler Pulley Assembly for:		
(1) Looseness in the idler yoke shaft rod end bearing (Fig. 11-14, Item 38).	________	Fig. 11-14, Item 38
(2) Cracks in the idler yoke end. (This only applies to P/N 28-13299-1, S/N range 14-001-16 to 14-077-06, identified in the cast surface as 14-##-06 or 14-###-06.)	________	Fig. 11-14, Item 15 Para. 11-8.1, C
(3) Cracks and security of the idler stabilizer.	________	Fig. 11-16, Item 49
(4) Evidence of idler pulley out of track.	________	Para. 11-5,A and D,(3),(a) Para. 11-8,A
(5) Worn or loose idler yoke support bushings.	________	Fig. 11-14, Item 26
(6) Proper clearance of the belt “snubber” roller (clutch engaged).	________	Para. 11-5, B,(11)
(7) Security of all hardware.	________	
C. Inspect the Drive Belt for:		
(1) Condition of sealed edge.	________	Fig. 11-8.5, Fig. 11-8.6
(2) Possible contact with adjacent structures.	________	Fig. 11-8.4
(3) Loose or protruding cord on forward and aft edges of the drive belt around the circumference of the upper and lower pulleys.	________	Para. 11-5,D, (3),(c)

4-51 100 HOUR/ANNUAL INSPECTION GUIDE – PERIODIC INSPECTION

AIRCRAFT REGISTRATION NUMBER:		SIGNATURE:	
AIRCRAFT SERIAL NUMBER:		DATE:	
HOURS:	Engine:	Flight:	
CYCLES (Start Counter):			

100 HOUR/ANNUAL INSPECTION GUIDE		
INITIAL EACH ITEM AFTER ACCOMPLISHMENT	**INITIAL**	**REF**
1. GENERAL INSPECTION		
A. Perform a complete 50 Hour Inspection.	______	
B. Inspect the aircraft records and discrepancy sheets.	______	
C. Check the aircraft and engine records for TBO and Retirement Life items.	______	
D. Check for special airframe or engine inspections.	______	
E. Check compliance with applicable Service Information Letters, Service Directive Bulletins, and Airworthiness Directives.	______	
F. Inspect the aircraft for evidence of fuel and oil leaks.	______	
G. Clean the aircraft thoroughly.	______	
H. Remove the following cowling, access panels, and components:		
(1) Wrap around cowling (top and sides)	______	
(2) Engine side panels	______	
(3) Upper side panels	______	
(4) Spark plug covers	______	
(5) Cabin doors	______	
(6) Seat deck	______	
(7) Floor panels	______	
(8) Firewall panels (cabin backwall)	______	
(9) Fuel transmitter panel (right fuel tank)	______	
2. AIRCRAFT STRUCTURE & FUSELAGE		
A. Aircraft Exterior:		
(1) Inspect the aircraft exterior for cleanliness, corrosion, and damage.	______	
(2) Inspect the cowling and access panels for worn, loose, or missing fasteners.	______	
B. Fuel System:		
(1) Inspect the fuel tanks for evidence of loose rivets, bond separation, leaks, condition of gasket in the fuel caps, and proper operation of the fuel caps.	______	

100 HOUR/ANNUAL INSPECTION GUIDE		
INITIAL EACH ITEM AFTER ACCOMPLISHMENT	**INITIAL**	**REF**
(2) Inspect the fuel supply lines for condition, leaks, and security of installation.	________	
(3) Inspect the vent and drain lines for obstructions, condition, and security of installation.	________	
(4) Inspect the drain valves and the fuel shutoff valve for leaks, condition, proper operation, and security of installation.	________	
(5) Inspect the scupper bags for looseness, tears, condition, and security of installation.	________	
(6) Inspect the fuel quantity transmitter wiring and transmitter terminals for evidence of corrosion, condition, and security of installation.	________	Para. 13-10, B,(4),(a.1)
NOTE: If maintenance is performed on the fuel quantity system, calibrate the fuel quantity transmitter.		
(7) Inspect the fuel filter assembly for cracks, evidence of corrosion, lose or damaged fittings, worn or damaged gaskets, or securing of filter retaining pin.	________	Para. 13-10, E, (3), (a)
3. COMPONENTS		
A. Components:		
(1) Inspect components installed on the aircraft for condition, damage, proper operation, and security of installation.	________	
4. ENGINE		
A. Inspect and service the engine in accordance with the Textron-Lycoming O, HO, AIO, HIO, TIO-360 Series Operator's Manual (60297-12).	________	
B. Lubrication System:		
(1) Drain the engine oil coolers and inspect the oil cooler(s) for condition, security of installation, and obstruction of airflow.	________	Para. 4-8
(2) Inspect the cooler cleanout doors for condition and security.	________	
(3) Inspect the scavenge oil pump for condition, security of installation, and leaks.	________	
(4) Inspect the oil lines for condition, chaffing, and security.	________	
(5) Service the engine oil.	________	Para. 4-7
C. Fuel System:		
(1) Inspect the fuel boost pump for condition, security of installation, operation, and leakage.	________	
(2) Inspect the engine driven fuel pump for condition, security of installation, and leakage.	________	Para. 13-10, D,(2)
(3) Inspect the main fuel filter for condition, security of installation, and leakage.	________	Para. 13-10, E,(3)
(4) Inspect and clean the main fuel filter element.	________	Para. 4-5.1
(5) Inspect the fuel lines for condition, chaffing, and security.	________	

100 HOUR/ANNUAL INSPECTION GUIDE		
INITIAL EACH ITEM AFTER ACCOMPLISHMENT	**INITIAL**	**REF**
(6) Inspect the fuel nozzle air manifolds and lines for condition and security of installation.	______	
D. Fuel Servo:		
(1) Inspect the fuel servo for condition and security of installation.	______	Para. 13-4, D,(6)
(2) Inspect the Automatic Mixture Control (AMC) blast tube for condition and security of installation.	______	
(3) Inspect the throttle and mixture controls for proper operation, condition, and security of installation. NOTE: Verify proper installation of the spring washers if adjustments were performed on the mixture adjustment rod.	______	Para. 13-4, D,(8),(a)
E. Exhaust System:		
(1) Inspect the exhaust system for evidence of leaks or cracks and proper security and installation of all clamps.	______	Para. 13-5, C, D
(2) Inspect the heat exchanger (muff heater) for evidence of leaks, cracks, condition, and security of installation.	______	
F. Turbocharger System:		Para. 13-5,C
(1) Inspect the turbocharger, oil lines, and fittings for leaks, condition, and security of installation.	______	
(2) Inspect the turbocharger support brackets for condition and security of installation.	______	
(3) Inspect the turbo inlet adaptor gasket condition, adapter flange weld condition, and condition security of installation.	______	Para. 13-5, D,(1)
(a) Verify adapter attachment screw torque (35 in-lb/4.0 Nm)		
(4) Inspect the exhaust pipe, air induction pipes, and clamps for condition and security of installation.	______	Para. 13-5, C and D
(5) Inspect the turbocharger heat shield for condition and security of installation.	______	
(6) Inspect the wastegate system for proper operation and security of installation.	______	Para. 13-3,H
(7) Inspect the wastegate control rod for proper operation of the override detent.	______	
G. Cooling System:		
(1) Inspect the fan shroud for condition, alignment, worn or missing fasteners.	______	
(2) Inspect the fan shroud seal for condition.	______	
(3) Inspect the cowling and baffling for condition and security of installation.	______	
(4) Inspect the cooling fan for condition and security of the fan blades and proper clearance at the shroud.	______	
(5) Inspect the fire curtain for condition and security of installation.	______	

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INITIAL EACH ITEM AFTER ACCOMPLISHMENT	**INITIAL**	**REF**
H. Starter:		
(1) Inspect starter for condition and security of installation.	________	
I. Alternator:		
(1) Inspect alternator for condition, evidence of overheating, and security of installation.	________	
(2) Inspect the alternator drive belt for condition and proper tension.	________	
J. Engine Mounts:		
(1) Inspect the engine mounts for condition and security of installation.	________	
K. Engine Electrical System:		
(1) Inspect the engine electrical wiring harness for chaffing, condition, proper clamping, and security of installation.	________	
(2) Inspect the electrical component panel and components for condition and security of installation.	________	
(3) Inspect the engine to pylon ground strap for condition and security of installation.	________	
L. Pylon Assembly:		
(1) Inspect the pylon in the engine area for corrosion, cracks, dents, or other damage, and condition of the protective primer/epoxy coating.	________	Para. 8-10,B
M. Air Induction System:		
(1) Inspect the filter container assembly for condition, proper operation of the bypass door, and security of installation.	________	SDB 0129
(2) Replace the filter element.	________	
(3) Inspect the flex duct and fuel servo adapter for condition and security of installation.	________	
(4) Inspect the vent line and check valve for condition and security of installation.	________	
(5) Inspect engine access panel seal for condition.	________	
N. Engine Cylinder Compression:		
(1) Inspect engine cylinders for proper compression (Refer to the latest revision of Textron-Lycoming Service Instruction No. 1191, latest revision). Cylinder 1 ____________ Cylinder 2 ____________ Cylinder 3 ____________ Cylinder 4 ____________		Textron-Lycoming SI 1191
O. Engine Access Panels:	________	
(1) Inspect the engine access panels for cracks, damage, condition of hinges, and worn or missing fasteners.	________	

100 HOUR/ANNUAL INSPECTION GUIDE		
INITIAL EACH ITEM AFTER ACCOMPLISHMENT	**INITIAL**	**REF**
5. LANDING GEAR ASSEMBLY		
A. Crosstubes:		
(1) Inspect the crosstube attachment clamps for deformation, corrosion, cracks, evidence of elongated bolt holes, and security of the attaching hardware.	_______	Para. 8-9,A, (2),(d)
(2) Inspect the crosstubes for damage, worn or missing hardware, and security of installation.	_______	Para. 8-9, A, (2),(a)
(3) Inspect the crosstubes for excessive bowing (>0.5 inch/12.7 mm) while the aircraft is hanging and not sitting on ground.	_______	Para. 8-9,A, (2),(a)
B. Landing Gear Legs and Drag Struts:		
(1) Inspect the landing gear legs and drag struts for cracks, damage, corrosion, and security of installation.	_______	Para. 8-9,A, (2),(b)
(a) Inspect the landing gear leg opposite the lower oleo fitting and adjacent to the upper portion of the bottom gusset utilizing a tapping procedure in any area that may exhibit surface blisters or roughness.	_______	Para. 8-9, A, (b)
(2) Inspect the landing gear leg fairings for condition and security of installation (280FX).	_______	Para. 8-9,E, (3)
C. Landing Gear Oleos:		
(1) Inspect the oleos for leaks, corrosion, proper servicing, and security of installation.	_______	Para. 8-9,D, (3)
(2) Inspect the oleo fairings for condition and security of installation (280FX).	_______	Para. 8-9,E, (3)
D. Skid Tubes:		
(1) Inspect the skid tubes for condition and security of installation.	_______	Para. 8-9,A, (2),(c)
(2) Inspect the skid shoes for condition and security of installation.	_______	Para. 8-9,B
(3) Inspect the non-skid tape/paint for condition.	_______	
E. Ground Handling Wheels:		
(1) Inspect the ground handling wheels and brackets for condition and security of installation.	_______	
(2) Inspect the tires for condition and proper inflation.	_______	
(3) Inspect the quick disconnect locking pins for condition.	_______	

100 HOUR/ANNUAL INSPECTION GUIDE		
INITIAL EACH ITEM AFTER ACCOMPLISHMENT	**INITIAL**	**REF**
6. DRIVE BELT SYSTEM		
A. Belt Engagement (Clutch) Assembly:		
(1) Inspect spring capsule for proper extension with belt clutch disengaged and engaged (measurement: 1.63-1.75 in/41.1-44.5 mm), worn or loose nylon guides in the side plates, condition, and security of installation.	________	Para. 11-1, A, (2),(e) Fig. 11-18, Item 8
(2) Inspect clutch capsule adapter and bushing for wear. Replace Bushing (P/N 07DU08) as required.	________	Table 11-8, Item 5
NOTE: Lube spring and capsule.		Para. 11-19, I
(3) Inspect side plates for wear in slot, condition, and security of installation.		Table 11-7, Item 9
(4) Inspect over-center microswitch for condition and proper operation.	________	Para. 11-1,B
(5) Inspect engagement bellcrank for loose or worn bushings, condition, and security of installation.	________	Fig. 11-3, Item 20
(6) Inspect clutch engagement cable for condition and security of installation.	________	
(7) Verify clearance of 0.125 in/3.2 mm between clutch lever and the spacer in the bellcrank.	________	Fig. 11-1, Detail e
B. Idler Pulley Assembly:		Para. 11-8
(1) Inspect idler pulley support bracket for worn bushings, cracks, condition, and security of installation.	________	
(2) Inspect idler pulley yoke and shaft for cracks, worn rod end bearing, rod end threads (corrosion and corrosion protection condition, condition, and security of installation). (a) Check records for compliance with SDB 0127 and type of corrosion inhibitor applied. If ACF-050, re-apply as required.	________	Fig. 11-13, Items 8, 1 Fig. 11-14, Item 38 SDB 0127
(3) Inspect idler pulley yoke straps (actuator arms) for worn bushings, cracks, condition, and security of installation.	________	Para. 11-8.2, D
(4) Inspect idler pulley for worn bearings, evidence of drive belt not tracking properly, condition, and security of installation.	________	Table 11-3, Item 3
(5) Inspect belt snubber roller for worn bearings, condition, security of installation, and proper alignment/clearance with drive belt (drive belt engaged).	________	Fig. 11-14, (31) Para. 11-1, A, (g)
(6) Inspect idler pulley pylon support strut for condition and security of installation.	________	Fig. 11-16, Item 49

100 HOUR/ANNUAL INSPECTION GUIDE		
INITIAL EACH ITEM AFTER ACCOMPLISHMENT	**INITIAL**	**REF**
C. Jackstrut and Lower Pulley Assembly:		Para. 11-4, D
(1) Inspect the jackstrut for bond separations, condition, and security of installation.	_______	Table 11-1
(2) Inspect the lower pulley for wear, excessive grease leakage, condition, and security of installation.	_______	Table 11-1
D. Upper Pulley Assembly:		
(1) Inspect the upper pulley wear, condition, and security of installation.	_______	Para. 11-7, F Table 11-2
(2) Inspect the overrunning clutch for proper servicing, leaks, condition, and security of installation. Service the overrunning clutch.	_______	Para. 4-13
(3) Inspect the pinion bearing assembly for evidence of worn or loose bearing, condition, and security of installation.	_______	
(4) Check pinion bearing nut for proper torque (250 ft-lb/339.0 Nm).	_______	
E. Drive Belt		
(1) Inspect the drive belt for cracks, fraying, missing sections, and edge condition.	_______	Para. 11-5, D
F. Pylon:		
(1) Inspect the pylon in the belt drive area for corrosion, cracks, dents, or other damage, and condition of the protective primer/epoxy coating.	_______	Fig. 11-20
7. TAIL CONE ASSEMBLY		
A. Tail Cone:		
(1) Inspect the tail cone bulkheads, longerons, stringers, doublers, and fittings for cracks, dents, and loose rivets.	_______	Para. 8-12, B
(2) Inspect the tail cone for proper installation.	_______	
(3) Inspect the static ports for obstructions, damage, and security of installation.	_______	Fig. 7-3
B. Horizontal and Vertical Stabilizers:		
(1) Inspect the horizontal and vertical stabilizers for damage, cracks, loose rivets, and security of installation. (a) F-28F S/N 743 and earlier: Remove the spar and inspect the spar mounting holes and the two inboard stabilizer mounting holes in accordance with Para. 8-14, B. Visually the attachment fittings for security, cracks, and evidence of corrosion.	_______	Para. 8-15,B Para. 8-16,B Para. 8-14,B

100 HOUR/ANNUAL INSPECTION GUIDE		
INITIAL EACH ITEM AFTER ACCOMPLISHMENT	**INITIAL**	**REF**
C. Tail Rotor Guard:		
(1) Inspect the tail rotor guard for damage, loose rivets, and security of installation.	_______	Para. 8-12.1, B
E. Tail Rotor Driveshaft:		
(1) Inspect the tail rotor driveshaft, hubs, and taper pins for damage and security of installation.	_______	Para. 10-6, D
(2) Inspect the splined couplings, P/N 28-13609-1, proper lubrication, wear, and security of installation.	_______	
(3) Inspect the flex pack couplings for damage and security of installation.	_______	Para. 10-6.1, C
(4) Inspect the pillow block assemblies for evidence of rough/worn bearings, condition of the rubber inserts, and security of installation.	_______	Para. 10-6.2, B
(5) Inspect the main rotor tachometer drive belts and tachometer drive assembly for condition and security of installation.	_______	Para. 10-6.1, C,(2)
8. TAIL ROTOR TRANSMISSION		
A. Tail Rotor Transmission:		
(1) Inspect the tail rotor transmission for seal leakage, cracked/damaged housing, condition and security of plugs/sight plugs, and security of installation.	_______	Para. 10-5, D
(2) Drain the transmission and inspect the magnetic plug/chip detector for the presence of magnetic particles.	_______	Para. 4-16 Para. 4-62, B, (3)
(3) Service the transmission.	_______	Para. 4-15
B. Tail Rotor Pitch Controls:		
(1) Inspect the tail rotor pitch controls for worn bushings at the pivot points, damage, and security of installation.	_______	Fig. 10-15, Table 10-2
(2) Inspect the slider assembly for freedom of operation and wear.	_______	
(3) Inspect the pitch control bearing for condition.	_______	Table 10-2

100 HOUR/ANNUAL INSPECTION GUIDE		
INITIAL EACH ITEM AFTER ACCOMPLISHMENT	**INITIAL**	**REF**
9. TAIL ROTOR ASSEMBLY		
A. Tail Rotor Assembly:		Para. 10-1
(1) Inspect the tail rotor blade and grip assemblies for cracks, nicks, dents, scratches, bends, fretting, bond separations, corrosion, loose tip rivets, and condition of strike tabs.	______	Table 10-1
(2) Inspect the tail rotor spindle and hub for cracks, nicks, scratches, corrosion.	______	
(3) Inspect the teeter bearings for wear or excessive end play.	______	
(4) Inspect the tail rotor blade grip bearings for excessive play or notchiness.	______	
(5) Inspect the pitch change links for condition, worn rod end bearings, proper hardware, and security of installation.	______	Para. 10-1,J
(6) Inspect tail rotor static stop and rubber bumpers for condition and security of installation.	______	
10. MAIN ROTOR TRANSMISSION		
A. Main Rotor Transmission		
(1) Inspect the main rotor transmission for seal leakage, corrosion, damage, cleanliness of sight glass, and condition of installation hardware slippage marks.	______	
(2) Inspect the main rotor mast for corrosion, nicks, scratches or other damage.	______	
(3) Drain the transmission and inspect the magnetic pickup/chip detector for metal particles.	______	Para. 4-13 Para. 4-62,A, (1)
(4) Inspect the ring and pinion gears for wear and spalling.	______	
(5) Service the transmission.	______	Para. 4-12
B. Pylon:		
(1) Inspect the pylon in the main rotor transmission area for corrosion, cracks, dents, or other damage, and condition of the protective primer/epoxy coating.	______	
11. MAIN ROTOR ASSEMBLY		
A. Main Rotor Blades:		
(1) Inspect the main rotor blades for corrosion, nicks, dents, scratches, and bonding separations and security of installation.	______	Para. 9-9
(2) Inspect the trim tabs, drag link attachment fittings, and tip rib for condition and loose rivets.	______	
(3) Inspect the blade tape, if installed, for condition and security of installation.	______	
(4) Review records for date of last CPC application. Re-apply, if required.	______	Para. 4-54,4 Para. 4-90

100 HOUR/ANNUAL INSPECTION GUIDE		
INITIAL EACH ITEM AFTER ACCOMPLISHMENT	**INITIAL**	**REF**
B. Main Rotor Retention Assemblies:		
(1) Inspect the flapping stops and pitch horn for condition and security of installation.	______	Table 9-2
(2) Inspect the blade grips and drag links for condition and security of installation.	______	
(3) Inspect the blade pins for corrosion and condition.	______	
(4) Inspect Lamiflex bearings for condition, if equipped.	______	
C. Universal Block Assemblies:		
(1) Inspect the lead/lag stops and lower nuts for condition and security of installation.	______	
D. Main Rotor Dampers:		
(1) Inspect the main rotor dampers for leaks, condition, and security of installation.	______	
(2) Inspect the damper rod end bearings for excessive radial wear (.007"/.18 mm max.), inspect for corrosion in the threads and thread corrosion protection condition.	______	Table 9-3, SDB 0127
E. Main Rotor Hub Center Section:		Table 9-1
(1) Inspect the hub center section for cracks, nicks, scratches, corrosion, and condition and security of hardware.	______	
(2) Inspect the upper and lower spline adapters for fretting.	______	
(3) Inspect the torque stripe indicators on the mast nut. If the indicators show loss of torque on the mast nut or are not installed, check the torque on the mast nut (400 ft-lb/542.3 Nm).	______	
F. Pitch Change Bellcranks:		
(1) Inspect the pitch change bellcranks for condition, excessive wear and bearing operation at pivot points, and security of installation.	______	Table 9-1
G. Pitch Change Links:		
(1) Inspect the pitch change links for excessive rod end bearing wear, condition, and security of installation.	______	
H. Upper Control Push-Pull Rods:		
(1) Inspect the push-pull rods for excessive wear in the upper fitting, looseness of fitting, and evidence of damage.	______	Para. 12-12, B
12. SWASHPLATE CONTROL SYSTEM		
A. Swashplate Assembly:		
(1) Inspect the lower swashplate assembly for condition and security of installation.	______	Para. 12-10,C
(2) Inspect the lower swashplate assembly universal joint for looseness.	______	Para. 12-10,C

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INITIAL EACH ITEM AFTER ACCOMPLISHMENT	**INITIAL**	**REF**
(3) Inspect the upper control rod end (dogleg) bearings for excessive wear and security of installation.	________	Para. 12-11,D
(4) Inspect the longitudinal and lateral control rod ends for excessive wear, corrosion, and security of installation.	________	Para. 12-12,B SDB 0096
(5) Inspect the cyclic bearing for excessive wear.	________	
B. Collective Guide Tube Assembly:		
(1) Inspect the collective guide tube assembly for condition and security of installation.	________	Table 12-2
(2) Inspect the guide tube DU washers for radial wear.	________	
(3) Inspect the collective bearing for excessive wear.	________	Para. 12-11, C, 1, d)
(4) Inspect the collective walking beam for cracks, nicks, scratches, condition, excessive wear at the pivot strap bushings, and security of installation.	________	
13. CABIN SECTION		
A. Cabin Exterior:		
(1) Inspect the cabin doors for proper operation, condition, and security of installation.	________	Para. 8-4,B Para. 8-4,H
(a) 280F Series: Verify door latch operation and inspect and adjust the door handle assembly, if required.	________	Para. 8-4, H,(2)
(2) Inspect the windshield(s), cabin windows, and door windows for cracks, crazing, and other damage.	________	Para. 8-2, A
(3) Inspect the pitot tube for obstructions, damage, and security of installation.	________	Fig. 7-3
(4) Inspect the position light assemblies for condition and security of installation (If applicable).	________	
B. Cabin Interior:		
(1) Inspect the cabin interior for corrosion, damage, and presence/legibility of required and other placards.	________	Para. 8-8,A
(2) Inspect the carpeting/upholstery and trim for condition and security of installation.	________	
(3) Inspect the seat cushions and seat deck for damage and security of installation.	________	
(4) Inspect the safety belts and shoulder harnesses for condition, proper operation, and security of attachment.	________	
(a) Verify proper orientation of belt fitting and locking spring latch.		Para. 8-7, B.1
(5) Inspect the fire extinguisher for date of the last inspection and security of installation.	________	

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INITIAL EACH ITEM AFTER ACCOMPLISHMENT	**INITIAL**	**REF**
C. Instrument Console/Panel:		
(1) Inspect the instrument console/panel and shrouds/covers for condition, security of installation, presence/legibility of required placards and other placards.	________	
(2) Inspect the instruments and other equipment for condition and security of installation.	________	
D. Seat Structure		
(1) Inspect the seat structure and bulkheads for corrosion, loose rivets, and other damage.	________	Para. 8-8, B
E. Cabin Heating System:		
(1) Inspect the heating system ducts and outlets for obstructions, condition, and security of installation.	________	
(2) Inspect the heater controls for proper operation, condition, and security of installation.	________	
14. FLIGHT CONTROLS		
A. Cyclic Flight Controls:		
(1) Inspect the cyclic flight controls for freedom of operation and proper range of travel (refer to para. 12-7, B).	________	Para. 12-7, B
(2) Inspect the cyclic sticks, control rods, and bellcranks for condition, excessively worn rod end bearings/bushings, and security of installation.	________	
(3) Inspect the upper cabin bellcrank mounts for cracks, condition, and security of installation, and freedom of movement.	________	Para. 12-7, F
(a) Verify torque (50-70 in-lb/5.6-7.9 Nm).		
(4) Inspect the trim motor assemblies and bias springs for condition and security of installation.	________	
B. Collective Flight Controls:		
(1) Inspect the collective flight controls for freedom of operation and proper range of travel (collective contacts up stop and down stop).	________	
(2) Inspect the collective friction for proper operation, condition, and security of installation.	________	Para. 12-10, C, 1, c)
(3) Inspect the collective sticks, torque tube assembly, control rods and bellcranks for excessively worn rod end bearings/bushings, and security of installation.	________	
(4) Inspect the collective spring capsule assembly for proper operation, condition and security of installation.	________	

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INITIAL EACH ITEM AFTER ACCOMPLISHMENT	**INITIAL**	**REF**
(5) Inspect the correlator system for proper operation, condition, and security of installation.	________	
C. Tail Rotor Controls:		
(1) Inspect the tail rotor control cables, cable ends, turnbuckles, and hardware for wear, corrosion, proper operation, proper cable tension, correct range of travel, and security of installation (refer to para. 10-8, A).	________	Para. 10-8,A
(a) Inspect the cable ends for PVC tape and remove if present.		
(2) Inspect the pulleys and fairleads for wear, proper operation, and security of installation.	________	Para. 10-8, A, (5)
(3) Inspect the pedal assemblies, control rods, and bellcranks for excessively worn rod end bearings/bushings, condition, and security of installation.	________	Para. 10-7, A, (3), 12-7
(a) Apply a corrosion inhibitor (ACF-50, or equivalent) to unpainted pivot areas of the removable foot pedal assembly.	________	
(4) Inspect the tail rotor pitch change horn/pitch change link assembly for condition and security of installation.	________	SDB 0125
15. BATTERY AREA		
A. Battery		
(1) Inspect the battery as required in accordance with the manufacturer's instructions.	________	Table 2-2
B. Battery Tray (Forward or Aft Installation):		
(1) Inspect the battery tray, hold down hardware, and surrounding area for evidence of electrolyte leakage and other damage.	________	
(2) Inspect the battery cables and other electrical components/wiring in the area for corrosion, condition, and security of installation.	________	
(3) Inspect the battery vent lines for obstructions, condition, and security of installation.	________	
16. ELECTRICAL SYSTEMS		
A. Inspect the wiring harness and terminal strips for condition and security of installation.	________	
B. Inspect the external power system for proper operation, condition and security of installation.	________	
C. Inspect the cockpit/instrument lighting for proper operation, condition, and security of installation.	________	
D. Inspect the landing, anti-collision, and position light systems for proper operation, condition, and security of installation.	________	
E. Inspect the caution and warning systems for proper operation, condition, and security of installation.	________	

100 HOUR/ANNUAL INSPECTION GUIDE		
INITIAL EACH ITEM AFTER ACCOMPLISHMENT	**INITIAL**	**REF**
F. Inspect the cyclic trim system for proper operation, condition, and security of installation.	________	Para. 12-9
G. Inspect the fuel boost pump for proper operation.	________	
H. Cycle all switches and circuit breakers and inspect for proper operation, condition, and security of installation.	________	
I. Inspect all other electrical equipment not specifically covered by this checklist for proper operation, condition, and security of installation.	________	
16.1 OPTIONAL EQUIPMENT WITH MAINTENANCE MANUAL SUPPLEMENTS		
A. Avionic Systems:		
(1) Inspect the applicable Avionic System(s) I/A/W Maintenance Manual Supplement 1	________	Maintenance Manual Supplement 1

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INITIAL EACH ITEM ACCOMPLISHMENT	**INITIAL**	**REF**
18. POST INSPECTION		
A. Lubrication and Servicing:		Para. 13-11
(1) Ensure all required items have been lubricated and serviced per the maintenance manual lubrication and servicing charts.	_______	
B. Correct all discrepancies and install all cowling, access panels, doors, and other items removed for this inspection.	_______	Para. 8-1, D, (19)
C. Operation Check:		
(1) Engine Run-Up:		
Check engine/post flight requirements in the Textron-Lycoming O, HO, AIO, HIO, TIO-360 Series Operator's Manual. Run the aircraft I/A/W the Enstrom F-28F, 280F, or 280FX Rotorcraft Flight Manual. Check the engine instruments, fuel quantity and flow systems for proper operation.	_______	
(2) Flight Control Check:		
Whenever disassembly of the flight controls, especially the removal of the main rotor hub, has been accomplished, it is recommended that a test flight be performed. See the Enstrom F-28F/280F Series Maintenance Manual for full details.	_______	Para. 8-1, D, (18)
WARNING **Test flight to be performed by authorized personnel only.**		
(3) Avionics and Flight Instruments: Check operation.	_______	
D. Post Operation Check:		
(1) Inspect the engine compartment for oil and fuel leaks.	_______	Para. 13-2, D, (1)
E. Enter the inspection compliance in the airframe and engine logbooks as applicable.	_______	
F. Perform a maintenance test flight.		
WARNING **Test flight to be performed by authorized personnel only.**	_______	

4-52 200 HOUR INSPECTION GUIDE – PERIODIC INSPECTION

AIRCRAFT REGISTRATION NUMBER:		SIGNATURE:	
AIRCRAFT SERIAL NUMBER:		DATE:	
HOURS: Engine:	Flight:		

200 HOUR INSPECTION GUIDE INITIAL EACH ITEM AFTER ACCOMPLISHMENT	INITIAL	REF
1. GENERAL INSPECTION		
A. Perform a complete 100 Hour/Annual Inspection.	________	
2. MAIN ROTOR ASSEMBLY		
A. Inspect the main rotor retention assemblies for:		
(1) Evidence of ratcheting or binding in the feathering bearings.	________	
(2) Remove the retention assembly dust cover:		Fig. 9-4,(18)
(a) Inspect the T-T strap retention block (lug) and pin assembly for condition and security.	________	Fig. 9-4.1 (8)
(b) Evidence of seal leakage.	________	
(3) Evidence of a sheared roll pin at the hinge pin.	________	Fig. 9-3,(7)
(4) Evidence of ratcheting or binding of the flapping bearings.	________	Fig. 9-2,(22)
(5) Proper security of the hinge pin locking tang washer.	________	Fig. 9-3,(4)

4-53 400 HOUR INSPECTION GUIDE – PERIODIC INSPECTION

AIRCRAFT REGISTRATION NUMBER:		SIGNATURE:	
AIRCRAFT SERIAL NUMBER:		DATE:	
HOURS: Engine:	Flight:		

400 HOUR INSPECTION GUIDE		
INITIAL EACH ITEM AFTER ACCOMPLISHMENT	**INITIAL**	**REF**
1. GENERAL INSPECTION		
A. Perform a complete 100 Hour/Annual Inspection.	________	
2. ENGINE		
A. Inspect the engine in accordance with the Textron-Lycoming O, HO, AIO, HIO, TIO-360 Series Operator's Manual (60297-12).	________	

4-54 SPECIAL SCHEDULED INSPECTION GUIDE – PERIODIC INSPECTION

AIRCRAFT REGISTRATION NUMBER:		SIGNATURE:	
AIRCRAFT SERIAL NUMBER:		DATE:	
HOURS: Engine:	Flight:		

SPECIAL SCHEDULED INSPECTION GUIDE		
INITIAL EACH ITEM AFTER ACCOMPLISHMENT	**INITIAL**	**REF**
1. MAIN ROTOR TRANSMISSION		
A. Retorque the aft pinion nut 20-25 hours after installation.	________	Para. 11-7, H, (4)
2. PYLON ASSEMBLY		
A. Inspect the pylon I/A/W SIL 0173 every 10 hours time in service for aircraft used for agricultural or external load operations during that time period.	________	SIL 0173
3. HORIZONTAL STABILIZER		
A. For aircraft F-28F S/N 744 and subsequent and all 280FX, remove and disassemble the horizontal stabilizers and spar at the first 1200 hours of service and every 1200 hours of service thereafter for the inspection of the following:		Section 8, Para. 8-14, Para. 8-16
NOTE: Refer to Section 8, Paragraph 8-16 for complete disassembly, assembly, and inspection criteria. For models manufactured before 1986, refer to Section 8, Paragraph 8-14		
(1) Visually inspect all components for damage, cracks, loose rivets, and security of installation.	________	Tables 8-2 through 8-4
(2) Fluorescent inspect (Zyglo) or visually inspect with a 10 power glass the spar fitting, attachment rivets, bulkhead and vertical endplate attachments.	________	Tables 8-2 through 8-4
(3) Magnetic particle inspect the horizontal stabilizer steel spar.	________	Tables 8-2 through 8-4
4. MAIN ROTOR BLADES		
A. Remove the main rotor blades and reapply corrosion prevention compound (CPC) a minimum of once every two years.	________	Para. 4-90
NOTE: Shorter intervals may apply to aircraft operating in moderate and severe corrosion environments, as identified by SIL 0169.		

4-55 SPECIAL INSTRUCTIONS

4-56 General Information – Special Instructions

NOTE: Refer to the applicable Textron-Lycoming Technical Publications for special inspections applicable to the engine.

A. This section contains guidelines for performing the required inspections, by qualified maintenance personnel, after experiencing any of the following occurrences: main rotor blade and/or tail rotor strikes, hard landing, main rotor overspeed, chip indications on the main rotor or tail rotor transmission, engine overboost, and engine overspeed. It should be emphasized that other parts and/or adjacent components not listed may also be damaged, depending on the severity of the incident. Therefore, this guide should not be considered absolute and should be expanded as required by the inspecting maintenance personnel, as the occurrence may require, per the appropriate sections of this manual.

B. All aluminum and steel components must be inspected by the following processes after visual inspection has revealed a possible defect or as noted in the special inspections:

(1) Aluminum machined or cast components are to be inspected by liquid penetrant inspection (ASTM E165 or equivalent).

(2) Aluminum sheet metal components are to be inspected by liquid penetrant inspection (ASTM E165 or equivalent).

(3) Steel components are to be inspected by magnetic particle inspection (ASTM E1444 or equivalent).

C. All parts and components that may be affected by the specific occurrence are to be given a complete inspection for possible damage.

4-57 Main Rotor Blade Strike/Sudden Stoppage (Minor) – Special Instruction

NOTE: The following inspections are mandatory.

A. Blade damage does not exceed damage as defined in paragraph 9-9, and shows no visible kinks, ripples in the skin or the trailing edge. Perform the following:

(1) Repair the blade I/A/W paragraph 9-10.

(2) Refer to the latest revision of Textron-Lycoming Service Bulletin 533 for the recommended engine inspection.

B. Blade damage exceeds limits of paragraph 9-9, but has not contacted the airframe or other rigid object and shows no visible kinks, ripples in the skin or trailing edge. Perform the following:

(1) Replace the blade(s).

(2) Refer to the latest revision of Textron-Lycoming Service Bulletin 533 for the recommended engine inspection.

(3) Check the main rotor shaft run out. Maximum allowed is .012 inches/.305 mm FIM.

(4) Inspect the tail rotor driveshaft taper pins and taper pin holes (Para. 10-6, H) and flex packs (Para. 10-6, C).

NOTE: If the main rotor shaft run out, taper pins, or flex packs do not meet inspection requirements, proceed to paragraph 4-58.

4-58 Main Rotor Blade Strike/Sudden Stoppage (Major) – Special Instruction

A. Obvious blade damage exceeding the limits of paragraph 9-9. Perform the following:

(1) Replace the damaged blade(s) and inspect the remaining blade(s).

(2) Remove the main rotor transmission including the upper pulley and tail rotor drive shaft hub and return to Enstrom Helicopter Corporation for inspection and overhaul/replacement.

(3) Remove the main rotor hub and inspect by liquid penetrant method (ASTM E165 or equivalent) and in accordance with the inspection tables in Para. 9-1, D, or return to Enstrom Helicopter Corporation for inspection and overhaul/replacement.

(4) Inspect all flight control push-pull rods and torque tubes for sheared/damaged rivets at the fittings, damaged rod ends, or sheared/damaged roll pins.

(5) Inspect all flight control bellcranks for buckling and elongated bolt holes.

(6) Inspect the lower swashplate for warped or cracked casting and for bent or damaged guidetubes in the upper swashplate. Inspect the tie rod and universal rod for straightness. Inspect the bolt holes for elongation.

(7) Replace all tail rotor driveshaft taper pins.

(8) Inspect the tail rotor driveshaft for damage at the taper pin holes.

(9) Magnetic particle inspect (ASTM E1444 or equivalent) the tail rotor driveshaft.

(10) Inspect the pylon structure at the gearbox mounting areas for broken or bent tubes. Check the trueness of the four gearbox attachment points.

(11) Inspect all components of the drive system.

(12) Refer to the latest revision of Textron-Lycoming Service Bulletin 533 for the recommended engine inspection.

4-59 Tail Rotor Blade Strike/Sudden Stoppage – Special Instruction

A. Strike tab missing but no physical damage to the tail rotor blade(s).

(1) Inspect the tail rotor driveshaft for damage at the forward and aft coupling taper pin locations.

(2) Inspect the taper pins, flex packs, and drive shaft hubs at the forward and aft coupling locations (Para. 10-6, C).

(3) Check the runout (TIR) of the output shaft (Para. 10-5, H).

(4) If no damage is found, make a log book entry and notify Enstrom Helicopter Corporation to order replacement strike tabs.

(5) If damage is found, proceed to the following paragraph.

B. Obvious physical damage to the tail rotor blade. Perform the following:

(1) Remove the tail rotor transmission with the tail rotor pitch controls, the input drive hub, and the tail rotor assembly.

(a) Remove the tail rotor pitch controls and inspect in accordance with the inspection tables in Para. 10-4, C.

(b) Return the tail rotor transmission to Enstrom Helicopter Corporation for inspection and overhaul/replacement.

(c) Inspect the tail rotor assembly in accordance with Table 10-1.

(2) Replace all tail rotor driveshaft taper pins.

(3) Inspect the tail rotor driveshaft for damage at the forward and aft taper pin holes.

(4) Inspect the taper pin hole in the main rotor transmission pinion for complete or partial failure. If damage is found, return the main rotor transmission to Enstrom Helicopter Corporation for overhaul/replacement.

(5) Inspect all coupling hubs and the pinion shaft by liquid penetrant method (ASTM E165 or equivalent).

(6) Magnetic particle (ASTM E1444 or equivalent) inspect the tail rotor driveshaft.

(7) Inspect the hangar bearing housings and attachments.

(8) Inspect the tail rotor control cables and pulley attachments.

(9) Inspect the tail rotor pedal push-pull rods and bellcranks.

4-60 Hard Landing – Special Instruction

A. In the event of a hard landing which may or may not be associated with a main or tail rotor strike, perform the following:

(1) Inspect the forward and aft crosstube for bends or bowing. Replace the crosstube if bent or bow is greater than 0.5 inches/13 mm. It will be necessary to hoist the aircraft or remove the crosstubes to obtain a measurement.

(2) Inspect the forward and aft crosstube attachment clamps for damage and cracks. Inspect all fittings and bolt holes for elongation.

(a) Perform NDT inspection in the event of a moderate or severe hard landing.

NOTE: Moderate: A moderate hard landing shows deformation of the cross tubes up to but not beyond limits (0.5 inches/13 mm) or damage to the other landing gear components or rotables.

Severe: A severe hard landing shows obvious damage to the landing gear components, cross tube deformation beyond limits (0.5 inches/ 13 mm), and/or rotable damage. Physical injury to the pilot or the passengers is possible.

NOTE: Met-L-Chek Dye Penetrant Kit, Magnaflux Spotcheck Kit, or equivalent NDT method are acceptable.

1 Remove the cross tube assemblies.

2 Remove clamps from the cross tubes.

3 Remove the paint from the clamps and inspect for cracks using dye penetrant method or magnetic particle inspection. Follow the manufacturer's instructions.

a Positive indication – Reject the clamp and replace with an airworthy clamp.

b Negative indication – Clamp may be returned to service.

4 Apply epoxy primer (MIL-PRF-23377) to any bare metal surfaces of the clamp.

5 If removed from the cross tube, reinstall the clamps. Leave the pylon clamp attachment hardware loose until after the cross tube is attached to the pylon.

NOTE: Cross tubes with bows up to 0.5 inches/13 mm are serviceable and may be flipped over and reinstalled.

6 Reinstall the cross tubes assemblies. Torque all hardware.

a Center strut attachment, 60 in-lb/6.8 Nm (Figure 8-7, Detail C)

b Oleo assembly attachment, torque in accordance with Para. 8-9, D, (5).

(3) Inspect the landing gear leg assemblies for distortion or deformation. Inspect all fittings and bolt holes for elongation. Inspect all welds and gussets for cracks.

(4) Inspect the skid tubes for damage and straightness. Inspect all hardware attachment holes for elongation or tears.

(5) Inspect the oleos for damage, freedom of movement, and leakage.

(6) Inspect the tailcone to pylon, main rotor transmission to pylon, engine to pylon, crosstube to pylon, and cabin to pylon attachment points for deformation or hardware failures.

(7) Inspect the keel structure edges, beams, lightening holes, and intercostals for buckling or deformation. Closely inspect the keel structures for interference or contact with flight control mechanisms.

(8) Check the main rotor shaft run out. Maximum allowed is 0.012 inch/0.305 mm FIM.

(9) Check the main rotor transmission mount bolt torque. If torque is lost, replace the hardware or remove and magnetic particle inspect the hardware.

(10) Inspect the main rotor transmission mount lugs with liquid penetrant method.

(11) Refer to the latest revision of Textron-Lycoming Service Bulletin 533B for the recommended engine inspection.

4-61 Main Rotor Overspeed – Special Instruction

A. Overspeeds from 385-405 rpm for 5 seconds or less. No inspection required.

NOTE: If any damage is found, remove the main rotor hub and return to Enstrom Helicopter Corporation for inspection and overhaul/replacement.

B. Overspeeds from 385-405 rpm for more than 5 seconds or overspeeds from 406-420 rpm. Perform the following:

(1) Remove the main rotor blades and inspect flapping axis for proper drag, notchiness, and freedom of movement.

(2) Inspect the main rotor blade retention for any deformation.

(3) Retention assembly:

(a) If equipped with lamiflex bearings, inspect the lamiflex bearings for deformation, proper thickness, delamination or extruded brass. Inspect the nylatron strap for any damage or unusual wear.

(b) If equipped with tension-torsion (TT) straps, inspect the TT straps and pins (grip assembly) in accordance with Table 9-2.1.

(4) Inspect the main rotor spindles for pulled or distorted threads.

C. Overspeeds exceeding 420 rpm. Perform the following:

(1) Remove the main rotor hub and inspect by liquid penetrant inspection and in accordance with the inspection tables in Para. 9-1, D, or return to Enstrom Helicopter Corporation for inspection and overhaul/replacement.

4-62 Main Rotor or Tail Rotor Transmission Chip Indication – Special Instruction

NOTE: New or recently overhauled transmissions will often make a magnetic "fuzz" which will collect on the magnetic plug as gray sludge. This is normal and may be cleaned off the plug. The plug may then be reinstalled and the helicopter returned to service. If any main rotor transmission chips are found which are larger than 0.0625 inch/1.59 mm in cross-section or if any tail rotor transmission chips are found which are larger than 0.035 inch/0.9 mm in cross-section, contact Enstrom Customer Service Department and discontinue use until further instructions are received from Enstrom Customer Service Department.

A. Main rotor transmission chip indication. Perform the following:

(1) Inspect the chip detector for accumulation of metal particles as follows:

(a) Main rotor transmission metal particles, flakes, or slivers exceeding 0.0625 inch/1.59 mm: Contact Enstrom Customer Service Department and discontinue use until further instructions are received from Enstrom Customer Service Department.

NOTE: Sludge normally will not cause a chip indication by itself. There is normally a small particle, flake, or sliver on the detector also.

(b) Sludge (a mixture of oil and fine metal particles resulting from normal gear operation): Clean the detector and return the transmission to service.

(2) If the indication was caused by sludge or a particle, flake, or sliver not exceeding the maximum size, return the transmission to service and annotate the chip indication and results in the aircraft maintenance records.

B. Tail rotor transmission chip indication. Perform the following:

(1) Remove the tail rotor assembly and remove the flex pack.

(2) Turn the gearbox by hand using the output shaft.

(3) Inspect the chip detector for accumulation of metal particles as follows:

(a) Tail rotor transmission metal particles, flakes, or slivers exceeding .035 inch/.9mm: Contact Enstrom Customer Service Department and discontinue use until further instructions are received from Enstrom Customer Service Department.

NOTE: Sludge normally will not cause a chip indication by itself. There is normally a small particle, flake, or sliver on the detector also.

(b) Sludge (a mixture of oil and fine metal particles resulting from normal gear operation): Clean the detector and return the transmission to service.

C. Three main rotor or two tail rotor transmission chip indications occur within 10 flying hours. Perform the following:

NOTE: Check the aircraft inspection records for any annotations about the condition of the main rotor transmission ring and pinion gears or the tail rotor transmission input and output gears.

(1) Drain the oil from the transmission and inspect the ring and pinion gears (main rotor transmission) or the input and output gears (tail rotor transmission) for cracks, excessive pitting, excessive spalling, or "hard wear" lines.

(2) Remove the tail rotor assembly from the tail rotor transmission output shaft and the aft tail rotor drive shaft flex plate assembly. Turn the tail rotor transmission output shaft by hand. If indications of a rough bearing are felt, the transmission must be replaced.

NOTE: If the gearbox is to be returned to Enstrom Service, do not clean the metal from the chip detector.

(3) If none of the above conditions are found, flush and service the transmission (main rotor, Para. 4-13.1; tail rotor, Para. 4-16.1) and return to service. If two chip indications occur within the next 10 flying hours, repeat the flush and servicing procedure. If two additional indications occur within the next 10 flying hours, contact Enstrom Helicopter Corporation for further instructions.

4-63 Engine Overboost – Special Instruction

A. Inspect the engine in accordance with the latest revision of Textron-Lycoming Service Bulletin 592.

4-64 Engine Overspeed – Special Instruction

A. Inspect the engine in accordance with the latest revision of Textron-Lycoming Service Bulletin 369.

NOTE: Perform the appropriate main rotor overspeed inspection if required.

4-65 MAINTENANCE GROUND RUN

A. General

(1) Perform a maintenance ground run after conducting a periodic inspection or maintenance action that will require operation of the aircraft to verify satisfactory performance of the aircraft.

(2) The periodic inspection or maintenance action will determine the extent of the post maintenance ground run.

B. Flight controls

NOTE: The following checks are performed before starting the engine.

(1) Position lateral and fore/aft trim motors to the neutral position.

(2) Move the cyclic stick around the cyclic stop in the floor. The stick must remain against the stop through the circle. If binding or interference is detected, re-check the basic rigging.

(3) Move the fore/aft trim to full forward position and move the cyclic stick full aft. Stick should contact the cyclic stop. Reverse the trim motor and stick positions and check that stick contacts the cyclic stop.

(4) Repeat step (3) using the lateral trim motor and moving the stick in the lateral direction.

C. Inspect engine operation for (1500 rpm idle):

(1) Oil pressure

(2) Alternator

(3) Engine compartment for oil or fuel leakage

(4) Magnetos for:

(a) Left

(b) Right

(c) Off

(5) Mixture control for idle cut-off operation.

D. Inspect rotor engagement for (1500 rpm idle):

(1) Smoothness of operation and positive over-center position (light)

(2) Proper clutch handle stowage

(3) Track of belt on idler roller

E. Inspect the following instruments for “green” operation:

(1) Oil pressure

(2) Oil temperature

(3) Cylinder head temperature

(4) Main gearbox temperature

(5) Tach needles married

F. Inspect ground run for (3050 rpm):

(1) Manifold pressure (17.5” to 19”)

(2) Operation of one way clutch

(3) Rotor blades for out of track

(4) Magneto check (left – right)

(5) Proper operation of all instruments

(6) Proper operation of “press-to-test” lights

(7) Proper operation of all avionics

G. Post Ground Run:

(1) Shut the aircraft down I/A/W the Rotorcraft Flight Manual.

(2) Record any discrepancies found during the ground run and notify maintenance personnel for corrective action.

4-66 GROUND HANDLING

4-67 Ground Handling Wheels

A. Each skid tube is equipped with a manually operated ground handling wheel assembly. The ground handling wheels shall be in the raised position for flight or ground operations with the engine running and the rotor systems turning. The wheels should also be in the raised position when the aircraft is parked.

CAUTION: PUSHING ON THE NOSE OF THE HELICOPTER MAY CAUSE THE CABIN NOSE TO DEFORM THEREBY WEAKENING THE CABIN STRUCTURE AND CAUSING EXTENSIVE REPAIR. USE CAUTION WHEN PUSHING ON THE NOSE TO MOVE THE AIRCRAFT BACKWARDS.

B. Use the following procedure to lower the ground handling wheels:

(1) Support the aircraft at the tail rotor guard.

WARNING: ENSURE THE WHEEL BAR HANDLE IS COMPLETELY INSTALLED ONTO THE GROUND HANDLING WHEEL LUG. DO NOT LET GO OF THE WHEEL BAR HANDLE WHILE LOWERING OR RAISING THE GROUND HANDLING WHEELS.

(2) Insert the wheel bar handle onto the lug on the ground handling wheel with the handle towards the aft end of the aircraft.

(3) Remove lock pin from the ground handling wheel.

(4) With a steady motion, rotate wheel bar handle 180° towards the front of the aircraft and install lock pin when holes line up.

(5) Remove the wheel bar handle from the ground handling wheel lug.

C. Use the following procedure to raise the ground handling wheels:

(1) Support the aircraft at the tail rotor guard.

WARNING: ENSURE THE WHEEL BAR HANDLE IS COMPLETELY INSTALLED ONTO THE GROUND HANDLING WHEEL LUG. DO NOT LET GO OF THE WHEEL BAR HANDLE WHILE LOWERING OR RAISING THE GROUND HANDLING WHEELS.

(2) Insert the wheel bar handle onto the lug on the ground handling wheel with the handle towards the front end of the aircraft.

(3) Remove lock pin from the ground handling wheel.

(4) With a steady motion, rotate wheel bar handle 180° towards the aft end of the aircraft and install lock pin when holes line up.

(5) Remove the wheel bar handle from the ground handling wheel lug.

4-68 EXTERNAL POWER

CAUTION: ENSURE THE EXTERNAL POWER SOURCE VOLTAGE RATING (14 VOLTS OR 28 VOLTS) MATCHES THE HELICOPTER ELECTRICAL SYSTEM BEFORE APPLYING EXTERNAL POWER.

A. Turn the helicopter MASTER and ALTERNATOR switches OFF.

B. Turn the external power source OFF.

C. Plug the external power source cable securely into the external power receptacle.

D. Turn the external power source ON.

E. Turn the helicopter MASTER switch ON.

4-69 PARKING

A. Raise the ground handling wheels allowing the helicopter to rest on its skids.

B. Install the main rotor tie down.

C. Install static ground.

D. Install the main rotor hub cover.

E. Install the tail rotor gearbox and hub cover.

4-70 LEVELING

WARNING: DO NOT CLIMB ON OR ENTER THE AIRCRAFT WHILE IT IS BEING LEVELED.

NOTE: The tail of the aircraft may have to be supported to maintain the aircraft in a level attitude.

A. Level the aircraft longitudinally by placing a level on the leveling location on the longitudinal pylon tube located on the left side of the pylon assembly. Adjust the attitude of the aircraft by using the ground handling wheels and/or shoring materials and by raising or lowering the tail of the aircraft. Level the aircraft laterally by placing the level on the cockpit floor and adjust the shoring materials under the skid tubes as required.

4-71 HOISTING

NOTE: Refer to Fig. 4-3.

A. If the main rotor hub is installed, install the lifting sling (T-0011) so that the arms are between the pitch arm and the blade retention assembly, over the lead/lag retaining nut, and outboard of the main rotor damper rod-end. The sling arms are long enough to be double rapped if preferred.

B. If the main rotor hub is removed, install the lifting eye (T-0017) onto the main rotor mast.

WARNING: THE LIFTING DEVICE MUST HAVE A LIFTING RATING EQUAL TO OR GREATER THAN THE ACTUAL WEIGHT OF THE AIRCRAFT TO BE HOISTED.

C. Connect a suitable lifting device to the lifting sling or eye.

D. Station a person at the tail rotor guard to steady the aircraft when hoisted. If lifting beyond reach from the ground, two people and two steadying ropes will be necessary.

E. Slowly hoist the aircraft using a steady lifting force.

4-72 CLEANING

4-73 Exterior – Cleaning

NOTE: The exterior of the aircraft is painted with a high quality paint. Proper maintenance of this finish will provide corrosion protection as well as an attractive finish.

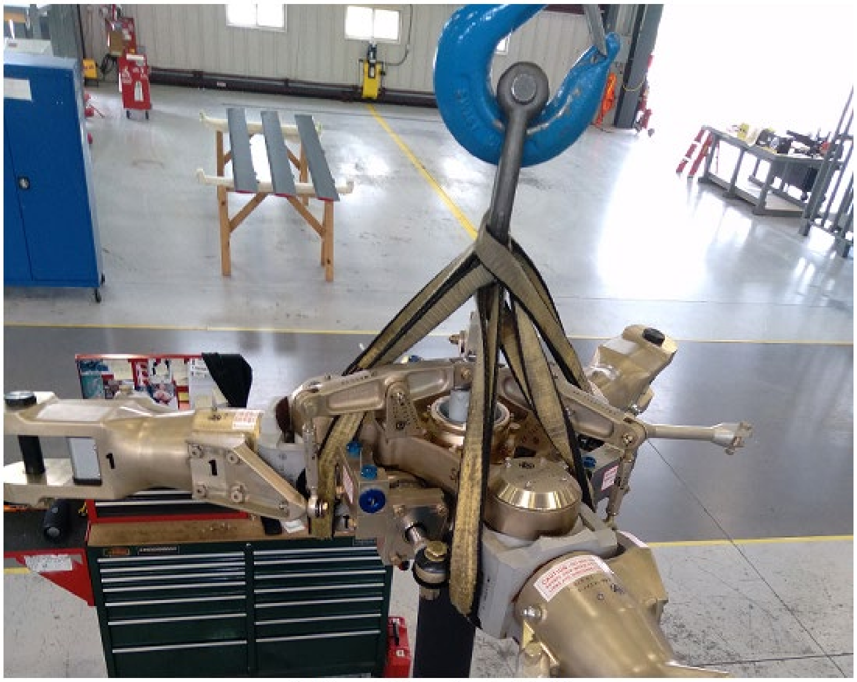
NOTE: Do not wash the aircraft using pressure washing equipment.

A. Wash the exterior as follows:

(1) Check the security of all doors and access panels before starting the washing operation.

(2) Flush the entire aircraft free of dirt.

NOTE: Avoid direct spraying of the main rotor hub, tail rotor assembly, and tail rotor driveshaft bearings to prevent the loss of lubricant. These areas should be purged with grease after washing to eliminate any moisture.



Lifting Sling Installation

Lifting Sling Arm Routing

Figure 4-3. Lifting Sling Installation

(3) Using a soap and water solution and a soft cloth pad, wash a specific area using a circular motion.

(4) Flush the washed area immediately.

(5) Repeat steps c and d until the entire aircraft is clean.

(6) Rinse with clear water and dry with a chamois.

B. Wax the exterior as follows:

(1) Clean the aircraft exterior as described in the washing procedure.

(2) Using a soft cloth, apply a good quality paste wax to the painted exterior using a circular motion.

(3) Polish the waxed area to a high luster using a clean and dry soft cloth.

4-74 Interior – Cleaning

NOTE: Do not use a solvent type cleaner to clean the inside of the cabin shell.

A. Clean the interior as follows:

(1) Clean the dirt and dust from the cabin using a small broom or brush.

(2) Vacuum the interior to remove any remaining dirt.

(3) Use a good quality upholstery cleaner to remove dirt and grease from the seat cushions and the floor covering.

4-75 Plexiglas – Cleaning

A. Wash the Plexiglas using your bare hand or a clean soft cloth and a mild soap and water solution. Rinse with clean water.

B. Dry the surface with a soft, clean cloth or tissue and polish it with a windshield cleaner especially approved for use on aircraft transparent plastics.

CAUTION: DO NOT USE COARSE ABRASIVE TYPE SOAPS AS THEY CAN CAUSE FINE SCRATCHES IN THE PLEXIGLASS.

C. Removal of fine scratches from the Plexiglas is accomplished by polishing and waxing the glass using Meguiar's Mirror Glaze - Plastic Cleaner MGH-17.

4-76 AIRCRAFT PRESERVATION AND STORAGE

4-77 General – Aircraft Preservation and Storage

A. Aircraft that see low usage or are stored for extended periods exhibit an accelerated rate of corrosion damage. Special attention should be given to aircraft inactive in a corrosive atmosphere (coastal, high humidity, air pollution, or sandy areas) to assure components remain in a serviceable condition.

B. The following maintenance procedures are categorized in terms of aircraft with low usage and those scheduled to be inactive for an extended period. This information is intended to cover both hangared and outdoor conditions unless otherwise noted, and is subject to owner/operator judgment regarding the helicopter's operating environment, and should be considered in addition to the normal servicing requirements.

NOTE: Wash and wax the helicopter prior to any type of storage.

4-78 Low Usage – Aircraft Preservation and Storage

NOTE: Aircraft flown for short periods several times a month.

NOTE: Preserve the engine I/A/W the applicable Textron-Lycoming Technical Publication if warranted by local corrosive conditions.

A. Ground run the aircraft every 14 days until normal operating temperatures for the engine are obtained.

B. Position the main rotor blades so that the tail rotor assembly is horizontal to the earth. Tie down the main rotor blades with the collective locked halfway up to relieve the steady load on the lamiflex bearings.

C. Install the main rotor hub and tail rotor assembly covers.

D. Protect the windshields and interior equipment with suitable dust covers and/or solar shields.

NOTE: If the interior temperature of the cabin exceeds 150°F, ventilate the cabin by opening the doors or vents.

E. Cover the pitot and static air vents.

F. Wash and wax the aircraft monthly to remove contaminants.

G. Prior the next flight, complete the following:

(1) Remove all covers and tiedowns.

(2) Perform a preflight inspection.

NOTE: When inspecting oil levels, inspect for evidence of water contamination.

(3) If preserved, depreserve the engine I/A/W the applicable Textron-Lycoming Technical Publication.

4-79 Storage Up to 45 Days – Aircraft Preservation and Storage

A. Complete steps A through F of paragraph 4-78.

B. Disconnect the battery.

C. Remove the main rotor blades.

NOTE: Store the main rotor blades in a horizontal position on wood racks cut out to the contour of the leading edge of the blades. Use care in handling the blades to prevent damage to the blades and trim tabs.

D. Return the aircraft to service using the following procedures:

(1) Remove all covers and tiedowns.

(2) Connect the battery.

(3) Install the main rotor blades.

(4) Perform a preflight inspection.

NOTE: When inspecting oil levels, inspect for evidence of water contamination.

(5) Lubricate the aircraft I/A/W the 50 Hour requirements.

(6) Depreserve the engine I/A/W the applicable Textron-Lycoming Technical Publication.

4-80 Storage from 45 Days to 6 Months – Aircraft Preservation and Storage

A. Complete Steps A through C of Paragraph 4-79.

B. Remove the battery and store in a cool dry area. Clean the battery shelf if required (AC43.13-1B).

NOTE: The aircraft may require an annual inspection.

C. Return the aircraft to service following the procedures in Step D of Paragraph 4-79.

4-81 Storage for Longer Than 6 Months – Aircraft Preservation and Storage

A. Complete Steps A and B of Paragraph 4-80.

B. Hangar the aircraft.

C. Return the aircraft to service using the following procedures:

(1) Remove all covers, tiedowns, and shields.

(2) Service the battery I/A/W the manufacturer's instructions. Install and connect the battery.

(3) Install the main rotor blades.

(4) Perform a 100 hour periodic inspection and lubricate I/A/W the 100 hour requirements.

NOTE: The aircraft may require an annual inspection.

(5) Depreserve the engine I/A/W the applicable Textron-Lycoming Technical Publication.

4-82 PREVENTIVE MAINTENANCE FOR CORROSION CONTROL

4-83 General Information – Preventive Maintenance for Corrosion Control

The airframe is fabricated of high strength aluminum and steel alloys and should be inspected regularly for signs of corrosion. Any areas where the protective finishes may have been scuffed, scratched, chipped, or worn off should be treated temporarily to control the onset of corrosive action. Then at the earliest convenience a permanent refinish of the area should be accomplished. Another very important step in any corrosion prevention program is regularly scheduled washing and waxing of the aircraft surfaces.

It is extremely important that the main rotor and tail rotor blade coatings be maintained and protected against oxidation, erosion, and atmospheric residues which are continually attacking these components during their service life. Once this coating is breached and corrosive action is allowed to propagate unchecked, premature bond line corrosion will occur resulting in early retirement of these components. Refer to Paragraph 4-90 for the corrosion prevention compound application procedure for the main rotor blades. Refer to the appropriate paragraphs in Section 9 of this manual for the inspection and repair procedures for the main and tail rotor blades. In coastal areas or wherever the air has a high moisture content, blade tape can be installed on the leading edge of the main rotor blades to help prevent the leading edge and bond line corrosion from occurring. In coastal areas, it is recommended that the blade tape be installed when the aircraft is placed into service. Refer to the appropriate paragraphs in Section 9 of this manual for the installation and repair procedures for blade tape.

4-84 Scheduled Field Preventive Maintenance Program

NOTE: This procedure is intended for the complete helicopter; however, give special attention given the main and tail rotor blades.

NOTE: Aircraft based in or near heavy industrial and/or metropolitan areas with heavy atmospheric pollution should use procedure "A" below.

NOTE: Do not wash the aircraft using pressure washing equipment.

A. Aircraft that are operated over salt water or coastal regions. Use the following procedures:

(1) Thoroughly flush the aircraft with fresh water daily.

(2) Wash the aircraft with mild soap and fresh water weekly.

NOTE: Use a good quality paste wax.

(3) Wax the aircraft every second week.

B. Aircraft that are operated in tropical or semi-tropical high humidity regions. Use the following procedures:

(1) Wash the aircraft with mild soap and fresh water weekly.

(2) Wax the aircraft every second week.

C. Aircraft that are operated in arid, moderate, or cold regions. Use the following procedures:

NOTE: This procedure may be suspended during cold or winter months if step 3 was accomplished prior to the cold season.

(1) Flush with fresh water weekly.

(2) Wash the aircraft with mild soap and fresh water monthly.

(3) Wax the aircraft every second month.

4-85 COMPONENT PRESERVATION AND STORAGE

4-86 Main Rotor Transmission

NOTE: This procedure applies to an uninstalled main rotor transmission.

A. Service the main rotor transmission (Para. 4-12), or alternatively, completely fill the transmission. Refer to Table 4-1 for system capacity and approved oils (30 weight engine oil is acceptable for storage).

B. Plug or cap the breather tube.

C. Ensure the fill cap is secured.

D. Place the transmission in storage with the mast upright.

E. Every 90 days, move the transmission to allow oil to flow to all internal surfaces.

(1) Tip the transmission to horizontal or vertical, as appropriate, approximately 90° from its storage position.

(2) Tip the transmission back to storage position.

F. Turn the pinion approximately three times completely lubricate all moving parts.

G. Prior to returning the main rotor transmission to service:

(1) Remove the breather tube plug or cap, if installed.

(2) Drain the oil (Para. 4-13).

(3) Service the main rotor transmission (Para. 4-12).

4-87 Tail Rotor Transmission

NOTE: This procedure applies to an uninstalled tail rotor transmission.

A. Completely fill the transmission. Refer to Table 4-1 for system capacity and approved oils.

B. Prior to returning the tail rotor transmission to service:

(1) Drain the oil (Para. 4-16).

(2) Service the tail rotor transmission (Para. 4-15).

4-88 Main Rotor Blades – Application of Corrosion Prevention Compound

4-89 General Information

Several factors may lead to bond line separation and corrosion of the blades. During operational service, the polyurethane topcoat applied to the blade may gradually wear away due to erosion from airborne particulate matter or precipitation. Special care should be taken to prevent nicking or chipping of the paint in the bond lines. Also, operation of the main rotor blades in wet or high humidity environments can also significantly accelerate bond line separation and the onset of corrosion through moisture intrusion into the blade. Improper storage of the blades for extended periods of time can foster corrosion.

Proper use of effective corrosion control products is central to all corrosion prevention programs. This procedure identifies a Corrosion Prevention Compound (CPC) compatible with the Enstrom main rotor blade. Enstrom recommends the application of MIL-PRF-81309, Type II or III water displacing soft film CPC (Table 4-1). The water displacing CPC acts on contact by spreading across the exterior blade surfaces, displacing any moisture present, and leaving behind a residue to act as a further barrier after the carrier solvent has evaporated.

Application of the CPC identified in this procedure will not affect the surface finish of the painted/waxed blade if the manufacturer's recommendations for application and the instructions in this procedure are followed.

WARNING: THE CPC'S LISTED IN TABLE 4-1 DO NOT AFFECT THE BONDING AGENT IN THE MAIN ROTOR BLADE. ENSTROM DOES NOT RECOMMEND ANY OTHER CPC'S BECAUSE THEIR EFFECT ON THE BONDING AGENT IS UNKNOWN.

Blades delivered after March 5, 2010 have been treated with CPC during initial production and require repetitive CPC treatment (Para. 4-90). Blades delivered before March 5, 2010 require an initial treatment of CPC (Para. 4-90), the addition of the AN526C1032R6 screw, as well as repetitive CPC treatment.

4-90 Application of CPC

A. Remove the blades from the aircraft, if not already removed, and arrange them on a rack.

B. Prepare a P/N AN526C1032R6 screw, or equivalent, for insertion in the hole at the tip of each blade, 2.75" (69.9 mm) from the leading edge. (If a screw is presently installed, remove the screw.) Apply MIL-PRF-81309 Type II or III CPC (Table 4-1) to the threads of the screw and in the 1032 UNF tapped hole prior to torquing the screw. Standard torque values apply.

C. Remove the tip weight assemblies from the outboard end of each blade using the Main Rotor Blade Plug Tool (Enstrom P/N T-1656-3, or equivalent). Mark each assembly to designate its position as either the forward or aft location and which blade the assemblies were removed from.

