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TO: HOLDERS OF MAINTENANCE MANUAL REPORT NO. 72-00-95 FOR TURBOPROP AIRCRAFT ENGINE PART NUMBERS, MODEL NUMBERS, AND AIRCRAFT APPLICATIONS LISTED BELOW.

ENGINE PART NO.	ENGINE MODEL NO.	AIRCRAFT APPLICATION
895720-1/-2/-3	TPE331-5-251K	Turbo Commander 690/690A/690B
896160-1/-2/-3	TPE331-6-251M	Mitsubishi MU-2J/2K/2L/2M
896950-1-1/-2/-3	TPE331-5-251C	Casa 212
3101300-2	TPE331-6-252M	Mitsubishi MU-2J/2K/2L/2M
3101630-1	TPE331-6-252B	Beech B100
3101840-1	TPE331-5-252M	Mitsubishi MU-2N/2P
*3102450-1	TPE331-6A-251M	Mitsubishi MU-2J/2K/2L/2M
*3102520-1	TPE331-5-252K	Turbo Commander 690A/690B
*3102520-2	TPE331-5-254K	Turbo Commander 690C

*Coverage added this revision.

REVISION NO. 5 DATED MARCH 28, 1980

Due to the extent of the changes involved in this revision, this publication has been reprinted in its entirety. Please remove and discard all pages of prior issues and all temporary revisions. Replace with Revision 5, dated March 28, 1980. Pages which have revised technical information are listed below, together with highlights of the revision.

HIGHLIGHTS

Chapter/Section/Pages | Description of Change

72-00-95

NOTE: Equipment identification coding system has been simplified in this revision and new identification system is reflected throughout the manual.

Illustrated parts list cross reference information has been added to keys of all exploded view illustrations.

Whenever various sections of the manual must be used to disassemble engine, sequence of disassembly instructions have been provided where needed.

A new tab divider concept, with a table of contents following each tab, has been incorporated to aid the user in locating specific material.

COMPLETE REISSUE

Chapter/Section/Pages	Description of Change
NOTE: (Cont)	Coverage for three additional engines have been added. They are TPE331-5-252K, TPE331-5-254K and TPE331-6A-252M. Added new codes throughout to reflect additional engines. The letter R is used throughout this manual to indicate change in text on pages prepared by automated means. Pointing hands in the image area are used to indicate changes on illustrations. Illustrations new to a revised manual (or illustration changes that cannot be suitably indicated by pointing hands) are indicated by the letter R on the left margin outside the image area.
Service Bulletin List	Updated to include new and revised service bulletins.
Spare Parts Bulletin List	Updated to include new and revised spare parts bulletins.
Introduction	
Pages 1 through 8	Revised instructions to aid user in use of maintenance manual.
Pages 9 through 104	Added configuration identification tables.
Pages 105 through 108	Updated applicable publications list.
70-00-00	
Page 7	Added procedure for installation of conical seals.
Page 12	Added lockwire information.
72-00-00	
Page 123	Revised minimum deadhead pressure of unfeathering pump.
Page 162	Added inspection of oil pressure pump rotor sets to trouble shooting procedure.
Page 187	Added trouble shooting procedure for slow acceleration; engine will not reach maximum power; engine overspeed with propeller on start locks.
Page 312	Clarified fuel microbicide use requirements.

Chapter/Section/Pages	Description of Change
72-00-00 (Cont)	
Pages 501 through 598.10	Separated operational check requirements and adjustment requirements to improve usability of manual.
Pages 527 through 530	Identified fuel manifold testers which contain pressure regulators.
Page 535	Added procedure for using conical seals to repair fuel leakage.
Page 540	Revised oil filter contamination/oil filter analysis check.
Pages 542 through 547	Added tables for fuel control rates and sequence of adjustments.
Page 547 through 555	Revised and clarified specific gravity adjustments after changes in fuel type.
Pages 555 through 558	Revised illustration to clarify adjustment point for acceleration schedule.
Page 605	Added inspection requirements for pneumatic tube assembly flares and sleeves.
Pages 612, 613	Added inspection procedure for checking contamination of oil system after gearbox repairs.
Pages 614 through 618	Added inspection criteria for abnormal deceleration.
Pages 619, 620	Added inspection criteria for lightening strike.
Pages 623, 624	Revised to clarify criteria for turbine section (hot section) inspection.
72-10-02	
Page 204	Added wear tolerances for propeller pitch control sleeve assembly.
72-10-09	
Page 202	Updated special tools, fixtures and equipment list.
Pages 209 through 229	Revised nose cone assembly procedure to provide simplicity and clarity

Chapter/Section/Pages	Description of Change
72-10-10	
Pages 202 through 207	Separated procedures and illustrations for different configurations of diaphragm oil tubes and jets to provide clarity and identification by service bulletin.
72-10-12	
Pages 203, 204	Added procedure for replacement of bull gear bearing retainer.
72-10-13	
Page 209	Identified gearcase oil scavenge tubes which cannot be replaced without separation of diaphragm.
Pages 212 through 217	Added procedure for separating diaphragm for inspection or maintenance.
Pages 232 through 234	Added repair procedure for damaged insert or threaded boss in diaphragm.
Pages 235 through 240	Added inspection and repair procedure for gearcase oil scavenge pump.
72-10-15	
Pages 201, 202	Updated special tools, fixtures and equipment list.
Pages 207, 208	Added usage of upgraded special tools during drilling and pinning operations.
72-10-16	
Pages 201 through 215	Revised and clarified removal and installation of torque sensor and associated components.
Pages 234 through 251	Added procedure for use of 293138-1 torque sensor calibrator during torque sensor calibration.
Pages 251, 252	Added inspection and repair procedure for oil transfer adapter strainers.
72-10-18	
Pages 206 through 210	Revised and expanded approved repairs for oil pressure pump.

Chapter/Section/Pages	Description of Change
72-10-20	
Page 208	Added inspection criteria for oil leakage and damaged torque sensor mounting arm insert on input housing.
Page 215	Added repair procedure for damaged insert at mount hole for torque sensor arm.
Page 216	Added repair procedure for oil leakage around input housing studs.
72-30-03	
Page 201 through 212	Added new section to incorporate maintenance practices for combustion transition liner.
72-40-01	
Page 205	Added minimum radius for bends in thermocouple harness.
Page 208	Revised resistance requirements for ITT sensor assembly circuit.
Page 209	Added inspection criteria for plenum chamber shouldered bolts.
72-50-04	
Pages 203, 204	Revised inspection criteria for turbine scavenge pump assembly.
72-50-06	
Page 202	Updated special tools, fixture and equipment table.
Pages 209, 210, 211, 218, 219	Revised procedure for removal or installation of main shaft nut when main shaft has internal threads.
Pages 209 through 219	Incorporated revised disassembly and assembly procedures to simplify build procedures when minimum or no parts have been replaced.
Page 219	Added CAUTION to ensure main shaft nut is cleaned of excessive lubricating compound to prevent oil system contamination.
Page 219	Added minimum radius for bends in ITT sensor assembly.

Chapter/Section/Pages	Description of Change
72-50-06 (Cont)	
Page 224	Revised inspection criteria for turbine bearing support assembly.
72-50-07	
Page 205	Added CAUTION to ensure protective coverings are removed from turbine wheel knife seals prior to installation.
Page 206	Revised inspection criteria for curvic coupling gaskets.
Pages 206 through 211	Revised inspection criteria for turbine wheels.
Pages 211 through 214	Revised inspection criteria for third stage stator assembly.
72-50-08	
Pages 210, 211, 214, 215	Revised procedure for measurement of replacement curvic coupling.
Pages 211, 212, 213	Revised and simplified procedure for assembly of first stage stator and liner assembly.
Page 222	Revised inspection criteria for curvic coupling gaskets.
Page 225	Revised inspection criteria for segmented shroud.
Pages 226, 227	Revised inspection criteria for first stage turbine wheel.
Pages 231, 232	Revised inspection criteria for first stage turbine stator vane section.
Page 236	Revised inspection criteria for second stage stator assembly.
72-50-10	
Pages 201 through 214	Added new section to simplify procedure for turbine bearing and bearing support (carrier) maintenance practices when further disassembly is not required.
73-10-09	
Pages 220, 221, 222	Revised procedure for installation of nozzle tip and key washer.

Chapter/Section/Pages	Description of Change
73-10-09 (Cont) Pages 222, 223, 224	Incorporated use of conical seals to repair fuel manifold and nozzle assembly fuel leakage.
73-20-01 Page 209	Revised procedure for grease packing of fuel control drive coupling.
73-21-03 Pages 201 through 206	Added new section to simplify maintenance practices for inlet temperature and pressure sensor.
Page 205	Incorporated inspection procedures for checking stroke of inlet temperature and pressure sensor bellows.
73-21-03 Pages 201 through 214	Added new section to simplify maintenance practices for fuel filter.
73-21-04 Pages 201 through 208	Added new section to simplify maintenance practices for fuel enrichment and pressurizing valves.
73-21-05 Page 207	Added CAUTION to prevent damage to fuel control unit caused by prying during removal.
Pages 220 through 222	Clarified procedure for removal and installation of coupling.
74-10-01 Pages 209, 210, 211	Revised ignition system removal and installation on TPE331-6-252B to incorporate SB 74-0002.
Pages 215, 216	Added repair procedure for ignition leads.
75-10-01 Pages 205 through 211	Revised to incorporate SB 72-0195 pertaining to TPE331-6-252B.
75-10-02 Pages 201 through 206	Revised to incorporate SPB-TPE0106.

Chapter/Section/Pages	Description of Change
76-10-01 Pages 201 through 240	Revised to identify optional length studs and update illustrations.
77-10-01 Pages 201 through 204	Revised to include recessed plug removal/installation.
77-10-03 Pages 201, 218	Revised to include maintenance practices for torque pressure transducer and torque indicator.
77-10-04 Pages 201 through 204	Added Chapter/Section/Subject for torque pressure adapter.
77-20-03 Pages 201 through 234	Revised to incorporate SB 72-0195, SB 77-0007 and SPB-TPE0119.
Page 212	Added minimum radius for bends on thermocouple harness.
Pages 216, 217	Added source information for obtaining digital voltmeter used during temperature testing.
Pages 218 through 221	Revised procedure for checking resistance of thermocouple harness and ITT sensor assembly.
79-10-01 Page 204	Corrected oil tank illustration.

VOLUME I

TURBOPROP AIRCRAFT ENGINE

PART NO.	MODEL NO.
895720-1	TPE331-5-251K
895720-2	TPE331-5-251K
895720-3	TPE331-5-251K
896160-1	TPE331-6-251M
896160-3	TPE331-6-251M
896160-5	TPE331-6-251M
896950-1-1	TPE331-5-251C
896950-2	TPE331-5-251C
896950-3	TPE331-5-251C
3101300-2	TPE331-6-252M
3101630-1	TPE331-6-252B
3101840-1	TPE331-5-252M
3102450-1	TPE331-6A-251M
3102520-1	TPE331-5-252K
3102520-2	TPE331-5-254K

REPORT NO. 72-00-95
(FAA APPROVED)
Apr 1/74
Revised Mar 28/80

LIST OF EFFECTIVE PAGES
72-00-95

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Record of Temporary Revision	-	Mar 28/80		23	Mar 28/80
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RECORD OF REVISIONS

REV NO.	ISSUE DATE	DATE INSERTED	BY	REV NO.	ISSUE DATE	DATE INSERTED	BY
1	Dec 15/75						
2	June 1/75						
3	Oct 20/76						
4	June 19/78						
R 5	Mar 28/80						

RECORD OF TEMPORARY REVISIONS

REV NO.	CHAP/SEC/SUBJ PAGE NO.	DATE ISSUED	DATE INSERTED	BY	DATE REMOVED	BY	INCORPO-RATED INTO MANUAL BY REV NO.

SERVICE BULLETIN LIST

Service Bulletin No.	Incorp.	Title
606, Rev 13	No Effect	Engine - TBO - Time Between Overhaul Intervals
613, Rev 2	Apr 1/74	Engine - Power Section - Replace Restrictor Assembly
R 617, Rev 12	Mar 28/80	Engine Fuel and Control - Distribution - Fuel Manifold and Nozzle Assembly Maintenance
644	Apr 1/74	Engine Flow Divider and Drain Valve - Drain Port Leakage
72-0009, Rev 1	No Effect	Engine - Air- Oil Turbine Seal - Replace Seal
72-0017	No Effect	Engine - Power Section - Rework or Replace Torque Sensor
72-0019, Rev 6	No Effect	Engine - Service Life - Service Limits of Critical Life Limited Components
72-0027, Rev 9	Mar 28/80	Engine - Fuel Control Assembly - Inspection and lubrication of Drive Coupling and Internal Splines of Fuel Pump Assembly and Oil Pump Assembly
72-0029, Rev 2	No Effect	Engine - Gearshaft Assemblies - Internal Plug Retention
72-0032	No Effect	Engine - Torque Indicating System - Remove and Replace Controller
72-0038, Rev 2	No Effect	Engine - Propeller Governor Assembly - Remove and Replace
72-0042, Rev 2	Oct 20/76	Engine - Engine Indicating - Installation of One Piece ITT Sensor Assembly and New Second Stage Stator
72-0044	Apr 1/74	Engine Operational Check NTS Lockout and Propeller Governor Reset System

SERVICE BULLETIN LIST (CONT)

Service Bulletin No.	Incorp.	Title
72-0046	No Effect	Engine - Reduction Gear Assembly - Remove and Replace Matched Intermediate Gearbox Housing Assembly Set
72-0049, Rev 1	Apr 1/74	Engine - Reduction Gear Section - Positive Retention of the Planetary Drive Helical Gearshaft Front Bearing
72-0052, Rev 3	Oct 20/76	Engine - Turbine Section - Installation of Three Piece First Stage Stator and Liner Assembly
72-0061, Rev 1	Dec 15/74	Engine - Reduction Gear Section - Installation of Modified Fuel Control Drive
72-0064, Rev 2	Dec 15/74	Engine - Reduction Gear Section - Installation of High Speed Pinion Journal Bearings
72-0072, Rev 1	No Effect	Engine - Preformed Packings (O-Rings) Conversion Table
R 72-0077, Rev 4	Mar 28/80	Engine - Reduction Gear and Shaft Section - Replacement of the Oil Scavenge Pump Assembly and the Inlet Tube and Screen Assemblies
72-0087, Rev 2	Oct 20/76	Engine - Turbine Section - Replacement of Hydraulic Turbine Bearing Support Mount Retainer and Inspection of Propeller Pitch Control Assembly on Selected Engines
72-0089, Rev 3	Oct 20/76	Engine - Turbine Section - Modification to Provide Dampening Capability for Turbine Bearing Mount
72-0090	No Effect	Engine - Intermediate Gearbox - Replace Retainer Part No. 868188-1 With Retainer Plate Part No. 896092-1
72-0091, Rev 1	No Effect	Engine - Reduction Gear and Shaft Section - Replace Packing Within Propeller Pitch Control Sleeve

SERVICE BULLETIN LIST (CONT)

Service Bulletin No.	Incorp.	Title
72-0092, Rev 5	Oct 20/76	Engine - Reduction Gear and Shaft Section - Inspection and/or Replacement of Oil Transfer Tube Part No. 3101187-1 and Replacement of Lubricating Adapter and Associated Parts
72-0095, Rev 4	Oct 20/76	Engine - Reduction Gear and Shaft Section - Inspection and/or Rework of Fuel Control Drive
72-0096	No Effect	Engine - Shipping Plates and Covers - Installation of Flow Restrictor Part No. 865706-6
72-0098, Rev 2	No Effect	Engine - Reduction Gear and Shaft Section - Replace Compressor Air and Oil Seal and Air Oil Seal Rotor
72-0102, Rev 2	No Effect	Engine - Reduction Gear and Shaft Section - Replace Torsion Shaft Bushings with Bushings of Improved Material
R 72-0104, Rev 6	Mar 28/80	Engine - Reduction Gear and Shaft Section and Fuel Controlling - Installation - of Oil Lubricated Fuel Pump Splined Drive Coupling and Rework or Replacement of Oil Pressure Pump Assembly
72-0107, Rev 2	Nov 28/79	Engine - Reduction Gear and Shaft Section - Replace Oil Transfer Adapter Assembly and Oil Transfer Tube
72-0111, Rev 2	No Effect	Engine - Reduction Gear Section Replace Torque Sensor Assembly Incorporating Welded Pins
72-0113, Rev 2	No Effect	Engine - Housing Assembly - Incorporation of New Matched Intermediate Gearbox Set Housing Assembly (Common Diaphragm)
72-0114	June 19/78	Engine - Propeller Shaft - Replace Mount Bolts and Add Key Washer on Propeller Shaft Bearing

SERVICE BULLETIN LIST (CONT)

	Service Bulletin No.	Incorp.	Title
	72-0115, Rev 4	No Effect	Engine - Propeller Pitch Control Assembly - Replace Propeller Pitch Control Sleeve Assembly
R	72-0119, Rev 2	Mar 28/80	Replace Long Torsion Shaft with Short Torsion Shaft with Bronze Bushing
	72-0120	No Effect	Engine - Conversion - Convert Engine Model TPE331-6-251M to Engine Model TPE331-6-252M
	72-0122	No Effect	Engine - Intermediate Gearbox Housing - Replace Bearing Plate Retainer Part No. 868190-1
	72-0126, Rev 1	No Effect	Replace Combustion Chamber with Redesigned Combustion Chamber to Reduce Carbon Formation
	72-0130	No Effect	Engine - Power Section - Convert Engine to Module Concept (Deletes Power Section)
	72-0133	No Effect	Engine - Power Section - Convert Engine to Module Concept (Deletes Power Section)
	72-0154	No Effect	Engine - Power Section - Convert Engine to Module Concept (Deletes Power Section)
	72-0159	No Effect	Engine - Air - Anti-Ice Tube Installation - Install Tube Assemblies With Drilled "B" Nuts for Lockwire Provision
	72-0162	No Effect	Engine - Nose Cone Assembly and Intermediate Housing Assembly - Incorporate Module With Wide Gears for Commonality
	72-0163	No Effect	Engine - Intermediate Housing and Gear Assembly - Incorporate Module With Wide Gears for Commonality

SERVICE BULLETIN LIST (CONT)

Service Bulletin No.	Incorp.	Title
72-0169	No Effect	Engine - Nose Cone Assembly and Intermediate Housing and Gear Assembly - Incorporate Module With Wide Gears for Commonality
R 72-0170, Rev 1	Mar 28/80	Engine - Intermediate Housing and Gear Assembly - Incorporate Anti-Rotation to Helical Drive Gearshaft Bearing Outer Race
R 72-0173 R R	No Effect	Engine - Combustion - Replace Certain Turbine Section Components Coated for Marinization
R 72-0175, Rev 1 R	No Effect	Engine - Power Section - Intermediate Housing and Gear Assembly
R 72-0181 R R R	No Effect	Engine - Propeller Governor - Distribution of Woodward Service Bulletin No. 33565 - New Propeller Governor Pump Idler Gear Stud
R 72-0182 R R	Mar 28/80	Engine - Input Housing Assembly - Incorporate Aluminum Input Housing Assembly
R 72-0185 R R	No Effect	Engine - Torque Sensor Assembly - Replace Key With Pin to Prevent Gear Movement
R 72-0190 R R	Mar 28/80	Engine - Manual - Reference Maintenance Material to Maintain Engine Model TPE331-6A-251M
R 72-0194 R R R	No Effect	Engine - Power Group Module - Replace or Rework Bearing Support Assembly Part No. 865042-1 and Add Retaining Ring Part No. 3101891-1 (Cancelled)
R 72-0195, Rev 1 R R	Mar 28/80	Engine - Anti-Ice Valve Installation - Reposition Anti-Ice Valve and Relocate Compensating Resistor
R 72-0196 R R	No Effect	Engine - Oil Flow Metal Tube Assembly - Replace Propeller Shaft Seal Plug Packing

SERVICE BULLETIN LIST (CONT)

	Service Bulletin No.	Incorp.	Title
R R R	72-0197	No Effect	Engine - Fuel Control Drive Gear Train - Replacement of Tachometer Spur Drive Gearshaft
R R R R	72-0199	Mar 28/80	Engine - Power Group Assembly - Install Power Group Assembly Incorporating Die-Cast First Stage Compressor Diffuser Assembly (Crossover Duct)
R R R	72-0201	No Effect	Engine - Intermediate Housing Oil Supply Tube Assembly - Replace Clamp on Metal Oil Transfer Tube
R R R	72-0208	No Effect	Engine - Manual - Reference Maintenance Material to Maintain Engine Model TPE331-5-252K
R R R R	72-0215	Mar 28/80	Engine - Input Housing Assembly - Incorporate Aluminum Housing Assembly (Applicable to Model TPE331-6A-251M, PN 3102450-1, SN P20579 only)
	73-0005	No Effect	Engine Fuel Control - Torque Limiting - Replace Torque Limiter Assembly
	73-0006	No Effect	Engine Fuel and Control - Body and Relief Valve - Stake Retainer
	73-0007	No Effect	Engine Fuel and Control - Fuel Control Assembly - Rework Fuel Control
	73-0009, Rev 2	Oct 20/76	Engine - Fuel System - Installation of Heated Pneumatic Lines and Ground Jumper Assemblies
	73-0010, Rev 1	No Effect	Engine - Fuel Control Assembly - Addition of Screened Fittings
	73-0012, Rev 2	Oct 20/76	Engine - Fuel System - Installation of Heated Pneumatic Lines and Ground Jumper Assemblies
	73-0013	No Effect	Engine - Fuel Nozzle and Manifold Assemblies - Remove and Replace

SERVICE BULLETIN LIST (CONT)

Service Bulletin No.	Incorp.	Title
73-0017, Rev 3	No Effect	Engine - Engine Fuel and Control - Remove and Replace Flow Divider and Drain Valve
73-0022, Rev 3	June 19/78	Engine - Engine Fuel and Control - Relocation of P_3 Filter and Installation of Test Fitting
73-0023, Rev 1	No Effect	Engine - Engine Fuel and Control - Rework to Provide Heated Orifice for Fuel Control
73-0024, Rev 1	No Effect	Engine - Engine Fuel and Control - Rework to Provide Heated Orifice for Fuel Control
73-0026, Rev 3	No Effect	Engine - Engine Fuel and Control - Install Tee Fitting to Facilitate Testing of Fuel Nozzle and Manifold Assemblies
73-0027	Dec 15/74	Engine Fuel and Control - Controlling Distribution of Bendix Service Bulletin GT No. 70 Which Provides Modification to Incorporate a Spring Loaded Drive Spline Coupling to the Fuel Control
73-0028, Rev 2	Oct 20/76	Engine Fuel and Control - Controlling - To Replace Fuel Control Support Assembly and Provide Check to Ensure the Security of the Engine Mounted Fuel Control Assembly
73-0029, Rev 1	No Effect	Engine Fuel and Control - Controlling - To Provide Additional Security of Attachment Between the Fuel Control Assembly and the Rear Support Bracket Assembly
73-0030, Rev 2	No Effect	Engine - Controlling - Distribution of Bendix Service Bulletin GT No. 71 Which Provides Modification to Incorporate a New or Reworked Start Flow Adjustment Valve

R

SERVICE BULLETIN LIST (CONT)

Service Bulletin No.	Incorp.	Title
73-0032	No Effect	Engine - Fuel - Distribution of Vickers Service Bulletin 406138-28-1 Which Provides for Rework of Fuel Pump Relief Valve
73-0035, Rev 3	Oct 20/76	Engine - Fuel - Installation of Pneumatic Connection for Fuel Line Purge System
73-0036, Rev 2	Oct 20/76	Engine Fuel and Controlling - Controlling - To Change Shim Installation on Fuel Control Assembly Mounting and Increase Torque on Mount Bolts
73-0038	Oct 20/76	Engine - Fuel - Installation on Pneumatic Connection for Fuel Line Purge System
73-0039	No Effect	Engine - Fuel - Fuel Pump Replacement
73-0040	No Effect	Engine - Fuel Controlling - Incorporate New Check Valve Housing on Fuel Control (Bendix Service Information Letter No. 15)
74-0049	Oct 20/76	Engine - Fuel Controlling - Distribution of Bendix Service Information Letter No. 14 Temperature Compensator Bendix Model TS-R1 Modification to Incorporate Additional Bimetallic Discs
73-0051, Rev 1	June 19/78	Engine - Fuel Replace Fuel Pump Assembly With Pump Incorporating Mounting Flange Integral With Pump Body
73-0053, Rev 1	June 19/78	Engine - Fuel Controlling - Distribution of Bendix Service Information Letter No. 17R2, Inspection of Fuel Control Maximum Condition Lever Quadrant Angle
R 73-0054, Rev 2	Mar 28/80	Engine - Fuel - Replace Fuel Control Assembly Insulator (Spacer) Part No. 693939 With Aluminum Spacer Part No. 897353-1

SERVICE BULLETIN LIST (CONT)

	Service Bulletin No.	Incorp.	Title
	73-0055	June 19/78	Engine - Fuel Controlling - Distribution of Bendix Service Bulletin Bendix Model DP-K2, Replacement of Fuel Inlet Filter Assembly
R	73-0059	Mar 28/80	Engine - Fuel - Replace Fuel Pump With Pump Incorporating Integral Mount Flange
R	73-0064	No Effect	Engine - Fuel Controlling - Distribution of Bendix Service Bulletin GT-92, Revision 1, Fuel Control, Bendix Model DP-K2, Incorporation of New Fuel Inlet Filter
R	73-0065	No Effect	Engine - Fuel Pump Assembly - Replace or Rework Centrifugal Fuel Pump Shouldered Shaft Part No. 895215-1
R	73-0068	No Effect	Engine - Fuel Pump - Replace Shaft and Impeller Assembly Part No. 869904-11 With Part No. 869904-12 and Delete Shaft Oil Seal Part No. 897365-1
R	73-0076	No Effect	Engine - Fuel Pressure Regulator - Incorporate Improved Fuel Pressure Regulator Valve Part No. 394312-X
R	73-0085	Mar 28/80	Distribution of Bendix Service Bulletin GT-99R1 - Removal of Inlet Screen from Start Fuel Flow Adapter Assembly
	74-0001, Rev 2	No Effect	Engine - Ignitor Plug - Replace Ignitor Plug
R	74-0002	Mar 28/80	Engine - Ignition Lead Installation - Reroute Ignition Lead to Eliminate ITT Electrical Signal Interference
	75-0002, Rev 3	No Effect	Engine - Anti-Icing - Rework Anti-Icing Solenoid Valve
R	76-0002	No Effect	Engine - Linkage - One Time Inspection and Retorque of Screw, Nut or Bolt Securing Linkage Levers to Concentric Shaft

SERVICE BULLETIN LIST (CONT)

	Service Bulletin No.	Incorp.	Title
	77-0002, Rev 1	Oct 20/76	Engine - Indicating - Replace Control Assembly Part No. 305520-1 Through -43 With Adjustable Compensating Resistor Part No. 897069-1
R	77-0003	No Effect	Engine - Replace Compensating Resistor Part No. 897069-1 With Improved Compensating Part No. 897069-2
R	77-0007	Mar 28/80	Engine - Thermocouple Harness Installation - Replace Thermocouple Harness Clamp to Eliminate Use of Glass Cloth Tape
	79-0005, Rev 2	Oct 20/76	Engine - Oil System - Replace Turbine Bearing Oil Inlet Tube and Add Support Bracket
R	79-0006, Rev 1	No Effect	Engine - Oil Pressure Pump Assembly - Replacement of Oil Pressure Pump Assembly Body

SERVICE BULLETIN LIST (CONT)

R	Spare Parts Bulletin No.	Incorp.	Title
R	TPE0001	No Effect	Engine - Torque Sensor Assembly Part No. 3101726-1 - Replace Helical Spring With Spring Incorporating Heavier Tang
R	TPE0006	No Effect	Engine - Helical Pinion Gearshaft Assembly - Replace Bearing and Shaft Matched Set Part No. 3101084-12
R	TPE0052	No Effect	Engine - Nose Cone Assembly - Replace Nameplate With Nameplate of Steel Material on Nose Cone Assembly Part No. 3101725-X
R	TPE0053	No Effect	Engine - Intermediate Housing and Gear Assembly Part No. 3101807-X - Replace Nameplate With Nameplate of Steel Material
R	TPE0059	No Effect	Engine - Fuel - Replace Nut on Fuel Shut-Off Valve Arm - Nut Interferes With Screw on Shut-Off Valve Cover
R	TPE0062	No Effect	Engine - Torque Sensor Assembly Part No. 3101726-X - Replace Bolts Part No. MS21279-15 With Shorter Bolts Part No. MS21279-14 and Add Washers Part No. AN960C10L
R	TPE0068	No Effect	Engine - Torque Sensor Gear Assembly - Replace Key Part No. MS35756-1 With Pin to Reduce Circumferential Movement of Gear
R	TPE0070	No Effect	Engine - Intermediate Housing and Gear Assembly - Incorporate Bearing and Shaft Set With Increased Spline Backlash for More Accurate Torque Sensor Response
R	TPE0073	No Effect	Engine - Fuel Control - Replace Fuel Control to Change Minimum Fuel Schedule to Allow Better Underspeed Governor Ground Check and to Maintain Commonality - Install Fuel Control Part No. 893561-12

SERVICE BULLETIN LIST (CONT)

	Spare Parts Bulletin No.	Incorp.	Title
R	TPE0075	No Effect	Engine - Torque Limiter Bypass Valve - Install Filter With Larger Micron Rating
R	TPE0075	No Effect	Engine - Oil Filter Assembly Adapter - Replace Oil Filter Assembly Adapter to Maintain Commonality with -10 Engine
R	TPE0076	No Effect	Engine - Oil Transfer, Torque Sensor and Fittings - Replace Oil Transfer Adapter Incorporating Screen With Large Hole Size
R	TPE0078	No Effect	Engine - Fuel Control - Install Fuel Control Assembly Part No. 895414-9 that is Compatible With Either Temperature Sensor Part No. 893587-5 or -8
R	TPE0079	No Effect	Engine - Torque Limiter Bracket - Replace Existing Bracket With Improved Bracket Design to Reduce Fatigue Factor
R	TPE0085	No Effect	Engine - Intermediate Housing and Gear Assembly (Diaphragm) - Eliminate Need for Part No. AN960C10L Washers Used With Part No. 868187 Oil Plugs and Part No. 896092-1 Retainers
R	TPE0086	No Effect	Engine - Feathering Valve - Replace Packing to Eliminate Excessive Squeeze and Cutting During Assembly
R	TPE0087	No Effect	Engine - Fuel Pump Assembly - Replaced Packing on Shouldered Shaft to Eliminate Possibility of Cutting Packing During Assembly
R	TPE0090	No Effect	Engine - Nuts - Replace Nuts Part No. 525-613-9005 With Part No. MS21043-3 (Nuts Fasten Clamps That Support Torque Limiter Tubing Assemblies

SERVICE BULLETIN LIST (CONT)

R Spare Parts R Bulletin No.	Incorp.	Title
R TPE0095	No Effect	Engine - Compensating Resistor Mounting Bracket - Replace Nuts and Bolts to Maintain Commonality
R TPE0097	No Effect	Engine - Fuel Pump Assembly - Changed Engine Fuel Pump Identification Plate Due to New License Agreement
R TPE0098	No Effect	Engine - Power Group Assembly - Change Grommets on Combustion Chamber Assembly to Sheet Metal Configuration - To Be Accomplished Manufacturer's Facility Only
R TPE0101	No Effect	Engine - First Stage Turbine Shroud - Install Improved First Stage Segmented Shroud Part No. 894622-2
R TPE0106	Mar 28/80	Engine - Anti-Ice - Replace Anti-Ice Shield With Anti-Ice Shield Incorporating Replaceable Fitting
R TPE0108	No Effect	Engine - Output Gearbox Housing Assembly - Replace Output Gearbox Housing Assembly Part No. 868939-2 With Part No. 3101783-1
R TPE0111	No Effect	Engine - Intermediate Housing and Gear Assembly Part No. 3101807-2/-4/-10/-11 - Replace Existing Washers to Increase Durability
R TPE0113	No Effect	Engine - Power Group Assembly - For Commonality, Replace Seal Ring Part No. 867680-1 With Part No. 3101874-1
R TPE0116	No Effect	Engine - Torque Sensor Shimming - Add Washer Part No. 3101357-1 to Increase Potential of Existing Washers Part No. 3101357-X
R TPE0119	Mar 28/80	Engine - Clamps Securing ITT Harness - Replace Clamps Part No. 211-536-9103 With Part No. 211-533-9002 and Eliminate Use of Tape Part No. 722-505-9001

SERVICE BULLETIN LIST (CONT)

R Spare Parts R Bulletin No.	Incorp.	Title
R TPE0120 R R R	No Effect	Engine - Solenoid Valve - Replace Solenoid Valve Part No. 692545-500 With Part No. 692545-8 for Better Reliability
R TPE0121 R R	No Effect	Engine - Torque Sensor - Add Washer Part No. 3101357-7 to Reduce Interference Fit of Torque Sensor Arm
R TPE0137 R R	No Effect	Engine - Torsion Shaft - Provide Torsion Shaft With Less Wear Characteristics
R TPE0147 R	No Effect	Engine - Manifold Assembly - Replace Fuel Nozzle Shroud
R TPE0148 R R R R	No Effect	Engine - Intermediate Housing and Helical Gearshaft Assembly - Install Bearing and Shaft Set With Crowned Flange Bearing to Decrease Roller End Wear
R TPE0150 R R	No Effect	Engine - Plumbing - Replace Hose Assembly Part No. 896194-1 With Part No. 896194-2 for Commonality
R TPE0153 R	No Effect	Engine - Fuel - Replace Phenolic Insulator With Aluminum Spacer
R TPE0158 R R	Mar 28/80	Engine - Power Group Assembly - Install Shouldered Shaft With Internal Threads for Ease of Stretching Shaft
R TPE0162 R	No Effect	Engine - Power Group Assembly - Install ITT Sensor Assembly With Longer Lead
R TPE0164 R R R	Mar 28/80	Engine - Fuel - Replace Fuel Pump Shaft Without Vent Hole - Vent Hole Not Required for Oil Mist Drive on Fuel Pump Assembly Part No. 895413-1

LIST OF CHAPTERS

INTRODUCTION

1. General

R A. This publication provides maintenance instructions for support of en-
R gines manufactured by The Garrett Corporation, AiResearch Manufacturing
R Company of Arizona, P.O. Box 29003, Phoenix, AZ 85038. Specific engines
R covered in this publication are listed on the title page.

R B. This publication is prepared generally in accordance with Air Transport
R Association Specification No. 100. Definitions of words and terms used
R in this publication are as stipulated therein.

R C. The Introduction section consists of the following subsections located
R under their respective index tabs:

R (1) How To Use Instructions

R (2) Effectivity Code List (Table 1)

R (3) Configuration Identification List (Tables 2 through 6)

R (4) Applicable Publication List (Table 7)

INTRODUCTION

TABLE OF CONTENTS

2. How to Use This Maintenance Manual

A. General

In accordance with Air Transport Association Specification No. 100, the manual is divided into chapters, sections, and subjects by a numbering system which consists of a three-element number separated by dashes:

First and second digits - System/Chapter (Assigned by specification)

Third and fourth digits - Sub-System/Section (Assigned by specification)

Fifth and sixth digits - Unit/Subject (Assigned by manufacturer)

The following example illustrates and describes use of each element of the number:

Typical Chapter - Section - Subject Number - 73-10-05

-73- This number designates a major system. Chapter 73 is "Engine Fuel and Control."

-10- This number designates a section or sub-system breakdown of material in Chapter 73. In this example: "Distribution."

-60- This number designates a specific component or unit of a section. In this case, -06 represents "Fuel Shutoff Valve and Plumbing."

The complexity and volume of material contained in the maintenance manual dictates the need for breaking the subjects within manual chapters down into reasonable small topics for ready reference and ease of revision.

To accomplish this, page number blocks are used to separate subjects into topics. It is necessary to use standard page block system so that topics may be broken out for special distribution. Page number blocks used are as follows:

Description and Operation	1 through 100
Trouble Shooting	101 through 200
Maintenance Practices	201 through 300
Servicing	301 through 400

Removal/Installation	401 through 500
Adjustment/Test	501 through 600
Inspection/Check	601 through 700
Cleaning/Painting	701 through 800
Approved Repairs	801 through 900

In the case of relatively simple components, coverage for description and operation and other topics may not be required. In such cases the unused page number blocks are omitted.

When topics are brief they are combined into one topic entitled, for example, Fuel System Installation - Maintenance Practices. Topics covered in this manner are page numbered within the 201 through 300 page number blocks. Maintenance Practices consists of a combination of the following topics: Servicing, Removal/Installation, Adjustment/Test, Inspection/Check, Cleaning/Painting, and Approved Repairs.

Maintenance procedures for components and systems are located in various chapters and sections within the manual as outlined in the following list.

(See Air Transportation Association Specification No. 100 for a complete listing of all Chapter/Section numbers.)

Chapter 70 - Standard Practices - Engine

Chapter 71 - Power Plant

71-30-XX Fireshields

Chapter 72 - Engine

72-00-XX General
72-10-XX Reduction Gear and Shaft Section
72-30-XX Compressor Section
72-40-XX Combustion Section
72-50-XX Turbine Section

Chapter 73 - Engine Fuel and Control

73-10-XX General
73-10-XX Distribution
73-20-XX Controlling

Chapter 74 - Ignition

74-00-XX General
74-10-XX Electrical Power Supply
74-30-XX Switching

R

Chapter 75 - Air

75-00-XX General
75-10-XX Engine Anti-Icing

Chapter 76 - Engine Controls

76-00-XX General
76-10-XX Power Control

Chapter 77 - Engine Indicating

77-00-XX General
77-10-XX Power
77-20-XX Temperature

Chapter 78 - Exhaust (Not Used)

Chapter 79 - Oil

79-00-XX General
79-10-XX Storage
79-20-XX Distribution
79-30-XX Indicating

R Index tab sheets are used to subdivide this publication for ease in
R locating specific information. Yellow tab sheets are used to index the
R introduction and each separate chapter. White tab sheets are used to
R subdivide Chapter 72. A table of contents follows each yellow and white
R tab to list significant material and material location within the tabbed
R section.

R 2. B. Engine Identification System

R Each engine is provided with a nameplate for identification of the
R engine. Information supplied on the engine nameplate includes model
R number, part number, and serial number. The model number defines sig-
R nificant features and specification ratings. The part number defines a
R group of specific configurations. All engines with the same part number
R are interchangeable. The part number is supplemented by a series num-
R ber, and if applicable, change numbers to define a specific
R configuration. A series number is assigned at engine manufacture or
R overhaul to identify product improvement changes incorporated beyond the
R initially manufactured configuration. Individual changes incorporated
R which are not within the series grouping are identified separately by
R change numbers. (Refer to tables 2 through 6, as applicable, for

configuration identification data.) Changes represented by series and change numbers are product improvements and do not affect interchangeability of the engine. Refer to the engine log book for changes incorporated since engine production which are not separately identified on the nameplate.

Each assembly of the engine which is a complete unit has a separate nameplate carrying part number, serial number, and product improvement change information. Any assembly is interchangeable with assemblies having the same part number.

2. C. Effectivity Code System and Configuration Notation System

Some of the instructions and information contained in this publication are applicable only to specific engine model numbers, engine series/serial numbers, or pre or post service bulletin configurations of engines. When this occurs, the applicability of the material is noted at the beginning of the paragraph, procedural step, table title, or figure title. When the applicability of material is to certain engine model numbers only, applicability is specified by effectivity codes representing engine model numbers. An effectivity code is assigned for each engine model number in Table 1, Effectivity Code List. When material is applicable only to specific engine series/serial numbers, or only to configurations which are pre or post service bulletin compliance, effectivity is specified by direct reference to engine series/serial numbers or service bulletin number. Tables 2 through 6 identify engine; power section or module series/serial number configurations and, when applicable, list associated service bulletin numbers.

Effectivity codes listed which are separated by a comma (AA, AC) mean any intervening codes do not apply. For example, a paragraph beginning with "(Codes AA, AC)" is applicable for Codes AA and AC and is not applicable to Code AB. Effectivity codes listed which are separated by a dash (AA-CA) mean all intervening codes do apply. For example, a paragraph beginning with "(Codes AA-CA)" is applicable for Codes AA, BA, and CA.

3. Applicable Publications

Other publications applicable to equipment specified in this publication are listed in Table 7 by report number, along with nomenclature and part number of the equipment covered. Separate publications for components of the engine, when available, are referenced in the text where applicable and listed in Table 7.

R 4. Abbreviations

R Abbreviations used within this publication are as follows.

	Abbreviation	Term	Abbreviation	Term
R	ACFT	Aircraft	MAX	Maximum
R	APPROX	Approximate	MIN	Minimum
R	ASSY	Assembly	NO.	Number
R	CHK	Check	OVHL	Overhaul
R	ENG CH	Engine Change	PN	Part Number
R	FCTN	Functional	PRESS.	Pressure
R	GRC	Gearcase	PROP	Propeller
R	HR	Hour	REPL	Replace
R	HSG	Housing	RMV	Remove
R	IAW	In Accordance With	SB	Service Bulletin
R	LAB	Laboratory	SW	Switch
R	MAINT	Maintenance	TEMP	Temperature

Table 1. Effectivity Code List

	Engine Model No.	Engine Part No.	Code Symbol
	TPE331-5-251C	896950-1-1	CA
	TPE331-5-251C	896950-2	CB
	TPE331-5-251C	896950-3	CC
	TPE331-5-251K	895720-1	AA
	TPE331-5-251K	895720-2	AB
	TPE331-5-251K	895720-3	AC
R	TPE331-5-252K	3102520-1	FA
	TPE331-5-252M	3101840-1	KA
R	TPE331-5-254K	3102520-2	LA
	TPE331-6-251M	896160-1	BA
	TPE331-6-251M	896160-3	BB
	TPE331-6-251M	896160-5	BC
	TPE331-6-252B	3101630-1	HA
	TPE331-6-252M	3101300-2	GA
R	TPE331-6A-251M	3102450-1	EA

NOTE: A description for the use of these Code Symbols may be found in paragraph 2.C., located under index tab labeled "HOW TO USE" instructions.

R Table 2. Engine Configuration Identification List
R (Model No. TPE331-5-251C, Part No. 896950-1-1/-2/-3)

	Engine Series No.	Change No. Included	Description and Service Bulletin No.	Engine Serial No.
R	1	-	Original Configuration	22001 through 22003
R	2	Same as Series 1, Plus Changes:		22004 and 22005
R		4	Propeller Governor with with base seal (SB72-0038)	
R		5	ITT harness and shroud (Power Section 895722-2 to 895722-5)(SB72-0042)	
R	3	Same as Series 2 Plus Changes:		22006 through 22009
R		7	Heated fuel control orifice (SB73-0023)	
R		3	Improved nozzle and manifold assembly (SB73-0013)	
R		1	Rear oil line support bracket (SB79-0005)	
R		8	Incorporate heated air lines (SB73-0009)	
R	4	Same as Series 3 Plus Changes:		22010 and 22011
R		2	Improved flow divider (SB73-0017)	

R Table 2. Engine Configuration Identification List
R (Model No. TPE331-5-251C, Part No. 896950-1-1/-2/-3) (Cont)

	Engine Series No.	Change No. Included	Description and Service Bulletin No.	Engine Serial No.
	5	Same as Series 4 Plus Changes:		22012 through 22029
		9	Grounding jumpers for heated air lines (SB73-0009)	
		10	Anti-ice valve installation kit (No service bulletin)	
R	6	Same as Series 5 Plus Changes:		22030 through 22103
R		11	Fuel shut-off valve installation kit (No service bulletin)	
R		12	Fuel control one piece support bracket (SB73-0028)	
R		13	Positive bracketing to reduce fuel control vibration (SB73-0029)	
R	7	Same as Series 6 Plus Changes:		22104 through 22169
R		14	Improved anti-ice solenoid valve (SB75-0002)	

Table 2. Engine Configuration Identification List
(Model No. TPE331-5-251C, Part No. 896950-1-1/-2/-3) (Cont)

Engine Series No.	Change No. Included	Description and Service Bulletin No.	Engine Serial No.
8	Same as Series 7 Plus Changes:		22170 through 22260
	15	Torque sensor transmitter installation kit to prevent cracking of lug on adapter (No service bulletin)	
9	Same as Series 8 Plus Changes:		22261 through 22304
	16	Oil lubricated fuel pump drive spline and deletion of fuel control assembly by separate callout of fuel pump assembly, fuel control and associated hardware (Power section 895722-5 to 895722-11) (SB72-0104 and SB73-0054)	
	18	Deleted power section and added nose cone, power group, intermediate gearbox (diaphragm) and torque sensor modules (SB72-0132)	
	19	Incorporate short torsion shaft with lubricated bronze bushing (SB72-0119)	
	20	Incorporate high speed pinion roller bearing (No service bulletin)	
	21	Incorporate intermediate housing and gear assembly module with wide gears (SB72-0163)	

Table 2. Engine Configuration Identification List
(Model No. TPE331-5-251C, Part No. 896950-1-1/-2/-3) (Cont)

Engine Series No.	Change No. Included	Description and Service Bulletin No.	Engine Serial No.
10	Same as Series 9 Plus Change:		22305 through 22324
	27	Replaced spring and washer with one piece assembly (SB72-0119)	
11	Same as Series 10 Plus Change:		22325 through 22330
	26	Incorporate sintered metal drive insert (SB72-0197)	
12	Same as Series 11 Plus Change:		22331 through 22336
	25	Die cast crossover duct (SB72-0199)	
13	Same as Series 12 Plus Change:		22337 and subsequent
	24	Incorporate Vickers pump with integral base pump eliminating need for insulator and improve eccentricity (SB73-0059)	

Table 2A. Engine Configuration Identification List
(Model No. TPE331-5-251K, Part No. 895720-1/-2/-3)

Engine Series No.	Change No. Included	Description and Service Bulletin No.	Engine Serial No.
2	Original Configuration		06001 through 06006
3	Same as Series 2 Plus Changes:		06007 through 06010
	2	Improved anti-ice capability (No service bulletin)	
	3	Improved power management (No service bulletin)	
	4	Propeller pitch cam change (No service bulletin)	
	5	Three speed switch (No service bulletin)	
	6	Replace Controller (No service bulletin)	
	7	Fireproof oil tank line (No service bulletin)	
	8	Incorporate NTS lockout and propeller governor reset (No service bulletin)	
4	Same as Series 3 Plus Change:		06011 through 06016
	9	Provide oil tank commonality (No service bulletin)	

Table 2A. Engine Configuration Identification List
(Model No. TPE331-5-251K, Part No. 895720-1/-2/-3) (Cont)

Engine Series No.	Change No. Included	Description and Service Bulletin No.	Engine Serial No.
5	Same as Series 4 Plus Changes:		06017 through 06028
	10	Nameplate Change (No service bulletin)	
	11	Improved propeller pitch control (No service bulletin)	
6	Same as Series 5 Plus Changes:		06029 through 06033
	12	Filter relocation (SB73-0022)	
	14	Added plugs to oil system (No service bulletin)	
7	Same as Series 6 Plus Change:		06034 through 06043
	13	Higher pressure limit calibration (No service bulletin)	
8	Same as Series 7 Plus Change:		06044, 06046 through 06049 and 06052
	15	Viscous damped by-pass valve (SB73-0005)	

R Table 2A. Engine Configuration Identification List
R (Model No. TPE331-5-251K, Part No. 895720-1/-2/-3) (Cont)

	Engine Series No.	Change No. Included	Description and Service Bulletin No.	Engine Serial No.
R R	9	Same as Series 8 Plus Change:		06045, 06050, 06051, 06053 through 06112
R R		16	Positive retention of retainer (SB73-0006)	
R R	10	Same as Series 9 Plus Changes:		06115 through 06140
R R R		17	Delete speed input below 95 percent power (SB72-0032)	
R R R		21	Propeller governor with new seal base (SB72-0038)	
R R	11	Same as Series 10 Plus Change:		06141 through 06150
R R		23	Heated fuel lines (SB73-0009)	
R R	12	Same as Series 9 Plus Change:		06114 ONLY
R R		23	Heated fuel line (SB73-0009)	
R R	13	Same as Series 11 Plus Change:		06151 through 06173
R R R R R		22	Interstage turbine temperature (single piece)(Power Section 895722-1 to 895722-4) (SB72-0042)	

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Table 2A. Engine Configuration Identification List
(Model No. TPE331-5-251K, Part No. 895720-1/-2/-3) (Cont)

	Engine Series No.	Change No. Included	Description and Service Bulletin No.	Engine Serial No.
R R	14	Same as Series 13 Plus Change:		06174 through 06176
R R		18	Rear oil line support bracket (SB79-0005)	
R R	15	Same as Series 14 Plus Change:		06177 through 06210 and 06212 through
R R R		20	Improved nozzle and manifold assembly (SB73-0013)	06214
R R	16	Same as Series 9 Plus Changes:		06113 ONLY
R R R		17	Deleted speed input below 95 percent power (SB72-0032)	
R R R		20	Improved nozzle and manifold assembly (SB73-0013)	
R R R R		22	Interstage turbine temperature (Power Section 895722-1 to 895722-4)(SB72-0042)	
R R		23	Heated fuel lines (SB73-0009)	
R R	17	Same as Series 15 Plus Change:		06211 and 06215 through 06255
R R		25	Heated fuel control orifice (SB73-0023)	

Table 2A. Engine Configuration Identification List
(Model No. TPE331-5-251K, Part No. 895720-1/-2/-3) (Cont)

Engine Series No.	Change No. Included	Description and Service Bulletin No.	Engine Serial No.
18	Same as Series 17 Plus Change:		06256 through 06289
	19	Improved flow divider (SB73-0017)	
19	Same as Series 18 Plus Change:	06343	06290 through 06340 and 06342 through
	26	Grounding jumpers for heated lines (SB73-0009)	
20	Same as Series 19 Plus Changes:		06341 and 06344 through 06535
	27	Fuel control one piece support bracket (SB73-0028)	
	28	Positive bracketing to reduce fuel control vibration (SB73-0029)	
21	Same as Series 20 Plus Change:		06536 through 06789
	29	Improved anti-ice solenoid valve (SB75-0006)	

Table 2A. Engine Configuration Identification List
(Model No. TPE331-5-251K, Part No. 895720-1/-2/-3) (Cont)

Engine Series No.	Change No. Included	Description and Service Bulletin No.	Engine Serial No.
22	Same as Series 21 Plus Changes:		06790 through 06923 and 06928
	32	Oil lubricated fuel pump drive spline and deletion of fuel control assembly by separate callout of fuel pump, fuel control and associated hardware (Power Section 895722-4 to 895722-10) (SB73-0054 and SB72-0104)	
	34	Deleted power section and added nose cone, power group, intermediate gear-box (diaphragm) and torque sensor modules (SB72-0130)	
	39	Incorporate short torsion shaft with lubricated bronze bushing (SB72-0119)	
	40	Incorporate high speed pinion roller bearing (No service bulletin)	
	41	Incorporate 840 gear train and compatible high speed pinion roller bearing (SB72-0163)	
23	Same as Series 22 Plug Changes:		06924 through 06927 and 06929 through 06931
	53	Relocated compensating resistor (SB77-0004)	
	55	Replaced spring and washer with one piece assembly (SB72-0119)	

R Table 2A. Engine Configuration Identification List
R (Model No. TPE331-5-251K, Part No. 895720-1/-2/-3) (Cont)

Engine Series No.	Change No. Included	Description and Service Bulletin No.	Engine Serial No.
24	Same as Series 23 Plus Change:		06928 and 06932 through 06978
	49	Die cast crossover duct (SB72-0199)	
25	Same as Series 24 Plus Change:		06979 through 06999 then 40000 through 40009
	50	Incorporated sintered metal drive insert (SB72-0197)	
26	Same as Series 25 Plus Change:		40010 and subsequent
	46	Incorporated Vickers pump with integral base pump eliminated need for insulator and improve eccentricity (SB73-0059)	

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Table 2B. Engine Configuration Identification List
(Model No. TPE331-5-252K, Part No. 3102520-1)

R	Engine Series No.	Change No. Included	Description and Service Bulletin No.	Engine Serial No.
R	1	Original Configuration same as 895720 Series 3 except with Woodware fuel control and associated hardware replacing Bendix fuel control system.		Converted 06001 through 06010
R	2	Same as Series 1 Plus Change:		Converted 06011 through 06016
R		9	Provides oil tank commonality (No service bulletin)	
R	3	Same as Series 2 Plus Change:		Converted 06017 through 06028
R		11	Improved propeller pitch control (No service bulletin)	
R	4	Same as Series 3 Plus Changes:		Converted 06029 through 06033
R		12	Filter relocation (SB73-0022)	
R		14	Added plugs to oil system (No service bulletin)	
R	5	Same as Series 4 Plus Change:		Converted 06034 through 06043
R		13	Higher pressure limit calibration (No service bulletin)	

Table 2B. Engine Configuration Identification List
(Model No. TPE331-5-252K, Part No. 3102520-1) (Cont)

Engine Series No.	Change No. Included	Description and Service Bulletin No.	Engine Serial No.
6	Same as Series 5 Plus Change:		Converted 06044 through 06112 and 06114
	15	Viscous damped by-pass valve (SB73-0005)	
7	Same as Series 6 Plus Change:		Converted 06115 through 06150
	17	Delete speed input below 95 percent power (SB72-0032)	
8	Same as Series 7 Plus Change:		Converted 06151 through 06173
	22	Interstage turbine temperature (single piece) (Power Section 895722-1 to 895722-4) (SB72-0042)	
9	Same as Series 8 Plus Change:		Converted 06174 through 06176
	18	Rear oil line support bracket (SB79-0005)	
10	Same as Series 9 Plus Change:		Converted 06177 through 06255
	20	Improved nozzle and manifold assembly (SB73-0013)	
11	Same as Series 6 Plus Change:		Converted 06113 ONLY
	17	Delete speed input below 95 percent power (SB72-0032)	

R Table 2B. Engine Configuration Identification List
R (Model No. TPE331-5-252K, Part No. 3102520-1) (Cont)

	Engine Series No.	Change No. Included	Description and Service Bulletin No.	Engine Serial No.
R	11 (Cont)	20	Improved nozzle and manifold assembly (SB73-0013)	
R		22	Interstage turbine temperature (single piece) (Power Section 895722-1 to 895722-4)(SB72-0042)	
R	12	Same as Series 10 Plus Change:		Converted 06256 through 06535
R		19	Improved flow divider (SB73-0017)	
R	13	Same as Series 12 Plus Change:		Converted06536 through 06789
R		29	Improved anti-ice solenoid valve (SB75-00006)	
R	14	Same as Series 13 Plus Changes:		Converted 06790 through 06923
R		34	Deleted power section and added nose cone, power group, intermediate gearbox (diaphragm) and torque sensor modules (SB72-0130)	
R		39	Incorporate short torsion shaft with lubricated bronze bushing (SB72-0119)	
R		40	Incorporate high speed pinion roller bearing (No service bulletin)	
R		41	Incorporate 840 gear train and compatible	

R Table 2B. Engine Configuration Identification List
R (Model No. TPE331-5-252K, Part No. 3102520-1) (Cont)

	Engine Series No.	Change No. Included	Description and Service Bulletin No.	Engine Serial No.
R	14 (Cont)	41 (Cont)	high speed pinion roller bearing configuration (SB72-0163)	
R	15	Same as Series 14 Plus Changes:		Converted 06924 through 06927 and 06929 through 06931
R		53	Relocated compensating resistor (SB77-0004)	
R		55	Replaced spring and washer with one piece assembly (SB72-0119)	
R	16	Same as Series 15 Plus Change:		Converted 06929 and 06932 through 06978
R		49	Die cast crossover duct (SB72-0199)	
R	17	Same as Series 16 Plus Change:		Converted 06979 through 06999 then 40000 through 40096
R		50	Incorporate sintered metal drive insert (SB72-0197)	
R	18	Same as Series 17 Plus Change:		40097 and subsequent
R		61	Install in-line check valve (SB73-0076)	

Table 2C. Engine Configuration Identification List
(Model No. TPE331-5-252M, Part No. 3101840-1)

Engine Series No.	Change No. Included	Description and Service Bulletin No.	Engine Serial No.
1	-	Original Configuration - A counterclockwise turning 1591 RPM (Prop Shaft) engine using Woodward fuel control system	33001 through 33032
2	Same as Series 1 Plus Changes:		33033 through 33062
	1	Oil lubricated fuel pump drive spline (SB73-0051 and SB72-0104)	
	2	Deleted power section and added nose cone, power group, intermediate gearbox (diaphragm) and torque sensor modules (SB72-0130)	
	3	Incorporate roller bear-ring (No service bul-letin)	
	4	Incorporate short tor-sion shaft with lubri-cated bronze bushing (SB72-0119)	
	5	Incorporate wide gears (SB72-0163)	
	6	Replace spring and washer with one piece assembly (SB72-0119)	

Table 2C. Engine Configuration Identification List
(Model No. TPE331-5-252M, Part No. 3101840-1) (Cont)

Engine Series No.	Change No. Included	Description and Service Bulletin No.	Engine Serial No.
3	Same as Series 1 Plus Changes:		Not manufactured-for converting SN 30001 through 30006 and 30008 only
	2	Deleted power section and added nose cone, power group, intermediate gearbox (diaphragm) and torque sensor modules (SB72-0130)	
	3	Incorporate roller bearing (No service bulletin)	
	4	Incorporate short torsion shaft with lubricated bronze bushing (SB72-0119)	
	5	Incorporate wide gears (SB72-0163)	
	6	Replace spring and washer with one piece assembly (SB72-0119)	
	12	Permits use of pre-module torque sensor (No service bulletin)	
4	Same as Series 2 Plus Change:		33063 through 33080
	11	Incorporate sintered metal drive insert (SB72-0197)	

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Table 2C. Engine Configuration Identification List
(Model No. TPE331-5-252M, Part No. 3101840-1) (Cont)

	Engine Series No.	Change No. Included	Description and Service Bulletin No.	Engine Serial No.
R R	5	Same as Series 4 Plus Change:		33081 and subsequent
R R		10	Die cast crossover duct (SB72-0199)	

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Table 2D. Engine Configuration Identification List
(Model No. TPE331-5-254K, Part No. 3102520-2)

	Engine Series No.	Change No. Included	Description and Service Bulletin No.	Engine Serial No.
R R	1	-	Original Configuration	40143 then 40149 through 40158
R R	2	Same as Series 1 Plus Change:		40159 and subsequent
R R R		62	Revise check valve to prevent possible back-wards installation	

R Table 2E. Engine Configuration Identification List
R (Model No. TPE331-6-251M, Part No. 896160-1/-3/-5)

	Engine Series No.	Change No. Included	Description and Service Bulletin No.	Engine Serial No.
R	1	-	Original Configuration	20001 through 20003
R	2	Same as Series 1 Plus Changes:		20004 through 20031
R		1	Delete speed switch mounting plate (No service bulletin)	
R		2	Prevent plumbing interference (No service bulletin)	
R		3	Prevent flow divider interference (No service bulletin)	
R		5	Reroute plumbing, improve reliability (No service bulletin)	
R		6	Improve accessibility for start fuel schedule adjustment (No service bulletin)	
R		7	Reroute plumbing to satisfy customer mock-up (No service bulletin)	
R		8	Reroute plumbing to satisfy customer mock-up (No service bulletin)	
R		9	Improved temperature compensator (No service bulletin)	
R		10	Fuel flow divider and manifold installation kit (No service bulletin)	

Table 2E. Engine Configuration Identification List
(Model No. TPE331-6-251M, Part No. 896160-1/-3/-5) (Cont)

Engine Series No.	Change No. Included	Description and Service Bulletin No.	Engine Serial No.
2 (Cont)	11	Anti-ice installation kit (No service bulletin)	
	12	Oil tank installation kit (No service bulletin)	
	13	Filter and adapter installation kit (No service bulletin)	
	14	Oil tank clearance (No service bulletin)	
	15	Ignition kit, provide clearance between ignition unit (No service bulletin)	
	16	Plug interference (changed oil vent valve fitting installation kit) (No service bulletin)	
	20	Eliminate undesirable transients (No service bulletin)	
3	Same as Series 2 Plus Changes:		20032 through 20063 and 20065 and 20069
	4	Reduce length to improve reliability on manifold (No service bulletin)	
	17	RPM condition lever (Delete) (No service bulletin)	
	18	Reroute plumbing to eliminate interference (SB-646)	

Table 2E. Engine Configuration Identification List
(Model No. TPE331-6-251M, Part No. 896160-1/-3/-5) (Cont)

Engine Series No.	Change No. Included	Description and Service Bulletin No.	Engine Serial No.
3 (Cont)	19	Reroute fuel heater line (SB-646)	
4	Same as Series 3 Plus Change:		20064, 20066, 20068, 20070 and 20071
	21	Higher pressure limit calibration (torque limiter) (No service bulletin)	
5	Same as Series 4 Plus Change:		20067 and 20072 through 20110
	22	Viscous damped by-pass valve (torque limiter) (SB73-0005)	
6	Same as Series 5 Plus Change:		20111 through 20115 and 20117 through 20121
	24	Delete rate governor control below 95 percent power (SB72-0032)	
7	Same as Series 6 Plus Change:		20116 and 20122 through 20143
	27	Prop governor new base seal (SB72-0038)	
8	Same as Series 7		20145 through 20165
	28	Interstage turbine temperature (Power Section 896162-1 to 896162-2) (SB72-0042)	

R Table 2E. Engine Configuration Identification List
R (Model No. TPE331-6-251M, Part No. 896160-1/-3/-5) (Cont)

R	Engine Series No.	Change No. Included	Description and Service Bulletin No.	Engine Serial No.
R	9	Same as Series 8 Plus Changes:		20166 through 20174
R		29	Incorporate heated pneumatic tubes (SB73-0012)	
R		23	Rear oil line support bracket (SB79-0005)	
R	10	Same as Series 9 Plus Change:		20144 and 20175 through 20222 and 20224 through 20228
R		26	Improved nozzle and manifold assembly (SB73-0013)	
R	11	Same as Series 10 Plus Change:		20223 and 20229 through 20273
R		31	Heated fuel control orifice (SB73-0024)	
R	12	Same as Series 11 Plus Change:		20274 through 20284
R		25	Improved flow divider (SB73-0017)	
R	13	Same as Series 12 Plus Change:		20285 through 20359
R		32	Reroute plumbing (No service bulletin)	

Table 2E. Engine Configuration Identification List
(Model No. TPE331-6-251M, Part No. 896160-1/-3/-5) (Cont)

Engine Series No.	Change No. Included	Description and Service Bulletin No.	Engine Serial No.
14	Same as Series 13 Plus Changes:		20260 through 20416
	34	Grounding jumpers for heated lines (SB73-0012)	
	33	Change pressure trans-ducer (No service bul-letin)	
15	Same as Series 14 Plus Changes:		20418 through 20472
	37	Positive bracketing to reduce fuel control vibration (Keensert) (SB73-0029)	
	36	Fuel control one piece support bracket (Power Section 896162-2 to 896162-3) (SB73-0028)	
16	(Applicable to 896160-2 produc-tion engine only)		20473 through 20551, 20553 through 20555, 20557 through 20559
	Same as Series 15 Plus Change:		
	35	Improved upper shield assembly (No service bulletin)	
17	(Applicable to 896160-1 produc-tion engine only)		20561 and 20562 only
	Same as Series 16 Plus Changes:		

R Table 2E. Engine Configuration Identification List
R (Model No. TPE331-6-251M, Part No. 896160-1/-3/-5) (Cont)

	Engine Series No.	Change No. Included	Description and Service Bulletin No.	Engine Serial No.
R	17 (Cont)	38	Improved anti-ice solenoid valve (SB75-0002)	
R		39	Improved ignition unit to provide suitable energy level (No service bulletin)	
R	16	Same as Series 15 Plus Changes:		20552 and 20556 through 20560 and 20563 through 20575
R		35	Improved upper shield assembly (No service bulletin)	
R		38	Improved anti-ice valve solenoid (SB75-0002)	
R		39	Improved ignition unit to provide suitable engery level (No service bulletin)	
R	17	Same as Series 16 Plus Changes:		20576 and subsequent
R		41	Oil lubricated fuel pump drive spline and deletion of fuel control assembly by separate call out of fuel pump assembly, fuel control and associated hardware (Changes power section from 896162-3 to 896162-6) (SB73-0054 and SB72-0104)	

R Table 2E. Engine Configuration Identification List
R (Model No. TPE331-6-251M, Part No. 896160-1/-3/-5) (Cont)

	Engine Series No.	Change No. Included	Description and Service Bulletin No.	Engine Serial No.
R	17 (Cont)	46	Deleted power sections add added nose cone, power group, intermediate gearbox (diaphragm) and torque sensor modules (SB72-0154)	
R		50	Incorporate short torsion shaft with lubricated bronze bushing (SB72-0119)	
R		51	Incorporate high speed pinion roller bearing (No service bulletin)	
R		52	Incorporate wide gears (SB72-0169)	
R	-	58	Incorporate sintered metal drive insert (SB72-0197)	
R	-	59	Die cast crossover duct (Power group 3101880-5 to 3101880-7) (SB72-0199)	

R Table 2F. Engine Configuration Identification List
R (Model No. TPE331-6A-251M, Part No. 3102450-1)

R	Engine Series No.	Change No. Included	Description and Service Bulletin No.	Engine Serial No.
R	1	-	Original Configuration Same as 896160, Series 2 with aluminum gearbox PN 896148-11 replacing magnesium gearbox PN 896148-2/-8 or -9. Without die cast cross-over duct and marinized hardware.	For Conversion of 20001 through 20031
R	2	Same as Series 1 Plus Changes:		For Conversion of 20032 through 20041
R		1	Reduce length to improve reliability on manifold (No service bulletin)	
R		2	Delete RPM condition lever	
R		3	Reroute plumbing to eliminate interference (SB-646)	
R		4	Reroute fuel heater line (SB-646)	
R		5	Replace washer to prevent distortion (No service bulletin)	
R	3	Same as Series 2 Plus Change:		For Conversion of 20042 through 20063
R		6	Improved insert retention (SB72-0004)	

R R Table 2F. Engine Configuration Identification List
(Model No. TPE331-6A-251M, Part No. 3102450-1) (Cont)

	Engine Series No.	Change No. Included	Description and Service Bulletin No.	Engine Serial No.
R	4	Same as Series 3 Plus Changes:		For Conversion of 20064 through 20071
R		7	High pressure limit calibration (No service bulletin)	
R	5	Same as Series 4 Plus Changes:		For Conversion of 20072 through 20083
R		8	Stud replaces insert (SB72-0017)	
R		9	Improved seal and rotor (SB72-0009)	
R		10	Improved first stage impeller (No service bulletin)	
R		11	Tighter clearance compressor seal (No service bulletin)	
R		12	Increased flow area (No service bulletin)	
R		13	Viscous damped by-pass valve (SB73-0005)	
R	6	Same as Series 5 Plus Change:		For Conversion of 20084 and 20085
R		14	Replace compressor seal (No service bulletin)	

Table 2F. Engine Configuration Identification List
(Model No. TPE331-6A-251M, Part No. 3102450-1) (Cont)

Engine Series No.	Change No. Included	Description and Service Bulletin No.	Engine Serial No.
7	Same as Series 6 Plus Change:		For Conversion of 20086 through 20110
	15	Increased filter flow (SB-613)	
8	Same as Series 7 Plus Change:		For Conversion of 20111 through 20115
	16	Delete rate governor control below 95 percent power (SB72-0032)	
9	Same as Series 8 Plus Change:		For Conversion of 20116 through 20126
	17	Propeller governor new base seal (SB72-0038)	
10	Same as Series 9 Plus Changes:		For Conversion of 20127 ONLY
	18	Single wall oil inlet tube (SB79-0005)	
	19	Forward diaphragm clinch bolt (SB72-0046)	
11	Same as Series 10 Plus Changes:		For Conversion of 20128 through 20143
	20	Bull gear bearing retainer (SB72-0049)	

R Table 2F. Engine Configuration Identification List
R (Model No. TPE331-6A-251M, Part No. 3102450-1) (Cont)

	Engine Series No.	Change No. Included	Description and Service Bulletin No.	Engine Serial No.
R	11 (Cont)	21	Decrease sensitivity of torque sensor to oil temperature (No service bulletin)	
R	12	Same as Series 11 Plus Changes:		For Conversion of 20144 ONLY
R		29	Direct drive fuel control (SB72-0061)	
R		31	High speed journal bearing (SB72-0064)	
R		32	Improved torque sensor-gear center distance control (No service bulletin)	
R	13	Same as Series 11 Plus Change:		For Conversion of 20145 ONLY
R		22	Interstage turbine temperature (Power Section 896162-1 to 896162-2) (SB72-0042)	
R	14	Same as Series 13 Plus Change:		For Conversion of 20146 through 20164
R		23	High speed pinion gearshaft and bearing set (No service bulletin)	

Table 2F. Engine Configuration Identification List
(Model No. TPE331-6A-251M, Part No. 3102450-1) (Cont)

Engine Series No.	Change No. Included	Description and Service Bulletin No.	Engine Serial No.
15	Same as Series 14 Plus Change:		For Conversion of 20165 ONLY
	24	Incorporate aspirated ITT shield (No service bulletin)	
16	Same as Series 15 Plus Changes:		For Conversion of 20166 through 20174
	25	Hydraulic turbine bearing mount (SB72-0089)	
	26	Incorporate heated pneumatic tubes (SB73-0012)	
	27	Rear oil line support bracket (SB79-0005)	
17	Same as Series 16 Plus Change:		For Conversion of 20175 through 20181
	28	Improved nozzle and manifold assembly (SB73-0013)	
18	Same as Series 17 Plus Changes:		For Conversion of 20182 through 20202
	29	Direct drive fuel control (SB72-0061)	
	30	One piece gearshaft (No service bulletin)	
	31	High speed journal bearing (SB72-0064)	

Table 2F. Engine Configuration Identification List
(Model No. TPE331-6A-251M, Part No. 3102450-1) (Cont)

Engine Series No.	Change No. Included	Description and Service Bulletin No.	Engine Serial No.
19	Same as Series 18 Plus Change:		For Coversion of 20203 through 20206
	32	Improved torque sensor-gear center distance control (No service bulletin)	
20	Same as Series 19 Plus Change:		For Conversion of 20207 through 20228
	33	Three piece stator (SB72-0052)	
21	Same as Series 20 Plus Changes:		For Conversion of 20229 through 20273
	34	Oil pressure regulator calibration change (No service bulletin)	
	35	Heated fuel control orifice (SB73-0024)	
22	Same as Series 21 Plus Change:		For Conversion of 20274 through 20284
	36	Improved flow divider (SB73-0017)	
23	Same as Series 22 Plus Change:		For Conversion of 20285 through 20292
	37	Reroute plumbing (No service bulletin)	

R
R Table 2F. Engine Configuration Identification List
(Model No. TPE331-6A-251M, Part No. 3102450-1) (Cont)

	Engine Series No.	Change No. Included	Description and Service Bulletin No.	Engine Serial No.
R R	24	Same as Series 23 Plus Change:		For Conversion of 20293 through 20312
R R		38	Improved gearbox scavenging (SB72-0077)	
R R	25	Same as Series 24 Plus Change:		For Conversion of 20313 through 20358
R R R		39	Pinion gearshaft with increased backlash (No service bulletin)	
R R	26	Same as Series 25 Plus Change:		For Conversion of 20359 ONLY
R R		40	Improved torsion shaft (No service bulletin)	
R R	27	Same as Series 26 Plus Changes:		For Conversion of 20360 through 20377
R R		41	Grounding jumpers for heated lines (SB73-0012)	
R R R		42	Change pressure trans-ducer (No service bulletin)	
R R	28	Same as Series 27 Plus Change:		For Conversion of 20378 through 20396
R R R R		43	Incorporate thermocouple harness with protective wear band (No service bulletin)	

Table 2F. Engine Configuration Identification List
(Model No. TPE331-6A-251M, Part No. 3102450-1) (Cont)

Engine Series No.	Change No. Included	Description and Service Bulletin No.	Engine Serial No.
29	Same as Series 28 Plus Change:		For Conversion of 20397 through 20406
	44	Incorporate one piece diffuser assembly (No service bulletin)	
30	Same as Series 29 Plus Change:		For Conversion of 20407 through 20417
	45	Improved bracket for fuel control (SB73-0028)	
31	Same as Series 30 Plus Changes:		For Conversion of 20418 ONLY
	46	Positive bracketing to reduce fuel control vibration (Keensert) (SB73-0029)	
	47	Fuel control one piece support bracket (SB73-0028)	
	48	Improved torque sensor (No service bulletin)	
32	Same as Series 28 Plus Change:		For Conversion of 20419 through 20431
	51	Improved one piece gear-shaft (No service bulletin)	

Table 2F. Engine Configuration Identification List
(Model No. TPE331-6A-251M, Part No. 3102450-1) (Cont)

Engine Series No.	Change No. Included	Description and Service Bulletin No.	Engine Serial No.
33	Same as Series 31 Plus Change:		For Conversion of 20432 through 20437
	49	Improved combustor/ stator fit (No service bulletin)	
34	Same as Series 33 Plus Change:		For Conversion of 20438 through 20446
	50	Incorporate new turbine retainer to preclude vibration (SB72-0087)	
35	Same as Series 34 Plus Changes:		For Conversion of 20447 through 20472
	39	Pinion gearshaft with increased backlash (No service bulletin)	
	51	Improved one piece gear-shaft (No service bulletin)	
36	Same as Series 35 Plus Change:		For Conversion of 20473 through 20535
	52	Improved upper shield assembly (No service bulletin)	
37	Same as Series 36 Plus Changes:		For Conversion of 20536 through 20551 and 20553 through 20555
	53	Added lock plate to journal bearing retainer bolts (SB72-0092)	

Table 2F. Engine Configuration Identification List
(Model No. TPE331-6A-251M, Part No. 3102450-1) (Cont)

Engine Series No.	Change No. Included	Description and Service Bulletin No.	Engine Serial No.
37 (Cont)	54	Added corrosion resistant steel tube clamp to reduce fatigue at clamping point (SB72-0092)	
38	Same as Series 37 Plus Changes:		For Conversion of 20558 ONLY
	55	Changed to aged tube to increase strength (SB72-0092)	
	56	Added corrosion resistant steel tube to increase strength (SB72-0092)	
	57	Improved mounted torque sensor to prevent housing rotation and improper tooth engagement (SB72-0095)	
	58	Chrome plated bull gear retainer (No service bulletin)	
	59	Changed seal assembly to permit removal and replacement of seal from hot end (No service bulletin)	
	60	Improved transition liner (SB72-0052)	

Table 2F. Engine Configuration Identification List
(Model No. TPE331-6A-251M, Part No. 3102450-1) (Cont)

Engine Series No.	Change No. Included	Description and Service Bulletin No.	Engine Serial No.
39	Same as Series 38 Plus Changes:		For Conversion of 20552, 20556, 20557 and 20559
	61	Improved upper shield assembly (No service bulletin)	
	62	Improved anti-ice sole-noid valve (SB75-0002)	
	63	Improved ignition unit to provide suitable energy level (No service bulletin)	
40	Same as Series 39 Plus Changes:		For Conversion of 20560 through 20564
	64	Provides steel adapter (SB72-0092)	
	65	Provides steel nozzle (SB72-0092)	
	66	Incorporate common diaphragm (SB72-0113)	
41	Same as Series 40 Plus Changes:		For Conversion of 20565 through 20575
	67	Hex head bolts and lock tabs for steel tube and adapter (No service bulletin)	
	73	Changed to corrosion resistant steel tube for increased reliability (SB72-0092)	

R Table 2F. Engine Configuration Identification List
R (Model No. TPE331-6A-251M, Part No. 3102450-1) (Cont)

Engine Series No.	Change No. Included	Description and Service Bulletin No.	Engine Serial No.
R 41 (Cont)	75	Improved steel tube with clamp (SB72-0092)	
R 42	Same as Series 41 Plus Changes:		For Conversion of 20576 through 20585
R	68	Oil lubricated fuel pump drive spline and deletion of fuel control assembly by separate call out of fuel pump, fuel control and associated hardware (SB73-0051 and SB72-0104)	
R	69	Deleted power section and added nose cone, power group, intermediate gearbox (diaphragm) and torque sensor modules (SB72-0154)	
R	70	Incorporate short torsion shaft with lubricated bronze bushing (SB72-0119)	
R	71	Incorporated roller bearing (No service bulletin)	
R	72	Incorporate wide gears (SB72-0169)	

R Table 2F. Engine Configuration Identification List
R (Model No. TPE331-6A-251M, Part No. 3102450-1) (Cont)

	Engine Series No.	Change No. Included	Description and Service Bulletin No.	Engine Serial No.
R	43	Same as Series 42 Plus Change:		For Conversion of 20586 through 20622
R		74	Provides select fit bushings to reduce wear (SB72-0102)	
R	44	Same as Series 43 Plus Changes:		For Conversion of 20623 and subsequent
R		76	Torque sensor with spur gear and cam assembly with welded pins (SB72-0111)	
R		77	Hex head bolts and key washer for propeller shaft rear bearing (SB72-0114)	
R		78	Provides select fit bushings to reduce wear (SB72-0102)	
R	-	79	Die cast crossover duct (Power group 3101880-5 to 3101880-7) (SB72-0199)	

Table 2G. Engine Configuration Identification List
(Model No. TPE331-6-252B, Part No. 3101630-1)

Engine Series No.	Change No. Included	Description and Service Bulletin No.	Engine Serial No.
1	-	Original Configuration	27001 through 27014
2	Same as Series 1 Plus Change:		27015 through 27045
	1	Add clamp and associated hardware to keep ignition lead off plenum (No service bulletin)	
3	Same as Series 2 Plus Change:		27046 through 27057
	2	Provide lockwire provisions for anti-ice valve sensing tube (SB72-0159)	
4	Same as Series 3 Plus Changes:		27058 through 27085
	3	Oil lubricated fuel pump drive spline and deletion of fuel control assembly by separate call out of fuel pump, fuel control and associated hardware (Power Section 896162-3 to 896162-6) (SB72-0104 and SB73-0051)	
	4	Deleted power sections and added nose cone, power group, intermediate gearbox (diaphragm) and torque sensor modules (SB72-0133)	

R Table 2G. Engine Configuration Identification List
R (Model No. TPE331-6-252B, Part No. 3101630-1) (Cont)

	Engine Series No.	Change No. Included	Description and Service Bulletin No.	Engine Serial No.
R	4 (Cont)	6	Incorporate short torsion shaft with lubricated bushing (SB72-0119)	
R		7	Incorporate high speed pinion roller bearing (No service bulletin)	
R		8	Incorporate wide gears (SB72-0162)	
R	5	Same as Series 4 Plus Change:		27086 through 27103
R		14	Replaced spring and washer with one piece assembly (SB72-0119)	
R	6	Same as Series 5 Plus Change:		27104 and 27105
R		16	Rotated anti-ice valve 180 degrees and relocated compensator resistor (SB72-0195)	
R	7	Same as Series 6 Plus Change:		27106 and 27107
R		12	Incorporate sintered metal drive insert (SB72-0197)	

R Table 2G. Engine Configuration Identification List
R (Model No. TPE331-6-252B, Part No. 3101630-1) (Cont)

	Engine Series No.	Change No. Included	Description and Service Bulletin No.	Engine Serial No.
R	8	Same as Series 7 Plus Change:		27108 through 27109
R		20	Rerouted ignition lead to eliminate electrical interference with ITT electrical signal (SB74-0002)	
R	9	Same as Series 8 Plus Changes:		27110 and subsequent
R		18	Relocated compensator resistor bracket (SB72-0195)	
R		11	Die cast crossover duct (Power Group 3101880-5 to 3101880-7) (SB72-0199)	
R	-	15	Incorporated a more reliable check valve in fuel pressure regulator (SB73-0076)	

Table 2H. Engine Configuration Identification List
(Model No. TPE331-6-252M, Part No. 3101300-2)

Engine Series No.	Change No. Included	Description and Service Bulletin No.	Engine Serial No.
1	Original Configuration - Same as 896160, Series 2 After Compliance with SB73-0035 and using Woodward Fuel Control System in Place of Bendix Fuel Control System		Manufactured 30001 through 30025
	Plus Changes:		
	3	Reduced length to improved reliability of manifold (No service bulletin)	
	4	Higher pressure limit calibration (No service bulletin)	
	5	Viscous damped by-pass valve (SB73-0005)	
	6	Delete rate governor control below 95 percent (SB72-0032)	
	7	Interstage turbine temperature (SB72-0042)	
	8	Rear oil line support bracket (SB79-0005)	
	9	Improved nozzle and manifold assembly (SB73-0013)	
	10	Improved flow divider (SB73-0017)	

Table 2H. Engine Configuration Identification List
(Model No. TPE331-6-252M, Part No. 3101300-2) (Cont)

Engine Series No.	Change No. Included	Description and Service Bulletin No.	Engine Serial No.
1 (Cont)	11	Change pressure transducer (No service bulletin)	
	12	Improved anti-ice solenoid valve (SB75-0002)	
	13	Improved ignition unit to provide suitable energy level (No service bulletin)	
2	Same as Series 1 Plus Changes:		30026
	1	Provide lockwire provisions for anti-ice valve sensing tube (SB72-0159)	
	14	Provide Woodward fuel control common with slow turn engine configuration (No service bulletin)	
3	Identity assigned for converted 896160, Series 2, Engines After Compliance with SB73-0035 and Installation of Woodward Fuel Control System		Converted 20001 through 20031
	Plus Change:		
	14	Provide Woodward fuel control common with slow turn engine configuration (No service bulletin)	

Table 2H. Engine Configuration Identification List
(Model No. TPE331-6-252M, Part No. 3101300-2) (Cont)

Engine Series No.	Change No. Included	Description and Service Bulletin No.	Engine Serial No.
4	Identity Assigned for Converted 896160, Series 3, Engines After Compliance of SB73-0035 and Installation of Woodward Fuel Control System		Converted 20032 through 20063, 20065 and 20069
	Same as Series 3 Plus Change:		
	3	Reduced length to improve reliability of manifold (No service bulletin)	
5	Identity Assigned for Converted 896160, Series 4 Engines After Compliance of SB73-0035 and Installation of Woodward Fuel Control System		Converted 20064, 20066, 20068, 20070 and 20071
	Same as Series 4 Plus Change:		
	4	Higher pressure limit calibration (No service bulletin)	

Table 2H. Engine Configuration Identification List
(Model No. TPE331-6-252M, Part No. 3101300-2) (Cont)

Engine Series No.	Change No. Included	Description and Service Bulletin No.	Engine Serial No.
6	Identity Assigned for Converted 896160, Series 5, Engines After Compliance of SB73-0035 and Installation of Woodward Fuel Control System		Converted 20067 and 20072 through 20110
	Same as Series 5 Plus Change:		
	5	Viscous damped by-pass valve (SB73-0005)	
7	Identity Assigned for Converted 896160, Series 6 Engines After Compliance of SB73-0035 and Installation of Woodward Fuel Control System		Converted 20111 through 20115 and 20117 through 20212
	Same as Series 6 Plus Change:		
	6	Delete rate governor control below 95 percent (SB72-0032)	

Table 2H. Engine Configuration Identification List
(Model No. TPE331-6-252M, Part No. 3101300-2) (Cont)

Engine Series No.	Change No. Included	Description and Service Bulletin No.	Engine Serial No.
8	Identity Assigned for Converted 896160, Series 7 or 8 Engines After Compliance of SB73-0035 and Installation of Woodward Fuel Control System		Converted 20116, 20122 through 20143 and 20145 through 20165
	Same as Series 7 Plus Change:		
	7	Interstage turbine temperature (SB72-0042)	
9	Identity Assigned for Converted 896160, Series 9 Engines After Compliance of SB73-0035 and Installation of Woodward Fuel Control System		Converted 20166 through 20174
	Same as Series 8 Plus Change:		
	8	Rear oil line support bracket (SB79-0005)	

Table 2H. Engine Configuration Identification List
(Model No. TPE331-6-252M, Part No. 3101300-2) (Cont)

Engine Series No.	Change No. Included	Description and Service Bulletin No.	Engine Serial No.
10	Identity Assigned for Converted 896160, Series 10, Engines After Compliance of SB73-0035 and Installation of Woodward Fuel Control System		Converted 20144, 20175 through 20222, and 20224 through 20273
	Same as Series 9 Plus Change:		
	9	Improved nozzle and manifold assembly (SB73-0013)	
11	Identity Assigned for Converted 896160, Series 11, Engines After Compliance of SB73-0035 and Installation of Woodward Fuel Control System		Converted 20274 through 20284
	Same as Series 10 Plus Change:		
	10	Improved flow divider (SB73-0017)	

Table 2H. Engine Configuration Identification List (Model No. TPE331-6-252M, Part No. 3101300-2) (Cont)

Engine Series No.	Change No. Included	Description and Service Bulletin No.	Engine Serial No.
12	Identity Assigned for Converted 896160, Series 13 or 14, Engines After Compliance of SB73-0035 and Installation of Woodward Fuel Control System		Converted 20285 through 20417
	Same as Series 11 Plus Change:		
	11	Change pressure transducer (No service bulletin)	
13	Identity Assigned for Converted 896160, Series 15 or 16, Engines After Compliance of SB73-0035 and Installation of Woodward Fuel Control System		Converted 20418 through 20575
	Same as Series 12 Plus Change:		
	12	Improved anti-ice solenoid valve (SB75-0002)	

R Table 2H. Engine Configuration Identification List
R (Model No. TPE331-6-252M, Part No. 3101300-20) (Cont)

	Engine Series No.	Change No. Included	Description and Service Bulletin No.	Engine Serial No.
R	14	Same as Series 2 Plus Changes:		Manufactured 30026 and subsequent
R				Converted 20576 and subsequent
R		19	Deleted power sections and added nose cone, power group, intermediate gearbox (diaphragm) and torque sensor modules (SB72-0154)	
R		2	Oil lubricated fuel pump drive spline and deletion of fuel control assembly by separate call out of fuel pump, fuel control and associated hardware (SB73-0051 and SB72-0104)	
R		22	Incorporate short torsion shaft (SB72-0119)	
R		23	Incorporate high speed pinion roller bearing (No service bulletin)	
R		24	Incorporate wide gears (SB72-0169)	
R	-	25	Incorporated sintered metal drive insert (SB72-0197)	
R	-	26	Die cast crossover duct (Power Group 3101880-5 to 3101880-7) (SB72-0199)	

R Table 3. Power Section Configuration Identification List
R (Part No. 896162-1/-2/-3/-4/-5/-6)

	Power Section Series No.	Change No. Included	Description and Service Bulletin No.	Power Section Serial No.
R	1	-	Original Configuration	20500
R	2	Same as Series 1 Plus Changes:		20504 and subsequent
R		1	Inlet gearbox	
R		2	High speed pinion bearing	
R		3	Spacer and seal	
R		4	Gearbox drain fitting	
R	3	Same as Series 2 Plus Changes:		20532 and subsequent
R		6	Prevent distortion	
R		8	Remove plug from housing	
R	4	Same as Series 3 Plus Changes:		20542 through 20571 then 20571 through 20581
R		9	Improved insert retention (No service bulletin)	
R	5	Same as Series 4 Plus Changes:		20572 then 20582, 20583 then 20585 and subsequent
R		11	Stud replaces insert (SB72-0017)	
R		5	Improved seal and rotor (SB72-0009)	

R Table 3. Power Section Configuration Identification List
R (Part No. 896162-1/-2/-3/-4/-5/-6) (Cont)

	Power Section Series No.	Change No. Included	Description and Service Bulletin No.	Power Section Serial No.
R R	5 (Cont)	10	Improved first stage impeller	
R R		13	Tighten clearance compressor seal	
R		12	Increased flow area	
R R	6	Same as Series 5 Plus Change:		20586 and subsequent
R		11	Increased filter flow	
R R R R R	7	Same as Series 6 Plus Change:		20584, 20587, 20588, 20589, 20591 through 20594 then 20596 20596 and subsequent
R		22	Compressor seal	
R R	8	Same as Series 7 Plus Changes:		20627 and subsequent
R R		15	Single wall oil inlet tube (SB79-0005)	
R R R		17	Forward diaphragm clinch bolts (SB72-0046)	
R R		41	Added corrosion resistant tube clamp	
R R R	9	Same as Series 8 Plus Changes:		20628 through 20643 and 20645
R R		20	Bull gear bearing retainer (SB72-0049)	

Table 3. Power Section Configuration Identification List
(Part No. 896162-1/-2/-3/-4/-5/-6) (Cont)

Power Section Series No.	Change No. Included	Description and Service Bulletin No.	Power Section Serial No.
9 (Cont)	16	Decrease sensitivity of torque sensor to oil temperature	
10	Same as Series 9 Plus Change:		20646 and subsequent
	21	High speed pinion gearshaft and bearing set	
11	Same as Series 10 Plus Change:		20665
	28	Incorporate aspirated ITT shield	
12	Same as Series 11 Plus Change:		20666 and subsequent
	18	Hydraulic turbine bearing mount (SB72-0089)	
13	Same as Series 12 Plus Changes:		20644 ONLY
	19	Three piece stator (SB-0052)	
	23	Direct drive fuel control (SB72-0061)	
	24	High speed journal bearing (SB72-0064)	

Table 3. Power Section Configuration Identification List
(Part No. 896162-1/-2/-3/-4/-5/-6) (Cont)

Power Section Series No.	Change No. Included	Description and Service Bulletin No.	Power Section Serial No.
14	Same as Series 12 Plus Changes:		20682 and subsequent
	23	Direct drive fuel control (SB72-0061)	
	26	One piece gearshaft	
	24	High speed journal bearing (SB72-0064)	
15	Same as Series 14 Plus Change:		20702 and subsequent
	30	Improved torque sensor gear center distance control	
16	Same as Series 15 Plus Change:		20707 and subsequent
	19	Three piece stator (SB72-0052)	
17	Same as Series 16 Plus Change:		20723 and subsequent
	32	Oil pressure regulator calibration change	
18	Same as Series 17 Plus Change:		20793 and subsequent
	33	Improved gearbox scavenging	

Table 3. Power Section Configuration Identification List
(Part No. 896162-1/-2/-3/-4/-5/-6) (Cont)

Power Section Series No.	Change No. Included	Description and Service Bulletin No.	Power Section Serial No.
19	Same as Series 18 Plus Change:		20813 and subsequent
	27	Pinion gearshaft with increased backlash	
20	Same as Series 19 Plus Change:		20859 and subsequent
	31	Improved torsion shaft	
21	Same as Series 20 Plus Change:		20878 and subsequent
	34	Incorporate thermocouple harness with protective wear band	
22	Same as Series 21 Plus Change:		20895, 20897, 20912, 20916, 20917 ONLY
	36	Incorporate one piece diffuser	
23	Same as Series 22 Plus Change:		20907 and subsequent
	38	Improved bracket for fuel control	
24	Same as Series 23 Plus Change:		20917 and subsequent
	35	Improved torque sensor	

Table 3. Power Section Configuration Identification List
(Part No. 896162-1/-2/-3/-4/-5/-6) (Cont)

Power Section Series No.	Change No. Included	Description and Service Bulletin No.	Power Section Serial No.
25	Same as Series 21 Plus Change:		20919 and subsequent
	35	Improved torque sensor	
26	Same as Series 25 Plus Change:		20932 and subsequent
	39	Improved combustor/ stator fit	
27	Same as Series 24 Plus Change:		20947 and subsequent
	37	Improved one piece gear-shaft	
28	Same as Series 27 Plus Change:		20938 then 20968 and 29069 then 20979 and subsequent
	42	Incorporate new turbine retainer to preclude vibration (SB72-0087)	
29	Same as Series 28 Plus Changes:		21036 and subsequent
	43	Added lock plate to journal bearing retainer bolts (SB72-0092)	
	44	Added corrosion resistant tube clamp to reduce fatigue at clamping point	

R
R
Table 3. Power Section Configuration Identification List
(Part No. 896162-1/-2/-3/-4/-5/-6) (Cont)

	Power Section Series No.	Change No. Included	Description and Service Bulletin No.	Power Section Serial No.
R R	30	Same as Series 29 Plus Changes:		21058 and subsequent
R R		45	Change to aged tube strength increase	
R R		46	Added CRES 347 tube for strength increase	
R R R R R		47	Improved mounted torque sensor to prevent housing rotation and improper tooth engagement	
R R		51	Chrome plated bull gear retainer	
R R		41	Replace seal to permit removal from hot end	
R		40	Improved transition liner	
R R	31	Same as Series 30 Plus Changes:		21060 and subsequent
R		48	Provide steel adapter	
R R		57	Incorporate common diaphragm	
R R	32	Same as Series 31 Plus Change:		21065 and subsequent
R R R		53	Hex head bolts and lock tabs for steel tube and adapter	

Table 3. Power Section Configuration Identification List
(Part No. 896162-1/-2/-3/-4/-5/-6) (Cont)

Power Section Series No.	Change No. Included	Description and Service Bulletin No.	Power Section Serial No.
33	Same as Series 32 Plus Changes:		21086 and subsequent
	49	Changed to CRES 347 tube for increased reliability	
	55	Provide select fit bushing to reduce wear	
34	Same as Series 33 Plug Change:		21123 and subsequent
	58	Provide improved steel tube with clamp	
35	Same as Series 34 Plus Changes:		21054 then 21134 and subsequent
	59	Torque sensor with spur gear and cam assembly with welded pins	
	60	Hex head bolts and key washer for rear bearing of prop shaft	
	61	Provide select fit on all three bushings to reduce wear	

R Table 3A. Power Section Configuration Identification List
R (Part No. 895722-1/-4/-7/-10)

	Power Section Series No.	Change No. Included	Description and Service Bulletin No.	Power Section Serial No.
R	1	-	Original Configuration	06504 through 06506 ONLY
R	2	Same as Series 1 Plus Change:		06501 through 06503 ONLY
R		1	New seal and rotor	
R	3	Same as Series 2 Plus Changes:		06507 and subsequent
R		2	Improved coupling assembly and shaft	
R		6	Seal and rotor	
R		7	Non-drilled cam gear	
R		8	Improved inlet contour	
R		9	Change to restrictor with filter	
R		10	Use of metal sprayed duct	
R		12	High speed pinion bearing	
R	4	Same as Series 3 Plus Change:		06511 and subsequent
R		15	Prevent distortion	
R	5	Same as Series 4 Plus Change:		06514 and subsequent
R		13	Plug chip detector hole in gearcase	

R Table 3A. Power Section Configuration Identification List
R (Part No. 895722-1/-4/-7/-10) (Cont)

	Power Section Series No.	Change No. Included	Description and Service Bulletin No.	Power Section Serial No.
R	6	Same as Series 5 Plus Changes:		06517 and subsequent
R		14	Remove plug from housing	
R		4	Internal plug retention (SB72-0029)	
R	7	Same as Series 6 Plus Changes:		06525 and subsequent
R		16	Improved insert retention (No service bulletin)	
R		3	Internal plug retention (SB72-0029)	
R	8	Same as Series 7 Plus Change:		06537 and subsequent
R		11	New seal and rotor (SB72-0009)	
R	9	Same as Series 8 Plus Changes:		06555 and subsequent
R		19	Stud replaces insert (SB72-0017)	
R		5	Internal plug retention (SB72-0029)	
R	10	Same as Series 9 Plus Changes:		06563 and subsequent
R		18	Tighter clearance compressor seal	

R Table 3A. Power Section Configuration Identification List
R (Part No. 895722-1/-4/-7/-10) (Cont)

	Power Section Series No.	Change No. Included	Description and Service Bulletin No.	Power Section Serial No.
R R	10 (Cont)	17	Improved first stage impeller	
R R	11	Same as Series 10 Plus Change:		06573 and subsequent
R		20	Increased flow area	
R R	12	Same as Series 11 Plus Change:		06603 and subsequent
R R		21	Increased filter flow (SB-613)	
R R R	13	Same as Series 12 Plus Change:		06605 through 06608 then 06610 and subsequent
R		29	Compressor seal	
R R R	14	Same as Series 13 Plus Changes:		06614, 06647, 06648, 06650 and subsequent
R R		22	Single wall oil inlet tube (SB79-0005)	
R R		24	Forward diaphragm clinch bolts (SB72-0046)	
R R	15	Same as Series 14 Plus Changes:		06651 and subsequent
R R R		23	Decrease sensitivity of torque sensor to oil temperature	

R
R Table 3A. Power Section Configuration Identification List (Part No. 895722-1/-4/-7/-10) (Cont)

	Power Section Series No.	Change No. Included	Description and Service Bulletin No.	Power Section Serial No.
R R R				
R R	15 (Cont)	27	Bull gear bearing retainer (SB72-0049)	
R R		28	High speed gearshaft and bearing set	
R R R	16	Same as Series 14 Plus Changes:		06658 through 06662 then 06664 and subsequent
R R R		23	Decrease sensitivity of torque sensor to oil temperature	
R R		27	Bull gear bearing retainer (SB72-0049)	
R R	17	Same as Series 16 Plus Change:		06663 then 06665 and subsequent
R R		36	Incorporate aspirated ITT shields	
R R	18	Same as Series 17 Plus Change:		06674 and subsequent
R R		25	Hydraulic turbine bearing mount (SB72-0089)	
R R	19	Same as Series 18 Plus Changes:		06613 ONLY
R R		26	Three piece stator (SB72-0052)	
R R		30	Direct drive fuel control (SB72-0061)	

R
R Table 3A. Power Section Configuration Identification List (Part No. 895722-1/-4/-7/-10) (Cont)

	Power Section Series No.	Change No. Included	Description and Service Bulletin No.	Power Section Serial No.
R R	19 (Cont)	31	High speed journal bearing (SB72-0064)	
R R	20	Same as Series 18 Plus Change:		06680 and subsequent
R		34	One piece gearshaft	
R R	21	Same as Series 20 Plus Changes:		06690 and subsequent
R R		30	Direct drive fuel control (SB72-0061)	
R R		31	High speed journal bearing (SB72-0064)	
R R	22	Same as Series 21 Plus Changes:		06695 and subsequent
R R		39	Torque sensor with improved gear mounting	
R R		26	Three piece stator (SB72-0052)	
R R	23	Same as Series 22 Plus Change:		06704 then 06753 and subsequent
R R R		38	Improved gearbox scavenging	
R R	24	Same as Series 23 Plus Change:		06756 and subsequent
R R		33	Pinion gearshaft with increased backlash	

R
R Table 3A. Power Section Configuration Identification List (Part No. 895722-1/-4/-7/-10) (Cont)

	Power Section Series No.	Change No. Included	Description and Service Bulletin No.	Power Section Serial No.
R	25	Same as Series 24 Plus Changes:		06799 and subsequent
R		37	Improved torsion shaft	
R		40	Incorporate thermocouple harness with protective wear band	
R	26	Same as Series 25 Plus Change:		06823 and 06837 ONLY
R		42	Incorporate one piece diffuser assembly	
R	27	Same as Series 25 Plus Change:		06849 through 06855 then 06859, 06862, 06865, 06867, 06869, 06869, 06870, 06872, 06874
R		41	Improved torque sensor with anti-rotation helical spring	
R	28	Same as Series 26 Plus Change:		06856, 06857, 06858, 06860, 06861, 06863, 06866, 06871,
R		41	Improved torque sensor with anti-rotation helical spring	
R	29	Same as Series 27 Plus Change:		06881 and subsequent
R		44	Improved combustor/ stator fit	

R
R
Table 3A. Power Section Configuration Identification List
(Part No. 895722-1/-4/-7/-10) (Cont)

	Power Section Series No.	Change No. Included	Description and Service Bulletin No.	Power Section Serial No.
R R	30	Same as Series 25 Plus Changes:		06897 then 06906 and subsequent
R R R		41	Improved torque sensor with anti-rotation helical spring	
R R		42	Incorporate one piece diffuser	
R R		44	Improved combustor/ stator fit	
R R	31	Same as Series 30 Plus Change:		06916 and subsequent
R R		43	Improved one piece gearshaft	
R R	32	Same as Series 31 Plus Change:		06936 and subsequent
R R R		47	Incorporate new turbine retainer to preclude vibration	
R R	33	Same as Series 32 Plus Changes:		06955 and subsequent
R R R		48	Added lock plate to journal bearing retainer bolts	
R R R		49	Added CRES tube clamp to reduce fatigue at clamp- ing point	

R
R Table 3A. Power Section Configuration Identification List (Part No. 895722-1/-4/-7/-10) (Cont)

	Power Section Series No.	Change No. Included	Description and Service Bulletin No.	Power Section Serial No.
R	34	Same as Series 33 Plus Change:		07002 and subsequent
R		50	Changed to aged tube, strength increase	
R	35	Same as Series 34 Plus Change:		06990 then 07021 and subsequent
R		45	Improved transition liner	
R	36	Same as Series 35 Plus Changes:		07038 and subsequent
R		52	Improved mounted torque sensor to prevent housing rotation and improper tooth engagement	
R		57	Chrome plated gear retainer	
R	37	Same as Series 36 Plus Changes:		07057 and subsequent
R		51	Added CRES 347 tube for strength increase	
R		35	Incorporate common diaphragm	
R	38	Same as Series 37 Plus Changes:		07077 and subsequent
R		53	Provide steel adapter	
R		63	Provide steel nozzle	

R
R
Table 3A. Power Section Configuration Identification List
(Part No. 895722-1/-4/-7/-10) (Cont)

	Power Section Series No.	Change No. Included	Description and Service Bulletin No.	Power Section Serial No.
R R R				
R R	39	Same as Series 38 Plus Change:		07090 and subsequent
R R R		46	Permit removal and re- placement of seal from hot end	
R R	40	Same as Series 39 Plus Change:		07092
R R R		60	Hex head bolts and lock tabs for steel tube and adapter	
R R	41	Same as Series 40 Plus Changes:		07137 and subsequent
R R		54	Changed to CRES 347 tube for increased reliability	
R R		61	Provide select fit bush- ing for reduced wear	
R R	42	Same as Series 41 Plus Changes:		07182 and subsequent
R R		64	Provide improved steel tube with clamp	
R R R		65	Torque sensor with spur gear and cam assembly with welded pins	
R R R		66	Hex bolts and key washer for rear bearing of prop shaft	
R R R		67	Provide select fit on all three bushings to reduce wear	

R
R Table 3A. Power Section Configuration Identification List
(Part No. 895722-1/-4/-7/-10) (Cont)

	Power Section Series No.	Change No. Included	Description and Service Bulletin No.	Power Section Serial No.
R R R				
R R	43	NOTE: Series 43 same as Series 9 plus changes 21, 22, 25, 26, 27, 29, 33, 34, 36, 37, 38, 40, and 42.		
R R	44	NOTE: Series 44 same as Series 22 plus changes 33, 40, 47, 48, 57, 51, 52, 54, 59, 60, 63, and 66.		

Table 3B. Power Section Configuration Identification List (Part No. 895722-2/-5/-8/-11)

Power Section Series No.	Change No. Included	Description and Service Bulletin No.	Power Section Serial No.
1	-	Original Configuration	22501 and subsequent
2	Same as Series 1 Plus Change:		22503 ONLY
	2	Stud replaces insert (SB72-0017)	
3	Same as Series 2 Plus Changes:		22504 and subsequent
	1	Improved first stage impeller	
	4	Increased flow area (SB-613)	
	5	Single wall oil inlet tube	
	6	Decrease sensitivity of torque sensor to oil temperature	
	3	Increase flow area	
	7	Forward diaphragm clinch bolts (SB72-0046)	
	10	Bull gear bearing re-tainer (SB72-0049)	
	12	Compressor seal	
	18	Incorporate aspirated ITT shields	

Table 3B. Power Section Configuration Identification List (Part No. 895722-2/-5/-8/-11) (Cont)

Power Section Series No.	Change No. Included	Description and Service Bulletin No.	Power Section Serial No.
4	Same as Series 3 Plus Changes:		22506 and subsequent
	8	Hydraulic turbine bearing mount (SB72-0089	
	13	Direct drive fuel control (SB72-0061)	
	14	High speed journal bearing (SB72-0064)	
	16	One piece gearshaft	
	9	Three piece stator (SB72-0052)	
5	Same as Series 4 Plus Changes:		22510 and subsequent
	19	Improved gearbox scavenging	
	15	Pinion gearshaft with increased backlash	
6	Same as Series 5 Plus Change:		22512 and subsequent
	20	Improved torsion shaft	
7	Same as Series 6 Plus Change:		22523 and subsequent
	21	Incorporate thermocouple harness with protective wear band (SB79-0005)	

Table 3B. Power Section Configuration Identification List (Part No. 895722-2/-5/-8/-11) (Cont)

Power Section Series No.	Change No. Included	Description and Service Bulletin No.	Power Section Serial No.
8	Same as Series 7 Plus Change:		22522, 22527, 22528 ONLY
	23	One piece diffuser assembly	
9	Same as Series 8 Plus Change:		22530 and subsequent
	22	Improved torque sensor with anti-rotation helical spring	
10	Same as Series 9 Plus Change:		22539 and subsequent
	25	Improved combustor/ stator fit	
11	Same as Series 10 Plus Change:		22543 and subsequent
	24	Improved one piece gearshaft	
12	Same as Series 11 Plus Change:		22546 then 22551 and subsequent
	28	Incorporate new turbine bearing mount to preclude vibration	
13	Same as Series 12 Plus Changes:		22558 and subsequent
	29	Added lock plate to journal bearing retainer bolts	

R R Table 3B. Power Section Configuration Identification List (Part No. 895722-2/-5/-8/-11) (Cont)

	Power Section Series No.	Change No. Included	Description and Service Bulletin No.	Power Section Serial No.
R	13 (Cont)	30	Added CRES tube clamp to reduce fatigue at clamping point	
R	14	Same as Series 13 Plus Change:		22577 and subsequent
R		31	Changed to aged tube, increased strength	
R	15	Same as Series 14 Plus Change:		22590 and subsequent
R		26	Improved transition liner	
R	16	Same as Series 15 Plus Change:		22604 and subsequent
R		33	Improved mounted torque sensor to prevent housing rotation and improper tooth engagement	
R	17	Same as Series 16 Plus Changes:		22620 and subsequent
R		32	Added CRES 347 tube for strength increase	
R		37	Chrome plated bull gear retainer	
R	18	Same as Series 17 Plus Change:		22621 and subsequent
R		17	Incorporated common diaphragm	

Table 3B. Power Section Configuration Identification List
(Part No. 895722-2/-5/-8/-11) (Cont)

Power Section Series No.	Change No. Included	Description and Service Bulletin No.	Power Section Serial No.
19	Same as Series 18 Plus Changes:		22640 and subsequent
	34	Provides steel adapter	
	43	Provides steel nozzle	
	27	Permit removal and replacement of seal from hot end	
20	Same as Series 19 Plus Change:		22641 and subsequent
	40	Hex head bolts and lock tabs for steel tube and adapter	
21	Same as Series 20 Plus Changes:		22683 and subsequent
	35	Changed to CRES 347 tube for increased reliability	
	41	Provide select fit bushing to reduce wear	
22	Same as Series 21 Plus Changes:		22696 and subsequent
	44	Provide improved steel tube with clamp	
	46	Hex head bolts and key washer for rear bearing of prop shaft	
	45	Torque sensor with spur gear and cam assembly with welded pins	

R Table 3B. Power Section Configuration Identification List
R (Part No. 895722-2/-5/-8/-11) (Cont)

R Power Section Series No.	Change No. Included	Description and Service Bulletin No.	Power Section Serial No.
R 22 (Cont)	47	Provide select fit on all three bushings to reduce wear	

Table 3C. Power Section Configuration Identification List
(Part No. 895722-6/-12)

Power Section Series No.	Change No. Included	Description and Service Bulletin No.	Power Section Serial No.
1	-	Original Configuration	101 and subsequent
2	Same as Series 1 Plus Changes:		106 and subsequent
	1	Incorporate common diaphragm	
	2	Permit removal and replacement of seal from hot end	
	3	Hex head bolts and lock tabs for steel tube and adapter	
	4	Chrome plated bull gear retainer	
	5	Select fit for torsion shaft bushings to reduce wear	
	6	Provide steel nozzle	
	7	Provide improved steel tube with clamp	
	8	Hex head bolts and key washer for rear bearing of prop shaft	
	9	Torque sensor with spur gear and cam assembly with welded pins	
	10	Provide select fit on all torsion shaft bushings to reduce wear	

R Table 4. Nose Cone Assembly Configuration Identification List
R (Part No. 3101725-2)

	Nose Cone Series No.	Change No. Included	Description and Service Bulletin No.	Nose Cone Serial No.
R	1	-	Original Configuration	P-143 and subsequent
R	-	-	Changed nameplate (SPB TPE0052)	

R
R Table 4A. Nose Cone Assembly Configuration Identification List (Part No. 3101725-3)

	Nose Cone Series No.	Change No. Included	Description and Service Bulletin No.	Nose Cone Serial No.
R R	1	-	Original Configuration	P-101 and subsequent
R R	-	-	Changed nameplate (SPB TPE0052)	

Table 5. Intermediate Housing and Gear Assembly (Diaphragm) Configuration List (Part No. 3101807-2)

Diaphragm Series No.	Change No. Included	Description and Service Bulletin No.	Diaphragm Serial No.
1	-	Original Configuration	P-135
-	-	Changed nameplate (SPB TPE0053)	
2	Same as Series 1 Plus Change: -	 Permit use of reworked diaphragm assembly with existing bearing	553 through 557 then 570 through 575
3	Same as Series 1 Plus Change: 2	 Bull gear anti-rotation to reduce possibility of bearing wear	660 through 817 then 1022 and subsequent
4	Same as Series 3 Plus Change: 4	 Improved high speed pinion bearing (SPB TPE0148)	818 through 1021 then 1253 and subsequent

Table 5A. Intermediate Housing and Gear Assembly (Diaphragm)
Configuration Identification List (Part No. 3101807-9)

Diaphragm Series No.	Change No. Included	Description and Service Bulletin No.	Diaphragm Serial No.
1	-	Original Configuration	P-164 through P-652, P-757, P-758
-	-	Changed nameplate (SPB TPE0053)	
2	Same as Series 1 Plus Change:		P-653 through P-756 then P-759 and subsequent
	2	Improved bull gear bearing retention (SB72-0170)	
3	Same as Series 2 Plus Change:		P-1201 and subsequent
	4	Improved high speed pinion bearing (SPB TPE0148)	

R
R Table 6. Power Group Assembly Configuration Identification List (Part No. 3101880-5)

	Power Group Series No.	Change No. Included	Description and Service Bulletin No.	Power Group Serial No.
R	1	-	Original Configuration	P-103 and subsequent
R	-	-	Changed nameplate	P-210 and subsequent
R	2	Same as Series 1 Plus Change:		P-884 and subsequent
R		9	Improved combustor (SB72-0126)	
R	3	Same as Series 2 Plus Change:		P-1090 and subsequent
R		8	Changed turbine bearing support (No service bulletin)	

R Table 6A. Power Group Assembly Configuration Identification List
R (Part No. 3101880-7)

Power Group Series No.	Change No. Included	Description and Service Bulletin No.	Power Group Serial No.
1	-	Original Configuration	
2	Same as Series 1 Plus Change:		P-884 and subsequent
	9	Improved combustor (SB72-0126)	
3	Same as Series 2 Plus Change:		P-994 and subsequent
	10	Provide diffuser assembly with stronger O.D. joint	
4	Same as Series 3 Plus Change:		P-1090 and subsequent
	8	Changed turbine bearing support (No service bulletin)	

Table 7. Applicable Publications List

Nomenclature	Part No.	Publication	Type
Turboprop Aircraft Engine	895720-1/-2/-3 896160-1/-3/-5 896950-1-1/-2/-3 3101300-2 3010630-1 3010840-1 3102450-1 31012520-1/-2	72-00-94, 72-00-96	IPC OH
Power Section	895722-1/-2/-4/ -5/-6/-7/-8/-10/ -11/-12 896162-1/-2/-3 -4/-5/-6	72-00-04	OH
Nose Cone Assy (Module)	3101725-2/-3	72-00-15	OH/IPC
Intermediate Housing and Gear Assy (Diaphragm) (Module)	3101807-2/-9	72-00-16	OH/IPC
Power Group Assy (Module)	3101880-5/-7	72-00-18	OH/IPC
Anti-Ice Valve Assy	895203-1 894436-1	73-10-20 73-10-21	OH/IPC OH/IPC
Feathering Valve Assy	869245-4	72-13-04	OH/IPC
Fuel Control Unit	893528-24 *Bendix Part No. 2524660-1 and -27	15-613	OH/IPC
	893528-32 *Bendix Part No. 2524660-1, -27 and -29 thru -31	15-613	OH/IPC
	893561-9 **Woodward Part No. 8070-108	40068B	OH/IPC

*Bendix Corp, 717 Bendix Dr, South Bend, IN 46620
**Woodward Governor Co, 5001 N 2nd St, Rockford, IL 61101

Table 7. Applicable Publications List (Cont)

Nomenclature	Part No.	Publication	Type
Fuel Control Unit (Cont)	893561-10 **Woodward Part No. 8070-110	40068B	OH/IPC
	893561-11 **Woodward Part No. 8070-211	40068B	OH/IPC
	893561-12 **Woodward Part No. 8070-212	40068B	OH/IPC
	895410-12 *Bendix Part No. 2524658-26/-27	15-613	OH/IPC
	895410-15 *Bendix Part No. 2524658-26/-27	15-613	OH/IPC
Fuel Enrichment Valve Assembly	895208-1	73-21-12	OH/IPC
Fuel Flow Divider and Drain Valve	394324-1-1/-2-1	73-10-14	OH/IPC
	394390-1-1	73-10-15	OH/IPC
Fuel Manifold and Nozzle Assembly - Primary	893468-1/-4/-7	73-10-16	OH/IPC
Fuel Manifold and Nozzle Assembly - Secondary	893469-2/-3/-5	73-10-16	OH/IPC
Fuel Pressure Regulator	394312-2-1/-4-1	73-10-03	OH/IPC
Fuel Pressurizing Valve	869381-1	73-21-15	OH/IPC
Fuel Pump Assembly	869151-5	73-21-07	OH/IPC
	895413-1	73-21-09	OH/IPC
	897400-1	73-21-19	OH/IPC
	897380-1	73-21-20	OH/IPC
Fuel Shutoff Valve	394230-4-1	73-10-06	OH/IPC

*Bendix Corp, 717 Bendix Dr, South Bend, IN 46620
**Woodward Governor Co, 5001 N 2nd St, Rockford, IL 61101

Table 7. Applicable Publications List (Cont)

Nomenclature	Part No.	Publication	Type
Oil to Fuel Cooler Assembly	156120-2-1	2-220	OH/IPC
Oil Pressure Pump Assembly	867165-6/-7/ -14/-16	72-10-03	OH/IPC
Oil Pressure Regulator Assembly	869601-2/-3	79-20-05	OH/IPC
Oil Scavenge Pump Assembly (Gearcase)	868948-1/-2 3101321-1	72-12-03 72-12-04	OH/IPC OH/IPC
Oil Scavenge Pump Assembly (Turbine)	865046-3	72-50-04	OH/IPC
Propeller Governor	893615-3 **Woodward Part No. 210536	33091	OH/IPC
	893615-4 **Woodward Part No. 210738	33091A	OH/IPC
	894418-3 **Woodward Part No. 210540J	72-13-20	OH/IPC
	894418-4 **Woodward Part No. 210735	72-13-20	OH/IPC
	894418-5 **Woodward Part No. 210742	72-13-20	OH/IPC
Propeller Pitch Control	869130-12/-13 895481-1/-2	72-13-11 72-13-12	OH/IPC OH/IPC
Resistor Assembly (Compensating Resistor)	305520-1-1 thru -43-1	77-20-01	OH/IPC
Solenoid Shutoff Valve Assembly (Anti-Ice)	319980-5-1/-6-1	75-10-01	OH/IPC

**Woodward Governor Co, 5001 N 2nd St, Rockford, IL 61101

Table 7. Applicable Publications List (Cont)

Nomenclature	Part No.	Publication	Type
Solenoid Valve (Oil Vent Valve)	319974-1-1	79-20-06	OH/IPC
Speed Switch	305394-2 305538-3/-6	74-30-01 74-30-02	OH/IPC OH/IPC
Torque Limiter Assy	895380-1/-2/-3	73-22-01	OH/IPC
Torque and Temperature Controller	***949594-4/-5	3-2188	Operation and Service Manual
Torque Sensor Assembly	895609-1/-2/-4/-5/-6/-8 896826-2 thru -5 and -8/-9/-11/-12	72-12-11 72-12-12	OH/IPC OH/IPC
Torque Sensor Assembly (Module)	3101726-1	72-00-17	OH/IPC
Torque Sensor Compensator Assembly	867916-6	77-10-01	OH/IPC

***AiResearch Mfg Co of California, 2525 W 190th St, Torrance, CA 90509

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CHAPTER 70 - STANDARD PRACTICES

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GENERAL - STANDARD PRACTICES

1. General

The standard practices and general maintenance instructions presented in this chapter are recommended by the engine manufacturer. Frequent reference shall be made to this chapter by personnel engaged in maintenance procedures outlined in this publication. Table 1 provides a list of tools and consumable material required to perform STANDARD PRACTICES.

Table 1. Tools and Consumable Materials

Tool, Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Any approved engine fuel	Commercially available
Any approved engine oil	Commercially available
Alternate lubricant: Lubricant (OS-124)	Monsanto Company, 800 N Lindbergh Blvd, St Louis, MO 63166
Brush-on paint remover (Federal Specification TT-R-251)	Commercially available
Color coat (Andrew Brown A423-66 Enamel No. 051 and C-1178 Converter)	Griggs Paint and Hardware Co, 3602 S 16th Place, Phoenix, AZ 85040
Heli-coil extracting tools	Mite Corp, 466 Blake St, New Haven, CT 06515
High temperature compound (Fel-Pro C5-A)	Fel-Pro Inc, Division of Felt Products Mfg Co, 7450 N McCormick Blvd, Skokie, IL 60076
Keensert installation tool	Tridair Ind, Fastener Div, 3000 W Lomita Blvd, Torrance, CA 90505
Lacquer (MIL-L-7146)	Commercially available
Paint and carbon remover (Turco XE-092 W)	Turco Products Inc, Purex Corp Ltd, 24600 S Main St, Wilmington, CA 90746

Table 1. Tools and Consumable Materials (Cont)

Tool, Material or Compound	Manufacture
Primer (P-415-66-611B with Catalyst C1178-66)	Griggs Paint, Subsidiary of Domcom Dist, 3602 S 16th Place, Phoenix, AZ 85040
Staking compound (Loctite, Grade AV)	Loctite Corp, 705 N Mountain Rd, Newington, CT 06111
Violet master marker (Grade 127-1/2)	Pannier Corp, 207 Sandusky, St, Pittsburgh, PA 15212

2. Standard Disassembly Procedures

A. Observe the following general procedures throughout disassembly or removal operations.

(1) Place each part removed from the engine on a clean workbench in the order of disassembly, in preparation for cleaning and inspection. Keep hardware and small parts together in trays to prevent parts from being mislaid.

(2) Provide proper covering or support to protect shafts, gears, studs, curvics or any projecting part from being bent, scratched or otherwise damaged.

(3) Do not use steel or lead hammers directly on the assemblies or their parts. Use cellulose-tipped hammers, fiber or rawhide mallets. Do not clamp parts directly in the steel jaws of a bench vise. Use a vise having micarta jaws or equivalent.

(4) Spray steel parts with engine oil after disassembly. Cover all parts with plastic sheeting or suitable plastic closures unless cleaning and inspection are to be accomplished immediately.

(5) Do not disassemble tube assemblies, hose assemblies, riveted assemblies, staked or press-fit parts (except seals and bearings), remove nameplates, modification plates, lubrication plates, decals, studs or their lockrings and thread inserts, unless specifically required in the text or necessary for replacement of a part. If disassembly or removal is necessary, proceed in a manner consistent with good shop practice.

2. A. (6) Always seal ports, bores and passages. Cover large openings with plastic sheeting. Cap open tube ends. If the engine is to be left for even a short period in a partially disassembled state, cover or cap all openings.

(7) During various stages of disassembly, examine all parts and assemblies for signs of scoring, burning or other defects. Note physical conditions which will not be apparent after cleaning. Tag involved parts before they are cleaned and laid out for detailed inspection.

(8) Note and record number and thickness of all shims or shim washers removed from the various components of the engine for reference at reassembly.

(9) Record manner of lockwiring for duplication at reassembly.

CAUTION: NO SCRIBE MARKS ARE ALLOWED ON ROTATING PARTS.

(10) Use violet master marker (Grade 127-1/2) for indexing housings and shafts where required during disassembly.

3. Standard Reassembly Procedures

A. Perform reassembly procedures with careful attention to details outlined in this publication. Highest standard of precision engine shop procedures shall be observed throughout reassembly. Observe the following general procedures at reassembly.

(1) Exercise extreme care to prevent dirt, dust or foreign particles from entering the engine. If any foreign particle is dropped into the engine during maintenance, stop work until foreign particle is located and removed, even if this may cause considerable disassembly.

(2) For added protection to the engine, cover large openings with plastic sheeting. Cap open tube ends. If the engine is to be left for even a short period in a partially disassembled state, cover or cap all openings.

(3) If any parts were coated with corrosion-preventive compound, remove all traces of compound and any accumulated foreign matter. Be sure all parts are thoroughly clean before assembly. Wipe all parts and surfaces with a clean, lint-free cloth.

CAUTION: NO SCRIBE MARKS ARE ALLOWED ON ROTATING PARTS.

3. A. (4) When special measurements for shimming of fitting are made on parts or on assembled parts prior to their installation in the next higher assembly, tag these parts as measured components of the higher assembly and keep with that assembly. If replacement of a measured component is required, repeat all measurements which include that part, using the new part.

(5) Lightly coat new packings and gaskets used in the engine fuel system with clean engine fuel or lubricant (OS-124) prior to installation, and lightly coat new packings and gaskets used in the engine oil system with clean engine oil or lubricant (OS-124) prior to installation. Unless otherwise specified, lightly coat oil wetted parts (gears, shafts, bearings, etc) with clean engine oil prior to assembly.

(6) Unless otherwise specified, coat threaded male plumbing fittings (except first two threads) lightly with clean engine oil before assembly.

(7) Whenever non-standard torque values are required for individual parts, the parts are identified and the torque requirements are listed in the applicable chapter/section/subject covering the part. These specified torque values do not include frictional torques developed by self-locking devices or "run-down" resistance. The frictional resistance or "run-down" torque must be added to the specified torque. Torque tolerances are not provided for nuts and bolts since this tolerance is assumed to be the nominal tolerance of a properly calibrated torque wrench. Where two torque values are included, the lower value shall be used when torque is applied to the nut and the bolt is held stationary. When torque is applied to the bolt and the nut is held stationary, the higher value shall be used. When torque values are not specified, conform to standard shop practice of sources such as FAA Manual AC65-9, Airframe and Powerplant Mechanics General Handbook.

3. A. (8) Follow general guidelines listed in Tables A and B for tightening small fasteners.

NOTE: Fasteners installed through essentially inelastic boundaries will first be tightened to remove visible clearance between parts. During this initial tightening of the fastener, the "run-down" resistance shall be noted on the last rotation just before establishment of a tensile preload in the fastener. The fastener shall then be given a steady additional tightening movement by the wrench to produce a final torque, that is approximately equal to the "run-down" torque plus the values shown in Table A for the respective thread size. This procedure will produce +35/-35 percent accuracy which is adequate for all items not listed under torque values below. As a further assistance, Table B gives general guidelines for obtaining the final torque.

Table A:

	Torque (in.-lb)	
Thread Size	Aluminum Fastener	Cres Fastener
6	5	10
8	10	20
10	15	35
1/4	45	75
5/16	80	160
3/8	140	275

Table B:

Thread Size	Approximate Rotation After Run-down
6-32	45 deg
8-32	60 deg
10-24	40 deg
1/4-20	40 deg
5/16-18	40 deg
3/8-24	60 deg

R

3. A. (8) (a) Fasteners installed through elastic boundaries (sealed by means of a diaphragm or similar elastomeric gasket) shall be tightened uniformly to effect a pressure-tight seal.

R (9) Unless otherwise specified flared tubing and hose fitting, not used
R with conical seals, shall be tightened to torque values specified in Table 2.

Table 2. Standard Torque Values for Flared Tubing and Hose Fittings
R Not Used with Conical Seals

Tube Dash No.	Aluminum Parts	All Steel Parts	Torque Units
2	12-15	35-40	in.-lb
3	20-35	70-80	in.-lb
4	40-60	100-120	in.-lb
5	65-85	140-160	in.-lb
6	100-120	190-220	in.-lb
7	140-160	240-280	in.-lb
8	180-220	300-350	in.-lb
10	270-330	440-500	in.-lb
12	360-440	600-660	in.-lb
16	500-620	840-960	in.-lb
20	660-780	1080-1320	in.-lb
24	800-960	1500-1800	in.-lb
28	960-1140	2160-2520	in.-lb
32	1080-1320	2400-2880	in.-lb

CAUTION: PROPER INSTALLATION OF CONICAL SEALS DESCRIBED IN THE FOLLOWING STEP IS ESSENTIAL TO AVOID FLOW RESTRICTION OR SUBSEQUENT LEAKAGE. CONICAL SEALS ARE TO BE USED ONLY ONCE AND SHALL BE REPLACED AT EACH DISASSEMBLY OF PLUMBING. ENSURE THAT PREVIOUSLY INSTALLED CONICAL SEAL IS REMOVED FROM PLUMBING FITTING BEFORE INSTALLING NEW CONICAL SEAL.

NOTE: Conical seals are used at specific locations during engine production to preclude leakage. However, conical seals may be used at any flared tubing fitting of appropriate size in fuel and oil systems as a repair to correct leakage at the option of the user.

3. A. (10) Unless otherwise specified, flared tubing fittings when used with conical seals shall be tightened to torque values in Table 3. When conical seals are used, install conical seals and tighten fittings as follows.

(a) Select proper conical seal part number for tube assembly being installed. (Refer to table 3.)

(b) Lubricate conical seal and threads of plumbing fitting with clean engine oil.

CAUTION: DO NOT INSTALL CONICAL SEAL INTO TUBE NUTS. SEAL SHALL BE INSTALLED ON MALE FITTING ONLY.

(c) Install conical seal onto male flare portion of plumbing fitting. Flats on conical seal are designed to provide proper positioning of seal onto plumbing fitting to prevent cocking of seal that could cause flow restriction.

(d) Thread tube nut onto plumbing fitting several turns with fingers until joint is snug. If tube nut cannot be tightened snugly with fingers, disassemble and correct problem to prevent assembly damage to conical seal.

CAUTION: USE CARE NOT TO TIGHTEN TUBE NUTS MORE THAN SPECIFIED TO AVOID DAMAGING SEAL. DO NOT LOOSEN TUBE NUT AFTER INITIAL TORQUE APPLICATION WITHOUT REPLACING CONICAL SEAL.

CONICAL SEAL IS SUBJECT TO COLD CREEP; THEREFORE A DOUBLE TIGHTENING PROCEDURE IS REQUIRED.

3. A. (10) (e) Tighten tube nuts as follows.

1 Tighten tube nuts to torque value specified in Table 3. Torque values are higher than torque values for tube nuts without conical seals installed.

2 Allow five minutes elapsed time for cold creep to occur.

3 Recheck torque on tube nuts and, if required, further tighten to torque value specified in Table 3.

Table 3. Standard Torque Values for Flared Tubing Fittings Used with Conical Seals

Tube Dash No.	Conical Seal Part No.	Torque (in.-lb) All Steel Parts
3	651-525-9003	95 to 105
4	651-525-9004	135 to 155
5	651-525-9005	195 to 215
6	651-525-9006	270 to 300
8	651-525-9008	360 to 400

(11) Minimum running torque values have been established for several sizes of bolts and self-locking female threads. Bolts and inserts with running torques less than the below minimum shall be replaced.

Bolt/Insert Size	Minimum Running Torque
8-32	4 in.-lb
10-32	6 in.-lb
1/4-20	6 in.-lb
1/4-28	6 in.-lb

3\. A. (12) Any extension used with a torque wrench to provide access, or any special tool, providing an offset causes a difference indicated and actual torque. The actual torque applied in this condition may be calculated as follows.

$$R = \frac{T \times L}{L + E}$$

Where: R = Indicated torque on torque wrench

T = Actual torque

L = Effective length of torque wrench lever arm (See figure 1)

E = Effective length of offset (See figure 1)

4\. Replaceable Components

A. Replace the following components in addition to the replacable components outlined in other chapters.

(1) Replace all plumbing, tubing, fittings, brackets, grommets, and common hardware if required.

(2) Replace all packings and gaskets removed during maintenance.

B. Replace Damaged Keensert Studs and Inserts

NOTE: Studs less than three-eighths inch diameter do not have a pilot hole.

(1) Cut off stud just above mounting surface to expose pilot hole for removal drill.

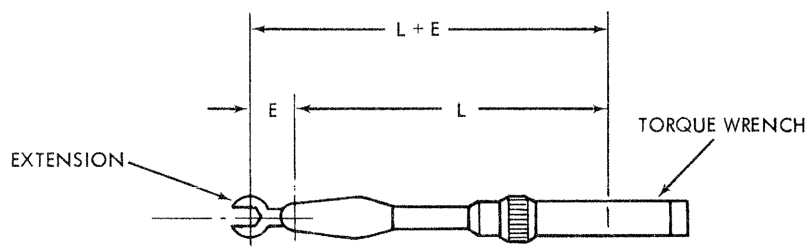
CAUTION: DO NOT ALLOW DRILL TO TOUCH HOUSING OR DAMAGE MAY RESULT.

(2) Using pilot hole as a guide, drill out stud or insert until only a thin shell remains.

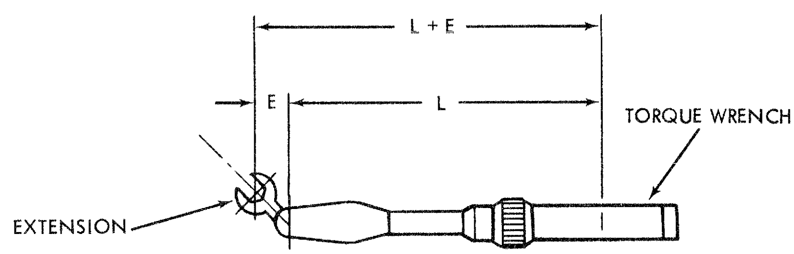
(3) Bend locking keys inward and break them off. Remove stud or insert with an "easy-out" tool.

(4) Install replacement stud or insert if same size as original.

(5) Check that hole and replacement stud or insert are free of foreign matter. Coat threads with staking compound (Loctite, Grade AV).



EXAMPLE 1



EXAMPLE 2

I-48A-300

Determining Effective Length of Torque Wrench and Extension
Figure 1

4. B. (6) Turn stud or insert into threaded hole until step is 0.01 to 0.03 inch below machined surface. Drive in locking key using a hammer and keensert installation tool.

C. Replace Damaged Heli-Coil Inserts

(1) Damaged heli-coil inserts may be removed with heli-coil extracting tools. For removal and replacement instructions and tools required, reference should be made to the manufacturer.

5. Cleaning

A. Specific cleaning procedures for individual parts are listed in 72-00-00, GENERAL - CLEANING/PAINTING. Correct and thorough cleaning of all components is important to successful inspection, maintenace and satisfactory operation maintenance.

WARNING: CLEANING SHALL BE PERFORMED IN A CLEAN, WELL-VENTILATED ROOM. RUBBER GLOVES AND PROTECTIVE CLOTHING SHALL BE WORN. EXTINGUISHERS AND VAT OR TANK COVERS SHALL BE ON HAND IN CASE OF FIRE.

(1) After cleaning, place components on clean paper-covered benches. Ports and orifices shall be capped, plugged or sealed, and protected from dust or other contaminants by plastic covers. Steel and 400 series stainless steel parts require the application of corrosion-preventive compounds after cleaning to prevent rust and corrosion.

(2) Clean all parts to remove oil, grease, dust stains and soiled areas. Flange areas, register diameters and sealing surfaces shall be cleaned of oil, gaskets and sealing compound, if present.

(3) Remove corrosion products, whenever they appear and re-treat base metal before reassembly. Heat discoloration of metal surfaces due to normal service temperature is not objectionable, however, scale that may come loose and damage the engine shall be removed. Carbon residue and combustion products shall be removed.

(4) Do not remove paint films that are tightly bonded to base metal and are otherwise serviceable; however, clean and touch up the top coat as required.

6. Painting

A. Prepare Parts for Repainting

(1) Dip part in paint and carbon remover (Turco XE-092 W). Where complete stripping is not desirable or feasible, a brush-on paint remover (Federal Specification TT-R-251) may be used.

(2) Following stripping operation, thoroughly clean, wipe and dry part.

(3) Treat magnesium parts from which paint has been removed in preparation for repainting to prevent corrosion in accordance with 72-00-00, GENERAL - CLEANING/PAINTING.

(4) Repaint external, non-critical surfaces of parts as follows, unless otherwise specified, in applicable repair instructions for individual parts.

(a) Plug all holes and mask all areas not to be painted. Thoroughly clean and dry the surfaces to be painted.

(b) Prepare primer (P-415-66-611B with Catalyst C1178-66) (mix in equal parts by volume). Prepare color coat (Andrew Brown A423-66 Enamel No. 051 and C-1178 Converter) (mix equal parts by volume).

(c) First apply one coat of primer and allow to air-dry 15 to 30 minutes followed by one hour at 79 to 107C (175 to 225F), then apply one coat of color coat. Allow to air-dry 15 to 30 minutes followed by one hour at 79 to 107C (175 to 225F).

7. Other Standard Practices

A. Standard practices which are considered common throughout industry, such as riveting, welding, etc, are not included in this publication.

B. Lockwiring

(1) The double-twist method of safetywiring is the most common method used. The single-wire method may be used on parts in electrical systems and in places that are difficult to reach.

(2) When securing closely spaced bolts, the number that can be secured by a 24 inch length of wire is the maximum number that may be safety wired in a series.

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CHAPTER 71 - POWER PLANT

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FIRESHIELDS - DESCRIPTION AND OPERATION

The fireshields consists of upper and lower shield half assemblies mounted around the circumference of the plenum assembly mounting flange. Purpose of the fireshields is to confine the heat generated in the combustion section to the rear half of the engine.

FIRESHIELDS - MAINTENANCE PRACTICES

1. Removal/Installation

NOTE: Table 201 provides a list of all materials and compounds required to perform Removal/Installation.

Table 201. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
High temperature compound (Fel-Pro C5-A)	Fel-Pro Inc, Division of Fel Products Mfg Co, 7450 North McCormick Blvd, Skokie, IL 60076

R A. (Codes BA-EA, GA, KA) Remove Fireshields (See Figures 201, 202)

(1) Remove thermocouple harness assembly. Refer to 77-20-03, MAINTENANCE PRACTICES.

(2) Remove turbine oil supply lines. Refer to 79-20-08, MAINTENANCE PRACTICES.

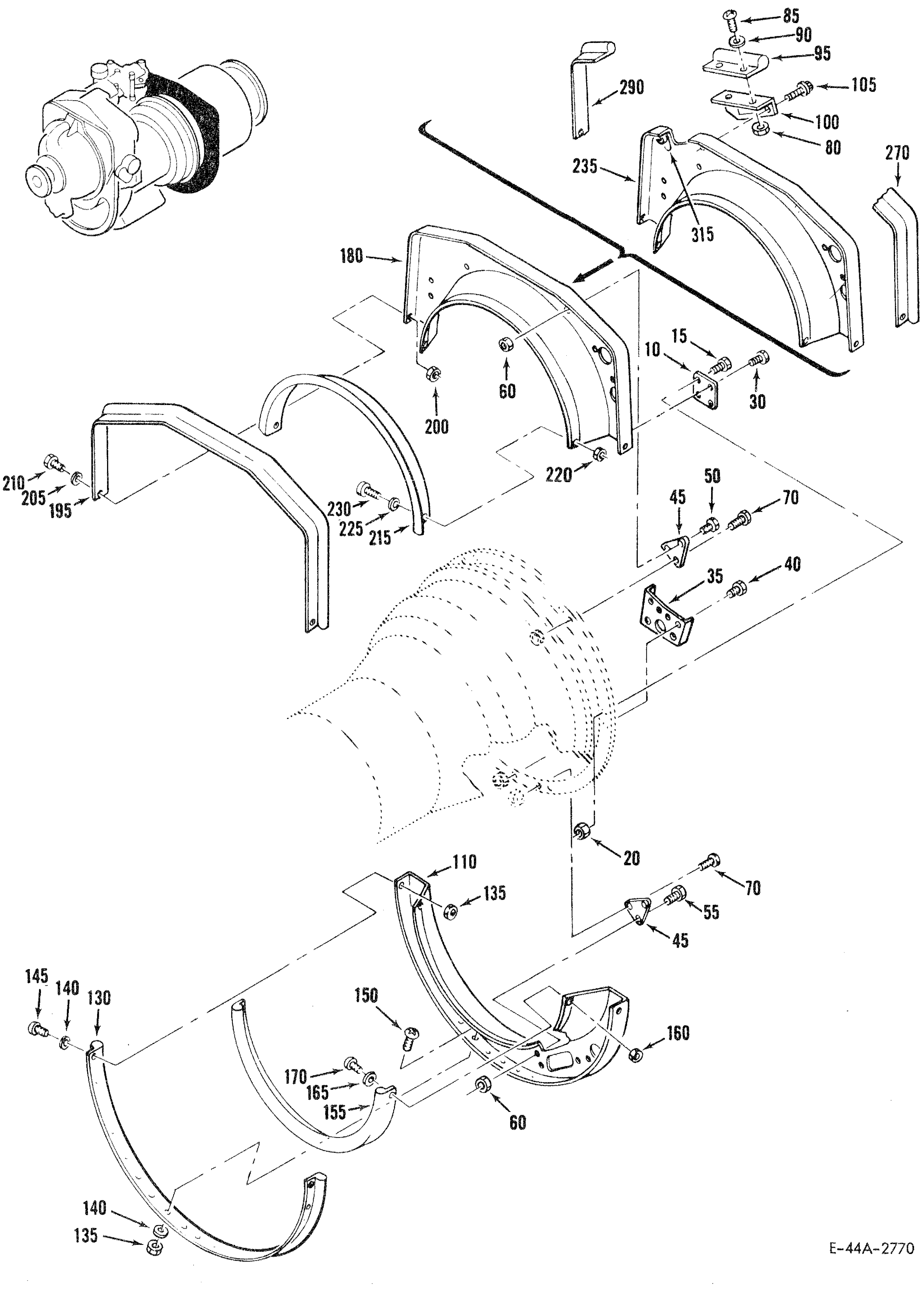
R (3) Remove bleed air lines. Refer to 73-10-01, 73-10-13, 73-10-02 and 75-10-01, MAINTENANCE PRACTICES.

R (4) (Codes BA-BC, EA, GA, KA) Remove fuel heater lockout valve plumbing. Refer to 73-10-01, MAINTENANCE PRACTICES.

(5) Remove fuel manifold assembly and fuel flow divider. Refer to 73-10-07, MAINTENANCE PRACTICES.

(6) Remove ignition leads. Refer to 74-10-01, MAINTENANCE PRACTICES.

(7) Remove shield half assemblies.



R

(Codes BA-BC, EA, GA, KA) Fireshield Installation
Figure 201

NOTE: Apply high temperature compound (Fel-Pro C5-A) to threads of bolts, studs, screws or nuts and to threads (except first two threads) of male plumbing fittings located aft of the fireshield unless otherwise specified.

R 1. B. (Codes BA-BC, EA, GA, KA) Install fireshields (See Figure 201)

(1) Apply compound (Fel-Pro C5-A) to bolts.

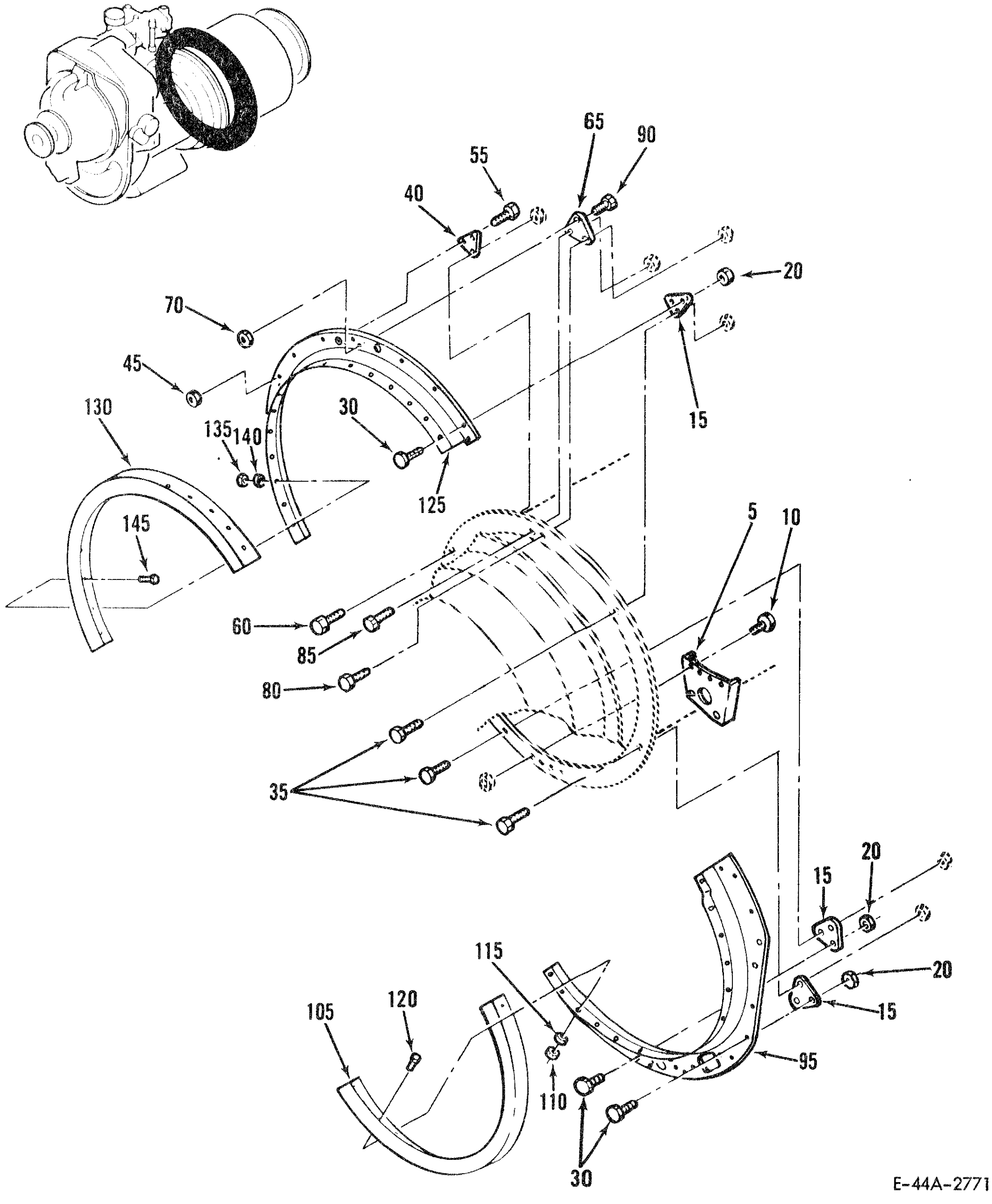
(2) Assemble gaskets on lower shield half. Install supports and secure. Tighten bolts (30, 55, figure 201) to 25 inch-pounds torque. Tighten bolts (40) to 60 inch-pounds torque. Tighten screws (145, 150, 170) to seven inch-pounds torque.

(3) Assemble seal, upper shield half assembly. Install supports and secure. Tighten bolts (30, 50, figure 201) to 25 inch-pounds torque. Tighten screws (210, 230) to seven inch-pounds torque.

(4) Install shield half assemblies. Tighten bolts (15, 40, 70, figure 201) to 60 inch-pounds torque.

KEY TO FIGURE 201

10. SUPPORT
15. BOLT
20. NUT
30. BOLT
35. SUPPORT
40. BOLT
45. SUPPORT
R 50. BOLT
55. BOLT
60. NUT
70. BOLT
80. NUT
85. SCREW
90. WASHER
95. GASKET
100. COVER
R 105. BOLT
110. SHIELD LOWER HALF
130. GASKET
135. NUT
140. WASHER
145. SCREW
150. SCREW
155. GASKET
160. NUT
165. WASHER
170. SCREW
180. SHIELD UPPER HALF (CODES BA-BC, EA)
195. GASKET
200. NUT
205. WASHER
210. SCREW
215. GASKET
220. NUT
225. WASHER
230. SCREW
235. SHIELD UPPER HALF (CODES GA, KA)
270. GASKET
290. GASKET
315. NUT PLATE



R

(Codes CA-CC) Fireshield Installation
Figure 202

1. B. (5) (Codes GA, KA) Install cover and secure. Tighten bolts (105, figure 201) to 35 inch-pounds torque. Tighten screws (85) to seven inch-pounds torque.

(6) Install ignition leads. Refer to 74-10-01, MAINTENANCE PRACTICES.

(7) Install fuel manifold assembly and fuel flow divider. Refer to 73-10-07, MAINTENANCE PRACTICES.

(8) Install bleed air lines. Refer to 73-10-01, 73-10-13, 73-10-02, and 75-10-01, MAINTENANCE PRACTICES.

R (9) (Codes BA-BC, EA, GA, KA) Install fuel heeater lockout valve plumbing in accordance with 73-10-01, MAINTENANCE PRACTICES.

(10) Install turbine oil supply line. Refer to 79-20-08, MAINTENANCE PRACTICES.

(11) Install thermocouple harness assembly. Refer to 77-20-03, MAINTENANCE PRACTICES.

C. (Codes CA-CC) Install Fireshields (See Figure 202)

(1) Apply compound (Fel-Pro C5-A) to bolts.

(2) Assemble gasket onto shield lower half and secure. Tighten screws (120, figure 202) to seven inch-pounds torque. Install supports and secure. Tighten bolts (30, figure 202) to 25 inch-pounds torque.

(3) Assemble gaskets onto shield upper half and secure. Tighten screws (145, figure 202) to seven inch-pounds torque. Install supports and secure. Tighten bolts (30, 55, 90, figure 202) to 25 inch-pounds torque.

KEY TO FIGURE 202

5. SUPPORT
10. BOLT
15. SUPPORT
20. NUT
30. BOLT
35. BOLT
40. SUPPORT
45. NUT
55. BOLT
60. BOLT
65. SUPPORT
70. NUT
80. BOLT
85. BOLT
90. BOLT
95. SHIELD LOWER HALF
105. GASKET
110. NUT
115. WASHER
120. SCREW
125. SHIELD UPPER HALF
130. GASKET
135. NUT
140. WASHER
145. SCREW

1. C. (4) Install shield half assemblies. Tighten bolts (35, 60, 80, 85, figure 202) to 60 inch-pounds torque. Install support (5) and tighten bolts (10) to 60 inch-pounds torque.

(5) Install ignition leads. Refer to 74-10-01, MAINTENANCE PRACTICES.

(6) Install fuel manifold assembly and fuel flow divider. Refer to 73-10-07, MAINTENANCE PRACTICES.

(7) Install bleed air lines. Refer to 73-10-01, 73-10-13, 73-10-02, and 75-10-01, MAINTENANCE PRACTICES.

(8) Install turbine oil supply line. Refer to 79-20-08, MAINTENANCE PRACTICES.

(9) Install thermocouple harness assembly. Refer to 77-20-03, MAINTENANCE PRACTICES.

2. Inspection/Check

A. Inspect Fireshields

(1) Inspect shaped section for deterioration or obvious damage. Replace damaged shaped sections.

(2) Inspect shield half assemblies for cracks or obvious damage. Refer to Approved Repairs.

3. Approved Repairs

Repair damaged shield half assemblies in accordance with standard shop practices.

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CHAPTER 72 - ENGINE

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CHAPTER 72 - DESCRIPTION AND OPERATION

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GENERAL - DESCRIPTION AND OPERATION

1. General (See Figures 1 and 2)

The turboprop aircraft engine is a lightweight fixed-shaft engine designed to provide primary power for fixed wing aircraft. The primary divisions of the engine are the reduction gear and shaft section, compressor section, combustion section, turbine section and associated systems. Accessories and components of power management system and other systems (fuel, oil, air, ignition, electrical, torque limiting and indicating, and temperature indicating) required for engine operation are mounted on the reduction gear and shaft section and along the body of the engine.

Output drive for the aircraft propeller is provided by the reduction gear section. The gear trains of the reduction gear section are driven by the rotating group of the engine. The engine main rotating group is made up of the compressor impellers, turbine wheels and tie bolt. The compressor impellers and turbine wheels are joined and indexed by curvic (special face) couplings which are held in place by the tie bolt to make up the rotating assembly.