D. Following the manufacturer's recommendations, using a pump or aerosol sprayer, spray a coating of CPC on the entire interior surface (i.e., interior blade cavity) of each blade.

E. Rotate or position the spray wand to coat all interior areas of the blade with particular attention given to the interior trailing edge structure.

F. Rotate and flip the blade to introduce a sloshing effect with the excess CPC. Ensure all interior areas of the blade are coated with the CPC.

G. Drain excess CPC from the blade.

NOTE: The CPC may produce toxic vapors. Use only in well ventilated areas. Avoid contact with skin and eyes. Avoid inhalation and ingestion. Follow the manufacturer's warning and safety recommendations.

NOTE: Do not use synthetic wiping cloths or rags during application or clean up. The CPC will dissolve the fabric.

H. Reinstall the tip weight assemblies making sure they are installed in the same location from which they were removed.

I. Wipe off dirt or excess moisture from the exterior blade surface.

J. Following the manufacturer's recommendations, apply a coating of CPC over the entire exterior surface of the blades, including the tip (cap) and along the trailing edge seam.

4-91 Storage of CPC

NOTE: Unless otherwise specified, do not store the CPC at temperatures greater than 50°C (120°F).

WARNING: KEEP THE CPC AWAY FROM OPEN FLAMES, HEAT, OR SPARKS AS THEY MAY BE FLAMMABLE.

A. Follow the recommendations provided by the manufacturer.

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SECTION 5

WEIGHT AND BALANCE

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SECTION 5

WEIGHT AND BALANCE

5-1 GENERAL INFORMATION

This helicopter must be flown within the weight and center of gravity limits. The helicopter empty weight, empty weight c.g., total basic weight and basic weight c.g. for this helicopter are found on form F 168A, Figure 5 9. Removal or installation of approved optional equipment will change the basic helicopter weight and moment. This change shall be recorded on Form F 165A, Figure 5 8, Basic Weight and Balance Record. The pilot will use the figures on Form F 165A when performing calculations to ensure the helicopter is loaded properly.

NOTE: Initial production F-28F and 280F models were limited to maximum gross weight of 2350 lb. Any early F-28F or 280F models modified with kit P/N 28-100015 and all later F-28F production helicopters are certified to 2600 lb maximum gross weight. (Refer to the H1CE Type Certificate Data Sheet for more information for float operations.)

5-2 APPROVED CENTER OF GRAVITY ENVELOPES

A. Longitudinal c.g.

(1) Station zero located 100.0 inches forward of centerline of main rotor hub.

(2) Longitudinal c.g. range varies with gross weight from 92.0 inches to 100.0 inches. See Figure 5-1.

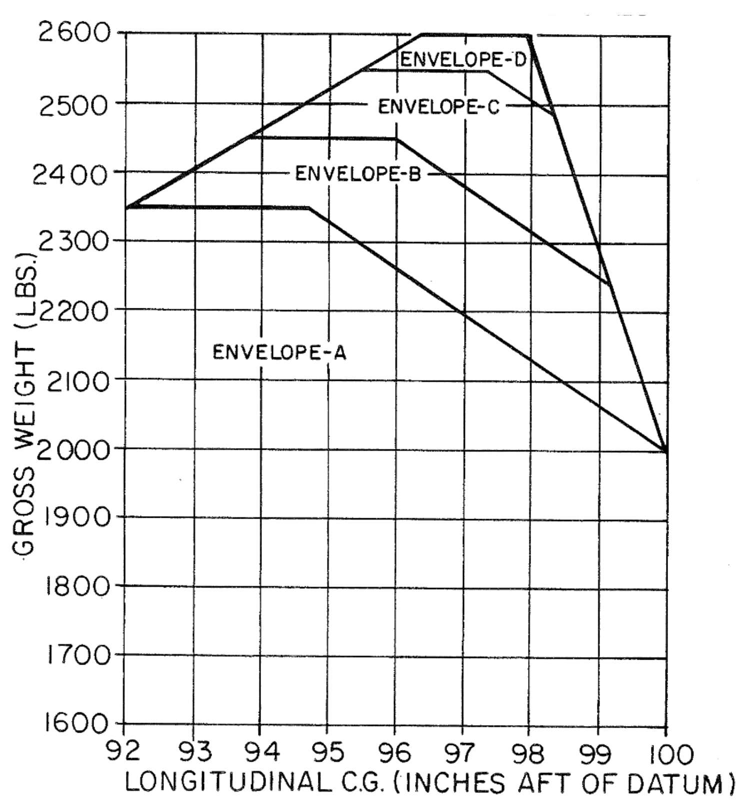

Figure 5-1. Longitudinal C.G. Envelopes

B. Lateral Offset Moment

(1) Centerline of helicopter is 0 inch lateral moment arm. Moment arms left of centerline are negative.

(2) Lateral c.g. Locations

(a) Two on board

1 Left seat (pilot) -13.5

2 Right seat (co-pilot) +13.5

(b) Three on board

1 Left seat (pilot) -13.5

2 Center passenger +3.0

3 Right passenger +20.5

(3) Lateral offset moments variable with gross weight from -3250 in-lb to +3700 in-lb. See Figure 5-2.

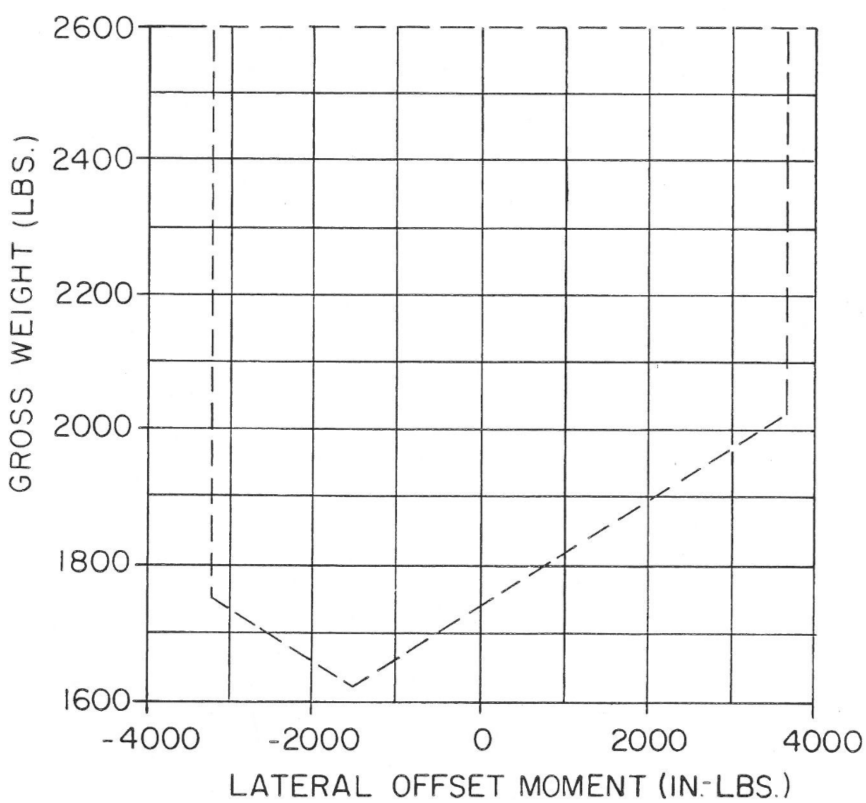

Figure 5-2. Lateral Offset Moment Envelope

5-3 WEIGHING THE HELICOPTER

A. Tools and Equipment

(1) Tape measure

(2) Two scales - 1000 lb capacity

(3) Scale - 100 lb capacity

(4) Bubble level

(5) Work stand

B. Weighing Procedure

(1) Clean helicopter - remove rags, charts, etc.

(2) Drain fuel, check all other operating fluids full.

(3) Move helicopter inside closed building.

(4) Check for proper installation of accessory items.

(5) Close and secure both doors.

(6) Align one main rotor blade over tail cone.

(7) Hoist or jack helicopter to a height to clear scales.

(8) Position a pipe nipple in the center of left and right 1000 lb capacity scales. Place scales under landing skids so nipples will contact skid gear at a point 17.7 inches aft from the centerline of the forward 3 inch diameter cross tube.

NOTE: This distance is identified by a rivet (STA 93.4) in the skid tube of later S/N helicopters.

NOTE: See Figure 5-3 for locating fulcrum by using T-1794. This tool may be purchased from Enstrom Helicopter Service Department.

(9) Locate the 100 lb capacity scale at the center line of the tail rotor output shaft. See Figure 5-4.

(10) Adjust height of tail to level helicopter. Level checked at left lower pylon tube. Lateral level checked at lower forward pylon tube.

(11) When helicopter is level, read the scales and enter weights on Weight Chart, Figure 5-7.

CAUTION: WEIGHT AND MEASUREMENT READINGS ARE CRITICAL. DOUBLE CHECK RESULTS.

(12) Remove helicopter from scales.

NOTE: DO NOT remove curbing, nipples, blocks, etc. from scales. Weigh these items and enter weights in tare column on Figure 5-7.

(13) Subtract tare from scale readings and enter net weights.

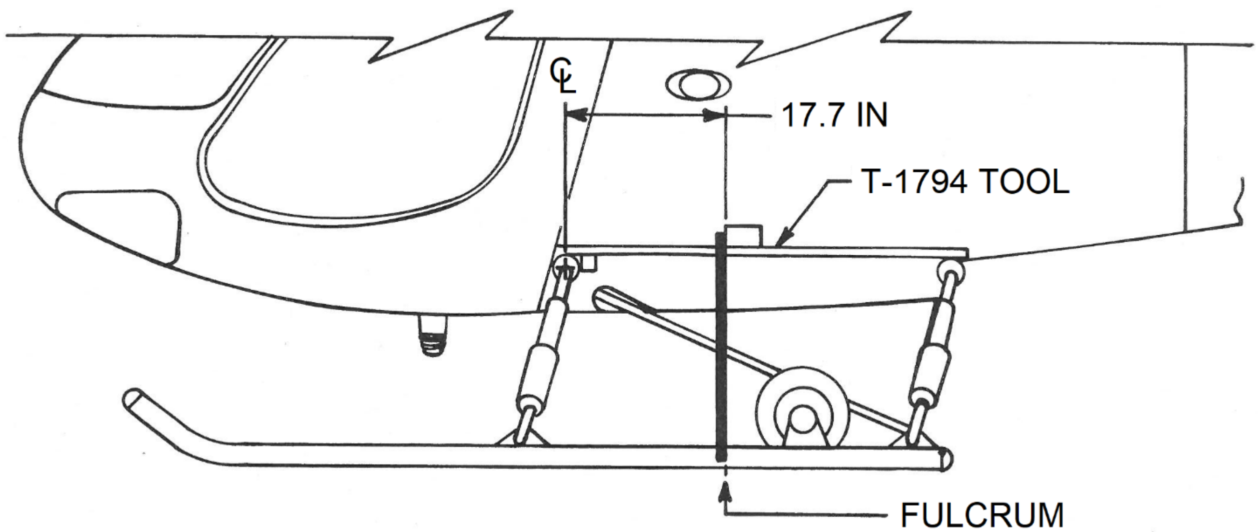

Figure 5-3. Weight and Balance, Tool Positioning

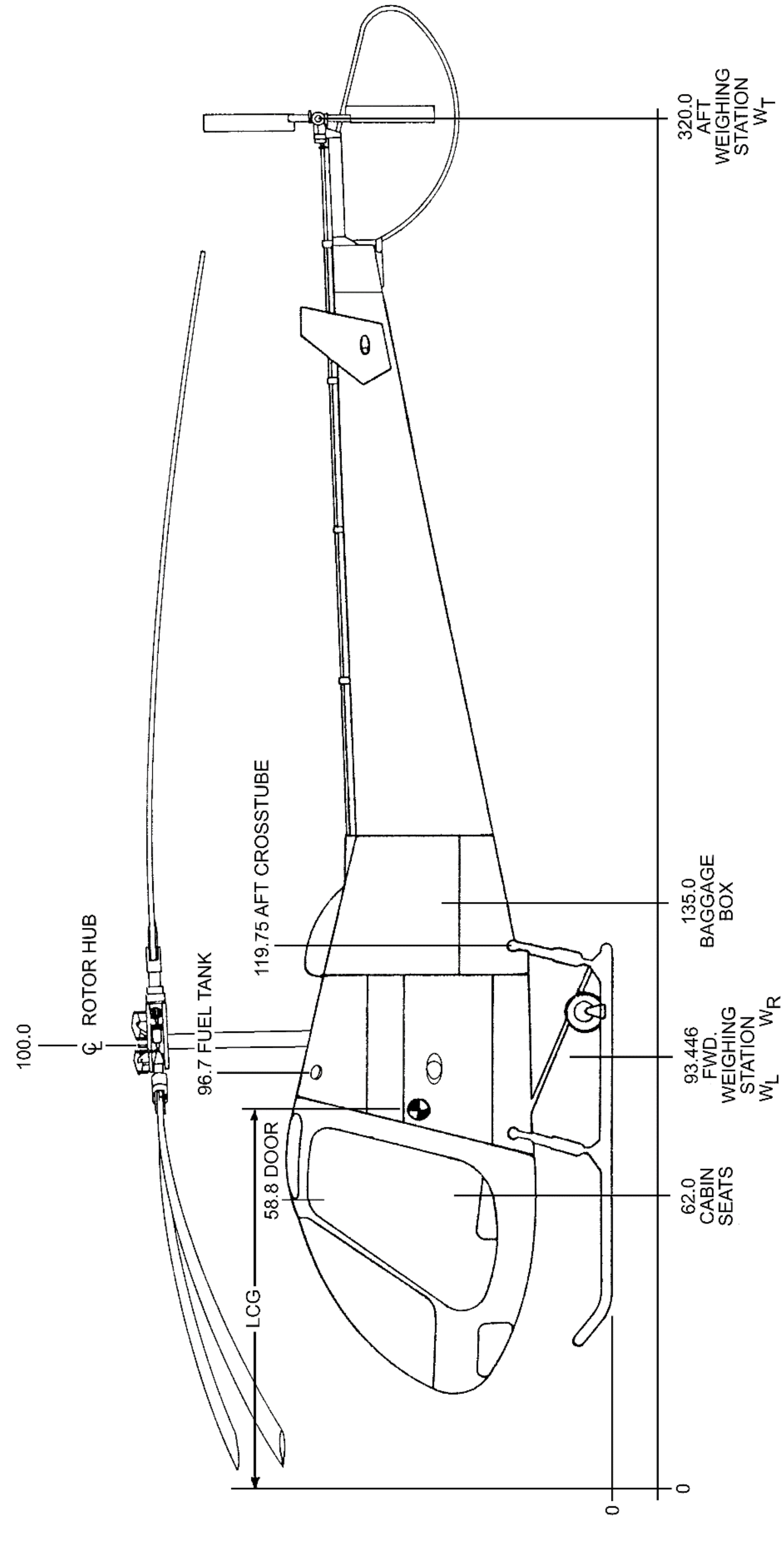

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Figure 5-4. Weighing Stations

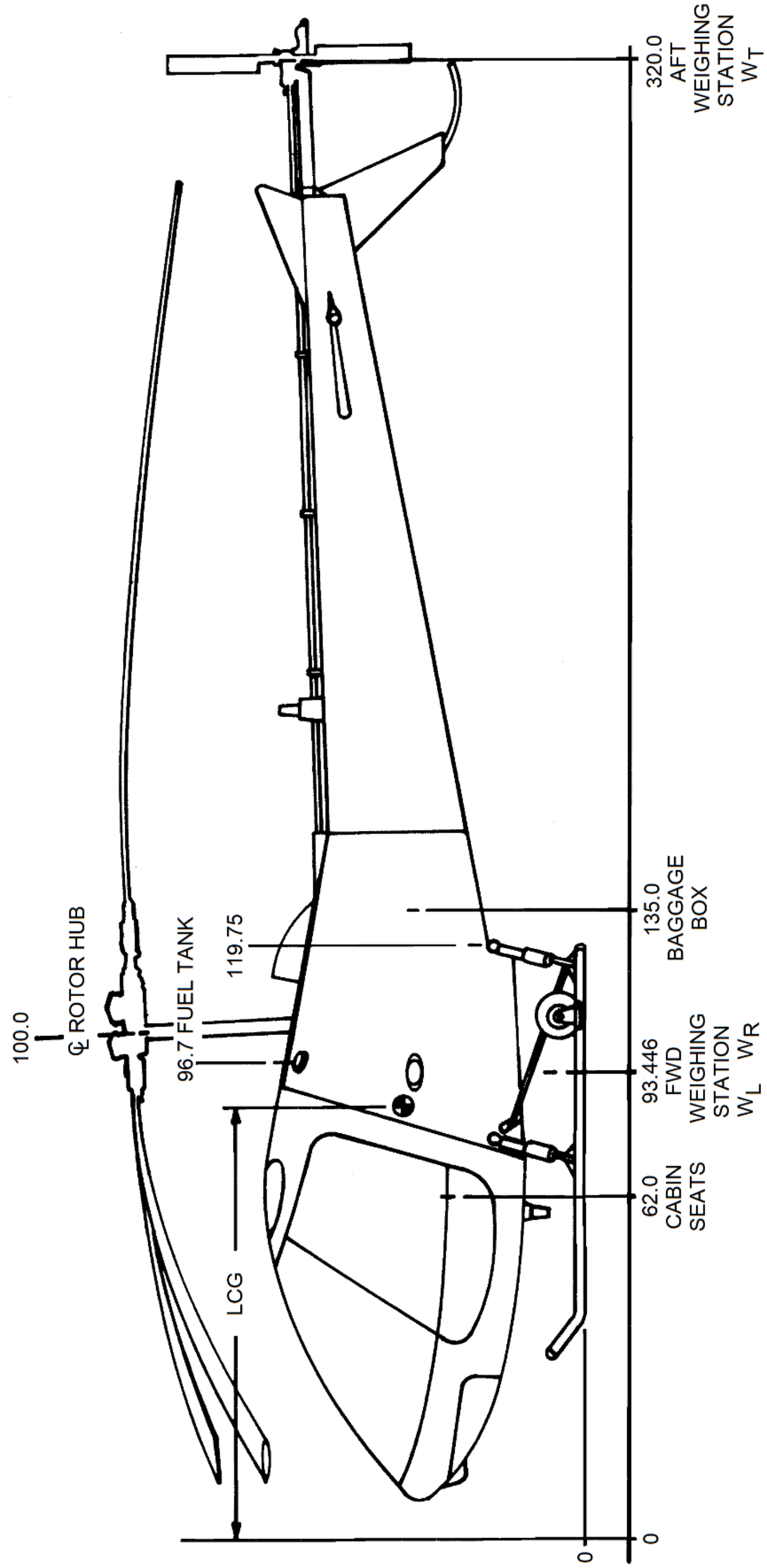

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Figure 5-4. Weighing Stations

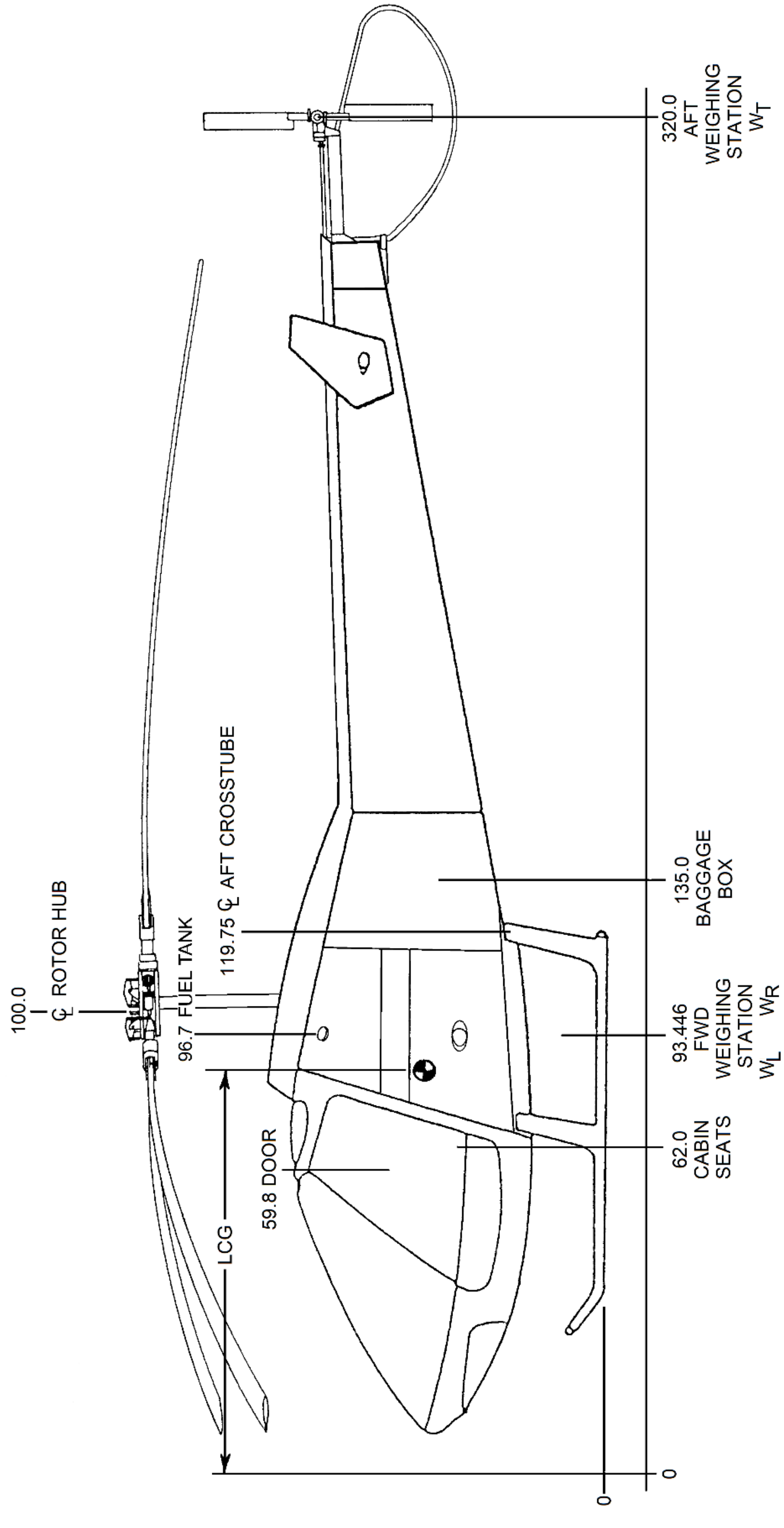

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Figure 5-4. Weighing Stations

(14) Enter arms and multiply by weights to get moments.

(15) Total weights and moments.

(16) Using formula on bottom of Figure 5-7, calculate c.g.

(17) Transfer weight, c.g. or arm and moment to top of form F-168A (Figure 5-8).

(18) On Form F-168A enter all optional and surplus equipment in the helicopter at weigh-in. Then enter all standard equipment not installed on the helicopter at weigh-in.

(19) Total weights and moments.

(20) Find total empty weight and moment of standard helicopter.

(21) Add to this figure optional equipment to obtain total basic weight and moment.

(22) Transfer these figures to Form F-165A (Figure 5-8), Basic Weight and Balance Record.

NOTE: Any changes to the helicopter such as structural repairs or modifications, installation of optional equipment or removal of optional equipment, will require an entry on Form F-165A.

5-4 LOADING

A. General Information

It is the responsibility of the helicopter pilot to ensure that the helicopter is loaded properly. Using the basic weight and moment from Form F-165A (Figure 5-8) and the loading Chart (Figure 5-5), the pilot can obtain the total weight and moment for various loading conditions. The pilot should first calculate the total weight and moment for zero usable fuel, as this will show the c.g. shift with fuel burn-off. If the c.g. is within limits, add the planned fuel load and compute the c.g. If the c.g. is within limits, the last item to check is the lateral offset moment.

B. Sample Calculation - Longitudinal C.G.

	SAMPLE HELICOPTER			HELICOPTER S/N_______	
SAMPLE LOADING	Arm (in)	Weight (lb)	Moment (1000 in-lb)	Weight (lb)	Moment (1000 in-lb)
1. Basic empty weight from Form F-165A	100.7	1610.0	162.1		
2. Pilot and passengers Cabin seats	62.0	480.0	29.8 (1)		
3. Baggage compartment load	135.0	20.0	2.7 (1)		
4. Total weight and moment with zero usable fuel to check c.g. shift with fuel burn-off (landing condition)	92.2 (2)	2110.0	194.6		
5. Usable fuel	96.7	240.0	23.2 (1)		
6. Total weight and moment with usable fuel (takeoff condition)	92.6 (2)	2350.0 (3)	217.6		

(1) Moments obtained by multiplying weight times arm or from Loading Chart, Figure 6.5.

(2) The longitudinal c.g. relative to the datum line may be found by dividing the moment by the weight.

$$\text{c.g. zero fuel} = \frac{194{,}600 \text{ in-lb}}{2110.0 \text{ lb}} = 92.2 \text{ in}$$

$$\text{c.g. zero fuel} = \frac{217{,}600 \text{ in-lb}}{2350 \text{ lb}} = 92.6 \text{ in}$$

The total weight and moment can also be plotted on Figure 6.6 to determine if the loading is within longitudinal limits.

(3) Maximum gross weight is 2600 lb.

C. Sample Calculations – Lateral Offset Moment

	Arm (in)	Weight (lb)	Moment (in-lb)
Pilot (left seat)	- 13.5	170	- 2295
Passenger (center seat)	+ 3.0	140	+ 420
Passenger (right seat)	+ 20.5	170	+ 34
			+ 1610

Plot 2350 lb and +1610 in-lb on Figure 5-1 to assure moment is in approved area.

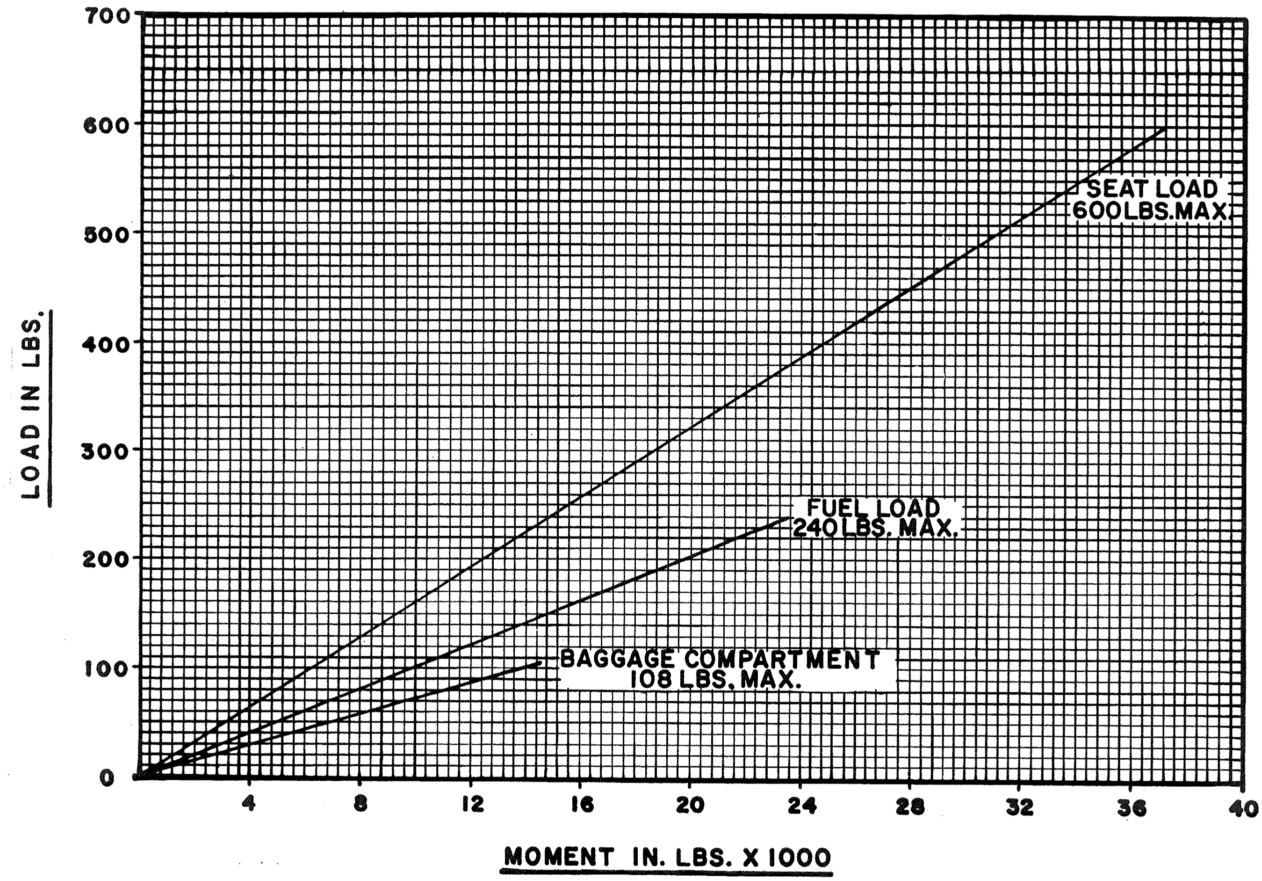

Figure 5-5. Loading Chart

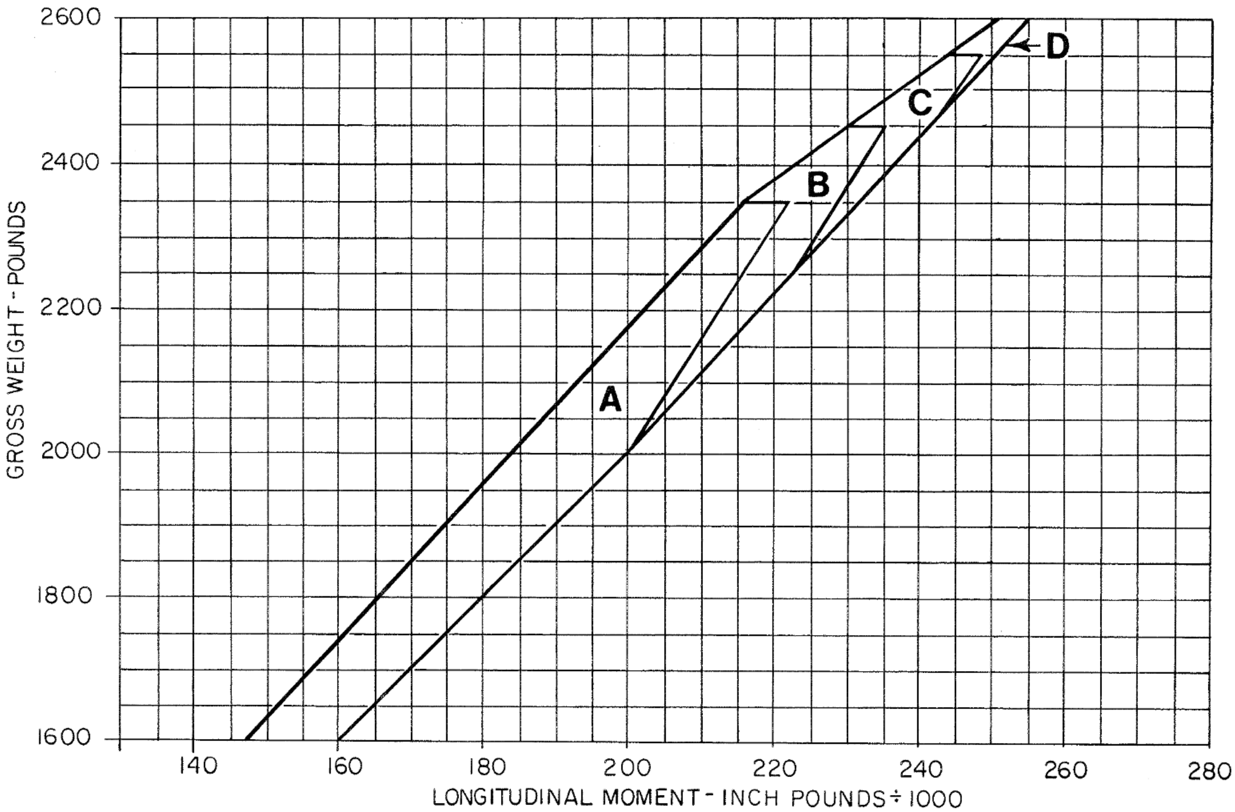

Figure 5-6. Gross Weight Vs. Longitudinal Moment

Model ____________	Serial No. __________	Reg No. __________	Date __________________

WEIGHT POINT	SCALE-LBS.	TARE	NET. WT.	ARM	MOMENT x 100
LEFT GEAR	(W_L)	----		93.446	
RIGHT GEAR	(W_R)	----		93.446	
TAIL	(W_T)	X		320.0	
TOTAL	X X X	X		X	

$$LCG = \frac{W_T\,(320.0) + (W_L + W_R)(93.446)}{W_T + W_L + W_R} = \_\_\_\_\_\_\_\_$$

DATE

WEIGHED BY ____

Figure 5-7. Weight Sheet

BASIC WEIGHT AND BALANCE RECORD

Model Serial No. Reg No. Date

ACTUAL DELIVERED WEIGHT AND BALANCE DATA								WEIGHT		ARM		MOMENT	
Item No.	Date	Item		Description or Modification	WEIGHT ADDED			WEIGHT REMOVED			RUNNING BASIC TOTAL		
		In	Out		Weight	Arm	Moment	Weight	Arm	Moment	Weight	Arm	Moment

Figure 5-8. Basic Weight and Balance Record (F-165A)

Model ____________	Serial No. __________	Reg No. __________	Date __________________

		WEIGHT LBS.	ARM IN.	MOMENT IN-LB.
WEIGHT (AS WEIGHTED)				
PLUS: MISSING STD. EQUIPMENT - net				
LESS: OPT & SURPLUS WT. (next page)				
LESS: ENGINE OIL				
PLUS: UNUSABLE FUEL				
WEIGHT				
	ACTUAL			
PLUS: ENGINE OIL				
PLUS: OPTIONAL EQUIPMENT (next page)				

ITEMIZED MISSING STD. EQUIP:

	WEIGHT LBS.	ARM IN.	MOMENT IN-LB.
None			

	WEIGHT LBS.	ARM IN.	MOMENT IN-LB.
TOTAL BASIC WEIGHT & C.G.			

Figure 5-9. Helicopter Weight and C.G. Calculation (F-168A)

Model __________ Serial No. __________ Reg No. __________ Date __________

ENSTROM OPTIONAL EQUIPMENT LIST

INSTRUMENTS - REQUIRED (STD EQUIP)	Item Wt.	Arm STD Panel
Altimeter	1.2	36
Airspeed Indicator	.5	36
Tachometer	1.3	36
Manifold-Fuel Pressure	1.5	36
Instrument Cluster	2.0	36
Oil Temperature		
Oil Pressure		
Gearbox Temperature		
Cylinder Temperature		
Fuel Quantity		
Ammeter		
Compass	1.0	40
Graphic Engine Monitor	1.0	36
Clock*	.5	36
Annunciator	.04	32
* Standard equipment not required by FAA		

No.	OPTIONAL EQUIPMENT	WT.	ARM	MOMENT IN/LB
	TOTAL		**X**	

Figure 5-10. Enstrom Equipment List

No.	OPTIONAL EQUIPMENT	WT.	ARM	MOMENT IN/LB

Figure 5-10. Optional Equipment List Continued

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SECTION 6

ELECTRICAL

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SECTION 6

ELECTRICAL

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6-1 ELECTRICAL SYSTEM

A. General Information

The F-28F/280F Series electrical system is either a 12 volt or a 28 volt D.C. solid state regulated type. The system consists of one main buss, one generating source and one power storage source. Electric current is distributed via buss bar thru individual trip free circuit breakers. Networks not protected by trip free breakers contain inline fuses. Later F-28F/280FX helicopters are equipped with a 28 volt D.C. electrical system. Electrical power is supplied by a 24-volt, direct current, 70 ampere alternator and an 11 amp-hour lead acid battery.

Electrical safety devices are provided for buss overcurrent and overvoltage protection.

Aircraft equipped with avionics systems are supplied with radio frequency interference filters.

Refer also to Section 21 for discussion regarding F-28F/280FX electrical system equipment updates.

B. General Troubleshooting

(1) Always refer to the Electrical System Schematic for system interconnections (Section 6 or Section 21 as applicable).

(2) Simple, fast, wire checks can be performed by making continuity tests with an ohmmeter. The continuity check is a quick procedure for isolating electrical problems to a specific circuit.

(3) Check for loose hardware or loose connectors at wire terminations.

(4) Check all ground connections for evidence of looseness or corrosion.

(5) Check wire insulation, grommets, and tie wraps for wear or deterioration.

(6) In the event of trouble with A/C lighting (non-LED type), substitute equivalent bulbs (known to operate) from a different location on the A/C to determine whether the problem is lamp or system related. This is especially useful for check strobes and anti-collision lamps.

(7) The following devices should be serviced as recommended by the respective manufacturers:

(a) Alternator

(b) Starter motor

(c) Magneto-vibrator-ignition switch

(d) Fuel boost pump motor

(e) Strobe systems

(8) Continuous wire runs (ref. schematic diagram) are typically identified by an assigned wire number, i.e. 24-2, from the aircraft battery positive terminal to the starter relay contacts. In cases where wire runs are interrupted by splices, disconnects, fuses etc., the wire number

is also assigned a letter, i.e., wire 49-1A from buss to F3, and wire number 49-1B from the opposite end of F3 to wire number 49-1C. The A-B designation indicates wire discontinuities. Typically wire numbers (not letters) sequence through electrical devices, such as lamps, motors, and relays, etc.

6-2 BATTERY

A. General Information

The aircraft is equipped with a 12 volt or 24 volt battery as described below. The following specifications apply to the standard aircraft battery:

	12 VOLT	24 VOLT
Manufacturer	Concorde	Concorde
Type	RG-35A	RG-24-11M
Voltage	12	24
Amp Hours	29	11
Cold Cranking Amperes	390	160
Overall Dimensions (in) (mm)	9.78L x 5.17W x 6.83H (248L x 131W x 174H)	8.65L x 7.31W x 6.73H (220L x 186W x 171H)

B. Battery – Troubleshooting

Problem	Cause	Required Action
Battery discharged.	Loose or corroded terminals.	Clean connections, tighten terminal hardware.
	Loose belt.	Reference Para. 6-3, E Alternator Installation.

NOTE: Refer to Concorde RG Series Component Maintenance Manual, Document No. 5-0171 for electrical renew test procedure.

C. Battery Master Power – Troubleshooting

Problem	Cause	Required Action
Master switch-on, all electrical systems in-operative.	Dead battery.	Replace or recharge.
	Master relay faulty (RL1)* (coil or contacts bad).	Replace master relay.
	Overcurrent trip breaker "open" or faulty (CB16)*.	Reset overcurrent breaker or replace breaker if faulty.
	Inline fuse blown (F18)*.	Replace fuse.
	Overcurrent breaker faulty (CB17)*.	Replace breaker.
	Current limiter faulty (F9).	Replace current limiter.

* Applies to early F-28F/280F with buss faults breaker protection system.

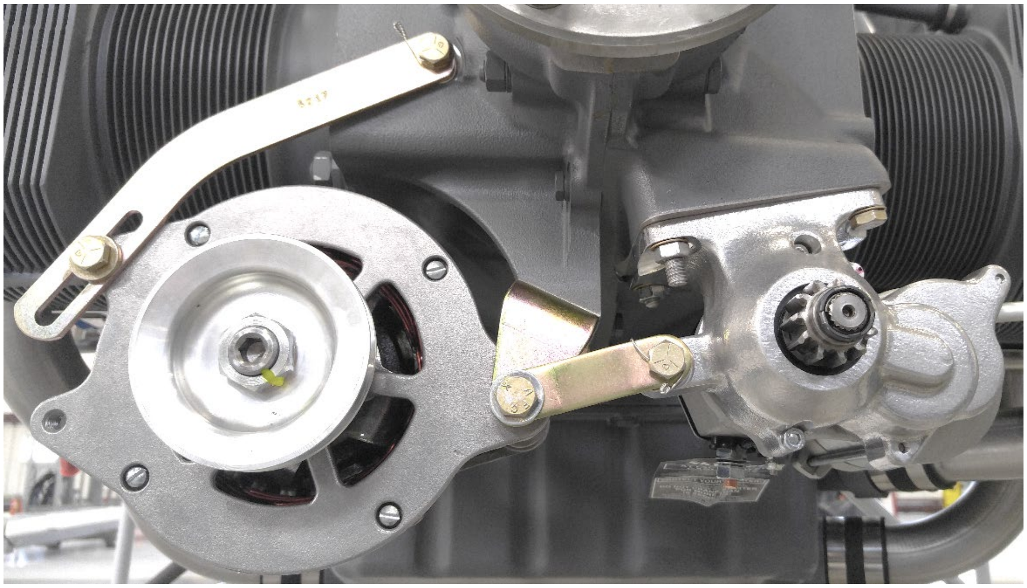

Figure 6-1A. Alternator (left) and Starter Installation (right)
(shroud removed for clarity)

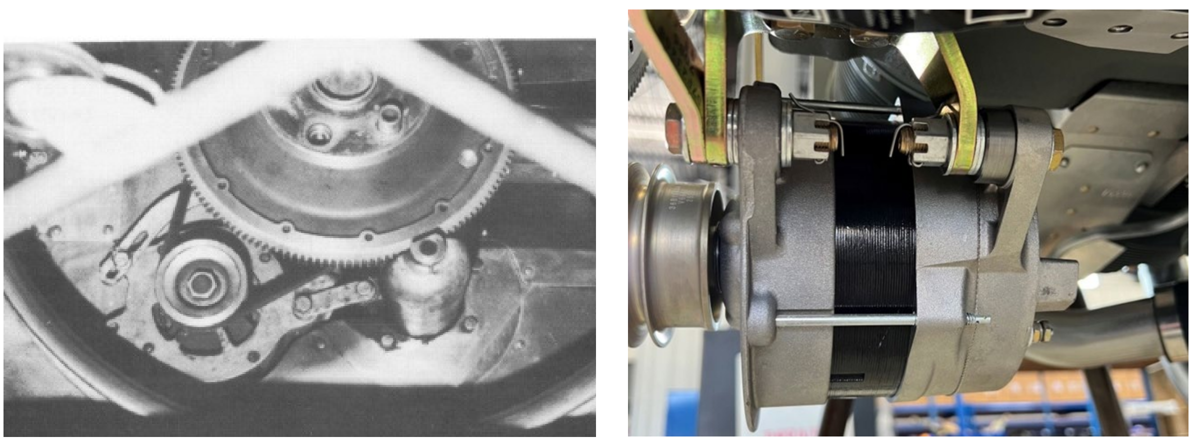

Figure 6-1B. Alternator and Starter Installation

Top - Fan shroud side showing alternator mount pivot slide tension bar and drive belt
Bottom - Underside of engine showing alternator mount position and pivot mount bolts

D. Buss Faults Breaker System

General Description – Early F-28F/280F Series:

The battery protection system is designed to remotely sense electrical overloads in the aircraft which cause excessive battery current drain. This system consists of fuse (FIB), overcurrent breaker (CB17) and the “overcurrent trip” breaker (CB16) on the instrument panel. Circuit breaker CB17 (located at the aircraft battery) senses the overload condition, simultaneously trips the dash-mounted overcurrent breaker CB16 and deactivates the master relay. The action removes the battery from the aircraft buss. Battery power cannot be returned to the aircraft buss unless the “overcurrent trip” dash-mounted breaker is first reset. The "overcurrent trip” breaker cannot be reset until the overload condition has been corrected. Repair of this system is limited to replacement of faulty components, and the removal of the overload condition.

Electrical current is distributed via buss bar through individual trip-free circuit breakers. Networks not protected by trip-free breakers contain inline fuses.

General Description – Later F-28F/280FX:

The battery and APU buss are protected by a current limiter (F9) which is located at the aft mounted battery box and is installed between the starter relay and the master switch relay which is located on the electrical panel located just inboard of the airbox. The remaining circuits are protected by either switch type circuit breakers or trip free push/pull circuit breakers installed on the lower console switch panel or on the lower avionics panel. Secondary circuits are normally protected by fuses located on a panel which is installed on the left side of the lower instrument panel console. On aircraft (F-28F S/N 833 and subsequent; 280FX S/N 2167 and subsequent) with illuminated panels, all standard equipment (except for the starter stuck relay), is protected by a circuit breaker or switch type circuit breaker. Some optional equipment may be protected by an in-line fuse. The starter stuck relay fuse (F25) is an in-line type and is located on the aft side of the battery tray.

6-3 ALTERNATOR

A. General Information

The aircraft alternator is a belt driven type. The alternator output rating is 70 amperes continuous at approximately 12 volts D.C. or 28 volts D.C., depending on the electrical system. Principle components of the alternator are the stator, the rotor, the slip ring end head, the drive end head and the rectifier diodes.

B. Troubleshooting

The following list suggests areas to be investigated should alternator performance be suspect:

(1) Brushes – Remove and inspect for condition and seating

(2) Rotor – Test for ground or shorted windings

(3) Rectifier Diodes – Test for open or shorted diodes

(4) Stator – Test for open

(5) Bearings – Check for roughness or excessive clearance.

(6) Housing cleanliness – End housing should be kept clean by wiping with a cloth dampened in solvent

NOTE: It is recommended that the service manual applicable to your alternator type be consulted for detailed repair procedures.

C. Alternator – Removal

(1) Disconnect battery cables.

(2) Remove cowling and baggage box.

(3) Remove jackstrut and pulley assembly. (See Para. 11-4 for jackstrut removal procedure).

(4) Remove the fan assembly exposing the alternator.

(5) Cut safety wire on bolt securing alternator belt tension arm and remove bolt. Pivot alternator and remove v-belt from alternator pulley.

(6) Disconnect wires from alternator. Label the wires or note the position of the wire numbers for correct placement on reinstallation.

NOTE: The ground wire is connected to the case of the alternator; not to the AUX terminal.

(7) Remove the two alternator mount bolts and remove alternator.

NOTE: Identify and record position of any spacers prior to removing the alternator bolts.

D. Alternator – Inspection

(1) Inspect the alternator I/A/W the manufacturer's instructions.

(2) Inspect the alternator mount for corrosion, damage, and security.

(3) Check belt tension slip at 12-14 ft-lbs/16.3-19.0 Nm.

NOTE: It is recommended that the service manual applicable to the alternator type be consulted for detailed repair procedures.

E. Alternator – Installation

CAUTION: INADVERTENT ENGIINE SARTING MAY OCCUR WHEN TURNING THE ENGINE BY HAND UNLESS PRECAUTIONS ARE TAKEN. REMOVE THE IGNITION WIRES FROM THE SPARK PLUGS BEFORE MANUALLY TURNING THE CRANK SHAFT.

NOTE: On new or replacement alternators, remove fan and replace with spacer from removed alternator (Reference SIL 0016).

NOTE: Remove cooling shroud from the aft side of the alternator.

(1) Align alternator with mount bracket and install the two attachment bolts.

NOTE: Tighten mount bolts finger tight allowing alternator to pivot. (Tighten alternator attachment bolts to take out clearance but allow movement for adjusting tension.)

(2) Install the alternator adjusting arm and tighten the bolts finger tight to allow the alternator to pivot.

(3) Install the starter ring gear support (flywheel) on the crankshaft and secure with two, temporary, ½ x 20 x 1 inch bolts installed in the two positions where there are no crankshaft bushings. (It is acceptable to use a ¾ x 6 inch tubular spacer over two of the 28-13306-1 (AN178H bolts).)

CAUTION: DO NOT INSTALL ANY SHIMS BETWEEN THE FLYWHEEL AND THE CRANKSHAFT FLANGE.

(4) Install the belt over the two pulleys.

(5) Pivot the alternator and adjust the belt tension until the pulley just slips at 12 ft-lbs/16.3 Nm. (Set tension to 14 ft-lbs/19.0 Nm for new installations.)

(6) Torque the outboard bolt through the adjustment arm (80-90 in-lb/9.0-10.1 Nm).

NOTE: Visually inspect and verify alignment between the alternator pulley and the starter ring gear pulley.

(7) Remove the bolts securing the starter ring gear support and pull off the starter ring gear support and the belt.

(8) Torque the inboard adjusting arm bolts (80-90 in-lb/9.0-10.1 Nm) and safety wire both bolts (MS20995C32).

CAUTION: ALTERNATOR ATTACHMENT HARDWARE MUST NOT BE LOOSE.

(9) Torque the alternator mount bolts (160-190 in-lb/19.1-21.6 Nm) and install the cotter pins.

(10) Install the starter ring gear support on the flywheel.

(11) Install the alternator belt over the alternator pulley and turn the crankshaft by hand while guiding the belt onto the pulley.

CAUTION: CONNECT THE GROUND WIRE TO CASE GROUND. DO NOT CONNECT IT TO THE AUX TERMINAL.

(12) Connect wires to the alternator as previously marked.

(13) Install and secure the lower access panel on the fan shroud and tighten hardware to standard torque.

(14) Position auxiliary oil cooler in place and secure with four attachment bolts.

(15) Install fan assembly and shims on flywheel.

(16) Install jackstrut and pulley assembly. (See Para. 11-4 for jackstrut installation procedure.)

(17) Inspect all items for security.

(18) Install cowling.

(19) Connect battery cables.

6-4 VOLTAGE REGULATOR

A. General Information

Alternator voltage is controlled by a solid state transistor regulator. The regulator is factory set for proper voltage control and should not normally require field adjustment (refer to Paragraph 6-4, E, regarding temperature compensation adjustment). Field repair of the regulator is generally not practical and the unit should be replaced in the event of failure.

For early F-28F and 280F (12V) helicopters, the voltage regulator was mounted to the electrical plate in the right side engine compartment. This was changed under SDB 0090 whereby is required to relocate the voltage regulator to the seat structure. Later F-28F (12V and 24V) and 280F series (12V and 24V) are originally equipped from the factory with the voltage regulator mounted on the right side of the seat structure in the cabin.

B. Troubleshooting

Symptoms of a faulty regulator include:

(1) Continuous discharge on aircraft ammeter.

(2) Large fluctuations in ammeter needle (needle oscillates from charge to discharge.

(3) Excessive charging indication on ammeter with fully charged or new battery.

(4) Ammeter needle drops to discharge position as additional electrical loads are switched on, such as strobes, landing lights, etc.

C. Removal

(1) Remove the seat deck (fiberglass seat cover) (Para. 8-8, A).

(2) Remove the wire leads from the terminal strip.

(3) Remove the two screws that secure the voltage regulator to the seat structure.

D. Installation

(1) Install the mounting screws. Include the ground wires (white and black) for the top screw installation.

(2) Attach the wire leads to the terminal strip (ref. Diagram 21-6, Sheet 8).

(3) Install the seat deck (Para. 8-8, D).

E. Adjustment

NOTE: If ammeter shows continuous charge or discharge, check voltage regulator adjustment. A voltmeter will be required to check the regulator

(1) Establish an electrical system load of approximately 15 to 20 amperes.

(2) Connect the voltmeter positive lead to the aircraft battery (+) terminal. Connect voltmeter negative lead to the battery (-) terminal.

(3) After one minute of engine operation at proper electrical load, rotate the regulator adjustment screw until the voltmeter at the batter indicates 14.0 ± 0.2 volts for a 12 volt system, or 28.5 ± 0.2 volts for a 24 volt system.

NOTE: Clockwise screw rotation increases voltage. Do not force adjustment screw.

NOTE: Some battery manufacturers may specify a different voltage setting for operations in certain temperature environments. Consult the battery manufacturer’s manual for additional guidance.

(a) The setting for a Concorde RG Series lead acid battery should be as follows:

Battery Temperature	Voltage Regulator Settings	
	12V System	24V System
Below 0°C (32°F)	14.5 to 14.75	29.0 to 29.5
0 to 15°C (32 to 59°F)	14.25 to 14.5	28.5 to 29.0
16 to 30°C (60 to 86°F)	14.0 to 14.25	28.0 to 28.5
31 to 45°C (87 to 113°F)	13.75 to 14.0	27.5 to 28.0
Above 45°C (113°F)	13.5 to 13.75	27.0 to 27.5

(4) Disconnect meter from the battery and secure the battery compartment for airworthiness.

6-5 OVERVOLTAGE RELAY

[Deleted]

6-6 STARTER

A. General Information

For early 12V and 24V systems, the components which comprise the starter system include the ignition breaker (CB6), starter switch (S8), starter relay (RL2) and the starter motor (SM). The starter motor receives power directly form the aircraft battery through relay RL2. A pushbutton switch located at the throttle end of the collective stick activates the starter relay by drawing power from the main buss through ignition breaker CB6. The starter relay is located near the aircraft battery.

For later 24V systems, the components which comprise the starter system include the start arm circuit breaker switch (CB/SW1) (7.5 amp), a junction module (JM1A), pilot and copilot start switch (SW119 and SW118, respectively), starter relay (RL2), and the starter motor (SM).

Troubleshooting this system is best accomplished by component replacement with the exception of the starter motor which can be serviced. Servicing of the starter motor should be performed to manufacturer's specification.

B. Troubleshooting

Problem	Cause	Required Action
Starter motor inoperative.	Low battery voltage.	Charge or replace battery.
	Collective start switch defective (S8 or SW119 or SW118).	Replace switch.
	Starter breaker switch open or defective (CB6 or CB/SW1).	Reset breaker switch or replace if defective.
Starter relay does not activate.	Relay coil "open".	Check continuity of relay coil, replace relay if defective.
Starter relay (RL2) activates, starter motor does not run.	Relay contacts defective.	Replace starter relay.
Starter relay OK, sufficient battery voltage at starter motor, starter motor does not run.	Starter motor defective.	Rebuild or replace starter motor.

C. Removal

(1) Disconnect the battery cables.

(2) Remove cowling and baggage box.

(3) Remove the access panels that connect the fan shroud to the main oil cooler to gain access to the starter mounting hardware.

(4) Disconnect the heater hose from the fan shroud.

(5) Remove hardware and loosen the strap that secures the starter housing to the alternator housing. Pivot the strap away from the starter.

NOTE: Early helicopters may have a bolt installed from the aft side of the fan shroud.

(6) If applicable, remove the starter housing bolt from the aft side of the fan shroud.

(7) Disconnect the power cable from the starter.

(8) Remove the hardware that secures the starter to the starter housing mount pad.

(9) Remove starter shim from mount pad area, if applicable.

NOTE: Refer to the manufacturer's manual for guidance pertaining to the shim installation.

D. Installation

NOTE: If applicable, ensure shim is installed between the mount pad and the starter housing.

NOTE: If required, check starter ring gear back lash in accordance with Lycoming Service Instruction No. 1447, latest revision.

(1) Install starter on engine pad.

(2) Secure starter with mounting hardware.

NOTE: Early helicopters may have a bolt installed from the aft side of the fan shroud.

(3) If applicable, install starter housing mount bolt in aft side of fan shroud.

(4) Install strap between starter housing and the alternator housing and safety.

(5) Connect battery cables and power cable to starter.

(6) Install fan shroud access panels in the engine compartment.

(7) Install baggage box and cowling.

6-7 FUEL BOOST PUMP

A. General Information

For early 12V and 24V systems, the electric fuel boost system consists of the electric boost pump assembly and the boost pump breaker switch (CB12). Fuel boost pressure is monitored by an independent electric circuit comprised of the fuel pressure switch, red pressure status indicator (red and green indicators in early F models) and a circuit breaker (CB7). Low fuel boost pressure (example: electric boost pump off) will cause the red indicator to be energized. With sufficient fuel pressure (electric boost pump on) the red indicator will be extinguished. The indicator lamp has a press-to-test function for checking the lamp filament continuity.

For later 24V systems, the components which comprise the electric fuel boost system include boost pump assembly (BM), RFI filter (EF1), and boost pump circuit breaker switch (CB/SW2) (5 amp). Fuel boost pressure is monitored by an independent electric circuit comprised of the fuel pressure switch (S21) and indicator LOW FUEL PRESSURE on the annunciator panel. (Additional description of the low fuel pressure warning circuit is provided in paragraph 21-3, C.)

B. Troubleshooting

Problem	Cause	Required Action
As applicable: Either or both indicator lamps out (early 12V and 24V helicopters), low fuel pressure. Or, Annunciator panel segment out (later 24V helicopters), low fuel pressure.	Indicator lamp filaments failed (L8 or L9).	Replace lamps.
	CB7 instrument breaker failed or open.	Reset or replace breaker.
	Annunciator panel lamp failed (segment 7).	Replace lamp.
	Circuit breaker ANN PNL (CB48) failed or open.	Reset or replace circuit breaker.
	Fuel pressure switch faulty.	Replace switch.
	Boost pump circuit breaker switch (CB12) or BOOST PUMP (CB/SW2) open or failed.	Reset or replace circuit breaker.
	Boost pump motor (BM) failure.	

NOTE: Updates to lighting, caution/warning annunciators, and electrical schematics are provided in Section 21.

6-8 LIGHTING

A. Forward Landing Light – Troubleshooting

NOTE: Paragraph 6-8, A through C, apply to early F-28F and 280F models. Refer to Paragraph 21-4 for troubleshooting procedures pertaining to later F and FX helicopters.

Problem	Cause	Required Action
Landing light inoperative.	Lamp filament burned out (L14).	Replace lamp.
	Landing light breaker (CB5) open or failed.	Reset or replace breaker.
	Inline fuse (F2) open (F-28F only).	Replace fuse.
	Landing light relay (RL4) open or shorted, contacts worn (F-28F only).	Replace relay RL4.
	Cyclic stick forward landing light switch failed (F-28F only).	Replace landing light switch.

B. Aft Landing Light – Troubleshooting

Problem	Cause	Required Action
Aft lamp inoperative.	Lamp filament burned out (L3).	Replace lamp.
	Circuit breaker switch (CB10) open or failed.	Reset or replace breaker.

C. Panel Lights – Troubleshooting

Problem	Cause	Required Action
Lights do not dim/lights inoperative.	Rheostat (R3) wiper faulty, rheostat windings open.	Replace rheostat.
	Rheostat (R3) knob loose on rheostat shaft.	Tighten set screw of knob.
	Panel light breaker switch (CB2) open or faulty.	Reset breaker, replace if defective.

NOTE: Illuminated legend bar lamps are not easily replaced. Replacement of bar is recommended if lamp failure occurs.

D. Navigation Lighting

NOTE: Paragraph 6-8, D, applies to early F-28F and 280F models. Refer to Paragraph 21-4 for troubleshooting procedures pertaining to later F and FX helicopters.

Problem	Cause	Required Action
Running lights inoperative.	Lamp filaments (L5-2) and (L5-1) burned out.	Replace lamps.
Tail lights inoperative	Lamp filaments (L4) or (L2) burned out.	Replace lamp.
All navigation lights inoperative (F-28F).	Navigation light circuit breaker tripped or faulty.	Reset or replace circuit breaker CB3.
Tail light inoperative (280F).	Lamp filament (L1) burned out. Circuit breaker CB3 tripped or faulty.	Replace lamp (L1), reset or replace circuit breaker CB3.
Right or left strobe lamps inoperative (L2-1, L2-2) (280F).	Strobe power supply (SLPS) faulty. NOTE: Lamps have separate power supplies.	Repair or replace strobe power supply.
Both left-right navigation lights and tail light inoperative (280F).	Navigation light circuit breaker open or faulty.	Reset or replace circuit breaker CB3.
Both right and left strobe lamps inoperative (280F).	Anti-collision light breaker (CB4) open or faulty.	Reset or replace circuit breaker CB4.
Anti-collision lamp inoperative (F-28F).	Lamp filament burned out.	Replace lamp (L11-1, L12-1).
Both anti-collision lamps inoperative (F-28F).	Circuit breaker (CB4) open or tripped.	Replace or reset breaker (CB4).
Both anti-collision lamps inoperative (F-28F).	Power supply faulty.	Repair or replace power supply.

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6-9 CLUTCH DISENGAGE WARNING LIGHT

NOTE: The following information pertains to early F-28F and 280F series helicopters. For helicopters equipped with the annunciator panel, refer to Paragraph 21-3, B.

A. General Information

The clutch disengage warning system consists of a red indicator lamp mounted in the instrument panel and a limit switch located on the clutch actuator mechanism. This circuit is protected with an inline fuse located in the instrument panel.

The system provides a visual cockpit warning indication of an improperly positioned clutch overcenter mechanism. The red warning cockpit lamp is illuminated whenever the clutch overcenter mechanism is not properly positioned tightly against the clutch side plates.

Troubleshooting this system consists mainly of clutch rigging checks, switch replacement, and indicator lamp or fuse replacement.

NOTE: Installation and rigging is covered in Paragraph 11-1, Clutch Control and Belt Tension Mechanism Rigging.

6-10 MANIFOLD PRESSURE OVERBOOST CAUTION LIGHT

NOTE: The following information pertains to early F-28F and 280F series helicopters. For helicopters equipped with the annunciator panel, refer to Paragraph 21-3, F.

A. General Information

The manifold overboost caution system consists of a pressure activated snap switch and associated amber indicator. System fault protection is provided by a single inline fuse (F17) located in the instrument panel.

Engine manifold pressure near maximum allowable will illuminate the amber caution lamp drawing the operator’s attention to the manifold gauge for possible corrective action. The lamp activating switch operates from a tap in the aircraft manifold pressure instrument line. Transient pressures from quick throttle inputs may appear to illuminate the lamp at low gauge pressure readings. This occurs due to inherent dampening characteristics of the pressure gauge which prevent the needle from following transient pressures. Lamp filament and fuse continuity can be checked via the indicator press to test feature.

6-11 HOURMETER

A. Troubleshooting

Problem	Cause	Required Action
Hour meter inoperative.	Inline fuse (F1) open.	Replace Fuse (F1).
	Oil pressure switch (OPS) failed.	Replace oil pressure switch (OPS).
	Hour meter faulty.	Replace hour meter (HM).

6-12 TRIM MOTORS

A. Troubleshooting

Problem	Cause	Required Action
Erratic or no trim motor operation.	Lateral limit switch S11 or S12 failed.	Replace S11 or S12 limit switch.
	Fore-aft limit switch S9 or S10 failed.	Replace S9 or S10 limit switch.
	Shorted motor TM1 or TM2.	Replace trim motor.
	Four-way cyclic switch faulty.	Replace four-way switch.
	Circuit breaker switch CB8 open or failed.	Reset or replace breaker CB8.

6-13 AMMETER – CHARGING SYSTEM

A. Troubleshooting

Problem	Cause	Required Action
Ammeter shows continuous discharge (engine running).	Regulator failed or out of adjustment.	Adjust regulator per recommended specification. Replace if defective.
	Alternator breaker open or defective (CB1).	Reset or replace breaker (CB1).
	Alternator breaker (CB15) open or defective.	Reset or replace breaker (CB15).
	Overvoltage relay tripped or defective.	Reset overvoltage relay. Replace if defective.
	Alternator switch (S6) defective.	Replace switch (S6).
	Alternator windings shorting.	Service alternator per mfg. spec.
	Worn or loosened alternator belt.	Replace/tighten belt.

6-14 INSTRUMENT CLUSTER TROUBLESHOOTING

A. Troubleshooting

Problem	Cause	Required Action
Fuel quantity indicator inoperative or erratic.	Instrument breaker (CB7) faulty or open.	Reset or replace breaker (CB7).
	Loose, damaged, broken ground wire from sending unit.	Inspect sending unit wiring – repair as necessary.
	Faulty module electronics.	Perform electrical check of module – see Figure 6-7.
	Faulty bracket connection in the fuel quantity assembly (Figure 13-19).	Abrade bracket surfaces (Para. 13-10, B, (4), (a.1), 2, NOTE).

B. Troubleshooting – Main Rotor Gearbox Temperature

Problem	Cause	Required Action
Erroneous indication or inoperative temperature meter	Instrument breaker CB7 open or faulty	Replace or reset breaker CB7
	Loose, damaged or broken ground wire from sending unit	Inspect sending unit wiring – repair as necessary
	Damaged thermocouple	Replace thermocouple wire. Use type approved for application
	Faulty module electronics	Perform electrical check of module – See Figure 6-6
Needle pegged beyond full scale	Excessive resistance in temperature probe line	Check robe wiring for break and repair as necessary
Needle pegged below zero	Shorted probe wire	Inspect probe wire for improper ground. Replace wire.

C. Troubleshooting Amperage Meter

Problem	Cause	Required Action
Meter not operating	Loose connection at meter shunt	Tighten shunt terminals
	Faulty indicator	Perform electrical check of module See Figure 6-7

D. Oil Temperature Module

Problem	Cause	Required Action
Oil temperature	Breaker CB7 faulty or open	Reset or replace breaker
	Faulty indicator	Perform electrical check of module – see Figure 6-5
	Faulty sending unit ground	Repair or replace defective wiring
Needle pegs	Excessive resistance in temperature probe wiring	Check probe wiring for break and repair as necessary
	Defective sending unit	Replace temperature probe
Needle pegs below zero	Open in probe wiring	Inspect wiring from probe for improper ground. Replace ground wire.

E. Cylinder Head Temperature Module Troubleshooting

Problem	Cause	Required Action
Cylinder head temperature module inoperative	Circuit breaker CB7 open or faulty	Replace lamp
	Defective temperature probe	Replace temperature probe
Needle pegged at full scale	Excessive resistance in temp probe wiring	Check wiring for break. Repair or replace probe wire.
Needle pegged below zero	Shorted probe wire	Inspect wiring from probe for improper ground. Replace defective wiring.

F. Instrument Cluster Module Check Procedure

This procedure will assist in determining the operational status of the individual instrument modules. The steps do not constitute an instrument calibration procedure. Resistance values given are approximate.

Equipment Required:

(1) 14 or 28 volt, 2 amp, filtered-regulated power supply.

(2) Variable power resistor or resistance decade box.

(3) Test Leads

Procedure:

(1) Position rear of module as pictured.

(2) Connect power and variable resistor per individual diagram.

(3) Adjust desired resistance level.

(4) Set power supply for 14 volts D.C. or 28 volts D.C., as appropriate.

(5) Do not use resistance values lower than those specified in the respective charts, instrument damage may result.

(6) Pin having "no connection" is 14 or 28 volt lighting.

(7) All grounds are power supply "negative output" connections.

(8) Proper instrument operation is observed when resistance values and scale readings correlate. See applicable chart for each module type.

NOTE: Excessive resistance or open in probe wires may cause meter needle to "peg" full scale.

A short or very low resistance in probe wires may cause meter needle to "peg" below zero.

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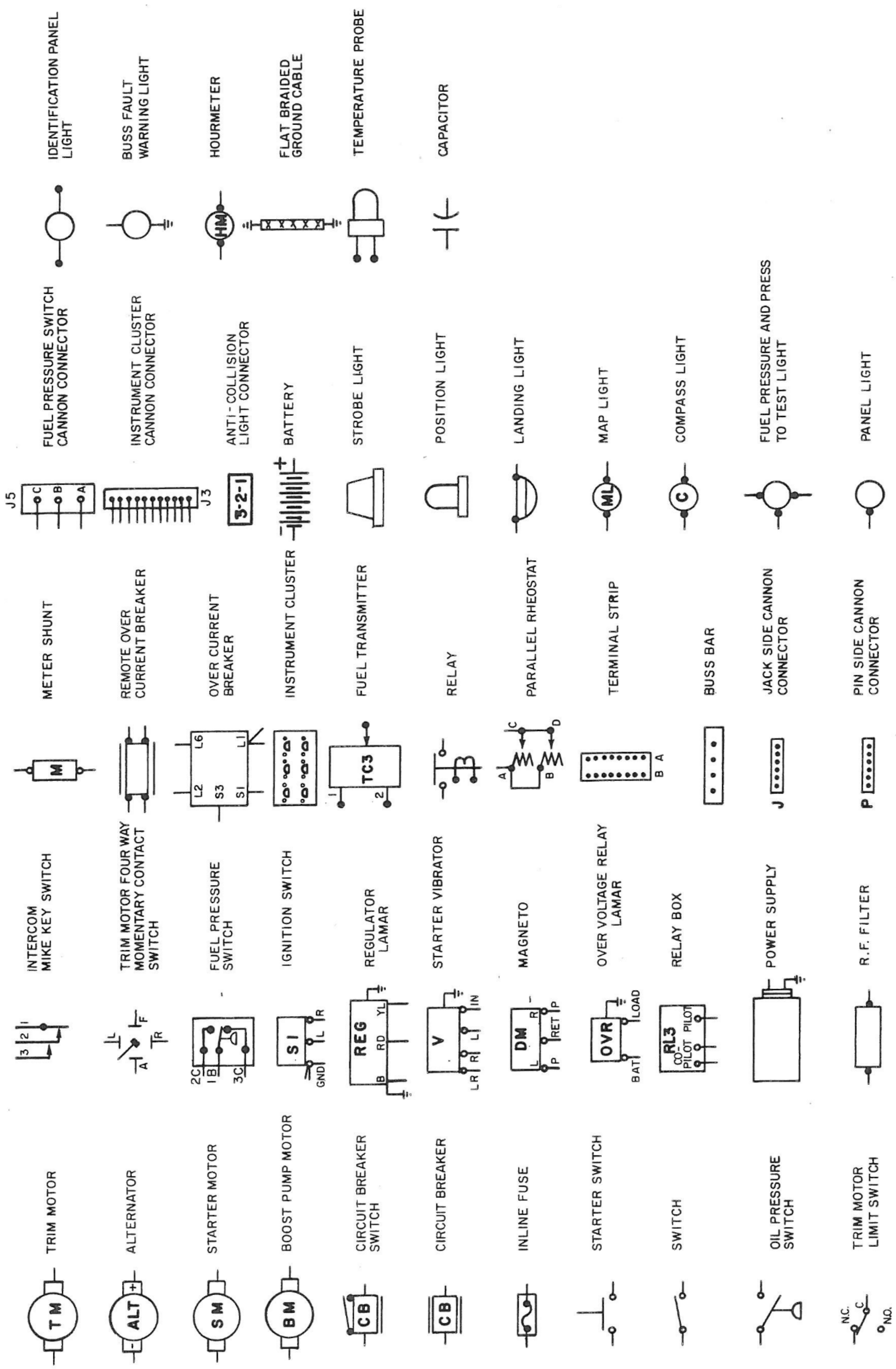

Figure 6-3. Electrical Symbols

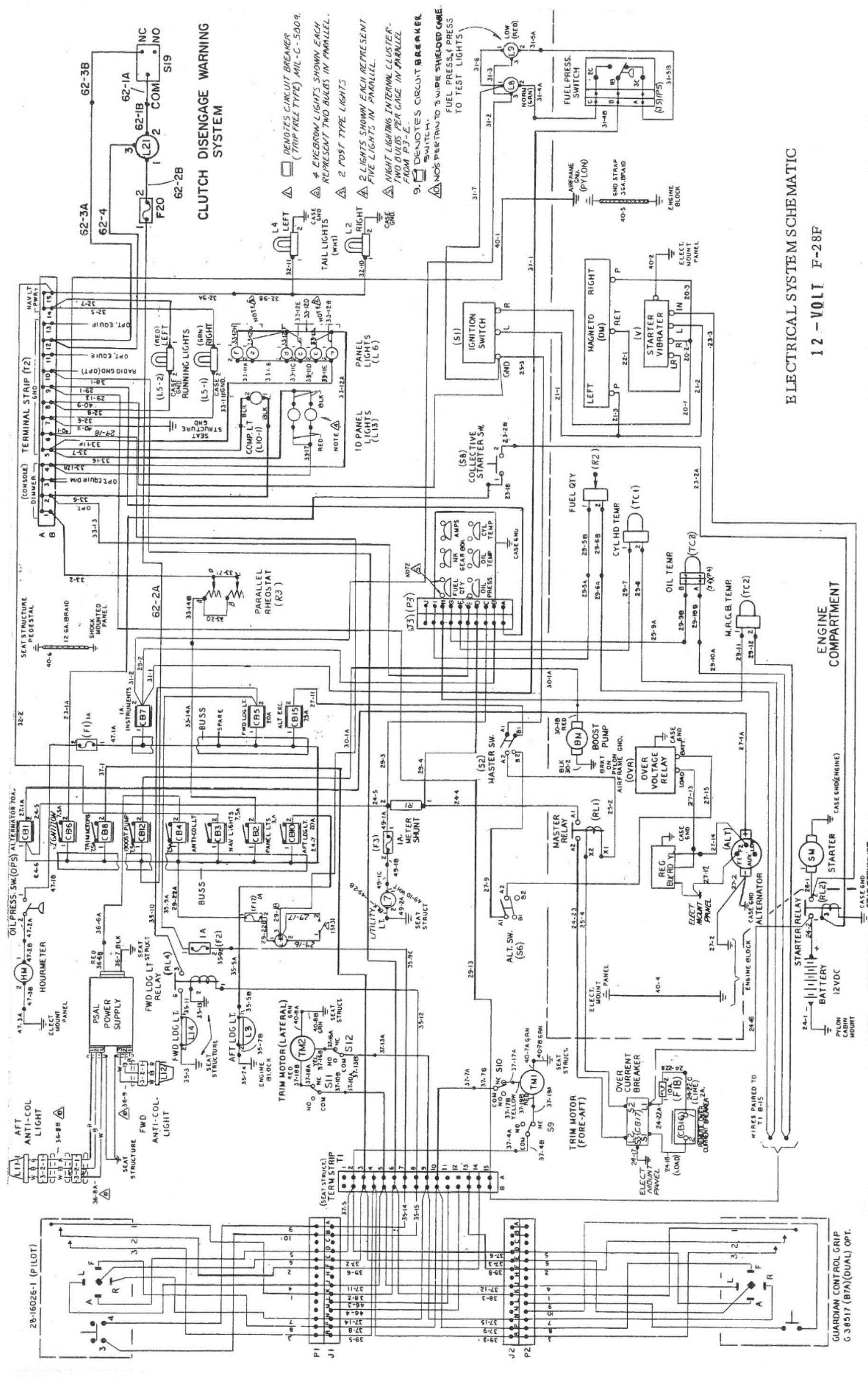

Figure 6-4. Electrical System Schematic 12-Volt F-28

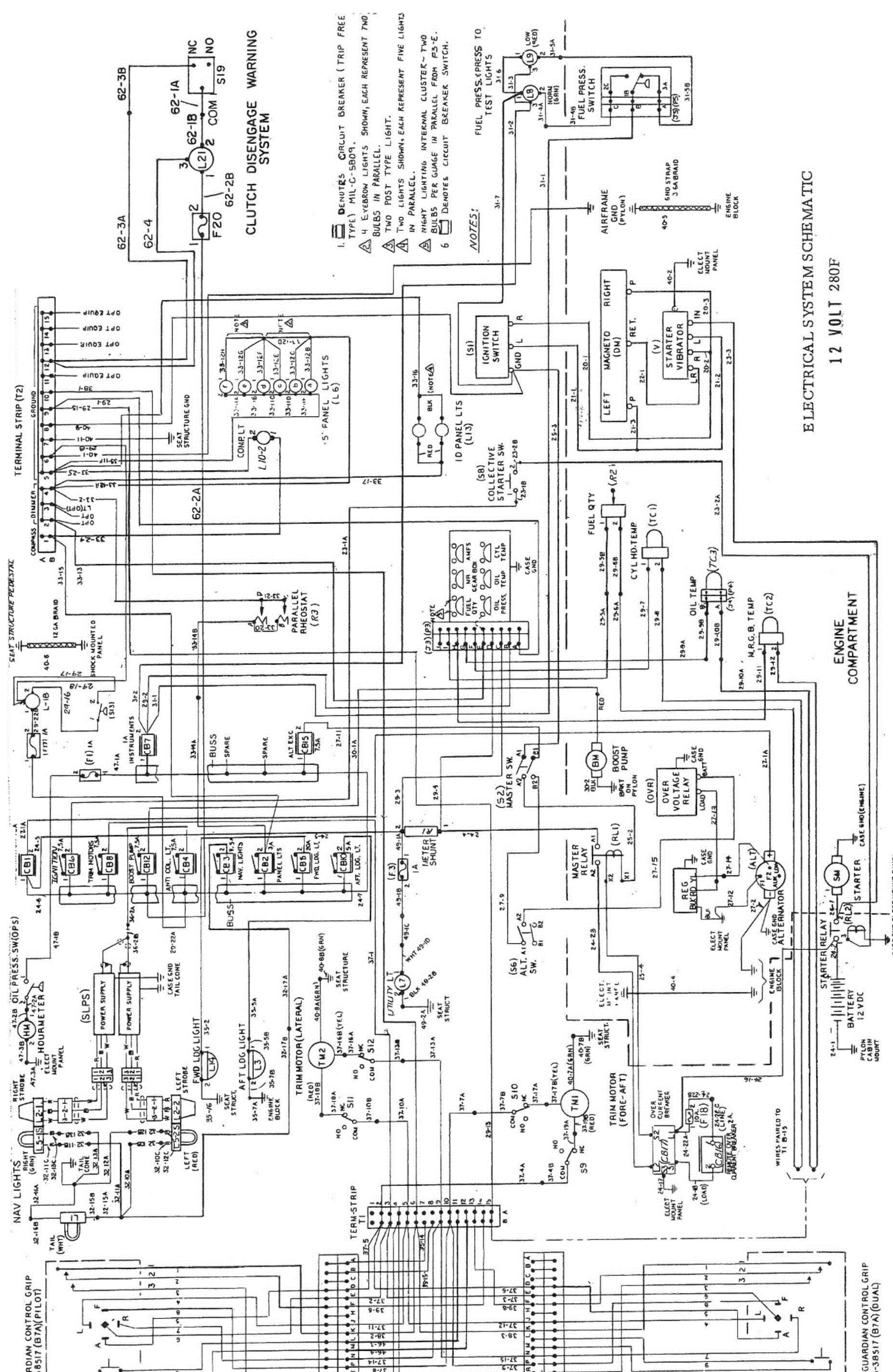

Figure 6-5. Electrical System Schematic 12 Volt 280F

6-15 CHARTS

A. Electrical Loads

NOTE: The following data pertains to early F-28F and 280F (12V) helicopters.

The flight ampere load conditions chart describes the typical amperage required to operate specific standard electrical devices in the F-28F and 280F aircraft. Total electrical loads (amperes) are shown for various combinations of electrical devices under simultaneous operation. The electrical load totals can be used to estimate the percent reserve power available from the alternator when additional electrical equipment is installed on the aircraft. (Maximum continuous alternator output is 70 amperes).

Component Location Chart

Fuses

Location	Schematic ID	Description	F-28F	280F
Instrument panel	F1	Hourmeter fuse	X	X
Instrument panel	F2	Forward landing light fuse	X	X
Instrument panel	F3	Utility light fuse	X	X
Instrument panel	F17	Overboost light	X	X
Battery Box	F18	Overcurrent system	X	X
Instrument panel	F20	Clutch disengaged system	X	X

Relays

Location	Schematic ID	Description	F-28F	280F
Aft firewall co-pilot side	RL1	Master relay	X	X
Battery box	RL2	Starter relay	X	X
Behind seat deck Pilot side	RL4	Landing lamp relay		X

Special Switches

Location	Schematic ID	Description	F-28F	280F
Engine compartment cross tube co-pilot side	FPS	Fuel pressure switch	X	X
Instrument panel	OPS	Oil pressure switch	X	X
Instrument panel	S13	Turbo boost pressure		X
Instrument panel	S13	Turbo boost pressure	X	

ELECTRICAL DEVICE	DAY A	DAY B	DAY C	DAY D	DAY E	NIGHT F	NIGHT G	NIGHT H	NIGHT I	NIGHT J	NIGHT K	NIGHT L
Boost Pump	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Longitudinal Trim*	-	6.0	-	6.0	-	-	6.0	-	6.0	-	6.0	-
Lateral Trim*	-	-	6.0	-	6.0	-	-	6.0	-	6.0	-	-
Radio Transmit*	-	3.5	3.5	-	-	-	3.5	3.5	-	-	3.5	-
Radio Receive	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Instrument Cluster	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14
Master Relay	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Stroke Kits (Total)	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4
Position Lights - Right & Left	-	-	-	-	-	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Panel Lights	-	-	-	-	-	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Aft Position Light	-	-	-	-	-	1.6	1.6	1.6	1.6	1.6	1.6	1.6
Forward Landing Light 4509**	-	-	-	-	-	-	-	-	-	-	8.23	8.23
Forward Landing Light (4313)***	-	-	-	-	-	-	-	-	-	-	(20.8)	(20.8)
Aft Landing Lights**	-	-	-	-	-	-	-	-	-	-	3.14	3.14
	9.64	19.14		15.64		17.24	26.74		23.24		38.11 (50.68)	28.61 (41.18)

NOTE: Flight condition "A" is day normal cruise

Flight condition "F" is night normal cruise

* Denotes intermittent use

** Denotes short duration use (5 minutes)

*** 4313 Landing lamp acceptable substitute

The above load conditions include typical electrical appliances for 280F series helicopters. If other special equipment is added, the loads for conditions A and F in the above table are to be modified.

280F Flight Mode Load Conditions – 12 Volt System

ELECTRICAL DEVICE	DAY A	DAY B	DAY C	DAY D	DAY E	NIGHT F	NIGHT G	NIGHT H	NIGHT I	NIGHT J	NIGHT K	NIGHT L
Nav Lights 4 @ 1.61 amps each	-	-	-	-	-	6.44	6.44	6.44	6.44	6.44	6.44	6.44
Boost Pump	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Longitudinal Trim*	-	6.0	-	6.0	-	-	6.0	-	6.0	-	6.0	-
Lateral Trim*	-	-	6.0	-	6.0	-	-	6.0	-	6.0	-	-
Radio - Transmit*	-	3.5	3.5	-	-	-	3.5	3.5	-	-	3.5	-
Radio - Receive	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Instrument Cluster	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14
Master Relay	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Anti-Collision	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Panel Lights	-	-	-	-	-	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Forward Landing Light 4509**	-	-	-	-	-	-	-	-	-	-	8.23	8.23
Forward Landing Light (4313)***	-	-	-	-	-	-	-	-	-	-	(20.8)	(20.8)
Aft Landing Light 4509**	-	-	-	-	-	-	-	-	-	-	8.23	8.23
Aft Landing Light (4313)***	-	-	-	-	-	-	-	-	-	-	(20.8)	(20.8)
Landing Light Relay	-	-	-	-	-	-	-	-	-	-	0.21	0.21
	14.24	23.74		20.24		22.68	32.18		28.68		48.85 (73.99)	39.35 (64.49)

NOTE: Flight condition "A" is day normal cruise
Flight condition "F" is night normal cruise
* Denotes intermittent use
** Denotes short duration use (5) minutes)
*** 4313 Landing lamp acceptable substitute

The above load conditions include typical electrical appliances for F-28F series helicopters. If other special equipment is added, the loads for conditions A and F in the above table are to be modified.

F-28F Flight Mode Load Conditions – 12 Volt System

AMOUNT	LOCATION	ASSEMBLY MANUFACTURER	ASSEMBLY NO.	BULB NO. 12 Volt	BULB NO. 28 Volt
1	Aft Landing Light	Enstrom		4313 or 4509	4591
1	Forward Landing Light	Enstrom		4313 or 4509	4596
1	Forward, Right Position Light - Green	Grimes	A-1285-G-12	1512	1524
1	Forward, Left Position Light - Red	Grimes	A-1285-R-12	1512	1524
2	Aft Position Lights	Grimes	A-1285-C-12	1512	1524
2	Anti-Collision Lights	Whelen	HDA-14	A469A Flash Tube	A469A
1	Map Light	Grimes	15-007-5	1816	313
2	Post Lights	Grimes	A8970	330	327
8	Eyebrow Lights	Grimes	B4855-B-330	330	327
1	Fuel Boost Light - Red	Dialight	803-1710-0331-504	1815	1819
2	Switch Panel Placard	Enstrom	28-18091-1 (Master Switch, etc)	Replace	
	Lights		28-18091-3 (Alternator, etc)	Assembly	
1	Overboost Caution Light	Dialight		1815	1819
1	Clutch Disengage Warning Light	Dialight	803-1710-0331-504	1815	1819

F-28F Lamp Replacement Chart

AMOUNT	LOCATION	ASSEMBLY MANUFACTURER	ASSEMBLY NO.	BULB NO. 12 Volt	BULB NO. 24 Volt
1	Aft Landing Light	Enstrom		4406	4591
1	Forward Landing Light	Enstrom		4313 or 4509	4596
1	Right Side Position	Whelen (modified by Enstrom)	A650PG	W1290-14	W1290-28
	Light and Strobe		(Enstrom 28-21048-3)	A610 Strobe	A610
1	Left Side Position	Whelen (modified by Enstrom)	A6050PR	W1290-14	W1290-28
	Light and Strobe		(Enstrom 28-21048-1)	A610 Strobe	A610
1	Aft Position Light	Whelen	A555	A508-14	A508-28
1	Map Light	Grimes	15-007-5	1816	313
2	Post Lights	Grimes	A8970	330	327
8	Eyebrow Lights	Grimes	B-4855-B330	330	327
1	Fuel Boost Light - Red	Dialight	803-1710-0331-504	1815	1819
1	Fuel Boost Light - Green	Dialight	804-1710-0332-504	1815	1819
2	Switch Panel Placard	Enstrom	28-18091-1 (Master Switch, etc)	Replace	
	Lights		28-18091-3 (Alternator, etc)	Assembly	
1	Overboost Caution Light	Dialight		1815	1819
1	Clutch Disengage Warning Light	Dialight	803-1710-0331-504	1815	1819

280F Lamp Replacement Chart

SECTION 7

INSTRUMENTS

TABLE OF CONTENTS

SECTION 7

INSTRUMENTS

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7-1 INSTRUMENT PANEL

The instrument panel is centrally located in the front of the cabin for optimum visibility by either pilot or co-pilot. The "F" model instrument panel is mounted at an 8° angle. Refer to Figures

NOTE: Instrument panel angle is required when replacing an attitude gyro (horizontal horizon) designed to operate at the same angle.

7-2 ALTIMETER

A. Description

The altimeter indicates the height of the helicopter above sea level. It is operated by static air pressure derived from the airspeed pitot-static system. The altimeter is of the sensitive type that provides a height reading from 0 to 20,000 feet. The long hand reads in increments of 100 feet, the middle hand in increments of 1,000 feet, and the short hand in increments of 10,000 feet. The control knob on the face of the altimeter adjusts the barometric pressure reading to set field altitude.

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

B. Altimeter – Troubleshooting

Problem	Cause	Required Action
Indicating hands fail to respond.	Static pressure line obstructed.	Disconnect static pressure line from instruments and blow with compressed air.
	Static pressure connection improperly made.	Check static pressure lines and connect correctly.
Indications are obviously incorrect.	Leaks in static pressure line and/or leaks in cases of instruments in same system.	Replace damaged tubing and/or check instruments for leaks.
	Defective instrument.	Replace altimeter.
Indicating hands vibrate.	Excessive vibration of static pressure tubing.	Anchor tubing with tube clamps.

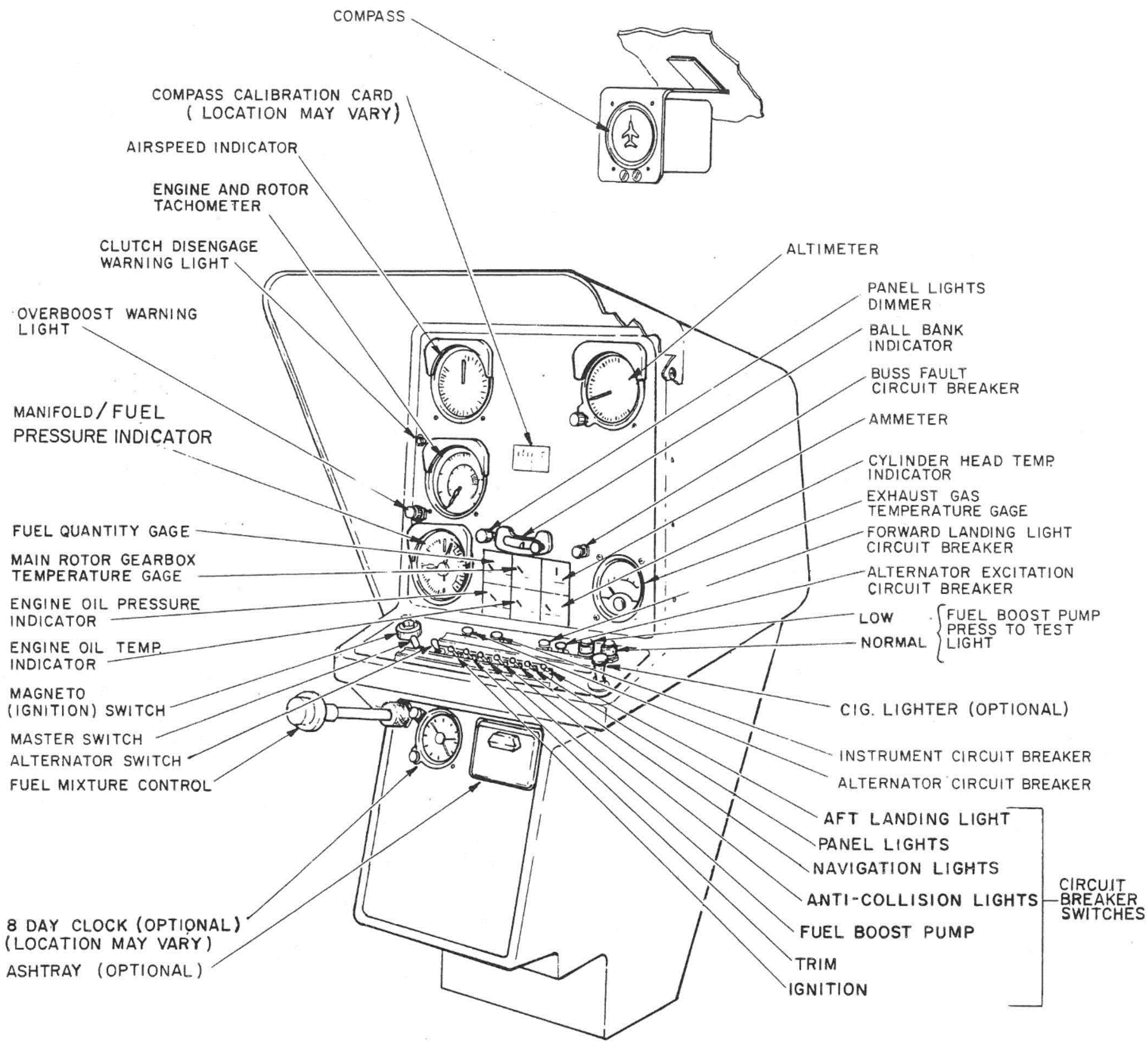


Figure 7-1. Early F-28F Instruments and Instrument Panel

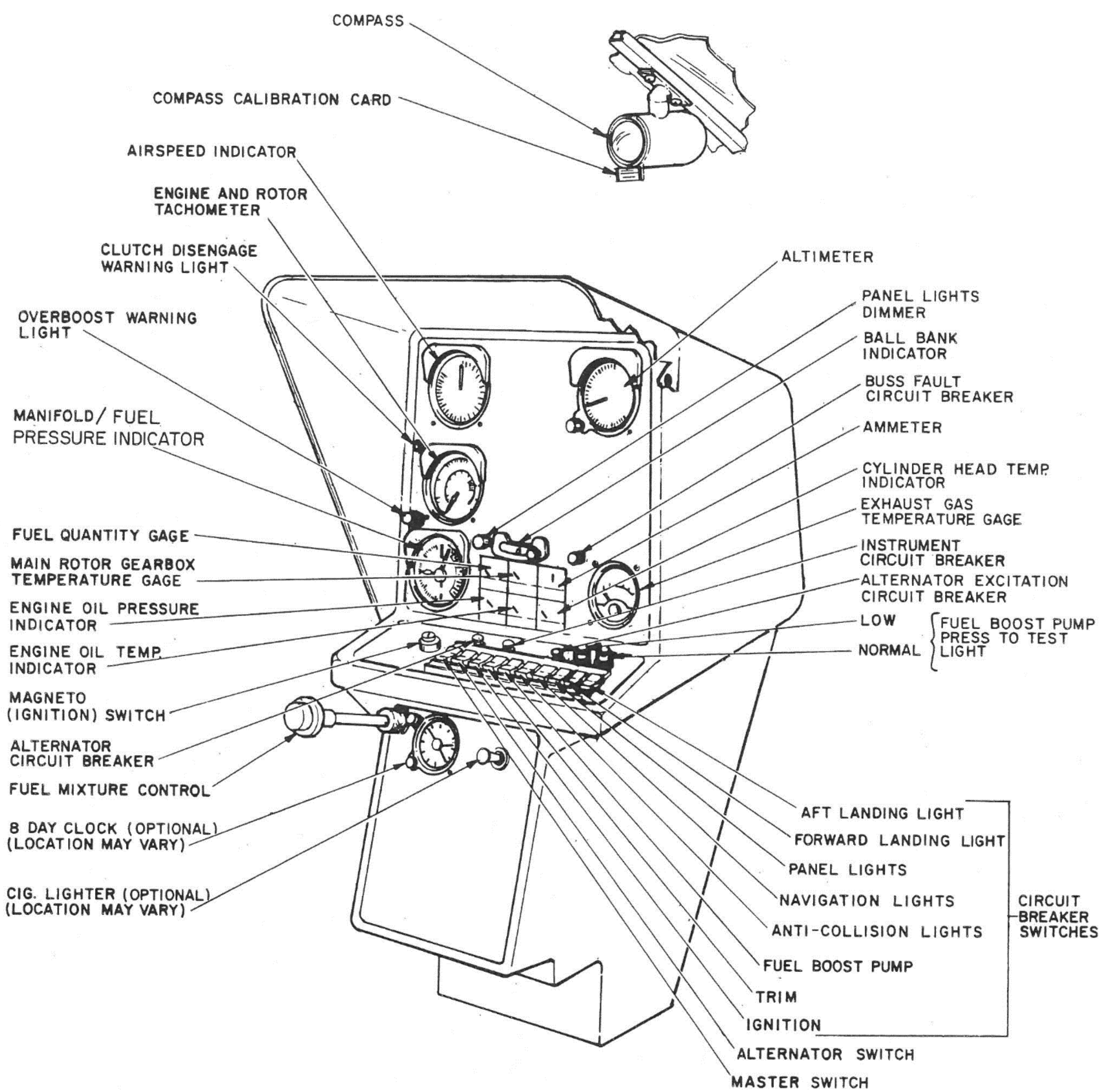
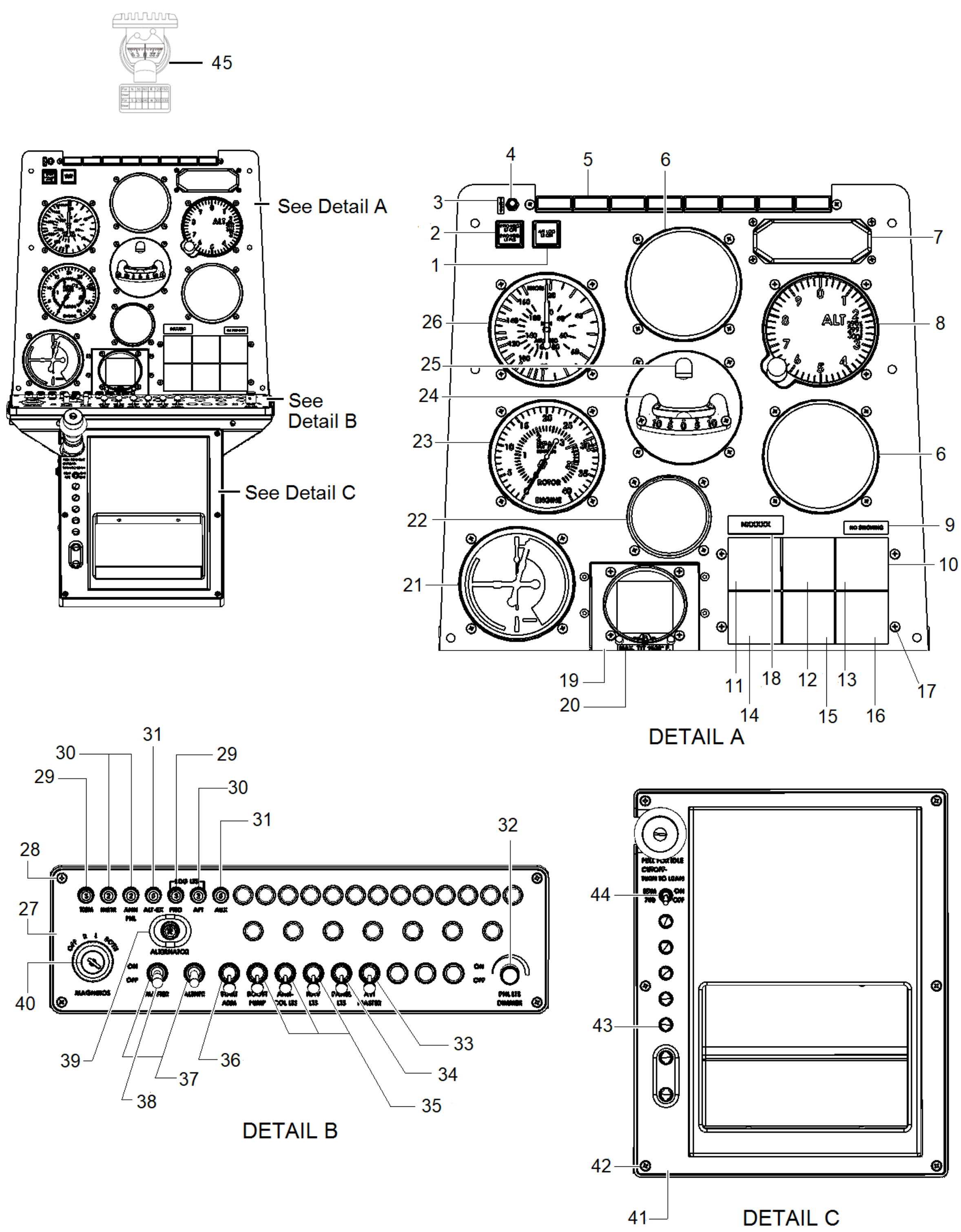


Figure 7-2. 280F Instruments and Instrument Panel



Narrow panel configuration shown.
Instrument face and control features and switch labels may vary.

Figure 7-2.1 F-28F (later) and 280FX Instruments and Instrument Panel

Figure 7-2.1 F-28F (later) and 280FX Instruments and Instrument Panel Legend

1. Aft Landing Light Annunciator
2. FWD Landing Light Annunciator
3. Placard
4. Switch
5. Light Assembly Annunciator
6. Instrument Cutout Cover
7. Cover
8. Altimeter
9. Placard
10. Instrument Cluster
11. Fuel Quantity Gauge
12. Oil Temp. MRGB Guage
13. Ammeter Gauge
14. Eng. Oil Press. Gauge
15. Eng. Oil Temp. Gauge
16. Cylinder Temp. Gauge
17. Screw
18. Placard
19. Engine Monitor
20. Placard
21. Manifold Pressure and Fuel Flow Gauge
22. Cover
23. Dual Tachometer
24. Inclinometer
25. Post Lite
26. Airspeed Indicator
27. Illuminated Panel
28. Screw
29. Circuit Breaker (3 Amp)
30. Circuit Breaker (2 Amp)
31. Circuit Breaker (5 Amp)
32. Knob
33. Switch (35 Amp)
34. Switch (3 Amp)
35. Switch (5 Amp)
36. Switch (7 ½ Amp)
37. Switch-Toggle
38. Cap
39. Circuit Breaker
40. Ignition Switch
41. Illuminated Radio Panel
42. Screw
43. Plug
44. Switch
45. Compass

7-3 AIRSPEED INDICATOR

A. Description

The single scale airspeed indicator is calibrated in miles per hour or knots 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 on the lower side 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 instrumentation operation.

CAUTION: NEVER APPLY POSITIVE PRESSURE TO STATIC LINES WITH THE INSTRUMENTS CONNECTED; THIS WILL DAMAGE THE INSTRUMENT MECHANISM.

B. Airspeed Indicator - Troubleshooting

Problem	Cause	Required Action
Airspeed indicator needle fails to respond.	Incorrect pitot tube hookup.	Check tubing connection and make necessary corrections.
	Obstruction in pitot lines.	Disconnect pitot line from pitot head and instruments and static line from fuselage and instruments, clear lines with compressed air. Check pitot tube drain hole.
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 drain hole.

7-4 ENGINE & ROTOR TACHOMETER

A. Description

The engine and rotor tachometers are combined on a single indicator (twin tach) with concentric scales calibrated in engine and rotor rpm. The needle marked "E" indicates engine rpm, while the needle marked "R" indicates rotor rpm. The tachometer is mechanically connected to the rotor assembly and engine assembly through flexible drive cables.

B. Engine & Rotor Tachometer – Troubleshooting

Problem	Cause	Required Action
NOTE: The engine and rotor rpm tach cables can be switched at the back of the instrument to isolate an issue if it is limited to either the engine or rotor rpm tach cable.		
Fluctuating needle(s).	Binding cable.	Lubricate cable.
	Defective instrument.	Replace instrument.
No reading on indicator.	Twisted or broken cable or tach drive belts.	Replace cable or drive belts.
Needles either permanent or intermittent.	Defective instrument.	Replace instrument.
	Reverse installation of cable.	Install cables in correct position.
Needles do not superimpose.	Instrument out of tolerance.	Check tolerance: 2900 ± 25 rpm, 3050 ± 25 rpm. Spread between needles 1/4 of needle width maximum.
	Tach drive belts slipping or broken.	Replace drive belts.

7-5 FUEL QUANTITY INDICATOR

A. Description

The fuel quantity gauge continuously indicates the total quantity of fuel. It is electrically actuated by a float type sending unit located in the right-hand fuel tank.

NOTE: See Paragraph 13-10, B, (3) for gauge calibration procedure and adjustments.

B. Fuel Quantity Indicator - Troubleshooting

Problem	Cause	Required Action
Indicator registers "F", or consistently high reading (battery switch on).	Poor connections or sender ground.	Clean and tighten connection.
	Faulty bracket connection (Figure 13-19).	Abrade bracket surfaces (Para. 13-10, B, (4), (a.1), 2, NOTE).

7-6 ENGINE OIL PRESSURE GAUGE

A. Description

The engine oil pressure gauge indicates the pressure in the engine oil lines in pounds per square inch.

CAUTION: LOW OIL PRESSURE CAN RESULT FROM IMPROPER OIL LEVEL, INCORRECT OIL VISCOSITY, FAULTY OIL PUMP, OR BEARING FAILURE.

B. Engine Oil Pressure Gauge - Troubleshooting

Problem	Cause	Required Action
Low reading on oil pressure gauge.	Kinked tubing or obstruction in tubing.	Replace or clean tubing.
	Instrument out of tolerance.	Replace instrument.
Sticking oil pressure indicator.	Defective gauge.	Replace gauge.
Sluggish oil pressure reading.	Sludge or heavy oil in line.	Bleed line and service with engine oil, or in cold climates use kerosene.
	Safety orifice in engine fitting partially blocked by debris.	Remove engine fitting and blow clear.
Fluctuating oil pressure.	Air in pressure line.	Service oil pressure line with engine oil.

7-7 MAIN ROTOR TRANSMISSION TEMPERATURE INDICATOR

A. Description

The main rotor transmission temperature indicator is located in the instrument cluster. It is electrically operated by a temperature sensitive heat probe connected to the transmission.

B. Main Rotor Transmission Temperature Indicator – Troubleshooting

Problem	Cause	Required Action
Open circuit – no reading.	Check continuity.	Clean and tighten ground connection.
	Blown fuse	Replace fuse.

7-8 ENGINE OIL TEMPERATURE INDICATOR

A. Description

The engine oil temperature indicator measures engine oil temperature electrically by means of a resistance probe installed on the left side of the engine aft of the oil filter.

B. Engine Oil Temperature Indicator – Troubleshooting

Problem	Cause	Required Action
No reading on oil temperature indicator with battery switch on, either constant or intermittent.	Open circuit.	Repair or replace leads.
	Poor ground at panel.	Repair ground.
	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 probe to indicator.	Make continuity check and repair or replace lead.
	Short circuit in probe.	Replace probe. NOTE: Do not use thread lube when installing new probe.

7-9 AMMETER

A. Description

The ampmeter indicates the amount of electric current supplied by the alternator to the battery and electrical bus.

B. Ammeter – Troubleshooting

Problem	Cause	Required Action
No reading or erratic reading with battery and alternator switch on and engine at idle rpm.	Worn brushes, burned commutator, belt slippage or broken.	Repair or replace alternator, tighten belt, or replace belt.
Ø reading or showing discharge.	Overvoltage relay kicked out.	Reset (See Section 6).
Excessive charge or discharge in excess of 5-10 minute duration.	Faulty voltage regulator.	Replace.
	Loose or corroded connections in VR circuit.	Check as indicated, especially the ground connection.

NOTE: Normal operating system should show a medium to heavy charge rate just after engine is started. If the battery is in good condition, it will accept this charge until the set system voltage is reached (14 volts) in approximately 8-10 minutes. At this point the ammeter should drop to about zero or just above, depending on system load.

Ø reading everything is functional.	Defective meter or connections.	Check out and/or replace meter as required.

7-10 CYLINDER TEMPERATURE INDICATOR

A. Description

The cylinder temperature indicator measures the cylinder head temperature (CHT) by means of electric current from a temperature probe located in the bottom of No. 3 cylinder head.

B. Cylinder Temperature Indicator – Troubleshooting

Problem	Cause	Required Action
NOTE: The main transmission temperature probe and the CHT probe are the same part and can be swapped for troubleshooting.		
Temperature reading high throughout scale.	Poor connections or partial break in leads.	Check continuity of leads. Repair or replace faulty leads.
	Defective instrument.	Remove instrument for overhaul.
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.

7-11 TURBINE INLET TEMPERATURE (TIT) INDICATOR

NOTE: The TIT indication on early F series helicopters was initially presented on an analog instrument labeled as an “EGT” indicator. The analog instrument was replaced by a graphic engine monitoring (GEM) system or engine data management (EDM) system. Discussion relevant to both TIT indication systems is present in steps A through C below. Discussion relevant to the original analog instrument is presented in step D below. Further discussion relevant to the GEM and EDM systems is presented in Paragraph 7-21.

A. 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 turbine inlet temperature (TIT). The TIT indication operates off a heat sensitive probe located in the exhaust system just forward of the turbocharger.

B. TIT Readings at Cruise

(1) Turbine inlet temperature (TIT) should be used as an aid for fuel mixture leaning in cruising flight at 75% power or less, i.e. 29 inches manifold pressure and 3050 rpm.

(2) To obtain a best economy mixture, lean to 1650°F TIT. To obtain a best power mixture, lean to 1550°F TIT. Do not exceed 1650°F TIT. Operation on the lean side of peak TIT is not approved. Also, any change in altitude or power will require a recheck of the TIT indication.

CAUTION: FREQUENT OPERATION APPROACHING OR ABOVE 1650°F MAY ACCELERATE DEGRADATION OF EXHAUST SYSTEM COMPONENTS.

(a) Fuel Mixture: Engine may be leaned at 29" MP or below to 1600°F on rich side of peak. Never exceed 1650°F TIT. Mixture must be full rich for landing and takeoff regardless of power for proper engine cooling.

C. Functional Check

CAUTION: DO NOT OPERATE ABOVE 1600° F TIT NOR WITH A FUEL FLOW SETTING LESS THAN 80 POUNDS PER HOUR AT 75% POWER (28.0 INCHES MP) UNTIL A CALIBRATION CHECK HAS BEEN COMPLETED AFTER THE TIT SYSTEM OR ANY PART THEREOF HAS BEEN REPLACED.

(1) Due to the narrow margin of temperature error allowed while operating at or near 1650°F TIT, it is recommended that at each 100 hour inspection, or at any time an error is suspected, the analog, GEM, EDM system, as applicable, be tested for proper calibration

D. Calibration – Analog Instrument

Instructions for testing and calibrating of the analog system may be found in the Alcal EGT Operating Instruction Manual AR70-155. It is recommended that a log book entry be made during the next flight of the fuel flow reading with the power set at 29" manifold pressure, rpm at 3050, and mixture leaned to 1650°F. A normal fuel flow indication would be 83 pounds per hour plus or minus 3 pounds per hour. A variation exceeding this range would indicate that the EGT is reading either high or low respectively.

Example: Mixture normally leaned to 1650°F (TIT), fuel flow in excess of 86 pounds per hour -- actual (TIT) temperature is lower than indicated.

This information, if monitored, will give operators sufficient warning if there is a problem developing in either the engine or the system. A (TIT) reading that varies from normal and is engine related will be apparent by other symptoms.

Example: Partially restricted injector nozzle -- high fuel flow, low (TIT) with rough running engine.

CAUTION: DO NOT OPERATE ABOVE 1600°F (TIT) NOR WITH A FUEL FLOW SETTING LESS THAN 80 POUNDS PER HOUR AT 75% POWER (29.0" MP) UNTIL A CALIBRATION CHECK HAS BEEN COMPLETED AFTER THE SYSTEM OR ANY PART THEREOF HAS BEEN REPLACED.

After replacement of broken instrument or at 100 hour inspection, it is recommended that a functional check be made of the system using an ALCOR AlCal Mark V Calibrator in accordance with these instructions.

7-12 MANIFOLD PRESSURE & FUEL FLOW INDICATOR

A. Description

The manifold pressure indicator is connected to the primary airflow system at the #3 cylinder and measures power being produced and used. The fuel flow indicator which is mounted in the same instrument is connected to the fuel flow system at the flow divider. It indicates fuel flow in relation to manifold pressure.

B. Manifold Pressure Indicator - Troubleshooting

Problem	Cause	Required Action
Excessive error at existing barometric pressure.	Water or restriction in line between instrument and engine.	Disconnect at instrument and blow out line.
Sluggish operation of needle.	Damaged or restricted line.	Remove line and blow out restriction. Replace line if damaged. NOTE: Restricted fitting just aft of instrument must also be removed before blowing out line.
	Defective instrument.	Replace instrument.

C. Fuel Flow Indicator - Troubleshooting

Problem	Cause	Required Action
Low reading on fuel flow indicator.	Kinked tubing or obstruction in tubing.	Replace or clean tubing.
	Leak in fuel nozzle lines.	Repair leak or replace line.
	Instrument out of tolerance.	Replace instrument.
Sticking fuel flow indicator.	Defective instrument.	Replace instrument.

7-13 OUTSIDE AIR TEMPERATURE INDICATOR

A. Description

The outside 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 aid in determining performance capability of the helicopter at the existing climatic condition. The indicator is located in the top of the cabin.

7-14 MAGNETIC COMPASS (Early F-28F and 280F Models)

A. Description

(1) Vertical Card Compass (Early F-28F)

The vertical card compass is a dry compass utilizing eddy current dampening. It consists of a 2" vertical rotating dial and is compared with a fixed miniature airplane (lubber line) to present magnetic heading of the aircraft at all times. Heading information is more natural because the heading is read at the 12 o'clock position and off the nose of the miniature airplane. The compass card rotates and presents all quadrants in their true relation to line of flight. A compass light is furnished for night flying. A compass correction card and card holder is attached to the instrument console.

(2) Magnetic Compass (280F)

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 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.

7-15 MAGNETIC COMPASS (Later F-28F and 280FX)

NOTE: Due to improved performance, F-28F S/N 833 and subsequent and 280FX S/N 2167 and subsequent helicopters are equipped from the factory with a SIRS Navigation Aircraft Compass.

A. Description

The compass installation is mounted to the center windshield post and includes the correction card adjacent to the compass. The compass may feature a fluorescent card legend, LED illumination, and silicone card damping. Power for illumination is provided by the PNL LT switch and brightness may be controlled with the DIMMER PANEL LT knob.

Refer to Paragraph 7-18 for removal and installation instructions. Refer to Paragraph 7-19 for inspection requirements. In the event the compass must be replaced, refer to the manufacturer’s installation instructions. Vendor information is provided in Table 2-2.

7-16 HOURMETER

A. Description

The hourmeter is located inside the right side engine compartment door. It is mounted just forward of the air filter housing. The meter keeps a running log of the total hours on the aircraft.

7-17 PITOT STATIC SYSTEM

A. Description

To operate the airspeed indicator and altimeter, it is necessary to have a static source of air pressure. A pitot-static system has been installed in the aircraft with two static air pressure ports. One is on the left-hand side of the tail cone just aft of the baggage compartment and the other is on the right-hand side of the tail cone. The static pressure ports are interconnected to a single static pressure line which runs up the right side of the pylon and through the seat structure to a tee fitting in the instrument console. It then runs to the altimeter and to one side of the airspeed indicator. Refer to Figure 7-3.

CAUTION: THE TWO STATIC PORTS 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 OR INACCURATE.

B. Pitot Tube - Description

The pitot tube is located on the lower forward side of the cabin structure. It is a curved aluminum tube secured with mounting plates to the bottom of the fiberglass cabin wall. A flexible rubber hose is routed through the instrument console connecting the pitot tube to the airspeed indicator instrument line.

CAUTION: The pitot tube inlet end should be covered when the aircraft is to be parked for any prolonged period of time to prevent ingestion of dirt or ice that will impair the operation of the airspeed indicator. Use a red cover so it will be noticeable for removal on preflight inspection.

7-18 REPLACEMENT OF INSTRUMENTS

A. Replacement Procedures

NOTE: The following procedures are typical and apply to all instruments installed in the instrument panel.

(1) Check that all electrical power is off to avoid the possibility of electrical shorts while working in the area of the instrument panel.

(2) Remove covers from instrument console.

(3) Disconnect electrical plug, wiring, or tubing as applicable, from the back of the instrument. Install suitable covers over tube fittings, instrument fittings, and loose wire terminals. Tag all connections for reinstallation.

(4) Remove the screws securing the instrument to face of the panel and remove instrument from instrument panel.

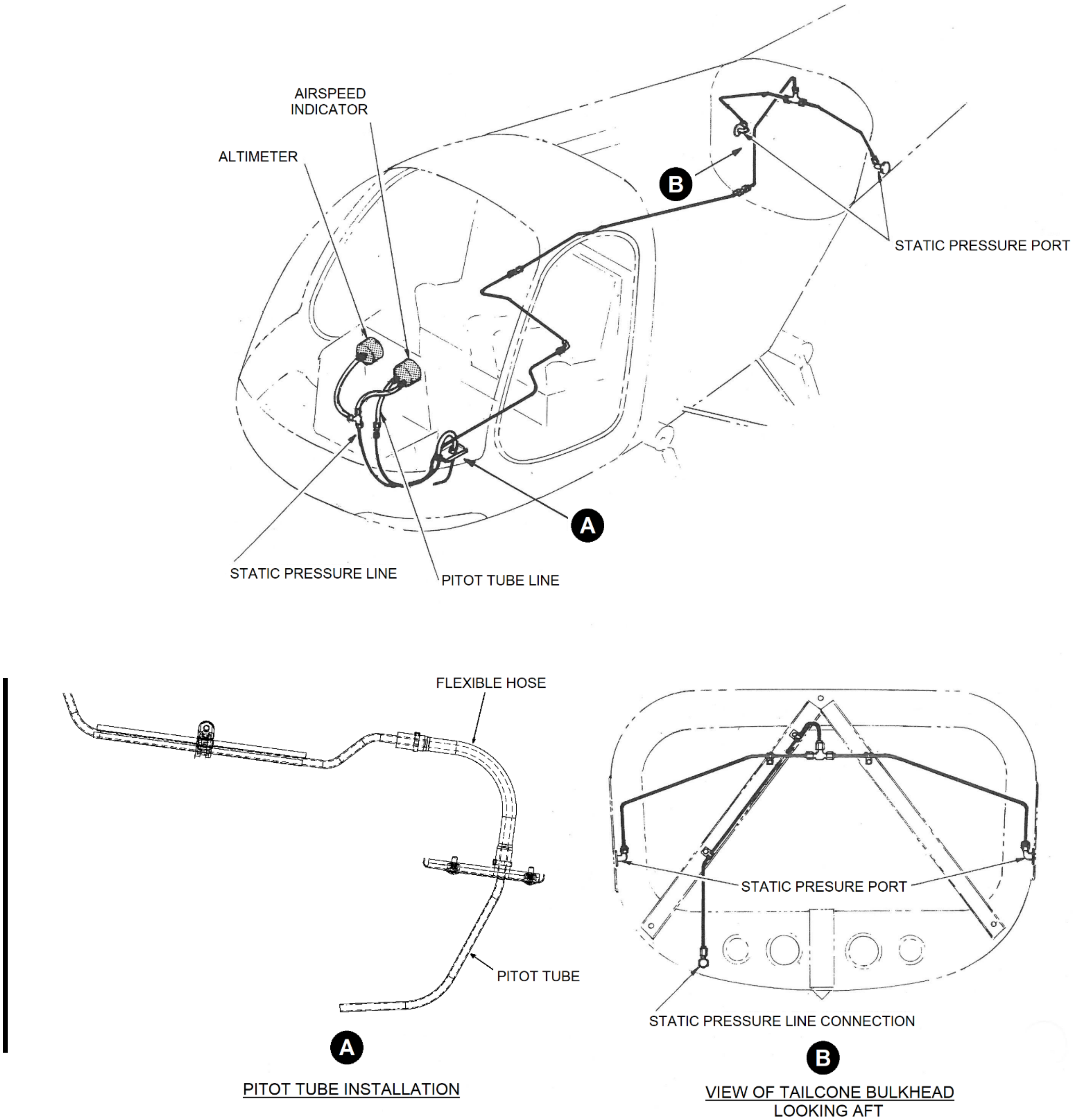


Figure 7-3. Pitot Static System

(5) Place replacement instrument into panel in mounting position and secure with mounting screws.

(6) Connect tubing, electrical plug or wiring as applicable to the back of the instrument. Use care to avoid reversing connections for pitot and static lines.

(7) Reinstall covers on instrument console.

7-19 INSPECTION OF INSTRUMENTS

A. Inspection

(1) Inspect instrument case for dents and cover glass for slippage and cracks.

(2) Inspect fitting or electrical connector at back of instrument for damaged threads that might prevent proper connection of the tube nut or electrical plug.

(3) Inspect index markings and numerals on dial face for discoloration and legibility. Inspect pointers for cracked or peeling fluorescent paint,

(4) Inspect for presence of all required range markings and slippage of any marks, indexes, or scales.

7-20 CALIBRATION OF INSTRUMENTS & INDICATORS

A. General Information

Calibration checks of the instruments are to be performed at qualified instrument calibration facilities.

7-21 ENGINE MONITOR

NOTE: Paragraph 7-21 was previously contained in Section 24.

A. Description

Later F-28F and all 280FX production aircraft are equipped with an engine monitor as an aid or as a replacement for the analog “EGT” indicator used in 280F and early F-28F production aircraft. Figure 7-2.1 depicts the location of the engine monitoring instrument.

NOTE: For early F-28F aircraft equipped with the analog indicator, the term defining the temperature of the exhaust gases delivered into the turbocharger unit was initially designated as exhaust gas temperature (EGT).

For F-28F and 280FX aircraft equipped with an engine monitor, the EGT term is replaced by the designation turbine inlet temperature (TIT). Where currently used, the term EGT is designated as the temperature of exhaust gas of the individual cylinders.

F-28F (S/N 830 and prior) and 280FX (S/N 2139 and prior) are equipped with the Graphic Engine Monitor (GEM) Model 603 or Model 610. F-28F (S/N 831 and 832) and 280FX (S/N 2140 through 2173) are equipped with the Engine Data Management (EDM) Model EDM-700. F-28F (S/N 833 and subsequent) and 280FX (S/N 2174 and subsequent) are equipped with the Graphic Engine Monitor (GEM) Model 610C (G2). GEM Model 610C is installed per STC SH13-45.

NOTE: The EDM-700 system is powered by a panel switch labeled **EDM 700**. The GEM 610C is powered by a panel switch labeled **ENG MON**.

The GEM and EDM models display EGT and cylinder head temperature (CHT) in bar graphs, one for each cylinder. TIT is displayed digitally for both models and is also displayed in bar graph on the EDM model. The GEM 610/C and EDM-700 also display EGT, CHT, and outside air temperature (OAT) digitally. The EDM-700 also monitors and displays rate of change of CHT (CLD), maximum EGT differential (DIF), and voltage (BAT).

NOTE: For Model 603, the TIT is displayed as a three-digit number (equal to the actual TIT in °F divided by 10); for Model 610, TIT is displayed as a four-digit number.

B. Maintenance

The engine monitor instrument requires no scheduled maintenance checks, calibration, field adjustments or field-serviceable components. Built-in self-tests start automatically on power-up to detect instrument malfunctions. Common start-up malfunctions are caused by a wiring anomaly. Refer to Diagram 21-5 Sheet 3 or 6, as applicable, to diagnose an open wire or probe with a poor connection.

Refer to instrument replacement (Para. 7-18) and inspection (Para. 7-19) procedures. In addition, inspect the instrument for proper operation. The inspection for proper engine monitor operation should consist of either a maintenance ground run or a maintenance test flight to compare the instrument indications to the indications observed during normal operation. Refer to the troubleshooting and diagnosis chart, Table 7-2, to help diagnose engine problems. Also, refer to the manufacturer's published installation and operation manuals for specific instrument troubleshooting.

C. CHT Probe Installation – Engine Monitor EDM-700

NOTE: Cylinder #3 CHT probe (P/N AN5546-1), specific to the EDM-700 installation, is a washer-type thermocouple. It is recommended to install a spacer (P/N 28-22096-11) whenever the CHT probe is removed, if not already installed. (This procedure was originally documented in SIL 0185.) Refer to Figure 7-4.

(1) If required, install Cylinder #3 EDM-700 CHT probe spacer as follows:

(a) Remove adaptor (P/N AN4076-1) from Cylinder #3.

(b) Remove gasket ring (of P/N MM-113-3/8) from end of adaptor.

(c) Inspect gasket ring for damage and replace P/N MM-113-3/8, if necessary.

(d) Install gasket ring (of P/N MM-113-3/8) over threaded end of adaptor.

(e) Install spacer (P/N 28-22096-11) over gasket ring over threaded end of adaptor.

(f) Reinstall adaptor (P/N AN4046-1) in Cylinder #3. (Hand tighten adaptor and snug an additional 1/16-1/8 turn.)

(g) Reconnect EDM 700 CHT probe in adaptor.

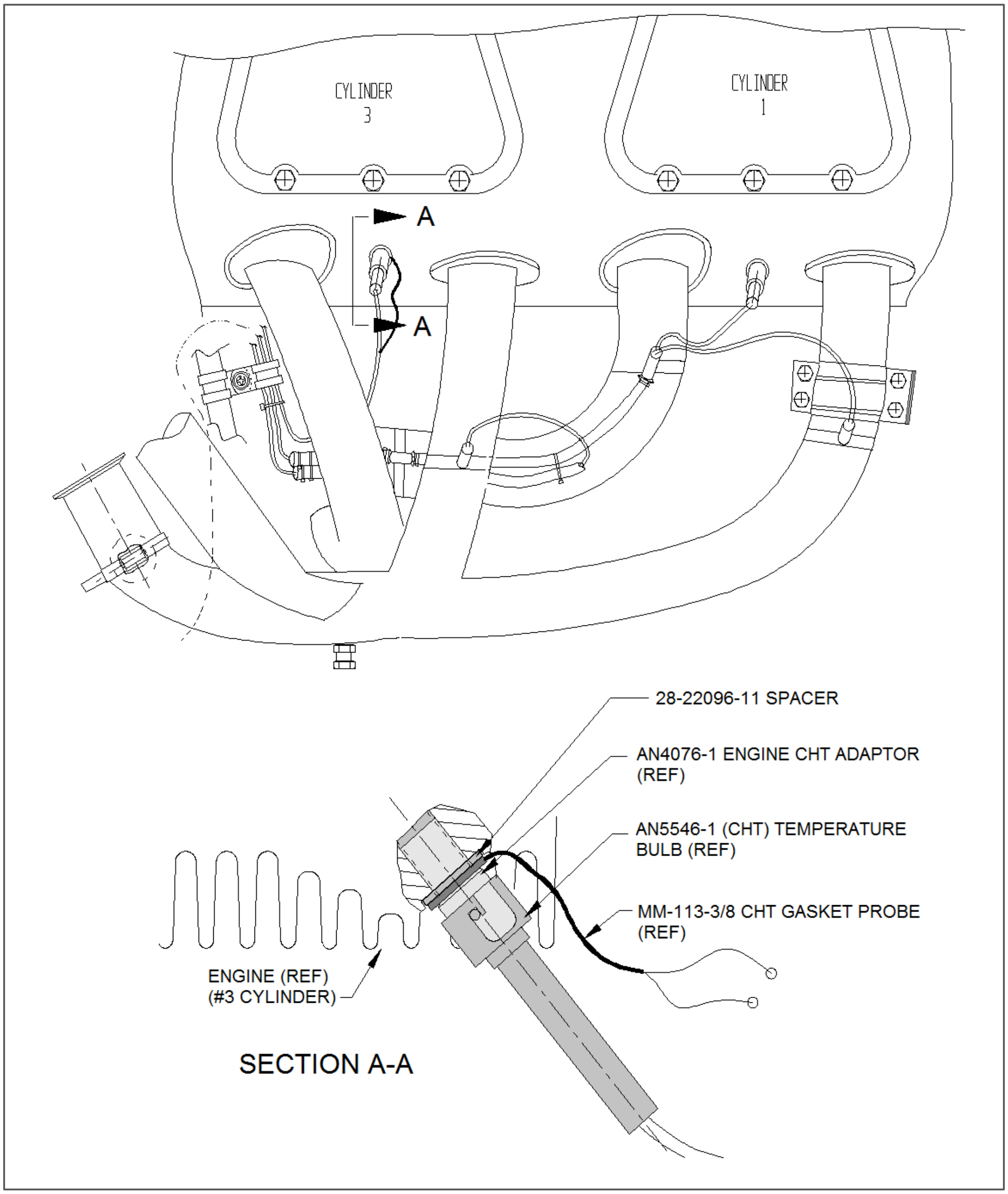


Figure 7-4. Cylinder #3 EDM-700 CHT Probe Installation

D. Programming Alarm Limits – Engine Monitor EDM-700

The EDM-700 has programmable alarms. The alarm limits are based on factory default settings but may be modified. Recommended alarm limit values are defined in Table 7-1. The operator may choose to reduce these to provide additional margins or increase engine life. Lycoming and various industry groups have additional guidance.

NOTE: Limits will reset to factory defaults when the display is switched between Fahrenheit and Celsius.

Table 7-1. EDM-700 Recommended Alarm Limit Values

Parameter	Description	Recommended Limit
CHT	Cylinder head temperature	500°F (260°C)
TIT	Turbine inlet temperature	1650°F (900°C)
CLD	Cylinder head cooling rate	-100°F/min (-55°C/min)
DIF	Difference between highest and lowest EGT values	500°F (280°C)
H BAT	Battery high voltage limit	30.0V
L BAT	Battery low voltage limit	24.5V

E. Troubleshooting

Refer to Table 7-2 to help diagnose engine problems when using the engine monitor. Not all possible engine display problems are presented. Refer to the applicable engine monitor installation and/or operation manual for a complete troubleshooting and diagnosis listing.

WARNING: MAGNETO CHECKS SHOULD BE CONDUCTED ON THE GROUND. THEY MAY BE CONDUCTED HOVERING IGE WITH A PILOT AND A MECHANIC TO MANIPULATE THE MAGNETO SWITCH, BUT THE PILOT MUST BE PREPARED FOR SUDDEN, COMPLETE ENGINE STOPPAGE.

Table 7-2. Graphic Engine Monitor Troubleshooting

Problem	Cause	Required Action
Gradual or sudden increase in EGT of one cylinder. **NOTE** GEM 603/610 display will blink when this occurs.	Partially plugged fuel nozzle, indicated by no variation in EGT during magneto check for that cylinder.	Remove and clean indicated cylinder nozzle.
	Fouled or defective spark plug or ignition lead. Failing EGT probe.	Perform a magneto check on the ground. Cylinder that has a faulty spark plug or ignition lead will drop on the bar graph and other cylinders will rise, indicating the top, bottom plug or lead, with the problem.
		Replace spark plug or lead as required on indicated cylinder.
		Replace EGT probe.
Rising EGT readings on all cylinders. **NOTE** GEM 603/610 display will blink when this occurs.	**WARNING** **This is a serious indication and can cause abrupt engine failure, if proper steps are not taken.**	
	Magneto out of time, or faulty.	Perform a magneto check on the ground. RPM drop on both magnetos should be excessive.
		Check timing. If correct, overhaul or replace magnetos.
	Restriction in fuel system or servo not flowing correctly.	Check fuel filters and clean.
		Perform fuel flow check at nozzles.
		Check lines for damage or flex lines for twist.
		Return servo to authorized Bendix overhaul center.
Above normal temperatures in one or more cylinders (CHT).	Cracked, missing or open baffles or doors. Obstruction or debris in cylinder fins. Cowl panel doors not secure.	Repair or replace baffles, remove obstructions, and close panel doors.

<table>
<tr><th>Problem</th><th>Cause</th><th>Required Action</th></tr>
<tr><td rowspan="3">Low EGT reading in one cylinder, continually.</td><td>Defective or blown exhaust gasket. Cracked or loose exhaust system.</td><td>Inspect exhaust system and correct as required.</td></tr>
<tr><td>Intake valve not opening completely causing low compression.</td><td>Perform a compression check.</td></tr>
<tr><td>Plugged fuel nozzle.</td><td>Clean nozzle.</td></tr>
<tr><td>Decline in EGT uniformity, most visible at cruise power settings.</td><td>Fuel system restriction or dirty injection nozzles.</td><td>Clean fuel nozzles. Do flow check for uniformity, and if problem persists check fuel system for proper pressure and flow.</td></tr>
<tr><td colspan="3">Magneto Check:
EGT is often a better indicator of ignition problems that have been traditionally diagnosed by observing rpm drop during run-up. If one spark plug or ignition wire on each mag is defective the single mag check would indicate an equal rpm drop on each. Such a double failure would go undetected. The engine monitor will not only identify the problem but pinpoint the affected cylinder.</td></tr>
<tr><td colspan="3">Mixture check:
The engine monitor displays a uniform EGT rise of all cylinders during mixture control check. An abnormally large exhaust gas temperature differential in one or more cylinders in fuel injected engines may warn of a fuel injector constriction.</td></tr>
</table>

NOTE: Paragraph 7-22 through 7-24 were previously contained in Section 24.

7-22 CLOCK

A digital clock, if equipped, may be installed in the switch and circuit breaker panel or the instrument panel (F-28F S/N 833 and subsequent; 280FX S/N 2167 and subsequent). The clock is powered by an internal alkaline battery which should be replaced every 12 months.

Refer to Paragraph 7-18 for removal and installation instructions.

Refer to the vendor's published literature for clock specifications and operation (see Table 2-2).

7-23 OUTSIDE AIR TEMPERATURE INDICATOR (OAT)

OAT indication is shown by the numeric display on the engine monitoring system (GEM or EDM). The interior, top cabin mounted outside air temperature indicator was discontinued for F-28F S/N 832 and subsequent and 280FX S/N 2147 and subsequent.

Refer to the vendor's published manuals for OAT display (see Table 2-2).

7-24 ROTOR RPM MAGNETIC PICK-UP

NOTE: This procedure for installing the magnetic pick-up must be followed to avoid serious damage to the main rotor transmission gears.

NOTE: Refer to Figure 7-5 for installation detail.

A. Removal

(1) Remove the left side fuel tank (Para. 13-10).

(2) Place ground handling wheels in the down position.

(3) Place 2 blocks (approximately 1.5 inches/3.8 mm) under the forward strut attachment points under the skid tube.

(4) Place the wheels in the up position. This will allow the oil in the gearbox to run aft and not leak out when the access plug is removed.

(5) Disconnect the magnetic pick-up electrical connector.

(6) Remove the magnetic pick-up from the main rotor transmission. If replacing the magnetic pick-up, remove any shims installed on the pick-up.

B. Inspection

(1) Inspect the magnetic pick-up for security of installation and condition and security the electrical wires and connectors.

(2) Using a multi-meter, check for 270-330 ohms across the leads.

C. Repair

(1) Repair damaged wiring or electrical connectors.

(2) Replace the magnetic pick-up if the ohm check is outside the 270-330 ohm range or if inspection of the system components and wiring isolates the problem to the magnetic pick-up.

D. Installation

(1) Remove the magnetic pick-up inspection plug on the forward, lower section of the main rotor gearbox.

(2) Turn the gearbox until a gear tooth is directly under the center of the magnetic pick-up installation hole.

(3) Install the magnetic pick-up into the main rotor transmission.

(a) Insert a 0.030 feeler gauge through the access plug hole.

(b) Install any shims, P/N 28-16524-( ), from the old pick-up onto the replacement magnetic pick-up between the check nut and the top base of the magnetic pick-up.

(c) Replace the O-ring on the magnetic pick-up.

(d) Screw the magnetic pick-up in until it touches the feeler gauge.

(e) Adjust the amount of shims (0.002-0.500 in max.) as required to set the final clearance between the magnetic tip of the pick-up and the gear tooth to .030-.045 inch/.76-1.14 mm.

(f) Torque the magnetic pick-up to 60-65 in-lb/6.8-7.3 Nm.

(4) Install the inspection plug.

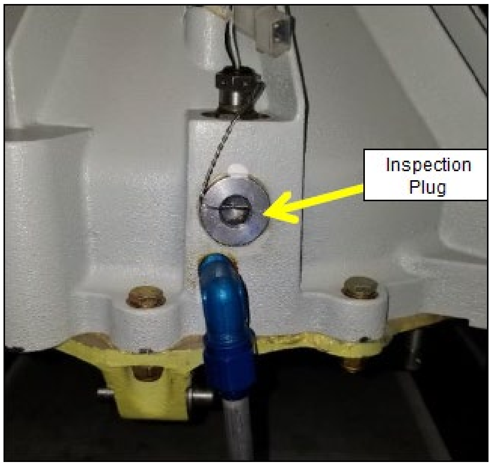
(a) Replace the O-ring on the plug and reinstall the plug in the front of the transmission.