A torsion shaft, positioned concentrically inside the main shaft, extends through the length of the shaft and is coupled to the reduction gear section. The torsion shaft is driven by a spline at the rear of the main shaft and drives the helical gearshaft set (high speed pinion) through a spline coupling at the front. On engines without a direct drive fuel control the high speed pinion in turn drives the remainder of the gear train. On engines with a direct drive fuel control the fuel control gear train is driven by a gear arrangement from the high speed pinion through the torque sensor gear. Leading particulars of the engine are listed in Table 1.

Table 1. Leading Particulars

Engine Type	Single-shaft turboprop engine with integral gearbox
Compressor	Two-stage centrifugal
Turbine	Three-stage axial
Combustion Chamber	Single annular
Engine Dry Weight (complete engine)	360 lb max
Length of Engine (nominal)	44 in.
Width of Engine (nominal)	22 in.
Height of Engine (nominal)	27 in.
R (Codes BA-BC, EA, GA, HA) Propeller Shaft Speed at Turbine Speed of 41,730 rpm (100 percent)	2000 rpm
R (Codes AA-AC, CA-CC, FA, KA, LA) Propeller Shaft Speed at Turbine Speed of 41,730 rpm (100 percent)	1591 rpm
Absolute Altitude	35,000 ft
Starting Altitude	Sea level to 20,000 ft

Table 1. Leading Particulars (Cont)

Ambient Air Temperature	
Operation	-54 to 55C (-65 to 130F)
Starting	-40 to 55C (-40 to 130F)
Exception: Lowest permissible temperature shall be that at which the fuel viscosity is 12 centistokes.	
Engine Oil Consumption	One qt max per 10 hours
Electrical Power for Starter	28 vdc, 600 amp (1000 amp momentary)
R (Codes AA-AC, CA-CC, FA, KA, LA) Propeller Shaft Rotation (looking forward)	Counterclockwise
R (Codes BA-BC, EA, GA, HA) Propeller Shaft Rotation (looking forward)	Clockwise
R (Codes AA-AC, CA-CC, FA, KA, LA) Propeller Shaft Gear Ratio	0.0382
R (Codes BA-BC, EA, GA, HA) Propeller Shaft Gear Ratio	0.0479
Propeller Mounting	Flanged
Approved Fuel and Oil Types	Refer to Aircraft Flight Manual

2. Reduction Gear and Shaft Section

The reduction gear and shaft section comprises the forward section of the engine above the air inlet duct. The main gear train of the section is directly coupled to the aircraft propeller through the propeller shaft assembly. Secondary gear trains operate shaft-driven accessories and components of associated systems mounted on the rear of the reduction gear and shaft section. Input, intermediate, and output housing assemblies enclose the reduction gear and shaft section.

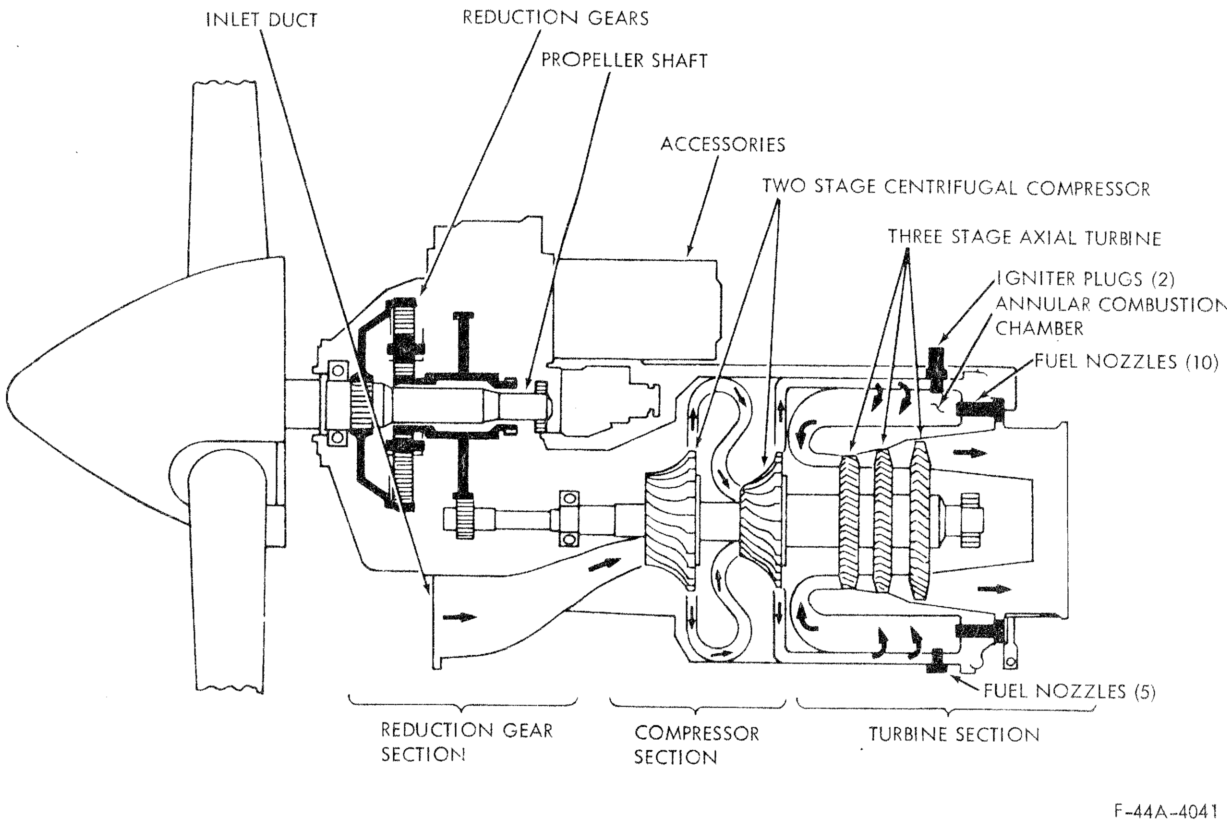
3. Compressor Section

Inlet air enters the compressor section through an inlet duct located at the bottom of the input housing assembly. The first stage impeller of the compressor section compresses the inlet air and forces it through the interstage duct assembly to the second stage impeller. Air is further compressed by the second stage impeller and is discharged into the combustion section.

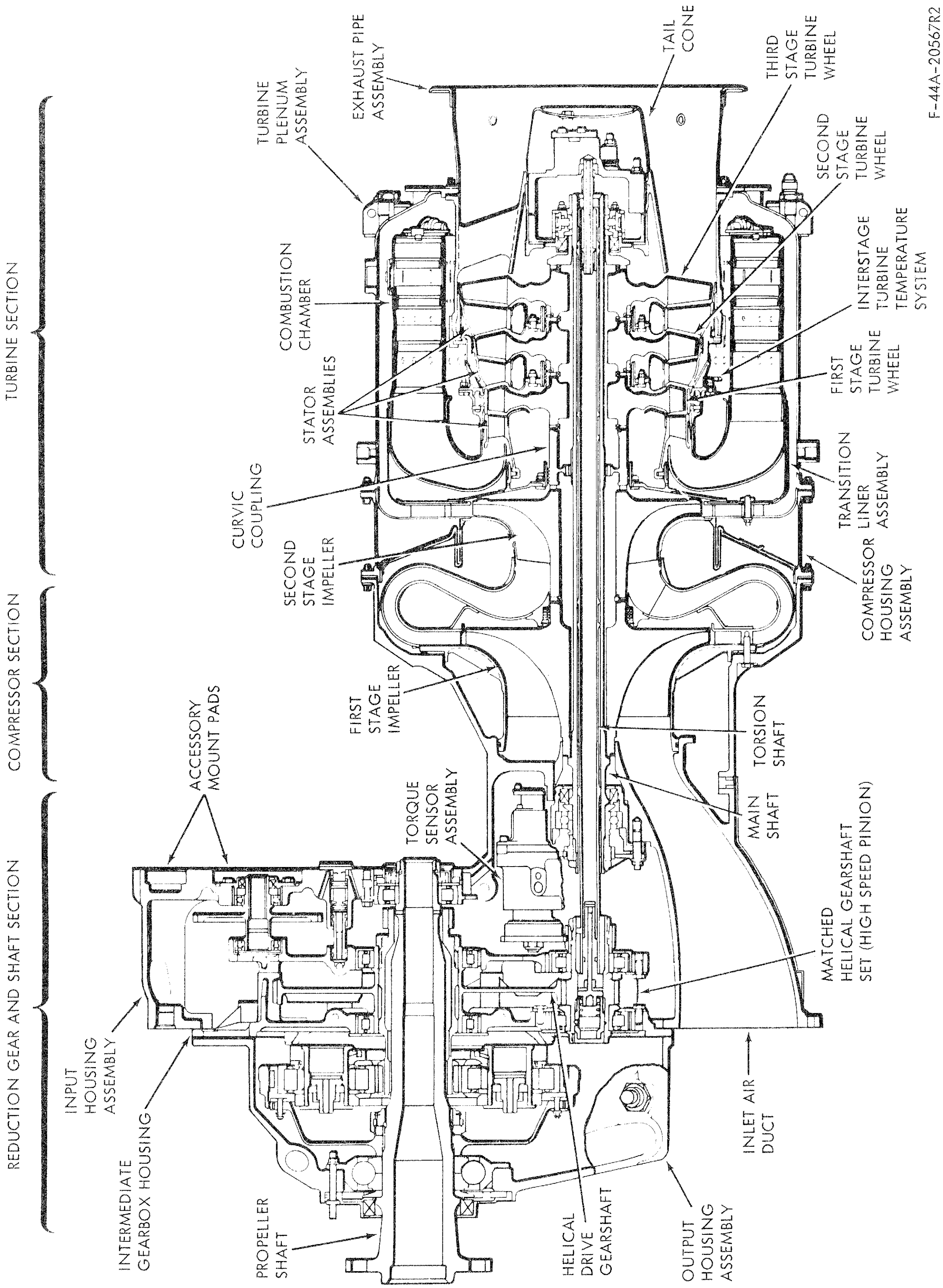
4. Combustion Section

The compressed air supplied from the compressor section flows into a single reverse flow annular combustion chamber assembly enclosd by the plenum assembly. Here atomized fuel supplied by the fuel nozzle and manifold assembly of the fuel system is mixed with the compressed air. Five primary fuel nozzles are used for starting and ten secondary fuel nozzles for all other phases of operation. During starting and inital acceleration, the fuel-air mixture is ignited by two igniter plugs of the ignition system. After ignition cutout, combustion is self-sustaining. The resultant

R



Simplified Cross Sectional View of Engine
Figure 1



Cross Sectional View of Engine Less Accessories
Figure 2

combustion gases are directed to the three-stage axial turbine by the transition liner assembly.

The turbine plenum assembly, attached to the compressor housing assembly, provides a plenum for compressed air which encloses the combustion area keeping the outer surfaces of the engine relatively cool. The rear end of the plenum assembly provides a register for the turbine bearing support and for mounting the fuel nozzle and manifold assemblies.

5. Turbine Section

The turbine section contains three axial-flow turbine wheels and three stator assemblies. Gases from the combustion section flow through the stator and wheels and exhaust to atmosphere through the exhaust pipe assembly. Some compressor air is directed against the rear face of the first stage turbine wheel for cooling. The turbine section provides power through the reduction gear and shaft section to drive the propeller.

6. Power Management System (See Figures 3 Through 18)

The major components of the power management system are the engine fuel control assembly, the propeller governor assembly and the propeller pitch control, plus the interconnecting mechanical linkage that coordinate the control functions. These interrelated power management controls are rigged to provide two basic modes of operation: the beta mode and the propeller-governing mode.

Beta-mode operation provides for pilot control of propeller blade angle and selection of engine speed. The fuel control unit automatically meters fuel flow to supply engine power required by propeller load. Beta-mode operation is normally utilized at reduced aircraft speeds for reverse-pitch braking on the runway and for ground operation.

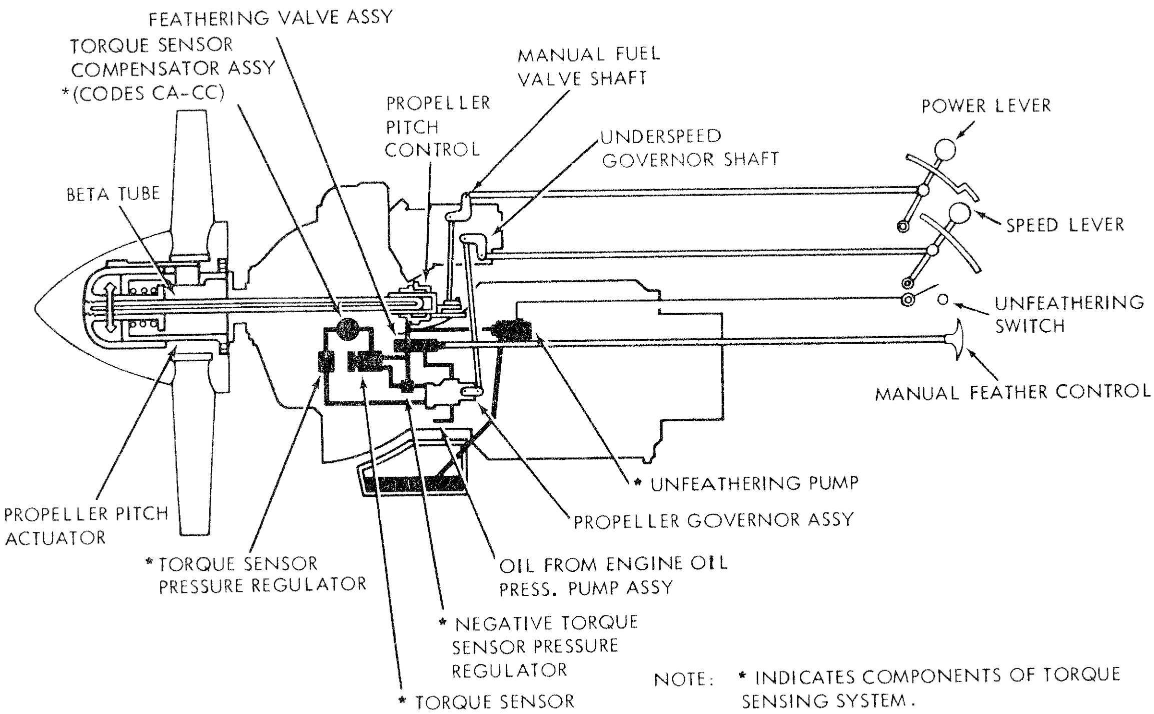
Propeller governing mode operation provides for pilot control of engine power and selection of the engine speed-governing point. The propeller governor controls the propeller blade angle position to absorb the pilot-selected power setting while maintaining constant engine speed. Propeller governing mode operation is utilized for all airborne operations.

R A. (Codes AA-EA) Fuel Control and Pump Assembly

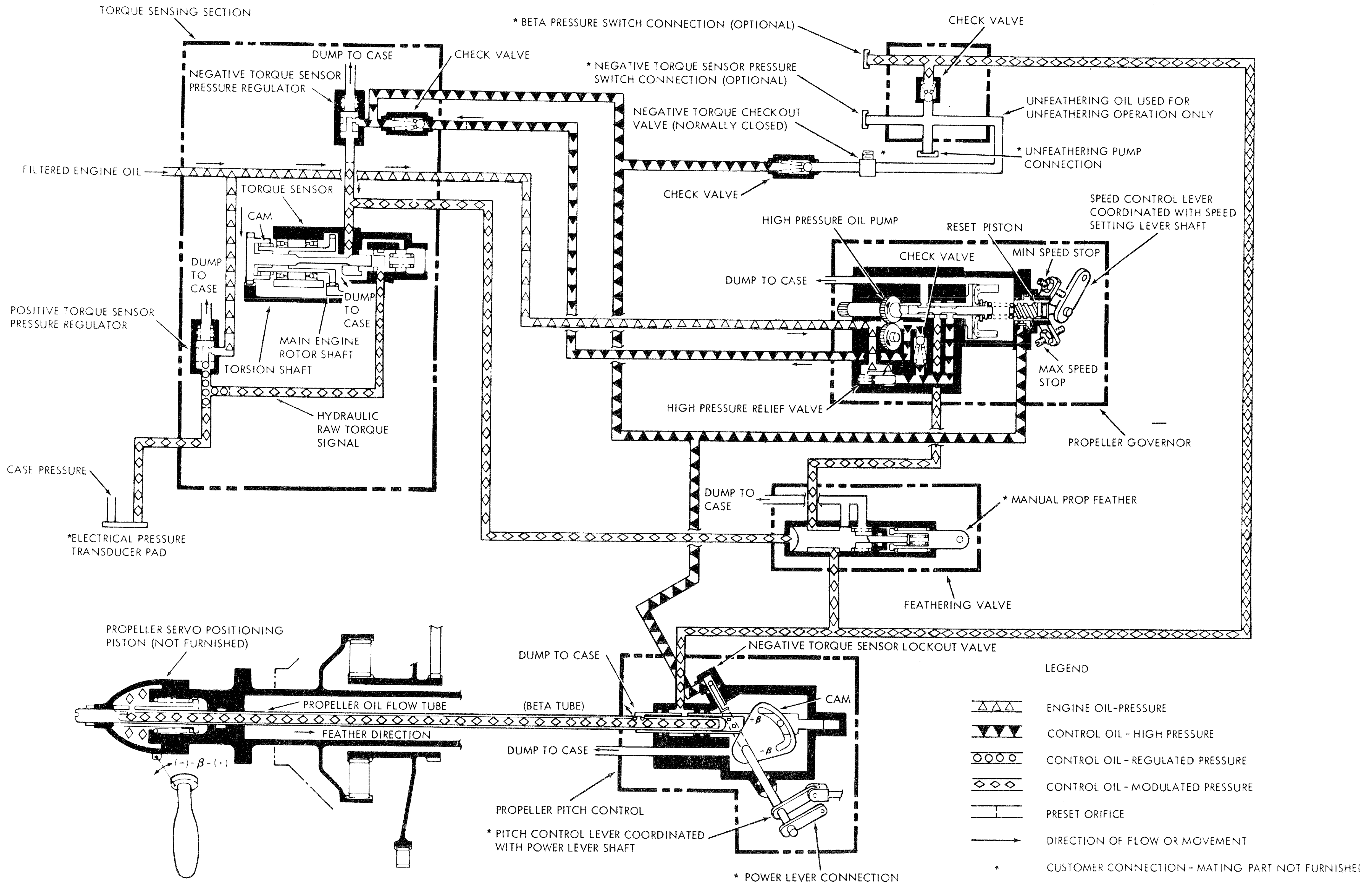
(1) General

The fuel control and pump assembly is composed of a fuel high pressure and boost pump assembly and fuel control unit. These components are stacked together as a single assembly on a four-stud drive pad, located in the upper right-hand position at the rear of the reduction gear section. The fuel control unit meters the fuel, supplied by the boost and high pressure fuel pumps, to the engine

R

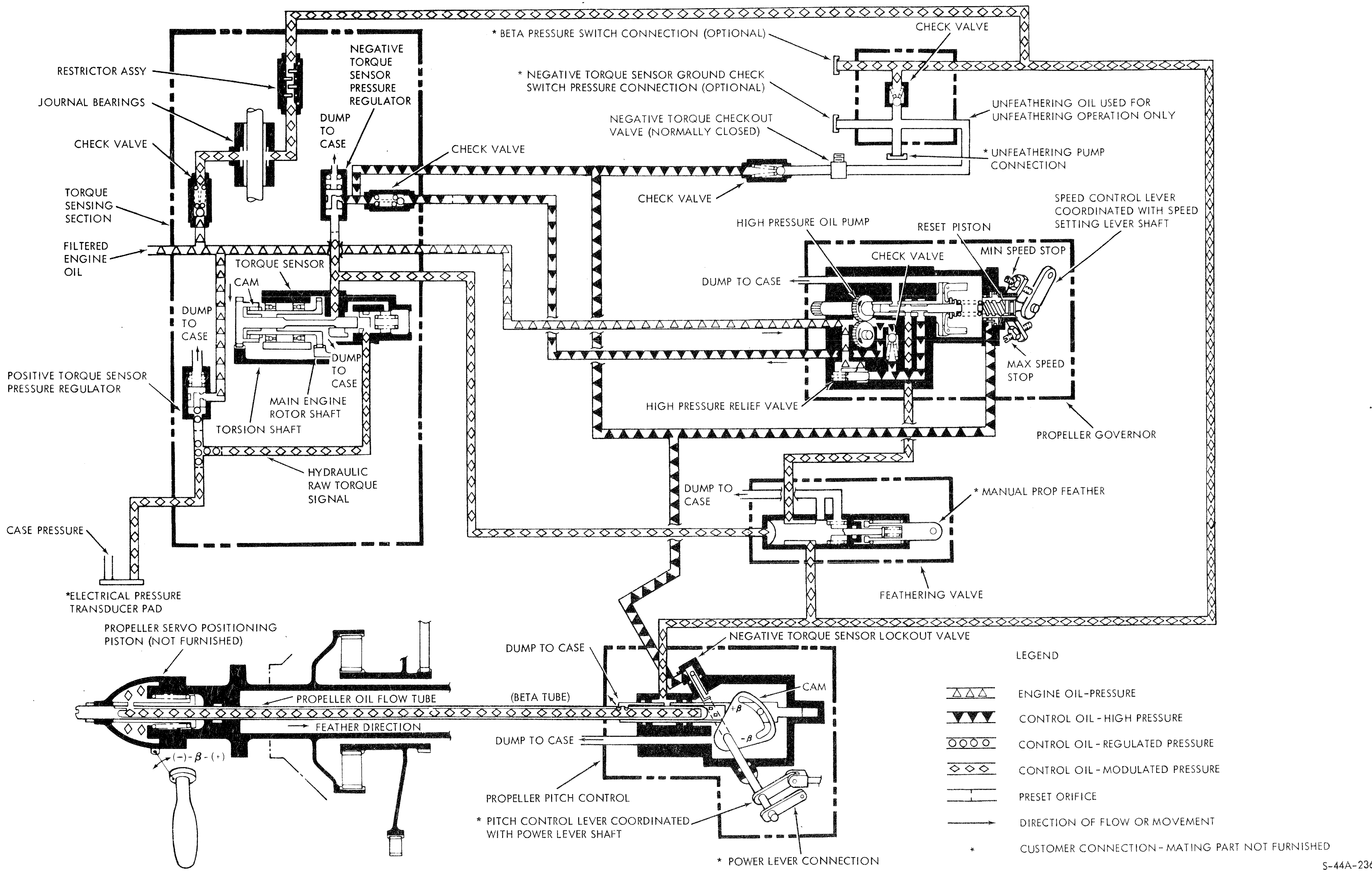


Simplified Power Management and Torque
Sensing Diagram (Typical)
Figure 3

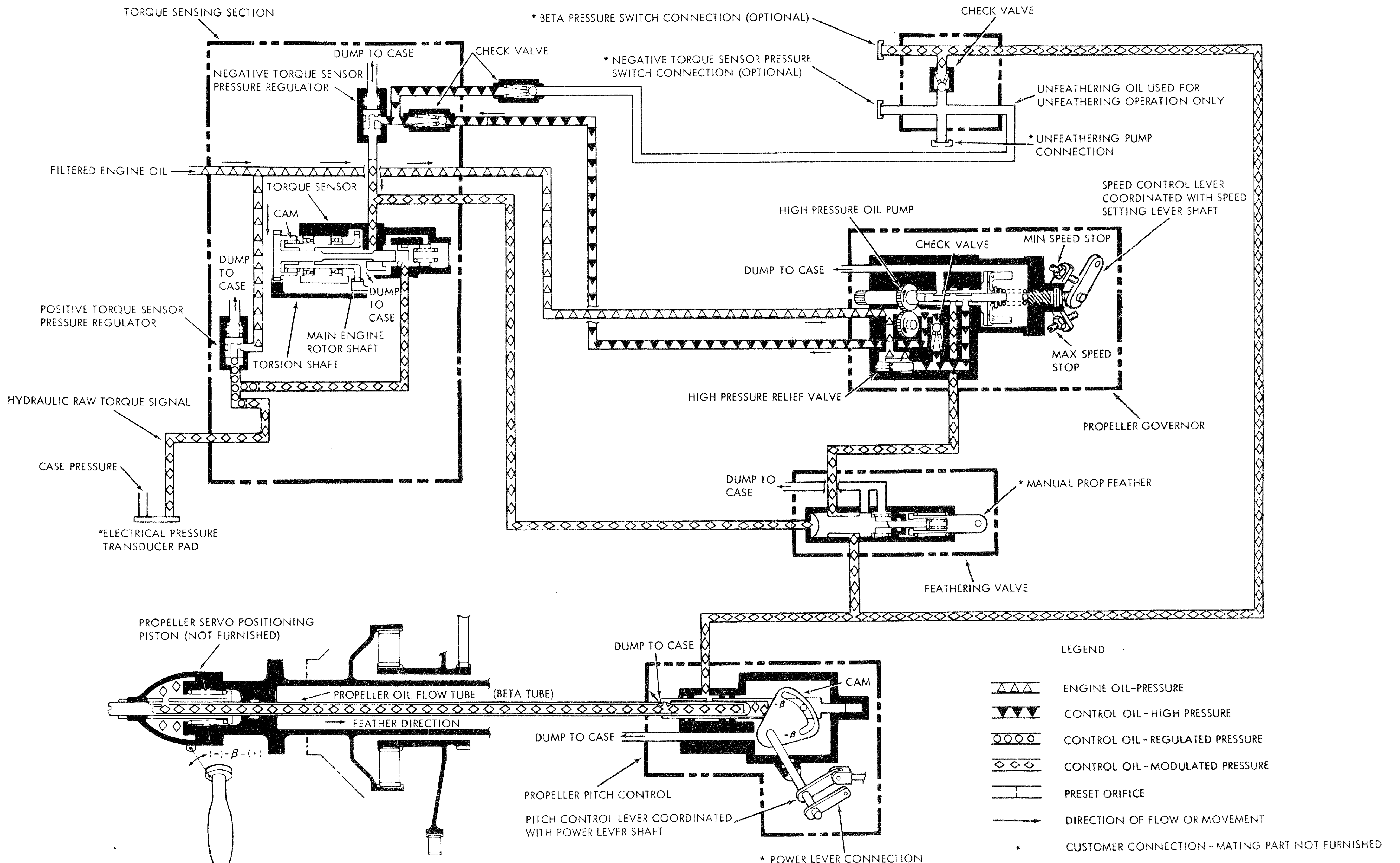


R (Codes AA-AC, Pre SB72-0064 or Post SB72-0162/0163/0169)
R (Codes FA, KA, LA, Post SB72-0162/0163/0169)
R Torque Sensing Schematic (Typical)

Figure 4



R (Codes AA-AC, FA, KA, LA, Post SB72-0064, Pre SB72-0162/0163/0164)
R Torque Sensing Schematic (Typical)
Figure 5



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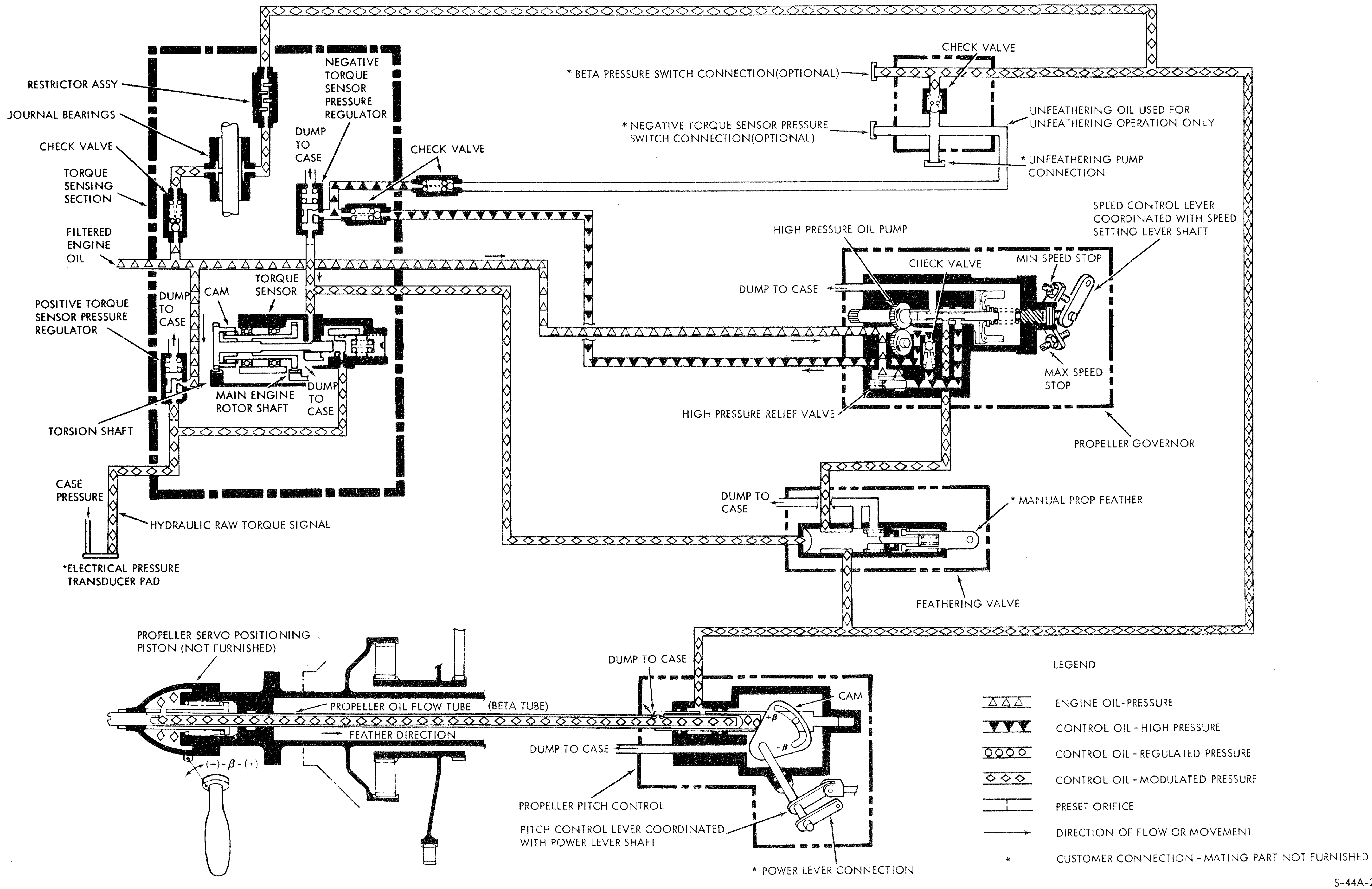
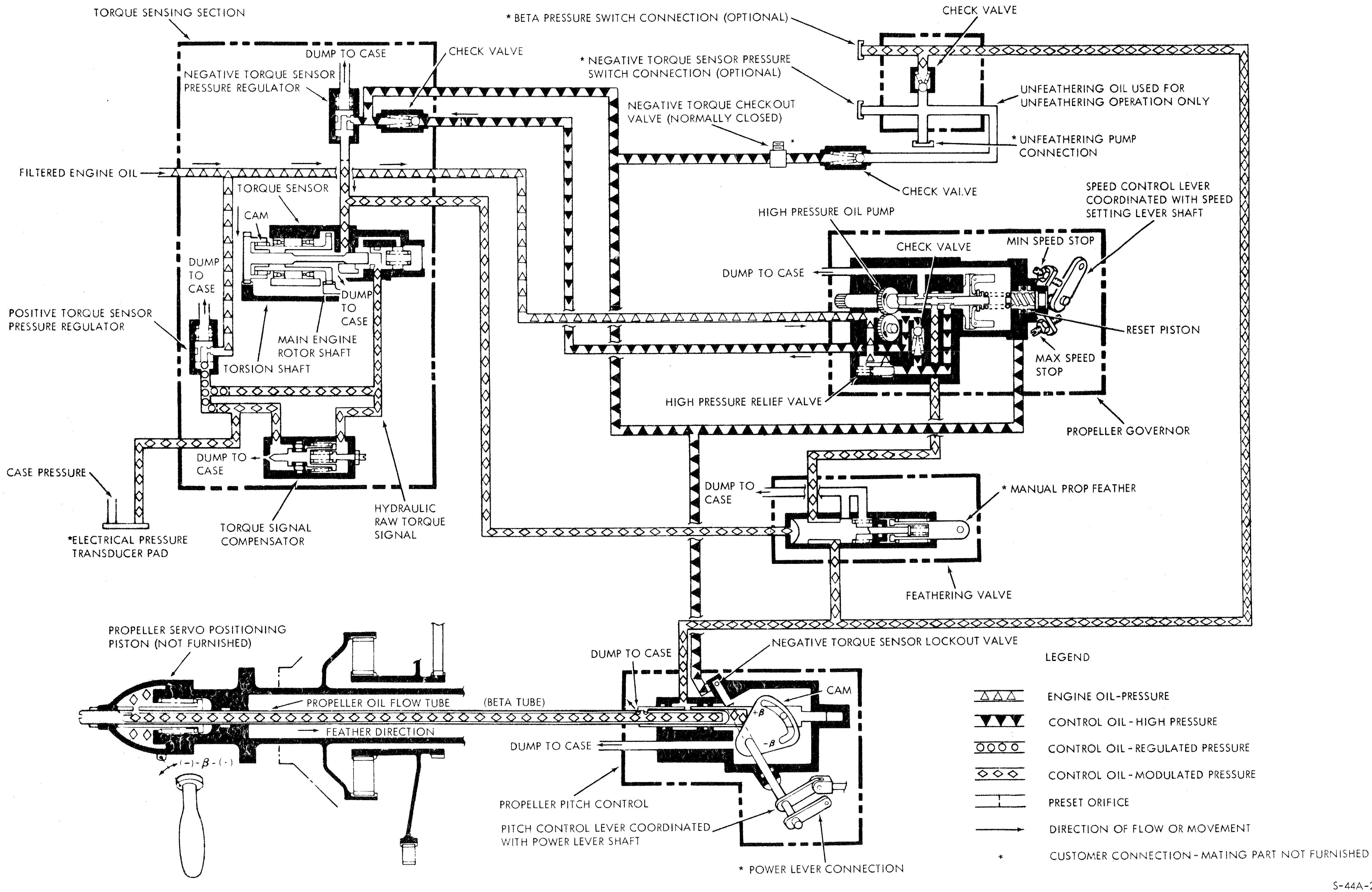
R (Codes GA, HA, Post SB72-0162/0163/0169)
R Torque Sensing Schematic (Typical)

Figure 6

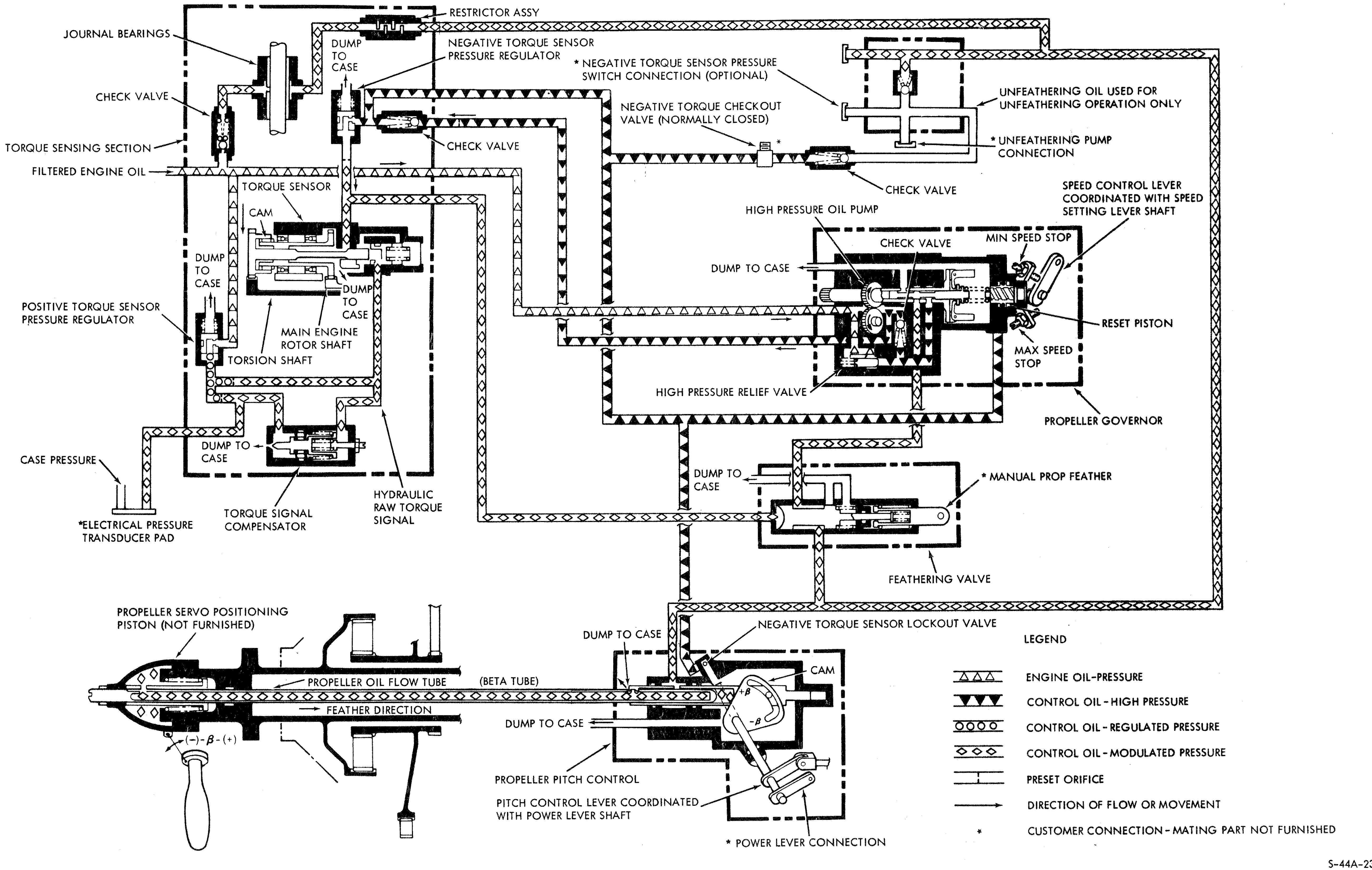


R (Codes BA-BC, EA, GA, HA. Post SB72-0064, Pre SB72-0162/0163/0164/0169)
R Torque Sensing Schematic (Typical)

Figure 7

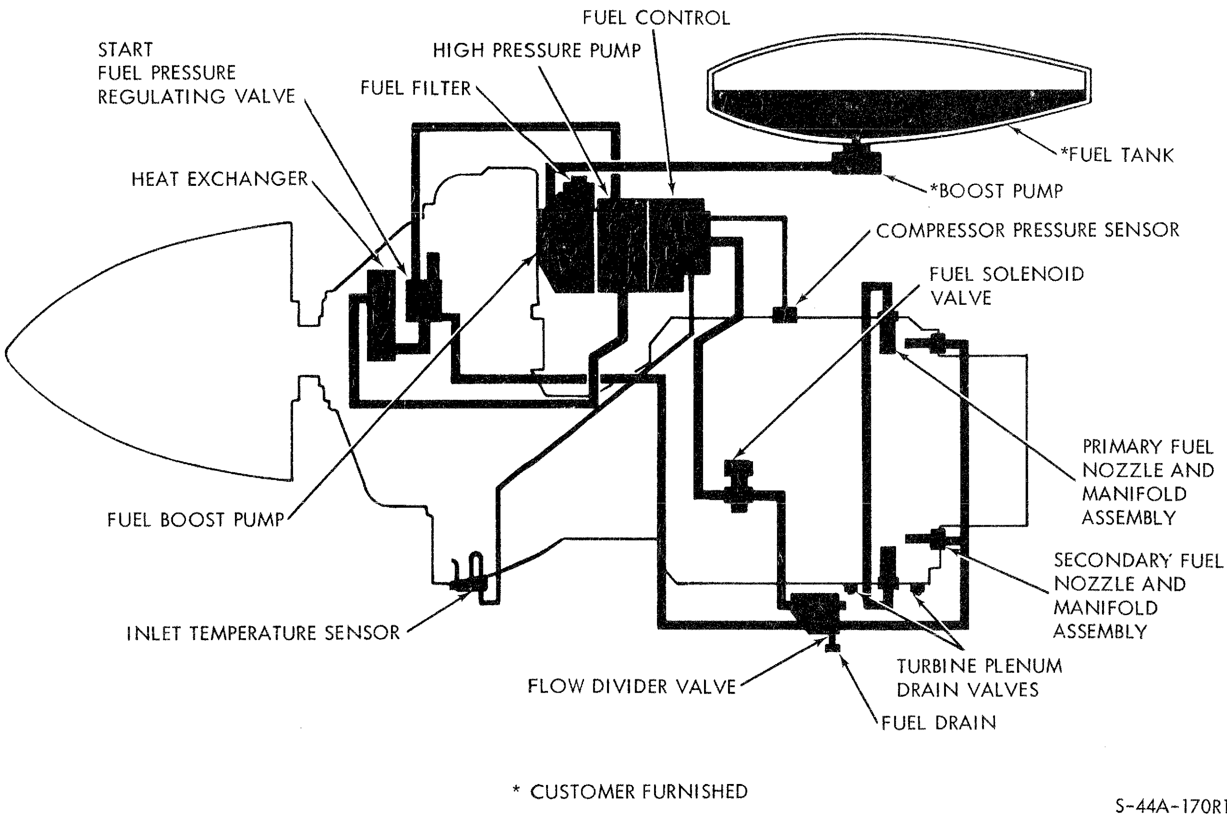


R (Codes CA-CC, Pre SB72-0064 or Post SB72-0162/0163/0169)
R Torque Sensing Schematic
Figure 8



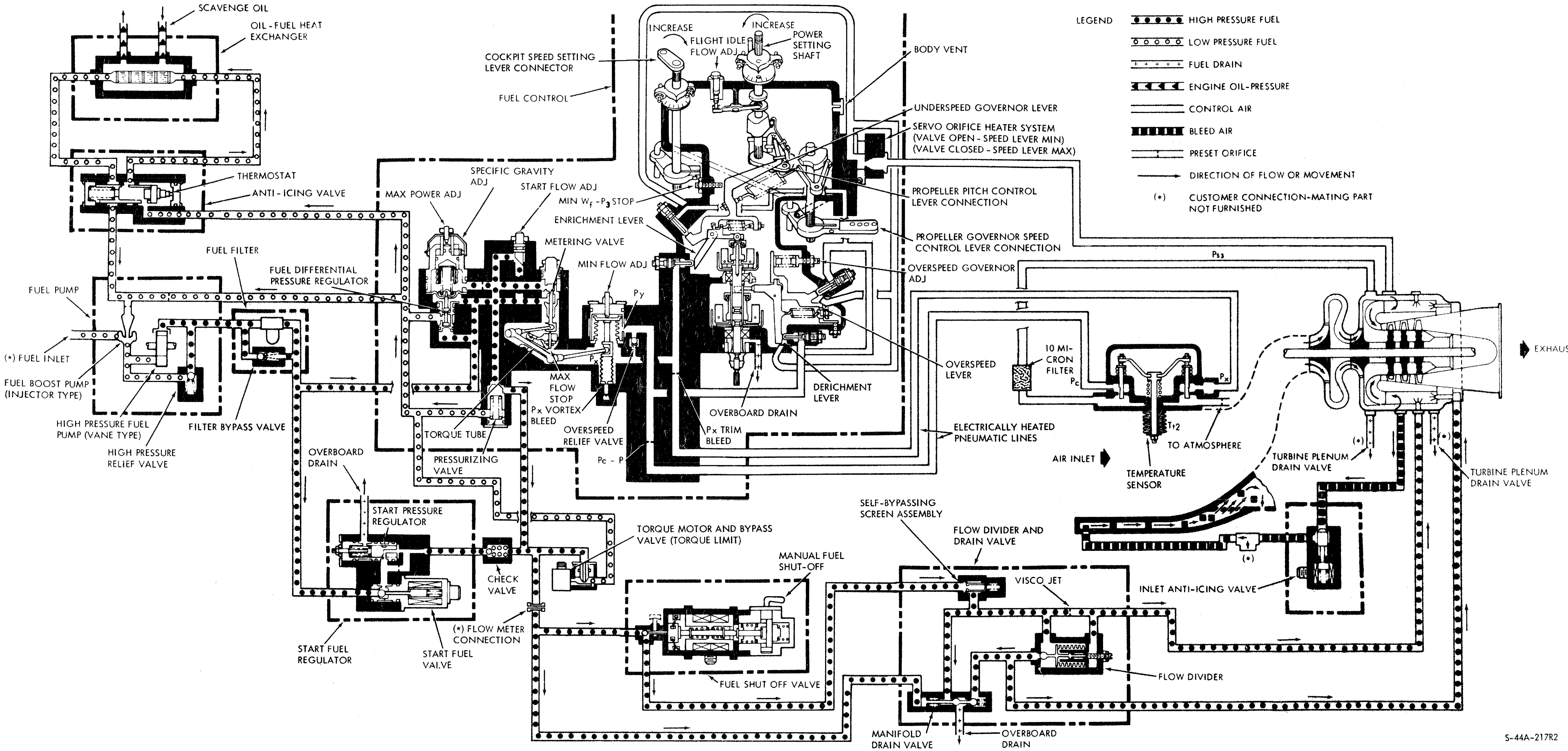
R
R

(Codes CA-CC, Post SB72-0064, Pre SB72-0162/0163/0169)
Torque Sensing Schematic
Figure 9



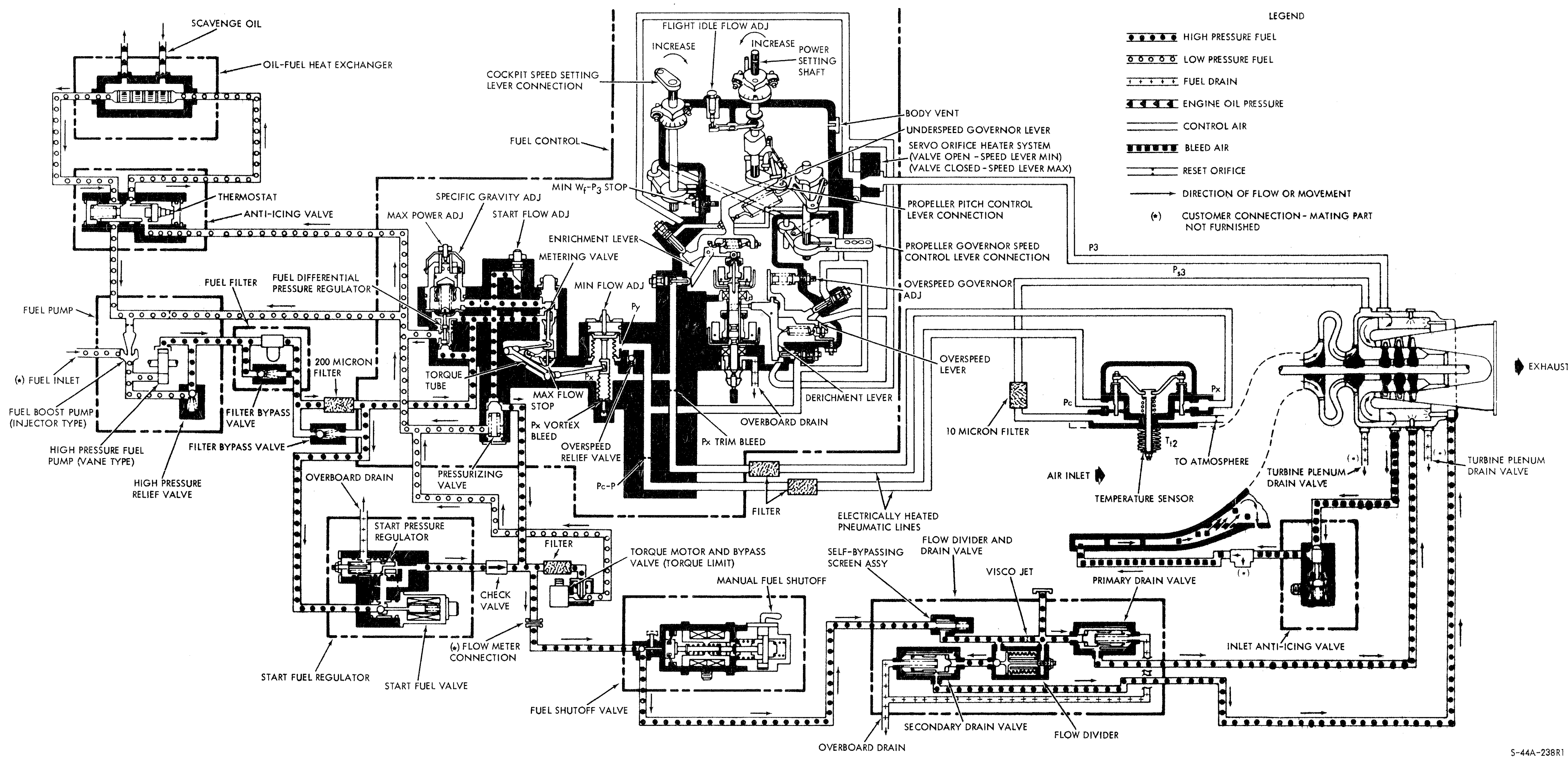
R

Simplified Fuel System Diagram (Typical)
Figure 10



R

(Pre SB73-0017) Engine Fuel Schematic
(Applicable to Engine Codes AA-AC)
Figure 11



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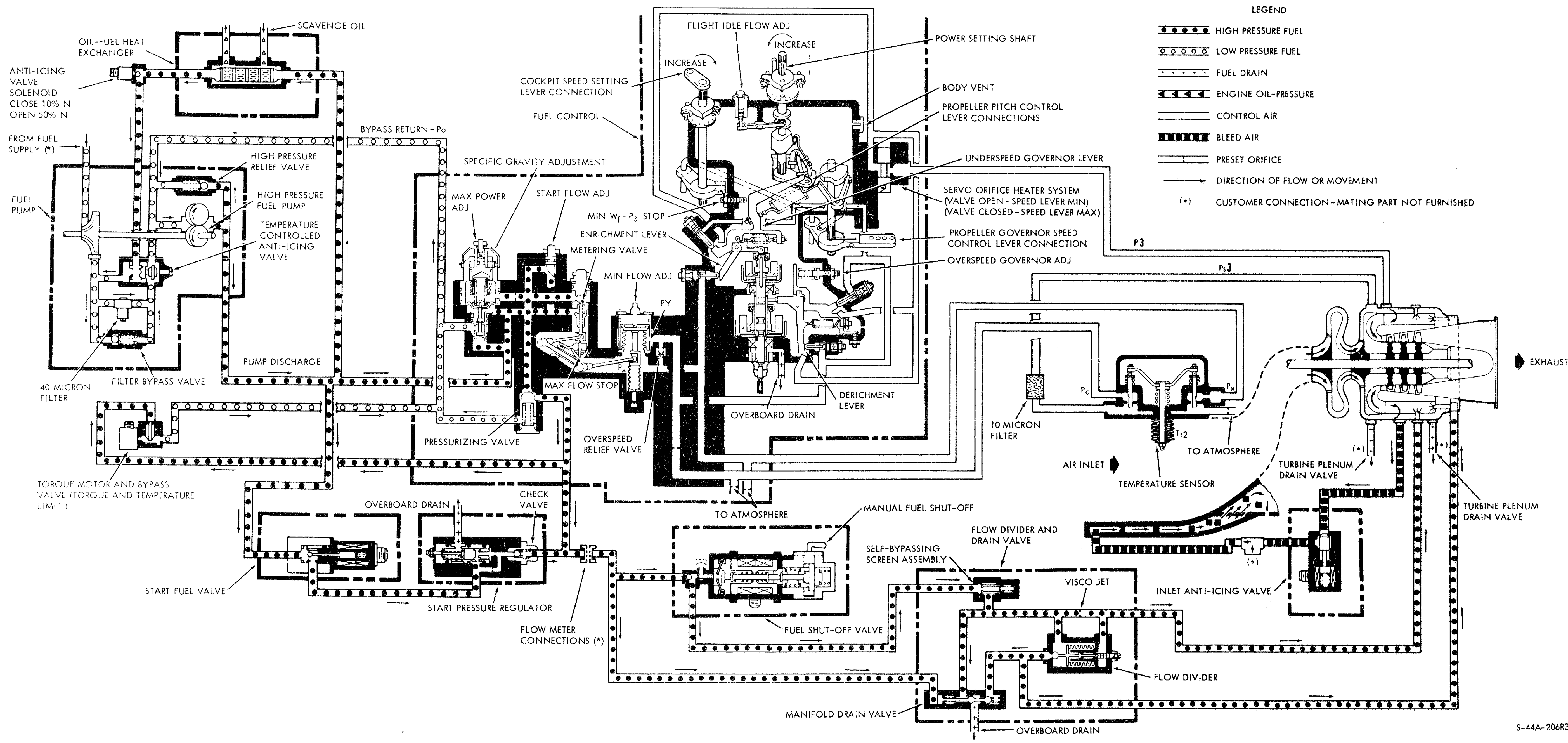
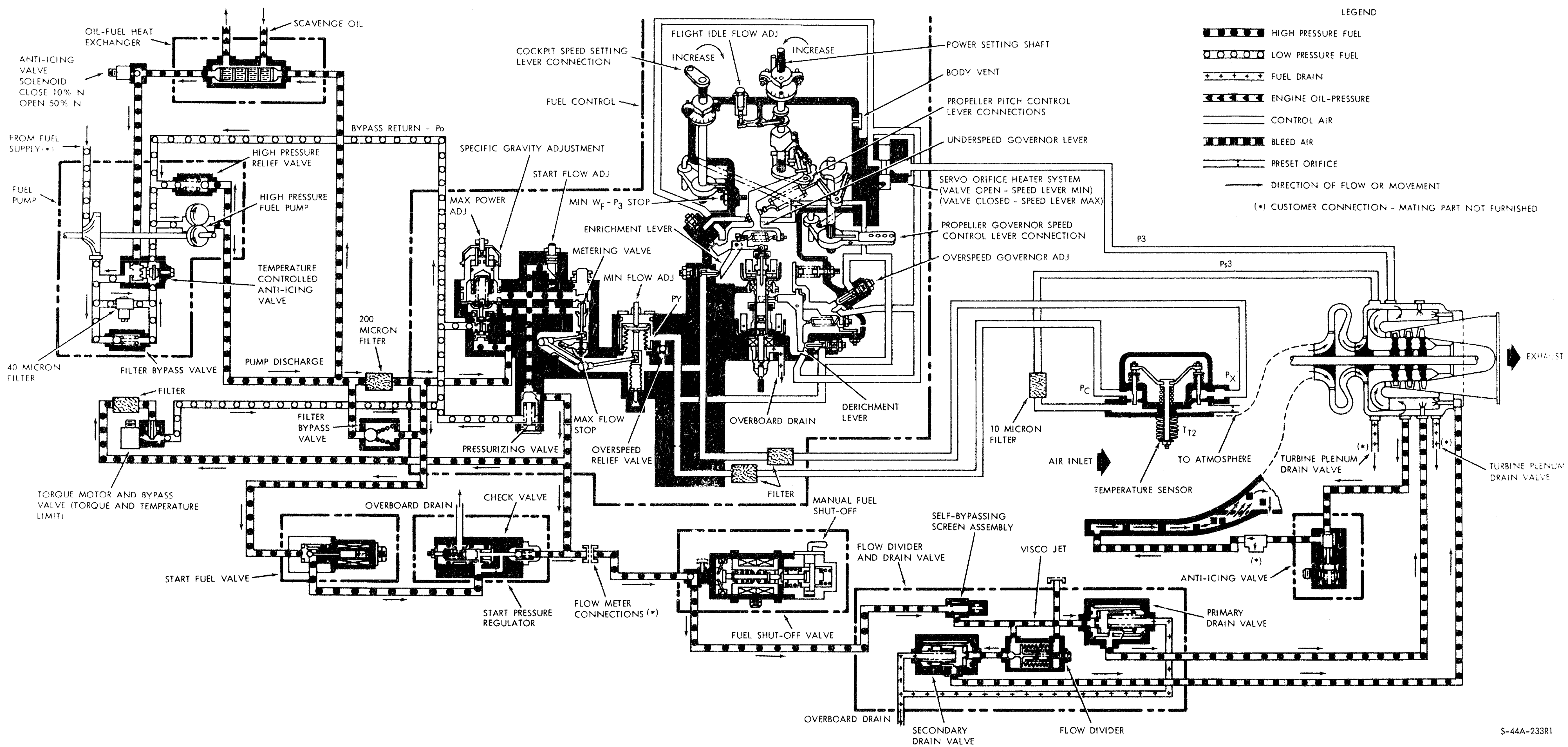
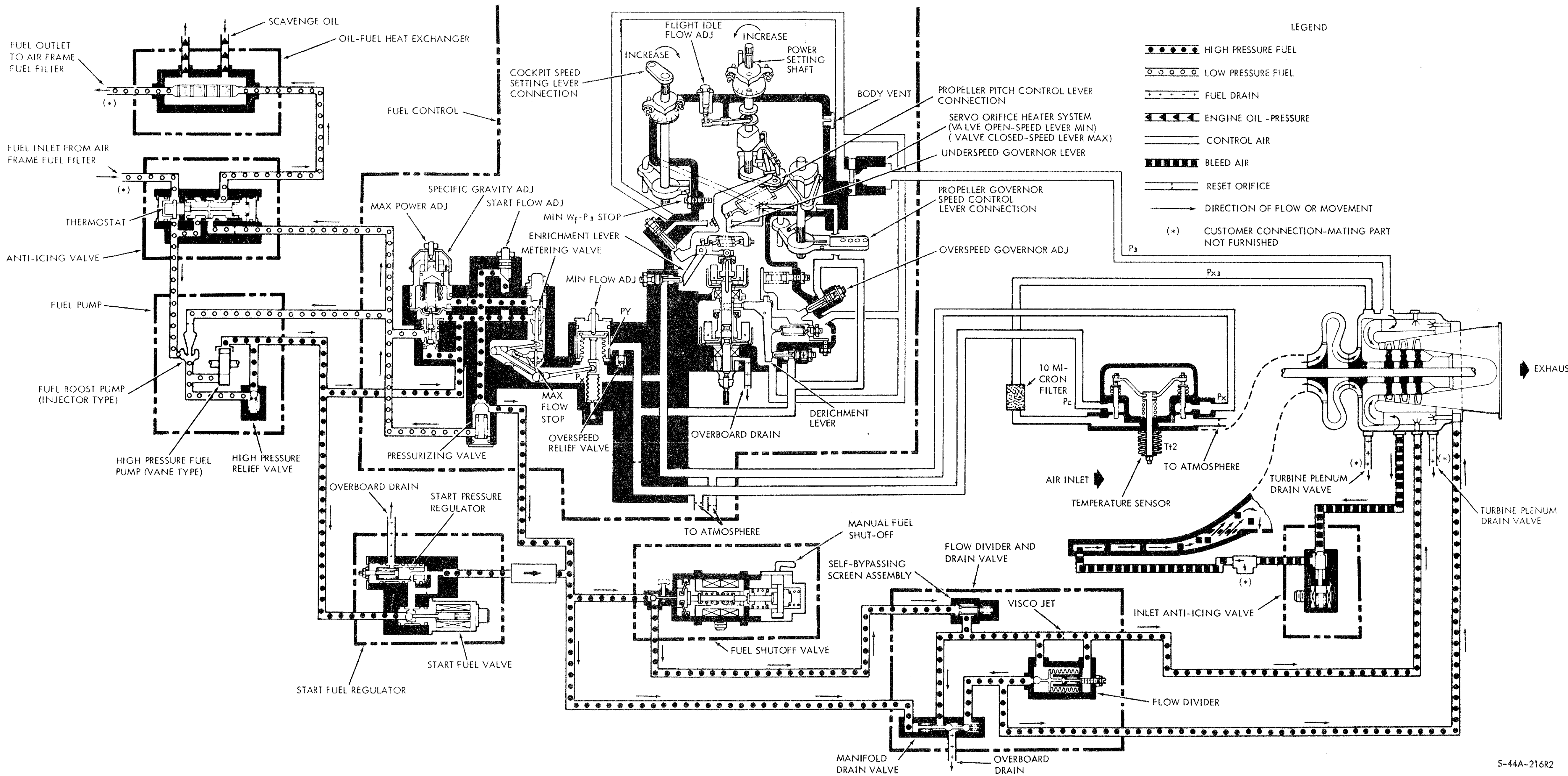
(Post SB73-0017) Engine Fuel Schematic
(Applicable to Engine Codes AA-AC)
Figure 12



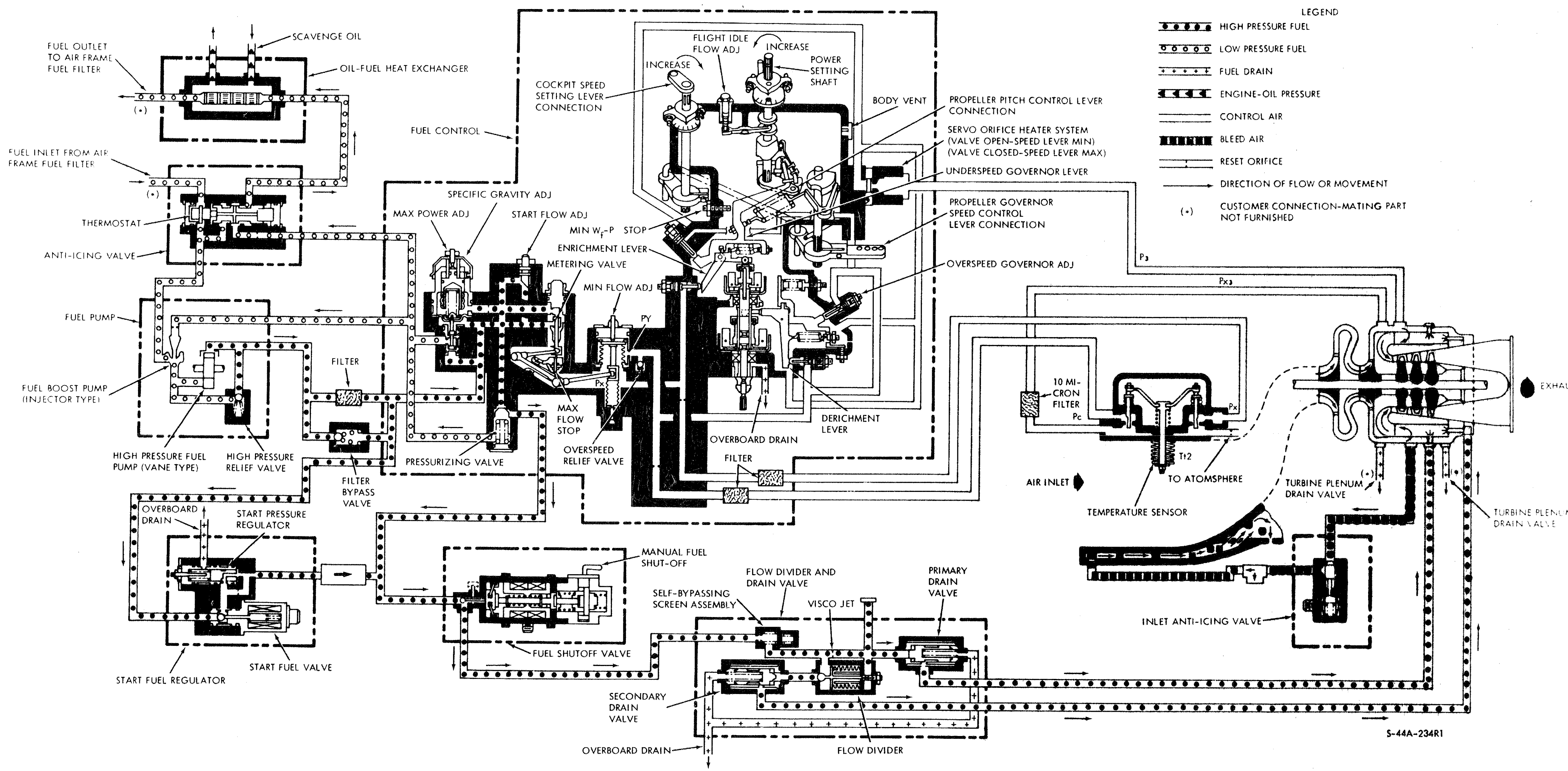
R (Pre SB73-0017) Engine Fuel Schematic
R (Applicable to Engine Codes BA-BC, EA)
Figure 13



R (Post SB73-0017) Engine Fuel Schematic
R (Applicable to Engine Codes BA-BC, EA)
Figure 14

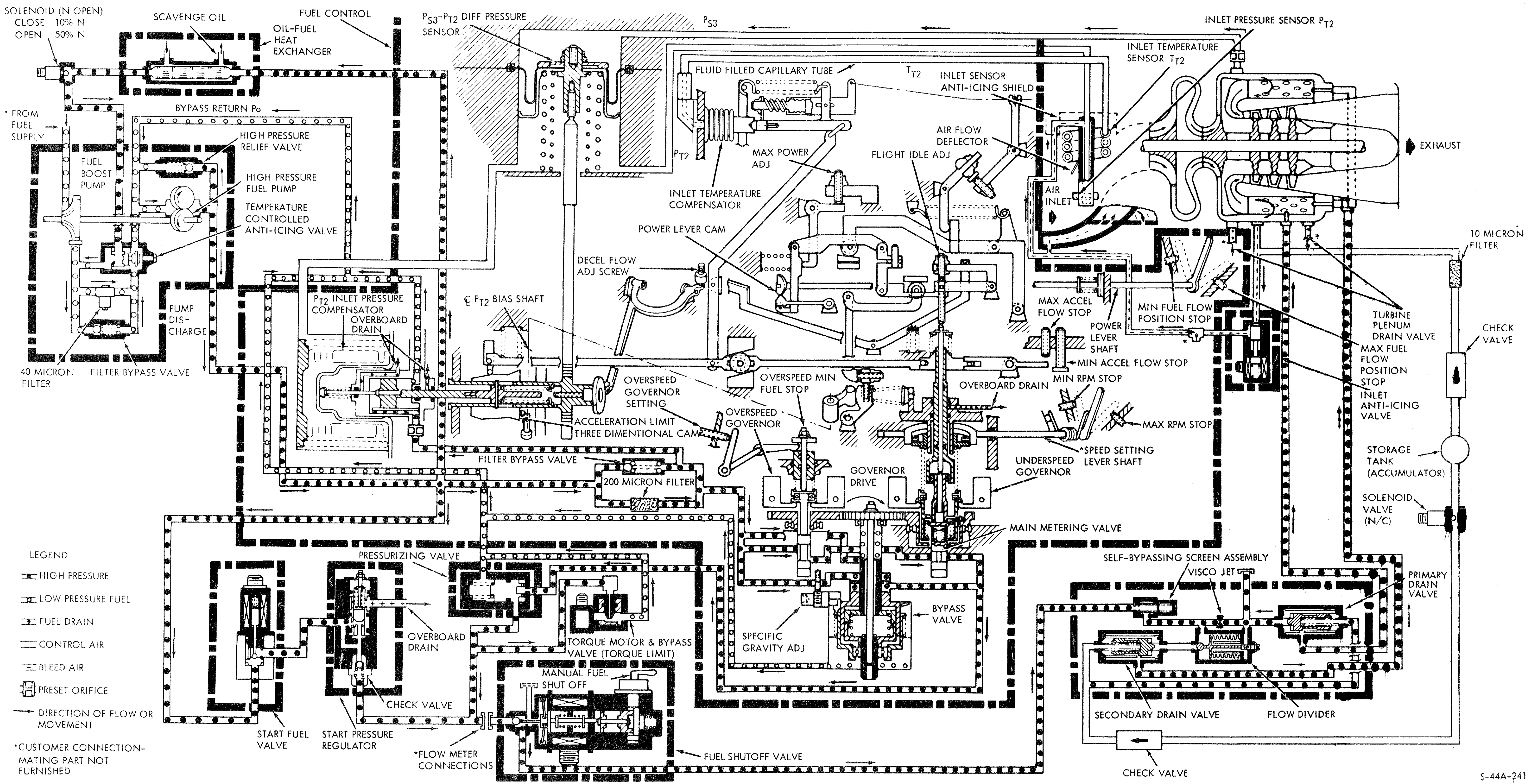


R
R
(Pre SB73-0017) Engine Fuel Schematic
(Applicable to Engine Codes CA-CC)
Figure 15

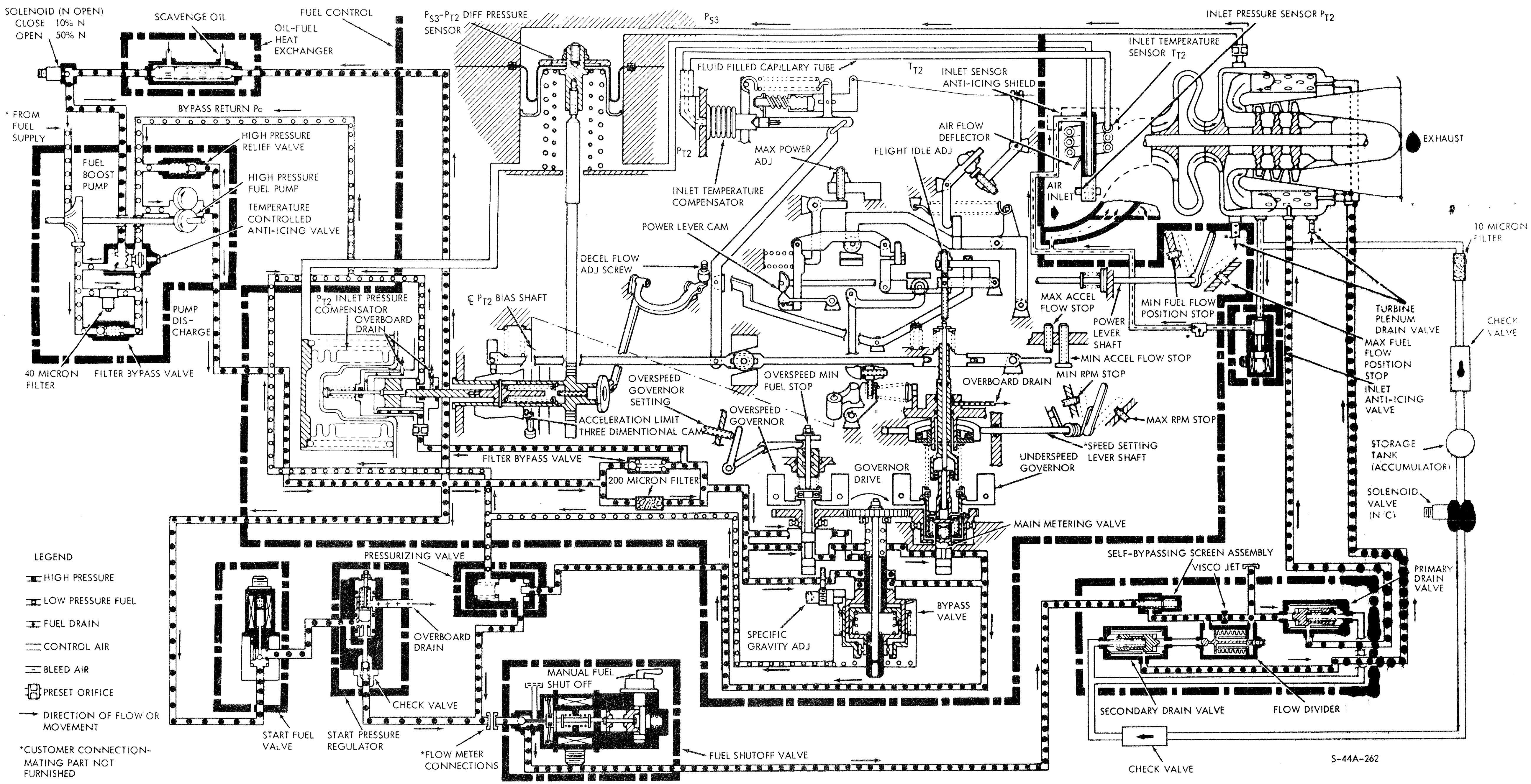


R
R

(Post SB73-0017) Engine Fuel Schematic
(Applicable to Engine Codes CA-CC)
Figure 16



(Codes FA, GA, KA, LA) Engine Fuel Schematic
Figure 17



R

(Code HA) Engine Fuel Schematic
Figure 18

combustion chamber in accordance with sensed engine requirements and pilot inputs. The fuel control unit is composed of three major fuel devices: an underspeed governor, an overspeed governor, and manual fuel valve (main metering valve).

Fuel-flow range is established by two basic limiting devices:

6. A. (1) (a) A pneumatically controlled maximum fuel schedule which is a function of engine speed and compressor discharge pressure as modified by an inlet temperature sensor.

(b) A pneumatically controlled minimum fuel flow schedule which is a function of compressor discharge pressure.

A specific gravity manual adjustment is externally located on the fuel control unit to provide compensation for different fuel types.

Figures 10 through 18 illustrate typical fuel system installations of various configurations.

(2) Underspeed governor.

The underspeed governor, a droop-type speed control, is functional at reduced engine speed in a beta-mode operation. The engine speed selection is pilot-controlled within limits specified in ADJUSTMENT/TEST. As engine speed increases beyond the selected setting, the underspeed governor reduces the fuel flow to oppose any speed increase.

The minimum speed setting provides a minimum engine speed during ground operation. The maximum speed setting provides more power for reverse-pitch braking operation during landing.

The minimum speed setting provides a minimum engine speed during ground operation. The maximum speed setting provides more power for reverse-pitch braking operation during landing.

The flyweight-type underspeed governor, driven by the fuel control unit drive shaft, positions a flapper which modulates pneumatic output to the metering valve to control fuel flow. Variable-speed selection is accomplished by controlling the speeder-spring tension that opposes the speed-sensing flyweight action. The speed lever shaft, which positions the speeder-spring tension mechanism, protrudes from the fuel control unit. Mechanical linkage connects the underspeed governor shaft to the propeller governor assembly speed-control shaft and, coordinated into a single cockpit control, provides for pilot control of the underspeed governor speed-setting during beta mode and pilot control of the propeller governor assembly speed-governing point during propeller-governing mode. The underspeed governor is set at least three percent below the propeller governor assembly setting to prevent interference between the two speed-control governors.

The linkage from the underspeed governor to the cockpit control is airframe-furnished.

6. A. (3) Power lever controlled metering valve.

The metering valve meters fuel flow to control engine power at all engine speeds during both beta-mode and propeller-governing mode.

At a fuel flow sufficient to drive the engine speed above 100 percent, the propeller governor assembly establishes a constant-engine-speed operation by automatically increasing propeller blade angle to absorb engine power. Additional fuel flow provides additional power at a constant engine speed (propeller-governing mode). Propeller-governor mode for engine speeds less than 100 percent can be established by pilot control of the speed lever.

The power lever shaft, which controls a flapper that sets pneumatic computer output to the metering valve, protrudes from the fuel control unit. Mechanical linkage connects the power lever shaft to the propeller pitch control cam shaft and, coordinated into a single cockpit control, provides for pilot control of the propeller blade angle during beta-mode of operation. The power lever position relationship to fuel flow and propeller blade angle (on a typical installation) is shown in Figures 19 through 22.

The linkage from the propeller pitch control to the cockpit control is airframe-furnished.

(4) Overspeed governor.

The flyweight-type overspeed governor is a safety device to control engine speed at approximately 105 percent in the event of control system malfunction. Excess engine speed produces overspeed governor flyweight action, which reduces fuel flow to oppose any engine speed increase.

R B. (Codes FA-LA) Fuel Control and Pump Assembly

(1) General.

The fuel control and pump assembly is composed of a fuel high pressure and boost pump assembly and fuel control unit. These components are stacked together as a single assembly on a four-stud drive pad, located in the upper right-hand position at the rear of the reduction gear section. The fuel control unit meters the fuel, supplied by the boost and high pressure fuel pumps, to the engine combustion chamber. The fuel control unit is composed of three major fuel devices: an underspeed governor, an overspeed governor, and manual fuel valve (main metering valve).

Fuel-flow range is established by two basic limiting devices:

6. B. (1) (a) A maximum fuel flow schedule functionally controlled by mechanical means and compressor discharge pressure and compensated for compressor inlet temperature and pressure variance.

(b) A minimum fuel flow schedule functionally controlled by mechanical means and compressor discharge pressure.

A fuel trim manual adjustment is externally located on the fuel control unit to provide compensation for different fuel types.

Figures 10 through 18 illustrate typical fuel system installations.

(2) Underspeed governor.

The underspeed governor, a droop-type speed control is functional in a beta-mode operation. The engine speed selection is pilot-controlled within limits specified in ADJUSTMENT/TEST, Table 503. Should engine speed attempt to increase beyond the selected setting, the underspeed governor reduces the fuel flow to oppose any speed increase.

The minimum speed setting provides a minimum engine speed during ground operation for reduced noise level. The maximum speed setting provides greater power during reverse-pitch braking operation.

The flyweight-type underspeed governor, gear-driven by the fuel control unit drive shaft, positions the fuel main metering valve through mechanical linkage to control fuel flow. Variable-speed selection is accomplished by controlling the speeder-spring loading that opposes the speed-sensing flyweight action. The speed lever shaft, which positions the speeder-spring loading mechanism, protrudes from the fuel control unit. Mechanical linkage connects the underspeed governor shaft to the propeller governor assembly speed-control shaft and, coordinated into a single cockpit control, provides for pilot control of the underspeed governor speed-setting during beta-mode and pilot control of the propeller governor assembly speed-governing point during propeller-governing mode. The underspeed governor is set at least three percent below the propeller governor assembly setting to prevent governing interference between the two speed-control governors.

The linkage from the underspeed governor to the cockpit control is airframe-furnished.

6. B. (3) Power lever controlled metering valve.

The manual fuel valve shaft position meters fuel flow to control engine power at all engine speeds during beta-mode and during propeller-governing mode.

At a fuel flow sufficient to drive the engine speed above the propeller governor setting, the propeller governor assembly establishes a constant-engine-speed operation by automatically increasing propeller-blade pitch angle. Additional fuel flow provides additional power at a constant engine speed (propeller-governing mode). Propeller-governor mode for speed setting can be established by pilot control of the speed lever.

The manual fuel valve shaft (power lever shaft) that controls the main metering valve position protrudes from the fuel control unit. Mechanical linkage connects the power lever shaft to the propeller pitch control cam shaft and, coordinated into a single cockpit control, provides for pilot control of the propeller-blade pitch angle during beta-mode of operation. The power lever position relationship to fuel flow and propeller blade angle (on a typical installation) is shown in Figures 21 and 22.

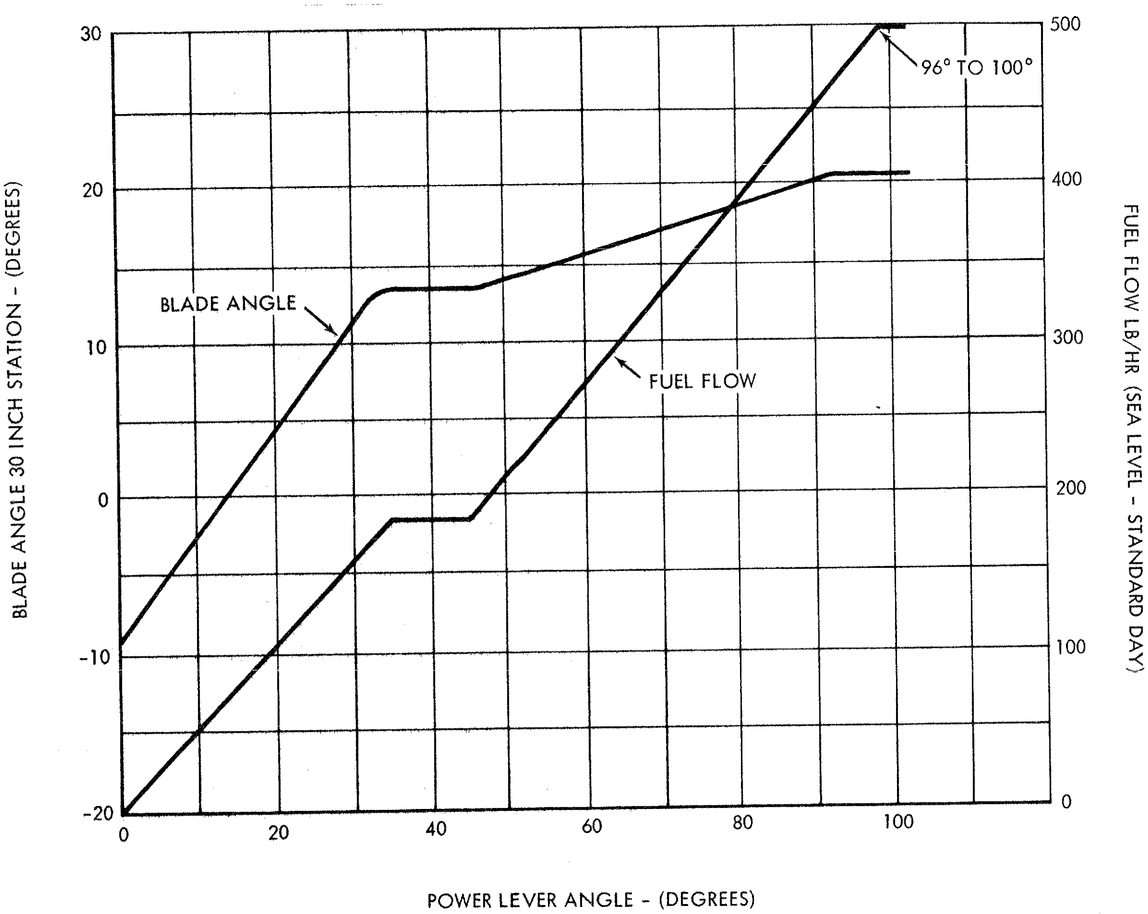
The linkage from the propeller pitch control to the cockpit control is airframe-furnished.

(4) Overspeed governor.

The flyweight-type overspeed governor is a safety device to control engine speed at appproximately 103 percent in the event of propeller governor assembly malfunction. Excess engine speed produces overspeed governor flyweight action, which reduces fuel flow to oppose any engine speed increase.

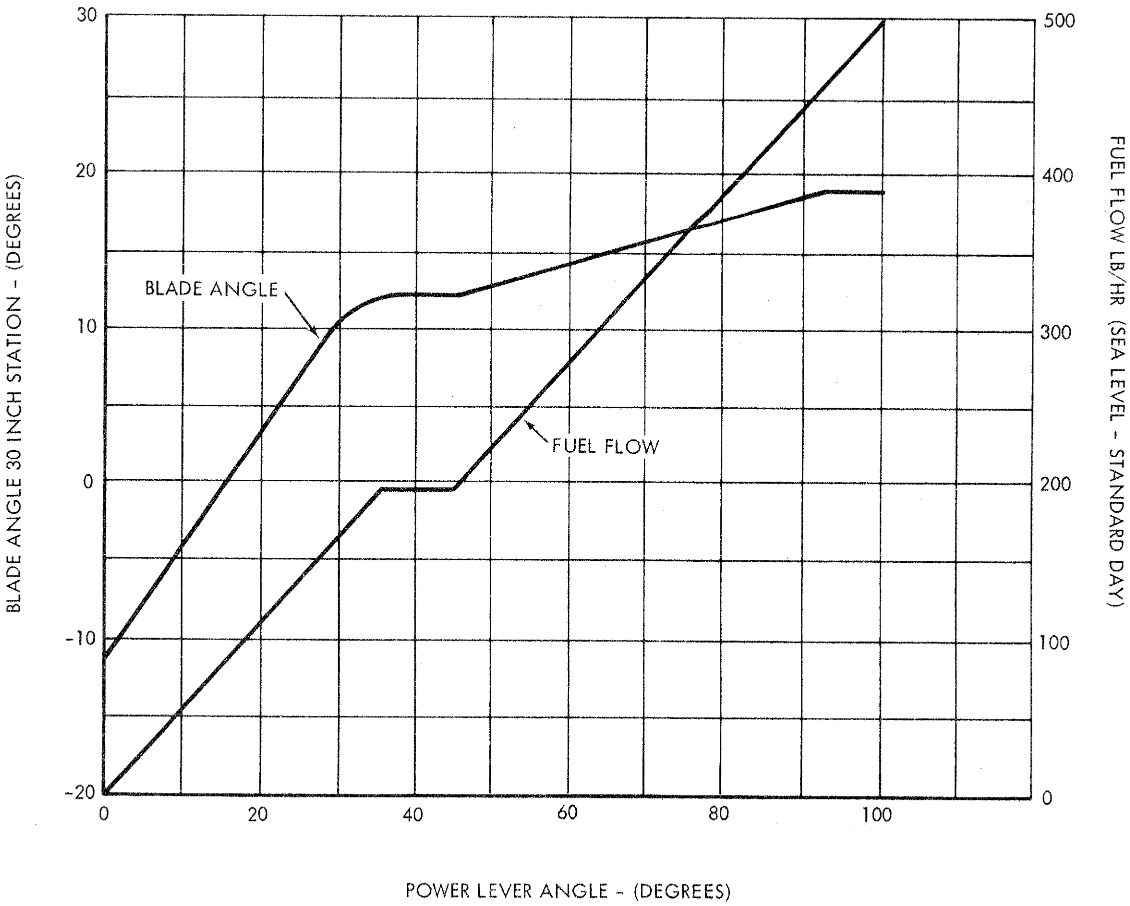
C. Propeller Governor Assembly

The propeller governor assembly is mounted in the lower left-hand position at the rear of the reduction gear section. The propeller governor assembly provides a constant engine speed during the propeller-governing mode of operation. The gear driven propeller governor assembly is composed of an integral gear type pump, metering valve, and flyweight governor. Engine lubricating oil is internally directed to the propeller governor assembly oil pump inlet. The pressure pump boosts the oil pressure sufficiently to position the propeller blade angle in propeller governing mode. The oil flow is metered by the metering valve, controlled by flyweight governor action in response to engine speed change. The oil flow is metered so as to maintain pressure in the pitch control and propeller so as to set the blade angle required to maintain the speed setting.



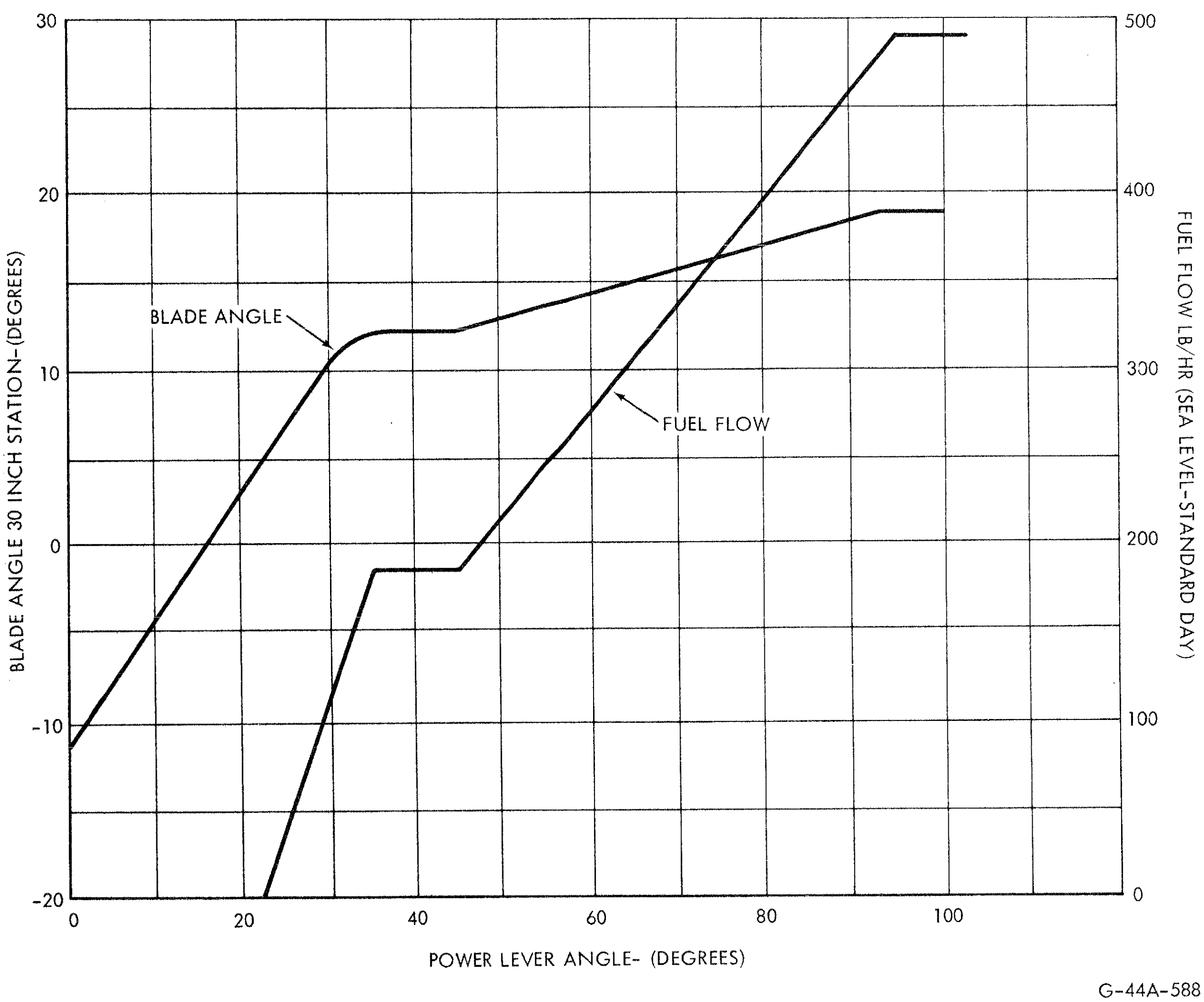
R

(Codes AA-AC, CA-CC) Control Functions (Typical)
Figure 19



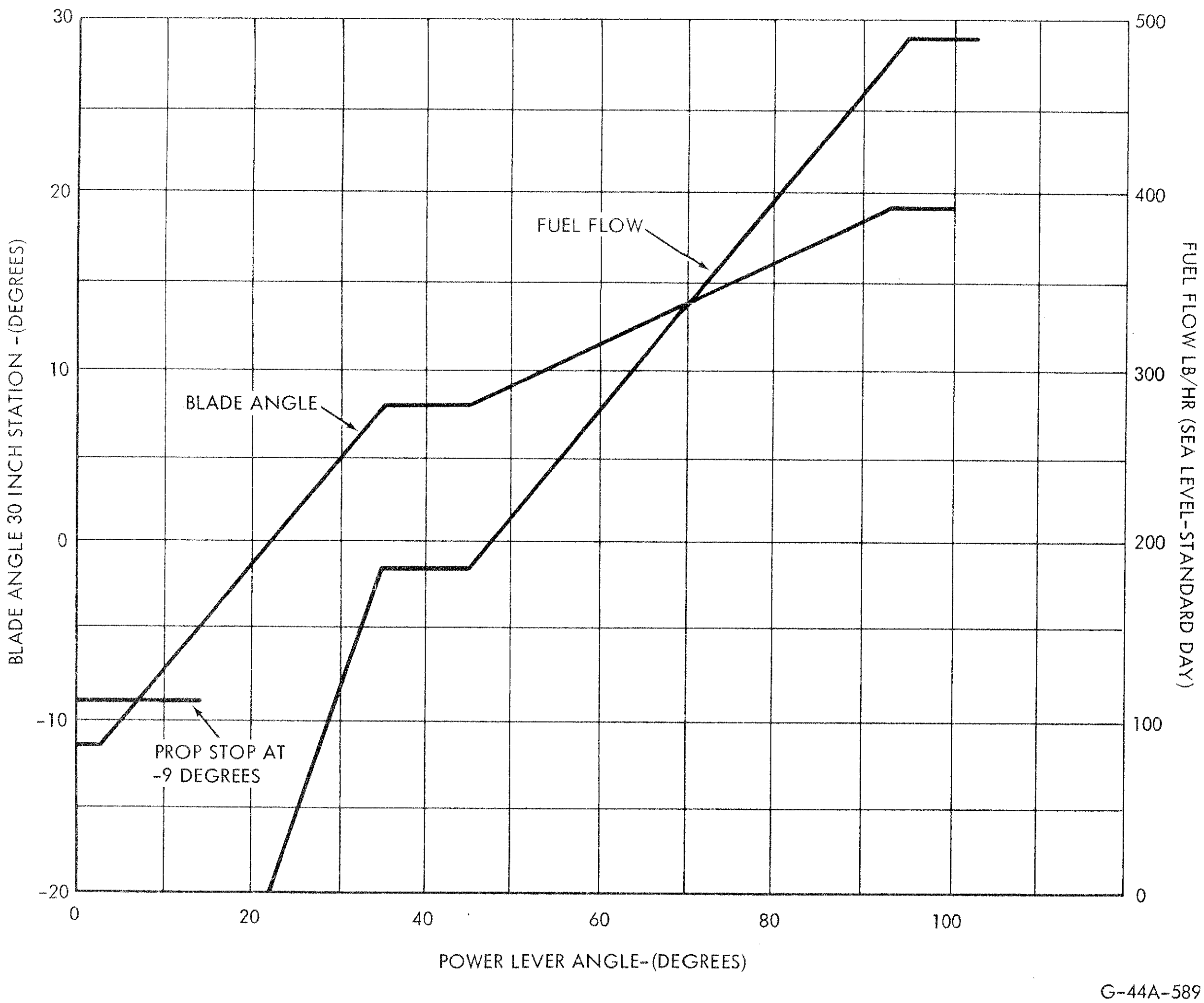
R

(Codes BA-BC, EA) Control Functions (Typical)
Figure 20



R

(Code GA) Control Functions (Typical)
Figure 21



R

(Code HA) Control Functions (Typical)
Figure 22

The propeller governor assembly speed setting shaft is connected to the underspeed governor shaft on the fuel control unit by mechanical linkage. The propeller governor assembly provides for propeller-governing mode of operation at a choice of engine speed settings. Pilot control of the cockpit speed lever determines the amount of preload on the governor speeder spring, which loads the flyweights.

During the beta-mode of engine operation the propeller governor assembly is not governing and supplies high-pressure oil via the propeller pitch control to the engine propeller control components.

6. D. Propeller Pitch Control

The propeller pitch control is mounted at the rear of the reduction gear section on the propeller shaft centerline. The propeller pitch control is composed of a ported sleeve, which is positioned by a cam. The control end of the beta tube (which also has oil-supply ports) rides inside the ported sleeve.

The positioning cam-control shaft is connected to the main metering valve power-lever shaft by mechanical linkage. During propeller-governing mode, the propeller pitch control serves no basic function other than oil passage and housing for the beta tube. In beta-mode, (underspeed governing), the propeller pitch control provides for pilot control of propeller blade pitch angle. Pilot control is accomplished by manually positioning the propeller pitch control cam. The beta tube oil supply holes are then aligned with the ported sleeve so that the pressure supplied to the propeller balances the propeller piston spring.

E. Beta Tube

The propeller oil-transfer (beta) tube extends aft from a threaded adjustable connection in the propeller dome, through the engine propeller shaft, and into the propeller pitch control. The tube portion, housed within the propeller pitch control ported sleeve has oil supply ports through which propeller governor discharge oil is supplied to the propeller dome. During beta-mode, the beta tube and the propeller pitch control jointly control the oil pressure to the propeller dome to position the blade pitch angle. During propeller-governing mode, the beta tube performs no control function (due to the ported sleeve position) and serves only as an oil passage.

F. Torque/Temperature Limiter

R (Codes AA-BC, EA-GA, KA, LA) The torque limiter is essentially a valve with one side connected between the fuel control and fuel shutoff valve and bypass metered fuel to reduce fuel supply to the engine. The torque limiter consists of a torque motor with two coils wound in parallel. If an overtorque condition arises, the torque motor receives an electrical signal from the torque limiter controller which is an electronic assembly remotely located in the airframe. The overtorque signal to the torque motor will position a plate valve in the torque limiter, permitting fuel to bypass directly back to the inlet of the fuel pump assembly thus reducing fuel flow to the engine.

R (Codes BA-BC, EA, GA, KA) The torque limiter bypass valve is also actuated by the electronic controller to limit engine interstage turbine temperature (ITT).

7. Negative Torque-Sensing (NTS) System

The NTS system is composed of two major components - the torque sensor assembly and the propeller feathering valve. The function of the NTS system is to limit the torque the engine can absorb from the propeller during windmilling and thereby prevent high propeller drag conditions. The NTS system effects a movement of the propeller blades automatically toward their feathered position (should the engine suddenly lose power while in flight) and precisely modulates the propeller-blade pitch angle during a propeller-windmilled engine air-start.

The torque sensor assembly is internally located. The torque-sensor function in the NTS system is to hydraulically actuate the propeller feathering valve when too much negative torque is applied to the engine.

The propeller feathering valve is hydraulically actuated by the torque sensor assembly, or can be manually actuated by pilot control. The feathering valve is externally mounted on the rear of the reduction gear section to provide a connection for a manual control. In response to the torque sensor assembly, or by manual actuation, the feathering valve blocks the high-pressure oil-flow to the pitch control, and simultaneously relieves high-pressure oil in the propeller dome, which allows the spring-loaded propeller blades to move toward a feathered position. The engine manual fuel shutoff valve must be rotated to its closed position immediately prior to manual actuation of the feathering valve. This function is performed by a cockpit control. Releasing the actuating pull on the spring-loaded feathering valve allows it to return to its normal operating position.

On aircraft equipped with an NTS indicator light, an NTS operational check may be performed. This check can be performed before and after flight, and can be used for trouble shooting and failure detection. The NTS check is made by observing the NTS indicator light during the engine cranking cycle. The unfeathering pump must be energized to raise the propeller oil pressure level sufficiently to activate a pressure-sensitive switch which will illuminate the NTS indicator light. When the starter is energized, the NTS indicator light should go out momentarily, then illuminates after the high initial negative torque decreases.

8. Ignition System (See Figure 23)

During engine starting, ignition of the fuel-air mixture within the combustion chamber assembly is accomplished by the ignition system. The ignition unit is energized by 24 volts dc through a speed switch at the appropriate engine rpm and delivers high voltage pulses to the igniter plugs through the ignition leads. The igniter plugs produce igniting sparks to start combustion. The system is de-energized by the speed switch when engine rpm reaches a value that indicates combustion has become self-sustaining. In addition to ignition control, the speed switch provides electrical control of the fuel shutoff valve and the starter-generator as functions of engine rpm.

9. Inlet Anti-Ice System (See Figures 24 and 25)

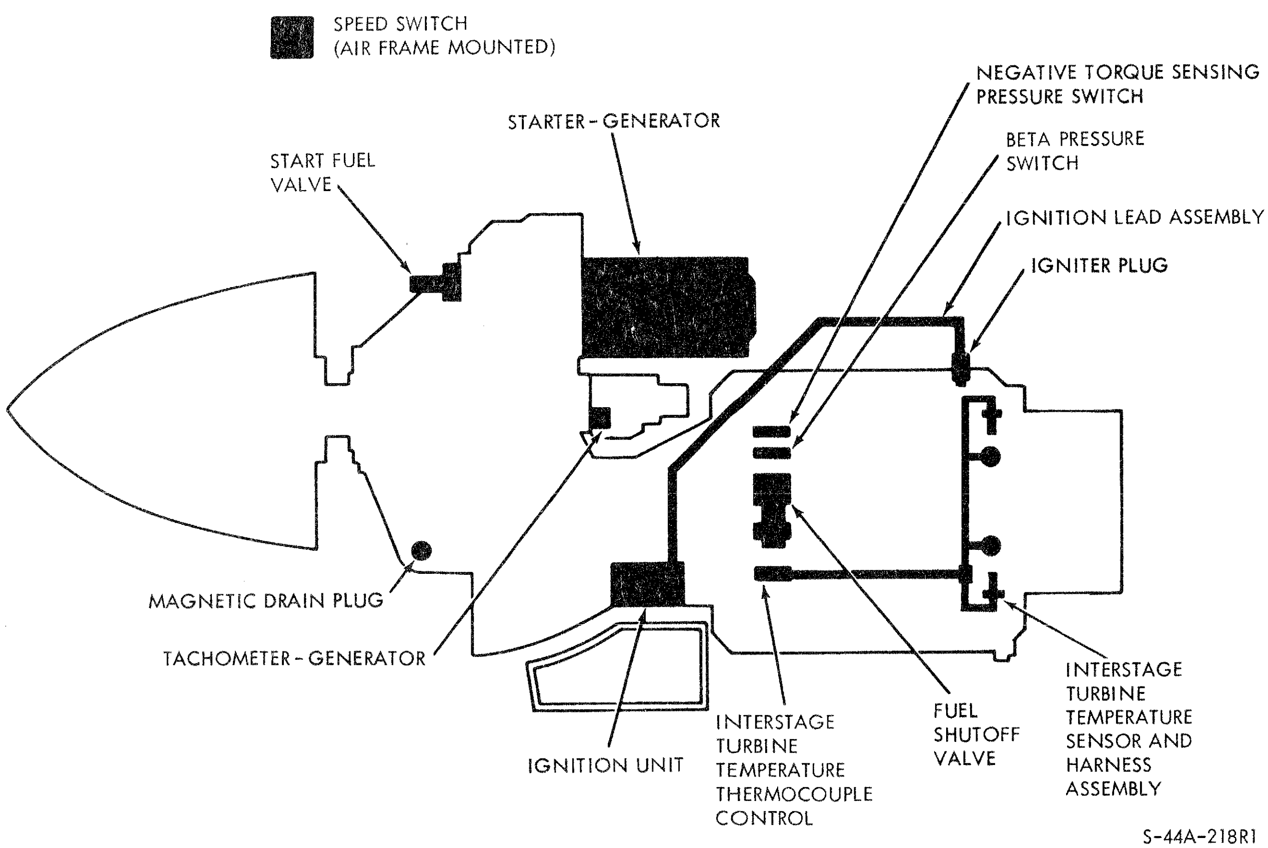
The inlet anti-ice valve, mounted on the lower left side of the compressor housing, is a normally-closed poppet-type valve actuated by a separate switch. Plumbing lines connect the valve ports to the compressor air discharge tap on the turbine plenum and to the inlet anti-icing shield. When the anti-ice valve is open, it permits flow of hot compressed air to prevent formation of ice. A connection is provided from which hot air may be obtained to provide anti-icing to other parts of the aircraft.

R 10. (Pre SB72-0042) Interstage Turbine Temperature (ITT) Indicating System (Multi-Piec)

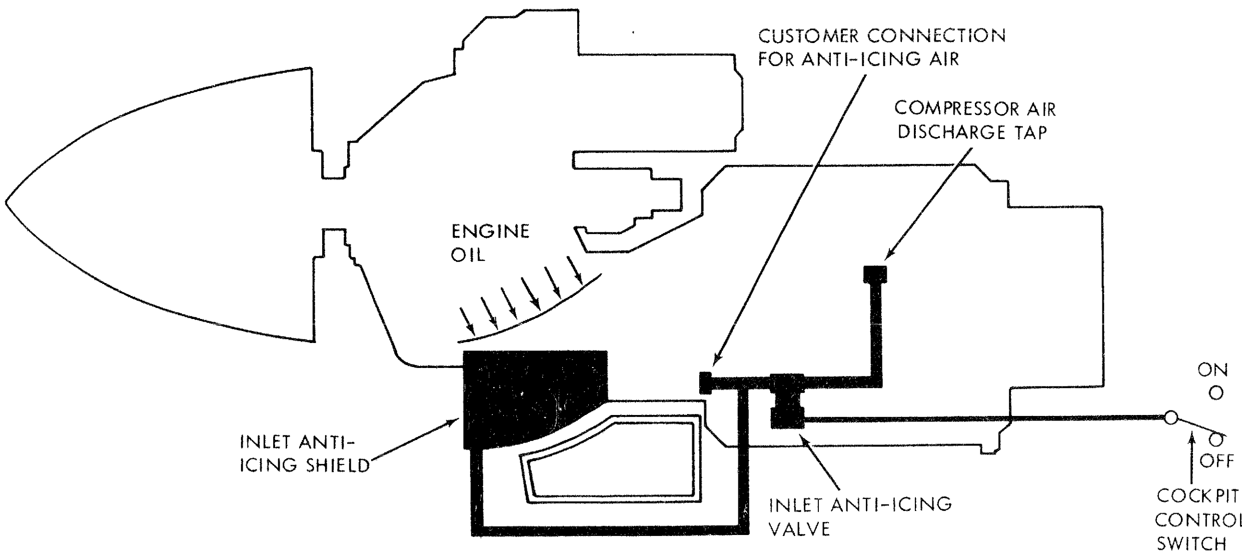
The interstage turbine temperature (ITT) system thermocouples are located at the second stage stator inlet position. The thermocouples are ungrounded, enclosed, junction type and are connected in parallel by 1/8 inch Chromel and Alumel bus bars. Construction of the system is such that each temperature probe may be individually replaced. Internal leadwires attach to the bus bars and route the temperature signal to the plenum connector located at the rear of the engine. An external harness assembly connects to the plenum connector and routes the signal to the compensating resistor control. The ITT compensating resistor control is mounted on the left side of the engine and is connected to the external thermocouples harness assembly.

R 11. (Post SB72-0042) Interstage Turbine Temperature (ITT) Indicating System (Single Piece)

The interstage turbine temperature (ITT) sensor assembly is a one-piece assembly consisting of twelve sensing probes located at the second stage stator inlet position and a lead which connects to the compensating resistor control. The sensing probes are ungrounded and enclosed in shields which are attached to the second stage stator assembly. The ITT compensating resistor control is mounted on the left side of the engine.

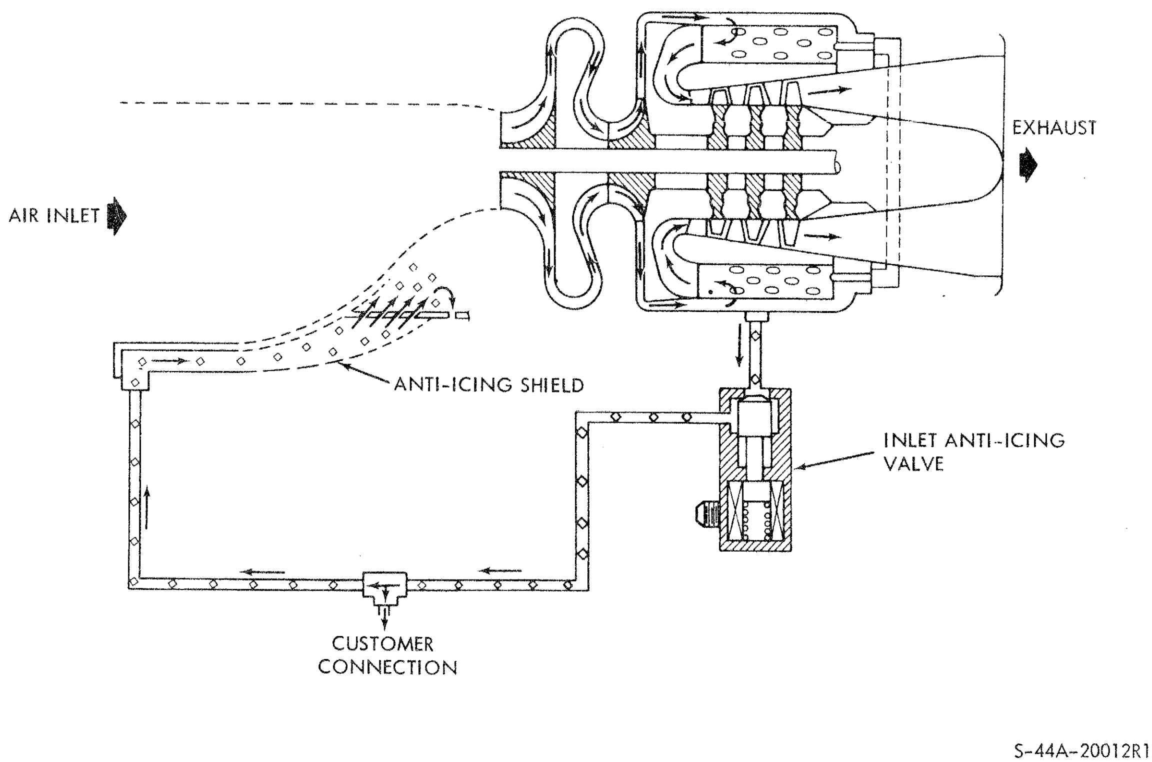


Electrical Components Diagram (Typical)
Figure 23



R

Inlet Anti-Ice System Diagram (Typical)
Figure 24



R

Inlet Anti-Ice System Schematic
Figure 25

12. Oil System (See Figures 26 Through 28)

The lubrication system includes an internal pressure pump and three internal scavenge pumps. The pressure pump provides jet and mist lubrication of engine bearings and gears. The scavenge pumps, two in the reduction gear section (in a single housing) and one in the turbine section, return lubricating oil cooling system and oil tank assembly, and oil-to-fuel heat exchanger for fuel filter anti-icing. An oil vent valve unloads the oil pump during starting. The lubrication system also supplies actuating oil to the propeller control system and to the torque sensing components. The system also includes an oil temperature bulb and magnetic drain plug for indication of oil temperature and the presence of magnetic particles in the oil.

13. Electrical System (See Figure 23)

NOTE: The details of customer-furnished electrical system component installation in the aircraft depend on the particular aircraft. The equipment installation shown in Figure 23 is included as an aid to description and represents a typical installation only.

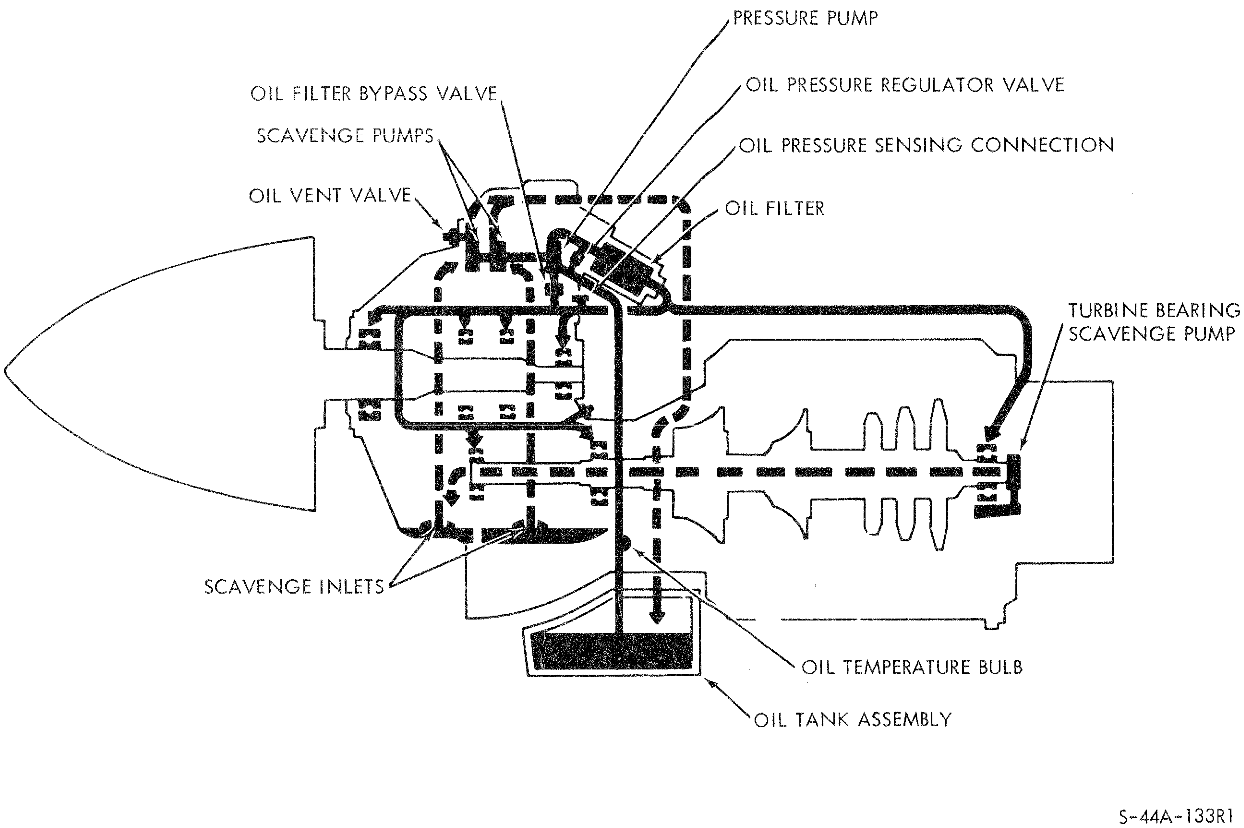
The electrical system includes engine and aircraft mounted components. Certain components are optional or customer-furnished equipment. The electrical system provides for required electrical starting and control operations as well as providing for operation of electrically actuated components, indicator lights, meters, etc, for monitoring engine operation.

Engine mounted electrical system components include an ignition system, fuel solenoid valve, inlet anti-icing valve, start fuel regulator valve, oil temperature bulb, oil vent solenoid valve, and magnetic drain plug. A solid state electronic speed switch is provided with the engine but is remotely located on the aircraft. Optional or customer-furnished engine mounted electrical system components may include a starter-generator, tachometer-generator and propeller pitch control (beta) pressure switch and NTS pressure switch.

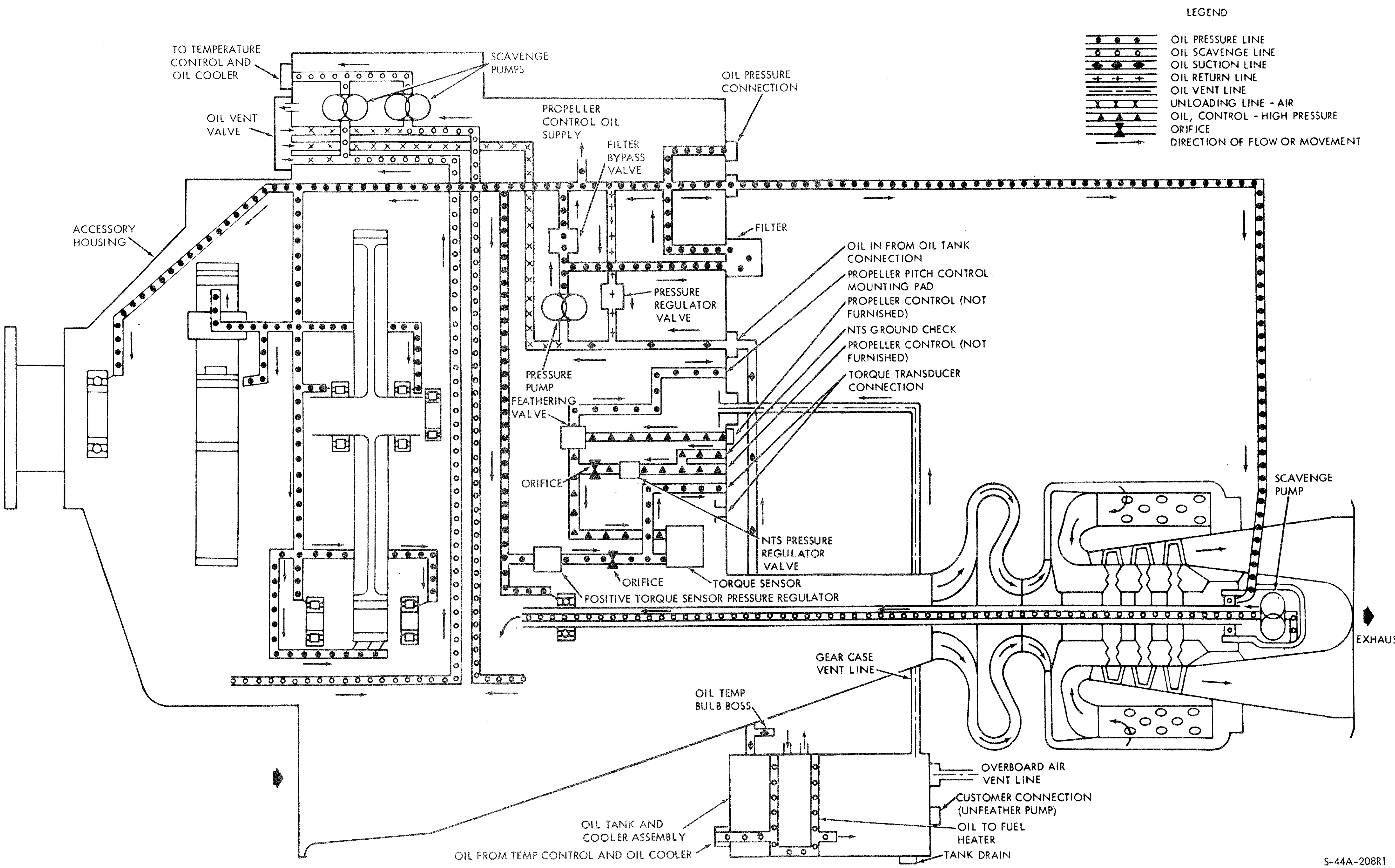
R (Codes AA-BC, EA-GA, KA, LA) A torque limiter system including an engine mounted torque limiter bypass valve and remotely located transducer and controller is incorporated. (See paragraph 6.F.)

14. Components and Accessories

All of the engine components and accessories are mounted in the reduction gear and shaft section area except the thermocouple harness assembly, primary and secondary fuel manifold and nozzle assemblies, turbine plenum drain valves, flow divider and drain valve, fuel shutoff valve, igniter plugs and ignition leads which are mounted in the combustion and turbine sections. The oil pressure and scavenge pumps, and torque sensor assembly are installed internally in the reduction gear and shaft section. The propeller governor, propeller pitch control, fuel control assembly, oil filter,

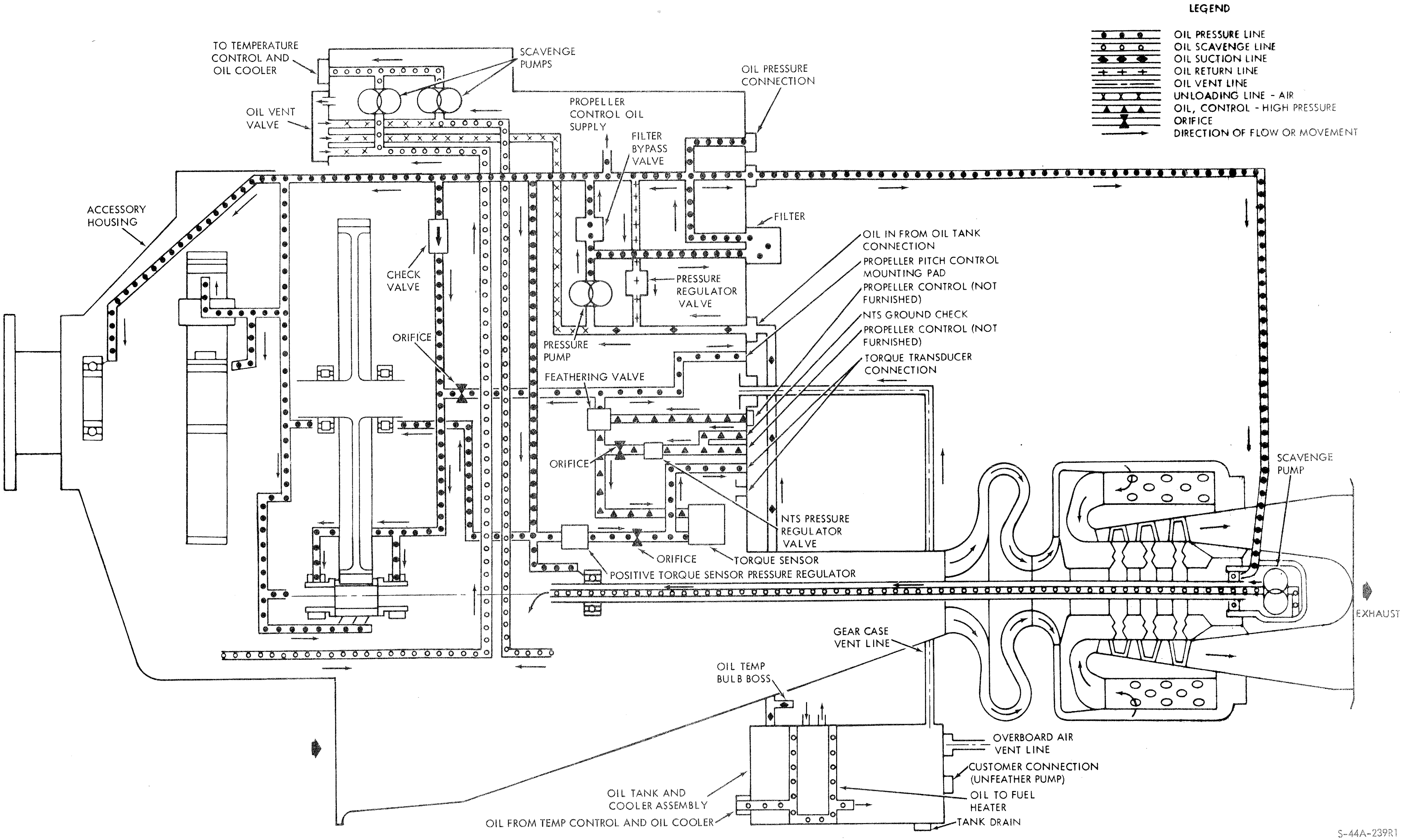


Simplified Lubricating Oil System Diagram (Typical)
Figure 26



R

(Engines With Roller Bearing High Speed Pinion)
Oil System Schematic (Typical)
Figure 27



R

(Engine With Journal Bearing High Speed Pinion)
Oil System Schematic
Figure 28

negative torque sensor pressure regulator, and feathering valve assembly and customer-furnished starter-generator and tachometer-generator, are installed on mounting pads on the outside rear face of the input housing assembly. The torque sensor pressure regulator and orifice assembly is installed on the center left side of the input housing assembly. The ignition unit, fuel solenoid valve, and inlet anti-ice valve are installed on the left side of the input housing assembly and compressor housing assembly. The oil filter bypass valve and oil pressure regulator valve assembly are installed in bosses on the upper right side of the input housing assembly. The oil vent valve is located on the upper front face of the input housing assembly. The inlet temperature sensor is located in the inlet air duct on the lower right side of the input housing assembly. Fuel flow divider and drain valve is mounted on the bottom center of the engine.

15. Accessory Mounting Provisions

The accessory pad mounts are shown in Figure 29.

R (Codes AA-AC, CA-CC, FA, KA, LA) The speeds noted are based on a propeller shaft speed of 1591 rpm.

R (Codes BA-BC, EA, GA-HA) The speeds noted are based on a propeller shaft speed of 2000 revolutions per minute.

16. Directional References

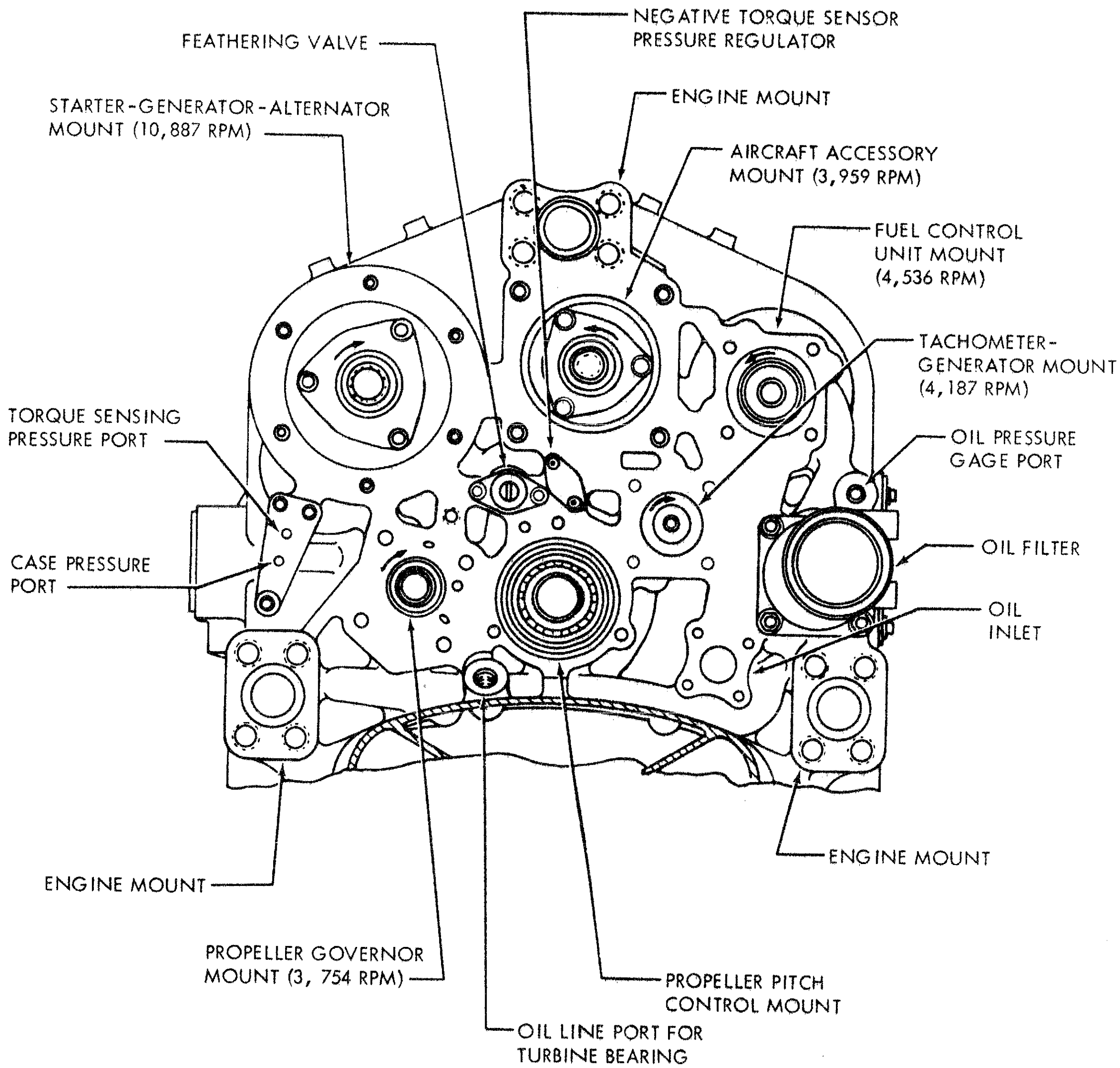
Directional references to front and rear, right and left, top and bottom and clockwise and counterclockwise are made facing the turbine discharge duct with the engine in a horizontal position and the air inlet downward. (See figure 30.)

R (Codes AA-AC, CA-CC, FA, KA, LA) The direction of rotation of the propeller shaft is counterclockwise.

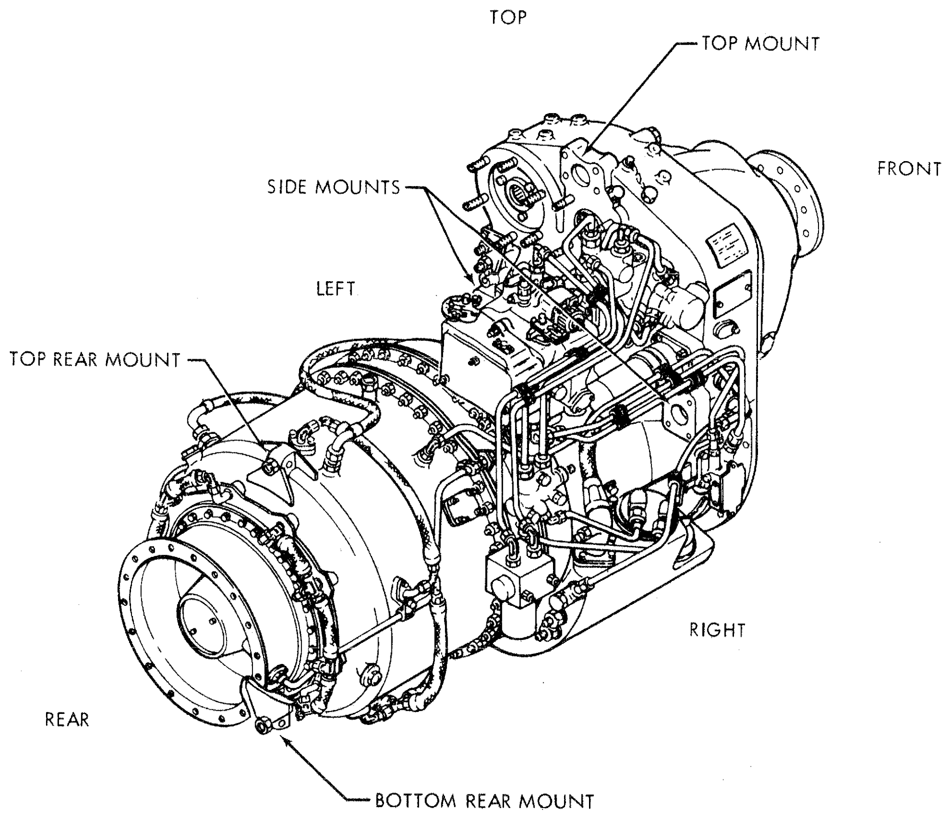
R (Codes BA-BC, EA, GA-HA) The direction of rotation of the propeller shaft is clockwise.

17. Engine Mounting Provisions

Five mounting pads are provided on the engine to satisfy various mounting requirements. (See figure 30.) Two pads are located at the top and bottom of the rear of the plenum assembly. Two other pads are located on the right and left sides of the back face of the reduction gear section. One pad is located at the top center of the rear face of the reduction gear section.



Accessory Pad Mounts (Typical)
Figure 29



Directional References and Mounting Provisions
Figure 30

18. Shipping Container Information

A. ATA300 Type Reusable Container (PN PST11) (See Table 2)

This container is constructed of wood and cardboard. A flexible foam form is placed into the container and the engine is nested in this form. The oil flow metal tube (beta tube) is encased in styrofoam and a cylindrical fiber container and nested with the engine. Another flexible foam form is then placed over the engine and beta tube. The shipping container is closed and secured with two straps.

Table 2. Shipping Container (PN PST11)

Length	56 inches
Height	41 inches
Width	31 inches
Weight (approximate) (engine included)	500 pounds

B. Metal Type Reusable Container (PN 869440-1) (See Table 3)

This container consists of a cylindrical metal shell mounted on skids. An engine cradle assembly is shock mounted in the lower half of the container. The cradle assembly suspends the engine within the container and protects the engine from vibration or shock encountered during handling. The container provides protection from various atmospheric conditions and allows for container pressurization, humidity control and indication, and record storage.

Table 3. Shipping Container (PN 869440-1)

Length	64 inches
Height	45 inches
Width	41 inches
Weight (approximate) (engine included)	665 pounds

19. Time Between Overhauls

TBO periods are specified in TPE Service Bulletin 606.

CHAPTER 72 - TROUBLE SHOOTING

TABLE OF CONTENTS

GENERAL - TROUBLE SHOOTING

1. General

The following procedures provide information for isolating and eliminating trouble which may occur during normal operation of the engine while installed in the aircraft.

Trouble shooting information is supplied in two sets of charts. The first chart provides an index by dividing normal operation of the engine into categories: pre-start (procedures 1 and 1A), ground start (procedures 2 through 16), air start (procedures 17 through 19), run up and engine check (procedures 20 through 41), cruise (procedures 42 through 45), landing (procedures 46 through 52), reverse thrust (procedures 53 through 56), after landing (procedures 57, 58 and 62 through 66), and shutdown (procedures 59 through 61).

The chart for each category lists possible trouble symptoms which may occur during operation and lists a specific trouble shooting procedure contained in the second set of charts for each set of symptoms. The second set of charts provide trouble shooting procedures in tree form to isolate the malfunctioning part or component. The tree format is used by performing the checks specified and then proceeding along the applicable path (OK or NOT OK) to the next check or instruction until the trouble is isolated and eliminated.

The second set of charts include references to certain test points; these are illustrated immediately following the trouble shooting charts in Figures 101 through 106. In addition, the second set of charts also require the use of certain curves and graphs. These are illustrated in Figures 107 through 111.

2. Trouble Shooting Tips

Values provided in the trouble shooting charts are as representative as possible. However, the Aircraft Flight and Maintenance Manuals are to be used as a basis for operating, adjusting and evaluating the performance of the engine installed in the aircraft.

Before taking corrective action indicated by the trouble shooting procedures, ensure that the instruments used to obtain indications are checked for accuracy.

Engines bearing the same part number, though similar in characteristics, are not identical. This, coupled with tolerable error in the torque, rpm, fuel flow, and temperature indicators, often causes differences in instrument readings between normal, healthy engines. Engine performance should be monitored for daily changes and trends as compared with original installed torque, fuel flow and ITT values. Cockpit readings obtained on each flight will aid greatly in monitoring engine performance.

The trouble shooting procedures are based on the symptoms which the engine displays to the operator, as well as procedures of the Aircraft Flight Manual for starting and operating the engine. There is no deliberate duplication of troubles presented - that is, a trouble which would become apparent when the engine is being started would not be covered in later operating modes. Simple and easily diagnosed troubles such as loose connections or incorrect control settings are not covered.

Table 101 provides specific maximum allowable fuel or oil leakages from engine components as an aid to determining component serviceability.

NOTE: As the majority of engine installations indicate fuel flow in pounds per hour, this unit of measurement is used in the following procedures.

Table 101. Fluid Leakage Limits (Static)

Location and Type	Maximum Allowable Limits
Fuel Pump Assembly Drive Pad	
Fuel	5.0 cc/hr
Oil	0.5 cc/hr (approx eight drops per hr)
Hydraulic Pump Drive Pad	0.5 cc/hr (approx eight drops per hr)
Accessory, Tachometer-Generator, or Starter-Generator Shaft Seal (oil)	0.5 cc/hr (approx eight drops per hr)
Fuel Pressure Regulator Drain Connection (fuel)	
During Regulator Operation	10.0 cc/min.
During Normal Engine Running	1.0 cc/min.
Fuel Control Assembly Drain (fuel)	1.0 cc/min.
Flow Divider and Drain Valve Drain (fuel)	5.0 cc/min.
Propeller Shaft Seal	0.5 cc/hr (approx eight drops per hr)
Compressor Seal (oil) (as viewed at air inlet) (Static leak only)	1.0 cc/min. (approx 15 drops per min.)
Turbine Seal (oil) (Check leakage during operation by monitoring oil consumption of engine. Consumption shall not exceed one quart per ten hours operation. Engine shall not emit smoke to indicate excessive leakage during operation.)	1.0 cc/min. (approx 15 drops per min.)

3. Trouble Shooting Procedures

NOTE: In order to satisfy high quality operational standards, as well as ensuring the accuracy of readings obtained during the test and calibration of the equipment, it is recommended that all instrumentation and gages to be used be checked on a periodic basis against instrumentation and gages of known accuracy. Table 102 provides a list of equipment and materials required to perform Trouble Shooting Procedures.

Table 102. Equipment and Materials

Equipment or Materials	Description
NOTE: Equivalent substitutes may be used for listed items.	
Gage A (Pressure)	Capable of indicating 0-250 psi, +2/-2 percent accuracy.
Gage B (Pressure)	Capable of indicating 0-300 psi, +2/-2 percent accuracy.
Gage C (Pressure)	Capable of indicating 0-600 psi, +2/-2 percent accuracy.
Gage D (Pressure)	Capable of indicating 0-1000 psi, +2/-2 percent accuracy.
Gage (Vacuum)	Capable of indicating 0-10 psi +2/-2 percent accuracy.

PRE-START. IF-

OK-PROCEED TO GROUND START.

NOT OK-PROP WILL NOT UNFEATHER OR DOES NOT UNFEATHER ADEQUATELY TO ENGAGE START LOCKS. PROCEDURE 1.

SQUEAKING OR SQUEALING SOUND IS HEARD WHEN TURNING ENGINE THROUGH BY HAND AFTER ENGINE HAS REMAINED STATIC FOR SEVERAL HOURS. REFER TO PROCEDURE 1A.

GROUND START. IF-

OK-PROCEED TO AIR START.

NOT OK-STARTER DOES NOT CRANK ENGINE. PROCEDURE 2.

NOT OK-ENGINE MOTORS-NO LIGHT OFF-ENGINE SPEED LESS THAN 10 PERCENT. PROCEDURE 3.

NOT OK-ENGINE MOTORS-NO LIGHT OFF-ENGINE SPEED OVER 16 PERCENT-COCKPIT FUEL PRESS OK-NO FUEL FLOW-IGNITION SNAP AUDIBLE. PROCEDURE 4.

NOT OK-ENGINE MOTORS-NO LIGHT OFF-ENGINE SPEED OVER 16 PERCENT-COCKPIT FUEL PRESS OK-PROPER FUEL FLOW-NO AUDIBLE IGNITION SNAP. PROCEDURE 5.

GROUND START. IF- (CONT)

NOT OK-ENGINE MOTORS-NO LIGHT OFF-ENGINE SPEED ABOVE 16 PERCENT-COCKPIT FUEL PRESS OK-NO FUEL FLOW-NO AUDIBLE IGNITION SNAP. PROCEDURE 6.

NOT OK-ENGINE MOTORS-NO LIGHT OFF-FUEL FLOW BELOW 50 LB/HR-ENGINE SPEED ABOVE 16 PERCENT-IGNITION SNAP AUDIBLE. PROCEDURE 7.

NOT OK-ENGINE MOTORS-NO LIGHT OFF-NORMAL FUEL FLOW-IGNITION SNAP AUDIBLE-ENGINE SPEED ABOVE 16 PERCENT. PROCEDURE 8.

NOT OK-LIGHT OFF OK-ENGINE DOES NOT ACCELERATE BEYOND 25 TO 40 PERCENT ENGINE SPEED-HIGH TURBINE TEMP. PROCEDURE 9.

GROUND START. IF- (CONT)

- NOT OK-LIGHT OFF OK-ENGINE DOES NOT ACCELERATE BEYOND 45 TO 60 PERCENT ENGINE SPEED-HIGH TURBINE TEMP. PROCEDURE 10.

- NOT OK-LIGHT OFF OK-ENGINE DOES NOT ACCELERATE TO SPEED OR EXCESSIVE TIME REQUIRED TO ACCELERATE TO SPEED-LOW TURBINE TEMP. FUEL PRESSURE NORMAL. PROCEDURE 11.

- NOT OK-FLAME OUT DURING START-FUEL PRESSURE ERRATIC. PROCEDURE 12.

- NOT OK-FLAME OUT DURING START-FUEL PRESSURE NORMAL. PROCEDURE 13.

GROUND START. IF- (CONT)

NOT OK-EXCESSIVE TURBINE TEMP DURING ACCELERATION BELOW 50 PERCENT ENGINE SPEED OR FLAMING START. (ABORT START PRIOR TO PASSING TURBINE TEMP LIMITS.) PROCEDURE 14.

NOT OK-ENGINE SPEED-FUEL FLOW-TURBINE TEMP AND TORQUE CYCLING DURING GROUND OPERATING CONDITIONS. PROCEDURE 15.

NOT OK-EXCESSIVE VIBRATIONS DURING START OR GROUND IDLE. PROCEDURE 16.

AIR START. IF-

OK-PROCEED TO RUN UP AND ENGINE CHECK.

NOT OK-ENGINE WILL NOT WINDMILL DURING AIRSTART ATTEMPT. PROCEDURE 17.

NOT OK-ENGINE WINDMILLING SPEED TOO LOW TO ACTUATE SPEED SWITCH DURING ATTEMPTED AIRSTART-AIRSPEED IN COMPLIANCE WITH ACFT FLIGHT MANUAL. PROCEDURE 18.

NOT OK-ENGINE WINDMILLING SPEED IN EXCESS OF 35 PERCENT RPM WHEN UNDER CONTROL OF NTS. PROCEDURE 19.

RUN UP AND ENGINE CHECK. IF-

OK-PROCEED TO CRUISE.

NOT OK-TURBINE TEMP LOW ON ONE ENGINE-TORQUE AND FUEL FLOWS MATCH-POWER IS SYMMETRICAL. PROCEDURE 20.

NOT OK-OIL PRESSURE LOW OR FLUCTUATING. PROCEDURE 21.

NOT OK-OIL FILTER BYPASS VALVE INDICATOR BUTTON POPS. PROCEDURE 21A.

NOT OK-HIGH OIL PRESSURE. PROCEDURE 22.

NOT OK-INSTALLATION WITH COMMON DRAIN MANIFOLD-OIL CONTAMINATED WITH FUEL. PROCEDURE 23.

RUN UP AND ENGINE CHECK. IF- (CONT)

NOT OK-INSTALLATION WITH SEPARATE DRAIN LINES-OIL CONTAMINATED WITH FUEL. PROCEDURE 24.

NOT OK-OVERSPEED GOVERNOR INDICATES LOW WITH PROP ON START LOCKS. PROCEDURE 25.

NOT OK-OVERSPEED GOVERNOR INDICATES HIGH WITH PROP ON START LOCKS. PROCEDURE 26.

NOT OK-UNDERSPEED GOVERNOR HIGH RPM SETTING CORRECT WITH SPEED LEVER POSITIONED AT TAKEOFF-PROP OFF START LOCKS-POWER LEVER IS IN ABNORMAL POSITION TO PROVIDE MINIMUM FUEL FLOW. PROCEDURE 27.

RUN UP AND ENGINE CHECK. IF- (CONT)

NOT OK-UNDERSPEED GOVERNOR HIGH RPM SETTING INCORRECT WITH SPEED LEVER POSITIONED AT TAKEOFF-PROP OFF START LOCKS-POWER LEVER IN PROPER POSITION TOWARD REVERSE TO PROVIDE MINIMUM FUEL FLOW. PROCEDURE 28.

NOT OK-UNDERSPEED GOVERNOR LOW RPM SETTING INCORRECT WITH SPEED LEVER POSITIONED AT MINIMUM-PROP OFF START LOCKS-POWER LEVER IN PROPER POSITION TOWARD REVERSE TO PROVIDE MINIMUM FUEL FLOW. PROCEDURE 29.

NOT OK-PROP START LOCKS DO NOT RELEASE WITH ENGINE AT SPEED AND POWER LEVER IN REVERSE THRUST-BETA LIGHT ON. PROCEDURE 30.

RUN UP AND ENGINE CHECK. IF- (CONT)

- NOT OK-NO PROP RESPONSE WITH POWER LEVER AT REVERSE THRUST-ENGINE AT SPEED-OIL PRESSURE NORMAL-BETA LIGHT OFF PROP RESPONDS NORMALLY TO UN-FEATHERING PUMP. PROCEDURE 31.

- NOT OK-PROP WILL NOT MOVE OFF START LOCKS WITH ENGINE AT SPEED-POWER LEVER AT REVERSE THRUST-BETA LIGHT OFF-ENGINE OIL PRESSURE NORMAL. PROCEDURE 32.

- NOT OK-BETA LIGHT DOES NOT GO ON WHEN REVERSE THRUST SELECTED BUT PROP RESPONDS NORMALLY. PROCEDURE 33.

RUN UP AND ENGINE CHECK. IF- (CONT)

- NOT OK-DURING PROP GOVERNOR CHECK-LOW OR HIGH RPM-ENGINE SPEED TOO LOW OR HIGH WHILE RUNNING ON PROP GOVERNOR-POWER LEVER AT CRUISE. PROCEDURE 34.

- NOT OK-PROP GOVERNOR SHIFT UPWARD OR FAILURE TO NTS. PROCEDURE 35.

- NOT OK-ENGINE TORQUE INDICATION NOT REPEATABLE WITH POWER LEVER AT FLIGHT IDLE AND SPEED LEVER AT MAX. PROCEDURE 36.

- NOT OK-LOW TORQUE INDICATED WITH TURBINE TEMP SET FOR MAX TAKEOFF-FUEL FLOW NORMAL-OIL TEMP NORMAL. PROCEDURE 37.

RUN UP AND ENGINE CHECK. IF- (CONT)

- NOT OK-HIGH TORQUE WHEN TURBINE TEMP SET FOR MAX TAKEOFF-FUEL FLOW NORMAL. PROCEDURE 38.

- NOT OK-LOW TORQUE READING WHEN TURBINE TEMP SET FOR MAX TAKEOFF-FUEL FLOW LOW. PROCEDURE 39.

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- NOT OK-(CODES AA-EA) SLOW ACCELERATION OR WILL NOT REACH MAX POWER OR OVERSPEEDS WITH PROP ON LOCKS. PROCEDURE 39A.

- NOT OK-LOW TORQUE-TURBINE TEMP AND FUEL FLOW WITH POWER LEVER FULL FORWARD. PROCEDURE 40 OR 40A.

- NOT OK-BETA LIGHT STAYS ON WHEN POWER LEVER ADVANCED TOWARD TAKEOFF-ENGINE SPEED AT NORMAL PROP GOVERNOR SPEED. PROCEDURE 41.

CRUISE (TWO ENGINE APPLICATION). IF-

OK-PROCEED TO LANDING.

NOT OK-LOW TURBINE TEMPERATURE WITH MATCHED TORQUE-FUEL FLOW AND RPM. PROCEDURE 42.

NOT OK-UNACCEPTABLE POWER LEVER SPLIT WITH ENGINE SPEED-TORQUE-FUEL FLOW MATCHED. PROCEDURE 43.

NOT OK-POWER LEVERS SPLIT AT ALTITUDE-SPLIT INCREASES AS ALTITUDE INCREASES (NO SPLIT ON TAKEOFF OR GROUND CHECK). PROCEDURE 44 OR 44A.

NOT OK-HIGH FUEL FLOW AT MAXIMUM POWER SETTING WITH TORQUE AND TURBINE TEMP MATCHED. PROCEDURE 45.

LANDING. IF-

- OK PROCEED TO REVERSE THRUST.
- NOT OK-ASYMMETRIC THRUST ON LANDING WITH POWER LEVER AT FLIGHT IDLE-BETA LIGHTS NOT ON (SYMMETRY RESTORED AFTER BETA LIGHTS GO ON). PROCEDURE 46.
- NOT OK-ASYMMETRIC THRUST ON LANDING WITH POWER LEVER AT FLIGHT IDLE-BETA LIGHT FOR LOW THRUST ENGINE ON-SYMMETRY RESTORED AFTER BOTH BETA LIGHTS ON AND FORWARD SPEED DE-CREASES. PROCEDURE 47.
- NOT OK-ASYMMETRIC THRUST ON LANDING BETA LIGHT FOR HIGH THRUST ENGINE ON-ASYMMETRY WORSENS AS FORWARD SPEED DECREASES. PROCEDURE 48.

LANDING. IF- (CONT)

NOT OK-(NON-STOL ACFT) ACFT SINK RATE TOO HIGH AT APPROACH AIRSPEED WITH POWER LEVERS AT FLIGHT IDLE-THRUST SYMMETRICAL. PROCEDURE 49.

PROCEDURE 50. (DELETED)

NOT OK-ACFT FLOATS ON LANDING-THRUST SYMMETRICAL-BETA LIGHTS ON DURING FLARE MANEUVER WHEN POWER LEVERS SET TO FLIGHT IDLE. PROCEDURE 51.

NOT OK-ACFT FLOATS ON LANDING-THRUST SYMMETRICAL-BETA LIGHTS OFF DURING FLARE MANEUVER WHEN POWER LEVERS SET TO FLIGHT IDLE. PROCEDURE 52.

REVERSE THRUST. IF-

R OK-PROCEED TO AFTER LANDING.

NOT OK-ASYMMETRIC THRUST WHEN PROPS ARE REVERSED-RUN UP CHECK SHOWS SAME FUEL FLOW-TURBINE TEMP-TORQUE AND SPEED ON BOTH ENGINES ALTHOUGH ONE ENGINE SLOWER TO REVERSE (BETA LIGHT SLOW TO COME ON IN LANDING AND REVERSE). PROCEDURE 53.

NOT-OK ASYMMETRIC THRUST WHEN PROPS REVERSED-BETA LIGHT ON-RUN UP CHECK SHOWS ONE ENGINE HIGH IN TURBINE TEMP-FUEL FLOW AND TORQUE COMPARED TO OTHER ENGINE. PROCEDURE 54.

NOT OK-ENGINE SPEED DECAYS WHEN REVERSE THRUST SELECTED. PROCEDURE 55.

NOT OK-REVERSE RESPONSE SLOW AT HIGH LANDING SPEEDS. PROCEDURE 56.

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AFTER LANDING. IF-

OK-PROCEED TO SHUTDOWN.

NOT OK-PROP FAILS TO ENGAGE START LOCKS AFTER SHUTDOWN. PROCEDURE 57.

NOT OK-OIL CONSUMPTION HIGH. PROCEDURE 58.