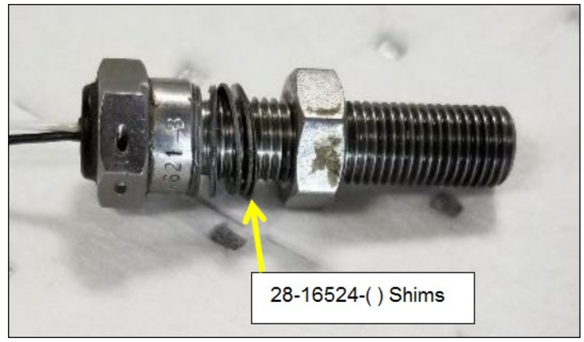
(b) Torque the plug and lockwire (.032) the magnetic pick-up to the plug.

(5) Reconnect the electrical connector.

(6) If required, service the main rotor transmission (Para. 4-12).

(7) Install the left side fuel tank (Para. 13-10).





Left: Inspection Plug; *Right:* Magnetic Pick-up

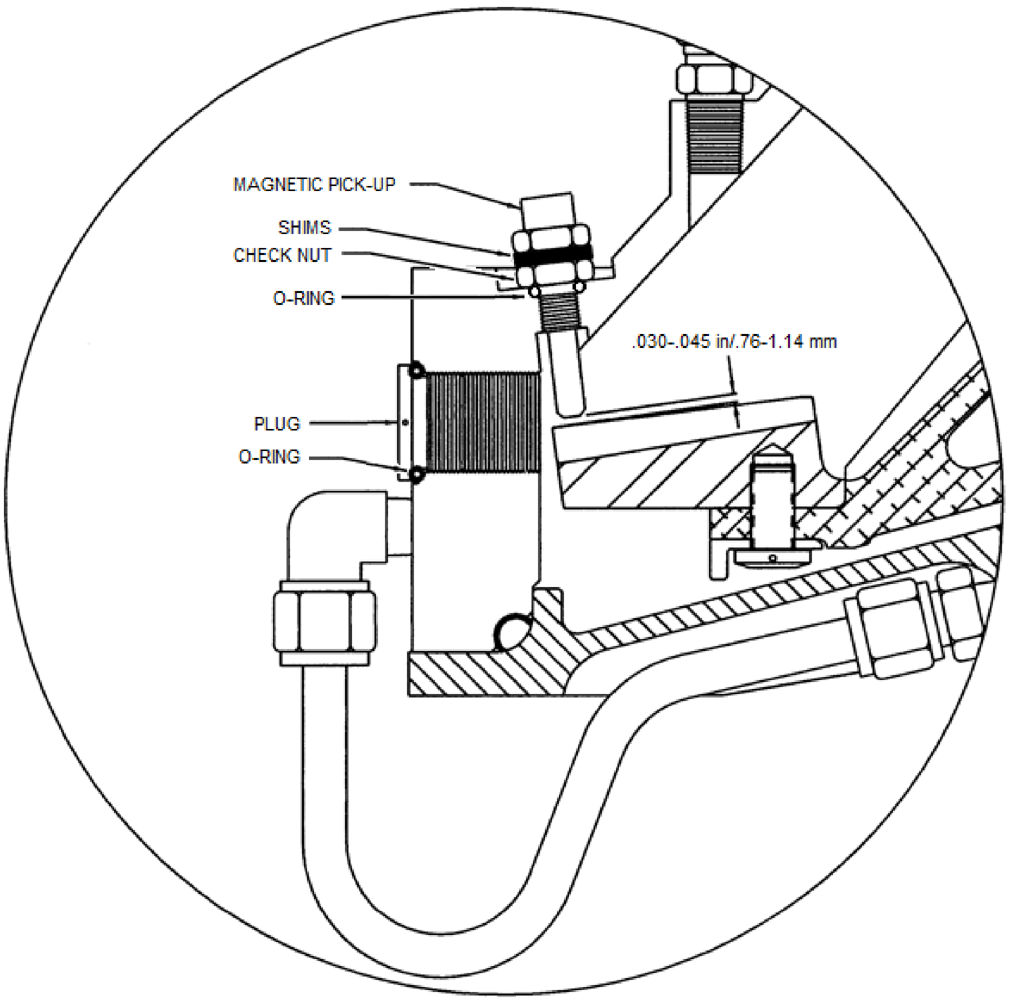


Figure 7-5. Magnetic Pick-up Installation

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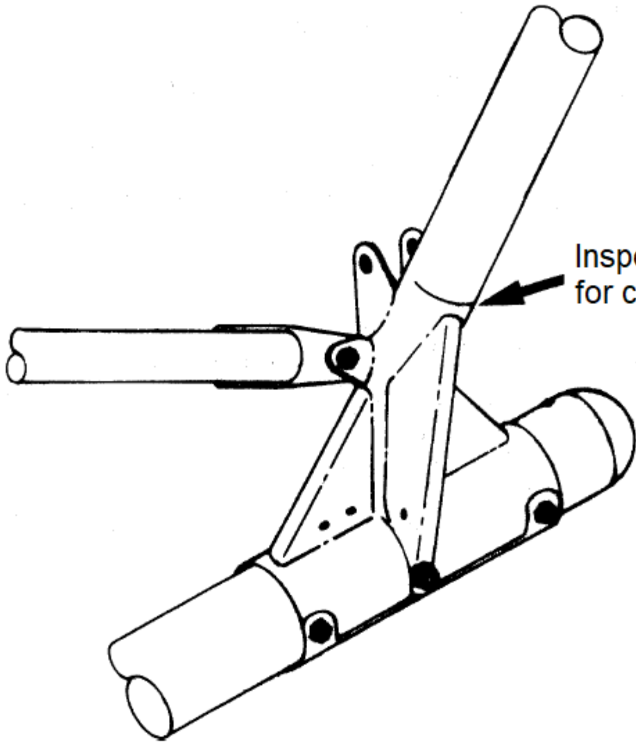


Figure 8-7.1. Landing Gear Leg Inspection

(3) Landing Gear Installation

(a) Install individual landing gear items as follows: (See Figure 8-8)

1 Skid tube (1): Install in reverse order of step (1), (d), 1.

2 Landing Leg (2): Install in reverse order of step (1), (d), 2.

3 Cross tube (6): Install in reverse order of step (1), (d), 3.

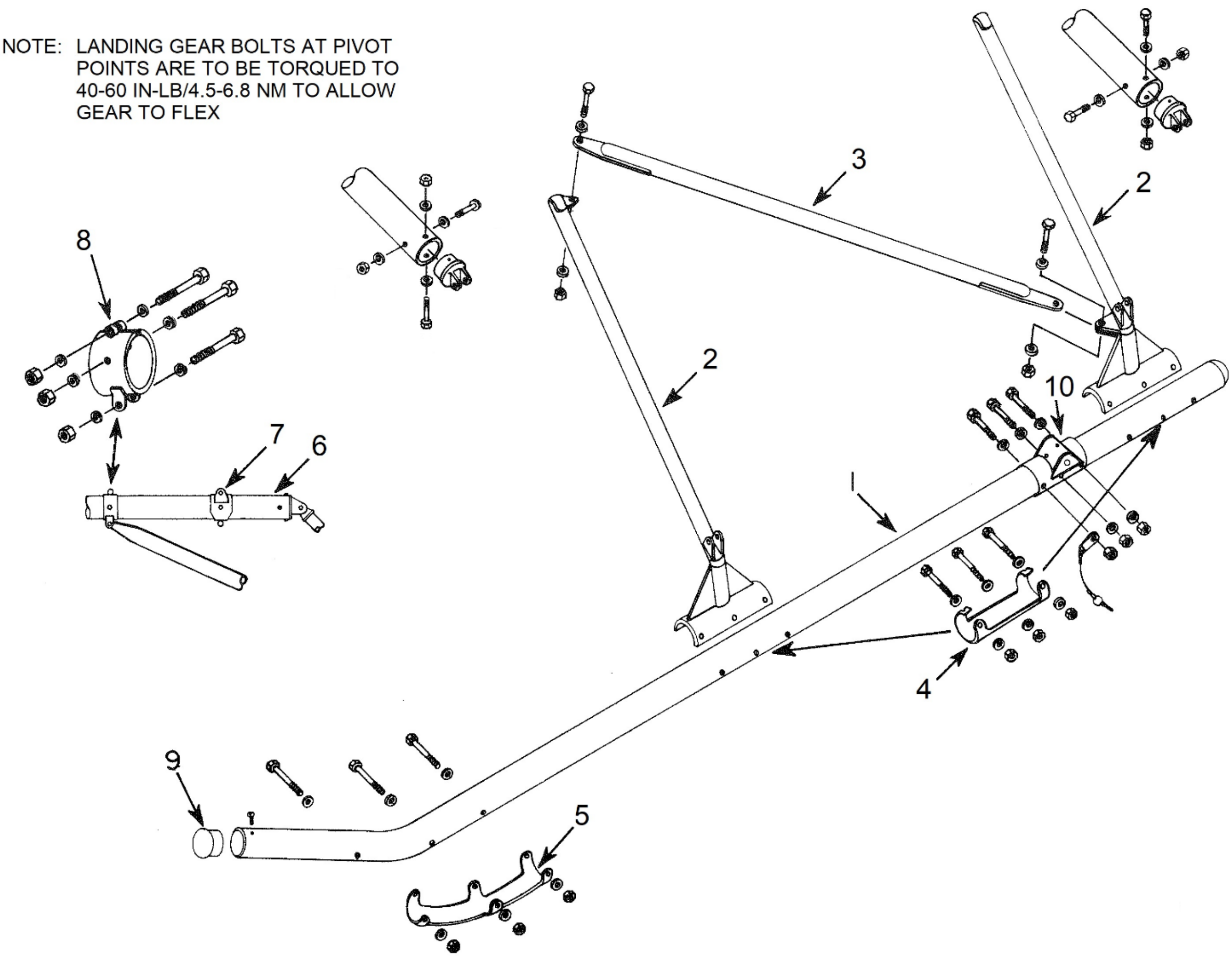
a Strut (3) attachment torque: 60 in-lb/6.8 Nm.

b Landing gear leg attachment torque at pivot points: 40-60 in-lb/4.5-6.8 Nm.

c Refer to Para. 8-9, D, 5 for oleo installation.

(b) Install the landing gear assembly in reverse order of steps (1), (a) through (c). Refer to Figure 8-7 for proper bolt orientation.

NOTE: LANDING GEAR BOLTS AT PIVOT POINTS ARE TO BE TORQUED TO 40-60 IN-LB/4.5-6.8 NM TO ALLOW GEAR TO FLEX



1. Skid Tube
2. Landing Leg
3. Drag Strut
4. Wear Plate
5. Forward Wear Plate
6. Cross Tube Assembly
7. Skid Clamp
8. Clamp
9. End Cap
10. Bracket Wheel Assy

Figure 8-8. Landing Gear Assembly Breakdown

(1) Remove the surface corrosion from the area using medium grit aluminum oxide abrasive paper/cloth or an aluminum oxide flapping wheel.

(2) Wash the reworked area thoroughly with mild soap and water, flush thoroughly.

WARNING: USE THE PROPER PROTECTIVE EQUIPMENT WHEN WORKING WITH THE METAL PREP. OBSERVE THE PRECAUTIONARY INFORMATION AND INSTRUCTIONS PROVIDED WITH THE METAL PREP.

(3) Treat the repaired area of the blade with a metal prep. Flush thoroughly with fresh water and allow to dry.

WARNING: USE THE PROPER PROTECTIVE EQUIPMENT WHEN WORKING WITH THE CHEMICAL CONVERSION COATING. OBSERVE THE PRECAUTIONARY INFORMATION AND INSTRUCTIONS PROVIDED WITH THE CHEMICAL CONVERSION COATING.

(4) Treat the blade as required with a chemical conversion coating complying with MIL-DTL-5541/MIL-DTL-81706 or equivalent.

(5) Refinish the area either using the small area repair in Para. 9-10, A, or if the entire blade needs refinishing, use Para. 9-11.

CAUTION: REFINISHED TAIL ROTOR BLADES WILL BE REQUIRED TO BE STATICALLY AND DYNAMICALLY REBALANCED. REFINISHED MAIN ROTOR BLADES WILL REQUIRE RETRACKING THE MAIN ROTOR SYSTEM. REFER TO PARAGRAPH 12-2. CONTACT ENSTROM PRODUCT SUPPORT ABOUT THE AVAILABILITY OF A MAIN ROTOR BALANCE TOOL TO AID BLADE REBALANCING IF TRACKING PROBLEMS OCCUR AFTER BLADE REFINISHING WORK.

C. Repair blade spars with flaking or slivering exceeding .032"/0.8 mm in depth but not the limits in Figure 9-19 as follows:

(1) Apply corrosion inhibitor to the affected area daily.

(2) Contact the Enstrom Customer Service Department for further instructions.

NOTE: Main rotor blades with intergranular spar corrosion (exfoliation) exceeding the limits of Figure 9-19 must be rejected as unairworthy.

D. Repair voids in the spar to skin bond lines that do not exceed the limits of Figure 9-20 as follows:

NOTE: Bond separations (voids) in the main rotor blade bond joints cannot be repaired/rebonded. The following repair provides corrosion treatment and sealing of the voided area until the void exceeds the allowable limits and the main rotor blade must be rejected as unairworthy.

(1) Remove the paint and or surface corrosion from the voided area with aluminum oxide abrasive paper.

(2) Degrease the area with denatured alcohol, Extreme Simple Green, or equivalent.

CAUTION: DO NOT HEAT THE BOND LINE TO MORE THAN 250°F/121°C.

(3) Warm the area to approximately 180-200°F/82-93°C to evacuate any residual moisture.

(4) Apply corrosion inhibitor and allow to dry for 30 minutes.

(5) Wipe the area with denatured alcohol, Extreme Simple Green, or equivalent.

(6) Seal the area with Hysol Type EA 9309.2NA epoxy sealant.

(7) Refinish the area in accordance with Para. 9-10, A, above or Para. 9-11 depending on the paint condition of the rest of the blade.

CAUTION: REFINISHED TAIL ROTOR BLADES WILL BE REQUIRED TO BE STATICALLY AND DYNAMICALLY REBALANCED. REFINISHED MAIN ROTOR BLADES WILL REQUIRE RETRACKING THE MAIN ROTOR SYSTEM. REFER TO PARAGRAPH 12-2. CONTACT ENSTROM PRODUCT SUPPORT ABOUT THE AVAILABILITY OF A MAIN ROTOR BALANCE TOOL TO AID BLADE REBALANCING IF TRACKING PROBLEMS OCCUR AFTER BLADE REFINISHING WORK.

(8) Enter into the maintenance log book the main rotor blade serial number and the location of the repair.

(9) Visually inspect the repaired area for further growth of the bond separation during the preflight check or daily inspection. Inspect the repaired area for further growth of the bond separation using the coin tap method at 25 hour intervals.

E. Repair voids in the trailing edge bond lines not exceeding the limits in Figure 9-20 using the procedure in Para. 9-10, D, except for the following:

(1) Inspect repairs outboard of Sta. 101 using the coin tap method at the normal periodic inspection interval.

(2) Inspect repairs inboard of Sta. 101 using the coin tap method at 25 hour intervals.

F. Repair voids in the root doubler and retention plate edge bond lines not exceeding the limits in Figure 9-20 using the procedure in Para. 9-10, D.

G. Damage to the blade spar not exceeding the limits in Figures 9-21 and Figure 9-22 must be repaired I/A/W Figure 9-23 and Figure 9-24. Reject any blades that have damage exceeding the limits in Figures 9-21 and Figure 9-22.

H. Reject blades with the following blade skin damage:

(1) Punctures in the blade skin.

(2) Sharp dents with a width to depth ratio less than 3:1 and deeper than .020"/.51 mm.

(3) Smooth dents which have resulted in permanent skin deformation greater than .060"/1.5 mm in depth.

(4) Nicks and scratches in the cordwise direction greater than .010"/.25 mm in depth.

(5) Nicks and scratches orientated within ± 30° of the spanwise direction greater than .020"/.51 mm in depth.

(6) Trailing edge cordwise dents or nicks deeper than .20"/5.1 mm.

(7) Trailing edge flapwise kinks extending more than .20"/5.1 mm.

(8) Cracks.

I. Repair blade skins with damage not exceeding the limits in Para. 9-10, H, above as follows:

(1) Buff out all light scratches.

(2) Polish out nicks, scratches, and sharp dents and blend the area to approximately .50"/13 mm around the damaged area.

(3) Repair damage to the trailing edge in accordance with Figure 9-25.

(4) Smooth dents that do not exceed the damage limits are acceptable and no repair is required.

NOTE: Refinish the repaired area in accordance with Para. 9-10, A, or Para. 9-11 depending on the condition of the rest of paint finish.

J. Reject blades with the following root doubler damage:

(1) Nicks, scratches, and sharp dents in the cordwise direction greater than .010"/.25 mm in depth.

(2) Nicks, scratches, and sharp dents orientated within ± 30° of the spanwise direction greater than .020"/.51 mm in depth.

(3) Smooth dents deeper than .020"/.51 mm.

(4) Cracks.

K. Repair blade doublers with damage not exceeding the limits in Para. 9-10, J, as follows:

(1) Buff out all light scratches.

(2) Polish out nicks, scratches, and sharp dents and blend the area to approximately .50"/13 mm around the damaged area.

(3) Smooth dents that do not exceed the damage limits are acceptable and no repair is required.

NOTE: Refinish the repaired area I/A/W Para. 9-10, A, or Para. 9-11 depending on the condition of the rest of paint finish.

L. Reject blades with the following blade retention plate damage:

(1) Nicks, scratches, and sharp dents greater than .050"/1.3 mm in depth.

(2) Cracks.

M. Repair blade retention plates with damage not exceeding the limits in Para. 9-10, L, as follows:

(1) Buff out all light scratches.

(2) Polish out nicks, scratches, and sharp dents and blend the area to approximately 2.0"/5.1 cm diameter area.

NOTE: Refinish the repaired area I/A/W Para. 9-10, A, or Para. 9-11 depending on the condition of the rest of paint finish.

NOTE: Do not paint the blade grip mating surface of the retention plates.

N. Repair or replace trim tabs as follows:

(1) Repair:

(a) Flatten dents or kinks and polish out scratches and nicks.

(b) Drill out and replace loose rivets.

(2) Replace:

(a) Drill out rivets and remove the trim tab.

(b) Open pilot holes in the replacement trim tab with a #40 drill.

(c) Position the trim tab on the main rotor blade and install the rivets.

O. Reject blades with the following drag link fitting damage:

(1) Nicks or scratches greater than .010"/.25 mm deep.

(2) Cracks.

(3) Loose rivets.

P. Repair drag link fittings with damage not exceeding the limits in Para. 9-10, O, as follows:

(1) Buff out all light scratches.

(2) Polish out nicks, scratches, and sharp dents.

NOTE: Refinish the repaired area I/A/W Para. 9-10, A, or Para. 9-11 depending on the condition of the rest of paint finish.

NOTE: Do not paint the drag link mating surface of the drag link fittings.

I. Paint the finish coat with any good quality flat or satin finish polyurethane paint.

CAUTION: REFINISHING MAIN ROTOR BLADES WILL REQUIRE RETRACKING THE MAIN ROTOR SYSTEM. THE ROTOR SYSTEM MAY ALSO BE DYNAMICALLY BALANCED USING A CHADWICK BALANCING SYSTEM.

CAUTION: TIP WEIGHT CHANGES MUST BE MADE TO KEEP 75% OF THE BLADE TIP WEIGHT IN THE FORWARD POCKET TO MAINTAIN THE CORDWISE BALANCE.

CAUTION: REFINISHED TAIL ROTOR BLADES WILL BE REQUIRED TO BE STATICALLY AND DYNAMICALLY REBALANCED.

9-12 Corrosion Prevention – Main Rotor Blades

A. Refer to Para. 4-83 and Para. 4-90 for the application of corrosion prevention compound to the main rotor blades.

9-13 Installation – Main Rotor Blades (Figure 9-17)

WARNING: DO NOT ALIGN THE HOLES IN THE GRIP AND BLADE BY PLACING YOUR FINGER IN THE RETENTION BOLT HOLE.

NOTE: Lifting the tip of the blade so the blade is parallel to the retention assembly will allow easy installation of the blade into the blade grip, installation of the blade bolt, and the drag brace bolt. If desired, use the main rotor blade bolt guide bullet, T-0009, to aid installation of the blade bolts.

A. If required, apply corrosion prevention compound to each blade (Para. 4-54, 4).

B. Install the root end of the blade into the blade grip.

C. Align the retention bolt hole in the grip with the hole in the blade. Install the bolt (2), washer, and nut. Torque the nut to 600 in-lb/68.2 Nm.

D. Connect the drag link to the trailing edge of the blade and secure with the hardware (1). Torque the nut to 140 in-lb/15.9 Nm.

E. Repeat the process for the other blades.

F. Perform a maintenance test flight if maintenance was performed on the main rotor blades.

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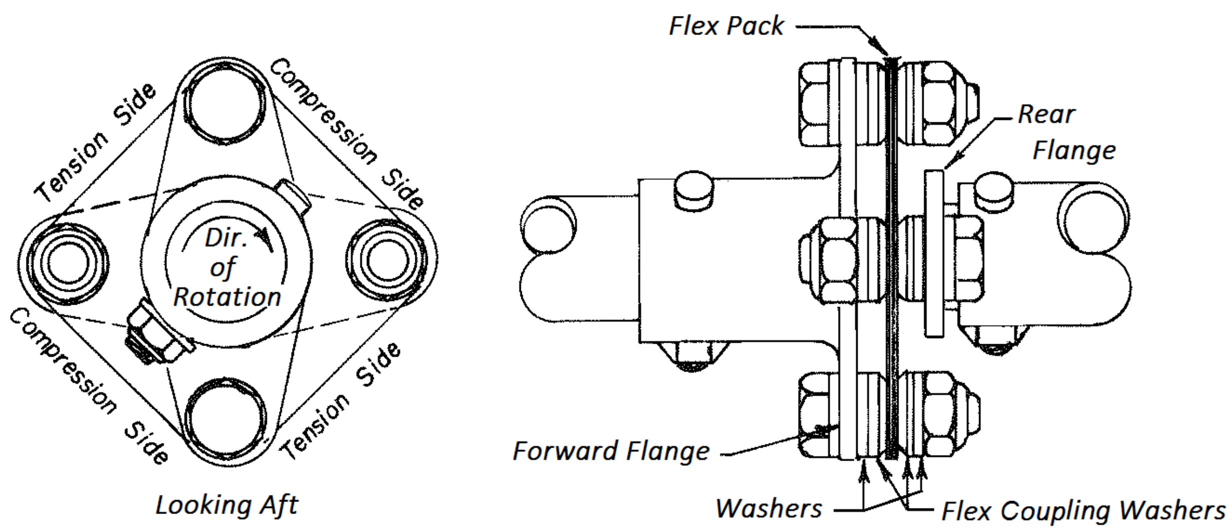
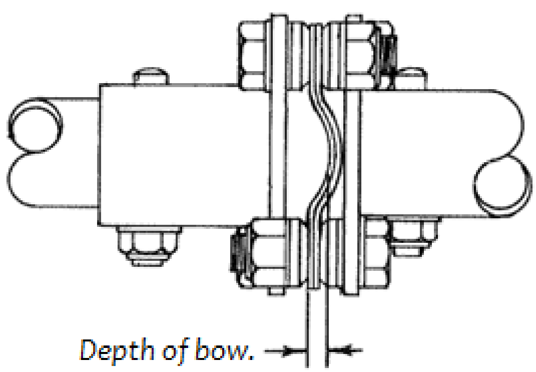


NOTE: Tie-wraps eliminated for clarity.

Figure 10-22. Tail Rotor Drive Shaft Coupling Installation, Rear Coupling Shown; Forward Coupling Similar



Must be less than 0.040" on compression side and less than 0.020" on tension side. Plates may be bowed in either direction.

NOTE: Tie-wraps eliminated for clarity.

Figure 10-23. Acceptable Limits of Bowed Flex Packs

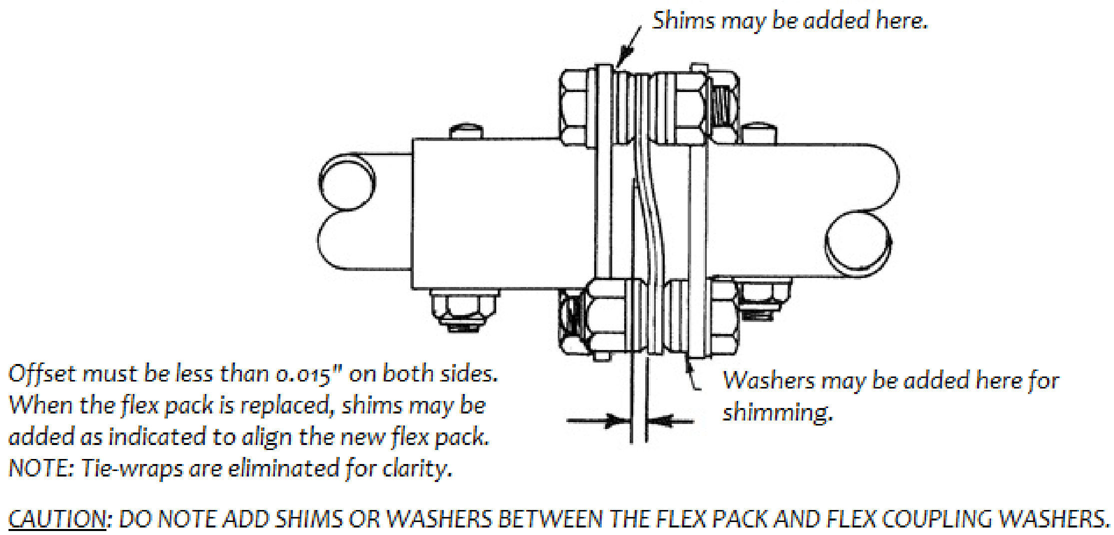


Figure 10-24. Acceptable Limits for Flex Packs with Offset Bends

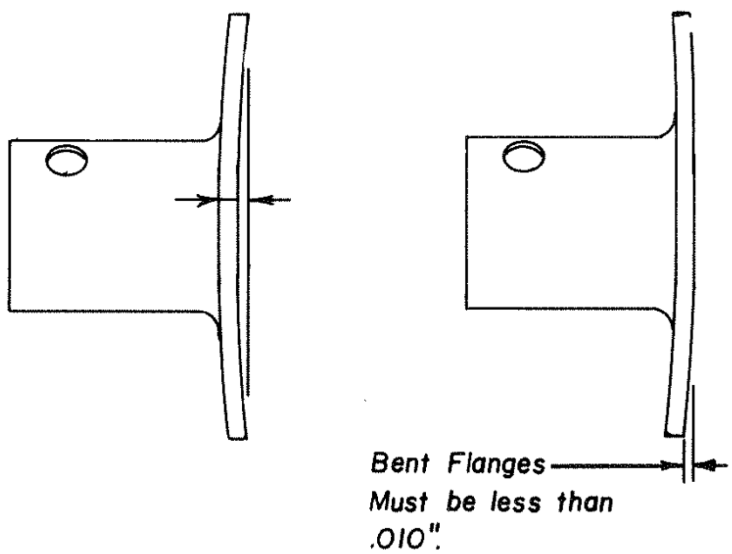


Figure 10-25. Acceptable Limits for Bent Coupling Hub Flanges

11-9 BELT TENSION ASSEMBLY

A. Troubleshooting – Belt Tension Assembly

Problem	Possible Cause	Action
Clutch lever sticks when releasing from engaged position.	Notches worn in lower end of in brackets, causing nylon bushings to stick in slots.	Notches which do not exceed .050 inch deep may be polished and blended until clutch releases smoothly. Replace brackets if notch exceeds .050 inch deep.
Excessive play in slider bolt area (bottom bolt through spring capsule). Maximum play .025 inch.	Nylon bushings worn. (Check by holding each end of bolt and pulling in and out.)	Replace bushings. (Tighten nuts until there is a slight amount of drag in the movement of the nylon bushing in the slots).
Excessive side play in spring capsule piston.	Worn DU bushing in capsule end cap.	Remove belt tension assembly and remove spring capsule. Replace bushing.
Excessive play in over-center bellcrank	Worn oilite pivot bushings in bellcrank.	Replace bushings.
Excessive play at spring capsule end cap (clutch engaged)	Worn bushing	Replace bushing. (Para. 11-9.1.B)

B. Removal – Belt Tension Assembly (Fig. 11-17)

NOTE: Refer to Fig. 11-17 for numbered items unless stated otherwise.

(1) Remove left side aft cowling.

(2) Disconnect the micro-switch wiring.

(3) Remove bolt (1) and hardware that secures spring capsule rod end (5) to bellcrank (3).

(4) Remove bolt (8) and hardware that secures clutch cable rod end (12) to bellcrank (14).

(5) Remove bolts (12) and hardware that secures mount block (14) to belt tension assembly brackets (9) (Fig. 11-18).

(6) Remove bolts (15) and hardware that secures the belt tension assembly to the pylon (2 places).

(7) Remove the belt tension assembly.

C. Disassembly – Belt Tension Assembly

NOTE: Refer to Fig. 11-18 for numbered items.

(1) Remove bolt (20) from brackets (9) and remove spacers (21), (22) and (23).

(2) Remove bolts (16) and spacers (19) from pivot straps (3).

(3) Remove bellcranks (18) and spacers (17).

(4) Remove bolt (1) from spring capsule (6) and remove pivot straps (3), spacers (4) and spacer (5).

(5) Remove nuts (7), washers (11) and nylon washers (10) from spring capsule slider bolt.

(6) Remove bolts (12) from brackets (9) and clutch cable mount block (14). Remove block (14).

(7) Remove brackets (9) from spring capsule (6).

D. Cleaning – Belt Tension Assembly

(1) Parts should be washed in toluene, kerosene, or an equivalent solvent. They may also be vapor degreased before inspection.

NOTE: The nylon bushings and washers may be deformed from the heat of a vapor degreaser and should be cleaned separately.

E. Inspection – Belt Tension Assembly

(1) See Table 11-7 for detailed inspection requirements of the belt tension assembly.

(2) Visually inspect the pylon area adjacent to the belt tensioning assembly mounting bracket for cracks (Fig. 11-20), wear caused by interference with the bottom of the capsule (14) (Fig. 11-19), and other damage.

(3) Replace bushing (5), if wear exceeds 0.020 inch/0.5 mm.

F. Repair – Belt Tension Assembly

(1) If contact between anchor (14) (Fig. 11-19) and pylon is observed, the bottom edge of the anchor may be chamfered (0.050 inch/1.3 mm maximum).

G. Assembly – Belt Tension Assembly

NOTE: Refer to Fig. 11-18 for numbered items.

(1) Install spacer (5) into ear of spring capsule assembly (6).

(2) Install bolt (1) through washer (2), strap (3), spacer (4), strap (3), and washer (2).

(3) Insert bolt through spacer (5) in the spring capsule assembly with the head of the bolt facing forward as installed in the helicopter.

(4) Install another washer (2), strap (3), spacer (4), strap (3), washer (2), and nut (7). Tighten nut to remove side play but do not torque at this point.

(5) Install nylon guide (8) on threaded shaft of spring capsule. Repeat on the opposite side.

(a) Remove the left side cowling.

(b) Remove hardware (24), (25), (26), and (27) (Fig. 11-18) connecting the spring capsule rod end (1) (Fig. 11-19) to the bellcrank (28) (Fig. 11-18).

(c) Remove screws (12) and washers (11) from the spring housing (13) (Fig. 11-19).

(d) Withdraw spring assembly (1) through (10) from spring housing (13).

(e) Remove the cotter pin through the rod end bearing (1) and loosen the two check nuts (2).

(f) Insert a flat screwdriver blade into the bottom end cap (8) to prevent nut (10) from turning and remove rod end (1) and the two check nuts (2) from the shaft (7).

(g) Measure the length of the exposed threads on rod (7) for reassembly.

(h) Remove adapter (3).

(i) Press the bushing (5) from the top of end cap (4).

(j) Insert a new 07DU08 bushing (5) into the top of end cap (4).

(k) Measure the adapter (3) to verify that it is within limits (Table 11-8).

(l) Install the adapter (3) and set it back to the same measurement obtained in step (g).

(m) Insert the two check nuts (2).

(n) Install the rod end (1). Line up the cotter pin hole and install the cotter pin.

(o) Apply grease (MIL-PRF-81322) liberally to the spring (6).

(p) Insert the spring assembly (1) through (10) back into the spring housing (13).

(q) Install the screws (12) and washers (11). Torque screws (20-25 in-lb/2.3-2.8 Nm).

(r) Safety wire the screws as a set of three around the outboard edge of the capsule. Do not run the safety wire around the inboard side of the capsule as the safety wire will contact the pylon when the clutch is engaged.

(s) Install spring capsule rod end attachment hardware (24) through (27) (Fig. 11-18). Torque nut (27) (50-70 in-lb/5.6-7.9 Nm) and install cotter pin (27).

(t) Verify that the clutch adjustment is correct (Para. 11-1).

(u) Torque jam nuts (2) (30-40 in-lb/4.3-4.5 Nm).

(v) Install cowling.

J. Assembly – Spring Capsule Assembly

NOTE: Refer to Fig. 11-19 for numbered items.

(1) Press anchor (14) on spring housing (13) while aligning holes for shaft (15).

(2) Press retainer (16) into spring housing (13) while aligning holes for the shaft.

(3) Press shaft (15) through anchor, housing, and retainer until threads of shaft are equally spaced in the housing.

(4) Install lock nut (10) on shaft (7) until slot in the lock nut aligns with the cotter pin hole in the shaft. Install cotter pin.

(5) Install washer (9) and retainer (8) on shaft (7) with recess in the retainer covering nut (10).

(6) Install spring (6) over shaft (7) and seat on the retainer.

(7) Press bushing (5) into end cap (4).

(8) Install adapter (3) through end cap and bushing (5).

(9) Turn adapter (3) onto shaft (7) and compress spring until unit will slide into spring housing (13) without bottoming against retainer (16).

(10) Apply grease (MIL-PRF-81322) to spring and to wall of spring housing (13) and insert spring assembly into housing assembly.

(11) Insert screws (12) through washers (11). Turn into end cap (4). Torque screws (20-25 in-lb/2.3-2.8 Nm).

(12) Safety wire screws in set of three with 0.032 wire.

(13) Install both jam nuts (2) on shaft (7).

(14) Install rod end (1) on shaft (7) until hole in rod end aligns with hole in shaft.

(15) Install cotter pin through rod end.

(16) Lock upper jam nut (2) against rod end (1).

SECTION 13

POWERPLANT AND ASSOCIATED SYSTEMS

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SECTION 13

POWERPLANT AND ASSOCIATED SYSTEMS

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13-1 POWERPLANT

A. General Information

The "F" model Enstrom helicopter utilizes a Lycoming air-cooled horizontally opposed four-cylinder direct drive engine, model HIO-360-F1AD. The engine is turbocharged by Enstrom, giving it the power capability of maintaining 225 HP up to a 12,000 foot density altitude.

The engine is mounted in the center airframe pylon by a dynafocal mount system attached to the rear engine case facing forward in the helicopter. The turbocharger is mounted to a tubular frame that is attached to the rear engine crankcase and accessory housing and is easily removable. Easy access to the engine is provided by two large, hinged panels, one on either side of the helicopter and another removable panel, located in the cabin firewall, for access to the rear engine accessory section.

B. Operating Specifications

Powerplant Limitations

Engine	Lycoming model HIO-360-F1AD with Rajay (Hartzell) model 3BT5EE10J2 turbocharger (600700-0000)
Fuel	(Refer to Table 4-1)
Oil viscosity	(Refer to Table 4-1)
Horsepower	225 HP at 3050 rpm, 39.0 in Hg manifold pressure
Operating rpm	3050 maximum 2900 minimum
Idle rpm	1500 minimum (clutch disengaged)
Manifold pressure	39.0 in Hg, Sea level to 12,000 ft density altitude
TIT	1650°F maximum

NOTE: The TIT gauge on early F series helicopters was originally labeled as an EGT gauge.

Oil temperature	245° maximum
Oil pressure	Normal – 50 to 95 psi Idling – 25 psi minimum Starting and warmup – 115 psi
Main rotor gearbox	225°F maximum

Cylinder head temp.	500°F maximum
Fuel mixture	Engine may be leaned at 75% power or below to 1600°F on rich side of peak. NEVER exceed 1650°F TIT. 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	334 rpm

Instrument Markings

Rotor tachometer	red line	385 rpm
	red line	334 rpm
	green arc	334-385 rpm
Engine tachometer	red line	3050 rpm
	red line	2900 rpm
	green arc	2900-3050 rpm
Airspeed indicator	red line	112 mph (F-28F)
		117 mph (280F)
		117 mph (280FX)
Manifold pressure	red line	39.0 in Hg
Engine oil temp.	red line	245°F
	green arc	120-245°F
	yellow arc	60-120°F
Oil pressure	red line	100 psi
	red line	25 psi
	green arc	60-100 psi
	yellow arc	25-60 psi
TIT	red line	1650°F

NOTE: The TIT gauge on early F series helicopters was originally labeled as an EGT gauge.

Cylinder head temp.	red line	500°F
	green arc	200-500°F
Transmission oil temp.	red line	225°F
	green arc	0-225°F

13-2 ENGINE

A. Engine and Turbocharger Troubleshooting

Experience has proven that the best method of troubleshooting is to analyze all symptoms of the problem and carefully eliminate any systems that are not contributing to it. The following troubleshooting chart has been prepared to help the maintenance personnel pinpoint the problem areas by focusing on specific engine operating symptoms. In the following charts these are depicted by the major headings followed by the most probable cause and remedy.

NOTE: The remedies and/or actions in the following charts are in an abbreviated form. For full description of any of the problems turn to the specific paragraph in the following sections of the Powerplant Section.

NOTE: In addition to the troubleshooting guide below, refer to Lycoming SI 1427 (latest revision) for steps pertaining to engine break-in, including engine preparation for ground operational tests, flight tests, after-flight tests, and oil consumption limits.

Problem	Possible Cause	Action
Failure of engine to crank over.	Dead battery, starter relay defective, defective starter or corroded terminals on ground or battery leads, defective starter switch on collective.	Self-explanatory.
Failure of engine to start.	Lack of fuel to engine.	Check main fuel valve “ON,” fuel level, boost pump pressure, filters, and mixture setting.
	Ambient air check valve stuck closed. May be accompanied by induction tube sump valve fuel leakage or backfire.	Clean valve or replace.
	Shower of sparks inoperative, no buzz from vibrator.	Check for low voltage to ignition circuit during cranking (9.5V min.), defective vibrator relay, or corroded connections.
	Sump valves stuck open, accompanied by backfire or popping.	Clean all three sump valves.
	Magneto inoperative or “P” lead grounded.	Check ignition lead for spark, or breakage. Check retard action, and “P” lead connections.
	Engine kicks back.	Check shower of sparks vibrator relay operation, check retard timing and breaker action, magneto timing, damaged distributor cap or shorting internally.

Problem	Possible Cause	Action
Failure of engine to start, accompanied by puffing black smoke from exhaust stack, fuel dripping from sump valves.	Severe flooding.	Review starting procedure.
	Excessive priming.	Review starting procedure.
	Servo center body seal leak.	Replace servo.
	Servo mixture valve plates leaking.	Remove and repair mixture valve plates.
	Excessive fuel boost pressure.	Reduce duration of priming – check fuel boost pressure.
Failure of engine to idle properly.	Incorrect idle mixture setting.	Correct idle mixture setting.
	Leak in induction system, sump drain valves stuck open.	Check induction system for leaks, check operation of sump drain valves.
		Check the turbocharger adapter gasket and weld condition. (Refer also to SIL 0163)
	Incorrect idle air adjustment.	Adjust throttle stop to obtain correct idle speed.
	Dirt in air side of fuel nozzle.	Carefully clean nozzles.
	Bad or fouled spark plugs.	Replace or clean as required.
	Shorting of ignition lead.	Check ignition leads.
Unable to pull full rated power, missing, or engine twitching in mounts.	Mixture too rich, indicated by sluggish operation, red exhaust flame, black soot residue in exhaust stack and smoky black exhaust.	Check fuel servo for proper fuel output metering.
	Partially clogged or clogged fuel injection nozzle or nozzles on either fuel or air side.	Clean as required.
	Air leaks in the air induction system, sump drain valves stuck open.	Check induction system for leaks, clean sump drain valves.
	Inadequate fuel supply, servo mis-rigged, restricted static air nozzle in fuel system, usually accompanied by high temperatures, ambient air check valve stuck open.	Check fuel flow, filters and rigging of controls.
	Restriction in air intake.	Check ducting, condition of filter and intake scoop.
	Air leak at the air cleaner seal.	Check condition of seal.

Problem	Possible Cause	Action
Unable to pull full rated power, missing, or engine twitching in mounts. (Continued)	Turbocharger wastegate and throttle override not functioning properly.	Check wastegate for proper operation, rigging and over-ride actuator ride, internal heat erosion.
	Leak in engine exhaust system, reducing exhaust pressure to turbo system.	Check exhaust flange gaskets, turbo gaskets and couplings or system tube failures.
	Turbo rotating assembly rubbing on housing, distorted housing, dirt accumulation on impeller, carbon build-up, or foreign object damage, bearing seizure.	Check freedom of assembly. Allowable shaft radial play is .017 to .028 inch (.43 to .71 mm) on bearings, allowable shaft axial play is .004 to .009 inch (.10 to .23 mm).
	Engine timing is slightly off	Check timing to required specifications.
	NOTE: During magneto check, if TIT has a variance of more than 100° from R to L magneto, check timing.	
	High speed ignition, high tension leak or faulty spark plugs.	Check wiring harness and plugs.
Engine will not accelerate from idle.	Idle mixture set too lean, fuel pressure too low, fuel supply restricted, or air supply restricted.	Check idle mixture, fuel pressure, supply, and air intake obstruction.
Engine accelerates from idle but is rough and erratic.	Idle mixture on lean side, servo too rich or center body pin hang-up caused by internal misalignment.	Check mixture or replace servo.
Rough engine operation at high power settings.	Engine mounts deteriorated or improper torque.	Check mounts, belts, and torque.
	Plugged or partially plugged fuel nozzle (air or fuel side). This is indicated by higher than normal fuel flow and slight increase in MAP.	Clean fuel nozzles thoroughly.
	Misfiring of ignition system, high tension leak, fouling spark plug.	Check fuel octane rating, reduce power, and increase mixture setting.

Problem	Possible Cause	Action
Low oil pressure at operating rpm.	Insufficient oil supply, improper grade of oil, excessive operating temperatures.	Check oil level, grade of oil, increase mixture setting for high ambient temperatures.
	Oil pressure relief valve hung up, defective or loose.	Check oil pressure relief valve setting and operation.
	Oil leakage from lines or fittings.	Check all lines and fittings.
	Oil pump failing or sump suction screen partially blocked.	Check oil pump output and suction screen.
High oil and cylinder head temperatures.	Insufficient cooling air to engine and oil coolers.	Check cooling air inlet for obstruction, check cylinder fins for excessive dirt accumulation, check oil cooler inlets for dirt and debris.
	Insufficient quantity of oil or improper grade.	Check oil level and grade.
	Operating at excessively high power settings exceeding TIT limitations.	Reduce power, increase mixture settings.
Excessive oil consumption.	Improper grade of oil, turbo seals failed, engine ring and/or valve clearance out of limits.	Check grade of oil. If turbo seals are bad, oil seepage from induction sump valves may occur after parking, and this oil may be found in turbo assembly. This condition is usually indicated by excessive exhaust smoke on start-up and at idle.
	On new engines or rebuilt engines, ring may not be properly sealed.	Continue to break in engine with recommended oil until oil consumption stabilizes.
	<u>NOTE</u>: Regarding power settings during break-in period, refer to Lycoming SI 1427 (latest revision).	
	Glazed cylinder walls, caused by improper engine operation during break-in period.	Cylinders must be removed and reworked by honing.

Problem	Possible Cause	Action
Excessive oil consumption. (Continued)	Clogged engine crank-case breather vent line. In cold weather frost can restrict this vent and cause nose seal to fail or pump oil.	Clean vent of sludge, be sure small side vent in tube inside of cowl line is clear and open. This will allow engine to breathe properly if the exposed portion below frosts closed.
Loss of, reduction of, or fluctuation of manifold pressure when turbocharging.	Malfunction of MAP indicator may be the result of debris in the MAP reference line to engine.	Clear line and re-check.
	Air intake restriction, duct collapsing, or air filter blocked or icing.	Check condition of ducting.
	Turbo output leakage through induction system, loose duct, adapter or collar, failure of intake pipe.	Check complete induction system for leaks or failures.
	Partial fuel vapor locking due to hot fuel, altitude, or combination of both with high power settings, may be accompanied by detonation.	Reduce power.
	Malfunctioning fuel pump or pressure regulator, blown seal or leaking pump deck pressure line.	Reduce power. If engine begins to detonate, terminate operation.
Engine runs hot during turbocharging.	Ambient temperatures too hot.	Reduce power to safe TIT levels.
	Over-boosting or mixture too lean.	Reduce power to proper MAP and TIT limitations. Increase mixture setting.
	Ignition timing off.	Check timing to required specification.
Oil in turbocharger or in exhaust pipe on shutdown.	Oil input line check valve stuck open.	Clean or replace check valve.

B. Preparation for Engine Removal for Replacement or Overhaul

The engine is removed as a unit with components of engine associated systems and engine accessory items (alternator, starter, magnetos, wiring harness, etc.) attached to the engine (Figure 13-1).

(1) Disconnect battery.

(2) Remove segmented cowl, baggage box, side panels, lower cowling, and engine compartment doors (Para. 8-11).

(3) Remove fuel tanks and drain fuel lines (Para. 13-10, B).

NOTE: Upon removal all line, fittings and/or openings to engine, tanks or coolers should be plugged with dust caps or covers to protect from contamination.

(4) Drain oil from engine, oil coolers and oil lines.

(5) Remove jack strut and fan assembly (Para. 13-8, B, (1)).

(6) Remove main rotor transmission (Para. 11-6, B).

NOTE: Utilizing some type of overhead lifting device is recommended as the easiest and safest method of engine removal. If overhead lifting capability is not available, it will not be necessary to remove the transmission (step 6) or install lifting ring (step 10).

(7) Disconnect fuel line from the fuel shutoff valve and detach the doubler encircling the fuel line at the fire curtain.

(8) Remove upper engine baffling.

(9) Remove or detach fire curtain as required.

(10) Remove primary oil cooler (right side) (Para. 13-11, B, (1), (a)).

(11) Remove induction air box and ducting (Para. 13-7, B, (4)).

(12) Disconnect exhaust gas temperature probes and remove exhaust system, wastegate, and associated flexible ducting.

(13) Detach fan shroud from engine and remove mount brackets from top and bottom of engine.

(14) Pull fan shroud and secondary oil cooler away from engine.

(15) Detach clutch cable clamps from bay tube.

(16) Disconnect fuel lines from main fuel strainer, if installed on the bay tubes.

NOTE: Later model helicopters have the fuel strainer located on the left side lower pylon longeron.

(17) Remove bay tubes.

(18) Remove sump drain lines and valves.

(19) Disconnect fuel inlet line to fuel pump, scavenge pump inlet line, and remove fuel pump drain line.

(20) Disconnect engine ground strap starter and alternator wiring.

(21) Remove turbocharger (Para. 13-5, B).

(22) Remove fuel injection servo with inlet air adapter and flexible duct.

(23) Disconnect static pressure lines from induction tube and remove induction tube.

(24) Disconnect static pressure line from fuel pump.

(25) Disconnect tach drive, oil cooler oil lines and crankcase breather tube from engine.

(26) Disconnect oil temperature, pressure, and cylinder head temperature probes.

(27) Remove fuel pressure lines from flow divider.

(28) Disconnect magneto primary leads.

(29) Remove static pressure manifolds from engine baffling.

(30) Remove top ignition wires from engine baffling.

(31) Remove remaining engine baffling.

(32) Remove oil filler tube.

(33) Remove turbocharger and injector mount brackets.

(34) Install caps or plugs on all disconnected lines, fittings, and engine openings to prevent contamination.

(35) Position all lines, wires, etc. to prevent interference with engine removal.

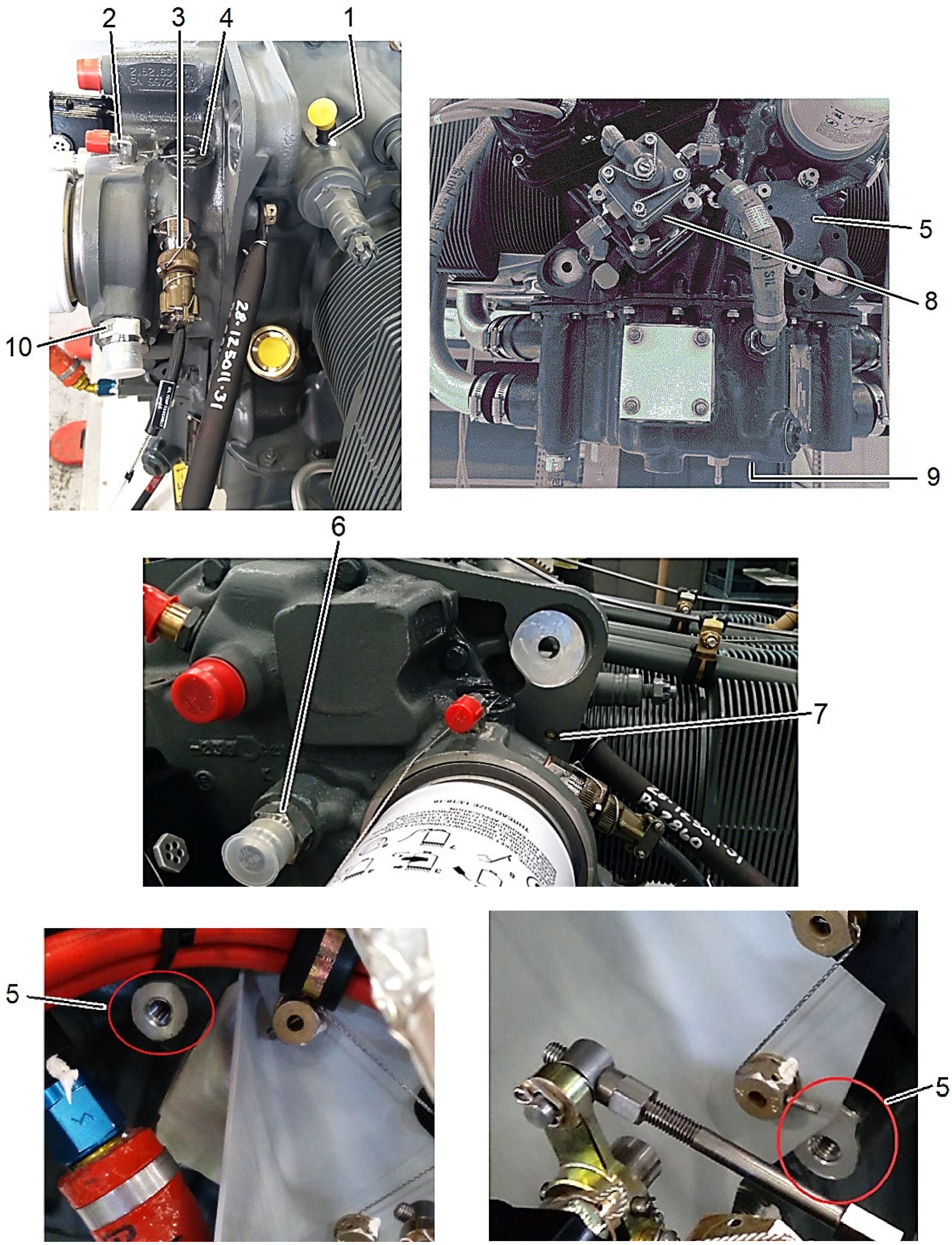


Figure 13-1. Engine Accessory Section

Figure 13-1 Legend

1. Engine oil pressure fitting: restricted fitting required. (Refer to Note in Para. 13-2, D, (3).)

2. Restricted turbo oil outlet fitting location.

3. Engine oil temperature probe fitting location.

4. Chamfered case plug location.

   NOTE: Upper right photo shown with bracket 28-123022-11 uninstalled. See lower left and right photos for clarity.

5. Check tapped stud holes for breakthrough of case to prevent oil leakage.

6. Oil outlet

   CAUTION: DO NOT OVERTORQUE FITTING (140-160 IN-LB MAX. (15.8-18.1 NM MAX), 20% LESS IF ENGINE IS HOT). CASE MAY CRACK.

7. Turbo mount hole – must be threaded to receive mount bolt. (Bolt is inserted from the other side.)

8. Scavenge pump and piggy-back fuel pump installation.

9. Check engine sump for a machined flat and tapped holes (1/4-20 UNC-3B) to receive turbo mount bracket.

10. Inlet

    CAUTION: DO NOT OVERTORQUE FITTING (140-160 IN-LB MAX. (15.8-18.1 NM MAX), 20% LESS IF ENGINE IS HOT). CASE MAY CRACK.

    NOTE: Images may not depict complete installation of engine.

C. Engine – Removal

(1) Install lifting ring; attach at third case half bolt from the accessory case.

(2) Support the weight of the engine with the lifting device.

(3) Remove the four mount bolts and mount assemblies.

(4) Lower engine to a suitable support on the floor, tilting it as necessary to allow accessories to clear pylon.

(5) Remove any remaining lines, fittings, brackets, probes, and accessories as required, preparing the engine for overhaul and replacement.

D. Inspection Prior to Engine Reinstallation

(1) Engine Compartment

(a) Check engine mount rings and tubes for cracks or distortion.

(b) Check pylon for worn spots, distorted tubes, cracks at welded joints and corrosion.

(c) Check firewall for loose fittings, cracks, and holes.

(d) Inspect fire curtain for general condition. Repair or replace as necessary (Para. 13-8, D).

(e) Inspect mounts for checks, cracks, deformity, and age hardening. Replace as required.

(f) Check electrical panel for security and condition of wiring, and clean ground connections.

(g) Clean main fuel sump screen.

(h) Check oil cooler for cracks, damaged fins, seal deterioration, and restrictions to airflow.

CAUTION: IF ENGINE REMOVAL WAS NECESSARY DUE TO INTERNAL ENGINE FAILURE, IT WILL BE NECESSARY TO FLUSH OIL LINES AND COOLERS WITH MINERAL SPIRITS, KEROSENE, ETC. TO ENSURE REMOVAL OF ALL POSSIBLE CONTAMINANTS. INSPECT TURBOCHARGER AND OIL LINES FOR DAMAGE OR CONTAMINATION.

NOTE: Oil coolers must be sent out for overhaul if oil exhibits metal contamination.

(2) Associated Engine Components

(a) Check all lines, hoses, fittings, and seals for evidence of deterioration, damage, or contamination.

(b) Check exhaust system for cracks and distortion of mounting flanges.

(c) Check wastegate for evidence of internal heat erosion, freedom of movement, cracks, and distortion.

(d) Check exhaust tube matting flanges and V clamps for distortion and cracks.

(e) Check heater muff and heat exchanger for evidence of cracks or deterioration.

(f) Check turbocharger for freedom of rotation, cracks, indications of leakage, condition of heat shroud, condition of adapter gasket and security (Para. 13-5, C, (2) and Para. 13-5, D, (1)), and security of fittings.

(g) Check turbo mount tubing and fittings for cracks, distortion, and excessive corrosion.

(h) Check intake induction tube for cracks or distortion of mounting flange, mating duct adaptor for deterioration, and damage to the clamps and security of clamp installation (Para. 13-5, C, (3) and Para. 13-5, D, (10)).

(i) Check static air fuel nozzle vent check valve for dirt contamination and freedom of movement at low pressures.

(j) Check three sump drain valves, two in bottom engine sump and one low point in intake induction tube, for sticking or clogging.

NOTE: These valves are open in a neutral pressure position; a slight positive or negative pressure will close them.

(k) Check engine baffling, fan shroud and fan for cracks, galling, or other damage.

NOTE: For full inspection requirements, see specific section identified.

(3) Engine Preparation Prior to Installation

NOTE: Refer to Figure 13-1 for numbered items.

NOTE: Some engines may have had an oil pressure restrictor fitting installed during engine overhaul, in the field, or by compliance with SDB 0123. If the fitting is engraved with the letter “R” or “D”, a restrictor fitting is installed. If no engraving is detected, verify if the fitting is a restrictor fitting in accordance with SDB 0123.

(a) Check mounting points on rear and case of new or rebuilt engine; hole on right upper rear case flange must be drilled and tapped for turbo mount bolt (7). Check bottom aft lower right sump for flatness (9) and turbo mount clearance to drain boss radius.

(b) Transfer restricted oil pressure fitting (1) (P/N ECD110-11 or P/N 02A22619). Torque 30-40 in-lb/3.4-4.5 Nm.

(c) Transfer restricted oil feed fitting (2) to turbo.

(d) Transfer oil return line fitting from scavenge pump (8).

(e) Transfer oil inlet and outlet fittings (6 and 10).

(f) Check four tapped stud holes (5) in accessory housing for break-through. If they show evidence of breaking through the case, the holes will have to be drilled and tapped to seal them or the accessory housing will have to be replaced.

(g) Transfer case plug (4) to upper port and safety (MS20995C32).

(h) Install oil temperature pick-up (3) in lower port.

NOTE: If a new plug is being used, machine the edge of the nut so that it will not contact the engine mount lug on the pylon. If a used plug is installed, the previously machined section of the nut may not align in the correct position; it will also need to be machined. (Plug is available as P/N 28-121018-11; use new crush washer P/N MS35769-11.)

NOTE: Items (a), (b), (c), (e), (f), and (g) must be accomplished prior to engine installation. If not, engine may have to be removed to perform.

(i) Remove fuel pump, transfer scavenge pump and bolts, and install fuel and scavenge pump. Apply Loctite 1552029 gasket sealant to the fuel pump bolts on installation.

NOTE: Verify a 0.014-0.020” restrictor fitting is installed on the fuel pump. The restrictor fitting should be stamped or marked with the letter “R”. (Reference Lycoming Service Bulletin 497 and AD 91-08-07.)

(j) Check security of oil filter.

(k) Check condition and security of magneto. Be sure fuel pressure line clamp support is attached under upper bolt. Verify timing in accordance with Para. 13-9, E, (2).

(m) Check security of alternator if new and remove fan to install spacer. If transferring alternator, inspect for cracks, check brushes and bearings, and reinstall.

(n) Check starter for security, condition of electrical connections and brushes, and lubricate Bendix assembly. Check for proper ring gear clearance to Bendix.

(o) Install CHT probes in cylinders.

(p) Install lifting ring, attach at third top engine case bolt from the accessory end.

E. Engine – Installation

(1) Place engine in position under the pylon and attach lifting device.

(2) Raise engine into pylon, tilting as necessary to ensure accessories are not damaged.

(3) Install serviceable mounts and bolts with one to three AN960-716 washers under the nuts.

CAUTION: CHECK NUMBER OF WASHERS REQUIRED ON EACH INSTALLATION SO NUT WILL NOT BOTTOM OUT AT TORQUING.

(4) Torque upper engine mount bolts to 460-500 in-lb (52.0-56.5 Nm) before releasing the weight of the engine.

(5) Install cotter pins on top bolts.

(6) Disconnect and remove lifting device.

(7) Torque lower engine mount bolts to 460-500 in-lb (52.0-56.5 Nm) and install cotter pins.

(8) Remove lifting ring.

(9) Install baffling around sides of engine. (Leave all attaching hardware loose until all the baffling and the fan shroud are all in place.)

(10) Install ignition wires to engine through baffling.

(11) Install static air manifolds on baffling.

(12) Connect static air lines to nozzles.

(13) Install oil filler tube.

(14) Loosely install fan shroud and mount brackets.

(15) Temporarily install top engine baffle cover.

(16) Install T-0204 on starter ring rear support. Attach with two #8 bolts and washers on the support where there are no crankshaft bushings.

NOTE: Fan tape must be removed from the fan shroud to install T-0204.

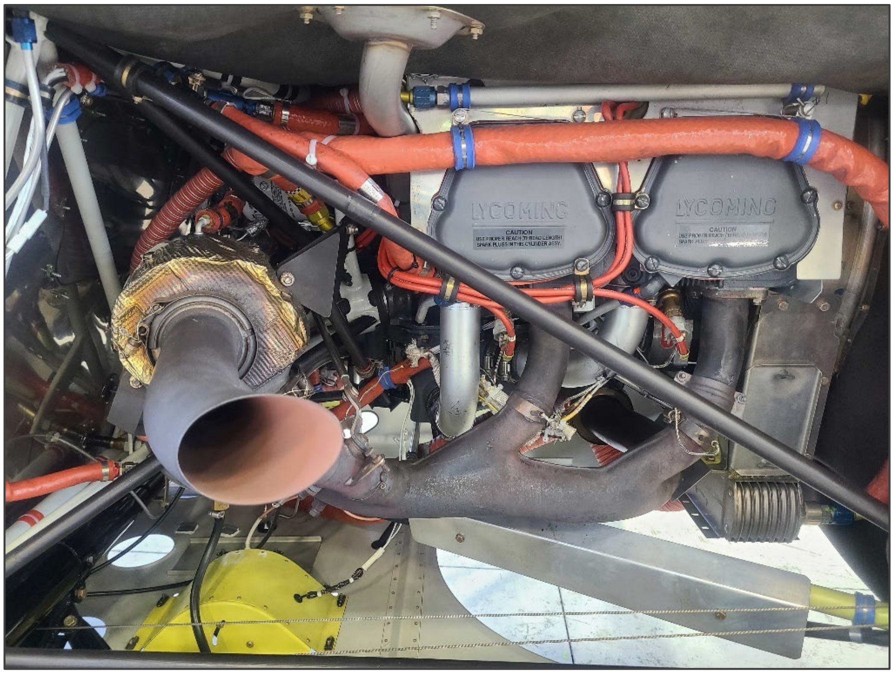
(17) Snug bolts or temporarily install fan to align shroud.

NOTE: If T-0204 is not available, use small wood wedges, or similar shims around the fan to maintain equal clearance between the edges of the fan blades and the inside of the shroud.

(18) Secure fan shroud, baffling, and brackets, ensuring the shroud stays centered during the process. Torque all hardware connecting side baffles and supports.

(19) Remove tool T-0204.

(20) Install new fan tape.



Left Side

Right Side

Figure 13-2. Engine Compartment Views

(21) Install fuel lines to engine driven fuel pump, oil lines to engine crankcase breather tube and fuel pump drain.

NOTE: Ensure the installed fuel lines are lagged. For reference, see SIL 0062.

(22) Install induction tube to engine sump. Do not torque at this time.

(23) Install sump drain valves, three places.

(24) Install bay tubes and fuel filter.

(25) Connect fuel lines to filter.

(26) Install induction air line from fuel pump to induction tube.

(27) Install primary oil cooler and ducting.

(28) Install oil lines to both oil coolers.

(29) Install induction air box, hoses, and fuel nozzle static air check valve.

(30) Install engine ground strap, starter wiring, and alternator wiring.

(31) Install injector and turbocharger mount brackets.

(32) Install injector, inlet adapter, and AMC assembly cooling shroud.

NOTE: Ensure that the cooling shroud of the automatic mixture control is not contacting the forward pylon tubes or the horizontal upper deck static line. If the cover contacts the pylon, it will cause a vibration that will be felt by the pilot. If the shroud is touching the airframe, insert a flat blade screwdriver between the shroud and the pylon to move the shroud. If the shroud contacts the static line or the clamp that secures the line to the pylon, the clamp on the pylon should be relocated so there is no interference.

(33) Connect fuel and air lines to injector.

(34) Install inlet adapter to injector and safety wire.

(35) Install turbocharger and connect induction tube, oil lines and controls. Do not torque until entire exhaust system is installed.

(36) Connect manifold pressure line.

(37) Install cylinder head, oil temperature, and oil pressure probes and connections.

NOTE: For CHT probe installation, refer to Para. 7-21, C, to install spacer (P/N 28-22096-11), if not currently installed.

(38) Install exhaust system and TIT temperature probes.

(39) Torque all fuel injector, turbocharger mounts, exhaust flange nuts, and exhaust clamps.

(40) Connect flexible duct to heater muff, heater control and fan shroud.

(41) Connect fuel and pressure lines to the fuel flow divider.

(42) Install fire curtain and seal with fire barrier sealant CP 25WB+ (3M) or equivalent.

(43) Install fuel line to fuel shutoff valve and seal doubler around line to the fire curtain with fire barrier sealant CP 25WB+ (3M) or equivalent.

(44) Install top engine baffling.

(45) Install main rotor transmission (Para. 11-6, D).

(46) Install fan and jack strut assembly (Para. 13-8, B, (5)).

(47) Install baggage box (Para. 8-11, D).

(48) Install fuel tanks (Para. 13-10, B, (2)).

(49) Connect battery.

(50) Service engine according to HIO-360 Operators Manual.

(51) Run engine to check control operation, fuel pressure and for evidence of system leaks.

(52) Check belt track (Para. 11-5, B).

(53) Install all cowling.

F. Cylinder – Removal

NOTE: Engine is installed for the following procedure.

(1) Remove upper side cowling to gain access to cylinder.

(a) Removing #1 cylinder will require removing the jack strut assembly and fan.

1 Remove jack strut assembly in accordance with Para. 11-4, A.

2 Remove fan in accordance with Para. 13-8, B, (1).

(2) Remove engine baffling above affected cylinder.

(3) Disconnect fuel and airlines from nozzle.

(4) Remove any clamps attached to cylinder tubes.

(5) Remove static air manifold.

(6) Remove ignition wires as necessary and remove side baffling.

(7) Disconnect exhaust system.

(8) Remove induction tube to cylinder.

(9) Disconnect oil return line from cylinder.

(10) Remove probes if there are any in the affected cylinder.

(11) Remove or relocate any other hoses or lines obstructing cylinder removal.

(12) Refer to Avco Lycoming HIO-360 Operators Manual for detailed procedure on cylinder removal, inspection, and assembly.

G. Cylinder – Installation

(1) Install cylinder per instructions in Avco Lycoming HIO-360 Operators Manual.

NOTE: Cylinder hold-down through studs must have the nuts torqued on both sides of the engine.

(2) Install any probes removed for disassembly.

NOTE: For EDM 700 CHT probe installation, refer to Para. 7-21, C, to install spacer (P/N 28-22096-11), if not currently installed.

(3) Connect oil return lines to the cylinder.

(4) Check condition of induction tube and install.

(5) Check exhaust system flanges and gaskets and install exhaust system.

NOTE: Exhaust system may require shimming (Para. 13-3, C.2).

(6) Install engine side baffling.

(7) Install ignition wires.

(8) Install static air manifold, safety wire screws in pairs.

(9) Install flow divider fuel line clamp.

(10) Install nozzle and connect fuel and static air lines.

(11) Service engine oil and fuel systems.

(12) Run engine to check for system leaks.

(13) Install remaining baffling and cowling.

13-3 ENGINE EXHAUST SYSTEM

A. General Information

The exhaust system on the engine consists of two manifold/collectors which route exhaust gases through the heater-exchange manifold and out through the wastegate and/or turbocharger, depending on engine power requirements. Refer to Figure 13-3 and Figure 13-9.

NOTE: For F-28F models prior to S/N 746, 280F models prior to S/N 1519, and 280FX models prior to S/N 2012 that have not complied with SDB 0073, refer to the procedure in Para. 13-3, J, to replace a clamp installation with a retention pin installation.

B. Exhaust Manifold – Removal

NOTE: Cylinder #1 and cylinder #3 are on the left side of the engine (pilot's side). Cylinder #2 and cylinder 4# are on the right side of the engine (co-pilot's side).

NOTE: The tips of the EGT/TIT probes will expand inside the exhaust pipes due to exhaust heat. Removal of a probe from a hot exhaust pipe may cause damage to the probe. If a probe will not come out of the pipe, disconnect the probe electrical lead and leave the probe installed in the pipe.

(1) Disconnect TIT probe (1) from exhaust manifold.

(2) Disconnect EGT (11) probes at cylinders.

(3) Remove ducting from heater muff (2).

(4) Remove clamp (4, Figure 13-9) that connects exhaust collector to turbocharger.

NOTE: The clamp connecting the exhaust collector to the turbocharger is hinged and can be easily removed. The clamp securing the tail pipe to the turbo is not hinged and must be spread gently to slide if off of the tail pipe and turbo flanges. Be careful to only spread the clamp enough to slide if off of the flanges so that it will not be damaged by bending.

(5) Remove exhaust inlet gasket (2).

(6) Disconnect linkage (4, Figure 13-3) at wastegate.

(7) Loosen v-band coupling (1, Figure 13-9) connecting tail pipe (or muffler) to turbocharger. Spread clamp open to permit clamp to slip off flange and onto tail pipe.

CAUTION: THE CLAMP SECURING THE TAIL PIPE TO THE TURBO IS NOT HINGED. DO NOT SPREAD THE CLAMP ANY FARTHER THAN NECESSARY.

(8) Remove exhaust pipe gasket (2, Figure 13-9).

(9) Remove safety wire and retention pin (8) and remove wastegate (6) (Figure 13-3).

(a) If a clamp (9) is present, replace clamp with a retention pin installation in accordance with Para. 13-3, J.

(10) Remove two clamshell clamps (10) that connect #1 and #4 risers to the collectors.

(11) Remove two nuts (7) and washers on exhaust flange on each cylinder.

(12) Lubricate (penetrating oil) sleeve joint where right side (#2) collector is inserted into left side collector (at the heater muff). Break it loose by pulling #2 collector off cylinder studs and rotating back and forth where inserted into the left side collector. This allows the exhaust system to be removed in two pieces.

(13) Remove right-side collector from the left-side collector.

NOTE: The left and right collectors can be removed from the helicopter in one piece if the #2 intake pipe is removed from the engine.

C. Exhaust Manifold – Inspection

Upon removal of the complete exhaust system, inspect for the following:

(1) Exhaust flange mounts for cracks.

(2) Distortion of exhaust mount flanges.

(3) Correct gaskets.

(4) Hardware condition.

(5) V-band couplings for cracks, splits, and broken weld joints.

(a) Refer to Para. 13-5, C for additional turbocharger inspection criteria.

(6) Protruding areas in exhaust (usually found at the base of the turbocharger bypass/wastegate) that resemble bubbles.

NOTE: These areas form due to aircraft operating with higher than acceptable EGT/TIT. If any areas such as these are found, the exhaust system must be overhauled or replaced prior to further operation.

(7) Heater exchange manifold for cracks.

WARNING: AT THE 100-HOUR INSPECTION, IT WILL BE NECESSARY TO REMOVE THE CABIN HEAT EXCHANGER COVER TO INSPECT FOR ANY CRACKS INTERNALLY WHICH COULD ALLOW CARBON MONOXIDE TO ENTER THE CABIN THROUGH THE HEATING SYSTEM.

(8) Check for indication of exhaust leakage.

NOTE: The primary cause of exhaust leaks on the F series Enstrom helicopters is the fit of the right side (co-pilot) collector to the #2 and #4 cylinders. Often the #4 stack is too long preventing the #2 collector from sitting flat on the cylinder exhaust port.

(a) If evidence of leakage is present on the cylinder fin or on the spark plug, the leakage may be caused by the following:

1 The #4 stack is too long.

2 Warped flange on the exhaust pipe.

NOTE: Warped flanges are usually caused by over-torquing the retention nuts. This is because the center spiral-wound part of the gasket is thicker than the flange around the outside edge. Disassembly is required to determine the repair required (Para. 13-3, C.1).

C.1 Exhaust Manifold – Disassembly

NOTE: Disassembly is required to determine the repair required if a warped flange is evident or if #4 exhaust stack is too long.

(1) Loosen four exhaust nuts on left side of engine (pilot's side).

(2) Remove clamp on #4 stack and nuts holding #2 exhaust pipe to the cylinder.

(3) Lubricate the sleeve joint where the right side (#2) collector is inserted into the left side collector (at the heater muff) with penetrating oil and break it loose by pulling the #2 collector off of the cylinder studs and rotating back and forth where it is inserted into the left side collector.

(4) Disconnect EGT wire leads.

CAUTION: OFTEN THE TIPS OF THE EGT PROBES WILL SWELL AND PREVENT THE PROBE ASSEMBLY FROM BEING REMOVED FROM THE PIPE. IF THE PROBES WILL NOT COME OUT OF THE PIPE EASILY, THEN DO NOT REMOVE THEM AS THE PROBES WILL BE DAMAGED.

(5) Remove right-side collector from engine and heater muff assembly.

(6) Remove #2 stack from the cylinder.

(7) Check collector assembly for stack lengths (Figure 13-3A, (a)).

(a) Place the collector assembly and the #4 riser on a flat surface with the #4 riser inserted into the collector assy. Both flanges should sit flat on the surface.

(b) If there is a gap under the inside edge of the #2 stack it is an indication that the #4 stack is too long and the collector assembly will need to be shimmed when installed on the helicopter.

(c) If required, refer to Para. 13-3, C.2 for shimming the exhaust stacks.

(8) Check exhaust pipe flanges for straightness (Figure 13-3A, (b)) and repair, if required.

(a) Place the flange on a flat surface such as the anvil surface of a vise.

(b) If a .001” feeler gauge can be inserted between the flange and the flat surface, the flange is warped (Figure 13-3A, (c)).

(c) A large punch and hammer can sometimes be used to straighten the flange by tapping it against the flat surface of the vise (Figure 13-3A, (d)). The stainless steel is quite soft and can normally be re-shaped to repair warped flange.

C.2 Exhaust Manifold – Shimming

NOTE: There are TWO styles of exhaust gaskets approved by Lycoming for turbocharged engines (Reference Lycoming SI-1204, latest revision). The blow-proof gasket is P/N 77611 and P/N LW-16567 is a thin stainless gasket that is intended to be a nested double gasket (12, Figure 3-3).

NOTE: Blow-proof gaskets may be reused but must be replaced at overhaul.

CAUTION: COPPER GASKETS MUST NEVER BE USED ON A TURBOCHARGED ENGINE DUE TO THE HIGHER EGTS.

(1) Install short stack (#1 or #4 cylinder) on engine and loosely torque nuts (7, Figure 3-3).

(2) Use a .001 feeler gauge to check for a gap under gasket or the exhaust flange on both sides of stack (Figure 13-3A, (e)).

(a) If the feeler gauge can be inserted into a gap on either side of the gasket, the collector will require shimming.

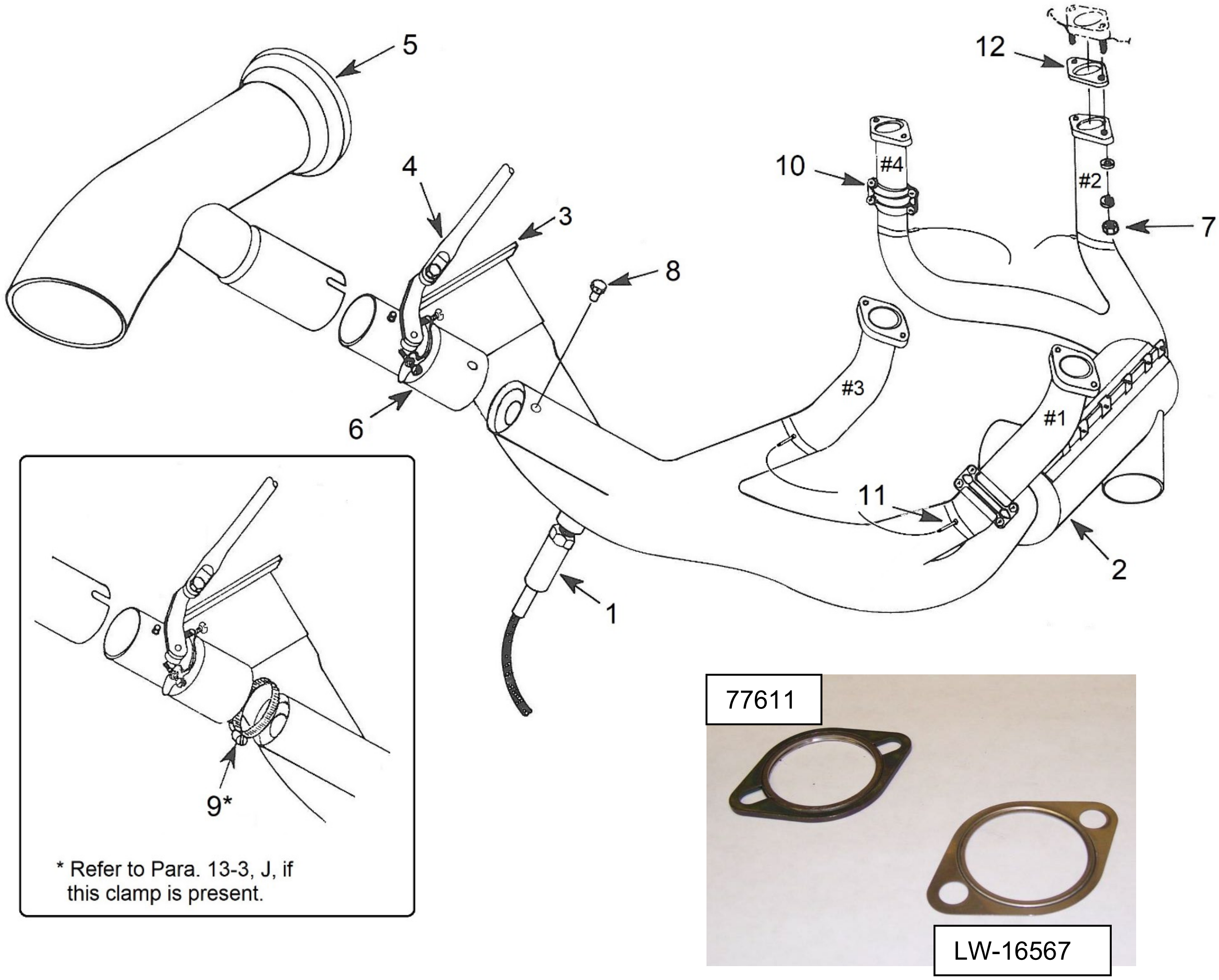
NOTE: The most common shimming is required because the #4 stack is frequently too long causing a gap on the inside (against the cylinder fin) on #2 cylinder.

(2) Install one P/N 77611 gasket and one P/N LW-16567 gasket on the #2 cylinder and two P/N LW-16567 gaskets under the flange on the #4 cylinder.

NOTE: P/N LW-16567 gasket is installed adjacent to the stack.

(a) Verify if gaskets are sealing at both exhaust flanges.

(b) The configuration of the gaskets can be adjusted between the two cylinders to compensate for individual differences between the cylinders.



1.	TIT probe	8.	Retention Pin
2.	Heater exchange manifold	9.	Clamp (Obsolete) (Replaced by Retention Pin (8)
3.	Exhaust to turbo collector clamp location	10.	Clamp
4.	Wastegate Linkage	11.	EGT probe
5.	Tailpipe to turbo location	12.	Gasket (77611 or LW-16567)
6.	Wastegate		
7.	Nut		

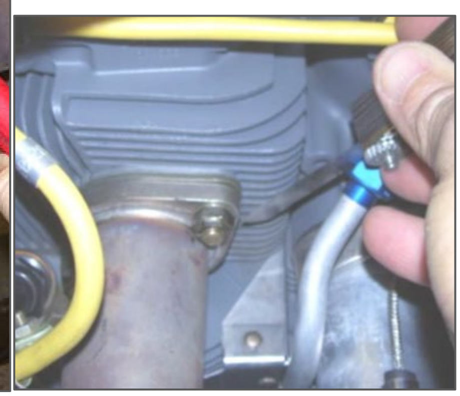
Figure 13-3. Engine Exhaust System and Wastegate

a) Stack Length Check

b) Flange Warp Check

c) .001” Feeler Gauge Inserted

d) Flange Repair



e) Feeler Gauge Check

Figure 13-3A

D. Exhaust Manifold – Installation

NOTE: If the engine has been run for many hours with exhaust leaks, the surface of the cylinder will be eroded, and the gaskets will not seal. Often the cylinder flange can be repaired on the helicopter. Contact customer support for instructions on how to perform this repair.

NOTE: Gasket sealer (Flo-Ex brand) applied between the interface of the manifold flange, gasket, engine cylinder head provides additional sealing for the exhaust manifold installation.

(1) Assemble the cover on the cabin heat exchanger (2, Figure 13-3).

(2) Install the #1 riser on the cylinder with gasket and hardware but leave the nuts loose by several threads.

(3) Install the left-side (pilot-side) manifold section with new gaskets (12) and hardware. Leave the nuts (7) loose by several threads.

(4) Apply a generous amount of anti-seize (Nickel Grade or Silver Grade, MIL-PRF-907) to the interior of the heat exchanger where the right-side collector will be inserted.

(5) Install #4 exhaust pipe riser with gaskets and hardware onto cylinder. DO NOT TORQUE.

(6) Install right-side manifold section into left side collector and connect to #2 cylinder with new gaskets (12) and hardware. DO NOT TORQUE.

(7) Connect exhaust inlet (manifold) to turbocharger inlet with v-band coupling (4, Figure 13-9).

(a) If the collar (5) can be removed, coat the inside of the collar with anti-seize (Nickel Grade or Silver Grade, MIL-PRF-907) and slide the collar up and rotate for proper alignment.

(b) Refer to Para. 13-5, D, (13), (a) through step 5 for partially installing the v-band coupling (4).

NOTE: Do not fully torque v-band coupling (4) at this time.

(8) Install wastegate assembly (6, Figure 13-3).

(9) Connect turbocharger exhaust outlet and exhaust tailpipe with v-band coupling (1, Figure 13-9).

(a) Refer to Para. 13-5, D, (13), (b) to complete the v-band coupling installation.

(10) Complete the v-band coupling (4) installation.

(a) Refer to Para. 13-5, D, (13), (a), step 6 through 11.

(11) Check all attachment points for alignment.

(12) Torque manifold nuts (7, Figure 13-3) (80-90 in-lb/9.0-10.2 Nm).

(13) Use a .001” feeler gauge to measure the gap between the #2 exhaust pipe flange and the cylinder exhaust port, especially around the back side of the exhaust port (Figure 13-3A, (e)).

(14) Install the clamshell clamps (10, Figure 13-3) on #1 and #4 stacks and torque (25 in-lb/2.8 Nm).

(15) Install or connect the TIT probe (1).

(16) Install or connect the EGT probes (11).

(17) Install heater muff ducting.

(18) Connect wastegate linkage (4).

(19) Check wastegate system for security, rigging, freedom of movement and proper operation (Para. 13-3, E and F).

(20) Run engine and check for possible exhaust leaks.

(21) Retorque the exhaust flange nuts (7) and all other exhaust installations after the engine has cooled. Re-safety (MS20995C32) as required.

CAUTION: DO NOT INSTALL A COPPER EXHAUST GASKET ON A TURBOCHARGED ENGINE.

E. Wastegate – Operational Check

NOTE: This check is done with the engine shut down.

(1) Check freedom of operation of injector to wastegate rod "breakaway" function by holding the wastegate arm stationary, partially opened, and rotating the throttle in both directions causing rod to break away and move approximately two inches in each direction.

(2) Ensure breakaway mechanism is engaged after completion of operational check.

F. Wastegate – Rigging

NOTE: Ensure throttle arm is properly rigged to the injector.

CAUTION: MISRIGGING CAN POTENTIALLY RESTRICT THE ABILITY OF THE ENGINE TO REACH FULL ENGINE POWER.

(1) Set injector to full throttle position.

(2) Check wastegate butterfly to ensure it is fully closed.

(3) Adjust butterfly position by adjusting the inboard rod end.

(4) Adjust wastegate closed stop to provide a .015-.020 inch gap between stop and arm.

(5) Lock closed stop with jam nut.

(6) Set injector to position throttle arm on the idle stop.

(7) Check wastegate butterfly to ensure it is open past center.

(8) Adjust wastegate open stop to provide a .015-.020 inch gap between stop and arm.

(9) Lock stop with jam nut.

G. Wastegate – Removal

(1) Disconnect wastegate linkage

(2) Loosen the v-band coupling (1, Figure 13-9) connecting the tail pipe (or muffler) to the turbocharger and being careful not to spread it apart any farther than is necessary, slide it of off the flange and onto the tail pipe.

(3) Remove exhaust pipe/muffler and gasket (2).

(4) Remove wastegate assembly (6, Figure 13-3).

H. Wastegate – Inspection

(1) Check wastegate for internal heat erosion of the butterfly valve and shaft, freedom of movement, excessive clearance, cracks, and distortion.

I. Wastegate – Installation

NOTE: Use anti-seize (Nickel Grade or Silver Grade, MIL-PRF-907) on all slip joints

NOTE: If a new wastegate is installed, modify the wastegate in accordance with Para. 13-3, K, before proceeding.

(1) Place wastegate in position on exhaust manifold.

(2) Install retention pin (8) and safety (MS20995C32).

(3) Install exhaust outlet to the wastegate (6, Figure 13-3).

(4) Install exhaust outlet, gasket (2), and v-band coupling (1) to the turbocharger (Figure 13-9).

(a) Refer to Para. 13-5, D, (13), (b) to complete the v-band coupling (1) installation.

(6) Connect wastegate actuating rod.

(7) Check assembly for security of attachment and freedom of movement.

J. Wastegate – Clamp Replacement

NOTE: For F-28F models prior to S/N 746, 280F models prior to S/N 1519, and 280FX models prior to S/N 2012 that have not complied with SDB 0073, refer to the following procedure to replace a clamp (9, Figure 13-3) installation with a retention pin (8, Figure 13-3) installation. Refer to Figure 13-3B for the following procedure.

(1) First determine that the wastegate assembly is properly positioned and rigged correctly (Para. 13-3, E through I).

(2) After readjustment or determination that the wastegate position and rigging are correct, its position relative to the exhaust stack stub must be marked for repositioning after drilling and reassembly.

(a) Draw a line radially along the lower edge of the wastegate tube to establish its position relative to the exhaust stack stub (Detail i, Line A).

(b) Use the steel scale to draw a centerline parallel to the tube sides on the exhaust stub overlapping the wastegate tube by at least 1 inch and extending at least 2 inches on the stub tube (Detail i, Line B).

(3) Remove stack and slide wastegate upward and off the exhaust stack stub (by-pass tube).

(4) Discard lower seal clamp (9).

(5) Measure exactly 2.50 inches from the end of the by-pass tube toward the exhaust stack and mark (Detail ii, Point C).

NOTE: Prior to reassembly, inspect the wastegate in accordance with Para. 13-3, H.

(6) Reassemble exhaust stack and wastegate, reposition wastegate to original location by matching index lines (Detail ii, Lines A and B) and recheck rigging.

(7) Position, mark, and install retention pin (8, Figure 13-3).

(a) Measure exactly 2.00 inches from Point C and mark Point D (Detail i).

(b) Center punch Point D and drill a 0.196 inch diameter hole to a depth of 0.38 inch. Deburr hole.

(c) Install stainless steel (retention) pin (8) (P/N 28-12574-11).

(d) Safety (MS20995C32) (MS9226-05) retention pin (8) in position: Thread wire through head and double wrap around wastegate and twist ends together (Detail iii).

(8) Check exhaust wastegate system for security, rigging, freedom of movement and proper operation (Para. 13-3, E and F).

K. Wastegate – Wastegate Replacement

(1) Before removal of an old wastegate assembly, transfer the existing position of the retention pin hole for relocating on the new replacement. Refer to the preceding steps (Para. 13-3, J).

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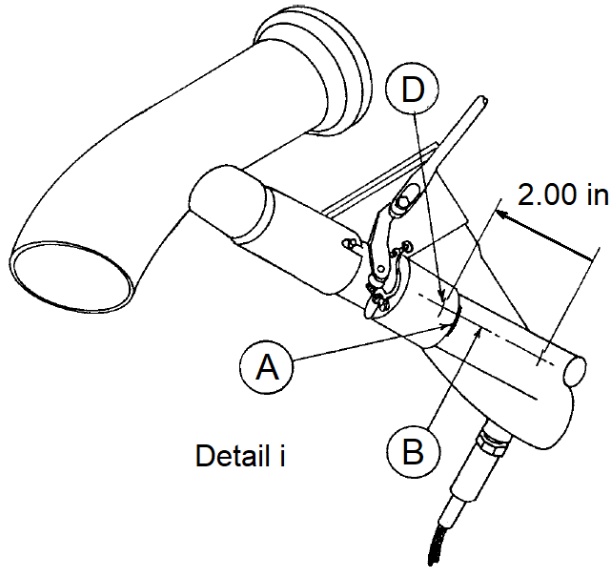
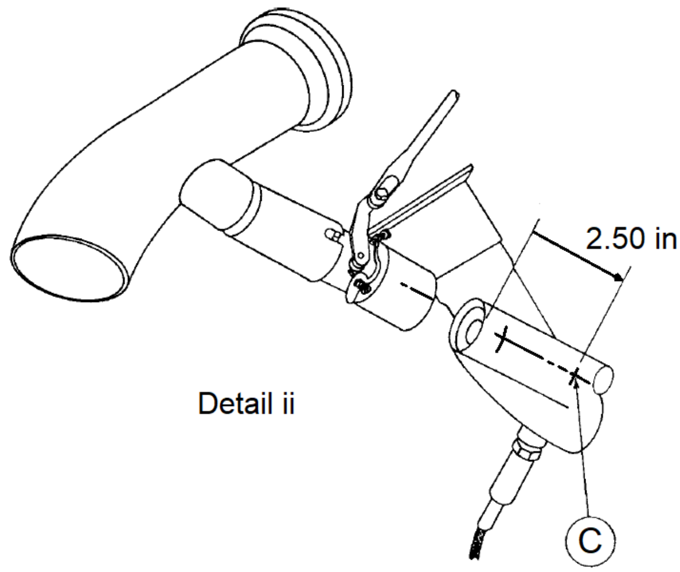


Detail i



Detail ii

Detail iii

Figure 13-3B. Wastegate Retention Pin Installation

13-4 FUEL INJECTION SYSTEM

A. General Information

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 via a fuel flow divider and fuel injection nozzles.

It is suggested that all adjustments to the RSA-5 fuel injection system be performed with the use of the Operation and Service Manual, Form 15-338 (latest revision), published by the Bendix Corporation (Precision Airmotive).

B. Fuel Injector System - Troubleshooting

NOTE: Internal field maintenance of RSA type injector is limited to lapping the main metering jet and rotating plates and replacing the O-ring.

Repairs to and calibration of the regulator section must be done by an authorized Bendix Service Center or Overhaul Facility, for the specific parts list number indicated on the servo data plate.

Problem	Possible Cause	Action
Hard starting accompanied by the discharge of black puffs of smoke and popping from exhaust stack while cranking and possible fuel leakage from the engine sump drains.	Flooding because of excessive prime with boost pressure or improper mixture setting.	Clear engine by cranking with throttle in the wide open position, ignition switch off, boost pump off, and mixture in idle cut-off position.
	Flooding because of fuel servo leaky mixture control plate, usually indicated previously by failure to have a crisp shut-off when mixture control was placed at idle cut-off position.	See Para. 13-4, D, (2), (c)
	Flooding because of center body seal leak in servo.	See Para. 13-4, D, (2), (b)
Hard starting accompanied by possible backfiring and fuel leakage from induction tube sump drain.	Insufficient fuel prime, improper mixture control setting, no boost pressure or obstructed fuel flow.	Reference normal engine starting procedures (Para. 13-4, E, (1)).
	Insufficient fuel to fuel nozzles because ambient air check valve on air filter box stuck, resulting in fuel being drawn into induction sump tube and seeping from drain.	Clean fuel static air vent valve (Para. 13-2, D, (2), (i)).
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.
	Fuel vaporizing in fuel line or distributor. Encountered only under high ambient temperature conditions or following prolonged operation at low idle rpm.	Increase engine rpm, turn into the wind or terminate ground operation (Para. 13-4, C).
	Plugged nozzle(s), usually accompanied by high takeoff fuel flow readings and slightly higher MAP'S.	Clean nozzles.

Problem	Possible Cause	Action
Rough idle. (Continued)	Slight air leak into induction system through manifold drain check valve. Usually able to adjust initial idle, but rough in 1000-1500 rpm range, and will have a slightly higher MAP.	Confirm by temporarily plugging sump drain lines. Replace or clean check valves as necessary.
	Internal leak in injector (usually unable to lean out idle range).	Replace injector.
	NOTE: If engine does not stop crisply at mixture idle cut-off position, check Para. 13-4, D, (2), (b) and (c), Para. 13-4, D, (8), (a), 9.	
Low takeoff fuel flow.	Fuel filter or finger screen partially plugged.	Remove and clean in a suitable solvent.
	Injector out of adjustment.	Replace injector with properly calibrated unit.
	Faulty gauge.	Replace as necessary.
	Low fuel pressure.	Readjust to correct setting.
Poor cut-off.	Improper rigging of mixture control.	Adjust.
	Mixture control valve scored or not seating properly.	Eliminate cause of scoring (usually a burr or dirt) and lap mixture control valve and plug on surface plate.
	Boost on.	Turn off.
Rough engine and poor cut-off.	Fuel injection nozzle air bleed hole(s) clogged.	Clean or replace nozzles.
Erroneous fuel flow.	Faulty gauge.	Replace as necessary.
	AMC blast tube disconnected.	Repair as necessary.
Abnormal engine operation – combination of cold start engine stalling, high TIT, rough of high engine idle.	Air leakage at adapter due to loose attachment screws, deteriorated gasket, and possible ingestion of adapter gasket.	Check condition of gasket and security of screws. Replace gasket, if necessary.

Typical Fuel Flow Performance For “F” Models

3050 rpm
Sea Density Altitude

Manifold Pressure Inches	Horsepower	Percent of Horsepower	Fuel Flow (PPH)		Endurance (Hours)	
			Lean	Rich	Lean	Rich
20”	120	53%	62	76	3.8	3.1
22”	130	58%	68	82	3.4	2.8
24”	142	63%	74	89	3.2	2.6
26”	153	68%	80	97	2.9	2.4
28”	165	73%	87	107	2.7	2.2
30”	176	78%	NA	119	NA	2.0
32”	186	83%	NA	131	NA	1.8
34”	198	88%	NA	142	NA	1.6
36”	208	92%	NA	153	NA	1.5
38”	220	98%	NA	163	NA	1.4
39”	225	100%	NA	168	NA	1.4

NOTE: This performance is typical for Enstrom "F" models. There will be some variation between individual helicopters.

NOTE: “LEAN” limits denote TIT at 1650 degrees Fahrenheit.

NOTE: “NA” denotes not approved mixture setting.

C. General Operating Information

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.

(1) 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 on how soon the next start is attempted. Within the first 20-30 minutes 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.

(2) Idling

During ground operation every precaution should be taken to keep nacelle temperatures from increasing to the extent that fuel will vaporize in the fuel 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 possible.

3 Upon restarting of a hot engine, operate engine at 1200-1500 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. The higher than normal temperature encountered during the heat of the day results in the engine requiring a considerably leaner idle mixture. However, with fuel injection, this richer setting at the heat of the day will help dissipate more engine heat.

(3) Shutdown (Cut-Off)

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

D. Injector (Fuel Servo)

(1) General

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.

Provisions have been made to compensate 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.

NOTE: The Bendix Model RSA5AB1 fuel injector which is supplied with the HIO-360-F1AD Lycoming engine is internally adjusted specifically for the Enstrom turbocharged installation. ALL replacement injectors must be acquired from your nearest Lycoming or Bendix distributor by parts list number.

(2) Operational Checks

(a) Idle Mixture and rpm Check

1 Operate helicopter to normal temperature and pressure ranges.

2 Verify magneto operation.

NOTE: Maximum engine drop 125 rpm and rise of 100°F.

3 Perform normal cool down.

a 1 minute at 2000 engine rpm

b 2 minutes with throttle off and clutch disengaged

4 Verify idle is 1450-1500 rpm.

NOTE: If required, perform any adjustment to the idle stop with the engine off.

5 Boost pump – remain ON.

6 Slowly lean the engine, observing rpm change.

NOTE: Move mixture to full rich before engine quits.

- If rpm rise during leaning – idle mixture is rich.
- If immediate rpm drop – idle mixture is lean.

7 Engage clutch.

a Accelerate engine to 2500 rpm.

b If engine will not accelerate smoothly from idle, idle mixture is too lean.

8 Perform idle mixture and rpm adjustment (Para. 13-4, D, (8)), if necessary.

(b) Center Body Seal Leakage Check

1 Remove intake flex hose from injector inlet.

2 Disconnect injector fuel outlet line.

3 Cap injector fuel outlet fitting

4 Magneto Switch – Off

5 Throttle – Full On

6 Mixture – Full Rich

7 Master Switch – On

8 Boost Pump – On

9 Observe injector impact tubes for fuel leakage.

NOTE: Leakage indicates a damaged center body seal. This repair is done ONLY by an authorized Bendix Service Center or Overhaul Facility.

10 Replace injector if necessary.

(c) Mixture Control Plates Leakage Check

1 Magneto Switch – Off

2 Disconnect injector fuel outlet line from injector.

3 Mixture Control – Full Lean

4 Throttle – All the way out (Off)

5 Master Switch – On

6 Boost Pump – On

7 Observe open fitting for evidence of fuel leakage.

NOTE: Fuel leakage indicates scored (a) mixture control jet, (b) rotating plates or a damaged O-ring on the jet.

8 Lap plates as necessary (Para. 13-4, D, (9)).

(3) Normal Operating Characteristics

(a) Mixture full rich, engine at 3050 rpm.

1 29" MAP fuel flow - 110/120 lb/hr.

2 39" MAP fuel flow - 150/155 lb/hr.

(b) Cold or hot engine may not idle with boost pump off.

(c) At normal operating temperature engine should idle with boost pump on or off.

(d) Engine idle rpm will not decrease, boost off to boost on.

(e) When throttle is rapidly reduced to idle (chopped) from 3050 rpm, engine idle will not drop below normal idle setting.

(4) Rigging Throttle and Wastegate Actuating Arm to Injector

(a) Position centerline of throttle arm two serrations (approximately 30°) counter clockwise from an imaginary line drawn between the throttle shaft end and the center of the idle valve arm pivot point.

(5) Injector - Removal

NOTE: Injector removal, through the firewall access, can be accomplished without removing the turbocharger or the turbocharger can be removed (Para. 13-5, B) to improve accessibility.

(a) Disconnect hose (1, Figure 13-5) from blast tube assembly.

(b) Disconnect mixture control cable (2).

(c) Disconnect fuel inlet (3) and outlet lines (4).

(d) Disconnect throttle (5) and wastegate (6) controls.

(e) Remove four attachment bolts (7).

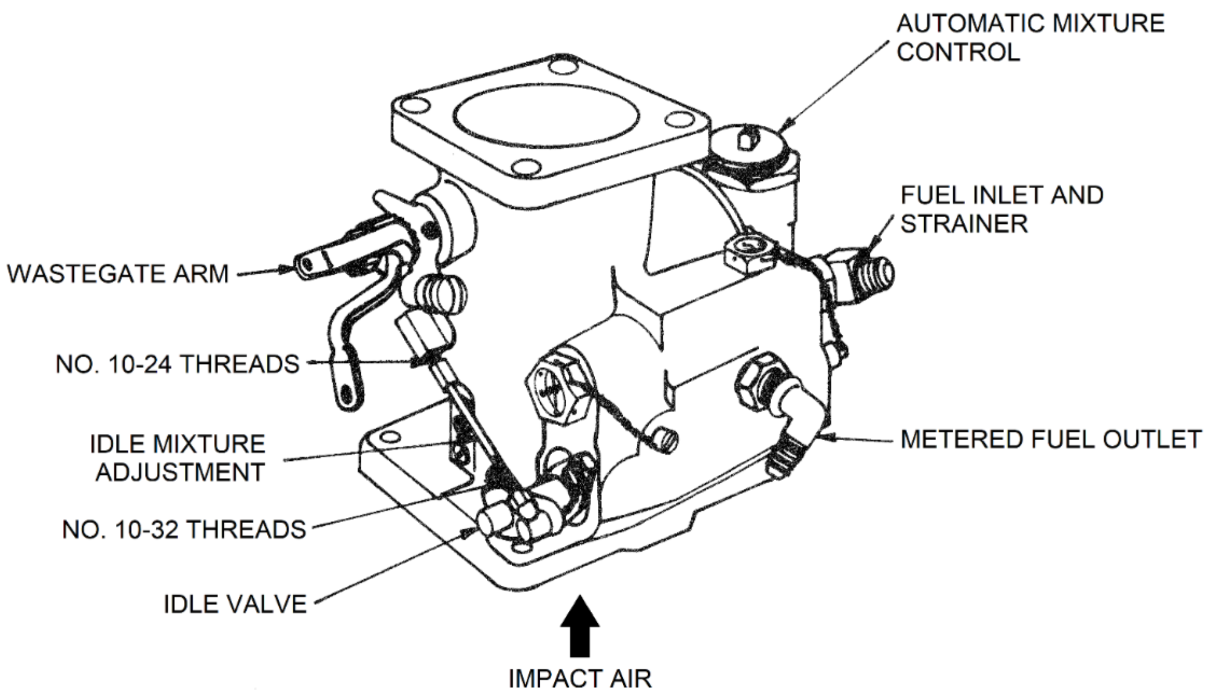


Figure 13-4. Fuel Injector (Servo)

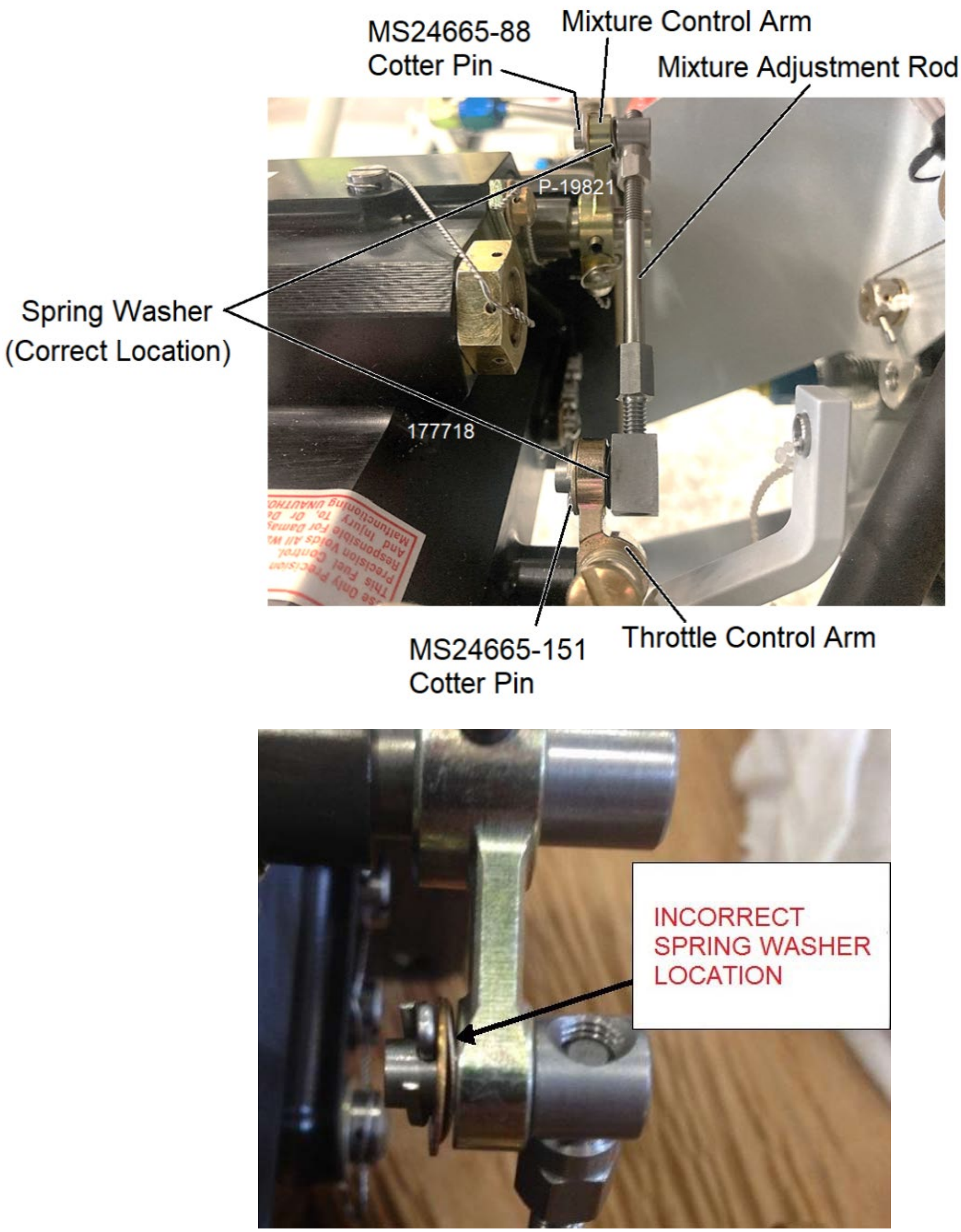


Figure 13-4.1. Mixture Adjustment Rod Installation

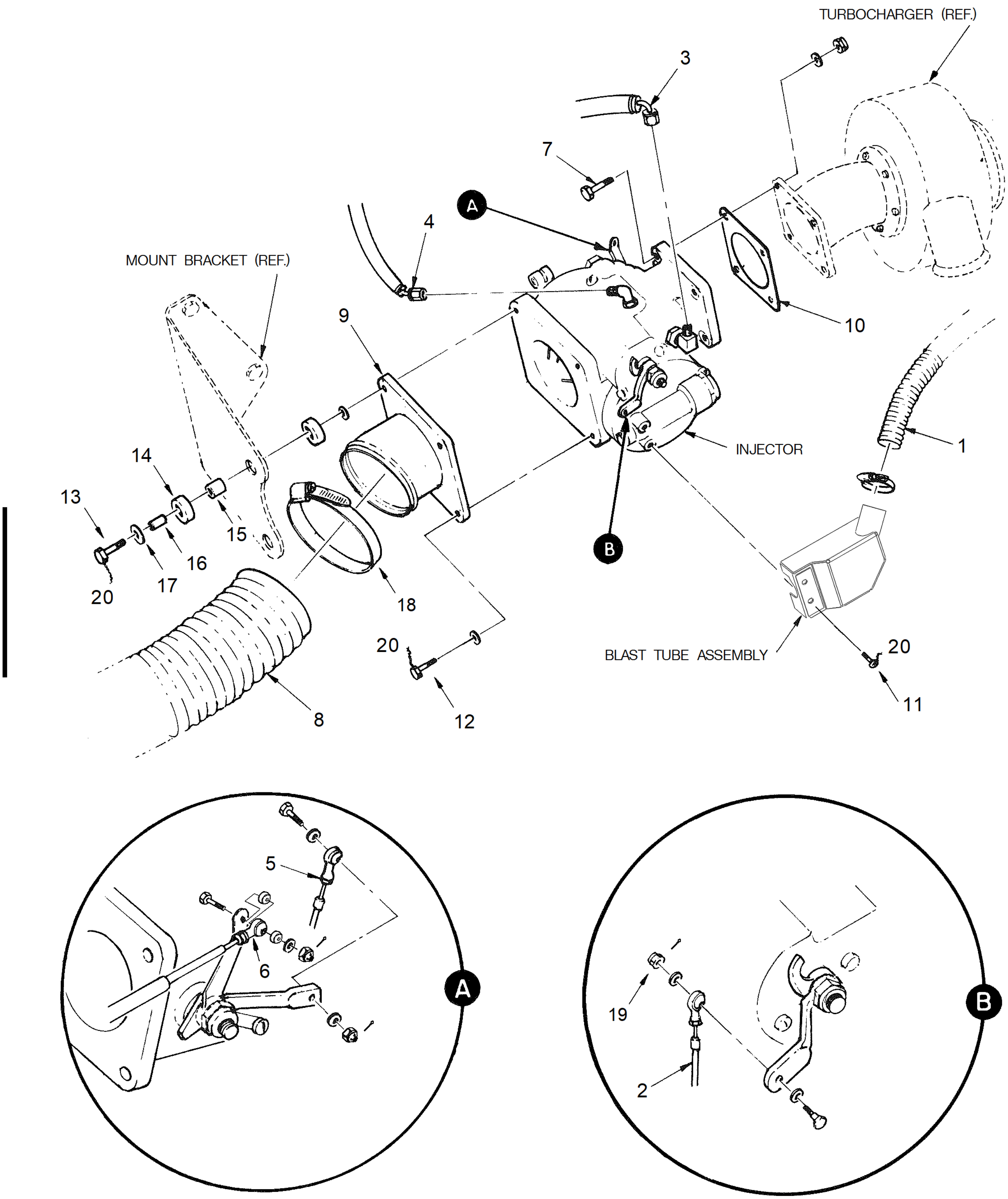


Figure 13-5. Fuel Servo Installation

Figure 13-5 Fuel Servo Installation Legend

1.	Blast Tube Hose	8.	Air Inlet Hose	15.	Shock Mount (small)
2.	Mixture Control Cable	9.	Air Inlet Adapter	16.	Metal Spacer
3.	Fuel Inlet Line	10.	Gasket	17.	1/4” Harper Washer
4.	Fuel Outlet Line	11.	Screw	18.	Clamp
5.	Throttle Control	12.	Bolt	19.	Nut
6.	Wastegate Control	13.	Bolt	20.	Safety Wire (MS20995C32)
7.	Bolt	14.	Shock Mount (large)		

(f) Disconnect air inlet hose (8) from injector adapter.

(g) Disconnect injector and air inlet adapter (9) by removing two mounting bracket connecting bolts (13) and two forward bolts (12).

(h) Remove the injector, inlet adapter and outlet gasket (10).

(6) Injector – Inspection

(a) Check air inlet hose and blast tube hose (1, Figure 13-5) for evidence of wear that could cause leakage.

(b) Check condition of gasket (10) between injector adapter and turbocharger.

(c) Check security of bolts (7).

(d) Inspect for proper location of spring washers (Figure 13-4.1).

(7) Injector - Installation

NOTE: On new injectors and those that have had throttle arm removed, it will be necessary to check rigging of the throttle arm to injector by checking operation of the waste gate. (See Figure 13-5)

(a) Place injector and air inlet adapter (9, Figure 13-5) in position in the engine compartment.

(b) Attach air inlet adapter (9) to injector with the two forward bolts (12).

(c) Assemble shock mounts on mounting bracket.

1 Place one large diameter shock mount (14) on each side of bracket, aligned with the hole.

2 Insert small diameter shock mount (15) into two large diameter shock mounts (14) and mounting bracket.

3 Insert metal spacer (16) into small diameter shock mount.

(d) Install injector and air inlet adapter with bolts (12) and (13). Install bolts (13) with one 1/4” Harper washer (17) on each side of the shock mounts. Torque 40-50 in-lb/4.5-5.6 Nm.

(e) Connect air inlet hose (8) to adapter (9). Secure with clamp (18).

(f) Insert gasket (10) between injector and turbocharger adapter and secure components with four bolts (7). Torque 100-140 in-lb/11.3-15.8 Nm.

(g) Safety wire injector inlet adapter bolts (7).

(h) Connect throttle cable (5) and wastegate actuating rod (6).

(i) Connect fuel line (3) and outlet (4) lines.

(j) Connect mixture control (2).

(k) Connect hose (1) to blast tube cover.

CAUTION: ON NEW SERVOS, WHEN TRANSFERRING BLAST TUBE ASSEMBLY BY REMOVING AMC SCREWS AND REPLACING THEM, BE SURE THE GASKET IS NOT ROTATED TO BLOCK VENT HOLE.

(l) Check security of all connections.

NOTE: After installing the servo, ensure that the AMC cover is not contacting the pylon tube. A flat-bladed screwdriver may be used to slightly modify the shape of the cooling shroud and prevent contact and potential vibration.

(m) Install turbocharger if it has been removed (Para. 13-5, D).

(n) Test run engine to ensure freedom of control movement and proper function.

(o) Shut engine down and inspect for leaks.

(8) Injector – Adjustments

(a) Idle Mixture and rpm

1 Perform idle mixture operational check (Para. 13-4, D, (2), (a)).

2 Loosen jam nut on mixture adjustment linkage rod (Figure 13-4).

3 Richen or lean the fuel flow to provide a 0 to 25 rpm rise before shutdown.

a Turning the coarse thread end of the rod into the throttle lever block leans the fuel mixture (mixture adjustment linkage shortens).

b Turning the coarse thread end of the rod from the throttle lever block richens the fuel mixture (mixture adjustment linkage lengthens).

4 While making adjustments, if the rod does not have proper thread engagement or disengages from the throttle lever block, it will be necessary to remove, adjust, and reassemble linkage rod, threaded pin and block as follows:

a Remove cotter pins and washers holding the throttle lever blocks to the arms on the fuel injector and remove assembly.

b Measure the overall length.

c Disassemble the rod from the blocks.

d Reassemble the rod to the previously measured length, allowing enough thread at each end for further adjustment, if required.

e Install assembly to the arms of the fuel injector.

NOTE: The spring washers must be installed between the arm of the fuel servo and the idle mixture blocks. See Figure 13-4.1.

5 After each adjustment, operate the engine up to 2200 rpm and back to idle to allow the system to normalize.

6 Adjust the idle mixture until the engine will accelerate through 1800 to 2200 rpm range without stuttering.

7 Perform mixture operational check (Para. 13-4, D, (2), (a)).

8 Secure the jam nut on the idle mixture adjustment rod.

9 Perform normal shutdown procedure.

NOTE: Optional alternate idle mixture adjustment: (Required equipment: 150 cc flask and spare 28-12463-1 fuel outlet line).

Method: Engine off, mixture full rich, main fuel valve on, throttle at idle, attach spare fuel line to servo outlet, turn boost pump on and measure flow in cc. For one minute - flow should be 90-100CC. If not, readjust idle mixture to required flow.

Perform mixture operational check (Para. 13-4, D, (2), (a).

(9) Injector – Repairs

(a) Lapping idle valve and mixture control valve:

1 Disconnect mixture control cable (2, Figure 13-5, Inset B) from the injector mixture control lever.

2 Remove the following:

a Two screws holding the mixture control lever assembly

b Mixture control level assembly

c Packing

d Idle valve

NOTE: A hook fabricated from 1/8" brass rod can be used to hook the orifice of the idle valve and gently work it out.

3 Visually inspect non-tapered end of valves and control plates for scoring.

4 Remove scores by lapping components in a figure 8 pattern with crocus cloth and clean oil on a surface plate.

5 Wash components with clean gasoline or solvent.

6 Reinspect components to ensure they are free of scores.

7 Reinstall the components as follows:

a Idle valve, flat side first

NOTE: Idle valve has a full length keyed slot.

b New packing and O-ring on mixture control valve

c Mixture control valve, flat side out

d Mixture control lever assembly

8 Connect mixture control cable.

9 Perform leakage check.

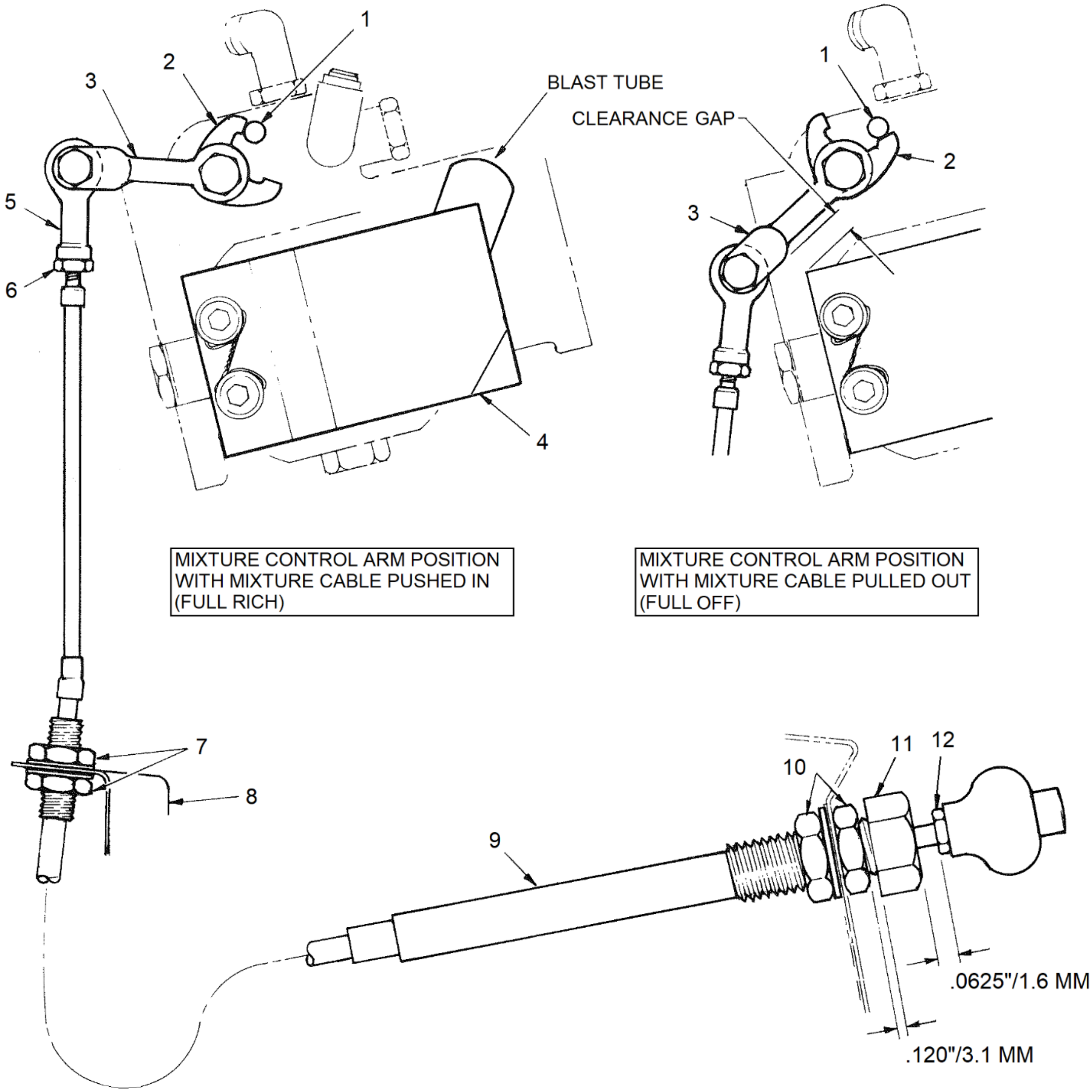
E. Mixture Control

(1) General Information (See Figure 13-6).

The mixture control cable is manually operated by depressing the knob in end of control handle and pushing inward to richen mixture and pulling out to lean mixture. The mixture control handle also has a vernier adjustment to complete fine mixture adjustments. Vernier adjustments are made by turning the large diameter portion of the control handle.

CAUTION: IT IS IMPORTANT TO KEEP FRICTION ON THE MIXTURE CONTROL SHAFT TO PREVENT VIBRATION FROM TURNING THE VERNIER CONTROL DURING FLIGHT. IF UNOBSERVED, CYLINDER HEAD TEMPERATURES AND EXHAUST GAS TEMPERATURE COULD EXCEED LIMITS, CAUSING ENGINE AND/OR TURBOCHARGER DAMAGE.

Mixture control friction should be adjusted to provide sufficient "drag" to prevent rotation due to vibration yet allow normal mixture adjustment without binding. Friction adjustments can be made by varying the torque on the large hex nut (11, Figure 13-6) by finger pressure without disturbing the mounting position of the control.



1. Stop
2. Mixture Control Arm
3. Mixture Control Lever
4. Cover (Blast Tube Assembly)
5. Rod End
6. Nut
7. Nut
8. Mount Bracket
9. Mixture Cable
10. Nut
11. Friction Nut
12. Jam Nut

Figure 13-6. Mixture Control Rigging

(2) Mixture Cable – Removal

(a) Remove fiberglass seat deck (Para. 8-8, A) and firewall inspection panels.

(b) Remove covers from instrument console.

(c) Disconnect mixture cable rod end (5) from mixture control lever (3) on injector.

(d) Break jam nut (6) loose from rod end (5) and remove both items from cable (9).

(e) Remove jam nuts (7) securing mixture cable to pylon mount which is aft of firewall. Remove nuts from cable.

(f) Cut tie wraps securing cable in seat structure.

(g) Remove jam nut (10) from mixture cable inside instrument console.

(h) Carefully pull mixture cable (9) through seat structure and out through instrument console.

(3) Mixture Cable – Installation

(a) Install mixture cable (9, Figure 13-6) through instrument panel and route it through seat structure and firewall.

NOTE: Install jam nut (10) on cable before routing through seat structure.

(b) Secure mixture control to instrument console with jam nuts (10).

NOTE: Mixture control is to be located in panel with a 0.120 in/3.1 mm gap between friction nut (11) and jam nut (10).

(c) Route mixture cable through pylon mount (8) on aft side of firewall and temporarily secure with jam nuts (7).

NOTE: The final steps of cable installation are completed in the following rigging procedure.

(4) Mixture Control Rigging

(a) Locate mixture control lever (3, Figure 13-6) on injector as follows:

1 Rotate the mixture control arm (2) until it hits stop (1) in the full rich position.

2 Locate mixture control lever (3) in a down position, leaving a slight gap between lever and blast tube cover (4) while aligning notches to mesh with mixture control arm (2).

3 Install nut (19, Figure 13-5) to secure mixture control lever (3) in this position.

NOTE: Recheck arm and lever positions after tightening nut. Control arm will sometimes rotate with nut during torque procedure.

(b) Install jam nut (6) and rod end (5) on mixture cable. Rotate rod end until it bottoms out on cable.

(c) Attach mixture cable rod end to mixture control lever (3) and secure with hardware. nut (19, Figure 13-5) and install cotter pin.

(d) Tighten jam nut (6) against rod end (5).

(e) Position mixture control knob allowing 1/16 in/1.6 mm gap between jam nut (12) and friction nut (11).

(f) With mixture control in this position, loosen jam nuts (7) at pylon mount and adjust cable sheath at mount bracket (8) until mixture control arm (2) hits the stop (1). Secure jam nuts (7).

NOTE: Mixture control arm (2) must be in full rich position as shown in Figure 13-6.

(g) Pull mixture control knob out to full lean position and check that control arm (2) hits the stop (1).

(h) Inspect all hardware for security.

(i) Install covers on instrument console.

(j) Install firewall inspection panels and fiberglass seat deck (Para. 8-8, D).

F. Automatic Mixture Control (AMC)

(1) General Information

This unit provides a variable orifice between impact 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 incorporates a contoured needle that is moved in or out of an orifice by a bellows assembly. The sealed bellows, which reacts to changes in air density, is filled with helium gas and a small quantity of inert oil to help damp vibration. Under high density conditions, the bellows are contracted and positions the needle in the orifice so that the effect of impact pressure on venturi throat pressure in the airflow section is at a minimum. As density decreases, due to either a decrease in pressure or an increase in temperature, the bellows elongate and repositions the needle in the orifice to increase the effect of impact pressure on venturi pressure which decreases the air metering forces to maintain a constant fuel-air ratio.

Attached to the aluminum housing, enclosing the temperature sensitive AMC unit, is a blast tube assembly which provides the necessary cooling airflow.

(2) AMC Blast Tube Assembly – Removal

(a) Disconnect hose (1) from blast tube shroud.

(b) Remove safety wire and two screws (11, Figure 13-5) attaching blast tube assembly to the fuel servo and AMC unit.

NOTE: Observe position of gaskets and spacer to ensure correct reassembly and operation.

(3) AMC - Cleaning

NOTE: Enstrom does not recommend disassembly of the AMC for cleaning.

(4) AMC Blast Tube Assembly – Installation

(a) Install screws (11) and safety (MS20995C32).

(b) Connect hose (1) to blast tube shroud and secure with clamp.

NOTE: Ensure that the AMC cover is not contacting the pylon tube. Refer to Para. 13-4, D, (7), (l) NOTE.

G. Fuel Servo Screen

(1) Servo Screen - Removal

(a) Disconnect hose (1, Figure 13-5) from blast tube assembly.

(b) Disconnect and cap fuel inlet line.

(c) Loosen jam nut on fuel inlet elbow and turn elbow to point downward.

NOTE: Place a container under inlet fitting to catch fuel that drains from the fuel inlet elbow.

(d) Cut safety wire and loosen plug that is installed in servo at opposite end of screen.

NOTE: When the hydraulic lock is released as the plug is loosened, remaining fuel inside the screen chamber will drain from the inlet plug.

(e) Remove plug on aft side of servo and carefully pull out screen.

(2) Servo Screen - Cleaning

Refer to Bendix Overhaul Manual for RSA-AB1 Fuel Injectors, Form 15-419.

(3) Servo Screen - Installation

(a) Insert screen into injector body with spring oriented aft. Twist spring carefully and ensure screen seats fully in inlet fitting.

(b) Install new O-ring on fuel inlet elbow. Torque and safety.

(c) Turn inlet fitting back to permit attachment of fuel line.

(d) Connect fuel inlet line.

(e) Torque inlet fitting jam nut.

(f) Torque inlet line to inlet fitting.

(g) Turn on main fuel valve.

(h) Run engine and check for fuel leakage around the inlet elbow.

H. Fuel Flow Divider

(1) Flow Divider - Removal

(a) Remove top right and left engine baffles.

(b) Disconnect fuel gauge (1) and fuel inlet (2) lines (Figure 13-7, View A) from flow divider.

(c) Disconnect fuel lines (5).

(d) Remove bolt (6) attaching center of flow divider mount bracket.

(e) Remove two bolts (4) attaching inboard side of mount bracket to engine case.

(f) Remove flow divider and mount bracket from engine compartment.

(2) Flow Divider - Disassembly

Refer to Bendix Form 15-540, latest revision, Flow Divider Overhaul Manual.

(3) Flow Divider - Installation

(a) Place flow divider and mount bracket in position on the top right side of the engine (Figure 13-7, View A).

(b) Install bolt (6) attaching center of mount bracket to engine case.

(c) Install two bolts (4), washers and nuts attaching top side of mount bracket to engine case.

(d) Connect fuel gauge (1) and fuel inlet (2) lines.

(e) Connect fuel lines (5).

(f) Briefly run engine and check connections for fuel leaks.

(g) Install baffling.

I. Air Bleed Nozzles

(1) Nozzles - Troubleshooting

Engines operating with a plugged nozzle may exhibit some of the following characteristics:

NOTE: If the engine exhibits any of the following, refer to step (2) below to perform an operational check.

(a) Rough idle (with severe obstruction, a popping exhaust noise).

(b) Roughness during high power settings.

(c) Engine may quit with power reduction with severe obstruction.

(d) Fuel nozzle pressure will indicate slightly higher fuel flows than normal.

(e) Slightly higher MAP setting than normal for conditions.

(2) Nozzles - Operational Check

(a) Run or hover the helicopter until it starts to run poorly. Shut down and quickly remove the static lines from the manifolds at the valve covers.

(b) If fuel runs out of one of the lines, one of the nozzles on that side of the engine is plugged.

(c) Remove the intake pipes from the cylinder.

NOTE: If it has been determined which side of the engine has the plugged nozzle, it is necessary to only remove the intake pipes of the side with the plugged nozzle. If it cannot be determined which nozzle is plugged, remove all four intake pipes.

(d) Place metal containers under the intake ports to catch the fuel and run the boost pump with the fuel valve on, the mixture rich, and the throttle wide open.

CAUTION: PERFORM THIS OPERATION OUTSIDE, WITH APPROPRIATE FIRE PREVENTION APPARATUS AVAILABLE. TAKE CARE TO GROUND THE AIRCRAFT. WORKING WITH OPEN FUEL CONTAINERS IS A HAZARDOUS OPERATION.

(e) Using a mirror and a flash light inspect the fuel flow from the nozzles by looking up into the intake port of the cylinder.

(f) The spray pattern must be perfectly formed, needle thin, clear and must shoot all the way across the port and hit the other side. If the stream is not perfectly shaped or spits air, the nozzle must be cleaned (Para. 4 below) or changed.

(g) Do not clean and re-use the old one-piece nozzles. Replace them with new nozzles.

(3) Nozzles - Removal

(a) Remove right and left panels from top of engine.

(b) Disconnect air line hose (7, Figure 13-7, View B) from air line fitting (3).

(c) Disconnect fuel line (5) from nozzle assembly.

(d) Remove air line fitting (3) and spring and spring holders (8) to provide access for socket installation on nozzle and remove nozzles.

NOTE: Use care in retaining the two O-rings (packing) located inside airline fitting for reinstallation.

(4) Nozzles – Cleaning (Ref. Figure 13-8)

NOTE: Cleaning the nozzles annually as was previously published is not required. Clean a nozzle only if it is plugged.

NOTE: Keep each restrictor with its respective body.

(a) Remove fuel restrictor (7) from nozzle body (8) and clean in MEK or acetone.

(b) Use air pressure to clean the nozzle body (8).

(5) Nozzles - Installation (See Figure 13-7, View B)

(a) Install nozzle assembly in cylinder. Torque to 60 in-lb/6.8 Nm.

NOTE: The bleed hole in the side of the nozzle should be pointing up.

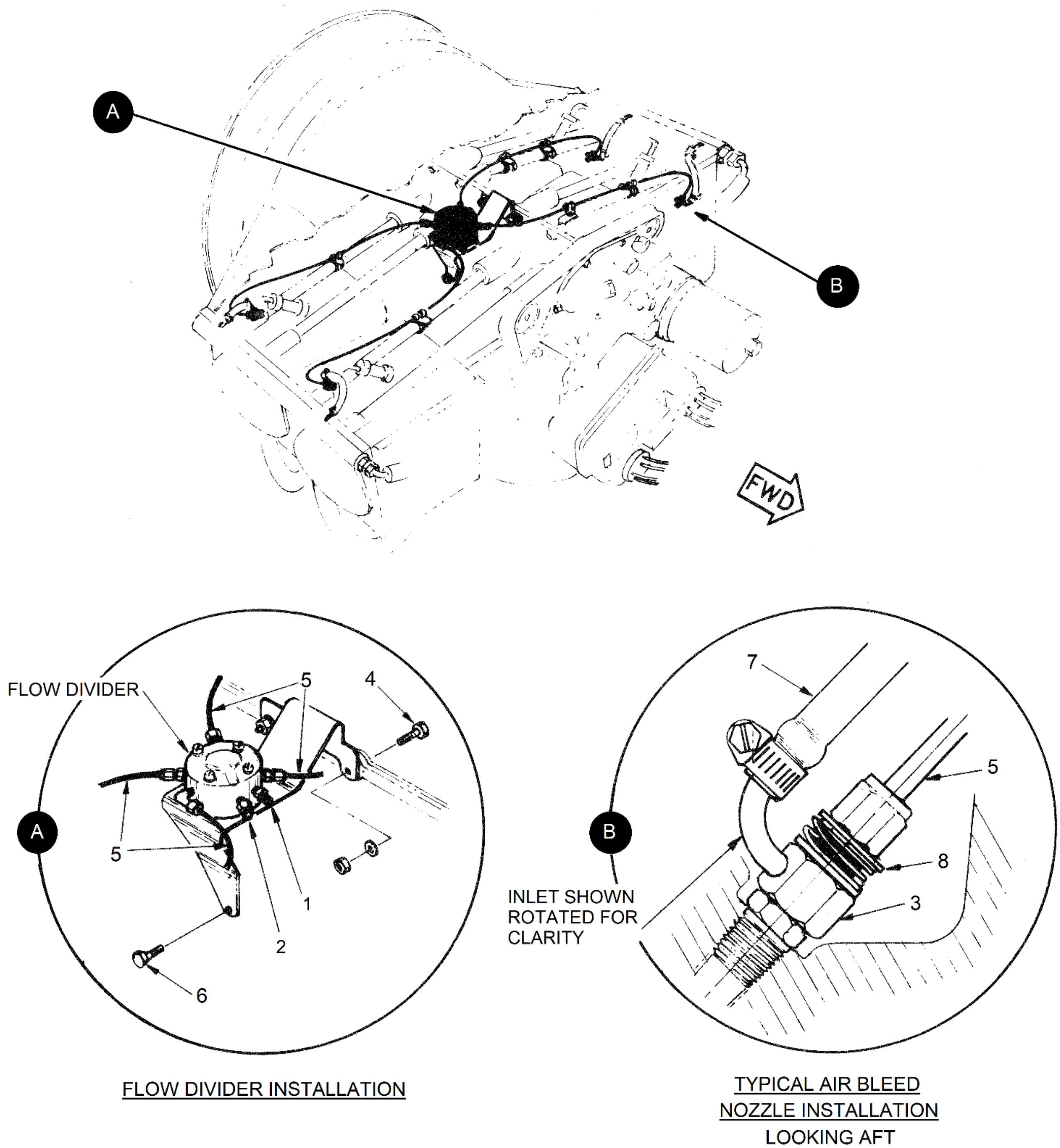
(b) Install air line fitting (3) and nozzle spring and spring holders (8).

NOTE: Be sure to install both O-rings under air line fitting.

(c) Connect fuel line (5) to nozzle assembly. Torque 25-50 in-lb/2.8-5.6 Nm maximum

(d) Connect air line hose (7) to air line fitting (3) and secure with clamp.