NOT OK-MALFUNCTION ISOLATED TO TORQUE AND TEMPERATURE LIMITING SYSTEM-REFER TO PROCEDURES 62 THROUGH 66.

SHUTDOWN. IF-

- NOT OK-UNINTENTIONAL SHUTDOWN DURING GROUND RUN. PROCEDURE 59.
- NOT OK-NOISY DECELERATION FOLLOWING SHUTDOWN. PROCEDURE 60.
- NOT OK-UNINTENTIONAL SHUTDOWN DURING FLIGHT. PROCEDURE 61.

PROCEDURE 1

PROP WILL NOT UNFEATHER OR DOES NOT UNFEATHER ADEQUATELY TO ENGAGE START LOCKS-CHECK THAT POWER LEVER IS AT FULL REVERSE. IF-

OK-CHECK FOR LOW OIL SUPPLY. CAUTION: DO NOT SERVICE OIL SUPPLY UNTIL OIL HAS BEEN SCAVENGED FROM GEARCASE-IF STARTER IS USED OBSERVE TIME LIMIT ESTABLISHED BY STARTER MANUFACTURER. IF-

NOT OK-REPOSITION POWER LEVER.

OK-CHECK THAT FEATHERING VALVE IS NOT MANUALLY ACTUATED BY COCKPIT FEATHERING CONTROL. IF-

NOT OK-CRANK ENGINE TO SCAVENGE OIL FROM GEARCASE AND RETURN OIL TO OIL TANK ASSEMBLY.

OK-CHECK FOR INOPERATIVE UNFEATHERING PUMP (UNFEATHERING PUMP OPERATION IS AUDIBLE). IF-

NOT OK-REPOSITION FEATHERING VALVE CONTROL.

PROCEDURE 1 (CONT)

OK-CHECK AIRCRAFT RIGGING TO FEATHERING VALVE. IF-

NOT OK-CHECK FOR PROPER AIRCRAFT SWITCH POSITIONS AND WIRING CONTINUITY-REFER TO ACFT MAINT MANUAL.

OK-CONNECT GAGE (B, TABLE 102) TO UNFEATHERING PUMP OUTPUT TO READ DEADHEAD PRESSURE-REFER TO ACFT MAINT MANUAL-DEADHEAD PRESSURE
R SHALL BE 125 PSIG MINIMUM. IF-

NOT OK-RERIG IN ACCORDANCE WITH ACFT MAINT MANUAL.

OK-CHECK FOR CONTAMINATION OF FEATHERING VALVE. IF-

NOT OK-REPLACE UNFEATHERING PUMP.

OK-CAP OFF NTS SYSTEM UPSTREAM OF NTS CHECK VALVE (IF NTS SYSTEM INSTALLED)-REFER TO FIGURES 101
R THROUGH 105-RECHECK UNFEATHER OPERATION. IF-

NOT OK-REMOVE CONTAMINATION OR REPLACE FEATHERING VALVE. REFER TO 72-10-07, MAINTENANCE PRACTICES.

PROCEDURE 1 (CONT)

OK-CHECK PACKINGS ON NTS PRESSURE REGULATOR. IF-

NOT OK-REMOVE AND INSPECT BETA TUBE-REFER TO 72-10-01, MAINTENANCE PRACTICES. IF-

NOT OK-REPLACE PACKINGS. IF-

OK-ACCOMPLISH ENGINE REPAIR AT SERVICE CENTER.

OK-WITH BETA TUBE REMOVED ENSURE PROPELLER CAN BE EXTERNALLY MOVED THROUGH FULL RANGE OF TRAVEL. IF-

NOT OK-AS APPLICABLE REPLACE PACKINGS OR BETA TUBE-NOTE: DAMAGE AT SERVO LAND ON BETA TUBE INDICATES POSSIBLE DAMAGE TO PROP PITCH CONTROL-INSP PROP PITCH CONTROL SLEEVE ASSY PRIOR TO OPERATION. REFER TO 72-10-02, MAINTENANCE PRACTICES.

PROCEDURE 1 (CONT)

OK-REMOVE PROP GOVERNOR AND INSPECT GASKET-REFER TO 72-10-03, MAINTENANCE PRACTICES. IF-

NOT OK-REPLACE PROPELLER.

OK-REPLACE PROP GOVERNOR AND CHECK PROP UNFEATHERING. IF-

NOT OK-REPLACE GASKET.

NOT OK-REPAIR OR REPLACE PROP PITCH CONTROL (INTERNAL LEAKAGE INDICATED) REFER TO 72-10-02, MAINTENANCE PRACTICES-CHECK PROP UNFEATHERING. IF-

NOT OK-REMOVE ENGINE-RETURN TO SERVICE CENTER OR OVERHAUL FACILITY FOR FURTHER INVESTIGATION.

PROCEDURE 1A

SQUEAKING OR SQUEALING SOUND IS HEARD WHEN TURNING ENGINE THROUGH BY HAND AFTER ENGINE HAS REMAINED STATIC FOR SEVERAL HOURS-OPEN AIRCRAFT FUEL SHUT-OFF VALVE AND TURN ON AIRCRAFT FUEL BOOST PUMPS. SLOWLY TURN PROPELLER BY HAND IN NORMAL DIRECTION OF ROTATION WHILE LISTENING FOR SQUEAKING OR SQUEALING SOUND. IF-

OK-SQUEAKING OR SQUEALING WAS FROM CARBON SHAFT BUSHING IN ENGINE DRIVEN FUEL PUMP-PROCEED WITH NORMAL OPERATION OF ENGINE.

NOT OK-PURGE AIR FROM NORMALLY FUEL LUBRICATED AREAS OF ENGINE DRIVEN FUEL PUMP BY DISCONNECTING FUEL LINE BETWEEN FUEL PUMP AND START PRESSURE REGULATOR (SPR) SOLENOID VALVE-PROVIDE CONTAINER FOR FUEL DRAINAGE-TURN AIRCRAFT BOOST PUMP ON AND ROTATE ENGINE BY HAND IN NORMAL DIRECTION OF ROTATION-LISTEN FOR SQUEAKING OR SQUEALING SOUND. IF-

OK-RECONNECT FUEL LINE BETWEEN FUEL PUMP AND START PRESSURE REGULATOR (SPR) SOLENOID VALVE AND CHECK FUEL LINE FOR LEAKAGE-PROCEED WITH NORMAL OPERATION OF ENGINE.

NOT OK-REFER TO PROCEDURE 60.

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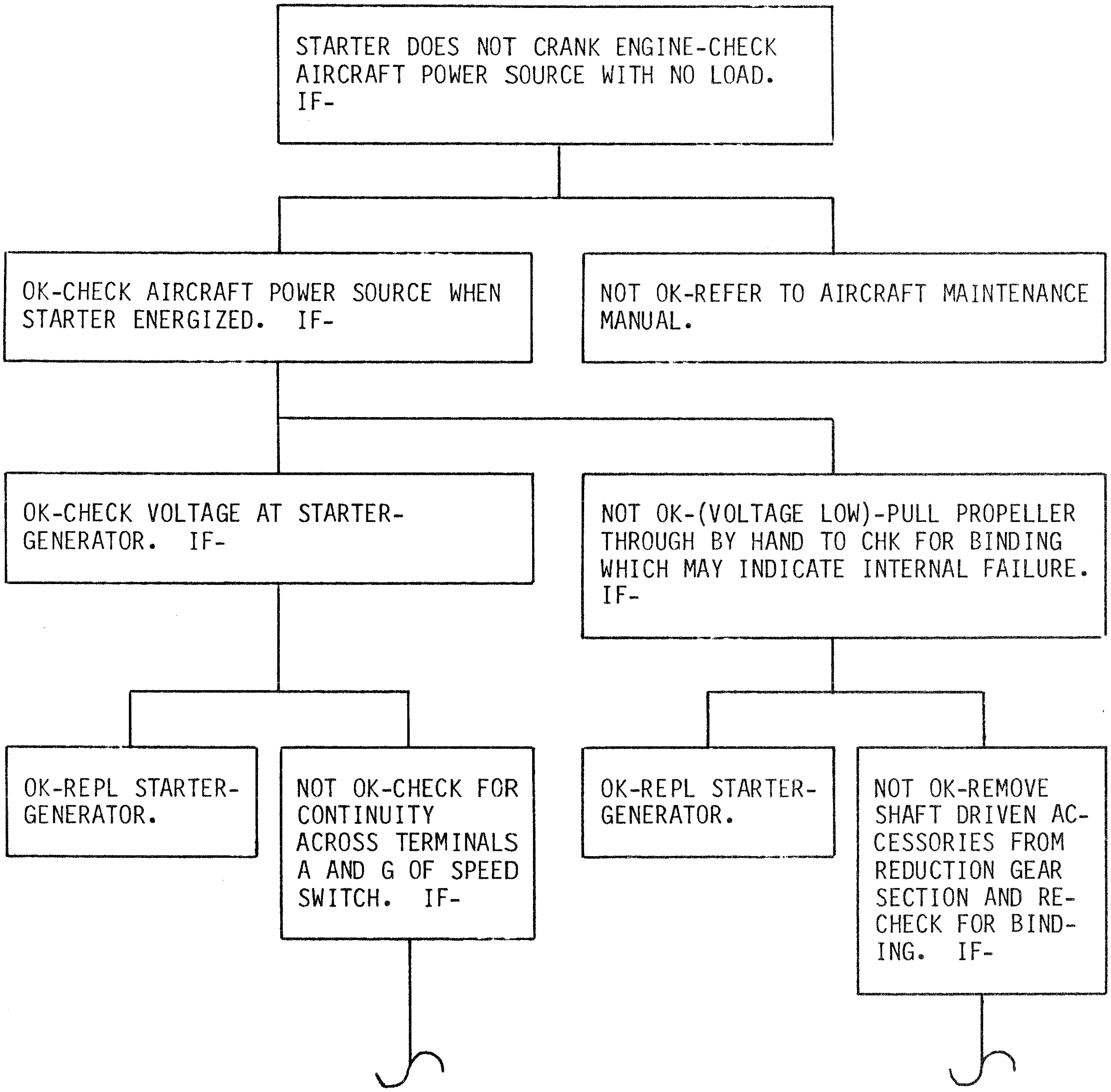
PROCEDURE 2


STARTER DOES NOT CRANK ENGINE-CHECK AIRCRAFT POWER SOURCE WITH NO LOAD. IF-
OK-CHECK AIRCRAFT POWER SOURCE WHEN STARTER ENERGIZED. IF-
NOT OK-REFER TO AIRCRAFT MAINTENANCE MANUAL.
OK-CHECK VOLTAGE AT STARTER-GENERATOR. IF-
NOT OK-(VOLTAGE LOW)-PULL PROPELLER THROUGH BY HAND TO CHK FOR BINDING WHICH MAY INDICATE INTERNAL FAILURE. IF-
OK-REPL STARTER-GENERATOR.
NOT OK-CHECK FOR CONTINUITY ACROSS TERMINALS A AND G OF SPEED SWITCH. IF-
OK-REPL STARTER-GENERATOR.
NOT OK-REMOVE SHAFT DRIVEN ACCESSORIES FROM REDUCTION GEAR SECTION AND RECHECK FOR BINDING. IF-

PROCEDURE 2 (CONT)

OK-REFER TO AIRCRAFT MAINTENANCE MANUAL (ACFT WIRING FAULTY).

NOT OK-REPLACE SPEED SWITCH. REFER TO 74-30-01, MAINTENANCE PRACTICES OR ACFT MAINTENANCE MANUAL.

OK-REPLACE ACCESSORY CAUSING BINDING.

NOT OK-REMOVE ENGINE-RETURN TO SERVICE CENTER OR OVERHAUL FACILITY FOR FURTHER INVESTIGATION.

PROCEDURE 3

ENGINE MOTORS-NO LIGHT OFF-ENGINE SPEED LESS THAN 10 PERCENT-CHECK AIRCRAFT POWER SOURCE. IF-

OK-CHECK THAT PROP IS ON START LOCKS. IF-

NOT OK-REFER TO AIRCRAFT MAINTENANCE MANUAL. CHECK ACFT ELECTRICAL POWER SOURCE.

OK-PULL PROP THROUGH BY HAND TO CHECK FOR INTERNAL BINDING. IF-

NOT OK-REFER TO AIRCRAFT MAINTENANCE MANUAL. CHECK PROP START LOCK ADJUSTMENT.

OK-CHECK VOLTAGE AT STARTER-GENERATOR. IF-

NOT OK-REMOVE SHAFT DRIVEN ACCESSORIES FROM REDUCTION GEAR SECTION AND RECHECK FOR INTERNAL BINDING. IF-

NOT OK-REFER TO AIRCRAFT MAINTENANCE MANUAL. CHECK ELECTRICAL CONTROL SYSTEM.

OK-REPLACE ACCESSORY CAUSING BINDING.

NOT OK-REMOVE ENGINE-RETURN TO SERVICE CENTER OR OVHL FACILITY FOR FURTHER INVESTIGATION.

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PROCEDURE 4

ENGINE MOTORS-NO LIGHT OFF-ENGINE SPEED ABOVE 16 PERCENT-NO FUEL FLOW-IGNITION SNAP AUDIBLE-(CAUTION: OBSERVE TIME LIMITS ON STARTER-GENERATOR AND ACFT BATTERY (IF USED) WHEN MOTORING ENGINE)-CHECK THAT COCKPIT CONTROL FOR FEATHERING VALVE IS IN NORMAL POSITION. IF-

OK-CHK ACFT FUEL SHUTOFF VALVES FOR PROPER OPERATION AND NORMAL FUEL SUPPLY TO ENGINE. IF-

NOT OK-SET CONTROL TO NORMAL POSITION.

OK-CHK FUEL SHUTOFF VALVE MANUAL OVERRIDE ARM FOR PROPER RIGGING. IF-

NOT OK-REFER TO AIRCRAFT MAINTENANCE MANUAL. TROUBLE SHOOTING SECTION.

OK-CHK FOR VOLTAGE ACROSS PINS A AND C OF FUEL SHUTOFF VALVE ELEC CONNECTOR-VOLTAGE SHALL BE PRESENT WITH ENGINE SPEED ABOVE APPROX 10 PERCENT. IF-

NOT OK-CORRECT FAULTY RIGGING-REFER TO AIRCRAFT MAINTENANCE MANUAL.

PROCEDURE 4 (CONT)

OK-DISCONNECT METERED FUEL LINE (FIGURES 101 THROUGH 104) BETWEEN FUEL CONTROL UNIT AND FUEL SHUTOFF VALVE-DISCONNECT WIRING HARNESS ASSY ELEC CONNECTOR TO IGNITION UNIT (SEE FIGURES 101 THROUGH 105)-CHK FOR FUEL FLOW FROM FUEL CONTROL UNIT WHILE MOTORING ENGINE ABOVE 16 PERCENT ENGINE SPEED. IF-

NOT OK-REFER TO AIRCRAFT MAINTENANCE MANUAL-ELEC PROBLEM IN FUEL SHUTOFF VALVE RELAY

OK-WITH ENGINE RPM ABOVE 10 PERCENT CHK FOR FUEL FLOW FROM SHUTOFF VALVE DISCHARGE PORT (FIGURES 101 THROUGH 105) TO FLOW DIVIDER. IF-

NOT OK-REPLACE FUEL PUMP ASSY. REFER TO 73-21-06, MAINTENANCE PRACTICES-REPEAT CHECK. IF-

OK-PERFORM FUEL NOZZLE AND MANIFOLD ASSY FCTN CHK IAW 72-00-00, ADJUSTMENT/TEST. IF-

NOT OK-REPL FUEL SHUTOFF VALVE-REFER TO 73-10-06, MAINTENANCE PRACTICES.

NOT OK-REPL FUEL CONTROL UNIT. REFER TO 73-21-05, MAINTENANCE PRACTICES.

NOT OK-RMV-CLEAN-INSP AND TEST PRIMARY AND SECONDARY FUEL NOZZLE AND MANIFOLD ASSY IAW 73-10-09, MAINTENANCE PRACTICES.

PROCEDURE 5

ENGINE MOTORS-NO LIGHT OFF-ENGINE SPEED ABOVE 16 PERCENT-COCKPIT FUEL PRESSURE INDICATION OK-PROPER FUEL FLOW-NO AUDIBLE IGNITION SNAP (CAUTION: OBSERVE TIME LIMITS ON STARTER-GENERATOR AND ACFT BATTERY (IF USED) WHEN MOTORING ENGINE) CHK FOR VOLTAGE ACROSS PINS A AND B OF IGNITION UNIT ELEC CONNNECTOR. IF-

OK-REPLACE IGNITION UNIT. REFER TO 74-10-01, MAINTENANCE PRACTICES. IF-

NOT OK-REFER TO AIRCRAFT MAINTENANCE MANUAL-PROBLEM IN IGNITION UNIT ELECTRICAL RELAY.

NOT OK-REPLACE
IGNITER PLUGS-
R REFER TO 74-20-
R 01, MAINTENANCE
R PRACTICES. IF-

NOT OK-REPLACE
IGNITION LEADS-
R REFER TO 74-20-
R 01, MAINTENANCE
R PRACTICES.

PROCEDURE 6

ENGINE MOTORS-NO LIGHT OFF-ENGINE SPEED ABOVE 16 PERCENT-COCKPIT FUEL PRESSURE INDICATION OK-NO FUEL FLOW-NO AUDIBLE IGNITION SNAP IS HEARD (CAUTION: OBSERVE TIME LIMITS ON STARTER GENERATOR AND ACFT BATTERY (IF USED WHEN MOTORING ENGINE) REFER TO AIRCRAFT MAINTENANCE MANUAL FOR PROPER ELECTRICAL CONNECTION TO SPEED SWITCH. IF-

OK-REPLACE SPEED SWITCH. REFER TO ACFT MAINTENANCE MANUAL. IF-

NOT OK-REPAIR AIRCRAFT IN ACCORDANCE WITH ACFT MAINTENANCE MANUAL.

NOT OK-REFER TO PROCEDURES 4 AND 5.

PROCEDURE 7

ENGINE MOTORS-NO LIGHT OFF-FUEL FLOW BELOW 50 LB/HR-ENGINE SPEED OVER 16 PERCENT-IGNITION SNAP AUDIBLE-CONNECT GAGE (D, TABLE 102) TO MEASURE HIGH PRESS PUMP DISCHARGE AT FUEL PRESS TAP PORT ON FUEL CONTROL ASSY-DISCONNECT WIRING HARNESS ASSY ELEC CONNECTOR TO FUEL SHUTOFF VALVE (SEE FIGURES 101 THROUGH 105) MOTOR ENGINE IAW AIRCRAFT FLIGHT MANUAL-PRESS INDICATED ON PRESS GAGE SHALL BE 300 PSI MINIMUM WITH ENGINE SPEED ABOVE 16 PERCENT. IF-

OK-CHECK FUEL NOZZLE AND MANIFOLD ASSEMBLIES. REFER TO 72-00-00, ADJUSTMENT/TEST.

NOT OK-CHECK PRESSURIZING VALVE FOR STICKING OR CONTAMINATION OR DAMAGED PACKINGS. IF-

OK-REMOVE AND REPLACE FUEL PUMP ASSY-REFER TO 73-21-06, MAINTENANCE PRACTICES. IF-

NOT OK-CLEAN OR REPAIR PRESSURIZING VALVE USING NEW PACKINGS-REFER TO 73-21-04, MAINTENANCE PRACTICES.

NOT OK-REPL FUEL CONTROL UNIT-REFER TO 73-21-05, MAINTENANCE PRACTICES.

PROCEDURE 8

ENGINE MOTORS-NO LIGHT OFF-NORMAL FUEL FLOW-IGNITION SNAP AUDIBLE-ENGINE SPEED OVER 16 PERCENT-CHK FOR MALFUNCTIONING FLOW DIVIDER VALVE AS EVIDENT BY FUEL FLOWING FROM FLOW DIVIDER DRAIN DURING ENGINE MOTORING OR UNBURNED FUEL IN EXHAUST. IF-

OK-FUEL VAPOR FROM EXHAUST AND SUBSEQUENT DRAINAGE FROM PLENUM DRAINS-CHECK PRIMARY FUEL NOZZLE SHROUDS FOR CORRECT INSTALLATION AND POSSIBLE RESTRICTION. IF-

NOT OK-REPAIR OR REPLACE FLOW DIVIDER VALVE-REFER TO 73-10-07, MAINTENANCE PRACTICES.

NOT OK-REMOVE RESTRICTION OR REPOSITION PRIMARY FUEL NOZZLE SHROUDS.

PROCEDURE 9

LIGHT OFF OK-ENGINE DOES NOT ACCELERATE BEYOND 25 TO 40 PERCENT ENGINE SPEED-HIGH TURBINE TEMP-CHECK FOR OBSTRUCTION AT AIR INLET OR EXHAUST. IF-

OK-ENSURE THAT PROP IS ON START LOCKS. IF-

NOT OK-CLEAR OBSTRUCTION.

OK-CHK POWER LEVER FOR PROPER POSITION (NOT IN PARTIAL REVERSE). IF-

NOT OK-REFER TO AIRCRAFT FLIGHT MANUAL FOR PROPER START PROCEDURE.

OK-CHK POWER LEVER OR ENGINE CONTROLS FOR IMPROPER RIGGING THAT COULD CAUSE SOME DEGREE OF REVERSE BLADE ANGLE. IF-

NOT OK-REPOSITION POWER LEVER.

OK-CHK SPEED SWITCH FOR PREMATURE STARTER POWER INTERRUPTION-NORMAL STARTER DROP OUT IS AT APPROX 50 PERCENT ENGINE SPEED. IF-

NOT OK-CORRECT FAULTY RIGGING-REFER TO ACFT MAINTENANCE MANUAL FOR AIRCRAFT TO ENGINE CONTROLS RIGGING.

PROCEDURE 9 (CONT)

OK-PULL PROP THROUGH BY HAND TO CHECK FOR BINDING WHICH MAY INDICATE INTERNAL FAILURE. IF-

NOT OK-CHECK FOR ACFT ELECTRICAL FAULT-REFER TO AIRCRAFT MAINTENANCE MANUAL. IF-

OK-REPLACE SPEED SWITCH-REFER TO ACFT MAINTENANCE MANUAL.

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OK-CHK THAT START LOCK BLADE ANGLE IS SET AS SPECIFIED IN AIRCRAFT MAINTENANCE MANUAL. IF-

NOT OK-REMOVE SHAFT DRIVEN ACCESSORIES FROM REDUCTION GEAR SECTION AND RECHECK FOR INTERNAL BINDING. IF-

NOT OK-RESET START LOCKS-REFER TO AIRCRAFT MAINTENANCE MANUAL.

OK-REPLACE ACCESSORY CAUSING BINDING.

NOT OK-REMOVE ENGINE-RETURN TO SERVICE CENTER OR OVHL FACILITY FOR FURTHER INVESTIGATION.

PROCEDURE 10

LIGHT OFF OK-ENGINE DOES NOT ACCELERATE BEYOND 45 TO 60 PERCENT ENGINE SPEED-HIGH TURBINE TEMP-CHK FOR EXCESSIVE ELECTRICAL LOAD-REFER TO AIRCRAFT FLIGHT MANUAL. IF-

OK-CHK POWER LEVER FOR PROPER POSITION (NOT IN PARTIAL REVERSE). IF-

NOT OK-CORRECT EXCESSIVE ELEC LOAD-REFER TO AIRCRAFT FLIGHT MANUAL.

OK-CHK FOR MISRIGGED ENGINE CONTROLS. IF-

NOT OK-REPOSITION POWER LEVER.

OK-PULL PROP THROUGH BY HAND TO CHK FOR BINDING WHICH MAY INDICATE INTERNAL FAILURE. IF-

NOT OK-CORRECT FAULTY RIGGING-REFER TO AIRCRAFT MAINTENANCE MANUAL.

PROCEDURE 10 (CONT)

OK-ENGINE DETERIORATION INDICATED-REMOVE ENGINE-RETURN TO SERVICE CENTER OR OVHL FACILITY FOR FURTHER INVESTIGATION.

NOT OK-REMOVE SHAFT DRIVEN ACCESSORIES FROM REDUCTION GEAR SECTION AND RECHECK FOR BINDING. IF-

OK-REPLACE ACCESSORY CAUSING BINDING.

NOT OK-REMOVE ENGINE-RETURN TO SERVICE CENTER OR OVHL FACILITY FOR FURTHER INVESTIGATION.

PROCEDURE 11

R LIGHT OFF OK-ENGINE DOES NOT ACCELERATE TO SPEED OR EXCESSIVE TIME REQUIRED TO ACCELERATE TO SPEED-LOW TURBINE TEMP-FUEL PRESS NORMAL-CHECK FOR LEAKS IN COMPRESSOR DISCHARGE PRESS SENSE (P3) LINE TO FUEL CONTROL UNIT (FIGURES 101 THROUGH 105). IF-

R OK-(CODES AA-EA) CHECK P3 FILTER FOR CONTAMINATION. IF-

NOT OK-TIGHTEN FITTINGS OR REPLACE PARTS TO ELIMINATE LEAKAGE.

R OK-(CODES AA-BC, EA-GA, KA, LA) CAP TORQUE LIMITER BYPASS VALVE. IF-

NOT OK-CLEAN FILTER-REFER TO 73-10-01, MAINTENANCE PRACTICES.

OK-CHECK FOR FAULTY FLOW DIVIDER AND DRAIN VALVE AS EVIDENT BY FUEL NOT BEING DISCHARGED INTO SECONDARY FUEL MANIFOLD ASSY. IF-

NOT OK-REPLACE TORQUE LIMITER BYPASS VALVE. REFER TO 73-22-01, MAINTENANCE PRACTICES.

PROCEDURE 11 (CONT)

OK-CONNECT GAGE (D, TABLE 102) TO MEASURE HIGH PRESS PUMP DISCHARGE AT FUEL METERED PRESS TAP PORT (FIGURES 101 THROUGH 104)-DISCONNECT WIRING HARNESS ASSY CONNECTOR FROM FUEL SHUTOFF VALVE (SEE FIGURES 101
R THROUGH 105) MOTOR ENGINE AND OBSERVE PRESS GAGE-PRESS SHALL BE 300 PSIG MINIMUM WITH ENGINE SPEED ABOVE 16 PERCENT. IF-

NOT OK-REPAIR OR REPLACE FLOW DIVIDER AND DRAIN VALVE-REFER TO 73-10-07, MAINTENANCE PRACTICES.

R OK-CONNECT GAGE (D, TABLE 102) INTO
R METERED FUEL LINE BETWEEN FUEL CON-
R TROL UNIT AND FUEL SHUTOFF VALVE
R (FIGURES 101 THROUGH 105) AND GAGE (B, TABLE 102) TO COMPRESSOR DISCHARGE PRESS START ENGINE IAW NORMAL START PROCEDURES AND COMPARE FUEL FLOW RATE AGAINST FUEL PRESS OF METERED FUEL LINE-COMPARED PRESS/RATE SHALL BE SPECIFIED IN 72-00-00, ADJUSTMENT/TEST. IF-

NOT OK-CHECK PRESSURIZING VALVE FOR STICKING OR CONTAMINATION OR DAMAGED PACKINGS. IF-

OK-REMOVE AND REPL FUEL PUMP ASSY-REFER TO 73-21-06, MAINTENANCE PRACTICES. IF-

NOT OK-CLEAN OR REPAIR PRESSURIZING VALVE USING NEW PACKINGS-REFER TO 73-21-04, MAINTENANCE PRACTICES.

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R
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NOT OK-REPL FUEL CONTROL UNIT-REFER TO 73-21-05, MAINTENANCE PRACTICES.

PROCEDURE 11 (CONT)

R OK-INSPECT INLET TEMPERATURE AND
R PRESSURE SENSOR-REFER TO 73-21-02,
R MAINTENANCE PRACTICES. IF-

OK-REPL FUEL CONTROL UNIT-REFER TO 73-21-05, MAINTENANCE PRACTICES.

NOT OK-REPL INLET TEMP AND PRESS. SENSOR-REFER TO 73-21-02, MAINTENANCE PRACTICES.

NOT OK-(FUEL PRESS HIGH WITH RESPECT TO FUEL FLOW) CHECK AND CORRECT RIGGING OF LINKAGE TO MANUAL OVERRIDE ARM ON FUEL SHUTOFF VALVE AND ATTEMPT TO START ENGINE USING START PROCEDURE. IF-

NOT OK-(ORIGINAL TROUBLE STILL EVIDENT) PERFORM FUEL NOZZLE AND MANIFOLD ASSY FUNCTIONAL CHECK IAW 72-00-00, ADJUSTMENT/TEST. IF-

OK-REPAIR OR REPLACE FLOW DIVIDER AND DRAIN VALVE-REFER TO 73-10-07, MAINTENANCE PRACTICES.

NOT OK-(FUEL PRESS HIGH WITH RESPECT TO FUEL FLOW) REMOVE-CLEAN-INSPECT AND TEST PRIMARY AND SECONDARY FUEL NOZZLE AND MANIFOLD ASSEMBLIES-REFER TO 73-10-09, MAINTENANCE PRACTICES.

PROCEDURE 12

FLAMEOUT DURING START-FUEL PRESSURE ERRATIC-PERFORM PROCEDURE 4.

PROCEDURE 13

FLAME OUT DURING START-FUEL PRESSURE NORMAL-CHECK THAT FUEL SHUTOFF VALVE IS FULLY OPEN. IF-

OK-CHK THAT VOLTAGE IS NOT APPLIED TO FUEL SHUTOFF VALVE SOLENOID PINS B AND C CAUSING VALVE TO CLOSE. IF-

NOT OK-CORRECT FAULTY RIGGING TO MANUAL OVERRIDE ARM ON FUEL SHUTOFF VALVE-REFER TO AIRCRAFT MAINTENANCE MANUAL.

OK-PERFORM FUEL NOZZLE AND MANIFOLD ASSY FUNCTIONAL CHECK-REFER TO 72-00-00, ADJUSTMENT/TEST. IF-

NOT OK-(VOLTAGE PRESENT)-CORRECT AIRCRAFT ELECTRICAL FAULT-REFER TO AIRCRAFT MAINTENANCE MANUAL.

OK-INDICATES FUEL CONTROL PROBLEM-REPLACE FUEL CONTROL ASSY-REFER TO 73-20-01, MAINTENANCE PRACTICES.

NOT OK-REMOVE-CLEAN-INSPECT AND TEST PRIMARY AND SECONDARY FUEL NOZZLE AND MANIFOLD ASSEMBLIES-REFER TO 73-10-09, MAINTENANCE PRACTICES.

PROCEDURE 14

EXCESSIVE TURBINE TEMP DURING ACCELERATION BELOW 50 PERCENT ENGINE SPEED OR FLAMING STARTS (ABORT START PRIOR TO PASSING TURBINE TEMP LIMITS)-CHECK THAT PROPER PROCEDURE IS BEING USED (PROP ON START LOCKS-POWER LEVER IN STARTING POSITION (NOT PARTIAL REVERSE)). IF-

OK-CHECK FOR TAIL WINDS OR CROSS WINDS. IF-

NOT OK-REFER TO AIRCRAFT FLIGHT MANUAL FOR PROPER PROCEDURE.

OK-CHECK ACFT POWER-REFER TO AIRCRAFT MAINTENANCE MANUAL. IF-

NOT OK-REPOSITION ACFT INTO WIND.

OK-CHECK STARTER FOR DROPOUT AT APPROX 50 PERCENT ENGINE SPEED. IF-

OK-(STARTER DROPOUT NORMAL)-CHECK THAT FUEL ACCUMULATION FROM PREVIOUS START ATTEMPT HAS HAD TIME TO DRAIN. IF-

NOT OK-(STARTER DROPS OUT PRIOR TO APPROX 50 PERCENT ENGINE SPEED) - CHECK SPEED SWITCH-REFER TO AIRCRAFT MAINTENANCE MANUAL.

PROCEDURE 14 (CONT)

- OK-CHECK THAT SPECIFIC GRAVITY OR FUEL TRIM ADJUSTMENT ON FUEL CONTROL UNIT IS PROPERLY SET-REFER TO 72-00-00, ADJUSTMENT/TEST. IF-
  - OK-PULL PROP THROUGH BY HAND TO CHECK FOR BINDING WHICH MAY INDICATE INTERNAL MALFUNCTION. IF-
    - OK-CHECK FOR MISRIGGED ENGINE CONTROL (CAUSING PARTIAL REVERSE). IF-
    - NOT OK-REMOVE SHAFT DRIVEN ACCESSORIES FROM REDUCTION GEAR SECTION AND RECHECK FOR INTERNAL BINDING. IF-
      - OK-REPLACE ACCESSORY CAUSING BINDING.
      - NOT OK-REMOVE ENGINE-RETURN TO SERVICE CENTER OR OVHL FACILITY FOR FURTHER INVESTIGATION.
  - NOT OK-SET SPECIFIC GRAVITY OR FUEL TRIM ADJUSTMENT.
- NOT OK-REFER TO AIRCRAFT FLIGHT MANUAL FOR PROPER PROCEDURE.

PROCEDURE 14 (CONT)

OK-CHECK START LOCKS FOR IMPROPER ADJUSTMENT. IF-

NOT OK-CORRECT FAULTY ENGINE CONTROLS RIGGING.

R OK-(CODES BA-BC, EA-LA) DISCONNECT FUEL LINE FROM START PRESS REGULATOR TO FUEL SHUTOFF VALVE AT START PRESS REGULATOR DISCHARGE PORT. CAP FITTING ON START PRESS REGULATOR AND LINE TO SHUTOFF VALVE - RESTART ENGINE AND MONITOR TURBINE TEMP. IF-

NOT OK-RESET START LOCK BLADE ANGLE-REFER TO AIRCRAFT MAINTENANCE MANUAL.

OK-(BENDIX) CHECK START FUEL FLOW BY REDUCING 10 CLICKS AND CHECKING START TEMPERATURE. IF-

NOT OK-(TURBINE TEMPERATURE STILL EXCESSIVE) DISCONNECT ELECTRICAL CONN TO IGNITION UNIT (FIGURES 101 THROUGH 105) AND MOTOR ENGINE-ALLOW ENGINE SPEED TO STABILIZE ON STARTER-OBSERVE FUEL FLOW-FLOW SHALL NOT EXCEED 70 LB/HR AFTER STABILIZING.

OK-DISCONNECT ELECTRICAL CONNECTOR TO FUEL SOLENOID (START FUEL) VALVE -RESTART ENGINE AND MONITOR TURBINE TEMP. IF-

NOT OK-SET START FUEL FLOW ADJUSTMENT TO GIVE CORRECT INTERSTAGE TURBINE TEMPERATURE. IF-

PROCEDURE 14 (CONT)

OK-ACFT ELECTRICAL PROBLEM-REFER TO AIRCRAFT MAINTENANCE MANUAL.

OK-(FUEL FLOW WITHIN LIMITS) CHECK FUEL FLOW DIVIDER VALVE FOR LEAKAGE THROUGH TO SECONDARY NOZZLES BELOW 50 PERCENT ENGINE SPEED-(DISCONNECT AND CAP OFF SECONDARY NOZZLES) (SEE
R FIGURE 106) RECONNECT IGNITION UNIT-INITIATE START ON PRIMARY NOZZLES AND MONITOR TURBINE TEMPERATURE. IF-

NOT OK-(FUEL FLOW EXCESSIVE)-REPLACE FUEL CONTROL UNIT-REFER TO 73-21-05, MAINTENANCE PRACTICES.

OK-(TURBINE TEMP NOT EXCESSIVE) REPLACE FUEL FLOW DIVIDER AND DRAIN VALVE-REFER TO 73-10-07, MAINTENANCE PRACTICES. IF-

NOT OK-REPLACE START FUEL REGULATOR VALVE-REFER TO 73-10-03, MAINTENANCE PRACTICES.

NOT OK-ENGINE INTERNAL DAMAGE-REMOVE ENGINE-RETURN TO SERVICE CENTER OR OVERHAUL FACILITY FOR FURTHER INVESTIGATION.

PROCEDURE 15

ENGINE SPEED-FUEL FLOW-TURBINE TEMP AND TORQUE CYCLING DURING GROUND OPERATING CONDITION-CHECK FOR TAIL WINDS OR CROSS WINDS. IF-

NOT OK-REPOSITION AIRCRAFT INTO WIND

PROCEDURE 16

EXCESSIVE VIBRATION DURING START OR GROUND IDLE-CHECK THAT AMBIENT WIND CONDITIONS OR RECIRCULATION OF EXHAUST GASES DUE TO ACFT POSITION IS NOT CAUSING VIBRATION. IF-

OK-CHECK THAT ALL START LOCKS ARE ENGAGED AND START LOCK BLADE ANGLE IS SET ON ALL BLADES AS SPECIFIED IN AIRCRAFT MAINTENANCE MANUAL. IF-

NOT OK-REPOSITION ACFT INTO WIND (GUSTY WIND CONDITIONS CONTRIBUTE TO APPARENT VIBRATION)

OK-PULL PROP THROUGH BY HAND TO CHK FOR BINDING WHICH MAY INDICATE INTERNAL MALFUNCTION. IF-

NOT OK-RESET START LOCKS-REFER TO AIRCRAFT MAINTENANCE MANUAL.

OK-INSPECT ENGINE MOUNTS FOR SIGNS OF UNUSUAL WEAR-CONFIRM TORQUE OF ENGINE MOUNT BOLTS SPECIFIED IN AIRCRAFT MAINTENANCE MANUAL IF-

NOT OK-REMOVE SHAFT DRIVEN ACCESSORIES FROM REDUCTION GEAR SECTION AND RECHECK FOR BINDING. IF-

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PROCEDURE 16 (CONT)

OK REPL ACCESSORY CAUSING BINDING.

NOT OK-REMOVE ENGINE-RETURN TO SERVICE CENTER OR OVHL FACILITY FOR FURTHER INVESTIGATION.

OK-INSPECT PROP BLADES FOR FOREIGN OBJECT DAMAGE AS SPECIFIED IN AIRCRAFT MAINTENANCE MANUAL. IF-

NOT OK-REFER TO AIRCRAFT MAINTENANCE MANUAL FOR PROPER TORQUE OR FOR ENGINE MOUNT REPLACEMENT PROCEDURE.

OK-INSPECT COMPRESSOR FIRST STAGE IMPELLER-REFER TO 72-30-01, MAINTENANCE PRACTICES. IF-

NOT OK-REPAIR OR REPLACE PROPELLER IAW AIRCRAFT MAINTENANCE MANUAL.

OK-REMOVE OIL FILTER AND CHECK FOR CONTAMINATION. IF-

NOT OK-REPAIR FIRST STAGE IMPELLER-REFER TO 72-30-01, MAINTENANCE PRACTICES.

PROCEDURE 16 (CONT)

OK-CHECK DYNAMIC BALANCE OF PROP-REFER TO AIRCRAFT MAINTENANCE MANUAL. IF-

NOT OK-DEPENDING UPON QUANTITY AND TYPE OF CONTAMINATION EITHER REMOVE ENGINE OR REFER TO 72-00-00, INSPECTION.

OK-CONNECT GAGE (D, TABLE 102) TO BETA PRESS SW PORT (FIGURES 101
R THROUGH 105) AND OBSERVE BETA PRESS ON PRESS GAGE DURING GROUND IDLE-PRESS SHALL BE STABLE WITHIN 50 PSI. IF-

NOT OK-REBALANCE PROP IAW AIRCRAFT MAINTENANCE MANUAL.

OK-CONNECT GAGE (D, TABLE 102) INTO METERED FUEL LINE (FIGURES 101 THROUGH 105) BETWEEN FUEL CONTROL UNIT AND FUEL SHUTOFF VALVE WITH TEE-(CAUTION: HARD LINES MUST BE USED) OBSERVE METERED FUEL PRESS ON PRESS GAGE DURING GROUND IDLE-PRESS SHALL BE STABLE WITHIN 25 PSI. IF-

NOT OK-REPLACE PROP GOVERNOR ASSY-REFER TO 72-10-03, MAINTENANCE PRACTICES.

NOT OK-REPLACE FUEL CONTROL UNIT-REFER TO 73-21-05, MAINTENANCE PRACTICES.

PROCEDURE 17

ENGINE WILL NOT WINDMILL DURING AIR START ATTEMPT-PERFORM GROUND CHECK WITH PROP IN FEATHERED POSITION-OPERATE UNFEATHERING PUMP-BLADES SHOULD MOVE FROM FEATHERED POSITION-LISTEN FOR SOUND OF UNFEATHERING PUMP RUNNING. IF-

OK-CONNECT GAGE (B. TABLE 102) TO UNFEATHERING PUMP DISCHARGE LINE (NO FLOW)-PUMP RELIEF PRESS SHALL BE
R 125 PSI MIN. IF-

NOT OK-CHECK FOR VOLTAGE TO UNFEATHERING PUMP MOTOR-REFER TO AIRCRAFT MAINTENANCE MANUAL. IF-

OK-SUSPECT UNFEATHERING PUMP MOTOR-REFER TO AIRCRAFT MAINTENANCE MANUAL.

NOT OK-NO VOLTAGE TO UNFEATHERING PUMP MOTOR -CHK ACFT ELEC CIRCUITRY-REFER TO AIRCRAFT MAINT MANUAL.

OK-CHECK FEATHERING VALVE RIGGING. IF-

NOT OK-CHECK FOR LOSS OF OIL PRIME OR LOW OIL SUPPLY (AIR IN INLET LINE) REFER TO AIRCRAFT MAINTENANCE MANUAL. IF-

PROCEDURE 17 (CONT)

OK-REPLACE UN-FEATHERING PUMP REFER TO ACFT MAINT MANUAL.

NOT OK-PRIME UN-FEATHERING PUMP REFER TO ACFT MAINT MANUAL.

OK-CHECK FEATHERING VALVE FOR CONTAMINATION WHICH COULD CAUSE INTERNAL LEAKAGE OF CONTROL OIL PRESSURE. IF-

NOT OK-RERIG FEATHERING VALVE.

OK-CHECK FEATHERING PUMP CHECK VALVE FOR RESTRICTION. IF-

NOT OK-CLEAN CONTAMINANTS FROM FEATHERING VALVE.

OK-CHECK BETA TUBE PACKINGS. IF-

NOT OK-REPLACE RESTRICTED UNFEATHERING PUMP CHECK VALVE.

OK-CHECK PITCH CONTROL PACKING FOR LEAKAGE. IF-

NOT OK-REPLACE BETA TUBE PACKINGS-REFER TO 72-10-01, MAINTENANCE PRACTICES

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PROCEDURE 17 (CONT)

NOT OK-REPLACE PACKING OR PITCH CONTROL-REFER TO 72-10-02, MAINTENANCE PRACTICES.

PROCEDURE 18

ENGINE WINDMILLING SPEED TOO SLOW TO ACTUATE SPEED SWITCH DURING ATTEMPTED AIRSTART-AIRSPEED IN COMPLIANCE WITH AIRCRAFT FLIGHT MANUAL-CHECK THAT COCKPIT FEATHERING VALVE CONTROL IS CORRECTLY POSITIONED TO ALLOW FEATHERING VALVE TO CLOSE. IF-

OK-PULL PROP THROUGH BY HAND TO CHECK FOR BINDING WHICH MAY INDICATE INTERNAL MALFUNCTION. IF-

NOT OK-CORRECT POSITION OR RERIG COCKPIT FEATHERING VALVE CONTROL-REFER TO AIRCRAFT MAINT MANUAL.

OK-UNFEATHER PROP USING ACFT UNFEATHERING PUMP-ENSURE PROPELLER MOVES THROUGH FULL RANGE OF TRAVEL. IF-

NOT OK-REMOVE SHAFT DRIVEN ACCESSORIES FROM REDUCTION GEAR SECTION AND RECHECK FOR INTERNAL BINDING. IF-

OK-REPLACE ACCESSORY CAUSING BINDING.

NOT OK-REMOVE ENGINE-RETURN TO SERVICE CENTER OR OVHL FACILITY FOR FURTHER INVESTIGATION.

OK-TORQUE SENSING SYSTEM FAULT-REFER TO 72-10-05, MAINTENANCE PRACTICES.

NOT OK-PERFORM TROUBLE SHOOTING PROCEDURE 1.

PROCEDURE 19

ENGINE WINDMILLING SPEED IN EXCESS OF 35 PERCENT WHEN UNDER CONTROL OF NTS-CHECK THAT NO FUEL FLOW IS INDICATED. IF-

OK-CHECK FEATHERING VALVE FOR FREEDOM OF MOVEMENT OF PISTON. IF-

NOT OK-CHECK FUEL SHUTOFF VALVE RIGGING TO ASSURE THAT IT CLOSES COMPLETELY. IF-

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OK-REPLACE FUEL SHUTOFF VALVE-REFER TO 73-10-06, MAINTENANCE PRACTICES.

NOT OK-RERIG-REFER TO 73-10-06, MAINTENANCE PRACTICES AND AIRCRAFT MAINTENANCE MANUAL.

OK-CHECK NTS ORIFICE FOR RESTRICTIONS. IF-

NOT OK-CHECK FOR CONTAMINATION OF FEATHERING VALVE-CLEAN-IF DAMAGED REFER TO 72-10-07, MAINTENANCE PRACTICES.

OK-CHECK FOR LOW NTS PRESSURE REGULATOR SETTING-REFER TO 72-00-00, ADJUSTMENT/TEST. IF-

NOT OK-CLEAN NTS ORIFICE-REFER TO 72-10-06, MAINTENANCE PRACTICES.

PROCEDURE 19 (CONT)

OK-CHECK TORQUE SENSOR CALIBRATION-REFER TO 72-10-16, MAINTENANCE PRACTICES. IF-

NOT OK-REPLACE NTS PRESSURE REGULATOR-REFER TO 72-10-04, MAINTENANCE PRACTICES.

NOT OK-REPLACE TORQUE SENSOR-REFER TO 72-10-16, MAINTENANCE PRACTICES.

PROCEDURE 20

TURBINE TEMP LOW ON ONE ENGINE-TORQUE AND FUEL FLOWS MATCH-POWER IS SYMMETRIC CHECK THE AIRCRAFT TEMP INDICATING SYSTEM-REFER TO AIRCRAFT MAINTENANCE MANUAL. IF-

OK-CHECK FOR CONTINUITY OF THE HARNESS ASSY AT THE COMPENSATING RESISTOR TWO PIN CONNECTOR. RESISTANCE SHALL BE AS SPECIFIED IN 77-20-03. IF-

NOT OK-CALIBRATE SYSTEM. REFER TO AIRCRAFT MAINTENANCE MANUAL.

OK-VERIFY CORRECT COMPENSATING RESISTOR IS INSTALLED AND FUNCTIONAL. REFER TO DATA SHEET CUSTOMER (DSC). IF-

NOT OK-REPLACE ENGINE HARNESS ASSY-REFER TO 77-20-03, MAINTENANCE PRACTICES.

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NOT OK-REPLACE RESISTOR ASSY-REFER TO 77-20-04, MAINTENANCE PRACTICES.

PROCEDURE 21

OIL PRESSURE LOW OR FLUCTUATING IN NORMAL FLIGHT ATTITUDES AND NORMAL OIL TEMPERATURE-CHECK OIL SUPPLY. IF-

OK-CHECK OIL FOR FUEL CONTAMINATION IF-

NOT OK-REPLENISH OIL SUPPLY AND CHK THAT OIL CONSUMPTION DOES NOT EXCEED ONE QUART PER TEN HOURS OPERATION.

OK-CONNECT GAGE (B, TABLE 102) TO OIL PRESS FITTING ON REDUCTION GEAR SECTION-OBSERVE OIL PRESSURE. IF-

NOT OK-REFER TO TROUBLE SHOOTING PROCEDURE 23.

OK-REPLACE COCKPIT OIL PRESSURE INSTRUMENT-REFER TO AIRCRAFT MAINTENANCE MANUAL.

NOT OK-CHECK FOR CLOGGED OIL FILTER. IF-

PROCEDURE 21 (CONT)

R OK-REMOVE OIL FILTER BYPASS VALVE AND CHECK FOR DAMAGED PACKINGS-RE-
R FER TO 79-20-04, MAINTENANCE PRACTICES. IF-

NOT OK-DEPENDING UPON QUANTITY AND TYPE OF CONTAMINATION-REMOVE ENGINE OR REFER TO 72-00-00, INSPECTION/CHECK.

OK-REMOVE OIL PRESSURE REGULATOR VALVE ASSY AND CHECK FOR DAMAGE OR DAMAGED PACKINGS-REFER TO 79-20-05, MAINTENANCE PRACTICES. IF-

NOT OK-REPLACE OIL FILTER BYPASS VALVE-PACKINGS-REFER TO 79-20-04, MAINTENANCE PRACTICES.

OK-CHECK THAT OIL VENT VALVE IS NOT STUCK OPEN OR ENERGIZED ABOVE 50 PERCENT ENGINE SPEED. IF-

NOT OK-REPLACE OIL PRESSURE REGULATOR VALVE ASSY OR PACKINGS-REFER TO 79-20-05, MAINTENANCE PRACTICES.

OK-CHECK FOR DAMAGED PACKINGS ON OIL PRESSURE PUMP ASSY INLET TUBE ASSY. IF-

NOT OK-CHECK THAT VOLTAGE IS NOT APPLIED TO OIL VENT VALVE WITH ENGINE SPEED ABOVE 50 PERCENT. IF-

PROCEDURE 21 (CONT)

OK-REMOVE OIL VENT VALVE AND CHK OPERATION ON BENCH-REFER TO 79-20-06, MAINTENANCE PRACTICES. IF-

NOT OK-REFER TO ACFT MAINTENANCE MANUAL TO COR-RECT ELEC FAULT.

NOT OK-REPLACE OIL VENT VALVE-REFER TO 79-20-06, MAINTENANCE PRACTICES.

OK-EXCESSIVE LUBE SYSTEM FLOW-INSP TURBINE OIL SYSTEM JET AND HYDRAU-LIC MOUNT. IF-

NOT OK-REPLACE PACKINGS.

OK-REFER TO PROCEDURE 53 FOR BETA PRESS SYSTEM EXCESSIVE LEAKAGE. IF-

NOT OK-REPAIR OR REPLACE JET OR HYDRAULIC MOUNT.

R OK-OIL PRESSURE PUMP OUTPUT LOW-REPL
R PUMP ROTOR OR REPL PUMP-REFER TO 72-
R 10-18, MAINTENANCE PRACTICES.

PROCEDURE 21A

NO OTHER APPARENT OIL SYSTEM PROBLEMS BUT OIL FILTER BYPASS VALVE INDICATOR BUTTON POPS OUT-OIL TEMPERATURE NORMAL-CHECK OIL FILTER FOR CONTAMINATION. IF-

OK-REPLACE OIL FILTER BYPASS VALVE. IF-

NOT OK-REFER TO PROCEDURE 21.

NOT OK-REPLACE OIL FILTER ELEMENT. (FILTER ELEMENT MAY BE CREATING
R EXCESSIVE PRESSURE DROP)-REFER TO
R 79-20-02, MAINTENANCE PRACTICES.

PROCEDURE 22

HIGH OIL PRESSURE-CHECK OIL TEMP. IF-

OK-CONNECT GAGE (B, TABLE 102) TO OIL PRESS FITTING ON REDUCTION GEAR SECTION AND RUN ENGINE WITH OIL AT NORMAL OPERATING TEMP AND CHK GAGE INDICATION. IF-

OK-REPLACE COCKPIT OIL PRESSURE INSTRUMENT.

NOT OK-(OIL PRESSURE HIGH)-REPLACE OIL PRESSURE REGULATOR VALVE ASSY-REFER TO 79-20-05, MAINTENANCE PRACTICES.

NOT OK-RUN ENGINE WITH OIL AT NORMAL OPERATING TEMP AND RECHECK OIL PRESSURE.

PROCEDURE 23

INSTALLATION WITH COMMON DRAIN MANIFOLD OIL CONTAMINATED WITH FUEL-CHANGE OIL AND OIL FILTER-CHECK FOR OBSTRUCTION IN COMMON DRAIN MANIFOLD-REFER TO AIRCRAFT MAINTENANCE MANUAL. IF-

OK-DISCONNECT DRAIN MANIFOLD FROM ACCESSORY DRIVE PAD-RUN ENGINE TEN MINUTES-SHUT DOWN AND CHECK FOR OIL CONTAMINATED WITH FUEL. IF-

NOT OK-REMOVE OBSTRUCTION-REFER TO AIRCRAFT MAINTENANCE MANUAL.

OK-REPLACE ACCESSORY DRIVE PAD SEAL-REFER TO 72-10-08, MAINTENANCE PRACTICES.

NOT OK-REPLACE OIL TO FUEL COOLER IN OIL TANK ASSY-REFER TO 79-10-01, MAINTENANCE PRACTICES.

PROCEDURE 24

INSTALLATION WITH SEPARATE DRAIN LINES-OIL CONTAMINATED WITH FUEL-CHANGE OIL AND OIL FILTER-REPLACE OIL TO FUEL COOLER IN OIL TANK ASSY-REFER TO 79-10-01, MAINTENANCE PRACTICES.

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PROCEDURE 25

OVERSPEED GOVERNOR INDICATES LOW WITH PROP ON START LOCKS-(NOTE: WHEN CHECKING OVERSPEED GOVERNOR AN INCREASE IN VIBRATION MAY BE NOTED THIS IS NORMAL AS LONG AS VIBRATION IN OPERATING SPEED RANGE IS SATISFACTORY-TIME OF OPERATION ON OVERSPEED GOVERNOR SHALL BE HELD TO MINIMUM) CHECK THAT CONDITION LEVER IS AT MAXIMUM WHEN POWER LEVER IS ADVANCED. IF-

OK-CHECK TACHOMETER INDICATOR CALIBRATION. IF-

NOT OK-(BENDIX) MOVE CONDITION LEVER TO MAXIMUM.

OK-PERFORM OVERSPEED GOVERNOR CHECK NOTING FUEL FLOW AND RPM-TAKE PROP OFF LOCKS WITH SPEED LEVER AT RPM LESS THAN NOTED ABOVE-MOVE POWER LEVER TOWARD TAKEOFF-FUEL FLOW INCREASES ABOVE VALUE NOTED DURING INITIAL OVERSPEED GOVERNOR CHECK-(OBSERVE TORQUE AND TEMP LIMITS.) IF-

NOT OK-REPLACE TACHOMETER INDICATOR.

PROCEDURE 25 (CONT)

OK-(FUEL FLOW INCREASES) ADJUST OVERSPEED GOVERNOR (TO INCREASE OVERSPEED GOVERNOR SETTING)-REFER TO 72-00-00, ADJUSTMENT/TEST. IF-

NOT OK-(FUEL FLOW REMAINS THE SAME) REFER TO PROCEDURE 28.

NOT OK-REPLACE FUEL CONTROL UNIT-REFER TO 73-21-05, MAINTENANCE PRACTICES.

PROCEDURE 26

OVERSPEED GOVERNOR INDICATES HIGH WITH PROP ON START LOCKS-(NOTE: WHEN CHECKING OVERSPEED GOVERNOR AN INCREASE IN VIBRATION MAY BE NOTED-THIS IS NORMAL AS LONG AS VIBRATION IN NORMAL OPERATING SPEED RANGE IS SATISFACTORY-TIME OF OPERATION ON OVERSPEED GOVERNOR SHALL BE HELD TO A MINIMUM)-CHECK TACHOMETER INDICATOR CALIBRATION. IF-

OK-ADJUST OVERSPEED GOVERNOR-REFER TO 72 00-00, ADJUSTMENT/TEST. IF-

NOT OK-REPLACE TACHOMETER INDICATOR.

NOT OK-REPLACE FUEL CONTROL UNIT-REFER TO 73-21-05, MAINTENANCE PRACTICES.

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PROCEDURE 27

UNDERSPEED GOVERNOR HIGH RPM SETTING CORRECT WITH SPEED LEVER POSITIONED AT TAKEOFF-PROP OFF START LOCKS-POWER LEVER IS IN ABNORMAL POSITION TO PROVIDE MINIMUM FUEL FLOW-CHECK TO ENSURE THAT PROP PITCH CONTROL IS CORRECTLY RIGGED TO POWER LEVER. IF-

OK-CHECK FLIGHT IDLE BLADE ANGLE. IF-

NOT OK-RERIG-REFER TO 76-10-01 MAINTENANCE PRACTICES.

NOT OK-RESET FLIGHT IDLE BLADE ANGLE -REFER TO 72-10-01, MAINTENACE PRACTICES.

PROCEDURE 28

UNDERSPEED GOVERNOR HIGH RPM SETTING INCORRECT WITH SPEED LEVER POSITIONED AT TAKEOFF-PROP OFF START LOCKS-POWER LEVER IN PROPER POSITION TOWARD REVERSE TO PROVIDE MINIMUM FUEL FLOW-CHECK THAT SPEED LEVER SETTING CAUSES POSITIVE CONTACT OF UNDERSPEED GOVERNOR SHAFT WITH MAXIMUM SPEED STOP.
IF-

OK-ADJUST UNDERSPEED GOVERNOR MAX SPEED STOP TO OBTAIN CORRECT ENGINE SPEED-REFER TO 72-00-00, ADJUSTMENT/TEST.

NOT OK-ADJUST PROP GOVERNOR/UNDER SPEED GOVERNOR LINKAGE-REFER TO 76-10-01, ADJUSTMENT/TEST OR AIRCRAFT LINKAGE.

PROCEDURE 29

UNDERSPEED GOVERNOR LOW RPM SETTING INCORRECT WITH SPEED LEVER POSITIONED AT MINIMUM-PROP OFF START LOCKS-POWER LEVER IN PROPER POSITION TOWARDS REVERSE TO PROVIDE MINIMUM FUEL FLOW-CHECK THAT SPEED LEVER SETTING CAUSES POSITIVE CONTACT OF UNDERSPEED GOVERNOR SHAFT WITH MINIMUM SPEED STOP.
IF-

OK-ADJUST UNDERSPEED GOVERNOR MINIMUM SPEED STOP TO OBTAIN CORRECT ENGINE SPEED-REFER TO 72-00-00, ADJUSTMENT/TEST.

NOT OK-ADJUST PROP GOVERNOR/UNDERSPEED GOVERNOR LINKAGE-REFER TO 76-10-01, ADJUSTMENT/TEST.

PROCEDURE 30

PROP START LOCKS DO NOT RELEASE WITH ENGINE AT SPEED AND POWER LEVER IN REVERSE THRUST-BETA LIGHT ON (COLD OIL AFFECTS TIME REQUIRED FOR PROP SYSTEM TO RESPOND-ON FIRST START ALLOW ADEQUATE TIME FOR PROP OIL SYSTEM TO FILL AND OIL TEMP TO STABILIZE)-CHECK THAT PROPER PROCEDURE IS BEING USED TO UNLATCH PROP FROM START LOCKS. IF-

OK-SHUT DOWN ENGINE-POSITION POWER LEVER AT REVERSE AND TURN ON UNFEATHERING PUMP-PROP SHALL MOVE IN REVERSE. IF-

NOT OK-USE SPECIFIED PROCEDURE-REFER TO AIRCRAFT FLIGHT MANUAL.

OK-CHECK PROP LATCH MECHANISM FOR BINDING-REFER TO AIRCRAFT MAINTENANCE MANUAL.

NOT OK-CHECK FOR FAULTY ENGINE/PROP CONTROL RIGGING-CHECK ACFT RIGGING IAW ACFT MAINTENANCE MANUAL-CHECK PROP PITCH CONTROL-REFER TO 76-10-01, MAINTENANCE PRACTICES-CHECK BETA TUBE POSITION-REFER TO 72-10-01, MAINTENANCE PRACTICES.

PROCEDURE 31

NO PROP RESPONSE WITH POWER LEVER POSITIONED AT REVERSE THRUST-SPEED LEVER AT HIGH-OIL PRESS NORMAL-BETA LIGHT OFF (PROP RESPONDS NORMALLY TO UNFEATHERING PUMP)-POSITION SPEED LEVER TO LOW AND CHECK THAT BETA LIGHT GOES ON. IF-

OK-ADJUST PROP GOVERNOR HIGH RPM SETTING-REFER TO 72-00-00, ADJUSTMENT/TEST. IF-

NOT OK-(BETA LIGHT STILL OFF)-CHECK FOR CONTAMINATED OR DAMAGED UNFEATHERING PUMP CHECK VALVE (FIGURES 101 THROUGH 105).

OK-CHECK PROP GOVERNOR GASKET. IF-

NOT OK-REPLACE UNFEATHERING PUMP CHECK VALVE-REFER TO 77-10-02, MAINTENANCE PRACTICES.

OK-REPLACE PROP GOVERNOR ASSY-REFER TO 72-10-03, MAINTENANCE PRACTICES.

NOT OK-REPLACE PROP GOVERNOR GASKET-REFER TO 72-10-03, MAINTENANCE PRACTICES.

PROCEDURE 32

PROP WILL NOT MOVE OFF START LOCKS WITH SPEED LEVER HIGH-POWER LEVER AT REVERSE THRUST-BETA LIGHT OFF-ENGINE OIL PRESS NORMAL-CHECK THAT PROP RESPONDS TO UNFEATHERING PUMP WITH ENGINE STOPPED. IF-

OK-REFER TO TROUBLE SHOOTING PROCEDURE 31.

NOT OK-REFER TO TROUBLE SHOOTING PROCEDURE 1.

PROCEDURE 33

BETA LIGHT DOES NOT GO ON WHEN REVERSE THRUST SELECTED BUT PROP RESPONDS NORMALLY-CHECK WIRING FROM BETA PRESSURE SWITCH TO BETA LIGHT-REFER TO AIRCRAFT MAINTENANCE MANUAL. IF-

OK-CONNECT GAGE (C, TABLE 102) INTO BETA PRESS SW PORT (FIGURES 101 THROUGH 105)-RUN ENGINE WITH PROP ON START LOCKS AND POWER LEVER POSITIONED AT FLIGHT IDLE-PRESS INDICATED ON PRESS GAGE SHALL BE IN ACCORDANCE WITH 77-10-02, MAINTENANCE PRACTICES. IF-

NOT OK-REPAIR WIRING FAULT-REFER TO AIRCRAFT MAINTENANCE MANUAL.

OK-ADJUST OR REPLACE BETA PRESSURE SWITCH-REFER TO 77-10-02, MAINTENANCE PRACTICES.

NOT OK-REFER TO TROUBLE SHOOTING PROCEDURE 1.

PROCEDURE 34

DURING PROP GOVERNOR CHECK-LOW OR HIGH RPM-ENGINE SPEED TO LOW OR HIGH WHILE RUNNING ON PROP GOVERNOR (POWER LEVER AT CRUISE)-CHECK FOR NORMAL OPERATING OIL TEMP (PROP GOVERNOR ASSY SPEED SETTING DECREASES 1/2 PERCENT FOR EACH 35C RISE IN OIL TEMP). IF-

OK-ADJUST PROP GOVERNOR ASSY HIGH OR LOW SPEED STOPS AS SPECIFIED IN 72-00-00, ADJUSTMENT/TEST AND REPEAT CHECK. IF-

NOT OK-CORRECT SPEED READING TO NORMAL FLIGHT OPERATING TEMP AND ADJUST SO THAT CORRECTED SPEED MEETS FLIGHT REQUIREMENTS.

NOT OK-RESET PROP GOVERNOR ASSEMBLY LINKAGE-REFER TO 76-10-01, MAINTENANCE PRACTICES. IF-

NOT OK-REPLACE PROP GOVERNOR-REFER TO 72-10-03, MAINTENANCE PRACTICES.

PROCEDURE 35

R

(CODES AA-AC, CA-CC, FA, KA, LA) PROP GOVERNOR SHIFT UPWARD OR FAILURE TO NTS-PRESS CHECK OF PROP GOVERNOR RESET FUNCTION AND NTS LOCKOUT SYSTEM COMPLETED-MAXIMUM PRESS WAS LESS THAN 250 PSI. INSTALL GAGE (C, TABLE 102) AT POSITION C (SEE 72-00-00, ADJUSTMENT/TEST FIGURE 503) TO CHECK BETA PRESS-OPERATE ENGINE WITH PROPELLER UNLATCHED AND WITH CONDITION LEVER AT MAXIMUM-POWER LEVER AT FLIGHT IDLE-BETA SHALL BE 350 PSIG MINIMUM. IF-

OK-(BETA PRESS OVER 350 PSIG) REMOVE GAGE (C, TABLE 102) AND INSTALL AT POSITION A (FIGURE 503)-INSTALL CAP AT POSITION D-OPERATE ENGINE TO CHECK PRESS AS IN PREVIOUS CHECK EXCEPT SET CONDITION LEVER AT MINIMUM (PROP GOVERNOR RESET SYSTEM DISABLED)-PRESS AT POSITION A (FIG. 503) SHALL BE ABOVE 250 PSIG. IF-

NOT OK-(BETA PRESS LESS THAN 350 PSIG) REPLACE PROP GOVERNOR (LOW RELIEF VALVE SETTING)-REFER TO 72-10-03, MAINTENANCE PRACTICES.

OK-(PRESS MORE THAN 250 PSIG) REPLACE PROP GOVERNOR (EXCESSIVE RESET SYSTEM LEAKAGE)-REFER TO 72-10-03, MAINTENANCE PRACTICES.

NOT OK-(PRESS LESS THAN 250 PSIG) REMOVE CAP AT POSITION D (FIGURE 503) AND INSTALL AT POSITION B (FIGURE 503)-OPERATE ENGINE TO CHECK PRESS AS IN PREVIOUS CHECK (CONDITION LEVER AT MINIMUM-PROP GOVERNOR RESET SYSTEM DISABLED) BETA PRESS SHALL BE ABOVE 250 PSIG. IF-

PROCEDURE 35 (CONT)

OK-(PRESS MORE THAN 250 PSIG) REPLACE PROP PITCH CONTROL (EXCESSIVE DUMP VALVE LEAKAGE)-REFER TO 72-10-02, MAINTENANCE PRACTICES.

NOT OK-(PRESSURE LESS THAN 250 PSIG) REMOVE CAP FROM POSITION B (FIGURE 503) AND RECONNNECT PROP GOVERNOR RESET SYSTEM-CHECK NTS CHECK VALVE IAW ACFT FLT MANUAL. IF-

OK-CHECK FOR DEFECTIVE PACKINGS ON NTS PRESSURE REGULATOR AND RESTRICTOR-REFER TO 72-10-04 AND 72-10-06, MAINTENANCE PRACTICES. IF-

NOT OK-REPLACE NTS CHECK VALVE-REFER TO 77-10-02, MAINTENANCE PRACTICES.

OK-REMOVE PROP GOVERNOR AND INSPECT ORIFICE SETSCREW-REFER TO 72-10-03, MAINTENANCE PRACTICES-ORIFICE DIAMETER SHALL BE 0.0295 TO 0.0305 INCH-REPLACE OR CLEAN ORIFICE IF CONTAMINATED OR RESTRICTED.

NOT OK-(PACKINGS DAMAGED) REPLACE PACKINGS.

PROCEDURE 36

FLIGHT IDLE POWER NOT REPEATABLE IN FLIGHT WHEN CHECK IAW ACFT FLT MANUAL CHECK THAT ENGINE RIG PINS CAN BE INSERTED WITH QUADRANT AT FLT IDLE. IF-

OK-CHECK THAT POWER LEVER CAN BE MOVED AWAY FROM FLIGHT IDLE DETENT 1/4 INCH WHILE IN FLIGHT IDLE DETENT WITH NO INCREASE IN FUEL FLOW. IF-

NOT OK-RERIG-REFER TO 76-10-01, MAINTENANCE PRACTICES OR RERIG ACFT LINKAGE IAW ACFT MAINTENANCE MANUAL.

NOT OK-INSPECT RIGGING REFER TO 76-10-01, MAINTENANCE PRACTICES. IF-

OK-REPLACE FUEL CONTROL UNIT-REFER TO 73-21-05, MAINTENANCE PRACTICES.

PROCEDURE 37

LOW TORQUE INDICATED WITH TURBINE TEMP NORMAL-FUEL FLOW NORMAL-OIL TEMP NORMAL-CHK FOR OIL LEAKS IN PLUMBING IN TORQUE INDICATING SYSTEM. IF-

OK-PERFORM STATIC CALIBRATION CHECK OF ACFT TORQUE INDICATING SYSTEM IN ACCORDANCE WITH 72-00-00, ADJUSTMENT/TEST. IF-

NOT OK-CORRECT LEAKS-REFER TO AIRCRAFT MAINTENANCE MANUAL.

OK-CHECK POSITIVE TORQUE SENSOR PRESSURE REGULATOR ASSEMBLY FOR RESTRICTION OR MALFUNCTION. IF-

NOT OK-RECALIBRATE-REPAIR OR REPLACE TORQUE INDICATING SYSTEM COMPONENTS AS REQUIRED-REFER TO 72-00-00, ADJUSTMENT/TEST AND 77-10-03, MAINTENANCE PRACTICES.

R

PROCEDURE 37 (CONT)

OK-CHECK ORIFICE HOUSING FOR CONTAMINATION OR PACKING DAMAGE. IF-

NOT OK-CLEAN OR REPLACE POSITIVE TORQUE SENSOR PRESSURE REGULATOR.

OK-CHECK TORQUE COMPENSATOR OR RECESSED PLUG FOR PACKING DAMAGE. IF-

NOT OK-CLEAN ORIFICE HOUSING OR REPLACE PACKING.

OK-CHECK RAW TORQUE IN ACCORDANCE WITH 72-00-00, ADJUSTMENT/TEST. IF-

NOT OK-REPLACE PACKINGS. REFER TO 77-10-01 MAINTENANCE PRACTCIES.

R OK-(CODES CA-CC) ADJUST TORQUE SENSOR COMPENSATOR IN ACCORDANCE WITH 72-00-00, ADJUSTMENT/TEST. ENTER AMOUNT OF ADJUSTMENT IN ENGINE LOG
R BOOK. (CODES AA-BC, EA, FA-LA) RECHECK STATIC CALIBRATION OF AIRCRAFT TORQUE INDICATING SYSTEM IN ACCORDANCE WITH 72-00-00, ADJUSTMENT/TEST. IF-

NOT OK-RECALIBRATE TORQUE SENSOR SYSTEM USING TORQUEMETER TEST KIT IN ACCORDANCE WITH 72-00-00, ADJUSTMENT/TEST. ADJUST TORQUE SENSOR COMPENSATOR OR TORQUE TRANSDUCER AS APPLICABLE.

R NOT OK-(CODES CA-CC) TORQUE SENSOR COMPENSATOR MALFUNCTION-REPLACE TORQUE SENSOR COMPENSATOR-REFER TO 77-10-01, MAINTENANCE PRACTICES.

PROCEDURE 38

HIGH TORQUE WHEN TURBINE TEMP AND FUEL FLOW NORMAL-CHECK THAT OIL TEMP IS NORMAL. IF-

OK-PERFORM STATIC CALIBRATION CHECK OF AIRCRAFT TORQUE INDICATING SYSTEM IN ACCORDANCE WITH 72-00-00, ADJUSTMENT/TEST. IF-

NOT OK-ALLOW OIL TO REACH OPERATING TEMP.

OK-CHECK POSITIVE TORQUE SENSOR PRESSURE REGULATOR ASSEMBLY FOR RESTRICTION OR MALFUNCTION. IF-

NOT OK-RECALIBRATE-REPAIR OR REPLACE TORQUE INDICATING SYSTEM COMPONENTS AS REQUIRED-REFER TO 72-00-00, ADJUSTMENT/TEST AND 77-10-03, MAINTENANCE PRACTICES.

OK-CHECK ORIFICE HOUSING FOR CONTAMINATION OR PACKING DAMAGE. IF-

NOT OK-CLEAN OR REPLACE POSITIVE TORQUE SENSOR PRESSURE REGULATOR.

PROCEDURE 38 (CONT)

OK-CHECK RAW TORQUE IN ACCORDANCE WITH 72-00-00, ADJUSTMENT/TEST. IF-

NOT OK-CLEAN ORIFICE HOUSING OR REPLACE PACKING.

R OK-(CODES CA-CC) ADJUST TORQUE SENSOR COMPENSATOR IN ACCORDANCE WITH 72-00-00, ADJUSTMENT/TEST. ENTER AMOUNT OF ADJUSTMENT IN ENGINE LOG
R BOOK. (CODES AA-BC, EA, FA-LA) RECHECK STATIC CALIBRATION OF AIRCRAFT TORQUE INDICATING SYSTEM IN ACCORDANCE WITH 72-00-00, ADJUSTMENT/TEST. IF-

NOT OK-RECALIBRATE TORQUE SENSOR SYSTEM USING TORQUEMETER TEST KIT IN ACCORDANCE WITH 72-00-00 ADJUSTMENT/TEST. ADJUST TORQUE COMPENSATOR OR TORQUE TRANSDUCER APPLICABLE.

R NOT OK-(CODES CA-CC) TORQUE SENSOR COMPENSATOR MALFUNCTION-REPLACE TORQUE SENSOR COMPENSATOR-REFER TO 77-10-01,

PROCEDURE 39

LOW TORQUE AND FUEL FLOW WITH ITT MATCHED-CHECK TO ENSURE ACFT BLEED SYSTEM IS OFF. IF-

OK-CHECK THAT ANTI-ICE VALVE HAS NOT FAILED IN THE OPEN POSITION. IF-

NOT OK-SHUT OFF ACFT BLEED AIR SYSTEM IAW AIRCRAFT FLIGHT MANUAL.

OK-PULL PROPELLER THROUGH BY HAND TO CHECK FOR INTERNAL BINDING. IF-

NOT OK-REPAIR/REPLACE ANTI-ICE VALVE-REFER TO 75-10-01, MAINTENANCE PRACTICES.

OK-CHECK PLUMBING INTERFACE BETWEEN ENGINE AND AFCT BLEED AIR SYSTEM FOR LEAKS-REFER TO AIRCRAFT MAINTENANCE MANUAL. IF-

NOT OK-REMOVE SHAFT DRIVEN ACCESSORIES FROM REDUCTION GEAR SECTION AND RECHECK FOR INTERNAL BINDING. IF-

OK-REPLACE ACCESSORY CAUSING BINDING.

NOT OK-REMOVE ENGINE-RETURN TO SERVICE CENTER OR OVHL FACILITY FOR FURTHER INVESTIGATION.

PROCEDURE 39 (CONT)

OK-CHECK ACFT TEMP INDICATING SYSTEM IAW AIRCRAFT MAINTENANCE MANUAL. IF

NOT OK-REPAIR LEAKS.

OK-CHECK ENGINE TURBINE TEMP SYSTEM-REFER TO 77-20-03, MAINTENANCE PRACTICES. IF-

NOT OK-REPAIR ACFT INDICATING SYSTEM-REFER TO AIRCRAFT MAINTENANCE MANUAL.

NOT OK-REPLACE ENGINE TURBINE TEMP SYSTEM AS NECESSARY-REFER TO 77-20-03, MAINTENANCE PRACTICES.

R

PROCEDURE 39A

(CODES AA-EA) ENGINE ACCELERATION SLOW OR ENGINE WILL NOT REACH MAX POWER OR ENGINE OVERSPEEDS WITH PROP ON LOCKS-CONTROL LINKAGE, PROP GOVERNOR AND FUEL CONTROL SET POINTS HAVE BEEN PROPERLY ADJUSTED-CHECK FOR LEAKAGE OF HEATED PNEUMATIC TUBES BETWEEN COM PRESSOR DISCHARGE PORT, INLET TEMP SENSOR AND FUEL CONTROL UNIT-REFER TO 73-10-01, MAINTENANCE PRACTICES. IF-

NOT OK-CHECK FLARES AND FLARE SLEEVES OF PNEUMATIC TUBES FOR COR-ROSION OR CRACKS AND PRESSURE TEST PNEUMATIC TUBES-REFER TO 73-10-01, MAINTENANCE PRACTICES. IF-

NOT OK-REPAIR LEAKAGE OR REPLACE DE-FECTIVE PARTS AND RETEST-REFER TO 73-10-01, MAINTENANCE PRACTICES.

OK-REFER TO PROCEDURES 26 OR 40.

PROCEDURE 40

R

(CODES AA-EA) LOW TORQUE-LOW TURBINE TEMP AND LOW FUEL FLOW WITH POWER LEVER FULL FORWARD CHECK THAT PROP GOVERNOR ASSY AND OVERSPEED/UNDERSPEED GOVERNOR SETPOINTS ARE WITHIN LIMITS-REFER TO 72-00-00, ADJUSTMENT/TEST. IF-

OK-CHECK ACFT POWER LEVER RIGGING. IF-

NOT OK-RESET WITHIN LIMITS.

OK-CHECK COMPRESSOR DISCHARGE PRESSURE, PX AND PC LINES FOR LEAKS. IF-

NOT OK-CORRECT MISRIGGED ACFT POWER LEVER RIGGING-REFER TO ACFT MAINTENANCE MANUAL.

OK-CAP TORQUE LIMITER BYPASS VALVE. IF-

NOT OK-REPAIR LEAKS.

PROCEDURE 40 (CONT)

OK-FUEL CONTROL ADJUSTMENT REQUIRED -REFER TO 72-00-00, ADJUSTMENT/TEST.

NOT OK-REPLACE TORQUE LIMITER BY-PASS VALVE-REFER TO 73-22-01, MAINTENANCE PRACTICES.

OK-(ENGINE INSTALLATIONS WITHOUT FUEL MANIFOLD PURGE SYSTEM) CHECK THAT THERE IS NO LEAKAGE FROM FLOW DIVIDER AND DRAIN VALVE WHEN ENGINE IS RUNNING AT POWER. IF-

OK-CHECK RIGGING AND POSITION OF MANUAL OVERRIDE ARM ON FUEL SHUTOFF VALVE-REFER TO ACFT MAINTENANCE MANUAL. IF-

NOT OK-CAP DRAIN FITTING ON FUEL FLOW DIVIDER AND DRAIN VALVE (FIGURE 105) AND REPEAT CHECK-(CAUTION REMOVE CAP AFTER CHECK AND MONITOR TURBINE TEMP ON NEXT START.) IF-

OK-REPAIR FLOW DIVIDER AND DRAIN VALVE-REFER TO 73-10-07, MAINTENANCE PRACTICES.

PROCEDURE 40 (CONT)

OK-PERFORM FUEL NOZZLE AND MANIFOLD ASSY CHECK IAW 72-00-00, ADJUSTMENT/ TEST. IF-

NOT OK-RERIG FUEL SHUTOFF VALVE- REFER TO ACFT MAINTENANCE MANUAL.

OK-CONNECT GAGE (D, TABLE 102) TO MEASURE HIGH PRESSURE PUMP DISCHARGE AT FUEL PRESSURE PORT TAP ON FUEL CONT ASSY-PRESSURE SHALL BE LESS THAN 900 PSI. IF-

NOT OK-REMOVE-CLEAN-INSPECT AND TEST PRIMARY AND SECONDARY FUEL NOZZLE AND MANIFOLD ASSEMBLIES-REFER TO 73-10-09, MAINTENANCE PRACTICES.

OK-CONNECT GAGE (D, TABLE 102) INTO ACFT FUEL SUPPLY LINE TO FUEL CONTROL ASSY (FIGURES 101-102) PRESSURE SHALL BE MORE THAN FIVE PSI. IF-

NOT OK-CONNECT GAGE (D, TABLE 102) TO DISCHARGE PORT ON FUEL SHUTOFF VALVE (FIGURES 101-102) WITH TEE-PRESS SHALL BE LESS THAN 800 PSI. IF-

NOT OK-CHECK ACFT FUEL SUPPLY SYSTEM-REFER TO ACFT MAINTENANCE MANUAL.

OK-CONNECT GAGE (D TABLE 102) INTO METERED FUEL LINE (FIG. 101-102) FROM FUEL CONT UNIT-PRESS SHALL BE LESS THAN 800 PSI. IF-

NOT OK-REPAIR OR REPLACE FLOW DIVIDER AND DRAIN VALVE-REFER TO 73-10-MAINTENANCE PRACTICES.

R

PROCEDURE 40 (CONT)

NOT OK-REPAIR OR REPLACE FUEL SHUT-OFF VALUE-REFER TO 73-10-06, MAINTENANCE PRACTICES.

OK-REPLACE INLET TEMP SENSOR-REFER TO 73-21-02, MAINTENANCE PRACTICES. IF-

NOT OK-REPLACE FUEL CONTROL UNIT-REFER TO 73-21-05, MAINTENANCE PRACTICES.

PROCEDURE 40A

R

(CODES FA-LA) LOW TORQUE-TURBINE TEMP AND FUEL FLOW WITH POWER LEVER FULL FORWARD-CHK THAT PROP GOVERNOR ASSY AND OVERSPEED/UNDERSPEED GOVERNOR SET-POINTS ARE WITHIN LIMITS-REFER TO 72-00-00, ADJUSTMENT/TEST. IF-

OK CHECK POWER LEVER RIGGING. IF-

NOT OK-RESET WITHIN LIMITS.

OK-RETARD SPEED LEVER TO LOW WITH POWER LEVER FULL FORWARD (CAUTION: MONITOR TURBINE TEMP AND DO NOT EXCEED LIMIT)-FUEL FLOW SHALL DROP LESS THAN TEN LB/HR. IF-

NOT OK-CORRECT MISRIGGED ACFT POWER LEVER RIGGING-REFER TO AIRCRAFT MAINTENANCE MANUAL.

OK-SET SPEED LEVER TO HIGH POSITION AND SLOWLY ADVANCE POWER LEVER FROM FLIGHT IDLE POSITION WHILE MONITORING FUEL FLOW-FUEL FLOW SHALL INCREASE CONTINUOUSLY WITH POWER LEVER ADVANCEMENT. IF-

NOT OK-CHECK COMPRESSOR DISCHARGE PRESSURE SENSING LINE (FIGURE 103 THROUGH 105) FOR LEAKS. IF-

PROCEDURE 40A (CONT)

OK-REPLACE FUEL CONTROL UNIT. REFER TO 73-21-05, MAINTENANCE PRACTICES.

NOT OK-CHK THAT FUEL LINES ARE NOT LEAKING. IF-

OK-CHECK RIGGING AND POSITION OF MAN. OVERRIDE ARM ON FUEL SHUT-OFF VALVE-REFER TO ACFT MAINT MANUAL. IF-

NOT OK-REPAIR LEAKS.

OK-SET FUEL TRIM ADJUSTMENT AND REPEAT CHK (CAUTION FLT IDLE FUEL FLOW IS AFFECTED BY FUEL TRIM ADJUSTMENTS). IF-

NOT OK-REPAIR LEAKS.

OK-(CODES FA-GA, KA-LA) CAP TORQUE LIMITER BYPASS VALVE. IF-

OK-FUEL CONTROL ADJUST REQUIRED-REFER TO 72-00-00, ADJUSTMENT/TEST.

NOT OK-(CODES FA-GA, KA-LA) REPL TORQUE LIMITER BYPASS VALVE-REFER TO 73-22-01, MAINTENANCE PRACTICES. IF-

R

PROCEDURE 40A (CONT)

NOT OK-MEASURE COMPRESSOR DISCHARGE (ACFT BLEED AIR PRESS)-PRESS SHALL BE APPROX AS SPECIFIED (FIGURE 111). IF-

OK-REPLACE INLET TEMP AND PRESS SENSOR-REFER TO 73-21-05, MAINTENANCE PRACTICES. IF-

NOT OK-REFER TO TROUBLE SHOOTING PROCEDURE 39.

NOT OK-REPLACE FUEL CONTROL UNIT-REFER TO 73-21-05, MAINTENANCE PRACTICES. IF-

NOT OK-REMOVE ENGINE AND RETURN TO SERVICE CENTER ON OVERHAUL FACILITY FOR FURTHER INVESTIGATION.

PROCEDURE 40A (CONT)

OK-PERFORM FUEL NOZZLE AND MANIFOLD ASSEMBLY CHECK-REFER TO 72-00-00, ADJUSTMENT/TEST. IF-

NOT OK-RERIG FUEL SHUTOFF VALVE-REFER TO AIRCRAFT MAINTENANCE MANUAL.

OK-CONNECT GAGE (D, TABLE 102) TO MEASURE HIGH PRESSURE PUMP DISCHARGE AT FUEL PRESSURE PORT TAP ON FUEL CONTROL ASSY-PRESSURE SHALL BE LESS THAN 900 PSI. IF-

NOT OK-REMOVE-CLEAN INSPECT AND TEST PRIMARY AND SECONDARY FUEL NOZZLE AND MANIFOLD ASSEMBLIES-REFER TO 73-10-09, MAINTENANCE PRACTICES.

R OK-CONNECT GAGE (A, TABLE 102) INTO ACFT FUEL SUPPLY LINE TO FUEL CONTROL ASSY (FIGURE 103 THROUGH 105) PRESSURE SHALL BE MORE THAN FIVE PSI. IF-

NOT OK-CONNECT GAGE (D, TABLE 102) TO DISCHARGE PORT ON FUEL SHUTOFF (FIGURE 103 THROUGH 105) WITH TEE-PRESSURE SHALL BE LESS THAN 800 PSI. IF-

PROCEDURE 40A (CONT)

OK-REPLACE FUEL
PUMP ASSY-REFER
TO 73-21-06,
MAINTENANCE
R PRACTICES-RUN
R ENGINE-CHECK
FOR NORMAL
OPERATION. IF-

NOT OK-CHECK ACFT FUEL SYSTEM-REFER TO AIRCRAFT MAINTENANCE MANUAL.

OK-CONNECT GAGE (D, TABLE 102) INTO METERED FUEL LINE (FIGURE 103 THROUGH 105) FROM FUEL CONTROL UNIT-PRESS SHALL BE LESS THAN 800 PSI. IF-

NOT OK-REPAIR OR REPLACE FLOW DIVIDER AND DRAIN VALVE-REFER TO 73-10-07, MAINTENANCE PRACTICES.

NOT OK-REPAIR OR REPLACE FUEL SHUTOFF VALVE-REFER TO 73-10-06, MAINTENANCE PRACTICES.

NOT OK-REPLACE FUEL CONTROL UNIT. REFER TO 73-21-05, MAINTENANCE PRACTICES.

PROCEDURE 41

BETA LIGHT STAYS ON WHEN POWER LEVER ADVANCED TOWARD TAKEOFF-ENGINE SPEED AT NORMAL PROP GOVERNOR SPEED-CHECK BETA PRESSURE SWITCH-REFER TO 77-10-02, MAINTENANCE PRACTICES. IF-

NOT OK-REPLACE BETA PRESSURE SWITCH.

PROCEDURE 42

LOW TURBINE TEMP WITH MATCHED TORQUE-FUEL FLOW AND RPM. CHECK TURBINE TEMP INDICATION SYSTEM-REFER TO AIRCRAFT MAINTENANCE MANUAL AND 77-20-03, MAINTENANCE PRACTICES.

PROCEDURE 43

UNACCEPTABLE POWER LEVER SPLIT ON THE GROUND WITH ENGINE SPEED-TORQUE AND WF MATCHED (POWER LEVER POSITION IS INFLUENCED BY ACFT LINKAGE HYSTERESIS-ALL SPLITS IN QUADRANT POSITION SHOULD BE MADE WITH MOVEMENT OF BOTH POWER IN SAME DIRECTION)-CHECK FOR FREEDOM OF POWER LEVER MOVEMENT. IF-

OK-TRACK AIRCRAFT POWER LEVERS WITH ENGINES SHUT DOWN-READ POWER LEVER PROTRACTORS AT EQUAL COCKPIT POSITIONS WITH LEVER MOVEMENT IN SAME DIRECTION-PROTRACTORS SHALL AGREE WITHIN +2/-2 DEG-RIG PINS SHALL DROP INTO RIG SLOT WITH POWER LEVER AT FLIGHT IDLE. IF-

NOT OK-REFER TO AIRCRAFT MAINTENANCE MANUAL.

OK-CHECK POWER LEVER ANGLE AT WHICH MAX TORQUE IS OBTAINED. IF-

NOT OK-CORRECT RIGGING-REFER TO AIRCRAFT MAINTENANCE MANUAL AND 76-10-01, MAINTENANCE PRACTICES.

OK-CHECK ENGINE SPEED WITH LATCHED PROPELLER-CONDITION LEVER HIGH-POWER LEVER AT FLIGHT IDLE-SPEEDS SHOULD BE MATCHED WITHIN +0.5/-0.5 PERCENT IF-

NOT OK-RESET MAXIMUM POWER LEVER POSITION IN ONE TURN INCREMENTS FOR EACH 4 DEG CHANGE REQUIRED IN POWER LEVER ANGLE.

R

PROCEDURE 43 (CONT)

OK-CHECK FOR EXCESSIVE WEAR ON ROD END BEARINGS USED TO RIG PROP PITCH CONTROL TO MANUAL FUEL VALVE SHAFT. IF-

NOT OK-RESET FLIGHT IDLE FUEL FLOWS TO PROVIDE EQUAL ENGINE SPEEDS-REFER TO 72-00-00, ADJUSTMENT/TEST.

NOT OK-REPLACE WORN ROD END BEARINGS -REFER TO 76-10-01, MAINTENANCE PRACTICES.

PROCEDURE 44

R

(CODES AA-EA) POWER LEVERS SPLIT AT ALTITUDE-SPLIT INCREASES AS ALTITUDE INCREASES (NO SPLIT ON TAKEOFF OR GROUND CHECK)-CHECK ALL BLEED-AIR USING SYSTEMS FOR LEAKAGE AND IF BLEED-AIR PRESSURES ARE EQUAL ON BOTH ENGINES. IF-

OK-CHECK LINES AND FITTINGS FROM PLENUM TO INLET TEMP SENSOR TO FUEL CONTROL UNIT FOR LEAKAGE. IF-

NOT OK-CORRECT LEAKAGE-REFER TO 75-10-01, 75-10-02, MAINTENANCE PRACTICES AND AIRCRAFT MAINTENANCE MANUAL.

OK-CHECK P3 FILTER FOR CLEANLINESS -REFER TO 73-10-01, MAINTENANCE PRACTICES. IF-

NOT OK-CORRECT LEAKAGE.

OK-(TURBINE TEMP DIFFERENCE BETWEEN ENGINES LESS THAN 20C WITH POWER LEVERS MATCHED AND WITH TURBINE TEMP ON HIGHER POWER ENGINE AT 923C)-INCREASE START FLOW ADJUSTMENT FIVE CLICKS COUNTERCLOCKWISE AND DECREASE MAX POWER ADJUSTMENT ONE-FOURTH TURN COUNTERCLOCKWISE ON LOWER POWER ENGINE FOR EACH 10C OF TURBINE TEMP DIFFERENCE.

NOT OK-CLEAN P3 FILTER-REFER TO 73-10-01, MAINTENANCE PRACTICES.

PROCEDURE 44 (CONT)

OK-(TURBINE TEMP DIFFERENCE BETWEEN ENGINES MORE THAN 20C WITH POWER LEVERS MATCHED AND WITH TURBINE TEMP ON HIGHER POWER ENGINE AT 923C)-SWITCH INLET TEMPERATURE SENSORS BETWEEN ENGINES AND RECHECK. IF-

R OK-REPLACE INLET TEMPERATURE SENSOR-REFER TO 73-21-02, MAINTENANCE PRACTICES.

NOT OK-REPLACE FUEL CONTROL UNIT-REFER TO 73-21-05, MAINTENANCE PRACTICES.

PROCEDURE 44A

R

(CODES FA-LA) POWER LEVERS SPLIT AT ALTITUDE-SPLIT INCREASES AS ALTITUDE INCREASES (NO SPLIT ON TAKEOFFF OR GROUND CHECK)-CHECK ALL BLEED-AIR USING SYSTEMS FOR LEAKAGE AND IF BLEED-AIR PRESSURES ARE EQUAL ON BOTH ENGINES. IF-

OK-CHECK FLIGHT IDLE AND MAX FUEL FLOW ADJUSTMENT PLUG AND GASKET ON REAR OF FUEL CONTROL UNIT FOR LEAKAGE. IF-

NOT OK-CORRECT LEAKAGE-REFER TO 75-10-01, 75-10-02, MAINTENANCE PRACTICES AND AIRCRAFT MAINTENANCE MANUAL.

OK-CHECK LINES AND FITTINGS FROM INLET TEMP AND PRESS SENSOR TO FUEL CONTROL UNIT FOR LEAKAGE. IF-

NOT OK-REPLACE PACKINGS AND GASKETS TO CORRECT LEAKAGE.

OK-ADJUST FUEL CONTROL FUEL TRIM REFER TO 72-00-00, ADJUSTMENT/TEST AND PERFORM FLIGHT CHECK.) IF-

NOT OK-SECURE PARTS OR CLEAN INLET TEMP AND PRESS SENSOR.

PROCEDURE 44A (CONT)

R

NOT OK-REPLACE INLET TEMP AND PRESS SENSOR-REFER TO 73-21-02, MAINTENANCE PRACTICES. IF-

NOT OK-REPLACE FUEL CONTROL UNIT-REFER TO 73-21-05, MAINTENANCE PRACTICES.

PROCEDURE 45

HIGH FUEL FLOW AT MAXIMUM POWER SETTING WITH TORQUE AND TURBINE TEMP MATCHED-CHECK FLOW INDICATING SYSTEM FOR MALFUNCTION. IF-

OK-(ENGINE INSTALLATIONS WITHOUT FUEL MANIFOLD PURGE SYSTEM) CHECK FUEL FLOW DIVIDER DRAIN FOR LEAKAGE. IF-

NOT OK-REFER TO AIRCRAFT MAINTENANCE MANUAL.

NOT OK-REPAIR FUEL FLOW DIVIDER VALVE AS NECESSARY-REFER TO 73-10-07, MAINTENANCE PRACTICES.

PROCEDURE 46

ASYMMETRIC THRUST ON LANDING WITH POWER LEVER AT FLIGHT IDLE-BETA LIGHTS NOT ON (SYMMETRY RESTORED AFTER BETA LIGHTS GO ON) CHECK FOR MATCHED ACFT AND ENGINE CONTROL LINKAGE RIGGING-CHECK FOR FUEL FLOW ON ENGINES IN FLIGHT IAW ACFT FLT MANUAL. IF-

OK-ADJUST FLIGHT IDLE FUEL FLOW-REFER TO ACFT MAINTENANCE MANUAL AND ENGINE LOG BOOK FOR PROPER VALUE-PERFORM ADJUSTMENT-REFER TO 72-00-00, ADJUSTMENT/TEST.

NOT OK-CORRECT RIGGING-REFER TO AIRCRAFT MAINTENANCE MANUAL.

PROCEDURE 47

ASYMMETRIC THRUST ON LANDING WITH POWER LEVER AT FLIGHT IDLE-BETA LIGHT FOR LOW THRUST ENGINE ON-SYMMETRY RESTORED AFTER LIGHTS ON AND FORWARD SPEED DECREASES-REFER TO TROUBLE SHOOTING PROCEDURE 46.

PROCEDURE 48

ASYMMETRIC THRUST ON LANDING-BETA LIGHT FOR HIGH THRUST ENGINE ON-ASYMMETRY WORSENS AS FORWARD SPEED DECREASES-CHECK THAT RIGGING PIN CAN BE INSERTED IN RIGGING PLATE ON PROP PITCH CONTROL WITH POWER LEVER POSITIONED AT FLIGHT IDLE. IF-

OK-CHECK FLIGHT IDLE BLADE ANGLE-REFER TO AIRCRAFT MAINTENANCE MANUAL. IF-

NOT OK-CORRECT RIGGING-REFER TO 76-10-01, MAINTENANCE PRACTICES AND AIRCRAFT MAINTENANCE MANUAL.

NOT OK-RESET FLIGHT IDLE BLADE ANGLE BY POSITIONING BETA TUBE-REFER TO 72-10-01, MAINTENANCE PRACTICES.

PROCEDURE 49

ACFT SINK RATE TOO HIGH AT APPROACH AIRSPEED WITH POWER LEVERS AT FLIGHT IDLE-THRUST SYMMETRICAL-CHECK THAT RIGGING PIN CAN BE INSERTED IN RIGGING PLATE OF MANUAL FUEL VALVE ON FUEL CONTROL WHEN POWER LEVER SET AT FLIGHT IDLE-REFER TO 76-10-01, MAINTENANCE PRACTICES. IF-

OK-INCREASE FLIGHT IDLE FUEL FLOW ON BOTH ENGINES AN EQUAL AMOUNT-REFER TO 72-00-00, ADJUSTMENT/TEST.

NOT OK-CORRECT RIGGING-REFER TO 76-10-01, MAINTENANCE PRACTICES AND AIRCRAFT MAINTENANCE MANUAL.

PROCEDURE 50 (DELETED)

R

PROCEDURE 51

ACFT FLOATS ON LANDING-THRUST SYMMETRICAL-BETA LIGHTS ON DURING FLARE MANEUVER WHEN POWER LEVERS SET TO FLIGHT IDLE-CHECK THAT RIGGING PIN CAN BE INSERTED IN PITCH CONTROL WHEN POWER LEVER SET AT FLIGHT IDLE-REFER TO 76-10-01, MAINTENANCE PRACTICES. IF-

OK-CHECK FLIGHT IDLE BLADE ANGLE-REFER TO AIRCRAFT MAINTENANCE MANUAL. IF-

NOT OK-CORRECT RIGGING-REFER TO 76-10-01, MAINTENANCE PRACTICES.

NOT OK-RESET FLIGHT IDLE BLADE ANGLE-REFER TO 72-10-01, MAINTENANCE PRACTICES.

PROCEDURE 52

ACFT FLOATS ON LANDING-THRUST SYMMETRICAL-BETA LIGHTS OFF DURING FLARE MANEUVER WHEN POWER LEVERS SET TO FLIGHT IDLE-CHECK THAT RIGGING PIN CAN BE INSERTED IN RIGGING PLATE OF MANUAL FUEL VALVE ON FUEL CONTROL WHEN POWER LEVER SET AT FLIGHT IDLE-REFER TO 76-10-01. MAINTENANCE PRACTICES. IF-

OK-REDUCE FLIGHT IDLE FUEL FLOW ON BOTH ENGINES AN EQUAL AMOUNT-REFER TO 72-00-00 ADJUSTMENT/TEST.

NOT OK-CORRECT RIGGING-REFER TO 76-10-01, MAINTENANCE PRACTICES AND AIRCRAFT MAINTENANCE MANUAL.

PROCEDURE 53

ASYMMETRIC THRUST ON LANDING WHEN PROPS REVERSED-RUN UP CHECK SHOWS SAME FUEL FLOW-TURBINE TEMP-TORQUE AND SPEED ON BOTH ENGINES ALTHOUGH ONE ENGINE SLOWER TO REVERSE (BETA LIGHT SLOW TO COME ON IN LANDING AND REVERSE)(PROP CONTROL SYSTEM IS AFFECTED BY OIL TEMP-OIL TEMP MUST BE IN NORMAL OPERATING RANGE ON BOTH ENGINES)-CHECK ALL GOVERNED SPEED SETTINGS (OVERSPEED/UNDERSPEED HIGH AND LOW AND PROP GOVERNOR HIGH AND LOW SETPOINTS) FOR REQUIRED SPEED AND PROPER SEPARATION (MINIMUM SEPARATION OF UNDERSPEED AND PROP GOVERNOR HIGH RPM SETPOINTS SHALL BE 2.5 PERCENT ENGINE SPEED. IF-

OK-CHECK FOR LOW BETA PRESSURE AS FOLLOWS:
(1)CONNECT GAGE (C, TABLE 102) TO BETA PRESS SW PORT (FIGURES 101)
R THROUGH 105).
(2)OPERATE ENGINE WITH PROP ON START LOCKS-POWER LEVER AT FLIGHT IDLE AND SPEED LEVER FULL FORWARD-NOTE BETA PRESSURE.
(3)OPERATE ENGINE WITH PROP OFF START LOCKS AT FLIGHT IDLE-GROUND IDLE AND FULL REVERSE WITH SPEED LEVER SET FULL FORWARD-NOTE BETA PRESSURE.
(4)BETA PRESSURE SHALL NOT BE LESS THAN 300 PSI IN EACH CASE. IF-

NOT OK-CHECK THAT ALL SPEEDS STOPS MAKE POSITIVE CONTACT. IF-

NOT OK-ADJUST APPLICABLE STOPS-REFER TO 72-00-00 ADJUSTMENT/TEST.

PROCEDURE 53 (CONT)

R NOT OK-CHECK FOR DEFECTIVE UNFEATHERING PUMP CHECK VALVE (FIGURES 101 THROUGH 105). IF-

OK-CHECK FEATHERING VALVE FOR CONTAMINATION OR LEAKAGE. IF-

NOT OK-REPLACE UNFEATHERING PUMP CHECK VALVE-REFER TO 77-10-02, MAINTENANCE PRACTICES.

OK-CAP OFF NTS CHECK SYSTEM UPSTREAM OF NTS CHECK VALVE (IF NTS SYSTEM
R INSTALLED)-SEE FIGURES 101 THROUGH
R 105-REPEAT BETA PRESS CHECKS. IF-

NOT OK-REMOVE CONTAMINATION OR REPL FEATHERING VALVE-REFER TO 72-10-07, MAINTENANCE PRACTICES.

OK-CHECK BETA TUBE PACKINGS FOR DETERIORATION. IF-

NOT OK-REPLACE NTS CHECK VALVE (FIG. 101-102)-REFER TO 77-10-02, MAINTENANCE PRACTICES.

PROCEDURE 53 (CONT)

OK-CHECK FOR EXCESSIVE BLEED OFF OF CONTROL OIL PRESS AT PROP PITCH CONTROL WITH PROP IN FEATHERED POSITION THE POWER LEVER AT FLIGHT IDLE-OPERATE UNFEATHERING PUMP UNTIL BLADES REACH LIMIT OF TRAVEL-DEENERGIZE UNFEATHERING PUMP AND CHECK TIME REQUIRED FOR BLADES TO RETURN TO FEATHER POSITION-REPEAT CHECK ON OTHER ENGINE AND COMPARE TIME REQUIRED. IF-

NOT OK-REPLACE BETA TUBE PACKINGS-REFER TO 72-10-01, MAINTENANCE PRACTICES.

OK-(BLEED DOWN TIMES APPROX EQUAL) REPLACE PROP GOVERNOR ASSY FOR LOW PUMP OUTPUT-REFER TO 72-10-03, MAINTENANCE PRACTICES.

NOT OK-(BLEED DOWN TIME TOO RAPID)-CHECK PROP GOVERNOR GASKET. IF-

OK-REPAIR OR REPLACE PROP PITCH CONTROL-REFER TO 72-10-02, MAINTENANCE PRACTICES.

NOT OK-REPLACE PROP GOVERNOR GASKET REFER TO 72-10-03, MAINTENANCE PRACTICES.

PROCEDURE 54

ASYMMETRIC THRUST ON LANDING WHEN PROPS REVERSED-BETA LIGHT ON-RUN UP CHK SHOWS ONE ENGINE HIGH IN TURBINE TEMP FUEL FLOW AND TORQUE COMPARED TO OTHER ENGINE-CHECK RIGGING BETWEEN POWER LEVER AND PROP PITCH CONTROL. IF-

OK-CHECK THAT RIGGING PIN CAN BE INSERTED IN RIGGING PLATE ON PROP PITCH CONTROL WITH POWER LEVER IN FULL REVERSE-REFER TO 76-10-01, MAINTENANCE PRACTICES. IF-

NOT OK-CORRECT RIGGING-REFER TO 76-10-01, MAINTENANCE PRACTICES AND AIRCRAFT MAINTENANCE MANUAL.

OK-CHECK FOR PROPER SETTING OF UNDERSPEED GOVERNOR. IF-

NOT OK-CORRECT RIGGING-REFER TO 76-10-01, MAINTENANCE PRACTICES.

OK-CHECK FLIGHT IDLE BLADE ANGLE WITH ENGINE OIL AT NORMAL OPERATING TEMP-REFER TO AIRCRAFT MAINNTENANCE MANUAL. IF-

NOT OK-ADJUST UNDERSPEED GOVERNOR-REFER TO 72-00-00, ADJUSTMENT/TEST.

PROCEDURE 54 (CONT)

OK-MAKE TAKE OFF POWER CHECK-REFER TO 72-00-00, ADJUSTMENT/TEST.

NOT OK-ADJUST FLIGHT IDLE BLADE ANGLE BY POSITIONING BETA TUBE-REFER TO 72-10-01, MAINTENANCE PRACTICES.

PROCEDURE 55

ENGINE SPEED DECAYS WHEN REVERSE THRUST SELECTED (ENSURE REVERSE NOT SELECTED AT TOO HIGH AIRSPEED)-CHECK THAT SPEED LEVER IS IN HIGH SPEED POSITION. IF-

OK-CHECK THAT UNDERSPEED GOVERNOR RPM SETPOINT IS CORRECT-REFER TO FUEL CONTROL ADJUSTMENTS, 72-00-00, ADJUSTMENT/TEST. IF-

NOT OK-REFER TO AIRCRAFT FLIGHT MANUAL FOR PROPER OPERATING PROCEDURES.

OK-PERFORM TAKEOFF POWER CHECK-REFER TO 72-00-00, ADJUSTMENT/TEST. IF-

NOT OK-CHECK UNDERSPEED GOVERNOR RIGGING-REFER TO 76-10-01, MAINTENANCE PRACTICES AND AIRCRAFT MAINTENANCE MANUAL. IF-

NOT OK-ADJUST UNDERSPEED GOVERNOR HIGH RPM SETPOINT-REFER TO 72-00-00, ADJUSTMENT/TEST.

OK-CHECK FLIGHT IDLE BLADE ANGLE-REFER TO AIRCRAFT MAINTENANCE MANUAL. IF-

NOT OK-ENGINE DETERIORATION INDICATED-REMOVE ENGINE-RETURN TO SERVICE CENTER OR OVHL FACILITY FOR FURTHER INVESTIGATION.

PROCEDURE 55 (CONT)

OK-CHECK REVERSE BLADE ANGLE IAW AIRCRAFT MAINTENANCE MANUAL. IF-

NOT OK-VERIFY FLIGHT IDLE BLADE ANGLE IAW AIRCRAFT MAINTENANCE MANUAL.

OK-REPLACE FUEL CONTROL UNIT-REFER TO 73-21-05, MAINTENANCE PRACTICS.

NOT OK-REPAIR OR REPLACE PROP.

PROCEDURE 56

REVERSE RESPONSE SLOW AT HIGH LANDING SPEED-ENGINE TESTED PER 72-00-00, ADJUSTMENT/TEST AND PRESS MINIMUM WAS IN EXCESS OF 20 PSI-CHECK RESTRICTOR ASSY FOR OBSTRUCTIONS-RESTRICTOR ASSY IS LOCATED INSIDE BORE WHICH HOUSES NTS PRESS REGULATOR. IF-

OK-REPLACE THE PROP PITCH CONTROL FOR INADEQUATE DUMP VALVE FLOW AND CHECK NTS LOCKOUT PRESSURE. IF-

NOT OK-CLEAN (OBSTRUCTION) AS REQUIRED.

R OK-(CODES AA-AC, CA-CC, FA KA, LA) (BELOW 20 PSIG) PERFORM FIELD TEST OF NTS LOCKOUT AND PROPELLER GOVERNOR RESET SYSTEM-REFER TO 72-00-00, ADJUSTMENT/TEST.

NOT OK-(CODES AA-AC, CA-CC, FA, KA, LA) (ABOVE 20 PSIG) ENSURE PROPER SEATING OF ORIFICE SETSCREW.

PROCEDURE 57

PROP FAILS TO ENGAGE START LOCKS AFTER SHUTDOWN-CHECK THAT POWER LEVER IS POSITIONED TO FULL REVERSE IMMEDIATELY AFTER INITIATING STOP. IF-

OK-UNFEATHER PROP USING UNFEATHERING PUMP-ENSURE SUFFICIENT REVERSE BLADE ANGLE EXISTS TO ALLOW START LOCKS TO ENGAGE. IF-

NOT OK-REFER TO AIRCRAFT FLIGHT MANUAL FOR PROPER OPERATING PROCEDURES.

OK-REFER TO AIRCRAFT MAINTENANCE MANUAL TO DETERMINE SERVICEABILITY OF PROP START LOCKS.

NOT OK-REFER TO TROUBLE SHOOTING PROCEDURE 1.

PROCEDURE 58

OIL CONSUMPTION HIGH-CHECK ALL LUBRICATION AND PROP CONTROL SYSTEM COMPONENTS-LINES-AND FITTINGS FOR EVIDENCE OF LEAKAGE. IF-

OK-CHECK FOR LEAKAGE OF COMPRESSOR SHAFT SEAL (EVIDENT BY OIL IN COMPRESSOR INLET). IF-

NOT OK-REPAIR OR REPLACE PARTS AS REQUIRED TO CORRECT LEAKAGE.

OK-CHECK FOR LEAKAGE OF OIL INLET FITTING ASSY AND OIL PRESS JET OR OIL SCAVENGE PUMP AT REAR TURBINE BEARINGS AS EVIDENT BY OIL LEAKING FROM BETWEEN TAIL CONE AND AFT SUPPORT. IF-

NOT OK-REMOVE ENGINE-RETURN TO SERVICE CENTER OF OVERHAUL FACILITY FOR REPAIR.

OK-CHECK FOR LEAKAGE OF REAR TURBINE SEAL OR GASKET BETWEEN BEARING SUPPORT AND SEAL AS EVIDENT BY OIL LEAKING INTO EXHAUST PIPE FROM BETWEEN AFT SUPPORT AND TURBINE WHEEL. IF-

NOT OK-REPAIR OR REPLACE AS REQUIRED TO CORRECT LEAKAGE.

R

PROCEDURE 58 (CONT)

OK-CHECK FOR ACCESSORY DRIVE SHAFT LEAKAGE BY REMOVING INDIVIDUAL DRAIN LINES AT COMMON DRAIN MANIFOLD TO DETERMINE SOURCE OF LEAKAGE AND BY CHECKING STARTER-GENERATOR MOUNTING PAD. IF-

NOT OK-REPLACE SEAL OR GASKET AS REQUIRED TO CORRECT LEAKAGE.

OK-CHECK THAT OIL IS NOT FOAMING AND BEING LOST THROUGH OIL TANK VENT LINE. IF-

NOT OK-REPLACE SEALS AS REQUIRED TO CORRECT LEAKAGE-(ACCESSORY DRIVE SHAFT SEALS REQUIRE NEGATIVE GEARCASE PRESSURE OF AT LEAST ONE PSIG TO SEAL PROPERLY).

NOT OK-IF OIL CONSUMPTION INCREASE WAS NOTED AFTER ADDING OIL OR RESERVICING-FOAM MAY BE CAUSED BY MIXING OF LUBRICATING OIL BRANDS OR BY IMPROPER SERVICING. IF-

OK-CHECK FOR CONTAMINATION OF OIL WITH FUEL. IF-

NOT OK-RESERVICE OIL SUPPLY WITH APPROVED LUBRICATING OIL.

PROCEDURE 58 (CONT)

OK-CONNECT VACUUM GAGE (TABLE 102) TO ACCESS HSG TO MEASURE GRC NEGATIVE PRESSURE-VACUUM GAGE SHALL INDICATE A NEGATIVE PRESSURE. IF-

NOT OK-REFER TO TROUBLE SHOOTING PROCEDURE 23 OR 24.

OK-REPLACE AIR/OIL SEPARATOR IN OIL TANK ASSY-REFER TO 79-10-01, MAINTENANCE PRACTICES.

NOT OK-REMOVE ENGINE-RETURN TO SERVICE CENTER OR OVERHAUL FACILITY FOR REPAIR.

PROCEDURE 59

UNINTENTIONAL SHUTDOWN DURING GROUND RUN-CHECK THAT ACFT CONTROLS AND SWITCHES ARE IN NORMAL POSITION. IF-

OK-CHECK THAT FUEL SUPPLY IS ADEQUATE AND FUEL PRESSURE IS NORMAL. IF-

NOT OK-REFER TO AIRCRAFT FLIGHT MANUAL FOR PROPER STARTING PROCEDURE.

OK-CHECK ACFT RIGGING TO MANUAL OVERRIDE ARM ON FUEL SHUTOFF VALVE. IF-

NOT OK-REFER TO AIRCRAFT FLIGHT MANUAL.

OK-RESTART ENGINE AND CHECK FOR PROPER ENGINE PARAMETER INDICATIONS. IF-

NOT OK-RERIG FUEL SHUTOFF VALVE-REFER TO AIRCRAFT MAINTENANCE MANUAL.

OK-CONDUCT FLAMEOUT CHECK-REFER TO 72-00-00, ADJUSTMENT/TEST. IF-

NOT OK-CHECK SYMPTOMS LISTED IN OTHER TROUBLE SHOOTING PROCEDURES AND PERFORM APPLICABLE PROCEDURE.

R

PROCEDURE 59 (CONT)

OK-CHECK FOR POSSIBLE ACFT ELECTRICAL MALFUNCTION-REFER TO AIRCRAFT MAINTENANCE MANUAL.

NOT OK-REPLACE FUEL CONTROL UNIT-REFER TO 73-21-05, MAINTENANCE PRACTICES.

PROCEDURE 60

NOISY DECELERATION FOLLOWING SHUTDOWN-PULL PROP THROUGH BY HAND TO CHECK FOR BINDING WHICH MAY INDICATE INTERNAL MALFUNCTION. IF-

NOT OK-REMOVE SHAFT DRIVEN ACCESSORIES FROM REDUCTION GEAR SECTION AND RECHECK FOR BINDING. IF-

OK-REPLACE ACCESSORY CAUSING BINDING.

NOT OK-REMOVE ENGINE-RETURN TO SERVICE CENTER OR OVERHAUL FACILITY FOR FURTHER INVESTIGATION.

R

PROCEDURE 61

UNINTENTIONAL SHUTDOWN DURING FLIGHT (LOW INLET FUEL PRESSURE RESULTING FROM UNINTENTIONALLY SHUTTING OFF ACFT BOOST PUMP AT HIGHER ALTITUDES WILL CONTRIBUTE TO ENGINE BLOW OUT-REFER TO ACFT FLIGHT MANUAL)-CHECK THAT ACFT CONTROLS AND SWITCHES ARE IN NORMAL POSITIONS. IF-

OK-CHECK THAT FUEL SUPPLY IS ADEQUATE AND FUEL PRESSURE IS NORMAL. IF-

NOT OK-REFER TO AIRCRAFT FLIGHT MANUAL FOR PROPER STARTING PROCEDURES.

OK-RESTART ENGINE AND CHECK FOR PROPER ENGINE PARAMETER INDICATIONS. IF-

NOT OK-REFER TO AIRCRAFT FLIGHT MANUAL.

OK-REFER TO TROUBLE SHOOTING PROCEDURE 59.

NOT OK-CHECK SYMPTOMS LISTED IN OTHER TROUBLE SHOOTING PROCEDURES AND PERFORM APPLICABLE PROCEDURE.

PROCEDURE 62

AT 90 PERCENT TORQUE-FUEL FLOW DROPS LESS THAN 60 POUNDS PER HR WHEN TEMP LIMITING SYSTEM SELF TEST ACTUATES. CHECK INLET FILTER TO TEMP LIMITER BYPASS VALVE FOR CONTAMINATION. IF-

OK-CHECK FOR FAULTY CONTROLLER BY EXCHANGING CONTROLLERS. IF-

NOT OK-CLEAN OR REPLACE FILTER IN TEMP LIMITER BYPASS FITTING. IF-

NOT OK-REPLACE TEMP LIMITER BYPASS VALVE.

OK-REPLACE FAULTY CONTROLLER.

NOT OK-REPLACE TEMP LIMITER BYPASS VALVE.

PROCEDURE 63

AT 90 PERCENT TORQUE-NO DECREASE IN FUEL FLOW WHEN TORQUE LIMITING SYSTEM SELF TEST ACTUATED. CHECK FOR FAULTY CONTROLLER BY EXCHANGING CONTROLLERS. IF-

OK-REPLACE FAULTY CONTROLLER.

NOT OK-ELECTRICAL PROBLEM-REFER TO ACFT MAINT MANUAL FOR CHECK OF WIRING CIRCUITS. IF-

OK-REPLACE TORQUE LIMITER BYPASS VALVE.

R

PROCEDURE 64

ITT-TORQUE-FUEL FLOW FLUCTUATING IN EXCESS OF LIMITS (+5/-5C (+9/-9F) ITT +2/-2 PERCENT TORQUE +10/-10 POUNDS PER HR FUEL FLOW) AT 100 PERCENT ENGINE SPEED. NOTE: GROUND EFFECTS OR WIND GUSTS MAY PRODUCE TRANSIENTS IN EXCESS OF ABOVE LIMITS. CHECK FOR DEFECTIVE SPEED SIGNAL FROM PROP GOV BY RETARDING POWER-TURN OFF TORQUE LIMITING SYSTEM-ADVANCE POWER TO 102.5 PERCENT HP-TURN ON TEMP LIMITING SYSTEM. IF-

- OK-PLACE POWER LEVER AT MAXIMUM (TO INCREASE BYPASS FLOW) AND CHECK FOR FLUCTUATIONS. IF-
- NOT OK-ENGINE STILL UNSTABLE-EXCHANGE CONTROLLERS. IF-
  - OK-REPLACE FAULTY CONTROLLER.
  - NOT OK-CHECK WIRING CONTINUITY TO SPEED SENSOR OR RE-REPLACE PROPELLER GOVERNOR.

R

PROCEDURE 64 (CONT)

OK-BYPASS FLOW MAY BE LOW DUE TO AMBIENT TEMP WARMER THAN WHEN FLUCTUATIONS REPORTED. ACTUATE TORQUE LIMITER SELF TEST TO CHECK BYPASS FLOW. NOTE FUEL FLOW DECREASE-IF FUEL FLOW DECREASES LESS THAN 25 POUNDS PER HR TEMPORARILY INCREASE SPECIFIC GRAVITY OR FUEL TRIM ADJ UNTIL SELF TEST ACTUATION INDICATES A BYPASS FLOW OF 10 TO 25 POUNDS PER HR. CHECK FOR FLUCTUATIONS. IF-

NOT OK-REPLACE BYPASS VALVE.

OK-CHECK PROP GOV SPEED SENSOR LEADS (MAY BE INTERMITTENT AND RANDOM CAUSING POWER FLUCTUATIONS UP TO 200 HP ON TAKEOFF). IF-

NOT OK-REPLACE BYPASS VALVE.

NOT OK-TURN OFF TORQUE LIMITING SYSTEM AND CHECK WIRING IN ACCORDANCE WITH ACFT MAINTENANCE MANUAL. (SYMPTOM WILL DISAPPEAR BELOW 94 PERCENT TORQUE).

PROCEDURE 65

HIGH TORQUE WITH SUCCESSFUL TORQUE LIMITING SYSTEM SELF TEST DUE TO SATURATED BYPASS VALVE-ACTUATE SELF TEST AT 90 PERCENT POWER AND CHECK FOR MINIMUM 60 POUNDS PER HR DECREASE IN FUEL FLOW. IF-

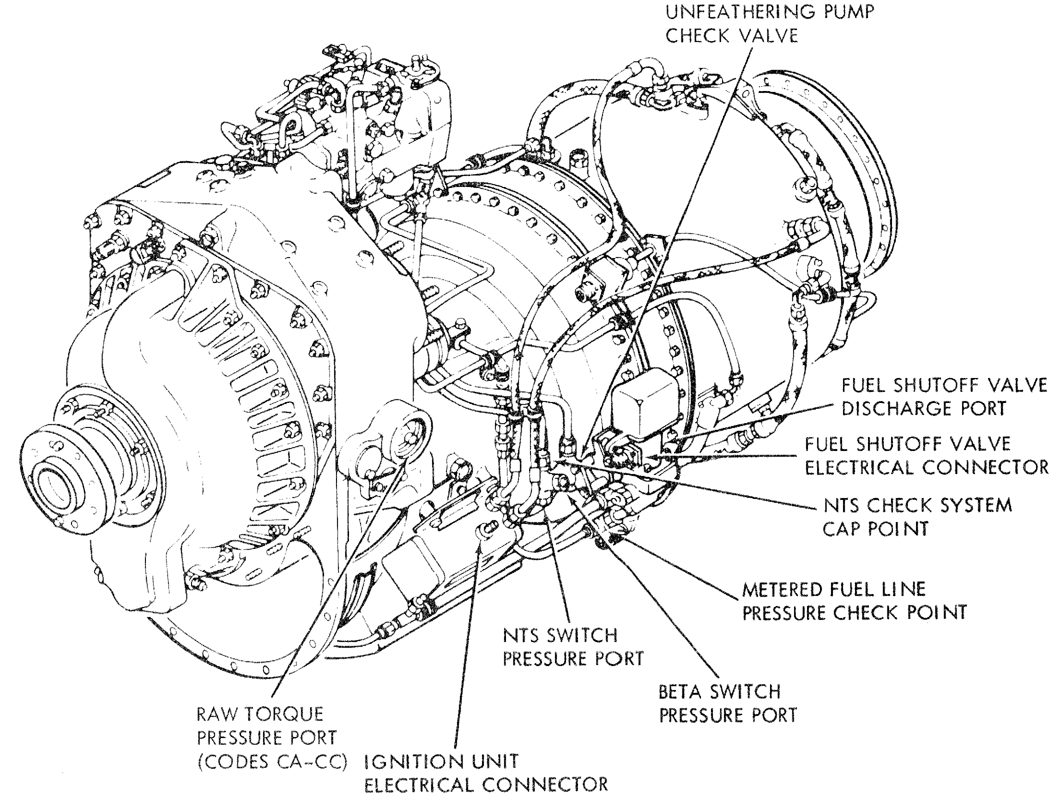
OK-ADJUST MAXIMUM POWER SCHEDULE DOWN UNTIL TORQUE IS CONTROLLED-REFER TO ADJUSTMENT/TEST.

NOT OK-REPLACE CONTROLLER.

PROCEDURE 66

PARTIAL POWER LOSS-CHECK FOR FAULTY CONTROLLER: (1) REMOVE CONNECTOR AT CONTROLLER AND JUMP PINS E/F AND G/D ON AIRCRAFT HARNESS TO MAINTAIN ITT INDICATION (2) NOTE TORQUE, FUEL FLOW AND ITT DURING STEADY STATE OPERATION (3) RECONNECT CONTROLLER CONNECTOR WHILE AT STEADY STATE OPERATION. AFTER INITIAL POWER LOSS TRANSIENTS CHECK TORQUE, FUEL FLOW AND ITT FOR RETURN TO PREVIOUSLY NOTED READINGS. IF-

NOT OK-SHORT OR GROUND IN CONTROLLER OR WIRING. REPLACE CONTROLLER OR REPAIR WIRING.



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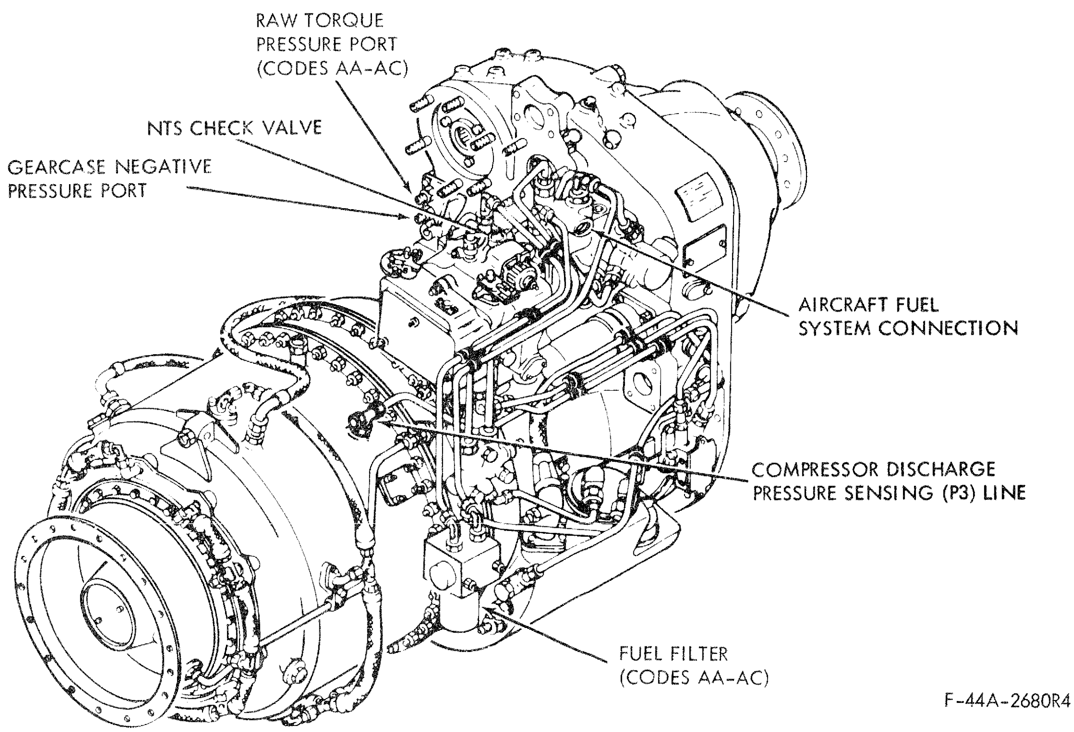
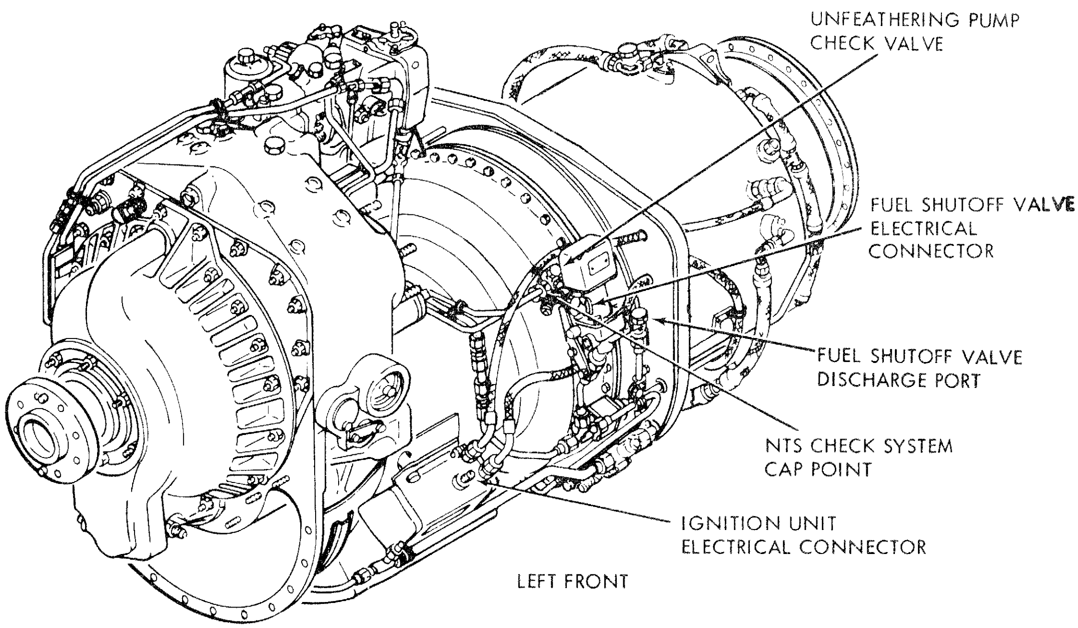
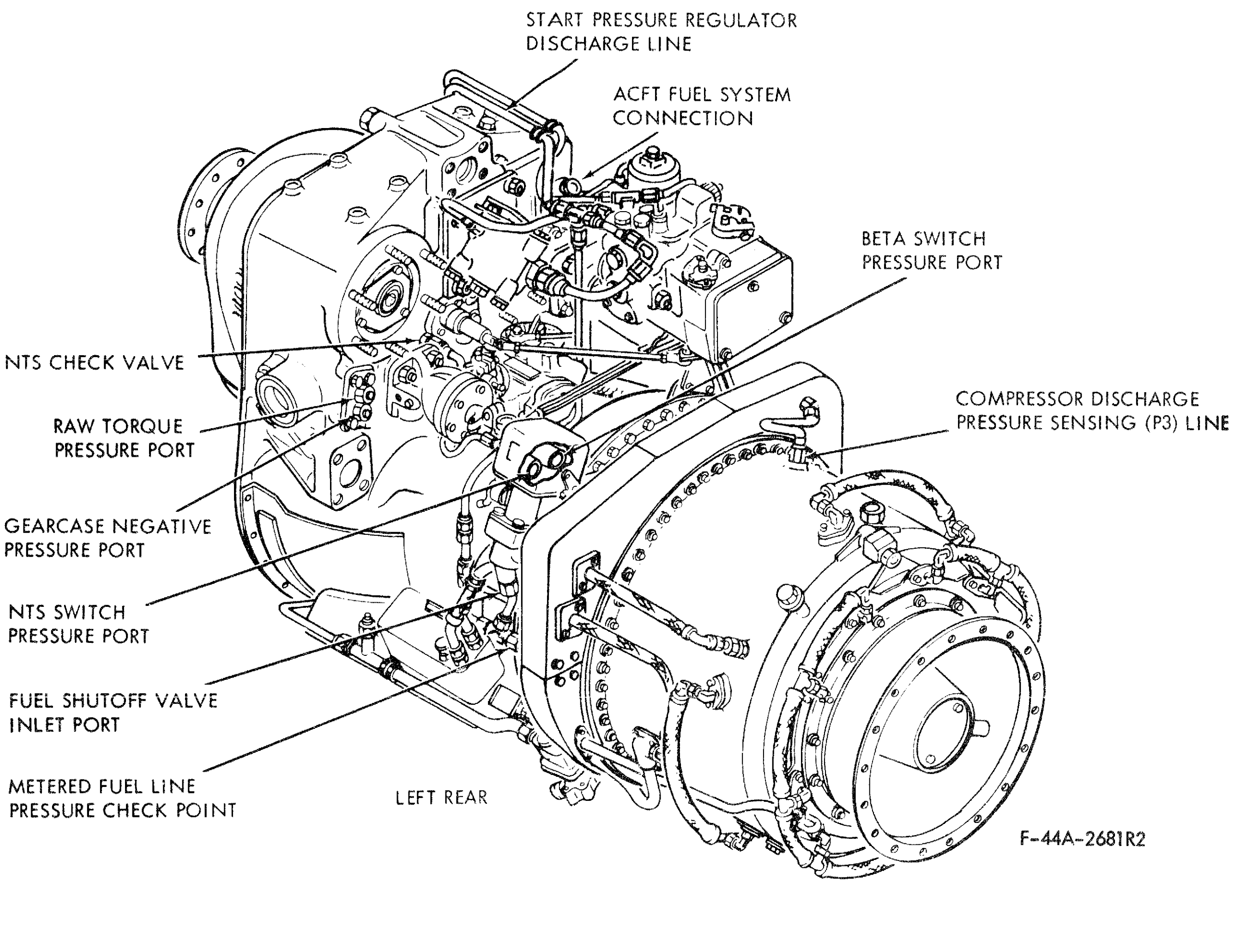


R

(Codes AA-AC, CA-CC) Trouble Shooting
Test Points (Typical)
Figure 101





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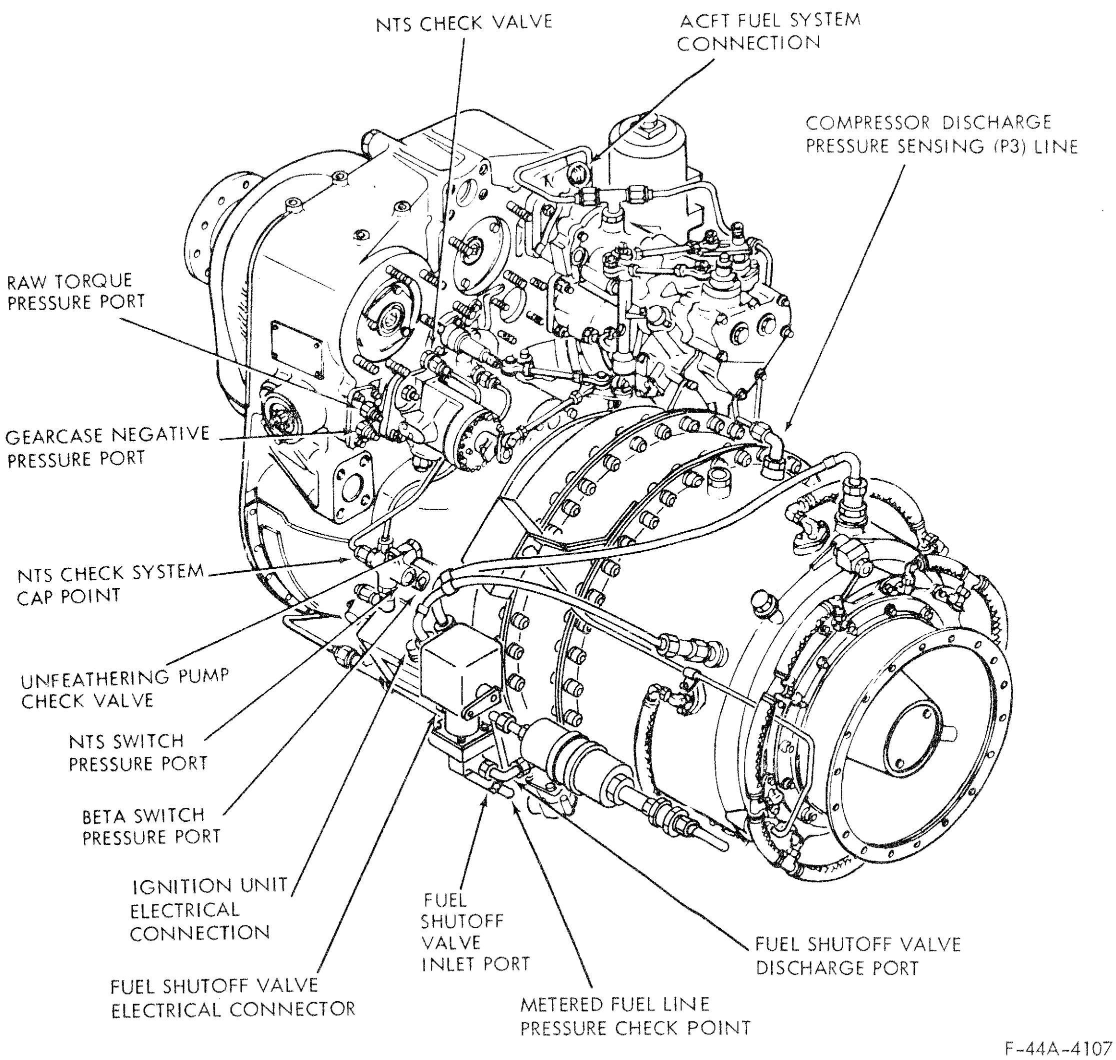
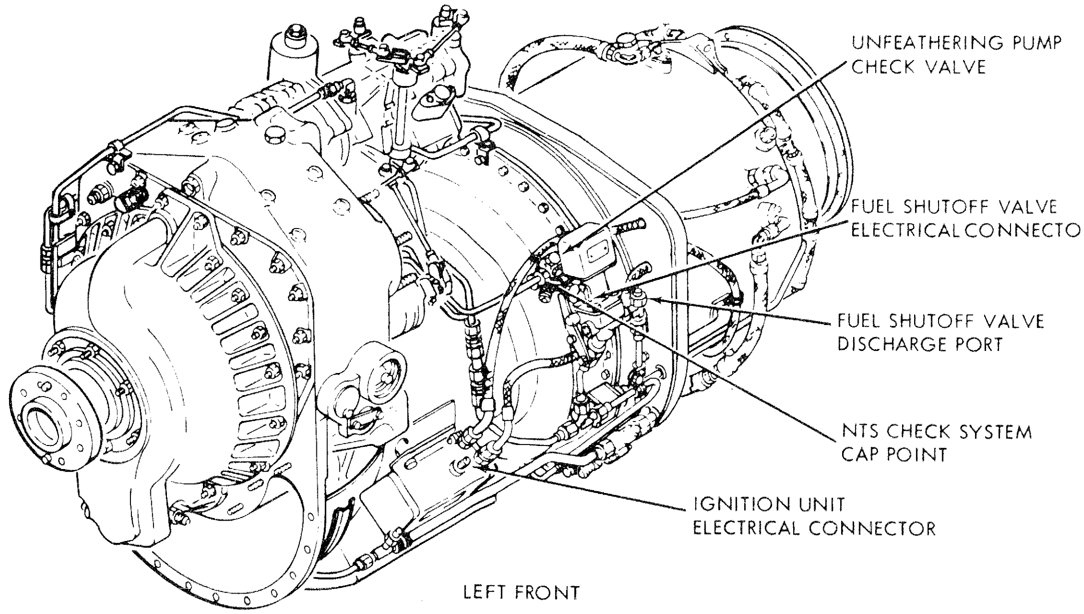
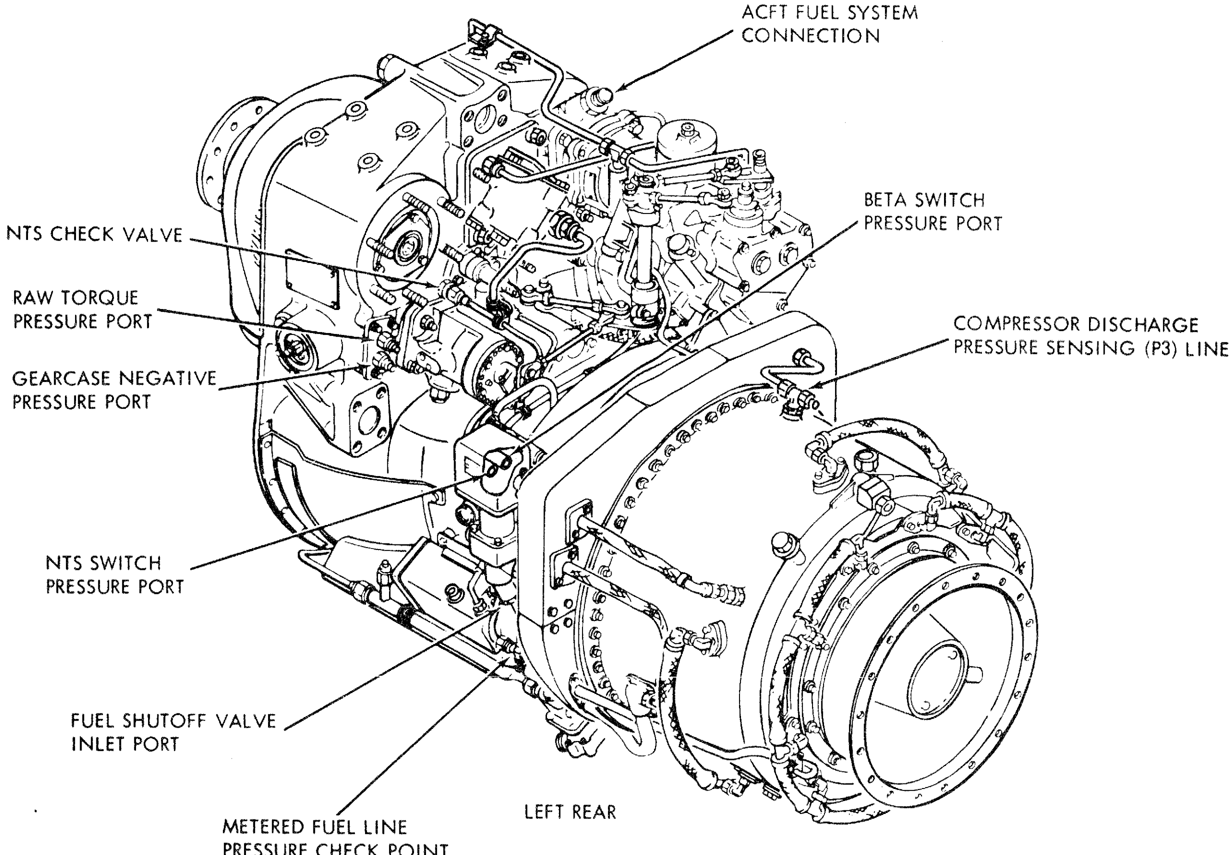
(Codes BA-BC, EA) Trouble Shooting
Test Points (Typical)
Figure 102



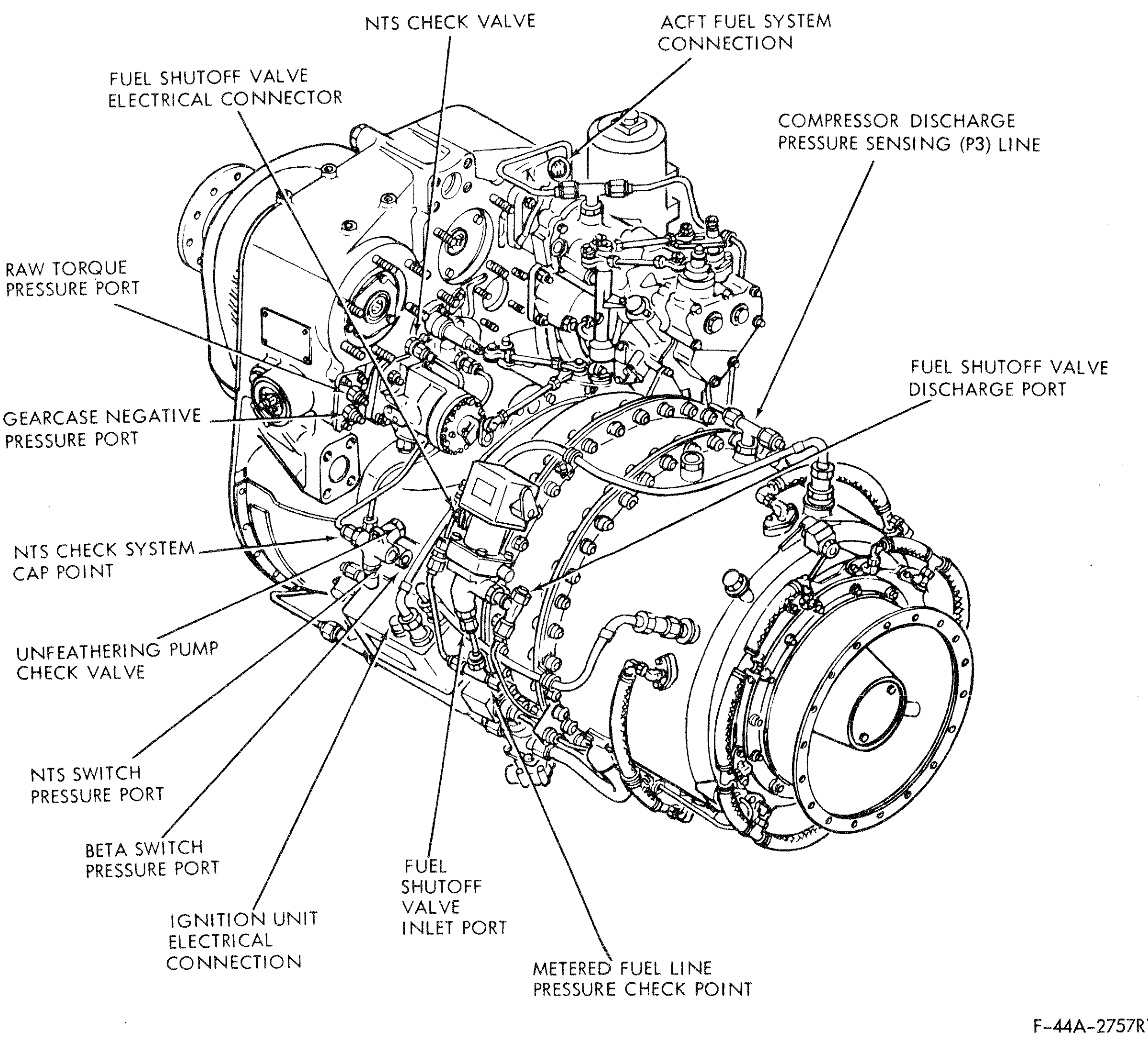
R

R (Codes FA, LA) Trouble Shooting
R Test Points (Typical)
Figure 103



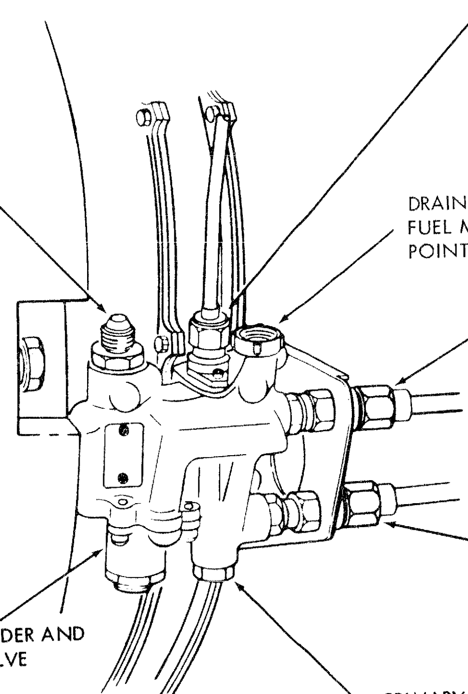


R (Codes GA, KA) Trouble Shooting
Test Points (Typical)
R Figure 104

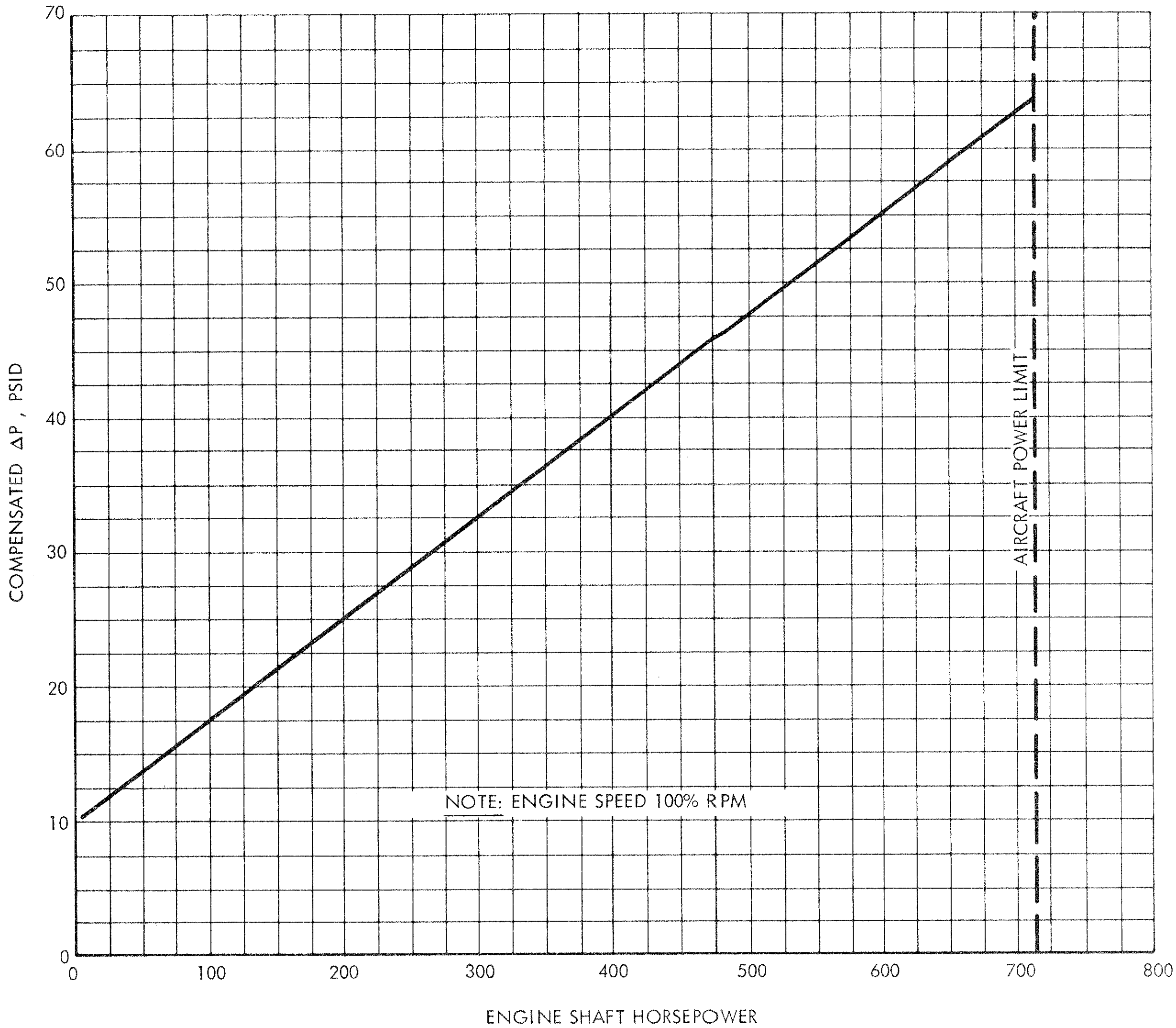


R (Codes HA) Trouble Shooting
Test Points (Typical)
R Figure 105

R

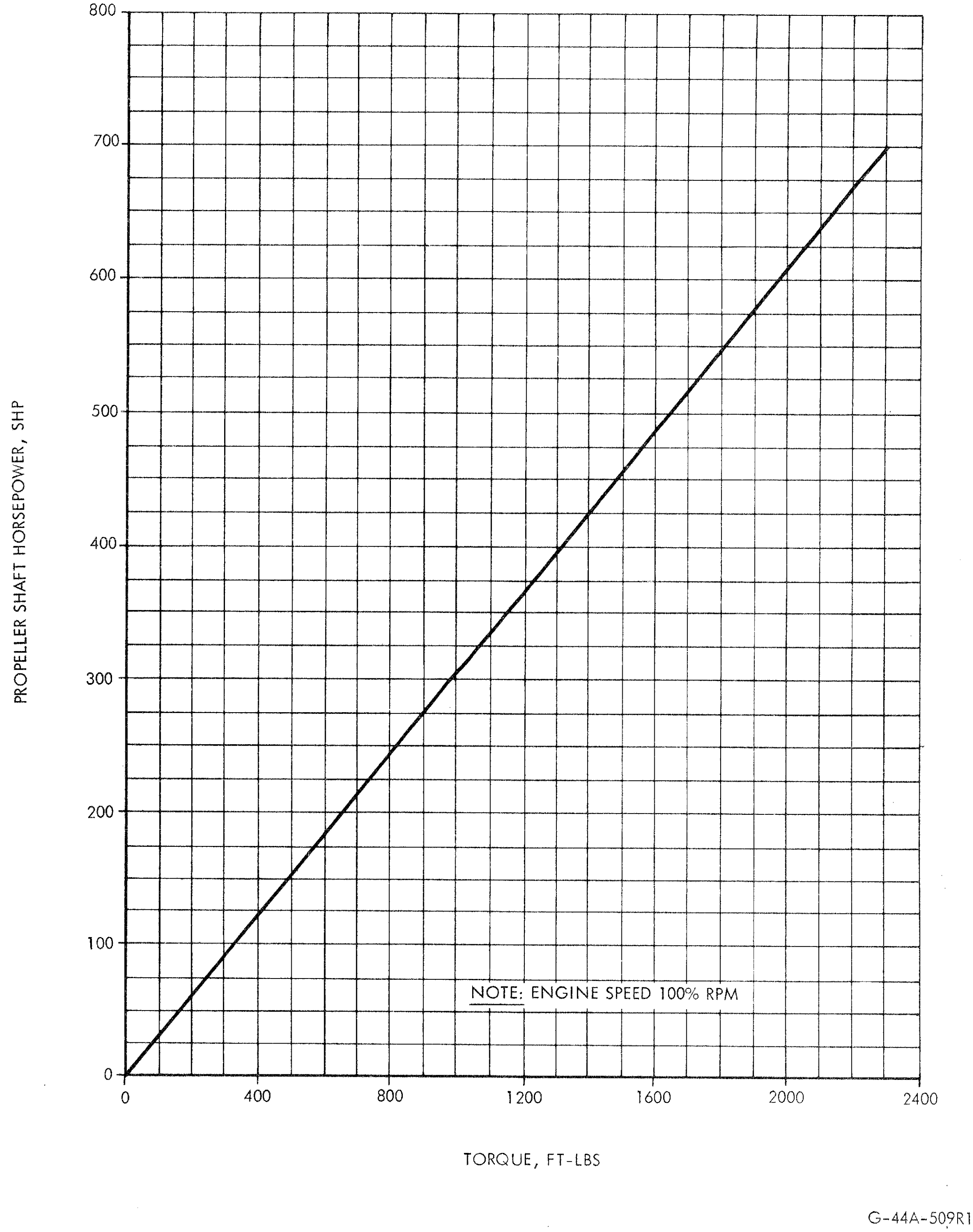


R Trouble Shooting Test Points (Typical)
Figure 106



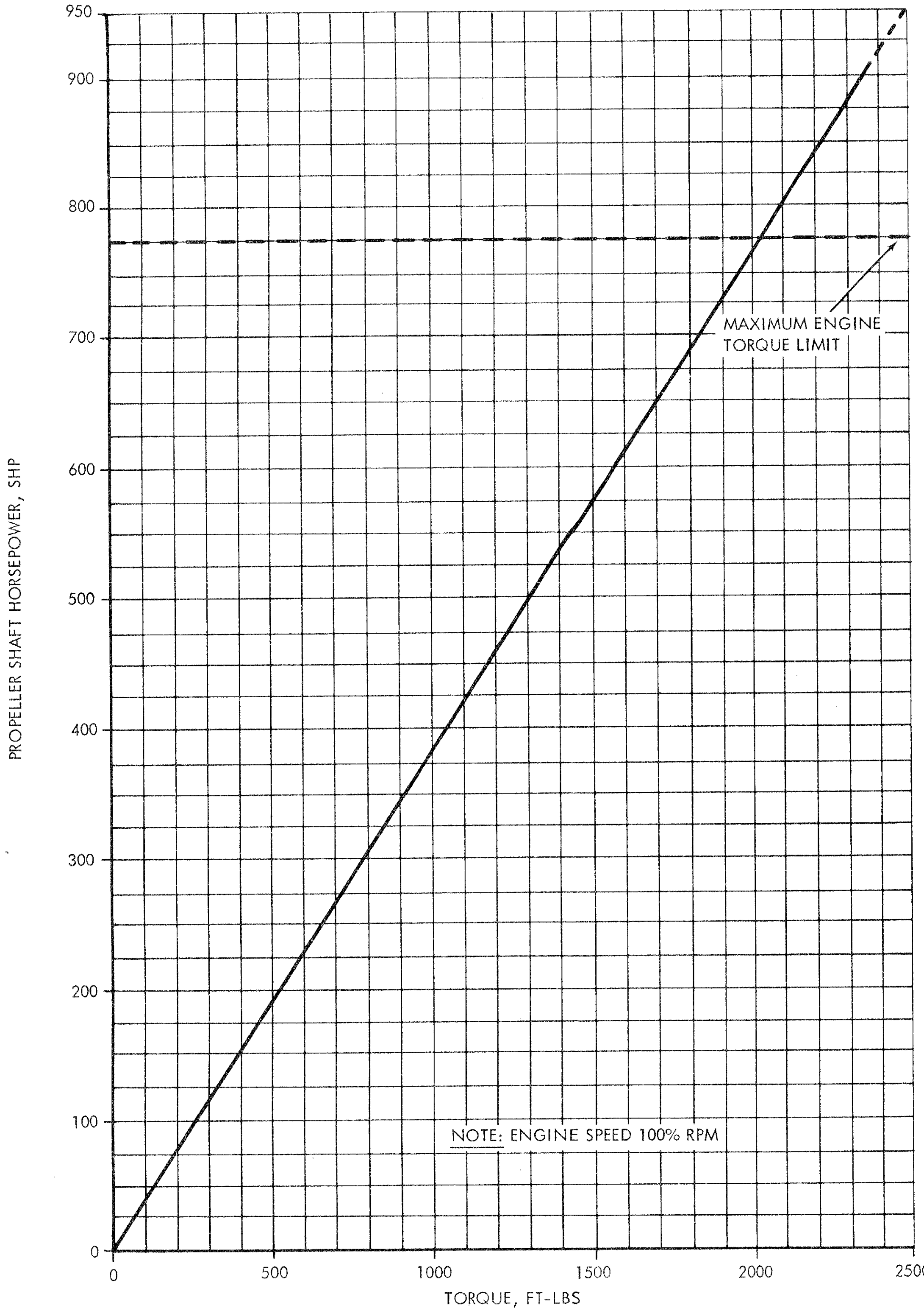
R

(Codes CA-CC) Horsepower Versus
Torque Pressure
Figure 107



R

(Codes AA-AC) Horsepower Versus Torque
Figure 108



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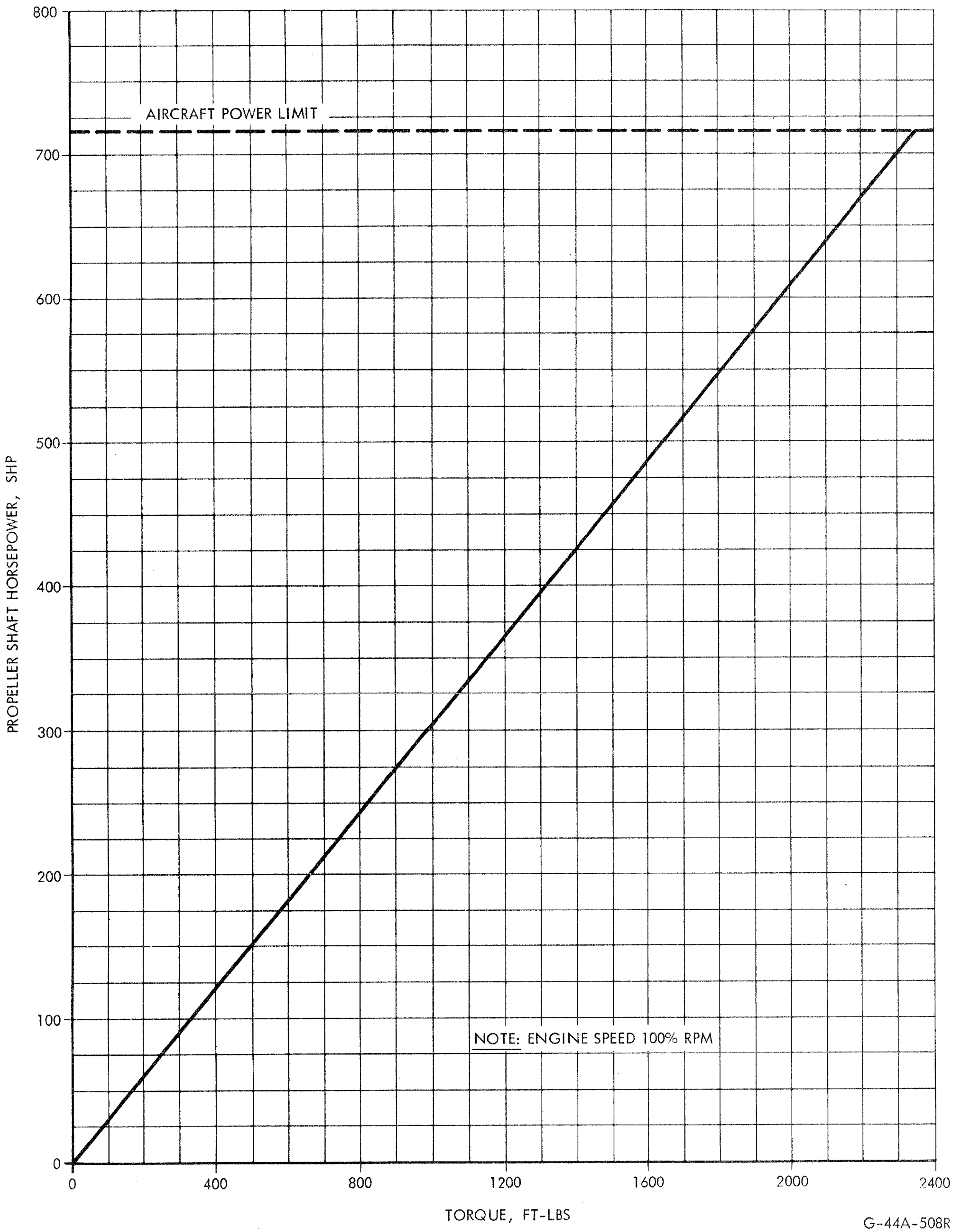
R

(Codes BA-BC, EA) Horsepower Versus Torque
Figure 109



R

(Codes CA-CC) Horsepower Versus Torque
Figure 110

4. Outside Air Temperature Versus Compressor Discharge Static Pressure

A. Instructions for Using Outside Air Temperature Versus Compressor Discharge Static Pressure Chart (Figure 111)

(1) Enter curve at outside air temperature, proceed to fuel flow and determine compressor discharge static pressure, $P_{S3}/_{\delta T2}$ on left side of curve.

(2) Compute δ^{T2} (pressure ratio of ambient barometric to standard barometric pressure) as follows.

$$\delta T2 = \frac{P_{T2} \text{ (ambient barometric)}}{29.92 \text{ (standard barometric)}}$$

(3) Compute ambient pressure P_{T2} as follows.

$$P_{T2} \text{ in PSIA} = (1 \text{ atmosphere}) \times (_{\delta T2})$$
$$= (14.7) \times (_{\delta}T2)$$

(4) Compute gage pressure (uncorrected) as follows.

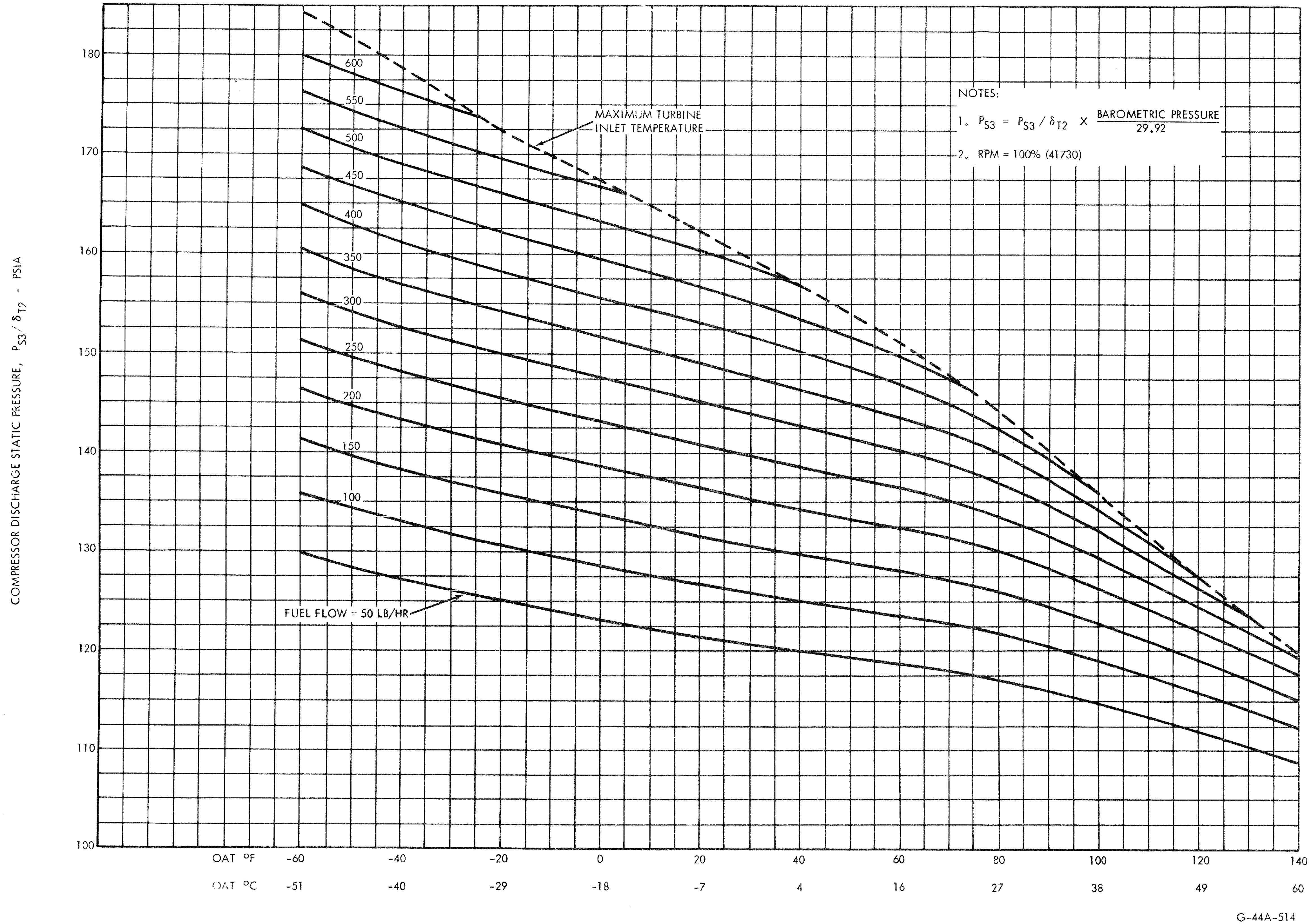
Gage pressure (uncorrected) in
$PSIG/_{\delta T2}$ = (Step (1)) - (Step (3))

(5) Compute gage pressure (corrected) as follows.

Gage pressure (corrected) =
(Step (4)) x (Step (2))

(6) Gage pressure (corrected) obtained in step (5) is nominal pressure which should be indicated on P_3 gage during engine run.

R



R Outside Air Temperature Versus Compressor Discharge Static Pressure
Figure 111

CHAPTER 72 - SERVICING

TABLE OF CONTENTS

GENERAL - SERVICING

1. General

NOTE: Table 301 provides a list of materials and compounds required to perform GENERAL - SERVICING.

Table 301. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Corrosion preventive compound (MIL-C-81309A, Grade A)	Rust-Lick Inc, (Rust-Lick 606), 755 Boylston St, Boston, MA 02116
Desiccant (MIL-D-3464)	Commercially available
Fuel (MIL-T-5624G (JP4/JP5))	Commercially available
Grease (MIL-G-21164)	Commercially available
Lubricating oil (MIL-L-6081 Grade 1010)	Commercially available
R Lubricating oil (MIL-L-23699A R or MIL-L-7808D, F or G)	Commercially available
Solution (Biobor JF)	U.S. Borax and Chemical Corp, 3075 Wilshire Blvd, Los Angeles, CA 90005
Solvent (Shell 360)	Shell Oil Co, 50 W 50th St, New York, NY 10020
Warning tag (Tag S8145-15A)	AiResearch Manufacturing Co of Arizona, P.O. Box 29003, Phoenix, AZ 85038

2. Depreservation

A. Depreserve Engine After Installation or When Required

(1) Remove plugs, caps or covers.

(2) Fill oil tank assembly to operating level with specified oil in accordance with Oil System Servicing, paragraph 6.B.

2. A. (3) Provide a source of specified fuel (refer to Aircraft Flight and Maintenance Manual) and connect to fuel inlet port on fuel control assembly.

(4) Disconnect fuel line between fuel control unit and fuel flow divider valve and connect a line to drain overboard.

CAUTION: DO NOT EXCEED MANUFACTURERS RECOMMENDED DUTY CYCLE FOR STARTER-GENERATOR.

(5) De-energize ignition system. Motor engine with starter-generator until clear fuel flows from overboard drain line.

(6) Stop motoring engine, disconnect overboard drain line, and reconnect fuel line between fuel shutoff valve and fuel control assembly.

(7) Start engine, observing normal start procedure and operate for approximately three minutes.

(8) Stop engine. When engine has stopped rotating, shut off aircraft fuel supply to engine.

(9) Inspect all lubrication lines and fuel lines and their connection points for any evidence of oil or fuel leakage, especially at the previously disconnected/connected fuel line.

(10) Remove fuel filter strainer element and inspect. Clean and reinstall, or replace observing procedures given in 73-21-03, MAINTENANCE PRACTICES.

(11) Remove oil filter element from input housing assembly and inspect. Clean and reinstall, or replace observing procedures given in 79-20-02, MAINTENANCE PRACTICES.

3. Preservation (Engine Installed in Aircraft)

A. Preserve Engine (INACTIVE From 1 To 60 Days)

(1) At beginning of period of idleness, using lubricating oil specified for engine, engine shall be operated for a minimum of ten minutes at approximately 75 percent rated speed to ensure coverage of all internal engine parts with oil.

(2) Allow engine to cool.

(3) Inspect engine to assure that inlet area is clean and dry.

3\. A. (4) Cap, plug or cover engine inlet and exhaust openings. Ensure these openings remain adequately sealed during period of idleness to prevent entrance of water or foreign matter.

(5) Engines preserved from 1 to 60 days require no depreservation.

(6) There shall be no renewal of the 1 to 60 days preservation.

B. Preserve Engine (INACTIVE From 60 To 180 Days)

(1) At beginning of period of idleness, using lubricating oil specified for engine, engine shall be operated for a minimum of ten minutes at approximately 75 percent rated speed to insure coverage of all internal engine parts with oil.

(2) Allow engine to cool.

(3) Disconnect fuel line between fuel control assembly and fuel shutoff valve and connect a line to drain overboard.

(4) Disconnect fuel supply line at inlet connection on fuel control assembly and connect a low pressure (two to five psig) source of filtered (ten micron nominal) MIL-L-6081, Grade 1010 oil to the inlet connection.

CAUTION: DO NOT EXCEED MANUFACTURERS RECOMMENDED DUTY CYCLE FOR STARTER-GENERATOR.

(5) DE-ENERGIZE IGNITION SYSTEM. Motor engine with starter-generator until the system flows oil only out of the fuel line

(6) Reconnect lines that were disconnected in steps (3) and (4).

(7) Inspect engine to assure that inlet area is clean and dry.

(8) Cap, plug or cover engine inlet and exhaust openings. Ensure these openings remain adequately sealed during period of idleness to prevent entrance of water or foreign matter.

(9) Once every 60 days of idleness depreserve engine in accordance with steps in paragraph 2. and preserve engine in accordance with paragraph 3.B., steps (1) through (8).

(10) The 60 to 180 day preservation procedures may be renewed once by repeating the techniques outlined in paragraph 3.B., steps (1) through (9).

3. C. Preserve Engine Subsequent to Operating in a Known Corrosive Environment (Engine Operated Daily)

WARNING: MOST CORROSION PREVENTIVE SOLUTIONS ARE FLAMMABLE AND SHOULD NOT BE USED EXCESSIVELY NOR APPLIED TO A HOT ENGINE. ALLOW ENGINE TO COOL FOR A MINIMUM OF TEN MINUTES BEFORE USING PRESERVATIVE MATERIAL ON ANY PART OF THE ENGINE.

(1) Allow engine to cool.

(2) Inspect engine to assure that inlet area is clean and dry.

CAUTION: CORROSION PREVENTIVE COMPOUND SHALL NOT BE SPRAYED DIRECTLY ON THE COMPRESSOR OR INTO THE ENGINE. NO HYDRO-CARBONS OR OILS SHALL EVER BE INTRODUCED INTO THE COMPRESSOR SECTION. UNCONTROLLED COMBUSTION COULD BE A POSSIBLE RESULT.

(3) Spray corrosion preventive compound (MIL-C-81309A, Grade A) into engine inlet area with engine static after last flight of the day. Preservative should be sprayed in quantity sufficient to cover area with a light film.

(4) Install inlet and tailpipe plugs.

D. Preserve Engine Subsequent to Operating in a Known Corrosive Environment (Engine Not Operated Daily)

(1) Once a week, engine conditions permitting, run engine for at least ten minutes at approximately 75 percent rated speed.

WARNING: MOST CORROSION PREVENTIVE SOLUTIONS ARE FLAMMABLE AND SHOULD NOT BE USED EXCESSIVELY NOR APPLIED TO A HOT ENGINE. ALLOW ENGINE TO COOL FOR A MINIMUM OF TEN MINUTES BEFORE USING PRESERVATIVE MATERIAL ON ANY PART OF THE ENGINE.

(2) Allow engine to cool.

(3) Inspect engine to assure that inlet area is clean and dry.

CAUTION: CORROSION PREVENTIVE MATERIAL SHALL NOT BE SPRAYED DIRECTLY ON THE COMPRESSOR OR INTO THE ENGINE. NO HYDRO-CARBONS OR OILS SHALL EVER BE INTRODUCED INTO THE COMPRESSOR SECTION. UNCONTROLLED COMBUSTION COULD BE A POSSIBLE RESULT.

3. D. (4) Spray corrosion preventive compound (MIL-C-81309A Grade A) into engine inlet area with engine static. Preservative should be sprayed in quantity sufficient to cover area with a light film.

(5) Install inlet and tailpipe plugs.

E. Preserve Engine During Extreme Wet Conditions (Aircraft Not Sheltered in Hangar)

(1) Once a week, engine conditions permitting, run engine for at least ten minutes at approximately 75 percent rated speed.

(2) Preserve engine in accordance with paragraph 3.C.

F. Preserve Engine When Operated in a Salt Atmosphere or Off Air Strips Treated With Salt

(1) Wash engine externally as soon as possible with clean water.

(2) Run engine at 75 percent rated speed for at least ten minutes to remove moisture and salt residue.

(3) Preserve engine in accordance with paragraph 3.C.

(4) Spray corrosion preventive compound (MIL-C-81309A, Grade A) on fuel control assembly, controls linkage assembly, and exposed metal parts.

(5) Inspect the gearcase for corrosion and spray with corrosion preventive compound. Extra care and attention is warranted in areas around studs and inserts.

4. Preservation (Engine Removed From Aircraft)

A. Preserve Engine (INACTIVE From 1 To 60 Days)

NOTE: The following steps to be completed as soon as possible after engine shutdown and while engine is still hot.

(1) Disconnect fuel line between fuel control assembly and fuel shutoff valve and cap off lines.

4. A. (2) Drain engine lubricating oil, observing applicable procedures given in Oil System Servicing, paragraph 6. Allow the engine to stand until all the excess oil has drained.

NOTE: Prior to installing new oil filter, flush the element with (MIL-L-23699A or MIL-L-7808D, F or G) lubricating oil ONLY.

(3) Remove and replace the oil filter element in accordance with 79-20-02, MAINTENANCE PRACTICES.

NOTE: Prior to installing fuel filter element, flush with filtered fuel (MIL-T-5624G (JP4/JP5)).

(4) Remove, clean and reinstall fuel filter element observing procedures given in 73-21-03, MAINTENANCE PRACTICES.

(5) Clean all excess fuel and oil from engine.

(6) Install covers over air intake and exhaust openings. Install plugs and dust covers on all line openings, wires and exposed sections.

(7) Tag the engine (Tag S8145-15A) to indicate that it has been preserved and indicate that the fuel system must be preserved with lubricating oil (MIL-L-6081, Grade 1010) if storage exceeding 60 days is contemplated.

B. Preserve Engine (INACTIVE 60 Days or More)

NOTE: The following steps to be completed as soon as possible after engine shutdown and while engine is still hot.

(1) Disconnect fuel line between fuel control assembly and fuel shutoff valve and connect a line to drain overboard.

(2) Disconnect fuel supply line at inlet connection on fuel control assembly and connect a low pressure (two to five psig) source of filtered (ten micron nominal) MIL-L-6081, Grade 1010 lubricating oil.

CAUTION: DO NOT EXCEED MANUFACTURERS RECOMMENDED DUTY CYCLE FOR STARTER-GENERATOR.

(3) DE-ENERGIZE IGNITION SYSTEM. Motor engine with starter-generator until clean oil flows from overboard drain line.

(4) Disconnect oil supply line from fuel inlet port on fuel control assembly and cap inlet port. Allow residual oil to drain from fuel control assembly and lines.

4. B. (5) Disconnect overboard drain line and reconnect fuel line between fuel shutoff valve and fuel control assembly.

(6) Drain engine lubricating oil observing procedures given in Oil System Servicing, paragraph 6.

NOTE: Prior to installing fuel filter, dip element in MIL-L-6081 lubricating oil ONLY.

(7) Remove filter from flow divider and drain valve and inspect. Clean and reinstall, or replace, observing procedures given in 73-10-07, Maintenance Practices.

NOTE: Prior to installing oil filter, dip element in lubricating oil (MIL-L-23699A or MIL-L-7808D, F or G) ONLY.

(8) Remove oil filter element from input housing assembly. Inspect oil filter element. Reinstall or replace observing procedures given in 79-20-02, Maintenance Practices.

(9) Wipe all fuel and oil from engine. Spray corrosion preventive compound (MIL-C-81309A, Grade A) on fuel control assembly, controls linkage assembly, gearcase and exposed metal parts.

(10) Install covers over air intake and exhaust openings. Install plugs and dust covers on all line openings, wires and exposed sections.

(11) Secure a warning tag (Tag S8145-15A) to engine indicating preservation procedures have been performed including preservation of fuel system with MIL-L-6081. Install engine in clean airtight bag containing desiccant (MIL-D-3464). Check discoloration of desiccant every month. If color changes from blue to pink replace bag and new desiccant (MIL-D-3464). If a sudden change in color of desiccant occurs, check the bag for damage and represerve engine in accordance with paragraph 4.B.

5. Preservation (Engine Removed From Aircraft) in a Corrosive Environment, Extreme Wet Conditions or Salt Atmosphere

   A. If Engine Will Not Be IMMEDIATELY Reinstalled, Preserve Engine In Accordance With Paragraph 4.B.

6. Oil System Servicing

   A. Drain Engine Oil

      (1) Drain the engine oil system when the engine is removed, at oil change intervals specified in INSPECTION/CHECK and whenever required, as follows.

         NOTE: If possible, oil shall be drained while the engine is still warm from operation.

         (a) Position aircraft propeller in feather position to ensure maximum drainage of control oil into engine oil sump and oil tank assembly.

         (b) Remove magnetic drain plug from bottom of output housing assembly and allow oil from housing sump to drain into suitable container. Check plug for chips and check drained oil for contamination which could indicate internal damage to engine.

         (c) Remove drain plug from oil tank assembly and allow oil to drain into suitable container. Check drained oil for contamination which could indicate internal damage to engine.

         (d) Drain oil cooler. Refer to Aircraft Maintenance Manual.

         (e) Remove oil filter element, observing procedures given in 79-20-02, MAINTENANCE PRACTICES. Inspect for unusual contamination which could indicate internal damage to engine.

   B. Fill Engine Oil System

      (1) Fill the engine oil system at initial installation of the engine, after oil drain for oil change at intervals specified in INSPECTION/CHECK and whenever required, as follows.

         (a) Install clean oil filter element in engine, observing procedures given in 79-20-02 MAINTENANCE PRACTICES.

         (b) Install drain plugs with new packings or gaskets in oil tank assembly and in bottom of output housing assembly.

6. B. (1) (c) Remove oil tank dipstick and cap assembly from oil tank assembly. Refer to Aircraft Maintenance Manual for type and quantity of oil required. Fill tank with oil until dipstick indicates FULL. Reinstall oil tank dipstick and cap assembly.

CAUTION: SHUT DOWN ENGINE IMMEDIATELY IF OIL PRESSURE IS NOT INDICATED WITHIN TEN SECONDS OF ENGINE START.

(d) Start engine, observing normal start procedures, and operate for at least one minute.

CAUTION: DO NOT MIX DIFFERENT TYPES OR BRANDS OF OILS WHEN ADDING OIL.

(e) Recheck oil level in oil tank and add oil if required.

C. Servicing Engine With Different Type or Brand of Oil

(1) Proceed as follows whenever engine oil system is filled with different type or brand of oil than previously used.

(a) Start engine and operate until normal oil temperature is reached.

(b) Shut down engine with propeller start locks disengaged and propeller in feather position.

NOTE: Disconnect electrical connector from oil vent valve when scavenging oil by cranking engine.

(c) Remove magnetic drain plug and drain as much oil as possible from engine. If magnetic drain plug is inaccessible, manually engage propeller start locks using a propeller blade wrench. Place feathering valve handle in FEATHER position, then crank engine approximately 20 seconds to scavenge as much residual oil as possible from the input housing assembly.

(d) Drain oil from oil tank, oil filter, fuel heater, and all interconnecting lines. Remove and replace oil filter element in accordance with 79-20-02, MAINTENANCE PRACTICES.

(e) Drain oil cooler. Refer to Aircraft Maintenance Manual.

(f) Refill oil system with new oil. Refer to Aircraft Flight Manual.

NOTE: Reengage propeller start locks prior to starting engine.

(g) Operate engine for approximately 15 minutes and monitor oil pressure and temperature. If pressure or temperature fluctuates, repeat steps (d) through (f).

6. C. (1) (h) If a different type (i.e. Type I or Type II) oil was serviced, make entry in permanent aircraft records so that different temperature limits will be observed.

7. Lubrication Requirements

NOTE: Perform lubrication of accessory (hydraulic pump) drive pad and tachometer-generator drive pad on rear of reduction gear section at initial installation of accessories with grease (MIL-G-21164).

A. Perform Starter-Generator Drive Spline Lubrication

(1) Perform starter-generator drive spline lubrication and inspection at intervals specified in INSPECTION/CHECK as follows

(a) Remove starter-generator from engine in accordance with Aircraft Maintenance Manual.

(b) Clean both engine drive splines and starter-generator splines with solvent (Shell 360).

(c) Dry splines using a directed air blast.

NOTE: The following dimensional inspection can be accomplished by making a comparison between the worn area of a spline and the end where there is no wear. This "no wear" area would normally be the extreme aft end where there is no engagement with the mating starter-generator shaft.

(d) Inspect the internal starter-generator drive splines of engine. Maximum allowable depth of internal spline wear measured at the pitch line of tooth, is a nominal 0.020 inch.

(e) Apply a film of grease (MIL-G-21164) to internal starter-generator drive splines of engine.

(f) Install starter-generator on engine in accordance with Aircraft Maintenance Manual.

B. Perform Tachometer-Generator Drive Lubrication

(1) Perform tachometer-generator drive lubrication and inspection at intervals specified in INSPECTION/CHECK as follows:

(a) Remove tachometer-generator from engine in accordance with Aircraft Maintenance Manual.

7. B. (1) (b) Clean both engine and tachometer-generator drives with solvent (Shell 360).

(c) Dry drives using a directed air blast.

NOTE: The following dimensional inspection can be accomplished by making a comparison between the worn area of a drive and the end where there is no wear. This "no wear" area would normally be the extreme aft end where there is no engagement with the mating tachometer-generator shaft.

(d) Inspect the internal tachometer-generator drive of the engine. The maximum allowable depth of internal drive wear, is a nominal 0.020 inch per surface.

(e) Apply a film of grease (MIL-G-21164) to the internal generator drive of the engine.

(f) Install tachometer-generator on engine in accordance with Aircraft Maintenance Manual.

C. Perform Fuel Pump Drive Spline Lubrication

(1) Perform fuel pump drive spline lubrication at intervals specified in INSPECTION/CHECK as follows:

(a) Remove fuel control and pump assembly from engine in accordance with 73-20-01, MAINTENANCE PRACTICES.

(b) Remove grease from female spline area on reduction gear section and fuel pump assembly cavity. Thoroughly clean splines of both cavities plus splines of drive coupling in accordance with 73-20-01, MAINTENANCE PRACTICES.

(c) Dry splines using direct low pressure air.

(d) Inspect splines of reduction gear section cavity, fuel pump assembly and drive coupling in accordance with 73-20-01, MAINTENANCE PRACTICES. Lubricate and install fuel pump drive splines in accordance with 73-20-01, MAINTENANCE PRACTICES.

8. Servicing After Water Ingestion

A. Perform Engine Ground Run

(1) If water has been suspected to have been introduced into engine, start engine and operate at ground idle for ten minutes.

(2) Shut down engine and cover engine inlet and tailpipe as required to prevent further water ingestion.

CAUTION: DO NOT OPERATE ANTI-ICE VALVE FOR MORE THAN 10 SECONDS AT TEMPERATURES ABOVE 4.4C (40F).

8. B. Removal of Water From Anti-Icing Shield Following Engine Washing

(1) Operate engine and actuate anti-ice valve. Anti-ice valve operation is limited to 10 seconds at temperature above 4.4C (40F).

9. Fuel Microbicide Requirements

NOTE: Microbicides should not be used in engine fuel unless inspection has indicated the presence of micro-organisms or conditions are such that their presence can be definitely anticipated. Refer to applicable aircraft manual to ensure approval for use in aircraft fuel system.

A. Use of Microbicides

(1) If micro-organisms are present in engine fuel, or engine fuel system, solution (Biobor JF) may be added by batch blending at fuel storage points, at aircraft fuel tenders at time of filling, or at over-the-wing refueling as follows.

(a) Add solution (Biobor JF) using any convenient gravity filling device either concurrent with fueling or at intervals during fueling provided that concentrations of solution do not exceed 270 ppm.

(b) Fuel shall be treated for a period not LESS than three months or 600 engine operating hours.

(c) If conditions require continued treatment stored fuel may be premixed at concentrations not to exceed 135 ppm of solution.

CHAPTER 72 - REMOVAL/INSTALLATION

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GENERAL - REMOVAL/INSTALLATION

1. General

CAUTION: WHEN REMOVING ENGINE FROM AIRCRAFT, TO AVOID DAMAGE TO THE OIL FLOW METAL TUBE ASSEMBLY (BETA TUBE), ALWAYS REMOVE THE BETA TUBE PRIOR TO PROPELLER REMOVAL.

If maintenance procedures require removal of the engine from the aircraft, consult the Aircraft Maintenance Manual for necessary removal and installation procedures.

2. Removal/Installation of Engine From/In Shipping Container

Table 401 provides a list of all special tools, fixtures and equipment required to perform REMOVAL/INSTALLATION.

Table 401. Special Tools, Fixtures and Equipment

Item No.	Nomenclature	Use	Source/ Part No.
NOTE: Equivalent substitutes may be used for listed items.			
1.	Hoisting Adapter	Used to mount on propeller shaft to provide a hoisting mount for lifting operation.	284357-1-1
2.	Maintenance Stand Engine	Used to support engine during transportation and maintenance.	284493-1-1
3.	Maintenance Stand Adapter	Used to mount engine in stand.	284557-1-1
4.	Maintenance Stand Adapter	Used to support aft end of engine when installed in stand using Adapters Part No. 284557-1-1.	284558-1-1
5.	Maintenance Stand Adapter	Used to bolt to each side of engine to mount engine to maintenance stand.	284203-1-1

2. A. Remove Engine From Shipping Container

CAUTION BE CAREFUL NOT TO DAMAGE PARTS OR LOG BOOK WHEN ITEMS ARE PACKAGED IN ENGINE CONTAINER.

(1) Remove plastic shipping band securing cover of container, then remove top flexible foam form and beta tube from shipping case.

(2) Install 284357-1-1 adapter on propeller shaft flange and secure. Attach a hoist of suitable capacity (approximately 600 pounds) to adapter and lift engine from bottom flexible foam form.

(3) Install engine in aircraft or 284493-1-1 maintenance stand.

B. Install Engine in Shipping Container

(1) Install 284357-1 1 adapter on propeller shaft flange and secure. Attach a hoist of suitable capacity (approximately 600 pounds) to adapter and lift engine.

(2) Install engine in bottom flexible foam form in shipping container. Place beta tube and engine log book in shipping container.

(3) Place top flexible foam form over engine. Install container cover and secure with plastic shipping bands.

3. Removal/Installation of Engine in Maintenance Stand

A. Remove Engine From Maintenance Stand

(1) Remove 284558-1-1 maintenance stand adapter from aft end of engine. Remove 284557-1-1 maintenance stand adapters or 284203-1-1 adapters from engine side mounts.

(2) Attach hoist of suitable capacity (approximately 600 pounds) to 284357-1-1 adapter on propeller shaft flange and lift engine from stand.

B. Install Engine in Maintenance Stand

CAUTION: TO PREVENT DAMAGE TO ACCESSORY DRIVE HOUSING ASSEMBLY ENGINE MOUNT PADS, DO NOT OVERTIGHTEN ENGINE MOUNT BOLTS OR USE BOLTS OF EXCESSIVE LENGTH WHICH MAY BOTTOM IN BLIND HOLES.

(1) Secure engine to 284493-1-1 maintenance stand with 284557-1-1 maintenance stand adapters or 284203-1-1 adapters attached to engine side mounts.

3. B. (2) Position engine as required to facilitate work to be performed, then support aft end of engine with 284558-1-1 maintenance stand adapter attached to plenum assembly.

4. Component Disassembly

Whenever removing and disassembling engine components, always note the number and thickness of washers used for shimming and note manner and placement of any lockwire as an aid to reassembly.

5. Preinstallation

NOTE: Preinstallation inspections are of a general nature and are performed primarily to determine that engines received from the factory or from overhaul have suffered no shipping or handling damage.

A. Perform Preinstallation Inspection

(1) Check engines for any sign of mishandling or obvious physical damage. Check that lines are secure and free of dents.

(2) Check to determine that all components, instruments and controls are included.

(3) Check for tag to determine if engine has been preserved. If engine has been preserved, proper depreservation procedures shall be performed after engine installation. (Refer to 72-00-00, SERVICING.)

CHAPTER 72 - ADJUSTMENT/TEST

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CHAPTER 72 - ADJUSTMENT/TEST

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GENERAL - ADJUSTMENT/TEST

1. General

This section includes engine maximum permissible operations limits, engine operational checks and engine adjustments which can be accomplished at a field maintenance level by personnel who operate and maintain subject equipment using equipment listed in Tables 501 and 502. Complete and detailed adjustments of the engine and engine components is accomplished at overhaul facilities where specialized test and calibration equipment is available.

CAUTION: REFER TO TABLE 503 (MAXIMUM PERMISSIBLE OPERATING LIMITS). SHUT THE ENGINE DOWN IMMEDIATELY IF OPERATING LIMITS ARE EXCEEDED, OR IF UNUSUAL ENGINE NOISES, VIBRATION, SMOKE, OR FIRE ARE EXPERIENCED OR IF FUEL OR OIL LEAKAGE IS NOTED. DIAGNOSE AND CORRECT ANY MALFUNCTION OR CONDITION PRIOR TO ATTEMPTING ANOTHER START.

DO NOT START ENGINE WHEN TURBINE TEMPERATURE EXCEEDS 300C.

IF ENGINE COMBUSTION SECTION CONTAINS EXCESSIVE FUEL OR FUEL VAPOR, ALLOW AT LEAST THREE MINUTES FOR DRAINING OR CLEARING BEFORE ATTEMPTING A RESTART, OR MOTOR ENGINE IN ACCORDANCE WITH INSTRUCTIONS OUTLINED IN APPLICABLE AIRCRAFT FLIGHT MANUAL.

UNDER NO CIRCUMSTANCES ALLOW ENGINE TO EXCEED 106 PERCENT RPM.

THE OPERATOR SHALL FAMILIARIZE HIMSELF WITH ALL EMERGENCY PROCEDURES NOTED IN APPLICABLE AIRCRAFT FLIGHT MANUAL, ESPECIALLY THOSE RELATED DIRECTLY TO GROUND OPERATIONS.

ON INITIAL ENGINE START FOLLOWING REPLACEMENT OF FUEL CONTROL ASSEMBLY, FUEL CONTROL UNIT OR FUEL PUMP ASSEMBLY, BE PREPARED TO MANUALLY SHUT DOWN ENGINE IF UNCONTROLLABLE ACCELERATION OCCURS.

ENGINES EQUIPPED WITH A FUEL-PURGE SYSTEM WILL NOT TOTALLY PURGE UNLESS A MINIMUM ENGINE RPM OF 95 PERCENT IS ATTAINED DURING THE OPERATIONAL CYCLE.

CAUTION: (CONT) ENGINES EQUIPPED WITH A FUEL-PURGE SYSTEM REQUIRE ACTUATION OF THE "STOP" CIRCUIT FOR FIVE SECONDS MINIMUM OR UNTIL ENGINE SPEED DECREASES BELOW GROUND IDLE SPEED. THE RPM SHOULD INCREASE WITH ACTUATION OF THE STOP SWITCH, THEN DECAY WHEN THE MANIFOLD FUEL IS DEPLETED. ACTUATION OF THE STOP SWITCH FOLLOWING MANUAL SHUTDOWN OF AN ENGINE EQUIPPED WITH A FUEL PURGE SYSTEM, WILL RESULT IN A FUEL ACCUMULATION IN THE PLENUM. IT IS RECOMMENDED THAT THE ELECTRICAL SHUTDOWN CIRCUITS NOT BE ACTIVATED UNTIL ENGINE COOLING PRECLUDES COMBUSTION, ON IN THE CASE OF INITIAL ENGINE OPERATION WITH INTENTIONAL MANUAL SHUTDOWNS REQUIRED, THE PURGE SYSTEM MAY BE DISABLED.

NOTE: Operating information contained in this section is included for the convenience of the user and is for reference purposes. Installed engine data required for engine performance checks is available in the Aircraft Flight Manual or from the Aircraft Manufacturer.

In order to satisfy high quality operational standards, as well as ensuring the accuracy of readings obtained during the test and calibration of the equipment, it is recommended that all instrumentation and gages to be used be checked on a periodic basis against instrumentation and gages of known accuracy.

Table 501. Equipment and Materials

Equipment or Material	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Air Pressure Source	Adjustable from 0 to 100 psig
Degreaser and cleaner (MS-180 Freon)	Miller-Stephensen Chemical Co, Inc, Danbury, CT 06810
Gage (Pressure/Vacuum)	Capable of indicating +15 psig to -30 Hg +2/-2 percent accuracy
Gage A (Pressure) (2 required)	Capable of indicating 0 to 100 psi, +2/-2 percent accuracy
Gage B (Pressure)	Capable of indicating 0 to 600 psi, +2/-2 percent accuracy

Table 501. Equipment and Materials (Cont)

Equipment or Material	Manufacturer
Gage C (Pressure)	Capable of indicating 0 to 150 psi, +2/-2 percent accuracy
Lint-free cloth	Commercially available
Pressure Regulator	Capable of regulating air pressure from 0 to 100 psig
Sampling Kit (Part No. 287545-1)	AiResearch Manufacturing Company of Arizona, P.O. Box 29003, Phoenix, AZ 85038

Table 502. Special Tools, Fixtures and Equipment

Item No.	Nomenclature	Use	Source Part No.
NOTE: Equivalent substitutes may be used for listed items.			
1.	Torque Calibration Adapter Plate	Used to adapt to gage assemblies.	284453-1-1
2.	Torque Calibration Adapter Plate	Used to adapt torque sensor compensator raw torque pressure port to gage assembly.	284461-1-1
3.	Torque Wrench Adapter	Used to adjust torque sensor compensator.	284694-1-1
4.	Fuel Manifold Tester	Used for pneumatic flow test of fuel nozzle and manifold assembly.	291613-1/-2/5/-6
5.	Primary Fuel Manifold Flow Test Adapter	Used to adapt primary fuel manifold to drain port of fuel flow divider and drain valve.	291678-1-1

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Table 502. Special, Tools, Fixtures and Equipment (Cont)

Item No.	Nomenclature	Use	Source/ Part No.
6.	Secondary Fuel Manifold Flow Test Adapter	Used to adapt secondary fuel manifold to drain port of fuel flow divider and drain valve.	291679-1-1
7.	Torque Test Kit	Used to obtain engine torque readout for required adjustment of the torque system.	291862-1 or 291862-2
* 8.	Gage Assembly (See figure 517)	Used to read gearcase pressure.	292472-1
* 9.	Gage Assembly (See figure 517)	Used to read raw torque pressure.	292471-1
*10.	Tube Assembly (See figure 517)	Used to facilitate installation of gage assembly.	292473-1
*11.	Flexible Hose Assembly (See figure 517)	Used to connect gage assembly to torque sensor transmitter.	MS28741-4-0120
*12.	Packing	Used on propeller shaft prior to installing torquemeter.	S9413-142
*13.	Packing	Used on torquemeter prior to installing propeller.	S9413-037
*14.	Anti-rotation Bracket (See figure 517)	Used to prevent torquemeter sensor rotation during engine operation.	283973-1
**15.	Adapter Wrench	Used to tighten bolts securing propeller to torquemeter.	292155-1
*16.	Adapter Wrench	Used to tighten bolts securing torquemeter to propeller shaft flange.	292157-1
*17.	Electrical Cable Assembly (See figure 517)	Used to connect torquemeter and digital torque indicator.	292158-1

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Table 502. Special Tools, Fixtures and Equipment (Cont)

Item No.	Nomenclature	Use	Source/ Part No.
*18.	Storage Case Assembly	Used to store all components of torque test kit.	292159-1
**19.	Beta Tube Case Assembly	used to store and protect kit and engine beta tube.	292160-1
**20.	Extented Beta Tube Assembly (See figure 517)	Used in place of engine beta tube during calibration run.	868369-1
***21.	Extended Beta Tube Assembly	Used in place of engine beta tube during calibration run (Dowty Propeller).	294626-1
***22.	Extended Beta Assembly	Used in place of engine beta tube during calibration run (Hartzel Propeller).	294626-3

*Component of 291862-1 and 291862-2 torque test kit.
**Component of 291862-1 torque test kit only.
***Used with 291862-2 torque test kit.

Table 503. Maximum Permissible Operating Limits

Condition	Operating Limit	Action if Exceeded
CAUTION: LIMITATIONS CONTAINED IN THIS SECTION REFER TO THE ENGINE ONLY. THE AIRCRAFT MAINTENANCE OR AIRCRAFT FLIGHT MANUAL SHOULD BE CONSULTED FOR ADDITIONAL AIRCRAFT-REQUIRED ENGINE LIMITATIONS. ALL VALUES ARE STEADY STATE EXCEPT AS NOTED.		
Light-off time (from 10 percent speed to light-off)		
Ground starts	10 seconds (when not using start fuel pressure regulator)	Abort start
	2 seconds (when using start fuel pressure regulator)	

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Table 503. Maximum Permissible Operating Limits (Cont)

Condition	Operating Limit	Action if Exceeded
Air starts	15 seconds	Abort start
Oil pressure	70 to 120 psig at normal operating temperature range	Shut down as soon as possible
	50 psig minimum above 23,000 feet	
	40 psig minimum at ground idle at maximum oil temerature of 70C (158F)	
	Minor oil pressure fluctuation of up to +3/-3 psi is acceptable	
Oil temperature *Type II oil (MIL-L-23699)	Minimum -40C (-40F) starting and ground operation	Heat engine prior to start
	Maximum (Refer to Aircraft Flight Manual)	Shut down engine
*Type I oil (MIL-L-7808)	Minimum -40C (-40F) starting and ground operation	Heat engine prior to start
	Maximum (Refer to Aircraft Flight Manual)	Shut down engine

*Refer to Aircraft Flight Manual for approved oil.

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Table 503. Maximum Permissible Operating Limits (Cont)

Condition	Operating Limit	Action if Exceeded
NOTE: The purpose of the Beta light are: (1) to warn the pilot of a failure or malfunction of the engine/propeller governor system during flight and (2) to indicate to the pilot that the propeller has moved into the ground operating (beta) range after landing in response to power lever movement. Therefore operation of the Beta light between 65 and 85 percent engine rpm is not essential since the engine is not operated in this speed range during takeoff, flight or landing, and safety of flight is not involved.		
Beta Light (at normal operating oil temperature)	Beta light must be on when operating in the Beta rang at engine speeds of 85 percent and above. At speeds below 85 percent this requirement is not mandatory	Troubleshoot as soon as possible for low Beta pressure or switch malfunction. If engine is to be operated prior to troubleshooting, use extreme caution and beware of asymmetric thrust condition if reverse power is applied
NOTE: Starting the engine at oil temperature as low as -40C (-40F) is permitted providing adequate cranking torque is provided and the fuel viscosity is not lower than 12 centistokes; operation at oil temperature lower than 55C (131F) is not advisable due to fuel icing and in the interest of optimum engine and lubricant performance. (Refer to Aircraft Flight Manual for minimum temperature for fuel anti-icing.)		
Ambient temperature ranges		
Starting	-40 to 55C (-40 to 130F)	Do not attempt start unless temperature is within these limits.
Operation	-54 to 55C (-65 to 130F)	

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Table 503. Maximum Permissible Operating Limits (Cont)

Condition	Operating Limit	Action if Exceeded
Turbine temperature		
R Starting (Air and Ground)	**1149C (2100F maximum) for one second	Abort start. If 1149 to 1155C (2100 to 2111F) in excess of one second, conduct a takeoff power check to determine satisfactory operation. If 1149 to 1155C (2100 to 2111F) in excess of three seconds or over 1155C (2111F) at any time, remove engine. Perform turbine section inspection. Refer to 72-00-00, INSPECTION/CHECK.
Takeoff at 100 percent rpm (five minute limit)	923C (1693F)	0 to 5C overlimit, reduce power
		5 to 15C overlimit for 30 seconds, reduce power
		5 to 15C overlimit in excess of 30 seconds, or 15 to 20C overlimit for five seconds, conduct a power check to determine satisfactory performance

**Refer to Flight Manual for limits related to specific temperature measuring system installed in aircraft.

Table 503. Maximum Permissible Operating Limits (Cont)

	Condition	Operating Limit	Action if Exceeded
	Turbine Temperature (Cont)		
	Takeoff at 100 percent rpm (five minute limit) (Cont)	923C (1693F) (Cont)	15 to 20C to 36F) overlimit in excess of five seconds or over 20C (36F) overlimit at any time, remove engine. Perform turbine section inspection. Refer to 72-00-00- INSPECTION/CHECK.
	Maximum continuous at 100 percent rpm	923C (1693F)	Reduce power to bring within limits
R R	Maximum cruise (96 percent engine speed)	(Codes AA-AC CA-CC, FA KA, LA) 885C (1625F)	Reduce power to bring within limits
R		(Codes BA-BC, EA GA, HA) 905C (1661F)	
	Rotor speeds		
	Maximum continuous	101.0 percent	Correct to within limits by movement of engine speed lever
R R R R R R	5 minutes overspeed limit	101.0 to 101.5 percent	Reduce speed. Enter speed and time of operation in excess of limit in permanent aircraft records.

Table 503. Maximum Permissible Operating Limits (Cont)

Condition	Operating Limit	Action if Exceeded
Rotor speeds (Cont)		
R 30 seconds overspeed limit	101.5 to 105.5 percent	Reduce speed. Enter speed and time of operation in excess of limit in permanent aircraft records.
Five seconds overspeed limit	105.5 to 106.0 percent	Remove engine, return to overhaul facility for inspection
Maximum overspeed limit	106.0 percent	Remove engine, return to overhaul facility for inspection
Windmilling		
NOTE: Reverse rotation of engine is not permitted.		
0 to 5 percent rpm	Continuous	
5 to 10 percent rpm	Thirty minute limit	Feather propeller or reduce airspeed
CAUTION: AVOID WINDMILLING OR ENGINE OPERATION BETWEEN 18 AND 28 PERCENT RPM EXCEPT FOR TRANSIENT OF THIS RANGE DURING START AND SHUTDOWN AS THIS IS A CRITICAL RPM RANGE.		
10 to 18 percent rpm	Five minute limit	Feather propeller or reduce airspeed
28 to 100 percent rpm	One minute limit	Feather propeller

Table 503. Maximum Permissible Operating Limits (Cont)

Condition	Operating Limit	Action if Exceeded
Maximum gearbox torque limits		
R Maximum engine five seconds torque limit	(Codes AA-AC, FA, LA) 2565 to 2835 ft-lb (777 to 859 HP)	Remove engine, return to overhaul facility for inspection
R	(Codes BA-BC, EA, GA, HA) 2040 to 2260 ft-lb (116.8 to 129.4 percent HP)	
	(Codes CA-CC) 2564 to 2835 ft-lb (68.5 to 75.0 psid)	
	(Code KA) 2564 to 2835 ft-lb (108.7 to 120.2 percent HP)	
R Maximum engine five minutes torque limit	(Codes AA-AC, FA, LA) 2564 ft-lb (777 HP)	Remove engine, return to overhaul facility for inspection
R	(Codes BA-BC, EA, GA, HA) 2040 ft-lb (116.8 percent HP)	
	(Codes CA-CC) 2564 ft-lb (68.5 psid)	
	(Codes KA) 2564 ft-lb 108.7 percent HP)	
R Continuous operation	(Codes AA-AC, FA, LA) 2392 ft-lb (715 HP)	Reduce power. Observe maximum engine torque limit
R	(Codes BA-BC, EA, GA, HA) 1878 ft-lb (107.5 percent HP)	

Table 503. Maximum Permissible Operating Limits (Cont)

	Condition	Operating Limit	Action if Exceeded
	Maximum gearbox torque limits (Cont)		
	Continuous operation (Cont)	(Codes CA-CC) 2392 ft-lb (64.6 psid)	
		(Codes KA) 2392 ft-lb (101.4 percent HP)	
	Torque fluctuation	+4/-4 psig, +130/-130 ft-lb, +50/-50 shaft horsepower or +7.5/-7.5 percent	Shut down engine. Refer to 72-00-00, TROUBLE SHOOTING
	Full reverse		
R R	Landing minimum	(Codes AA-AC, CA-CC, FA, KA, LA) 93.0 percent rpm	Return power lever to ground idle position if engine speed drops below limits.
R		(Codes BA-BC, EA, GA, HA) 94.5 percent rpm	
	Static minimum	94.5 percent rpm	
	Additional operating limits		
	Sudden stoppage or externally induced engine deceleration	Any deceleration of the engine due to impact with any object	Shut down engine. Refer to 72-00-00, INSPECTION/CHECK.
	Cooling prior to shutdown	Three minute minimum at taxi conditions (taxi time (included)	
	Recommended air start altitude and air speed envelope	100-180 kts IAS 0-20,000 altitude	Adjust air speed and altitude to bring within limits

Table 503. Maximum Permissible Operating Limits (Cont)

	Condition	Operating Limit	Action if Exceeded
	Engine speed governor settings		
R	Static takeoff setting of propeller governor	99.0 to 101.0 percent	Adjust linkage and/or propeller governor maximum setting prior to next flight
R	Static minimum setting of propeller governor	93.5 to 94.5 percent	Adjust linkage and/or propeller governor minimum setting prior to next flight
R	Minimum in-flight cruise setting	96.0 percent	Adjust speed lever within limits
R	Static maximum underspeed fuel governor setting with engine speed lever at high speed position and power lever set slightly in reverse	96.5 to 97.5 percent	Adjust linkage and/or underspeed governor maximum settings prior to next flight
R	Static minimum underspeed fuel governor setting with engine speed lever at low speed position and power lever set slightly in reverse	(Codes AA-AC, CA-CC, FA, LA) 69 to 71 percent (Codes BA-BA, EA, GA, HA) 65 to 66 percent (Codes KA) 72 to 74 percent	Adjust linkage and/or underspeed governor minimum settings prior to next flight
	Static underspeed fuel governor setting with propeller governor set at 96 percent	93.5 percent	Adjust linkage and/or underspeed fuel governor settings prior to next flight

Table 503. Maximum Permissible Operating Limits (Cont)

Condition	Operating Limit	Action if Exceeded
Engine Speed Governor settings (Cont)		
Overspeed fuel gover- R nor setting	104.5 to 105.5 percent (Bendix Fuel Control) R R 103.0 to 105.0 percent (Woodward Fuel Control)	Refer to rotor over-speed limits. Shut-down engine

R NOTE: (Codes AA-EA) Ground effects and wind gusts will produce power changes in excess of the following limits but these changes are distinguishable by a non-cyclic nature. In all cases, care shall be taken to ensure that fluctuation are attributable to the fuel control unit. (Codes AA-AC, BA-BC, EA). Do not reject the fuel control without first capping the torque limiter bypass valve and rechecking the fluctuation.

R (Codes AA-EA) Consistent cyclic fluctuations in ITT, torque and fuel flow during operation in reverse power	+5/-5C (+9/-9F) ITT +2/=2 percent torque +10/-10 lb/hr fuel flow	Replace fuel control unit
R (Codes AA-EA) Fluctuations that result in consistent visible engine speed variation	Sufficient magnitude to create a distinctly audible cyclic beat frequency between engines. Fluctuations within limits of reverse power check above are satisfactory	Replace fuel control unit if requirements of reverse power check are not met
R (Codes AA-EA) Consistent fluctuations in ITT, torque and fuel flow in steady state flight	Simultaneous fluctuations of ITT, torque and fuel flow at steady state power settings and flight conditions	Replace fuel control unit

Table 503. Maximum Permissible Operating Limits (Cont)

Condition	Operating Limit	Action if Exceeded
R (Codes AA-EA) Consistent and simultaneous fluctuations in ITT, torque and fuel flow in steady state flight	Simultaneous fluctuations in excess of +15/-15C (+27/-27F) ITT, +4/-4 percent torque, and +10/-10 lb/hr fuel flow	Replace fuel control unit

2. Engine Operational Checks

NOTE: The operation of various switches and controls is described with reference to a function performed at the engine and does not reflect a specific installation. Since different aircraft manufacturers often combine the function of switches and controls, consult the applicable Aircraft Flight Manual for cockpit controls configuration and operational procedures.

The oil temperature must be 75 to 85C (167 to 185F) for all operational checks unless otherwise specified in Aircraft Maintenance Manual.

A. Overspeed Governor Check

CAUTION: WHEN PERFORMING THIS CHECK, DO NOT ALLOW ENGINE SPEED OF 101.0 TO 105.5 PERCENT IN EXCESS OF 30 SECONDS, 105.5 TO 106.0 PERCENT IN EXCESS OF FIVE SECONDS, OR 106.0 PERCENT AT ANY TIME.

NOTE: This check will be made following any maintenance work involving disassembly or adjustment of engine or removal or adjustment of control components. Perform this check whenever air starts are intentionally scheduled. Start locks are to remain engaged for this check. Ensure aircraft checks satisfactory prior to performing this check.

When checking overspeed governor, an increase in vibration may be noted. This is normal as long as vibration in the the normal operating speed range is satisfactory. Time of operation on overspeed governor shall be held to a minimum.

(1) Start engine normally. Use authorized check list furnished by aircraft manufacturer. Do not remove propeller from start locks. R

2. A. (2) Operate engine until oil temperature reaches normal operating range. Refer to Aircraft Maintenance Manual.

(3) (Codes AA-EA) Place aircraft speed lever in high rpm position. Advance aircraft power lever slowly toward maximum position, while closely observing engine rpm. When overspeed governor setting is reached, the engine speed will not increase with further movement of power lever. If overspeed governor does not control engine speed between 104.5 and 105.5 percent, refer to Fuel Control Adjustments.

(4) (Codes FA-LA) Place aircraft speed lever in high rpm position. Advance aircraft power lever slowly toward maximum position while slowly observing engine rpm. When overspeed governor setting is reached, the engine speed will not increase with further movement of power lever. If overspeed governor does not control engine speed between 103.0 and 105.0 percent, adjust overspeed governor. Refer to Fuel Control Adjustments.

B. Disengage Propeller Start Locks

(1) Move aircraft speed lever to position specified in Aircraft Flight Manual.

NOTE: To positively determine that start locks have been disengaged, advance power lever toward the maximum position with speed lever at high speed position, until governing rpm is reached, as indicated by stabilized rpm and an increase in fuel flow as power lever is advanced.

(2) Move power lever slowly towards reverse to release propeller blade locks.

C. Propeller Governor High RPM Check

CAUTION: DO NOT EXCEED A TURBINE SPEED OF 102.5 PERCENT RPM, THE MAXIMUM ALLOWABLE TURBINE TEMPERATURE OR ENGINE TORQUE LIMITS DURING PROPELLER GOVERNOR CHECKS.

NOTE: This check to be accomplished with propeller off start locks.

(1) With speed lever in high speed position, move the power lever slowly toward the maximum position while observing engine speed. Note the maximum engine speed which can be attained regardless of amount of power lever advancement.

2. C. (2) Return power lever to a position slightly aft of start position. Operate engine for three minutes at taxi condition for cooling, then shut down engine.

R (3) (Codes AA-EA) For each percent of speed more than 101.0 percent
reached in step (1), turn the propeller governor high speed stop
R screw one turn clockwise. For each percent of speed less than 99.0
percent, turn screw one turn counterclockwise.

R (4) (Codes FA, KA, LA) For each 2.5 percent of speed more than 101.0
R percent reached, turn propeller high speed stop screw (located on
R top of concentric shaft assembly) one turn counterclockwise. After
R adjustment has been accomplished and while holding speed setting
R (underspeed governor) shaft against maximum stop, ensure that
R propeller governor high speed stop on propeller governor contacts
R simultaneously with underspeed governor high speed stop.

R (5) (Codes GA, HA) For each 2.5 percent of speed more than 101.0 percent reached, turn propeller high speed stop screw (located on top of concentric shaft assembly) one turn counterclockwise. After adjustment has been accomplished and while holding speed setting (underspeed governor) shaft against maximum stop, ensure that propeller governor high speed stop on propeller governor is backed out three turns from propeller governor stop arm.

(6) Restart the engine and repeat check. Continue making adjustment
R until the propeller governor maintains the engine speed at 99.0 to
R 101.0 percent regardless of amount of power lever advancement.

D. Propeller Governor Low RPM Check

NOTE: If propeller governor does not control rpm within limits specified, adjust low speed stop on propeller governor. Turning stop screw clockwise one turn will increase engine rpm approximately one percent.

R CAUTION: DO NOT EXCEED TORQUE OR TURBINE TEMPERATURE LIMITS.

(1) Move the speed lever to maximum position.

R (2) Move the power lever to approximately 50 percent takeoff power.

R CAUTION: (BENDIX CONTROLS) DO NOT CONTINUE TO RETARD SPEED
R LEVER AFTER RPM STOPS DROPPING. EXCESSIVE RETARDATION
R MAY DAMAGE ENGINE.

(3) Retard speed lever SLOWLY until propeller governor speed does not drop further with reduction in speed lever setting. Do not exceed cruise torque and temperature limits. Refer to Aircraft Flight Manual.

2. D. (4) The propeller governor shall maintain the engine speed at a setting of 93.5 to 94.5 percent.

(5) Adjust propeller governor low speed stop screw one turn clockwise to increase rpm approximately one percent.

R (6) Shut down engine in accordance with Aircraft Flight Manual.

E. Underspeed Governor High RPM Check

NOTE: If engine rpm does not stabilize at limit specified, adjust maximum speed stop on the underspeed governor. Refer to Fuel Control Adjustments.

Recheck and adjust linkage between underspeed governor and propeller governor as required following any adjustment of underspeed governor stop. Refer to 76-10-01, MAINTENANCE PRACTICES.

(1) Move speed lever to high speed position. Move power lever slowly towards reverse, observing interstage turbine temperature indication. When minimum interstage turbine temperature is indicated, continue movement until interstage turbine temperature increases 10C then tighten friction lock on power lever. Rpm should stabilize within limits. Refer to Table 503 for operating limits.

F. Underspeed Governor Low RPM Check

NOTE: If engine rpm does not stabilize within the limits specified, adjust the minimum speed stop on underspeed governor. Refer to Fuel Control Adjustments. Recheck and adjust linkage between underspeed governor and propeller governor as required following any adjustment of underspeed governor stop. Refer to 76-10-01, MAINTENANCE PRACTICES.

(1) With power lever slowly moved toward reverse to attain interstage turbine temperature increase of 10C, move speed lever to the low speed position. Refer to Table 503 for operating limits.

G. Underspeed Governor - Propeller Governor Separation Check (Static Underspeed Fuel Governor Setting with Propeller Governor Set at 96 Percent)

CAUTION: DO NOT EXCEED CRUISE TORQUE OR TEMPERATURE LIMITS. REFER TO AIRCRAFT FLIGHT MANUAL.

(1) Start engine. Remove propeller from start locks.

NOTE: Ensure engine oil temperature is within normal operating limits.

2. G. (2) Move engine speed lever to maximum stop. Move power lever to a mid-range (approximately 50 percent of takeoff power) position.

(3) Slowly move engine speed lever back and stablizie engine rpm at 96 percent. Set friction lock.

(4) Retard power lever and obtain minimum fuel flow.

(5) Stabilized engine rpm shall not exceed 93.5 percent.

R (6) If rpm is not within limits, recheck and adjust underspeed governor
R and/or adjust linkage. Refer to 76-10-01, MAINTENANCE PRACTICES
R for linkage adjustment.

H. (Codes AA-EA) Start Flow Check

CAUTION: OBSERVE MAXIMUM STARTING TEMPERATURE OF 1149C (2100F).

NOTE: (Codes BA-BC, EA) Use start fuel pressure regulator for ignition and as required above 25 percent engine speed.

(1) Start the engine and observe the time, in seconds, from ignition (ITT rise) to ground-idle speed.

(2) If starting time is less than 60 seconds and ITT does not exceed start limits adjustment is not required. Proceed with flight idle check.

(3) If the time is greater than 60 seconds, check propeller blade angle on latches in accordance with Aircraft Maintenance Manual.

(4) If blade angle is correct, refer to Fuel Control Adjustments.

(5) Allow engine to cool to ambient temperature before repeating check after adjustments.

(6) When the check satisfies the 60 second requirement, proceed with the flight idle check.

R J. (Codes AA-EA) Flight Idle Check

R (1) Start engine in accordance with Aircraft Flight Manual. Do not un-
R latch propeller. Turn environmental system OFF.

R (2) Move speed lever to maximum with power lever at flight idle
R position. Engine speed shall be 97.5 percent minimum.

R 2. J. (3) If flight idle fuel adjustment is required, refer to Fuel Control
R Adjustments.

R K. (Codes FA-LA) Flight Idle Low Speed Flat Check

(1) Move speed lever to low engine speed position and advance power lever slowly from minimum fuel flow position toward takeoff. In area of flight idle hard stop, a constant fuel flow shall be noted.

(2) Record fuel flow at flat and advance power up to 750C (1382F) interstage turbine temperature.

NOTE: If engine is correctly rigged, misalignment of flight idle flat can usually be corrected in the aircraft power lever linkage in accordance with aircraft maintenance manual.

(3) Retard power lever to flight idle hard stop and record fuel flow. Fuel flow shall be same as fuel flow noted in step (2).

R NOTE: Propeller shall be off start locks for flight idle
R check.

R Adjustment of flight idle fuel flow to 90 to 91 percent
R engine speed will make the aircraft safe for flight
R test purposes. However, final evaluation of the fuel
R flow for flight idle shall be determined by the pilot
R and the necessary adjustment to the appropriate engine
R or engines made per his request. The resulting engine
R speed on the engines after proper adjustment shall be
R recorded in the maintenance log sheets and noted appro-
R priately in order to prevent additional adjustments by
R other maintenance personnel.

R L. (Codes FA-LA) Flight Idle Low Speed Check

(1) Move speed lever to low engine speed position and slowly advance power lever until engine speed reaches approximately 95 percent.

(2) Retard power lever rapidly to flight idle position. Engine speed shall stabilize at 90 to 91 percent.

(3) If correct engine speed is not obtained, an adjustment of flight idle fuel flow will be required. Refer to Fuel Control Adjustments.

(4) Repeat check after adjustment has been accomplished and after flight test if required.

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NOTE: If maximum power can be obtained, record ITT, fuel flow, torque, oil temperature and oil pressure in permanent aircraft records.

(2) If maximum power cannot be obtained (torque limiting or maximum ITT), check fuel control pneumatic system for leaks or blockage and check ITT system. Refer to Trouble Shooting to determine if problem exists in control linkage, inlet temperature sensor or ITT system. If required, adjust fuel control maximum power adjustment such that maximum power is achieved at appropriate power lever protractor angle. Refer to Fuel Control Adjustments.

N. (Codes FA-LA) Maximum Fuel Flow Check (Woodward Fuel Control)

NOTE: Aircraft air bleed system shall be on and torque limiting system shall be off, as applicable, for this check.

(1) Place speed lever in high RPM position. Advance power lever until ITT or torque limit specified in Aircraft Flight Manual is reached.

CAUTION: DO NOT EXCEED TORQUE OR ITT LIMIT. (REFER TO TABLE 503.)

NOTE: If maximum power can be obtained, record ITT, fuel flow, torque, oil temperature and oil pressure in permanent aircraft records.

(2) If engine does not make maximum torque or maximum temperature, refer to Trouble Shooting to determine if problem exists in control linkage, inlet temperature sensor or ITT system. If required, adjust fuel control maximum power adjustment. Refer to Fuel Control Adjustments.

TEMPORARY REVISION NO. 72-143

To holders of Turboprop Aircraft Engine Maintenance Manual Report No. 72-00-95, Revision 5, dated March 28, 1980. Insert facing page 521, 72-00-00.

ENGINE PART NO.	ENGINE MODEL NO.	AIRCRAFT APPLICATION
895720-1/-2/-3	TPE331-5-251K	Turbo Commander 690/690A/690B
896160-1/-2/-3	TPE331-6-251M	Mitsubishi MU-2J/ 2K/2L/2M
896950-1-1/-2/-3	TPE331-5-251C	Casa 212
3101300-2	TPE331-6-252M	Mitsubishi MU-2J/ 2K/2L/2M
3101630-1	TPE331-6-252B	Beech B100
3101840-1	TPE331-5-252M	Mitsubishi MU-2N/2P
3102450-1	TPE331-6A-251M	Mitsubishi MU-2J/ 2K/2L/2M
3102520-1	TPE331-5-252K	Turbo Commander 690A/690B
3102520-2	TPE331-5-254K	Turbo Commander 690C

Reason: To revise title of Takeoff Power Check to read Maximum Fuel Flow Check to clarify intention of check and position of bleed-air system switch.

Use the following paragraphs 2.M. and N. in lieu of existing paragraphs 2.M. and N.

2. M. (Codes AA-EA) Maximum Fuel Flow Check (Bendix Fuel Control)

CAUTION: DO NOT EXCEED TORQUE OR ITT LIMITS. (REFER TO TABLE 503.)

NOTE: Aircraft air bleed system shall be on and torque limiting system shall be off, as applicable, for this check.

(1) Place speed lever to high RPM position. Advance power lever until ITT or torque limit specified in Aircraft Flight Manual is reached. See Tables 504, 505 or 506 for appropriate fuel control power lever protractor angle under existing ambient conditions.

2. M. (Codes AA-EA) Takeoff Power Check

CAUTION: DO NOT EXCEED TORQUE OR ITT LIMITS. (REFER TO TABLE 503.)

NOTE: Aircraft air bleed system shall be on and torque limiting system shall be off, as applicable, for this check.

(1) Place speed lever in high speed position. Advance power lever until ITT or torque limit specified in Aircraft Flight Manual is reached. See Tables 504, 505 or 506 for power lever angle.

NOTE: If maximum power can be obtained, record ITT, fuel flow, torque, oil temperature and oil pressure in permanent aircraft records.

(a) If outside air temperature is less than 38C (100F) and torque limit is not obtained, check for pneumatic system leaks or blockage. Correct and repeat until torque is obtained.

(b) If outside air temperature is greater than 38C (100F) and maximum ITT is less than 900C (1652F), check ITT system, pneumatic lines and flow divider drain valve. If ITT is 900C to 923C (1652F to 1693F), increase maximum power adjustment to obtain 923C (1693F). Refer to Fuel Control Adjustments.

R N. (Codes FA-LA) Takeoff Power Check

NOTE: Aircraft air bleed system shall be on for this check.

(1) Place speed lever in high position. Advance power lever until ITT or torque limit specified in Aircraft Flight Manual is reached.

CAUTION: DO NOT EXCEED TORQUE OR ITT LIMIT. (REFER TO TABLE 503.)

NOTE: If maximum power can be obtained, record ITT, fuel flow, torque, oil temperature and oil pressure in permanent aircraft records.

(a) If engine does not make maximum torque or maximum temperature adjust maximum power. Refer to Fuel Control Adjustments.

R Table 504. (Codes AA-AC) Power Lever Angle Preflight Ground Setting at 100 Percent Indicated Torque and 65C Oil Temperature

OAT (deg C)	POWER LEVER ANGLE (DEGREES) AT PRESSURE ALTITUDE Sea Level	2000 Ft	4000 Ft	6000 Ft
-40	77	80	83	86
-36	78	81	84	87
-32	79	81	84	87
-28	79	82	85	88
-24	80	82	86	89
-20	80	83	86	90
-16	81	84	87	91
-12	82	85	88	92
- 8	83	86	89	93
- 4	84	87	90	94
0	85	88	92	95
4	86	89	93	96
8	87	91	94	97
12	88	92	96	Turbine Temp Limited
16	90	94	97	
20	92	96	Turbine Temp Limited	
24	93	98		
28	95	Turbine Temp Limited		
32	97			
36	Turbine Temp Limited			

R Table 505. (Codes BA-BC, EA) Power Lever Angle Preflight Ground Setting at 100 Percent Indicated Torque and 65C Oil Temperature

OAT (deg C)	POWER LEVER ANGLE (DEGREES) AT PRESSURE ALTITUDE Sea Level	2000 Ft	4000 Ft	6000 Ft
-40	75	78	81	84
-36	76	79	81	85
-32	76	79	82	85
-28	77	80	82	86
-24	77	80	83	86
-20	78	81	84	87
-16	79	82	85	88
-12	79	83	86	89
- 8	80	83	86	90
- 4	81	84	87	91
0	82	95	89	92
4	83	86	90	94
8	84	88	91	95
12	85	89	93	96
16	87	90	94	98
20	88	92	96	99
24	90	94	98	Turbine Temp
28	92	96	99	Limited
32	94	98	Turbine Temp	
36	96	Maximum	Limited	
40	98	Turbine Temp		
		Limited		

R Table 506. (Codes CA-CC) Power Lever Angle Preflight Ground Setting at 100 Percent Indicated Torque and 65C Oil Temperatue

OAT (deg C)	POWER LEVER ANGLE (DEGREES) AT PRESSURE ALTITUDE Sea Level	2000 Ft	4000 Ft	6000 Ft
-40	77	79	82	85
-36	77	80	82	86
-32	78	80	83	86
-28	78	81	84	87
-24	79	82	84	88
-20	79	82	85	89
-16	80	83	86	90
-12	81	84	87	91
- 8	82	85	88	92
- 4	83	86	89	93
0	84	87	90	94
4	85	88	92	95
8	86	90	93	97
12	88	91	95	Turbine Temp Limited
16	89	93	96	
20	91	94	98	
24	92	96	Turbine Temp Limited	
28	94	98		
32	96	Turbine Temp Limited		
36	98			
40	Turbine Temp Limited			

2. O. Static Reverse Power Check

CAUTION: USE REVERSE POWER CAUTIOUSLY IF BETA RANGE LIGHT DOES NOT COME ON IN THE GROUND OPERATING RANGE WITH SPEED LEVER AT HIGH SPEED POSITION. IF ENGINE SPEED DROPS BELOW 94.5 PERCENT DO NOT CONTINUE FURTHER INTO REVERSE POWER.

NOTE: Refer to Aircraft Flight Manual for minimum limits used during landing.

(1) Place speed lever in high speed position. Move power lever towards full reverse position while monitoring engine rpm. In full reverse position engine rpm should be 94.5 percent minimum.

(2) If engine rpm drops below limits specified, recheck flight idle propeller blade angle under hot oil conditions and perform Underspeed Governor High RPM Check.

P. Reverse Power Symmetry Check (Twin Engine Requirement)

CAUTION: OBSERVE REVERSE POWER LIMITS AS SPECIFIED IN AIRCRAFT FLIGHT MANUAL.

(1) Place both speed levers in the high speed position. Set both power levers to obtain 100 percent engine speed. Pull both power levers smoothly into full reverse. Both engines shall transition into reverse simultaneously. Torque and fuel flow should be symmetrical. If one engine is slow to reverse, recheck separation between underspeed governor and propeller governor at high rpm. Speed separation of governors must be 2.5 percent minimum. If torque and fuel flow are not symmetrical check propeller blade angle at flight idle and reverse.

Q. Flameout Check

(1) Place the power lever in the normal start position and the speed lever at the high speed stop.

(2) Move the speed lever from the high speed to the low speed stop in one second or less. Repeat an additional two times.

(3) The engine shall not flame out and deceleration time shall not exceed 10 seconds.

(4) If limits are not met, recheck the underspeed governor settings in accordance with paragraphs E and F. Reset the speeds within limits and repeat steps (1) through (3).

R 2. R. (Codes AB-AC, BB-BC, CB-LA) Fuel Manifold Purge System

CAUTION: ACTUATION OF THE STOP SWITCH FOLLOWING MANUAL SHUTDOWN OF AN ENGINE EQUIPPED WITH A FUEL PURGE SYSTEM, WILL RESULT IN A FUEL ACCUMULATION IN THE PLENUM. IT IS RECOMMENDED THAT THE ELECTRICAL SHUTDOWN CIRCUITS NOT BE ACTIVATED UNTIL ENGINE COOLING PRECLUDES COMBUSTION, OR IN THE CASE OF INITIAL ENGINE OPERATION WITH INTENTIONAL MANUAL SHUTDOWNS REQUIRED THE PURGE SYSTEM MAY BE DISABLED.

ENGINE EQUIPPED WITH A FUEL-PURGE SYSTEM WILL NOT TOTALLY PURGE UNLESS A MINIMUM ENGINE RPM OF 95 PERCENT IS ATTAINED DURING THE OPERATIONAL CYCLE.

(1) Actuate engine "STOP" circuit for five seconds minimum or until engine speed decreases below ground idle speed.

(2) RPM should increase for about one second when the stop switch is actuated and then decay when the manifold fuel is depleted.

(3) Absence of the momentary speed increase indicates an inoperable purge system.

S. Fuel Manifold and Nozzle Assembly Functional Check

NOTE: Perform the following check at interval specified in 72-00-00, INSPECTION/CHECK or whenever low engine horsepower is indicated or when fuel system is found to be contaminated.

(1) Perform Pneumatic Flow Test (Recommended Method). This test method requires that a baseline run be accomplished on new or cleaned fuel manifold and nozzle assemblies. Subsequent flow test results will be compared to the baseline test to determine extent of nozzle clogging.

NOTE: Fuel manifold and nozzle assembly baseline value is established by one of three methods.

Manufacturer's baseline is established on later assemblies at time of manufacture and is indicated by a value stamped on a metal tag attached to the inlet section of each manifold and nozzle assembly.

If the assembly does not bear a manufacturer's metal tab indicating the baseline value, an engine log book entry should be made to carry a record of the baseline value established at the initial test.

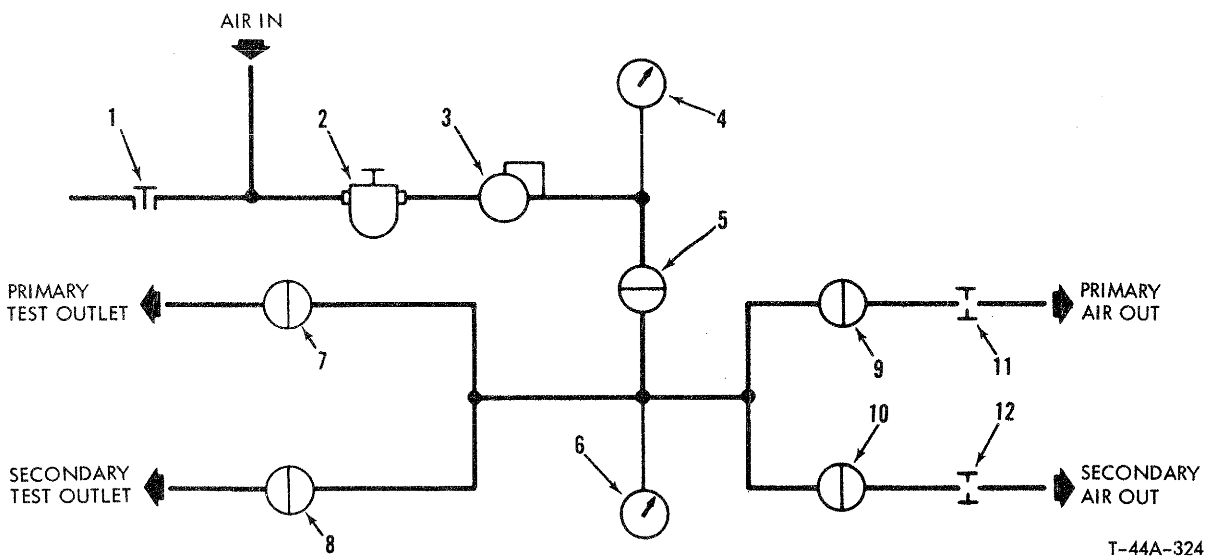
In the event that no metal tag indicating baseline value is installed on the manifold and nozzle assemblies and no log book entry has been made for baseline values, baseline will be arbitrarily established as 80 psig for primary manifold and nozzle assembly and 200 psig for the secondary manifold and nozzle assembly.

2. S. (1) (a) Provide a nitrogen bottle or a source of clean, dry, high pressure air (600 psi).

NOTE: (Pre SB73-0017) The following (recommended) method of testing may be performed by connecting 291613-1/-2/-5 or -6 fuel manifold tester directly to the fuel manifold and nozzle assemblies, referred to as the "direct flow method."

(Post SB73-0017) Testing may be performed by connecting 291613-1/-2/-5 or -6 fuel manifold tester to the drain port of the flow divider and drain valve using 291678-1 and 291679-1 adapters. This test is referred to as the "flow drain method."

(b) Use 291613-1/-2/-5 or -6 fuel manifold tester and test each fuel manifold and nozzle assembly. (See figure 501.)



R 1. RELIEF VALVE
2. FILTER
R 3. PRESSURE REGULATING VALVE (291613-1/-5) (TESTER ONLY)
4. PRESSURE GAGE
5. VERNIER TRIM VALVE
6. PRESSURE GAGE
7. SHUTOFF VALVE
8. SHUTOFF VALVE
9. SHUTOFF VALVE
10. SHUTOFF VALVE
11. RESTRICTOR (291800-1)
12. RESTRICTOR (291800-2)

Test Setup for Fuel Manifold Tester Part No. 291613-1/-2/-5 and -6
R Figure 501

CAUTION: TO PREVENT ERRONEOUS TEST RESULTS, LEAK TEST LOCALLY FABRICATED TEST LINES UNDER 400 PSIG AIR OR NITROGEN PRESSURE.

NOTE: During the following tests all valves shall be in the OFF position (regulator valve counterclockwise) except those required to be opened. Do not use excessive force when opening or closing tester valves.

2. S. (1) (c) (Pre SB73-0017) Perform primary manifold and nozzle assembly test, direct flow method as follows.

1 Disconnect primary and secondary manifold and nozzle assemblies from flow divider and drain valve.

2 Connect test lines (six foot lengths of dash four flex line, locally fabricated) from primary and secondary manifold and nozzle assemblies on the engine to the respective test outlets on fuel manifold tester shown on Figure 503.

R NOTE: 291613-2/-6 fuel manifold testers do not
R contain pressure regulators, therefore use
R shop regulators. Relief valve in all
R testers is pre-set to 285 to 325 psi. If
R leakage is heard from within tester,
R reduce source pressure.

3 Turn air source on to 280 psi and adjust pressure regulating valve (3) to indicate 160 psig on gage (4). Open valve (9) to allow airflow through restrictor (11), then adjust trim valve (5) to indicate 80 psig on gage (6).

NOTE: A decreased pressure compared to baseline indicates a possible leak path such as loose fittings or nozzle tip and should be investigated.

4 Open valve (7) fully to primary manifold and nozzle assembly and close valve (9). Record reading on gage (6). This pressure reading will serve as a comparison with baselines established in step S.(1)NOTE if available or the arbitrary baseline of 80 psig to determine the extent of nozzle clogging. An increase of 21 psig over baseline is equivalent to one clogged nozzle (table 507) and indicates that the primary manifold and nozzle assembly shall be removed and replaced or cleaned.

Table 507. Test Pressures and Sensitivities - Direct Flow Method

Part Name	Regulated Pressure. Gage (4, figure 501)	Pressure Gage (6, figure 501)	Rise in psig on Gage (6, figure 503) for clogged nozzles. One clogged nozzle	Two clogged nozzles
Primary Fuel Manifold	160 psig	80 psig	21 psig	47 psig
Secondary Fuel Manifold	280 psig	200 psig	14 psig	28 psig

R 2. S. (1) (d) (Post SB73-0017) Perform secondary manifold and nozzle assembly test, direct flow method, as follows.

R NOTE: 291613-2/-6 fuel manifold testers do not con-
R tain pressure regulators, therefore use shop
R regulators. Relief valve in 291613-1/-5
R testers is pre-set to 285 to 325 psi. If
R leakage is heard within tester, reduce source
R pressure.

1 Turn air source on and adjust pressure regulating valve (3) to indicate 280 psig on gage (4). Open valve (10) to allow airflow through restrictor (12), then adjust trim valve (5) to indicate 200 psig on gage (6).

NOTE: A decrease in pressure compared to baseline indicates a possible leak path such as loose fittings or nozzle tip and should be investigated.

2 Open valve (8) fully to secondary manifold and nozzle assembly and close valve (10). Record reading on gage (6). This pressure reading will serve as a comparison with baselines established in step S.(1)NOTE if available or the arbitrary baseline of 200 psig to determine the extent of nozzle clogging. An increase of 14 psig over baseline is equivalent to one clogged nozzle (table 507) and indicates that the secondary manifold and nozzle assembly shall be removed and replaced or cleaned.

(e) Increases in gage (6) pressures of 21 psig for primary and 14 psig for secodary manifold and nozzle assembly are maximum increases permitted. Manifold and nozzle assemblies shall be replaced or cleaned if it is anticipated that they will exceed these limits prior to the next scheduled inspection.

2. S. (1) (f) Close air source valve to tester. Disconnect tester and set all valves to OFF position.

(2) (Post SB73-0017) Primary and secondary manifold and nozzle assemblies test, flow drain method.

(a) Perform primary manifold and nozzle assembly test, flow drain method, as follows.

1 Disconnect drain line, then remove drain fitting from flow divider and drain valve. Install 291678-1-1 primary manifold flow test adapter in drain port of the flow divider and drain valve.

2 Connect test lines (six foot length of dash four flex line, locally fabricated) from fuel manifold tester outlet to the flow test adapter fitting. Provide a source (600 psi) of clean dry nitrogen or air.

R NOTE: 291613-2/-6 fuel manifold testers do not
R contain pressure regulator, therefore use
R shop regulator. Relief valve in 291613-
R 1/-5 testers is pre-set to 285 to 325 psi.
R If leakage is heard within tester, reduce
R source pressure.

3 Turn air source on and adjust pressure regulating valve (3) to indicate 160 psig on gage (4). Open valve (9) to allow airflow through restrictor (11), then adjust trim valve (5) to indicate 80 psig on gage (6).

NOTE: A decrease in pressure compared to baseline indicates a possible leak path such as loose fittings or nozzle tip and should be investigated.

4 Open valve (7) fully to primary manifold and nozzle assembly and close valve (9). Record reading on gage (6). This pressure reading will serve as a comparison with baselines established as in step S.(1)NOTE if available or the arbitrary baseline of 80 psig to determine the extent of nozzle clogging. An increase of 21 psig over baseline is equivalent to one clogged nozzle (table 508) and indicates that the primary manifold and nozzle assembly shall be removed and replaced or cleaned.

(b) Perform secondary manifold and nozzle assembly test, flow drain method, as follows.

1 Install 291679-1-1 secondary manifold flow test adapter in drain port of the flow divider and drain valve.

2. S. (2) (b) 2 Connect test lines (six foot length of dash four flex line, locally fabricated) from fuel manifold tester outlet to the flow test adapter fitting.

R NOTE: 291613-2/-6 fuel manifold testers do not
R contain pressure regulator, therefore use
R shop regulator. Relief valve in all
R testers is pre-set to 285 to 325 psi. If
R leakage is heard within tester, reduce
R source pressure.

3 Turn air source on and adjust pressure regulating valve (3) to indicate 280 psig on gage (4). Open valve (10) to allow airflow through restrictor (12), then adjust trim valve (5) to indicate 200 psig on gage (6).

NOTE: A decrease in pressure compared to baseline indicates a possible leak path such as loose fittings or nozzle tip and should be investigated.

4 Open valve (8) fully to secondary manifold and nozzle assembly and close valve (10). Subtract three psi from reading on gage (6) and record. This pressure reading will serve as a comparison with baselines established as in step S.(1)NOTE if available or the arbitrary baseline of 200 psig to determine the extent of nozzle clogging. An increase of 14 psig over baseline is equivalent to one clogged nozzle (table 508) and indicates that the secondary manifold and nozzle assembly shall be removed and replaced or cleaned.

Table 508. Test Pressures and Sensitivities - Flow Drain Method

Part Name	Regulated Pressure. Gage (4, figure 501)	Pressure Gage (6, figure 501)	Rise in psig on Gage (6, figure 501) for clogged nozzles: One clogged nozzle	Two clogged nozzle	Correction
Primary Fuel Manifold	160 psig	80 psig	21 psig	47 psig	0
Secondary Fuel Manifold	280 psig	200 psig	14 psig	28 psig	-3 psig

2. S. (2) (b) 5 Increase in gage (6) pressures of 21 psig for primary and 14 psig for secondary manifold and nozzle assembly are maximum increases permitted. Manifold and nozzle assemblies shall be replaced or cleaned if it is anticipated that they will exceed these limits prior to the next scheduled inspection.

6 Remove test line and secondary manifold flow test adapter. Install drain fitting in fuel flow divider and drain valve and connect drain line.

(3) Perform differential pressure test (Alternate Method) as follows.

(a) Ensure aircraft fuel flow measuring system is calibrated.

(b) Connect pressure gage 0 - 600 psi into line between the fuel shutoff valve and the flow divider and drain valve assembly with tee to read fuel pressure.

(c) Connect pressure gage 0 - 150 psi into compressor discharge pressure line using tee between the turbine plenum and the fuel control heated line to measure compressor discharge pressure (P3).

(d) Operate engine at high rpm. Set up fuel flows at 250, 300 and 350 lb/hr (observe turbine temperature limits). Record fuel pressure and compressor discharge pressure (P3) for each fuel flow setting.

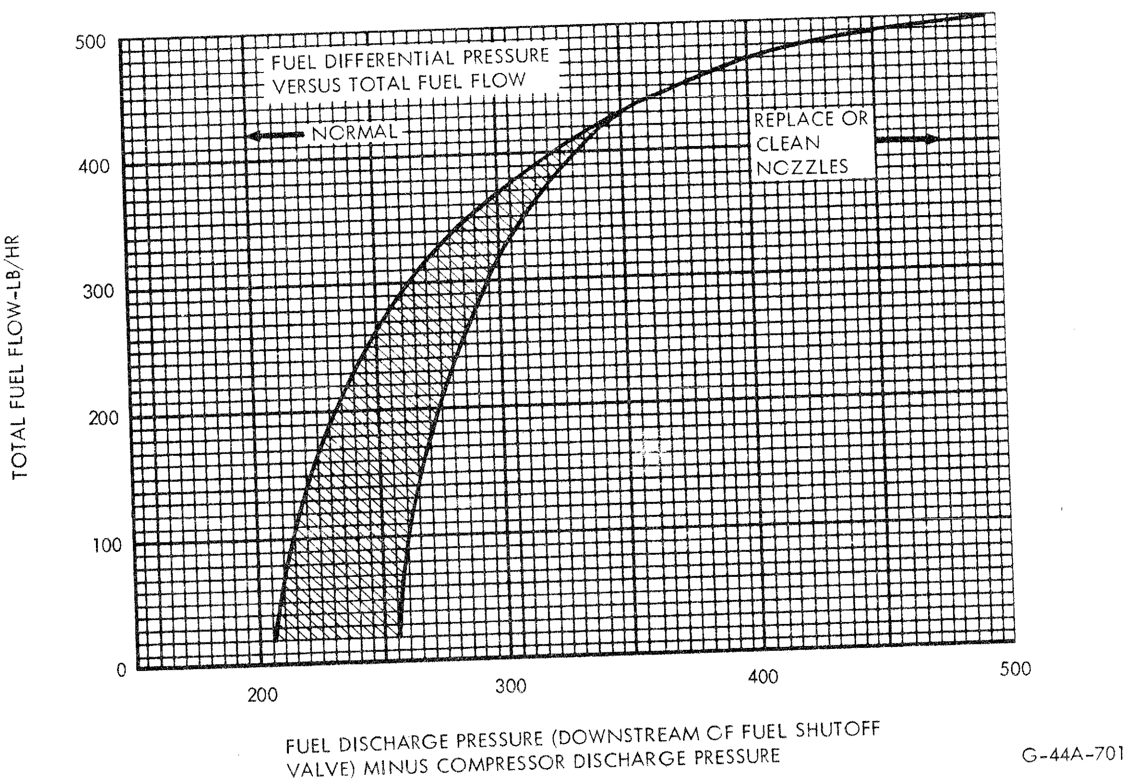
(e) Subtract compressor discharge pressure (P3) from fuel pressure for each power setting and plot these differential pressure points on chart (figure 502).

NOTE: A defective flow divider and drain valve could result in false nozzle clogging indications that may cause the removal of clean fuel nozzles. If flow divider and drain valve is suspected; inspect clean or replace flow divider and drain valve assembly. Refer to 73-10-07, MAINTENANCE PRACTICES.

(f) If differential pressure points are plotted to the right of the curve nozzles should be replaced or cleaned. Pressure points plotted to the left of the curve are considered normal. Pressure points slotted within the shaded area indicate questionable nozzles which may result from flow divider variation as well as fuel nozzle clogging. If manifold and nozzle assembly is suspected; inspect clean or replace nozzles. Refer to 73-10-09, MAINTENANCE PRACTICES.

R

NOTE:
SHADED AREA IS RESULT OF FLOW DIVIDER VARIATION. MANIFOLDS WHICH FALL IN THIS ZONE SHOULD BE REPLACED OR CLEANED.



Fuel Flow/Pressure Check
Figure 502

2. T. Inlet Anti-Ice Valve Check

(1) Start engine normally. Refer to applicable Aircraft Flight Manual.

(2) With propeller off start locks, speed lever at high rpm and power lever at ground idle (position providing minimum fuel flow), place inlet anti-icing valve switch in on position and check that inlet anti-icing valve indicator light illuminates and ITT increases.

(3) Return anti-icing valve switch to off position. Ensure light goes out and ITT returns to normal.

(4) Shut down engine.

U. NTS Test System Check

(1) Perform ground check of NTS test system in accordance with Aircraft Flight Manual.

V. Functional Check of Engine to Assure NTS Operation

(1) Perform engine start in accordance with Aircraft Flight Manual.

NOTE: Operate engine until oil temperature reaches normal operating range.

(2) Operate engine with propeller off start locks, speed lever at high speed position, power lever at ground idle (position providing minimum fuel flow), brakes off and aircraft wheel chocks removed.

NOTE: Procedure of the following step is similar to shutting engine down on the ground except the power lever is not placed in the reverse position.

(3) Fuel chop engine (shut off engine fuel flow) by placing engine run switch to off. A surge shall be felt from engine, indicating NTS operation. When engine speed has decayed to 50 percent move power lever to reverse position to ensure propeller blades engage start locks. If satisfactory NTS operation is not indicated, do not repeat procedure until NTS system has been corrected.

W. (Codes AA-AC, CA-CC FA, KA, LA) Ground Check of NTS Lockout

(1) Turn unfeathering pump on. Place speed lever in low position and power lever at flight idle.

(2) Depress and hold NTS test switch. NTS light shall illuminate.

(3) Move power lever to ground idle position. NTS light shall go out.

2. W. (4) Move power lever to flight idle position. NTS light shall illuminate.

(5) Release NTS test switch. Turn unfeathering pump off.

R X. (Codes AA-AC, CA-CC, FA, KA, LA) Pressure Check of Propeller Governor Reset Function and NTS Lockout System

(1) (Codes CA-CC, KA) Remove tee at position A (figure 503) and install a cross fitting. Connect tube assemblies to cross and install gage 0 - 600 psi on open port of cross.

R (2) (Codes AA-AC, FA, LA) Remove tee if installed, and install cross fitting at position A, or remove cap from cross. Install gage 0 - 600 psi on open port of cross.

(3) Operate the engine. With the speed lever at both 94 percent rpm and maximum 100 percent rpm and with power lever positioned from flight idle to maximum available (do not exceed SHP or ITT limits), pressure on gage at position A shall be 250 psig minimum.

(4) Position the speed lever to maximum and position power lever to select reverse blade angle. The pressure at position A shall not exceed 20 psig at full reverse thrust.

(5) With power lever positioned to 885C ITT or 700 SHP, position the speed lever to establish 94 percent rpm. Lock speed lever in position. Position power lever at ground idle. Shut down engine.

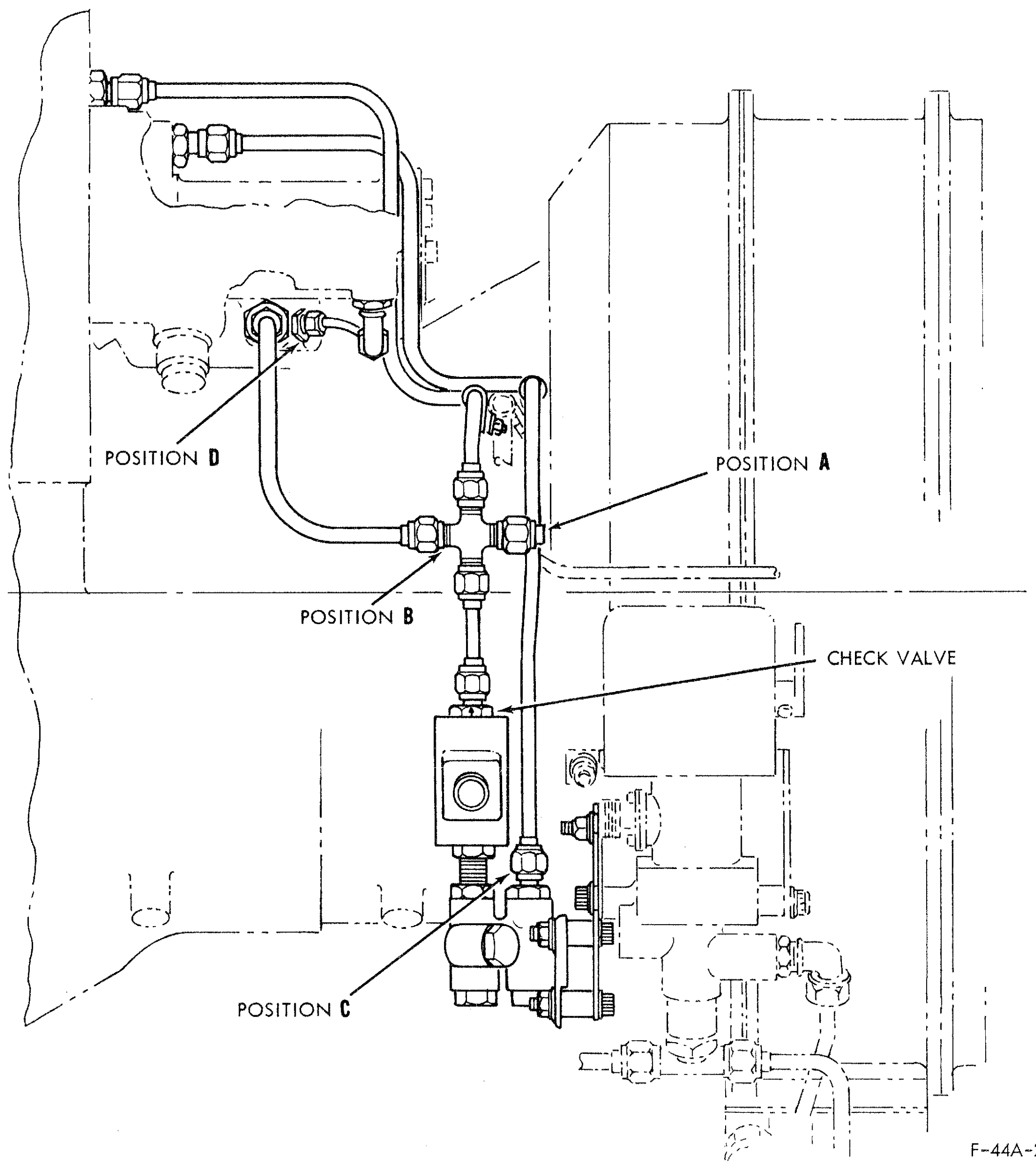
(6) Disconnect tube assembly from cross and install a cap on cross at position B on Figure 503. Operate engine. With the condition lever positioned per step (4) above, advance power lever to 885C ITT or 700 SHP. Engine speed shall be a minimum of 5 percent greater than preceding value.

NOTE: NTS lockout system pressure below 250 psig for forward thrust operation, or, above 20 psig for reverse thrust operation is not acceptable. In addition, the propeller governor shall reset approximately five percent upward with pressure line disconnected.

(7) Remove cap at position B and pressure gage from position A.

(8) (Codes CA-CC, KA) Remove cross. Reinstall tee.

(9) Reinstall tube assemblies.



R (Codes AA-AC, CA-CC, FA, KA, LA) (Typical) Propeller
R Governor Reset and NTS Lockout System Test
Figure 503

2. X. (10) If the engine fails to meet pressure requirements outlined in steps (3) and (4), refer to 72-00-00, TROUBLE SHOOTING.

(11) Engines which fail to pass check outlined in step (3) shall be flight tested to ensure proper NTS function after correct pressures are obtained.

Y. NTS Calibration Check by Flight Test

NOTE: Refer to Aircraft Flight Manual for operating procedures relating to engine shutdown and air-start procedures for this test.

(1) Attain an indicated airspeed between 120 to 140 knots.

(2) Attain an altitude of 5000 feet with altimeter set at 29.92.

(3) Fuel chop the engine by placing engine run switch to stop and power lever at take-off. Procedure is similar to shutting engine down on ground except power lever is not placed in reverse position.

CAUTION: IF ENGINE RPM DOES NOT DECAY TO 40 PERCENT OR BELOW WITHIN 30 SECONDS OR AN EXCESSIVE AMOUNT OF DRAG IS EXPERIENCED ON THE FUEL CHOPPED ENGINE, FEATHER IMMEDIATELY.

(4) RPM shall decay to 40 percent within 30 seconds.

CAUTION: DO NOT ALLOW ENGINE TO WINDMILL IN RPM RANGE BETWEEN 20 AND 26 PERCENT.

NOTE: Intentional windmilling of this engine in the 18 to 28 percent RPM range is prohibited in normal operation. This limit has been modified to 20 to 26 percent RPM for this aircraft flight test only.

(5) Allow engine to windmill down to 30 percent RPM then feather engine. Thirty percent RPM should be reached in less than 40 seconds.

(6) Allow engine to stabilize at feather for two minutes.

TEMPORARY REVISION NO. 72-144

To holders of Turboprop Aircraft Engine Maintenance Manual Report No. 72-00-95, Revision 5, dated March 28, 1980. Insert facing page 538, 72-00-00.

ENGINE PART NO.	ENGINE MODEL NO.	AIRCRAFT APPLICATION
895720-1/-2/-3	TPE331-5-251K	Turbo Commander 690/690A/690B
896160-1/-2/-3	TPE331-6-251M	Mitsubishi MU-2J/ 2K/2L/2M
896950-1-1/-2/-3	TPE331-5-251C	Casa 212
3101300-2	TPE331-6-252M	Mitsubishi MU-2J/ 2K/2L/2M
3101630-1	TPE331-6-252B	Beech B100
3101840-1	TPE331-5-252M	Mitsubishi MU-2N/2P
3102450-1	TPE331-6A-251M	Mitsubishi MU-2J/ 2K/2L/2M
3102520-1	TPE331-5-252K	Turbo Commander 690A/690B
3102520-2	TPE331-5-254K	Turbo Commander 690C

Reason: To revise time limit for RPM decay during NTS flight check to clarify total time allowed for RPM decay.

Use the following step 2.Y.(5) in lieu of existing step 2.Y.(5).

2. Y. (5) Allow engine to windmill down to 30 percent RPM, then feather engine. Thirty percent RPM should be reached in less than 60 seconds total time. Propeller shall not stop rotating during this time.

CAUTION: DO NOT ALLOW ENGINE TO WINDMILL IN RPM RANGE BETWEEN 20 AND 26 PERCENT.

NOTE: Intentional windmilling of this engine in the 18 to 28 percent RPM range is prohibited in normal operation. This limit has been modified to 20 to 26 percent RPM for this aircraft flight test only.

2. Y. (7) Unfeather engine using unfeathering pump and allow engine to windmill. Take action, as appropriate. to prevent fuel and ignition from coming on. Engine should reach a minimum of 12 percent RPM but not exceed 20 percent RPM in 30 seconds.

(8) When above windmilling checks have been satisfactorily completed, feather engine and conduct a normal air start in speed range of 120 to 180 knots indicated airspeed using normal airstart procedures. Refer to Aircraft Flight Manual.

(9) If the above NTS checks are not satisfactory no further attempts at engine fuel chops shall be made until NTS system is corrected.

R Z. (Codes AA-AC, FA, LA) Torque Limiter Test

(1) Start engine in accordance with Aircraft Flight Manual.

(2) Operate engine until oil temperature is in normal operating range.

(3) Place engine speed lever at high speed position.

(4) Unlatch propeller.

(5) Set power lever for 100 percent engine speed.

(6) Place torque limiter switch ON.

(7) Depress torque test switch until a reduction in engine speed is noted.

(8) Shut down engine in accordance with Aircraft Flight Manual.

R AA. (Codes BA BC, EA, GA, KA) Torque and ITT Temperature Limiter Test

(1) Start engine in accordance with Aircraft Flight Manual.

(2) Operate engine until oil temperature is at normal operating range.

(3) Position engine speed lever at maximum.

2. AA. (4) Unlatch propeller.

(5) Set power lever for 100 percent engine speed.

(6) Place torque and ITT temperature limiter switch ON.

(7) Depress torque test switch to torque position and then to ITT position. Engine speed shall decrease to underspeed governor setting in both cases.

(8) Shut down engine in accordance with Aircraft Flight Manual.

NOTE: Spectrographic Oil Analysis Program (SOAP) has proved to be effective at other than intervals recommended in diagnosing engine problems. Therefore, it is recommended an oil sample (with oil filter) be submitted for analysis when an intermittent or change in engine operating parameter occurs. Example: fluctuating oil pressure, change in audible noise level, etc.

3. Oil System Contamination - Oil Filter Analysis Check

NOTE: The following procedures are required after any repair which requires removal of intermediate gearbox (diaphragm) assembly. Inspect engines that have had gearbox repair that have at least ten but not more than 25 hours operating time since repair.

A. Inspect Oil System for Contamination

(1) Remove oil filter element in accordance with 79-20-02, MAINTENANCE PRACTICES.

(2) Perform inspection of oil filter element by carefully spreading the pleated segments and visually checking for trapped metal particles. Be careful not to damage or mutilate the filter element. A check for presence of magnetic particles may be accomplished by passing a clean magnet along the inside surface of the filter element and observing the reaction of the particles on the outside of the filter. This will leave the particles in place for future analysis. If a greater than normal amount of metal particles are found in the filter, and are considered to be more than normal gear train wear, contact AiResearch Manufacturing Company, Propulsion Customer Service Engineering, Department 77-4-601, Phoenix, Arizona (Telephone: Area Code 602, 267-3011 extension 4098 or 3257) for guidance and further instructions.

R
R
R
R NOTE: Sampling Kit (Part No. 287545-1) is available from any approved AiResearch Service Center as listed in AiResearch Service Information Letter (SIL) P331-27.

R
R 3. A. (3) Place removed oil filter element in large container provided in 287545-1 Sampling Kit.

R (4) Install new oil filter element in engine.

R
R
R
R
R NOTE: Make sure oil sample obtained in the following step represents the condition of the engine by following the directions contained in the sampling kit. Sample to be analyzed should come from a warm engine within 30 minutes after shutdown.

R
R
R (5) Siphon an oil sample from engine oil tank at filler cap using plastic tube provided in sampling kit. Route plastic tube into small container provided in sampling kit to contain oil sample.

R
R
R
R (6) Prepare sampling kit for shipment in accordance with instructions provided in sampling kit. Refer to AiResearch Service Information Letter (SIL) P331-97 to obtain address of approved oil analysis facility.

R 4. Engine Fuel Control Adjustments

R
R
R
R
R
R NOTE: The fuel control adjustments outlined in this paragraph are necessary only when indicated by specific operating parameters or requirements. Adjustment rates outlined in Table 509 or 510 may be used when adjustments are required. The direction of rotation of adjustment screws is determined by facing end that accepts key wrench.

R
R
R Fuel control adjustment sequence is contained in Table 511 or 512. Use of this data may eliminate excessive readjustments and trail runs.

R
R Adjustments points are shown in Figures 504, 505, 506, 507, 509, and 510.

R
R
R
R Upon completion of adjustments perform operational check according to type of adjustment made and make entry in permanent aircraft records noting engine time, type and amount of adjustment accomplished.

Table 509. (Codes AA-EA) Fuel Control Adjustment Rates (Bendix)

Figure No.	Adjustment Point	*Adjustment Rate
504	Specific gravity adjustment	Set to type fuel being used 1. One click of specific gravity adjustment changes specific gravity setting 0.02. A specific gravity adjustment of 0.06 (three clicks) is equal to approximately one turn on maximum power adjusting screw. Degreasing the specific gravity adjustment increases maximum power. 2. One click of specific gravity adjustment is equivalent to approximately two degrees of power lever travel for maximum power on ground. 3. If the specific gravity adjustment does not provide enough adjustment, maximum power trim adjusting screw may be used to restore adjustability range.
504	Start flow adjustment	One click cw = 0.75 pounds per hour decrease

*The adjustment rate is an approximate value and is intended only as a guide for the maintenance technician.

R Table 509. (Codes AA-EA) Fuel Control Adjustment Rates (Bendix) (Cont)

Figure No.	Adjustment Point	*Adjustment Rate
504	Underspeed governor minimum stop (low rpm stop)	One turn cw = 2.0 percent speed increase setting
504	Underspeed governor maximum stop (high rpm stop)	One turn cw = 1.0 percent speed increase setting
504	Overspeed governor adjustment	One-fourth turn cw = 2.0 percent speed increase setting
504	Maximum power trim adjustment	One turn cw = Approx 15 pounds per hour fuel flow increase
504	Flight-idle fuel flow adjustment	One click cw = 2.5 pounds per hour increase fuel flow

R *The adjustment rate is an approximate value and is intended only as a
R guide for the maintenance technician.

Table 510. (Codes FA-LA) Fuel Control Adjustment Rates (Woodward)

Figure No.	Adjustment Point	*Adjustment Rate
	NOTE: Fuel trim adjustment may be used as an alternate to adjustment of maximum power trim adjusting screw. Intermediate fuel flow will be affected when fuel trim adjustment is made.	
505, 506	Fuel trim adjustment 1. Fuel trim adjustment of three clicks is equal to approximately one turn on the maximum power adjusting screw. Clockwise movement of fuel trim adjustment increases maximum power. 2. If fuel trim adjustment does not provide enough adjustment, maximum power trim adjusting screw may be used to restore adjustability range.	One click cw = 4 pounds per hour increase fuel flow and approximately 8C at cruise
507	Acceleration schedule adjustment	One turn cw = 100 pounds per hour increase fuel flow (3/16 turn maximum allowable adjustment)
505, 506	Underspeed governor minimum stop (low rpm stop)	One turn cw = 2.0 percent speed increase setting
505, 506	Underspeed governor maximum stop (high rpm stop)	One turn cw = 1.0 percent speed decrease setting

*The adjustment rate is an approximate value and is intended only as a guide for the maintenance technician.

R Table 510. (Codes FA-LA) Fuel Control Adjustment Rates (Woodward) (Cont)

R	Figure No.	Adjustment Point	*Adjustment Rate
R		NOTE: When adjusting overspeed governor with external adjustment, hold adjusting screw until lock nut is loosened, then hold lock nut while turning adjusting screw.	
R	505, 506	Overspeed governor adjustment	One turn cw = 4.7 percent speed increase setting
R		NOTE: A change in intermediate fuel flow setting will result in corresponding change in maximum power adjustment setting.	
R	505, 510	Intermediate (flight-idle) fuel flow adjustment	One click cw = 2 pounds per hour increase fuel flow
R		CAUTION: DO NOT EXCEED +1.5/-1.5 TURN ADJUSTMENT OF MAXIMUM POWER TRIM ADJUSTMENT.	
R	505, 510	Maximum power trim adjustment	One turn cw = 20 pounds per hour fuel flow increase

R *The adjustment rate is an approximate value and is intended only as a
R guide for the maintenance technician.

R Table 511. (Codes (AA-EA) Fuel Control Sequence of Adjustments (Bendix)

R	Adjustment Sequence	Procedure	Affect on Other Adjustments
R	1. Specific gravity	Set to type of fuel being used	Affects all other fuel control adjustments (fuel schedules) except overspeed governor.
R	2. Start flow	Adjust to maintain peak ITT start temperature and start time within specified limits. Ascertain Service Bulletins 73-0030, 73-0064 and 73-0085 have been accomplished if problems are experienced.	Affects all other fuel control adjustments (fuel schedules) except overspeed governor. Affects power lever matching and maximum fuel available at altitude.
R	3. Underspeed governor low and high	-	Affects maximum power and flight idle.
R	4. Overspeed governor	Other adjustments to fuel control do not affect overspeed governor adjustment once it is set correctly.	Affects maximum power and flight idle if set too low.
R	5. Maximum power trim adjustment	All previous adjustments must be set correctly before maximum power trim adjustment is set.	Affects flight idle adjustment Affects power lever matching at takeoff and low altitudes.
R	6. Flight idle	Accomplish as last adjustment in adjustment sequence.	No affect on previous adjustments.

R Table 512. (Codes FA-LA) Fuel Control Sequence of Adjustment (Woodward)

	Adjustment Sequence	Procedure	Affect on Other Adjustments
R	1. Specific gravity (Fuel trim)	Set to type of fuel being used	Affects maximum power and all other adjustments (Fuel schedules) except overspeed governor.
R	2. Acceleration schedule	Adjust to maintain peak ITT start temperature and start time within specified limits.	Affects all other fuel control adjustments (fuel schedules) except overspeed governor.
R	3. Underspeed governor low and high	-	Independent of other adjustments.
R	4. Overspeed governor	Other adjustments to fuel control do not affect overspeed governor adjustment once it is set correctly	Affects flight idle and maximum power if set too low.
R	5. Flight idle	-	Affects maximum power adjustment.
R	6. Maximum power trim adjustment	Accomplish as last adjustment in adjustment sequence	No affect on previous adjustments. Affects power lever matching.

NOTE: Log book entry required for any adjustment made.

4. A. (Codes AA-EA) Fuel Control Adjustments (Bendix)

(1) Adjust fuel trim (specific gravity) as follows. (See figure 504.)

NOTE: If specific gravity adjustment has been varied from recommended setting to accomplish maximum power trim adjustment, change specific gravity adjustment by the difference between actual fuel specific gravities when a change in fuel type is made in order to maintain maximum power trim adjustment.

When fuels are mixed, the proper specific gravity setting is obtained by multiplying the specific gravity of each fuel by the percentage of the fuel used and adding the results.

(a) Use specific gravity Table 513 when making adjustments at fuel control unit. Adjust fuel control unit to correspond with type fuel being used, using following adjustment rates.

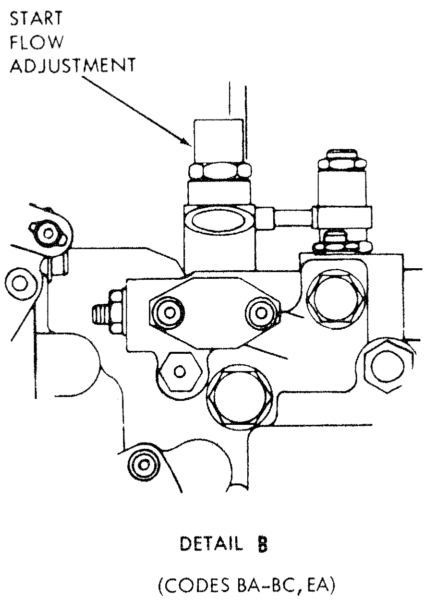
1 One click of specific gravity adjustment changes specific gravity setting 0.02. A specific gravity adjustment of 0.06 (three clicks) is equal to approximately one turn on maximum power adjusting screw. Decreasing specific gravity adjustment increases maximum power.

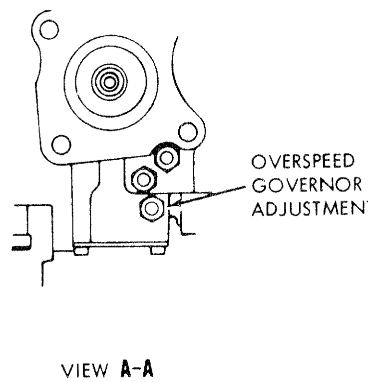
2 One click of specific gravity adjustment is equivalent to approximately two degrees of power lever travel for maximum power on ground.

3 If specific gravity adjustment does not provide enough adjustment, maximum power trim adjusting screw may be used to restore adjustability range.

Table 513. Fuel Control Specific Gravity Adjustments (Bendix)

Fuel Used	Recommended Specific Gravity Setting
ASTM D1655-66T, Jet A	0.80
ASTM D1655-66T, Jet A-1	0.80
ASTM D1655-66T, Jet B	0.77
MIL-T-5624G-1, JP-4	0.77
Aviation Gas (80/87 octane)	0.69
MIL-F-5616-1, JP-1	0.81
MIL-T-5624G-1, JP-5	0.83





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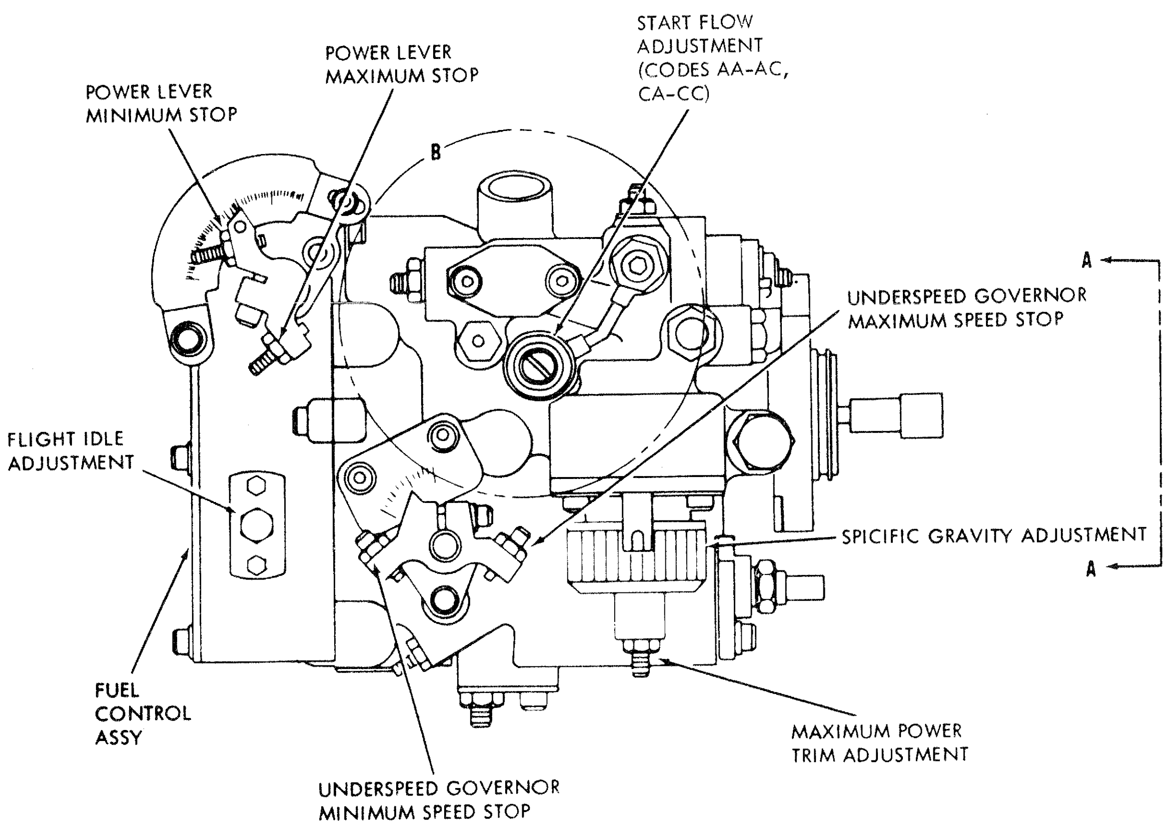


F-44A-2673R4

R

(Codes AA-EA) Fuel Control Adjustment Points (Bendix)
Figure 504

4. A. (2) Adjust start flow as follows. (See figure 504.)

NOTE: (Post SB73-0030 or Bendix SB GT No. 71) Start-flow adjustment sensitivity is increased from 0.8 pph per click to 2.0 pph per click due to replacement of start-flow adjustment valve assembly. The replacement valve assembly has B-40 or D-40 etched on head. Increased adjustment sensitivity must be compensated for when start-flow adjustment is used for altitude power trim adjustment.

Start-flow adjustment affects all schedules and shall be checked and adjusted prior to adjustment of flight idle and maximum power. If the temperature margin of 200C (392F) is consistently available, adjust the slow engine to match the faster engine. Match the engines to within ten seconds.

(a) (Pre SB73-0030 or Bendix SB GT No. 71) Turn start flow adjustment screw one click counterclockwise to obtain 0.75 pounds per hour increase in fuel flow.

(b) (Post SB73-0030 or Bendix SB GT No. 71) Turn start flow adjustment screw one click counterclockwise to obtain 2.0 pounds per hour increase in fuel flow.

(3) Adjust underspeed governor low rpm as follows. (See figure 504.)

(a) If engine rpm does not stabilize at limit specified in Table 503, adjust minimum speed stop on underspeed governor. Turning adjustment screw one turn clockwise will increase engine rpm 2.0 percent.

(b) Recheck and adjust linkage between underspeed governor and propeller governor for proper operation following any adjustment of underspeed stop. Refer to 76-10-01, MAINTENANCE PRACTICES.

(4) Adjust underspeed governor high rpm as follows. (See figure 504.)

(a) If engine rpm does not stabilize at limit specified in Table 503, adjust maximum speed stop on underspeed governor. Turning adjustment screw one turn clockwise will decrease engine rpm 1.0 percent.

(b) Recheck and adjust linkage between underspeed governor and propeller governor for proper operation following any adjustment of underspeed governor stop. Refer to 76-10-01, MAINTENANCE PRACTICES.

R 4. A. (5) Adjust overspeed governor as follows. (See figure 504.)

R NOTE When adjusting overspeed governor, hold adjusting screw until lock nut is loosened, then hold lock nut while turning adjusting screw

R (a) Loosen lock nut on adjusting screw and adjust overspeed governor as required. One-fourth turn clockwise will increase engine rpm 2.0 percent.

R (b) Tighten lock nut while holding adjusting screw at adjusted position.

R (6) Adjust maximum power trim adjustment as follows. (See figure 504.)

R NOTE: When adjusting maximum power trim, hold adjusting screw until lock nut is loosened, then hold lock nut while turning adjusting screw.

R A maximum of two turns in either direction from the factory setting is permissible. Do not adjust external stops of the power lever shaft.

R (a) Loosen lock nut on maximum power trim adjustment screw and adjust maximum power trim as required. One turn clockwise of adjustment screw produces a nominal fuel flow increase of 12 to 15 pounds per hour.

R (b) Hold adjustment screw and tighten lock nut to 30 inch-pounds torque and lockwire lock nut.

R (7) Adjust flight idle fuel flow as follows. (See figure 504.)

R CAUTION: ALTHOUGH ADJUSTMENT OF THE FLIGHT IDLE FUEL FLOW TO A SPECIFIC RPM MAKES THE AIRCRAFT SAFE FOR FLIGHT TEST, FINAL EVALUATION OF FUEL FLOW MUST BE DETERMINED BY FLIGHT TEST AND NOTATIONS RELATIVE TO ENGINE RPM NOTED IN RESPECTIVE PERMANENT AIRCRAFT RECORDS IN ORDER TO PREVENT ADDITIONAL, UNNECESSARY ADJUSTMENTS BY MAINTENANCE PERSONNEL.

R (a) Turn adjustment screw as required to obtain desired rpm. One click clockwise will increase fuel flow a nominal 2.5 pounds per hour.

NOTE: Log book entry required for any adjustment made.

4. B. (Codes FA-LA) Fuel Control Adjustments (Woodward)

(1) Adjust fuel trim (specific gravity) as follows. (See figure 505 or 506.)

(a) Use specific gravity Table 514 when making initial adjustments to fuel control unit not previously adjusted. Adjust fuel control unit to correspond with type fuel being used.

Table 514. Fuel Control Specific Gravity Adjustments (Woodward)

Fuel Used	Recommended Specific Gravity Setting
ASTM D1655-66T, Jet A	0.80
ASTM D1655-66T, Jet A-1	0.80
ASTM D1655-66T, Jet B	0.77
MIL-T-5624G-1, JP-4	0.77
Aviation Gas (80/87 octane)	0.69
MIL-F-5616-1, JP-1	0.81
MIL-T-5624G-1,JP-5	0.83

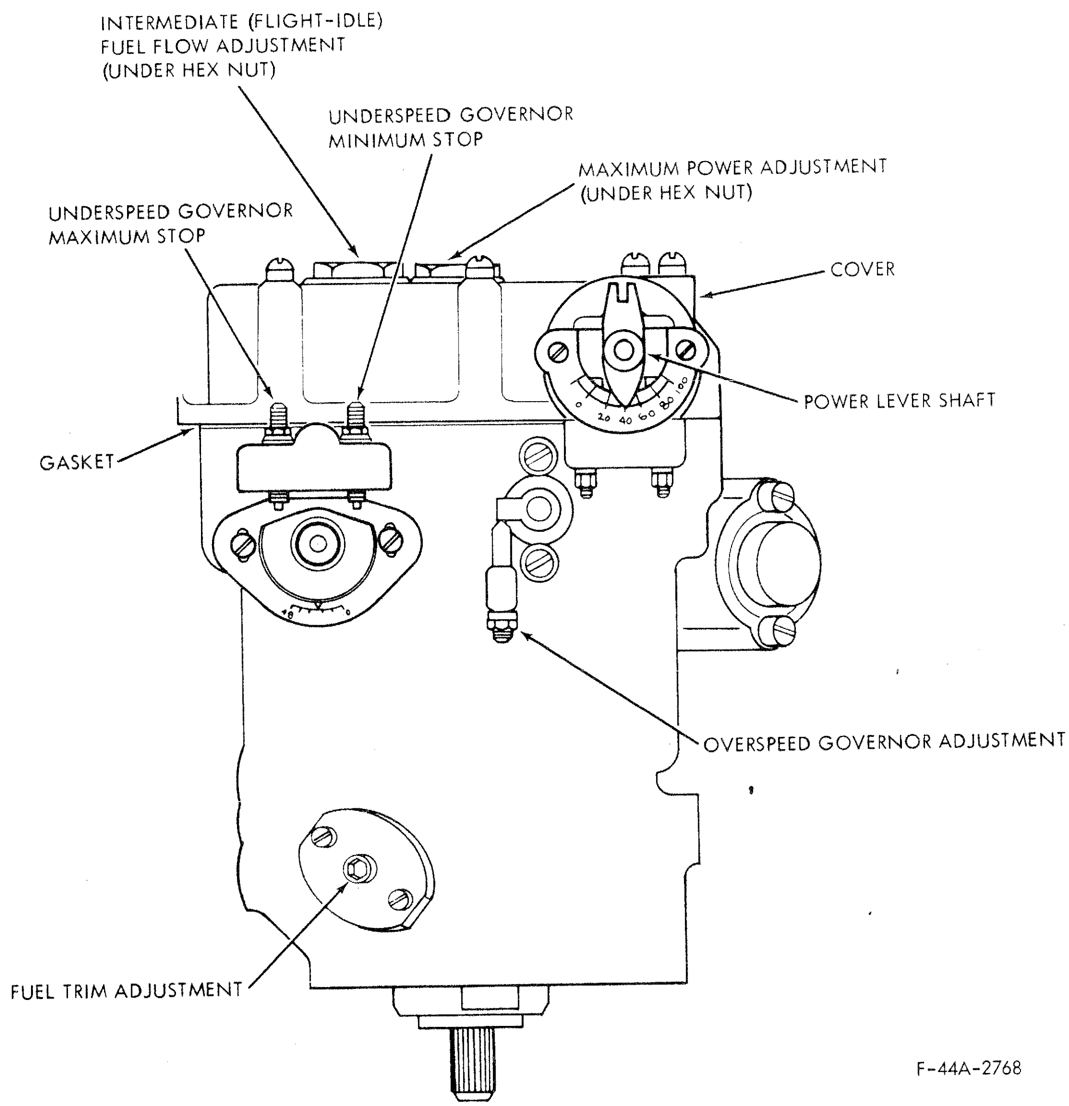
NOTE: When required, the fuel trim (specific gravity) adjustment may be utilized to raise acceleration schedule and obtain additional cruise power. This adjustment should be performed prior to attempting to adjust acceleration schedule as outlined in paragraph 4.B.(2).

(b) Ensure that fuel trim adjustment is properly set for fuel being used observing the following instructions.

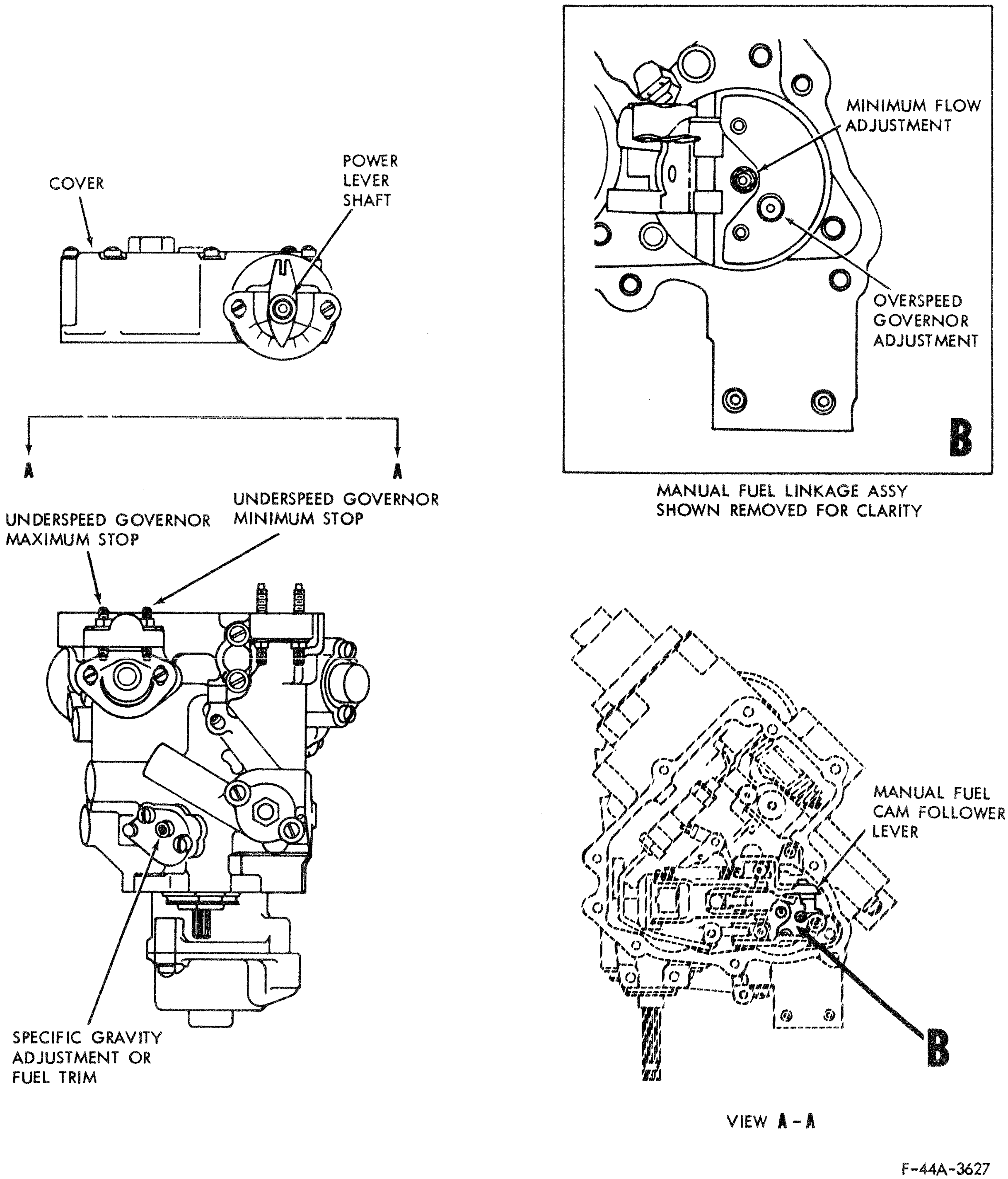
1 Determine type of fuel used on previous flight.

2 Determine type of fuel being added. Refer to Table 515 to determine fuel trim adjustment required.

R



(Codes FA-LA) (Woodward Fuel Controls with External Overspeed Governor Adjustment) Fuel Control Adjustments
Figure 505



R (Codes FA-LA) (Woodward Fuel Controls with Internal Overspeed
R Governor Adjustment) Fuel Control Adjustments
Figure 506

Table 515. Fuel Trim Adjustment for Changes in Fuel Type

From	To	*Fuel Trim Adjustment
Aviation Kerosene (JP-5)	Aviation Gasoline	CW 6 Clicks
Aviation Kerosene (JP-5)	JP-4	CW 3 Clicks
JP-4	Aviation Gasoline	CW 3 Clicks
Aviation Gasoline	JP-4	CCW 3 Clicks
JP-4	Aviation Kerosene (JP-5)	CCW 3 Clicks
Aviation Gasoline	Aviation Kerosene (JP-5)	CCW 6 Clicks

*Adjustments are to be made without consideration of fuel mix percentages.

4. B. (1) (c) Reset fuel trim (specific gravity) adjustment as required to obtain proper acceleration schedule and cruise power. A change of 0.02 (one click) clockwise in fuel trim setting will result in approximately 3.5 pounds per hour fuel increase with a corresponding increase in ITT of approximately 7C at cruise. Counterclockwise adjustment will decrease fuel flow and ITT a corresponding amount.

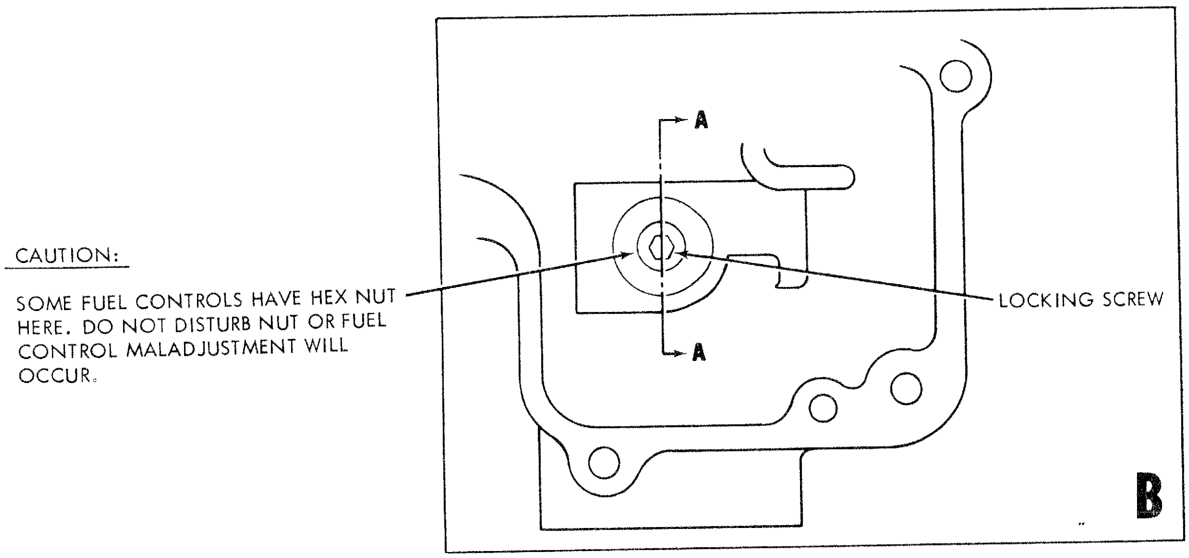
(2) Adjust acceleration schedule as follows. (See figure 507.)

NOTE: Fuel control acceleration schedule may be adjusted to increase starting fuel flow when slow acceleration is encountered due to a lean starting schedule. This is evidenced by the tendency of the engine to swell or hang at approximately 50 percent engine speed.

The fuel control acceleration schedule may also be adjusted to decrease starting fuel flow when high initial peak temperatures are encountered during the engine start.

Fuel trim (specific gravity) adjustment should be performed before attempting to adjust acceleration schedule.

(a) Prior to adjustment of acceleration schedule, perform following.



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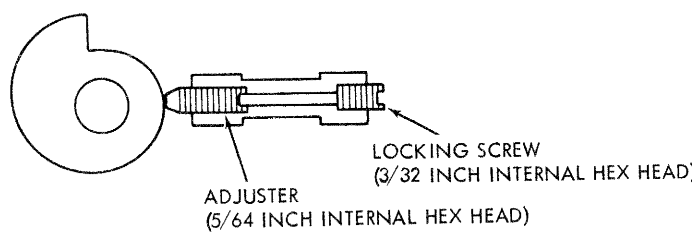
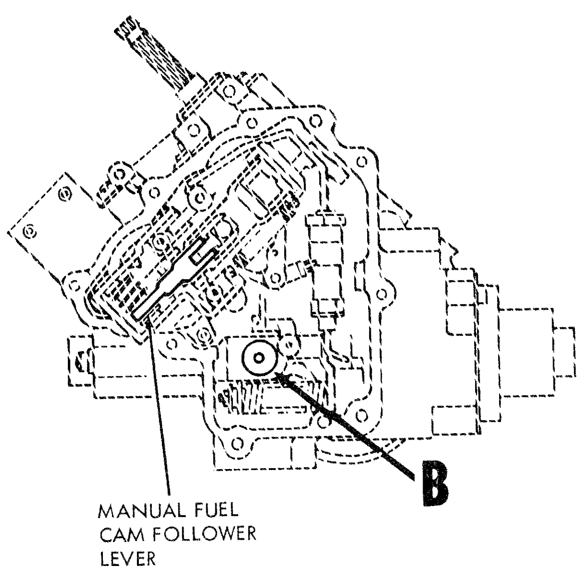


SECTION A-A

ACCELERATION ADJUSTMENT POINT



FUEL CONTROL (REAR COVER REMOVED)

F-44A-3741

(Codes FA-LA) (Woodward Fuel Controls) Acceleration
Schedule Adjustment
Figure 507

4. B. (2) (a) 1 Ascertain that no aircraft systems, such as low battery power, speed switch malfunction, defective starter or switching relays, are inadvertantly causing the start problem.

2 Check fuel flow divider for leakage during start cycle. This would be indicated by a steady stream of fuel draining overboard while engine is undergoing start cycle.

3 Inspect condition of packings in the fuel pressurizing valve. Replace defective packings as necessary. Refer to 73-21-04 MAINTENANCE PRACTICES.

4 Disconnect compressor discharge pressure sensing (P3) line from fitting on turbine plenum. Check fitting for tightness. Inspect flared end of tube for cracks or other deformities. Apply approximately five to ten psig pressure to tube, noting if leakage through fuel control unit bellophram is occurring. None is allowed.

5 Reconnect P3 sensing line to fitting on turbine plenum and secure.

(b) Adjust acceleration schedule in accordance with following procedure. (Refer to table 510 and figures 507 and 509.)

NOTE: Do not remove the power lever arm assembly from the power lever shaft.

1 Disconnect control rod from power lever arm assembly on fuel control unit by removing cotter pin, nut and washers.

2 Remove intermediate (flight idle) fuel flow adjustment plug. (see figure 509.)

NOTE: Rotate cover during removal, after clearing alignment pins, toward vertical centerline of engine to clear 2D cam from internal linkage.

3 Remove cover from rear of fuel control unit observing following instructions.

a Remove six screws and two twelve point bolt which secure cover to fuel control unit.

b Rotate power lever shaft to minimum position, then tap cover loose using a soft faced hammer. Remove cover.

4. B. (2) (b) 4 Remove locking screw (figure 507) turn adjuster to desired position (3/16-turn maximum), then reinstall locking screw. Turn locking screw until contact is made with adjuster, then tighten locking screw to seven to nine inch-pounds torque.

(c) Install cover onto fuel control unit observing following instructions.

CAUTION: ENSURE THAT MANUAL FUEL CAM FOLLOWER LEVER (INTERNAL LINKAGE) IS IN SLOT PRIOR TO POSITIONING COVER ONTO FUEL CONTROL. IF MANUAL FUEL CAM FOLLOWER IS NOT IN SLOT, OVERTEMPERATURE CONDITION WILL RESULT ON ENGINE START. INSTALL NEW COVER GASKET ENSURING THAT GASKET DOES NOT INTERFERE WITH END OF MANUAL FUEL CAM FOLLOWER LEVER. DO NOT INSTALL FLIGHT IDLE ACCESS PLUG OR SPRING UNTIL FUEL CONTROL COVER HAS BEEN INSTALLED.

1 Ensure that manual fuel valve shaft is in minimum position, then install cover (without flight idle access plug or spring) using new gasket (Woodward PN 3054-726, available from Woodward Governor Company 5001 N 2nd Street, Rockford, IL 61101) onto fuel control unit.

2 Install screws and bolts securing cover to fuel control unit. Tighten screws to a torque value of 12 to 14 inch-pounds and bolts to a torque value of 60 to 75 inch-pounds.

CAUTION: USE CARE WHEN INSTALLING FLIGHT IDLE ACCESS PLUG AND SPRING TO ENSURE THAT SPRING IS LOCATED DIRECTLY ON TOP OF FLIGHT IDLE ADJUSTMENT AND THAT SPRING IS NOT CRIMPED OR COCKED.

3 Install flight idle access plug and spring. Tighten plug and lockwire.

(d) Reconnect control rod to power lever arm assembly by installing washers and nut. Tighten nut to 12 inch-pounds torque and install new cotter pin.

(e) Upon completion of adjustments, perform operational check according to type of adjustment made and make entry in permanent aircraft records noting engine time, type and amount of adjustment accomplished.

4. B. (3) Adjust underspeed governor low RPM as follows. (See figure 505 or 506.)

(a) If engine rpm does not stabilize at limit specified in Table 503, adjust minimum speed stop on underspeed governor. Turning adjustment screw one turn clockwise will increase engine rpm 2.0 percent.

(b) Recheck and adjust linkage between underspeed governor and propeller governor for proper operation following any adjustment of underspeed governor stop. Refer to 76-10-01, MAINTENANCE PRACTICES.

(4) Adjust undespeed governor high RPM as follows. (See figure 505 or 506.)

(a) If engine rpm does not stabilize at limit specified in Table 503, adjust maximum speed stop on underspeed governor. Turning adjustment screw one turn clockwise will decrease engine rpm 1.0 percent.

(d) Recheck and adjust linkage between underspeed governor and propeller governor for proper operation following any adjustment of underspeed governor stop. Refer to 76-10-01, MAINTENANCE PRACTICES.

(5) Adjust overspeed governor as follows. (See figure 505 or 506.)

(a) Adjust fuel control with external adjustment as follows. (See figure 505.)

NOTE: When adjusting overspeed governor, hold adjusting screw until lock nut is loosened, then hold lock nut while turning adjusting screw.

1 Loosen lock nut on adjusting screw and adjust overspeed governor as required. One turn clockwise will increase engine speed setting by 4.5 percent rpm.

2 Tighten lock nut while holding adjusting screw at adjusted position.

(b) Adjust fuel control with internal adjustment as follows. (See figure 506.)

NOTE: Do not remove the power lever arm assembly from the power lever shaft.

1 Disconnect control rod from power lever arm assembly on fuel control unit by removing cotter pin, nut and washers.

4. B. (5) (b) 2 Remove intermediate (flight idle) fuel flow adjustment plug. (See figures 509 and 510.)

NOTE: Position power lever shaft in 100 degree position to aid in removal of cover.

3 Remove cover from rear of fuel control unit observing following instructions.

NOTE: Rotate cover during removal, after clearing alignment pins, toward vertical centerline of engine to clear 2D cam from internal linkage.

a Remove six screws and two twelve point bolts which secure cover to fuel control unit.

b Rotate power lever shaft to minimum position, then tap cover loose using a soft faced hammer. Remove cover.

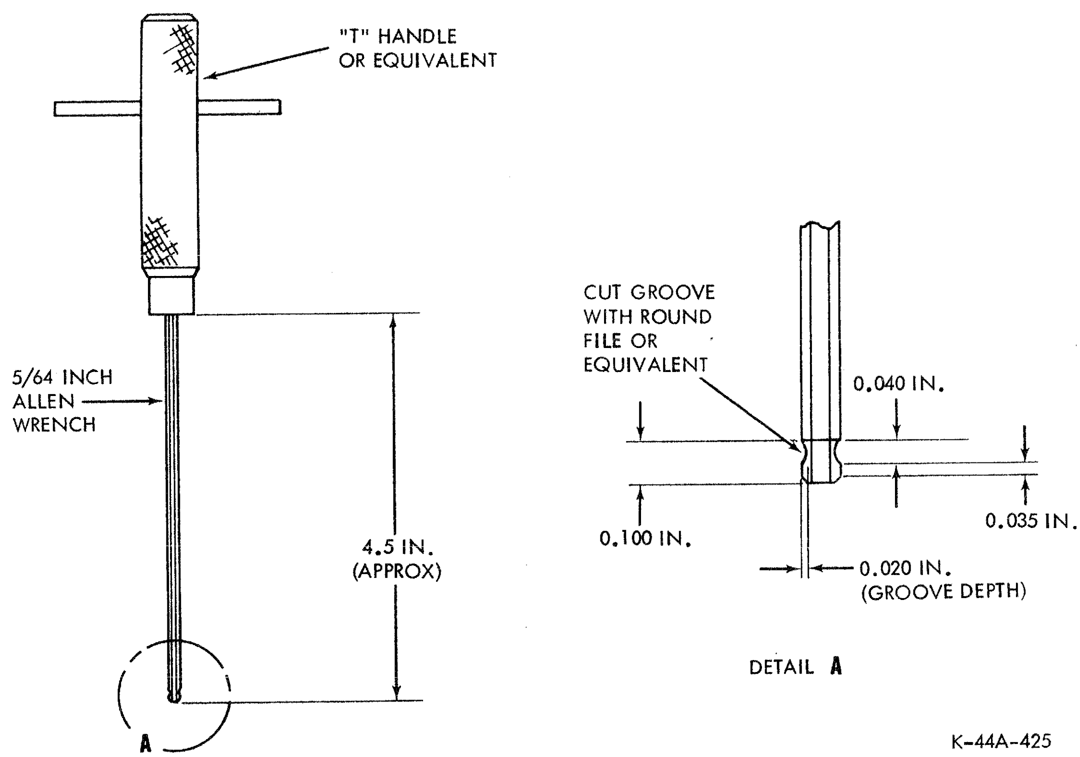
CAUTION: MINIMUM FLOW ADJUSTMENT AND OVERSPEED GOVERNOR ADJUSTMENT ARE LOCATED IN CLOSE PROXIMITY WITHIN THE FUEL CONTROL AND UTLIZE THE SAME SIZE ALLEN WRENCH FOR REQUIRED ADJUSTMENTS. REFER TO FIGURE 507, DETAIL B, TO ENSURE PROPER SELECTION OF OVERSPEED GOVERNOR ADJUSTMENT.