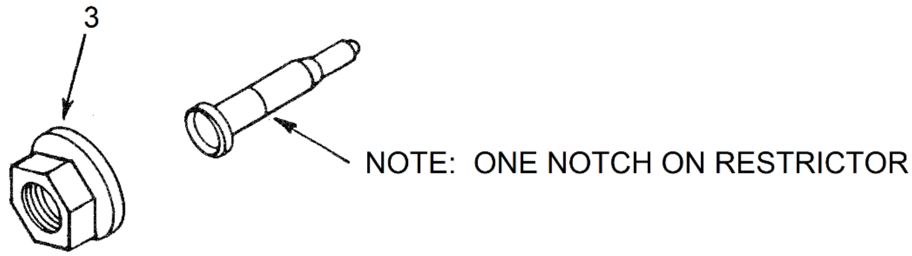
(e) Install right and left top engine panels.



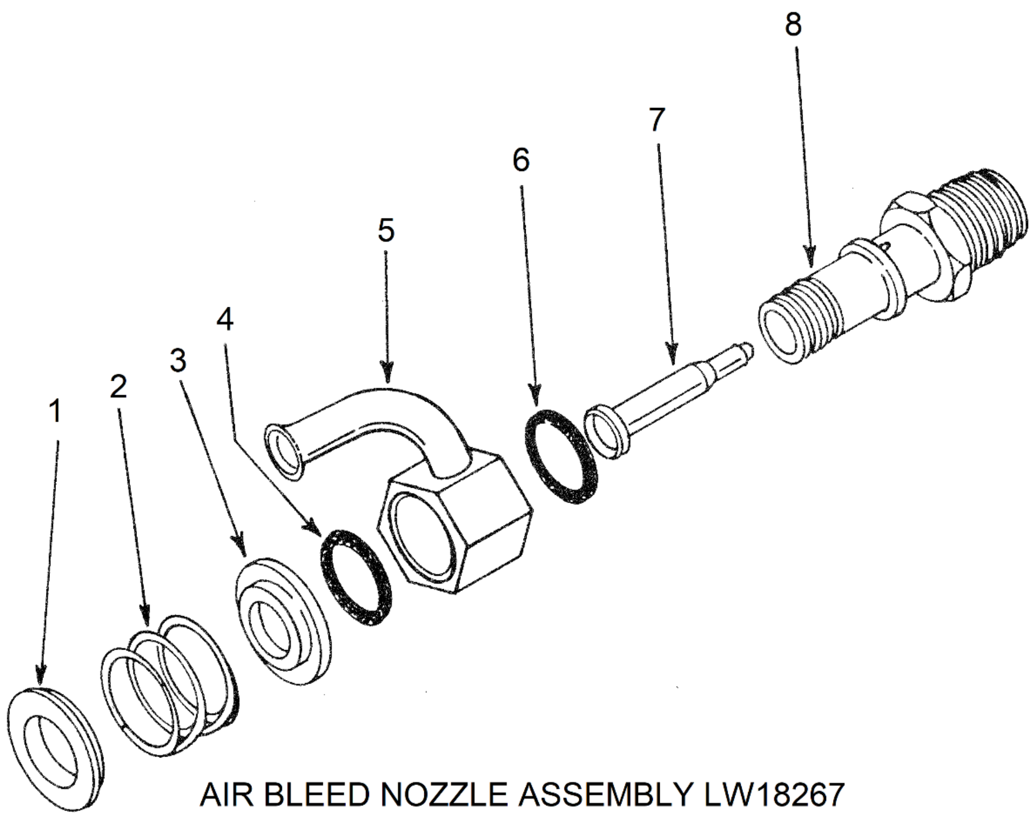
1. Fuel gauge (line)
2. Fuel inlet (line)
3. Air line fitting
4. Bolt
5. Fuel line
6. Bolt
7. Air line
8. Spring/Spring holders (See Figure 13-8)

Figure 13-7. Flow Divider and Air Bleed Nozzles

LA-8249A AIR BLEED NOZZLE ASSEMBLY SAME AS LW-18267
EXCEPT DEVIATIONS AS NOTED FOR ITEM NUMBER 3 AND
NOTCHED RESTRICTOR



AIR BLEED NOZZLE ASSEMBLY LA-8249A



AIR BLEED NOZZLE ASSEMBLY LW18267

1. Spring holder
2. Spring
3. Spring holder
4. Preformed packing
5. Air line fitting
6. Preformed packing
7. Restrictor
8. Nozzle body

Figure 13-8. Air Bleed Nozzle Assembly

13-5 TURBOCHARGER

A. General Information

The turbo unit's primary moving parts are a rotating shaft with a turbine wheel on one end and a compressor impeller on the other, all precision balanced, and each impeller 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, and produce equivalent power, at all altitudes up to 12,000 feet density altitude.

When turbocharged, the 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 ensures a full charge of the fuel/air mixture, resulting in more power during each combustion stroke. It also ensures a more evenly balanced air/fuel/power ratio between cylinders. Refer to Figure 13-9 for installation detail and numbered items.

Pertinent data established in FAA AD 2023-09-09, *Exhaust Turbine System (Recip)* and applicable data provided in publication, *Best Practices Guide for Maintaining Exhaust System Turbocharger to Tailpipe V-band Couplings/Clamps* has been included in the relevant procedures that follow. These publications can be found on the internet for further information.

B. Turbocharger – Removal

(1) Remove seat cushions and back access panel in fiberglass seat deck.

(2) Remove firewall access panels from cabin firewall.

(3) Open left side engine panel.

(4) Loosen v-band coupling (1, Figure 13-9) connecting tail pipe (or muffler) to turbocharger. Spread open to permit v-band coupling to slip off flange and onto tail pipe.

CAUTION: THE V-BAND COUPLING SECURING THE TAIL PIPE TO THE TURBO IS NOT HINGED. DO NOT SPREAD THE V-BAND COUPLING ANY FARTHER THAN NECESSARY.

(5) Remove exhaust pipe gasket (2, Figure 13-9).

(6) Remove the tail pipe or muffler assembly (depending on which is installed).

(7) Disconnect and remove turbo heat shield (3).

(8) Remove exhaust inlet v-band coupling (4) and slide adapter collar (5) down on the exhaust tube. Remove gasket (2).

(9) Loosen induction tube clamps (6) and slide adapter collar down on the induction inlet tube.

(10) Disconnect oil inlet line (18) and outlet lines (8).

NOTE: The outlet line should be disconnected at the junction to the hard line and left attached to the turbocharger to avoid flexing the line and causing leaks from cracks in the flexible hose.

(a) Leave the lower elbow (9) and flexible line (8) attached to the turbocharger.

(11) Remove the four bolts (10) from the turbo inlet adapter (11) at the injector. Leave inlet adapter (11) mounted on the turbocharger.

(12) Detach turbocharger from the turbo mount brackets (12) and (19) by removing bolts (16).

NOTE: Identify washers (shims) (17) for proper assembly.

(13) Slide turbocharger (with turbo inlet adapter attached) up and off the mount brackets (12) and (19).

(14) Cover openings at injector, induction tube, and exhaust system to prevent contamination.

(15) Remove screws (14) to remove injector inlet adapter (11) and gasket (13) from turbocharger.

NOTE: Identify orientation of adapter to turbocharger for reassembly.

NOTE: Replace slotted head screws (AN503-10-8) with cap screws (P/N NAS1352-3H8P).

C. Turbocharger – Inspection

NOTE: Refer to the publication, *Best Practices Guide for Maintaining Exhaust System Turbocharger to Tailpipe V-band Couplings/Clamps* for comprehensive inspection and installation tips as well as depictions of various v-band coupling failures. Refer also to Figure 8-3.1 when performing the inspection steps in paragraphs (5) and (6).

(1) Check turbocharger unit for the following:

(a) Rotating unit rubbing housing.

(b) Cracked or distorted housing.

(c) Dirt accumulation on impeller.

(d) Carbon buildup on turbine wheel.

(e) Foreign object damage.

(f) Evidence of looseness between compressor and turbine sections.

(2) Check turbocharger adapter installation for the following:

(a) Check condition of gasket (13) and security of visibly accessible screws (14).

1 If screws are loose or gasket shows signs of deterioration, remove the turbocharger with adapter. Replace gasket as required. Torque and safety screws (35 in-lb/4.0 Nm).

2 Inspect the condition of the welds on the adapter flanges. The weld should be continuous and in good condition.

NOTE: The round flange on the adapter may have a segmented weld joint on the outside of the adapter; however, the inside weld on the flange must be a continuous weld joint.

(3) Check induction system hose clamps (6) for damage or faulty operation.

(4) Visually inspect v-band coupling (4) (P/N 28-12162-1) as installed:

CAUTION: ENSURE V-BAND COUPLING SELF-LOCKING NUTS ARE SERVICEABLE AND RETAIN THEIR LOCKING CAPABILITY.

NOTE: P/N 28-12162-1 is a hinged v-band coupling that connects the turbocharger inlet to the exhaust manifold.

NOTE: Inspection of P/N LW-13464, as installed, requires use of a flashlight or other bright light source and an inspection mirror.

(a) Using a flashlight or other bright light source, inspect the v-band coupling, the area around the v-band coupling, the turbocharger inlet, and the exhaust manifold for exhaust stains, soot, and discoloration. If any conditions are found, note the pattern and location of the condition relative to the v-retainers, remove the coupling, and perform the inspections in step (6).

(5) Visually inspect v-band coupling (1) (P/N LW-13464) as installed:

NOTE: Per AD 2023-09-09, the inspections listed in step (6) may be performed as an alternative to the inspection steps listed in (5).

NOTE: P/N LW-13464 is a continuous, spot-welded, multi-segment v-band coupling that connects the tailpipe (or muffler) to the turbocharger outlet.

WARNING: NEVER USE HIGHLY FLAMMABLE SOLVENTS, WIRE BRUSHES, OR ABRASIVES TO CLEAN EXHAUST SYSTEMS. DO NOT USE AN ETCH TOOL, GRAPHITE LEAD PENCIL, OR SCRIBE TO APPLY A MARK ON EXHAUST PIPES.

NOTE: Inspection of P/N LW-13464, as installed, requires use of a flashlight or other bright light source and an inspection mirror.

(a) Using a flashlight or other bright light source, inspect the v-band coupling, the area around the v-band coupling, and tailpipe flange for exhaust stains, soot, and discoloration. If any conditions are found, remove the coupling and proceed to step (6).

(b) Inspect the v-band coupling outer band for cracks, paying particular attention to the spot weld areas. If there is a crack, before further flight, remove the v-band coupling from service and install a new v-band coupling.

(c) Inspect the v-band coupling for looseness and for separation of the outer band from the v-retainer segments at all spot welds. If there is any looseness or separation of the outer band from any retainer segments, before further flight, remove the v-band coupling from service and install a new v-band coupling. To facilitate the inspection, perform the following:

1 Remove the safety wire.

2 Apply a penetrant (LPS 2, ACF-50, or equivalent) to the base of the nut.

3 Loosen the nut.

4 Lightly tap the v-band coupling circumference to check that the outer band is securely attached to the v-retainer segments. Finger tap or use a soft rubber mallet.

(d) Inspect the v-band coupling outer band for cupping, bowing, and crowing as depicted in Figure 13-8.1. If there is cupping, bowing, or crowning, before further flight, remove the v-band coupling and proceed to step (6).

(e) Inspect the area of the v-band coupling, including the outer band, opposite the t-bolt for damage and distortion. If there is any damage or distortion, before further flight, remove the v-band coupling from service and install a new v-band coupling.

(f) Using a mirror, inspect the v-band coupling to determine whether there is a space between the v-retainer segments next to the t-bolt. If there is no space between the two v-retainer coupling segments next to the t-bolt, before further flight, remove the v-band coupling from service and install a new v-band coupling.

(g) Determine whether the v-band coupling nut is properly torqued and apply correct torque as necessary.

(6) Visually inspect v-band couplings (1) (P/N 28-12162-1) and (4) (P/N LW-13464), as removed, as follows:

NOTE: Per AD 2023-09-09, remove P/N LW-13464 v-band coupling and do the inspections listed in step (6) if required by step (5) (a) or (d) or as an alternative to the inspection steps listed in (5).

(a) Using crocus cloth or fine abrasive cloth and mineral spirits, clean the outer band of the v-band coupling. Pay particular attention to the spot weld areas on the v-band coupling. If there is corrosion that cannot be removed by cleaning or if there is pitting, before further flight, remove the v-band coupling from service and install a new v-band coupling.

(b) Using a 10X magnifying glass, visually inspect the outer band for cracks, paying particular attention to the spot weld areas. If there is a crack, before further flight, remove the v-band coupling from service and install a new v-band coupling.

(c) Visually inspect for flatness of the outer band using a straight edge. Lay the straight edge across the width of the outer band as depicted in Figure 13-8.1. If the gap between the outer band and the straight edge exceeds 0.062 inch/1.57 mm, before further flight, remove the v-band coupling from service and install a new v-band coupling.

(d) With the t-bolt in the 12 o’clock position, visually inspect the attachment of the outer band to the v-retainer coupling segments for gaps between the outer band and the v-retainer coupling segments from the 1 o’clock through 11 o’clock positions. Use of backlighting may facilitate inspection for gaps. If there are any gaps between the outer band and the v-retainer coupling segments, before further flight, remove the v-band coupling from service and install a new v-band coupling.

(e) Visually inspect the bend radii of the v-retainer coupling segments, throughout the length of the segment, as depicted in Figure 13-8.1 for cracks. If there are any cracks, before further flight, remove the v-band coupling from service and install a new v-band coupling.

(f) Visually inspect the outer band opposite the t-bolt for damage (distortion, creases, bulging, or cracks) caused by excessive spreading of the coupling during installation or removal. If there is any damage, before further flight, remove the v-band coupling from service and install a new v-band coupling.

(g) If either v-band coupling (1) or (4) passes all of the inspections, it may be re-installed.

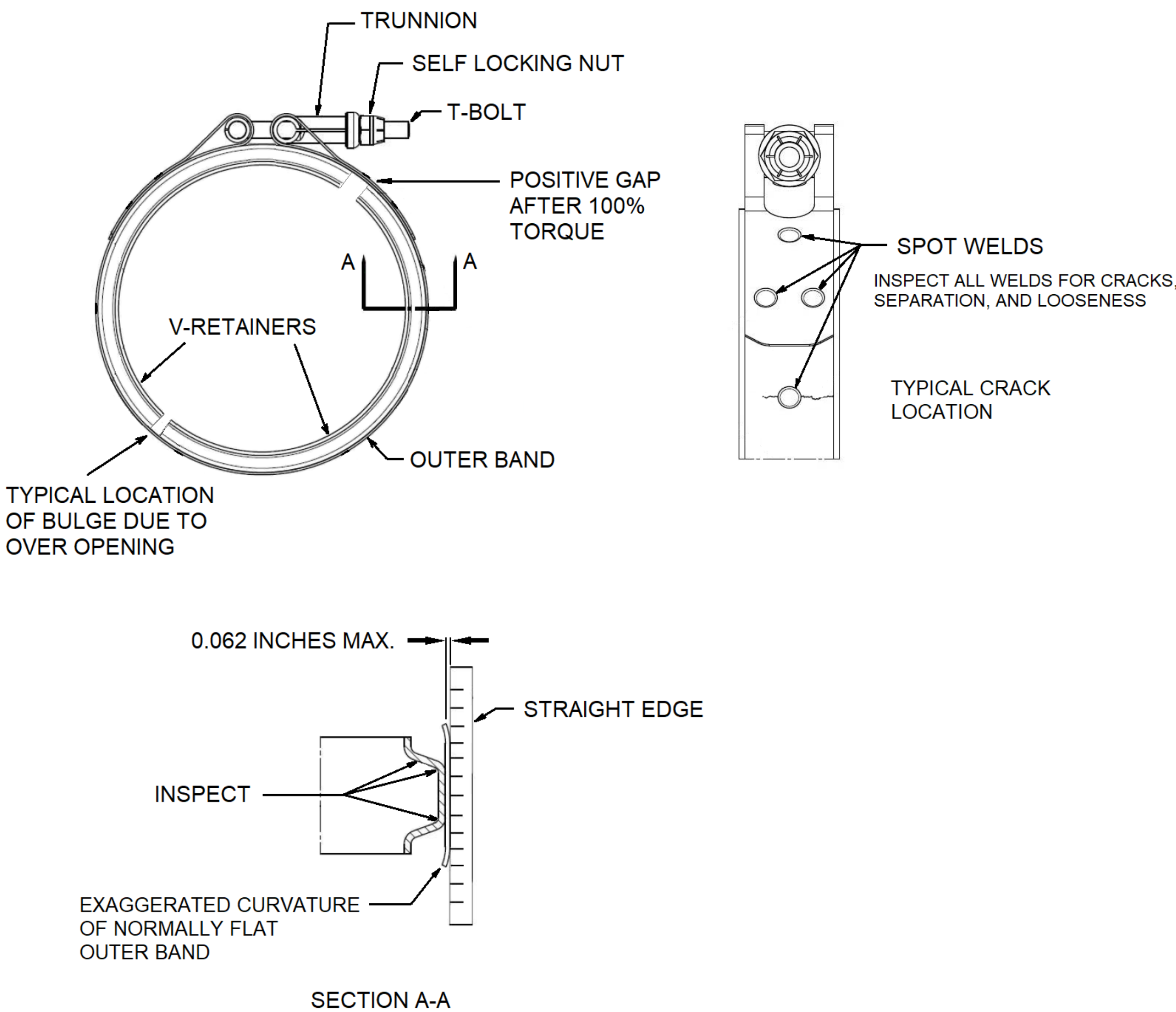


Figure 13-8.1. V-band Coupling P/N LW-13464 Schematic – Inspection Checks

D. Turbocharger – Installation

WARNING: CRACKS AS WELL AS INCORRECT ASSEMBLY OR INSTALLATION OF THE TURBOCHARGER EXHAUST SYSTEM CAN ADVERSELY AFFECT ENGINE OPERATION, OR RESULT IN RELEASE OF HOT AND TOXIC GASES, WHICH CAN CAUSE DAMAGE TO NEARBY COMPONENTS AND SYSTEMS OR A FIRE.

CAUTION: USE CARE TO SUPPORT THE ENTIRE EXHAUST SYSTEM DURING INSTALLATION. DO NOT FORCE, PRY, OR BEND COMPONENTS DURING FINAL ALIGNMENT TO PREVENT DAMAGE TO THE PARTS.

(1) Prior to installation:

(a) Ensure the v-band couplings (1) and (4) and attaching hardware are free from any damage such as cracks, gouges, tears, bulges, and fractures.

(b) Ensure the turbocharger exhaust exit flange and exhaust tailpipe flange interfaces are free from any wavy condition, cracks, warps, gouges, nicks, grease, dirt, or deposits.

(2) Install new gasket (13) between turbo inlet adapter (11) and turbocharger. Secure turbo inlet adapter (11), properly oriented, to turbocharger. Torque screws (14) to 35 in-lb/4.0 Nm and safety with .020 or .025 safety wire.

NOTE: Replace slotted head screws (AN503-10-8) with cap screws (P/N NAS1352-3H8P).

(3) If removed, install the lower oil outlet elbow (9) and flexible outlet line to the turbocharger on the bench. If required, install adapter (21) and O-ring (22).

NOTE: Adapter (21) and O-ring (22) installation is effective for F-28F S/N 832 and subsequent and 280FX S/N 2147 and subsequent and should be retrofitted onto older serial number helicopters to help with alignment of the oil outlet line.

NOTE: Apply a thread sealant to adapter (21) and elbow (9) on installation (Loctite 569, or equivalent).

NOTE: Orient elbow (9) for clearance with mounting bracket upon installation.

(4) Install oil inlet nipple (7), if removed.

NOTE: Apply a thread sealant (Loctite 569, or equivalent) to nipple (7).

(5) Install turbocharger on mount brackets (12) and (19) with stainless bolts (16), nuts, washers, and shims (17). The bolts should be installed with the heads inboard and lubricated with anti-seize before installation. DO NOT torque bolts (16).

NOTE: If required, turbo mount brackets may be secured only finger tight to facilitate proper turbo alignment.

NOTE: It may be required to loosen the turbocharger center divider clamp (20) so that the exhaust side housing can be turned on the center section to install the turbo on to the mounts. DO NOT break the seal.

(7) Install turbocharger heat shield (3). Safety wire from a cap on one side of each mount bracket, behind the bracket, to the next cap.

(8) Install new gasket (15) and the bolts (10) connecting the injector to turbo inlet adapter (11). DO NOT torque bolts (10).

CAUTION: WHEN INSTALLING EXHAUST SYSTEM COMPONENTS, INITIALLY TIGHTEN HARDWARE FASTENERS FINGER-TIGHT. ENSURE ALL COMPONENTS ARE ALIGNED PROPERLY BEFORE APPLYING FINAL TORQUE TO FASTENERS.

(9) Slip clamps (6) over ends of induction tube (24).

(10) Install the flexible sleeve (24) with clamps (6) between the induction inlet tube and the turbocharger compressor.

NOTE: The turbocharger center divider clamp (20) may be released to rotate the compressor section for adjustment. DO NOT break the seal.

(11) Torque clamps (6) 40-45 in-lb/4.5-5.1 Nm and safety (MS20995C32).

NOTE: If it is preferred to safety the hose clamp screw through a hole in the head of the screw, drill through the clamp screw head with a No. 55 (0.052” diameter) drill prior to installation and torquing.

(a) Thread the ends of the safety wire through the gap between the band and the screw housing, pulling the loop of the wire securely over the slot in the screw head or through the drilled hole and complete the safety. Refer to Figure 13-9.1.

(12) Connect exhaust collar (5) to the exhaust inlet. Rotate the collar for correct alignment.

(13) Install v-band coupling (1) (P/N LW-13464) and v-band coupling (4) (P/N 28-12162-1).

NOTE: Figures 13-8.2 through 13-8.5 depict a P/N LW-13464 installation. Differences in the installation of P/N 28-12162-1 are noted where applicable.

CAUTION SUBSTITUTION OF A V-BAND COUPLING PART NUMBER OR TYPE FOR ANOTHER COUPLING IS NOT ALLOWED.

WARNING: INCORRECT ASSEMBLY OR INSTALLATION OF THE V-BAND COUPLINGS CAN ADVERSELY AFFECT ENGINE OPERATION OR RESULT IN THE RELEASE OF HOT AND TOXIC GASES, WHICH CAN CAUSE DAMAGE TO NEARBY COMPONENTS, SYSTEMS, OR A FIRE.

(a) Slip the v-band coupling P/N 28-12162-1 (4) over the exhaust inlet.

CAUTION: THE SIDES OF P/N 28-12162-1 V-BAND COUPLING ARE MACHINED TO OPTIMIZE THE FIT ADJACENT TO THE TURBOCHARGER. FOR COUPLINGS MANUFACTURED CIRCA 2015 AND PRIOR, ONLY ONE SIDE WAS MACHINED. INSPECT THE COUPLING TO DETERMINE IF ONE OR BOTH SIDES ARE MACHINED.

CAUTION: INTERFACING FLANGES MUST BE ALIGNED CORRECTLY FOR THE COUPLING INSTALLATION TO ENSURE MAXIMUM SEALING.

NOTE: Anytime the turbocharger inlet v-band coupling is disassembled, it is recommended to install a new metal gasket at reassembly.

1 For v-band coupling (4) (P/N 28-12162-1) machined on one side only, verify the clamp is installed with machined side toward the turbocharger.

2 Place the metal gasket (2) in between the flanges (Figure 13-8.3).

3 Join the flanges.

4 Assemble the v-band coupling (4) over both flanges and the gasket (Figure 13-8.4).

5 Engage the t-bolt on the v-band coupling (4) and press the coupling over the flanges. Using a torque indicator wrench, tighten the nut to approximately 50 in-lb/5.6 N/m (70% of the maximum torque (70 in-lb/7.9 Nm)).

6 If possible, lightly tap the outer periphery of the coupling band in several places perpendicular to the circumference using a soft rubber mallet and a plastic drift (if required) to ensure proper seating and to distribute band tension. Do not tap in such a way that causes deformation.

NOTE: It may require approximately 10-15 tap and torque repetitions to achieve a stabilized torque reading.

7 Ensure there a no gaps at other exhaust system connections and all exhaust system components are correctly aligned before the final torque of all exhaust system hardware.

8 Ensure the turbocharger exhaust inlet flange and exhaust manifold flanges are aligned.

9 Tighten the nut the maximum required torque (70 in-lb/7.9 Nm).

10 Repeat as in steps 6 through 8 until the torque reading stabilizes. Do **NOT** overtorque.

11 Safety wire v-band coupling (4) using two twisted wraps of MS20995C32 safety wire.

(b) Install gasket (2) and connect turbocharger to exhaust outlet with v-band coupling (1) (P/N LW-13464). Ensure alignment of tailpipe flange and turbocharger exhaust exit flange with no gaps (maximum 0.005 in) prior to installing coupling.

CAUTION ENSURE THE TURBOCHARGER EXHAUST EXIT FLANGE AND EXHAUST TAILPIPE FLANGE INTERFACE DOES NOT EXHIBIT ANY NON-FLAT SURFACE OR CORROSION, PITTING, SCALING, OR DEPOSITS. REPAIR BEFORE PROCEEDING.

NOTE: Anytime the v-band coupling is disassembled, it is recommended to install a new metal gasket at reassembly.

Figure 13-8.2. V-band coupling (1), P/N LW-13464, joining the tailpipe to the turbocharger exhaust outlet

Figure 13-8.3. Installing metal gasket, P/N LW-14485

Figure 13-8.4. Flanges and metal gasket joined; V-band coupling positioned over joint

Figure 13-8.5. V-band coupling(1), P/N LW-13464, positioned for ease of spot weld inspections

CAUTION: DURING INSTALLATION OF V-BAND COUPLING P/N LW-13464, USE CARE NOT TO SPREAD OR FORCE THE COUPLING BEYOND ITS NORMAL OPEN POSITION TO PREVENT DISTORTION OF THE COUPLING. THIS DISTORTION CAN CAUSE AN INEFFECTIVE SEAL OR RUPTURE THE METAL WHICH CAN RESULT IN FAILURE OF THE COUPLING AND EXHAUST GAS LEAKAGE.

CAUTION: INTERFACING FLANGES MUST BE ALIGNED CORRECTLY FOR THE COUPLING INSTALLATION TO ENSURE MAXIMUM SEALING.

CAUTION: THE V-BAND COUPLING AT THE TURBOCHARGER EXHAUST FLANGE MUST BE CORRECTLY ALIGNED TO THE TAILPIPE FLANGE. DO USE THE COUPLING TO BRING THE EXHAUST SYSTEM COMPONENTS INTO ALIGNMENT. INCORRECT ALIGNMENT OF THE COUPLING IS AN INDICATION THAT THE EXHAUST SYSTEM IS NOT CORRECTLY INSTALLED. IF THE COUPLING DOES NOT ALGIN, ADJUST THE EXHAUST SYSTEM COMPONENTS UNTIL THE COUPLING IS IN CORRECT ALIGNMENT. A SLIGHT ADJUSTMENT TO THE TURBOCHARGER ORIENTATION MAY ALSO PERMIT CORRECT COUPLING ALIGNMENT.

NOTE: Step 1 below is intended to aid visual inspection of the spot welds during an intermediate inspection routine, such as a pre-flight inspection and during subsequent 100 hour/annual inspections.

1 Position the v-band coupling (1) to facilitate visual inspections of the spot welds (Figure 13-8.5).

CAUTION: USE OF POWERED TOOLS FOR INSTALLING THE NUT IS NOT RECOMMENDED. HOWEVER, IF USING A POWERED DEVICE TO INSTALL THE NUT, DO NOT INSTALL AT GREATER THAN 120 RPM. EXCESSIVE NUT INSTALLATION SPEED CAN CAUSE THREAD DAMAGE AND INCORRECT FINAL TORQUE.

2 Engage the t-bolt on the v-band coupling and press the coupling over the flanges.

3 Using a torque indicator wrench, tighten the nut to approximately 50 in-lb/5.6 N/m (70% of the maximum torque (70 in-lb/7.9 Nm)).

CAUTION: TO PREVENT DAMAGE, APPLY A LIGHT TAPPING FORCE PERPENDICULAR TO THE V-BAND COUPLING CIRCUMFERENCE – NOT TO THE EDGE OF THE COUPLING.

4 If possible, lightly tap the outer periphery of the coupling band in several places perpendicular to the circumference using a soft rubber mallet and a plastic drift (if required) to ensure proper seating and to distribute band tension. Do not tap in such a way that causes deformation.

NOTE: It may require approximately 10-15 tap and torque repetitions to achieve a stabilized torque reading.

5 Ensure there a no gaps at other exhaust system connections and all exhaust system components are correctly aligned before the final torque of all exhaust system hardware.

6 Ensure the turbocharger exhaust exit flange and exhaust tailpipe flanges are aligned.

7 Tighten the nut the maximum required torque (70 in-lb/7.9 Nm).

CAUTION: DO NOT OVER-TORQUE IN AN ATTEMPT TO ACHIEVE PROPER FIT OF EXHAUST SYSTEM COMPONENTS. IF AT 100% TORQUE, TAILPIPE FIT IS INCORRECT, DISASSEMBLE THE EXHAUST SYSTEM AS REQUIRED TO DETERMINE THE CAUSE AND CORRECT IT PRIOR TO PROCEEDING.

8 Repeat as in steps 3 through 8 until the torque reading stabilizes. Do **NOT** overtorque.

9 Safety wire v-band coupling (1) using two twisted wraps of MS20995C32 safety wire.

(14) Torque two turbocharger mount bolts (16) (100-140 in-lb/11.3-15.8 Nm).

(15) If required, torque lower engine turbocharger mount bracket bolts (40-50 in-lb/4.5-5.6 Nm) and safety to hole flange.

(16) Torque injector outlet attaching bolts (10) (100-140 in-lb/11.3-15.8 Nm) and safety (MS20995C32).

(17) If required, torque turbo center divider clamp (20) (20 in-lb/2.3 Nm) and safety (MS20995C32).

(18) Connect oil inlet line (18).

NOTE: Ensure that check valve (23) located in the oil inlet line has arrow pointing toward turbocharger.

(19) Connect oil outlet line (8).

NOTE: It is recommended to fill the turbocharger with oil before connecting the line.

(20) Inspect all areas prior to closure of the engine compartment and flight check.

CAUTION: WHEN INSTALLING A NEW OR OVERHAULED TURBOCHARGER AND BEFORE STARTING THE ENGINE. IT IS CRITICAL TO PRE-OIL THE TURBOCHARGER TO PREVENT DAMAGE TO THE TURBOCHARGER FROM A DRY START. REMOVE THE SPARK PLUGS FROM THE BOTTOM CYLINDERS AND RUN THE ENGINE ON THE STARTER WITH THE MAGS OFF UNTIL OIL PRESSURE IS OBSERVED ON THE OIL PRESSURE GAUGE. THEN REINSTALL THE SPARKPLUGS BEFORE ATTEMPTING TO START THE ENGINE.

NOTE: If a new v-band coupling is installed, update maintenance records to include a record of the coupling date of installation, the time-in-service of the new coupling, manufacturer, and part number.

(20) Check torque of all installations after initial engine run-up and cool-down. Re-safety (MS20995C32) as required.

(21) Recheck the torque on any new or re-installed v-band coupling after 25 hours time-in-service.

E. Turbocharger – Repair

Consult Hartzell Engine Technologies, or an authorized Hartzell/Rotomaster/Rajay turbocharger repair facility for information on turbocharger repair or overhaul.

NOTE: The following table is the legend for Figure 13-9, which is depicted on the following page.

Figure 13-9 Legend

1.	V-Band Coupling (Exhaust Outlet)	8.	Oil Outlet Line	17.	Shim
		9.	Oil Outlet Elbow	18.	Oil Inlet Line
2.	Gasket	10.	Bolt	19.	Mount Bracket
3.	Heat Shield	11.	Turbo Inlet Adapter	20.	Divider Clamp
4.	V-Band Coupling (Exhaust Inlet)	12.	Mount Bracket	21.	Adapter
		13.	Gasket	22.	O-ring
5.	Exhaust Collar	14.	Screw	23.	Check Valve
6.	Clamp	15.	Gasket	24.	Flexible Sleeve
7.	Oil Inlet Nipple	16.	Bolt		

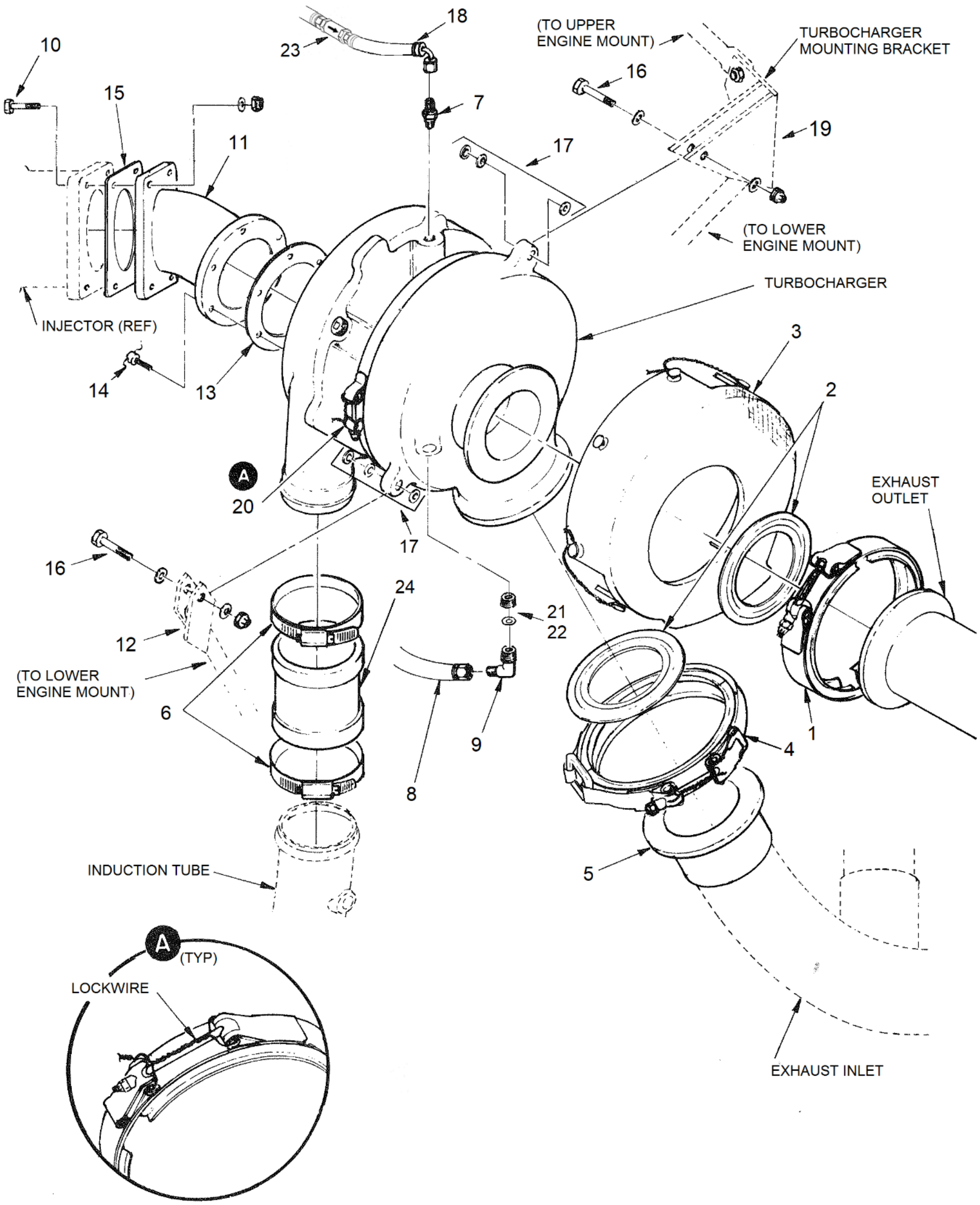


Figure 13-9. Turbocharger Installation

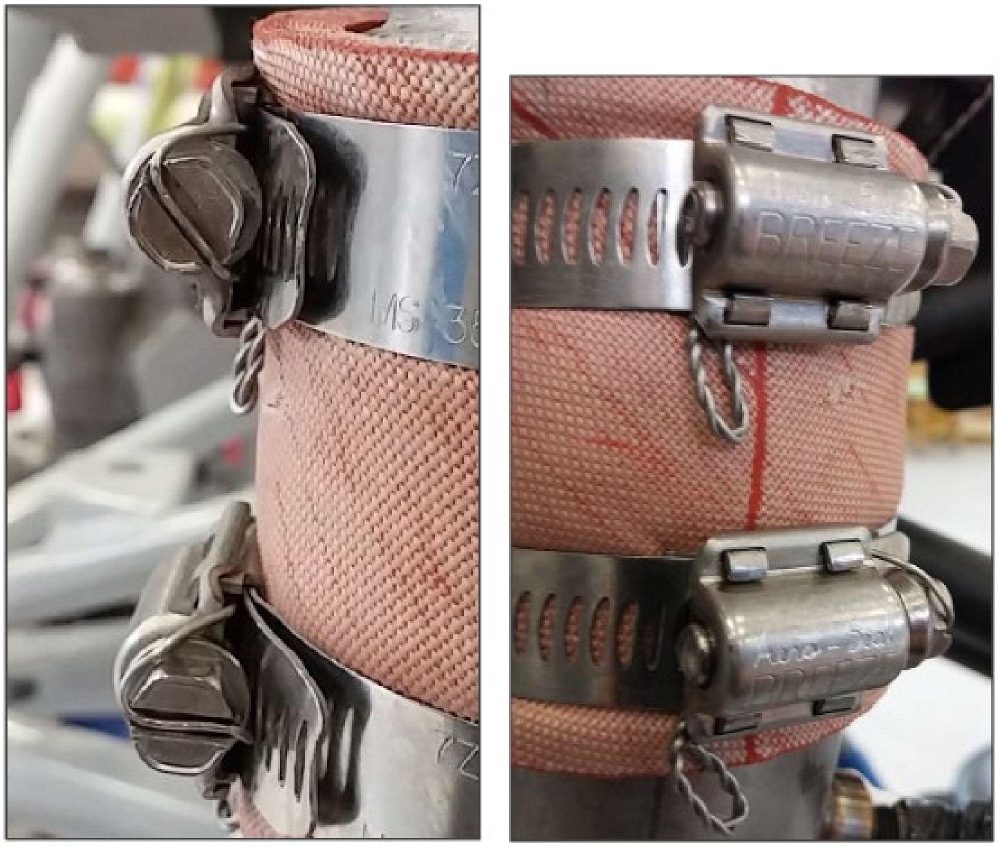


Figure 13-9.1. Safety Installation (over the screw slot).

13-6 TURBOCHARGER STATIC AIR PRESSURE SYSTEM

A. General Information

Installed in the static air system is a single, swing type, check valve which is vented to ambient air pressure on the filtered side of the inlet container. During starting, idling and manifold pressure up to ambient, this valve is open. The valve closes automatically when turbocharger compressor inlet pressure exceeds the existing ambient pressure. Pressurized air is now being furnished to the air bleed nozzle from a line connected to the induction inlet tube. Static pressure lines run to manifold pipes located above the rocker covers on each side of the engine. Flexible lines run from these manifolds to each cylinder nozzle to provide positive system pressure in all operating environments. (Refer to Figure 13-10 for the system schematic.)

B. Turbocharger Static Air Pressure System - Troubleshooting

Problem	Possible Cause	Action
Hard starting or will not start.	Ambient air check valve stuck closed or sticky.	Clean or replace valve.
	Dirt in nozzle.	Clean lines and nozzles.
	Dirt in air manifolds.	Disconnect lines and blow out static air manifolds.
Engine rough at idle and low power.	Ambient air check valve partially closed or sticky.	Clean or replace valve.
Excessive smoking at idle.	Ambient air check valve stuck closed or sticky.	Clean or replace valve.
Excessive EGT at high power.	Ambient air check valve stuck open.	Clean or replace valve.
Engine quits with power reductions at high density altitude.	Ambient air check valve stuck closed or sticky.	Clean or replace valve.

C. Ambient Air Check Valve

(1) Ambient Air Check Valve - Removal

(a) Disconnect inlet and outlet lines at the ends of the valve. Observe airflow marking on valve case for correct installation.

(2) Ambient Air Check Valve – Disassembly

(a) Remove "hinge" end of valve (marked on hex flat) by locking opposite end in vise and loosening hinge end with a wrench.

(3) Ambient Air Check Valve – Cleaning

(a) Carefully clean inside surfaces and components with a clean, lint-free cloth and air.

(4) Ambient Air Check Valve - Installation

(a) Connect to inlet and outlet lines to allow "free flow" from the air inlet container to the static pressure lines.

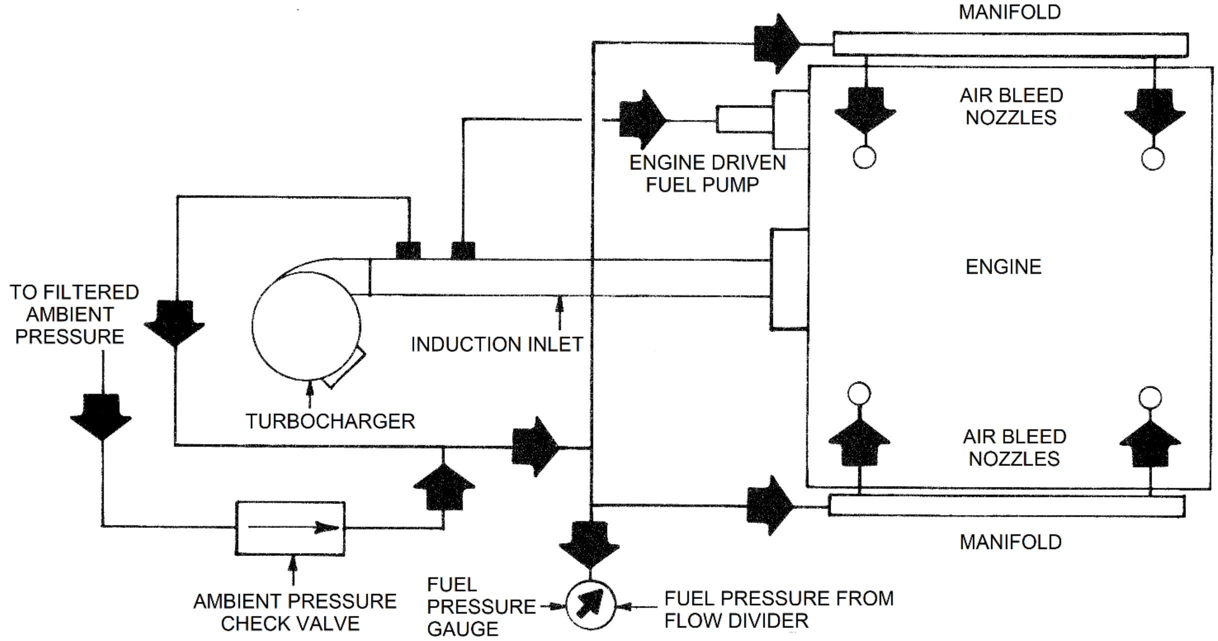


Figure 13-10. Turbocharger Static Pressure System

13-7 PRIMARY AIRFLOW SYSTEM

A. General Information

Intake air is drawn in through the non-ram air scoop mounted on the right side of the aircraft. The intake air then passes through the air filter on its way to the injector. At the injector the air volume is metered in proper proportion to the fuel mixture that the engine requires. The metered air is drawn into the compressor impeller section of the turbocharger where it is compressed. This compressed air is forced into the intake manifolds where it is delivered to the various cylinders. After combustion, the exhaust gases are expelled out the exhaust ports and through the exhaust manifolds back to the turbocharger. The engine exhaust gases drive the turbocharger exhaust turbine wheel which drives the compressor impeller through a common rotating shaft. Exhaust gases are then dumped overboard through the exhaust outlet. A bypass, just before the turbocharger exhaust inlet, incorporates a wastegate which is mechanically linked to the throttle lever to regulate exhaust flow through the turbocharger for varying engine power requirements. Refer to Figure 13-11 for the system schematic.

B. Air Filter and Housing (Air Box)

(1) General Information

A polyurethane filter is utilized to remove all foreign material from the air before it enters the induction system. The filter is installed in a housing which also incorporates an alternate air door and back-fire bypass door. In the event of a filter blockage, due to ingested dirt or ice buildup, the spring-loaded alternate air door will open, allowing engine compartment air to be drawn into the injector. The back-fire bypass door prevents damage to the filter assembly and flexible intake hose by allowing back pressure, due to engine back-fire, to escape with minimal restriction. (Refer to Figure 13-12 for numbered items.)

NOTE: Review maintenance records to determine compliance with SDB 0129 for modifying the hinge pin on the backfire housing door.

(2) Filter Removal

Filter change is recommended every 100 hours. More frequent changes will be necessary for aircraft used for agricultural spraying, dusting, or operation in dusty areas.

(a) Remove air box cover (1).

(b) Remove filter retainer (2).

(c) Remove and discard filter (3).

(3) Filter Installation

NOTE: Clean air box and check for freedom of operation of the alternate air door (4) and back-fire door (5) before installing filter.

(a) Install filter (3) in air box (6).

(b) Install filter retainer with back-fire door (5) oriented to align with aft side of inlet hole in air box cover (1).

(c) Install air box cover (1).

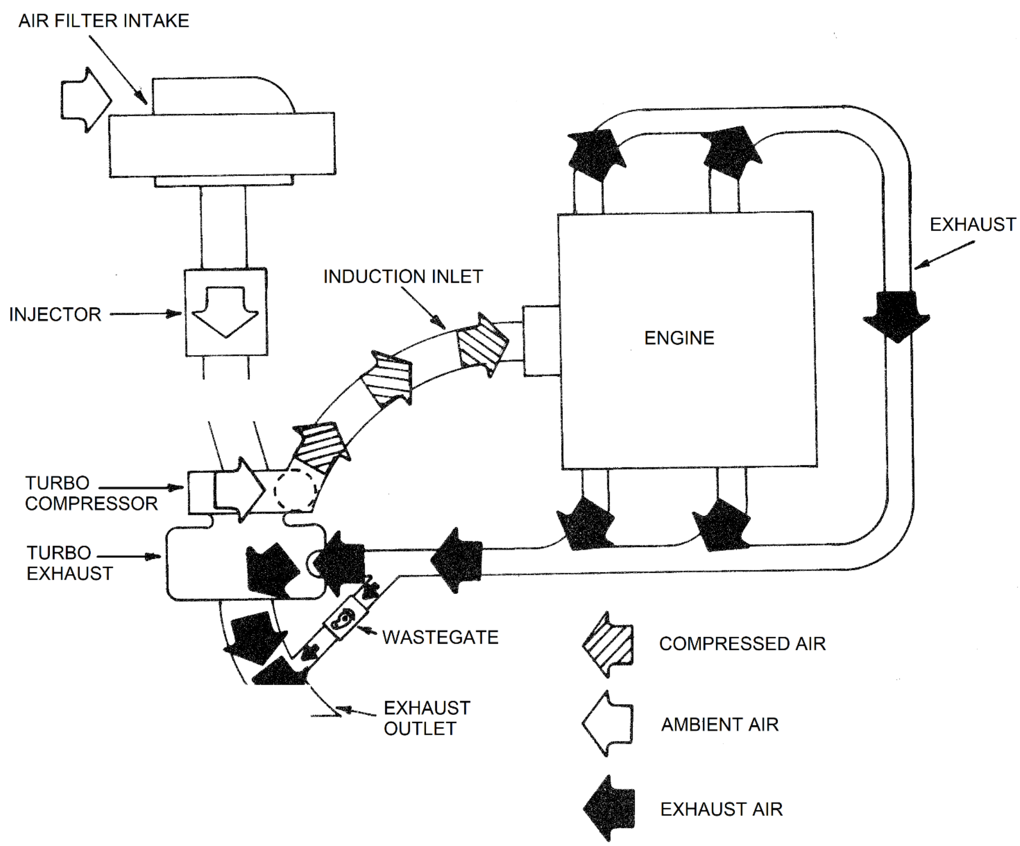


Figure 13-11. Primary Air Flow Schematic

(4) Air Box Removal

NOTE: The housing is attached to the pylon and the firewall mount brackets with quarter-turn fasteners (14).

(a) Disconnect flexible intake hose (7) from air box.

(b) Disconnect static air (fuel nozzle vent) line (8) above hose.

(c) Disconnect unit from pylon mount bracket (9).

(d) Support air box and disconnect it from the firewall mount bracket (10).

(e) Lift unit from aircraft, allowing drain line (11) to pull through cowling.

(5) Air Box Installation

(a) Position unit in aircraft with drain line (11) going out through the lower side cowling.

(b) Secure unit to firewall mount bracket (10).

(c) Secure to pylon mount bracket (9).

(d) Connect static air line (8).

(e) Connect flexible intake hose (7).

(f) Ensure that the cowling (16) fits tightly against the airbox seal.

(g) Ensure that the airbox seal (15) is in good condition.

(h) Ensure that each end of the pin in the backfire door hinge has a minimum 30° bend (SDB 0129).

C. Induction System Leak Check

WARNING: FAILURE TO ENSURE THAT THE MAGNETO SWITCH IS OFF COULD RESULT IN INJURY TO PERSONNEL.

(1) Ensure the magneto switch is off.

(2) Remove the access panels/cowling as required to access the engine cooling fan.

(3) Disconnect the spark plug lead from any one of the lower spark plugs on the engine and remove the spark plug.

(4) Carefully pull the engine through until the open cylinder is in the intake stroke.

(5) Install the spark plug hole adapter from a deferential compression test set into the open cylinder.

(6) Connect a shop air hose to the adapter and apply dry, filtered shop air to the cylinder. Do not exceed 80 psi/552 kPa pressure.

(7) Using a soapy water solution, check the following locations for leaks:

1 Engine induction tubes at the cylinders.

2 Engine induction tubes at the sump assembly.

3 Turbocharger outlet tube at sump assembly.

4 Turbocharger outlet tube at the turbocharger adapter collar.

5 Turbocharger inlet adapter to turbocharger.

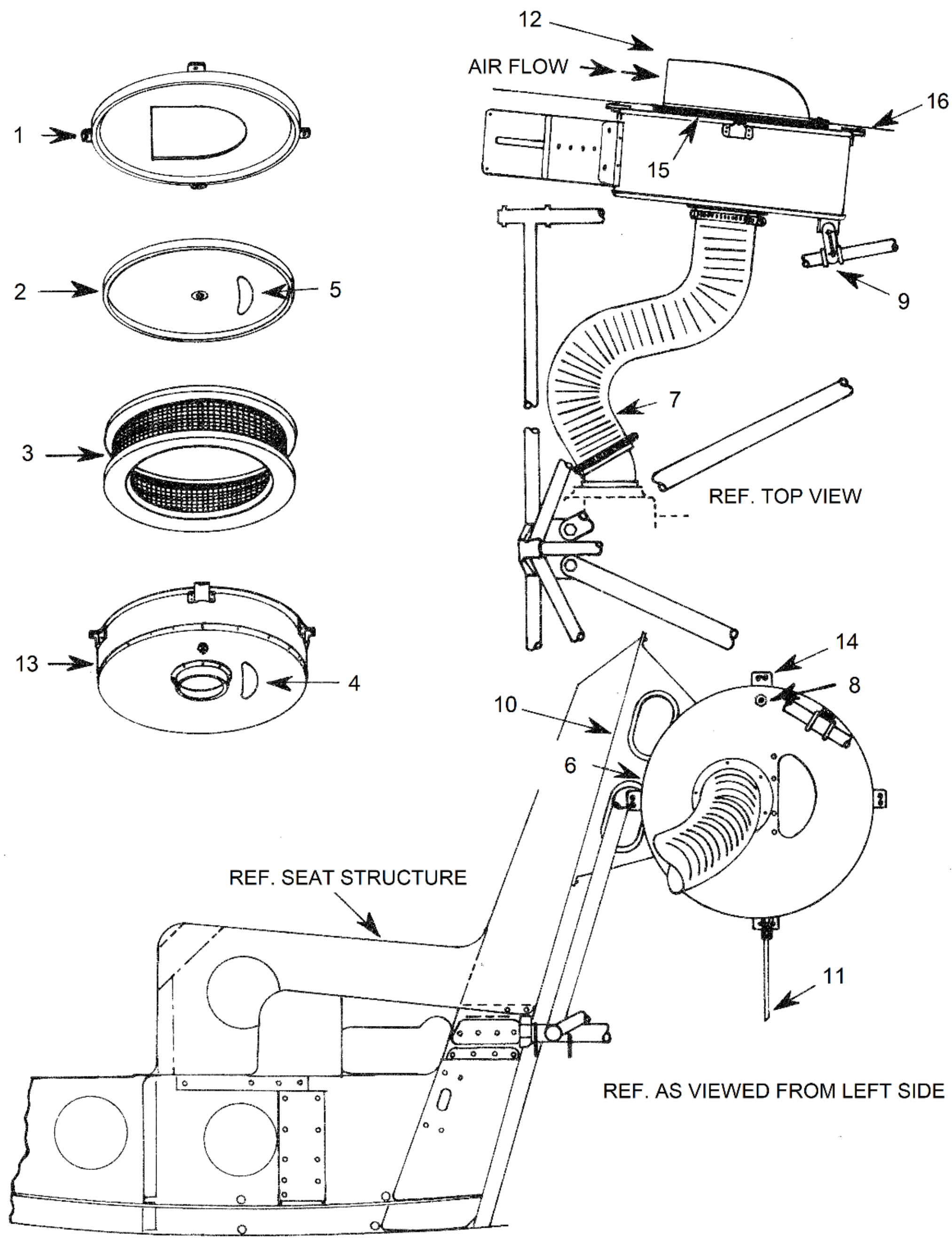
6 Turbocharger inlet adapter to fuel servo/injector.

7 Engine fuel pump drain line and fitting at fuel pump and turbocharger outlet tube.

8 Static pressure line fitting at turbocharger outlet tube.

9 Sump vent at turbocharger outlet tube.

(8) Repair induction leaks as required.



1. Air Box Cover
2. Filter Retainer
3. Filter
4. Alternate Air Door
5. Back-Fire Door
6. Air Box
7. Intake Flex Hose
8. Fuel Nozzle Vent Line
9. Pylon Mount Bracket
10. Firewall Mount Bracket
11. Drain Line
12. Air Scoop
13. Cover Assembly
14. Quarter-turn Fastener
15. Seal
16. Cowling

Figure 13-12. Filter – Primary Airflow System

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13-8 COOLING SYSTEM

A. General Information

The cooling system consists of the fan assembly, shroud assembly, oil coolers and ducting. Outside air is drawn in by the fan and forced through the shroud assembly to provide cooling air flow to the engine and other components.

B. Fan Assembly

(1) Fan - Removal

(a) Remove aft cowling and baggage box.

(b) Remove idler pulley assembly.

(c) Remove jack strut and drive pulley.

(d) Remove fan.

NOTE: The fan, like the starter ring gear support, is designed to fit on the output flange of the engine in only one position. Marking a fan mount hole and its associated stud is suggested to ease installation.

(2) Fan - Disassembly

NOTE: Disassembly of the fan to replace blades requires that the fan be statically rebalanced prior to installation. Repair and balancing can be accomplished by Enstrom Helicopter Corporation or a maintenance facility equipped with tools specified in the Balancing Procedure.

(a) Mark blade ring and fan disc to show proper relationship for reassembly.

(b) Remove all nuts, bolts and washers attaching blade ring to fan disc.

NOTE: Check for elongation of bolt holes. Fan should be replaced if evidence of hole elongation exists.

(c) Discard used locknuts.

(d) Drill out rivets securing damaged blade(s).

(3) Fan - Reassembly

(a) Attach new fan blade(s) to blade ring with AN427M4-7 rivets.

(b) Align and attach blade ring to fan disc.

NOTE: Attach with AN3-6A bolts, one AN960-10L washer under each nut, and new AN364-1032 nuts.

(c) Balance fan.

(4) Fan - Balancing (See Figure 13-13)

(a) Install balancing arbor (T-1900) to fan assembly.

(b) Place assembly on balancing stand and allow heavy side to settle to the bottom. Identify blade that is closest to the bottom.

(c) Remove bolts, nuts and washers from heavy side and replace with AN3-5A bolt, (2) AN960-10L washers, and a AN364-1032 nut and/or remove AN960-10L washers from light side and replace with AN960-10 washers as required for balancing.

NOTE: Not more than (3) AN960-10 washers may be used per bolt for balancing.

Fan blade should balance in any position with blade drift not exceeding one inch in five seconds from any check position.

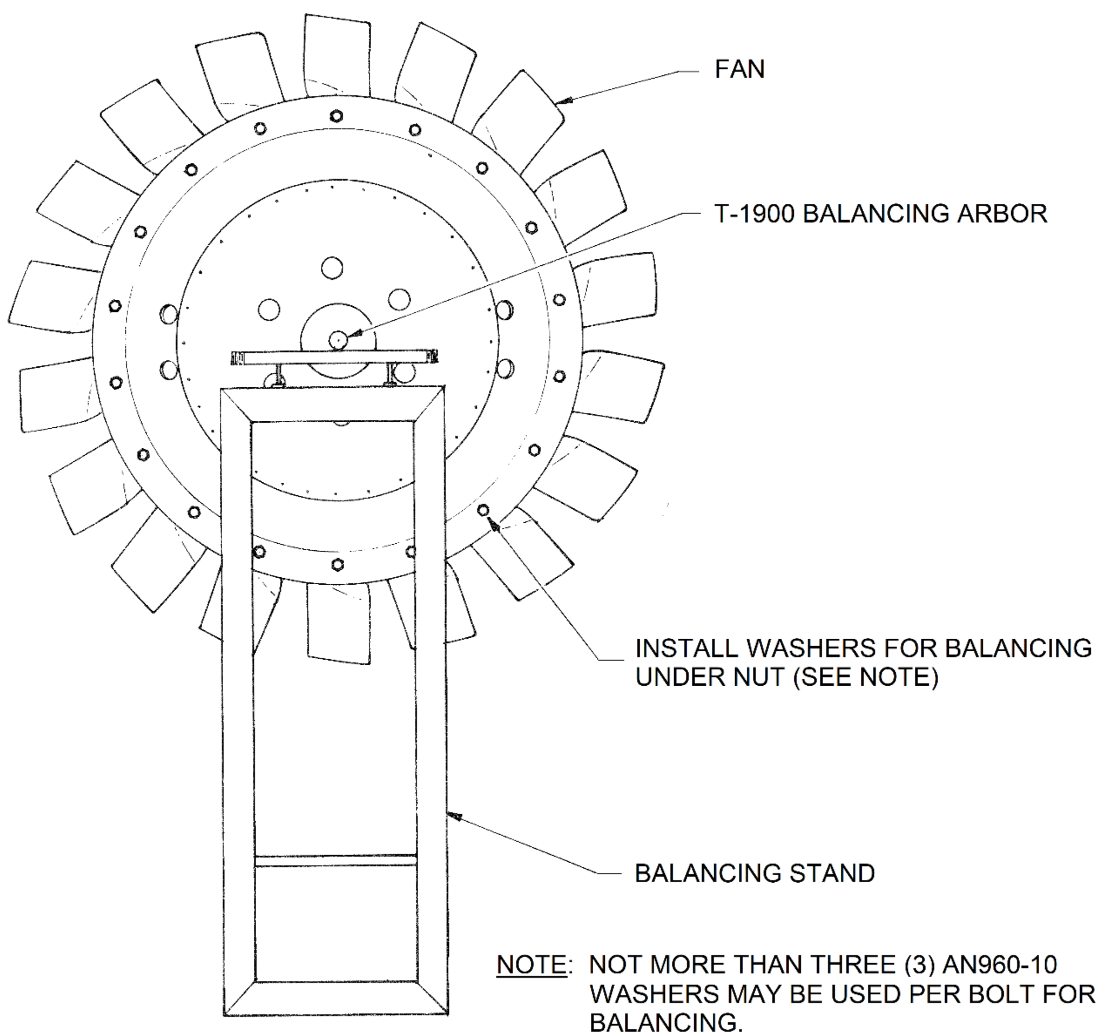
(d) Torque all nuts.

(5) Fan - Installation

(a) Align and install fan on engine output flange.

NOTE: Ensure .125” thick shim is installed on output flange before installing fan.

(b) Install jack strut and lower drive pulley.



NOTE: NOT MORE THAN THREE (3) AN960-10 WASHERS MAY BE USED PER BOLT FOR BALANCING.

FAN BLADE SHOULD BALANCE IN ANY POSITION WITH BLADE DRIFT NOT EXCEEDING ONE INCH IN FIVE (5) SECONDS FROM ANY CHECK POSITION.

Figure 13-13. Fan Balancing

(c) Install idler pulley assembly.

(d) Slowly rotate fan to check for proper fan to shroud clearance. Adjust shroud as necessary.

(e) Run engine to check belt tracking and fan operation.

(f) Install baggage box and cowling.

C. Fan Shroud

(1) Fan Shroud - Removal

(a) Remove aft cowling and cowling from both sides.

(b) Remove baggage compartment.

(c) Remove idler pulley assembly.

(d) Remove jack strut and drive pulley.

(e) Remove fan assembly.

(f) Remove shim, starter ring gear and alternator drive belt.

(g) Disconnect lines and drain oil from auxiliary oil cooler.

NOTE: Raise lines as they are disconnected to prevent drainage of oil from lines and primary oil cooler.

(h) Remove auxiliary oil cooler.

(i) Disconnect shroud from bracket attaching it to the bottom of the engine.

(j) Disconnect flexible duct to heater muff.

(k) Remove two lower panels from the front of the shroud assembly.

(l) Disconnect alternator from belt tension adjustment bracket and remove bracket.

(m) Remove fasteners attaching fan shroud to fire curtain and top and side engine baffling.

(n) Disconnect air deflection vanes.

(o) Remove air deflection vanes.

(p) Remove fan shroud assembly by pulling it aft and tipping it as necessary to clear pylon.

(2) Fan Shroud – Installation

NOTE: Use tool T-0204 or install small wood wedges between the fan blade tips and the fan shroud to maintain alignment while connecting the baffles.

(a) Position fan shroud in engine compartment and loosely attach it to the top engine bracket and side baffling.

(b) Temporarily install the fan to align shroud and tighten fasteners.

(c) Install air deflection vanes.

(d) Install two lower panels on front of shroud assembly and attach lower engine shroud bracket.

(e) Attach fire curtain.

(f) Install belt tensioning bracket.

(g) Install auxiliary oil cooler.

(h) Seal holes where leakage may occur with fire barrier sealant CP 25WB+ (3M) or equivalent.

(i) Connect flexible duct to heater muff.

(j) Connect lines to primary oil cooler.

(k) Install alternator drive belt and starter ring gear.

(l) Check alternator belt tension and adjust if necessary.

(m) Check shroud foam tape and replace if necessary.

(n) Install shim and fan assembly.

(o) Install drive pulley and jack strut.

(p) Install idler pulley assembly.

(q) Check engine oil level and replace oil removed with oil cooler.

(r) Run engine to check fan clearance and belt tracking.

(3) Foam Tape – Installation

(a) Remove all tape from the fan shroud and check fan blade to shroud clearance. Adjust if necessary.

NOTE: If significant amounts of tape were missing, check oil coolers for partial obstruction by tape fragments.

NOTE: The fan shroud must be clean and free of residue for the new tape to adhere. Use a plastic scraper and stripper (acetone, toluene, or equivalent solvent) to remove all adhesive residue. Use Scotch Brite to clean the aluminum thoroughly. Then using clean cloths or rags wetted with acetone, toluene, or equivalent solvent, wipe out residue until cleaning cloths are free of residue.

(b) Remove all grease, oil, and contaminants from area to be tapped by cleaning with solvent. Avoid finger prints on cleaned area.

(c) Cut end of foam tape at approximately 45° angle.

(d) Install tape and cut finishing end to match.

NOTE: Using a gentle application of heat may help facilitate the tape installation.

CAUTION: UPON INITIAL RUNNING OF THE ENGINE, IT IS NECESSARY TO CLEAN OIL COOLER AIR PASSAGES OF FOAM TAPE PARTICLES SHEARED OFF BY THE FAN.

D. Firewall Repairs

NOTE: Refer to Figure 13-14 for the following repair instructions.

NOTE: All openings in the firewall in excess of 1/32 inch/0.8 mm are to be repaired. Small openings, such as around pylon tubes, may be caulked with CP 25WB+ (3M) or equivalent sealant. Fire curtains requiring extensive repairs should be replaced.

(1) Clean area of repair with acetone.

(2) Holes up to 1/4 inch/6.4 mm in stainless steel cabin firewall:

(a) Caulk with fire barrier sealant CP 25WB+ (3M) or equivalent.

(3) Holes up to 1 inch in fabric (see Figure 13-14 A):

(a) Form (2) round patches of 0.015 thick stainless steel, allowing 1/2 inch/13 mm overlap on all sides of existing hole.

(b) Drill 0.015 inch diameter hole in center of both patches.

(c) Coat one side of each patch with fire barrier sealant CP 25WB+ (3M) or equivalent.

(d) Place one patch of each side of fabric hole with fire barrier sealant CP 25WB+ (3M) or equivalent against the fabric.

(e) Fasten patches over the hole with (1) AN525-6R6 screw, (1) AN960-6L washer, and (1) AN364-632 nut.

(4) Areas of worn fabric around pylon tubes or cables (see Figure 13-14 B):

(a) Cut a patch of firewall curtain (or equivalent) to cover 1/2 inch/13 mm to 3/4 inch/19 mm beyond the damaged area.

(b) Coat one side of patch with fire barrier sealant CP 25WB+ (3M) or equivalent.