4 Using a 5/64 inch swivel tip Allen wrench (see figure 508), or equivalent, adjust overspeed governor as required. One turn clockwise will increase engine speed setting by 4.5 percent rpm.

5 Install cover onto fuel control unit, observing following instructions.

CAUTION: ENSURE THAT MANUAL FUEL CAM FOLLOWER LEVER (INTERNAL LINKAGE) IS IN SLOT PRIOR TO POSITIONING COVER ONTO FUEL CONTROL. IF MANUAL FUEL CAM FOLLOWER IS NOT IN SLOT, OVERTEMPERATURE CONDITION WILL RESULT ON ENGINE START. INSTALL NEW COVER GASKET ENSURING THAT GASKET DOES NOT INTERFERE WITH END OF MANUAL FUEL CAM FOLLOWER LEVER. DO NOT INSTALL FLIGHT IDLE ACCESS PLUG OR SPRING UNTIL FUEL CONTROL COVER HAS BEEN INSTALLED.

a Ensure that manual fuel valve shaft is in minimum position, then install cover (without flight idle access plug or spring) using new gasket (Woodward PN 3054-726 available from Woodward Governor Company 5001 N 2nd Street, Rockford, IL 61101) onto fuel control unit.



R (Codes FA-LA) Dimension Requirements for Overspeed Governor Adjustment Tool (Woodward Internal Adjustment)
Figure 508

4. B. (5) (b) 5 b Install screws and bolts securing cover to fuel control unit. Tighten screws to a torque value of 12 to 14 inch-pounds and bolts to a torque value of 60 to 75 inch-pounds.

CAUTION: USE CARE WHEN INSTALLING FLIGHT IDLE ACCESS PLUG AND SPRING TO ENSURE THAT SPRING IS LOCATED DIRECTLY ON TOP OF FLIGHT IDLE ADJUSTMENT AND THAT SPRING IS NOT CRIMPED OR COCKED.

c Install flight idle access plug and spring. Tighten plug and lockwire.

6 Reconnect control rod to power lever arm assembly by installing washers and nut. Tighten nut to 12 inch-pounds torque and install new cotter pin

(6) Reindex intermediate (flight idle) fuel flow adjustment stop if required. (See figure 509.)

CAUTION: REINDEXING OF FLIGHT IDLE FUEL FLOW ADJUSTMENT STOP SHALL ONLY BE PERFORMED ONCE TO INCREASE RANGE FOR INCREASED FLIGHT IDLE FUEL FLOW ADJUSTMENT. PRIOR TO REINDEXING CHECK LOG BOOK TO DETERMINE IF REINDEXING HAS PREVIOUSLY BEEN PERFORMED. DECREASING FLIGHT IDLE FUEL FLOW ADJUSTMENT MAY BE PERFORMED AS REQUIRED.

NOTE: Do not remove the power lever arm assembly from the power lever shaft.

(a) Disconnect control rod from power lever arm assembly on fuel control unit by removing cotter pin, nut and washers.

(b) Remove intermediate (flight idle) fuel flow adjustment plug. (See figure 509.)

NOTE: Position power lever shaft in 100 degree position to aid in removal of cover.

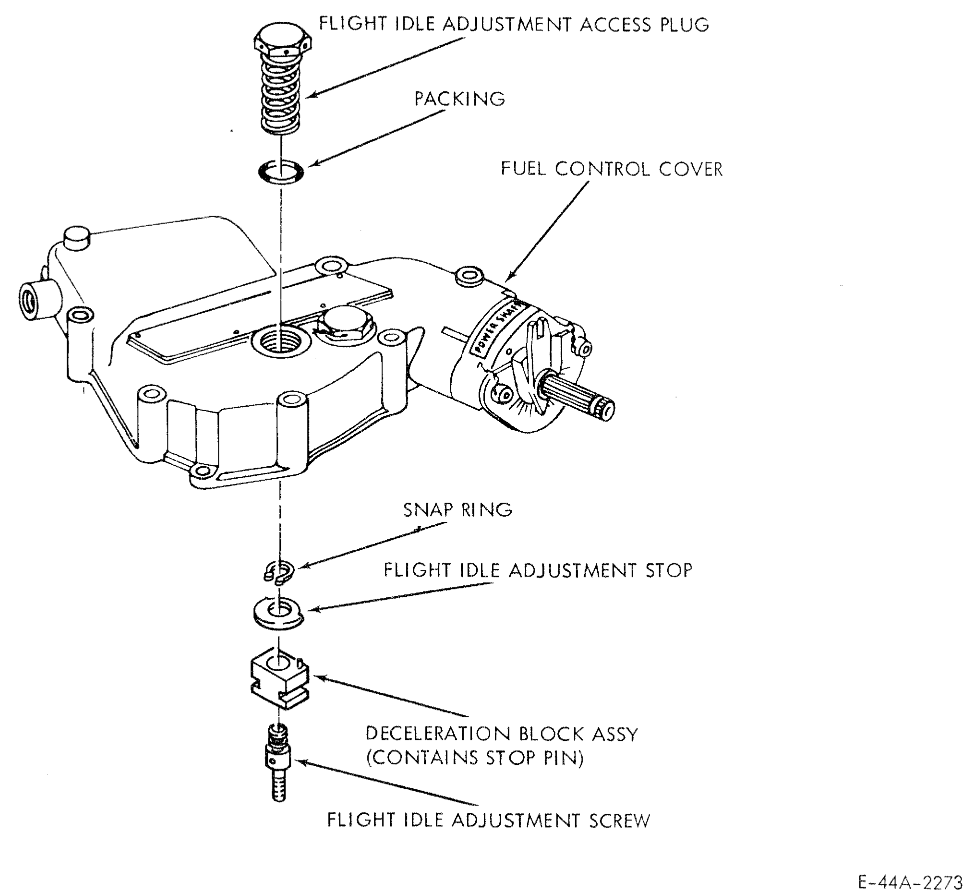
(c) Remove cover from rear of fuel control unit observing following instructions.

NOTE: Rotate cover during removal, after cleaning alignment pins, toward vertical centerline of engine to clear 2D cam from internal linkage.

1 Remove six screws and two twelve point bolts which secure cover to fuel control unit.

2 Rotate power lever shaft to minimum position, then tap cover loose using a soft faced hammer. Remove cover.

R



R

(Codes FA-LA) Reindexing of Flight Idle Adjustment
Screw Stop (Woodward)
Figure 509

4 B. (6) (d) Remove snap ring from slot in flight idle adjustment screw.

(e) Slide flight idle adjustment stop rearward to remove it from splined flight idle adjustment screw.

(f) Adjust screw as outlined. For fuel controls with flight idle click adjustment, turn adjusting screw desired number of clicks. Each click produces a nominal fuel flow change of two pounds per hour.

(g) Carefully reinstall stop so that equal adjustment range remains both in increase and decrease flow direction.

(h) Reinstall snap ring in its groove in adjustment screw.

(i) Install cover onto fuel control unit, observing the following instructions.

CAUTION: ENSURE THAT MANUAL FUEL CAM FOLLOWER LEVER (INTERNAL LINKAGE) IS IN SLOT PRIOR TO POSITIONING COVER ONTO FUEL CONTROL. IF FUEL CAM FOLLOWER IS NOT IN SLOT, OVERTEMPERATURE CONDITION WILL RESULT ON ENGINE START. INSTALL NEW COVER GASKET ENSURING THAT GASKET DOES NOT INTERFERE WITH END OF MANUAL FUEL CAM FOLLOWER LEVER. DO NOT INSTALL FLIGHT IDLE ACCESS PLUG OR SPRING UNTIL FUEL CONTROL COVER HAS BEEN INSTALLED.

1 Ensure that manual fuel valve shaft is in minimum position then install cover (without flight idle access plug or spring) using new gasket (Woodward PN 3054-726, available from Woodward Governor Company 5001 N 2nd Street Rockford, IL 61101) onto fuel control unit.

2 Install screws and bolts securing cover to fuel control unit. Tighten screws to a torque value of 60 to 75 inch-pounds.

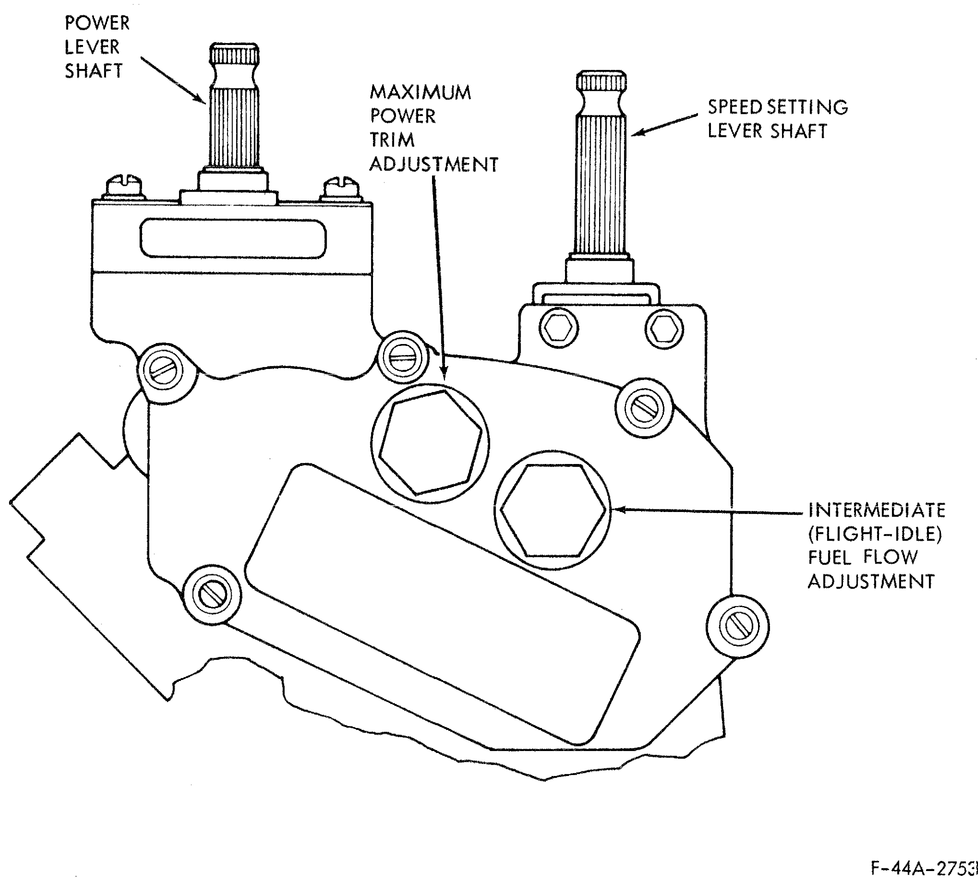
CAUTION: USE CARE WHEN INSTALLING FLIGHT IDLE ACCESS PLUG AND SPRING TO ENSURE THAT SPRING IS LOCATED DIRECTLY ON TOP OF FLIGHT IDLE ADJUSTMENT AND THAT SPRING IS NOT CRIMPED OR COCKED.

(j) Install flight idle access plug and spring. Tighten plug and lockwire.

R 4. B. (6) (k) Reconnect control rod to power lever arm assembly by installing washers and nut. Tighten nut to 12 inch-pounds torque and install new cotter pin.

(l) Upon completion of adjustments, perform operational check according to the type of adjustment made and make entry in permanent aircraft records noting engine time, type and amount of adjustment accomplished.

(7) Adjust intermediate (flight idle) fuel flow as follows. (See figure 510.)



(Codes FA-LA) Fuel Control Flight Idle Fuel Flow and
Maximum Power Trim Adjustment Points (Woodward)
Figure 510

CAUTION: ALTHOUGH ADJUSTMENT OF THE FLIGHT IDLE FUEL FLOW TO A SPECIFIC RPM AS DESCRIBED MAKES THE AIRCRAFT SAFE FOR FLIGHT TEST, FINAL EVALUATION OF FUEL FLOW MUST BE DETERMINED BY FLIGHT TEST AND NOTATIONS RELATIVE TO ENGINE RPM NOTED IN RESPECTIVE PERMANENT AIRCRAFT RECORDS IN ORDER TO PREVENT ADDITIONAL, UNNECESSARY ADJUSTMENTS BY MAINTENANCE PERSONNEL.

NOTE: A change in flight idle (intermediate) fuel flow setting will result in a corresponding change in maximum fuel flow setting. Maximum fuel flow setting must then be adjusted to original setting. Maximum fuel flow adjustment will not affect flight idle (intermediate) fuel flow setting.

4. B. (7) (a) Remove large hex nut in rear cover of fuel control unit.

CAUTION: DO NOT OVERTIGHTEN LOCKNUT.

(b) For fuel control without flight idle click adjustment, use deep socket to loosen and hold locknut while adjusting screw and to secure locknut after adjustment is completed. One-sixteenth turn of adjusting screw procedures a nominal fuel flow change of ten pounds per hour. Tighten locknut to ten inch-pound torque. Reinstall large hex nut. Tighten large hex nut to 30 inch-pounds torque.

(c) For fuel controls with flight idle click adjustment, turn adjusting screw desired number of clicks. Clockwise adjustment of adjusting screw increases fuel flow. Each click produces a nominal fuel flow change of two pounds per hour. Reinstall large hex nut and tighten to 30 inch-pounds torque.

(8) Adjust maximum power trim as follows. (See figure 510.)

(a) Remove large hex nut on rear of fuel control and loosen locknut. Be careful not to change Allen screw adjustment.

NOTE: Maximum adjustment of maximum power fuel flow for increasing fuel flow is 3/4 turn from factory setting. Do not adjust external stops of the power lever shaft.

(b) Use deep socket to loosen and hold locknut while adjusting screw. Clockwise adjustment increases fuel flow. One-fourth turn produces a nominal fuel flow change of four pounds per hour. Secure locknut and tighten to ten inch-pounds torque. Reinstall large hex nut and tighten to 30 inch-pounds torque.

5. Check Aircraft Torque/Horsepower Indicating System

R A. (Codes AA-AC, FA, LA) Torque Indicating System Check

(1) Disconnect oil pressure line and gearcase vacuum line from torque transducer.

(2) Connect air pressure source (0 - 100 psi) through pressure regulator (0 - 100 psi) to high pressure port of torque transducer or use suitable deadweight tester. Vent vacuum port of torque transducer to ambient.

(3) With no electrical power applied to aircraft torque indicating circuit, set adjustment screw on the front face of torque indicator so that indicator reads 700 shaft horsepower.

(4) From the engine DSC, record torque pressure corresponding to 27,700 inch-pounds torque (equivalent of 700 shaft horsepower).

CAUTION: ENSURE AIR PRESSURE SOURCE IS CONNECTED TO HIGH PRESSURE PORT OF TORQUE TRANSDUCER AND NOT TO LOW PRESSURE PORT.

(5) Adjust pressure regulator to apply air pressure recorded in step
R (4) to high pressure port of torque transducer. Refer to 77-10-03, MAINTENANCE PRACTICES.

(6) While observing cockpit torque indicator very closely, apply and maintain aircraft electrical power to torque transducer.

(7) If indicator reading does not vary from its position when power is applied, proceed to step (11).

(8) If the indicator reading varies, loosen Allen zero adjust lockscrew
R on right face of transducer. Refer to 77-10-03, MAINTENANCE
R PRACTICES. Using a suitable spanner wrench in two holes in face of transducer, rotate inner body of transducer to obtain 700 shaft horsepower.

NOTE: The torque indicator reading will often increase as the Allen lockscrew is tightened. It will be necessary to position inner body of the transducer so that the torque indicator reads 700 shaft horsepower when the Allen lockscrew is tightened to a torque value of 11 to 15 inch-pounds.

(9) Apply a torque value of 11 to 15 inch-pounds to Allen lockscrew and verify that torque indicator reading remains unchanged.

5. A. (10) While maintaining air pressure value from step (4) to torque transducer, remove and re-apply electrical power, observing that torque indicator reading does not change. If torque indicator reading changes, repeat steps (3) through (10).

(11) From engine DSC, record torque pressure corresponding to 2300 inch-pounds torque (equivalent to 58 shaft horsepower).

(12) With aircraft electrical power applied to aircraft torque indicating system, apply air pressure recorded in step (11) to the torque transducer high pressure port.

(13) Remove the span-adjust dust cover from face of transducer. Refer
R to 77-10-03, MAINTENANCE PRACTICES.

(14) Using a small screwdriver, adjust the span-adjust screw to obtain a reading of 58 shaft horsepower on cockpit torque indicator.

(15) Adjust regulator valve (0 - 100 psi) to increase air pressure at torque transducer high pressure port to value recorded in step (4). Verify that torque indicator repeats its 700 shaft horsepower reading. If not, repeat procedure beginning with step (8).

(16) Add pressure recorded in step (4) to pressure recorded in step (11) and divide sum by 2 to obtain a mid-point average reading.

(17) Adjust pressure regulator (0 - 100 psi) to apply air pressure to torque transducer high pressure port equal to mid-port average reading obtained in step (16) Verify that torque indicator reads 370 to 390 shaft horsepower.

CAUTION: THE SPAN ADJUST DUST CAP SHALL BE INSTALLED FINGER TIGHT. DO NOT OVERTIGHTEN.

(18) Install span-adjust dust cap and tighten finger tight. Lockwire cap to zero adjustment.

(19) If proper adjustment of torque indicating system cannot be obtained in preceding steps, perform adjustment/test of torque indicating
R system components in accordance with 77-10-03, MAINTENANCE PRACTICES.

R B. (Codes BA-BC, EA, GA, KA) (665 SHP Engine) Torque Indicating System Check

(1) Disconnect oil pressure line and gearcase vacuum line from torque transducer.

5. B. (2) Connect air pressure source (0 - 100 psi) through pressure regulator (0 - 100 psi) to high pressure port of torque transducer or use suitable deadweght tester. Vent vacuum port of torque transducer to ambient.

(3) With no electrical power applied to aircraft torque indicating circuit, set adjustment screw on front face of torque indicator so that indicator reads 100 percent torque.

R (4) (Codes BA-BC, EA, GA) From engine DSC, record torque pressure corresponding to 21,000 inch-pounds torque (equivalent of 100 percent torque) or 21,600 inch-pounds torque (equivalent of 103 percent torque).

(5) (Code KA) From engine DSC, record torque pressure corresponding to 26,300 inch-pounds torque (equivalent to 100 percent torque).

CAUTION: ENSURE AIR PRESSURE SOURCE IS CONNECTED TO HIGH PRESSURE PORT OF TORQUE TRANSDUCER AND NOT TO LOW PRESSURE PORT.

(6) Adjust pressure regulator (0 - 100 psi) to apply air pressure recorded in step (4) or (5) to high pressure port of torque
R transducer. Refer to 77-10-03, MAINTENANCE PRACTICES.

(7) While observing cockpit torque indicator very closely, apply and maintain aircraft electrical power to torque transducer.

(8) If indicator reading does not vary from its position when power is applied, proceed to step (12) or (13).

(9) If indicator reading varies, loosen Allen zero adjust lockscrew on
R right face of transducer. Refer to 77-10-03, MAINTENANCE PRACTICES. Using a suitable spanner wrench in two holes in face of transducer, rotate inner body of transducer to obtain 100 percent torque.

NOTE: The torque indicator reading will often increase as the Allen lockscrew is tightened. It will be necessary to position the inner body of the transducer so that the torque indicator reads 100 percent torque when the Allen lockscrew is tightened to a torque value of 11 to 15 inch-pounds.

(10) Apply a torque value of 11 to 15 inch-pounds to Allen lockscrew and verify that torque indicator reading remains unchanged.

5. B. (11) While maintaining air pressure value from step (4) or (5) to torque transducer, remove and re-apply electrical power, observing that torque indicator reading does not change. If torque indicator reading changes, repeat steps (3) through (11).

R (12) (Codes BA-BC, EA GA) From the engine DSC, record the torque pressure corresponding to 1800 inch-pounds torque (equivalent to 8.5 percent torque).

(13) (Codes KA) From the engine DSC, record pressure corresponding to 2260 inch-pounds torque (equivalent to 8.6 percent torque)

(14) With aircraft electrical power applied to aircraft torque indicating system, apply air pressure recorded in step (12) or (13) to torque transducer high pressure port.

(15) Remove the span-adjust dust cover from the face of transducer.
R Refer to 77-10-03, MAINTENANCE PRACTICES.

R (16) (Codes BA-BC, EA, GA) Using a small screwdriver adjust span-adjust screw to obtain a reading of 8.5 percent torque on cockpit torque indicator.

(17) (Codes KA) Using a small screwdriver, adjust span-adjust screw to obtain 8.6 percent torque on cockpit torque indicator.

(18) Adjust regulator valve (0 - 100 psi) to increase air pressure at torque transducer high pressure port to value recorded in step (4) or (5). Verify that torque indicator repeats its 100 percent torque reading. If not, repeat procedure beginning with step (9).

(19) Add pressure recorded in step (4) or (5) to pressure recorded in step (12) or (13) and divide sum by 2 to obtain a mid-point average reading.

(20) Adjust pressure regulator (0 - 100 psi) to apply air pressure to torque transducer high pressure port equal to mid-point average reading obtained in step (16) or (17). Verify that torque indicator reads 53 to 56 percent torque.

CAUTION: THE SPAN-ADJUST DUST CAP SHALL BE INSTALLED FINGER TIGHT. DO NOT OVERTIGHTEN.

(21) Install span-adjust dust cap and tighten finger tight. Lockwire cap to zero adjustment.

(22) If proper adjustment of torque indicating system cannot be obtained in preceding steps, perform adjustment/test of torque indicating
R system components in accordance with 77-10-03, MAINTENANCE PRACTICES.

5. C. (Codes CA-CC) Statically Check Aircraft Torque Indicating System in Accordance with Aircraft Maintenance Manual

R D. (Codes BA-BC, EA, GA, KA) (715 SHP Engine) Torque Indicating System Check

(1) Disconnect oil pressure line and gearcase vacuum line from torque transducer.

(2) Connect air pressure source (0 - 100 psi) through pressure regulator (0 - 100 psi) to high pressure port of torque transducer or use suitable deadweight tester. Vent vacuum port of torque transducer to ambient.

(3) With no electrical power applied to aircraft torque indicating circuit, set adjustment screw on front face of torque indicator so that indicator reads 100 percent torque.

R (4) (Codes BA-BC, EA, GA) From engine DSC, record torque pressure corresponding to 22,536 inch-pounds torque (equivalent of 100 percent torque) or 23,212 inch-pounds torque (equivalent of 103 percent torque).

(5) (Code KA) From engine DSC, record torque pressure corresponding to 28,300 inch-pounds torque (equivalent to 100 percent torque).

CAUTION: ENSURE AIR PRESSURE SOURCE IS CONNECTED TO HIGH PRESSURE PORT OF TORQUE TRANSDUCER AND NOT TO LOW PRESSURE PORT.

(6) Adjust pressure regulator (0 - 100 psi) to apply air pressure recorded in step (4) or (5) to high pressure port of torque
R transducer. Refer to 77-10-03, MAINTENANCE PRACTICES.

(7) While observing cockpit torque indicator valve closely, apply and maintain aircraft electrical power to torque transducer.

(8) If indicator reading does not vary from its position when power is applied, proceed to step (12) or (13).

(9) If indicator reading varies, loosen Allen zero adjust lockscrew on right face of transducer. Refer to 77-10-03, MAINTENANCE PRACTICES. Using a suitable spanner wrench in two holes in face of transducer, rotate inner body of transducer to obtain 100 percent torque.

NOTE: The torque indicator reading will often increase as Allen lockscrew is tightened. It will be necessary to position the inner body of the transducer so that the torque indicator reads 100 percent torque when the Allen lockscrew is tightened to a torque value of 11 to 15 inch-pounds.

5. D. (10) Apply a torque value of 11 to 15 inch-pounds to Allen lockscrew and verify that torque indicator reading remains unchanged.

(11) While maintaining air pressure value from step (4) or (5) to torque transducer, remove and re-apply electrical power, observing that the torque indicator reading does not change. If torque indicator reading changes, repeat steps (3) through (11).

R (12) (Codes BA-BC, EA, GA) From engine DSC, record torque pressure corresponding to 1800 inch-pounds torque (equivalent to 7.1 percent torque).

(13) (Code KA) From the engine DSC, record torque pressure corresponding to 2260 inch-pounds torque (equivalent to 8.0 percent torque).

(14) With aircraft electrical power applied to aircraft torque indicating system, apply air pressure recorded in step (12) or (13) to torque transducer high pressure port.

(15) Remove span-adjust dust cover from the face of transducer. Refer
R to 77-10-03, MAINTENANCE PRACTICES.

R (16) (Codes BA-BC, EA, GA) Using a small screwdriver, adjust span-adjust screw to obtain a reading of 7.1 percent torque on cockpit torque indicator.

(17) (Code KA) Using a small screwdriver, adjust span-adjust screw to obtain a reading of 8.0 percent torque on cockpit torque indicator.

(18) Adjust regulator valve to increase air pressure at torque transducer high pressure port to value recorded in step (4) or (5). Verify that torque indicator repeats its 100 percent torque reading. If not, repeat procedure beginning with step (9).

(19) Add the pressure recorded in step (4) or (5) to pressure recorded in step (11) or (12) and divide sum by 2 to obtain a mid-point average reading.

5. D. (20) Adjust pressure regulator (0 - 100 psi) to apply air pressure to torque transducer high pressure port equal to mid-point average reading obtained in step (19). Verify that torque indicator reads 53 to 56 percent torque.

CAUTION: THE SPAN-ADJUST DUST CAP SHALL BE INSTALLED FINGER TIGHT. DO NOT OVERTIGHTEN.

(21) Install span-adjust dust cap and tighten finger tight. Lockwire cap to zero adjustment.

(22) If proper adjustment of torque indicating system cannot be obtained in preceding steps, perform adjustment/test of torque indicating system components in accordance with 77-10-03, ADJUSTMENT/TEST.

E. (Code HA) Torque Indicating System Check

(1) Disconnect oil pressure line and gearcase vacuum line from torque transducer.

(2) Connect air pressure source (0 - 100 psi) through pressure regulator (0 - 100 psi) to high pressure port of torque transducer or use suitable deadweight tester. Vent vacuum port of torque transducer to ambient.

(3) With no electrical power applied to aircraft torque indicating circuit, set adjustment screw on front face of torque indicator so that indicator reads 1875 foot-pounds.

(4) From engine DSC, record torque pressure corresponding to 22,500 inch-pounds torque (equivalent of 1875 foot-pounds).

CAUTION: ENSURE AIR PRESSURE SOURCE IS CONNECTED TO HIGH PRESSURE PORT OF TORQUE TRANSDUCER AND NOT TO LOW PRESSURE PORT.

(5) Adjust pressure regulator (0 - 100 psi) to apply air pressure recorded in step (4) to HIGH pressure port of torque transducer.
R Refer to 77-10-03, MAINTENANCE PRACTICES.

(6) While observing cockpit torque indicator very closely, apply and maintain aircraft electrical power to torque transducer.

(7) If indicator reading does not vary from its position when power is applied, proceed to step (11).

(8) If indicator reading varies, loosen Allen zero adjust lockscrew on right face of transducer. Refer to 77-10-03, MAINTENANCE PRACTICES. Using a suitable spanner wrench in two holes in face of transducer, rotate inner body of transducer to obtain 1875 foot-pounds.

NOTE: The torque indicator reading will often increase as Allen lockscrew is tightened. It will be necessary to position the inner body of the transducer so that the torque indicator reads 1875 foot-pounds when the Allen lockscrew is tightened to a torque value of 11 to 15 inch-pounds.

5. E. (9) Apply a torque value of 11 to 15 inch-pounds to Allen lockscrew and verify that torque indicator reading remains unchanged.

(10) While maintaining air pressure value from step (4) to torque transducer, remove and re-apply electrical power, observing that torque indicator reading does not change. If torque indicator reading changes, repeat steps (3) through (10).

(11) From engine DSC, record torque pressure corresponding to 1800 inch-pounds torque (equivalent to 150 foot-pounds torque).

(12) With aircraft electrical power applied to aircraft torque indicating system, apply air pressure recorded in step (11) to torque transducer high pressure port.

(13) Remove span-adjust dust cover from face of transducer. Refer to
R 77-10-03, MAINTENANCE PRACTICES.

(14) Using a small screwdriver, adjust span-adjust screw to obtain a reading of 150 foot-pounds torque on cockpit torque indicator.

(15) Adjust regulator valve (0 - 100 psi) to increase air pressure at torque transducer high pressure port to value recorded in step (4). Verify that torque indicator repeats its 1875 foot-pounds torque reading. If not, repeat procedure beginning with step (8).

(16) Add pressure recorded in step (4) to pressure recorded in step (11) and divide sum by 2 to obtain a mid-point average reading.

(17) Adjust pressure regulator (table 501) to apply air pressure to torque transducer high pressure port equal to mid-port average reading obtained in step (16). Verify that torque indicator reads 975 to 1055 foot-pounds torque.

CAUTION: THE SPAN ADJUST DUST CAP SHALL BE INSTALLED FINGER TIGHT. DO NOT OVERTIGHTEN.

(18) Install span-adjust dust cap and tighten finger tight. Lockwire cap to zero adjustment.

5. E. (19) If proper adjustment of torque indicating system cannot be obtained in preceding steps, perform adjustment/test of torque indicating system components in accordance with 77-10-03, MAINTENANCE PRACTICES.

6. (Codes CA-CC) Torque Sensor Compensator Assembly Calibration

NOTE: Prior to calibration and adjustment of torque sensor compensator assembly, check aircraft torque/horsepower indicating system as specified in paragraph 5.C.

If the engine raw torque signal is not satisfactory, special test procedures and equipment are required as specified in paragraph 8. If equipment is available, repair the engine and follow procedures in paragraph 8 to establish a new raw torque plot. If equipment specified in paragraph 8 is not available the engine must be returned to a facility capable of establishing a new raw torque plot.

A. Calibrate Torque Sensor Compensator Assembly

(1) Connect pressure gages to indicate raw torque pressure, compensated torque pressure and gearcase negative pressure as follows.

(a) Remove bleed port plug from torque sensor compensator assembly. Install 284461-1-1, torque calibration adapter plate and connect pressure gage (0 - 100 psi).

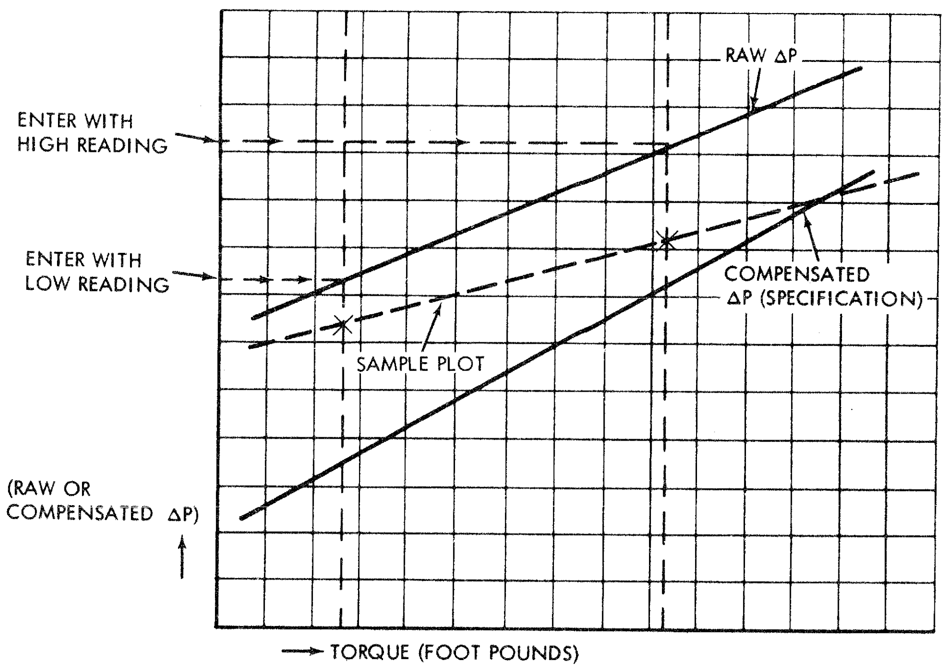
(b) Remove torque sensor transmitter and mounting adapter. Refer to 77-10-03, MAINTENANCE PRACTICES. Install 284453-1-1, torque calibration plate.

(c) Connect pressure gage (0 - 100 psi) to compensated pressure port of adapter plate.

(d) Connect vacuum gage (+15 to -30 psi) to gearcase negative pressure port.

(2) Start and run engine in accordance with Aircraft Flight Manual. Unlatch propeller from start locks and run engine at ground idle. Operate until oil temperature stabilizes at normal operating value. Ensure oil pressure is within normal operating limits. Bleed lines at connections to raw torque pressure gage and compensated torque pressure gage to purge air from lines.

(3) With power lever set at minimum position where 100 percent engine speed is reached and speed lever at takeoff position, record raw torque pressure, compensated torque pressure, gearcase pressure.



Example of Raw and Compensated Delta Pressure Plot
Figure 511

CAUTION: SET HIGHEST POWER POINT ATTAINABLE WITHOUT EXCEEDING ENGINE LIMITATIONS SPECIFIED IN AIRCRAFT FLIGHT MANUAL.

6. A. (4) With power lever set at minimum propeller governing position and speed lever at takeoff position, record raw torque pressure, compensated torque pressure, and gearcase negative pressure.

(5) Calculate raw torque differential (delta) pressure by subtracting gearcase pressure reading from raw torque pressure reading obtained in steps (3) and (4). Result is raw torque differential (delta) pressure. The following is an example of a typical calculation.

Raw Torque Pressure (psig)	-	Gearcase Negative Pressure (psig)	=	Raw Torque Differential (delta) Pressure (psig)
(20)	-	(-3.5)	=	23.5

(6) Calculate compensated torque differential (delta) pressure by subtracting gearcase pressure reading from compensated torque reading obtained in step (3) and step (4). Result is compensated torque differential (delta) pressure. The following is an example of a typical calculation.

Compensated Torque Pressure (psig)	-	Gearcase Negative Pressure (psig)	=	Compensated Torque Differential (delta) Pressure (psid)
(18)		(-3.5)		21.5

(7) Enter engine DSC curve with raw torque differential (delta) pressure obtained in step (5) and intersect raw torque differential (delta) pressure plotted line. (See figure 511.)

(8) Plot corresponding compensated torque differential (delta) pressure value obtained in step (6) at same torque values (foot-pounds) that raw torque differential (delta) pressure plotted line was intersected. (See figure 511.)

(9) Draw a straight line through the points plotted in step (8) and compare with compensated torque differential (delta) pressure specification line. (See figure 511.)

(10) If slope of drawn line is steeper or shallower than specification, correct slope by adjusting body of torque sensor compensator assembly using 294694-1-1, adapter. Turning body clockwise will steepen slope of drawn line. Turning body counterclockwise will make slope shallower.

Adjust body in one-eighth turn increments between engine runs and repeat procedure until drawn line and compensated torque pressure specification line are parallel.

6. A. (11) After correct slope is obtained, adjust center screw on torque sensor compensator to raise or lower line plotted in step (9). Turning screw clockwise decreases indicated torque pressure, torque, or horsepower and turning screw counterclockwise increases indicated value. One-third turn provides a change in indicated value of 1.5 psig, 55 foot-pounds, or 20 shaft horsepower. Run engine and adjust center screw of torque sensor compensator assembly until points plotted in step (8) coincide with compensated torque differential (delta) pressure specification line. (See figure 511.)

7. Torque Sensor Compensator Assembly or Torque Transducer Reset Check

NOTE: Prior to and after accomplishing maintenance requiring removal of the intermediate gearbox housing assembly, run engine to obtain a pre-teardown and post-assembly realtionship of the torque sensing system.

If an adequate pre-run is not obtainable, a satisfactory setting must be established using 291862-1 torque test kit or equivalent. Refer to paragraph 8 for procedures using torque test kit.

Torque sensor compensator assembly or torque transducer calibration procedures may require multiple engine run-ups.

Ensure that no auxiliary power or bleed air is being used for operation of non-essential equipment during all checks.

A. Prepare Engine and Perform Torque Sensor Compensator or Torque Pressure Transducer Reset

(1) Check aircraft torque-horsepower indicating system for proper calibration in accordance with paragraph 5.

(2) Install pressure and vacuum gages as follows.

R (a) (Codes AA-BC, EA-LA) Connect pressure gage (0 - 100 psi) to raw torque pressure port. Connect vacuum gage (+15 to -30 psi) to gearcase negative pressure port (figure 101 through 105).

7. A. (2) (b) (Codes CA-CC) Remove bleed port plug from torque sensor compensator assembly. Install 284461-1-1, torque calibration adapter plate and connect pressure gage (0 - 100 psi). Remove tube assembly connecting torque sensor transmitter to mounting adapter. Fabricate a flexible line with tee fitting and install in place of removed tube assembly. Connect pressure/vacuum gage (+15 psi to -30 Hg) to tee fitting.

NOTE: If desired, compensated differential (delta) pressure may be taken in lieu of cockpit torque indication or as a comparison for verification of cockpit torque indication.

(c) (Codes CA-CC) If compensated differential (delta) pressure is to be used in lieu of cockpit torque indication it will be necessary to remove torque sensor transmitter and adapter, install 284453-1-1, torque calibration adapter plate and connect gage (0 - 100 psi) and pressure/vacuum gage (+15 psi to -30 Hg) to adapter plate.

(d) In all subsequent engine runs during calibration procedure, subtract vacuum gage reading from pressure gage reading.

1 The following are examples of typical calculations for correction of raw torque signal differential (delta) pressure (psid) and for calculating compensated differential (delta) pressure.

Raw Torque Pressure (psig)		Gearcase Pressure (Negative) (psig)		Raw Torque Differential (Delta) Pressure (psid)
(20)	-	(-3.5)	=	23.5

Compensated Torque Pressure (psig)		Gearcase Negative Pressure (psig)		Compensated Torque Differential (Delta) Pressure (psid)
(18)	-	(-3.5)	=	21.5

		UNITS	POINT NUMBER AND POWER SETTING 1 MAXIMUM	2 80%	3 60%	4 40%
PRE-TEARDOWN CALIBRATION	(1) OUTSIDE AIR TEMPERATURE, OAT	DEG C				
	(2) PRESSURE ALTITUDE	FEET				
	(3) FUEL FLOW RATE, WF 1	LB/HR				
	(4) RAW TORQUE DELTA (FOR REFERENCE ONLY)	PSI				
	(5) COCKPIT TORQUE INDICATION OR COMPENSATED TORQUE DELTA PRESSURE NOTE 2	PSI, PCT, HP, FT-LB				
	(6) TURBINE TEMPERATURE (EGT OR ITT)	DEG C				
PRE-TEARDOWN CALCULATION	(7) FUEL FLOW FACTOR, WFCT 1 ENTER TABLE 513 WITH (1)(2) AND (6) NOTE 1	FACTOR				
	(8) FUEL FLOW CORRECTION FOR ALTITUDE, WFCA 1 ENTER CURVE FIGURE 514 WITH (2)	LB/HR				
	(9) CORRECTED FUEL FLOW, WFC 1 ((3) X (7)) + (8) = (9)	LB/HR				
	(10) TORQUE RATIO - TR1 ENTER CURVE FIGURE 515 WITH (9)	RATIO				
POST-ASSEMBLY CALIBRATION	(11) OUTSIDE AIR TEMPERATURE, OAT	DEG C				
	(12) PRESSURE ALTITUDE	FEET				
	(13) FUEL FLOW RATE, WF 2	LB/HR				
	(14) RAW TORQUE DELTA PRESSURE	PSI				
	(15) COCKPIT TORQUE INDICATION OR COMPENSATED TORQUE DELTA PRESSURE NOTE 2	PSI, PCT HP, FT-LB				
	(16) TURBINE TEMPERATURE (EGT OR ITT)	DEG C				
POST-ASSEMBLY CALCULATION	(17) FUEL FLOW FACTOR, WFCT 2 ENTER TABLE 513 WITH (11) (12) AND (16) NOTE 1	FACTOR				
	(18) FUEL FLOW CORRECTION FOR ALTITUDE, WFCA 2 ENTER CURVE FIGURE 514 WITH (12)	LB/HR				
	(19) CORRECTED FUEL FLOW, WFC 2 ((13) X (17) + (18) = (19)	LB/HR				
	(20) TORQUE RATIO, TR2 ENTER CURVE FIGURE 515 WITH (19)	RATIO				
COMPENSATOR RESET CALCULATION	(21) TORQUE RATIO FACTOR, TRF (20) ÷ (10) = (21)	FACTOR				
	(22) REQUIRED COCKPIT TORQUE INDICATION ((5) - 10.0) X (21) + 10.0 = (22) NOTE 2	PSI				
	(22a) REQUIRED COCKPIT TORQUE INDICATION ((5) X (21) = (22) NOTE 2	PCT, HP FT-LB				
	(23) PLOT (14) VERSUS (22)	FUNCTION				
	(24) RECORD RAW TORQUE DELTA PRESSURE VERSUS COMPENSATED TORQUE DELTA PRESSURE	ENGINE LOG ENTRY				

NOTES:

1. IF THE DIFFERENCE BETWEEN (1) AND (11) DOES NOT EXCEED 20 DEG C OR THE DIFFERENCE BETWEEN (2) AND (12) DOES NOT EXCEED 2000 FEET USE A VALUE OF 1.00.
2. USE THE UNITS WHICH CORRESPOND TO THE CALIBRATION OF THE COCKPIT TORQUE INDICATOR. USE EITHER STEP (22) OR STEP (22a) AS APPLICABLE.
3. IF TEMP LIMIT IS USED FOR MAX POWER POINT, THEN 80% IS: $0.8\,(T_{MAX} - T_{IDLE}) + T_{IDLE}$.
4. ON POST TEARDOWN RUN, SET POWER LEVEL TO OBTAIN FUEL FLOWS BY USING: STEP (3) VALUES X $\frac{W_{F2}\ (MAX)}{W_{F1}\ (MAX)}$

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Torque Sensor Compensator or Torque Transducer Adjustment Calculation Worksheet
Figure 512

7. A. (3) Perform pre-teardown calibration as follows.

NOTE: Record pertinent data in appropriate section of a calibration worksheet similar to worksheet illustrated in Figure 512.

(a) Record prevailing outside air temperature (OAT) and pressure altitude on worksheet.

(b) Start and run engine in accordance with Aircraft Flight Manual. Unlatch propeller from start locks and run engine at ground idle. Operate until oil temperature stabilizes at normal operating value. Ensure oil pressure is within normal operating limits.

(c) Record fuel flow rate (WF1), raw torque delta pressure, cockpit torque indication and ITT values at each of four power settings (figure 512). Refer to paragraph 8.B.(6) for determining four power settings.

(d) Recheck raw date prior to commencing with calculations or disassembly of engine to allow for repeat of any questionable data points as follows.

NOTE: A relatively straight line should pass through each of the four data points plotted. Repeat check of any data point that does not lie sufficiently close to a straight line.

1 Plot the raw torque differential (delta) pressures versus fuel flow rate (WF) from Figure 512 on a plotting form similar to Figure 513.

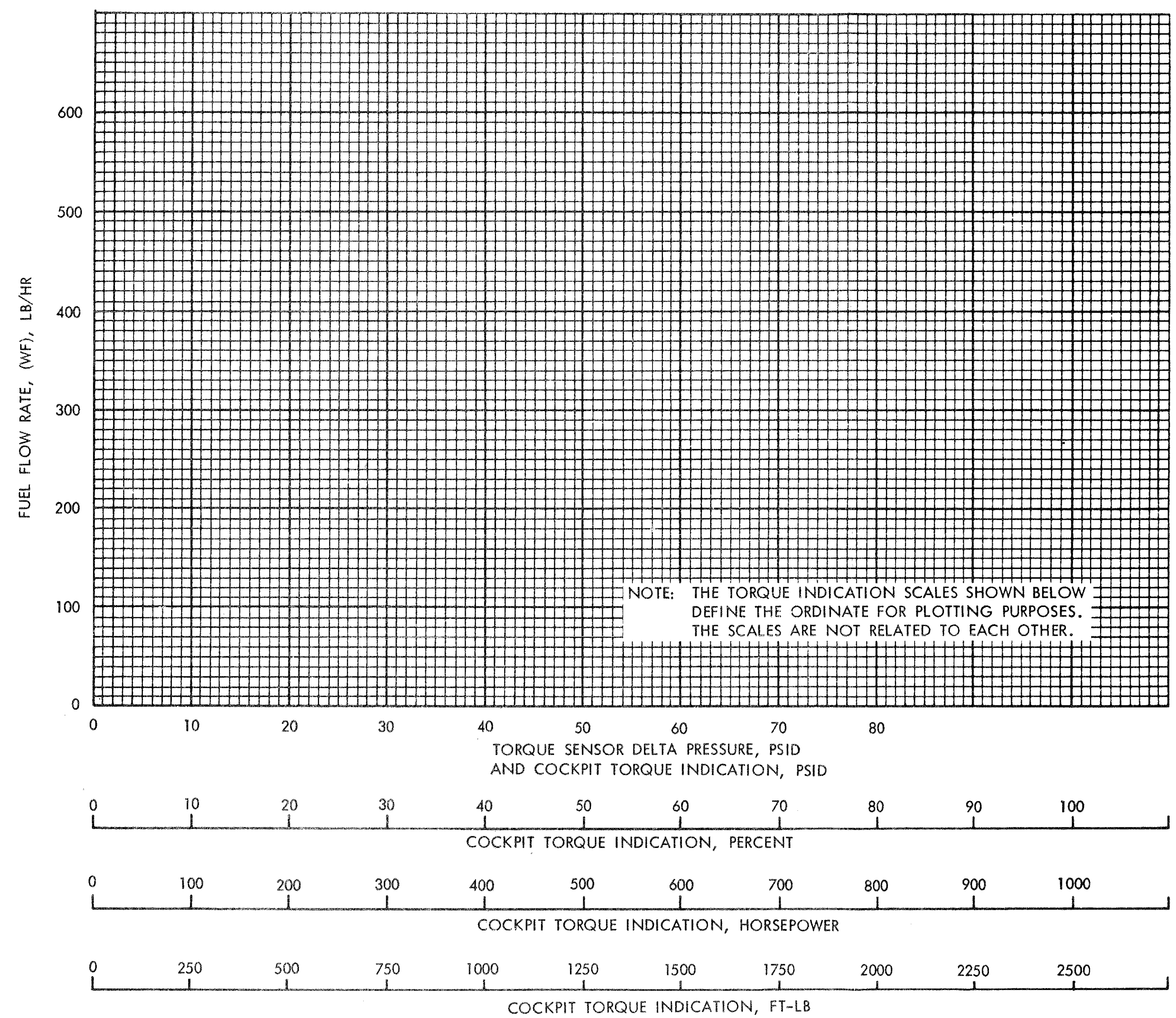
2 Plot the cockpit torque indication versus fuel flow rate (WF) from Figure 512 on the same form.

(4) Perform pre-teardown calculation.

NOTE: Use recorded data in the pre-teardown calibration section of worksheet for determining the following calculations.

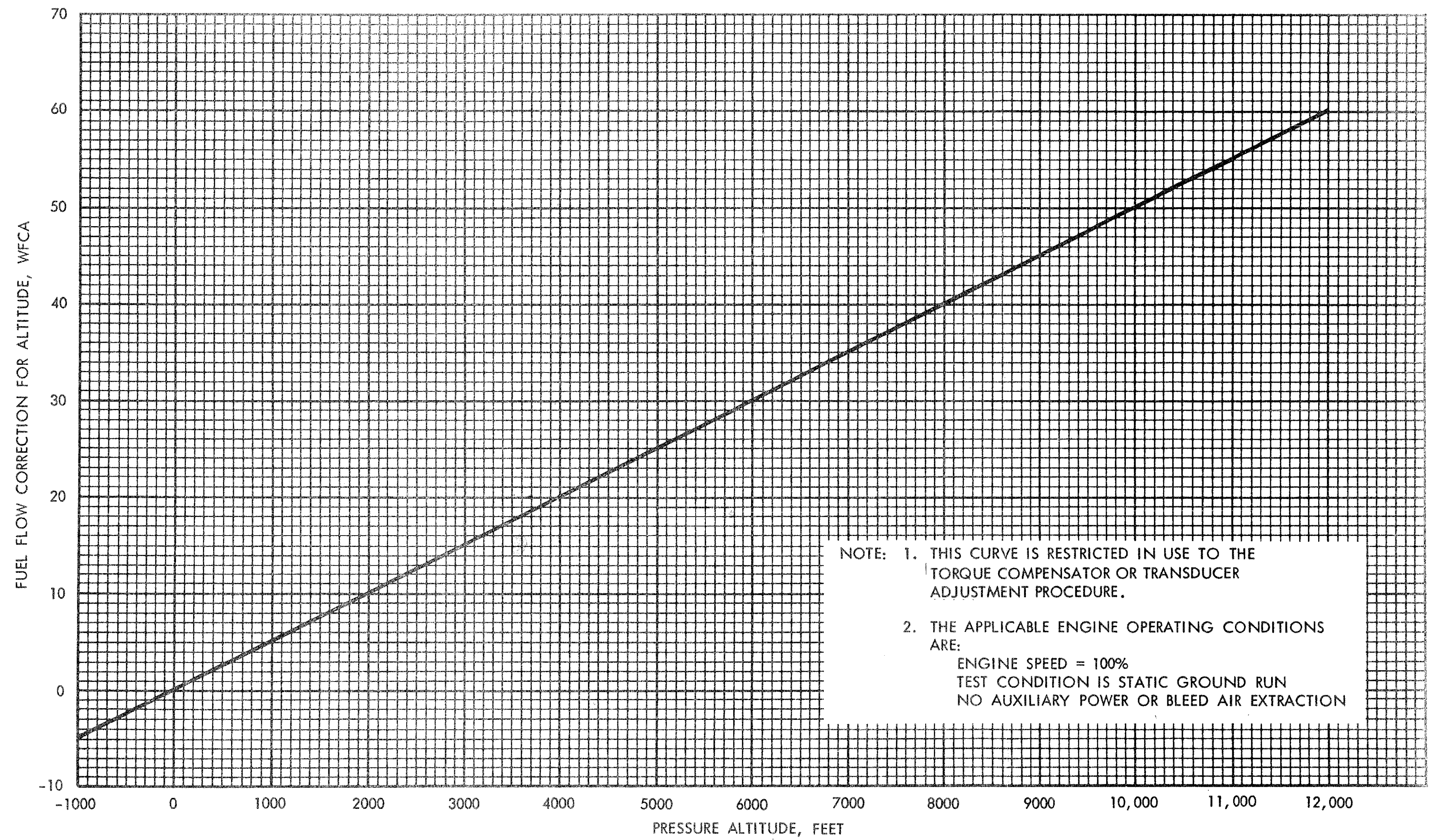
(a) Obtain the fuel flow factor (WFCT1) from Table 516 using recorded outside air temperature (OAT), pressure altitude and ITT.

(b) Obtain fuel flow correction for altitude (WFCA1) by entering curve



Torque Versus Fuel Flow Rate
Figure 513

R



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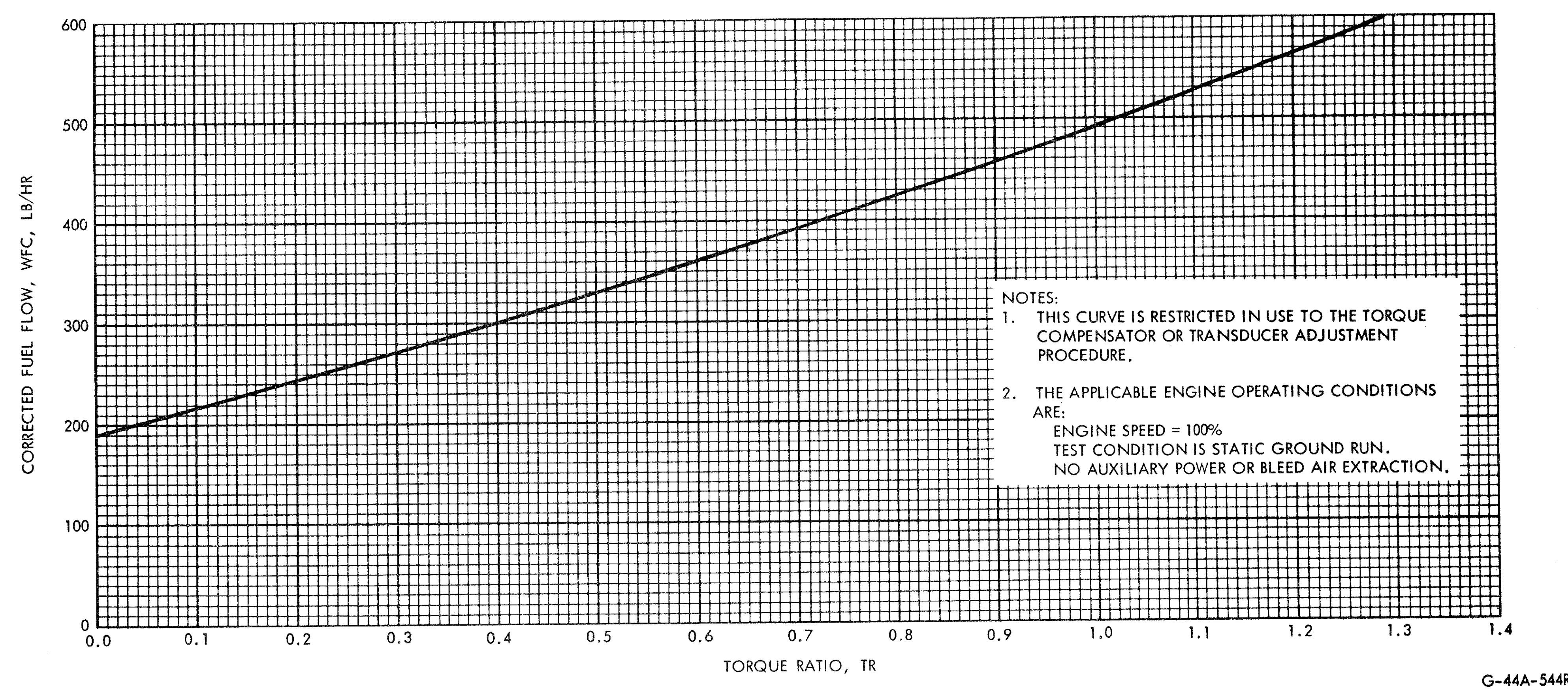
Fuel Flow Correction for Altitude
Figure 514



Torque Ratio Versus Corrected Fuel Flow
Figure 515

R

Table 516. Fuel Flow Factor

Turbine Discharge Temperature (ITT 900C or Higher)

Altitude (Feet)	Outside Air Temperature (OAT) C -50	-40	-30	-12	-10	0	10	20	30	40	50
-1000	0.95	0.97	0.98	0.99	0.99	0.00	1.00	1.00	1.00	1.00	1.00
0	0.95	0.97	0.98	0.98	0.98	0.99	1.00	1.00	1.00	1.00	1.00
1000	0.95	0.97	0.98	0.98	0.98	0.99	1.00	1.00	1.00	1.00	1.00
2000	0.95	0.97	0.98	0.98	0.98	0.99	1.00	1.00	1.00	1.00	1.00
3000	0.95	0.97	0.98	0.98	0.98	0.99	1.00	1.00	1.00	1.00	1.00
4000	0.95	0.96	0.97	0.98	0.98	0.99	1.00	1.00	1.00	1.00	1.00
5000	0.94	0.96	0.97	0.98	0.98	0.99	0.99	1.00	1.00	1.00	1.00
6000	0.94	0.96	0.97	0.98	0.98	0.98	1.00	1.00	1.00	1.00	1.00
7000	0.94	0.96	0.97	0.97	0.97	0.98	0.99	1.00	1.00	1.00	1.00
8000	0.93	0.96	0.96	0.97	0.97	0.98	0.99	0.99	1.00	1.00	1.00
9000	0.93	0.95	0.96	0.96	0.97	0.98	0.98	0.99	1.00	1.00	1.00
10000	0.93	0.95	0.96	0.96	0.96	0.98	0.98	0.99	0.99	1.00	1.00
11000	0.92	0.94	0.95	0.96	0.96	0.97	0.98	0.99	0.99	0.99	1.00
12000	0.92	0.94	0.95	0.95	0.96	0.97	0.98	0.98	0.99	0.99	1.00

NOTE: 1. Table is restricted in use to the torque compensator or torque transducer adjustment procedure.

2. Applicable engine operating conditions are:

a) Engine speed 100 percent rpm.
b) Test condition is ground static engine run.
c) No auxiliary power or bleed air extraction.

Table 516. Fuel Flow Factor (Cont)

Turbine Discharge Temperature (ITT 800 to 899C)

Altitude (Feet)	Outside Air Temperature (OAT) C -50	-40	-30	-20	-10	0	10	20	30	40	50
-1000	0.95	0.96	0.97	0.98	0.98	0.99	1.00	1.00	1.01	1.01	1.01
0	0.94	0.96	0.98	0.98	0.98	0.99	1.00	1.00	1.01	1.01	1.01
1000	0.94	0.96	0.98	0.98	0.98	0.99	1.00	1.01	1.01	1.01	1.01
2000	0.94	0.96	0.97	0.98	0.98	0.99	1.00	1.01	1.01	1.01	1.01
3000	0.94	0.96	0.97	0.98	0.98	0.99	1.00	1.01	1.01	1.01	1.02
4000	0.94	0.96	0.97	0.97	0.98	0.99	1.00	1.01	1.01	1.01	1.02
5000	0.94	0.96	0.97	0.97	0.98	0.99	1.00	1.01	1.01	1.02	1.02
6000	0.94	0.96	0.97	0.97	0.98	0.99	1.00	1.01	1.01	1.02	1.02
7000	0.93	0.95	0.97	0.97	0.98	0.99	1.00	1.01	1.01	1.02	1.02
8000	0.93	0.95	0.96	0.97	0.98	0.99	1.00	1.00	1.01	1.01	1.02
9000	0.93	0.95	0.96	0.97	0.97	0.99	0.99	1.01	1.01	1.02	1.02
10000	0.93	0.95	0.96	0.96	0.97	0.98	0.99	1.00	1.01	1.02	1.02
11000	0.92	0.94	0.96	0.96	0.97	0.98	0.99	1.00	1.01	1.01	1.02
12000	0.92	0.94	0.95	0.96	0.97	0.98	0.99	1.00	1.00	1.01	1.02

NOTE: 1. Table is restricted in use to torque compensator or torque transducer adjustment procedure.

2. Applicable engine operating conditions are:

a) Engine speed 100 percent rpm.
b) Test condition is ground static engine run.
c) No auxiliary power or bleed air extraction.

R

Table 516. Fuel Flow Factor (Cont)

Turbine Discharge Temperature (ITT 700 to 799C)

Altitude (Feet)	-50	-40	-30	-20	-10	0	10	20	30	40	50
	Outside Air Temperature (OAT) C										
-1000	0.92	0.95	0.96	0.96	0.97	0.98	0.99	1.00	1.01	1.02	1.02
0	0.92	0.95	0.96	0.97	0.97	0.98	1.00	1.00	1.02	1.02	1.03
1000	0.93	0.95	0.96	0.97	0.97	0.99	1.00	1.01	1.02	1.02	1.03
2000	0.93	0.95	0.96	0.97	0.98	0.99	1.00	1.01	1.02	1.03	1.04
3000	0.93	0.95	0.96	0.97	0.98	0.99	1.00	1.01	1.02	1.03	1.04
4000	0.93	0.95	0.96	0.97	0.98	0.99	1.00	1.01	1.03	1.04	1.05
5000	0.93	0.95	0.97	0.97	0.98	0.99	1.00	1.02	1.03	1.04	1.05
6000	0.93	0.95	0.97	0.97	0.98	0.99	1.00	1.02	1.03	1.04	1.05
7000	0.93	0.95	0.97	0.97	0.98	0.99	1.00	1.02	1.03	1.04	1.05
8000	0.93	0.95	0.96	0.97	0.98	0.99	1.01	1.02	1.03	1.05	1.05
9000	0.93	0.95	0.96	0.97	0.98	0.99	1.00	1.02	1.03	1.05	1.06
10000	0.92	0.95	0.96	0.97	0.98	0.99	1.00	1.02	1.03	1.04	1.06
11000	0.92	0.94	0.96	0.97	0.98	0.99	1.00	1.02	1.03	1.05	1.06
12000	0.92	0.94	0.96	0.96	0.97	0.99	1.00	1.02	1.03	1.05	1.06

NOTE: 1. Table is restricted in use to torque compensator or torque transducer adjustment procedure.

2. Applicable engine operating conditions are:

a) Engine speed 100 percent rpm.
b) Test condition is ground static engine run.
c) No auxiliary power or bleed air extraction.

Table 516. Fuel Flow Factor (Cont)

Turbine Discharge Temperature (ITT 700C or Lower)

Altitude (Feet)	Outside Air Temperature (OAT) C -50	-40	-30	-20	-10	0	10	20	30	40	50
-1000	0.90	0.92	0.93	0.94	0.95	0.96	0.98	1.00	1.02	1.04	1.06
0	0.90	0.92	0.94	0.94	0.95	0.97	0.99	1.00	1.03	1.05	1.07
1000	0.90	0.93	0.94	0.94	0.96	0.97	0.99	1.01	1.03	1.06	1.08
2000	0.91	0.93	0.94	0.95	0.96	0.98	1.00	1.02	1.04	1.06	1.08
3000	0.91	0.93	0.95	0.95	0.97	0.98	1.00	1.02	1.05	1.07	1.09
4000	0.91	0.94	0.95	0.96	0.97	0.98	1.01	1.03	1.05	1.07	1.09
5000	0.91	0.94	0.94	0.96	0.97	0.99	1.01	1.04	1.05	1.08	1.10
6000	0.92	0.94	0.95	0.96	0.98	1.00	1.02	1.04	1.06	1.08	1.10
7000	0.92	0.94	0.96	0.96	0.98	1.00	1.02	1.04	1.06	1.09	1.11
8000	0.92	0.94	0.96	0.97	0.98	1.00	1.02	1.04	1.07	1.09	1.11
9000	0.92	0.95	0.96	0.97	0.98	1.00	1.02	1.05	1.07	1.09	1.12
10000	0.92	0.94	0.96	0.97	0.99	1.00	1.02	1.04	1.07	1.09	1.11
11000	0.92	0.94	0.96	0.97	0.99	1.00	1.02	1.04	1.07	1.09	1.12
12000	0.92	0.94	0.96	0.97	0.98	1.00	1.02	1.05	1.07	1.09	1.11

NOTE: 1. Table is restricted in use to the torque compensator or torque transducer adjustment procedure.

2. Applicable engine operating conditions are:

a) Engine speed 100 percent rpm.
b) Test condition is ground static engine run.
c) No auxiliary power or bleed air extraction.

7. A. (4) (c) Obtain corrected fuel flow (WFC1) as follows:

WFC1 = (WF1 x WFCT1) + WFCA1 where; WFC1 = Corrected fuel flow required for pre-teardown calculation.
WF1 = Fuel flow rate observed during pre-teardown calibration.
WFCT1 = Fuel flow factor obtained during pre-teardown calculation.
WFCA1 = Fuel flow correction for altitude obtained during pre-teardown calculation.

(d) Obtain torque ratio (TR1) by entering curve (figure 515) with the corrected fuel flow (WFC1) obtained in preceding step (c).

(5) Perform post-assembly calibration as follows.

(a) Perform ground check of engine to assure NTS operation in accordance with paragraph 2.V.

(b) Record prevailing outside air temperature (OAT) and pressure altitude in post-assembly calibration section of worksheet (figure 512).

(c) Obtain fuel flow correction for altitude (WFCA2) by entering curve (figure 514) with pressure altitude values entered in post-assembly calibration section of worksheet. Enter values obtained in post-assembly calculation section of worksheet (figure 512).

(d) Determine fuel flow rate (WF2) required to obtain power settings proportional to pre-teardown calibration power settings by taking into account fuel flow correction for altitude. Fuel flow values are obtained as follows:

WF2 = WF1 + WFCA1 - WFCA2 where; WF2 = Fuel flow rate required for post-assembly calibration.
WF1 = Fuel flow rate observed during pre-teardown calibration.

WFCA1 = Fuel flow correction for altitude obtained during pre-teardown calculation.

WF2 = WF1 + WFCA1 - WFCA2 where; WFCA2 = Fuel flow correction for altitude obtained during post-assembly calculation.

CAUTION: DO NOT EXCEED TURBINE DISCHARGE TEMPERATURE LIMITS.

7. A. (5) (e) If ITT limit is reached before desired fuel flow rate (WF2) is obtained use fuel flow value obtained at that point for maximum power setting. Fuel flows for part-power settings are obtained as follows:

$$WF2 = WF1 \times \frac{WF2\ (max)}{WF1\ (max)}$$

(f) Start and run engine in accordance with Aircraft Flight Manual. Unlatch propeller from start locks and run engine at ground idle. Operate until oil temperature stabilizes at normal operating value. Ensure oil pressure is within normal operating limits.

NOTE: Data is obtained at four power settings similar to pre-teardown calibration (step (3)) except that the power settings are obtained by operating engine to a fuel flow rate because the characteristics of the torque sensor system of the reassembled engine are unknown at this time.

(g) Record fuel flow rate (WF2), raw torque delta pressure, cockpit torque indication and ITT values on worksheet (figure 512) at each of the four power settings.

(h) Recheck raw data in accordance with step (3)(d).

7. A. (6) Perform post-assembly calculation as follows.

NOTE: Use recorded data in the post-assembly calibration section of worksheet for determining the following calculations.

If the pre-teardown calibration and post-assembly calibration conditions are such that the difference between the outside air temperature (OAT) values is not in excess of 20C and the difference between the pressure altitude values is not in excess of 2000 feet, the value of the fuel flow factor (WFCT2) may be entered as 1.00 without referring to Table 516.

(a) Obtain the fuel flow factor (WFCT2) from Table 516 using recorded outside air temperature (OAT), pressure altitude and ITT.

(b) Values for fuel flow correction for altitude (WFCA2) were obtained in preceding step (5)(c).

NOTE: If the fuel flow factor (WFCT2) obtained in step (a) is 1.00 the multiplication step is not necessary, but the fuel flow correction for altitude (WFCA2) must be added to the fuel flow factor.

(c) Obtain corrected fuel flow (WFC2) as follows:

WFC2 = (WF2 x WFCT2) + (WFC2) where; WFC2 = Corrected fuel flow required for post-assembly calculation.
WF2 = Fuel flow rate obtained during post-assembly calculation.
WFCT2 = Fuel flow factor obtained during post-assembly calculation.
WFCA2 = Fuel flow correction for altitude obtained during post-assembly calibration.

(d) Obtain torque ratio (TR2) by entering curve (figure 515) with corrected fuel flow (WFC2) obtained in preceding step (c).

7. A. (7) Obtain torque sensor compensator assembly or torque transducer adjustment calculations as follows.

(a) Obtain torque ratio factor (TFR) by dividing torque ratio (TR2) obtained in step (6)(d) by torque ratio (TR1) obtained in step (4)(d).

R (b) (Codes AA-BC, FA-LA) Calculate torque required for engines with cockpit torque indicators calculated to read in percent or horsepower as follows.

1 Multiply cockpit torque indication recorded in pre-teardown section of worksheet by torque ratio factor (TRF) obtained in preceding step (a) to obtain required torque indication for power settings during torque sensor compensator or torque transducer adjustment calibration.

NOTE: Slight variations to a straight line are allowed for normal data scatter which should not affect torque sensor compensator assembly or torque transducer adjustment.

(c) (Codes CA-CC) Calculate torque required for engines with cockpit torque indicators calibrated to read psi (with 10 psi indication at zero torque condition) as follows.

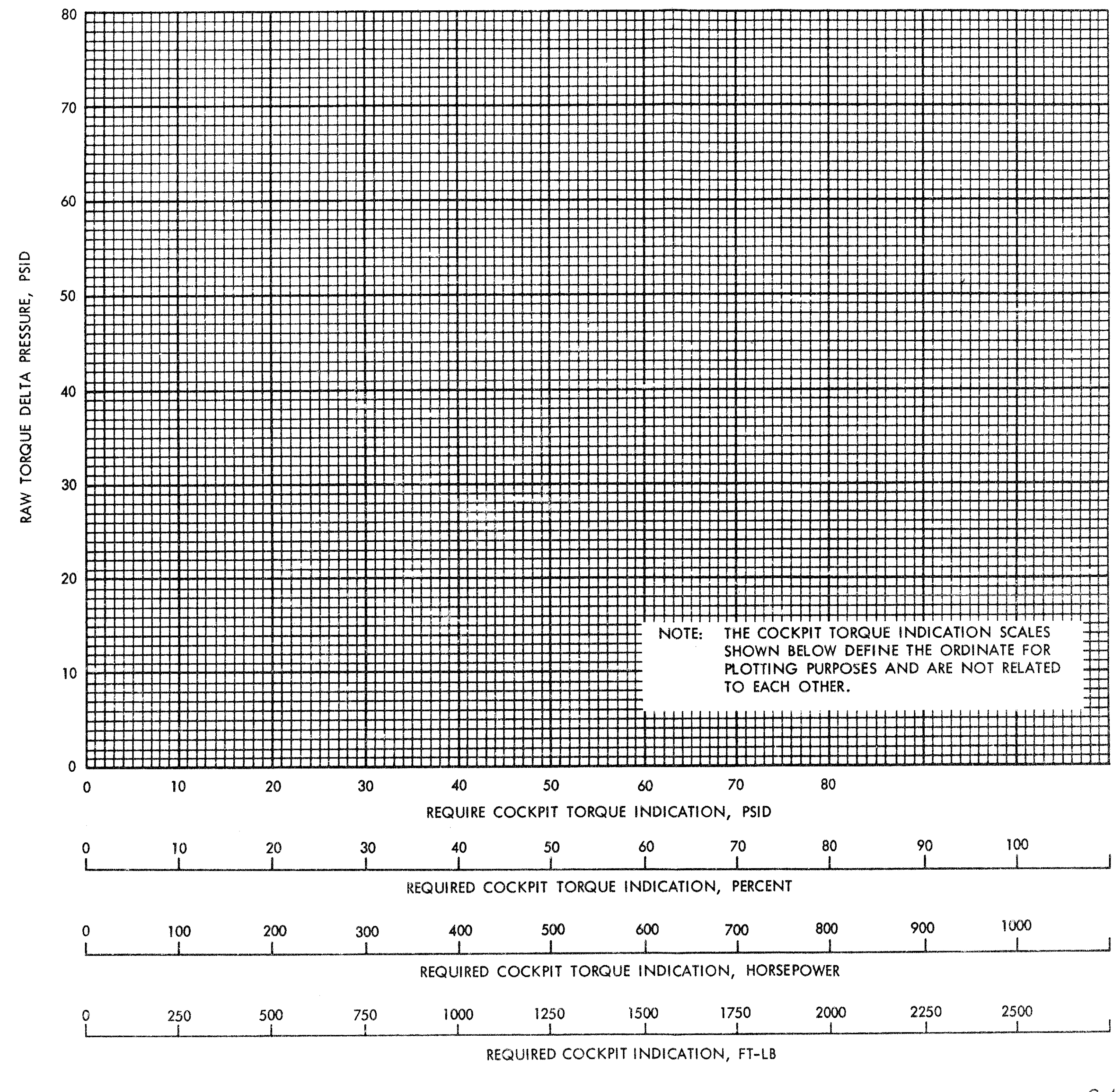
1 Subtract 10 psi from cockpit torque indication recorded in pre-teardown calibration section of worksheet.

2 Multiply result by torque ratio factor (TRF) obtained in preceding step (a), then add 10 psi to obtain required torque indication for power setting during torque sensor compensator adjustment calculation.

(d) Plot four raw torque delta pressure values obtained during post-assembly calibration versus required cockpit torque indication obtained in preceding step (b) or (c), using a plotting form similar to illustration, Figure 516.

(e) Record the values of required cockpit torque indication for corresponding raw torque differential (delta) pressures in engine log book and on DSC (data sheet - customer). Attach plot made in Figure 516 to DSC.

(f) Make notation on original DSC (data sheet - customer) form that raw torque versus power data is no longer applicable.



Torque Compensator or Torque Transducer Adjustment Plot
Figure 516

R

7. A. (8) Adjust torque sensor compensator assembly or torque transducer if required as follows.

NOTE: Use plotted data obtained in preceding step
R (7)(d) for plotting data in following steps 1
R through 3.

R (a) (Codes AA-BC, FA-LA) Adjust torque transducer in accordance with paragraph 5.A. 5.B. or 5.D. as applicable.

(b) (Codes CA-CC) Adjust torque sensor compensator assembly as follows.

1 Obtain raw torque differential (delta) pressure required to provide 100 percent cockpit torque indication from line plotted in preceding step (7)(d).

2 Increase power setting to required raw torque differential (delta) pressure setting equal to 100 percent cockpit torque indication or ITT limit, whichever is obtained first.

3 Reduce power to a setting that will give a raw torque differential (delta) pressure corresponding to approximately 40 percent required cockpit torque indication, or 40 percent of torque obtained at ITT limit.

4 Note actual cockpit torque versus required cockpit torque indication plotted in preceding step (7)(d). Repeat steps
R 1 through 3 above until a satisfactory agreement is reached between the two plots by adjusting torque sensor compensator assembly as follows.

a If torque sensor compensator assembly slope line (figure 516) is steeper or shallower than specification, correct slope by adjusting body of torque sensor compensator assembly using 284694-1-1 adapter. Turning body clockwise will steepen slope of drawn line. Turning body counterclockwise will make slope shallower. Adjust body in one-eighth turn increments between engine runs and repeat procedure until drawn line and specification line are parallel. After correct slope is obtained, adjust center screw on torque sensor compensator to obtain required minimum torque pressure, torque or horsepower value on Figure 516. Turning screw clockwise decreases indicated torque pressure, and turning screw counterclockwise increases indicated value. One-third turn provides a change in indicated value of 1.5 psid, 55 foot-pounds, or 20 shaft horsepower.

8. Indicated Torque Output Check Using Torque Test Kit

NOTE: Prior to any procedure requiring removal of intermediate gearbox (diaphragm) assembly a determination of engine torque value shall be made if engine condition permits (Refer to paragraph 7). If torque values cannot be established prior to teardown, a new raw torque plot must be established following repair. This new raw torque plot is required for post-repair calibration of the torque sensor compensator assembly and for future engine evaluation. Establishment of a raw torque plot requires special tools and procedures specified in this paragraph. Maintenance personnel should ensure that they are thoroughly familiar with the procedures and that special tools (table 502) are available before untertaking maintenance requiring raw torque determination.

A. Preparation for Indicated Torque Output Check

NOTE: Locate digital torque indicator so that a temperature range of 10 to 49C (50 to 120F) is maintained during test and adjustment procedure. Ensure that digital torque indicator case is grounded through AC power cable (3 prong plug). Ensure that sliprings of torquemeter are clean and dry by removing slipring cover and if necessary spray sliprings with degreaser and cleaner (MS-180 Freon). Wipe accessible surfaces clean with lint-free cloth.

(1) Connect digital torque indicator to a 115 +10/-10 volts (grounded power supply), 50 to 60 Hz outlet.

(2) Connect digital torque indicator to torquemeter using 292158-1 electrical cable.

(3) Place power switches (located at rear of digital torque indicator) to ON position.

CAUTION: PROTECT OIL FLOW (BETA) TUBE FROM CORROSION AND POSSIBLE DAMAGE UNTIL RE-INSTALLATION. STORE IN BETA TUBE CASE.

(4) Remove engine propeller spinner, oil flow (beta) tube assembly and propeller assembly.

NOTE: On some installations existing "O" ring (packing) may be used instead of special "O" ring (packing) provided with torque test kit.

(5) Remove existing propeller shaft "O" ring and install S9413-142 "O" ring (packing).

8. A. (6) Remove propeller de-icing brush block assembly if installed. Refer to Aircraft Maintenance Manual.

NOTE: Carefully fit torquemeter on propeller shaft flange ensuring that aligning pins on shaft flange and pin holes on torquemeter engage and seat fully with hand pressure. If satisfactory alignment cannot be achieved return torque test kit to AiResearch Manufacturing Co, Product Support Division, Dept. 74, P.O. Box 29003, Phoenix, AZ 85038, for repair. R

(7) Install electrically connected torquemeter on propeller shaft. If torquemeter fails to bottom against propeller shaft flange, remove torquemeter, clean pin holes and pins of dirt, corrosion or other obstruction and reinstall. Secure with existing propeller mount bolts and washers only hand tightened at this time.

R (8) (Codes AA-BC, EA-LA) Remove existing adapter plate from gearcase. Install 294453-1-1 torque calibration adapter plate on gearcase. Connect gage assembly (50, figure 517) to gearcase negative pressure port and connect existing tube assembly from torque pressure transducer to tee on gage assembly.

R (9) (Codes AA-BA, EA-LA) Connect gage assembly (45, figure 517) to raw torqe pressure port and connect existing tube assembly from transducer to tee on gage assembly.

(10) (Codes CA-CC) Remove existing tube assembly connecting torque sensor transmitter to mounting adapter. Connect gage assembly (55, figure 517) to union on mounting adapter. Connect flexible hose assembly (60) between tee on gage assembly and union on torque sensor transmitter.

(11) (Codes CA-CC) Remove existing adapter plug from torque sensor compensator assembly and install adapter (35, figure 517). Connect tube assembly (40) to adapter (35). Connect gage assembly (45) to tube assembly (40). Ensure that open end of tee on gage assembly (45) is capped.

8. A. (12) Adjust digital torque indicator as follows.

NOTE: Ensure that digital torque indicator and torquemeter have been electrically stabilized for a minimum of one hour prior to setting.

(a) Set zero on indicator by adjusting coarse and fine balance screws on digital torque indicator face plate.

NOTE: On later model torque indicators there is no propeller rotation selector and clockwise rotation reads out as a positive value and counterclockwise rotation reads out as a negative value.

(b) Set propeller rotation switch at CW (clockwise) for right hand propeller rotation (viewed from rear of engine) or CCW (counterclockwise) for left hand propeller rotation (viewed from rear of engine).

(c) Depress shunt calibrate switch and adjust coarse and fine span to read calibration positions as specified in data sheet provided with digital torque indicator.

(d) Recheck zero and span in accordance with preceding steps (a) and (c). Repeat steps as necessary until rquired calibration is achieved.

CAUTION: TORQUEMETER INSTALLATION BOLT TORQUE IS CRITICAL. EXERCISE CARE DURING INSSTALLATION.

(13) Initially tighten bolts securing torquemeter to propeller shaft flange to 30 foot-pounds torque using 292157-1 adapter wrench and following sequence shown on Figure 518. Tighten bolts to final torque of 100 foot-pounds following same torque sequence.

(14) Check reading on digital torque indicator to determine if a shift of more than +300/-300 inch-pounds occurred, loosen and retighten bolts in accordance with preceding step (13) to remove side loading of torquemeter. If shift is less than +300/-300 inch-pounds rebalance indicator to zero in accordance with preceding step (12)(a).

(15) Install extended beta tube and propeller as follows.

(a) Set propeller pitch control in full reverse position, install beta tube and check for freedom of movement in propeller shaft. Remove beta tube.

7. A. (15) (b) Install S9413-037 packing on piston packing groove of torquemeter. Carefully (so as not to damage packing) install propeller on torquemeter and secure (hand tight) with bolts and washers furnished with torquemeter.

CAUTION TORQUEMETER INSTALLATION BOLT TORQUE IS CRITICAL. EXERCISE CARE DURING INSTALLATION.

(c) Initially tighten bolts to 30 foot-pounds torque using 292155-1 adapter wrench and following torque sequence shown in Figure 518. Tighten bolts to final torque of 100 foot-pounds following same torque sequence.

NOTE: If satisfactory alignment cannot be achieved return torque test kit to AiResearch Manufacturing Co, Product Support Division, Dept.
R 74, P.O. Box 29003, Phoenix, AZ 85038, for repair.

(d) Check reading on digital torque indicator to determine if a shift occurred in zero adjustment. If a shift of more than +50/-50 inch-pounds is noted loosen bolts. check alignment and proper fit of alignment pins and pin holes and reinstall propeller in accordance with peceding step (c). If problem persists, change propeller and repeat step (c).

(e) Set aircraft power lever at flight idle and pin propeller pitch control lever so that no movement from this position takes place during following steps (f), (g), and (h).

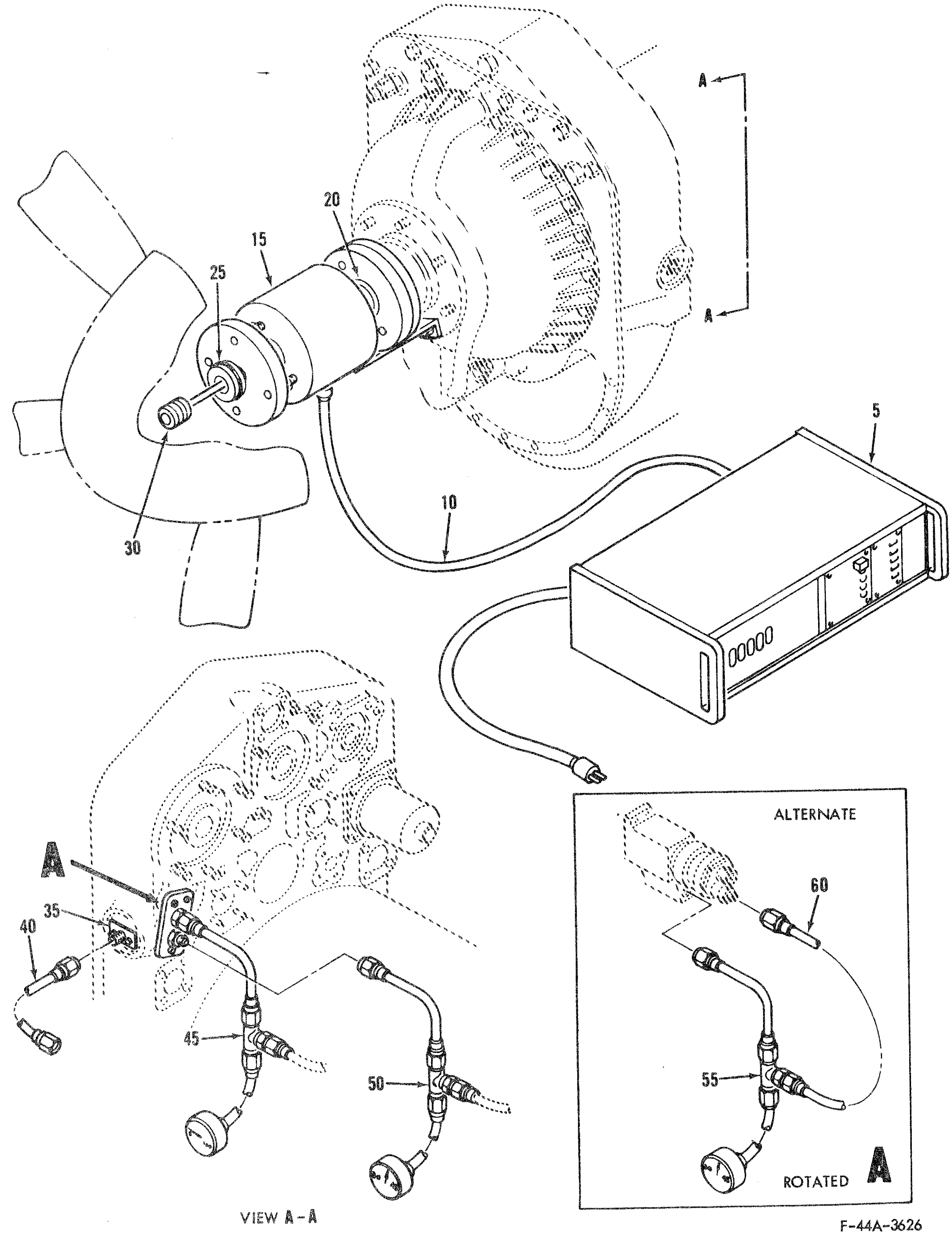
(f) With propeller in feather position, carefully insert extended beta tube. Screw beta tube in until tube has approximately two threads showing at propeller dome.

(g) Operate unfeathering pump and adjust beta tube in until blade is at angle specified. (Turning beta tube counterclockwise one turn increases blade angle approximately 2.4 degrees.)

(h) When propeller blade angle is confirmed, lock beta tube in position with existing bolt and nut and remove rig pin installed in preceding step (e).

NOTE: Allow clearance between arms of anti-rotation bracket to give slight amount of play and prevent stress on torquemeter.

(16) Secure short arm of loosely jointed anti-rotation bracket to torquemeter using existing bolts and long arm of bracket to engine case using existing stud and nut and washer supplied with test kit.



Torque Test Kit Installation
Figure 517

8. B. Data Acquisition

(1) Ensure that digital torque indicator and torquemeter have been electrically stabilized for a minimum of one hour.

(2) Recheck digital torque indicator calibration in accordance with preceding paragraph A.(12)(a) through A.(12)(d).

(3) Start and run engine at approximately 50 percent power until oil temperature is at normal operating range. Cycle propeller through reverse and normal ranges several times (for a minimum of three minutes) to ensure adequate oil flow through torquemeter to bring to operating temperature.

(a) Set power lever at minimum point that will maintain 100 percent rpm and record digital indicator torque.

(b) Run at maximum power point for ambient conditions (refer to aircraft or flight manual) and record digitial indicator torque.

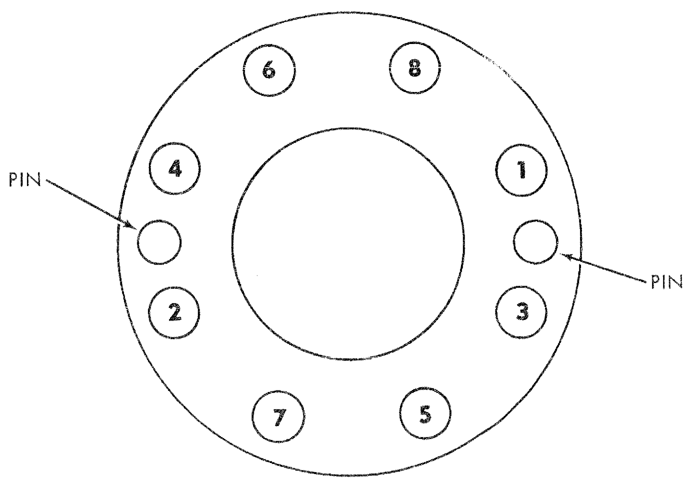
NOTE: Recalibrate digital indicator immediately after propeller has stopped rotating.

(4) Shut down engine and calibrate digital indicator in accordance with paragraph A.(12)(d) prior to final calibration run.

(5) Check test kit installation for security and leakage.

KEY TO FIGURE 517

5. DIGITAL TORQUE INDICATOR ASSY
10. CABLE ASSY
15. TORQUEMETER PN S9413-142
20. PACKING PN S9413-142
25. PACKING PN S9413-037
30. EXTENDED BETA TUBE
35. ADAPTER PN 284461-1
40. TUBE ASSY PN 292473-1
45. GAGE ASSY PN 292471-1
50. GAGE ASSY PN 292472-1
55. GAGE ASSY PN 292472-1
60. FLEXIBLE HOSE ASSY PN MS28741-4-120



Torquemeter and Propeller Bolt Torque Sequence
Figure 518

NOTE: Power settings are based on percent of increment between minimum and maximum established in following step (6).

8. B. (6) The approximate power settings that will be used during test are listed below:

Power Setting	RPM
Minimum	100 percent
20 percent	100 percent
40 percent	100 percent
60 percent	100 percent
80 percent	100 percent
100 percent	100 percent

To determine cockpit indicated torque to be used at each power setting point, subtract minimum power point digital indicator torque from maximum power point digitial indicator torque found in step (3). Multiply difference by power setting percentage. Add result to minimum point cockpit torque to obtain final value. The following is an example at 40 percent power point.

(MAX - MIN) x (PERCENTAGE) + MIN = INDICATED COCKPIT TORQUE
(2000 - 800) x .40 + 800 = 1280

(7) Restart engine and proceed as follows.

(a) Operate engine at ground idle low position.

(b) Bleed gage end of Gage Assembly Part No. 292471-1 (see figure 517) thoroughly, obtaining continuous oil flow, to ensure that no air is trapped in gage assembly lines.

NOTE: Maintain normal engine operating temperature during entire run. Refer to Aircraft Maintenance Manual.

(c) Run engine at power points calculated in step (6) above. Allow power to stabilize at each point. Plot raw torque values noted on original DSC sheet.

(d) Record digital torque indicator torque, raw torque pressure, engine case pressure and oil temperature.

NOTE: Post-run record shall be taken immediately after the propeller has stopped rotating.

8. B (7) (e) Shut down engine and record post-run zero and span. If zero and/or span does not repeat within +150/-150 inch-pounds recheck equipment and repeat run.

NOTE: Case pressure Gage Assembly Part No. 292472-1 readout is psi in the positive range and Hg in the negative range. To convert Hg to psi multiply Hg by .5.

(f) Subtract case pressure from raw torque.

Raw Pressure (psig)	-	Case Negative Pressure (psig)	=	Raw Signal delta P (psid)
(20)	-	(-3.5)	=	23.5

NOTE: A raw torque plot of the torque output system is necessary to determine the degree of compensation required when performing the torque compensator calibration specified in paragraph 4 and for future engine evaluation and trouble shooting.

(g) Enter test data and torquemeter serial number on engine DSC sheet and attach to permanent engine records for future evaluation and trouble shooting.

(h) Record and enter on engine log the values of each point noted in step (7)(c).

(i) Remove test kit components from engine.

CHAPTER 72 - INSPECTION/CHECK

TABLE OF CONTENTS

R

GENERAL - INSPECTION/CHECK

1. General

   A. Inspection checks and procedures in this publication are those which can be performed at field level to aid in determining if a component or part is serviceable. All components or parts removed from the engine shall be given a careful visual inspection for general appearance and obvious damage. A component or part which shows evidence of damage beyond field level repair capabilities shall be replaced and the damaged component or part sent to an overhaul depot. Detail instructions for inspection and check are provided where required in the text pertaining to each replaceable component. In addition, the following general inspection shall be performed.

      (1) Visually inspect all welded, brazed or soldered assemblies for security of joints.

      (2) Visually check all external surfaces and components of the entire engine for cracks. No cracks are allowed.

      (3) Visually inspect all tubes for kinks, cracks, excessive wear, signs of corrosion or other damage. Inspect all fittings for broken threads, deterioration and cleanliness.

      (4) Inspect oil drained from engine. If excessive metal particles are found or if particles are magnetic in nature, contact AiResearch Field Service for disposition.

      (5) Check for fuel and oil leaks.

      (6) Check drains and vents for restrictions.

      (7) Check compressor inlet for foreign material, obstructions or damage.

      (8) Check inlet temperature and pressure sensor for security and evidence of damage.

      (9) Check oil level.

      (10) Check security of ignition wiring and connections.

      (11) Check for oil seal leakage around starter-generator mount, tachometer-generator mount, aircraft accessory mount and fuel control assembly mount.

      (12) Check for oil leakage around base of feathering valve assembly and beta pressure switch.

1. A. (13) When any disassembly is performed which permits inspection of gears or splined parts, check for abnormal wear patterns, chipped or broken teeth, enlarged or peened keyways, scoring, grooving, scuffing, pitting, galling or other damage. Spline tooth wear shall not exceed ten percent except in fuel pump drive coupling. Refer to 73-20-01, MAINTENANCE PRACTICES for fuel pump assembly drive coupling inspection and wear limits.

2. Periodic Inspection Requirements

A. Routine Periodic Inspections

Routine periodic inspections are recommended at intervals of engine operating hours specified in Table 601.

Table 601. Routine Periodic Inspection Requirements

Nature of Inspection	Pre-Flight	Each 100 Hour	Each 200 Hour	Each 400 Hour	Each 600 Hour	Each 800 Hour
AIR INLET - Check for obstruction and evidence of FOD.	X					
OIL LEVEL - Must be above ADD mark.	X (Daily)					
AIR INLET AND EXHAUST PIPE - Check for oil leakage from compressor and turbine air-oil seals			X			
FIRST STAGE COMPRESSOR IMPELLER - Inspect for foreign object damage. (Refer to 72-30-01, MAINTENANCE PRACTICES)			X			
PLUMBING LINES AND CONNECTIONS - Check for security, leaks, cracks, cuts or rubbing.			X			

Table 601. Routine Periodic Inspection Requirements (Cont)

Nature of Inspection	Pre-Flight	Each 100 Hour	Each 200 Hour	Each 400 Hour	Each 600 Hour	Each 800
ELECTRICAL WIRING AND CONNECTIONS - Check for security and damage.			X			
MAGNETIC DRAIN PLUG - Remove and inspect. (For two-piece unit, remove knurled plug and perform visual inspection.) (Refer to 79-30-01, MAINTENANCE PRACTICES.)			X			
FUEL FILTER (if installed) - Remove clean and inspect for damaged or separated screen. (Refer to 73-21-03, MAINTENANCE PRACTICES.)		X				
OIL FILTER - Remove and inspect for damaged or separated screen. Replace paper element. (Refer to 79-20-02, MAINTENANCE PRACTICES.)		X				
FLOW DIVIDER AND DRAIN VALVE FILTER - Remove clean and inspect for damaged or separated screen. (Refer to 73-10-07, MAINTENANCE PRACTICES.)			X			
P3 AIR FILTER (Codes AA-EA) - Remove clean and inspect. (Refer to 73-10-01, MAINTENANCE PRACTICES.)			X			
FUEL MANIFOLD PURGE SYSTEM TEN MICRON FILTER - Remove, clean and inspect. (Refer to 73-10-13, MAINTENANCE PRACTICES.)			X			
TORQUE LIMITER (BY-PASS) VALVE) FILTER (Codes AA-BC, EA-GA, KA-LA) Remove and clean			X			

Table 601. Routine Periodic Inspection Requirements (Cont)

Nature of Inspection	Pre-Flight	Each 100 Hour	Each 200 Hour	Each 400 Hour	Each 600 Hour	Each 800 Hour
CONTROLS LINKAGE ASSEMBLY - Check for security of locking features. Check for proper alignment of control rods, arms and levers and for obvious damage. Check torque of bolts and screws securing levers and arms to serrated shafts. (Refer to 76-10-01, MAINTENANCE PRACTICES.) Lubricate rod end bearings as required.			X			
STARTER-GENERATOR DRIVE SPLINES - Inspect and lubricate. (Refer to 72-00-00, GENERAL - SERVICING.)			*X			
TACHOMETER GENERATOR DRIVE - Inspect and lubricate. (Refer to 72-00-00, GENERAL - SERVICING.)				X		
IGNITER PLUGS - Remove, clean and inspect. (Refer to 74-10-01, MAINTENANCE PRACTICES.)			X			
R FUEL NOZZLE - Test (Remove and R clean if necessary.) (Refer to R 73-10-09, MAINTENANCE PRACTICES.)			X			
R PLENUM DRAIN VALVES - Remove and R test for closing and opening. (Refer R to 72-00-05, MAINTENANCE PRACTICES.) R				X		

R *Initial inspection/lubrication at 100 hours. Subsequent inspection/
R lubrication each 200 hours.

Table 601. Routine Periodic Inspection Requirements (Cont)

Nature of Inspection	Pre-Flight	Each 100 Hour	Each 200 Hour	Each 400 Hour	Each 600 Hour	Each 800 Hour
R PNEUMATIC TUBE ASSEMBLY FLARES R AND SLEEVES (CODES AA-EA) - Inspect R for cracks or corrosion. (Refer to R 73-10-01. MAINTENANCE PRACTICES.)				X		
(Codes BA-BC, EA, GA-KA) FUEL PUMP ASSEMBLY DRIVE COUPLING - Inspect and lubricate. (Engines without following service bulletins accomplished.) (SB72-0104, Installation of Oil Lubricated Fuel Pump Splined Drive Coupling and Rework or Replacement of Oil Pressure Pump Assembly and SB73-0051, Replace Fuel Pump Assembly with pump Incorporating Mounting Flange Integral with Pump Body.) (Refer to 73-20-01, MAINTENANCE PRACTICES.) No inspection/lubrication required for engines incorporating SB72-0104 and SB73-0051.				**X		
(Codes AA-AC, CA-CC) FUEL PUMP ASSEMBLY DRIVE COUPLING - Inspect and lubricate. (Engines without following service bulletins accomplished.) (SB72-0104, Installation of Oil Lubricated Fuel Pump Splined Drive Coupling and Rework or Replacement of Oil Pressure Pump Assembly and SB73-0054, Replace Fuel Control Assembly Insulator (Spacer) PN 693939 with Aluminum Spacer PN 897353-1.) (Refer to 73-20-01, MAINTENANCE PRACTICES.) No inspection/lubrication required for engines incorporating SB72-0104 and SB73-0054.				**X		

**Initial inspection/lubrication at first aircraft inspection after 200 hours engine operation. Subsequent inspection/lubrication each 400 hours.

Table 601. Routine Periodic Inspection Requirements (Cont)

Nature of Inspection	Pre-Flight	Each 100 Hour	Each 200 Hour	Each 400 Hour	Each 600 Hour	Each 800 Hour
AIR ANTI-ICE VALVE - (PN 319980-5-1 only) Remove, disassemble, clean and inspect. (Refer to 75-10-01, MAINTENANCE PRACTICES.)			X			
FUEL CONTROL UNIT DRIVE SPLINES - Inspect						***X
FUEL CONTROL ASSEMBLY - (Codes AA-EA) Without loosening, check torque the following fasteners to torque given.						
(1) Bolt securing support to fuel control lug - 100 inch-pounds torque.		****X				
(2) Bolts securing support to input accessory drive housing assembly aft flange - 70 inch-pounds torque.		****X				
(3) Nuts securing fuel control assembly to gear case - 70 inch-pounds torque.		X				
(4) Nuts securing fuel control to fuel pump - 70 inch-pounds torque.		X				

**Initial inspection/lubrication at first aircraft inspection after 200 hours engine operation. Subsequent inspection/lubrication each 400 hours.
***Initial inspection/lubrication at or before 1400 hours. Subsequent inspection/lubrication each 800 hours.
****After compliance with SB73-0029 inspection is no longer required.

Table 601. Routine Periodic Inspection Requirements (Cont)

Nature of Inspection	Pre-Flight	Each 100 Hour	Each 200 Hour	Each 400 Hour	Each 600 Hour	Each 800 Hour
(Codes FA-LA) Without loosening check torque the following fasteners to torque given. (1) Bolt securing support to fuel control lug - 60 inch-pounds torque. (2) Bolt securing support to input accessory drive housing assembly aft flange - 55 inch-pounds torque.				**X		
R OIL TRANSFER TUBE - Inspection R (Refer to step 2.A.(1), Oil R Transfer Tube Inspection) (Engines R without SB72-0092, Rev 5 accomplished.)			*****X			
DIRECT DRIVE FUEL CONTROL BACKLASH INSPECTION (Refer to step 2.A.(2) Direct Drive Fuel Control Backlash Inspection) (Engines without SB72-0095 accomplished.)				******X		
COMPENSATING RESISTOR - Test temperature compensation value. (Refer to step 2.A.(4), Compensating Resistor Test.)			X			

**Initial inspection/lubrication at first aircraft inspection after 200 hours engine operation. Subsequent inspection/lubrication each 400 hours.

*****After compliance with SB72-0092, Rev 5 inspection is no longer required.

******After compliance with SB72-0095, inspection is no longer required.

Table 601. Routine Periodic Inspection Requirements (Cont)

	Nature of Inspection	Pre-Flight	Each 100 Hour	Each 200 Hour	Each 400 Hour	Each 600 Hour	Each 800 Hour
R R R R R	OIL SYSTEM AND OIL FILTER - Check for contamination (Refer to step 2.A.(3), Check for oil system and oil filter contamination.)	Inspect engines that have had gearbox repairs after at least 10 but not more than 25 hours operating time.					
	ENGINE OIL, TYPE I ONLY - Change				X		
	ENGINE OIL, TYPE II ONLY - Change					X	

NOTE: The inspection outlined in step 2.A.(1) must be repeated at each succeeding 200 engine operating hours. However, installation of steel Oil Transfer Tube Part No. 3101475-1 or aluminum Oil Transfer Tubes Part No. 3101187-2 or -3 eliminates the necessity of continued inspection.

2. A. (1) Inspect Oil Transfer Tube Part No. 3101187-1 as follows.

NOTE: The oil transfer tube bracket may be visually inspected by removal of the matched intermediate gearbox housing assembly at facilities having tooling and personnel capable of performing NTS calibration. The borescope inspection outlined below does not require removal of intermediate gearbox housing.

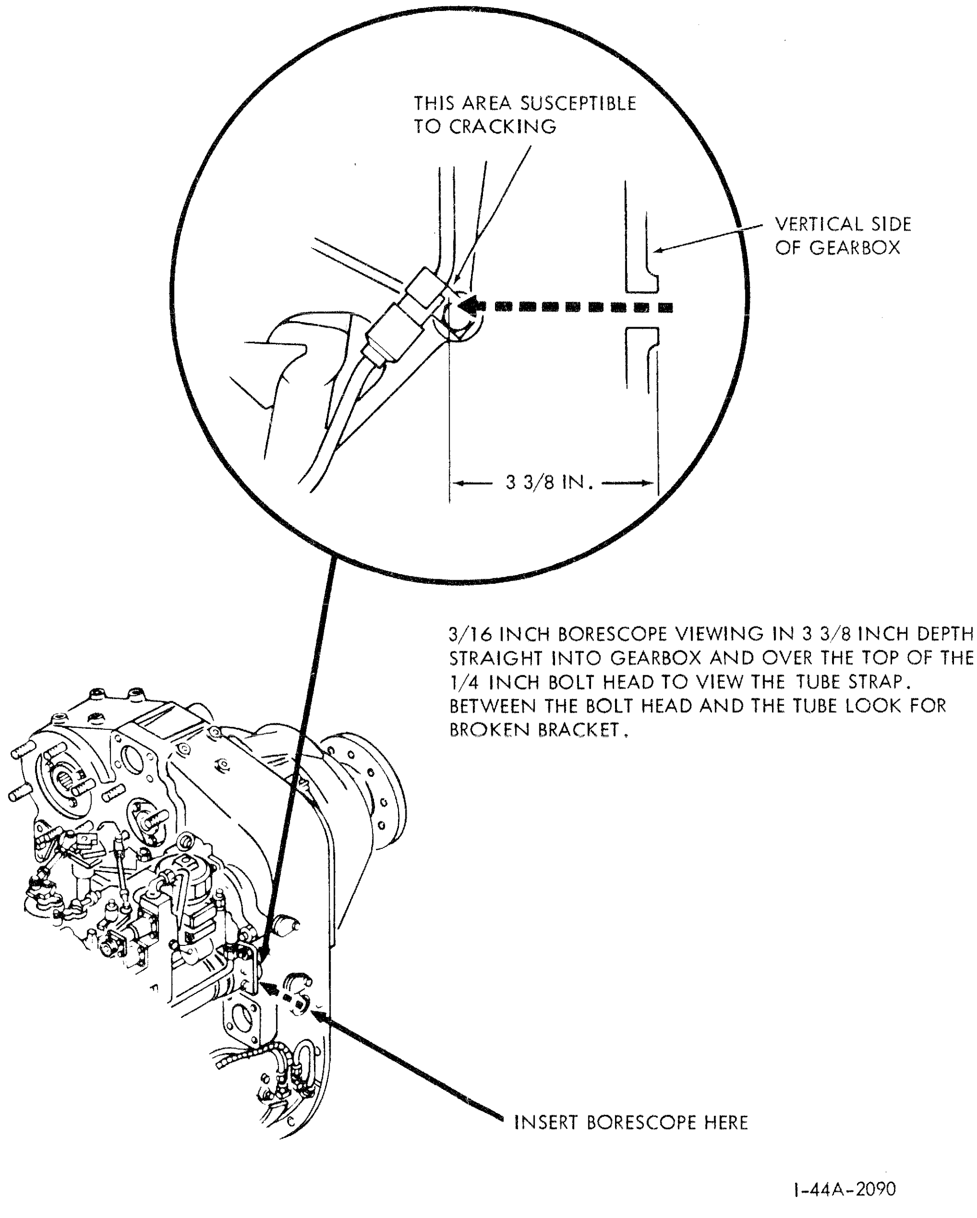
(a) Remove union from right side of gearbox forward of engine mount. (See figure 601.)

(b) With the aid of suitable borescope, inspect oil transfer tube for cracked or separated attaching bracket. (See figure 601.)

1 If bracket is cracked or separated, replace tube. Refer to 72-10-13, MAINTENANCE PRACTICES.

2 If oil transfer bracket is serviceable, reinstall union removed in step (a).

R



Inspection of Oil Transfer Tube
Figure 601

NOTE: Table 601A provides a list of special tools, fixtures and equipment required for backlash inspection.

Table 601A. Special Tools, Fixtures and Equipment

Item No.	Nomenclature	Use	Source/ Part No.
NOTE: Equivalent substitutes may be used for listed items.			
1.	Backlash Checking Gage	Used to check direct drive fuel control drive gear train for backlash.	293114-1-1

2. A. (2) Perform direct drive fuel control backlash inspection as follows.

NOTE: This inspection applies to engines with direct drive fuel control configuration and without SB72-0095 accomplished (Torque Sensor Part No. 896826-4 or 896826-5 installed).

(a) Remove fuel control and pump assembly in accordance with 73-20-01, MAINTENANCE PRACTICES.

(b) Install bracket portion of 293114-1-1 gage on fuel pump assembly mounting studs and install dial indicator on bracket arm. (See figure 602.)

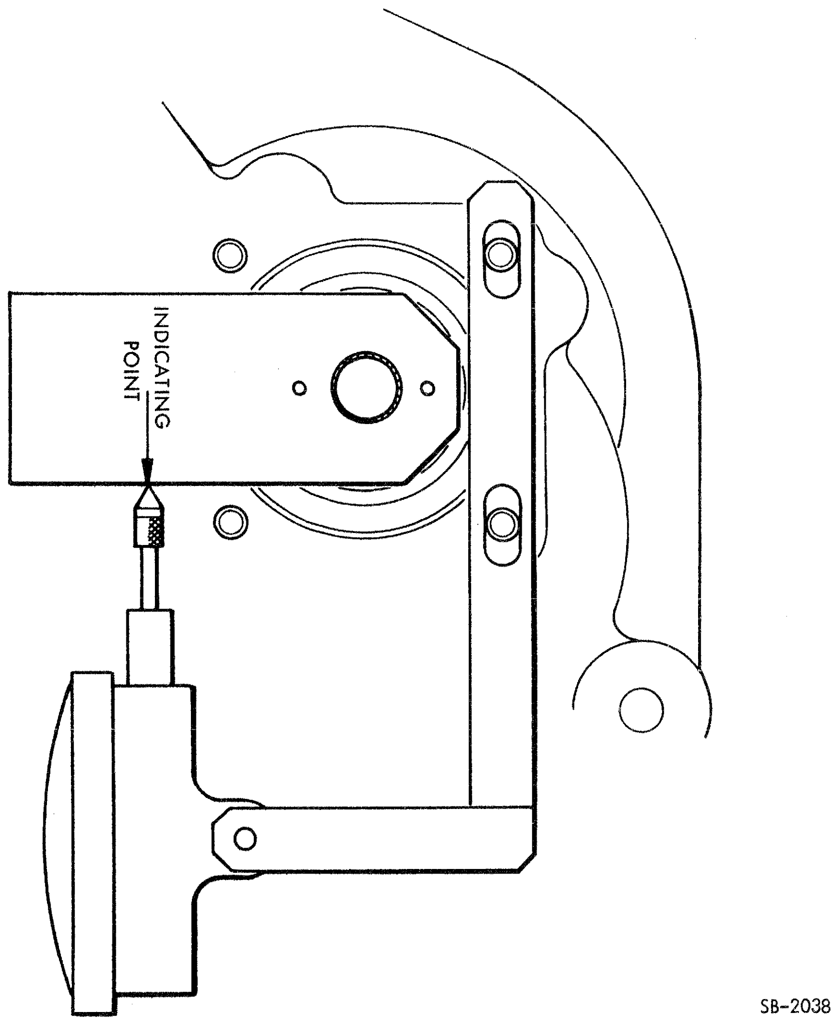
(c) Install gage portion of 293114-1-1 gage in fuel pump drive spline with indicating arm parallel with bracket arm holding dial indicator. (See figure 602.)

(d) Position the dial indicator so spindle is on indicating point of the gage arm.

(e) Rotate fuel pump drive spline by hand (ensure there is no propeller shaft rotation). Gear train backlash should not exceed 0.030 inch. This procedure should be repeated three times to obtain accurate measurements.

(f) If backlash is less than 0.030 inch remove tools and reinstall fuel control and pump assembly in accordance with 73-20-01, MAINTENANCE PRACTICES.

(g) If backlash is greater than 0.030 inch the torque sensor housing must be returned to an overhaul facility.



Direct Drive Fuel Control Backlash Inspection
Figure 602

2. A. (3) Check oil system and oil filter for contamination as follows.

NOTE: Spectrographic Oil Analysis Program (SOAP) has proved to be effective at other than intervals recommended in diagnosing engine problems. Therefore, is is recommended an oil sample (with oil filter) be submitted for analysis when an intermittent or change in engine operating parameter occurs. Example: fluctuating oil pressure, change in audible noise level, etc.

(a) Inspect engines that have had gearbox repairs after at least 10 but not more than 25 hours operating time as follows.

1 Remove oil filter element in accordance with 79-20-02, Removal/Installation.

2 Perform inspection of oil filter element by carefully spreading pleated segments and visually checking for trapped metal particles. Be careful not to damage or mutilate filter element. A check for presence of magnetic particles may be accomplished by passing clean magnet along inside surface of filter element and observing reaction of particles on outside of filter. This will leave particles in place for future analysis. If greater than normal amount of metal particles are found in filter, and are considered to be more than normal gear train wear, contact AiResearch Manufacturing Company Propulsion Customer Service Engineering. Department 77-4-601 Phoenix, Arizona (Telephone: Area Code 602, 267-3011 extension 4098 or 3257) for guidance and further instructions.

NOTE: Sampling Kit (Part No. 287545-1) is available from any approved AiResearch Service Center as listed in AiResearch Service Information Letter (SIL) P331-27.

3 Place removed oil filter element in large container provided in 287545-1 sampling kit.

4 Install new oil filter element in engine.

NOTE: Make sure oil sample obtained in the following step represents the condition of the engine by following the directions contained in the sampling kit. Sample to be analyzed should come from a warm engine within 30 minutes after shutdown.

5 Siphon an oil sample from engine oil tank at filler cap using plastic tube provided in sampling kit. Route plastic tube into small container provided in sampling kit to contain oil sample.

R 2. A. (3) (a) 6 Prepare sampling kit for shipment in accordance with in-
R structions provided in sampling kit. Refer to AiResearch
R Service Information Letter (SIL) P331-97 to obtain address
R of approved oil analysis facility.

R (4) Check compensating resistor temperature correction value as
R follows.

R (a) Check ITT indicator temperature reading with power off and
R with power on while operating engine at a steady state
R condition.

R (b) Difference between power off and power on readings shall ap-
R proximate temperature compensation value specified in 77-20-
R 03, Adjustment/Test for appropriate compensating resistor dash
R number or setting number.

B. Major Periodic Inspections

Major periodic inspections are defined as inspections required at specified engine operating hours such as inspection of turbine section (hot section) components or at occurrence of certain events such as hot start, abnormal deceleration (propeller strike) or lightening strike.

(1) Perform inspection for abnormal deceleration (propeller strike) or transient torque input as follows.

NOTE: Engine inspection is required if engine has been subjected to an abnormal transient torque input such as conditions listed in Table 602.

(a) Minor nicks and dents to the propeller where only local damage has occurred and none of the conditions listed in Table 602 have occurred should normally not result in further gearbox inspection.

(b) Perform engine inspection as specified in Table 602.

Table 602. Abnormal Decleration or Transient Torque Input Inspection Criteria

Condition	Recommendation
1. A. "SHIFT IN TORQUE" indication as result of: (a) Propeller strike. (b) Propeller slipping off locks.	NOTE: If any of the conditions (1 through 4) exist, perform the following sequence of inspections: 1. Remove the output gearbox housing (nose cone) in accordance with 72-10-09, MAINTENANCE PRACTCIES. Visually examine gears for chips or tooth damage. If any chips or tooth damage to the gears or cracks cracks in the nose cone are evident, replace damaged components or return the nose cone to an overhaul facility for inspection and repair.
2. Known high transient torque input to engine from object striking propeller or sudden engine stoppage, regardless of propeller condition following incident. (A bird strike on the propeller tip can induce a high input transient torque to the engine and leave no evidence on the propeller itself. A similar situation could occur with a propeller strike into snow).	2. Remove the oil filter element in accordance with 79-20-02, MAINTENANCE PRACTICES. Inspect oil filter element for extent of engine damage by carefully spreading the pleated segments and visually checking for trapped metal particles. Use care not to damage or mutilate the oil filter element. A check for presence of magnetic particles may be accomplished by passing a clean magnet along the inside surface of the filter element and observing the reaction of the particles on the outside of the filter element. This will leave the particles in place for future analysis. If a greater than normal amount of metal particles are found in the filter element, and are considered more than normal gear train wear, proceed with steps 3 through 13. If filter appears normal, proceed to step 3. Install a clean oil filter element at conclusion of inspection.
3. Obvious severe damage to propeller. Examples: A dent anywhere along leading edge of propeller to depth of 1/2 inch or greater, or only the blade tips (outer three inches of blades) bent.	
4. Unusual noise or rub inside engine when propeller is pulled through by hand following propeller strike or suspected internal malfunction or engine.	

Table 602. Abnormal Deceleration or Transient Torque Input Inspection Criteria (Cont)

Condition	Recommendation
	3. Visually inspect planetary gear train as follows.
	(a) Visually inspect for cracks at attaching flanges to intermediate gearbox assembly (diaphragm), particularly around securing nuts. If any cracks are evident, remove the planetary carrier assembly and/or ring gear and ring gear support and return to an authorized repair facility.
	(b) Inspect for looseness between planetary carrier assembly or ring gear support and intermediate gearbox assembly (diaphragm) by attempting to rotate planetary carrier assembly or ring gear support in either direction by hand. The planetary carrier assembly shall be tightly secured and there shall be no rotation. If any looseness or rotation is evident, remove planetary carrier assembly or ring gear support in accordance with 72-10-12, MAINTENANCE PRACTICES and proceed with steps 4 through 13. If no looseness or rotation is present and the oil filter element is clean as inspected in step 2., recheck torque on planetary carrier assembly or ring gear support mount bolts as specified in 72-10-12, Removal/Installation and proceed to step 7.
	4. Reinspect planetary carrier assembly and/or ring and ring gear support for cracks as specified in step 3.(a).

Table 602. Abnormal Deceleration or Transient Torque Input Inspection Criteria (Cont)

Condition	Recommendation
	5. Visually inspect mating surfaces of planetary carrier assembly or ring gear support and intermediate gearbox assembly (diaphragm) for wear. Wear in excess of 0.003 inch in depth on either the planetary carrier/ring gear support assembly or intermediate gearbox assembly (diaphragm) mating surface shall require return of the affected part to an authorized repair facility.
	6. Visually inspect planetary carrier assembly or ring gear support stud holes for hole elongation and mating dowel pins for cracks. If any hole has elongation of 0.0005 inch or greater or any dowel pin cracks are found, the planetary carrier assembly or ring gear support shall be returned to an authorized repair facility.
	6a. Disassemble intermediate gearbox housing assembly (diaphragm) in accordance with 72-10-13, MAINTENANCE PRACTICES, and inspect components as follows.
	(a) Visually inspect gears for chips or tooth damage. Refer to 72-10-13, Approved Repairs for rework of helical (bull) gear teeth.
	(b) Perform magnetic particle inspection of assembled helical (bull) gearshaft (sun) gearshafts in accordance with MIL-I-6868. No cracks allowed. If cracks are found return diaphragm to an approved overhaul facility for repair.
	7. Replace torsion shaft in accordance with 72-10-14, MAINTENANCE PRACTICES and replace compressor bearing in accordance with 72-10-19, MAINTENANCE PRACTICES.

Table 602. Abnormal Deceleration or Transient Torque Input Inspection Criteria (Cont)

Condition	Recommendation
	8. Visually inspect torque sensor assembly for freedom of rotation of camset gear and helical splined gear and for any external cracks in mounting structure. Check for roughness of camset gear and helical splined gear by hand rotating throughout range of rotation. If any cracks are found in torque sensor structure or roughness or loss of freedom of rotation is found for camset gear or helical splined gear, the torque sensor assembly shall be returned to an authorized repair facility.
	9. Visually inspect the fuel control and fuel pump assembly mounting provisions for broken or loose studs or cracks where the fuel pump assembly mates to the accessory drive gearbox. If any broken or loose studs or cracks are found the engine shall be returned to an approved overhaul facility for repair.
	10. Visually inspect engine mount for cracks. If any cracks are found, remove engine and return to an approved overhaul facility for repair.
	11. Remove propeller governor assembly and return to authorized overhaul facility. Propeller governor removed from an engine which has experienced a sudden stoppage shall not be reinstalled on an engine until governor assembly has been overhauled by an authorized overhaul facility. Propeller governor removed from engine experiencing a sudden stoppage shall be tagged for the information of overhaul facility.

Table 602. Abnormal Deceleration or Transient Torque Input Inspection Criteria (Cont)

Condition	Recommendation
	12. Following above inspections, reassemble engine as required. Start engine and run engine for 15 minutes, then shutdown. Check oil filter element for greater than normal amount of metal particles including magnetic particles. Check for presence of magnetic particles by following the directions given in step 2. If abnormal amounts of particles are found, remove engine and return to an approved overhaul facility for repair. If filter inspection is satisfactory, start engine and run engine for one hour at various intermediate power settings. Shut down engine. Check oil filter element as for 15 minute run above.
	13. If oil filter element is satisfactory following one hour engine run in step 12, reinstall oil filter element and operate engine in normal service to accumulate an additional 9 to 12 hours. Submit oil sample and oil filter element to approved analysis facility in accordance with oil system contamination check contained in 72-00-00, ADJUSTMENT/TEST as a mean of monitoring engine condition.
	14. If subsequent engine operation after following steps 1 through 12 above shows high engine vibration with proper dynamic propeller balancing, the engine shall be removed and returned to an approved overhaul facility for repair.

2. B. (2) Perform lightning strike inspection as follows.

NOTE: The following inspection of propeller and engine components shall be performed if aircraft has experienced an actual or suspected lightning strike.

(a) Visually inspect propeller, propeller deice boots, propeller dome and spinner for evidence of pitting and/or arcing.

(b) With cowling removed, visually inspect external engine surface, engine mounting structure and all electrical connections for evidence of pitting and/or arcing. Visually inspect propeller and propeller boots for evidence of arcing.

If no pitting or arcing is found after a suspected lightning strike or a strike on the aircraft airframe there is no need to proceed further with the inspection. An oil contamination sample may be taken and an oil filter element inspection accomplished in accordance with step 2.A.(3) as a precautionary measure 10 to 15 engine operating hours following the lightning strike incident. A second oil sample should be taken approximately 50 engine operatings hours after the first oil sample or at an interval recommended by AiResearch Customer Service Engineering to verify stabilization of wear metal levels in the oil system and oil filter element.

(c) If evidence of pitting and/or arcing is found in step (a) or (b), accomplish following inspection.

1 Remove fuel control and return to authorized overhaul facility for functional test.

2 Remove nose cone assembly. Refer to 72-10-09, MAINTENANCE PRACTICES. Visually inspect all accessible bearings and gears for evidence of pitting and/or arcing. If any pitting and/or arcing is found replace affected gears and/or bearings.

NOTE: If any pitting and/or arcing is found on bull and sun gear assembly, high speed pinion assembly or diaphragm housing bearings for bull and sun gear, return diaphragm to an authorized overhaul facility for repair.

3 Remove, disassemble and inspect intermediate gearbox assembly (diaphragm). Refer to 72-10-13, MAINTENANCE PRACTICES. Visually inspect all accessible gears and bearings for pitting and/or arcing. Replace affected gears and/or bearings as required.

2. B. (2) (c) 4 Replace oil filter element in accordance with 79-20-02, MAINTENANCE PRACTICES.

(d) Reassemble engine as required. Start and run the engine for 15 minutes and shutdown. Remove oil filter element (which should now have a total accumulated time of 15 minutes) and perform inspection by carefully spreading the pleated segments and visually checking for a greater than normal amount of trapped particles. Check for a higher than normal amount of magnetic particles by passing a magnet inside filter element and observing reaction of particles on outer surface of filter element. Use care not to damage or mutilate filter element. If a higher than normal amount of metal particles are found, remove engine and return to overhaul facility for repair. If filter element is satisfactory, reinstall filter element and ground run engine for one hour at various intermediate power settings, then shutdown and check oil filter element as in 15 minute engine run above.

(e) If no abnormal amount of additional metal particles are found in oil filter element after one hour engine run in step (d), reinstall oil filter element and return engine to service.

(f) Operate engine in normal service to accumulate 9 to 12 additional engine operating hours on oil filter element. After accumulating this time, submit an oil sample and oil filter element for analysis/inspection to appropriate analysis facility in accordance with step 2.A.(3) as a means of monitoring the engine condition.

If subsequent engine operation after accomplishing step (e) results in any of the following symptoms.

1 Low or fluctuating oil or torque pressure.

2 Any unusual engine noise or binding during rolldown.

Attempt to determine the cause of symptom. If unable to determine cause, or if oil filter element is contaminated, contact an AiResearch Propulsion Field Service Representative or AiResearch Approved Major Repair Service Center for confirmation of the above engine symptoms before returning the engine to an overhaul facility for repair.

2. B. (3) Perform turbine section (hot section) inspection as follows.

NOTE: Inspection of turbine section components may be accomplished at any time but shall be accomplished following any engine overtemperature condition specified in Table 503, Maximum Permissible Operating Limits, and at engine operating hours specified in Service Bulletin 606. Refer to Table 603 for specific turbine section requirements.

(a) Remove engine components for turbine section inspection, observing the following.

1 Remove oil inlet retainer shield assembly. Refer to 72-50-01, MAINTENANCE PRACTICES.

2 Remove tail cone. Refer to 72-50-02, MAINTENANCE PRACTICES.

3 Remove oil inlet fitting and oil pressure jet. Refer to 72-50-03, MAINTENANCE PRACTICES.

4 Remove turbine scavenge pump assembly. Refer to 72-50-04, MAINTENANCE PRACTICES.

5 Remove exhaust pipe assembly. Refer to 72-50-05, MAINTENANCE PRACTICES.

6 Remove turbine plenum assembly and combustion chamber assembly. Refer to 72-40-01, MAINTENANCE PRACTICES.

7 Remove interstage turbine temperature assembly (single piece), turbine bearing and bearing support (carrier) and bearing support assembly. Refer to 72-50-06, MAINTENANCE PRACTICES.

8 Remove third stage turbine stator and second and third stage turbine wheel assmblies. Refer to 72-50-07, MAINTENANCE PRACTICES.

9 Remove first stage turbine wheel, first and second stage stator assemblies and ITT sensor assembly (multi-piece). Refer to 72-50-08, MAINTENANCE PRACTICES.

R Table 603. Inspection of Turbine Section Components

	Component	Inspection Requirements
R	Turbine Plenum and Combustion Assembly	Refer to 72-40-01, Inspection Check.
R	Turbine Bearing	Refer to 72-50-06, Inspection/Check.
R	Interstage Turbine Temperature (ITT) System	
R	(Pre SB72-0042) Multi Piece	Refer to 72-50-08 and 77-20-03, Inspection/Check.
R	(Post SB72-0042) Single Piece	Refer to 72-50-06 and 77-20-03, Inspection/Check.
R	Turbine Bearing Support Assembly	Refer to 72-50-06, Inspection/Check.
R	Curvic Coupling (Center Curvic Coupling)	Refer to 72-50-08, Inspection/Check.
R	One Piece First Stage Turbine Stator and Liner Assembly (Pre SB72-0052)	Refer to 72-50-08, Inspection/Check.
R	Three Piece First Stage Turbine Stator and Liner Assembly (Post SB72-0052)	
R	Turbine Stator Vane Section	Refer to 72-50-08, Inspection/Check.
R	Turbine Support Assembly	Refer to 72-50-08, Inspection/Check.

R Table 603. Inspection of Turbine Section Components (Cont)

R	Component	Inspection Requirements
R	First Stage Turbine (Cont)	
R R	Stator and Liner Assembly (Post SB72-0052)	
R	Transition Liner	Refer to 72-50-08, Inspection/Check.
R R R R R R R	Combustion Transition Liner	NOTE: Inspection is performed with combustion transition liner installed in engine. If damage is indicated, liner shall be repaired or replaced in accordance with 72-30-03, MAINTENANCE PRACTICES.
R		Refer to 72-30-03, Inspection/Check.
R R	Third Stage Turbine Stator Assembly	Refer to 72-50-07, Inspection/Check.
R R	Second Stage Turbine Stator Assembly	Refer to 72-50-08, Inspection/Check.
R R	Third Stage Turbine Wheel Assembly	Refer to 72-50-07, Inspection/Check.
R R	Second Stage Turbine Wheel Assembly	Refer to 72-50-07, Inspection/Check.
R R	First Stage Turbine Wheel Assembly	Refer to 72-50-08, Inspection/Check.
R R	First Stage Segmented Shroud	Refer to 72-50-08, Inspection/Check.
R R	Turbine Bearing Support Assembly	Refer to 72-50-06, Inspection/Check.

R 2. B. (3) (b) Reassmble engine following turbine section (hot section) in-
R spection observing the following.

R 1 Install first stage turbine wheel and first and second
R stage turbine stator assemblies. Refer to 72-50-08, MAIN-
R TENANCE PRACTICES.

R 2 Install third stage stator and second and third stage tur-
R bine wheel assemblies. Refer to 72-50-07, MAINTENANCE
R PRACTICES.

R 3 Install ITT sensor assembly (single piece), turbine bearing
R and bearing support (carrier) and bearing support assembly.
R Refer to 72-50-06, MAINTENANCE PRACTICES.

R 4 Install turbine plenum assembly and combustion chamber
R assembly. Refer to 72-40-01, MAINTENANCE PRACTICES.

R 5 Install exhaust pipe assembly. Refer to 72-50-05, MAINTEN-
R ANCE PRACTICES.

R 6 Install turbine scavenge pump. Refer to 72-50-04, MAINTEN-
R ANCE PRACTICES.

R 7 Install oil inlet fitting and oil pressure jet. Refer to
R 72-50-03, MAINTENANCE PRACTICES.

R 8 Install tail cone. Refer to 72-50-02, MAINTENANCE
R PRACTICES.

R 9 Install oil inlet retainer shield assembly. Refer to 72-
R 50-01, MAINTENANCE PRACTICES.

CHAPTER 72 - CLEANING/PAINTING

TABLE OF CONTENTS

1. Cleaning

NOTE: Table 701 provides a list of all materials and compounds required to perform Cleaning/Painting.

Table 701. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Acetone (Federal Specification O-A-51C)	Commercially available
Alkaline cleaner (Diversey 909)	Diversey Chemical Co, Div of Diversey Corp, 1855 S Mt Prospect Rd, Des Plaines, IL 60018
Aluminum oxide grit (120 Mesh)	Commercially available
Brush-on paint remover (Federal Specification TT-R-251)	Commercially available
Calcium sulfate	Commercially available
Chromic acid flake	Dow Corning Corp, S Saginaw Rd, Midland, MI 48640
Color coat (Andrew Brown A423-66 Enamel No. 051 and C-1178 Converter)	Griggs Paint and Hardware Co, 3602 S 16th Place, Phoenix, AZ 85040
Corrosion-preventive compound (MIL-C-6529, Type III)	Commercially available
Crocus cloth (Federal Specification P-C-458)	Commercially available
De-oxidizer (Oakite 34M)	Oakite Products Inc, 50 Valley Rd, Berkeley Heights, NJ 07922
Glass beads (Screen No. 100-230 (130 Grit) Class IV, Size AF or AG)	Potters Brothers Inc, 600 Industrial Rd, Carlstadt, NJ 07072

Table 701. Materials and Compounds (Cont)

	Material or Compound	Manufacturer
	Lubricant (MIL-L-7808 or MIL-L-23699	Commercially available
	Nitric acid (Federal Specification 0-N-350)	Commercially available
R R	Oil (Hancock Rust Oil B)	Burmah Oil and Gas Co, 2828 Junipero, Long Beach, CA 90806
	Paint and carbon remover (Turco Transpo)	Turco Products Inc, Purex Corp Ltd, 24600 S Main St, Wilmington, CA 90746
	Powder (Iridite No. 14-2)	Richardson Chemical Co, Allied Kelite Products Div, 400 Midland Ave, Highland Park, MI 48203
	Preservation oil (MIL-L-6085)	Commercially available
	Primer (P-415-66-611B with with Catalyst C1178-66)	Griggs Paint Subsidiary of Domcom Dist, 3602 S 16th Place, Phoenix, AZ 85040
	Rust stripper (Oakite Rust Stripper)	Oakite Products Inc, 50 Valley Rd, Berkeley Heights, NJ 07922
	Sand (120 Grit) (MIL-S-17726A)	Commercially available
	Solvent, Stoddard (Federal Specification P-D-680, Type I)	Commercially available
	1,1,1-Trichloroethane (MIL-T-81533)	Commercially available

1. A. Follow General Cleaning Instructions

WARNING: CLEANING SHALL BE PERFORMED IN A CLEAN, WELL-VENTILATED AREA. RUBBER GLOVES AND PROTECTIVE CLOTHING SHALL BE WORN. EXTINGUISHERS AND VAT OR TANK COVERS SHALL BE ON HAND IN CASE OF FIRE.

(1) Cleaning procedures for individual parts shall be consistent with good shop practices and the following procedures. Correct and thorough cleaning for all parts is important to the successful inspection, maintenance, and satisfactory operation after maintenance.

(2) All metallic parts shall be cleaned to remove oil, grease, rust stains, and soiled areas. Flange areas, register diameters, and sealing surfaces shall be cleaned of oil, gaskets, and sealing compounds, if present. Remove adherent gasket or sealing compound residues using acetone (Federal Specification O-A-51C) and a soft or stiff fiber bristled brush.

(3) Clean painted parts but do not remove old paint if paint is still serviceable.

(4) Heat discoloration of metal surface is not objectionable; however, scale which may become loose and damage the unit shall be removed. Carbon residue and combustion products shall be removed.

(5) Corrosion products wherever they appear shall be removed and the base metal treated to prevent corrosion before reassembly.

(6) Steel and 400 series stainless steel parts require the application of corrosion-preventive compound (MIL-C-6529, Type III) after cleaning to prevent rust and corrosion.

(7) Clean dissimilar materials as follows.

CAUTION: AN ASSEMBLY SHALL NOT BE CLEANED IN A SOLUTION THAT IS DETRIMENTAL TO ONE OF THE PARTS IN THE ASSEMBLY.

(a) Analyze assemblies that combine dissimilar materials carefully and determine types of materials.

R (b) Clean assemblies containing brass, bronze, steel, and cadmium,
R using methods applicable to the base metal involved. Brass
R and bronze alloys can be affected by chromic acid solutions.

(c) Clean assemblies containing synthetic materials using methods that are non-destructive to the material.

1. A. (8) Place parts in clean plastic bags or equivalent containers after cleaning, for protection from contaminants. Ports and orifices shall be capped plugged, or sealed.

B. Prepare Specified Solutions for Cleaning of Component Parts

WARNING: THE FOLLOWING SOLUTIONS ARE HAZARDOUS. AVOID INHALATION OF FUMES, DUST, OR MIST. AVOID CONTACT WITH SKIN. AFTER PREPARATION, WASH HANDS AND FACE THOROUGHLY.

NOTE: Use either distilled or de-ionized water for preparation of the following solutions.

(1) Prepare alkaline cleaner solution as follows.

(a) Dissolve four to six ounces of alakaline cleaner (Diversey 909) in each gallon of distilled or de-ionized water.

(b) Maintain solution at 54 to 82C (130 to 180F) in an air agitated tank.

(2) Prepare chromate conversion coating solution as follows.

NOTE: Prepare chromate conversion solution in small batches. Use only fresh prepared solutions.

(a) Dissolve one ounce of powder (Iridite 14-2) in each quart of distilled or de-ionized water.

(b) Maintain solution at 21 to 27C (70 to 80F).

(3) Prepare chromic-nitric pickle solution as follows.

(a) Mix 12.0 to 13.5 ounces of chromic acid flake and 1.0 to 1.4 pints of nitric acid (Federal Specification 0-N-350) with enough distilled or de-ionized water to make one gallon on solution.

(b) Maintain solution at 21 to 27C (70 to 80F).

(4) Prepare de-oxidizer solution as follows.

(a) Dissolve eight to sixteen ounces of de-oxidizer (Oakite 34M) in one gallon of distilled or de-ionized water.

(b) Maintain solution at 18 to 35C (65 to 95F) in an air agitated tank.

1. B. (5) Prepare rust stripper solution as follows.

WARNING: EXERCISE EXTREME CAUTION WHEN PREPARING RUST STRIPPER SOLUTION. USE OF A RESPIRATOR IS STRONGLY RECOMMENDED. MIXING MAY PRODUCE TEMPERATURES EXCEEDING THE BOILING POINT OF THE
R SOLUTION. ADD OAKITE RUST STRIPPER WHILE AGI-
R TATING SOLUTIONS AS A MEANS TO PREVENT
R LOCALIZED OVERHEATING.

(a) Dissolve three to five pounds of rust stipper (Oakite Rust Stripper) in each gallon of distilled or de-ionized water

(b) Maintain solution at 71 to 93C (160 to 200F) in an air agitated tank.

(6) Prepare magnesium touch-up solution as follows.

(a) Add 1.3 ounces chromic acid flake to slightly less than one gallon of distilled or de-ionized water. Mix completely until dissolved.

(b) Add 1.0 ounce calcium sulfate and enough distilled or deionized water to make one gallon.

(c) Stir vigorously for at least 15 minutes to ensure saturation of the solution with calcium sulfate.

C. Clean Components Parts

NOTE: More than one cleaning method may be specified for a particular part or assembly, e.g., a part may require removal of heavy grease deposits using a brush and petroleum solvent followed by vapor degreasing for final cleaning. An additional cleaning method may be required for corrosion removal. If a particular cleaning method is not required due to the condition of the part it may be omitted, however only those cleaning methods specified for that part may be used.

CAUTION: THE SPECIFIC CLEANING METHODS OUTLINED MUST BE FOLLOWED. THE VARIOUS SOLUTIONS AND MATERIALS SPECIFIED IN THE CLEANING METHODS CAN BE USED ONLY ON THE PARTS AND MATERIALS INDICATED. FAILURE TO USE THE PROPER CLEANING METHOD MAY RESULT IN IRREPARABLE DAMAGE TO THE PART BEING CLEANED.

CLEANING METHOD NO. 1

Degrease parts using petroleum solvent as follows.

WARNING: SPRAY VAPORS ARE TOXIC AND SHALL NOT BE INHALED. OBSERVE ALL FIRE PRECAUTIONS.

(a) Place solvent, Stoddard (Federal Specification P-D-680, Type I) in dip tank or use as a spray in a positive outside-ventilated spray booth.

(b) Dip, soak, agitate, or spray parts to be cleaned until oil and grease have been removed.

(c) Remove caked grease or soft carbon deposits using a stiff plastic fiber bristled brush.

CLEANING METHOD NO. 2

Degrease parts using vapor degreasing method as follows.

WARNING: 1,1,1-TRICHLOROETHANE IS TOXIC, USE IN A WELL-VENTILATED AREA. AVOID BREATHING FUMES OR CONTACT WITH SKIN.

(a) Use 1,1,1-Trichloroethane (MIL-T-81533) in vapor degreaser at a temperature range of 86 to 90C (187 to 194F).

(b) Place parts in rack so that all surfaces will have direct contact with vapor. Parts that do not allow free drainage shall be racked so they may be turned over below vapor level to eliminate 1,1,1-Trichloroethane (MIL-T-81533) dragout when parts are removed.

(c) Spray flush parts free of heavy grease or other contaminants, then position parts in vapor zone for final cleaning.

(d) Air-dry parts with low pressure compressed air (20 psig).

CLEANING METHOD NO. 3

Clean parts using glass bead peening as follows.

NOTE: Do not glass bead peen curvic couplings until fluorescent penetrant or magnetic particle inspecton has been performed. Maximum pressure of 20 psig shall be used on titanium couplings. Maximum pressure of 40 psig shall be used on all other coupling materials.

(a) Clean hard carbon, paint, corrosion, and scale from parts by peening with glass beads (Screen No. 100-230 (130 Grit) Class IV, Size AF or AG).

(b) Clean parts with solvent, Stoddard (Federal Specification P-D-680, Type I) to remove oil and grease contamination.

NOTE: Glass bead peening equipment shall be cleaned and recharged with new beads after each 24 hour period of operation.

(c) Mask any surfaces that could be damaged by peening.

CAUTION: REGULATE AIR PRESSURE TO KEEP EROSION OF BASE METAL TO A MINIMUM. KEEP NOZZLE IN MOTION TO PREVENT BLAST FROM DWELLING ON ONE SPOT.

(d) Peen corroded areas with glass beads (Screen No. 100-230 (130 Grit) Class IV, Size AF or AG) until corrosion products are removed.

(e) Rinse surface free of glass beads (Screen No. 100-230 (130 Grit) Class IV, Size AF or AG). Dry part in oven at 96 to 112C (205 to 235F) for one hour.

CLEANING METHOD NO. 4

Clean parts using abrasive method.

NOTE: Do not abrasive blast part until fluorescent penetrant or magnetic particle inspection has been performed.

(a) Clean hard carbon, lead deposits, corrosion, and scale from parts by abrasive blasting using a standard sandblast cabinet and sand (120 Grit) (MIL-S-17726A) or aluminium oxide grit (120 Mesh).

(b) Clean parts with solvent, Stoddard (Federal Specification P-D-680, Type I) or vapor degreaser to remove oil and grease contamination.

(c) Mask any surfaces that could be damaged by abrasive blasting.

CAUTION: REGULATE AIR PRESSURE TO KEEP EROSION OF BASE METAL TO A MINIMUM. KEEP NOZZLE IN MOTION TO PREVENT BLAST FROM DWELLING ON ONE SPOT.

(d) Set blasting equipment air pressure at 15 to 30 psig, then subject parts to abrasive blasting. Reduce air pressure as required to control action on base metal.

CLEANING METHOD NO. 5

Clean non-corroded aluminum parts as follows.

(a) Clean surface with solvent, Stoddard (Federal Specification P-D-680, Type I) to remove oil and grease contamination.

(b) Immerse parts in alkaline cleaner solution for five minutes minimum. Scrub surface with a soft plastic fiber bristled brush to remove surface contamination. If old gaskets or sealing compound are present, carefully lift softened gaskets with a knife blade and scrape surface clean.

(c) Rinse parts with water at 27 to 43C (80 to 110F). Use low pressure air (20 psig maximum) to dry part.

CAUTION: DO NOT ALLOW PARTS TO REMAIN IN CONTACT WITH DE-OXIDIZING SOLUTION LONGER THAN THREE (3) MINUTES OR CHEMICAL ETCHING WILL OCCUR.

(d) Treat bare areas with de-oxidizing solution for one to three minutes. Repeat step (c) to rinse part.

NOTE: Maintain the pH of the chromate conversion coating solution at 0.9 to 1.0 by adding chromic acid flake or nitric acid (Federal Specification O-N-350) to the solution.

(e) Coat threaded areas with chromate conversion coating solutin. Allow area to remain wet for one minute.

(f) Rinse parts with water at 27 to 43C (80 to 110F). Blow off excess water with low pressure air (20 psig maximum), then dry in oven at a temperature not to exceed 71C (160F).

(g) Store parts in dry place away from corrosive fumes.

CLEANING METHOD NO. 6

Clean corroded aluminum parts as follows.

CAUTION: CORROSION MAY BE CAUSE FOR REJECTION OR REPAIR OF A PART. REFER TO INSPECTION/CHECK AND/OR REPAIR WHENEVER CORROSION APPEARS TO BE BEYOND SURFACE FINISH.

(a) Clean surfaces with solvent, Stoddard (Federal Specification P-D-680, Type I) to remove oil and grease contamination.

(b) Immerse parts in alkaline cleaner solution for five minutes minimum. Scrub surface with a stiff plastic fiber bristled brush to remove surface contamination. If old gaskets or sealing compound are present, carefully lift softened gaskets with a knife blade and scrape surface clean.

(c) Rinse parts with water at 27 to 43C (80 to 110F). Use low pressure air (20 psig maximum) to dry part.

NOTE: If parts are hard anodized and chromic-nitric pickle solution is used to remove heavy corrosion, softening of the finish will result. Completely strip parts and apply a new anodize finish in accordance with Repair.

(d) Treat corroded areas with chromic-nitric pickle solution until corrosion is removed. Repeat step (c) to rinse part.

(e) Coat bare areas with chromate conversion coating solution. Allow area to remain wet for one minute.

(f) Rinse parts with water at 27 to 43C (80 to 110F). Blow off excess water with low pressure air (20 psig maximum), then dry in oven at a temperature not to exceed 71C (160F).

(g) Store parts in dry place away from corrosive fumes.

CLEANING METHOD NO. 7

Clean non-corroded magnesium parts as follows.

(a) Clean surfaces with solvent, Stoddard (Federal Specification P-D-680, Type I) to remove oil and grease contamination.

(b) Immerse parts in alkaline cleaner solution and brush surfaces with a soft plastic fiber bristled brush to remove contaminants. Allow parts to soak for five to ten minutes if flange surfaces have baskets or sealing compounds stuck to them. When softened, carefully lift gaskets with knife blade and scrape surface until clean.

(c) Rinse parts in warm tap water at 27 to 43C (80 to 110F).

(d) Brush magnesium touch-up solution onto any bare metal areas. Keep surfaces wet for one to two minutes, then rinse with clean tap water.

(e) Dry parts in oven at 79 to 197C (175 to 225F) for one hour.

CLEANING METHOD NO. 8

Clean corroded magnesium parts as follows.

CAUTION: CORROSION MAY BE CAUSE FOR REJECTION OR REPAIR OF A PART. REFER TO INSPECTION/CHECK AND/OR REPAIR WHENEVER CORROSION APPEARS TO BE BEYOND SURFACE FINISH.

(a) Clean surfaces with solvent, Stoddard (Federal Specification P-D-680, Type I) to remove oil and grease contamination.

(b) Immerse parts in alkaline cleaner solution for 10 to 15 minutes. Scrub surfaces with a stiff plastic fiber bristled brush to remove any loose contaminants. If oil gaskets or sealing compounds are stuck to flange areas, carefully lift the softened materials with a steel blade and scrape surface until clean.

(c) Rinse parts in warm tap water at 27 to 43C (80 to 110F).

NOTE: All traces of moisture shall be removed within eight hours to prevent corrosion.

(d) Pressure air-dry to remove excess water from part, then place in oven at 79 to 107C (175 to 225F) for one hour to complete drying.

CAUTION: REGULATE AIR PRESSURE TO KEEP EROSION OF BASE METAL TO A MINIMUM. KEEP NOZZLE IN MOTION TO PREVENT BLAST FROM DWELLING ON ONE SPOT.

NOTE: If glass bead peening equipment is not available, abrasive blasting at 15 to 30 psig may be used to remove corrosion. Mask any surface that could be damaged by abrasive blasting. Glass bead peening or abrasive blasting shall not be used until fluorescent penetrant inspection has been performed. If paint is loose or blistered following cleaning, refer to Painting for treating and repainting.

(e) Glass bead peen corroded areas to remove corrosion. Regulate air pressure in blasting equipment to keep erosion of base metal to a minimum.

NOTE: All traces of moisture shall be removed within eight hours to prevent corrosion.

(f) Rinse surface free of glass beads (Screen No. 100-230 (130
R Grit) Class IV, Size AF or AG). Dry part in oven at 121C
R (250F) for two hours or proceed immediately with step (g).

(g) Immerse parts in magnesium touch-up solution for 15 to 45 seconds.

NOTE: All traces of moisture shall be removed within eight hours to prevent corrosion.

R (h) Rinse in clean tap water at 10 to 32C (50 to 90F). Pressure
R air-dry to remove excess water. Dry in oven at 121C (250F)
R for two hours.

CLEANING METHOD NO. 9

Clean plain steel and stainless steel parts as follows.

NOTE: It is not necessary to remove heat discoloration.

(a) Clean surfaces with solvent, Stoddard (Federal Specification P-D-680, Type I) to remove oil and grease contamination.

CAUTION: EXTREME DAMAGE CAN OCCUR TO NON-STEEL PARTS IF CLEANED WITH RUST STRIPPER SOLUTION.

(b) Immerse in rust stripper solution for 10 to 20 minutes. The solution shall remove rust, loosen scale, dissolve varnish deposits, and soften organic compounds.

CAUTION: DO NOT DAMAGE HIGHLY FINISHED SURFACES. USE ONLY STIFF PLASTIC FIBER BRISTLED BRUSH.

NOTE: Do not glass bead peen parts until fluorescent penetrant or magnetic particle inspection has been performed.

(c) After soak in solution, remove parts, rinse, and scrub sur faces with stiff plastic fiber bristled brush, or glass bead peen to remove carbon and scale.

(d) Rinse thoroughly in clean tap water at 27 to 43C (80 to 110F). Dry parts by blowing with clean compressed air until free of moisture.

(e) Preserve steel parts after cleaning. Low alloy steel parts that will be subjected to magnetic particle inspection within eight hours may be left dry until inspected. Place in clean container.

(f) Low alloy steel parts that will be subjected to magnetic particle inspection but will be held longer than eight hours prior to inspection shall be coated with oil (Hancock Rust Oil B). Place in clean container.

(g) Low alloy steel parts not subject to inspection and those that have completed inspection shall be placed in a solution of corrosion-preventive compound (MIL-C-6529, Type III) for three to five minutes. Place in clean container and store away from moisture and corrosive fumes.

(h) Stainless steel and heat resistant alloy parts shall be kept dry and boxed for protection from physical damage.

(i) Stainless steel of the 400 series shall be placed in a solution of corrosion-preventive compound (MIL-C-6529, Type III) for three to five minutes. Place in clean container.

CLEANING METHOD NO. 10

Clean titanium parts as follows.

CAUTION: DO NOT USE 1,1,1-TRICHLOROETHANE TO CLEAN TITANIUM PARTS. HIGH TEMPERATURE OPERATION OF TITANIUM PARTS, AFTER CONTACT WITH CHLORINATED CHEMICALS, CAN CAUSE PART FAILURE DUE TO EROSION AND CRACKS.

(a) Clean surfaces with solvent, Stoddard (Federal Specification P-D-680, Type I) to remove oil and grease contamination.

(b) Immerse parts in alkaline cleaner solution at temperature of 71 to 82C (160 to 180F) for three to five minutes minimum. Scrub surface with a stiff plastic fiber bristled brush to remove surface contamination. If old gaskets or sealing compound are present, carefully lift softened gaskets with a knife blade and scrape surface clean.

(c) Rinse parts in fresh running water. Air-dry to remove excess water, then dry in oven at 71 to 121C (160 to 250F) for one hour.

(d) Store parts in dry place.

CLEANING METHOD NO. 11

Clean electrical component parts as follows.

(a) Wipe with clean lint-free cloth dipped in solvent, Stoddard (Federal Specification P-D-680, Type I).

(b) Clean electrical connectors with dry soft plastic fiber bristled brush and remove oily type soil with cotton swab dipped in 1,1,1-Trichloroethane.

CLEANING METHOD NO. 12

Clean fittings and plumbing as follows.

(a) Spray tubes and fittings externally and internally with solvent, Stoddard (Federal Specification P-D-680, Type I) in an outside-ventilated spray booth.

(b) Dry parts with dry, filtered compressed air.

(c) Insert protective plugs and caps in each end of plumbing and fittings.

1. D. Perform Special Cleaning Instructions for Specific Components

(1) Clean components with curvic coupling ends.

Do not clean curvic couplings by glass bead peening or abrasive blasting until fluorescent penetrant or magnetic particle inspection has been performed.

NOTE: During cleaning do not permit high rotational speed of bearings as damage can result. Slow rotational speeds are permissible.

(2) Clean bearings.

(a) Demagnetize bearings so that residual magnetism does not exceed five gauss.

(b) Dip, soak or agitate bearings in solvent, Stoddard (Federal Specification P-D-680, Type I) until oil and grease have been removed.

(c) Allow bearings to drain dry.

(d) Coat bearings with any approved clean engine oil following Inspection/Check if bearings are to be reused immediately.

(e) If bearings are not to be reused immediately coat bearings with preservation oil (MIL-L-6085), individually seal bearings in plastic bag (MIL-B-22205, Type I) and store in dry, cool area. Do not store in area cooled by evaporative cooler. Do not store near electrical equipment to preclude possibility of magnetizing bearings.

1. D. (3) Clean Tube Assembly Part No. 3101475-1 as follows. (See figure 701.)

(a) Using only 1,1,1-Trichloroethane (MIL-T-81533) and a nylon bristled brush, clean external surfaces of tube assembly.

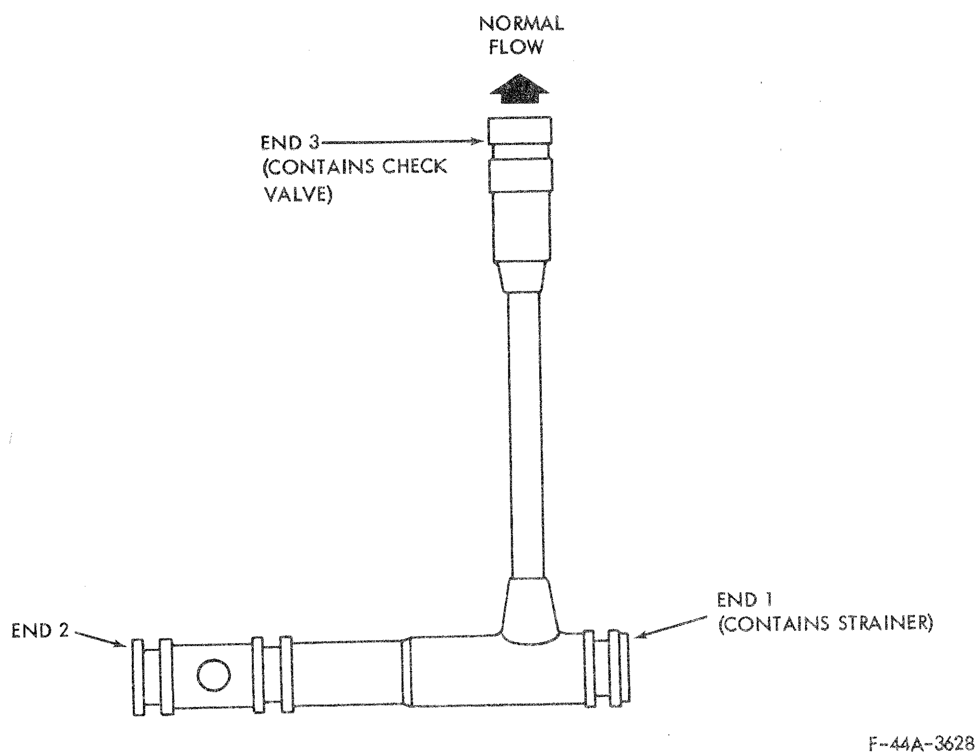
(b) Plug or cap End 2 including the two porting holes. Spray 1,1,1-Trichloroethane (MIL-T-81533) into End 1 with sufficient pressure to cause fluid to exit through End 3. Continue spray until fluid is clear.

(c) Remove plugs or caps from End 2. Spray all ends until clean.

CAUTION: DO NOT DIP ENTIRE TUBE ASSEMBLY INTO RUST STRIPPER OR DAMAGE TO STRAINER AND CHECK VALVE MAY OCCUR.

(d) If rust is precent on End 2, remove by dipping End 2 not more than 1.5 inches into rust stripper solution (as prepared in paragraph 1.B.(5)) until rust is dissolved. Rinse End 2 thoroughly in clean water. Blow with compressed air until free of moisture.

(e) Submerge tube assembly in 1,1,1-Trichloroethane and blow dry with compressed air.



Tube Assembly PN 3101475-1
Figure 701

2. Painting

A. Before Parts are Repainted, Properly Prepare Surfaces to Receive Paint

(1) Dip the part in paint and carbon remover (Turco Transpo). Where complete stripping is not desirable or feasible, brush-on paint remover (Federal Specification TT-R-251) may be used.

(2) Following the stripping operation, thoroughly clean, wipe and dry the part.

(3) Magnesium parts from which the paint has been removed in preparation for repainting shall be treated to prevent corrosion as described in CLEANING METHODS.

(4) External, non-critical surfaces of parts shall be repainted as follows, unless otherwise specified in applicable repair instructions for individual parts.

(a) Plug all holes and mask all areas not to be painted. Thoroughly clean and dry the surfaces to be painted.

(b) Prepare primer (P-415-66-611B with Catalyst C1178-66) (mix in equal parts by volume). Prepare color coat (Andrew Brown A423-66 Enamel No. 051 and C-1178 Converter) (mix equal parts by volume).

(c) First apply one coat of primer and allow to air-dry 15 to 30 minutes followed by one hour at 79 to 107C (175 to 225F), then apply one coat of color heat. Allow to air-dry 15 to 30 minutes followed by one hour at 79 to 107C (175 to 225F).

CHAPTER 72 - ENGINE COMPONENTS

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SHIPPING AND IDENTIFICATION PLATES AND COVERS - DESCRIPTION AND OPERATION

Shipping plates and covers are provided with the engine to protect against damage or contamination from foreign objects. These shipping plates and covers shall be retained for future use.

SHIPPING AND IDENTIFICATION PLATES AND COVERS - MAINTENANCE PRACTICES

1. Removal/Installation

NOTE: Shipping and identification plates and covers are illustrated in Figures 201 and 202 where accessories are normally mounted. These should be installed whenever accessories are removed.

Table 201 provides a list of all materials and compounds required for Removal/Installation.

Table 201. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed item.	
Grease (DC-11)	Dow Corning Corp, South Saginaw Rd, Midland, MI 48640

NOTE: Do not remove trade mark or identification plate unless replacement is intended.

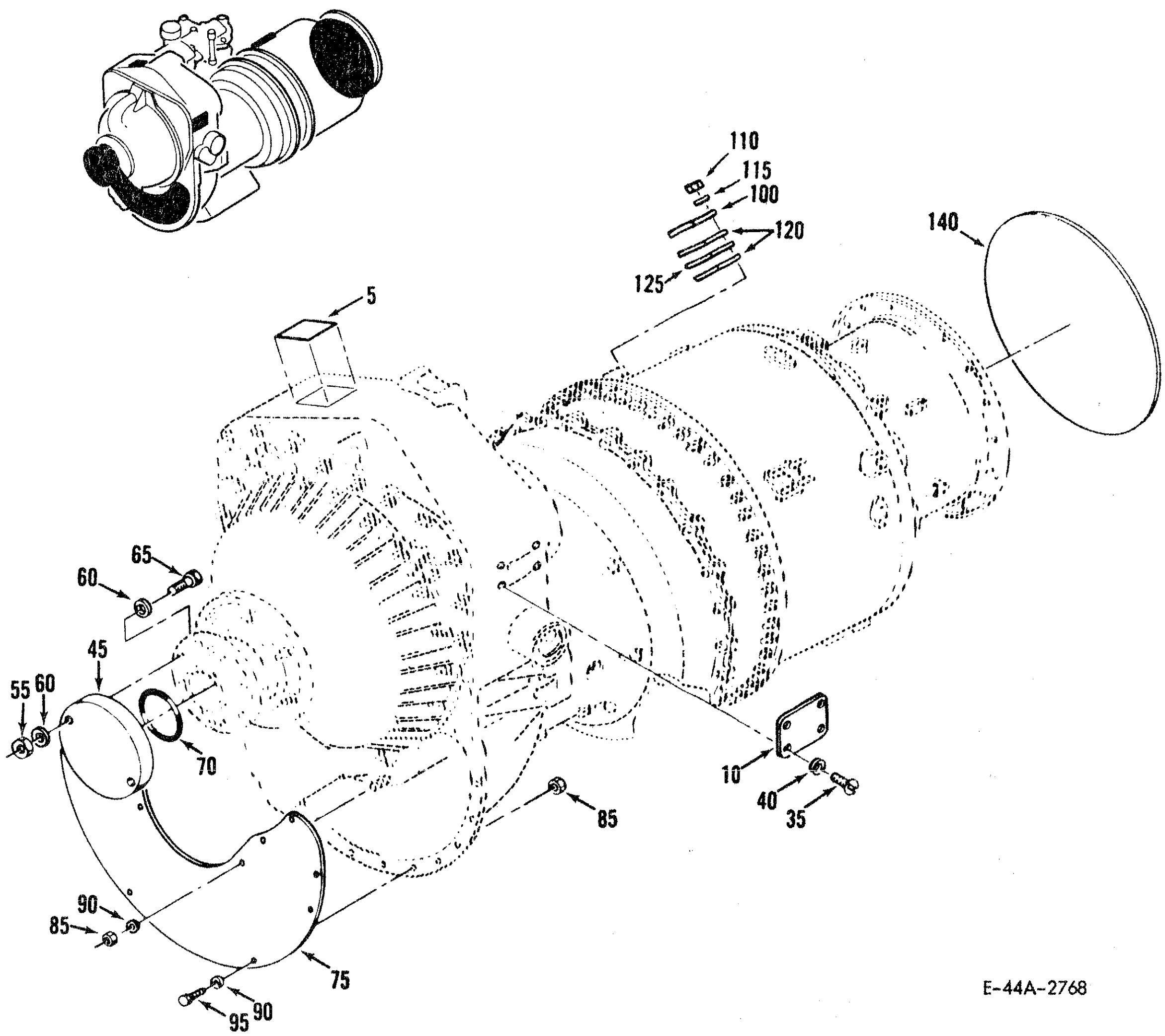
A. Remove Shipping and Identification Plates and Covers (See Figures 201 and 202)

NOTE: Apply grease (DC-11) to gasket (45, figure 202) prior to installation. Refer to 70-00-00, STANDARD PRACTICES, for recommended general torque values.

B. Install Shipping and Identification Plates and Covers (See Figures 201 and 202)

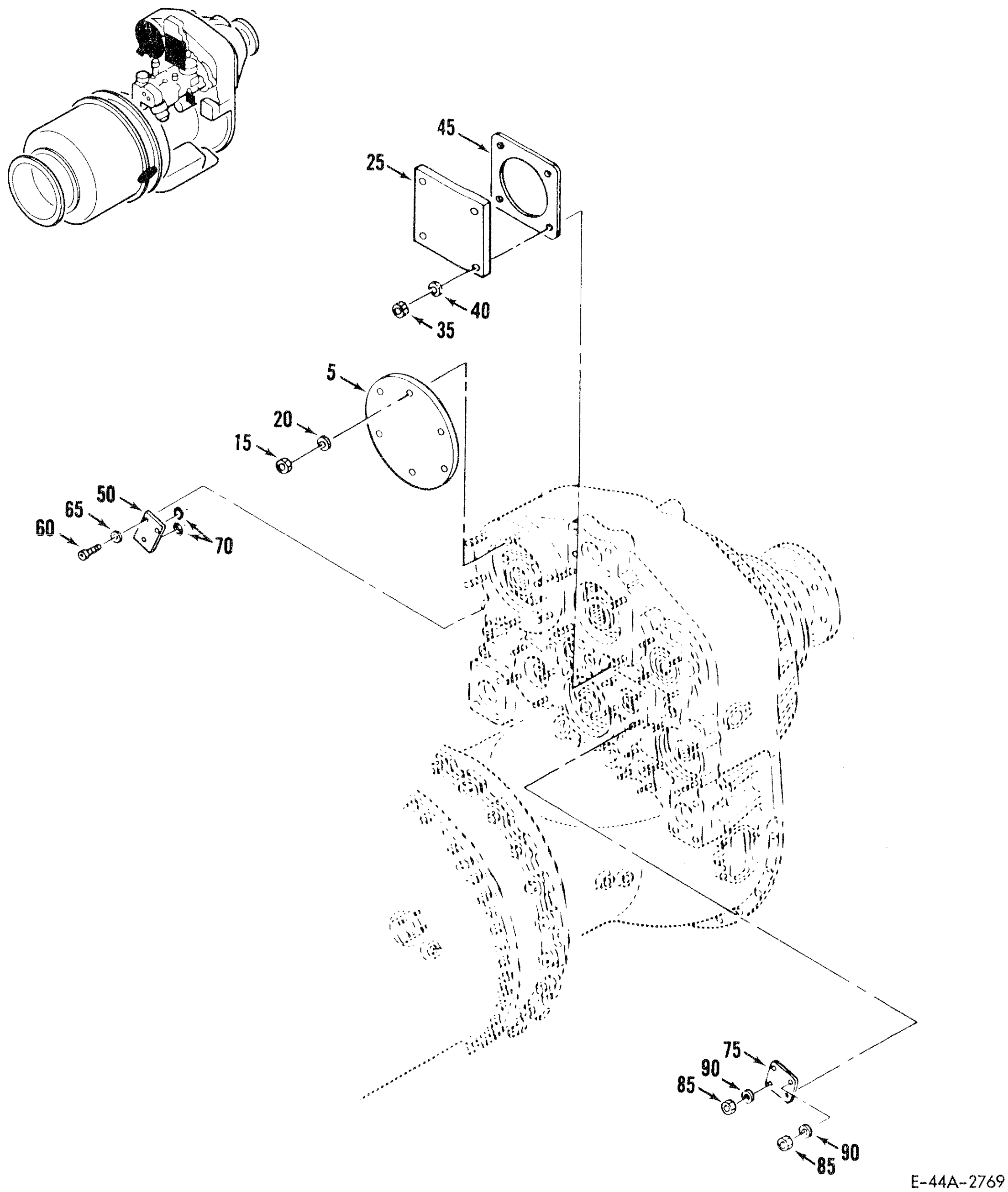
2. Inspection/Check

Check for security, punctures, or obvious damage.



R 5. TRADE MARK PLATE (IPC FIG. 3)
10. IDENTIFICATION PLATE
35. SCREW
40. WASHER
45. PROPELLER SHAFT COVER
55. NUT
60. WASHER
65. BOLT
70. PACKING
75. ENGINE INTAKE COVER PLATE
85. NUT
90. WASHER
95. BOLT
100. BLEED PORT COVER PLATE
110. NUT
115. WASHER
120. GASKET
125. FLOW RESTRICTOR
140. ENGINE EXHAUST COVER PLATE

Shipping and Identification Plates and Covers
Figure 201



R 5.	STARTER PAD COVER PLATE (IPC FIG. 4)	50.	TORQUE SENSOR PAD COVER PLATE
15.	NUT	60.	BOLT
20.	WASHER	65.	WASHER
25.	HYDRAULIC PAD COVER PLATE	70.	PACKING
35.	NUT	75.	OIL INLET COVER PLATE
40.	WASHER	85.	NUT
45.	GASKET	90.	WASHER

Shipping Plates and Covers
Figure 202

PLENUM DRAIN VALVES - DESCRIPTION AND OPERATION

The plenum drain valves drain excess fuel from the turbine plenum upon shutdown of the engine. The valves are spring-loaded open and are closed by rising air pressure.

PLENUM DRAIN VALVES - MAINTENANCE PRACTICES

1. Removal/Installation

NOTE: Table 201 provides a list of all materials and compounds required to perform Removal/Installation.

Table 201. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed item.	
High temperature compound (Fel-Pro C5-A)	Fel-Pro Inc, Division of Felt Products Mfg Co, 7450 North McCormick Blvd, Skokie, IL 60076

A. Remove Drain Valve (See Figure 201)

(1) Remove drain valves and gaskets.

B. Installation of Drain Valves (See Figure 201)

NOTE: Apply high temperature compound (Fel-Pro C5-A) to threads of drain valves (except first two threads) prior to installation.

(1) Install new gaskets on drain valves.

(2) Install drain valves in plenum with arrows on drain valves pointing away from plenum. Tighten drain valves (5) to a torque of 60 to 65 inch-pounds.

2. Inspection/Check

A. Inspect Drain Valves

(1) Visually inspect for foreign material, stripped, crossed, or peened threads, or other obvious damage.

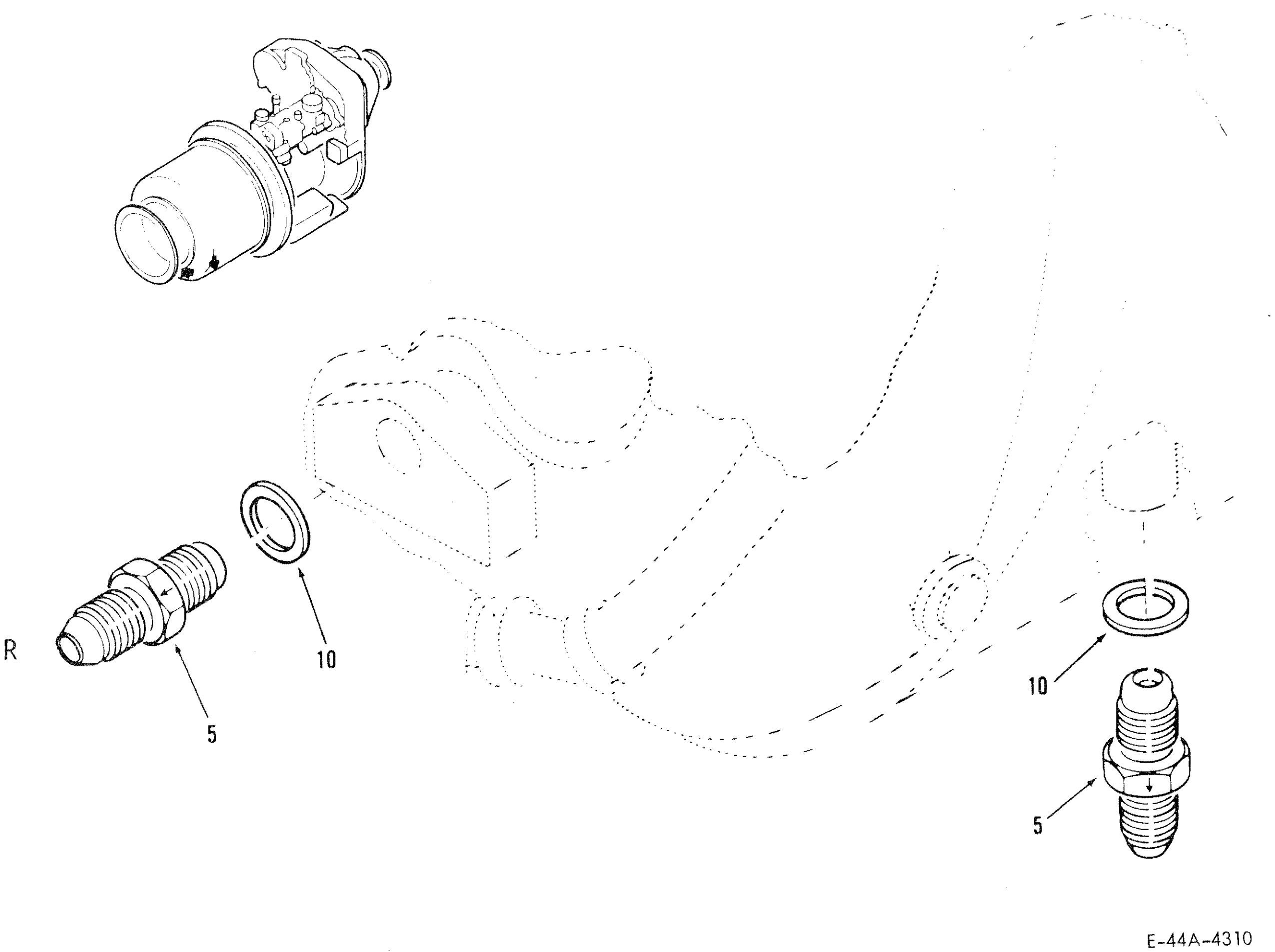
(2) Clean foreign material from drain valves using acceptable shop practices.

(3) Replace damaged valves.

2. B. Check Drain Valves

(1) Valves shall be capable of being closed by 2.0 to 5.0 psig air pressure.

(2) Replace valves which fail to close or open properly.



R 5. DRAIN VALVES (IPC FIG. 175)   10. GASKETS

Plenum Drain Valves
Figure 201

CHAPTER 72 - REDUCTION GEAR AND SHAFT SECTION

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REDUCTION GEAR AND SHAFT SECTION - DESCRIPTION AND OPERATION

The reduction gear section is located in the front of the engine above the air inlet duct and is enclosed by the input, intermediate and output housing assemblies. The propeller and shaft-driven accessories and components of associated systems are driven by a series of gears, shafts and integral parts through the reduction gear section. The output housing contains the propeller shaft for mounting the aircraft propeller and couples rotating torque from reduction gearing of the intermediate gearbox housing to drive the propeller.

1. Oil Flow Metal Tube Assembly (Beta Tube)

   The propeller oil-transfer (beta) tube extends aft from a threaded adjustable connection in the propeller dome, through the engine propeller shaft and into the propeller pitch control. The tube portion housed within the propeller pitch control ported sleeve has oil supply ports through which propeller governor discharge oil is supplied to the propeller dome.

2. Propeller Pitch Control Assembly

   The propeller pitch control is mounted at the rear of the reduction gear section on the propeller shaft centerline. During propeller-governing mode the propeller pitch control serves no basic function other than oil passage and housing for the beta tube. In beta-mode, (underspeed governing), the propeller pitch control provides for pilot control of propeller blade pitch angle.

3. Propeller Governor Assembly

   The propeller governor assembly is mounted in the lower left-hand position at the rear of the reduction gear section. The propeller governor assembly provides a constant engine speed during the propeller-governing mode of operation.

4. Negative Torque Sensor Pressure Regulator

   The negative torque sensor pressure regulator, mounted on the rear face of the reduction gear section, is a preset spring loaded piston actuated regulator which functions to maintain oil pressure from the propeller governor to the negative torque sensor system.

5. Positive Torque Sensor Pressure Regulator

   The positive torque sensor pressure regulator mounted on the right side of the reduction gear section directly above the torque signal compensator, is a preset, spring loaded, piston actuated regulator which functions to regulate lube oil pressure to the torque sensing system.

6. Orifice Housing Assembly

   The orifice housing assembly is a preset restrictor to meter oil to the negative torque sensor pressure regulator.

7. Feathering Valve Assembly

The propeller feathering valve assembly, mounted on the outside of the input housing assembly provides for connection of a customer-furnished control. The valve has normally open ports through which the propeller positioning control oil passes from the governor to the pitch control. If manual feathering of the propeller is required, pulling the feather control valve lever moves a spool valve to close the entry port for control oil from the governor and simultaneously opens a port for dumping oil. The port to the pitch control remains open, allowing propeller oil to flow back into the valve and into the oil sump in the reduction gear housing, allowing the propeller to feather. In addition to the above function, the propeller feathering valve assembly operates automatically to bring the propeller toward the feathered position if a negative torque is sensed by the torque sensor. Negative torque causes a pressure differential to build up across the spool valve. This pressure moves the spool valve in the same manner as manual feathering. As soon as the negative torque is removed, the pressure on the spool valve is removed and the spring loaded spool valve moves back into normal position.

8. Shaft Oil Seals

Shaft oil seals are incorporated in the accessory mount pads to prevent oil leakage.

9. Torsion Spline (Quill) Shaft and Coupling Assembly

Torsion spline shaft and coupling assembly couples the torsion shaft to the high speed pinion.

10. Planet Carrier and Gear Assembly

Planet carrier and gear assembly is mounted on the intermediate gearbox assembly and provides a means of coupling the propeller shaft to the main shaft rotating group through the intermediate gearbox gear train.

11. Torsion Shaft Assembly

A torsion shaft, positioned concentrically inside the main shaft, extends through the length of the shaft and is coupled to the reduction gear section. The torsion shaft is driven by a spline at the rear of the main shaft and drives the matched gearshaft and bearing set (high speed pinion) through a spline coupling at the front.

12. Oil Transfer Manifold, Torque Sensor Assembly and Fitting

The torque sensor assembly is essentially a pressure regulator valve, mounted inside the reduction gearcase, which varies settings with a change in the angular position of two gears. Oil pressure from the torque sensor assembly is supplied, through oil transfer manifold plumbing, to a compensated torque indicating system which provides an ouput proportional to engine power.

A torsion shaft, splined into the aft end of the turbine compressor shaft, transmits the torque to the propeller through the reduction gear train. Being connected together, both shafts rotate at the same speed, however, as propeller load increases, the torsion shaft exhibits a twist with respect to the compressor shaft. Gears mounted on the forward ends of the compressor and torsion shafts drive the gears of the torque sensor assembly. This torque supplied to the propeller is measured by the torque sensor assembly by measuring the amount of relative twist in the torsion shaft.

13. Oil Pressure Pump Assembly

The pressure pump assembly is a gerotor type pump keyed to the shaft of the fuel control unit drive gear. The gerotor gears are installed in a housing attached to the inside of the fuel control unit mounting pad on the reduction gear section.

The pump delivers oil from the oil tank through a pressure regulator and a filter into cored passages and internal plumbing in the reduction gear housing, where the oil is directed to bearings and gears. An external plumbing line carries lubricating oil to an oil jet in the turbine section for lubrication of the rear bearing. Pressurized oil is also provided to the propeller governing system.

14. Gearcase Oil Scavenge Pump Assembly

The oil scavenge pump assembly is a gerotor type pump driven by a splined shaft, which in turn is driven by internal splines in the fuel control unit drive gear. Gerotor gears for the pump assembly are installed in a housing attached to the inside of the reduction gear section intermediate housing assembly.

Lubricating oil, supplied to the bearings and gears (and also pressurized oil supplied to the propeller governing system), drains into a sump in the bottom of the reduction gear section housing, where it is picked up by the tubes in the sump and passed through vertical tubes to the main scavenge pumps. From the scavenge pumps, the oil is directed to the fuel heater, the aircraft heat exchanger and the oil tank.

15. Compressor Bearing Carrier Support Assembly

The compressor bearing carrier support assembly supports the roller bearing and the air-oil seal and rotor at the forward end of the main shaft.

REDUCTION GEAR AND SHAFT SECTION - MAINTENANCE PRACTICES

CAUTION: MAINTENANCE PRACTICES OUTLINED IN THIS CHAPTER/SECTION ASSUMES THAT PROCEDURES WILL BE PERFORMED BY ADEQUATELY TRAINED PERSONNEL. EXTENSIVE TESTING REQUIRING SPECIAL TOOLS MUST BE PERFORMED WHENEVER INTERMEDIATE GEARBOX ASSEMBLY (DIAPHRAGM) IS REMOVED. REFER TO 72-00-00, ADJUSTMENT/TEST, PRIOR TO PERFORMING ANY MAINTENANCE REQUIRING INTERMEDIATE GEARBOX ASSEMBLY (DIAPHRAGM) REMOVAL. ENSURE ALL MATERIALS AND SPECIAL TOOLS REQUIRED IN THIS AND REFERENCED CHAPTER/SECTIONS ARE AVAILABLE BEFORE ATTEMPTING ANY OF THE FOLLOWING MAINTENANCE PRACTICES.

NOTE: Removal and installation procedures are provided to completely disassemble and reassemble the reduction gear section. Components should be removed only to the extent required for the maintenance action to be performed.

OIL FLOW METAL TUBE ASSEMBLY (BETA TUBE) - MAINTENANCE PRACTICES

1. Removal/Installation

NOTE: Table 201 provides a list of all special tools, fixtures and equipment required for Removal/Installation. Table 202 provides a list of all materials and compounds required for Removal/Installation.

Table 201. Special Tools, Fixtures and Equipment

Item No.	Nomenclature	Use	Source/ Part No.
NOTE: Equivalent substitutes may be used for listed items.			
1.	Plug Puller	Used to remove plug from flanged end of propeller shaft.	285397-1-1
2.	Bearing and Bushing Driver	Used to install plug in flanged end of propeller shaft.	285398-1-1
3.	Oil Flow Metal Tube Wrench	Used to install, remove or adjust oil flow metal tube (beta).	287335-1-1
4.	Propeller Shaft Cover Plate	Used to provide proper covering to protect shaft, gears and projecting parts from damage.	868727-1

Table 202. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed item.	
Any approved engine oil	Commercially available
Alternate lubricant, Lubricant (OS-124)	Monsanto Company, 800 N Lindbergh Blvd, St Louis, MO 63166

1. A. Remove Beta Tube (See Figure 201)

WARNING: ENSURE PROPELLER IS FULLY FEATHERED BEFORE PROCEEDING.

(1) Ensure propeller is feathered for beta tube removal.

(2) Remove that portion of the spinner and the propeller hub assembly that will afford accessibility to beta tube. (Refer to Aircraft Maintenance Manual.)

CAUTION: PROTECT BETA TUBE FROM CORROSION AND ANY POSSIBLE DAMAGE UNTIL REINSTALLATION. IF POSSIBLE STORE IN SHIPPING CONTAINER.

(3) Carefully remove beta tube from propeller shaft using 287335-1-1 wrench. Remove packings.

CAUTION: ENSURE 285397-1-1 PULLER IS PROPERLY INSTALLED AND SEATED ON PROPELLER SHAFT FLANGE, PRIOR TO ATTEMPTING TO REMOVE PLUG, TO PRECLUDE POSSIBLE DAMAGE TO PULLER.

(4) Remove propeller in accordance with Aircraft Maintenance Manual.

NOTE: Do not remove plug from propeller shaft unless required for maintenance.

(5) Remove plug using 285397-1-1 puller.

(6) Install 868727-1 cover plate to protect propeller shaft.

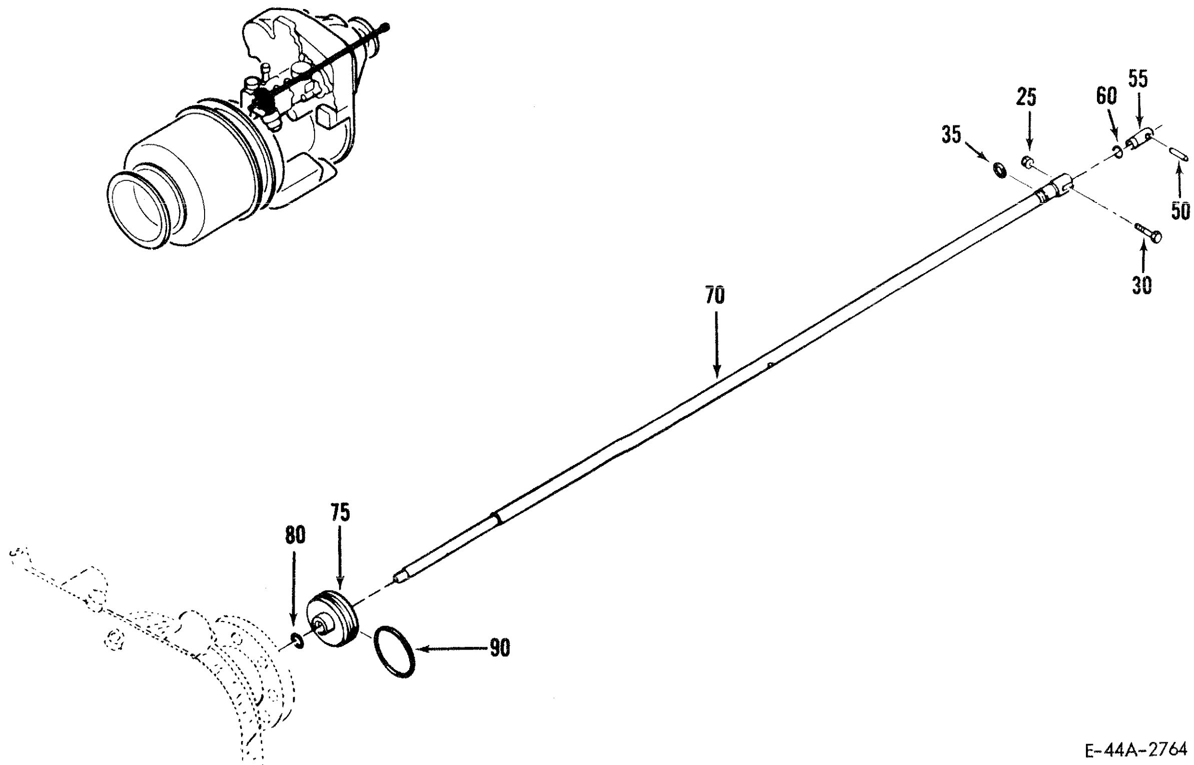
B. Install Beta Tube (See Figure 201)

R NOTE: Refer to 70-00-00, STANDARD PRACTICES, for recommended
R general torque values. Add frictional drag (run-down)
R torque of self locking devices to recommended values.

R Lightly coat new packings with clean engine oil or lu-
R bricant (OS-124) prior to installation.

(1) Remove 868727-1 cover plate installed on propeller shaft.

(2) Ensure plug is installed in propeller shaft. If necessary, install new packings on shaft seal plug then install plug using 285398-1-1 driver.



R 25. NUT (IPC FIG. 119)	60. PACKING
R 30. BOLT	70. BETA TUBE
R 35. PACKING	75. PLUG (PROP SHAFT SEAL)
50. PIN	80. PACKING
R 55. PLUG (TUBE END)	90. PACKING

Beta Tube Installation
Figure 201

1. B. (3) Install new packings on beta tube.

(4) Ensure ports on beta tube are free of obstructions.

(5) Ensure propeller is in feather position.

(6) Install beta tube using 287335-1-1 wrench until approximately half of threaded section is showing at propeller dome.

(7) Hand actuate the propeller pitch control. Check to ensure full travel to reverse position without drag or binding.

NOTE: Do not lock position of beta tube with bolt and nut until flight-idle angle is set. Refer to Adjustment/Test.

(8) Upon completion of assembly of engine, operate engine in accordance with Aircraft Flight Manual and perform operational checks specified in 72-00-00, ADJUSTMENT/TEST.

2. Adjustment/Test

NOTE: Oil temperature affects the following procedure If performed when engine is cold, recheck and adjust on first engine run when oil is at normal operating temperature.

A. Observe Adjustment/Test Procedures

(1) Set propeller pitch control lever on FLIGHT-IDLE and pin so that no movement from this position takes place during the following check. Withdraw beta tube until approximately half of the threaded section is showing at propeller dome.

(2) Check that unfeathering pump is connected to engine oil tank.

CAUTION: DO NOT SERVICE OIL SUPPLY UNTIL OIL HAS BEEN SCAVENGED FROM GEARCASE. AT END OF UNFEATHERING PUMP OPERATING PERIOD, ACTIVATE AND CRANK ENGINE TO SCAVENGE OIL FROM THE ACCESSORY HOUSING SUMP. IF STARTER IS USED, OBSERVE TIME LIMIT ESTABLISHED BY STARTER MANUFACTURER AND DISABLE OIL VENT VALVE.

R NOTE: (Codes BA-BC, EA, GA, HA) If unable to set flight idle blade angle with engine hot (oil temp within operating band) cap off the NTS ground check system and set the flight idle blade angle. Return NTS ground check system to normal (remove cap). Then run engine with propeller off the start locks until oil temperature is within operating limits. Shut engine down normally to ensure propeller blades will be latched. If not latched refer to trouble shooting procedures. Start engine verifying proper operation of NTS ground check system. After oil temperature is in normal operating range stop engine allowing propeller to go to full feather. Unfeather propeller using aircraft unfeathering pump. If propeller blades will not return to latches allow oil to cool to 55C (131F) (cockpit gage) or for 40 minutes whichever comes first and recheck unfeathering. If OK go for NTS flight check. If not OK refer to trouble shooting procedures.

2. A. (3) Determine propeller blade flight-idle angle at blade measuring station. Operate unfeathering pump and position beta tube. One turn counter-clockwise of beta tube provides a two degree blade angle increase. Check blade angle with propeller protractor following adjustment of beta tube.

(4) Lock beta tube in position with bolt and nut when specified propeller blade angle is achieved. Tighten nut in accordance with Aircraft Maintenance Manual.

(5) Perform dynamic oil leakage check with spinner on unless Aircraft Maintenance Manual specifies otherwise.

(6) Perform flight-idle low rpm check. Refer to 72-00-00, ADJUSTMENT/TEST.

(7) Shut down engine and check for leakage.

(8) Reinstall spinner if removed for leak check.

3. Inspection/Check

   A. Inspect Beta Tube (See Figure 201)

      (1) Visually inspect beta tube for scoring, nicks, scratches, corrosion and distortion. Replace beta tube if any scratches are detected on the metering and sealing surfaces. Replace beta tube if raised material or indentation is detectable.

      (2) Replace part that does not meet Inspection/Check requirements.

4. Cleaning/Painting

   A. Clean Component Parts

      (1) Clean all standard metallic hardware in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 1 or 2.

      (2) Clean end plug of beta tube in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 10.

      (3) Clean beta tube in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 12.

PROPELLER PITCH CONTROL - MAINTENANCE PRACTICES

1. Removal/Installation

R NOTE: Table 201 provides a list of all materials and compounds
R required for Removal/Installation.

R Table 201. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed item.	
Grease (DC-11)	Dow Corning Corp, S Saginaw Rd, Midland, MI 48640

A. Remove Propeller Pitch Control (See Figure 201)

NOTE: Before replacing propeller pitch control, ensure trouble has been isolated to this component. If propeller pitch control is removed because of damage or malfunction, beta tube should also be removed and checked. Refer to 72-10-01, Inspection/Check. If new propeller pitch control is to be installed, rigging plate and pitch control arm must be removed from the removed unit for installation on the replacement unit. Refer to 76-10-01, MAINTENANCE PRACTICES.

(1) Remove beta tube. Refer to 72-10-01, MAINTENANCE PRACTICES.

(2) Disconnect plumbing as required.

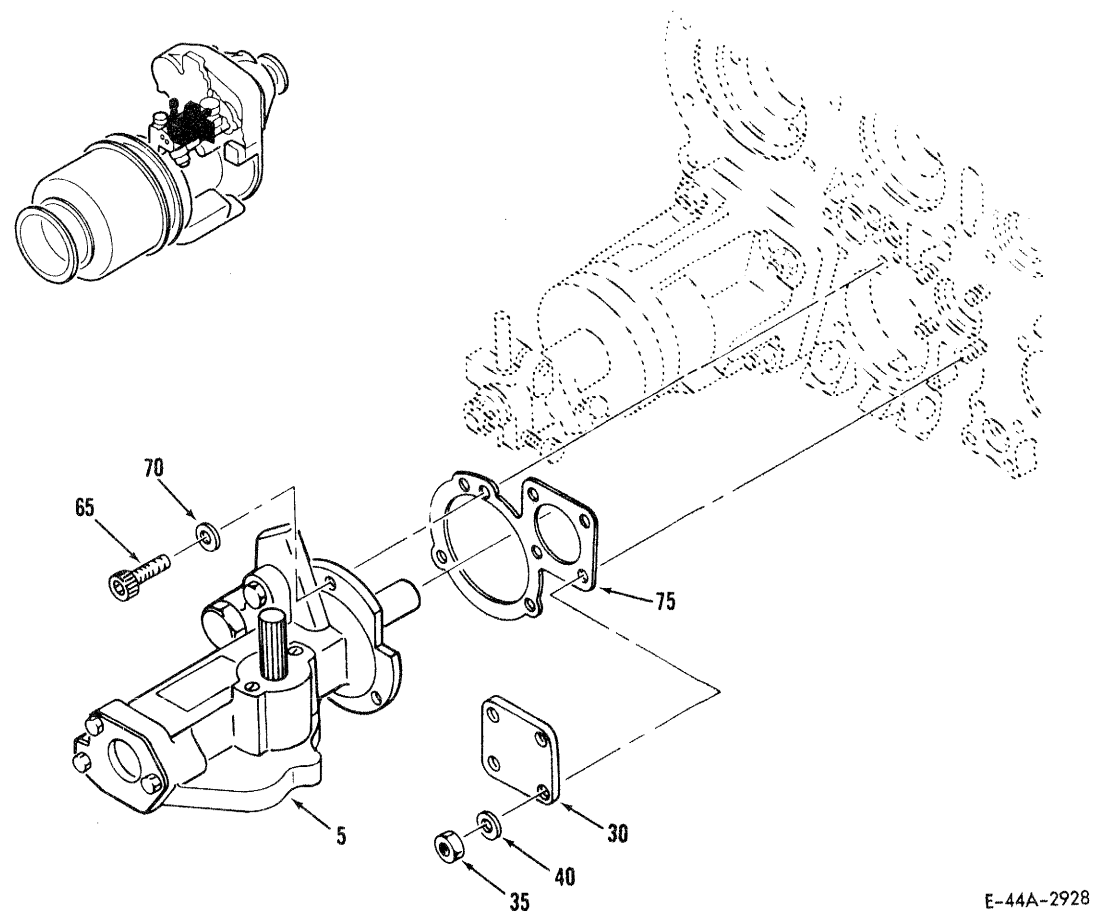
(3) Disconnect controls linkage assembly to pitch control arm on propeller pitch control. Refer to 76-10-01, MAINTENANCE PRACTICES.

(4) Rotate propeller pitch control shaft lever fully counterclockwise.

(5) Remove bolts, washers and propeller pitch control from engine.

NOTE: Do not remove gasket unless damage is indicated by inspection.

(6) If gasket requires replacement, remove shipping cover or aircraft shaft driven component. Refer to Aircraft Maintenance Manual.



R 5. PROPELLER PITCH CONTROL (IPC FIG. 120)
30. SHIPPING COVER
35. NUT
40. WASHER
65. BOLT
70. WASHER
75. GASKET

R Propeller Pitch Control Installation
Figure 201

1. B. Install Propeller Pitch Control (See Figure 201)

R NOTE: Refer to 70-00-00, STANDARD PRACTICES, for recommended
R general torque values. Add frictional drag (run-down)
R torque of self locking devices to recommended values.

R Apply grease (DC-11) to gasket prior to installation.

(1) Rotate propeller pitch control shaft fully counterclockwise.

NOTE: Installation of aircraft shaft driven component (or shipping cover) with new gasket may not be necessary if original gasket was judged serviceable when propeller pitch control was removed.

(2) Install propeller pitch control using new gasket (if required) and secure with washers and bolts. Tighten bolts to 75 inch-pounds torque.

(3) Install shipping cover or aircraft shaft driven component adjacent to propeller pitch control if gasket was replaced.

(4) Connect plumbing.

(5) Connect controls linkage assembly. Refer to 76-10-01, MAINTENANCE PRACTICES.

(6) Install beta tube. Refer to 72-10-01, MAINTENANCE PRACTICES.

2. Adjustment/Test

A. Perform engine operational checks. Refer to 72-00-00, ADJUSTMENT/TEST.

3. Inspection/Check

A. Inspect Propeller Pitch Control (See Figure 201)

NOTE: If propeller pitch control assembly was removed because of damage or malfunction, inspect beta tube. Refer to 72-10-01, MAINTENANCE PRACTICES.

(1) Inspect for security or evidence of oil leaks and obvious damage. Check for internal binding of propeller pitch control shaft by rotating shaft. Shaft should rotate freely through 0 to 100 degrees minimum.

(2) If pitch control assembly is disassembled for any reason, inspect components of pitch control for wear as follows. (See figure 202.)

(a) Inspect sides of cam assembly track for wear. Wear shall not exceed 0.004 inch on either side of track.

(b) Inspect diametrical clearance between pin and roller of propeller pitch control sleeve. Diametrical clearance shall not exceed 0.0052 inch and shall be less than 0.0007 inch.

(c) Inspect guide of sleeve for cracks, bending, separation of braze or weld, wear and freedom of movement. Cracks, visible bending and separation of braze or weld are not allowed. Replace sleeve if requirements are not met.

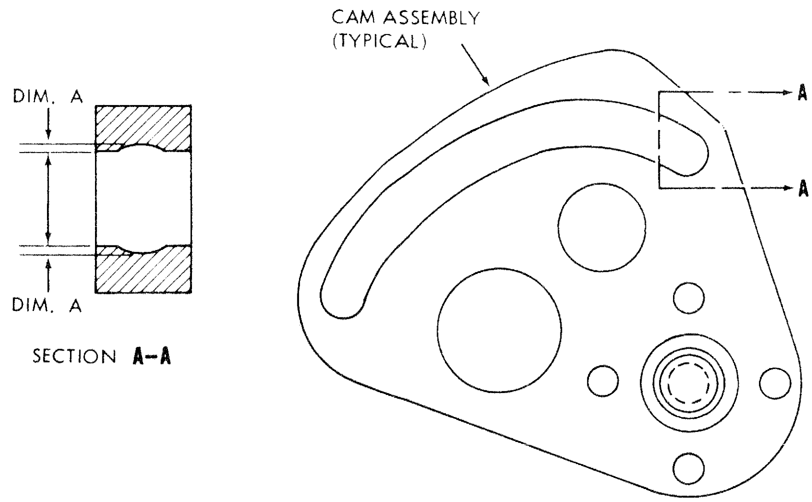
R (d) Inspect sleeve where contact is made with bearing. Wear marks
R up to 0.010 inch deep are acceptable.

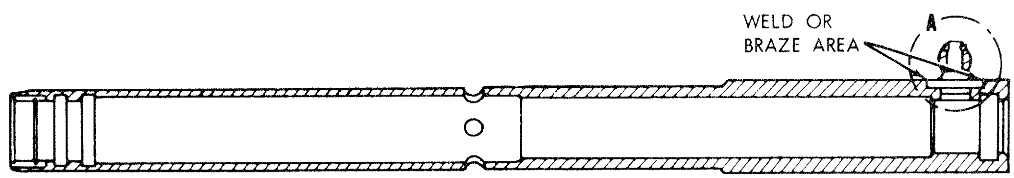
(e) Inspect body for excessive wear, foreign materials and obvious damage.

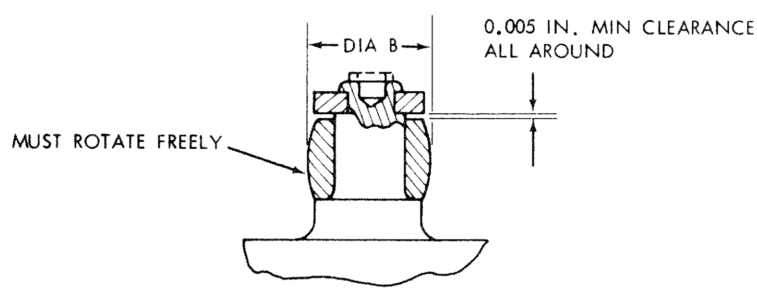
(f) Replace any part that does not meet the above Inspection/Check requirements.

(3) Internal leakage of pitch control assembly may be indicated by propeller not unfeathering or not unfeathering adequately to engage start locks.

(4) Internal leakage and/or binding may be corrected in accordance with Approved Repairs.







DIAMETRICAL CLEARENCE BETWEEN PIN AND ROLLER SHALL NOT EXCEED 0.0052 INCH AND SHALL NOT BE LESS THAN 0.0007 INCH.

A	B
0.004 IN. MAX	0.2490 TO 0.2495 IN.

I-44A-2322

Propeller Pitch Control Wear Limits
Figure 202

4. Cleaning/Painting

A. Clean Component Parts

(1) Refer to 72-00-00, CLEANING/PAINTING, for general cleaning instructions and for description of cleaning methods specified in Table 202.

NOTE: Reference shall be made to Table 202 for recommended cleaning method.

Table 202. Cleaning Methods

Figure No.	Item No.	Nomenclature	Cleaning Methods 1	2	3	4	5	6	7	8	9	10	11	12
All standard metallic hardware			X	X										
203	55	Cover Assembly	X	X			X	X						
	70	Bushing	X	X										
	110	Cam Assembly	X	X			X				X			
	135	Retainer Assembly	X	X							X			
	160	Retainer	X	X							X			
	165	Valve Seat	X	X										
	175	Sleeve Assembly	X	X							X			
	185	Cam Guide	X	X							X			
	210	Sleeve Bearing	X	X										
	240	Body	X	X			X	X						

5. Approved Repairs

NOTE: Table 203 provides a list of all materials and compounds required for Approved Repairs.

Table 203. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed item.	
Any approved engine oil	Commercially available
Compound (MIL-S-22473, Grade H)	Commercially available
Alternate lubricant (OS-124)	Monsanto Company, 800 N Lindbergh Blvd, St Louis, MO 63166

5. A. Correct Internal Leakage (See Figure 203)

(1) Disassemble propeller pitch control assembly as follows.

NOTE: Do not remove inserts and bushings from body or cover assembly unless required to replace damaged part.

(a) Remove screws, washers, cover assembly and gasket.

NOTE: Do not remove bushings from cover assembly and body unless damage is indicated by inspection.

(b) Remove cam assembly and sleeve bearing.

R (c) Remove cam guide (on Part No. 869647-2/-3 only).

(d) Remove screws, washers, retainer assembly and gasket.

NOTE: Do not disassemble sleeve assembly unless damage is indicated by inspection.

(e) Remove sleeve assembly.

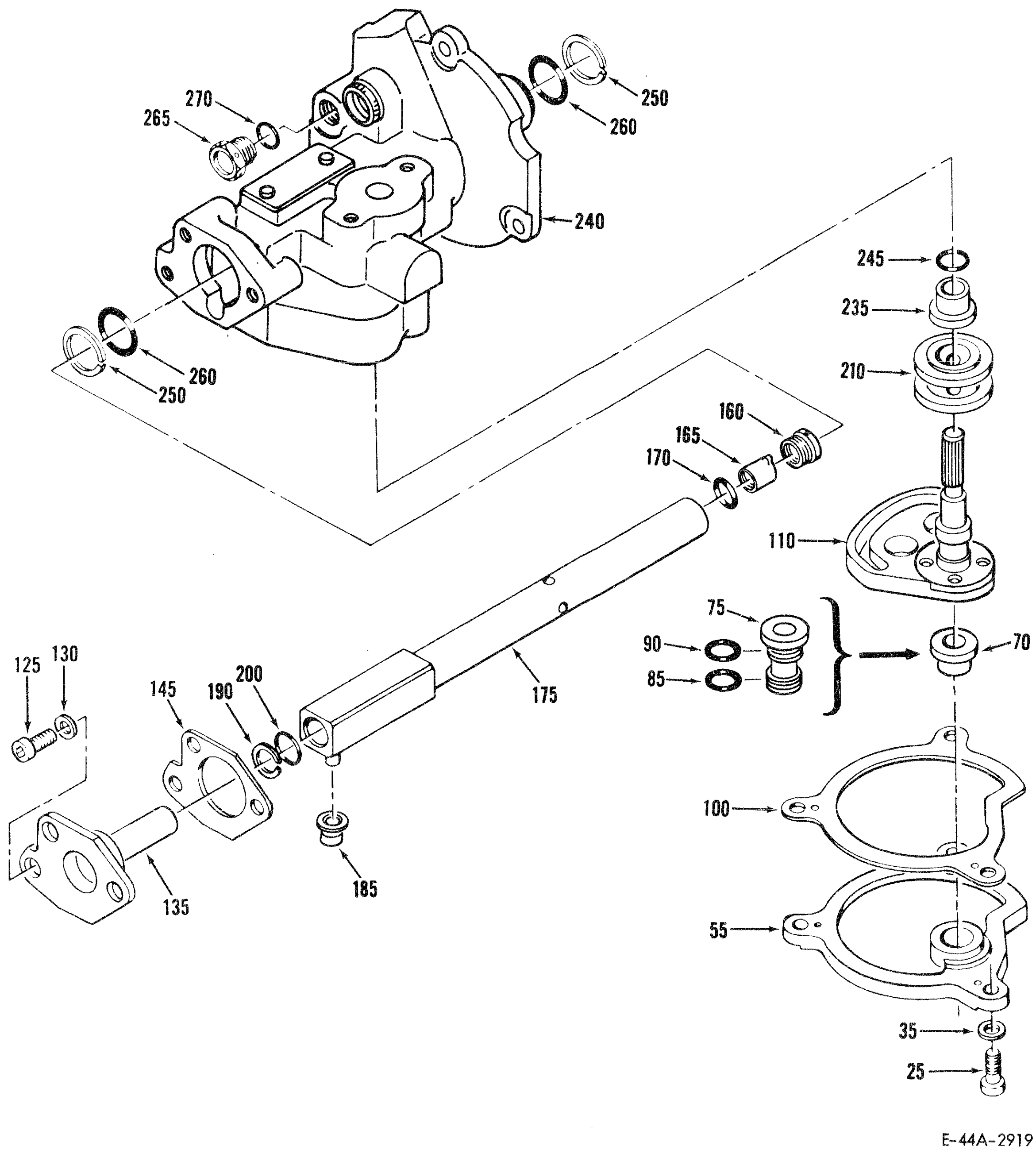
CAUTION: RETAINER (160) HAS LEFT-HANDED THREADS.

(f) Remove retainers and packings from sleeve assembly.

(g) Remove bushing and packing from body.

(h) Remove retainers and use small wire to remove packing from shaft bore.

(i) Remove plug and packing from body.



R

Propeller Pitch Control (Field Maintenance Breakdown)
Figure 203

5. A. (2) Reassemble propeller pitch control assembly as follows. (See figure 203.)

NOTE: Replace all gaskets, packings, and retainers that secure packings. Coat all internal surfaces of body assembly with clean engine oil. Lightly coat new packings with clean engine oil or lubricant
R (OS-124) prior to installation. Refer to 70-00-
R 00, STANDARD PRACTICES, for recommended general
R torque values. Add frictional drag (run-down)
R torque of self-locking devices to recommended
R values.

(a) Coat threads of retainer with compound (MIL-S-22473, Grade H) and install packing, valve seat, and retainer into sleeve assembly then tighten retainer (160) to 25 inch-pounds torque. Bake assembled sleeve assembly for 10 minutes at 100C (212F).

CAUTION: WHEN CHECKING BREAKAWAY TORQUE, ENSURE THAT NO MOVEMENT OF RETAINER OCCURS. IF MOVEMENT IS OBSERVED, DISASSEMBLE SLEEVE ASSEMBLY AND REPEAT STEP (a).

(b) Verify breakaway torque of retainer to be 35 inch-pounds or greater.

(c) Install packings and retainers into body assembly.

(d) Install packing and plug into body assembly. Tighten plug (265, figure 203) to 25 inch-pounds torque.

(e) Install packing and retainer, retainer assembly, and gasket into sleeve assembly.

KEY TO FIGURE 203

R 25. SCREW (IPC FIG. 121)
35. WASHER
R 55. COVER ASSY
R 70. BUSHING (CODES BA-BC, EA, GA, HA)
R 75. BUSHING (CODES AA-AC, CA-CC, FA, KA, LA)
R 85. PACKING (CODES AA-AC, CA-CC, FA, KA, LA)
R 90. PACKING (CODES AA-AC, CA-CC, FA, KA, LA)
100. GASKET
R 110. CAM ASSY
125. SCREW
130. WASHER
135. RETAINER
145. GASKET
160. RETAINER
165. VALVE SEAT
170. PACKING
175. SLEEVE ASSY
185. CAM GUIDE (ON PART NO. 869647-2/-3 SLEEVES)
190. RETAINER
200. PACKING
210. SLEEVE BEARING
235. BUSHING
240. BODY
245. PACKING
250. RETAINER
260. PACKING
265. PLUG
270. PACKING

5. A. (2) (f) (Propeller pitch controls using Sleeve Assembly Part No. 869647-2/-3). Install cam guide onto sleeve assembly.

(g) Install assembled retainer and sleeve assemblies onto body assembly. Install screws and washers. Tighten screws (125, figure 203) to 25 inch-pounds torque.

(h) Position bearing on shaft of cam assembly and insert cam assembly and bearing into body so that the sleeve assembly guide is positioned in the slot of the cam assembly.

(i) Install gasket and cover assembly to body and tighten screws (25, figure 203) to 20 to 25 inch-pounds torque.

(j) Check propeller pitch control operation by rotating cam assembly to check for freedom of movement. Cam shall rotate freely with no binding or rough spots. Sleeve assembly shall extend and retract smoothly as cam assembly is rotated. Torque required to rotate cam assembly to within 0.010 inch of full travel shall be one to seven inch-pounds.

R (CODES AA-GA, KA-LA) PROPELLER GOVERNOR ASSEMBLY - MAINTENANCE PRACTICES

1. Removal/Installation

NOTE: Table 201 provides a list of all materials and compounds required for Removal/Installation.

Table 201. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed item.	
Grease (DC-11)	Dow Corning Corp, S Saginaw Rd, Midland, MI 48640

A. Remove Propeller Governor Assembly (See Figures 201 through 204)

NOTE: Before replacing propeller governor assembly, be sure trouble has been isolated to this component. If new propeller governor assembly is to be installed, rigging shall be accomplished in accordance with Adjustment/Test section of 76-10-01, MAINTENANCE PRACTICES.

(1) Disconnect controls linkage assembly between propeller governor assembly and fuel control assembly. Refer to 76-10-01, MAINTENANCE PRACTICES.

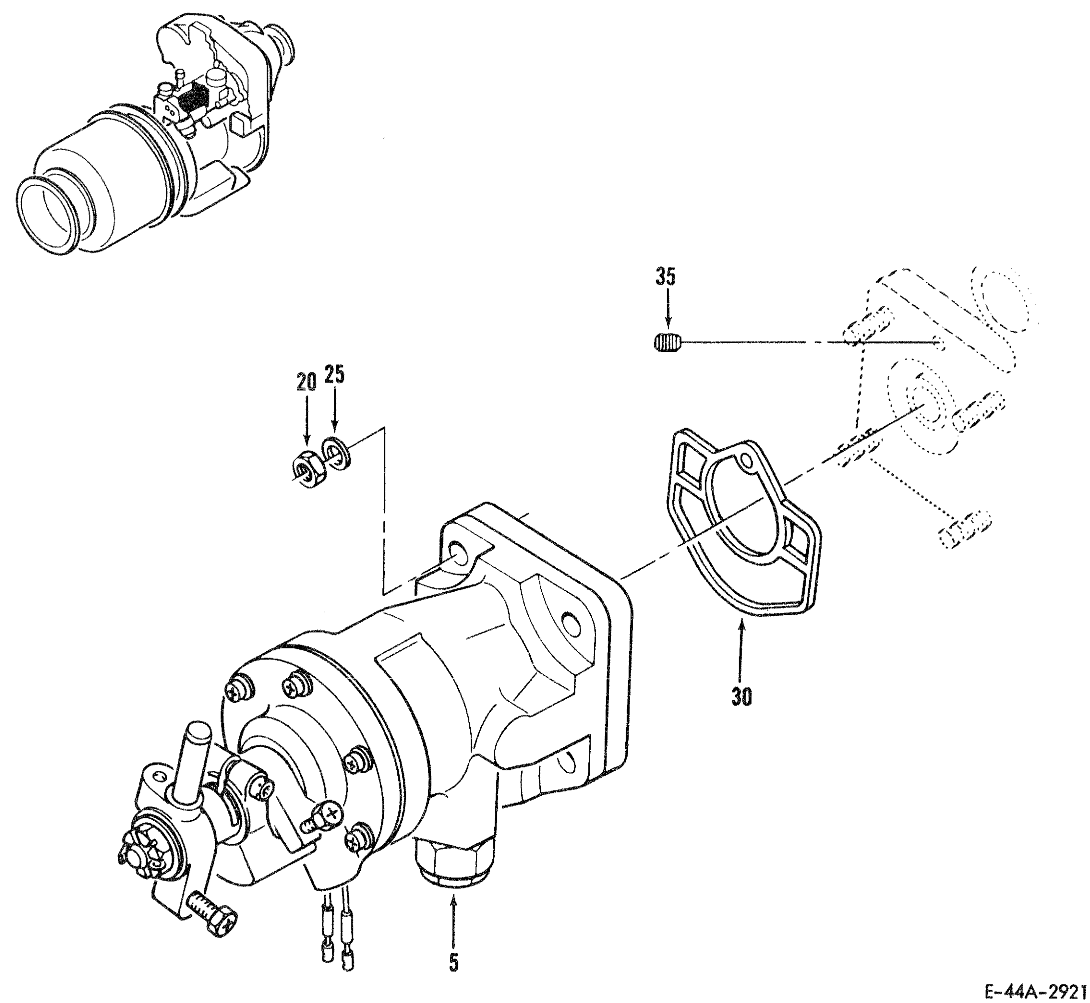
(2) Disconnect wiring or plumbing as applicable.

(3) Remove nuts and washers securing propeller governor assembly to housing.

(4) Remove propeller governor assembly from engine in a straight line to avoid damage.

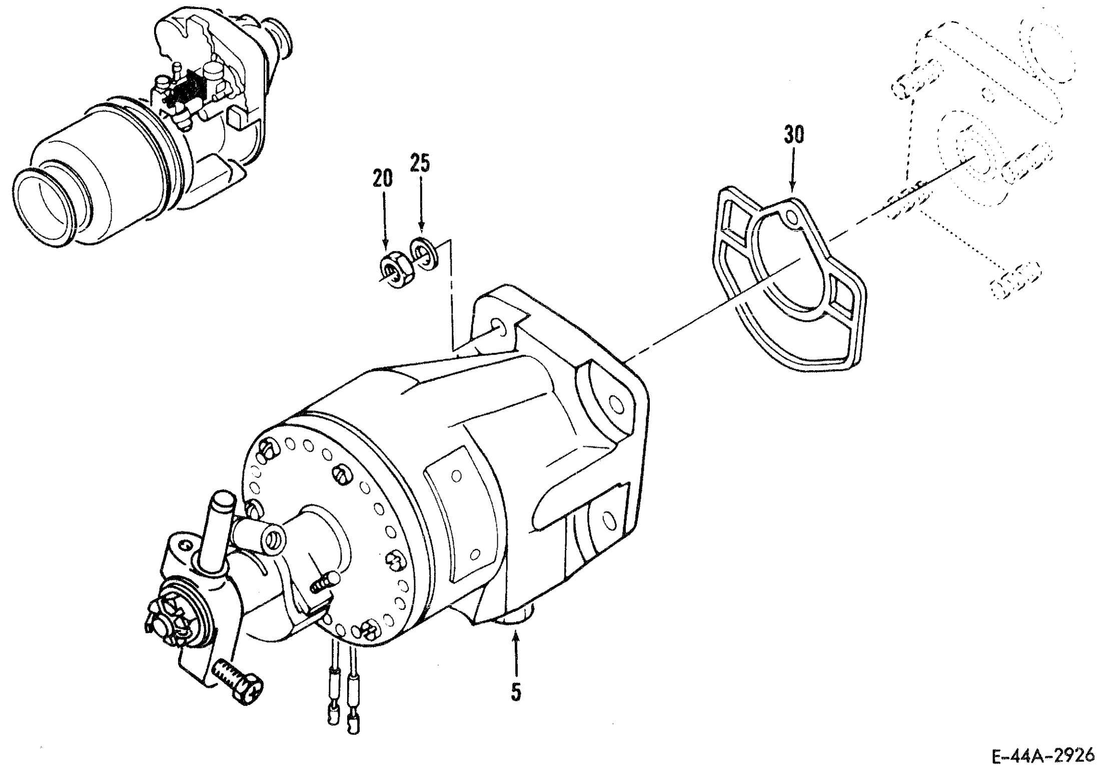
(5) Remove gasket from propeller governor assembly.

R (6) (Codes AA-AC, CA-CC, FA, KA, LA) Remove orifice setscrew if required for maintenance.



5. PROPELLER GOVERNOR ASSY
R (IPC FIG. 123)
20. NUT
25. WASHER
30. GASKET
35. ORIFICE SETSCREW

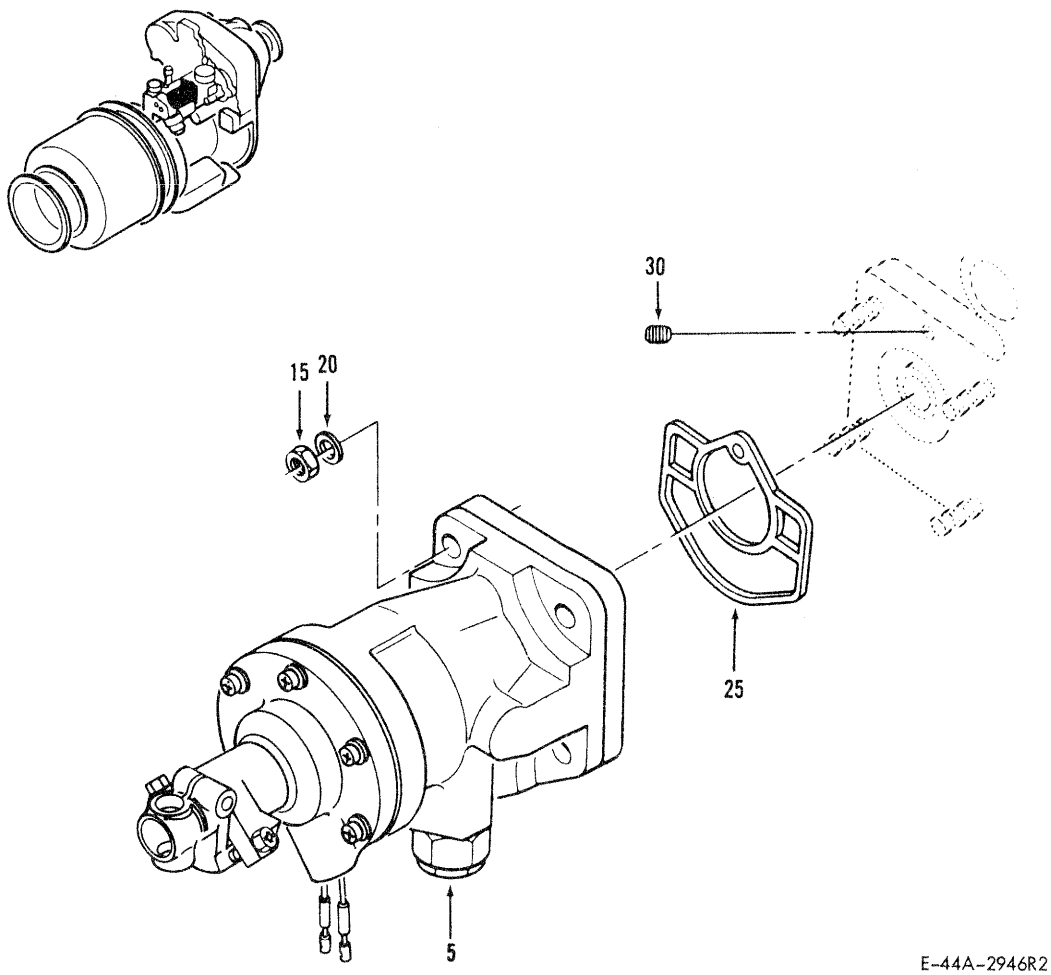
R (Codes AA-AC, CA-CC) Propeller Governor Assembly Installation
Figure 201



5. PROPELLER GOVERNOR ASSY
R (IPC FIG. 123)
20. NUT
25. WASHER
30. GASKET

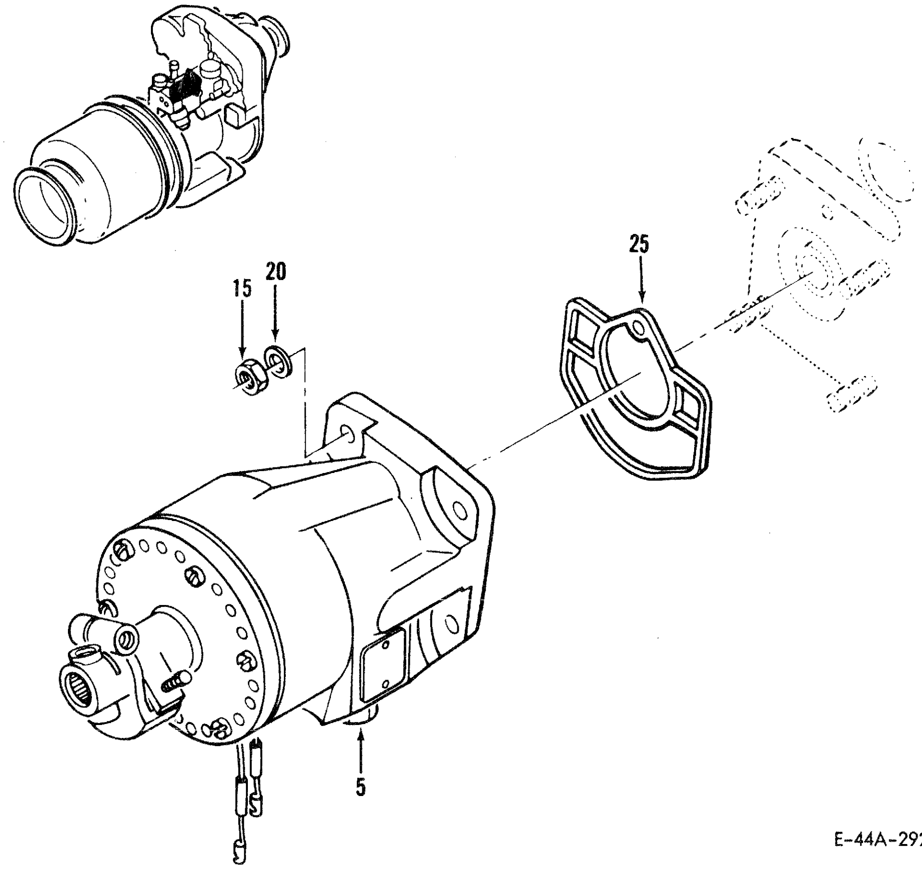
R (Codes BA-BC, EA) Propeller Governor Assembly Installation
Figure 202

R



5. PROPELLER GOVERNOR ASSY
R (IPC FIG. 124)
15. NUT
20. WASHER
25. GASKET
30. ORIFICE

R (Codes FA, KA, LA) Propeller Governor Assembly Installation
Figure 203



5. PROPELLER GOVERNOR ASSY
R (IPC FIG. 125)
15. NUT
20. WASHER
25. GASKET

R (Codes GA) Propeller Governor Assembly Installation
Figure 204

1. B. Install Propeller Governor Assembly (See Figures 201 through 205)

R NOTE: Refer to 70-00-00, STANDARD PRACTICES, for recommended
R general torque values. Add frictional drag (run-down)
R torque of self-locking devices to recommended values.

R (1) (Codes AA-AC, CA-CC, FA, KA, LA) Install orifice setscrew, if removed. Tighten orifice setscrew to seven inch-pounds torque.

(2) Coat gasket with grease (DC-11).

(3) Install gasket on propeller governor assembly. If gasket with beveled side is used, install with beveled side of gasket towards engine accessory drive pad. (See figure 205.)

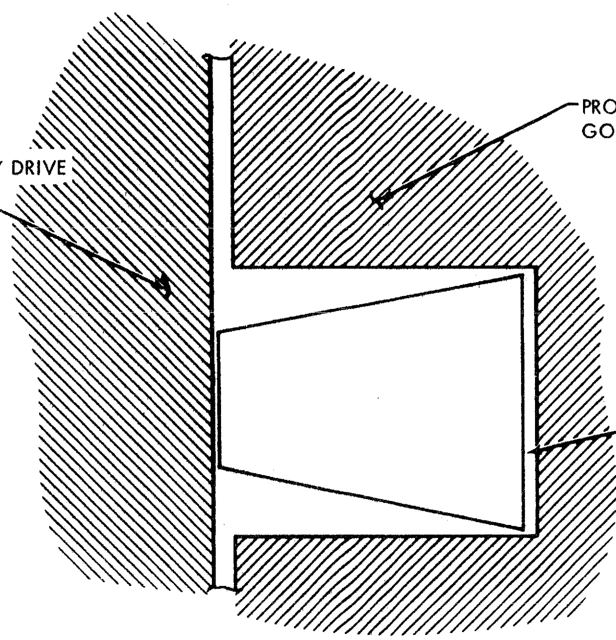
(4) Install propeller governor assembly in a straight line to avoid damage and secure with washers and nuts. Tighten retaining nuts to 100 inch-pounds torque.

(5) Connect wiring or plumbing as applicable.

(6) (Codes GA) Install lever length adjustment screw and nut on propeller governor assembly shaft in accordance with 76-10-01, MAINTENANCE PRACTICES.

(7) Connect controls linkage assembly. Refer to 76-10-01, MAINTENANCE PRACTICES.

(8) Perform propeller governor checks. Refer to 72-00-00, ADJUSTMENT/TEST.



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Position of Propeller Governor Gasket
Figure 205

2. Inspection/Check

A. Propeller Governor Assembly (See Figures 201 through 208)

(1) Inspect for security, evidence of oil leakage or obvious damage. Check propeller governor assembly arm for freedom of movement. Move propeller governor assembly arm against high speed stop and check that arm returns against low speed stop without assistance when released. Check high and low speed stops for security.

(2) Damaged arm or lever assemblies may be repaired in accordance with Approved Repairs.

3. Cleaning/Painting

A. Clean Parts

(1) Clean all standard metallic hardware. Refer to 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 1 or 2.

(2) Clean outside surface of propeller governor. Refer to 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 1.

4. Approved Repairs

A. Repair or Replace Damaged Arm or Lever Assembly (See Figures 206, 207, 208)

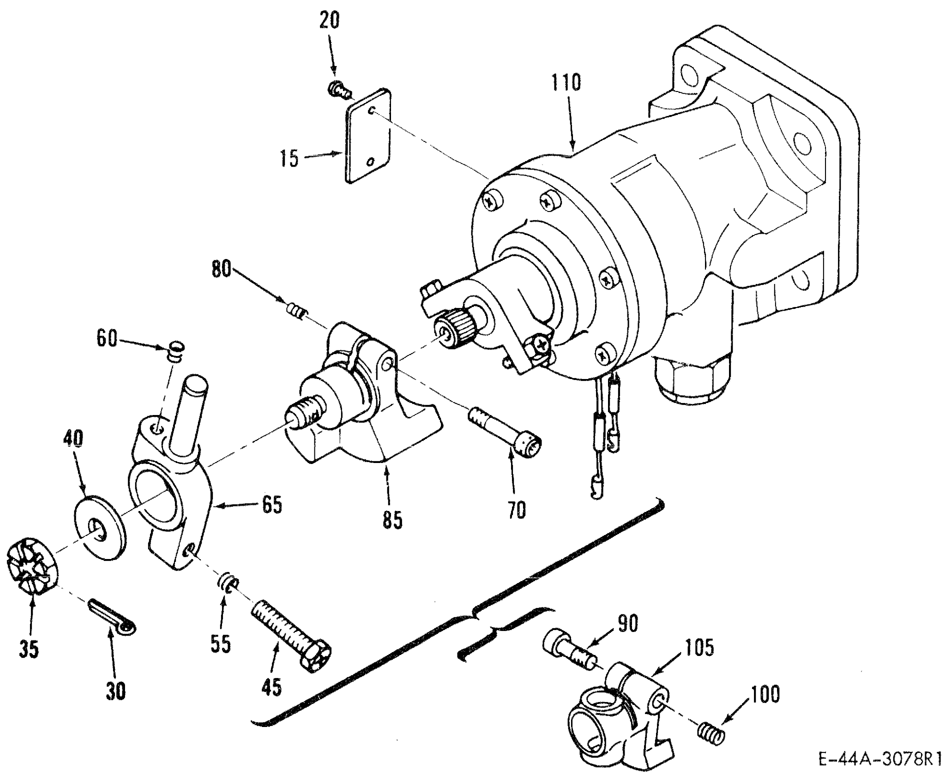
NOTE: Note position of arm or lever assembly prior to removal.

(1) Remove screws, washers and damaged arm or lever assembly.

(2) Install new insert in arm or lever assembly as required in accordance with good shop practices.

(3) Install arm or lever assembly on governor in position noted during removal.

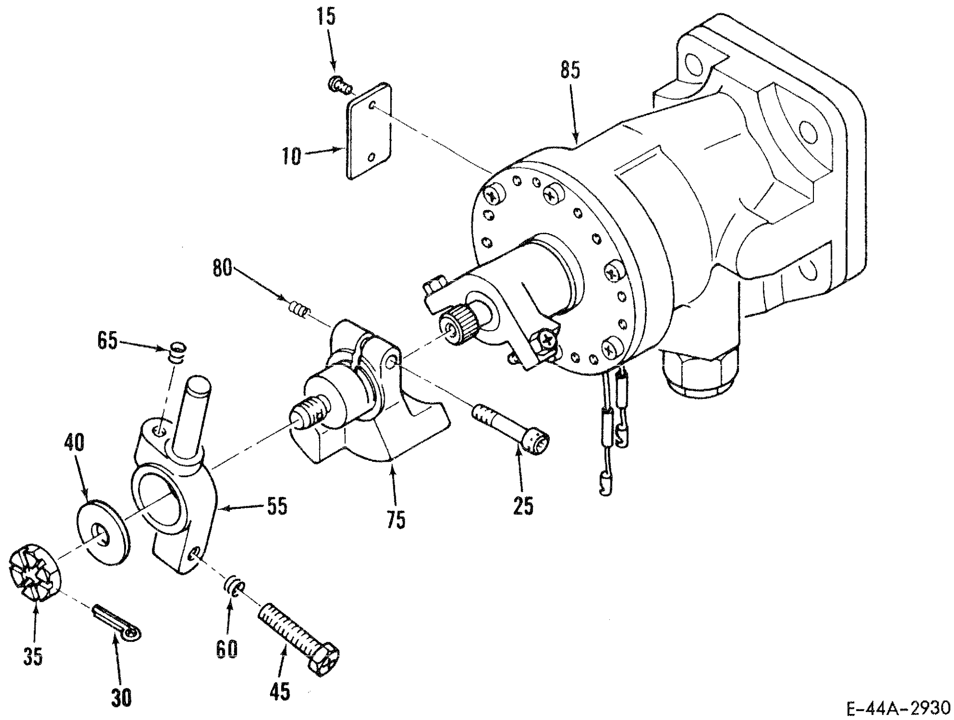
R



R 2. PROPELLER GOVERNOR (IPC FIG. 126)
3. IDENTIFICATION PLATE
4. SCREW

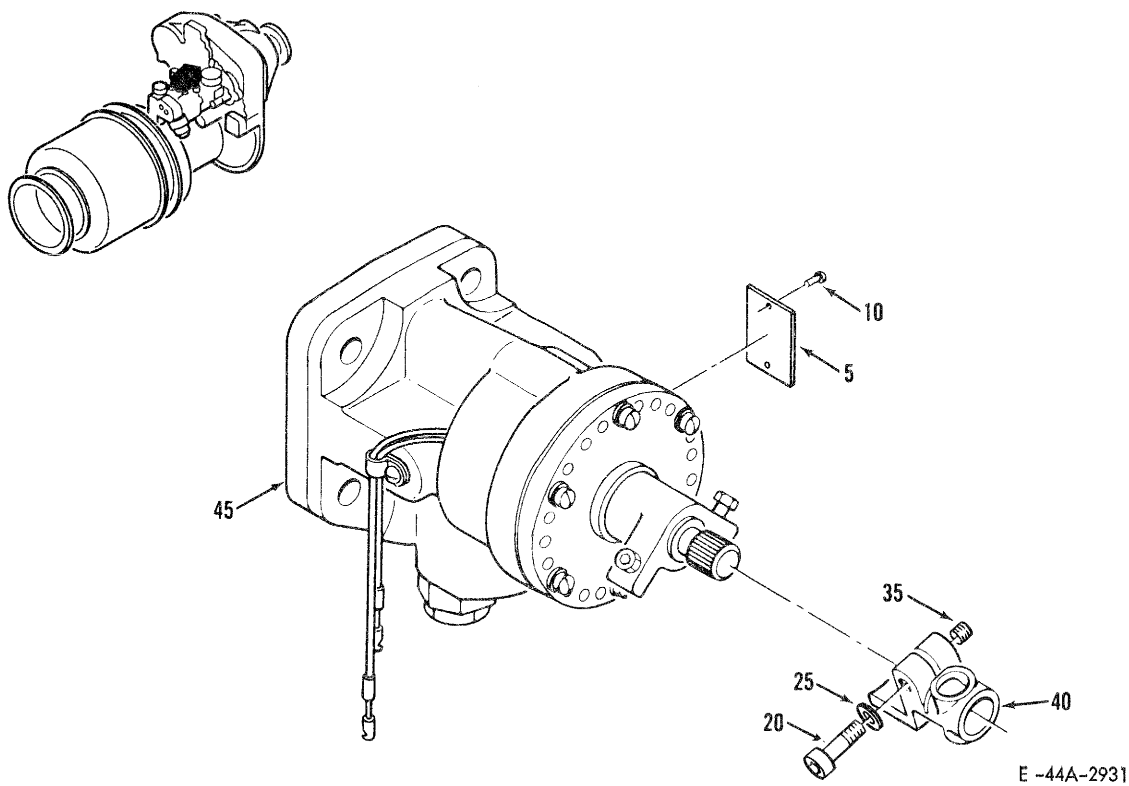
13. SCREW
15. INSERT
16. SERRATED ARM

R (Codes AA-AC, CA-CC, FA, KA, LA) Propeller Governor Assembly
R (Field Maintenance Breakdown)
Figure 206



R 10.	IDENTIFICATION PLATE (IPC FIG. 127)	55.	GOVERNOR OVERRIDE LEVER
15.	SCREW	60.	INSERT
25.	SCREW	65.	INSERT
30.	PIN	75.	OVERSPEED GOVERNOR ADJUSTMENT ARM
35.	NUT	80.	INSERT
40.	WASHER	85.	PROPELLER GOVERNOR
45.	SCREW		

R (Codes BA-BC, EA) Propeller Governor Assembly
R (Field Maintenance Breakdown)
Figure 207



R 5. IDENTIFICATION PLATE (IPC FIG. 128)
10. SCREW
20. SCREW
25. WASHER
35. INSERT
40. SERRATED ARM
45. PROPELLER GOVERNOR

R (Codes GA) Propeller Governor Assembly
R (Field Maintenance Breakdown)
Figure 208

NEGATIVE TORQUE SENSOR PRESSURE REGULATOR - MAINTENANCE PRACTICES

1. Removal/Installation

NOTE: Table 201 provides a list of all materials and compounds required for Removal/Installation.

Table 201. Materials and Compounds

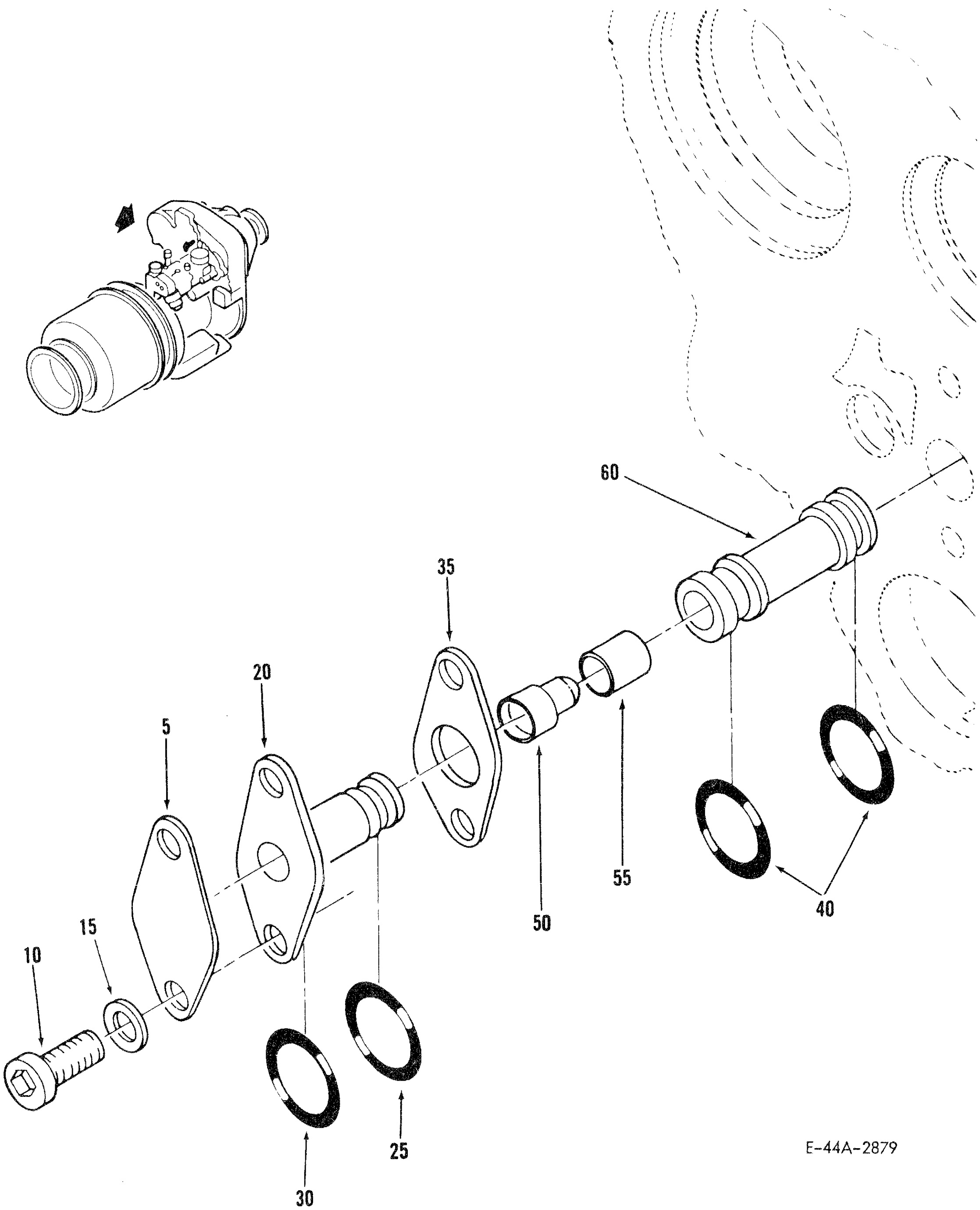
Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed item.	
Any approved engine oil	Commercially available
Alternate lubricant, Lubricant (OS-124)	Monsanto Company, 800 N Lindbergh Blvd, St Louis, MO 63166

A. Remove Negative Torque Sensor Pressure Regulator (See Figure 201)

(1) Remove screws, washers, cover, valve, and gasket. Remove and discard packings. Remove (using an 8-32 UNF threaded bolt) restrictor body, packings, screen, and restrictor as an assembly. Remove and discard packings.

NOTE: Do not remove restrictor from restrictor body unless damage is indicated by inspection.

(2) Screw an 8-32 UNF threaded bolt (two inches or longer) into screen. Pull screen from restrictor body. Remove bolt from screen.



R 5.	COVER (IPC FIG. 163)	25.	PACKING	50.	SCREEN
10.	SCREW	30.	PACKING	55.	RESTRICTOR
15.	WASHER	35.	GASKET	60.	RESTRICTOR BODY
20.	METERING VALVE ASSY	40.	PACKING		

R Negative Torque Sensor Pressure Regulator Installation
Figure 201

1. B. Install Negative Torque Sensor Pressure Regulator (See Figure 201)

NOTE: Refer to 70-00-00, STANDARD PRACTICES, for recommended general torque values. Add frictional drag (run-down) torque of self-locking devices to recommended values.

Lightly coat new packings with clean engine oil or lubricant (OS-124) prior to installation.

Install restrictor so arrow on body of restrictor points toward nose of engine after installation.

(1) Install oil filter screen and new packings on restrictor assembly. Screw an 8-32 UNF threaded bolt (two inches or longer) into screen and restrictor assembly and push into bore and seat. Remove bolt.

(2) Install new packings in valve assembly. Position gasket and install valve assembly in bore. Install cover and secure with screws and washers. Tighten screws to 15 inch-pounds torque.

2. Inspection/Check

A. Inspect Negative Torque Sensor Pressure Regulator (See Figure 201)

(1) Inspect negative torque sensor pressure regulator for leaks or obvious damage.

(2) Replace part that does not meet Inspection/Check requirements.

3. Cleaning/Painting

A. Clean Component Parts

(1) Refer to 72-00-00, CLEANING/PAINTING, for general cleaning instructions and description of cleaning methods specified in Table 202.

NOTE: Reference shall be made to Table 202 for recommended cleaning method.

Table 202. Cleaning Methods

Figure No.	Item No.	Nomenclature	Cleaning Methods 1	2	3	4	5	6	7	8	9	10	11	12
All standard metallic hardware			X	X										
201	5	Cover					X	X						
	20	Metering Valve Assembly												X
	50	Screen												X
	55	Restrictor					X	X						
	60	Body					X	X						

R

POSITIVE TORQUE SENSOR PRESSURE REGULATOR - MAINTENANCE PRACTICES

1. Removal/Installation

R NOTE: Table 201 provides a list of all materials and compounds
R required for Removal/Installation.

R Table 201. Materials and Compounds

R Material or Compound	Manufacturer
R NOTE: Equivalent substitutes may be used for listed item.	
R Any approved engine oil	Commercially available
R Alternate lubricant, R Lubricant (OS-124)	Monsanto Company, 800 N Lindbergh Blvd, St Louis, MO 63166

A. Remove Positive Torque Sensor Pressure Regulator (See Figure 201)

(1) Remove bolts and washers securing fluid pressure valve. Remove cover, valve, filter and gasket.

(2) Remove packings from fluid pressure valve.

B. Install Positive Torque Sensor Pressure Regulator (See Figure 201)

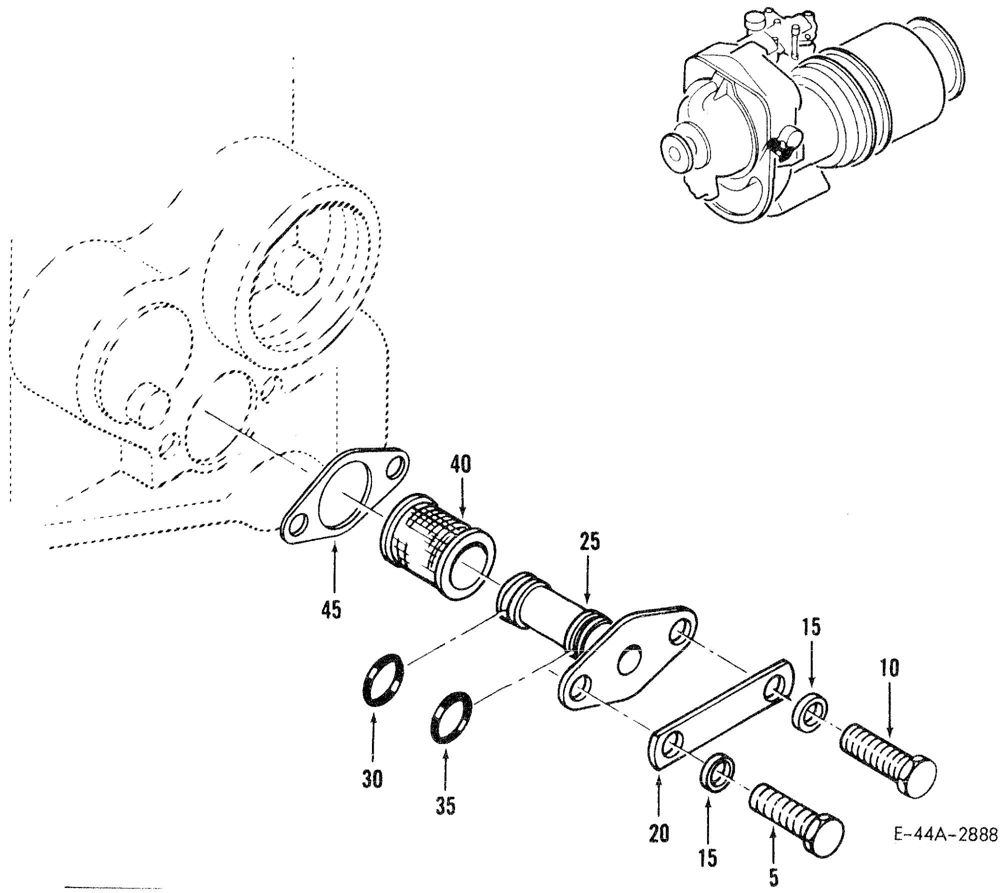
CAUTION: INSTALL FILTER ON FLUID PRESSURE VALVE ASSEMBLY.

R NOTE: Refer to 70-00-00, STANDARD PRACTICES, for recom-
R mended general torque values. Add frictional drag
R (run-down) torque of self-locking devices to
R recommended values.

R Lightly coat new packings with clean engine oil or
R lubricant (OS-124) prior to installation.

(1) Install new packings and filter on fluid pressure valve.

(2) Install gasket on fluid pressure valve, then install on engine and secure with cover, bolts and washers. Tighten retaining bolts to 40 inch-pounds torque.



R 5. BOLT (IPC FIG. 162)
10. BOLT
15. WASHER
20. COVER
25. FLUID PRESSURE VALVE
30. PACKING
35. PACKING
40. FILTER
45. GASKET

Positive Torque Sensor Pressure Regulator Installation
Figure 201

2. Inspection/Check

A. Inspect Positive Torque Sensor Pressure Regulator (See Figure 201)

(1) Inspect fluid pressure valve assembly for leaks or obvious damage.

(2) Replace part that does not meet Inspection/Check requirements.

3. Cleaning/Painting

A. Clean Component Parts

(1) Clean all standard metallic hardware. Refer to 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Methods No. 1 or 2.

(2) Clean fluid pressure valve and filter assembly. Refer to 72-00-00, CLEANING/PAINTING, Cleaning Method No. 12.

ORIFICED HOUSING AND ORIFICED BODY - MAINTENANCE PRACTICES

1. Removal/Installation

R NOTE: Table 201 provides a list of all materials and compounds
R required for Removal/Installation.

R Table 201. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed item.	
Any approved engine oil	Commercially available
Alternate lubricant, Lubricant (OS-124)	Monstanto Company, 800 N Lindbergh Blvd, St Louis, MO 63166

A. Remove Orificed Housing or Orificed Body (See Figure 201)

(1) Remove bolt and washer securing orificed housing or orificed body and remove unit.

(2) Remove packings.

(3) Remove restrictors only if damaged and replacement is required.

B. Install Orificed Housing or Orificed Body (See Figure 201)

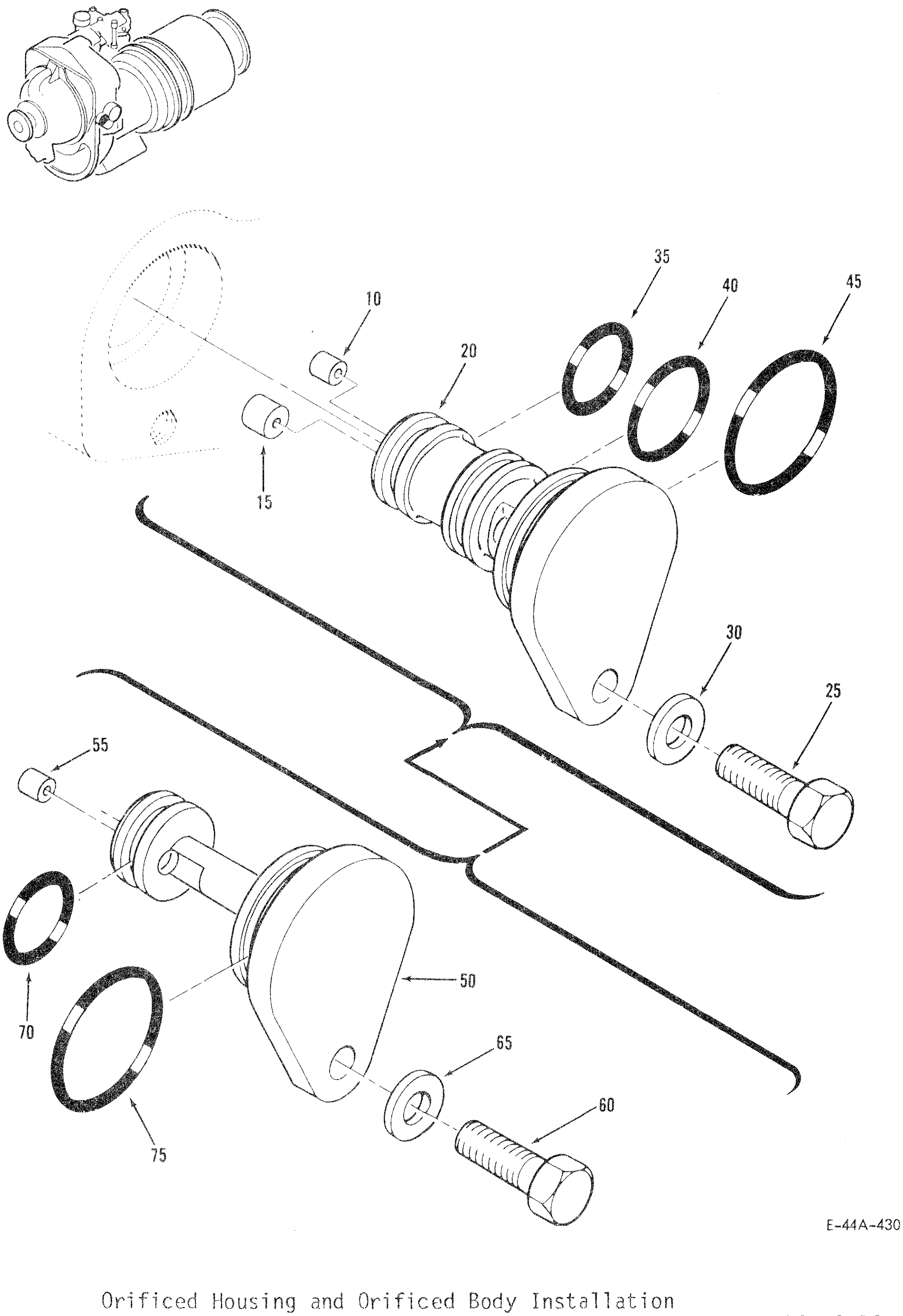
R NOTE: Refer to 70-00-00, STANDARD PRACTICES, for recommended
R general torque values. Add frictional drag (run-down)
R torque of self-locking devices to recommended values.

R Lightly coat new packings with clean engine oil or lu-
R bricant (OS-124) prior to installation.

Ensure that restrictors are installed.

(1) Install new packings on orificed housing or orificed body.

(2) Position orificed housing or orificed body on engine and secure with washer and bolt. Tighten retaining bolt to 70 inch-pounds torque.



R

Orificed Housing and Orificed Body Installation
Figure 201

2. Inspection/Check

A. Inspect Orificed Housing or Orificed Body (See Figure 201)

(1) Inspect restrictor holes for proper size: Part No. 114508-32 shall be 0.0235 to 0.0245 inch. Part No. 114355-29 shall be 0.0300 to 0.0310 inch.

(2) Inspect orificed housing or orificed body for obvious damage.

(3) Replace part that does not meet Inspection/Check requirements.

3. Cleaning/Painting

A. Clean Component Parts

(1) Clean all standard metallic hardware. Refer to 72-00-00, GENERAL - CLEANING/PAINTING Cleaning Methods No. 1 or 2.

(2) Clean orifice housing or orificed body. Refer to 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Methods No. 5 or 6.

KEY TO FIGURE 201

R 10. RESTRICTOR (IPC FIG. 164)
R 15. RESTRICTOR
R 20. ORIFICED HOUSING (CODES CA-CC)
R 25. BOLT
R 30. WASHER
R 35. PACKING
R 40. PACKING
R

45. PACKING
50. ORIFICED BODY (CODES AA-BC, EA-KA)
55. RESTRICTOR
60. BOLT
65. WASHER
70. PACKING
75. PACKING

FEATHERING VALVE ASSEMBLY - MAINTENANCE PRACTICES

1. Removal/Installation

R NOTE: Table 201 provides a list of all materials and compounds
R required for Removal/Installation.

R Table 201. Materials and Compounds

Material or Compound	Manufacturer
R NOTE: Equivalent substitutes may be used for listed item.	
R Any approved engine oil	Commercially available
R Alternate lubricant, R Lubricant (OS-124)	Monsanto Company, 800 N Lindbergh Blvd. St Louis, MO 63166

A. Remove Feathering Valve Assembly (See Figure 201)

(1) Remove attaching screws and washers, then remove feathering valve assembly. Remove packings.

(2) Remove oil transfer tube. Remove packings.

B. Install Feathering Valve Assembly (See Figure 201)

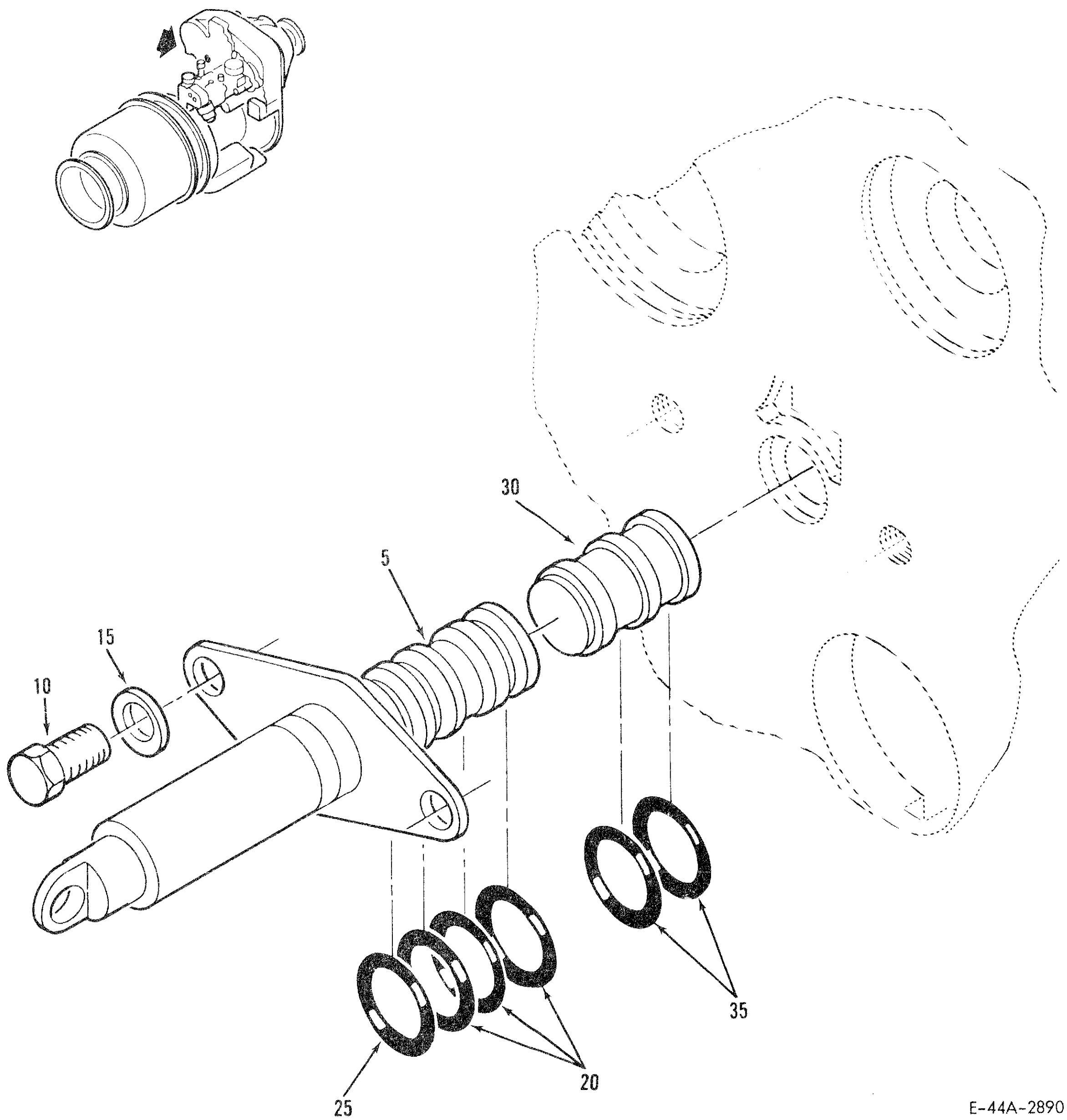
R NOTE: Refer to 70-00-00, STANDARD PRACTICES, for recom-
R mended general torque values. Add frictional drag
R (run-down) torque of self-locking devices to
R recommended values.

R Lightly coat new packings with clean engine oil or
R lubricant (OS-124) prior to installation.

Install intermediate gearbox (diaphragm) assembly prior to proceeding.

(1) Install new packings on oil transfer tube and install in engine.

(2) Install new packings on feathering valve assembly, then install on engine and secure with bolts and washers. Tighten bolts to 40 inch-pounds torque.



R 5. FEATHERING VALVE ASSY (IPC FIG. 129)
10. BOLT
15. WASHER
20. PACKINGS
25. PACKING
30. OIL TRANSFER TUBE
35. PACKINGS

Feathering Valve Assembly
Figure 201

2. Inspection/Check

   A. Inspect Feathering Valve Assembly (See Figure 201)

      (1) Inspect feathering valve body for obvious damage. Ensure feathering valve assembly piston does not bind or stick.

      (2) Replace part that does not meet Inspection/Check requirements.

3. Cleaning/Painting

   A. Clean Component Parts

      (1) Clean all standard metallic hardware. Refer to 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Methods No. 1 or 2.

      (2) Clean feathering valve assembly. Refer to 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Methods No. 5 or 6.

SHAFT OIL SEALS - MAINTENANCE PRACTICES

1. Removal/Installation

NOTE: Table 201 provides a list of special tools, fixtures and equipment required for Removal/Installation. Table 202 provides a list of materials and compounds required for Removal/Installation.

Table 201. Special Tools, Fixtures and Equipment

Item No.	Nomenclature	Use	Source/ Part No.
NOTE: Equivalent substitutes may be used for listed items.			
1.	Seal Pilot	Used to guide and protect seal during installation.	284173-2-1
2.	Seal Pilot	Used with 284174-4-1 seal pressing driver, to install seal into plate.	284173-3-1
3.	Seal Pressing Driver	Used to press seal in carrier.	284174-1-1
4.	Seal Pressing Driver	Used to press seal in carrier.	284174-3-1
5.	Seal Puller	Used to install seal into tachometer drive gearshaft port.	285155-1-1
6.	Seal Puller	Used to remove seal from tachometer drive gearshaft port.	285156-1-1

Table 202. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed item.	
Any approved engine oil	Commercially available
Grease (MIL-G-7421)	Commercially available

Table 202. Materials and Compounds (Cont)

Material or Compound	Manufacturer
Lubricant (OS-124)	Monsanto Company, 800 N Lindbergh Blvd, St. Louis, MO 63166
Lubricating compound (Liqui-Moly, Grade NV)	Lockrey Co, Lubricants Div, Cedar Shores, Southampton, NY 11968

1. A. Remove Shaft Oil Seals (See Figure 201)

(1) Remove accessory shaft seal.

(2) Remove starter shaft seal.

(3) Remove tachometer drive shaft seal using 285156-1-1 puller.

B. Install Shaft Oil Seals (See Figure 201)

R NOTE: Refer to 70-00-00, STANDARD PRACTICES, for recom-
R mended general torque values. Add frictional drag
R (run-down) torque of self-locking devices to
R recommended values.

Lightly coat new packings with clean engine oil or lubricant (OS-124) prior to installation.

Apply lubricating compound (Liqui-Moly, Grade NV) to threads of bolts, studs, screws or nuts unless otherwise specified.

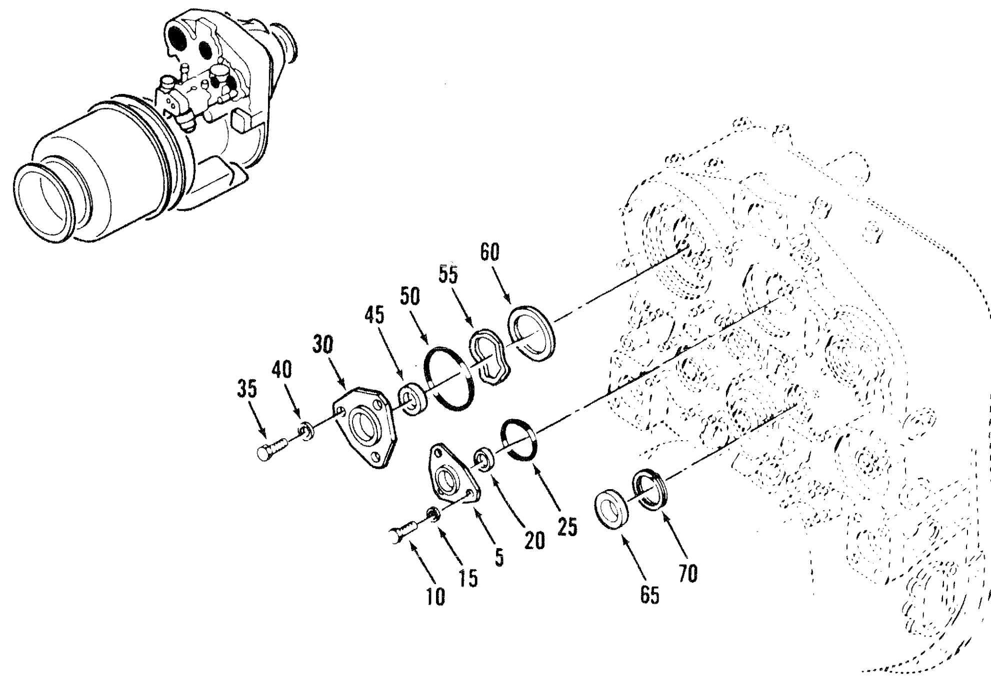
(1) Install accessory shaft seal as follows.

(a) Press accessory shaft seal into carrier using 284174-3-1 driver.

(b) Install new packing in carrier.

(c) Pack cavity and coat lip of seal with grease (MIL-G-7421), then install seal using 284173-2-1 pilot. (See figure 202.)

(d) Secure carrier. Tighten bolts to 25 inch-pounds torque.



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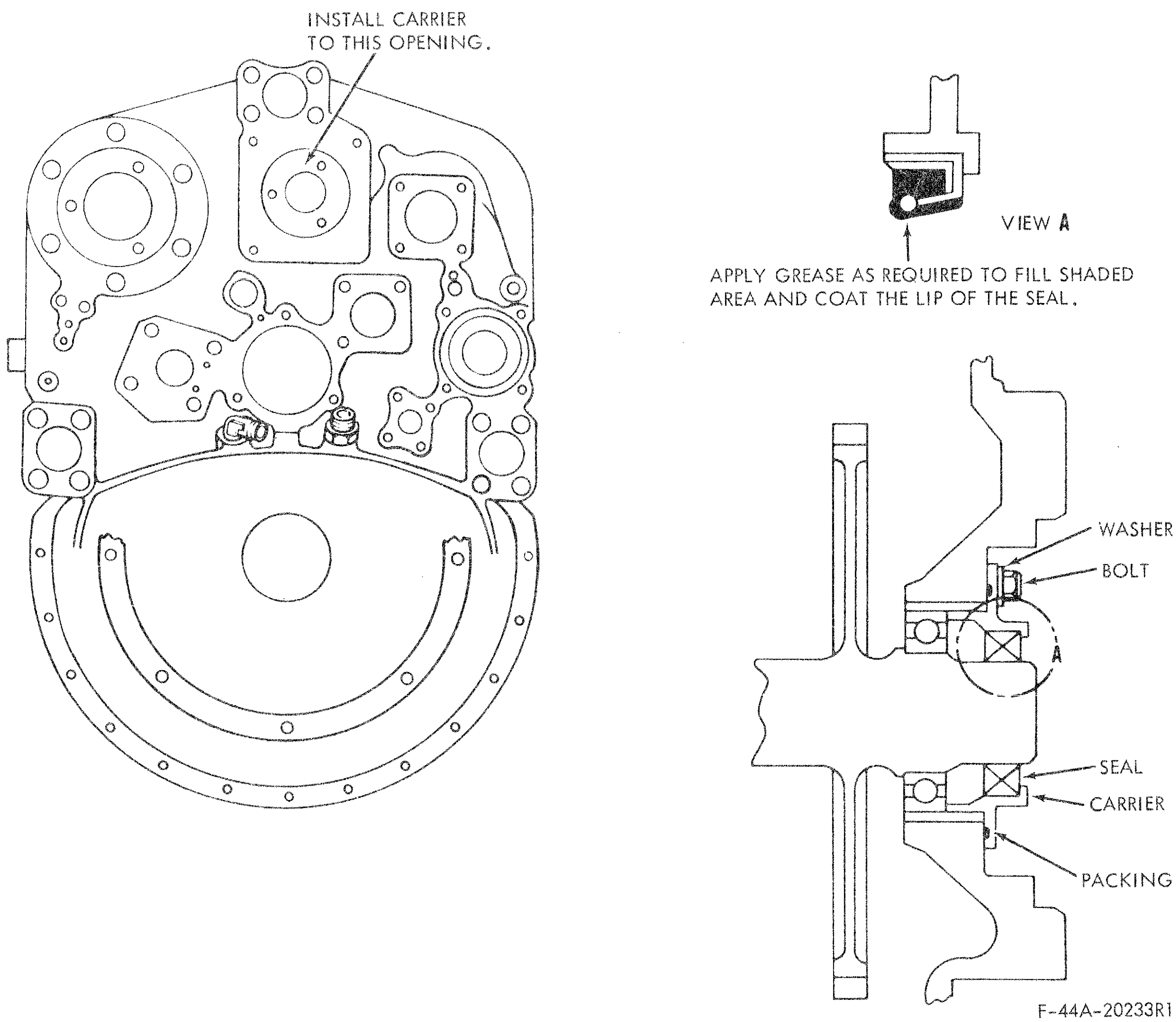
R 5. CARRIER (IPC FIG. 150)
10. BOLT
15. WASHER
20. SEAL (ACCESSORY SHAFT)
25. PACKING
30. CARRIER
35. BOLT
40. WASHER
45. SEAL (STARTER SHAFT)
50. PACKING
55. SPRING WASHER
60. WASHER
65. SEAL (TACHOMETER SHAFT)
70. RETAINING RING

R Accessory Drive Shaft Oil Seals Installation
Figure 201



Assembly of Accessory Shaft Seal
Figure 202

1. B. (2) Install starter shaft seal as follows.

(a) Install seal into carrier using 284174-1-1 driver.

(b) Measure Dimension A and Dimension B. (See figure 203.)

NOTE: Use same thickness of washers noted at disassembly if old carrier is reinstalled.

(c) Subtract Dimension B from Dimension A and subtract 0.060 inch from result to obtain required thickness of washers.

(d) Install washers determined in step (c). Install spring washer.

(e) Install new packing on carrier.

(f) Coat lip of seal and mating surface of shaft with grease (MIL-G-7421). Install assembled seal and carrier using 284173-3-1 pilot.

(g) Secure carrier. Tighten bolts to 25 inch-pounds torque.

(3) Install tachometer drive shaft seal.

(a) Install retaining ring.

(b) Install seal using 284173-2-1 pilot and 285155-1-1 puller.

2. Inspection/Check

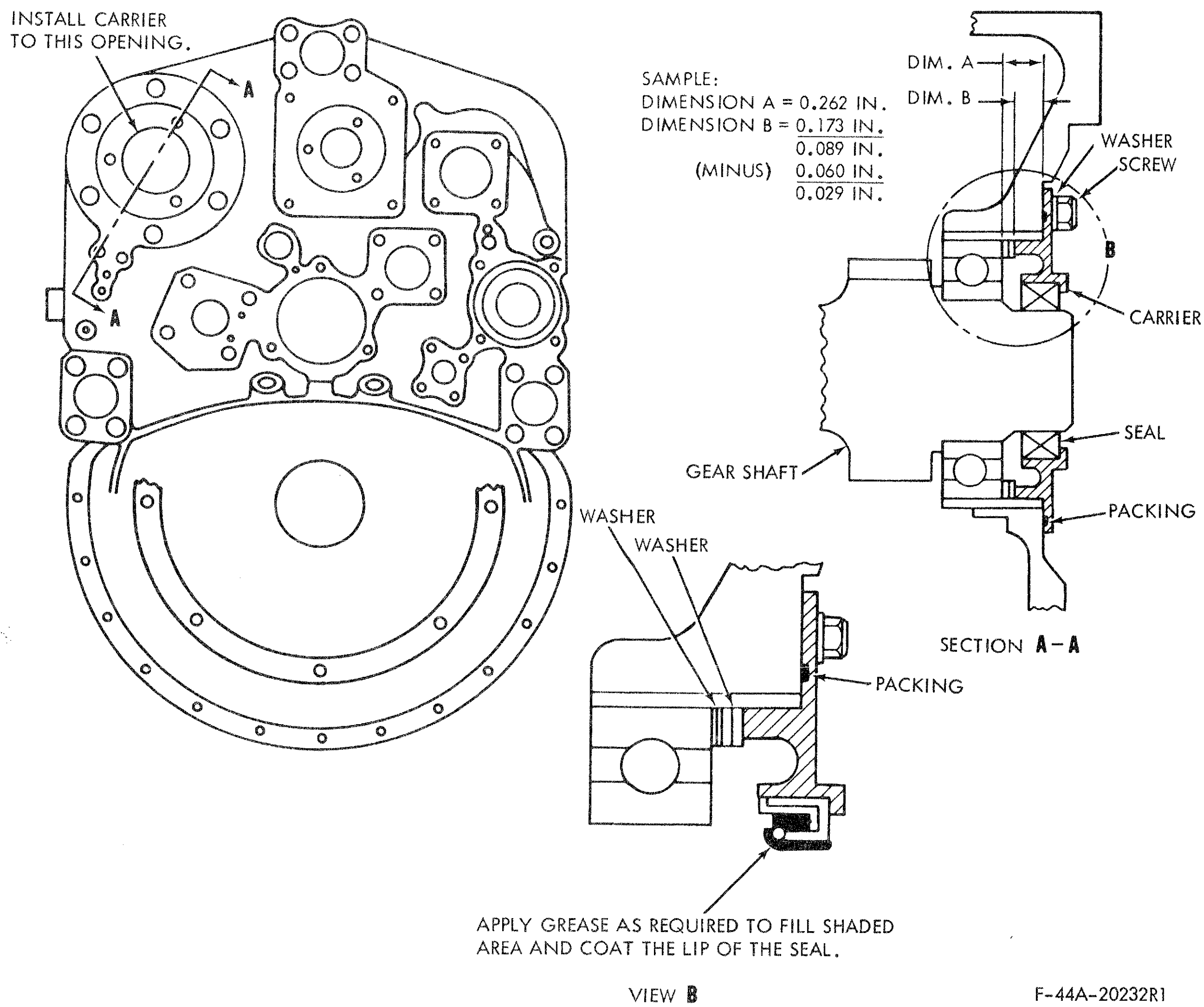
A. Inspect Shaft Accessory Drive Oil Seals (See Figure 201)

(1) Inspect accessory shaft seal carrier for severe scoring, grooving or damage in seal bore.

(2) Inspect starter shaft seal carrier for severe scoring, grooving or damage in seal bore.

(3) Inspect for oil leakage with parts installed. Refer to 72-00-00, TROUBLE SHOOTING.

(4) Replace part that does not meet Inspection/Check requirements.



Installation of Starter Shaft Seal
Figure 203

R

3. Cleaning/Painting

A. Clean Component Parts

(1) Clean all standard metallic hardware. Refer to 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Methods No. 1 or 2.

(2) Clean carrier. Refer to 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Methods No. 5 or 6.

(3) Clean spring washer. Refer to 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Methods No. 1 or 2.

(4) Clean retaining ring. Refer to 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Methods No. 1 or 2.

OUTPUT GEARBOX HOUSING (NOSE CONE) - MAINTENANCE PRACTICES

1. Removal/Installation

NOTE Table 201 provides a list of special tools, fixtures and equipment required for Removal/Installation. Table 202 provides a list of materials and compounds required for Removal/Installation.

Table 201. Special Tools, Fixtures and Equipment

Item No.	Nomenclature	Use	Source/ Part No.
NOTE: Equivalent substitutes may be used for listed items.			
1.	Shaft Holder	Used to hold propeller shaft from turning when loosening retaining nut and to support shaft when removing bearing.	284172-1-1
2.	Seal Pressing Driver	Used to press seal in carrier.	284174-2-1 Replaced by 293689-1
3.	Bearing Driver	Used to press bearing on propeller shaft.	284191-1-1
4.	Bearing Retainer	Used to bolt on rear of accessory drive housing to retain propeller shaft roller bearings when propeller shaft is removed.	284197-1-1
5.	Shaft Installing Sleeve	Used to pilot propeller shaft through roller bearing and to protect ball bearing inner race.	284308-1-1
6.	Bearing and Bushing Driver	Used to install bearing race on propeller shaft	284477-1-1
7.	Bearing Pressing Plate	Used to remove bearing races from propeller shaft.	284483-1-1
8.	Torque Wrench Adapter	Used to loosen propeller shaft locknut on propeller shaft.	284677-1-1

Table 201. Special Tools, Fixtures and Equipment (Cont)

	Item No.	Nomenclature	Use	Source/ Part No.
		NOTE: Equivalent substitutes may be used for listed items.		
	9.	Spring Loading Gage	Used to determine quantity of shims required to load propeller shaft bearing spring washer.	284685-1-1
	10.	Bearing Removing Holder	Used to remove propeller shaft from bearing.	285196-1-1
	11.	Hub Gear Puller	Used to remove ring gear and internal planetary gear.	285199-1-1
	12.	Seal Removal Driver and Holder	Used to press seal assembly from propeller shaft seal retainer.	285968-1-1
	13.	Nose Cone Bolt Holder	Used to hold propeller shaft seal retainer bolts from turning in nose cone when tightening or loosening retaining nuts.	285969-1-1
	14.	Shaft and Gear Gage	Used as a point of measurement to obtain bottomed out dimension during assembly of output gearbox housing.	285972-1-1
R R R R	15.	Gage	Used to provide reference measurements of prop shaft and components to ensure proper installation.	285973-1-1
	16.	Torque Wrench Adapter	Used to loosen bearing retaining nut on end of propeller shaft.	291898-1-1
R R R	17.	Seal Holder and Driver	Used to install seal assembly into propeller shaft seal retainer.	293689-1 Replaced by 284174-2-1

Table 202. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed item.	
Any approved engine oil	Commercially available
Grease (DC-11)	Dow Corning Corp, S Saginaw Rd, Midland, MI 48640
Grease (MIL-G-7421)	Commercially available
Lubricant (OS-124)	Monsanto Company, 800 N Lindbergh Blvd, St. Louis, MO 63166
Lubricating compound (Liqui-Moly, Grade NV)	Lockrey Co, Lubricants Div, Cedar Shores, Southampton, NY 11968
1,1,1-Trichloroethane (MIL-T-81533	Commercially available
Violet master marker (Grade 127-1/2)	Pannier Corp, 207 Sandusky St, Pittsburgh, PA 15212

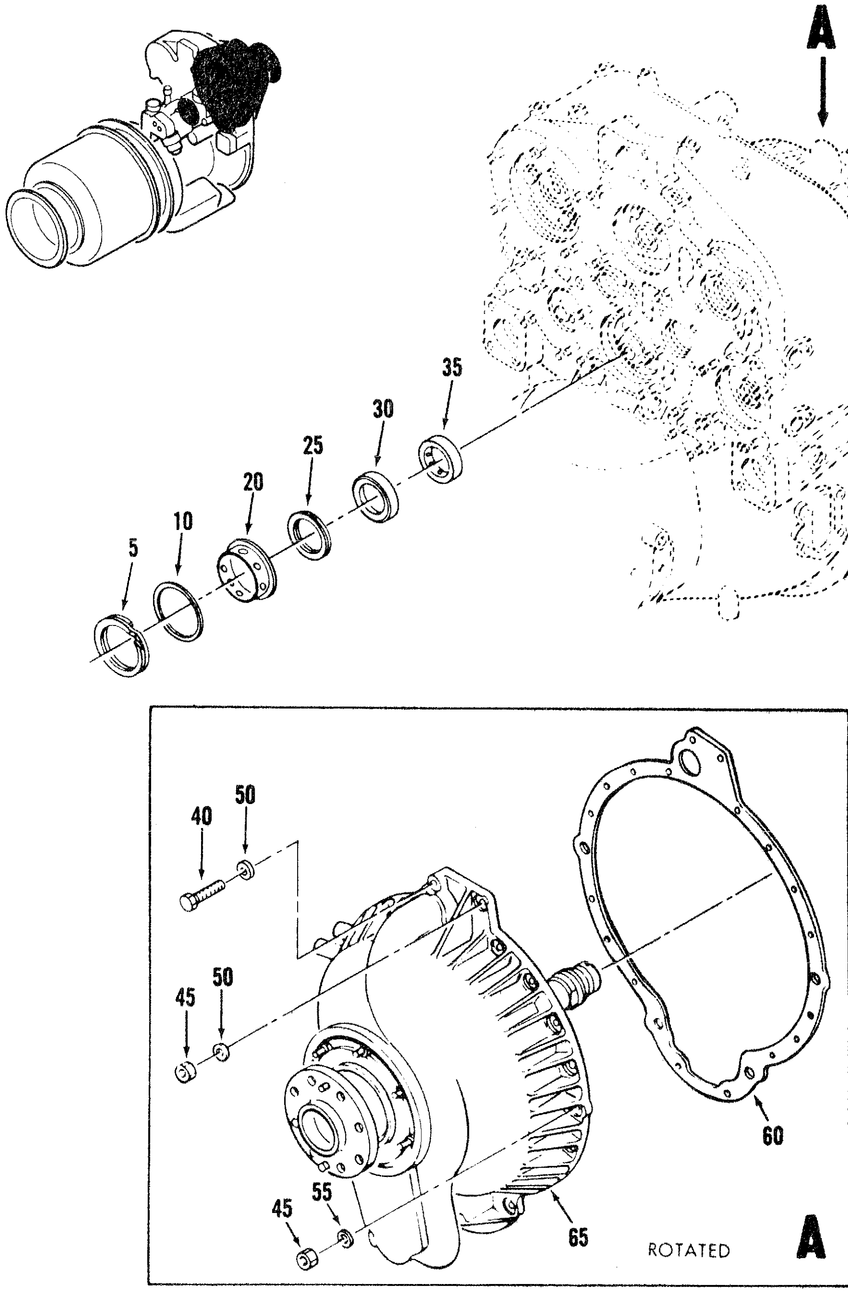
NOTE: To remove output gearbox housing to facilitate other maintenance accomplish paragraph A. only. Refer to 72-10-10, MAINTENANCE PRACTICES, for further engine disassembly.

1. A. Remove Nose Cone and Annular Ball Bearing (See Figure 201)

R CAUTION: (CODES AA-AC, CA-CC, FA, KA, LA) IF ENGINE IS IN HORIZONTAL POSITION DURING REMOVAL OF OUTPUT GEARBOX HOUSING ASSEMBLY, USE CARE TO PREVENT MATCHED PLANET GEAR AND BEARING SET ASSEMBLY FROM DROPPING OUT OF ENGINE.

(1) Carefully remove beta tube from propeller shaft. Refer to 72-10-01, MAINTENANCE PRACTICES.

(2) Remove propeller pitch control. Refer to 72-10-02, MAINTENANCE PRACTICES.



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5. RETAINING RING
R (IPC FIG. 130)
10. SHIM
20. SPRING RETAINER
25. WASHER
30. BEARING RETAINER
35. BEARING
40. BOLT
45. NUT
50. WASHER
55. WASHER
60. GASKET
65. OUTPUT GEARBOX HOUSING AND PROPELLER SHAFT

R Nose Cone and Annular Ball Bearing Installation
Figure 201

R 1. A. (3) (Codes BA-BC, EA-LA) Remove start fuel regulator. Refer to 73-10-
R 03, MAINTENANCE PRACTICES.

(4) Remove retaining ring, shims, spring retainer, washer set, bearing retainer and bearing.

(5) Remove nuts and washers securing output gearbox housing assembly, then carefully separate assembled propeller shaft and output gearbox housing assembly from input housing assembly. Remove gasket.

(6) Secure 284197-1-1 retainer at rear of assembled input housing assembly to retain rollers in bearing outer race.

B. Disassemble Nose Cone and Annular Bearing

R (1) (Codes AA-AC, CA-CC, FA, KA, LA) Remove nose cone shaft couplings, oil jet and bearings (inner race) as follows. (See figure 202.)

(a) Install 284172-1-1 holder on forward end of propeller shaft to keep shaft from rotating. Remove ring and sleeve, then remove nut using 284677-1-1 adapter and remove retainer.

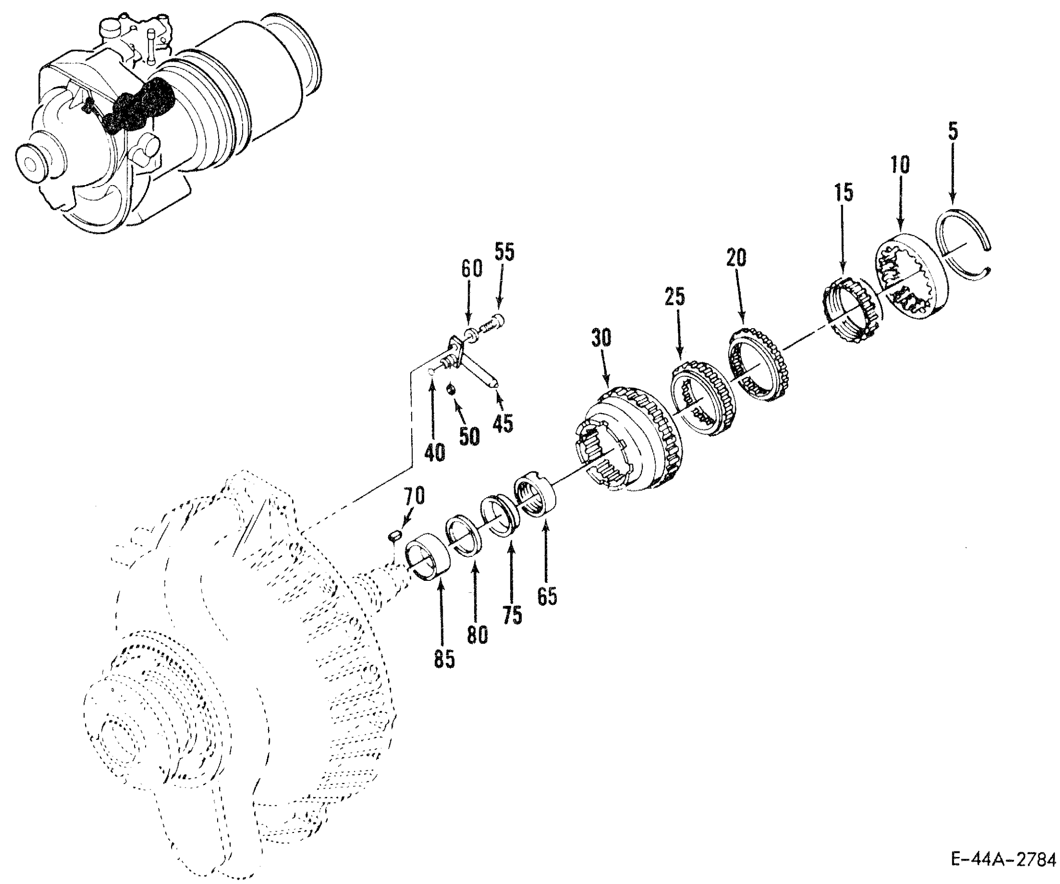
(b) Remove coupling and propeller shaft coupling from propeller shaft.

(c) Remove bolt and washer, then remove oil jet assembly from output housing assembly.

(d) Remove nut from propeller shaft using 291898-1-1 adapter, then remove insert.

CAUTION BEARING INNER AND OUTER RACES ARE MATCHED PARTS. WHEN EITHER RACE MUST BE REPLACED, REPLACE COMPLETE BEARING AS A UNIT.

(e) Install 284483-1-1 plate around propeller shaft behind bearing inner race. Press assembled output housing and propeller shaft out of spacer and bearing inner race. Remove propeller shaft from 284172-1-1 holder.



R 5. RETAINING RING (IPC FIG. 131)
10. SLEEVE
15. NUT
20. RETAINER
25. COUPLING
30. COUPLING
40. STRAINER ELEMENT
45. OIL JET
50. PACKING
55. BOLT
60. WASHER
65. NUT (ROUND)
70. INSERT
75. BEARING (INNER RACE)
80. SPACER
85. BEARING (JOURNAL INNER RACE)

R (Codes AA-AC, CA-CC, FA, KA, LA) Nose Cone Shaft Couplings, Oil Jet and Bearings (Inner Race) Installation
Figure 202

R 1. B. (2) (Codes BA-BC, EA, G, HA) Remove nose cone internal planetary gear and ring gear hub oil jet and bearings as follows. (See figure 203.)

NOTE: Retainer (20, figure 203) is an integral com-
R ponent of ring gear hub (45) when Ring Gear
R Hub Part No. 893756-1 is used.

(a) Install 284172-1-1 holder on forward end of propeller shaft to keep shaft from rotating. Remove ring and sleeve, then remove nut using 284677-1-1 adapter and remove retainer. Use 285199-1-1 puller and slide gear and hub from propeller shaft.

(b) Remove nuts securing plate assemblies and separate plates, plate assemblies, and gear from hub.

(c) Remove bolt and washer, then remove oil jet assembly from output housing assembly.

(d) Remove nut from propeller shaft using 291898-1-1 adapter, then remove insert.

CAUTION: BEARING INNER AND OUTER RACES ARE MATCHED PARTS. WHEN EITHER RACE MUST BE REPLACED, REPLACE COMPLETE BEARING AS A UNIT.

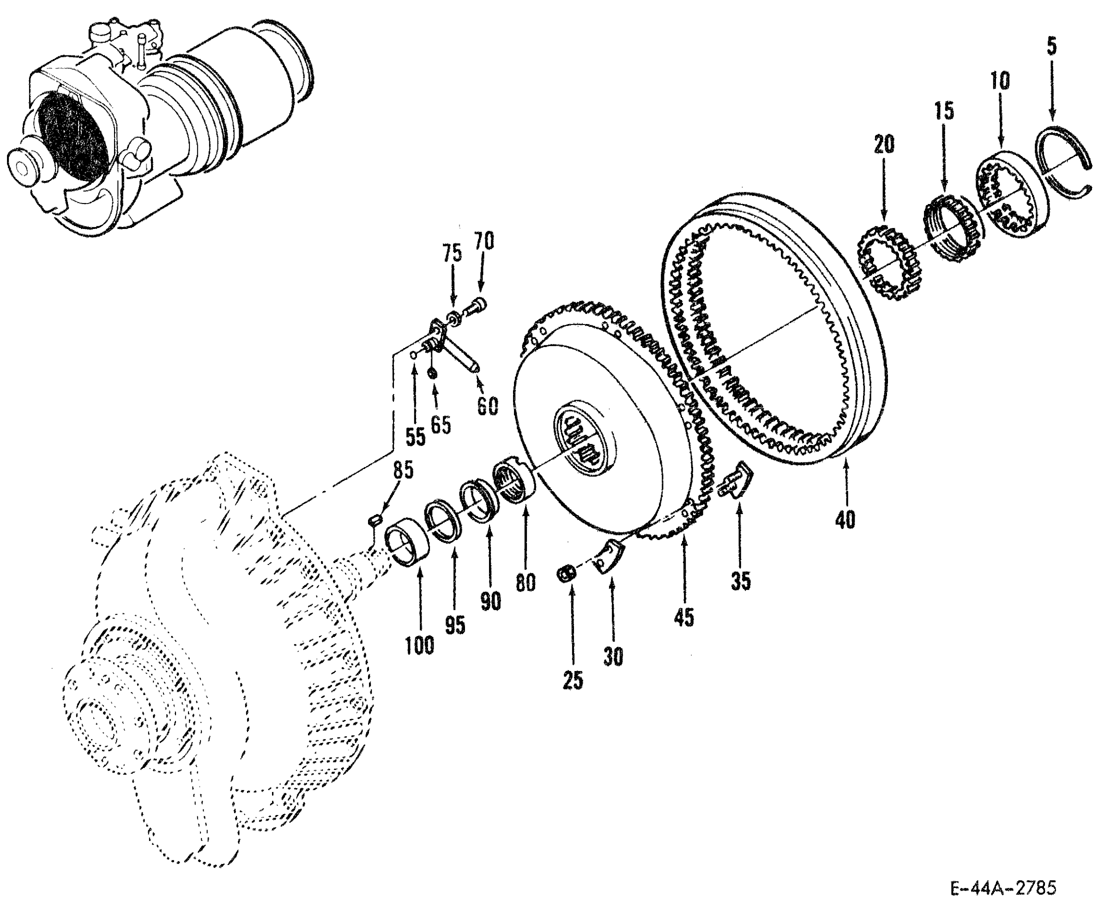
(e) Install 284483-1-1 plate around propeller shaft behind bearing inner race. Press assembled output housing and propeller shaft out of spacer and bearing inner race. Remove propeller shaft from 284172-1-1 holder.

(3) Remove propeller shaft assembly as follows. (See figure 204.)

(a) Place assembled output housing assembly on 285969-1-1 holder. Remove nuts, bolts, and packings securing bearing. Position seal assembly and retainer down against flange end of shaft.

NOTE: Make certain that top raised side of ring (part of 285196-1-1 holder) rests against seal rotor.

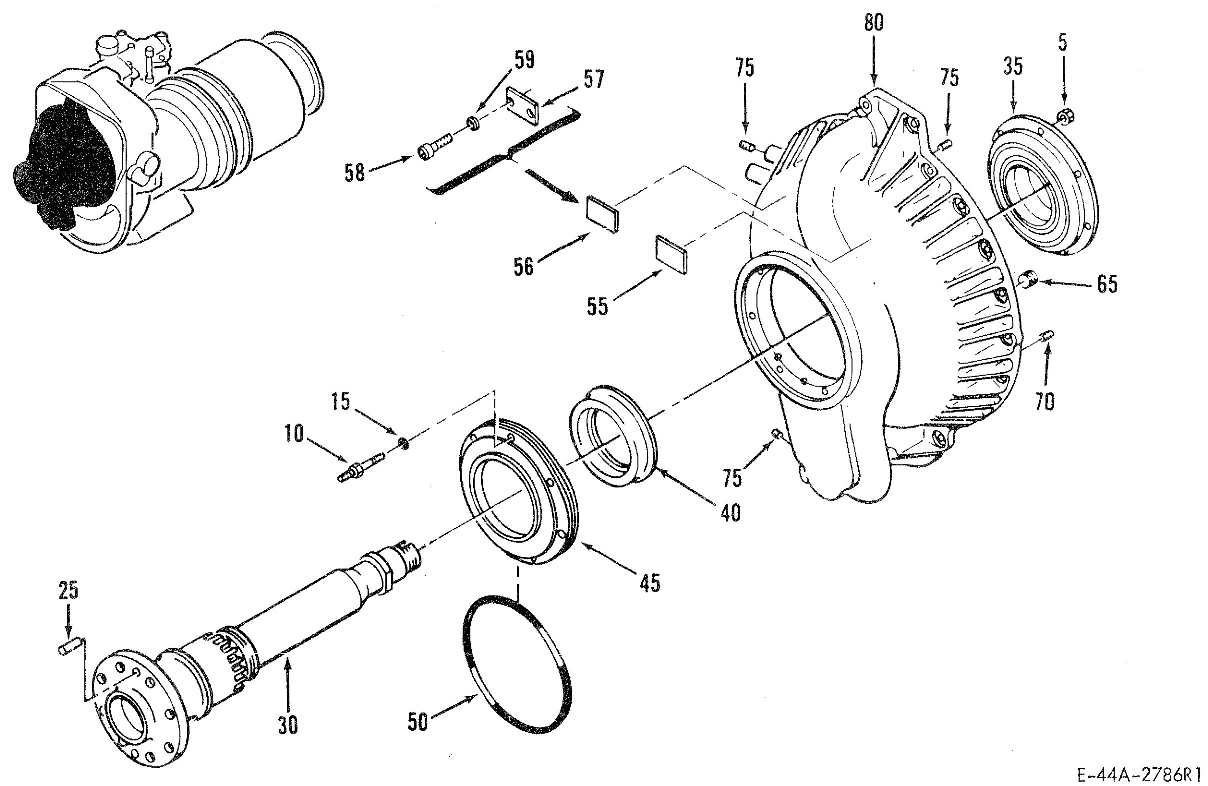
(b) Place forward end of shaft in cylinder portion of 285196-1-1 holder and position split ring portion of holder between stator and rotor portions of seal assembly.



R 5. RETAINING RING (IPC FIG. 132)
10. SLEEVE
15. NUT
20. RETAINER
25. NUT
30. PLATE
35. PLATE ASSY
40. PLANETARY GEAR
45. RING GEAR HUB
55. STRAINER ELEMENT
60. OIL JET
65. PACKING
70. BOLT
75. WASHER
80. NUT (ROUND)
85. INSERT
90. BEARING (INNER RACE)
95. SPACER
100. BEARING (JOURNAL INNER RACE)

R (Codes BA-BC, EA, GA, HA) Nose Cone Internal Planetary Gear
Ring Gear Hub, Oil Jet and Bearings Installation
Figure 203

R



R 5. NUT (IPC FIG. 133)
R 10. BOLT
R 15. PACKING
R 25. PIN
30. PROPELLER SHAFT
35. BEARING
40. SEAL ASSY
45. SEAL RETAINER
50. PACKING
55. LABEL
56. IDENTIFICATION PLATE
57. IDENTIFICATION PLATE
58. SCREW
59. WASHER
65. PLUG
70. INSERT
75. INSERT
80. OUTPUT GEARBOX HOUSING

Output Gearbox Housing and Propeller Shaft Installation
Figure 204

CAUTION: PROTECT END OF PROPELLER SHAFT ASSEMBLY WHEN PERFORMING THE FOLLOWING STEP

NOTE: Do not remove pin from propeller shaft unless damage is indicated by inspection.

Do not remove inserts from housing assembly unless damage is indicated by inspection.

1. B. (3) (c) Press propeller shaft from housing assembly using arbor press. Remove packings, retainer, and seal rotor of seal assembly from shaft. Remove bearing from housing.

(d) Press seal stator of seal assembly out of retainer using driver and 285968-1-1 holder.

R NOTE: Refer to 70-00-00, STANDARD PRACTICES, for
R recommended general torque values. Add fric-
R tional drag (run-down) torque of self-locking
R devices to recommended values.

R Lightly coat new packings with clean engine
R oil or lubricant (OS-124) prior to
R installation.

C. Assemble Nose Cone and Annular Bearing

(1) Install seal assembly and bearing into output gearbox housing as follows. (See figurew 204, 205 and 206.)

(a) Assemble seal stator onto retainer as follows. (See figures 204 and 205.)

1 Heat retainer in an oven at 260C (500F) for approximately fifteen minutes. While hot, place retainer on arbor press.

2 Position seal stator onto retainer with lip up. Press seal stator into retainer using 293689-1 holder and driver.

3 Install packing on outside diameter of retainer. Position seal rotor with flat surface against lip of seal stator in preparation for installation into output gearbox housing.

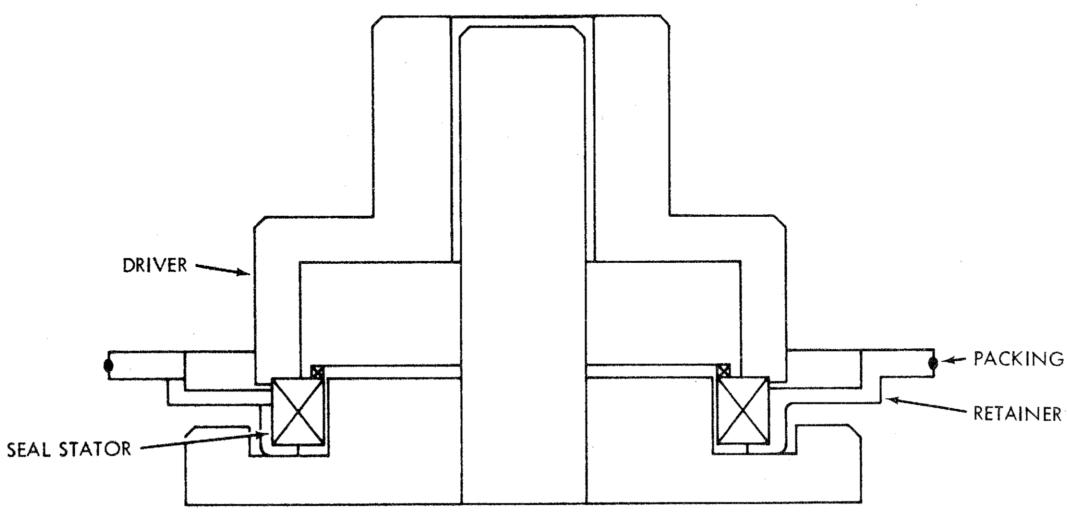
1. C. (1) (b) Install retainer and seal assembly into output gearbox housing as follows. (See figure 206.)

1 Heat output gearbox housing in an oven at 86C (155F) for approximately ten minutes.

2 Place packings on bolts and install bolts in retainer. Place assembled bolts and retainer on 285969-1-1 holder.

3 Remove output gearbox housing from oven and place on retainers, press firmly in place until retainer bottoms in output gearbox housing.

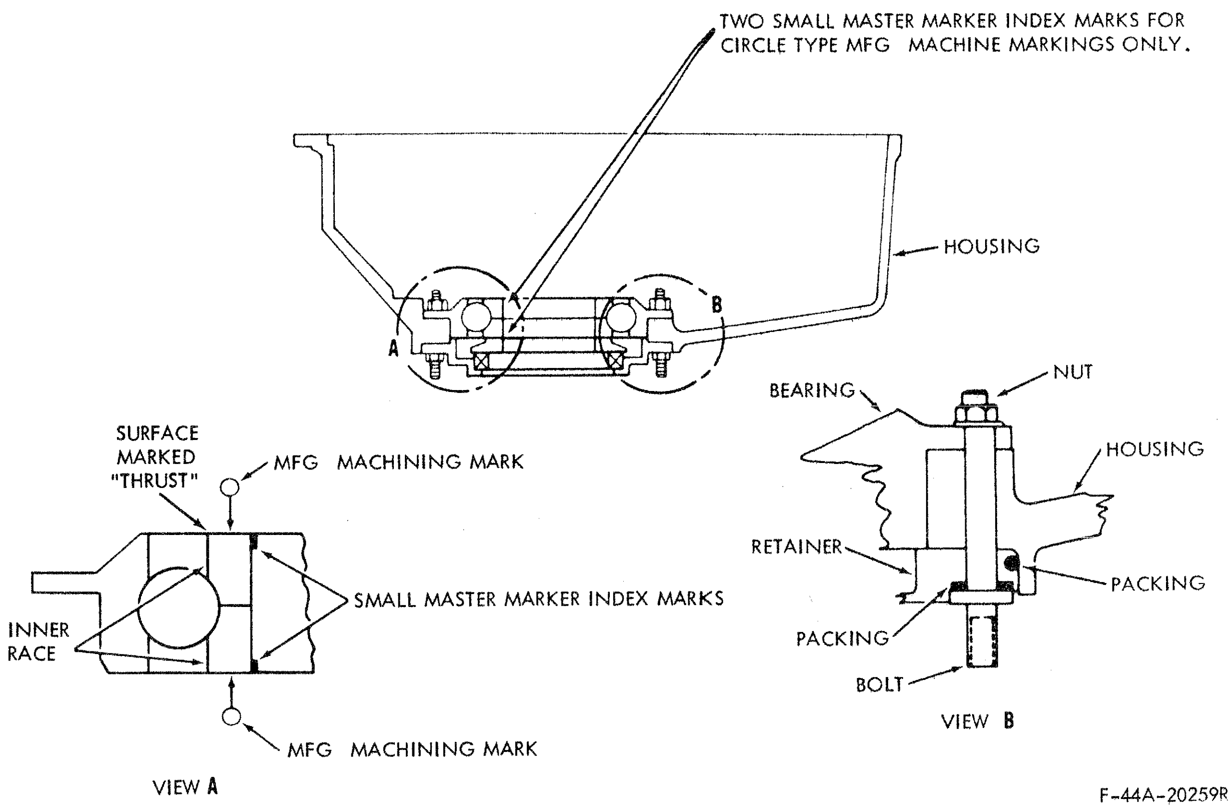
R



R

Assembly of Seal Stator and Retainer
Figure 205

R



R

Installation of Propeller Shaft Seal Assembly and Bearings
Figure 206

1. C. (1) (c) Install bearing assembly into output gearbox housing as follows. (See figure 206.)

CAUTION: IF BEARING MANUFACTURER'S MARKINGS APPEAR ON OUTER FLAT SIDE OF INNER RACE HALVES, ALIGN MANUFACTURER'S MARKS AND MAKE TWO SMALL INDEX MARKS, USING VIOLET MASTER MARKER (GRADE 127-1/2), ON INNER DIAMETER OF INNER RACE HALVES TO AID IN MAINTAINING ALIGNMENT DURING INSTALLATION OF BEARING ASSEMBLY.