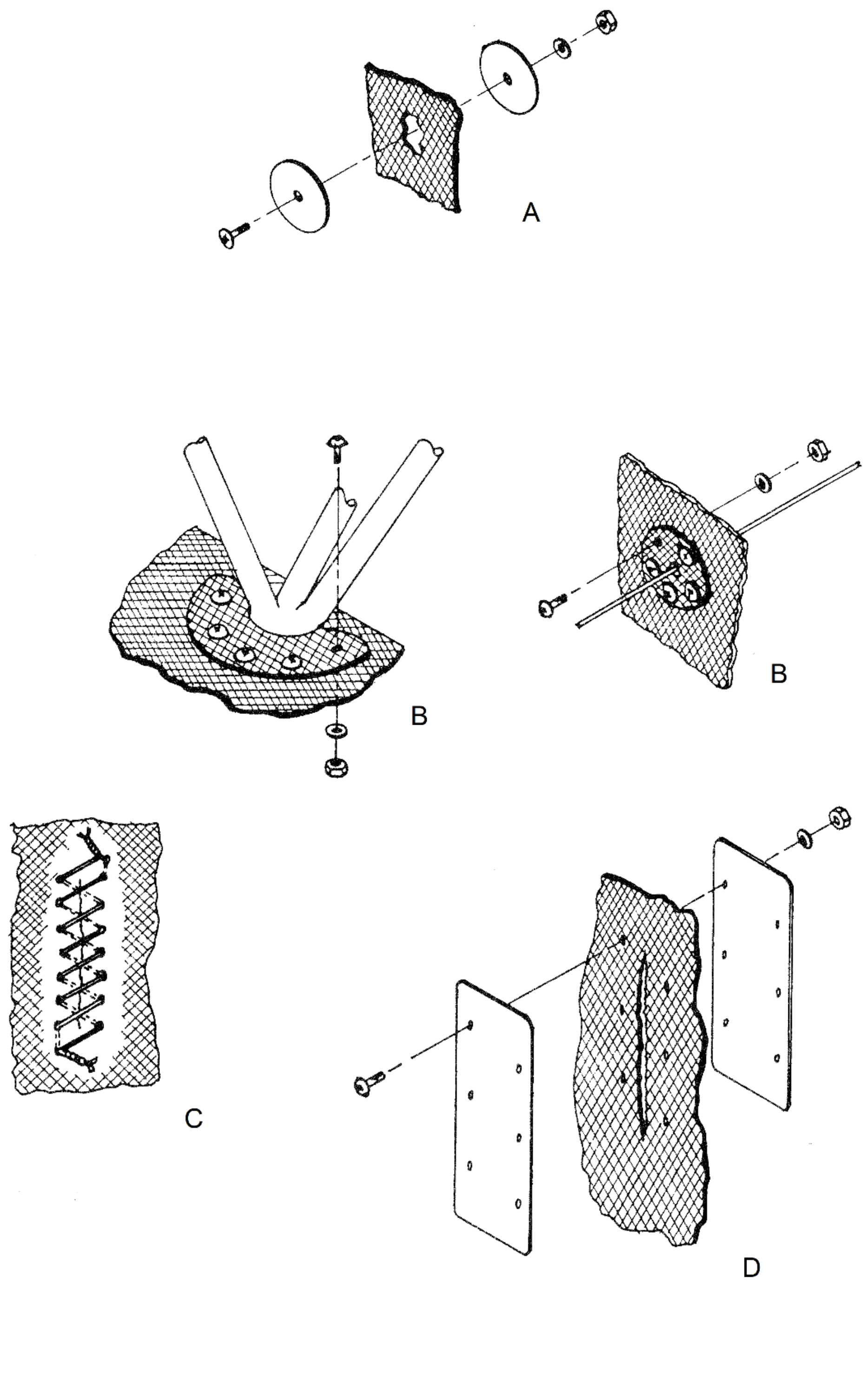


Figure 13-14. Standard Fire Curtain Repair Procedure

(c) Apply patch, sealant side against fabric.

(d) Attach patch with AN525-6R6 screws, AN960-6L washers, and AN364-632 nuts at 3/4 inch/19 mm to 1 inch/25 mm spacing.

(e) Seal nonessential gaps (around pylon tubes, etc.) with fire barrier sealant CP 25WB+ (3M) or equivalent.

(5) Tears in fabric material which are less than 3 inch/7.6 cm in length (Figure 13-14 C):

(a) Lace damaged area together with .020-inch stainless steel safety wire.

(b) Apply sealant to repaired area on the side away from the engine compartment.

(6) Tears in fabric material in excess of 3 inches/7.6 cm in length:

(a) Cut two 1-inch/25 mm wide strips of .015-inch stainless steel to a length allowing for 1/2 inch/13 mm overlap at each end of the repair (Figure13-14, D)

(b) Drill .150-inch (approximate) diameter holes, space 1 inch/25 mm apart diagonally.

(c) Apply patch, sealant side against fabric.

(d) Attach patch, sealant sides against fabric, with AN525-6R6 screws, AN960-6L washers, and AN364-632 nuts.

13-9 IGNITION SYSTEM

A. General Information

The D-3200 ignition system consists of a dual magneto which features two electrically independent ignition circuits in one housing, a harness assembly, starting vibrator (for shower of sparks starting system), and the magneto switch.

At low cranking speed of the engine the vibrator provides the high voltage spark necessary to fire the plug. The vibrator provides interrupted battery current to the primary coil of the magneto where it is stepped up by transformer action, producing a shower of sparks which is directed to the spark plugs through the retard points located in the left magneto. Detailed operation, installation and service instruction may be found in Bendix Operational Manual No. L-928 and Overhaul Manual No. L-945.

B. Ignition System - Troubleshooting

NOTE: Reference information found in Bendix Installation, Operating and Maintenance Instructions Manual L-928.

Problem	Possible Cause	Action
Hard starting.	Low voltage at vibrator input (9.5 volts minimum on 12 volt systems, measured between vibrator "IN" and ground terminal with starter engaged).	Check and change or replace battery as required. Use of an auxiliary power unit is recommended for cold weather starts. Check all electrical grounds and connections for corrosion or looseness.
	Inoperative vibrator (no buzzing audible when starter is engaged).	Check – ground and power in. Replace vibrator.
	Incorrect vibrator point gap.	.025" ± .005" gap
	Retard points opening too late.	Check timing of retard points (Para. 13-9, E, (2)).
Starting upon release of starter button.	Retard timing set too far advanced	Check timing of retard points (Para. 13-9, E, (2)).
	Rubber retard terminal P-insulator installed.	Replace rubber P-lead insulator (Para. 13-9, E, (3)).
Engine kicks back during starting.	Open retard circuit. Engine fires only in its normal advance position.	Check continuity (10 ohms or less) between LR terminal of the vibrator to nearest paint-free ground. If circuit is open, retard contact spring in magneto may not be making contact.
	Retard points not closing due to incorrect adjustment.	Check and adjust retard points as necessary.
	Poor electrical connection.	Check connections at vibrator and magneto.
	Internal relay in vibrator unit not functioning.	Replace vibrator assembly.
	Magneto incorrectly timed to the engine.	Check magneto to engine timing (Para. 13-9, E, (2))
	Magneto internal timing incorrect.	Check magneto timing (Para. 13-9, E, (2)).

Problem	Possible Cause	Action
Engine roughness.	Fouled or defective spark plugs.	Clean or replace spark plugs
	Defective spark plug leads.	Check plug leads for continuity and break-down.
	Arcing in distributor.	Check distributor block for moisture and carbon tracking.
	Eroded or compressed distributor block contact spring(s).	Check contact springs in distributor block.
	Burned magneto contacts.	Check magneto contact assemblies for burring or dirt.
Excessive magneto drop on rpm check.	Magneto to engine timing incorrect.	Adjust timing.
	Incorrect contact adjustment.	Inspect contact assemblies for proper opening.
	One or more cylinders misfiring.	Check plugs and leads.

C. Vibrator/Magneto Check

(1) Method 1 – Vibrator/Magneto Check:

(a) Disconnect starter input wire to prevent engine from turning during this check.

(b) Turn engine in direction of normal rotation to bring number one cylinder to top dead center on its compression stroke.

(c) Check to ensure retard points have opened.

(d) Hold No. 1 cylinder top plug wire 3/16 inch/4.8 mm from ground.

(e) Turn magneto switch to BOTH.

(f) Depress starter button.

NOTE: A steady spark should be visible between the plug wire and ground. A weak or missing spark indicates possible faulty vibrator, electrical connection, or magneto internal timing.

(g) Release the starter button.

(h) Turn the magneto switch to OFF.

(i) Check the system, replace, or adjust components as necessary.

(j) Repeat checking procedure before reconnecting the starter.

(2) Method 2 – Vibrator/Magneto Check:

(a) Remove the top spark plugs.

(b) Re-attach #1 spark plug to its ignition wire and lay it on top of the cylinder so it can be observed while turning the fan.

(c) Remove the wires from the starter.

(d) With mags on BOTH, master ON, ignition ON, hold the starter switch down, and listen for buzzing from the vibrator.

(e) Pull the engine through in the direction of rotation using the fan until the #1 spark plug starts to fire.

(f) Immediately stop turning and observe where the timing mark is on the starter. (It should be 1/2 tooth on the ring gear after top dead center.)

(g) If the spark plug does not fire after the engine has been rotated through all four cylinders, and if the vibrator can be heard buzzing, remove the magneto cover and investigate the cause.

(h) If the magneto is off time, remove the magneto cover and investigate the retard contactor timing.

D. Magneto Operation Check

(1) Start the engine and engage the rotor.

NOTE: Maintain rotor in flat pitch during the following procedure.

(2) Advance the throttle to 1800 rpm and allow cylinder head temperature to reach 200°F.

(3) Slowly advance the throttle to 2300 rpm and allow oil temperatures to reach 80°F.

(4) Advance the throttle to 3050 rpm.

(5) Check manifold pressure; 17-19 inches.

(6) Check fuel flow; 60-80 lb/hr.

(7) Turn the magneto switch from BOTH to L (left magneto) position. Note rpm drop (125 rpm max.) and EGT rise (100°F max.) in 5 seconds.

(8) Return the switch to BOTH position and allow rpm to stabilize.

(9) Turn the magneto switch from BOTH to R (right magneto) position. Note rpm drop (125 rpm max.) and EGT rise (100° F max.) in 5 seconds.

NOTE: Maximum permissible rpm differential between left and right magnetos is 50 rpm without engine roughness. A differential of greater than 50 rpm or a drop in rpm greater than 125 rpm may indicate spark plug, spark plug lead wire, or magneto problems. An EGT rise in excess of 100°F, while operating either in L or R position of the magneto switch indicates a magneto timing problem.

(10) Return the switch to BOTH position and allow rpm and EGT to stabilize prior to engine shutdown.

E. Magneto

(1) Magneto – Removal

(a) Remove the magneto cover.

(b) Remove nuts and washers from the magneto mounting clamp studs.

(c) Pull the flow divider fuel line bracket forward to clear the stud and rotate the bracket and clamp upwards to allow clearance for magneto clamp removal.

(d) Remove the magneto and clamps.

(2) Magneto Installation and Timing to the Engine

NOTE: Refer to Enstrom Tech Tip, Magneto Maintenance, for additional information regarding magneto installation before proceeding.

NOTE: Remove bottom spark plugs for ease of turning over engine.

NOTE: Refer to the maintenance records to check compliance with SIL 0189. If there is no record of compliance, inspect for a rubber P-lead insulator prior to performing the timing procedure. Refer to step (3) for inspection and replacement of the P-lead insulator, if necessary.

(a) Remove the bottom spark plugs.

(b) Remove the plastic viewing plug from the left side of the magneto. Ensure that the other three plugs are installed and that the vented plug(s) is not in the top.

(c) Turn the magneto drive shaft in the direction of normal rotation until the chamfered tooth on the distributor gear is visible in the timing hole and the “C” printed on the rotating magnet is aligned with the cast marker on the inside of the magneto housing.

NOTE: Observe at this time that the pointer in the rotor viewing window aligns with the “L” marked on the rotor. If internal timing of the magneto is required, refer to the Enstrom Tech Tip or Bendix Operation and Maintenance Manual No. L-928.

(d) Set engine No. 1 cylinder at 21.5° +0.05/-0 BTDC (align mark on the starter ring gear with the mark on the starter housing) on its compression stroke (see Figure 13-15).

(e) Maintain magneto No. 1 firing position (chamfered tooth visible in the hole and pointer aligned with “C” on the rotor).

NOTE: Ensure the flow divider fuel line support bracket is placed on the magneto mount stud before the nut and washer are installed.

(f) Install the magneto to the engine. Install the clamps, new lock washers, nuts, and the flow divider fuel line bracket. Tighten the nuts finger tight so that the magneto can be moved for final timing to the engine.

TIMING MARKS

NOTES: TIMING MARKS ARE VISIBLE THROUGH HOLES IN THE FAN ASSEMBLY

NEWER FLYWHEEL SUPPORTS INCLUDE A 23° INDEX MARK

LOCATION OF INDEX MARKS RELATIVE TO GEAR TOOTH WILL VARY DEPENDING HOW GEAR WAS INITIALLY MARKED

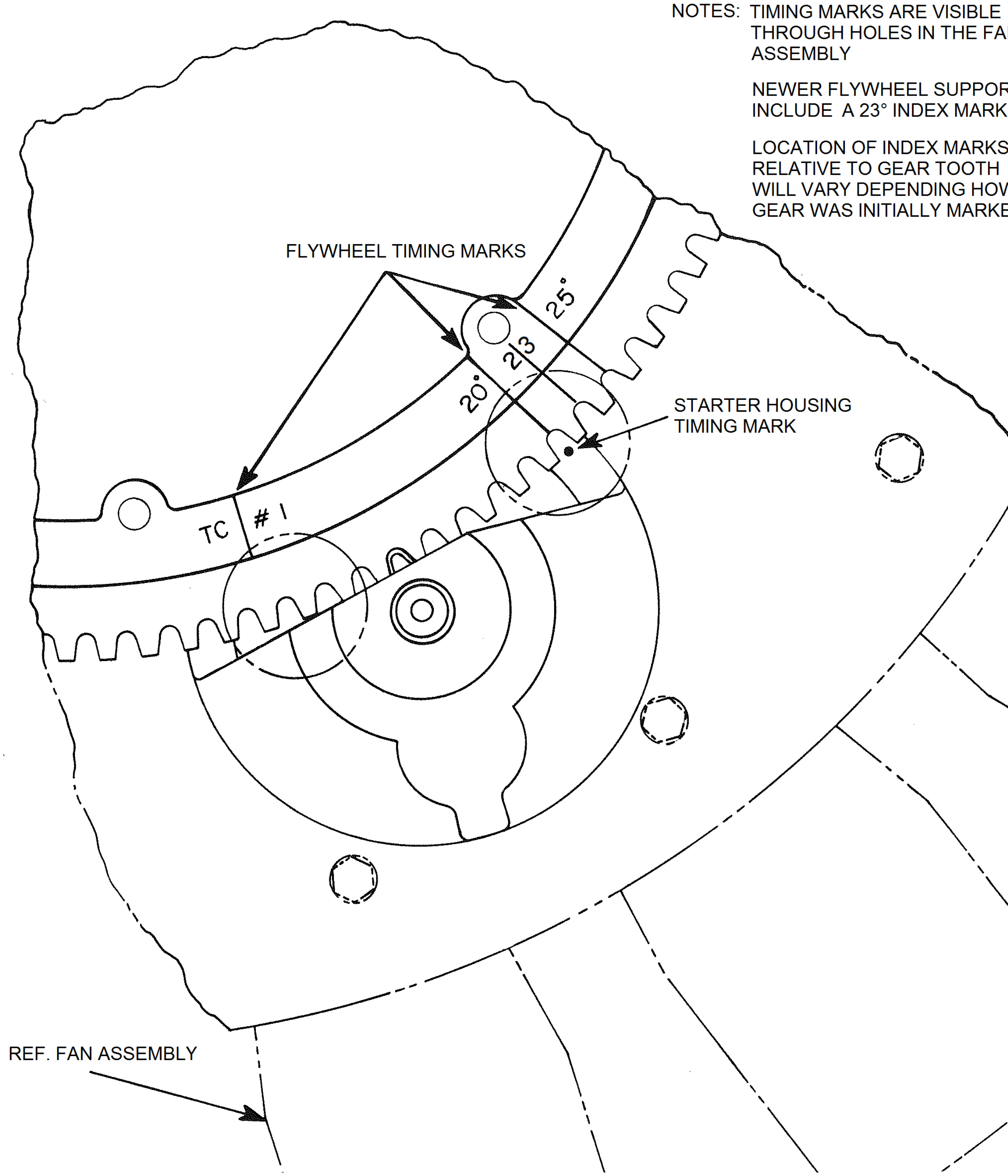


Figure 13-15

(g) Attach the “P” lead wires from the magneto timing light to each “P” lead, black lead to ground.

(h) Turn the entire magneto in the direction of rotor rotation until the timing light indicates the contacts (points) have closed.

(i) Rotate the magneto in the opposite direction until the first set of contacts opens.

(j) Tighten the magneto clamps and install the plug in the viewing hole.

(k) Back the engine up approximately 20° to 30° and then carefully bump the engine forward while observing the timing light.

(l) At the No. 1 firing position (21.5° BTDC), the first contact should open. The second contact should open within +0.5 / -1.5° of the first contact.

NOTE: Each tooth of the starter ring gear is approximately 2°.

(m) Torque the magneto hold-down nuts to 17 ft-lb (23 Nm)

(n) Disconnect the timing light leads from the “P” leads and reconnect one to the retard breaker terminal.

(o) Rotate the crankshaft to bring No. 1 cylinder to half tooth (1°) on the ring gear after TDC.

NOTE: The timing light should go out at a half tooth after TDC indicating the retard points have opened.

(p) Loosen the retard cam securing screw and adjust the cam, as necessary, to achieve correct timing.

(q) Retorque the cam securing screw to 16-20 in-lb/1.8-2.3 Nm.

(r) Back the engine off 20° to 30° and bump it forward again until the timing light goes out. Check the timing mark on the starter ring gear to ensure the crankshaft is at half tooth in the ring gear after TDC (1° crankshaft rotation after TDC). Adjust the retard cam as necessary.

(s) Remove the timing light leads.

(t) Install the magneto cover. Torque the screws to 30-35 in-lb (3.4-4.0 Nm).

(u) Install the “P” leads.

NOTE: It is important that the retard P lead slides freely within the magneto cover to ensure that the P lead makes an electrical connection with the retard points (contactor) inside the magneto.

NOTE: Is it possible to distort the retard points (copper contactor tang) when installing the cover; thus, it is important to check that the retard P lead is actually contacting the retard points during installation of the P lead. When installing the retard P lead, and before the coupling nut is installed, push the P lead insulator into the magneto cover and ensure that the contactor inside the magneto is touching and pushes the insulator back out a small amount.

(v) Install the bottom spark plugs and torque in accordance with Lycoming specifications (30-35 ft-lb/40.7-47.5 Nm).

(3) Magneto Retard Terminal P-Lead Insulator

NOTE: The following procedure is applicable to aircraft that have not complied with SIL 0189 and are eligible per the serial number effectivity provided in the SIL. The procedure inspects for a soft retard terminal P-lead insulator and if installed, replaces it with a phenolic bushing. The bushing is P/N 10-157212 and is available in kit P/N 10-157208.

NOTE: The retard contact inside the magneto is designed to contact the inside of the cover when the P-lead is removed from the magneto to deactivate the shower of sparks system. It is important that the retard P-lead slides freely within the magneto cover to ensure that the P-lead makes an electrical connection with the retard points (contactor) inside the magneto.

(a) Remove seat cushions and the access panel in the seat back, if not already removed.

(b) Remove the co-pilot side firewall access panel.

(c) Identify the retard circuit P-lead.

(d) Remove the retard P-lead from the magneto cover and determine if the P-lead insulator is the soft rubber insulator or the hard phenolic bushing. If the insulator is rubber, proceed to step (e). If the insulator is the phenolic bushing, proceed to step (i).

NOTE: If the aircraft has a phenolic insulator and has been starting when the starter button is released, set the magneto retard timing per Para. 13-9, E, (2), (n).

(e) Cut the P-lead wire about 2 inch/51 mm from the terminal.

CAUTION: THE MAGNETO RETARD TERMINAL BUSHING (P/N 10-157212) IS SIMILAR TO RIGHT AND LEFT P-LEAD CONNECTION BUSHINGS (P/N 10-382697) BUT IS SHORTER IN LENGTH. ENSURE THE CORRECT BUSHING IS BEING INSTALLED ON THE RETARD TERMINAL P-LEAD WIRE. INSTALLING THE INCORRECT BUSHING WILL CAUSE IMPROPER MAGNETO OPERATION

(f) Slide the rubber P-lead insulator (P/N 10-382812) off of the wire and slide the phenolic insulated bushing (P/N 10-157212) onto the wire.

(g) Reconnect the P-lead wire with a butt connector (P/N AS-N-345) or equivalent.

(h) Install the P-lead back into the magneto.

NOTE: It is possible to distort the retard points copper contactor tang when installing the cover. It is important to check that the retard P-lead is contacting the retard points during installation of the P-lead. When installing the retard P-lead, and before the coupling nut is installed, push the P-lead insulator into the magneto cover and ensure that the contactor inside the magneto is touching and pushes the insulator back out a small amount.

(i) Reinstall the access panels and aircraft seat cushions upon completion of timing procedures.

F. Harness Assembly

Ignition wires are routed from the left magneto to all the cylinder top spark plugs and those from the right magneto to all the cylinder bottom spark plugs. (Refer to Figure 13-16)

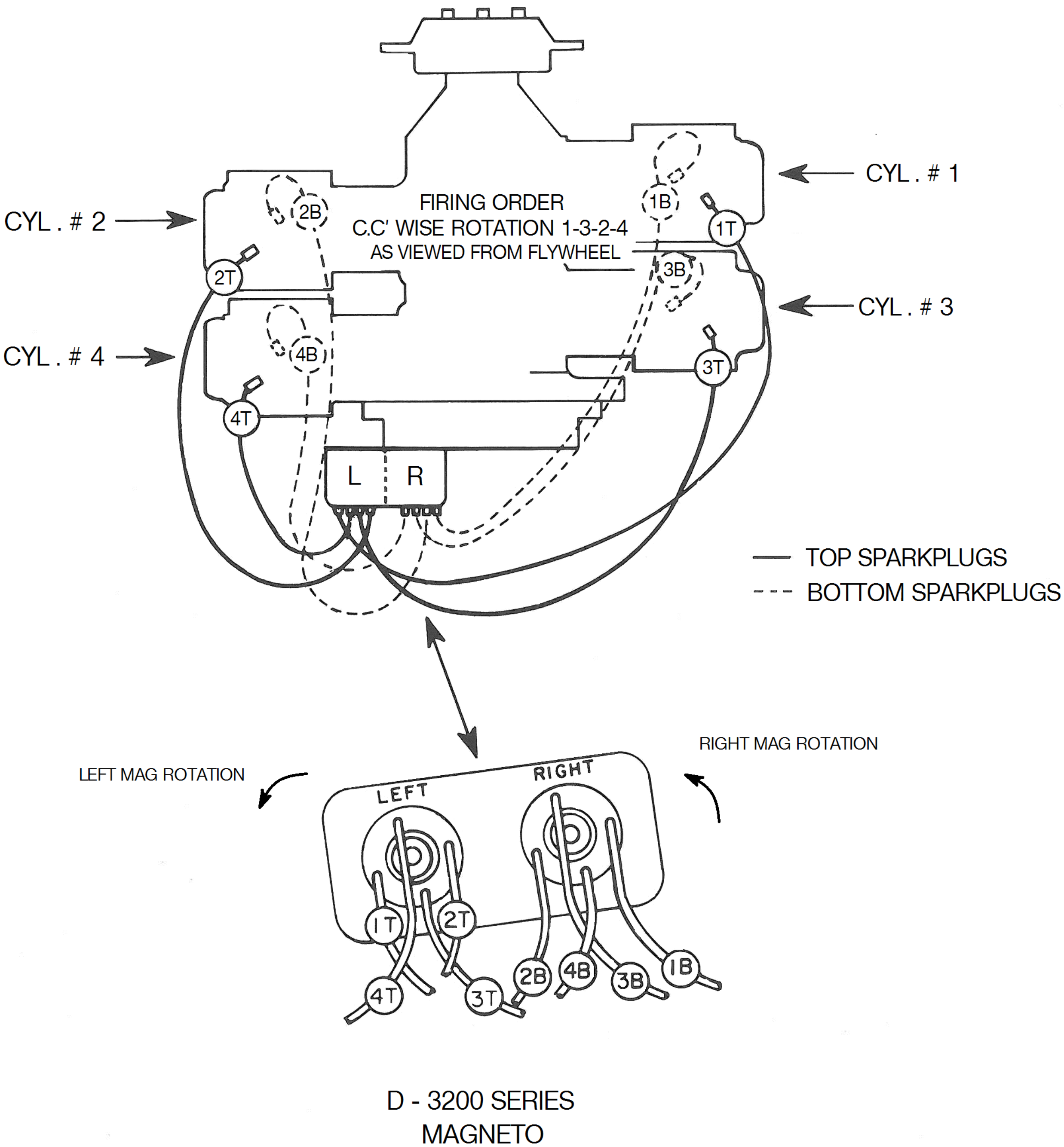


Figure 13-16. Ignition Wire Installation

13-10 FUEL SYSTEM

A. General Information

The fuel system consists of the fuel tanks, fuel boost pump, valve, filter, fuel lines, engine driven fuel pump and fuel pressure switch. Fuel is gravity fed from the tanks through the shut-off valve, boost pump, filter, and fuel 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 fuel metering section of the injector. The fuel metering section operates by measuring the airflow through the throttle body of the injector and uses this measurement to operate a servo valve within the section. The accurately regulated fuel pressure established by the servo valve is used to control the flow divider, which then schedules fuel flow to the cylinders in proportion to airflow. Refer to Figure 13-17 for the fuel system installation.

B. Fuel Tanks

(1) Tank – Removal

(a) Drain fuel into suitable containers, siphon fuel from tanks, then drain remaining fuel by opening the tank drain valves (1) at the bottom of each tank.

(b) Disconnect vent lines (2) at top of tanks.

(c) Disconnect fuel level sending unit wires at the “wristlock” connections located between the tops of the tanks.

(d) Disconnect fuel outlet lines (3), tank drain lines (1), and scupper drain lines (4) at bottom of tank.

(e) Remove screws (5) attaching tanks to bulkhead and cabin.

(f) Remove fuel tanks.

NOTE: Shims dislodged during tank removal should be resecured in position with 3M brand Trim Adhesive, P/N 08021, or equivalent.

(2) Tank – Installation

(a) Position tanks on bulkheads and install attachment screws (5), at cabin and bulkhead.

(b) Connect vent lines (2) at top of tanks.

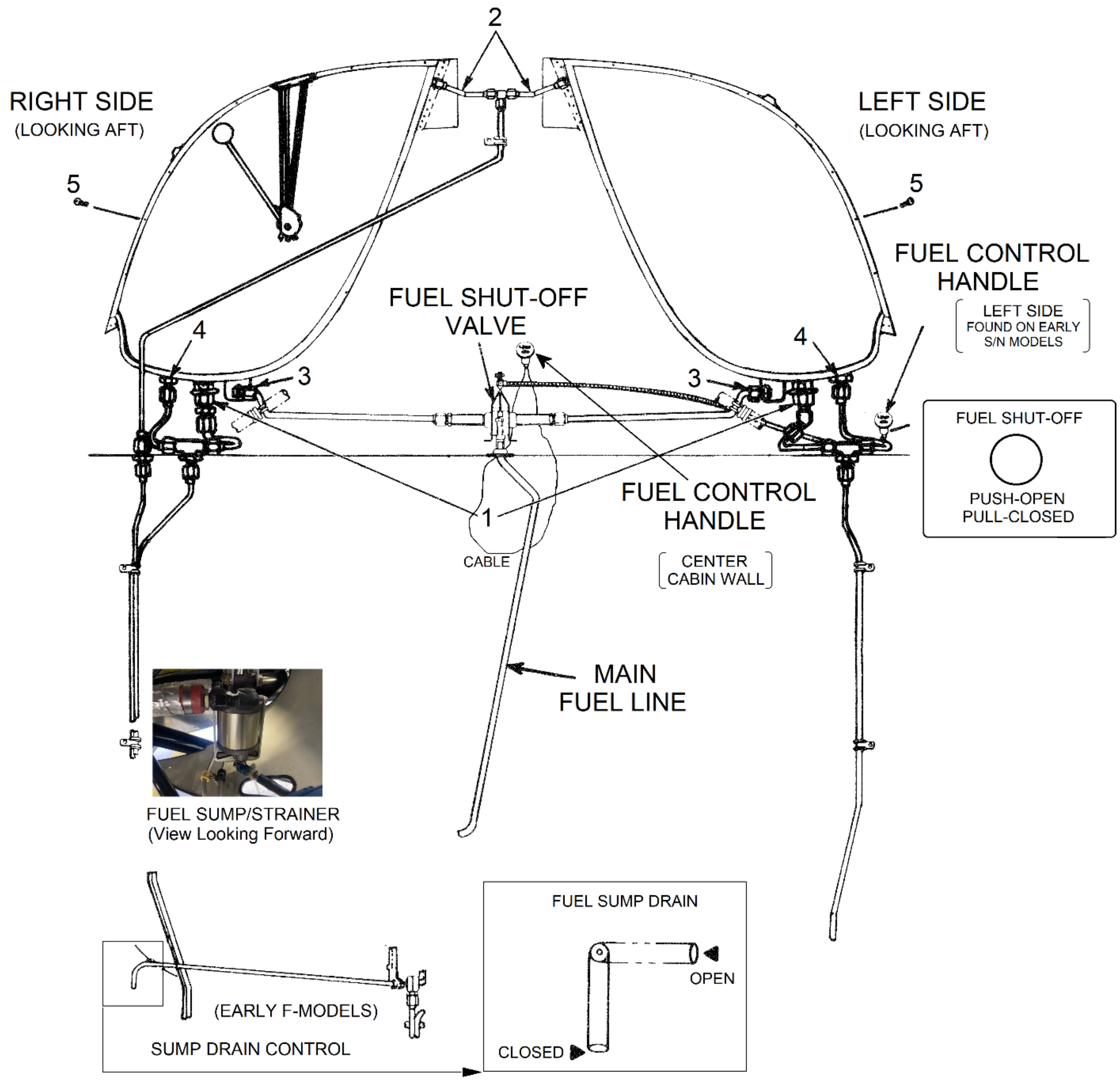
(c) Connect fuel level sending unit wires at the “wristlock” connections.

(d) Secure plastic covers over "wristlock" connections with tie-wrap.

(e) Secure wires to main rotor transmission vent pipe with tie-wrap.

(f) Connect fuel outlet lines (3), tank drain lines (1), and scupper drain lines (4) at bottom of tank.

(g) Fill fuel tanks to check gauge calibration (Para. 13-10, B, (3)).



1.	Drain Line	4.	Scupper Drain Line
2.	Vent Line	5.	Screw
3.	Outlet Line		

Figure 13-17. Fuel Tank Installation

(3) Fuel Transmitter Calibration (See Figure 13-18, Figure 13-19)

NOTE: Calibrate the fuel quantity system in accordance with the following procedure any time maintenance is performed on the fuel quantity system (i.e. replacing a quantity transmitter, wiring, or indicator).

NOTE: Perform the inspection procedure listed in Para. 13-10, B, (4), (a.1) anytime the fuel quantity system is suspected of being out of calibration.

NOTE: Cabin fuel gauge calibration is done with aircraft in flight attitude (6° nose down angle), ground handling wheels down.

NOTE: Fuel dip stick calibration procedures are provided in SIL 0182. When calibrating the fuel dip stick, the helicopter must be in its normal parked attitude.

(a) Place aircraft into 6° nose down attitude and level aircraft laterally to within ±1/2 degree using ground handling wheels and shoring materials or other suitable means. Measure the 6° nose down angle at the lower fore and aft tube located on the left side of the pylon assembly and the lateral level angle using the cockpit floor.

(b) Drain fuel from fuel system including sumps and gascolator located in lower right side of engine compartment.

(c) Close sump drains and gascolator drain.

NOTE: Each tank contains one gallon of unusable fuel.

(d) Service each tank with 1 gallon/3.78 liters of fuel (2 gallons/7.56 liters total) (zero fuel condition).

NOTE: Allow the fuel levels to stabilize in the fuel tanks before checking quantity indications or making adjustments. Verify the fuel level has stabilized with dip stick.

(e) Turn Master Switch ON.

(f) Check that the fuel quantity indicator is at “0".

(g) If indicator is not at “0":

1 Turn Master Switch “OFF”.

2 Disconnect wiring from fuel transmitter and remove transmitter from tank.

3 Bend the float arm down at the approximate midpoint if the indicator is below “0" (Figure 13-19).

4 Bend the float arm up at the approximate midpoint if the indicator is above “0" (Figure 13-19).

5 Reinstall the transmitter and check the “0" indication.

6 Repeat the adjustment procedure as required.

(h) Service each tank with 5 gallons/18.9 liters of fuel (10 gallons/37.85 liters total).

NOTE: Allow the fuel levels to stabilize in the fuel tanks before checking quantity indications or making adjustments.

(i) Check fuel quantity indication as follows:

NOTE: In the following checks, the location of the bend in the transmitter arm can be moved to adjust the indicator range movement. If the zero fuel indication is “0" and the “1/4” or “60" indication is high, move the location of the bend in the arm closer to the arm pivot. If the indication is low, move the bend location closer to the arm float. After making an adjustment to the bend in the arm, always recheck the zero fuel condition. The indicator must indicate “0" when the aircraft is in the zero fuel condition.

NOTE: Some older F-models are equipped with the fuel tank sight window.

1 Check that the fuel quantity indication is “60" lbs ± 1 gallon/3.78 liters.

2 Replace fuel transmitter if the indication cannot be corrected by moving the bend location on the float arm.

NOTE: Previously published procedure regarding F-models equipped with the fuel tank sight window was removed due to obsolescence.

Figure 13-18. [Deleted]

(4) Fuel Transmitter (See Figure 13-19)

(a) Removal – Fuel Transmitter

NOTE: Note the orientation of the fuel transmitter and screws before removal.

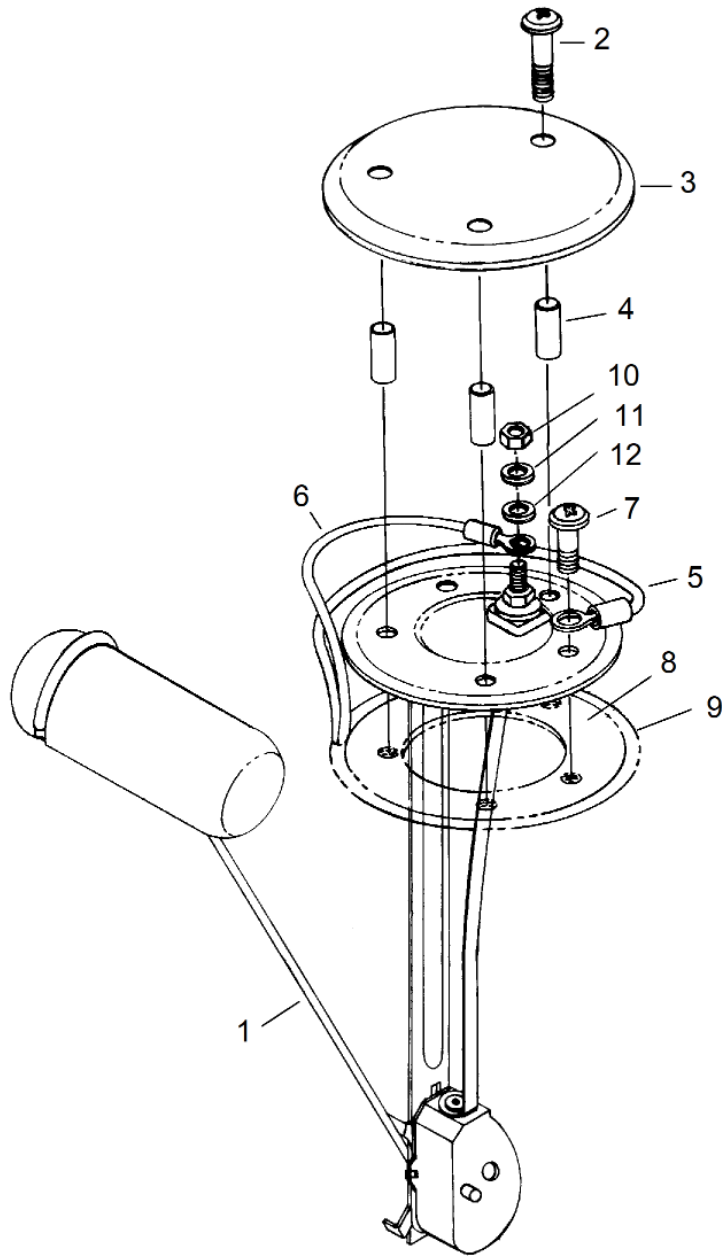
1 Remove three screws (2) attaching sending unit cover (3) to top of right fuel tank. Remove cover (3) and spacers (4).

2 Remove screw (7) and disconnect ground wire (5).

3 Remove nut (10) and washers (11), (12) and remove transmitter output wire (6).

NOTE: Due to the shape of the float, it is necessary to tilt the unit to get float out of fuel tank opening.

4 Remove remaining screw attaching unit to fuel tank, note location for reassembly. Remove fuel transmitter.



Two-piece bracket configuration
(float arm not shown)

1.	Float Arm	5.	Ground Wire	9.	Backing Plate (bonded to fuel cell)
2.	Screw	6.	Transmitter Wire	10.	Nut
3.	Cover	7.	Screw	11.	Lockwasher
4.	Spacer	8.	Gasket	12.	Washer

Figure 13-19. Fuel Transmitter

(a.1) Inspection – Fuel Transmitter

1 Remove the cover from the fuel transmitter in accordance with preceding step 1 (if not already accomplished).

2 Inspect fuel transmitter for condition and corrosion. Remove any corrosion from the fuel transmitter stud and/or ground location. If corrosion is excessive, replace the fuel transmitter.

NOTE: In some instances, the fuel quantity transmitter can develop a high resistance at the interface between the upper and lower bracket of the two-piece bracket configuration (see Figure 13-19, inset photo). Mark the upper and lower brackets with a reference mark and disassemble the two brackets. Using Scotch Brite, abrade the interface and then reassemble. Verify operation when inspection steps are completed.

3 Inspect wiring for condition and security. Clean the electrical contacts to remove any waxy or oily residue. Repair the wiring as required. Apply a corrosion inhibitor (ACF-50) to the ground wire and the transmitter wire connections.

NOTE: ACF-50 protects for up to one year (two years on new metal).

4 Determine quantity of fuel in tank using a dip stick or similar method. Verify fuel gauge reading matches the actual fuel quantity.

5 If the fuel quantity system is suspected of being out of calibration or if any maintenance on the fuel quantity system, i.e., right side fuel tank, quantity transmitter, wiring, or indicator has been performed, check the calibration of the fuel quantity system in accordance with preceding Para. (3), steps (a) through (i).

NOTE: Ensure the spacers are installed on the transmitter cover screws.

6 Remove the old sealant from the fuel transmitter cover and fuel tank. Apply sealant (Dow Corning RTV 732 or equivalent) to the cover, under the cover screw heads, and seal the wire conduit. Install the cover and torque the screws to 12-15 in. lbs./1.4-1.7 Nm. Remove any excess sealant.

(b) Installation – Fuel Transmitter

1 Replace gasket (8), if damaged, or installing a replacement fuel transmitter.

2 Install fuel transmitter into fuel tank.

3 For a replacement fuel transmitter, apply CP8-TB (Kopr-Shield) to the ground wire contact and the transmitter output wire contact.

4 Install the one mounting screw and connect ground wire (5) with screw (7). Torque screws (12-15 in-lb/1.4-1.7 Nm).

5 Connect transmitter wire (6) with washers (11), (12) and nut (10).

NOTE: Do not over torque. If stud is spun, a system fault can occur.

6 Apply corrosion inhibitor (ACF-50) to ground wire (5) and transmitter wire connections (6) and remaining exposed sending unit surface within the cavity.

NOTE: ACF-50 protects for up to one year (two years on new metal).

7 Calibrate the fuel quantity system in accordance with preceding Para. (3), (a) through (i).

8 Remove old sealant from fuel transmitter cover (3) and fuel tank.

9 Apply sealant (Dow Corning RTV 732, or equivalent) to cover (3), under cover screw (2) heads, and wire conduit.

NOTE: Ensure spacers are installed on transmitter cover screws.

10 Install cover (3), spacers (4), and screws (2). Torque screws (12-15 in-lb/1.4-1.7 Nm).

11 Remove any excess sealant.

(5) Fuel Tank – Repairs

(a) Drain fuel from tanks.

(b) Remove leaking tank(s) from aircraft.

(c) Remove fuel level sending unit (right tank) and all other fittings, as applicable.

NOTE: Sloshing sealer used is 3M Fuel Resistant Coating EC-776.

(d) Repair a fuel tank seam as follows:

NOTE: This procedure is limited to sealing only the area of the tank with the suspected leak. This limited application is sufficient to repair a seam leak without excessive or unnecessary use of sloshing sealer.

CAUTION: CARE MUST BE TAKEN TO PREVENT SLOSHING SEALER FROM COATING FUEL FITTINGS. REMOVE FITTINGS AND PLUG HOLES IF NECESSARY.

1 Prop tank such that the seam (especially the area of the seam with the suspected leakage) is visible through the filler neck.

2 Using a funnel, pour approximately 1/4 cup/60 mL of sealer into the area of the tank seam. Rock the tank back and forth to allow the sealer to flow along the seam in each direction until the seam is fully coated with sealer. (There should be no excess sealer remaining.)

NOTE: A fabricated channel formed of non-porous cardboard or similar material may be used in lieu of a funnel.

3 Repeat step (e).

4 Prop the tank so that the suspected leakage area is oriented at the bottom and at the lowest point possible while propped up.

5 Insert an air hose into the tank to provide a gentle air flow. Leave the tank in place to allow sealer to cure per manufacturer's instructions.

NOTE: Allow a minimum of eight hours cure time. (Sloshing compound is tack-free when cured.)

6 Install fuel level sending unit (right tank) and fittings, if required.

7 Check sump drain to assure it is not blocked.

8 Cap all fuel outlets.

9 Place approximately five gallons of fuel in the tank to check for leaks before installation on the aircraft.

10 Drain fuel and reinstall tank on aircraft.

(e) Repair leak(s) around tank cover seam.

1 Drill out rivets in area of leak.

2 Remove old fuel tank sealant from between tank and cover by scraping.

3 Install a new coating of PR1440 B-2 fuel tank sealant.

4 Drill out rivet holes and install next size larger diameter rivets.

5 Allow PR1440 B-2 to cure tack-free.

6 Coat interior of tank in area of repair with sloshing sealer.

CAUTION: CARE MUST BE TAKEN TO PREVENT SLOSHING SEALER FROM COATING FUEL FITTINGS. REMOVE FITTINGS AND PLUG HOLES IF NECESSARY.

7 Drain excess sloshing sealer.

8 Allow compound to cure tack-free.

9 Place approximately five gallons of fuel in the tank to check for leaks.

10 Drain fuel and reinstall on aircraft.

C. Fuel Boost Pump

(1) General Information

The fuel system boost pump is factory set at a pressure of 27 psi. A pressure switch monitors the fuel system pressure and activates the indicator panel lights. The green light will come on when the fuel system pressure increases to 20 psi and above. The red warning light will come on when the fuel system pressure falls to 15 psi or below.

NOTE: Newer F-models will not have the green normal fuel pressure indicator.

(2) Boost Pump – Adjustment

NOTE: Adjustments are to be made with a fully charged battery.

(a) Master switch - OFF

(b) Boost pump switch - OFF

(c) Fuel shutoff valve - CLOSED

(d) Remove 7/16 inch plug from RSA fuel injector.

(e) Install 0-50 psi pressure gauge.

(f) Fuel shutoff valve - OPEN

(g) Mixture control to idle cutoff.

(h) Master switch - ON

(i) Magneto switch - OFF

(j) Boost pump switch - ON

NOTE: Fuel pressure should read 27 psi.

(k) Loosen jam nut on boost pump relief valve adjustment screw.

(l) Adjust boost pump pressure.

NOTE: Clockwise rotation of the adjustment screw decreases pressure.

(m) Lock adjustment screw with jam nut.

(n) Recheck pressure.

(o) Boost pump switch - OFF

(p) Master switch - OFF

(q) Fuel shutoff valve - CLOSED

(r) Adjust engine-driven fuel pump.

D. Engine-Driven Fuel Pump

(1) Engine-Driven Fuel Pump - Removal (See Figure 13-21)

WARNING: ENSURE FUEL SHUTOFF VALVE IS CLOSED.

(a) Remove firewall access panels.

(b) Disconnect fuel inlet line (1) and outlet line (2).

(c) Disconnect static pressure line (3) and drain line (4).

(d) Cut safety wire and remove bolts (5) which secure fuel pump to scavenge pump and engine accessory case mounting pad.

(e) Remove fuel pump and fiber spacer (7).

CAUTION: WITHDRAW FUEL PUMP STRAIGHT AWAY FROM ENGINE. SCAVENGE PUMP WILL REMAIN IN POSITION WITH OIL LINES INTACT.

(2) Engine-Drive Fuel Pump - Inspection

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

(3) Engine-Driven Fuel Pump - Installation (See Figure 13-21)

NOTE: On new fuel pumps, install elbows in correct locations prior to installation on engine.

(a) Install bolts (5) with washers through the fuel pump.

(b) Install fiber spacer (7) on bolts.

(c) Align splined shaft and bolts to scavenge pump and slide fuel pump into position, lubricate spline.

NOTE: Be sure gasket between scavenge pump and engine is properly aligned before securing bolts.

(d) Secure scavenge pump and fuel pump to engine accessory case. Torque bolts and safety wire in pairs with MS20995C32 wire.

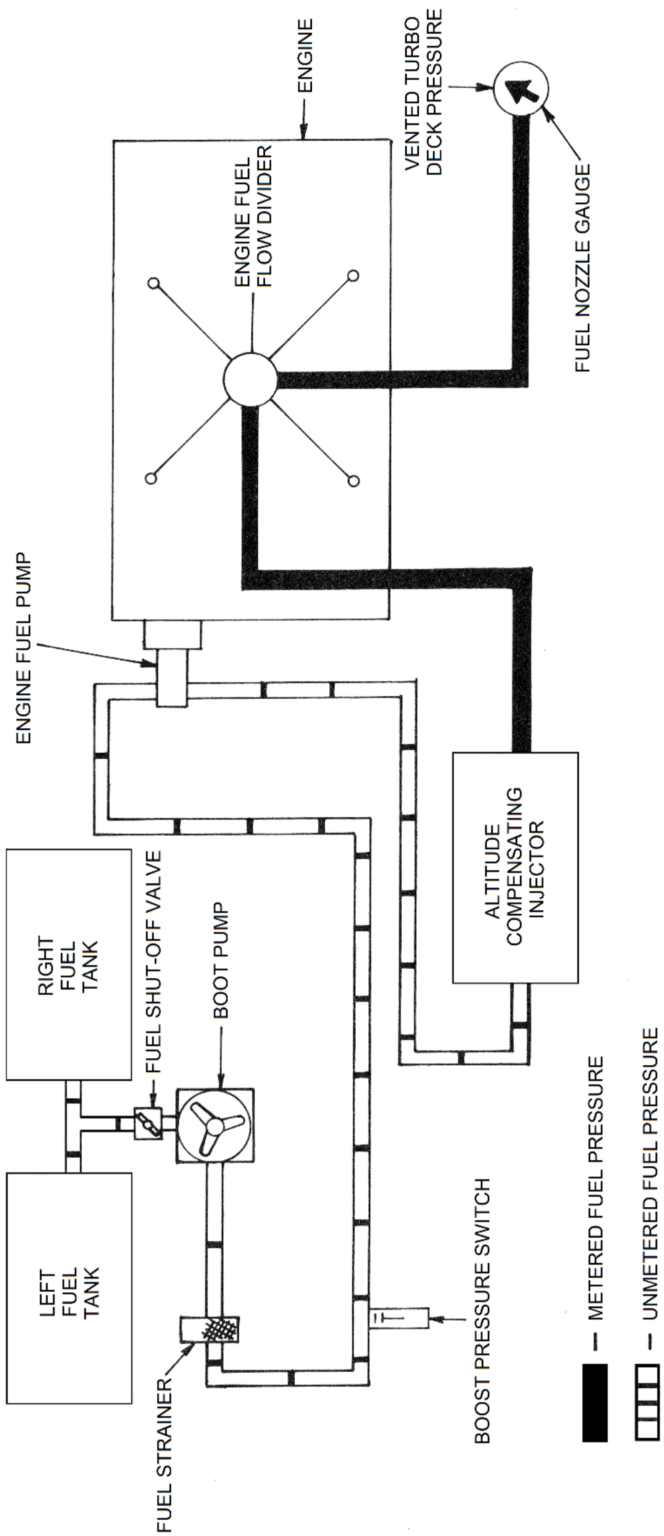
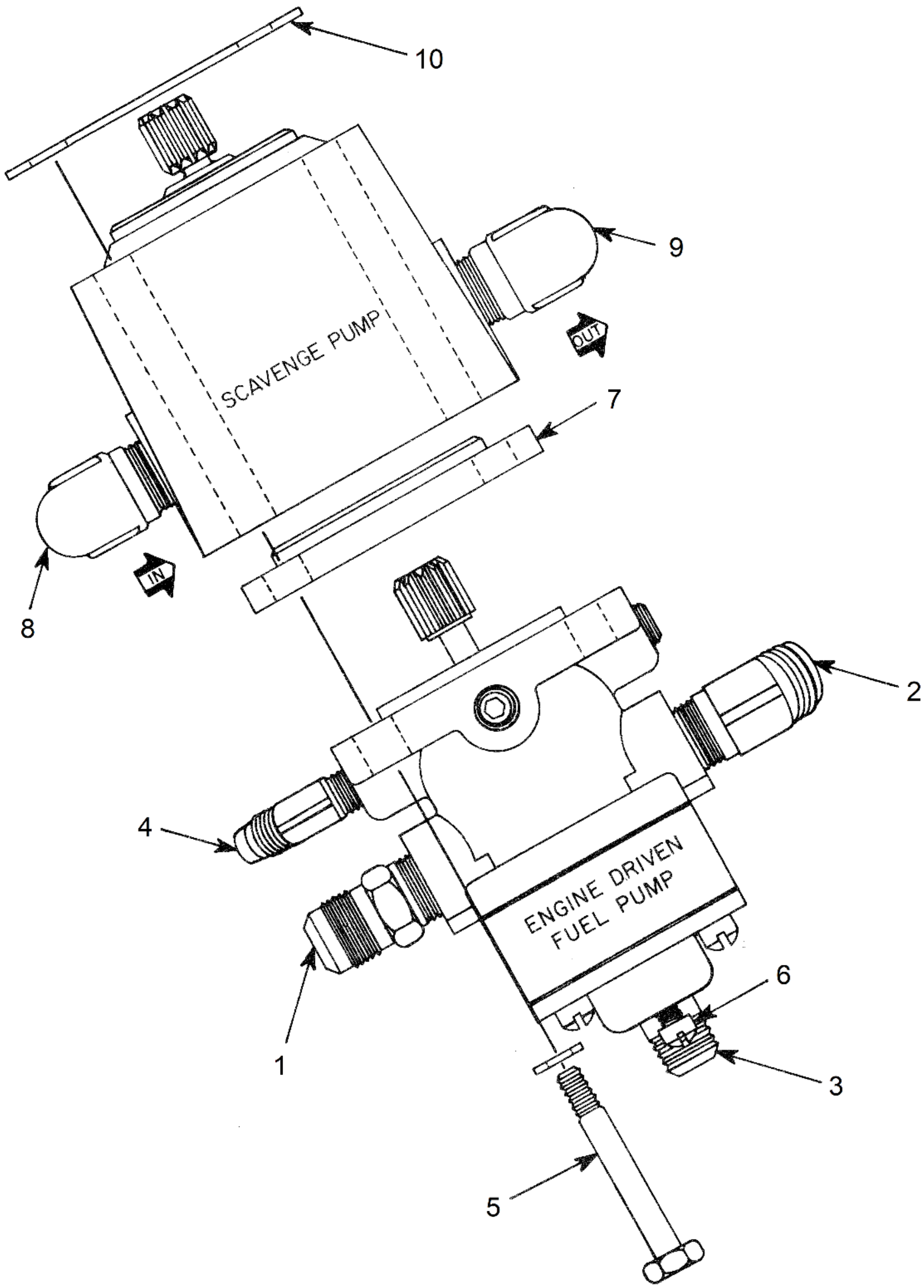


Figure 13-20. Fuel Flow Schematic



1. Fitting (Fuel Inlet Line)
2. Fitting (Fuel Outlet Line)
3. Fitting (Static Pressure Line)
4. Fitting (Drain Line)
5. Bolt
6. Adjustment Screw
7. Fiber Spacer
8. Fitting (Oil Inlet Line)
9. Fitting (Oil Outlet Line)
10. Gasket

Figure 13-21. Engine Driven Fuel Pump and Scavenge Pump

(e) Connect drain line (4) and static line (3).

(f) Connect fuel inlet line (1) and outlet line (2).

NOTE: Following the removal and overhaul of any fuel system-related engine components, turn fuel on and check operation of fuel system. Every 25 hours a visual check of the pump drain should be made with the engine running. If the engine-driven pump fails, there is a possibility that it will pump fuel overboard through the drain line.

(4) Engine-Driven Fuel Pump - Adjustment

NOTE: Fuel boost pump pressure should be adjusted prior to adjustment of engine-driven fuel pump.

(a) Remove safety wire from engine-driven fuel pump adjustment screw (6).

(b) Follow normal engine starting and rotor engagement procedures.

(c) Engine rpm - 3050

(d) Boost pump - OFF

(e) Adjust engine driven fuel pump to 24 ± 1 psi.

NOTE: Clockwise rotation of the adjustment screw increases pressure.

(f) Follow normal engine cooling and shutdown procedure.

(g) Safety wire adjustment screw (6).

(h) Remove 0-50 psi pressure gauge.

(i) Reinstall and safety wire 7/16-inch plug.

(j) Run engine and check for fuel system leaks.

(k) Perform idle mixture and rpm check.

E. Fuel Filter

(1) Fuel Filter - Removal

(a) Shut off fuel with fuel shutoff valve.

(b) Drain fuel from filter by opening sump drain.

(c) Disconnect sump drain valve extension shaft from assembly.

(d) Disconnect fuel inlet and outlet line.

(e) Cap lines and fittings.

(f) Remove safety wire from pipe plug at top of assembly.

(g) Remove bolts securing strainer assembly to pylon mount bracket.

(2) Fuel Filter - Disassembly

NOTE: The assembly does not have to be removed from aircraft for filter inspection.

(a) Remove safety wire from bolt at bottom of filter retaining bracket.

(b) Loosen filter retaining bracket bolt.

(c) Swing retaining bracket forward to release bottom cover, outer body, and gaskets.

(d) Remove retaining pin at bottom of filter to release end cap.

(3) Fuel Filter - Inspection

(a) Check fuel filter assembly for:

1 Cracks and evidence of corrosion.

2 Loose or damaged fittings.

3 Worn or damaged gaskets.

4 Security of filter retaining pin.

(b) Check filter for:

1 Rips, dents, or deformation.

2 Contamination.

(4) Fuel Filter Assembly - Cleaning

(a) Clean fuel filter assembly in accordance with Para. 4-5.1.

(5) Fuel Filter Housing - Assembly

(a) Install upper gasket, filter top ring, screen, and end cap.

(b) Secure filter with pin (spring clip).

WARNING: THE CURVED SECTION OF THE PIN MUST BE INSTALLED BETWEEN THE STRAIGHT SECTION OF THE PIN AND THE BASE OF THE SCREEN AND THE CURVED TAIL OF THE PIN MUST BE TUCKED UNDER THE STRAIGHT SECTION OF THE PIN (FIGURE 1). THE SCREEN ASSEMBLY MUST BE CHECKED FOR LOOSENESS AND MUST FIT TIGHTLY INTO THE FILTER BASE.

NOTE: Take care that the curved portions of the pin are installed between the bottom cap of the filter and the straight section of the pin and that the curved section of the pin tail is tucked under the straight section of the pin (Figure 13-21.1).

(c) Check screen fits tightly into filter assembly top cap with no looseness.

(d) Install gasket in bottom cover.

(e) Install outer body and end cap on assembly.

NOTE: Align drain port on end cap with fuel outlet port on top of assembly.

(f) Swing retaining bracket under assembly and align bolt with recess in end cap.

(g) Secure assembly by tightening retaining bracket bolt (torque 20-25 in-lb/2.3-2.8 Nm) and safety (MS20995C32) bolt to bracket.

(h) Install drain valve and tube in bottom of assembly.

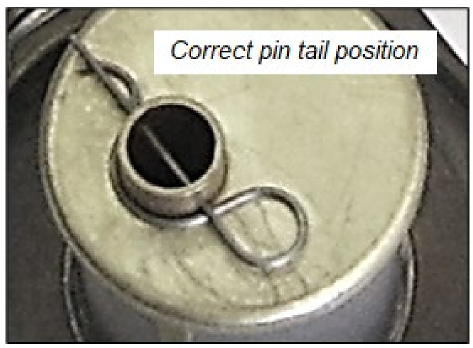


Figure 13-21.1a. Correct Installation of Pin; Curved tail is installed under the straight tail.

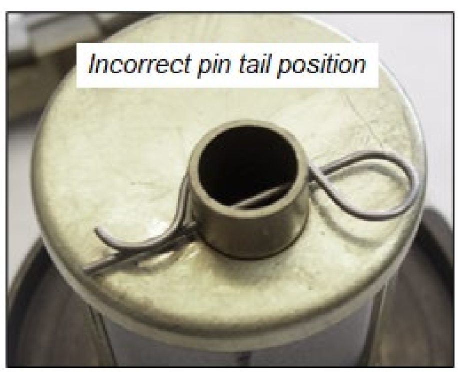


Figure 13-21.1b. Incorrect Installation of Pin; Curved tail is installed over the straight tail.

(6) Fuel Filter Assembly - Installation

(a) Attach filter assembly to pylon with drain valve positioned aft.

(b) Safety wire plug on top of assembly.

(c) Attach fuel inlet line to the forward top port.

(d) Attach fuel outlet line to the aft top port.

(e) Attach drain valve extension.

(f) Close drain valve.

(g) Open fuel shutoff valve.

(h) Turn boost pump ON.

(i) Mixture control to idle cutoff.

(j) Check for fuel leakage.

(k) Turn off boost pump and close fuel shutoff valve.

F. Fuel Pressure Switch

(1) Fuel Pressure Switch - Removal

(a) Close fuel shutoff valve.

(b) Drain fuel sump.

(c) Remove safety wire from electrical connection.

(d) Disconnect electrical connection.

(e) Disconnect switch assembly from pylon attachment.

(f) Loosen jam nut on fuel line attachment fitting.

(g) Remove switch assembly from fuel line fitting.

(2) Fuel Pressure Switch - Installation

(a) Install switch assembly on fuel line fitting.

(b) Secure with jam nut.

(c) Attach switch assembly to pylon clamp.

(d) Install electrical connector.

(e) Safety wire connector to switch assembly.

(f) Open fuel shutoff valve.

(g) Turn boost pump on.

(h) Mixture control to idle cutoff.

(i) Check for fuel leakage.

(j) Turn off boost pump and close fuel shutoff valve.

G. Fuel Shutoff Valve

(1) Fuel Shutoff Valve - Removal

(a) Remove left fuel tank to gain access to shutoff valve.

(b) Disconnect fuel line from aft side of valve.

(c) Disconnect fuel lines from left and right sides of valve.

(d) Disconnect cable from valve actuating arm: loosen jam nut, loosen screw, and unhook wire.

(e) Remove bolts securing valve to pylon.

(2) Fuel Shutoff Valve - Installation

(a) Secure valve to pylon mount with two nuts and bolts.

(b) Install and check rigging (step (3)) of control cable.

(c) Connect fuel inlet and outlet lines.

(d) Install fuel tank.

(e) Place fuel in tanks and check for leaks prior to flight.

(3) Fuel Shutoff Valve - Rigging

(a) Position top of shutoff valve actuating arm full forward to ensure valve is open.

(b) Insert wire from control cable through hole in valve actuating arm attachment swivel.

(c) Secure cable sheath to pylon.

(d) Secure wire in swivel by tightening the screw on the swivel end and locking it with the jam nut.

(e) Form a hook in the wire end by bending it upward and aft.

(f) Position shutoff valve control knob pushed in to within 0.25 inch of nut securing it to firewall.

NOTE: This 0.25-inch "cushion" is used to ensure the valve is completely open when the control knob is pushed in.

(g) Check control operation: Pull knob out, to close valve, and push it back in to open the valve.

1 The knob should not bottom out at the firewall.

2 Check for further movement of the shutoff valve actuating arm by manually pulling the top of the arm forward. The arm should not have any further movement forward. If there is further movement forward, check the cable security and repeat the rigging procedure.

13-11 LUBRICATION SYSTEM

A. Description

Engine oil flows to the turbocharger from the engine through a restricted elbow fitting. On this same line, a valve is located just before the oil inlet to the turbocharger. This check valve prevents an oil buildup in the turbocharger after the engine is shut down. An engine-driven scavenge pump is utilized to return the turbocharger oil back to the engine sump. The scavenge pump parts are stamped "in" or "out" and the correct rotation is marked.

Two reverse flow oil coolers are used to cool the oil for the entire system. Cooling air from the fan is directed through the cores of the coolers 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.

Refer to Figure 13-22 for the lubrication system schematic.

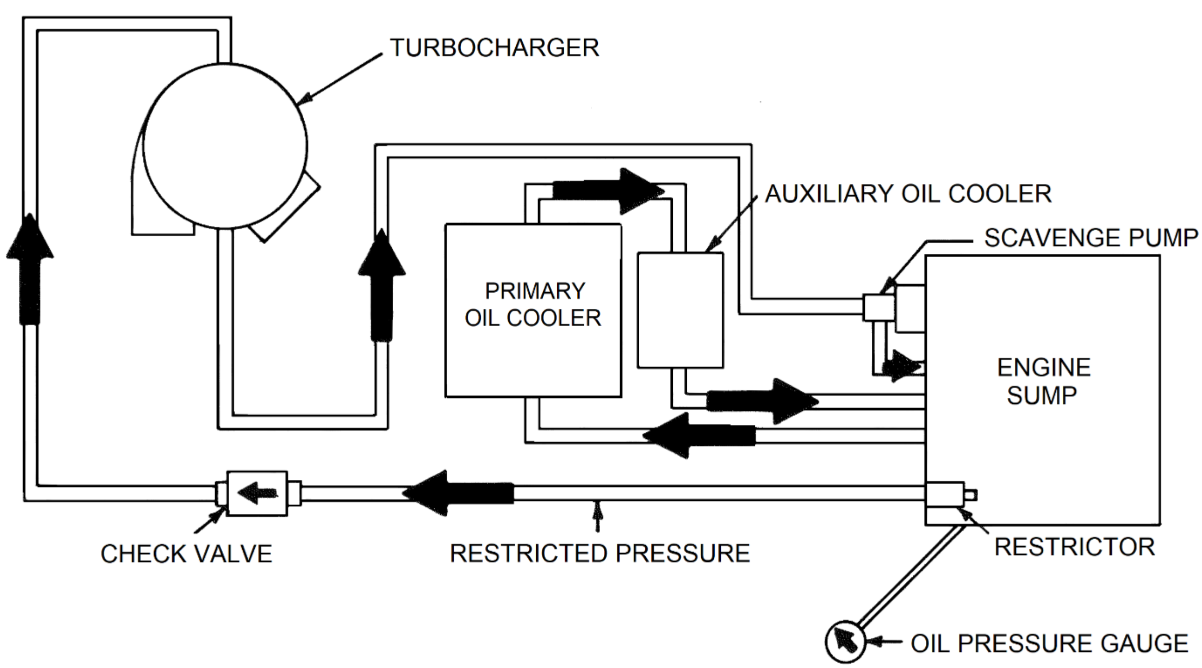


Figure 13-22. Oil System Diagram

B. Oil Coolers

(1) Oil Cooler - Removal

The primary oil cooler is mounted on the right-hand side of the engine compartment. The auxiliary oil cooler is mounted to a duct located on the lower left side of the cooling fan shroud.

(a) Primary Oil Cooler

1 Open right side cowl.

NOTE: Place magneto switch in OFF position.

2 Drain oil out of the lower inlet oil line fitting.

NOTE: Place container beneath the oil cooler when disconnecting lines to collect any drain oil from the cooler and lines.

3 Disconnect and cap the inlet lines.

4 Remove four bolts holding the oil cooler boot to the inboard side of the oil cooler.

5 Remove four bolts holding the oil cooler air exit duct to the outboard side of the oil cooler.

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

(b) Auxiliary Oil Cooler

1 All switches - OFF

2 Drain oil from engine sump.

3 Open left cowl.

4 Place oil catch pan beneath oil cooler.

5 Disconnect and plug inlet and outlet lines.

6 Remove two screws and washers from bottom of oil cooler heat shield.

7 Remove two screws and washers from top of oil cooler heat shield.

8 Remove heat shield.

9 Remove two screws and washers attaching aft side of oil cooler to oil cooler duct.

10 Remove oil cooler.

(2) Oil Cooler - Inspection

(a) Inspect oil coolers for:

1 Bent, broken or dirty core fins.

2 Nicked, burred, or deformed plumbing fittings.

3 Deformed screw holes.

4 Loose boot attachment to oil cooler inlet.

(b) Inspect oil cooler air ducts for:

1 Cleanliness.

2 Cracks, checking, tears or dents.

3 Integrity of mounting flanges.

(c) Inspect oil inlet and return lines for:

1 Cleanliness and freedom from obstructions.

2 Cracks, checking, swelling, and kinks.

3 Integrity of wire shields.

4 Plumbing fittings for nicks, burrs, and deformity.

(3) Oil Cooler - Leakage Check

(a) Perform a hydrostatic test on the oil cooler. Operate test set in accordance with manufacturer's instructions or take oil cooler to certified facility 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.

(4) Oil Cooler - Installation

(a) Primary oil cooler.

1 Secure oil cooler to the oil cooler boot and lower mount with four bolts.

2 Secure oil cooler inlet and return lines.

3 Secure air inlet duct to oil cooler and lower mount with four bolts.

4 Thoroughly inspect the oil cooler assembly installation, torque on fittings, routing of lines, and ducting.

5 Perform preflight inspections; service engine as required.

6 Perform operational check of engine prior to flight.

7 After the engine has been run up to operating temperature, inspect assembly for oil leaks.

NOTE: Oil circulates through the entire system only when engine is at operating temperature.

8 Secure right side cowl.

(b) Auxiliary Oil Cooler

1 Position oil cooler in place on the duct from the cooling fan shroud with inlet and outlet fittings aft.

2 Install two screws and washers in aft side of oil cooler mount.

3 Place heat shield in position.

4 Install two screws and washers in top of heat shield.

NOTE: It may be necessary to bend the heat shield slightly to facilitate installation of the top two screws.

5 Install two screws and washers in the bottom of the heat shield.

6 Remove inlet and outlet line plugs and connect lines to oil cooler.

7 Check routing of lines.

8 Check fittings and attachment hardware for security.

9 Service oil system to proper level.

10 Run engine to bring oil to normal operating temperature.

11 Shut down engine and inspect for leaks.

C. Scavenge Pump

(1) Scavenge Pump – Removal (See Figure 13-21)

The scavenge pump is removed with the same procedure listed under Engine-Driven Fuel Pump Removal – Section 13-10, with the following additions:

(a) Disconnect oil inlet line (8).

(b) Disconnect oil outlet line (9).

(c) Pull engine-driven fuel pump and scavenge pump out as a unit.

(d) Remove gasket (10).

(2) Scavenge Pump – Installation (See Figure 13-21)

Complete Engine-Driven Fuel Pump Installation Procedure, Section 13-10, with the following additions:

(a) Install scavenge pump and gasket (10) on bolts (5) with spacer (7) and engine-driven fuel pump.

(b) Install both pumps as a unit into engine case.

(c) Connect oil inlet line (8) and outlet line (9).

(d) Check for both oil and fuel leaks.

(e) Verify the operation:

NOTE: The turbocharger does not have seals on the turbo wheel and relies on the scavenge pump scavenging more oil than the engine can supply as there is a restrictor in the oil line from the engine to the turbocharger.