NOTE: Bearing has two piece inner race. Inner race halves are index marked for alignment by manufacturer. Location and type of markings
R may vary with different manufacturers. Aft
R side of inner race is marked "THRUST".

1 While output gearbox housing is hot, install bearing (with large chamfer away from housing) over bolts, using caution to prevent inner race halves from falling out, press bearing into input gearbox housing until bearing bottoms in
R housing. Ensure inner race surface marked "THRUST" is tow-
R ard aft side of output gearbox housing.

CAUTION: SECURE BOLT HEADS WHILE TIGHTENING NUTS TO PREVENT DAMAGE TO OUTPUT GEARBOX HOUSING (USE 285969-1-1 HOLDER).

2 Secure bearing with nuts. Tighten nuts to a torque value of 100 inch-pounds.

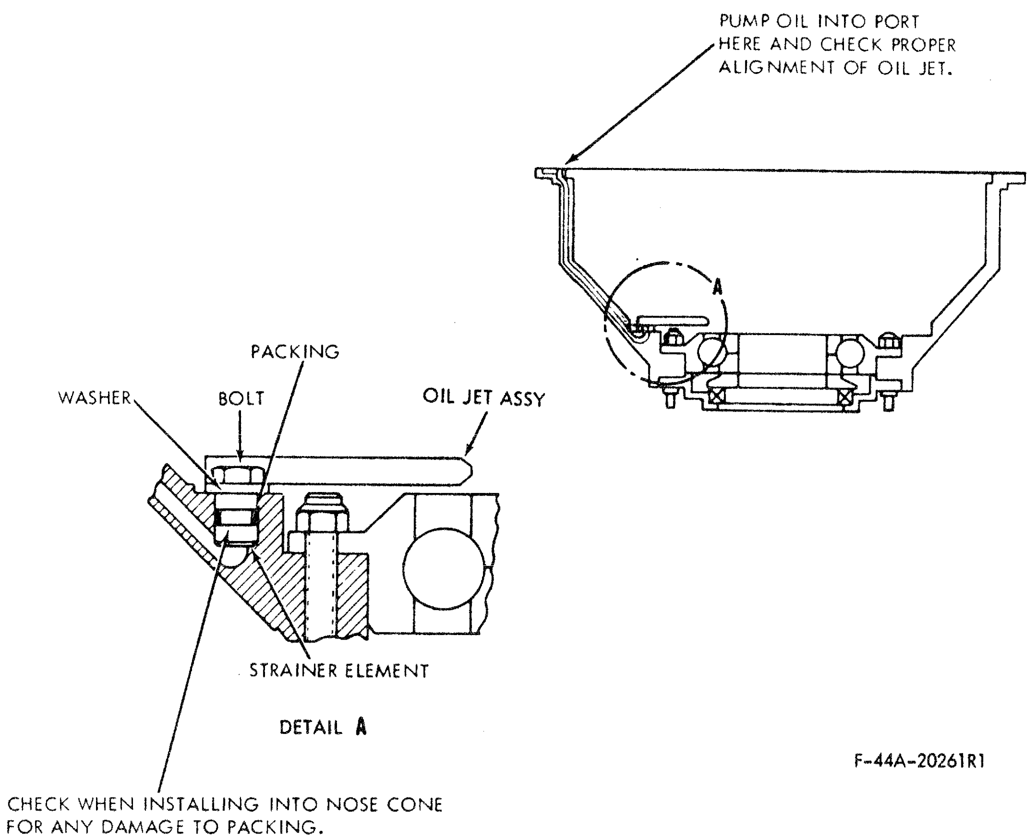
(2) Install oil jet assembly onto output gearbox housing as follows. (See figure 207.)

(a) Install new packing on oil jet. Ensure that strainer element is in place. Install jet assembly onto output gearbox housing.

(b) Secure oil jet assembly with bolt and washer. Tighten bolt to a torque value of 40 inch-pounds.

(c) Pump engine oil into ports as shown in Figure 207 to check alignment of oil jet. Ensure that oil spray pattern hits bearing between bearing races.

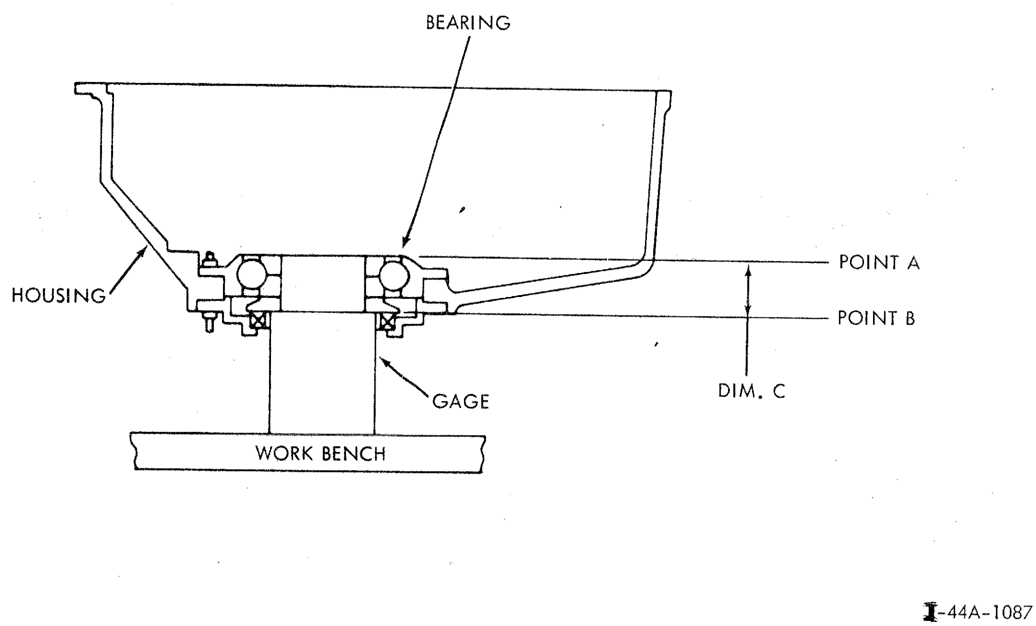
R



Installation of Oil Jet Assembly
Figure 207

R 1. C. (3) (Codes AA-AC, CA-CC, FA, KA, LA) Install propeller shaft onto output gearbox housing as follows. (See figures 208, 209 and 210.)

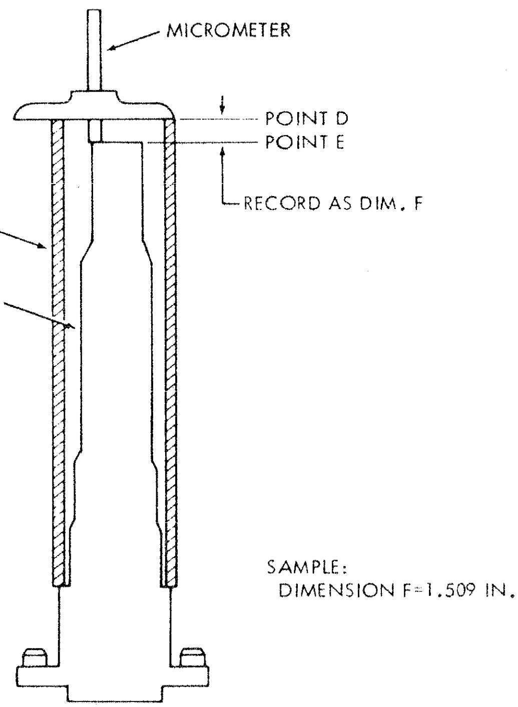
(a) Place output gearbox housing on 285972-1-1 gage (see figure 208). Use depth micrometer and measure from Point A (top of bearing) to Point B (top of tool) and record result as Dimension C for later use.



R

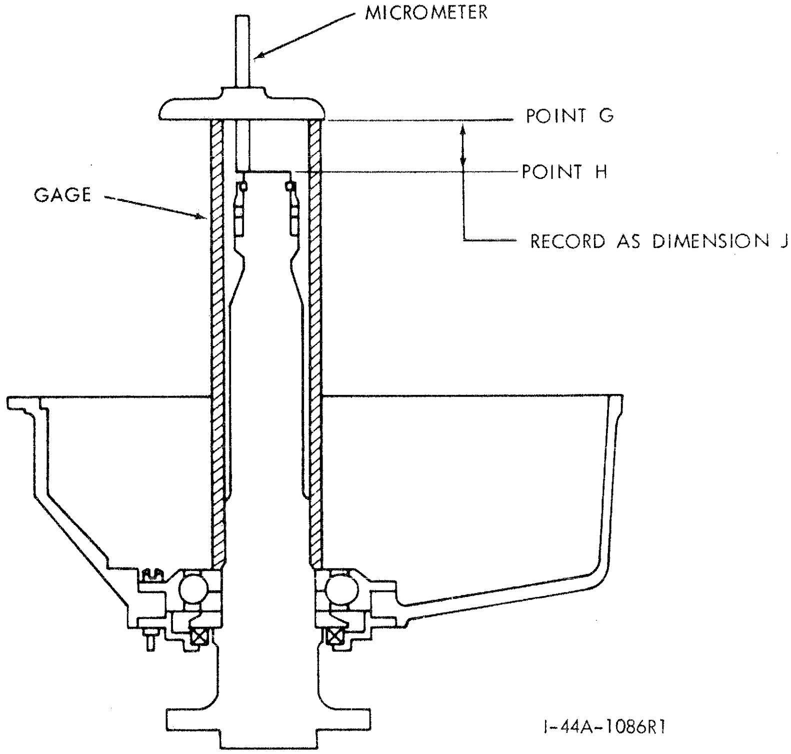
(Codes AA-AC, CA-CC, FA, KA, LA)
Measurement of Output Gearbox Assembly
Figure 208

R



Measurement of Propeller Shaft Assembly
Figure 209

R



R (Codes AA-AC, CA-CC, FA, KA, LA) Measurement of Propeller Shaft Assembly
Figure 210

1. C. (3) (b) Install 285973-1-1 gage over propeller shaft (see figure 209). Place on work bench in upright position and using a depth micrometer, measure from Point D (top of gage) to Point E (end of propeller shaft) and record result as Dimension F for later use.

(c) Install and secure propeller shaft on 284172-1-1 holder.

NOTE: Apply light film of engine oil to propeller shaft in area where bearing will be placed.

If bearing manufacturer's index markings are located on outer flat sides of inner race halves and violet master marker index marks were made while installing bearing, remove violet master marker index marks using 1,1,1-Trichloroethane (MIL-T-81533).

If bearing manufacturer's index markings are located on inner diameter of inner race halves, align marks and make a corresponding mark on outer flat side of upper inner race half using violet master marker (Grade 127-1/2).

(d) Ensure that bearing inner race halves are properly aligned. Place output gearbox housing and bearing over propeller shaft so that index mark on bearing is aligned with insert slot on propeller shaft. Using 284191-1-1 driver and an arbor press, press output gearbox housing down on propeller shaft until metal-to-metal contact is made. Remove any remaining violet master marks using 1,1,1-Trichloroethane (MIL-T-81533).

(e) Place 285973-1-1 gage over propeller shaft (see figure 210), use a depth micrometer and measure from Point G (top of gage) to Point H (end of propeller shaft). Record result as Dimension J.

(f) To ensure that propeller shaft is properly bottomed out, subtract Dimension F from Dimension J. The remainder shall equal Dimension C (J - F = C). If J minus F does not equal Dimension C within +0.001/-0.001 inch, disassemble and reassemble in accordance with paragraph 1.B.(3).

R 1. C. (4) (Codes AA-AC, CA-CC, FA, KA, LA) Install couplings on propeller shaft as follows. (See figure 202, 211.)

NOTE Apply light film of engine oil to propeller shaft prior to installing couplings.

(a) Install coupling (30, figure 202) on propeller shaft. Using 284191-1-1 driver, press coupling against ball bearing. Remove driver. Install coupling (25, figure 202) on coupling (30, figure 202).

(b) Install retainer on propeller shaft.

R
R
R
NOTE: Remove excessive lubricating compound after torquing nut to prevent engine oil contamination.

(c) Apply lubricating compound (Liqui-Moly, Grade NV) to face and threads of nut. Install nut of shaft. Use 284677-1-1 adapter with suitable torque wrench and tighten nut to a torque value of 14,400 inch-pounds (1200 foot-pounds).

(d) Install sleeve and retaining ring.

R (5) (Codes AA-AC, CA-CC, FA, KA, LA) Install bearing inner races and slotted round nut on aft end of propeller shaft as follows. (See figure 202, 211.)

(a) Press roller bearing inner race on propeller shaft using 284477-1-1 driver. Install spacer. Install ball bearing inner race with bearing ball pocket away from spacer. Use same driver and press in place.

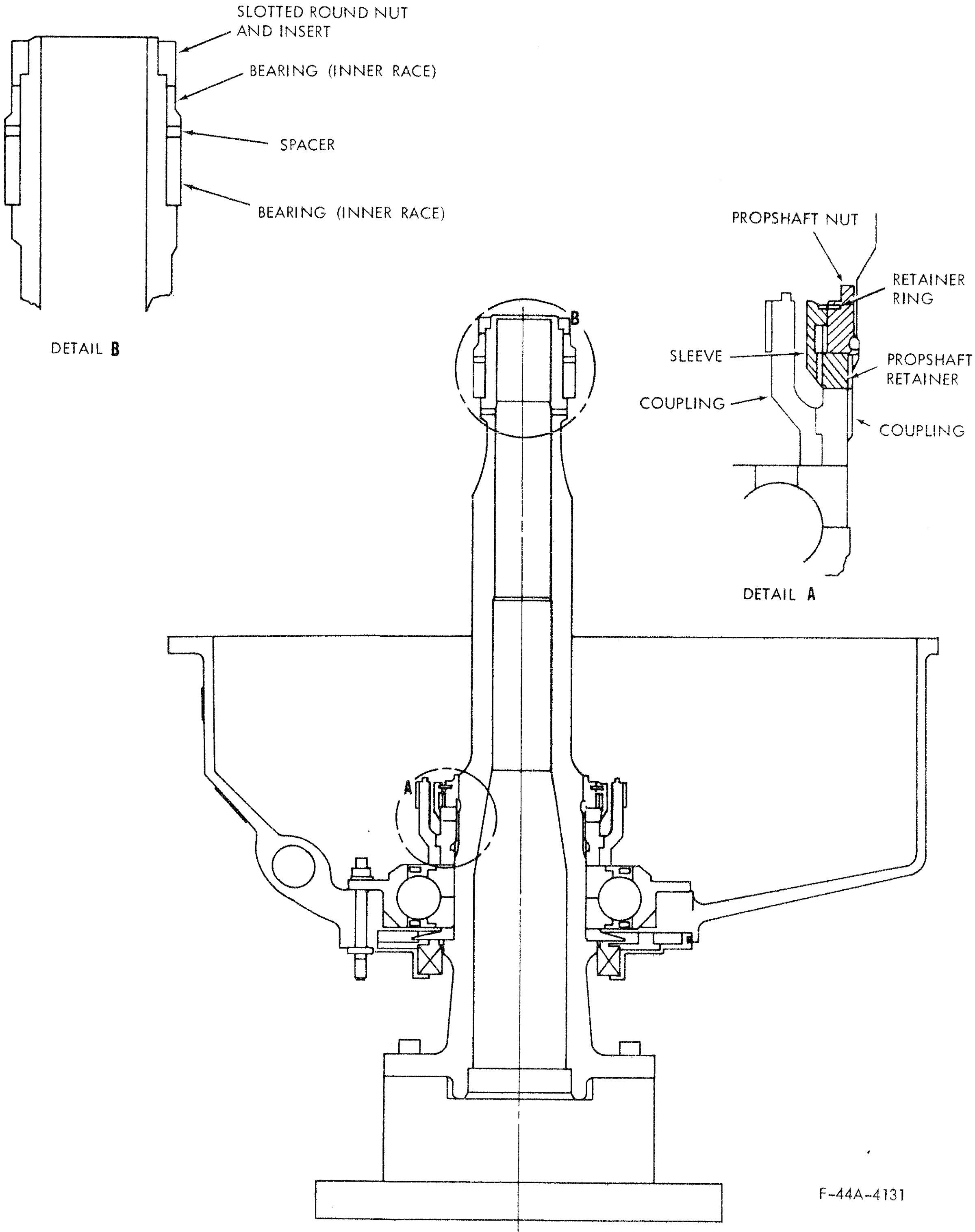
(b) Place nylon insert in propeller shaft slot and sand small flat to be smooth with outer diameter of threads.

R
R
R
NOTE: Remove excessive lubricating compound after tightening nut to prevent engine oil contamination.

(c) Apply lubricating compound (Liqui-Moly Grade NV) to face and threads of slotted round nut. Install nut on propeller shaft. Use 291898-1-1 adapter and suitable torque wrench and tighten nut to a torque value of 1800 inch-pounds (150 foot-pounds).

(d) Store assembled output gearbox housing assembly in a clean plastic bag until installation on engine is required.

R



R (Codes AA-AC, CA-CC, FA, KA, LA) Installation of Propeller
R Shaft Couplings and Aft Bearing Races
Figure 211

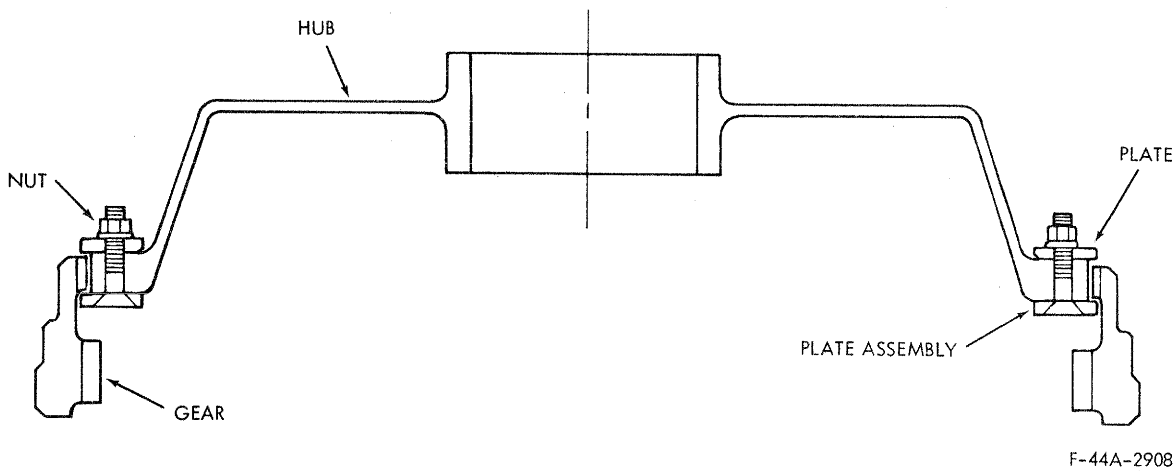
R 1. C. (6) (Codes BA-BC, EA, GA, HA) Assemble ring gear hub and internal
R planetary gear as follows. (See figures 203, 212).

R NOTE: Plates shall be installed with beveled side
R down and inward toward hub.

(a) Engage hub with planetary gear. Install plate assembly studs through hub.

(b) Install plates and secure with nuts. Tighten nuts to a torque value of 25 inch-pounds.

R



R (Codes BA-BC, EA GA, HA) Assembly of Ring Gear
R Hub and Internal Planetary Gear
Figure 212

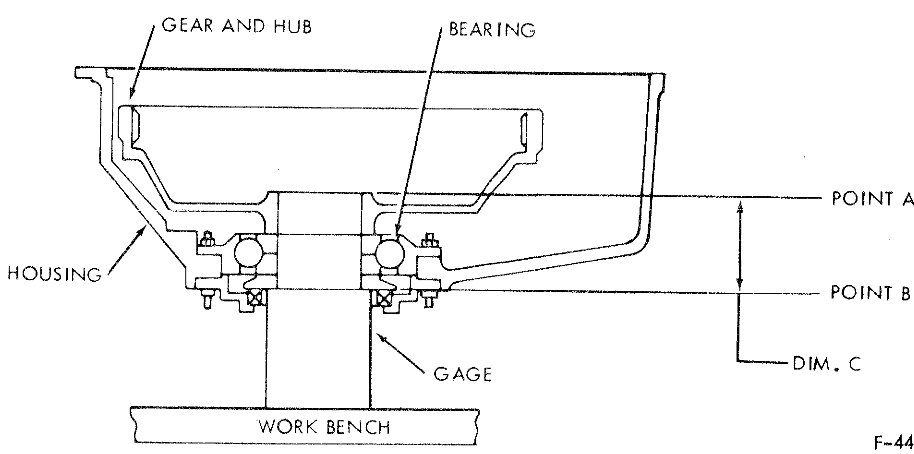
R 1. C. (7) (Codes BA-BC, EA, GA, HA) Install propeller shaft onto output gearbox housing as follows. (See figures 203, 209 and 213.)

(a) Place output gearbox housing on 295972-1-1 gage (see figure 213). Ensure that manufacturer's index markings, on inner races of bearing, are aligned. Place assembled internal planetary gear and ring gear hub into housing on bearing. Use depth micrometer and measure from Point A (top of hub inner flange) to Point B (top of tool) and record results as Dimension C for later use.

R (b) Install 285973-1-1 gage over propeller shaft (see figure 209). Place on work bench in upright position and using a depth micrometer, measure from point D (top of gage) to Point E (end of propeller shaft) and record result as Dimension F for later use.

(c) Install and secure propeller shaft on 284172-1-1 holder.

R



R (Codes BA-BC, EA, GA, HA) Measurement of Output Gearbox Assembly
Figure 213

NOTE: Apply light film of engine oil to propeller shaft in area where bearing will be placed.

If bearing manufacturer's index markings are located on outer flat sides of inner race halves and violet master marker index marks were made while installing bearing, remove violet master marker index marks using 1,1,1-Trichloroethane (MIL-T-81533).

If bearing manufacturer's index markings are located on inner diameter of inner race halves, align marks and make a corresponding mark on outer flat side of upper inner race half using violet master marker (Grade 127-1/2).

1. C. (7) (d) Ensure that bearing inner race halves are properly aligned. Place output gearbox housing and bearing over propeller shaft so that index mark on bearing is aligned with insert slot on propeller shaft. Using 284191-1 1 driver and an arbor press, press output gearbox housing down on propeller shaft until metal-to-metal contact is made. Remove any remaining violet master marks using 1,1,1-Trichloroethane (MIL-T-81533).

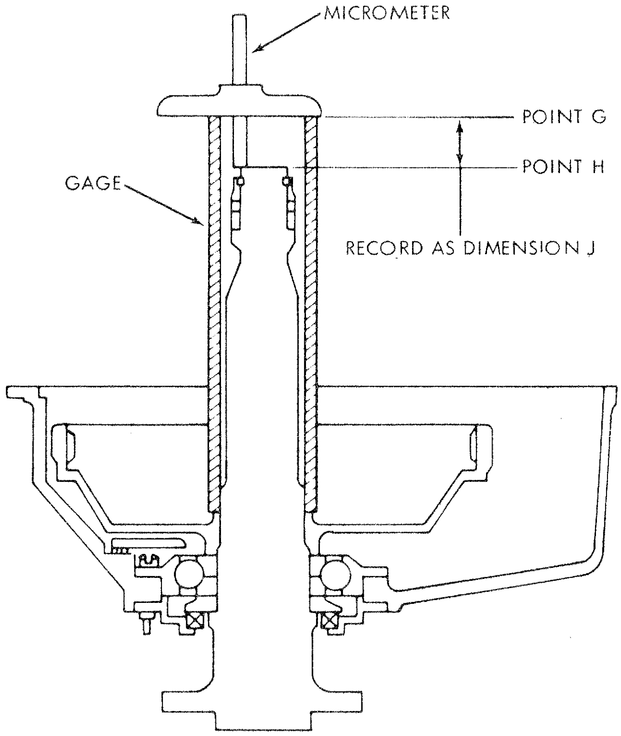
R (8) (Codes BA-BC, EA, GA, HA) Install assembled planetary gear and ring gear hub onto propeller shaft as follows. (See figures 203, 214 and 215.)

NOTE: Apply light film of engine oil to propeller shaft prior to installing planetary gear and ring gear hub assembly.

(a) Place planetary gear and ring gear hub assembly over propeller shaft. Using 284191-1-1 driver, press assembly down against bearing. Remove driver.

R (b) Place 285973-1-1 gage over propeller shaft (see figure 214) Use a depth micrometer and measure from Point G (top of gage) to Point H (end of propeller shaft). Record as Dimension J.

R



R (Codes BA-BC, EA, GA, HA) Measurement of
Propeller Shaft Assembly
Figure 214

1. C. (8) (c) To ensure that all assembled units on propeller shaft have been properly pressed together, refer to previously obtained dimension measurements C and F, use formula J - F = C. If J minus F does not equal C within +0.001/-0.001 inch, disassemble and reaccomplish assembly.

NOTE: Retainer (20, figure 203) is an integral component of Ring Gear Hub (45) when Ring Gear Hub, Part No. 893756-1-1 is used.

(d) Install retainer, nut, sleeve and retaining ring. (See figure 203, 215.)

1 Install retainer on propeller shaft.

2 Apply lubricating compound (Liqui-Moly, Grade NV) to face and threads of nut. Install nut on shaft. Using 284677-1-1 adapter with suitable torque wrench, tighten nut to a torque value of 14,400 inch-pounds.

3 Install sleeve and retaining ring.

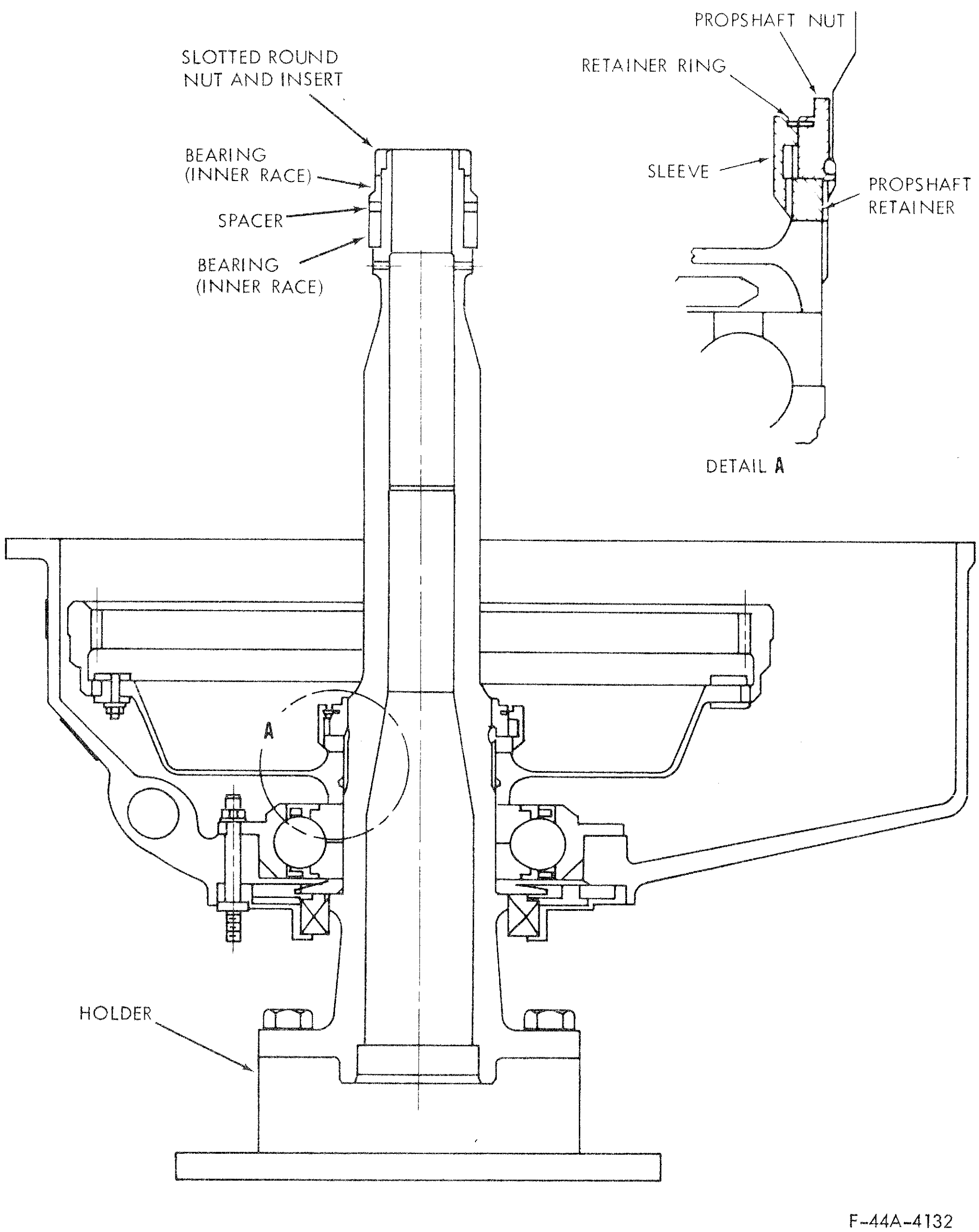
R (9) (Codes BA-BC, EA, GA, HA) Install bearing inner races on aft end of propeller shaft as follows. (See figures 203, 215.)

(a) Press roller bearing inner race on propeller shaft using 284477-1-1 driver. Install spacer. Install ball bearing inner race with bearing ball pocket away from spacer. Use same driver and press in place.

(b) Place nylon insert in propeller shaft slot and sand small flat to be smooth with outer diameter of threads.

(c) Apply lubricating compound (Liqui-Moly, Grade NV) to face and threads of slotted round nut. Install nut on propeller shaft. Use 291898-1-1 adapter and suitable torque wrench and tighten nut to a torque value of 1800 inch-pounds.

(d) Store assembled output gearbox housing assembly in a clean plastic bag until installation on engine is required.



R

R (Codes BA-BC, EA, GA, HA)
R Installation of Propeller Shaft
R Hub and Aft Bearing Races
R Figure 215

1. D. Install Output Gearbox Housing and Annular Ball Bearing (See Figures 201 and 216)

(1) Place 284308-1-1 sleeve over aft end of propeller shaft. Carefully remove nuts securing 284197-1-1 bearing retainer in place on rear of accessory housing nut but do not remove bearing retainer.

(2) Clean gasket with a solution of soap and water, then apply grease (DC-11) to gasket and install on intermediate gearbox housing.

NOTE: Install large diameter washers at bushing locations in the following step.

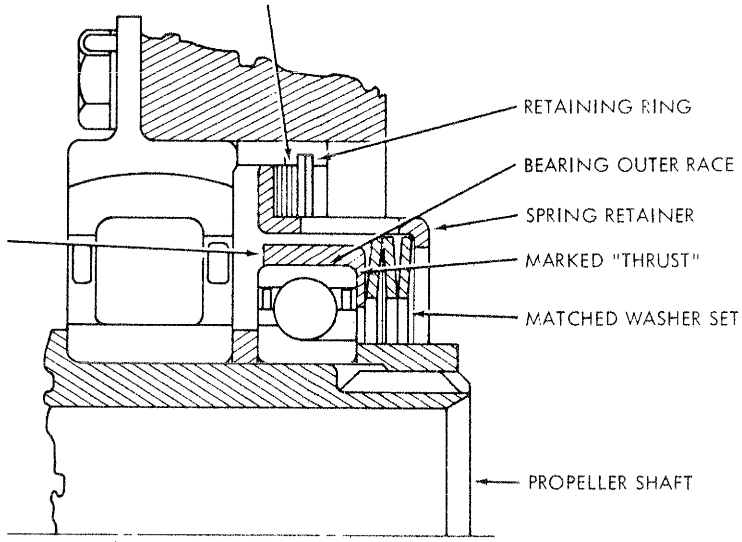
When tightening output gearbox housing, loosen intermediate gearbox (diaphragm) retaining nuts and retighten in sequence along with output gearbox housing retaining nuts. Tighten nuts 180 degrees opposite each other in 20 inch-pounds increments until required torque is reached.

(3) Install output gearbox housing on accessory housing assembly. As propeller shaft slides through bearing, 284197-1-1 retainer will be pushed out. Remove retainer. Install washers and nuts to secure output gearbox housing. Tighten nuts to 80 inch-pounds torque. Remove 284308-1-1 sleeve.

CAUTION: ENSURE THAT MATCHED WASHER SET COMPONENTS ARE PROPERLY ORIENTATED WITH EACH OTHER TO PROVIDE A SPRING WASHER STACK FOR PROPER TENSION AND CLEARANCES (SEE FIGURE 216).

NOTE: Aft side of ball bearing outer race is marked "THRUST".

(4) Install outer race of bearing (includes balls and separator) into bearing retainer. Ensure outer race surface marked "THRUST" is toward rear of engine. Position assembled bearing outer race and retainer over propeller shaft. Place spring washer set into spring retainer and install retainer over propeller shaft.



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R

Installation of Matched Washer Set
Figure 216

1. D. (5) Determine amount of shims required between spring retainer and retaining ring as follows. (See figure 216.)

NOTE: Matched spring washer set to be compressed 0.018 to 0.020 inch below free height.

The 284685-1-1 gage has a 0.019 inch allowance built into gage. Therefore, micrometer reading minus thickness of retaining ring shall be thickness of total shims required.

(a) Place 284685-1-1 gage over aft end of propeller shaft and position gage leg extrusions into retaining ring groove.

(b) Ensure that spring loaded center section of gage is released (turn gage knob counterclockwise).

(c) Ensure that center section of gage is snug against face of outer flange of spring retainer and that main body of gage is locked firmly in place by gage legs.

(d) Through hole in aft end of gage, measure (using depth micrometer) distance between smooth surface of outer section of gage and plunger of center section of gage. Record as Dimension A.

(e) Using a standard micrometer, measure thickness of retaining ring. Record as Dimension B.

(f) Subtract Dimension B from Dimension A. The remainder is total thickness of shims to place between spring retainer and retaining ring (A - B = total thickness of shims).

(g) Remove 284685-1-1 gage.

(6) Install shims and retaining ring as follows.

(a) Loosen nose cone retaining nuts sufficiently to move housing slightly forward (approximately 0.050 inch).

(b) Install shims (total thickness as determined in step (5)) and retaining ring. Retighten nose cone retaining to 80 inch-pounds torque in accordance with note preceeding step (3).

(7) Install beta tube. Refer to 72-10-01, MAINTENANCE PRACTICES.

(8) Install prop pitch control. Refer to 72-10-02, MAINTENANCE PRACTICES.

2. Inspection/Check

A. Inspect Nose Cone Components (See Figures 201, 202, 203, 204 and 217)

(1) Inspect bearings for freedom of rotation. Inspect gears for chipped or broken teeth or unusual wear pattern. Replace part that does not meet Inspection/Check requirements.

(2) Inspect entire output gearbox housing for cracks. No cracks allowed.

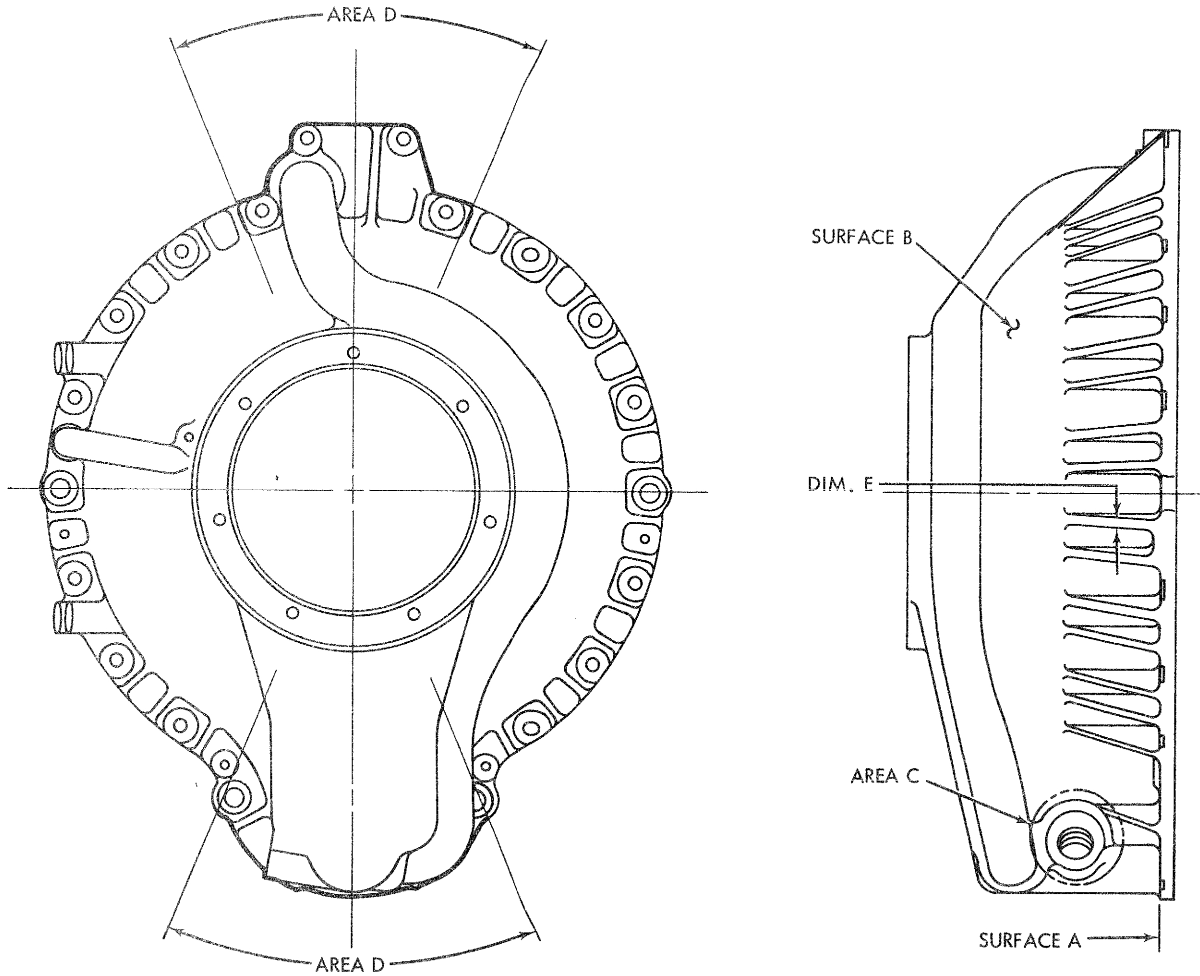
(3) Inspect output gearbox housing assembly for corrosion as follows. (See figure 217.)

(a) Inspect output gearbox housing assembly (Surface B, figure 217) for evidence of corrosion or salt deposits. Particular attention must be given to areas where dissimilar metals contact the magnesium alloy faying surface. Treat corrosion in accordance with Approved Repairs.

(b) Inspect all screw and bolt locations and magnetic drain plug area for evidence of corrosion (see figure 217). Treat corrosion in accordance with Approved Repairs.

(c) Inspect ribs for evidence of corrosion. Treat corrosion in accordance with Approved Repairs. Following removal of corrosion from rib area, minimum thickness of rib shall not be less than Dimension E (see figure 217).

(d) If limits (see figure 217) are exceeded replace components or nose cone in accordance with Removal/Installation.



	DEPTH	AREA	PLACES
SURFACE A EXCEPT AREA D	0.060 IN.	1/2 SQ IN. MAX	6 MAX
SURFACE B	0.010 IN.	6 SQ IN. TOTAL AREA	
AREA C	0.170 IN.	1/2 SQ IN. TOTAL AREA	
AREA D	0.020 IN.	1/2 SQ IN. TOTAL AREA	

DIM. E 0.130 INCH MINIMUM RIB THICKNESS

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Inspection of Output Gearbox Housing Assembly
Figure 217

3. Cleaning/Painting

A. Clean Component Parts

(1) Refer to 72-00-00, CLEANING/PAINTING, for general cleaning instructions and for description of cleaning methods specified in Table 203.

NOTE: Reference shall be made to Table 203 for recommended cleaning method.

Table 203. Cleaning Methods

Figure No.	Item No.	Nomenclature	Cleaning Methods 1	2	3	4	5	6	7	8	9	10	11	12
All standard metallic hardware			X	X										
201	5	Retaining Ring	X	X										
	20	Spring Retainer	X	X										
	25	Washer Set	X	X										
	30	Bearing Retainer	X	X										
	35	Bearing*												
202	5	Retaining Ring	X	X										
	10	Sleeve										X		
	15	Nut	X	X										
	20	Retainer	X	X										
	25	Coupling		X										
	30	Coupling		X										
	40	Strainer Element	X	X										
	45	Oil Jet					X	X						
	65	Nut (Round)	X	X										
	75	Bearing*												
	80	Spacer	X	X										
	85	Bearing*												
203	5	Retaining Ring	X	X										
	10	Sleeve										X		
	15	Nut	X	X										
	20	Retainer	X	X										
	30	Plate	X	X										
	35	Plate Assembly	X	X										
	40	Planetary Gear		X										
	45	Ring Gear Hub		X										
	55	Strainer Element	X	X										
	60	Oil Jet					X	X						
	80	Nut (Round)	X	X										
	90	Bearing*												
	95	Spacer	X	X										
	100	Bearing*												

*Refer to 72-00-00, CLEANING/PAINTING for special cleaning instructions.

Table 203. Cleaning Methods (Cont)

Figure No.	Item No.	Nomenclature	1	2	3	4	5	6	7	8	9	10	11	12
204	30	Propeller Shaft		X										
	35	Bearing*												
	40	Seal Assembly	X											
	45	Seal Retainer										X		
	80	Output Gearbox Housing							X	X				

*Refer to 72-00-00, CLEANING/PAINTING for special cleaning instructions.

4. Approved Repairs

NOTE: Table 204 provides a list of materials and compounds required for Approved Repairs.

Table 204. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed item.	
Acid resistant brush	Commercially available
Clear coat (V92VC10)	Sherwin-Williams Co, Main Store, 2312 N 16th St, Phoenix, AZ 85006
Color coat (Andrew Brown A423-66 Enamel No. 051 and C-1178 Converter)	Griggs Paint and Hardware Co, 3602 S 16th Place, Phoenix, AZ 85040
Cotton applicators	Commercially available
Fine bristled brush	Commercially available
Heat gun	Commercially available
Methanol	Commercially available
Primer (P-415-66-611B with Catalyst C1178-66)	Griggs Paint, Subsidiary of Domcom Dist, 3602 S 16th Place, Phoenix, AZ 85040

Table 204. Materials and Compounds (Cont)

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed item.	
Rubber gloves	Commercially available
Sealant (RTV731)	Dow Corning Corp, S Saginaw Rd, Midland, MI 48640
Sandpaper (210 grit size)	Commercially available
Touch-up solution (Dow 1)	Dow Corning Corp, S Saginaw Rd, Midland, MI 48640
Touch-up solution (Dow 19)	Dow Corning Corp, S Saginaw Rd, Midland, MI 48640

R NOTE: Corrosion Treatment Kit, Part No. 658532-1 containing
R materials required for corrosion treatment may be ordered
R from any AiResearch Aviation Company or from the Garrett
R Corporation, AiResearch Manufacturing Company of Arizona,
R P.O. Box 29003, Phoenix, AZ 85038.

4. A. Repair Corrosion Damaged Areas

WARNING: METHANOL IS TOXIC AND FLAMMABLE. USE IN WELL-VENTILATED AREA. AVOID BREATHING FUMES OR LONG CONTACT WITH SKIN TO PREVENT DAMAGE TO PHYSICAL HEALTH. KEEP AWAY FROM FLAME TO AVOID FIRE HAZARD.

NOTE: Do not dilute methanol with water or use water (including distilled water) to wash any exposed surface. Water will cause spreading of corrosion.

(1) Mechanically remove all corrosion by gently wire brushing or sanding. Clean areas to be treated by flushing or swabbing area with methanol to remove all traces of dirt, oil and foreign elements and drive out any residual moisture.

(2) Dry all areas to be treated with portable heat gun for five minutes, holding temperature to a maximum of 177C (350F) to prevent scorching the surrounding painted surfaces.

CAUTION: TOUCH-UP SOLUTION (DOW 1) SHALL NOT BE ALLOWED TO CONTACT ANODIC TREATED SURFACES. A RAPID DETERIORATION OF THE COATING WILL OCCUR.

4. A. (3) Apply touch-up solution (Dow 1) to bare metal area using an acid resistant brush. Prepare by mixing 1.5 pounds of sodium dichromate and 1.5 pints of nitric acid with enough demineralized or distilled water to make one gallon of solution. Allow solution to stand for one to two minutes.

(4) Rinse areas with methanol and blot dry. Thoroughly dry areas with portable heat gun for five minutes, holding temperature to a maximum of 177C (350F).

(5) Touch-up treated area with touch-up solution (Dow 19) using cotton applicator. Prepare by mixing 1.5 ounces of chromic acid and one ounce of calcium sulfate with enough demineralized or distilled water to make one gallon of solution. Allow solution to stand for five minutes then wipe off excess.

(6) Apply protective coating (clear coat, V92VC10) to treated areas using fine bristled brush or paint sprayer, overlap adjacent mating parts by a minimum of 0.20 inch. After application, heat cure for approximately 15 minutes at 177C (350F) using portable heat gun.

(7) Following the application of the protective coating, the areas that were exposed and surface treated are to be painted in the following manner.

(a) First, apply one coat of primer (P-415-66-611B mixed with an equal part of Catalyst C1178-66) (let stand 30 minutes before use), by either brushing or spraying. Dry for 15 minutes with portable heat gun.

(b) Next, apply one coat of finish paint, Color Coat (Andrew Brown A423-66 Enamel No. 051) mixed with an equal part of C-1178 Catalyst Converter (let stand 30 minutes before use), by either brushing or spraying. Dry for 15 minutes with portable heat gun.

4. A. (8) Provide added protection to area found to be susceptible to the accumulation of corrosive moisture as follows.

CAUTION: DO NOT USE SEALANT IN AIR INTAKE OF ENGINE TO AVOID POSSIBLE INGESTION.

(a) After the paint has dried, pockets and voids that are found to retain moisture may be filled by building up with sealant (RTV731) and allowing it to air cure.

(b) Sealant can be painted with primer and finish paints to provide an uniform appearance.

OIL TRANSFER TUBE, OIL JET AND LUBRICATION ADAPTER - MAINTENANCE PRACTICES

1. Removal/Installation

NOTE: Table 201 provides a list of special tools, fixtures and equipment required for Removal/Installation. Table 202 provides a list of materials and compounds required for Removal/Installation.

Table 201. Special Tools, Fixtures and Equipment

Item No.	Nomenclature	Use	Source/ Part No.
NOTE: Equivalent substitutes may be used for listed items.			
1.	Puller	Used to remove oil transfer tube from accessory drive housing.	285846-1-1

Table 202. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed item.	
Any approved engine oil	Commercially available
Lubricant (OS-124)	Monsanto Company, 800 N Lindbergh Blvd, St. Louis, MO 63166
Lubricating compound (Liqui-Moly, Grade NV)	Lockrey Co, Lubricants Div, Cedar Shores, Southampton, NY 11968

A. Disassemble Engine to Gain Access to Oil Transfer Tubes, Oil Jets and Lubrication Adapter

(1) Remove beta tube. Refer to 72-10-01, MAINTENANCE PRACTICES.

(2) Remove propeller pitch control. Refer to 72-10-02, MAINTENANCE PRACTICES.

1. A. (3) (Codes BA-BC, EA-LA) Remove start fuel regulator. Refer to 73-10-03, MAINTENANCE PRACTICES.

(4) Remove nose cone. Refer to 72-10-09, MAINTENANCE PRACTICES.

B. (Pre SB72-0162/-0163/-0169) Remove Oil Transfer Tubes, Oil Jets and Lubrication Adapter (See Figure 201)

(1) Remove oil transfer tube (5). Remove packings (10, 15).

(2) (Pre SB72-0064) Using 285846-1-1 puller, remove oil transfer tube (20). Remove packings (25).

(3) (Pre SB72-0064) Remove bolt (30), washer (35) and oil jet (40). Remove packing (55) from oil jet.

(4) (Post SB72-0064) Remove bolt (30), washer (35) and lubrication nozzle (45) or lubrication adapter (50). Remove packing (55) or packings (60, 65, 70).

(5) (Pre SB72-0064) Remove bolt (75), washer (80) and plug (85). Remove packing (90).

(6) (Post SB72-0064) Remove bolt (95), washer (100) and lubrication nozzle (105). Remove packing (110).

(7) Refer to 72-10-11 or 72-10-12, MAINTENANCE PRACTICES, as required, for further engine disassembly.

C. (Post SB72-0162/-0163/-0169) Remove Oil Transfer Tubes, Oil Jet and Plug (See Figure 202)

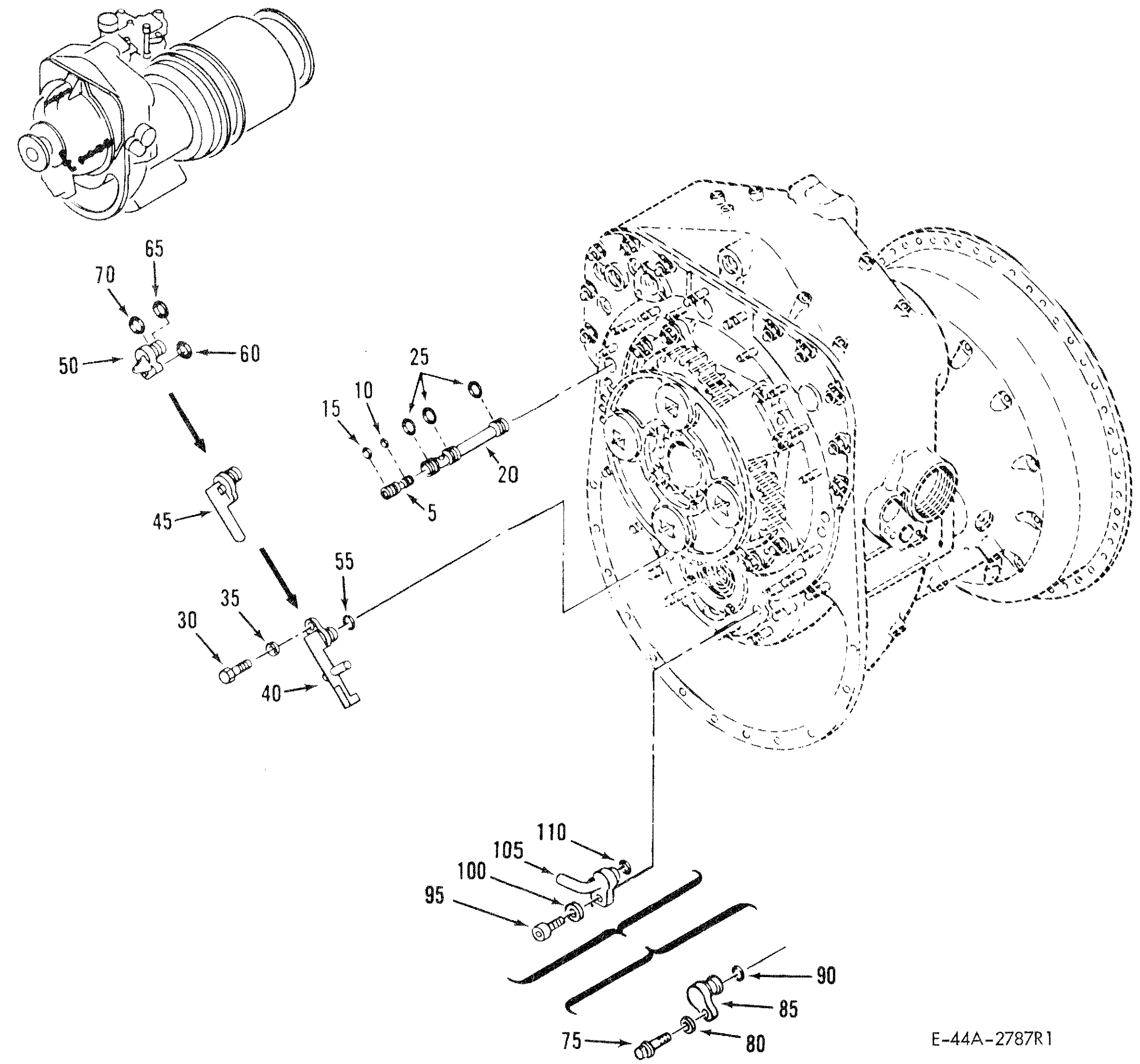
(1) Remove oil transfer tube (5). Remove packings (10, 15).

(2) Using 285846-1-1 puller, remove oil transfer tube (20). Remove packings (25).

(3) Remove bolt (40), washer (45) and oil jet (50). Remove packing (55). Remove pin (60) only if replacement is intended.

(4) Remove bolt (65), washer (70) and plug (75). Remove packing (80).

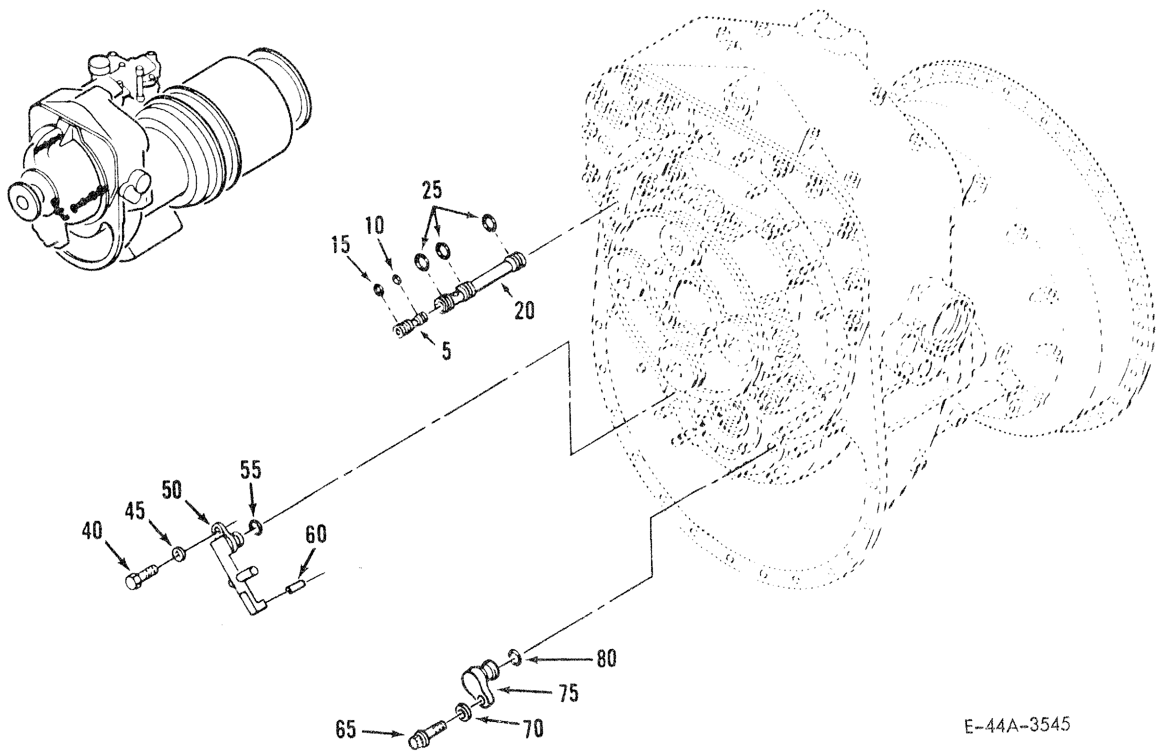
(5) Refer to 72-10-11 or 72-10-12, MAINTENANCE PRACTICES, as required, for further engine disassembly.



R

R 5.	OIL TRANSFER TUBE (IPC FIG. 134)	60.	PACKING
10.	PACKING	65.	PACKING
15.	PACKING	70.	PACKING
20.	OIL TRANSFER TUBE	75.	BOLT
25.	PACKING	80.	WASHER
R 30.	BOLT	85.	PLUG
35.	WASHER	90.	PACKING
R 40.	OIL JET	95.	BOLT
R 45.	LUBRICATION NOZZLE	100.	WASHER
R 50.	LUBRICATION ADAPTER	105.	LUBRICATION NOZZLE
R 55.	PACKING	110.	PACKING

R (Pre SB72-0169/-0163/-0169) Oil Transfer Tube,
Oil Jet and Lubrication Adapter Installation
Figure 201



R 5. OIL TRANSFER TUBE (IPC FIG. 135)
10. PACKING
15. PACKING
20. OIL TRANSFER TUBE
25. PACKING
40. BOLT
45. WASHER
50. OIL JET
55. PACKING
60. PIN
65. BOLT
70. WASHER
75. PLUG
80. PACKING

R (Post SB72-0162/-0163/-0169) Oil Transfer Tube,
Oil Jet and Plug Installation
Figure 202

NOTE: Refer to 70-00-00, STANDARD PRACTICES, for recommended general torque values. Add frictional drag (run-down) torque of self locking devices to recommended values.

Lightly coat new packings with clean engine oil or lubricant (OS-124) prior to installation.

Apply lubricating compound (Liqui-Moly, Grade NV) to threads of bolts, studs, screws or nuts unless otherwise specified. To prevent engine oil contamination, do not use excessive amounts of lubricating compound.

1. D. (Pre SB72-0162/-0163/-0169) Install Oil Transfer Tubes, Oil Jets and Lubrication Adapter (See Figure 201)

(1) (Post SB72-0064) Install packing (110) onto lubrication nozzle (105). Install lubrication nozzle and secure with bolt (95) and washer (100). Tighten bolt (95) to a torque value of 40 inch-pounds.

(2) (Pre SB72-0064) Install packing (90) onto plug (85). Install plug and secure with bolt (75) and washer (80). Tighten bolt (80) to a torque value of 60 inch-pounds, back off and retorque to 50 inch-pounds.

(3) (Post SB72-0064) Install packing (55) onto lubrication nozzle (45) or install packings (60, 65, 70) onto lubrication adapter (50). Install lubrication nozzle or lubrication adapter and secure with bolt (30) and washer (35). Tighten bolt (30) to a torque value of 40 inch-pounds.

(4) (Pre SB72-0064) Install packing on oil jet (40). Install oil jet and secure with bolt (30) and washer (35). Tighten bolt (30) to a torque value of 50 inch-pounds, back off and retorque to 40 inch-pounds.

(5) (Post SB72-0064) Install packings (10, 15) onto oil transfer tube (5). Install oil transfer tube into tube in housing.

(6) (Pre SB72-0064) Install packings (10, 15) onto oil transfer tube (5). Install oil transfer tube (5) into oil transfer tube (20). Install packings (25) onto oil transfer tube (20). Install assembled oil transfer tubes into housing.

1. E. (Post SB72-0162/-0163/-0169) Install Oil Transfer Tubes, Oil Jet and Plug (See Figure 202)

(1) Install packing (80) onto plug (75). Install plug and secure with bolt (65) and washer (70). Tighten bolt (65) to a torque value of 60 inch-pounds, back off and retorque to 55 inch-pounds.

(2) Install packing (55) and pin (60) onto oil jet (50). Install oil jet and secure with bolt (40) and washer (45). Tighten bolt (40) to a torque value of 50 inch-pounds, back off and retorque to 40 inch-pounds.

(3) Install packings (10, 15) onto oil transfer tube (5). Install oil transfer tube (5) into oil transfer tube (20). Install packings (25) onto oil transfer tube (20). Install assembled oil transfer tube into housing.

F. Install Engine Components that were Removed to Gain Access to Oil Transfer Tubes, Oil Jets and Lubrication Adapter

(1) Install nose cone. Refer to 72-10-09, MAINTENANCE PRACTICES.

(2) (Codes BA-BC, EA-LA) Install start fuel regulator. Refer to 73-10-03, MAINTENANCE PRACTICES.

(3) Install propeller pitch control. Refer to 72-10-02, MAINTENANCE PRACTICES.

(4) Install beta tube. Refer to 72-10-01, MAINTENANCE PRACTICES.

2. Inspection/Check

A. Inspect Oil Transfer Tube, Oil Jet and Lubrication Adapter (See Figure 201 and 202)

(1) Inspect oil transfer tubes, oil jet, lubrication adapter and lubrication nozzle for contamination, bends or other obvious damage.

(2) Replace part that does not meet Inspection/Check requirements.

3. Cleaning/Painting

A. Clean Component Parts

(1) Clean all standard hardware. Refer to 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 1 or 2.

(2) Clean oil transfer tubes. Refer to 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 12.

(3) Clean lubrication adapters, lubrication nozzles and oil jets. Refer to 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 5 or 6.

TORSION SPLINE (QUILL) SHAFT AND COUPLING ASSEMBLY - MAINTENANCE PRACTICES

1. Removal/Installation

NOTE: Table 201 provides a list of special tools, fixtures and equipment required for Removal/Installation.

Table 201. Special Tools, Fixtures and Equipment

Item No.	Nomenclature	Use	Source/ Part No.
NOTE: Equivalent substitutes may be used for listed items.			
1.	Spline (Coupler) Positioning Wrench	Use to reposition and indicate coupling spline position when adjusting negative torque.	284456-1-1 (For short coupler) 285159-1-1 (For long coupler)
2.	Spline (Quill) Positioning Wrench	Used to change torsion shaft spline position when adjusting negative torque.	284455-1-1
3.	Ball Lock Wrench	Used to install or remove ball lock in the helical pinion gearshaft assembly and to check for positive engagement of balls after installation.	289318-1-1

R A. Disassemble Engine to Gain Access to Quill Shaft and Coupler

R (1) Remove beta tube. Refer to 72-10-01, MAINTENANCE PRACTICES.

R (2) Remove propeller pitch control. Refer to 72-10-02, MAINTENANCE
R PRACTICES.

R (3) (Codes BA-BC, EA-LA) Remove start fuel regulator. Refer to 73-10-
R 03, MAINTENANCE PRACTICES.

R (4) Remove nose cone. Refer to 72-10-09, MAINTENANCE PRACTICES.

R (5) (Pre SB72-0064 or Post SB72-0162/-0163/-0169) Remove oil jet.
R Refer to 72-10-10, MAINTENANCE PRACTICES.

1. B. Remove Quill Shaft and Coupler (See Figures 201 and 202)

(1) Remove ball lock retainer as follows. (See figures 201 and 202.)

(a) Install 289318-1-1 wrench in shaft until locking balls are released. Remove shaft, balls, spacer and spring. Remove wrench from shaft.

(b) Install 284455-1-1 wrench in torsion spline shaft (quill) and remove shaft. Remove wrench.

(c) Install spline positioning 284456-1-1 (for short coupler) or 285159-1-1 (for long coupler) wrench in coupling assembly. Remove coupling assembly. Remove wrench from coupling assembly.

NOTE: Refer to 72-10-12, MAINTENANCE PRACTICES for further disassembly.

C. Install Quill Shaft and Coupler

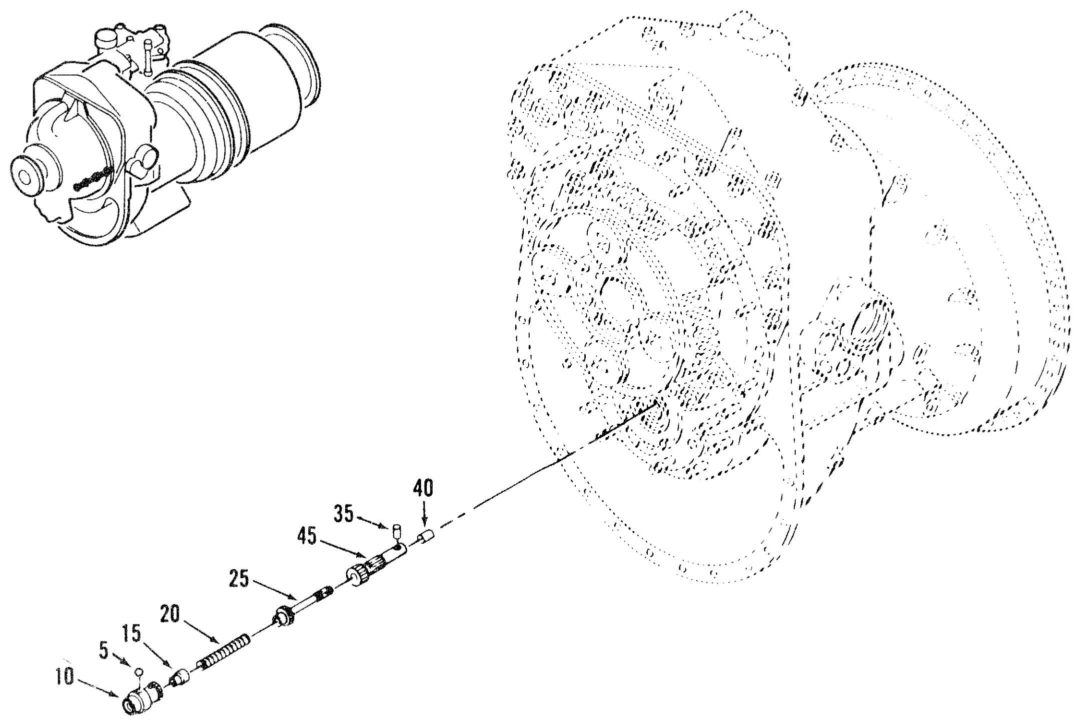
(1) Quill shaft and coupler must be installed in conjunction with torque sensor calibration. Refer to 72-10-16, MAINTENANCE PRACTICES, for installation procedure.

2. Inspection/Check

A. Inspect Quill Shaft and Coupler (See Figures 201 and 202)

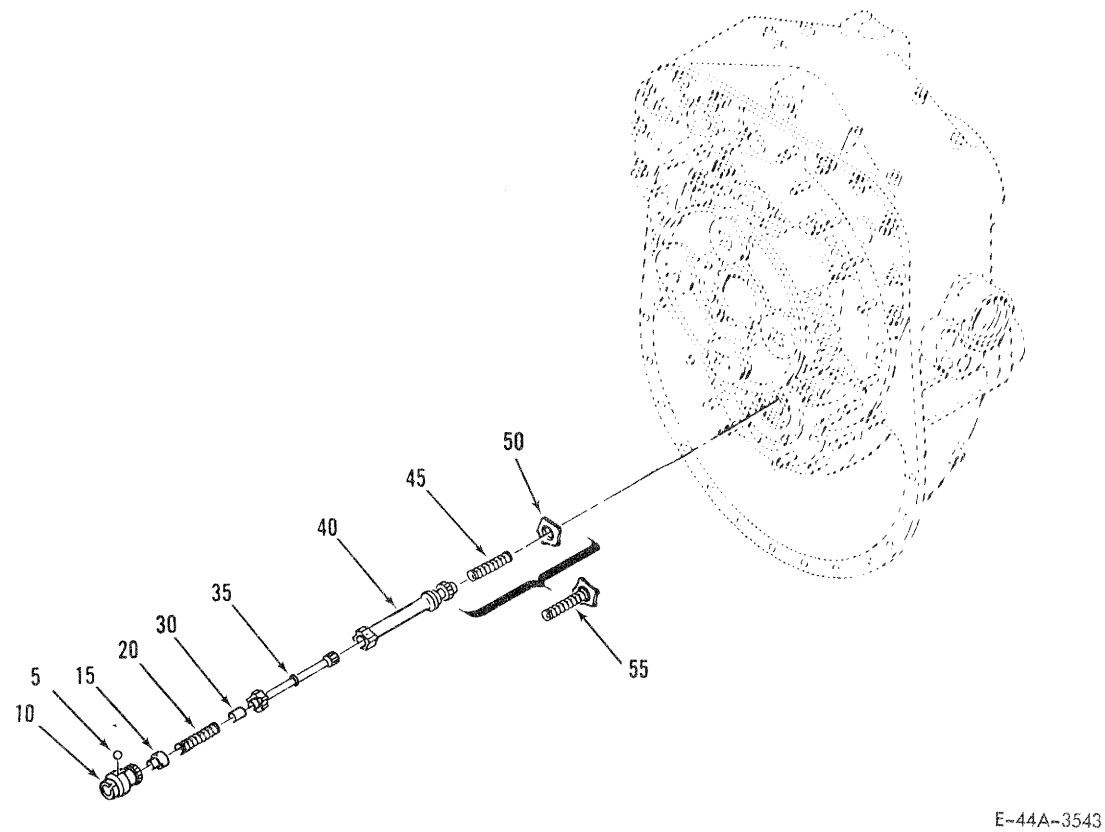
(1) Inspect splined parts for breaks, cracks, or unusual wear pattern.

(2) Replace part that does not meet Inspection/Check requirements.



R 5. BALL (IPC FIG. 151)
10. SHAFT
15. SPACER
R 20. SPRING
25. TORSION SPLINE (QUILL) SHAFT
35. PIN
40. PLUG
45. COUPLING (COUPLER)

(Pre SB72-0119) Quill Shaft and Coupler Installation
Figure 201



R 5. BALL (IPC FIG. 152)
R 10. SHAFT
15. SPACER
20. SPRING
30. INSERT
35. TORSION SPLINE (QUILL) SHAFT
40. COUPLING (COUPLER)
45. SPRING
50. WASHER
55. SPRING ASSY

(Post SB72-0119) Quill Shaft and Coupler Installation
Figure 202

3. Cleaning/Painting

A. Clean Component Parts

(1) Refer to 72-00-00, CLEANING/PAINTING, for general cleaning instructions and description of cleaning methods specified in Table 202.

NOTE: Reference shall be made to Table 202 for recommended cleaning method.

Table 202. Cleaning Methods

Figure No.	Item No.	Nomenclature	1	2	3	4	5	6	7	8	9	10	11	12
All standard metallic hardware			X	X										
201	10	Shaft		X										
	15	Spacer	X	X										
	20	Spring	X	X										
	25	Torsion Spline Shaft		X										
	45	Coupling		X										
202	10	Shaft		X										
	15	Spacer	X	X										
	20	Spring	X	X										
	35	Torsion Spline Shaft		X										
	40	Coupling		X										
	45	Spring	X	X										
	55	Spring Assy	X	X										

PLANET CARRIER AND GEAR ASSEMBLY - MAINTENANCE PRACTICES

1. Removal/Installation

NOTE: Table 201 provides a list of materials and compounds required for Removal/Installation.

Table 201. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed item.	
Any approved engine oil	Commercially available
Lubricant (OS-124)	Monsanto Company, 800 N Lindbergh Blvd, St. Louis, MO 63166

R A. Disassemble Engine to Gain Access to Planet Carrier and Gear Assembly

R (1) Remove beta tube. Refer to 72-10-01, MAINTENANCE PRACTICES.

R (2) Remove propeller pitch control. Refer to 72-10-02, MAINTENANCE
R PRACTICES.

R (3) (Codes BA-BC, EA-LA) Remove start fuel regulator. Refer to 73-10-
R 03, MAINTENANCE PRACTICES.

R (4) Remove nose cone. Refer to 72-10-09, MAINTENANCE PRACTICES.

NOTE: If the intermediate gearbox assembly is to be removed from the engine, the planet carrier and gear assembly and intermediate gearbox assembly may be removed as an assembly. Refer to 72-10-13, MAINTENANCE PRACTICES. If there is no need to remove the intermediate gearbox assembly, planet carrier and gear assembly shall be removed as follows.

Discard mounting flange gaskets if installed.

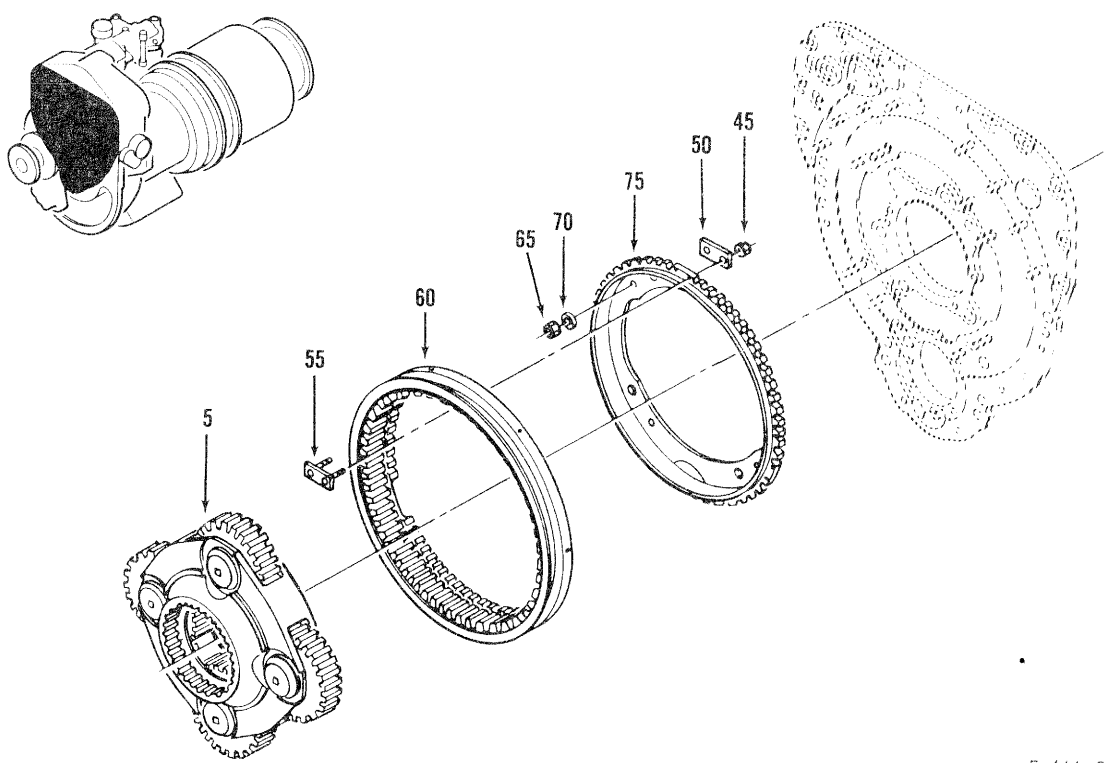
B. (Codes AA-AC, CA-CC, FA, KA, LA) Remove Planet Carrier and Gear Assembly (See Figure 201)

(1) Remove assembled matched planet gear and bearing set assembly.

(2) Remove nuts, retainer plates, plate assemblies and planetary gear.

(3) Remove nuts, washers, retainer ring and gasket.

R



5. PLANET CARRIER AND GEAR ASSY
R (IPC FIG. 139)
45. NUT
50. PLATE
55. PLATE ASSY
60. PLANETARY SPUR GEAR (RING GEAR)
65. NUT
70. WASHER
75. RING GEAR RETAINER

R (Codes AA-AC, CA-CC, FA KA, LA) Planet Carrier and Gears Assembly
Figure 201

R 1. C. (Codes BA-BC, EA, GA, HA) Remove Planet Carrier and Gear Assembly (See Figure 202)

(1) Remove nuts, washers and bolts securing assembled planet carrier and gear assembly to intermediate housing assembly.

(2) Remove packings and strainer elements.

R D. (Codes AA-AC, CA-CC, FA, KA, LA) Remove Diaphragm Oil Jets and Bull
R Gear Bearing Retainer (See Figure 203)

R (1) Remove bolts and washers securing oil jets and retainer.

R (2) Remove oil jets. Remove and discard packings from oil jets.

R (3) Remove retainer.

R E. (Codes BA-BC, EA, GA, HA) Remove Diaphragm Oil Jet, Oil Plug and Bull
R Gear Bearing Retainer (See Figure 204)

R (1) Remove bolts and washers securing oil jet, bearing retainer and oil
R plug retainer.

R (2) Remove oil jet. Remove and discard packing from oil jet.

R (3) Remove oil plug retainer and oil plug. Remove and discard packing
R from oil plug.

R (4) Remove bull gear bearing retainer.

R NOTE: Refer to 70-00-00, STANDARD PRACTICES, for recommended
R general torque values. Add frictional drag (run-down)
R torque of self-locking devices to recommended values.

R Lightly coat new packings with clean engine oil or lu-
R bricant (OS-124) prior to installation.

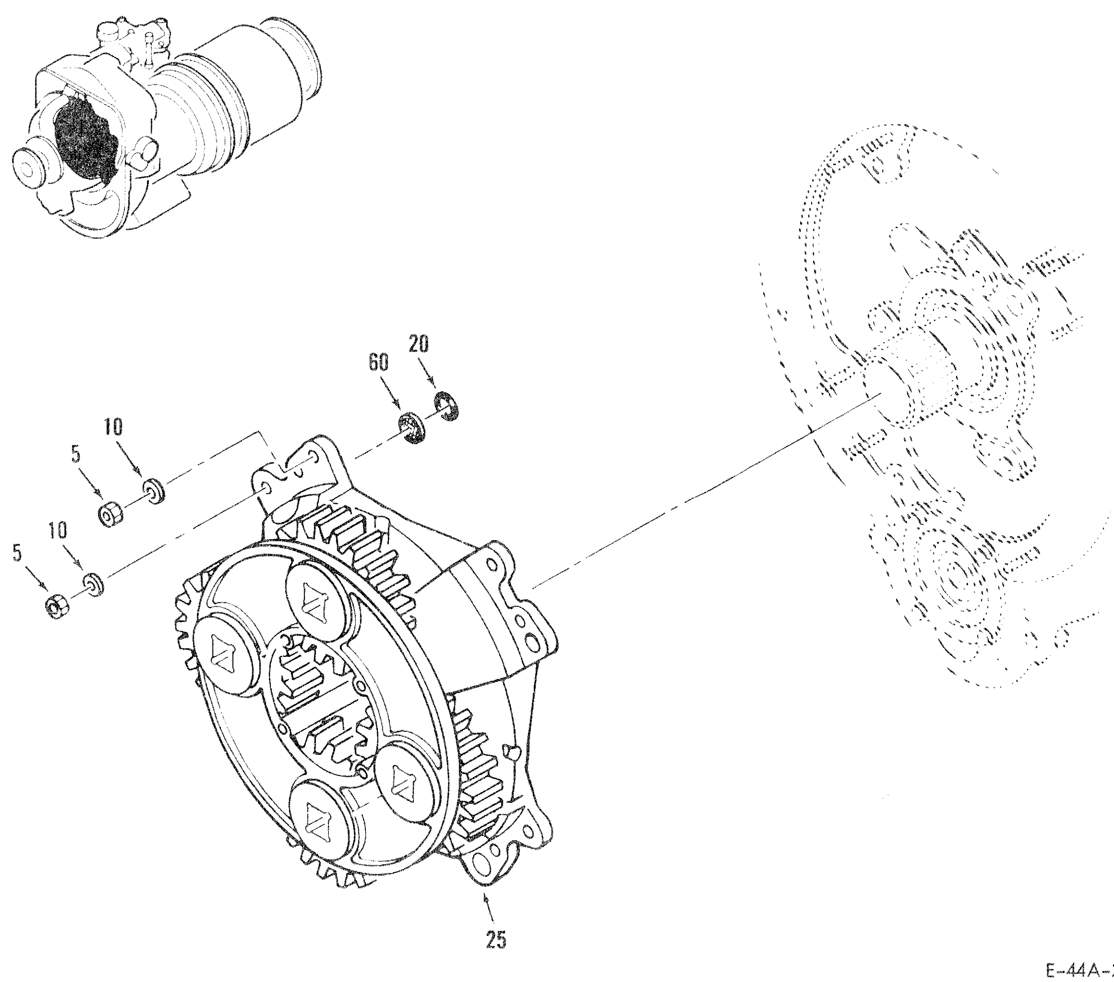
R F. (Codes AA-AC, CA-CC, FA, KA, LA) Install Diaphragm Oil Jets
R and Bull Gear Bearing Retainer (See Figure 203)

R (1) Install retainer.

R (2) Install new packings on oil jets. Install oil jets and
R secure with bolts and washers.

R (3) Tighten bolts (15, 45) to a torque value of 50 inch-
R pounds. Loosen bolts and retighten to 40 inch-pounds.

R

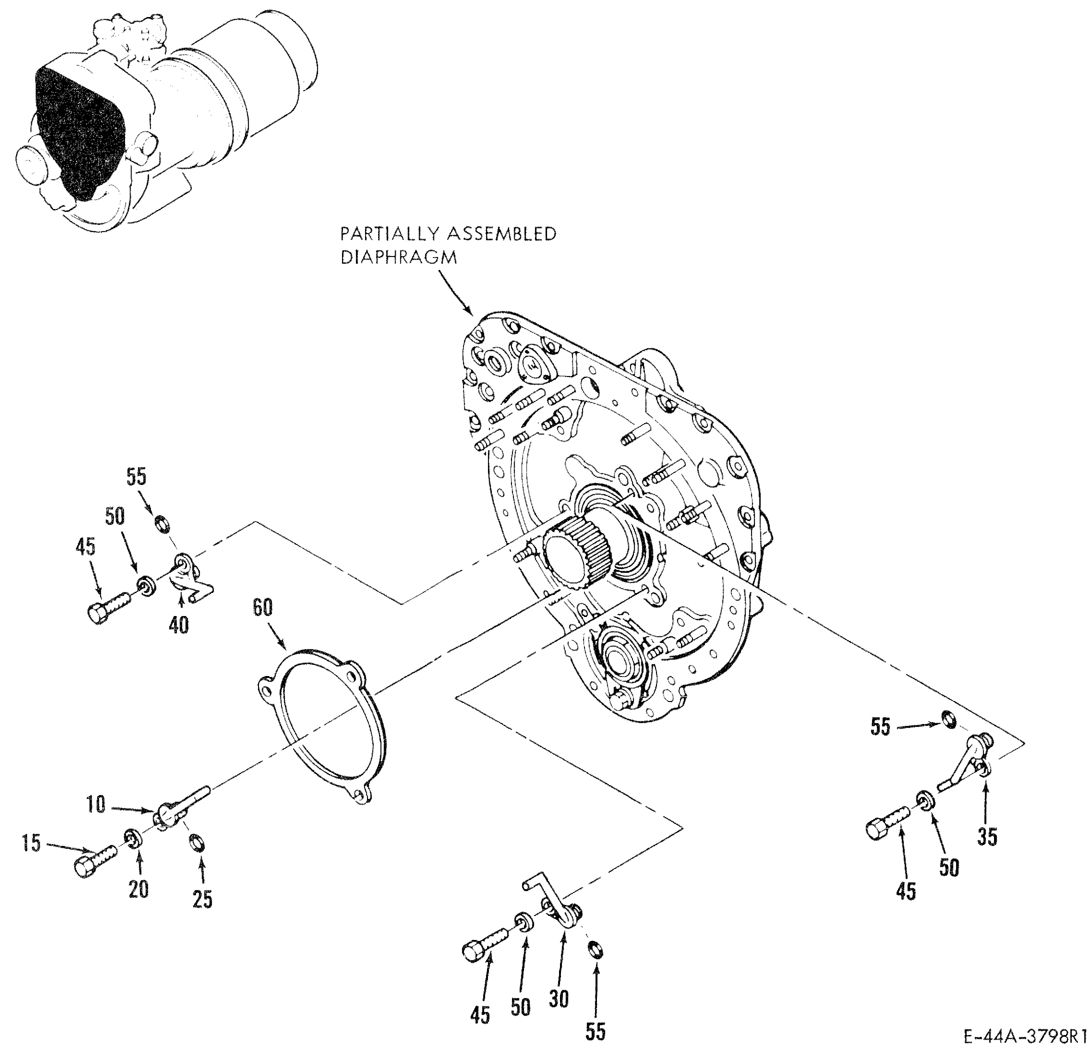


R 5. NUT (IPC FIG. 140)
R 10. WASHER
R 20. PACKING

25. PLANET CARRIER AND GEAR ASSY
60. STRAINER ELEMENT

R (Codes BA-BC, EA, GA, HA) Planet Carrier
and Gear Assembly
Figure 202

R

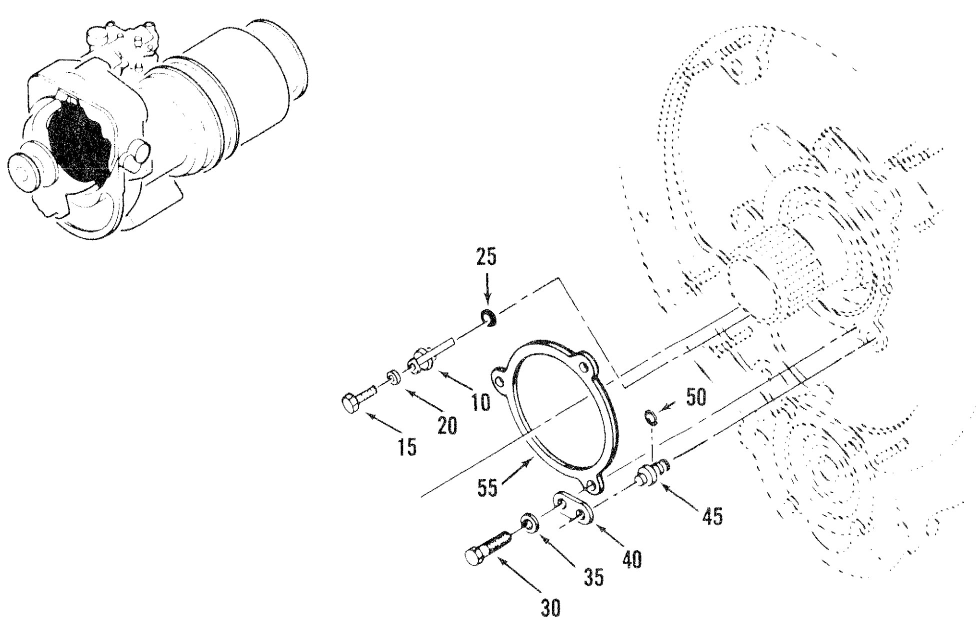


R 10. OIL JET ASSY (IPC FIG. 145)
R 15. BOLT
R 20. WASHER
R 25. PACKING
R 30. OIL JET ASSY
R 35. OIL JET ASSY

40. OIL JET ASSY
45. BOLT
50. WASHER
55. PACKING
60. RETAINER

R (Codes AA-AC, CA-CC, FA KA, LA) Diaphragm Oil Jets
R and Bull Gear Bearing Retainer Installation
Figure 203

R



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R 10. OIL JET ASSY (IPC FIG. 146)
R 15. BOLT
R 20. WASHER
R 25. PACKING
R 30. BOLT
35. WASHER
40. OIL PLUG RETAINER
45. OIL PLUG
50. PACKING
55. BEARING RETAINER

R (Codes BA-BC, EA, GA, HA) Diaphragm Oil Jet. Oil Plug and
R Bull Gear Bearing Retainer Installation
Figure 204

R 1. G. (Codes BA-BC, EA, GA, HA) Install Diaphragm Oil Jet, Oil Plug and Bull
R Gear Bearing Retainer (See Figure 204)

R (1) Install bearing retainer.

R (2) Install new packings on oil jet and oil plug. Install oil jet and
R oil plug. Install oil plug retainer.

R (3) Secure oil jet and oil plug retainer with bolts and washers.
R Tighten bolts (15, 30) to 50 inch-pounds. Loosen bolts and
R retighten to 40 inch-pounds.

R H. (Codes AA-AC, CA-CC, FA, KA, LA) Install Planet Carrier and Gear Assem-
R bly (See Figure 201)

NOTE: When aligning planetary spur gear (ring gear) teeth to ring gear retainer teeth, the missing tooth gap shall be to left of plate assembly when viewed from nut side of plate assembly.

When installing plate and plate assembly, place smaller surface of plate against teeth of gears with chamfered surface of plate and plate assembly inward toward center of ring gear retainer circle.

(1) Align gear teeth and install planetary spur gear (ring gear) onto ring gear retainer and secure with plate assembly, plate and nuts. Tighten nuts (45, figure 201) to 25 inch-pounds.

NOTE: When installing ring gear retainer on intermediate gearbox housing (diaphragm), position crescent shaped cut-out of ring gear retainer mounting flange, down (above high speed pinion bearing). Ensure no oil or foreign material exists on mounting surfaces of ring gear retainer and intermediate gearbox housing.

(2) Install assembled planetary spur gear and ring gear retainer onto intermediate gearbox housing (diaphragm) and secure with washers (70, figure 201) and nuts (65). Tighten nuts to 80 inch-pounds.

NOTE: To prevent planet carrier and gears assembly from inadvertently falling out of planetary spur gear (ring gear), install just prior to installing output gearbox housing.

(3) Install planet carrier and gears assembly into planetary spur gear.

R 1. I. (Codes BA-BC, EA, GA, HA) Install Planet Carrier and Gear Assembly (See Figure 202)

(1) Visually check to see that strainer elements are installed in openings on bottom of carrier legs, then install new packings.

CAUTION: IT IS EXTREMELY CRITICAL THAT ALL EVIDENCE OF OIL OR FOREIGN MATERIAL IS REMOVED FROM INTERFACING SURFACES OF PLANET CARRIER AND INTERMEDIATE GEARBOX PRIOR TO ASSEMBLY.

NOTE: Verify positions of packings just prior to metal-to-metal contact between carrier and intermediate gearbox assembly.

(2) Position carrier on intermediate gearbox assembly. Make certain that the packings and screen elements remain in place. Secure carrier with washers, bolts and nuts. Tighten nuts (5, figure 202) to 80 inch-pounds torque.

R J. Install Engine Components that were Removed to Gain Access to Planet
R Carrier and Gear Assembly

R (1) Install nose cone. Refer to 72-10-09, MAINTENANCE PRACTICES.

R (2) (Codes BA-BC, EA-LA) Install start fuel regulator. Refer to 73-
R 10-03, MAINTENANCES PRACTICES.

R (3) Install propeller pitch control. Refer to 72-10-02, MAINTENANCE
R PRACTICES.

R (4) Install beta tube. Refer to 72-10-01, MAINTENANCE PRACTICES.

2. Inspection/Check

A. Planet Carrier and Gear Assembly (See Figure 201, 202)

(1) Inspect gear and bearing sets for freedom of rotation and for chipped or broken teeth or unusual wear pattern. Inspect carrier for cracks or breaks.

R (2) (Codes BA-BC, EA, GA, HA) Inspect strainer elements for contamination or damage that may affect function.

(3) Inspect oil jet assemblies for contamination or damage that may affect oil flow.

R (4) (Codes BA-BC, DA, GA, HA) Inspect carrier assembly face that mates with intermediate gearbox assembly (diaphragm) for areas of wear. Maximum allowable wear in any area shall not exceed 0.003 inch.

(5) Replace part that does not meet Inspection/Check requirements.

3. Cleaning/Painting

A. Clean Component Parts

(1) Clean all standard metallic hardware in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Methods No. 1 or 2.

(2) Clean planet carrier and gear assembly in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Methods No. 1 or 2.

(3) Clean jet assembly in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 12.

INTERMEDIATE GEARBOX ASSEMBLY (DIAPHRAGM) - MAINTENANCE PRACTICES

1. Removal/Installation

NOTE: Table 201 provides a list of special tools, fixtures and equipment required for Remvoval/Installation Table 202 provides a list of materials and compounds required for Removal/Installation.

Table 201. Special Tools, Fixtures and Equipment

Item No.	Nomenclature	Use	Source/ Part No.
NOTE: Equivalent substitutes may be used for listed items.			
1.	Shaft Holder	Used to hold propeller shaft when removing and installing retaining nut and bearing components. Also used in conjunction with 285774-1-1, gear holder, while removing bearing retainer.	284172-1-1
2.	Bearing and Bushing Driver	Used to install bearing in diaphragm housing.	284184-1-1
3.	Mechanical Puller	Used to separate diaphragm from accessory drive housing.	284192-1-1
4.	Bearing and Bushing Driver	Used to install bearings on idler gearshaft.	284475-1-1
5.	Bearing and Bushing Driver	Used to press bearing on internally splined end of starter-generator spur gearshaft.	285162-1-1
6.	Bearing and Bushing Driver	Used to press bearing on end opposite internal splines of starter-generator spur gearshaft.	285163-1-1
7.	Bearing and Bushing Driver	Used to press larger bearing on tachmometer driver gearshaft.	285177-1-1

Table 201. Special Tools, Fixtures and Equipment (Cont)

Item No.	Nomenclature	Use	Source/ Part No.
8.	Bearing and Bushing Driver	Used to install or remove bearing on tachometer drive gearshaft.	285178-1-1
9.	Bearing and Bushing Driver	Used to press bearing on propeller governor spur gear.	285180-1-1
10.	Bearing and Bushing Driver	Used to press bearing on hydraulic pump spur gearshaft.	285181-1-1
11.	Gear Holder	Used to hold idler spur gearshaft while removing or installing bearing retainer.	285774-1-1
12.	Bearing Pressing Holder	Used to hold various bearings while removing or installing gearshafts.	285812-1-1
13.	Bearing and Bushing Driver	Used to press gearshaft from bearings.	285813-1-1
14.	Bearing and Bushig Driver	Used to press gearshaft from bearings.	285814-1-1
15.	Bearing Roller Guide	Used to retain rollers of bull gear bearing when diaphragm halves are separated.	287425-1-1

Table 202. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Any approved engine oil	Commercially available
Grease (DC-11)	Dow Corning Corp, S Saginaw Rd, Midland, MI 48640
Lubricant (OS-124)	Monsanto Company, 800 N Lindbergh Blvd, St. Louis, MO 63166
Lubricating compound (Liqui-Moly, Grade NV)	Lockrey Co, Lubricants Div, Cedar Shores, Southampton, NY 11968

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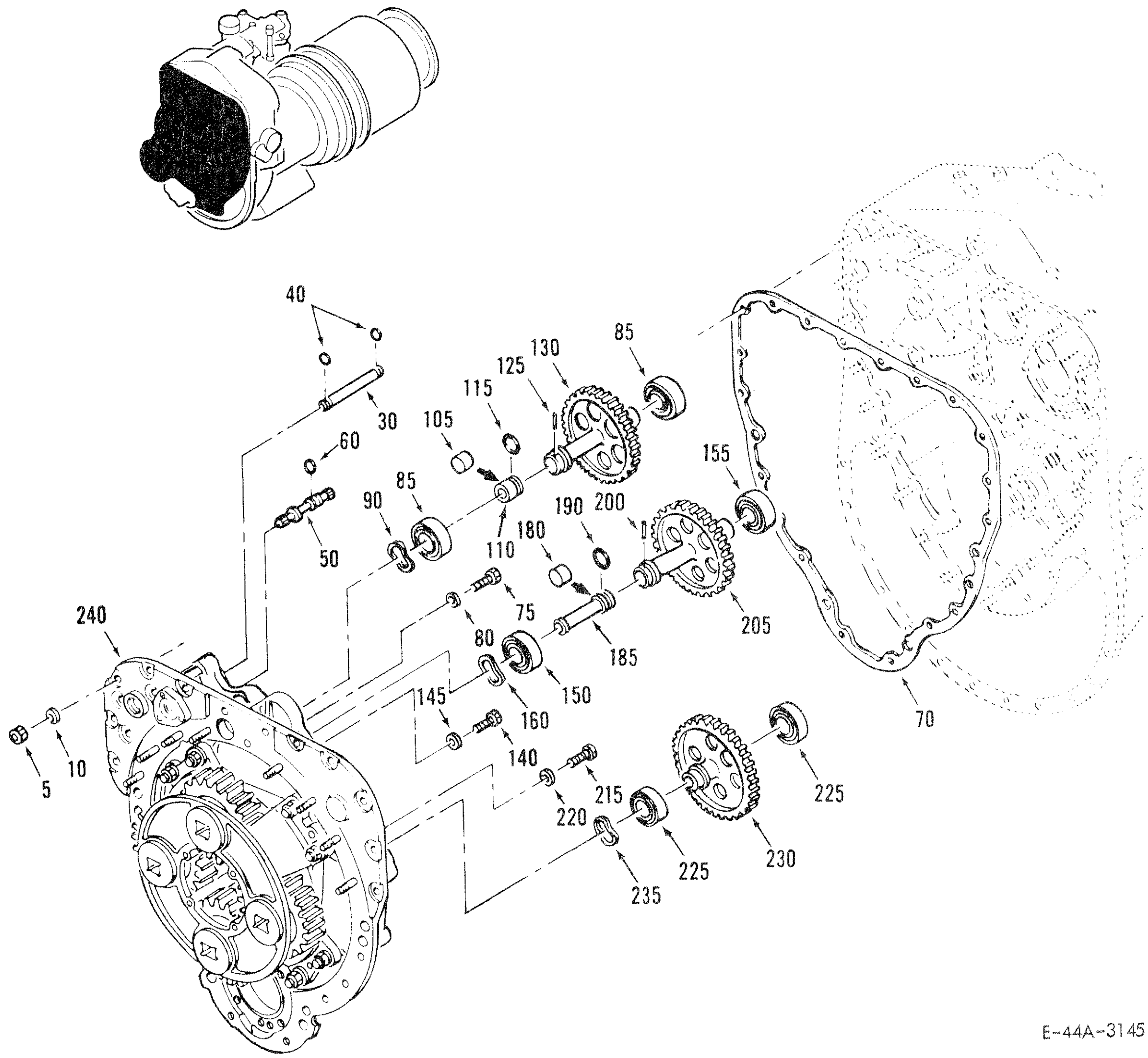


R 5. NUT (IPC FIG. 136)
10. WASHER
30. TUBE ASSY
40 PACKING
50. SHOULDERED DRIVE SHAFT
60. PACKING
70. GASKET
75. BOLT
80. WASHER
85. BEARING
90. SPRING WASHER
105. PLUG
110. SEAL PLUG
115. PACKING
125. PIN
130. SPUR GEARSHAFT
140. BOLT
145. WASHER
150. BEARING
155. BEARING
160. SPRING WASHER
180. PLUG
185. SEAL PLUG
190. PACKING
200. PIN
205. SPUR GEARSHAFT
215. BOLT
220. WASHER
225. BEARING
230. PROPELLER GOVERNOR SPUR GEAR
235. SPRING WASHER
240. INTERMEDIATE GEARBOX ASSY (DIAPHRAGM)

Diaphragm Installation
Figure 201

1. A. Remove Intermediate Gearbox Assembly (Diaphragm) and Disassemble as Required

NOTE: To remove intermediate gearbox to facilitate other maintenance, accomplish paragraph 1.A.(1) only. Refer to 72-10-14, MAINTENANCE PRACTICES for further engine disassembly.

Removal of the intermediate gearbox assembly (diaphragm) requires determination of existing engine torque indicating system calibration values. Prior to removal of intermediate gearbox assembly (diaphragm), perform engine pre-teardown calibration in accordance with 72-00-00, ADJUSTMENT/TEST. When intermediate gearbox assembly (diaphragm) is reinstalled, torque sensor calibration shall be performed in accordance with 72-10-16, ADJUSTMENT/TEST and engine post-teardown calibration in accordance with 72-00-00, ADJUSTMENT/TEST.

(1) Remove intermediate gearbox (diaphragm) assembly as follows. (See figure 201.)

R (a) Remove beta tube assembly. Refer to 72-10-01, MAINTENANCE
R PRACTICES.

R (b) Remove propeller pitch control. Refer to 72-10-02, MAINTEN-
R ANCE PRACTICES.

R (c) (Codes BA-BC, EA-LA) Remove start fuel pressure regulator.
R Refer to 73-10-03, MAINTENANCE PRACTICES.

R (d) Remove nose cone assembly. Refer to 72-10-09, MAINTENANCE
R PRACTICES.

R (e) Remove oil vent. Refer to 79-20-06, MAINTENANCE PRACTICES.

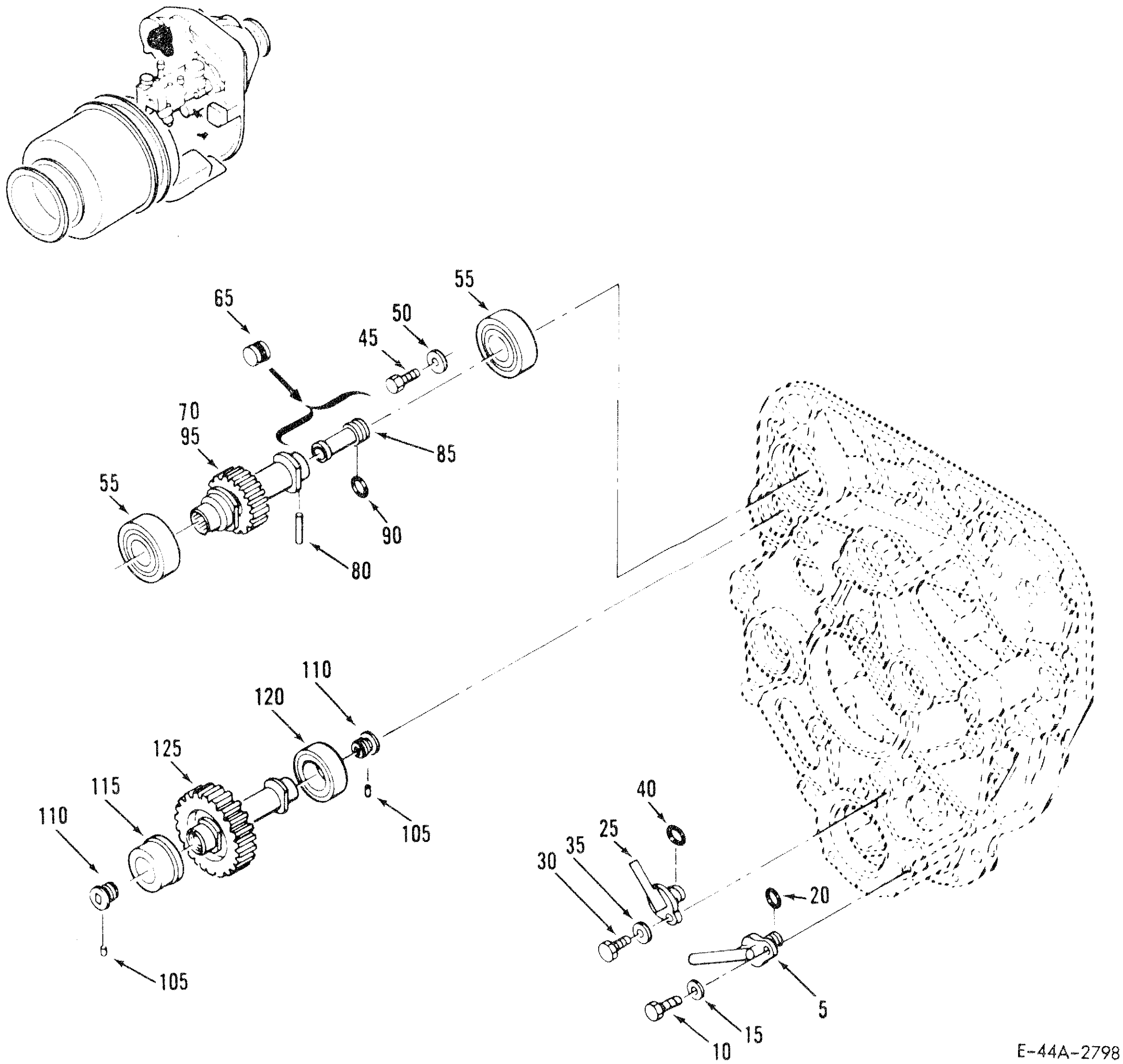
R (f) Remove oil transfer tube, oil jet and lubrication adapter.
R Refer to 72-10-10, MAINTENANCE PRACTICES.

R (g) Remove tosion spline (quill) shaft and coupling assembly.
R Refer to 72-10-11, MAINTENANCE PRACTICES.

R (h) Remove planet carrier and gear assembly. Refer to 72-10-12,
R MAINTENANCE PRACTICES.

R (i) Remove nuts and washers securing intermediate gearbox assembly
R to engine.

R



R 5. OIL JET (IPC FIG. 137)
10. BOLT
15. WASHER
20. PACKING
25. OIL JET
30. BOLT
35. WASHER
40. PACKING
45. BOLT
50. WASHER
55. BEARING
65. PLUG
70. GEARSHAFT
80. PIN
85. PLUG
90. PACKING
95. GEARSHAFT
105. PLUG
110. RETAINER
115. BEARING (INNER RACE)
120. BEARING
125. IDLER GEARSHAFT

Oil Jets and Starter-Generator Drive Gears Installation
Figure 202

NOTE: Use care when removing intermediate gearbox assembly (diaphragm) to prevent torque sensor spur gear and cam assembly from dropping out of engine.

1. A. (1) (j) Position lip of 284192-1-1 pullers under edge of intermediate gearbox assembly (diaphragm). Tighten jackscrews of pullers evenly and remove intermediate gearbox assembly with assembled gearshafts. Remove gasket between intermediate gearbox assembly and engine.

NOTE: Disassemble only as far as necessary to accomplish required maintenance. If no maintenance is required in this area, proceed to step (3).

(2) Remove shoulder drive shaft and spur gearshaft assemblies as follows. (See figure 201.)

(a) Remove shoulder drive shaft and packing.

(b) Remove tube assemblies and packings.

(c) Remove screws and washers securing assembled bearings and gearshaft assemblies to intermediate gearbox assembly. Remove assembled bearings and gearshaft assemblies. Press bearings from gearshaft assemblies using 285814-1-1 driver and 285812-1-1 holder.

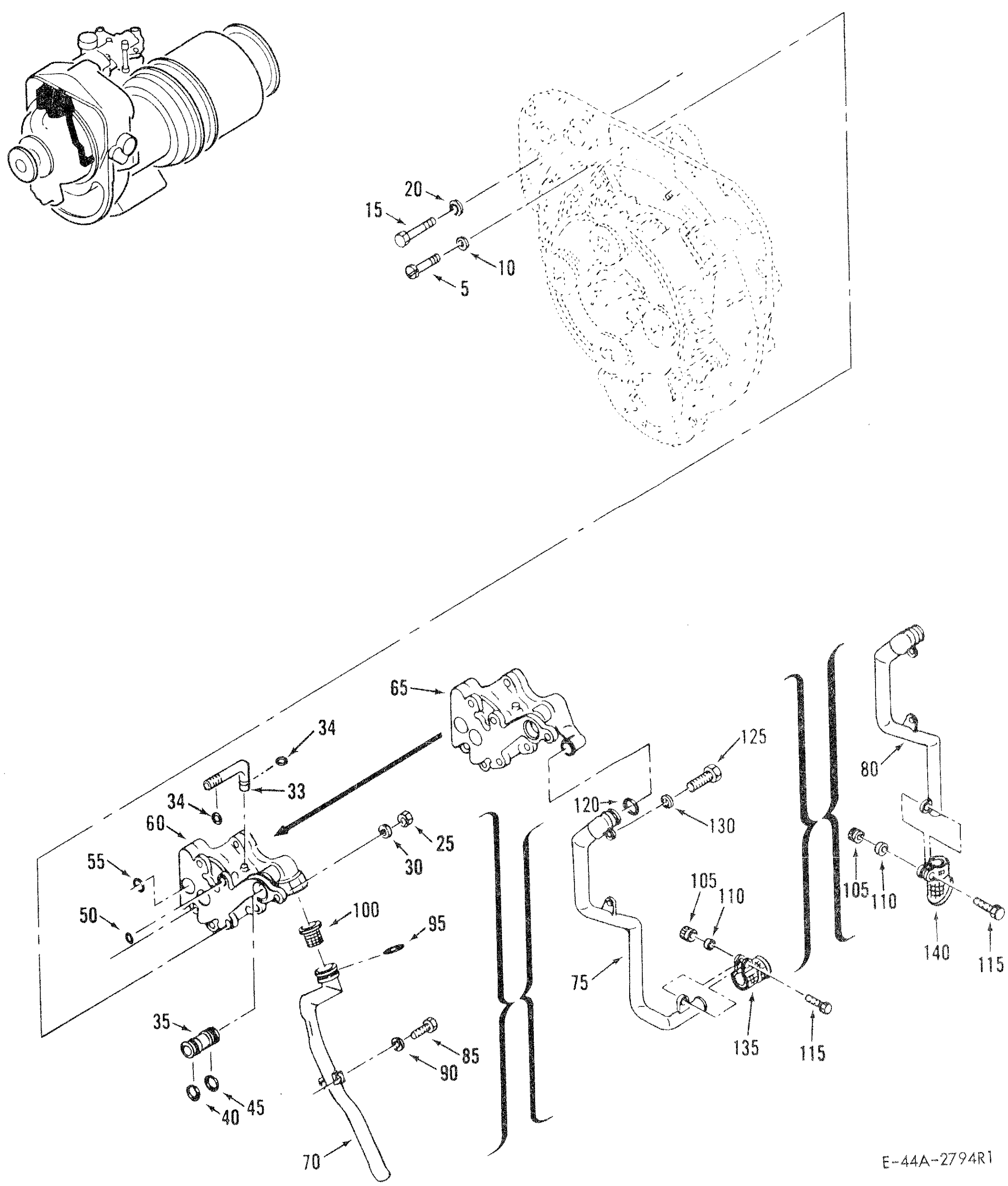
NOTE: Disassemble only as far as necessary to accomplish required maintenance. If no maintenance is required in this area, proceed to step (4).

(3) Remove oil jets and stater-generator drive gears as follows. (See figure 202.)

(a) Remove bolts and washers securing oil jets. Remove oil jets and packings. Discard packings.

(b) Remove screw and washer securing assembled bearings and gearshaft assemblies to intermediate gearbox assembly.

(c) Remove assembled bearings and starter-generator idler gearshaft from intermediate gearbox assembly. Install starter-generator idler gearshaft assembly in 284172-1-1 and 285774-1-1 holders. Remove retainers. Remove starter-generator idler gearshaft from holders.



Gearcase Oil Scavenge Pump and Plumbing Installation
Figure 203

1. A. (3) (d) Install 285812-1-1 holder on starter-generator idler gearshaft and remove inner race of aft bearing using 285814-1-1 driver. Remove forward bearing.

(e) Remove assembled bearings and starter-generator drive gearshaft. Press bearings from starter-generator drive gear-shaft using 285814-1-1 driver and 285812-1-1 holder.

NOTE: Disassemble only as far as necessry to accomplish required maintenance. If no maintenance is required in this area proceed to step (5).

(4) Remove gearcase oil scavenge pump and plumbing as follows. (See figure 203.)

R NOTE: Scavenge Tube Part No. 869457-1 can be
R replaced without disassembly of diaphragm.
R To replace Scavenge Tube Part No. 896863-1 or
R 3101336-1, diaphragm must be disassembled in
R accordance with step 1.A.(6).

(a) Remove bolts and washers securing scavenge tube and remove scavenge tube, packing and screen.

(b) Remove nuts, bolts. washers, and packings with retainers securing gearcase oil scavenge pump.

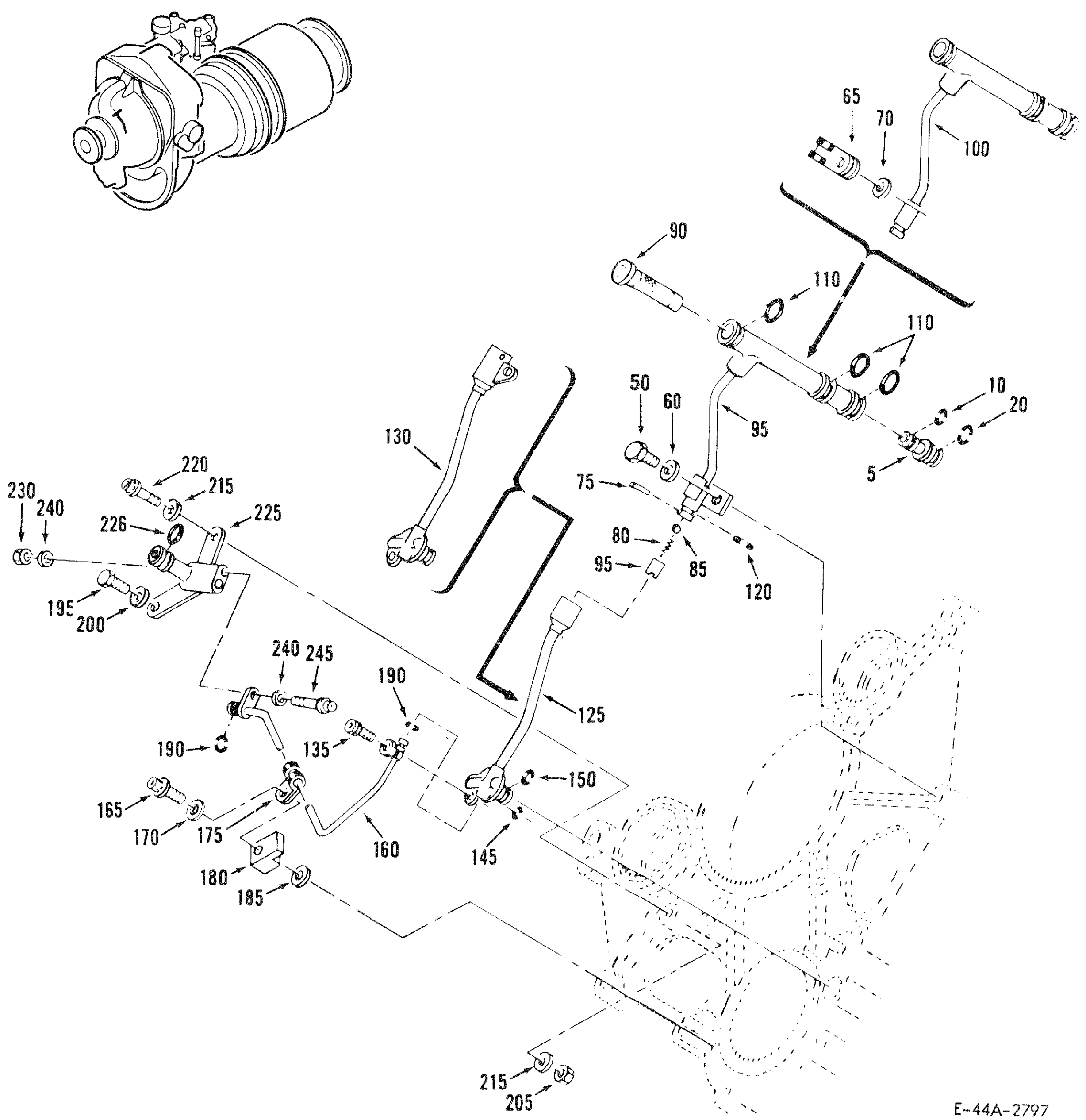
(c) Remove gearcase oil scavenge pump and discard pump packings.

(d) Remove tube (33) from scavenge pump, remove packings from tube.

(e) Remove transfer tube (35) and packings.

KEY TO FIGURE 203

R 5.	BOLT (IPC FIG. 141)	45.	PACKING	95.	PACKING
10.	WASHER	50.	PACKING	100.	SCREEN
15.	BOLT	55.	PACKING	105.	NUT
20.	PACKING (WITH RETAINER)	60.	SCAVENGE PUMP	110.	WASHER
25.	NUT	65.	SCAVENGE PUMP	115.	BOLT
30.	WASHER	70.	SCAVENGE TUBE	120.	PACKING
33.	TUBE	75.	SCAVENGE TUBE	125.	BOLT
34.	PACKING	80.	SCAVENGE TUBE	130.	WASHER
35.	TRANSFER TUBE	85.	BOLT	135.	SCREEN
40.	PACKING	90.	WASHER	140.	SCREEN



R

R (Post SB72-0064) (Pre SB72-0162/0163/0169) Diaphragm
Oil Supply Tube Installation
Figure 204

R 1. A. (5) (Post SB72-0064) (Pre SB72-0162/0163/0169) Remove diaphragm oil supply tubes as follows. (See figure 204.)

(a) Remove oil transfer tube (5) from oil tube (95 or 100). Remove packings.

(b) Remove bolts, washers and clamps securing oil tubes, oil supply tubes and oil transfer tube to intermediate gearbox housing.

(c) Remove packings from tubes.

(d) Remove pin from oil supply tube and remove spring and ball.

(e) Remove bearing retainer.

(f) Remove nuts, washers and bolts securing restrictor assembly to intermediate gearbox assembly. Remove restrictor assembly.

KEY TO FIGURE 204

R 5. TRANSFER TUBE (IPC FIG. 138)
10. PACKING
20. PACKING
50. BOLT
60. WASHER
65. CLAMP
70. WASHER
75. PIN
80. SPRING
85. BALL
90. STRAINER
95. OIL TUBE
100. OIL TUBE
110. PACKING
120. PACKING
125. OIL SUPPLY TUBE
130. OIL SUPPLY TUBE
135. BOLT
145. PACKING
150. PACKING
160. TRANSFER TUBE
165. BOLT
170. WASHER
175. CLAMP
180. RETAINER
185. WASHER
190. PACKING
195. BOLT
200. WASHER
205. NUT
215. WASHER
220. BOLT
225. RESTRICTOR ASSY
226. PACKING
230. NUT
240. WASHER
245. BOLT

CAUTION: DO NOT SEPARATE DIAPHRAGM HALVES OF DIAPHRAGMS THAT DO NOT HAVE ENCASED HIGH SPEED PINION ASSEMBLY.

NOTE: The diaphragm may be partially disassembled to accomplish Approved Repairs or to accomplish inspections defined in 72-00-00, INSPECTION/CHECK. Do not remove or disassemble high speed pinion. Do not disassemble bull and sun gear assembly. If high speed pinion or bull and sun gear bearings are found to be damaged, return diaphragm to an overhaul facility. If bull and sun gear assembly or diaphragm housings are damaged beyond repair authorized in Approved Repairs, return diaphragm to an authorized overhaul facility.

1. A. (6) Disassemble diaphragm for inspection or repair as follows. (See figure 205, 206 or 207.)

(a) Remove nuts, bolts, and washers securing diaphragm halves.

NOTE: It may be necessary to apply heat to housing halves and use jackscrew to separate housing halves.

(Pre SB72-0162/0163/0169) Diaphragm housings will separate with sun and bull gears retained in forward housing half.

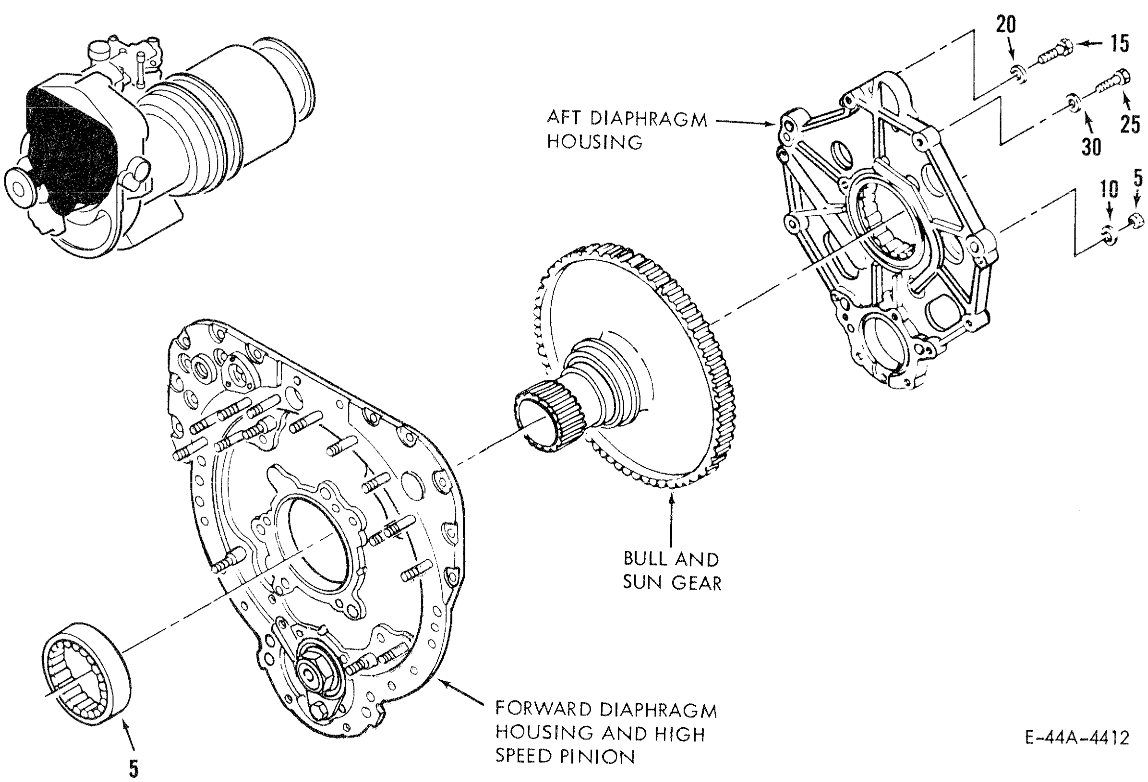
(Post SB-0162/0163/0169) Diaphragm housings will separate with sun and bull gears retained in aft housing half.

(b) Separate diaphragm housing halves. Apply heat, if necessary with propane torch. Do not exceed 93C (200F). Use jackscrews to aid in separating housing halves. Install 287425-1-1 bearing roller guide into bearing to prevent rollers from falling out.

CAUTION: WHEN SUN AND BULL GEAR ASSEMBLY IS SEPARATED FROM HOUSING HALF, THE INTERNAL COMPONENTS OF HIGH SPEED PINION MAY SEPARATE IF NOT SECURED.

(c) Using plastic tie wraps, secure high speed pinion components by tying gearshaft to high speed pinion housing.

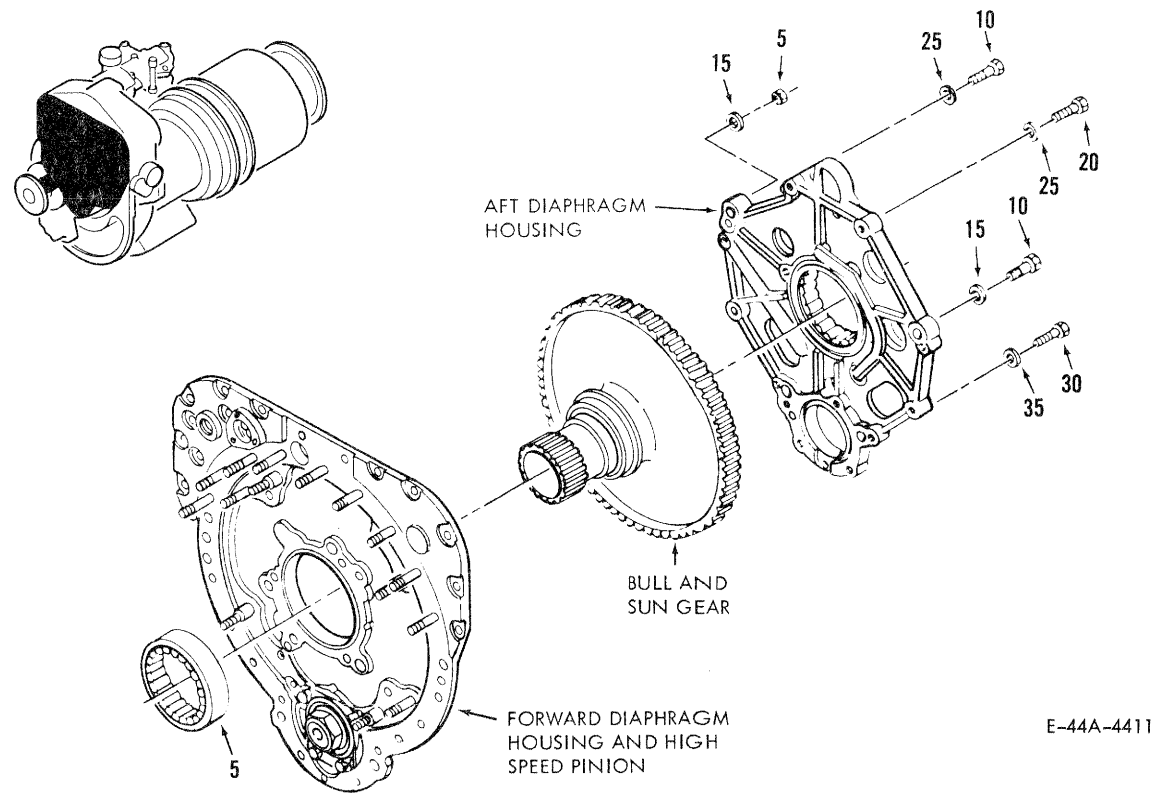
R



R 5. BEARING (IPC FIG. 145 OR 146)
R 5. NUT (IPC FIG. 142)
R 10. WASHER
R 15. BOLT
20. WASHER
25. BOLT
30. WASHER

R (Pre SB72-0064) Separating Diaphragm Housing Halves and
R Removing Bull and Sun Gear
R Figure 205

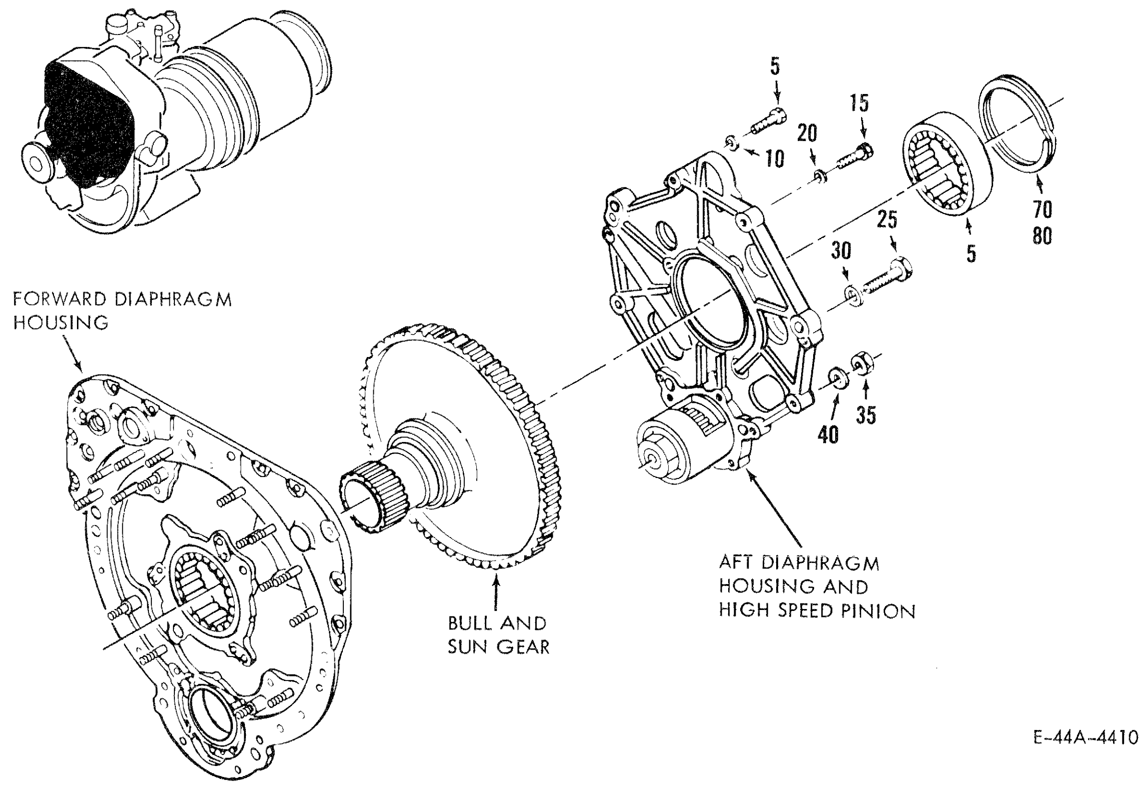
R



R	5. BEARING (IPC FIG. 145 OR 146)	20. BOLT
R	5. NUT (IPC FIG. 143)	25. WASHER
R	10. BOLT	30. BOLT
R	15. WASHER	35. WASHER

R (Post SB72-0064) (Pre SB72-0162/0163/0169) Separating
R Diaphragm Housing Halves and Removing Bull and Sun Gear
R Figure 206

R



R 5. BEARING (IPC FIG. 145 OR 146)
R 5. BOLT (IPC FIG. 144)
R 10. WASHER
R 15. BOLT
R 20. WASHER
R 25. BOLT
30. WASHER
35. NUT
40. WASHER
70. RETANER RING (IPC FIG. 146)
80. RETAINER RING (IPC FIG. 145)

R (Post SB72-0162/0163/0169) Separating Diaphragm Housing
R Halves and Removing Bull and Sun Gear
R Figure 207

R 1. A. (6) (d) (Pre SB72-0162/0163/0169) Remove oil jet and front bearing retainer. Refer to 72-10-12, MAINTENANCE PRACTICES.

R (e) (Post SB72-0162/0163/0169) Remove aft bearing ring retainer (70, 80 figure 207).

R CAUTION: REMOVAL OF BEARING MAY REQUIRE INSERTING A SOFT METAL ROD THROUGH HOLES IN BULL GEAR AND LIGHTLY TAPPING AGAINST BEARING OUTER RACE, USING CARE NOT TO DAMAGE BEARING.

R (f) (Pre SB72-0162/0163/0169) (Pre and Post SB72-0064) Remove bearing from forward diaphragm housing half.

R (g) (Post SB72-0162/0163/0169) Remove bearing from aft diaphragm housing half.

R (h) Separate bull and sun gear from diaphragm housing half.

R B. Assemble and Install Intermediate Gearbox Assembly (Diaphragm)

R (1) (Pre SB72-0162/0163/0169) Install bull and sun gear and assemble diaphragm housing halves as follows. (See figure 205 or 206.)

R (a) Place forward diaphragm housing with high speed pinion onto bench with aft side up. Remove plastic tie wrap from high speed pinion.

R (b) Install bull and sun gear into forward diaphragm housing, meshing teeth of bull gear with high speed pinion gearshaft.

R (c) Install aft diaphragm housing over bull and sun gear and secure to forward half of diaphragm with washers, nuts, and bolts.

R (d) Rotate diaphragm on bench with forward housing up.

R (e) Using 284184-1-1 driver, hand press bearing onto forward half of diaphragm.

R (f) Install oil jet and bearing retainer. Refer to 72-10-12, MAINTENANCE PRACTICES.

R 1. B. (1) (g) (Pre SB72-0064) Rotate diaphragm on bench with aft side up. Tighten bolts (15, 25, figure 205) to torque value of 100 inch-pounds. Tighten nuts (5) to torque value of 80 inch-pounds.

R (h) (Post SB72-0064) Rotate diaphragm on bench with aft side up. Tighten bolts (10, 20, 30, figure 206) to torque value of 100 inch-pounds. Tighten nuts (5) to torque value of 80 inch-pounds.

R (2) (Post SB72-0162/0163/0169) Install bull and sun gear and assemble diaphragm housing halves as follows. (See figure 207.)

R (a) Place aft diaphragm housing and high speed pinion onto bench with forward face up. Remove plastic tie wrap from high speed pinion.

R (b) Install bull and sun gear into aft diaphragm housing, meshing teeth of bull gear with high speed pinion gearshaft.

R (c) Install forward diaphragm housing over bull and sun gear and secure to aft diaphragm housing with washers, bolts, and nuts.

R (d) Rotate diaphragm on bench with aft side up.

R (e) Using 284184-1-1 driver, hand press bearing into aft half of diaphragm. Install bearing retainer ring.

R (f) Tighten nuts (35) to torque value of 80 inch-pounds. Tighten bolts (5, 15, 25) to torque value of 100 inch-pounds.

R NOTE: Lightly coat new packings with any approved engine oil or lubricant (OS-124) prior to installation.

R (3) (Post SB72-0064) (Pre SB72-0162/0163/0169) Install oil supply tube as follows. (See figure 204.)

R (a) Install restrictor assembly on intermediate gearbox assembly (diaphragm) and secure with bolts and washers. Tighten bolt (195) to 100 inch-pounds torque. Tighten bolt (220) to 25 inch-pounds torque.

R NOTE: Step (b) applies to Oil Tube (130) Part No. 3101605-1 only.

R (b) Perform pre-installation check of Oil Tube Part No. 3101605-1 as follows.

1. B. (3) (b) 1 Place oil tube (without packings) into proper position.

CAUTION: THIS CAUTION APPLIES TO INITIAL INSTALLATION OF OIL TUBE PART NO. 3101605-1 ONLY. IF THE CAST-IN RIB ON THE INTERMEDIATE GEARBOX HOUSING (DIAPHRAGM) INTERFERES WITH THE END OF TUBE (END WHICH MATES WITH TUBE PART NO. 3101187 OR 3101475) THE EXCESS MAGNESIUM MUST BE REMOVED. THE BARE MAGNESIUM MUST BE TOUCHED UP PER INSTRUCTIONS PROVIDED IN APPROVED REPAIRS.

2 Install Bolt (50) Part No. MS9490-26 in end of tube which mates with Tube Part No. 3101187 or 3101475 and tighten to a torque value of 100 inch-pounds.

3 If a gap appears between the aft face of high speed pinion bearing carrier and the face of oil tube where attaching bolt is to be installed, measure the space with a feeler gage. A gap of 0.015 inch or less is acceptable.

4 If no gap appears in step 3, remove bolt (50) and install bolt (135) in bearing carrier end of tube and tighten to a torque value of 40 inch-pounds. Measure gap between top mounting flange and intermediate gearbox housing. A gap of 0.003 inch or less is acceptable.

5 If gaps in steps 3 and 4 are not within tolerance repeat steps 1 through 4 with a different tube (same part number).

(c) Install ball, spring, retainer, pin, screen and packings, onto oil tube (95 or 100). Install tube.

(d) Place packings on transfer tube (5) and install transfer tube.

NOTE: See step (b) for special pre-installation check for Oil Supply Tube (130) Part No. 3101605-1.

(e) Place packings on oil supply tube (125 or 130). Slide end of oil supply tube over end of oil tube (95 or 100) and position into mounting position and secure with bolt (50) tighten bolt (50) to a torque value of 100 inch-pounds. After bolt (50) is tightened tighten bolt (135) to 40 inch-pounds.

(f) Prior to installing oil transfer tube (160) place retainer in positon on intermediate gearbox housing using bolt (165) to aid alignment. Determine amount of washers (185) needed to obtain 0.000 to 0.020 inch loose fit between retainer (180) and round retainer that retains journal bearing.

1. B. (3) (g) Install new packing on oil transfer tube and install tube. Install clamp, retainer, washers (170, 185) (exact amount of washers (185) as determined in step (f)) and secure with bolt. Tighten bolt (245) to a torque value of 25 inch-pounds. Tighten bolt (165) to a torque value of 40 inch-pounds.

(4) Install oil scavenge pump and plumbing as follows. (See figure 203.)

(a) Install new packings on tube (33) and transfer tube (35). Install tubes onto scavenge pump.

(b) Install new packings (50, 55) onto scavenge pump. Install scavenge pump and secure with nut, bolts, washers, and packings (with retainers). Tighten nut (25) and bolts (5, 15) to torque value of 70 inch-pounds.

(c) (Engines with Scavenge Tube Part No. 869457-1) Install screen into pump. Install new packing onto scavenge tube. Install scavenge tube and secure with bolts and washers. Tighten bolts (85) to torque value of 40 inch-pounds.

(d) (Engines with Scavenge Tubes Part No. 896863-1 or 3101336-1) Install screen onto scavenge tube and secure with bolt, nut and washer. Tighten nut (105) to torque value of 25 inch-pounds. Tighten bolts (85, 125) to torque value of 40 inch-pounds.

(5) Install starter-generator and idler spur gearshaft assemblies as follows. (See figure 202.)

(a) Install starter-generator idler gearshaft as follows.

1 Install plugs (Nyloc) into holes in retainers and dress smooth to threads.

2 Place starter-generator idler gearshaft on 285774-1-1 holder. Press forward bearing and inner race of aft bearing on starter-generator idler gearshaft using 284475 1-1 driver. Install aft bearing inner race with serial number next to shoulder of gearshaft. Apply lubricating compound (Liqui-Moly, Grade NV) to face and threads of retainers then install into each end of starter-generator idler gearshaft. Tighten retainer (110) to 450 inch-pounds torque.

3 Install assembled gearshaft into intermediate gearbox assembly and secure with washer and bolt.

(b) Install starter-generator drive gearshaft as follows.

1. B. (5) (b) 1 Press bearings onto each end of starter-generator drive gearshaft using 285812-1-1 holder and 285162-1-1 driver on internally splined end and 285163-1-1 driver on opposite end.

2 Remove washer and bolt installed in step (a) 3.

3 Install starter-generator drive gearshaft with assembled bearings into intermediate gearbox assembly. Secure both gearshaft assemblies with washer and bolt. Tighten bolt (45) to 25 inch-pounds torque.

(c) (Pre SB72-0064) Install new packings on oil jets (15, 25). Install oil jets into intermediate gearbox assembly. Secure with washers and bolts. Tighten bolts (10, 30) to 40 inch-pounds torque.

(d) (Post SB72-0064) Install new packing on oil jet (5). Install oil jet into intermediate gearbox, secure with washer and bolt. Tighten bolt (10) to torque value of 50 inch-pounds, loosen and retightn to torque value of 40 inch-pounds.

(6) Install shoulder driveshaft and spur gearshaft assemblies as follows. (See figure 201.)

(a) Assemble shoulder drive shaft and spur gearshaft assemblies as follows.

1 Press bearings on tachometer drive spur gearshaft using 285177-1-1 and 285178-1-1 drivers. Press bearings on propeller governor spur gear using 285180-1-1 driver. Press bearings on hydraulic pump spur gearshaft using 285181-1-1 driver.

2 Install tension washers and assembled bearings and gearshaft assemblies into intermediate gearbox assembly. Secure with washers and bolts. Tighten bolts (75, 140, 215) to 50 inch-pounds torque. Loosen and retighten to a torque value of 40 inch-pounds.

CAUTION: MAKE CERTAIN THAT GEARSHAFT IS INSTALLED WITH PACKING GROOVE END INTO OIL PRESSURE PUMP.

(b) Install new packing on shouldered driveshaft and install into pump.

(c) Install new packings on tube assembly (30), then install tube assembly into accessory housing. Install guide pins in tube assembly (30) to aid installation of diaphragm (pin to be removed after gearbox installed).

1. B. (7) Install intermediate gearbox assembly (diaphragm) as follows. (See figure 201.)

(a) Wash gasket thoroughly with soap and water to remove precoated compound, then coat gasket with grease (DC-11). Install gasket on accessory housing.

CAUTION: DO NOT USE FORCE WHEN INSTALLING INTERMEDIATE GEARBOX ASSEMBLY (DIAPHRAGM).

(b) Carefully install diaphragm assembly with assembled parts. Ease assembly into place using guide pins installed on tube assembly (30) as guides.

NOTE: Do not tighten nuts until installation of output gearbox housing. Final tightening to be accomplished in sequence with output gearbox housing retaining nuts.

(c) Install washers and nuts to secure intermediate gearbox assembly to studs of accessory housing. Tighten intermediate gearbox retaining nuts to a torque value of 80 inch-pounds.

(d) Remove guide pins.

(e) Perform torque sensor assembly calibration in accordance with 72-10-16, Adjustment/Test following installation of intermediate gearbox assembly (diaphragm).

(f) Install planet carrier and gear assembly. Refer to 72-10-12, MAINTENANCE PRACTICES.

2. Inspection/Check

A. Inspect Intermediate Gearbox Assembly (Diaphragm) (See Figures 201, 208, 209, 210)

(1) Inspect diaphragm components for binding of assembled gearing or unusual wear patterns.

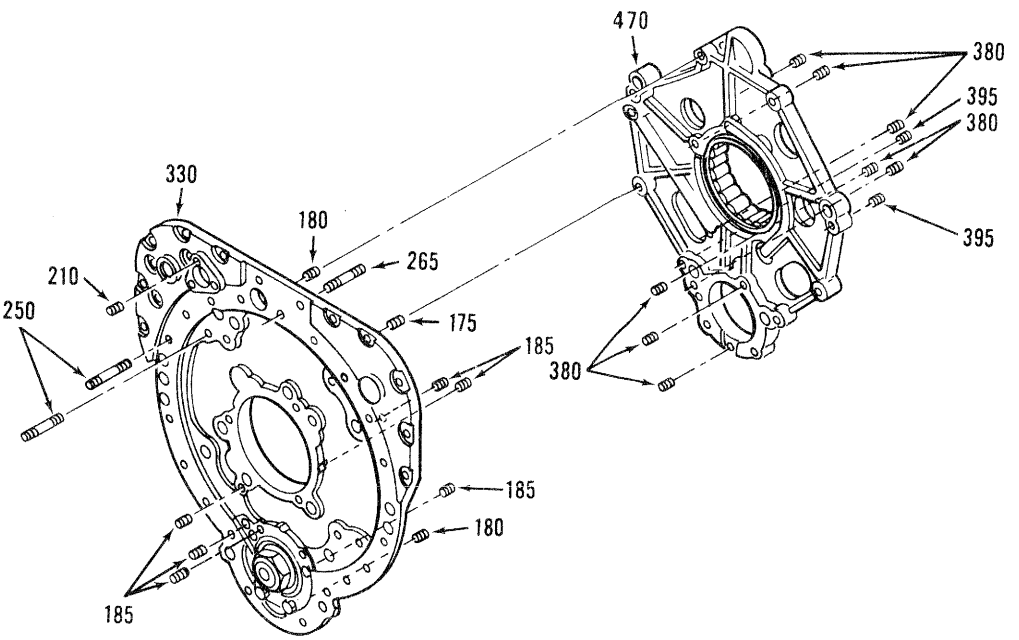
(2) Inspect gearshafts for chipped or broken teeth or unusual wear pattern.

(3) Inspect oil jets for contamination or distortion that may affect oil flow or spray pattern.

R 2. A. (4) Inspect diaphragm housing halves for cracks. No. cracks are
R allowed.

R (5) Inspect diaphragm housing halves for loose or damaged inserts and
R studs. (See figures 208 and 209.) Replace inserts or studs in ac-
R cordance with Approved Repairs.

R



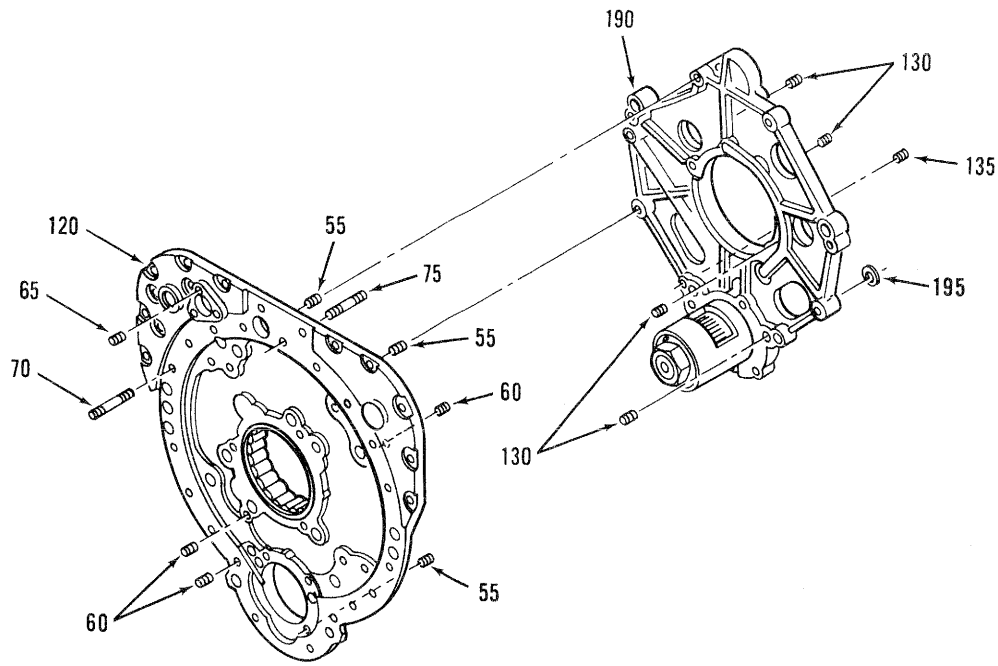
R 175.	INSERT (IPC FIG. 147)	265.	STUD
R 180.	INSERT	330.	FORWARD HOUSING
R 185.	INSERT	380.	INSERT
R 210.	INSERT	395.	INSERT
R 250.	STUD	470.	AFT HOUSING

R (Pre SB72-0162/0169/0192) Matched Diaphragm Housing Set
R Figure 208

2. A. (6) Inspect scavenge tube fitting port for damage and stripped threads. Repair damage and replace insert in accordance with Approved Repairs.

(7) Inspect forward housing half, where planet carrier assembly or ring gear support mates with housing, for wear. Wear in excess of 0.003 inch in depth is not permitted.

R



R 55.	INSERT (IPC FIG. 148)	120.	FORWARD HOUSING
R 60.	INSERT	130.	INSERT
R 65.	INSERT	135.	INSERT
R 70.	STUD	190.	AFT HOUSING
R 75.	INSERT	195.	WASHER

R (Post SB72-0162/0169/0192) Matched Diaphragm Housing Set
R Figure 209

2. A. (8) Inspect diaphragm housings for corrosion as follows.

(a) Inspect diaphragm housing (area A, figure 210) for evidence of corrosion or salt deposits. Particular attention must be given to areas where dissimilar metals contact the magnesium alloy faying surface. Treat corrosion in accordance with Approved Repairs.

(b) Inspect all screw and bolt locations for evidence of corrosion (see figure 210). Treat corrosion in accordance with Approved Repairs.

(c) If limits (see figure 210) are exceeded, return diaphragm assembly to overhaul facility for necessary repair or replace diaphragm assembly.

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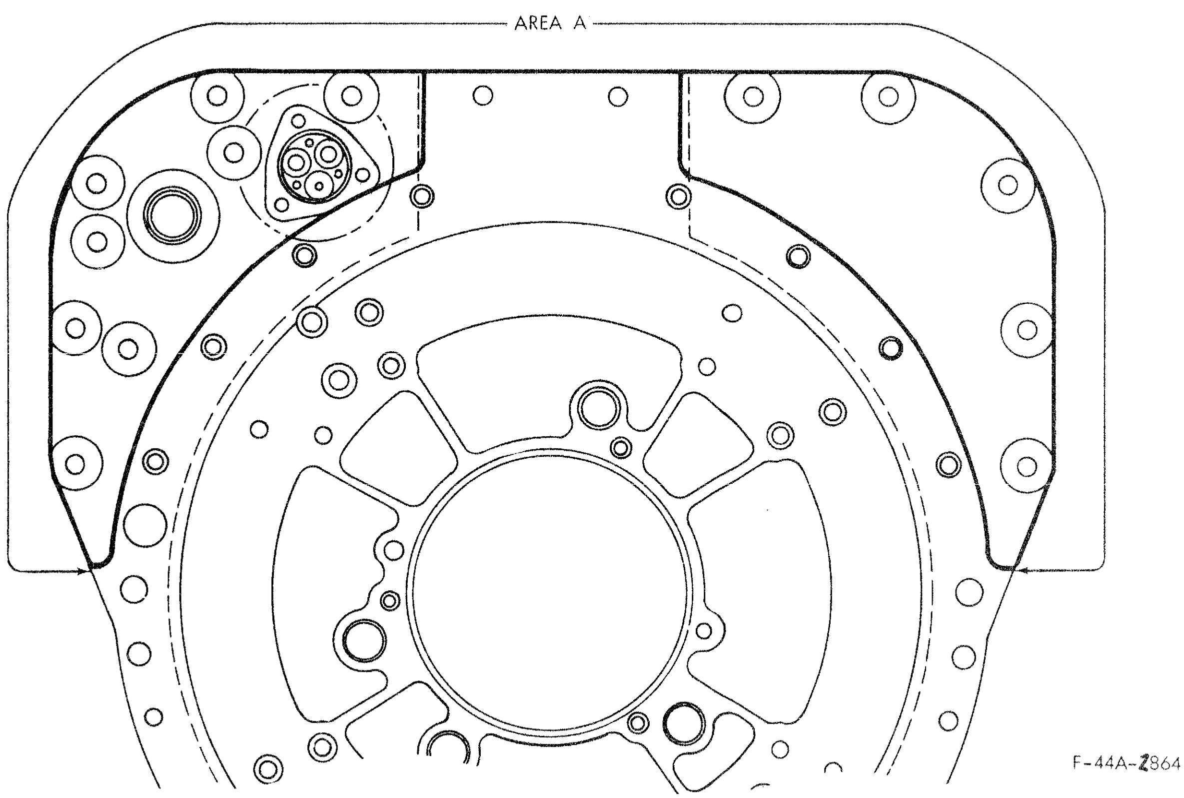


AREA A DEPTH 0.060 IN. AREA 1/2 SQ. IN. MAX IN 6 PLACES

Inspection of Forward Diaphragm Housing
Figure 210

2. A. (9) Replace part that does not meet Inspection/Check requirements or is damaged beyond repair.

B. Inspect Shoulder Drive Shaft and Spur Gearshaft Assembly (See Figure 201)

(1) Inspect bearings for freedom of rotation. Inspect gearshaft for chipped or broken teeth or unusual wear pattern. Inspect tube assemblies for contamination or bends that may affect oil flow.