1 Disconnect the turbocharger flexible drain line from the hard line to the scavenge pump.

2 Connect a line to each end of the hose and route both hoses down into a container with two quarts of clean fresh oil.

3 Crank the engine. The scavenge pump should empty the container of oil as it should remove more oil than what is supplied through the restrictor.

4 Reassemble the flexible drain line to the hard line.

13-12 CORRELATOR

This specification presents the method to most accurately and safely rig the throttle correlator system used on the F-28F and 280F aircraft. The correlator rigging is a repetitive process and, by necessity, some of the steps are repeated. Although this procedure is written to incorporate the minimum number of steps, the more repetitions used to rig the correlator, the better the correlator will perform.

A. Operating Principles

The mechanical correlator installed on the Enstrom Piston Engine helicopters automatically operates the throttle when the pilot moves the collective relieving the pilot of having to manipulate the throttle to maintain blade RPM in the green arc. The correlator is unlike an electronic governor in that the throttle twist grip must not move during collective operation. This forces the correlator to change the position of the throttle arm on the servo. If the throttle twist grip is allowed to rotate during collective operation, the correlator will not cause the throttle arm on the servo to move in the correct relationship to the collective, and the correlator will not work correctly.

With the helicopter sitting on the ground, the pilot begins the take-off process by opening the throttle to bring the engine and rotor RPM into the green arc, and then raises the collective while rolling OFF the throttle to maintain the RPM in the green arc. As the collective is raised, the correlator will automatically increase the throttle so to maintain the RPM in the green, the pilot must roll off throttle as the collective is raised. As the helicopter lifts into a hover with the RPM in the green, the throttle is then CORRELATED to the collective and the engine for the helicopter gross weight, density altitude, wind, etc., for that particular flight. As the pilot moves the collective up and down, the correlator automatically adjusts the throttle to maintain engine RPM.

The throttle friction must be set firmly enough so that when the collective is moved up and down, the throttle twist grip on the collective does not move.

B. Injector Rigging

(1) The injector shall be rigged as shown in Figure 13-26. The injector is at idle position. The lever may be repositioned in 15° increments by loosening the butterfly shaft nut.

(2) The injector used for the “F” model shall be one of two types:

(a) Part No. 2524858-A. This injector has been modified to obtain 85% butterfly travel with the idle screw fully backed out. Preflight idle is to be set such that the butterfly is closed to .020 inch gap in the sidewall.

(b) Part No. 2524858-1 and higher has the idle position preset at 97° and no further check is required.

(3) Connect the throttle cable:

(a) Set aft cable attach position at 6.88 plus .13/-.25 inch (Figure 13-24).

(b) Set the forward cable attach position at 1.13 ± .13 inches (Figure 13-23).

(c) Pre-adjust point "B" override stop to 0.60 ± .02 inches (Figure 13-25).

(d) Set collective stick on down stop and lock.

(e) Set injector at idle stop (Figure 13-26).

(f) Set summing lever (1) on idle stop, point "A." (Figure 13-25).

(g) Adjust throttle cable rod ends to fit. Attach at injector.

(4) Adjust override stop, point “B” (Figure 13-27):

(a) Position collective stick on down stop.

(b) Rotate throttle twist grip open enough to insert a 0.14 ± .01 inch thick shim or tool No. T-0113 between idle stop screw and stop pin on injector (Figure 13-28). Rotate twist grip against shim and maintain pressure during step 3-c.

(c) Check for 5.0 ± .06 inches dimension between offset shaft and summing lever output arm (points "D" and "E" respectively, Figure 13-27) by:

1 Use tool gauge T-0111 or similar device and slip over offset shaft (point "D") adjacent to offset fitting (1).

2 Attempt to slip other end of tool over cone washer on summing lever, point "E."

3 Adjust override stop, point "B", until gauge tool slips over cone washer on summing lever.

(d) Lock jam nut on stop bolt, point "B."

(e) Remove 0.14-inch shim from injector stop.

(f) Set injector idle stop arm against stop pin (Figure13-26).

(g) Set correlator summing lever at idle stop, point "A" (Figure 13-25).

(h) Remove bolt connecting throttle cable to throttle arm on servo and check that bolt is a slip fit and that the throttle stop is against the stop (Figure 13-26).

NOTE: If there is insufficient thread engagement in rod end, then aft cable housing attachment on pylon (Figure 13-24) can be moved 6.88 +13/-.25 inches.

(5) Check wide open rigging:

(a) Raise collective stick 2 inches at handle or .25 inch at stop (Figure 13-29) from down stop position and lock.

(b) Rotate twist grip to wide open position.

(c) Check if injector wide open stop arm is against stop pin for P/N 2524858-A only (Figure 13-30). On -1 or -2 servos, stop arm may not contact stop pin; adjust to within 0.125 inch of stop pin.

NOTE: If adjustment is required, make adjustments at cable rod ends and aft cable attach point dimension 6.88 +.13/-.25 inches (Figure 13-24).

(d) Check if output lever (1) is within 0.06 inch of stop point "C" (Figure 13-29). If out of tolerance, adjust aft cable attach point dimension 6.88 +.13/-.25 inches (Figure 13-24) and repeat steps 4-c and 4-d.

NOTE: Primary open stop should be at the injector and the stop at point “C” is secondary.

(e) Secure all hardware on cable rod ends.

(6) Recheck idle adjustments by:

(a) Set collective stick on down stop and lock.

(b) Rotate throttle twist grip to idle stop.

(c) Check at the injector that the idle adjustment screw is against the stop pin (Figure 13-26).

NOTE: The throttle twist grip must have enough authority to force all backlash out of the system and cable. A piece of paper placed between the idle adjustment screw and the stop pin should be clamped. However, only 10° rotation (20° maximum) of the twist grip should release the paper enough to be able to pull it free. Any more rotation than this causes a large dead band which uses up too much correlator motion, thus causing improper collective/throttle correlation. To adjust, move the aft cable attach point (Figure 13-24). Usually no more than one rotation of the jam nuts is required. For insufficient clamping of the paper, move the cable down. For excessive clamping move the cable up.

NOTE: Preflight rigging is now completed. Correlator will perform satisfactory until idle screw/mixture linkage adjustment has been made. Readjustment of correlator is then required for satisfactory and safe correlator function.

C. Verifying Proper Correlator Operation

(1) Remove the collective cover and the firewall access cover in the seat back to gain access to the correlator and to the fuel injector servo and waste gate linkage.

(2) Place the collective down and set the throttle so the rivet is in the 12 o’clock position.

(3) Check that the idle speed adjustment screw is against the stop on the servo.

(4) Check that the clearance between the waste gate arm and the open stop is 0.06 to 0.09 inch (Figure 13-22.1a). (The waste gate should be in the open position, Figure 13-22.1b.)

(5) Completely close the throttle; there should be no change in the position of the throttle-arm position on the servo. The throttle position between the point where the rivet is at 12 o’clock and fully closed is the override position and should have no effect on the position of the throttle arm on the servo. It is there only to make the correlator function properly.

(6) Open the throttle to the full throttle position.

(7) The throttle arm on the servo should be at least 90% open.

(8) Open and close the throttle several times.

(9) The operation of the output lever (Figure 13-22.2, Item 2) should be smooth and the output lever should rotate freely (perpendicular to the mounting plate (1) on its shaft bolt (3) without causing the shaft to move laterally. If moving the throttle causes the pivot shaft to lean over (move laterally forward) this is an indication that there is friction in the system, throttle cable, servo, or wastegate.

(10) Raise the collective about 2 inches. Rotate the throttle from the idle position (closed) to the wide-open position. As before, the actuator arm must rotate freely on the pivot shaft parallel to the seat frame and the pivot shaft should not lean over laterally (forward). There will be no override position at the closed throttle position with the collective up two inches.

(11) Open and hold the throttle at 100%, slowly raise the collective. As the collective is raised the shaft supporting the output lever should lean over sideways (forward) and allow the collective to be raised about 2 inches without the throttle turning. At about 2 inches, the throttle will begin to close as the pivot shaft deflection reaches its limit.

(12) If the output lever shaft leans over at any time other than when the throttle arm on the servo is at the full open position, it is an indication that there is binding (friction) in the system.

D. Troubleshooting the Correlator

NOTE: If the throttle cable actuator arm moves laterally (forward) when the throttle is rotated, there is an issue with the system binding that must be corrected for the correlator to operate correctly.

(1) Throttle Cable:

(a) Disconnect the throttle cable from the servo and operate the throttle. If the throttle output lever rotates on the pivot shaft and the pivot shaft does not move out of plane, (laterally forward), the correlator and throttle cable are working correctly and the servo or the waste gate are causing the problems.

(b) If the throttle actuator arm (Figure 13-22.2, Item 2) continues to pivot sideways (forward) on its shaft when the throttle is twisted, disconnect the throttle cable from the throttle actuator arm and test the correlator operation again.

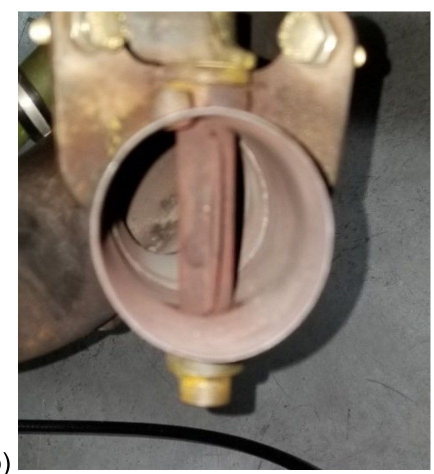
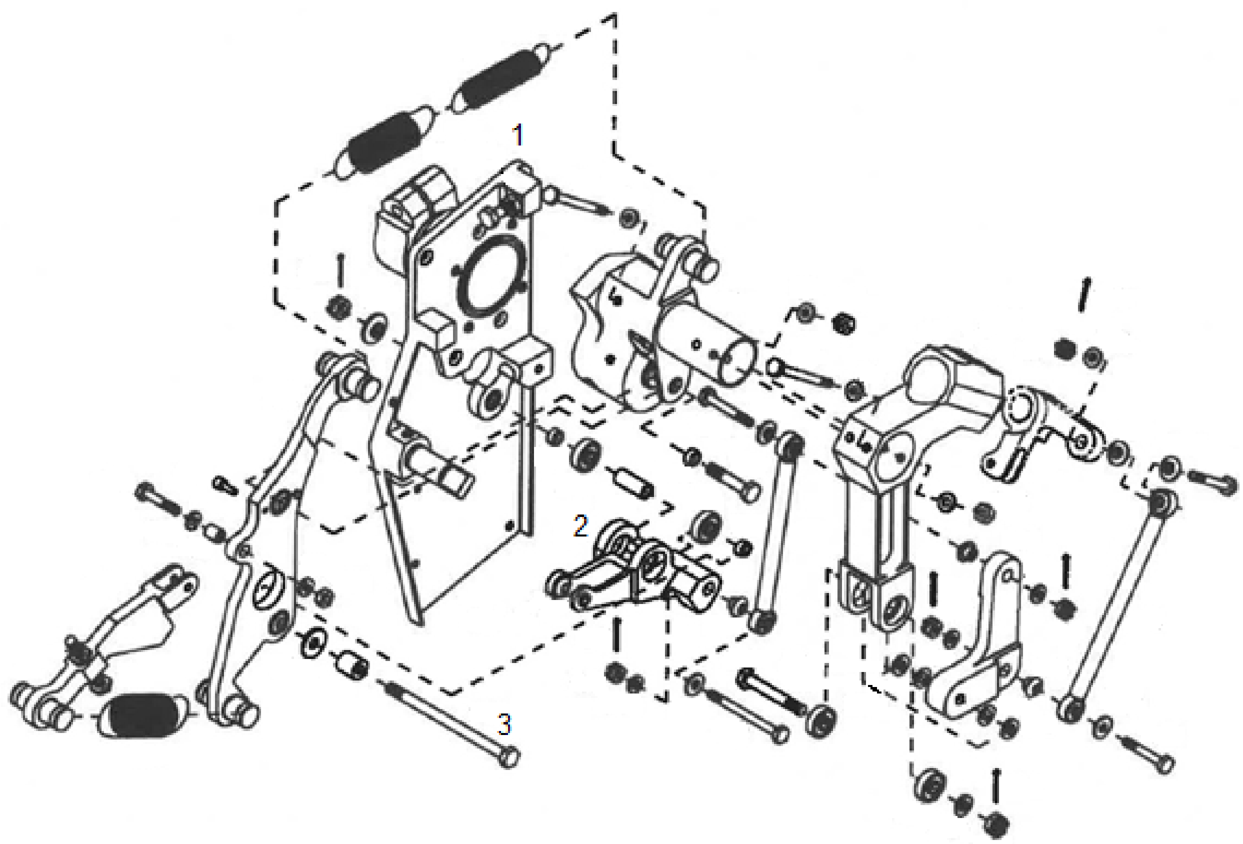
(a)  (b) 

Figure 13-22.1. (a) Clearance (0.06 – 0.09 inch) between the arm and the stop; (b) Open position



1. Mounting Plate
2. Output Lever
3. Shaft Bolt

Figure 13-22.2. Correlator Assembly

(c) If the correlator now works correctly, the throttle cable has internal friction and should be replaced (Para. 13-13).

NOTE: In some instances, the throttle cable sheath attachment may need modification upon installation of a replacement correlator throttle cable. Refer to Tech Tip, *Modifying the Throttle Cable Sheath Attachment of F and FX Series Helicopters* and contact Enstrom Product Support for further assistance.

(2) Correlator:

(a) If the actuator arm pivot shaft is still moving laterally (forward) after the throttle cable has been disconnected, there is a problem with the correlator. Contact Enstrom product support if the cause cannot be determined.

(3) Wastegate:

(a) Disconnect the wastegate actuating arm from the throttle arm on the servo and operate the wastegate by hand.

(b) Operate the throttle and observe the throttle actuating arm for lateral movement on the pivot shaft, if the correlator now works correctly the issue is in the servo.

(4) Servo:

(a) If the correlator, throttle cable, and wastegate have been eliminated as causes, the servo is the issue.

(b) Operate the throttle arm on the servo by hand. If the throttle arm is stiff, disconnect the mixture arm control rod and operate the mixture arm and the throttle arms independently to determine if the issue is in the throttle shaft or the mixture side of the servo.

E. Correlator Preflight Rigging

NOTE: The rigging procedure is written for three considerations:

(1) When installing a new throttle cable or replacing any part of the correlator or throttle system start with Item B - Correlator Preflight Rigging.

(2) For service adjustments to cover idle adjustment, injector servicing or replacement, start with Item C - Correlator Post-Flight Rigging.

(3) When installing a replacement throttle cable, fuel servo, waste gate or engine the throttle arm to waste gate rigging should be performed first to ensure that the throttle arm is installed in the correct position on the servo.

NOTE: When installing a replacement throttle cable, wastegate, or engine the wastegate to servo adjustment should be performed first to ensure that the throttle arm is installed in the correct position on the servo.)

(a) Wastegate Link Rod Adjustment:

1 Disconnect throttle cable from servo throttle arm.

2 Set throttle arm against the full throttle stop (Figure 13-30).

3 Adjust wastegate link length for 0.015 inch gap at wastegate closed stop. (DO NOT adjust stop. Stop was previously set for a 0.015 inch gap with the butterfly in the fully closed position.)

(4) Set throttle arm against the idle stop (Figure 13-26).

(5) Check that the gap at the waste gate open stop is 0.09 / 0.06 inch clearance.

(6) The position of the throttle arm on the servo may have to be changed if the rod cannot be adjusted.

(7) Lock jam nut on stop bolt, point "B."

(8) Remove 0.14-inch shim from injector stop.

(9) Set injector idle stop arm against stop pin (Figure13-26).

(10) Set correlator summing lever at idle stop, point "A" (Figure 13-25).

(11) Remove bolt connecting throttle cable to throttle arm on servo and check that bolt is a slip fit and that the throttle stop is against the stop (Figure 13-26).

NOTE: If there is insufficient thread engagement in rod end, then aft cable housing attachment on pylon (Figure 13-24) can be moved 6.88 +13/-.25 inches.

F. Correlator Post-Flight Rigging

(1) Readjust override stop, point "B" (Figure 13-27).

(a) Position collective stick on down stop.

(b) Rotate throttle twist grip open enough to insert a 0.14 ± .01 inch thick shim or tool No. T-0113 between idle stop screw and stop pin on injector (Figure 13-28). Rotate twist grip against shim.

(c) Check for 5.0" ± 0.06 dimension between offset shaft and summing lever output arm (points "D" and "E" respectively, Figure 13-27) by:

1 Use tool gauge T-0111 or similar device and slip over offset shaft (point "D") adjacent to offset fitting (1).

2 Attempt to slip other end of tool over cone washer on summing lever, point "E."

3 Adjust override stop, point "B", until gauge tool slips over cone washer on summing lever.

(d) Lock jam nut on stop bolt, point "B."

(e) Remove 0.14 inch shim from injector stop.

(2) Check idle stop position.

(a) Set collective stick on down stop and lock.

(b) Rotate throttle twist grip to idle stop.

(c) Check at the injector that the idle adjustment screw is against the stop pin (Figure 13-26).

NOTE: The throttle twist grip must have enough authority to force all backlash out of the system and cable. A piece of paper placed between the idle adjustment screw and the stop pin should be clamped. However, only 10° rotation (20° maximum) of the twist grip should release the paper enough to be able to pull it free. Any more rotation than this causes a large dead band which uses up too much correlator motion, thus causing improper collective/throttle correlation. To adjust, move the aft cable attach point (Figure 13-24). Usually no more than one rotation of the jam nut is required. For insufficient clamping of the paper, move the cable down. For excessive clamping move the cable up.

(d) Readjust stop on wastegate, if necessary, to provide .06/.09 inch clearance.

(3) Check wide open injector position:

(a) Raise collective stick 2" from down stop position and lock or .25 inch from stop (see Figure 13-29).

(b) Rotate twist grip to wide open position.

(c) Check if injector wide open stop arm is against stop pin.

(d) Readjust wastegate link length, if necessary, for 0.015 inch gap at wastegate stop. (DO NOT adjust stop. This stop was previously set for a 0.015 inch gap with the butterfly in fully closed position.)

G. Adjusting the Correlator After Maintenance

(1) Adjustments to the engine such as magneto timing and fuel injection mixture adjustments may affect the correlator operation requiring fine tune adjustments after a test flight.

(2) Throttle friction must be set high enough to prevent the throttle from moving when the collective is raised and lowered.

(3) Fly the helicopter with the RPM set at 2900, 25 in MAP, and 55 MPH.

(4) While holding airspeed at 55 MPH, increase collective to 39 in MAP.

(5) Note the RPM change.

(6) Hold airspeed and reduce collective to 25 in MAP.

(7) Note RPM change.

(8) The desired operation of the correlator will not allow the RPM to exceed the maximum RPM while increasing collective or the minimum RPM while lowering the collective.

(9) Make a small adjustment to the summing lever bolt (Figure 13-22.2, Item 180) (No more than 1/8 to 1/4 turn of the summing lever bolt each adjustment.)

(10) Fly the operational test again and continue to make adjustments until the best operation of the correlator is obtained.

13-13 CORRELATOR THROTTLE CABLE

NOTE: In some instances, the throttle cable sheath attachment may need modification upon installation of a replacement correlator throttle cable. Refer to Tech Tip, *Modifying the Throttle Cable Sheath Attachment of F and FX Series Helicopters* and contact Enstrom Product Support for further assistance.

Install a replacement correlator throttle cable in accordance with the following procedures.

A. Removal

(1) Remove fiberglass seat deck and firewall inspection panels.

(2) Remove bolt securing forward throttle cable to correlator output lever (Figure 13-25).

(3) Remove rod end and jam nut from throttle cable.

(4) Remove dust caps and measure and record the forward cable attach point (Figure13-23).

(5) Remove the sheath securing nut and lock washer from the cable sheath (Figure13-23).

(6) Remove bolt securing throttle cable to servo throttle arm (Figure13-24).

(7) Remove the dust caps and measure and record the aft cable attach point (Figure13-24).

(8) Remove the upper cable sheath securing nut and lock washer from the throttle cable aft attach point (Figure13-24).

(9) Remove the clamp securing the throttle cable to the quarter panel.

(10) Remove the throttle cable from the helicopter.

B. Installation

(1) Remove the dust caps, the outside two securing nuts, and the lock washers from the new cable.

(2) Insert one end of the cable through the firewall and the cable support (Figure13-23).

(3) Install the lock washer and securing nut. Set the cable sheath to the dimension measured in step A, (4) (Figure13-23) and torque the nut to 80 in-lb/9 Nm.

(4) Install the dust caps on the forward end of the throttle cable.

(5) Insert the aft end of the throttle cable into the aft throttle cable support bracket.

(6) Install the lock washer and the securing nut. Set the cable sheath to the dimension measured in step A, (7) (Figure13-24) and torque the nut to 80 in-lb/9 Nm.

(7) Set the collective on the down stop and roll the throttle to the full closed position.

(8) Ensure that the summing lever is against the idle stop Point "A" (Figure13-25).

(9) Adjust the rod ends to fit at the fuel injector throttle arm (Figure13-26) and the correlator output lever (Figure13-25).

(10) Install securing hardware and torque to 20-25 in-lb/2.3-2.8 Nm.

(11) Verify that the idle stop screw is against the pin (Figure13-26) when the rivet on the throttle twist grip is in the 12 position and that the summing lever touches the Throttle Idle Stop Point "A" when the throttle is rolled completely closed.

(12) Raise the collective 2 inches and open the throttle to the FULL throttle position. Ensure that the throttle arm is against the wide open stop on the fuel injector servo.

(13) If step (11) or (12) are not in tolerance, the correlator requires rigging in accordance with Para. 13-12.

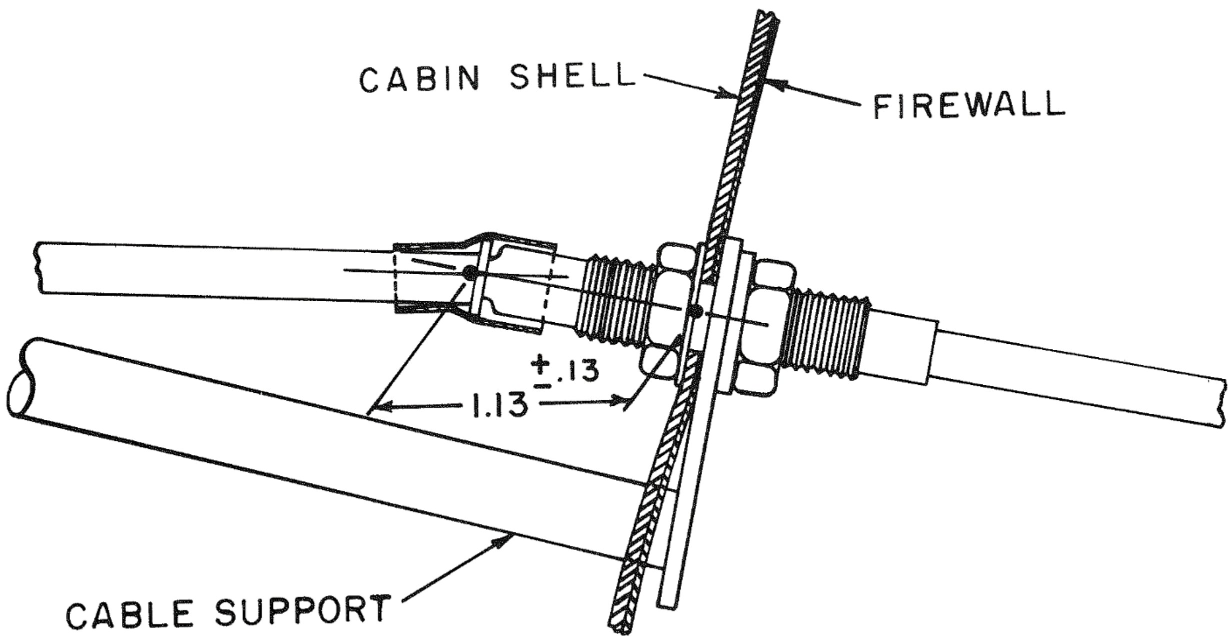


Figure 13-23. Forward Cable Attach Point

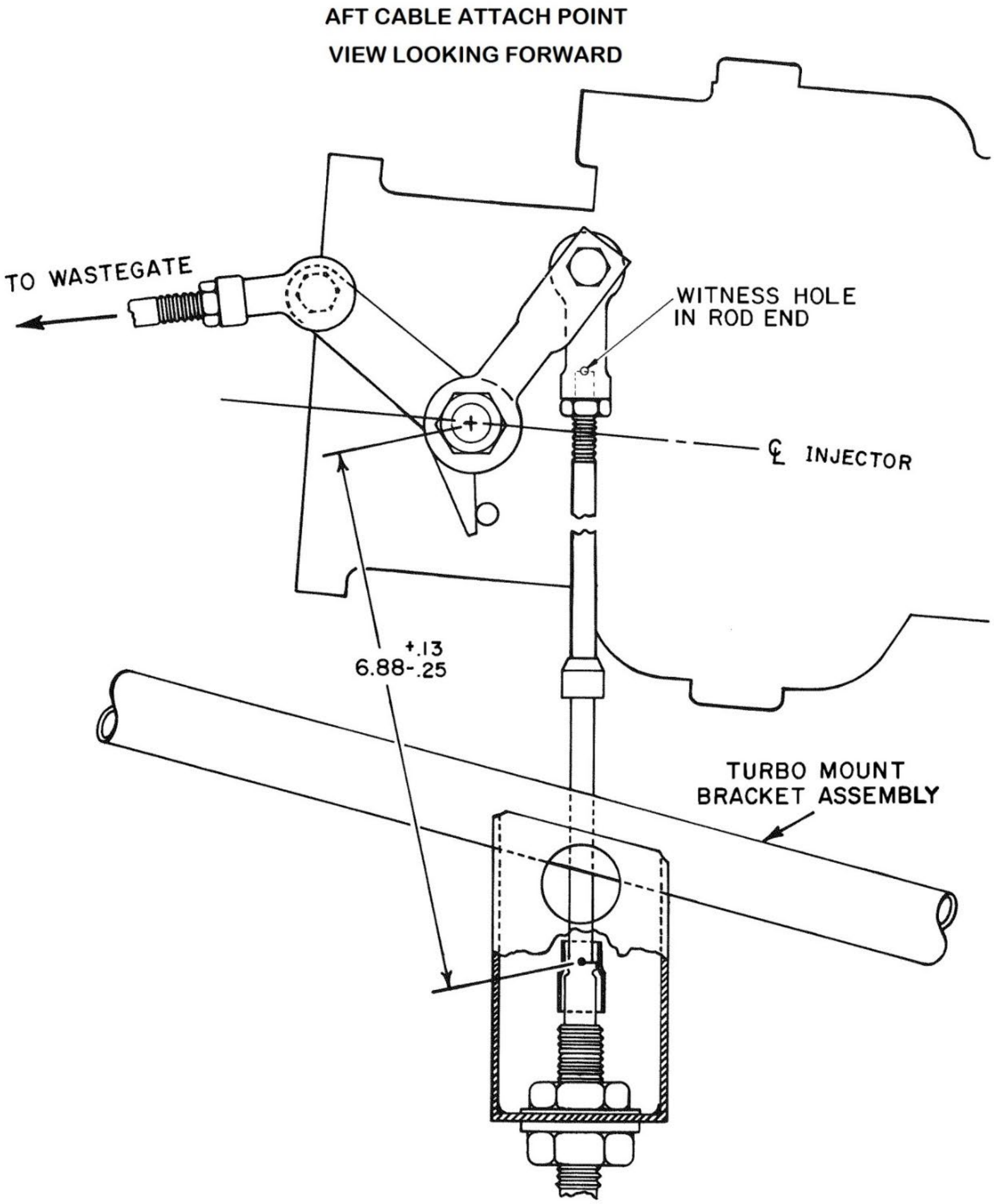


Figure 13-24. Aft Cable Attach Point

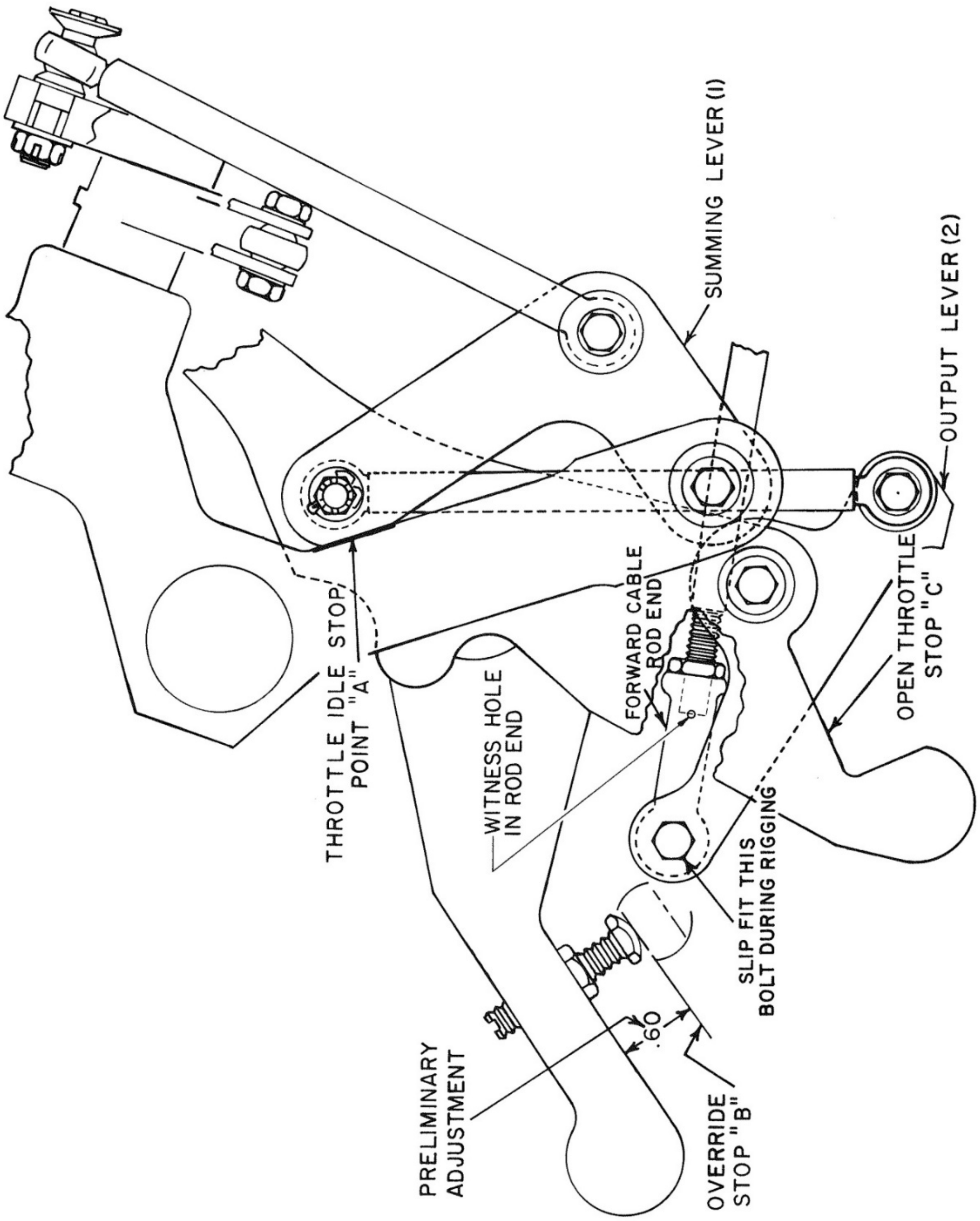


Figure 13-25. Correlator Idle Stop Position

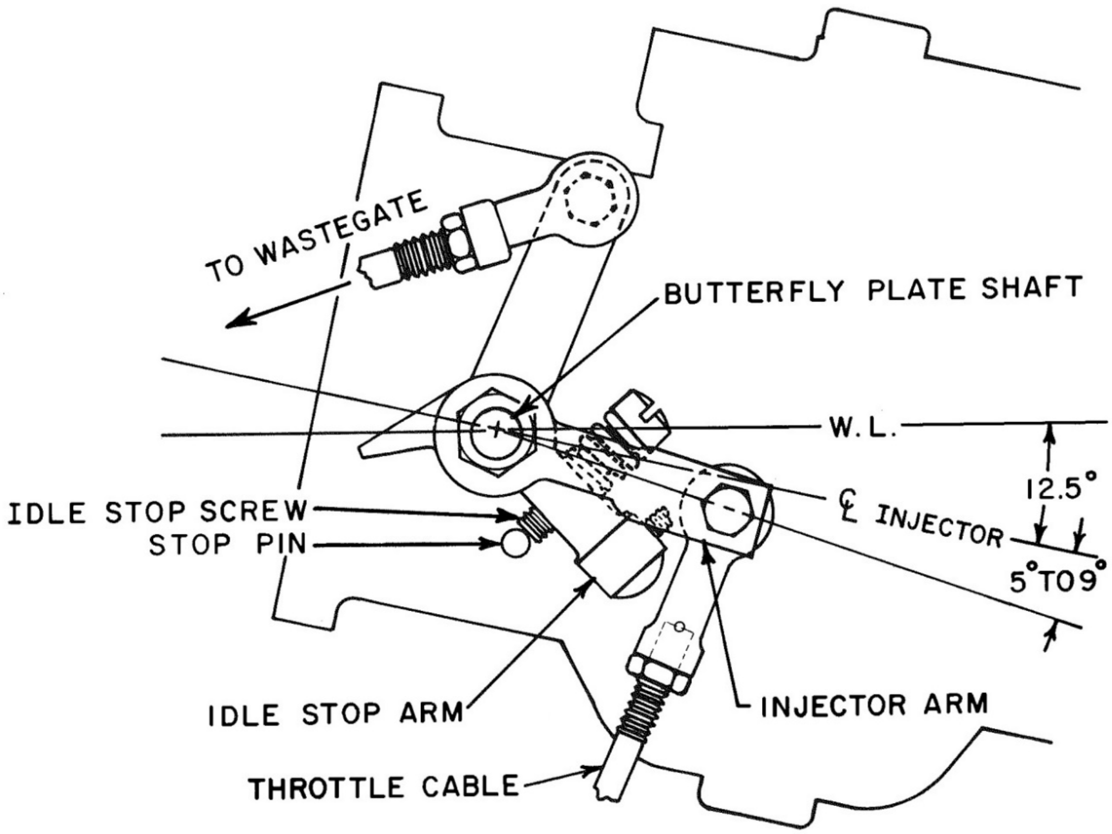


Figure 13-26. Fuel Servo Throttle Bellcrank

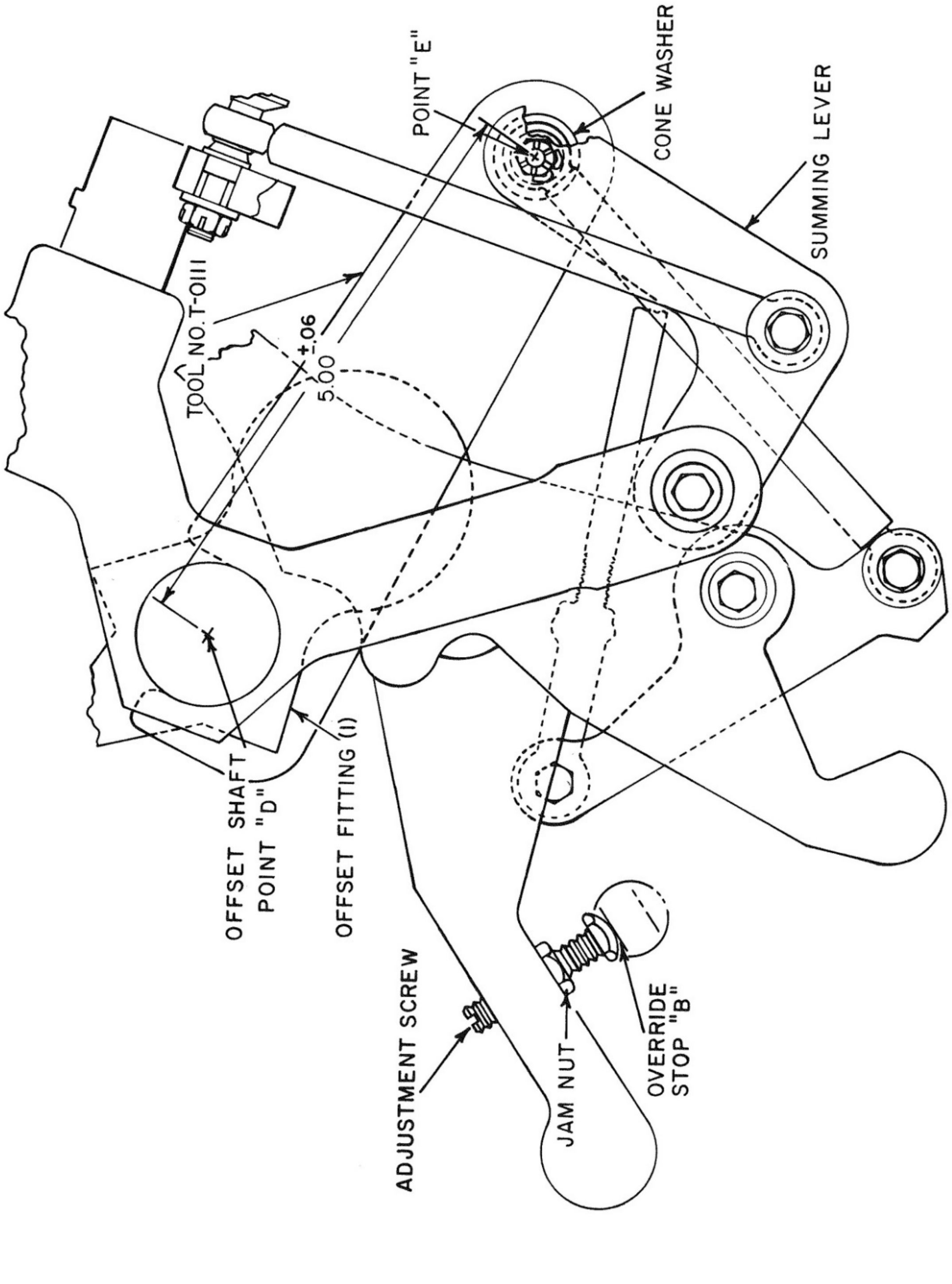


Figure 13-27. Override Stop Adjustment

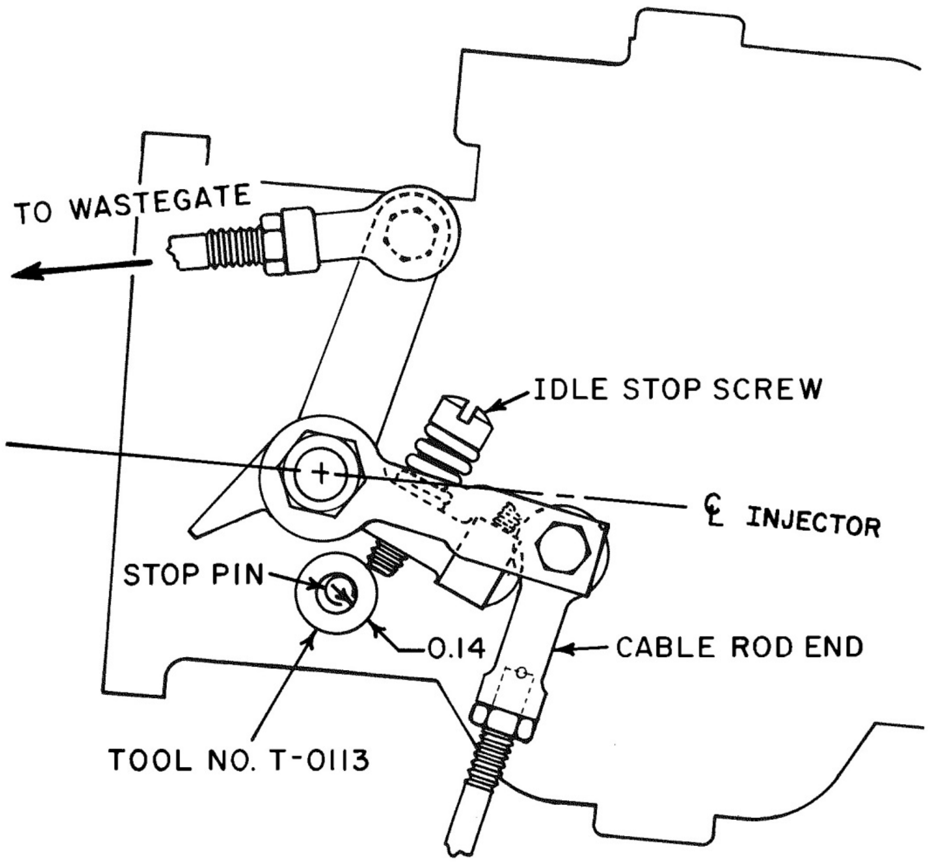


Figure 13-28. Fuel Servo with Tool No. T-0113 Installed

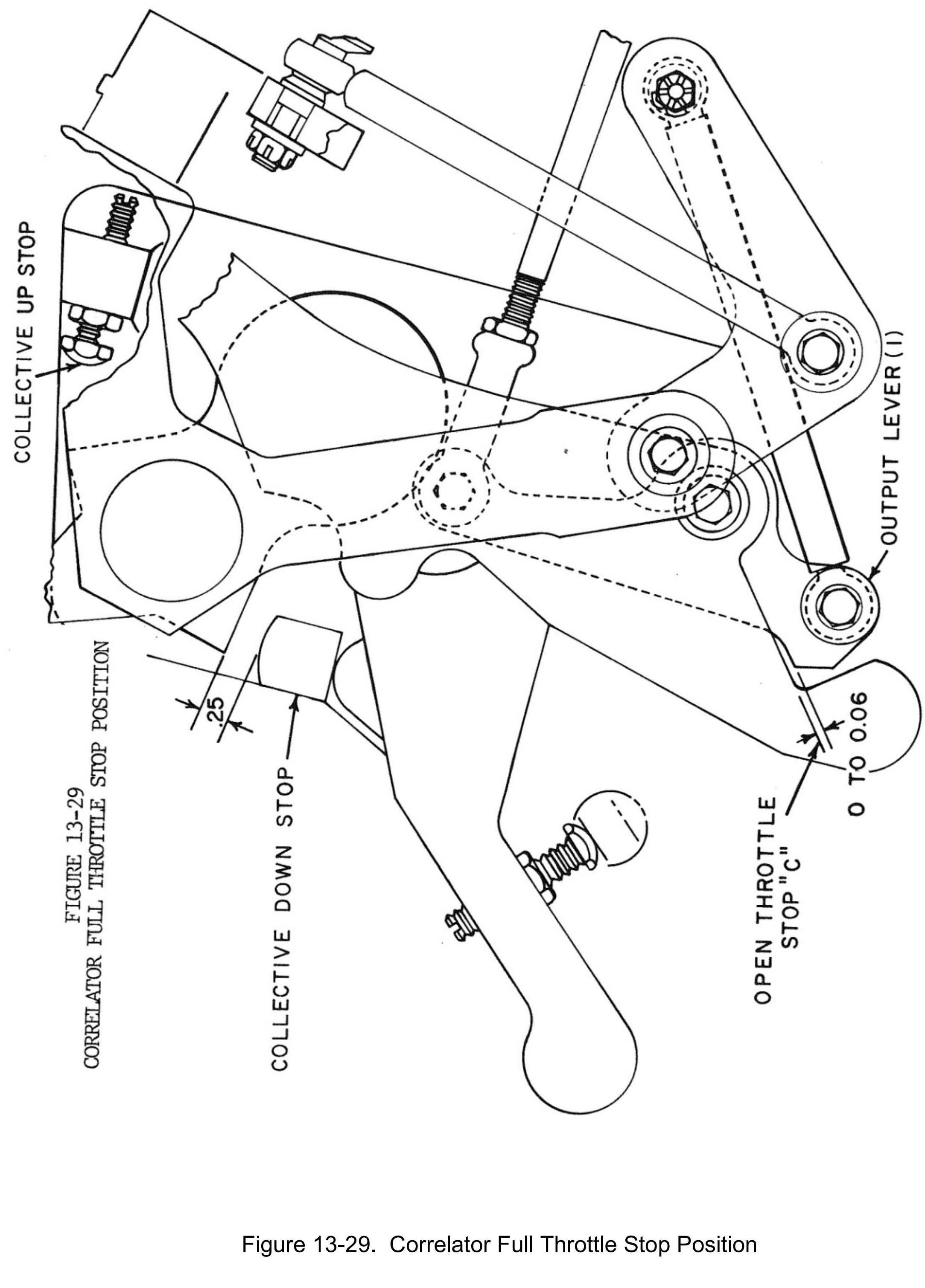


Figure 13-29. Correlator Full Throttle Stop Position

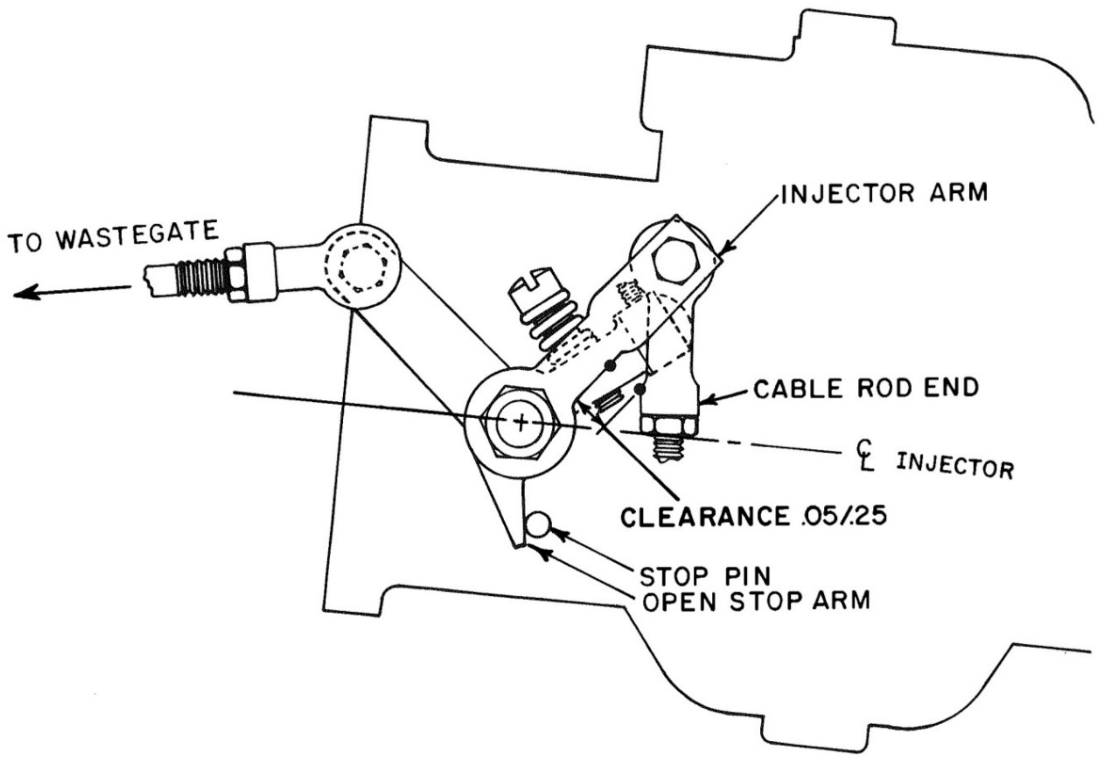


Figure 13-30. Fuel Servo Full Throttle Position

SECTION 14

UTILITY SYSTEMS

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14-1 CABIN HEAT

A. Description

Warm air used for heating the cabin is derived from a heat exchanger mounted on the exhaust muffler. The air enters this system from the engine cooling shroud and is ducted by a flexible hose to the heat exchanger. Air flows to the heater control valve which is mounted on the aft side of the firewall and regulates the air flow into the cabin area. The control is located on the left hand side of the pilot's seat for easy access to vary the temperature by pushing in to the OFF position or out to the ON position. There are three heat delivery ducts inside the cabin. The main duct is located in the center of the seat structure, with two smaller ducts located just forward of the tail rotor control pedals on either side of the cabin floor.

B. Cabin Heating System – Troubleshooting

Problem	Cause	Required Action
Exhaust fumes enter cabin when cabin heat is applied.	Crack in exhaust stack or heat exchanger.	Replace stack, heat exchanger, or repair by welding.
Insufficient heat.	Flexible hoses forward of firewall off or loose.	Connect hoses and secure with clamps.
	Control linkage disconnected or loose.	Connect linkage properly.
	Defective heater shroud.	Replace or repair heater shroud.
	Defective valve assembly.	Replace or repair valve assembly.

C. Heater Valve Assembly

(1) Heater Valve – Removal

NOTE: See Figure 14-1, View A.

(a) Remove fiberglass seat deck from cabin.

(b) Disconnect the heater control cable (1) from the heater valve (2).

(c) Disconnect and remove hose (3) from aft side heater valve.

(d) Remove the attachment screws securing heater valve to hose divider (4) and firewall. Remove valve.

(2) Heater Valve – Installation (See Figure 14-1, View A)

(a) Install heater valve (2) with valve control lever on top and align to hose divider (4) on firewall.

(b) Install attachment screws to secure valve to firewall, and torque screws.

(c) Connect heater control cable (1) to heater valve and adjust. See heater control cable installation.

(d) Connect hose (3) to aft side of heater valve and secure.

(e) Install fiberglass seat deck.

D. Heater Control Cable

(1) Heater Control Cable – Removal (See Figure 14-1, View A)

(a) Remove fiberglass seat deck.

(b) Disconnect control cable (1) at the heater valve (2).

(c) Disconnect cable clamp (6) from forward landing gear cross tube.

(d) Remove cable nut securing control knob to seat structure and pull cable out through front of seat structure.

(2) Heater Control Cable – Installation (See Figure 14-1, View A)

(a) Slide cable (1) through seat structure and install nut and lock washer on inboard side. Secure nut to mount cable control knob in place.

(b) Connect cable (1) to heater valve (2) and secure with clamp (5).

NOTE: Remove hose from aft end of heater valve (2) so valve damper is visible for cable adjustment.

(c) Adjust cable until valve is in closed position with 1/4” to 3/8” gap between seat structure and cable control knob with control knob pushed in.

NOTE: Adjustment is made by sliding cable sheath in or out at the cable clamp (5) on top side of heater control valve. Check that valve fully opens and closes after adjustment.

(d) Install hose and secure to aft side of control valve.

(e) Connect cable clamp (6) at landing gear cross tube.

(f) Install fiberglass seat deck and cushions.

E. Heater Shroud

(1) Heater Shroud – Removal (See Figure 14-1, View B)

(a) Remove hoses (7) and (9) from heater shroud (8).

(b) Remove screws along top of heater shroud.

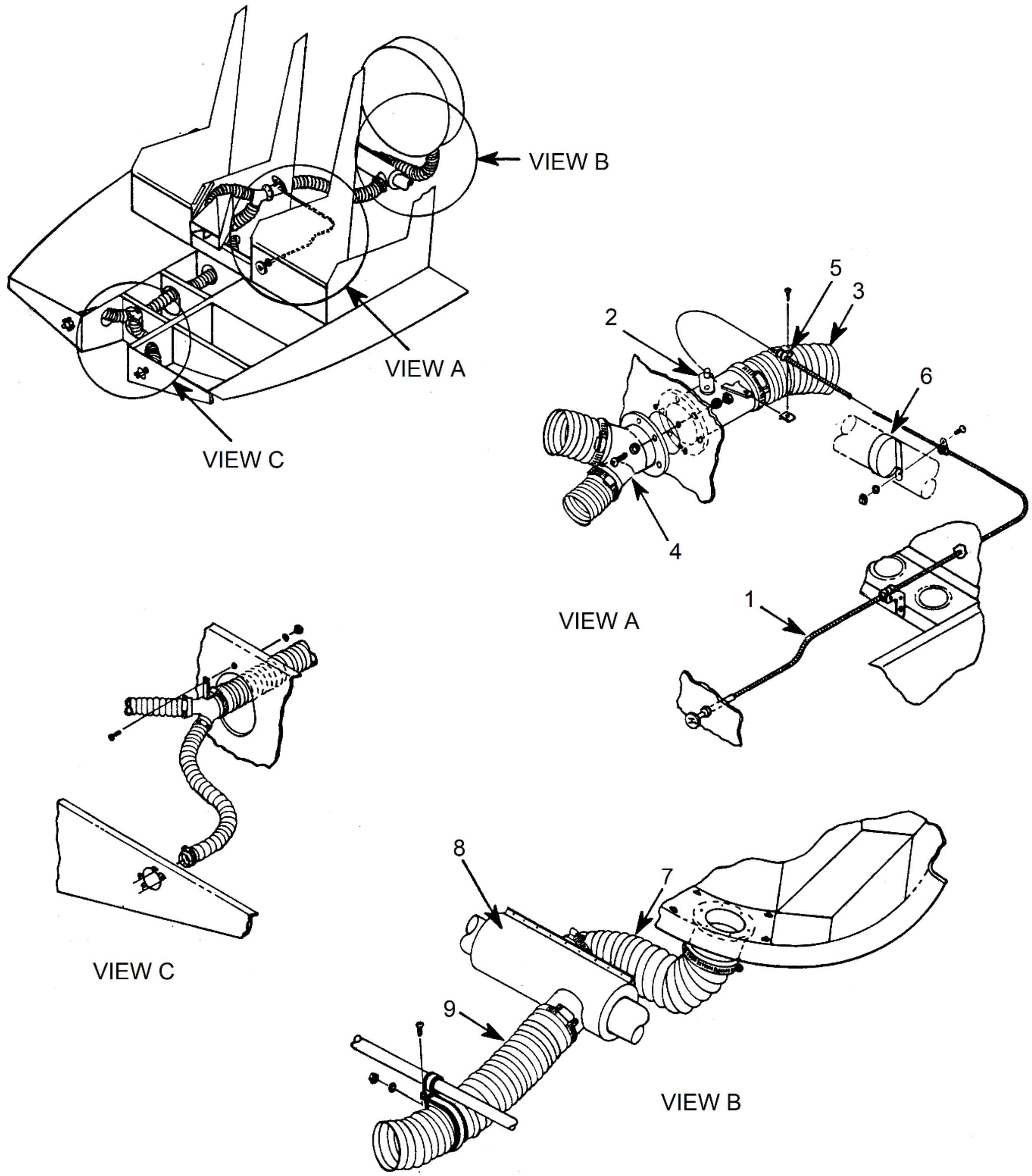
(c) Separate shroud and remove from heat exchanger.

(2) Heater Shroud – Installation (See Figure 14-1, View B)

(a) Install heater shroud (8) around heat exchanger with shroud seam on top.

(b) Install screws to secure shroud to heat exchanger.

(c) Connect hoses (7) and (9) to heater shroud and secure with hose clamps.



1.	Control Cable	4.	Hose Divider	7.	Hose
2.	Heater Valve	5.	Clamp	8.	Heater Shroud
3.	Hose	6.	Clamp	9.	Hose

Figure 14-1. Cabin Heating System

SECTION 15

SUPPLEMENT PROCEDURES

15-1 INTRODUCTION

The F-28F (1986) and 280FX Series Maintenance Manual Supplement Procedures portion of the manual (Sections 15 through 25) provided information defining the differences between the 1986 F-28F and the 280FX models from the standard F-28F and 280F helicopters. (The manual was originally published as the *F-28F and 280F Maintenance Manual*. It is currently published as the *F-28F and 280F Series Maintenance Manual*.)

Over the course of recent manual revisions, several supplement sections (Sections 16 through 20 and 22 through 25) have been integrated into the original maintenance manual. Section 15 and Section 21, *Electrical Systems and Components,* are the only supplement sections that remain active.

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SECTION 21

ELECTRICAL SYSTEMS AND COMPONENTS

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SECTION 21

ELECTRICAL SYSTEMS AND COMPONENTS

21-1. General – Reference Section 6 for Other Information

Updates to the electrical systems of the 280FX and F-28F include changes listed below:

- Combined anticollision and navigation lights and LED landing lights (Para. 21-2)
- Annunciator Panel 280FX and F-28F S/N 746 and subsequent (Para. 21-3)
- Hi/Lo rotor RPM warning system (Para. 21-7)
- Engine monitor 280FX and F-28F (Para. 7-21)
- Illuminated switch panel, radio panel, and collective control panel (Para. 21-9)

NOTE: Early F-28F aircraft do not have the annunciator panel but do have press-to-test lights for required items in Para. 21-3.

Refer to Paragraph 21-8 for the F-28F and 280FX electrical schematics.

21-2. Exterior Lighting

Refer to paragraph 21-4 for troubleshooting an inoperative LED landing light and refer to Paragraph 21-5 for replacement part numbers.

A. LED Forward and Aft Landing Lights

F-28F S/N 833 and subsequent and 280FX S/N 2167 and subsequent helicopters are equipped with LED landing lights (forward landing light standard for both models; aft landing light standard for 280FX, optional for F-28F). The installations are shown in Figure 21-1. Controls for landing light operation are provided by a forward landing light switch and an aft landing light switch on the pilot collective and co-pilot collective (if installed). The switches and location are shown in Figure 21-3.

Annunciation for the two modes of operation (“On” and “Pulse”) of the forward landing light is provided by an annunciator light installed in the upper left portion of the instrument console (Figure 21-4). The annunciator illuminates a green FWD LDG LT ON or FWD LDG LT PLS depending on the mode of operation. “On” annunciation of the aft landing light is also provided by an annunciator light installed next to the forward landing light annunciator. The annunciator illuminates a green AFT LDG LT ON when the light is in operation.

Both annunciators are readable in sunlight and include a discrete dimming feature that dims the annunciator when the PANEL LTS toggle switch located on the switch/circuit breaker panel is toggled ON.

B. Combined Anticollision and Navigation Lights

The 280FX and F-28F S/N 744 and subsequent are equipped with combined anticollision-navigation lights. These light assemblies are mounted on the outside of each vertical stabilizer, and the anti-collision light power supplies are located under the floor on either side of the cabin, as shown in Figure 21-1.

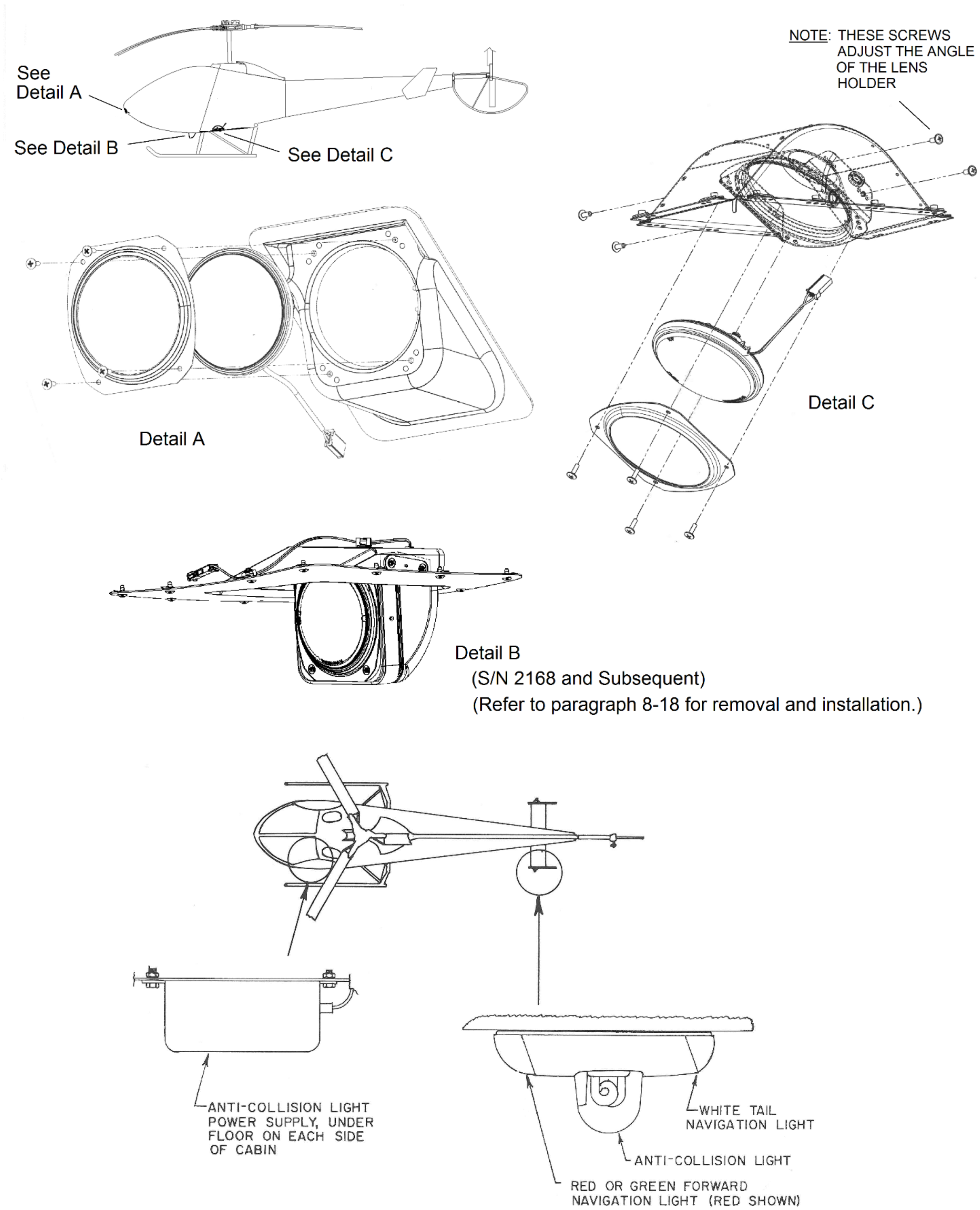

Figure 21-1. Forward and Aft Landing Light (280FX shown)
and Anti-Collision and Navigation Light Systems

21-3. Annunciator Panel

All of the warning and caution lights for 280FX helicopters are contained in an annunciator panel, which is located at the top of the instrument panel. On early production helicopters, the warning lights include LOW ROTOR RPM, CLUTCH ENGAGE, and LOW FUEL PRESS; the caution lights include OVERBOOST, MRGB CHIP, and TRGB CHIP. On later production helicopters, STARTER RELAY is added to the warning lights and LOW VOLTAGE is added to the caution lights.

The annunciator panel for F-28F helicopters was optional equipment starting with S/N 746. Later F-28F production helicopters incorporated the annunciator panel with all eight segments as standard equipment.

For aircraft equipped with the Hi/Low Rotor RPM Warning System, ROTOR RPM replaces LOW ROTOR RPM in the annunciator panel.

Pressing the “press-to-test” switch at the extreme left of the panel will illuminate all of the indicator lights.

A. Lamp Replacement – Annunciator Panel

Each indicator light contains two lamps. These lamps can be replaced as follows:

(1) Press inward on the right edge of the indicator until indicator opens.

(2) Swing indicator fully open.

(3) Grasp base of lamp firmly and pull lamp out of socket.

(4) Insert replacement lamp and push into place.

(5) Swing indicator closed.

(6) Push on left side of indicator to close.

B. Clutch Disengagement Warning Circuit

The clutch disengagement warning circuit consists of a microswitch on the clutch plate which operates a red warning light in the annunciator panel. This switch is normally closed and completes a circuit to ground when the clutch is disengaged. When the clutch snaps overcenter into the engaged position, an arm on the actuating mechanism opens the switch, which turns out the light. The “normally open” side of this switch arms the rotor rpm circuit.

If the clutch disengagement light does not go out when the clutch is engaged, or if the light comes on in flight, this indicates that the clutch is misrigged or the clutch actuator cable needs servicing. The problem must be found and corrected before the aircraft is returned to service. Press to test warning indicator on F-28F.

C. Low Fuel Pressure Warning Circuit

The low fuel pressure warning circuit comprises a pressure switch in the fuel line between the electric boost pump and the engine-driven fuel pump which activates a red light in the annunciator panel. If the pressure in this fuel line drops below 15 psi, the switch will turn on the red light. This circuit provides the pilot with a warning if the electric boost pump should fail. This light does not indicate the condition of the engine-driven fuel pump. Press to test warning indicator on F-28F.

D. Low Rotor RPM Circuit

The low rotor rpm circuit comprises a magnetic sensor in the main rotor transmission, a signal conditioning unit behind the passenger's seat, an amber light in the annunciator panel, and a warning horn. The magnetic sensor is located in the forward portion of the main rotor transmission housing. It is positioned to sense the passage of the ring gear teeth. The signal is sent to a small unit located in the backrest of the passenger's seat. The unit reads the signal from the magnetic sensor and activates the light and the warning horn.

The system is armed by the same switch which activates the clutch disengagement light. Thus, the low rotor rpm light will be on only when the clutch disengaged light is out, and the main rotor rpm is below 334. In addition, the warning horn is wired through a position switch on the collective torque tube such that the horn will not operate with the collective fully down. The horn has a pulsing tone of 2900 Hz at 80-95 decibels.

After the engine is started, the following sequence should occur in the annunciator panel. The red clutch disengagement light will be on until the clutch is engaged. When the clutch snaps into the engaged position, the red clutch disengagement light will go out and the amber low rotor rpm light will turn on. The low rotor rpm light will remain on until the rotor rpm exceeds 334. The horn will sound if the rotor rpm is below 334 and collective is raised off the lower stop.

This system is set to trigger the light and horn at 334 rpm ±1 rpm. The system can be adjusted with a potentiometer on the top of the signal conditioning unit. The position of the magnetic sensor was set at the factory and will need no readjustment. Contact Enstrom Product Support for service on the magnetic sensor. For electrical schematic see Diagram 21-4, for RPM adjustment on low rotor indicator see Figure 21-2.

E. Hi/Lo Rotor RPM Circuit

F-28F S/N 831 and subsequent and 280FX S/N 2136 and subsequent are equipped with a Hi/Lo Rotor RPM Circuit. Refer to paragraph 21-7 for maintenance procedures.

F. Overboost Circuit

The overboost circuit consists of a pressure switch behind the instrument panel and connected to the manifold pressure line which activates an amber warning light in the annunciator panel. The light will illuminate between 37.0 and 40.5 in-Hg manifold pressure. The light may be triggered by short pressure pulses which will not appear on the manifold pressure gauge. The manifold pressure gauge is the primary manifold pressure indicator, while the annunciator panel is a secondary indicator. The manifold pressure gauge should be used to determine severity of any overboost.

G. Main and Tail Rotor Gearbox Chip Detectors

The main and tail rotor gearboxes are equipped with magnetic chip detectors which operate amber lights in the annunciator panel. There is a separate circuit and light for each gearbox. When a chip attaches to the chip detector, it completes a circuit to ground, turning on the light. Further information regarding the chip detection system, refer to Paragraph 4-62, Paragraph 10-5.1, and Paragraph 11-6.1.