(2) Replace part that does not meet Inspection/Check requirements.

C. Inspect Starter-Generator and Idler Spur Gearshaft Assemblies (See Figure 202)

(1) Inspect bearings for freedom of rotation. Inspect gearshafts for chipped or broken teeth or unusual wear pattern. Inspect jet assemblies for contamination, bends or dents that may affect oil flow or spray pattern. Replace part that does not meet Inspection/Check requirements.

(2) Replace starter-generator drive gearshaft if internal spline wear exceeds 0.008 inch.

D. Inspect Oil Scavenge Pump and Plumbing (See Figure 203)

NOTE: Oil scavenge pump may be disassembled to inspect condition of rotor set and to inspect pump interior for contamiation in event of oil system contamination. Refer to Approved Repairs.

(1) Inspect oil scavenge pump for cracks or other obvious damage. No cracks allowed.

NOTE: Scavenge Tube Part No. 869457-1 can be replaced without disassembly of diaphragm. To replace Scavenge Tube Part No. 896863-1 or 3101336-1, diaphragm must be disassembled in accordance with Removal/Installation.

(2) Inspect tube assemblies for contamination, bends or dents that may affect oil flow. Inspect screen assemblies for holes or contamination that may affect function.

(3) Replace part that does not meet Inspection/Check requirements.

E. (Post SB72-0064, Pre SB72-0162/0163/0164) Inspect Oil Supply Tube Installation (See Figure 204)

2. E. (1) Inspect tube assemblies for bends or cracks and dents which would affect oil flow.

(2) Inspect restrictor assembly for cracks, contamination and other obvious damage.

(3) Inspect oil strainer for damage and contamination.

(4) Replace part that does not meet Inspection/Check requirements.

F. Inspect Bull Gear (See Figure 211)

(1) Visually inspect gear teeth of helical drive gearshaft for corner breakage. A maximum of two non-adjacent teeth may be chipped. After repair by blending, the reworked area shall not extend beyond the limits shown in Figure 211.

(2) Rework chipped teeth in accordance with Approved Repairs.

3. Cleaning/Painting

A. Clean Component Parts

NOTE: Refer to Table 203 for recommended cleaning method.

(1) Refer to 72-00-00, CLEANING/PAINTING, for general cleaning instructions and description of cleaning methods specified in Table 203.

Table 203. Cleaning Method

Figure No.	Item No.	Nomenclature	Cleaning Methods 1	2	3	4	5	6	7	8	9	10	11	12
All standard metallic hardware			X	X										
201	30	Tube Assembly												X
	50	Shouldered Shaft		X										
	85	Bearing*												
	90,160, 235	Spring Washer	X	X										
	105,180	Plug					X	X						
	110,185	Seal Plug	X											
	130,205	Spur Gearshaft		X										
	150, 155,225	Bearing*												
	230	Spur Gear		X										

*Refer to 72-00-00, CLEANING/PAINTING, for special cleaning instructions.

Table 203. Cleaning Methods (Cont)

Figure No.	Item No.	Nomenclature	Cleaning Methods 1	2	3	4	5	6	7	8	9	10	11	12
202	5.25	Oil Jet	X				X	X						
	55	Bearing*												
	65	Plug	X											
	70,95, 125	Gearshaft		X										
	85	Plug					X	X						
	110	Retainer		X										
	115	Bearing* (Inner Race)												
	120	Bearing*												
203	33,70, 75,80	Tube Assembly												X
	100, 135,140	Screen Assembly	X	X										
204	90	Strainer	X	X										
	95,100	Oil Tube**												X
	125,130	Oil Supply Tube												X
	160	Transfer Tube												X
	180	Retainer					X	X						
	225	Restrictor Assembly												X

*Refer to 72-00-00, CLEANING/PAINTING, for special cleaning instructions.
**Refer to 72-00-00, CLEANING/PAINTING, for special cleaning instructions when Tube Assembly Part No. 3101475-1 is used.

4. Approved Repairs

NOTE: Table 204 provides a list of materials and compounds required for Approved Repairs. Table 205 provides a list of special tools, fixtures and equipment required for Approved Repairs.

Table 204. Materials and Compound

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Acid resistant brush	Commercialy available
Any approved engine oil	Commercially available
Alternate lubricant, Lubricant (OS-124)	Monsanto Company, 800 N Lindbergh Blvd, St Louis, MO 63166
Clear coat (V92VC10)	Sherwin-Williams Co, Main Store, 2312 N 16th St, Phoenix, AZ 85006
Color coat (Andrew Brown A423-66 Enamel No. 051 and C-1178 Converter)	Griggs Paint and Hardware Co, 3602 S 16th Place, Phoenix, AZ 85040
Cotton applicators	Commercially available
Epoxy resin (Epoxylite 6203)	Epoxylite Corp, 1265 N Kramer Blvd Anaheim, CA
Fine bristled bush	Commercially available
Heat gun	Commercially available
Methanol	Commercially available
Nitric acid (Federal Specification O-N-350)	Commercially available
Primer (P-415-66-611B with with Catalyst C1178-66)	Griggs Paint, Subsidiary of Domcom Dist, 3602 S 16th Place, Phoenix, AZ 85040
Rubber gloves	Commercially available
Sealant (RTV731)	Dow Corning Corp, S Saginaw Rd, Midland, MI 48640

R

Table 204. Materials and Compounds (Cont)

Material or Compound	Manufacturer
Sodium dicromate	Commercially available
Sandpaper (210 grit size)	Commercially available
Touch-up solution (Dow 1)	Dow Corning Corp, S Saginaw Rd, Midland, MI 48640
Touch-up solution (Dow 19)	Dow Corning Corp, S Saginaw Rd, Midland, MI 48640

Table 205. Special Tools, Fixtures and Equipment

Item No.	Nomenclature	Use	Source/ Part No.
NOTE: Equivalent substitutes may be used for listed items.			
1.	Inspection Mounting Plate	Used to mount gearcase oil scavenge pump when checking freedom of rotation.	284484-1-1
2.	Spanner Wrench	Used to check freedom of rotation of gearcase oil scavenge pump.	284602-1-1

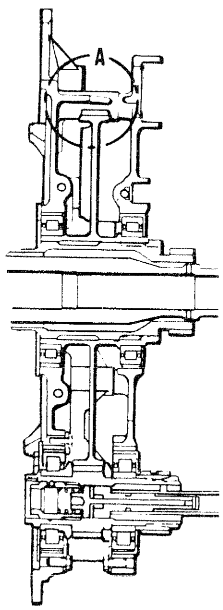
4. A. Repair Bull Gear (See Figure 211)

(1) Rework chipped gear teeth as follows.

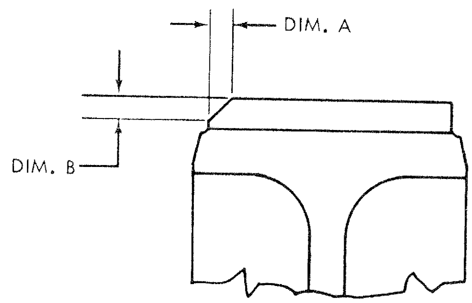
CAUTION: DURING BLENDING REWORK, USE EXTREME CARE TO AVOID CONTAMINATION OF INTERMEDIATE GEARBOX HOUSING ASSEMBLY (DIAPHRAGM) WITH FILINGS OR GRIT.

(a) Chipped gear teeth shall be reworked by blending with a stone which will insure a surface finish of AA63 or better. Do not exceed rework limits specified in Figure 211.

R



ASSEMBLED INTERMEDIATE
GEARBOX ASSEMBLY



VIEW A

PART NO. 868781	PART NO. 893739	
A	A	B
0.10 IN. MAX	0.15 IN. MAX	0.10 IN. MAX

I-44A-2068

Bull Gear Inspection and Rework Limits
Figure 211

4. B. Repair Diaphragm Housings

R NOTE: Corrosion Treatment Kit, Part No. 658532-1 con-
R taining materials required for corrosion treatment
R may be ordered from any AiResearch Aviation Com-
R pany or from The Garrett Corporation, AiResearch
R Manufacturing Company of Arizona, P.O. Box 29003,
R Phoenix, AZ 85038.

(1) Repair corrosion damaged areas as follows.

WARNING: METHANOL IS TOXIC AND FLAMMABLE. USE IN WELL-VENTILATED AREA. AVOID BREATHING FUMES OR LONG CONTACT WITH SKIN TO PREVENT DAMAGE TO PHYSICAL HEALTH KEEP AWAY FROM FLAME TO AVOID FIRE HAZARD.

NOTE: Do not dilute methanol with water or use water (including distilled water) to wash any exposed surface. Water will cause spreading of corrosion.

(a) Mechanically remove all corrosion by gently wire brushing or sanding. Clean areas to be treated by flushing or swabbing area with methanol to remove all traces of dirt, oil and foreign elements and drive out any residual moisture.

(b) Dry all areas to be treated with portable heat gun for five minutes, holding temperature to a maximum of 177C (350F) to prevent scorching the surrounding painted surfaces.

CAUTION: TOUCH-UP SOLUTION (DOW 1) SHALL NOT BE ALLOWED TO CONTACT ANODIC TREATED SURFACES. A RAPID DETERIORATION OF THE COATING WILL OCCUR.

(c) Apply touch-up solution (Dow 1) to bare metal area using an acid resistant brush. Prepare by mixing 1.5 pounds of sodium dichromate and 1.5 pints of nitric acid with enough demineralized or distilled water to make one gallon of solution. Allow solution to stand for one to two minutes.

(d) Rinse areas with methanol and blot dry Thoroughly dry areas with portable heat gun for five minutes, holding temperature to a maximum of 177C (350F).

(e) Touch-up treated area with touch-up solution (Dow 19) using cotton applicator. Prepare by mixing 1.3 ounces of chromic acid and one ounce of calcium sulfate with enough demineralized or distilled water to make one gallon of solution. Allow solution to stand for five minutes then wipe off excess.

4. B. (1) (f) Apply protective coating (clear coat (V92VC10) to treated areas using fine bristled bush or paint sprayer, overlap adjacent mating parts by a minimum of 0.20 inch. After application, heat cure for approximately 15 minutes at 177C (350F) using portable heat gun.

(g) Following the application of the protective coating, the areas that were exposed and surface treated are to be painted as follows.

1 First, apply one coat of primer (P-415-66-611B mixed with an equal part of Catalyst C1178-66) (let stand 30 minutes before use), by either brushing or spraying. Dry for 15 minutes with portable heat gun.

2 Next, apply one coat of finish paint, Color Coat (Andrew Brown A423-66 Enamel No. 051) mixed with an equal part of C-1178 Converter (let stand 30 minutes before use), by either brushing or spraying. Dry for 15 minutes with portable heat gun.

(h) Provide added protection to area found to be susceptible to the accumulation of corrosive moisture as follows.

CAUTION: DO NOT USE SEALANT IN AIR INTAKE OF ENGINE TO AVOID POSSIBLE INGESTION.

1 After the paint has dried, pockets and voids that are found to retain moisture may be filled by building up with sealatn (RTV731) and allowing it to air cure. Sealant can be painted with primer and finish paints to provide a uniform appearance.

(2) Repair or replace damaged inserts and studs (see figures 208, 209). Refer to 72-00-00, STANDARD PRACTICES.

R 4. B. (3) Repair damaged insert or threaded boss for scavenge tube fitting
R port as follows. (See figures 212 and 213.)

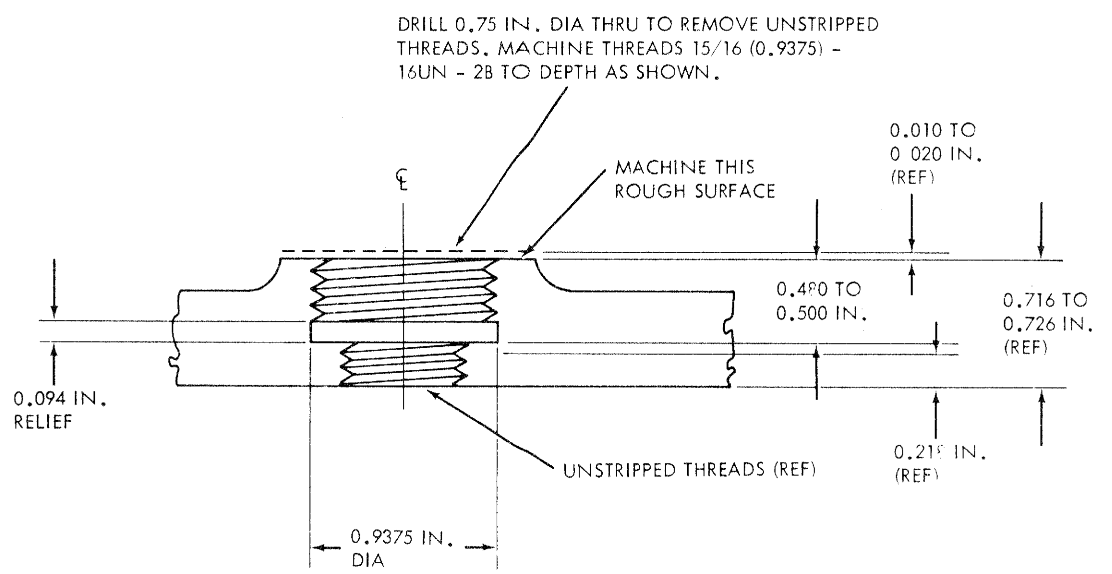
R (a) If forward diaphragm housing does not have insert previously
R installed, prepare housing as follows.

R 1 Machine damaged scavenge port surface and threads. (See
R figure 212.)

R 2 Apply touch-up solution (Dow 1) to bare metal area of
R reworked port using an acid resistant brush. Prepare
R touch-up solution by mixing three ounces of sodium
R dichromate and three ounces of nitric acid with enough dem-
R ineralized or distilled water to make one pint of solution.
R Allow solution to stand for one to two minutes.

R 3 Clean new Insert Part No. 3102391-1 and diaphragm housing
R in accordance with 72-00-00 GENERAL - CLEANING/PAINTING,
R Cleaning Method No. 2.

R



I-44A-1962

Rework of Scavenge Tube Fitting Port
Figure 212

R 4. B. (3) (b) If diaphragm housing had insert previously installed, prepare
R housing as follows. (See figure 213.)

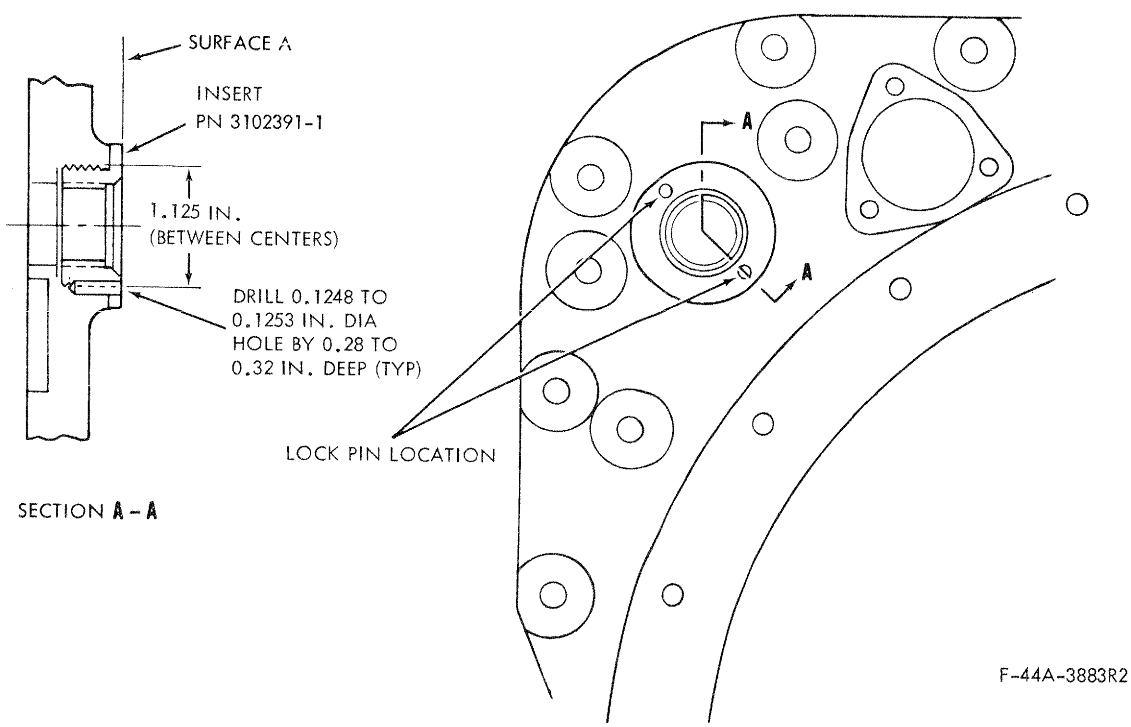
R 1 Drill out lock pins and remove damaged insert.

R 2 Clean new Insert Part No. 3102391-1 and diaphragm housing
R in accordance with 72-00-00 GENERAL - CLEANING/PAINTING,
R Cleaning Method No. 2.

R (c) Install new Insert Part No. 3102391-1 into housing with epoxy
R resin (Epoxylite 6203) and cure at room temperature for 24
R hours.

R (d) Drill two equally spaced lock pin holes in accordance with
R Figure 213 using a size 31 drill.

R (e) Press Lock Pins Part No. S9008A-163 into place 0.000 to 0.020
R inch below Surface A (see figure 213).

R


Installing Lock Pins in Scavenge Tube Fitting Port
Figure 213

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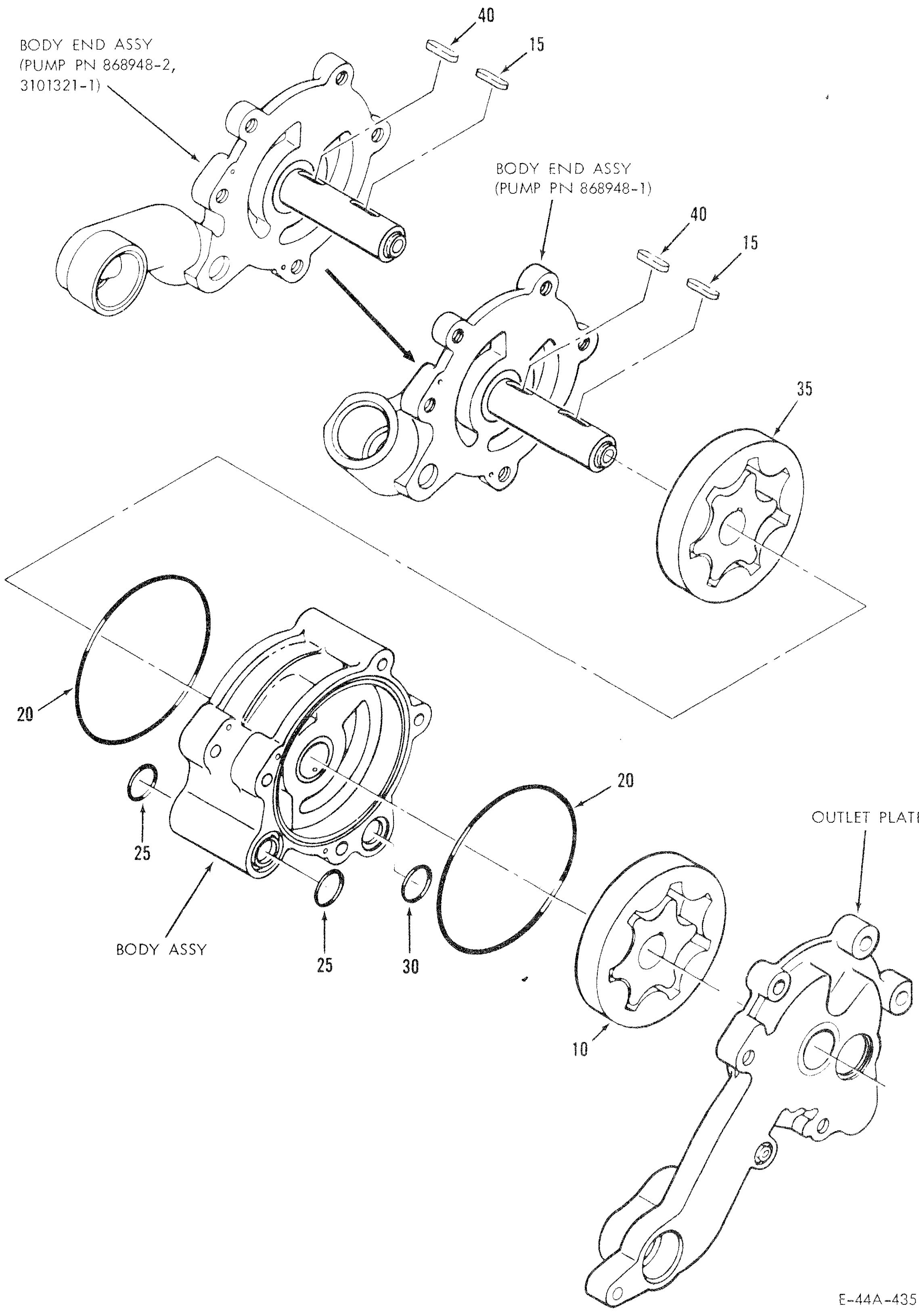


Gearcase Oil Scavenge Pump Assembly
(Field Maintenance Breakdown)
Figure 214

4. C. Inspect and Repair Gearcase Oil Scavenge Pump Assembly

(1) Disassemble gearcase oil scavenge pump assembly as follows. (See figure 214.)

NOTE: Gearcase oil scavenge pump assembly may be disassembled to inspect condition of rotor sets, and to inspect pump interior for contamination in event of oil system contamination.

Keep outlet plate, body assembly, and body end assembly together as a matched set.

(a) Separate outlet plate from body assembly.

NOTE: Keep rotor sets (10, 35) together as a matched set.

(b) Carefully remove rotor set (10) from shaft of body end. Remove key.

(c) Remove body assembly from shaft of body end assembly. Remove packings from body assembly.

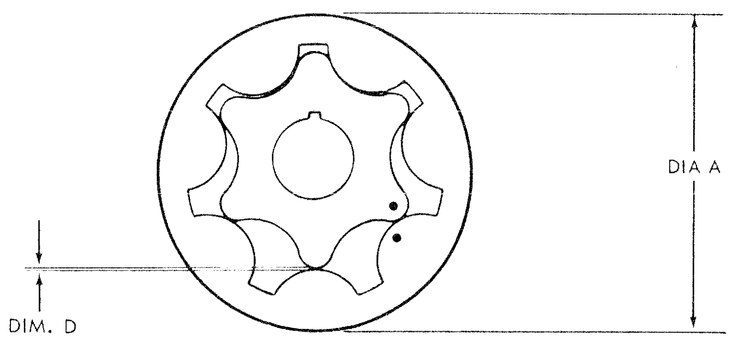
NOTE: Keep rotor sets (10, 35) together as a matched set.

(d) Carefully remove rotor set (35) from shaft of body end assembly. Remove key.

KEY TO FIGURE 214

10. ROTOR SET (PN 865101-1)
15. KEY (PN MS20068-53)
20. PACKING (PN S9413-526)
25. PACKING (PN S9412-017)
30. PACKING (PN S9412-015)
35. ROTOR SET (PN 865101-1)
40. KEY (PN MS20068-53)

R



A	D
2.9990 IN. MIN	0.010 IN. MAX

I-44A-2036

Inspection of Matched Rotor Set PN 865101-1
Figure 215

R 4. C. (2) Inspect matched rotor set as follows. (See figure 215.)

R (a) Inspect rotor (gerotor) teeth and pockets for evidence of ab-
R normal or deep wear patterns. If visual inspection reveals
R abnormal or deep wear patterns, dimensionally check part as
R shown in Figure 215.

R (b) Replace as a matched set if Inspection/Check requirements are
R not met.

R (3) Inspect gearcase oil scavenge pump for contamination or evidence of
R metal particles as follows. (See figure 214.)

R (a) Inspect interior or outlet plate, body housing, and body end
R assembly and shaft for evidence of contamination or metal
R particles.

R (b) If contamination is present, clean pump components in accord-
R ance with 72-00-00 GENERAL - CLEANING/PAINTING, Cleaning
R Method No. 1 or 2.

R (4) Assemble gearcase oil scavenge pump assembly as follows. (See
R figure 214.)

R NOTE: Rotor sets (10, 35) may be assembled without
R regard to position of side markings. Lubri-
R cate rotor sets with clean engine oil prior
R to installation in body assembly.

R (a) Install key. Install rotor set (35) on shaft of body end as-
R sembly, aligning key.

R NOTE: Lubricate packings with clean engine oil or
R lubricant (OS-124) prior to installation.

R (b) Install body assembly, with new packings, over shaft of body
R end assembly and rotor set, aligning body assembly with body
R end assembly.

R NOTE: Rotor sets (10, 35) may be assembled without regard to position of side markings. Lubricate rotor sets with clean engine oil prior to installation in body assembly.

R 4. C. (4) (c) Install key. Install rotor set (10) on shaft of body end assembly, aligning key.

R (d) Install outlet plate over shaft of body end assembly in alignment with body assembly

R (e) Mount pump assembly on 284484-1-1 plate and secure with four bolts. Tighten bolts to 70 inch-pounds torque.

R (f) Using 284602-1-1 wrench, check pump assembly for freedom of rotation.

R (g) If pump rotation is satisfactory, remove pump from 284484-1-1 plate.

R (h) If pump rotation is not satisfactory disassemble inspect, and reassemble pump.

TORSION SHAFT ASSEMBLY - MAINTENANCE MANUAL

1. Removal/Installation

NOTE: Table 201 provides a list of special tools, fixtures and equipment required for Removal/Installation. Table 202 provides a list of materials and compounds required for Removal/Installation.

Table 201. Special Tools, Fixtures and Equipment

Item No.	Nomenclature	Use	Source/ Part No.
NOTE: Equivalent substitutes may be used for listed items.			
1.	Bushing Pliers	Used to remove and install bushings from torsion shaft.	285768-1-1
R 2.	Hydraulic Torsion Shaft Removal Fixture	Used to remove torsion shaft from engine.	291171-1

Table 202. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Any approved engine oil	Commercially available
Lubricant (OS-124)	Monsanto Company, 800 N Lindbergh Blvd, St. Louis, MO 63166

R A. Disassemble Engine to Gain Access to Torsion Shaft

R (1) Remove beta tube. Refer to 72-10-01, MAINTENANCE PRACTICES.

R 1. A. (2) Remove propeller pitch control. Refer to 72-10-02, MAINTENANCE
R PRACTICES.

R (3) (Codes BA-BC, EA-LA) Remove start pressure regulator. Refer to 73-
R 10-03, MAINTENANCE PRACTICES.

R (4) Remove nose cone. Refer to 72-10-09, MAINTENANCE PRACTICES.

R (5) Remove oil jet or lubrication nozzle. Refer to 72-10-10, MAINTEN-
R ANCE PRACTICES.

R (6) Remove torsion spline (quill) shaft and coupling. Refer to 72-10-
R 11, MAINTENANCE PRACTICES.

R (7) Remove diaphragm. Refer to 72-10-13, MAINTENANCE PRACTICES.

R (8) Remove turbine oil inlet retainer shield. Refer to 72-50-01, MAIN-
R TENANCE PRACTICES.

R (9) Remove tail cone. Refer to 72-50-02, MAINTENANCE PRACTICES.

R (10) Remove turbine oil inlet tube and oil jet. Refer to 72-50-03,
R MAINTENANCE PRACTICES.

R (11) Remove turbine oil scavenge pump assembly. Refer to 72-50-04,
R MAINTENANCE PRACTICES.

R B. Remove Torsion Shaft (See Figures 201 and 202)

R NOTE: Do not remove turbine bearing and associated
R components

R (1) Remove main shaft (turbine end) nut. Refer to 72-50-01, MAINTEN-
R ANCE PRACTICES.

R (2) Install 291171-1 hydraulic torsion shaft removal fixture.

R (3) (Post SB72-0119) Loosen main shaft (compressor end) nut. Refer to
R 72-10-19, MAINTENANCE PRACTICES.

R (4) Using 291171-1 hydraulic torsion shaft removal fixture, remove tor-
R sion shaft.

R (5) (Post SB72-0119) Remove bushing (10, figure 202) from torsion
R shaft.

R (6) Using 285768-1-1 bushing pliers, remove bushings (15, 25, 35,
R figure 201 or 35, figure 202) from torsion shaft.

R (7) Remove packing and rings.

R 1. B. (8) Remove 291171-1 hydraulic torsion shaft removal fixture.

R (9) Replace main shaft (turbine end) nut. Refer to 72-50-10, MAINTEN-
R ANCE PRACTICES.

NOTE: Lightly coat new packings with any approved engine oil or lubricant (OS-124) prior to installation.

C. Install Torsion Shaft Assembly (See Figures 201 and 202)

CAUTION DO NOT FORCE TORSION SHAFT INTO MAIN SHAFT. IF DIFFICULTY IS ENCOUNTERED, REMOVE SHAFT AND INSPECT INTERNAL AND EXTERNAL SPLINES FOR BURRS. REMOVE BURRS AND REINSTALL SHAFT.

R NOTE: (Pre SB72-0119) Clearance between bushings (15, 25, 35, figure 201) and main shaft shall be 0.001 to 0.005 inch (bushing compressed). Select proper size bushing to obtain clearance. Largest dash number is largest bushing.

R (Post SB72-0119) Clearance between bushing (10, figure 202) and main shaft shall be 0.0002 to 0.0015 inch. Select proper size bushing to obtain clearance. Largest dash number is largest bushing.

(1) Install rings onto torsion shaft assembly so that slots in rings are 180 degrees apart. Install new packing on torsion shaft.

(2) Coat bushings to be installed on torsion shaft lightly with any approved engine oil. Using 285768-1-1 pliers install bushings on torsion shaft.

(3) Insert torsion shaft into main shaft from forward end. If required, compress bushings by hand to permit installation of torsion shaft assembly.

R (4) (Post SB72-0119) Install bushing (10, figure 202) as torsion shaft is being installed.

R (5) (Post SB72-0119) Tighten main shaft nut (compressor end). Refer to
R 72-10-19, MAINTENANCE PRACTICES.

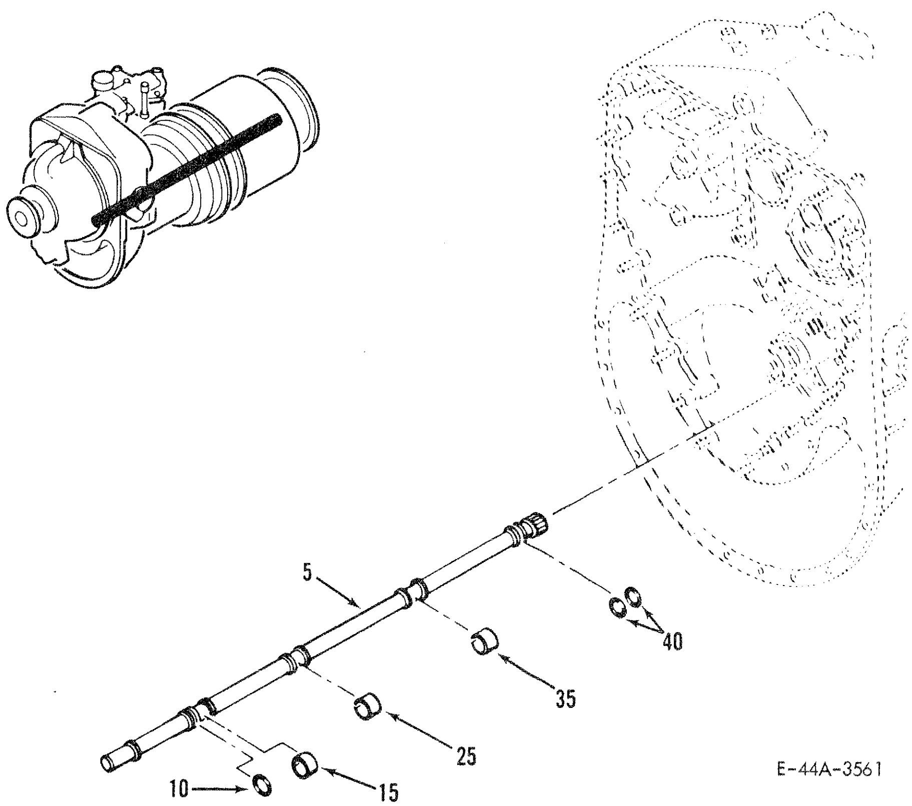
R D. Install Engine Components that were Removed to Gain Access to Torsion
R Shaft

R (1) Install diaphragm. Refer to 72-10-13, MAINTENANCE PRACTICES.

R (2) Install torsion spline (quill) shaft and coupling. Refer to 72-10-
R 16, MAINTENANCE PRACTICES.

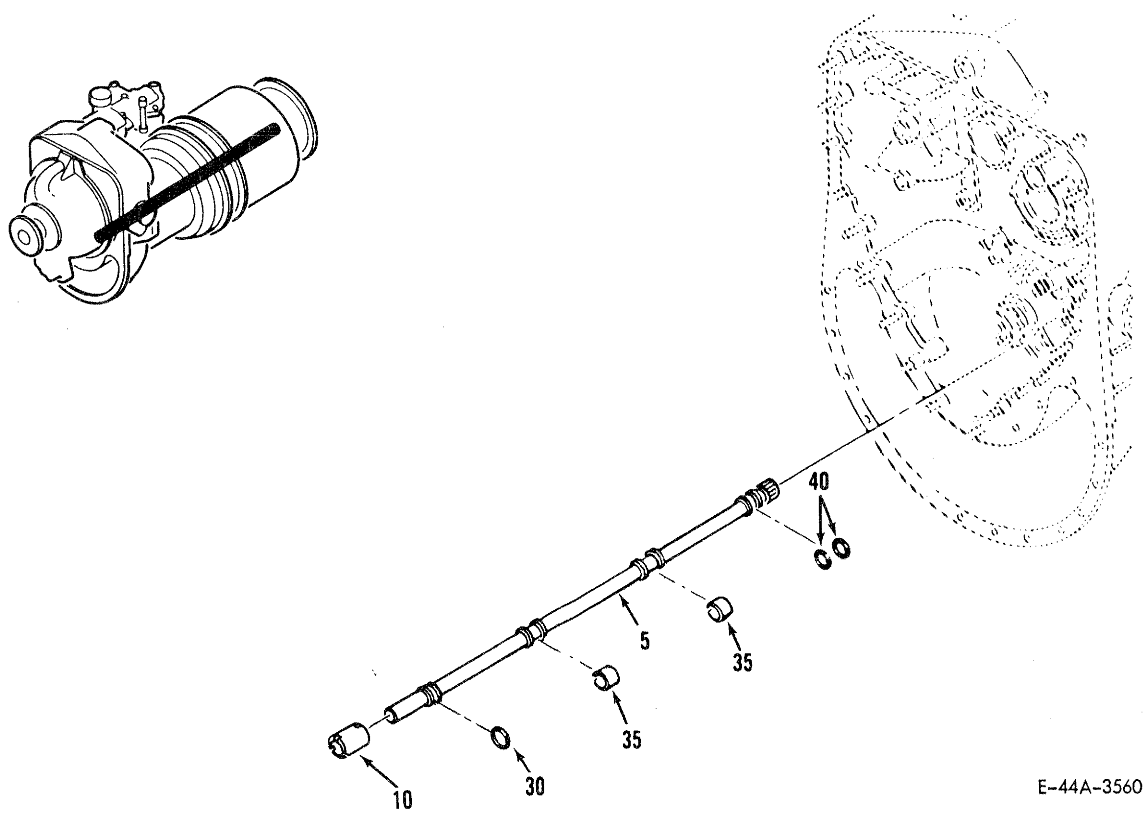
R (3) Install turbine oil scavenge pump assembly. Refer to 72-50-04,
R MAINTENANCE PRACTICES.

R



R 5. TORSION SHAFT (IPC FIG. 153)
10. PACKING
15. BUSHING
25. BUSHING
35. BUSHING
40. RING

R (Pre SB72-0119) Torsion Shaft Assembly
Figure 201



R 5. TORSION SHAFT (IPC FIG. 154)
10. BUSHING
30. PACKING
35. BUSHING
40. RING

R (Post SB72-0119) Torsin Shaft Assembly and Bushings
Figure 202

R 1. D. (4) Install nose cone. Refer to 72-10-09, MAINTENANCE PRACTICES.

2. Inspection/Check

A. Inspect torsion Shaft Assembly (See Figures 201 and 202)

(1) Inspect torsion shaft for cracks or breaks. No cracks or breaks allowed.

(2) Check torsion shaft bushing journals (where bushings (15, 25, 35, figure 201) and bushings (35, figure 202) are installed) for wear. Diameters shall be 0.7175 to 0.7210 inch.

(3) Replace part that does not meet Inspection/Check requirements.

3. Cleaning/Painting

A. Clean Component Parts

(1) Clean all standard metallic hardware in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 1 or 2.

(2) Clean torsion shaft in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 2.

(3) Clean bushing in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 1.

(4) Cleaning rings in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 1.

R (POST SB72-0061 OR POST SB72-0162/0163/0169)

DIRECT DRIVE FUEL CONTROL GEAR TRAIN - MAINTENANCE PRACTICES

1. Removal/Installation

NOTE: Table 201 provides a list of special tools, fixtures and equipment required for Removal/Installation. Table 202 provides a list of materials and compounds required for Removal/Installation.

Table 201. Special Tools, Fixtures and Equipment

Item No.	Nomenclature	Use	Source/ Part No.
NOTE: Equivalent substitutes may be used for listed items.			
1.	Bearing and Bushing Driver	Used to press larger bearing on tachometer drive gear shaft.	285177-1-1
2.	Bearing and Bushing Driver	Used to press smaller bearing on tachometer drive gear-shaft.	285178-1-1
R 3.	Bearing and Bushing Driver	Used to remove bearings from gearshaft.	284181-1-1
R 4.	Nut Staking Tool	Used to stake end of locking pin in nut.	285747-1-1
R 5.	Pin Staking Tool	Used to stake locking pin in place.	285748-1-1
6.	Bearing Pressing Holder	Used to hold various bearings while removing or installing gearshafts.	285812-1-1
R 7.	Fixed Depth Gage	Used to measure depth of locking pin hole.	287463-1 -2, -13, -15
R 8.	Bearing and Bushing Driver	Used to remove bearings from gearshaft.	291140-1-1

Table 201. Special Tools, Fixtures and Equipment (Cont)

Item No.	Nomenclature	Use	Source/ Part No.
9.	Torque and Drill Fixture	Used to torque and drill a TPE gearshaft assembly, then after installing on mating gearshaft, will torque and drill this assembly.	291606-1-1
10.	Torque and Drill Fixture	Used to hold a TPE gear assembly during torque and drill operations on a bearing retainer nut.	291607-1-1
11.	Bearing Installation and Removal Driver Set	Used to install and remove bearing set from bore in torque sensor housing and install bearing set on spur gear.	291786-1-1
R 12.	Bearing Flushing Kit (Consists of 293602-15/ 17/-19 flushing housings with case)	Used to pressure flush bearings following drilling and pinning operation.	293602-1

Table 202. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Any approved engine oil	Commercially available
Alternate lubricant, Lubricant (OS-124)	Monsanto Company, 800 N Lindbergh Blvd, St Louis, MO 63166

1. A. Remove Direct Drive Fuel Control Gear Train (See Figure 201)

NOTE: Removal of the intermediate gearbox assembly (diaphragm) requires determination of existing engine torque indicating system calibration values. Prior to removal of intermediate gearbox assembly (diaphragm), perform engine pre-teardown calibration. Refer to 72-00-00, ADJUSTMENT/TEST.

(1) Remove beta tube. Refer to 72-10-01, MAINTENANCE PRACTICES.

(2) Remove propeller pitch control. Refer to 72-10-02, MAINTENANCE PRACTICES.

(3) (Codes BA-BC, EA-LA) Remove start pressure regulator. Refer to 73-10-03, MAINTENANCE PRACTICES.

(4) Remove nose cone. Refer to 72-10-09, MAINTENANCE PRACTICES.

(5) Remove oil transfer tube oil jet and lubrication nozzle. Refer to 72-10-10, MAINTENANCE PRACTICES.

(6) Remove torsion spline shaft (quill) and coupling. Refer to 72-10-11, MAINTENANCE PRACTICES.

(7) Remove diaphragm. Refer to 72-10-13, MAINTENANCE PRACTICES.

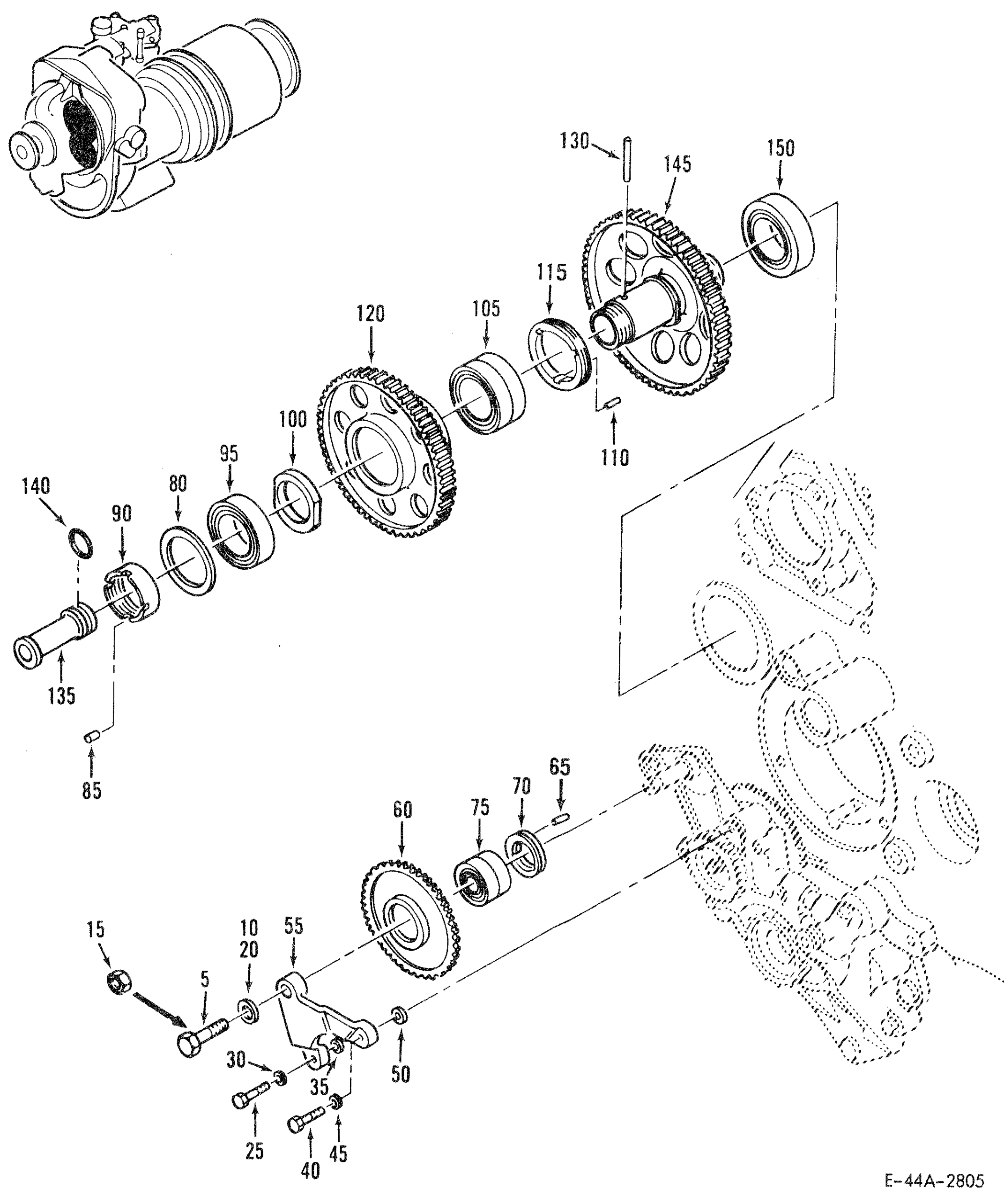
(8) Remove nut, bolts and washers securing support assembly and remove support assembly and shims. Record number and thickness of shims to aid in assembly.

(9) Remove spur gear assembly and install in 291607-1-1 torque and drill fixture. Drill pin out of nut (70) as follows.

(a) Install new drill bit (No. 53) in drill check of drill press making sure drill bit is bottomed.

(b) Drill out pin by applying pressure intermittently until a depth of 0.135 inch is achieved.

(10) Clean chips from area then remove nut using socket (part of torque and drill fixture). Remove spur gear and bearing set (75) from fixture.



R

Direct Drive Fuel Control Gear Train
Figure 201

1. A. (11) Remove bearing set (75) from spur gear. Discard bearing set and use new bearing set when re-assembling.

(12) Remove washer. Remove assembled gearshaft and bearing set from housing. Press bearing (150) from assembled gearshaft using
R 285812-1- holder and 291140-1 driver. Discard bearing and replace with new bearing when re-assembling.

(13) Place assembled gearshaft and bearing set in 291607-1-1 torque and drill fixture.

(14) Drill out pin (85) from assembled gearshaft and bearing set as follows.

(a) Install new drill bit (No. 53) in drill chuck of drill press making sure bit is bottomed.

(b) Drill out pin by applying pressure intermittently until depth of 0.175 inch is achieved.

(c) Clean drill chips from area, then remove nut using socket (part of torque and drill fixture).

(15) Remove assembled gearshaft and bearing set (95 through 145) from fixture.

R (16) Using 285812-1 1 holder and 291140-1 driver, press assembled gearshaft and bearing set from bearing (95). Discard bearing and replace with new bearing when re-assembling. Remove spacer.

(17) Remove bearing set (105), pin, nut and spur gear as an assembly from gearshaft, using 284181-1- driver.

KEY TO FIGURE 201

R 5. BOLT (IPC FIG. 157)
R 10. WASHER
R 15. NUT
R 20. WASHER
R 25. BOLT
R 30. WASHER
R 35. SHIM
R 40. BOLT
R 45. WASHER
R 50. SHIM
R 55. SUPPORT
R 60. SPUR GEAR
R 65. PIN
R 70. NUT
R 75. BEARING SET
80. WASHER
85. PIN
90. NUT
95. BEARING
100. SPACER
105. BEARING SET
110. PIN
115. NUT
120. GEAR
130. SPRING PIN
135. PLUG
140. PACKING
145. GEARSHAFT
150. BEARING

1. A. (18) Place assembled spur gear and bearing set (105 through 120) in 291606-1-1 torque and drill fixture.

(19) Drill out pin (110) from assembled gearshaft and bearing set as follows.

(a) Install new drill bit (No. 53) in drill chuck of drill press making sure drill bit is bottomed.

(b) Drill out bit by applying pressure intermittently until a depth of 0.135 inch is achieved.

(c) Clean drill chips from area then remove nut using socket (part of torque and drill fixture)

(20) Remove assembled gearshaft and bearing set (105, 120) from fixture.

(21) Using 291786-1-1 bearing removal set, remove bearing set (105) from gear. Discard bearing set and replace with new bearing set when re-assembling.

(22) (Pre SB72-0197) Remove pin, plug from gearshaft. Remove packing from plug.

B. Install Direct Drive Fuel Control Gear Train (See Figure 201)

NOTE: Refer to 70-00-00, STANDARD PRACTICES, for recommended general torque values. Add frictional drag (run-down) torque of self-locking devices to recommended values.

Lightly coat new packings with clean engine oil or lubricant (OS-124) prior to installation.

(1) Install new packing on plug. Install plug in gearshaft and secure with spring pin.

NOTE: Ensure manufacturer's markings on outer race of bearing set are aligned prior to installation.

(2) Align manufacturer's "V" mark on bearing set (105) and install new bearing set in gear (120) using 291786-1-1 bearing installation set. Place gear and bearing set in 291606-1-1 torque and drill fixture. Install nut in gear and tighten nut (115) to 100 inch-pounds torque using socket (part of torque and drill fixture).

NOTE: Install a protective rubber pad over exposed bearings prior to drilling operation.

(3) Drill and pin nut (115) as follows.

1. B. (3) (a) Install new drill bit (No. 52) in drill check of drill press making sure bit is bottomed.

(b) Align 291606-1-1 torque and drill fixture with drill press so drill bit is aligned with drill guide hole in fixture.

(c) Drill hole by applying intermittent pressure until a depth of
R 0.130 to 0.150 inch is achieved. Use 287463-15 depth gage to
R measure 0.130 inch depth hole and 287463-13 depth gage to
R measure 0.150 inch depth hole.

R (d) Use 23602-17 flushing housing to clean chips from area, then
R install pin to bottom of drilled hole.

R (4) Stake pin in place using 285747-1-1 staking tool. Use 285748-1-1
R nut staking tool to offset pin hole. Remove assembly from fixture.

(5) Install assembled components on gearshaft. Install spacer and then install new bearing (95) using 295178-1 1 driver. Install nut (90).

(6) Place assembled gearshaft in 291607-1-1 torque and drill fixture and tighten nut (90) to torque value of 80 inch-pounds using socket (part of torque and drill fixture).

NOTE: Install a protective rubber pad over exposed bearings prior to drilling operation.

(7) Drill and pin assembled gearshaft (90 through 145) as follows.

(a) Install new drill bit (No. 52) in drill chuck of drill press making sure drill bit is bottomed.

(b) Align 291607-1-1 torque and drill fixture with drill press so that drill bit is aligned with drill guide hole in fixture.

R (c) Drill hole by applying intermittent pressure until a depth of
R 0.170 to 0.190 inch is achieved. Use 287463-1 depth gage to
R measure 0.170 inch depth hole and 287463-2 depth gage to meas-
R ure 0.190 inch depth hole.

R (d) Use 293602-19 flushing housing to clean chips from area, then
R install pin to bottom of drilled hole.

R (e) Stake pin using 285747-1-1 staking tool and offset pin hole
R using 285748-1 1 nut staking tool. Remove assembly from
fixture.

(8) Remove gearshaft assembly from fixture and install new bearing
R (150) on gearshaft using 285177-1-1 driver. Install gearshaft as-
sembly in housing, install washer over nut on gearshaft assembly.

NOTE: Ensure manufacturer's markings on outer race of bearing set are aligned prior to installation.

1. B. (9) Align manufacturer's "V" mark on bearing set and install new bearing set (75) in spur gear. Place spur gear and bearing set in 291607-1-1 torque and drill fixture. Install nut in spur gear and tighten nut (70) to 110 inch-pounds torque using socket (part of torque and drill fixture).

NOTE: Install a protective rubber pad over exposed bearings prior to drilling operation.

(10) Drill and pin nut (70) as follows.

(a) Install new drill bit (No. 52) in drill chuck of drill press making sure drill bit is bottomed.

(b) Align 291607-1-1 torque and drill fixture with drill press so that drill bit is aligned with drill guide hole in fixture.

R (c) Drill hole by applying intermittent pressure until depth of
R 0.130 to 0.150 inch is achieved. Use 287463-15 depth gage to
R measure 0.130 inch depth hole and 287463-13 depth gage to
R measure 0.150 inch depth hole.

R (d) Use 293602-15 flushing housing to clean chips from area then
R install pin to bottom of hole.

(e) Stake pin in place using 285747-1-1 staking tool. Use 285748-1-1 nut staking tool to offset pin hole.

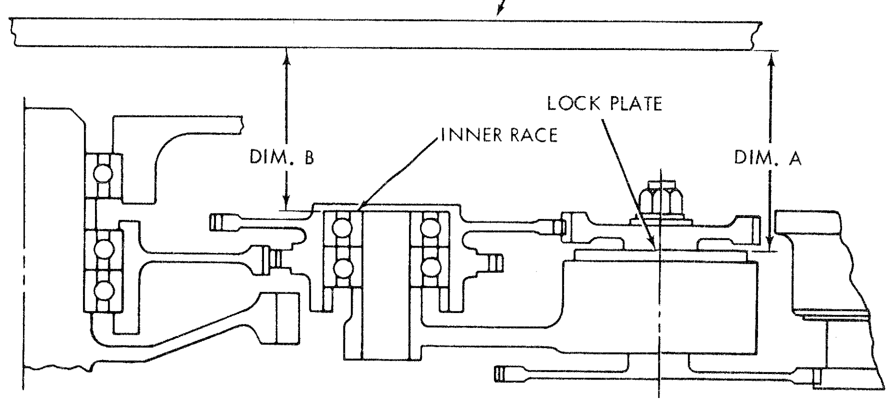
(11) Install spur gear assembly on torque sensor housing.

(12) Determine shim requirements and install support as follows. (See figures 202 and 203)

R NOTE: Prior to taking measurement to obtain Dimension A,
R ensure three bolts securing lock plate are
R tightened to 50 inch-pounds torque. Refer to 72-
R 10-17, MAINTENANCE PRACTICES.

(a) Place a parallel bar across input side accessory drive housing (see figure 202). Using a depth micrometer measure from face of housing to top of lock plate and record as Dimension A. Make this measurement at two places to ensure that lock plate is flat and measurement is accurate.

(b) Measure from face of housing to inner race of bearing set and record as Dimension B (see figure 202).



SAMPLE

DIM. A = 3.948
DIM. B = 3.627
DIM. C = 0.321

I-44A-1390R1

Support Assembly Shim Requirements
Figure 202

1. B. (12) (c) Subtract Dimension B from Dimension A and record result as Dimension C.

(d) Perform measurement of support as follows. (See figure 203.)

1 Fabricate a hold-down plate similar to that shown in Figure 203 so that support may be secured to parallel bar. Hold-down plate may be fabricated from any aluminum or steel material approximately one-eighth inch thick.

2 Place the two legs of support (legs with small holes) on parallel bar. Place hold-down plate across legs of support and install bolt through hold-down plate and hole through parallel bar. Secure bolt with washer and nut and tighten finger tight.

3 Determine distance from parallel bar to bottom surface of leg (surface D) of support as follows.

a Measure distance from bottom of parallel bar to bottom surface of leg (surface D) and record as Dimension E.

b Subtract thickness of parallel bar from Dimension E. Record result as Dimension F which is the distance from top surface of parallel bar to bottom surface of leg (surface D).

(e) Subtract Dimension F from Dimension C as determined in step (c). The remainder is the required thickness of washers (shims) (35, 50, figure 201) to provide a 0.000 inch interference fit for support. This thickness of shims with up to and additional 0.002 inch thickness of shims is required to provide 0.000 to 0.002 inch interference fit.

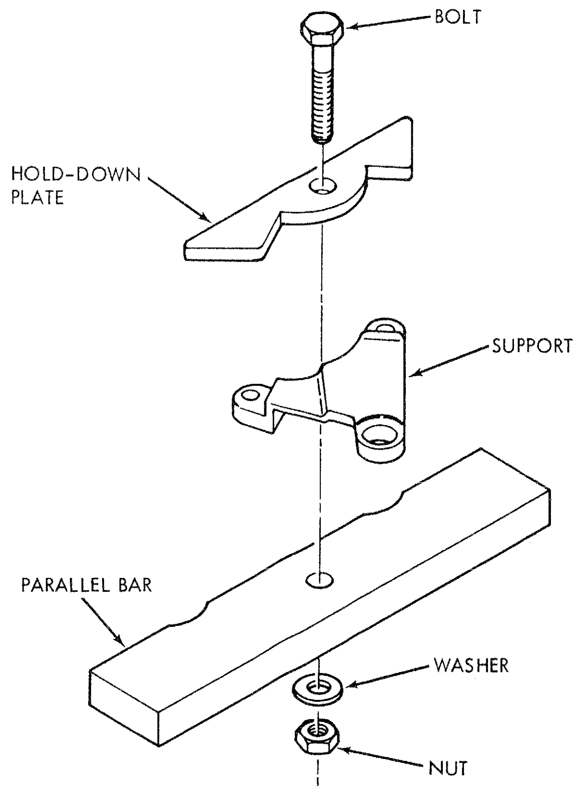
(f) Install support, thickness of washers (shims) as determined in step (e) above, and secure with washers and bolts. Tighten bolts (25, 40, figure 201) to 50 inch-pounds torque. Install washer and nut. Tighten bolt (5, figure 201) or nut (15, figure 201) to 27 inch-pounds torque.

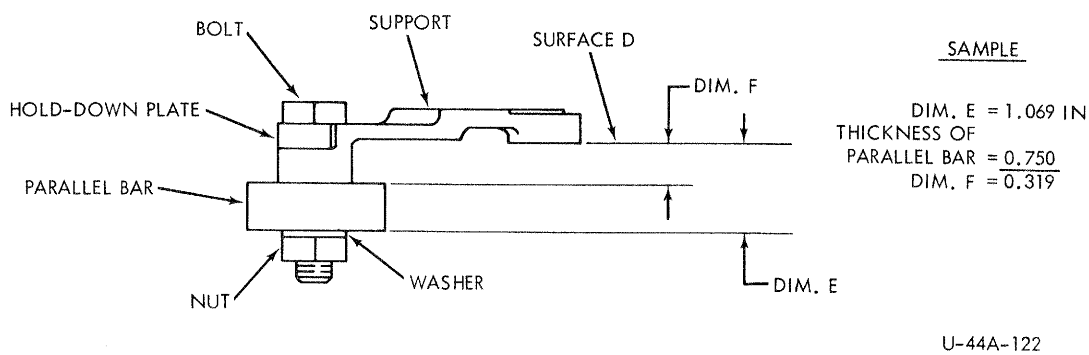
(13) Perform alignment check of spur gear as follows. (See figure 204.)

(a) Place parallel bar across forward surface of accessory drive housing. Using depth micrometer, measure from parallel bar to face of spur gear at four points.

(b) Spur gear shall be parallel at the four points within 0.004 inch.

(c) If gear is not parallel within 0.004 inch, rotate the engine rotating group. Loosen and retighten the two bolts (25, 40 figure 201) to 50 inch-pounds torque.





Measurement of Support for Direct Drive Gear Train
Figure 203

R 1. B. (13) (d) Tighten bolt (5, figure 201) or nut (15, figure 201) to 27
R inch-pounds. Recheck parallelism.

(e) If parallelism is not within 0.004 inch, loosen bolts and nut securing support and shift position of support slightly. Retighten bolts and nut and recheck parallelism of spur gear.

(f) If spur gear parallelism is still not within 0.004 inch, obtain a different support and repeat steps (12)(d)2 through (12)(f) and step (13).

(g) If spur gear parallelism is still not within 0.004 inch, install a different torque sensor assembly and repeat measurement and shimming procedures.

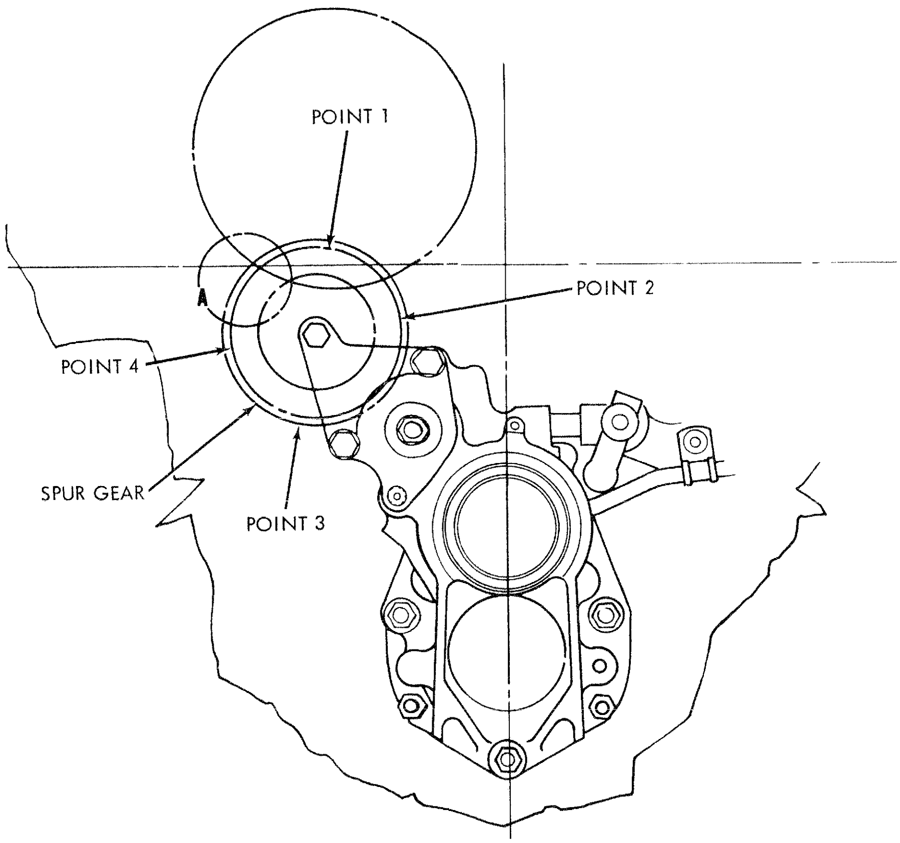
(14) Install diaphragm. Refer to 72-10-13, MAINTENANCE PRACTICES.

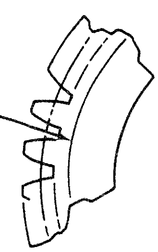
2. Inspection/Check

A. Inspect Direct Drive Fuel Control Gear Train (See Figure 201)

(1) Inspect spur gears, gearshaft and bearings for freedom of rotation. Inspect gear teeth for chips, cracks and uneven wear pattern.

(2) Replace part that does not meet Inspection/Check requirements.





DETAIL A

I-44A-1389

Alignment Check of Spur Gear
Figure 204

3. Cleaning/Painting

A. Clean Component Parts

(1) Refer to 72-00-00, GENERAL - CLEANING/PAINTING, for general cleaning instructions and description of cleaning methods specified in Table 203.

NOTE: Reference shall be made to Table 203 for recommended cleaning method.

Table 203. Cleaning Methods

Figure No.	Item No.	Nomenclature	Cleaning Methods 1	2	3	4	5	6
All standard metallic hardware			X	X				
201	55	Support					X	X
	60, 120, 145	Spur Gearshaft	X	X				
	70, 115	Nut	X	X				
	75, 105	Bearing Set*						
	95, 150	Bearing*						
	90	Nut	X	X				
	100	Spacer	X	X				
	135	Plug	X					

*Refer to 72-00-00, GENERAL - CLEANING/PAINTING, for special cleaning instructions.

R

OIL TRANSFER MANIFOLD AND TORQUE SENSOR ASSEMBLY - MAINTENANCE PRACTICES

1. Removal/Installation

NOTE: Table 201 provides a list of special tools, fixtures and equipment required for Removal/Installation. Table 202 provides a list of materials and compounds required for Removal/Installation.

Table 201. Special Tools, Fixtures and Equipment

Item No.	Nomenclature	Use	Source/ Part No.
NOTE: Equivalent substitutes may be used for listed items.			
1.	Orifice Plate	Used in place of propeller governor for covering oil passages and for providing orifice, when establishing negative and positive torque settings.	284459-1-1
2.	Torque Sensor Alignment Gage	Used to maintain proper alignment of torque sensor during installation into input side accessory housing.	293097-1-1
3.	Cam Assembly Lock Pin	Used to maintain zero degree position of torque sensor assembly during calibration.	865376-1

Table 202. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Any approved engine oil	Commercially available
Alternate lubricant Lubricant (OS-124)	Monsanto Company, 800 N Lindbergh Blvd, St Louis, MO 63166

R 1. A. Disassemble Engine to Accomplish Required Maintenance

R
R
R
R
R
R

NOTE: Removal of the intermediate gearbox assembly (diaphragm) requires determination of existing engine torque indicating system calibration values. Prior to removal of intermediate gearbox assembly (diaphragm) perform engine pre-teardown calibration. Refer to 72-00-00, ADJUSTMENT/TEST.

R (1) Remove beta tube. Refer to 72-10-12, MAINTENANCE PRACTICES.

R
R (2) Remove propeller pitch control. Refer to 72-10-02, MAINTENANCE PRACTICES.

R
R (3) (Codes BA-BC, EA-LA) Remove start pressure regulator. Refer to 73-10 03, MAINTENANCE PRACTICES.

R (4) Remove nose cone. Refer to 72-10-09, MAINTENANCE PRACTICES.

R
R (5) Remove oil transfer tube oil jet and lubrication nozzle. Refer to 72-10-10, MAINTENANCE PRACTICES.

R
R (6) Remove torsion spline (quill) shaft and coupling. Refer to 72-10-11 MAINTENANCE PRACTICES.

R (7) Remove diaphragm. Refer to 72-10-13, MAINTENANCE PRACTICES.

R
R (8) (Post SB72-0061 or Post SB72-0162/0163/0169) Remove direct drive fuel control gear train. Refer to 72-10-15, MAINTENANCE PRACTICES.

B. (Pre SB72-0061) Remove Oil Transfer Manifold and Torque Sensor Assembly (See Figure 201)

(1) Remove bolts, screws, washers, brackets, clamp and tube retainers.

(2) Remove bolt and washer securing adapter to accessory drive input housing.

(3) Remove bolt and washer securing fitting assembly and bracket to accessory drive input housing.

(4) Remove bolt and washers securing bracket to accessory drive housing if installed.

(5) Remove bolts, screw and washers securing manifold to accessory drive input housing.

(6) Remove nuts and washers securing torque sensor assembly to accessory drive input housing.

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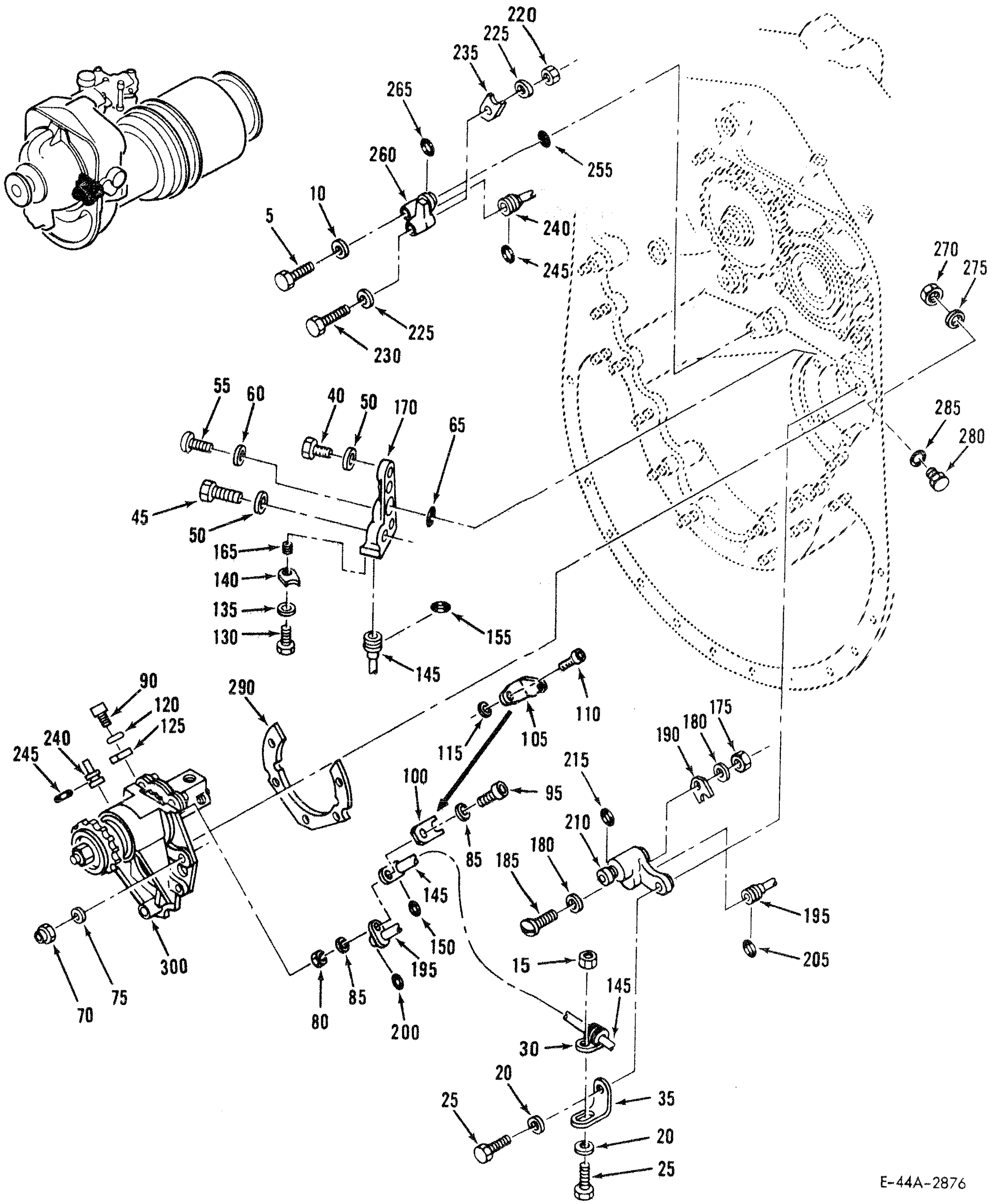

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R (Pre SB72-0061) Oil Transfer Manifold and Torque Sensor
Assembly Installation
Figure 201

1. B. (7) Carefully withdraw torque sensor assembly from accessory drive input housing.

(8) Do not remove strainers from adapter unless damage is indicated by inspection.

R NOTE: Record number and thickness of shims removed to
R aid in reassembly. Lockwire shims to torque sen-
R sor mounting flange compressor bearing shims.

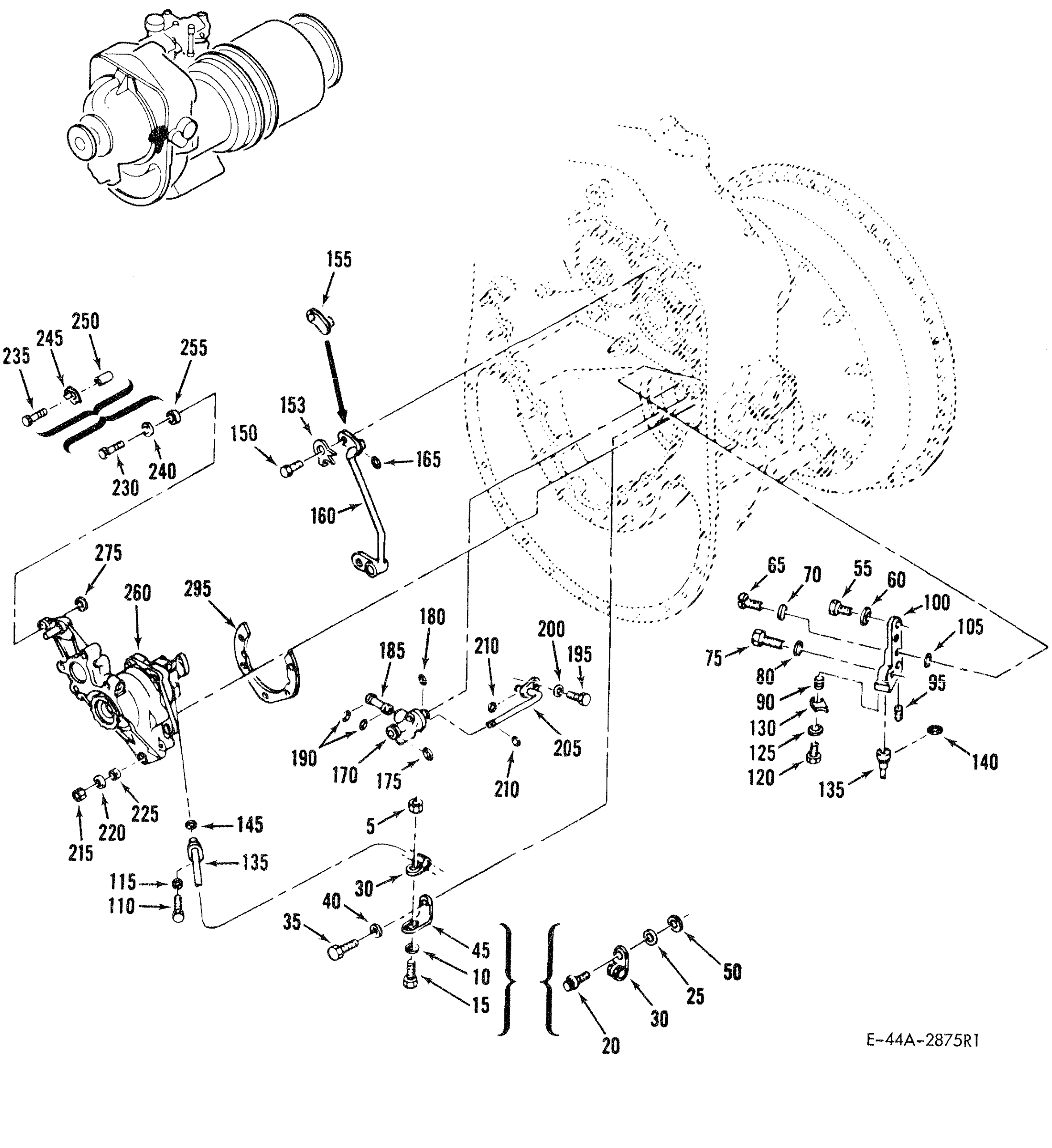
(9) Remove shims used between torque sensor assembly and accessory drive housing.

(10) Remove attaching parts securing tube assemblies to components, then withdraw tube assemblies. Remove packings.

(11) Remove packing between manifold and accessory drive input housing.

KEY TO FIGURE 201

R 5. BOLT (IPC FIG. 158)
R 10. WASHER
R 15. NUT
R 20. WASHER
R 25. BOLT
R 30. CLAMP
R 35. BRACKET
R 40. BOLT
R 45. BOLT
R 50. WASHER
R 55. SCREW
R 60. WASHER
R 65. PACKING
R 70. NUT
R 75. WASHER
R 80. NUT
R 85. WASHER
R 90. BOLT
R 95. SCREW
R 100. RETAINER
R 105. BRACKET
R 110. BOLT
R 115. WASHER
R 120. WASHER
R 125. RETAINER
R 130. SCREW
R 135. WASHER
R 140. RETAINER
R 145. TUBE ASSY
150. PACKING
155. PACKING
165. INSERT
170. MANIFOLD
175. NUT
180. WASHER
185. SCREW
190. RETAINER
195. TUBE ASSY
200. PACKING
205. PACKING
210. FITTING ASSY
215. PACKING
220. NUT
225. WASHER
230. SCREW
235. RETAINER
240. TUBE ASSY
245. PACKING
255. STRAINER ELEMENT
260. ADAPTER
265. PACKING
270. NUT
275. WASHER
280. PLUG
285. PACKING
290. SHIM
300. TORQUE SENSOR ASSY



R

(Post SB72-0061) Oil Transfer Manifold and Torque Sensor
Assembly Installation
Figure 202

1. B. (12) Remove packing from adapter.

(13) Refer to 72-10-18, MAINTENANCE PRACTICES, for further disassembly.

C. (Post SB72-0061) Remove Oil Transfer Manifold and Torque Sensor Assembly (See Figure 202)

(1) Remove bolts, washers, brackets, clamp and tube retainers

(2) Remove bolt and key washer securing plug or tube to accessory drive housing. Remove plug or tube and packing.

(3) Remove bolts, screw and washers securing oil transfer manifold assembly to accessory drive housing. Remove packings.

(4) Remove tube assembly from torque sensor assembly. Remove packing.

(5) Remove adapter from accessory drive housing.

(6) Remove bolt and nuts securing torque sensor assembly to accessory drive housing. Carefully remove torque sensor assembly.

R NOTE: Record number and thickness of shims removed to aid in
R reassembly. Lockwire shims to torque sensor mounting
R flange to prevent loss or intermingling with compressor
R bearing shims.

(7) Remove shims between torque sensor assembly and accessory drive housing.

(8) Refer to 72-10-17, MAINTENANCE PRACTICES, for further disassembly.

KEY TO FIGURE 202

5.	NUT	75.	BOLT	150.	BOLT	215.	NUT
	(IPC FIG. 159)	80.	WASHER	153.	KEY WASHER	220.	WASHER
10.	WASHER	90.	INSERT	155.	PLUG	225.	BUSHING
15.	BOLT	95.	PLUG	160.	TUBE	230.	BOLT
20.	BOLT	100.	MANIFOLD	165.	PACKING	235.	BOLT
25.	WASHER	105.	PACKING	170.	ADAPTER	240.	WASHER
30.	CLAMP	110.	BOLT	175.	PACKING	245.	WASHER
35.	BOLT	115.	WASHER	180.	PACKING	250.	BUSHING
40.	WASHER	120.	SCREW	185.	TRANSFER TUBE	255.	BUSHING
45.	BRACKET	125.	WASHER	190.	PACKING	260.	TORQUE SENSOR
50.	WASHER	130.	RETAINER	195.	BOLT		ASSY
55.	BOLT	135.	TUBE	200.	WASHER	275.	WASHER
60.	WASHER	140.	PACKING	205.	TUBE	295.	SHIM
65.	SCREW	145.	PACKING	210.	PACKING		
70.	WASHER						

1. D. (Pre SB72-0061) Install Oil Transfer Manifold, Torque Sensor Assembly, and Fittings

CAUTION: CARE SHOULD BE TAKEN TO INSTALL SHIMS PROPERLY ON TOP OF RETAINER. ACCURATE MEASUREMENTS MUST BE TAKEN FOR SHIMMING PROCEDURES OF TORQUE SENSOR COMPONENTS TO ENSUE PROPER ALIGNMENT OF COMPONENTS.

NOTE: Refer to 70-00-00, STANDARD PRACTICES, for recommended general torque values. Add frictional drag (run-down) torque of self-locking devices to recommended values.

Lightly coat new packings with clean engine oil or lubricant (OS-124) prior to installation.

(1) Place a parallel bar on face of housing assembly (see figure 203). With a depth micrometer, measure the distance from the face of accessory housing to face of bearing carrier retainer (see figure 203), then remove bearing carrier retainer nuts and install shims (290, figure 201) as required to obtain a dimension of 6.290 to 6.300 inches. Reinstall bearing carrier retainer nuts. Tighten bearing carrier retainer nuts finger tight.

(2) Assemble new packings (265, figure 201) on adapter (260) and new packings (245) on both ends of tube assembly (240). Install tube into adapter and secure with retainer (235), screw (230), washers (225), and nut (220).

(3) Install new packing (215) on fitting assembly (210), and new packings (200, 205) on tube assembly (195), then install tube assembly into fitting assembly and secure with retainer (190), screw (185), washers (180), and nut (175).

(4) Assemble new packings (150, 155) on tube assembly (145), then install tube assembly into manifold (170) and secure with retainer (140), washer (135), and screw (130).

(5) Insert tube assembly (240) with adapter (260) into torque sensor assembly (300) and secure with retainer (125), washer (120), and bolt (90).

(6) Insert tube assembly (195) with fitting assembly (210), into torque sensor assembly (300), then insert tube assembly (145) with manifold (170) into torque sensor assembly. Align holes into flange of tube assemblies (145, 195) and secure with bracket (105), bolt (110), washer (115) or washers (85), nut (80), screw (95), and retainer (100).

CAUTION: IF TORQUE SENSOR ASSEMBLY TO BE INSTALLED IS NOT THE TORQUE SENSOR WHICH WAS REMOVED ENSURE THAT TORQUE SENSOR HOUSING DOES NOT HAVE INTERFERENCE WITH BOSSES IN ACCESSORY DRIVE HOUSING AND THAT TORQUE SENSOR ASSEMBLY FULLY SEATS ON TORQUE SENSOR SHIMS.

1. D. (7) Install torque sensor assembly (300, figure 201) with assembled plumbing (position plumbing as necessary) over locating pins in retainer and against torque sensor shims (290). Secure with washers (75) and nuts (70). Tighten nuts (70) and bearing carrier retainer nuts to torque value of 80 inch-pounds.

(8) Swing tube assembly (145) up and install new packings (65) to back of manifold (170) and assemble to accessory housing. Secure manifold to housing with washers (50, 60), bolts (40, 45) and screw (55). Tighten bolts (40, 45) and screw (55) to torque value of 40 inch-pounds.

(9) Secure tube assembly (195) and fitting assembly (210) to housing assembly with bracket (35), clamp (30) washers (20), bolts (25), and nut (15). Tighten bolts (25) to torque value of 25 inch-pounds.

(10) Secure adapter (260) to housing assembly with washer (10) and bolt (5). Tighten bolt (5) to torque value of 25 inch-pounds.

(11) Tighten screws (95, 130, 185, 230) and bolts (90, 110) previously installed) to torque value of 15 inch-pounds.

(12) Rotate torque sensor assembly gear until hole in gear is on top by reaching through air intake and rotating first stage impeller.

(13) If 284880-1-1 test stand is to be used for torque sensor calibration, insert 865376-1 pin with tag through propeller shaft (propeller pitch control) mounting pad opening in accessory drive housing from the rear side and into hole in torque sensor gear assembly.

(14) If 293138-1 negative torque setting calibrator is to be used, install 865376-1 torque sensor cam lock pin or other suitable lock pin through torque sensor cam from forward side of engine so that lock pin can be removed after intermediate housing (diaphragm) is installed. Torque sensor lock pin may be fabricated from 0.040 to 0.050 inch diameter lockwire approximately 24 inches long. Lock pin may be passed through accessory drive housing drain plug or through accessory drive housing to oil tank balance line on side of housing above inlet temperature sensor.

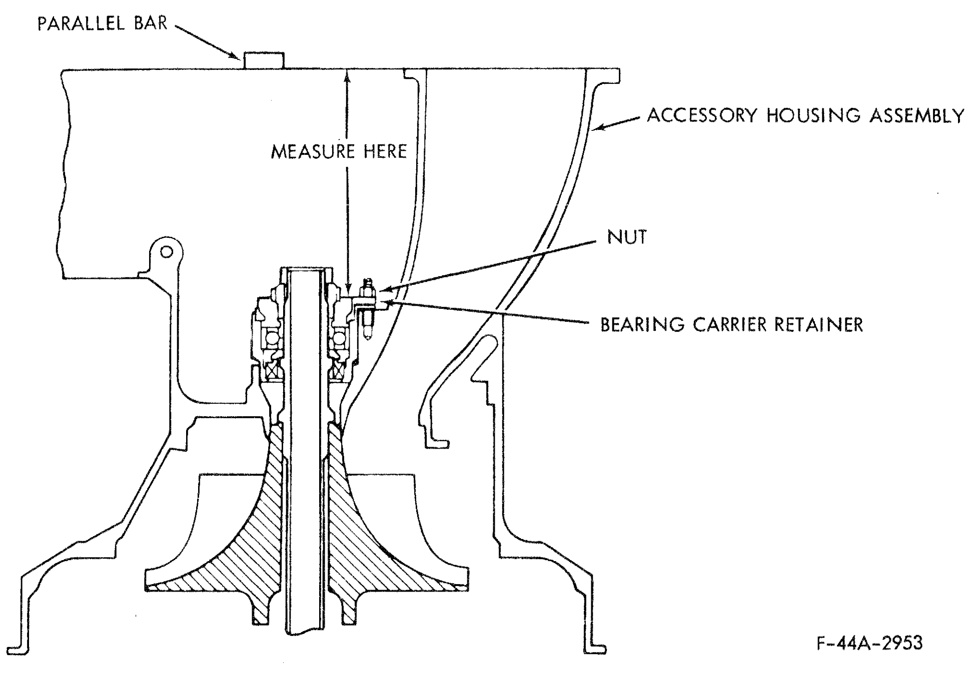
(15) Install diaphragm. Refer to 72-10-13, MAINTENANCE PRACTICES.

1. E. (Post SB72-0061) Install Oil Transfer Manifold, Torque Sensor Assembly and Fittings

R NOTE: Refer to 70-00-00, STANDARD PRACTICES, for recommended general torque values. Add frictional drag (run-down) torque of self-locking devices to recommended values.

Lightly coat new packings with clean engine oil or lubricant (OS-124) prior to installation.

(1) Install direct drive fuel control gearshaft. Refer to 72-10-17 MAINTENANCE PRACTICES.



Shimming for Torque Sensor Installation
Figure 203

CAUTION: CARE SHOULD BE TAKEN TO INSTALL SHIMS PROPERLY ON TOP OF RETAINER. ACCURATE MEASUREMENTS MUST BE TAKEN FOR SHIMMING PROCEDURES OF TORQUE SENSOR COMPONENTS TO ENSURE PROPER ALIGNMENT OF COMPONENTS.

1. E. (2) Place a parallel bar on face of housing assembly (see figure 203). With a depth micrometer, measure the distance from the face of accessory housing to face of bearing carrier retainer (see figure 203), then remove bearing carrier retainer nuts and install shims (295, figure 202) as required to obtain a dimension of 6.290 to 6.300 inches. Reinstall bearing carrier retainer nuts. Tighten bearing carrier retainer nuts finger tight.

(3) Install new packings (210) on both ends of tube assembly (205). Install new packings (190) on both ends of tube (185). Install new packings (175, 180) on adapter assembly (170). Install new packings (165) on tube (160) or plug (155). Install new packings (140, 145) on both ends of tube assembly (135).

(4) Assemble tube assembly (135) to manifold assembly (100) and secure with retainer (130), washer (125), and screw (120). Tighten screw to torque value of 15 inch-pounds.

(5) Assemble other end of tube assembly (135) into torque sensor port and secure with washer (115) and bolt (110). Tighten bolt to torque value of 40 inch-pounds.

(6) Install tube (185) and tube assembly (205) into adapter assembly (170). Install adapter assembly and tubes into ports in accessory drive housing. Install washer (200) and bolt (195). Tighten bolt to torque value of 40 inch-pounds.

(7) Install tube (160) or plug (155) and secure with bolt (150) and key washer (153). Tighten bolt to torque value of 60 inch-pounds and secure by bending tabs of key washer against bolt head.

CAUTION: IF TORQUE SENSOR ASSEMBLY TO BE INSTALLED IS NOT THE TORQUE SENSOR WHICH WAS REMOVED, ENSURE THAT TORQUE SENSOR HOUSING DOES NOT HAVE INTERFERENCE WITH BOSSES IN ACCESSORY DRIVE HOUSING AND THAT TORQUE SENSOR ASSEMBLY FULLY SEATS ON TORQUE SENSOR SHIMS.

(8) Install torque sensor assembly (260, figure 202) with assembled plumbing (position plumbing as necessary) over locating pins in retainer and against torque sensor shims (295). Guide torque sensor assembly port onto adapter assembly and tubes. Secure torque sensor assembly with washers (220) and nuts (215). Do not torque nuts (215) at this time.

1\. E. (9) (Post SB72-0095) Install 293097-1-1 alignment tool in idler gear bearing cavity and onto torque sensor spur gear pin. (See figure 204.)

CAUTION: SLEEVE BUSHING MUST NOT PROTRUDE ABOVE THE TORQUE SENSOR HOUSING WHEN INSTALLED, BUT MUST NOT BE FORCED IN PLACE.

(10) (Post SB72-0095) Remove the center torque sensor retaining nut (see figure 204) and install the largest of the three sleeve bushings (225, figure 202) that will fit over the center torque sensor housing stud. Ensure that the sleeve bushing is inserted through the compressor bearing retainer and shims. If no bushing will fit, the dimension tolerance is acceptable and no bushing is required. Install retaining nut (215). Do not tighten nut at this time.

(11) Install new packings (105) on back of manifold assembly (100). Swing manifold assembly up and secure with bolts (55, 75), screw (65) and washers (60, 70, 80). Tighten bolts and screws to torque value of 40 inch-pounds.

(12) Check installation alignment of assembled parts.

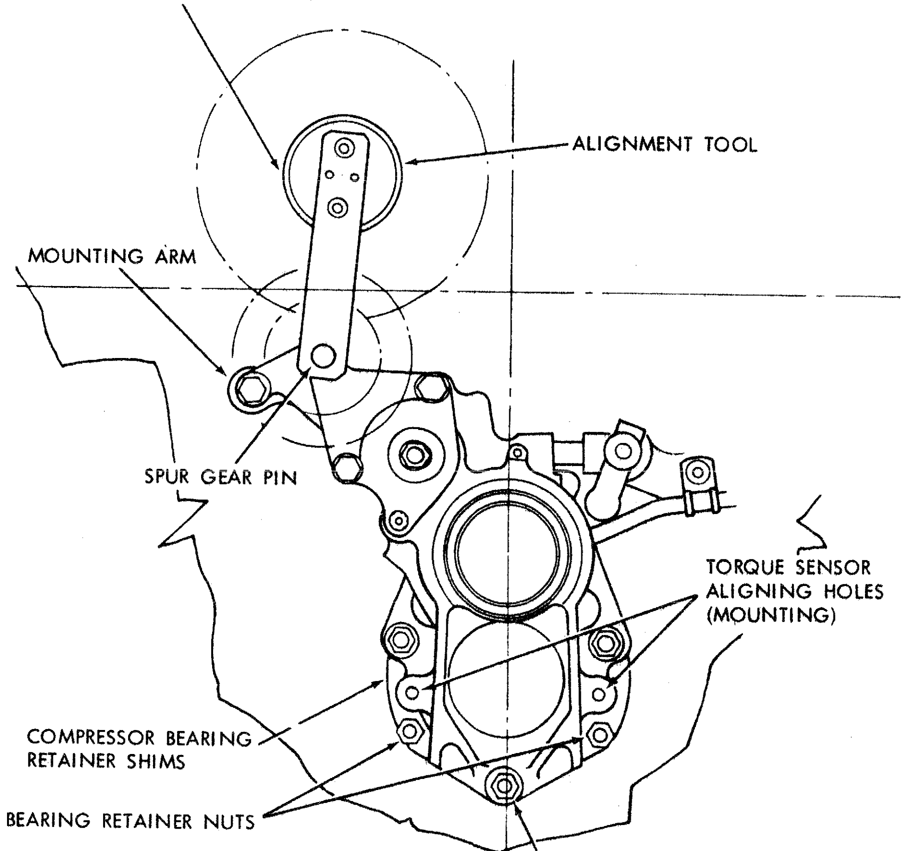
(13) Tighten nuts (215, figure 202) and bearing carrier retainer nuts to torque value of 80 inch-pounds.

NOTE: Gap between accessory drive housing and upper left portion of torque sensor housing should be as close to 0.000 inch as possible to reduce possibility of misalignment in subsequent shimming operations (see figure 205). Gap may be increased or decreased by adjusting shims under torque sensor assembly.

(14) Measure gap between accessory drive housing and upper left portion of torque sensor housing using feeler gage. See Figure 205 to determine quantity and thickness of washers (275, figure 202) (shims) required to obtain 0.000 to 0.002 inch interference between accessory drive housing and torque sensor housing. Install washers (275) (shims).

NOTE: Bushing (255, figure 202) is used with Torque Sensor Assembly Part No. 896826-2 only.

(15) (Pre SB72-0095) Install bushing (255, figure 202, when applicable), washer (240), and bolt (230). Tighten bolt to torque value of 50 inch-pounds.



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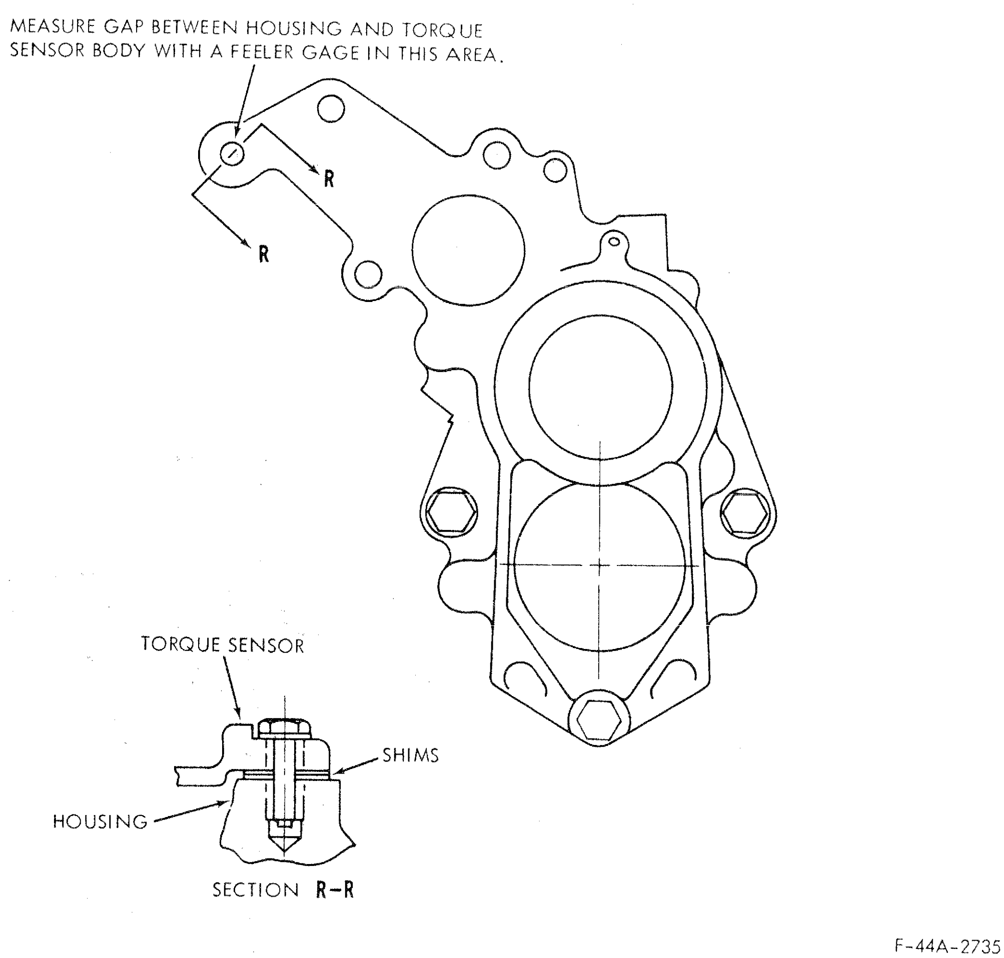
(Post SB72-0095) Torque Sensor Alignment
Figure 204



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(Post SB72-0061) Torque Sensor Assembly Housing
Shim Requirements
Figure 205

R 1. E. (16) (Post SB72-0095) Insert the sleeve bushing (250, figure 202) into the torque sensor housing arm bolt hole. Rotate the bushing until the eccentric hole is aligned to allow the bolt (235) to be started into the gearcase threads.

R (17) (Post SB72-0095) Remove bolt and place key washer (245) into position, inserting the large tab into the hole of torque sensor housing arm. The smaller tab will fit into one of the slots of the sleeve bushing. If necessary the bushing may be rotated slightly to accept the locking tab.

R (18) (Post SB72-0095) Install bolt (235, figure 202) and tighten to torque value of 50 inch-pounds. Bend tab locks over bolt head.

R (19) (Post SB72-0095) Remove the alignment tool. if tool binds, loosen nuts and bolts and retorque, recheck alignment with tool.

(20) Install clamp (30) and secure with washers (25, 50) and bolt (20) or install bracket (45), clamp (30), and secure with bolts (15, 35) washers (10, 40) and nut (5). Tighten bolts (20 or 35) to torque value of 40 inch-pounds or tighten bolt (15) to torque value of 25 inch-pounds.

(21) Rotate torque sensor assembly gear until hole in gear is on top by reaching through air intake and rotating first stage impeller.

(22) If 284880-1-1 test stand is to be used for torque sensor calibration, insert 865376-1 pin with tag through propeller shaft (propeller pitch control) mounting pad opening in accessory drive housing from the rear side and into hole in torque sensor gear assembly.

R (23) If 293138-1 negative torque setting calibrator is to be used in-
R stall 865376-1 torque sensor cam lock pin or other suitable lock
R pin through torque sensor cam from forward side of engine so that
R lock pin can be removed after intermediate housing (diaphragm) is
R installed. Torque sensor lock pin may be fabricated from 0.040 to
R 0.050 inch diameter lockwire approximately 24 inches long. Lock
R pin may be passed through accessory drive housing to oil tank
R balance line of side of housing above inlet temperature sensor.

(24) Install direct drive fuel control gear train. Refer to 72-10-15, MAINTENANCE PRACTICES.

2. Adjustment/Test

NOTE: Table 203 provides a list of special tools, fixtures and equipment required for Adjustment/Test.

Table 203. Special Tools, Fixtures and Equipment

Item No.	Nomenclature	Use	Source/ Part No.
NOTE: Equivalent substitutes may be used for listed items.			
1.	Gear Locking Fixture (For clockwise turning engines)	Used to lock planetary gear assembly while removing high speed pinion retainer.	284452-1-1
2.	Torque Calibration Adapter Plate	Used to cover oil passages and adapt to oil lines on accessory drive housing when establishing negative and positive settings.	284453-1-1
3.	Spline Positioning Wrench (Quill)	Used to change torsion shaft spline position when adjusting negative torque.	284455-1-1
4.	Spline Positioning Wrench	Used to reposition and indicate coupling spline position when adjusting negative torque.	284456-1-1
5.	Splined Torque Wrench Adapter	Used to hold turbine end of main shaft while applying torque when adjusting torque sensor on engine.	284457-1-1
6.	Orifice Plate	Used in place of propeller governor for covering oil passages and for providing orifice, when establishing negative and positive torque settings.	284459-1-1
7.	Oil Plug	Used to block oil passages in accessory drive housing when adjusting torque sensor. For use with high speed pinion roller bearing engines.	284460-1-1

Table 203. Special Tools, Fixtures and Equipment (Cont)

Item No.	Nomenclature	Use	Source/ Part No.
8.	Torque Calibration Cover	Used to seal oil port to accessory drive housing flange during negative torque adjustment.	284566-1-1
9.	Gear Train Lock	Used to lock gear train during positive and negative torque adjustment.	284689-1-1
10.	Test Stand (Torque Setting)	Used to supply oil, indicate and regulate pressure when establishing negative or positive torque setting.	284880-1-1
11.	Spline Positioning Wrench	Used to reposition and indicate coupling spline position when adjusting negative torque.	285159-1-1
12.	Locking Fixture (Turbine)	Used to lock rotating group while adjusting torque sensor.	285809-1-1
13.	Shaft Locking	Used to prevent rotation of engine main shaft when adjusting trip torque on unfeathering valve.	285821-1-1
14.	Dummy Feathering Valve	Used in place of feathering valve for adapting to oil lines when establishing positive and negative torque settings.	287220-1-1
R 15.	Coupler Indexing Holder	Used to hold coupler in torsion shaft while performing calibration.	287221-1-1
R 16.	Torque Wrench Adapter	Used when checking trip torque of feathering valve.	287277-1-1

Table 203. Special Tools, Fixtures and Equipment (Cont)

Item No.	Nomenclature	Use	Source/ Part No.
17.	Ball Lock Wrench	Used to install or remove ball lock in the helical pinion gearshaft assembly and to check for positive engagement of balls after installation.	289318-1-1
18.	Oil Plug	Used to block oil passages in accessory housing when adjusting torque sensor. For use with high speed pinion journal bearing engines.	291790-1-1
19.	Negative Torque Setting Calibrator	A self contained, portable calibrator used to adjust negative and positive torque setting with minimum removal of engine accessories.	293138-1
20.	Oil Pump Plug	Used to seal off shaft of oil lubricated fuel pump splined drive coupling when establishing negative or positive torque setting.	294195-1-1
21.	Cover	Used to cover solenoid vent valve port on accessory drive housing during torque sensor calibration.	865019-1
22.	Cam Assembly Lock Pin	Used to maintain zero degree position of torque sensor assembly during calibration.	865376-1

NOTE: After any maintenance requiring removal of intermediate gearbox assembly, torque sensor calibration shall be performed in accordance with 72-10-16, Adjustment/Test and NTS ground and flight check shall be accomplished in accordance with 72-00-00, ADJUSTMENT/TEST.

R Torque sensor calibration may be accomplished using
R either 284880-1-1 test stand or 293138-1 negative
R torque setting calibrator. If 293138-1 calibrator is
R used, calibration can be accomplished with engine in-
R stalled in aircraft without removal of turbine section
R components, propeller governor, propeller pitch con-
R trol, tachometer generator and without disturbing en-
R gine rigging or blocking the oil tank. Refer to para-
R graph A if 284880-1-1 test stand is to be used. Refer
R to paragraph B if 293138-1 negative torque setting
R calibrator is to be used.

2. A. Perform Torque Sensor Calibration Using 284880-1-1 Test Stand

(1) Prepare torque sensor calibration setup as follows. (See figures 206, 207 and 208.)

(a) (Post SB-0119) Remove turbine components in accordance with 72-50-01 through 72-50-04, MAINTENANCE PRACTICES, if installed.

R (b) (Codes AA-BC, EA-LA) Install 284453-1-1 torque calibration adapter plate (see figure 207) on engine. Cap both fittings of torque calibration adapter plate.

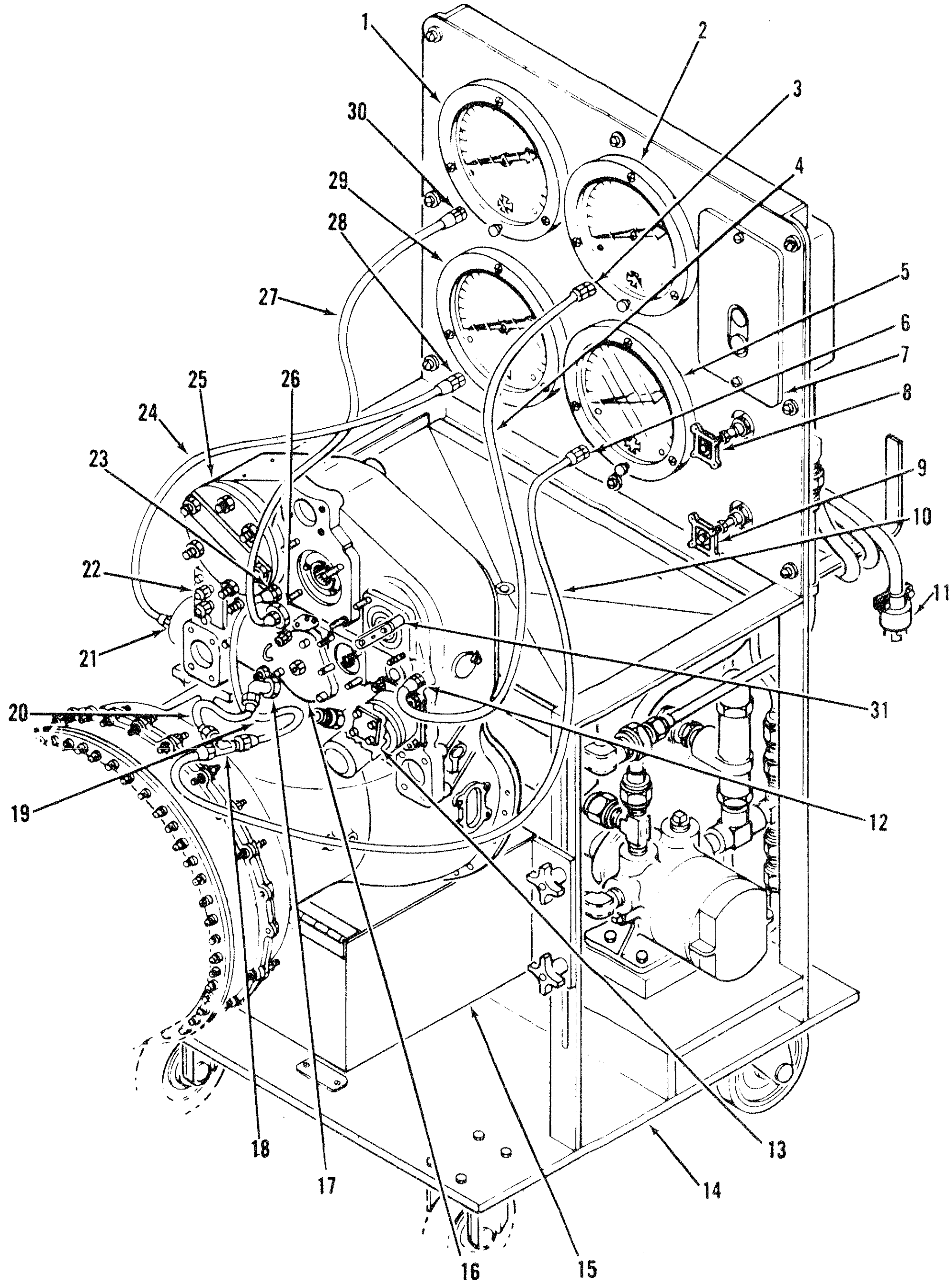
(c) Install 284459-1-1 orifice plate (see figure 207) with 865664-3 gasket on engine. Cap the upper fitting located on orifice plate.

(d) Install 284566-1-1 torque calibration cover (oil inlet cover) (see figure 207) with gasket on engine. Install 284195-1-1 oil pump plug if engine configured with oil lubricated fuel pump drive spline and pump is removed.

(e) Install 865019-1 cover (vent valve) (see figure 208) to cover solenoid valve port on engine during calibration procedure, or install solenoid vent valve with packings.

(f) Remove feathering valve and install 287220-1-1 dummy feathering valve and secure with bolts. Tighten bolts to 40 inch-pounds torque (see figure 207).

(g) (Roller Bearing High Speed Pinion) Install 284460-1-1 oil plug and secure with nuts. Tighten nuts to 70 to 80 inch-pounds torque (see figure 208).



R

R Torque Sensor Calibration Test Setup (PN 284880-1-1)
Figure 206

2. A. (1) (h) (Journal Bearing High Speed Pinion) Install 291790-1-1 oil plug and secure with nuts. Tighten nuts to 70 to 80 inch-pounds torque (see figure 208).

(i) Secure lower portion of intermediate gearbox assembly to input housing assembly by installing washers and speed nuts on empty studs. Tighten speed nuts to 80 inch-pounds torque.

(j) (Journal Bearing High Speed Pinion) Install oil plug and packing in intermediate gearbox housing on lower left side of high speed pinion port. Secure with bolt and washer.

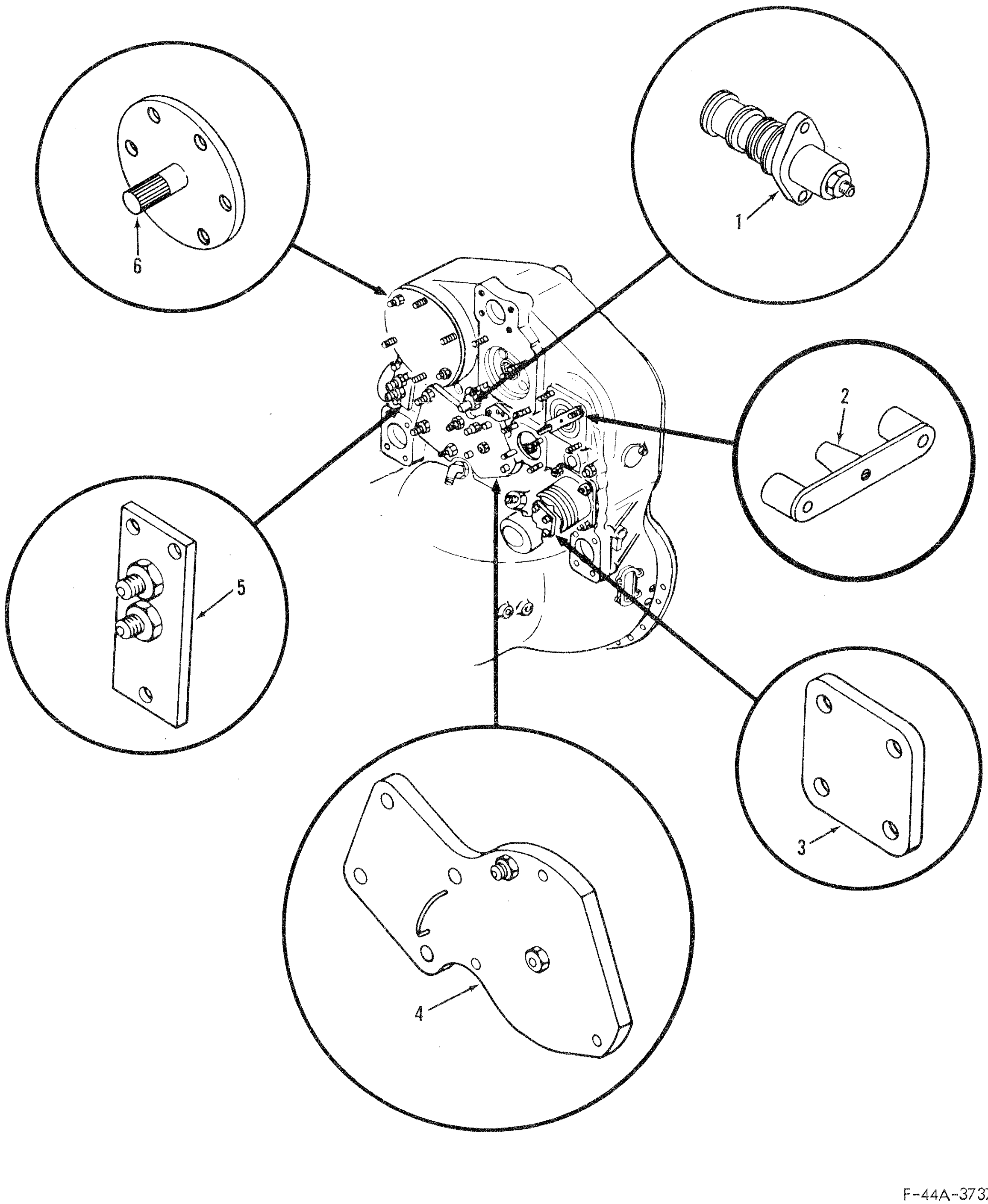
(k) Provide and install unions (12, 23, figure 206) in rear of reduction gear section in ports shown for connection of hose assemblies.

(l) Position 284880-1 test stand (see figure 206) in front of engine so oil which drains from engine will return to oil tank assembly.

KEY TO FIGURE 206

* 1.	GAGE (NEGATIVE TORQUE SENSOR)	*17.	ELBOW
* 2.	GAGE (INLET PRESSURE)	*18.	TEE
* 3.	UNION	*19.	HOSE ASSY
* 4.	HOSE ASSY	*20.	HOSE ASSY
* 5.	GAGE (PUMP PRESSURE)	21.	TORQUE COMPENSATOR ASSY
* 6.	UNION	22.	284453-1-1 PLATE
* 7.	SWITCH (TEST STAND POWER)	*23.	UNION
* 8.	GATE VALVE	*24.	HOSE ASSY
* 9.	GATE VALE	25.	284689-1-1 LOCK
*10.	HOSE ASSY	26.	287220-1-1 DUMMY FEATHERING VALVE
*11.	PLUG (ELECTRICAL CONNECTOR)	*27.	HOSE ASSY
*12.	UNION	*28	UNION
13.	284566-1-1 COVER	*29.	GATE (POSITIVE PRESSURE)
14.	284880-1-1 TEST STAND	*30.	UNION
*15.	OIL TANK ASSY	31.	294195-1-1 OIL PUMP PLUG
16.	284459-1-1 PLATE		

*COMPONENT OF 284880-1-1 TEST STAND (14).



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1. 287220-1-1 DUMMY FEATHERING VALVE
2. 294195-1-1 OIL PUMP PLUG
3. 284566-1-1 TORQUE CALIBRATION COVER (OIL INLET COVER)
4. 284459-1-1 ORIFICE PLATE
5. 284453-1-1 TORQUE CALIBRATION ADAPTER PLATE
6. 284689-1-1 GEAR TRAIN LOCK

Special Tools for Torque Sensor Calibration
Figure 207

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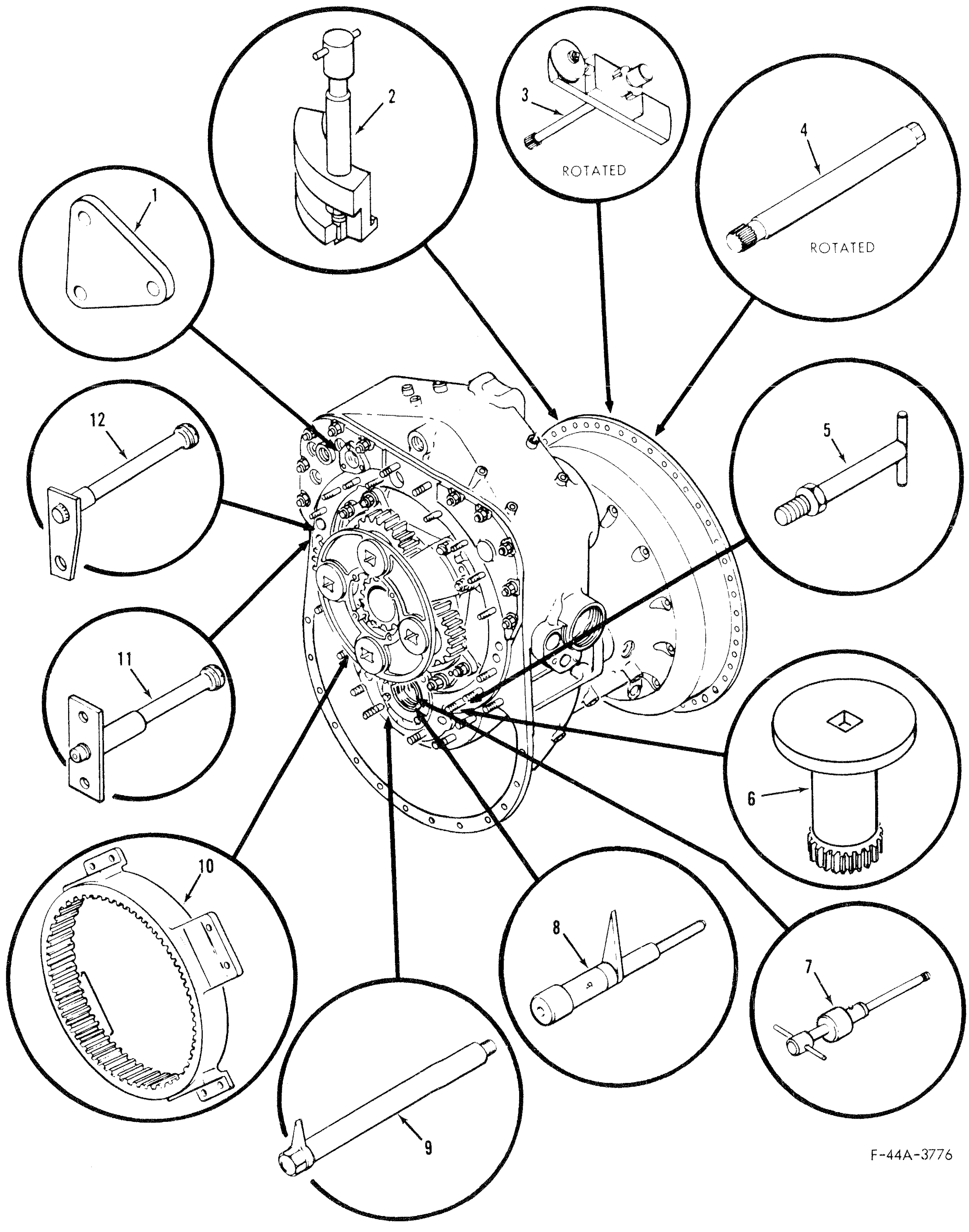


Torque Sensor Calibration Tools
Figure 208

R 2. A. (1) (m) (Codes AA-BC, EA-LA) Connect hose assembly (24) from union (28) below positive pressure gage (29) on test stand (14) to upper fitting of torque pressure transducer mounting adapter (22).

R (n) (Codes CA-CC) Connect hose assembly (24) from union (28) below positive pressure gage (29) on 284880-1-1 test stand to fitting located on torque sensor compensator assembly (21).

(o) Connect hose assembly (27) from union (30) below negative and servo pressure gage (1) on 284880-1-1 test stand to 287220-1-1 dummy feathering valve.

(p) Connect hose assembly (4) from union (3) below inlet pressure gage (2) to union (12) on right side of reduction gear section.

(q) Connect hose assembly (10) from union (6) below pump pressure gage (5) to tee (18). Connect hose assemblies (19, 20) from tee (18) to union (23) (installed adjacent to gear train lock) and elbow (17) respectively.

(r) Check test stand oil tank assembly for an adequate supply of oil (oil tank shall be at least half full).

(s) Close upper gate valve (8) and open lower gate valve (9) on test stand. Place starter motor switch (7) in the OFF position, then connect electrical connector plug (11) to a source of 220 volts, 60 Hz electrical power.

(t) Pressurize calibration setup as follows.

1 Place starter motor switch (7, figure 206) in the ON position and close gage valve (9). Allow the oil to circulate at approximately 100 psi for five minutes to allow oil to warm up and to purge air from system.

KEY TO FIGURE 208

1. 865019-1 COVER (VENT VALVE)
2. 285809-1-1 TURBINE LOCKING FIXTURE
3. 285821-1-1 SHAFT LOCKING FIXTURE
4. 284457-1-1 SPLINE TORQUE WRENCH ADAPTER
5. 289318-1-1 BALL LOCK WRENCH
R 6. 287277 1-1 TORQUE WRENCH ADAPTER
7. 284455-1-1 SPLINE POSITIONING WRENCH (QUILL SHAFT)
8. 285159-1-1 SPLINE POSITIONING WRENCH
9. 284456-1-1 SPLINE POSITIONING WRENCH
10. 284452-1-1 GEAR LOCKING FIXTURE
11. 284460-1-1 OIL PLUG (ROLLER BEARING)
12. 291790-1 1 OIL PLUG (JOURNAL BEARING)

2. A (1) (t) 2 Adjust knob of gate valve (8) to apply 100 to 103 psig inlet oil pressure to the engine as indicated on inlet pressure gage (2). Keep inlet oil pressure set at 100 to 103 psig for entire calibration procedure.

R (2) (Pre SB72-0119) Perform torque sensor calibration (long torsion shaft, short coupler) as follows.

CAUTION: IF TURBINE IS ROTATED TOO FAR DURING CALIBRATION (WITH COUPLING REMOVED) TORQUE SENSOR MOVEABLE CAM SET DISENGAGES FROM FIXED CAM SET. DO NOT RE-ENGAGE BY LIFTING NOSE OF ENGINE UP. THE DIAPHRAGM SHALL BE REMOVED AND MOVEABLE CAM SET RE-ENGAGED SO THAT PIN HOLES THROUGH THE FIXED AND MOVEABLE CAM SET ARE ALIGNED. THE CAM SET IS BALANCED IN THIS MANNER AND ANY OTHER CAM SET ORIENTATION MAY CAUSE IMBALANCE AND TORQUE SENSOR PRESSURE FLUCTUATION.

NOTE: Two men are required to perform following calibration procedures. Refer to Figure 208 for illustration of calibration tools.

(a) Using 284456-1-1 spline (coupler) positioning wrench, insert coupling assembly into any free position.

(b) Remove 865376-1 torque sensor cam assembly locking pin.

(c) Install 284689-1-1 starter drive gear lock to lock gear train.

(d) Using 284456-1-1 spline (coupler) positioning wrench remove coupling assembly.

(e) Rotate turbine slowly by hand clockwise (looking forward) to obtain 50 psi POSITIVE pressure (gage 28, figure 206).

(f) Rotate turbine slowly by hand counterclockwise (looking forward) to obtain a slight rise in NTS pressure (gage 1. figure 206).

(g) Using 284456-1 1 spline (coupler) positioning wrench insert coupling assembly.

NOTE: The minimum incremental change is obtained by rotating coupling 160 degrees. Remove, rotate and reinsert coupling assembly as necessary to obtain NTS pressure indicated in step (h). If unable to obtain pressure, replace coupling and repeat.

2. A. (2) (h) Apply (firm) counterclockwise (looking forward) hand torque to turbine to overcome static drag (do not snap turbine wheel). Recheck NTS pressure (gage 1, figure 206) making certain that 30 +6/-6 psig is obtained.

(i) Position turbine in the center of the backlash. Using 284456-1-1 spline (coupler) position wrench remove coupling assembly and rotate counterclockwise (looking aft) 160 degrees (180 degrees less 3 teeth on large end) then reinsert coupling assembly.

(j) Apply (firm) counterclockwise (looking forward) hand torque to turbine. Recheck NTS pressure (gage 1, figure 206) to check that pressure obtained is higher than pressure obtained in step (h).

(k) Repeat step (i) one time.

(l) Apply (firm) counterclockwise (looking forward) hand torque to turbine. NTS pressure (gage 1, figure 206) obtained should be 90 +10/-10 psig.

(m) Apply (firm) clockwise (looking forward) hand torque to turbine. POSITIVE pressure (gage 29, figure 206) obtained should be 11 to 18 psig.

(n) With clockwise (looking forward) hand torque applied to turbine remove 284456-1-1 spline (coupler) positioning wrench.

(o) Apply (light) clockwise (looking forward) hand torque to turbine and using 284455-1-1 spline (quill) positioning wrench insert torsion splined shaft at a position where it will install fully without binding.

(p) Using 284455-1-1 spline (quill) positioning wrench remove and reinsert torsion splined shaft rotating clockwise one long spline tooth at a time, until first tight position is found (slight resistance required for insertion and removal).

(q) Using 284455-1-1 spline (quill) positioning wrench remove torsion spline shaft and rotate clockwise 3 long spline teeth and reinsert, partially engaging long splines.

CAUTION: SHARPLY TAPPING TORSION SPLINE SHAFT UNTIL IT BOTTOMS MAY PRODUCE BURRS WHICH CAN INTERFERE WITH PROPER CALIBRATION.

2. A. (2) (r) Apply slight counterclockwise (looking aft) pressure to 284455-1-1 spline (quill) positioning wrench to engage short splines of torsion splined shaft. Lightly tap torsion splined shaft into place. Remove 284455-1-1 spline (quill) position wrench.

(s) Place starter motor switch (7, figure 206) to the OFF position. Disconnect hose assembly from 287220-1-1 dummy valve and connect to fitting located on orifice plate (16, figure 206). Remove dummy valve and reinstall feathering valve assembly. Turn on the test stand and adjust oil pressure to 100 to 103 psig as indicated by inlet pressure gage.

R (t) Install 285821-1-1 or 285809-1-1 turbine lock ring fixture to
R secure turbine wheel. (Use 285809-1-1 turbine lock ring fix-
R ture if scavenge pump is installed.)

R (u) Install 287277-1-1 internal spline adapter into high speed pinion gearshaft.

NOTE: Small ajdustments may be made to increase or decrease feathering valve trip torque by rotating the small end of the torsion spline shaft clockwise (looking aft) to increase or counterclockwise to decrease.

(v) Obtain feathering valve trip torque by applying counterclockwise torque to 287277-1-1 internal spline adapter using torque wrench. NTS pressure (gage 1, figure 206) should suddenly drop with 25 to 28 in./lb torque applied.

(w) Loosen 285821-1-1 or 285809-1-1 turbine lock ring fixture, rotate turbine 180 degrees and reinstall fixture. Repeat step (v). Remove turbine lock ring fixture and internal spline adapter.

(x) Screw 289318-1-1 ball lock wrench into shaft until it bottoms. Install spacer, spring and balls into ball lock retainer shaft. While holding balls in place, insert shaft with ball lock wrench into high speed pinion gearshaft. While applying pressure inward on wrench, partially unscrew ball lock wrench and check to see if shaft is locked in gearshaft. Remove ball lock wrench. (Shaft should be 0.270 inch depth from end of high speed pinion gearshaft.)

(y) Remove test equipment from engine.

2. A. (3) (Post SB72-0119) Perform torque sensor calibration (short torsion shaft, long coupler) as follows.

CAUTION: IF THE TURBINE IS ROTATED TOO FAR DURING CALIBRATION (WITH COUPLER REMOVED), THE TORQUE SENSOR MOVABLE CAM SET WILL DISENGAGE FROM THE FIXED CAM SET. DO NOT REENGAGE BY LIFTING THE NOSE OF THE ENGINE UP. THE DIAPHRAGM MUST BE REMOVED AND THE MOVABLE CAM SET REENGAGED SUCH THAT THE PIN HOLES THROUGH THE FIXED AND MOVABLE CAM SET LINE UP. THE CAM SET IS BALANCED IN THIS MANNER AND ANY OTHER ORIENTATION MAY CAUSE IMBALANCE AND TORQUE SENSOR PRESSURE FLUCTUATION.

NOTE: Rotate turbine, using 284457-1-1 spline torque wrench adapter with torque wrench, and measure amount of seal break-away torque required to start turbine rotation in three places 120 degrees apart. Compute and record average of the three seal break-away torques. Add the value recorded to torque applied to turbine in steps (h), (i), (k), and (l). Steps required are summarized in Table 204.

(a) Using 285159-1-1 spline positioning wrench, insert coupling assembly into any free position. Several free positions may be observed.

(b) Remove 865376-1 torque sensor cam assembly locking pin previously installed during torque sensor installation.

(c) Install 284689-1-1 gear train lock onto starter pad to lock gear train.

(d) Using 285159-1-1 spline positioning wrench, remove coupling assembly.

(e) Install 294457-1-1 spline torque wrench adapter in rear splines of main shaft (turbine scavenge pump and spur gearshaft removed). Rotate turbine slowly (using spline wrench adapter) clockwise (looking forward) to obtain 50 psig POSITIVE pressure (gage 29, figure 206).

(f) Rotate turbine slowly (using 284457-1-1 spline torque wrench adapter) counterclockwise (looking forward) until NTS pressure (gage 1, figure 206) rise is noted.

NOTE: Spring Assembly Part No. 3102049-1 may be left out and installed after the last coupler position has been determined.

2. A. (3) (g) Using 285159-1-1 spline positioning wrench, insert coupling assembly with spring assembly into any free position.

NOTE: The minimum increment change is obtained by rotating coupling 140 degrees.

Remove, rotate, and reinsert coupling assembly as necessary to obtain NTS pressures as per steps (h) and (i). If unable to obtain pressure replace coupling and repeat checks.

(h) Apply 100 inch-pounds counterclockwise (looking forward) torque to 284457-1-1 spline torque wrench adapter (in rear splines of main shaft) using torque wrench. NTS pressure (gage 1, figure 206) obtained should be less than 24 psig. If pressure is too high, center turbine and rotate coupler 140 degrees clockwise.

(i) Apply 130 inch-pounds counterclockwise torque to 284457-1-1 splined torque wrench adapter using torque wrench. NTS pressure (gage 1, figure 206) obtained should be more than 35 psig. If pressure in step (h) is within limit, but pressure in step (i) is too low, center turbine and rotate coupler 140 degrees counterclockwise and recheck steps (h) and (i).

NOTE: Spring Assembly Part No. 3102049-1 may be left out and installed after the last coupler position has been determined.

(j) Position turbine in the center of the backlash. Using 285159-1-1 spline positioning wrench, remove coupling assembly with spring and rotate counterclockwise (facing aft) 140 degrees, then reinsert coupling assembly with spring assembly.

NOTE: Using strong light and looking at internal splines in helical pinion gearshaft, determine if helical pinion gearshaft is pinned to prevent coupling assembly from being inserted too far. Pin is located approximately 2.20 inches from forward face of helical pinion gearshaft. If helical pinion gearshaft is not pinned, dimension 1.75 to 1.90 inches must be maintained throughout torque sensor calibration (see figure 209). This may be accomlished by one of the following methods.

2. A. (3) (j) 1 Take measurements or use maximum and minimum rods (gauges) each time coupler is repositioned. Measure through quill shaft slots after quill shaft has been installed.

2 By shimming 285159-1-1 spline positioning wrench to maintain coupler insertion depth within limits of Figure 209.

3 A depth tool may be fabricated as illustrated in Figure 209. Insert depth tool through aft end of main shaft and through torsion shaft. Install coupler until it contacts end of depth tool; this contact must be maintained during torque sensor calibration and quill shaft installation.

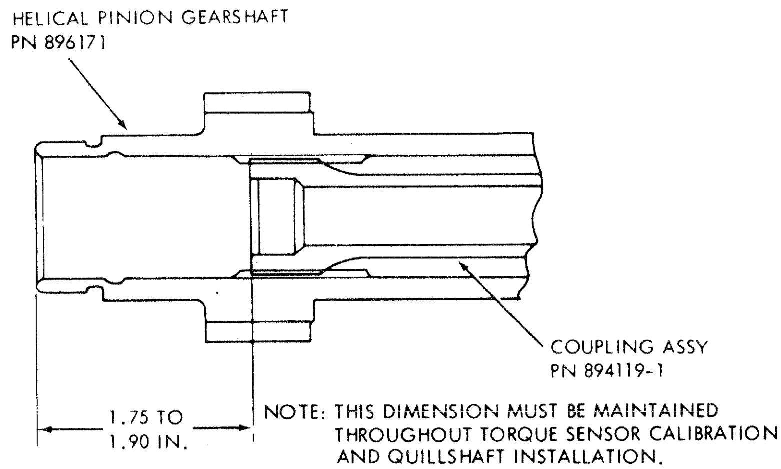
(k) Apply 100 inch-pounds counterclockwise (looking forward) torque to 284457-1 1 spline torque wrench adapter using torque wrench. Record NTS pressure (gage 1, figure 206) obtained.

NOTE: POSITIVE pressure obtained after fifth increment change as observed in step (1) shall be 14 +4/-4 psig (nominal).

(l) Apply 100 inch-pounds clockwise (looking forward) torque to 284457-1-1 spline torque wrench adapter using torque wrench. Record POSITIVE pressure (gage 29, figure 206).

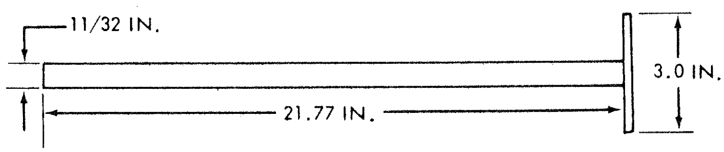
(m) Repeat steps (k) and (l) four times.

(n) Apply approximately 100 inch-pounds clockwise (looking forward) hand torque to turbine wheel to keep spring on coupler
R compressed and remove 285159-1-1 spline (coupler) positioning
R wrench. Ensure Spring Assembly Part No. 3102049-1 is installed.

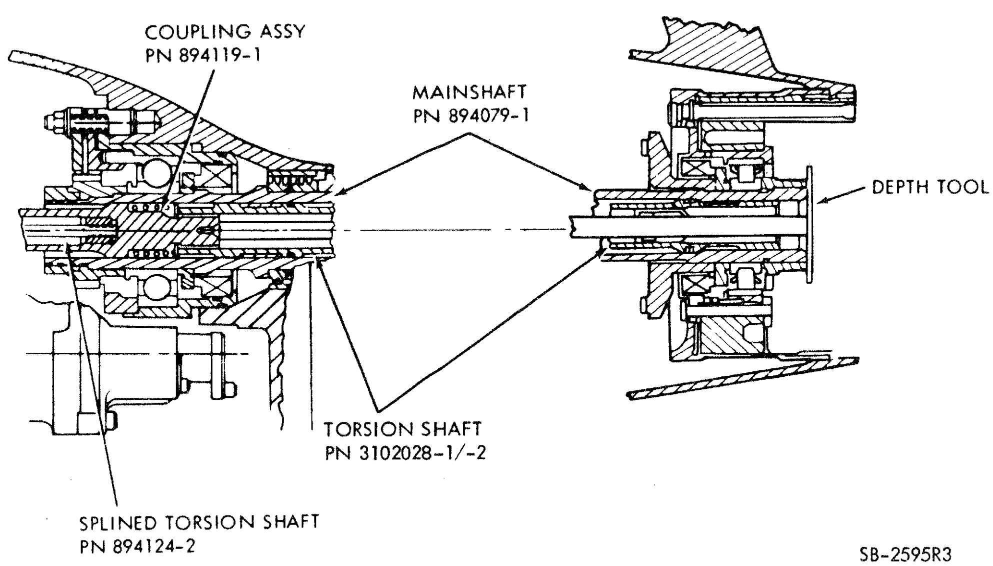


COUPLER INSTALLATION

R



DEPTH TOOL FABRICATION



R

(Post SB72-0119) Coupler Assembly Installation
Figure 209

CAUTION: WHEN INSTALLING TORSION SPLINED SHAFT IN HELICAL PINION GEARSHAFT THAT IS NOT PINNED, ENSURE THAT COUPLING ASSEMBLY MAINTAINS THE PROPER DEPTH (REFER TO FIGURE 210).

NOTE: Part No. 284455-1-1 spline positioning wrench has left hand threads.

2. A. (3) (o) Apply clockwise (looking forward) hand torque to turbine and using 284455-1-1 spline positioning wrench (quill), insert torsion spline shaft where it will install fully without binding.

(p) While holding approximately 100 inch-pound clockwise (looking forward) torque to turbine rotor and using 284455-1-1 spline positioning wrench (quill), remove and reinsert torsion spline shaft rotating clockwise (looking aft) one long spline tooth at a time, until first tight position is found (slight resistance required for insertion and removal).

(q) Using 284455-1-1 spline positioning wrench (quill), remove torsion spline shaft and rotate counterclockwise (looking aft) four long spline teeth and reinsert, partially engaging long splines.

CAUTION: SHARPLY TAPPING TORSION SPLINE SHAFT UNTIL IT BOTTOMS MAY PRODUCE BURRS WHICH CAN INTERFERE WITH PROPER CALIBRATION.

(r) Apply slight counterclockwise (looking aft) pressure to 284455-1-1 spline positioning wrench (quill) to engage short splines of torsion spline shaft. Lightly tap torsion spline shaft into place. Remove 284455-1-1 spline positioning wrench (quill).

(s) Remove 284457-1-1 spline torque wrench adapter (previously installed in step (e)). Install 285821-1-1 shaft locking fixture in rear splines of main shaft and on exhaust pipe.

(t) Install 287277-1-1 torque wrench adapter into high speed pinion gearshaft.

(u) Place starter motor switch (7, figure 206) to the OFF position. Disconnect hose assembly (27) from 287220-1-1 dummy feathering valve. Connect same end of hose to fitting located below 284459-1-1 orifice plate. Remove 287220-1-1 dummy feathering valve and reinstall feathering valve assembly. Turn on the test stand and adjust oil pressure to 100 to 103 psig as indicated by inlet pressure gage.

R NOTE: Small adjustments may be made to increase or
R decrease feathering valve trip torque by
R rotating the small end of the torsion spline
R shaft clockwise (facing aft) to increase, or
R counterclockwise to decrease.

R 2. A. (3) (v) (Roller Bearing High Speed Pinion) Obtain feathering valve
R trip by applying counterclockwise torque to 287277-1-1 torque
R wrench adapter using torque wrench. NTS pressure (gage 1, figure 206) should suddenly drop with 27 to 30 inch-pounds nominal torque applied.

(w) (Journal Bearing High Speed Pinion) Obtain feathering valve
R trip by applying counterclockwise torque to 287277-1-1 torque
R wrench adapter using torque wrench. NTS pressure (gage 1, figure 206) should suddenly drop with 29 to 37 inch-pounds nominal torque applied.

(x) Loosen 285821-1-1 shaft locking fixture, rotate turbine 180 degrees and reinstall. Repeat step (v) or (w). Remove 285821-1-1 shaft locking fixture.

CAUTION: DO NOT EXCEED 900 INCH-POUNDS TORQUE. DISTORTION OF PINION BEARING INNER RACE MAY OCCUR IF 900 INCH-POUNDS IS EXCEEDED.

(y) (Codes BA-BC, EA, GA, HA) Install 284457-1-1 splined wrench adapter in rear splines of main shaft and 284452-1-1 gear locking fixture. Apply 900 inch-pounds clockwise (looking forward) torque to 284457-1 1 spline torque wrench adapter using torque wrench. POSITIVE pressure (gage 29, figure 206) obtained should be 50 +5/-5 psig.

(z) (Codes AA-AC, CA-CC, FA, KA, LA) Install 284457-1-1 splined torque wrench adapter in rear splines of main shaft and 284689-1-1 gear train lock. Apply 900 inch-pounds clockwise (looking forward) torque to 284457-1-1 spline torque wrench adapter using torque wrench. POSITIVE pressure (gage 29, figure 206) obtained should be 50 +5/-5 psig.

NOTE: Ball lock shaft may require light tapping against quill shaft/coupler for full engagement.

R (aa) Remove 287277-1-1 torque wrench adapter. Screw 289318-1 ball lock wrench into shaft until it bottoms. Install spacer spring and balls into ball lock retainer shaft. While holding balls in place, insert shaft with 289318-1 ball lock wrench spacer and balls (ball lock retainer) into high speed pinion gearshaft. While applying pressure inward on wrench, partially unscrew 289318-1 ball lock wrench and check to see if shaft is locked in gearshaft. Remove ball lock wrench. Shaft (ball lock retainer) should be nominally 0.270 inch depth from end of high speed pinion gearshaft.

2. A. (3) (ab) Remove test equipment from engine. Remove speed nuts and washers installed in step A.(1)(i) if applicable.

B. Perform Torque Sensor Calibration Using 293138-1 Negative Torque Setting Calibrator Assembly (Mini Test Stand)

NOTE: After any maintenance requiring removal of intermediate gearbox assembly or coupler assembly torque sensor calibration shall be performed in accordance with 72-10-16, Adjustment/Test and NTS ground and flight check shall be accomplished in accordance with 72-00-00, ADJUSTMENT/TEST.

Torque sensor calibration may be accomplished using 293138-1 negative torque setting calibrator assembly (mini-test stand) without removing the propeller governor, propeller pitch control and tachometer generator and without disturbing the engine rigging or blocking the oil tank.

Two technicians may be required to accomplish calibration on some installations.

(1) Install 284460-1-1 oil plug (for roller bearing high speed pinion configuration) or 291790-1-1 plug (for journal bearing high speed pinion configuration) into intermediate housing (diaphragm). (See figure 208.)

(2) Install oil vent valve or 865019-1 oil vent valve cover (See figure 208.)

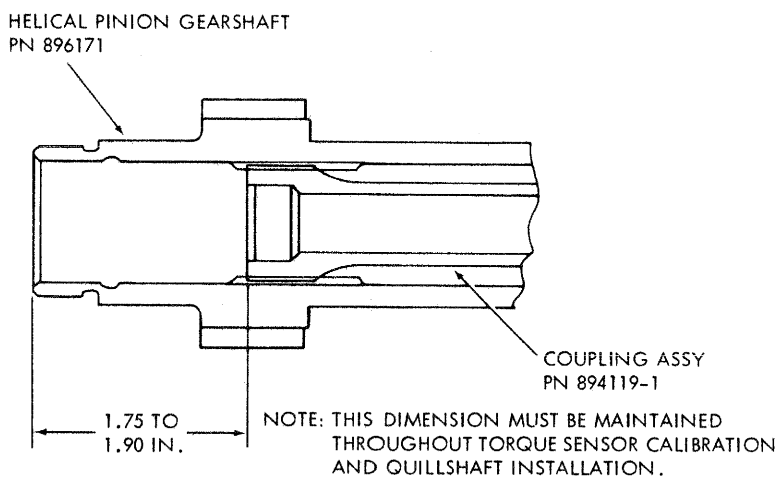
(3) (Codes AA-BC, EA-LA) Install 284453-1-1 torque calibration plate. (See figure 207.)

(4) (Codes CA-CC) Remove lock plate from torque compensator assembly and install 284461-1-1 torque calibration adapter plate.

(5) (Post SB72-0119) Using strong light and looking at internal splines in helical pinion gearshaft, determine if helical pinion gearshaft is pinned to prevent coupling assembly from being inserted too far. Pin is located approximately 2.20 inches from forward face of helical pinion gearshaft. If helical pinion gearshaft is not pinned, dimension 1.75 to 1.90 inches must be maintained throughout torque sensor calibration (see figure 210). This may be accomplished by one of the following methods.

R 2. B. (5) (a) Take measurements or use maximum and minimum rods (gauges) each time coupler is repositioned. Measure through quill shaft slots after quill shaft has been installed.

(b) By shimming 285159-1-1 spline positioning wrench to maintain coupler insertion depth within limits of Figure 210.



(Post SB72-0119) Maximum Depth of Coupling Assembly Into High Speed Pinion
Figure 210

NOTE: Post SB72-0119 engines use 285159-1-1 spline positioning wrench. Other configurations use 284456-1-1 spline positioning wrench.

2. B. (6) Install coupler into any free position using 285159-1-1 or 284456-1-1 spline positioning wrench.

(7) Install 284689-1-1 gear train lock onto starter pad to lock gear train.

(8) Carefully remove lock pin from torque sensor cam.

NOTE: Mini-Test Stands manufactured by manufacturers other than AiResearch may be connected slightly different than AiResearch mini-test stand. Follow manufacturers instructions for connection.

(9) Install and connect 293138-1 negative torque setting calibrator assembly (mini-test stand) components to engine as follows. (See figure 211.)

(a) Install 292513-1-1 beta tube support (5) on studs of intermediate housing (diaphragm), using speed nuts or diaphragm attaching nuts to secure support.

(b) Thread dummy beta tube with gage (22) into beta tube support until dummy beta tube bottoms in pitch control, then back out approximately one turn.

(c) Secure scupper drain (4) to intermediate gearbox housing below high speed pinion gearshaft so oil draining from engine will return to oil container (19).

(d) Remove engine feathering valve assembly and install 287220-1-1 dummy feathering valve (3). Install hose assembly (1) with gage (2) onto dummy feathering valve (3).

(e) Remove positive torque sensor regulator valve from engine housing port (7) and remove 292512-1-1 dummy positive torque sensor regulator from bracket of beta tube support assembly test block (6). Install 292512-1-1 dummy positive torque sensor regulator into port (7) in engine housing from which positive torque sensor regulator valve was removed and secure with bolts. Tighten bolts to 25 inch-pounds torque. Install positive torque sensor regulator valve which was removed from engine housing into bracket of beta tube support assembly test block (6).

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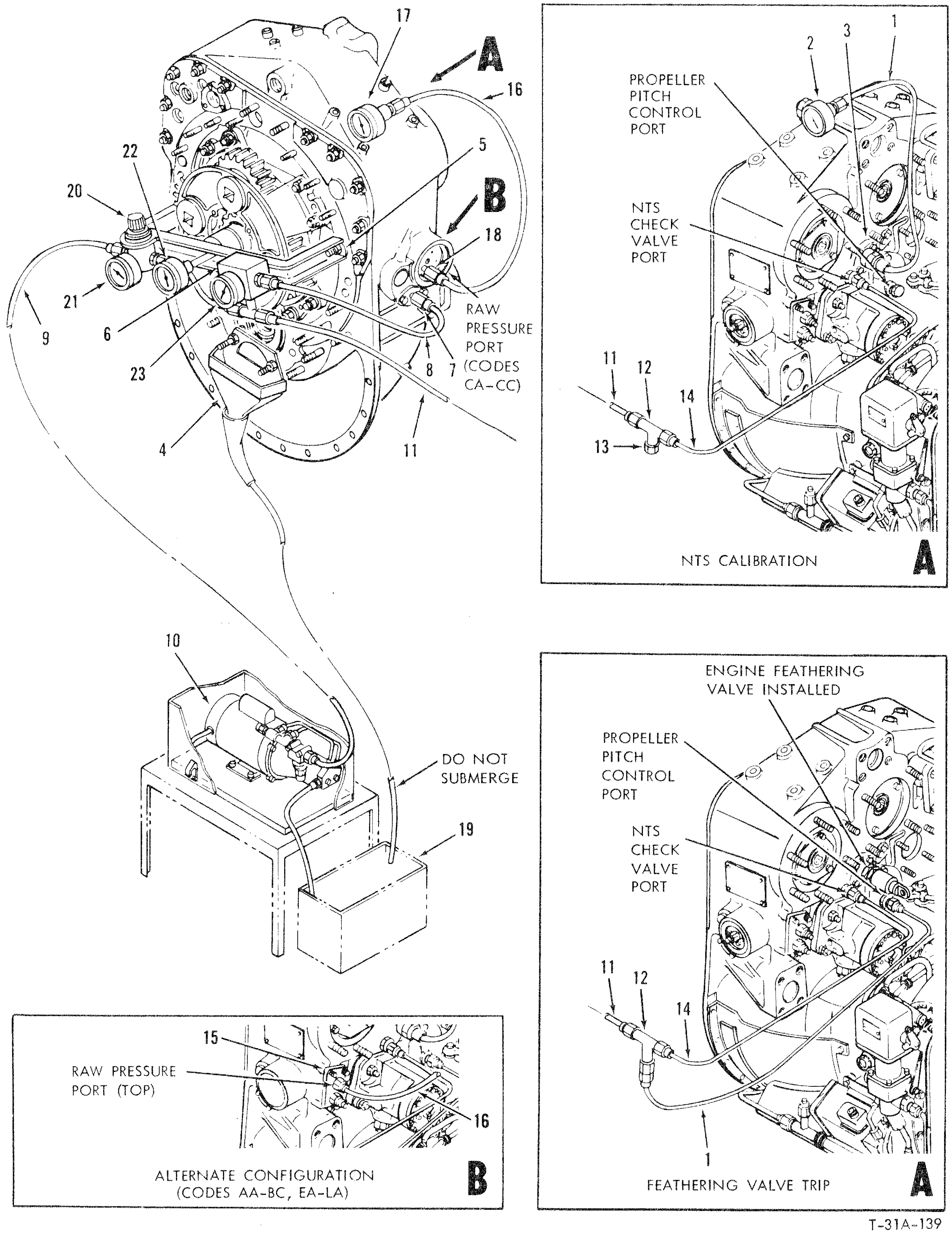


Negative Torque Sensor Calibrator Test Setup (PN 293138-1)
Figure 211

R 2. B. (9) (f) Install hose assembly (8) between dummy regulator valve (7) and fitting in test block (6).

R (g) Install hose assembly (9) from pump (10) to regulator fitting on 292513-1 beta tube support assembly (5). Ensure oil supply line from oil container (19) to pump (10) is installed.

R (h) Install hose assembly (11) with tee (12) and cap (13) onto tee of 292513-1 beta tube support assembly (5). Connect hose assembly (14) to tee (12) and to NTS check valve.

R (i) (Codes AA-BC, EA LA) Install hose assembly (16) with gage (17) to 284453-1-1 torque calibration plate (15, figure 211, ALTERNATE CONFIGURATION).

R (j) (Codes CA-CC) Install hose assembly (16) with gage (17) to 284461-1-1 torque calibration adapter plate on torque compensator assembly (18).

R (k) Check oil supply in oil container (19) to ensure adequate supply for calibration.

R (l) Pressurize calibration setup

R 1 Connect pump (10) to electrical supply and adjust pressure regulator (20) to 100 psig. Allow the oil to circulate long enough to warm up and to purge air from the system. Check fittings and connections for oil leakage.

R KEY TO FIGURE 211

R * 1. HOSE ASSY
R * 2. GAGE (NEGATIVE TORQUE SENSOR)
R 3. 287220-1-1 DUMMY FEATHERING VALVE
R * 4. SCUPPER DRAIN
R * 5. 292513-1-1 BETA TUBE SUPPORT
R * 6. TEST BLOCK
R * 7. 292512-1-1 DUMMY REGULATOR VALVE
R * 8. HOSE ASSY
R * 9. HOSE ASSY
R *10. PUMP
R *11. HOSE ASSY
R 12. TEE
R 13. CAP
*14. HOSE ASSY
15. 284453-1-1 CALIBRATION PLATES
*16. HOSE ASSY
*17. GAGE (POSITIVE TORQUE) SENSOR)
18. 284461-1-1 TORQUE CALIBRATION ADAPTER PLATE
19. OIL CONTAINER (CUSTOMER FURNISHED)
*20. PRESSURE REGULATOR
*21. GAGE
*22. GAGE
*23. GAGE

R *COMPONENTS OF 293138-1 NEGATIVE TORQUE SETTING CALIBRATION

2\. B. (9) (1) 2 Adjust pressure regulator (20) to obtain a nominal 100 psig inlet oil pressure to the engine as indicated on gage (21), maintain inlet oil pressure at nominal 100 psig throughout calibration procedure. If 100 psig cannot be maintained, check oil filter on mini test stand for contamination.

NOTE: A schematic of the mini-test stand test setup is shown in Figures 212 and 213.

(10) Calibrate torque sensor system as follows.

NOTE: Prior to removing coupler, rotate coupler back and forth slightly to find a free center position so that coupler may be removed without drag.

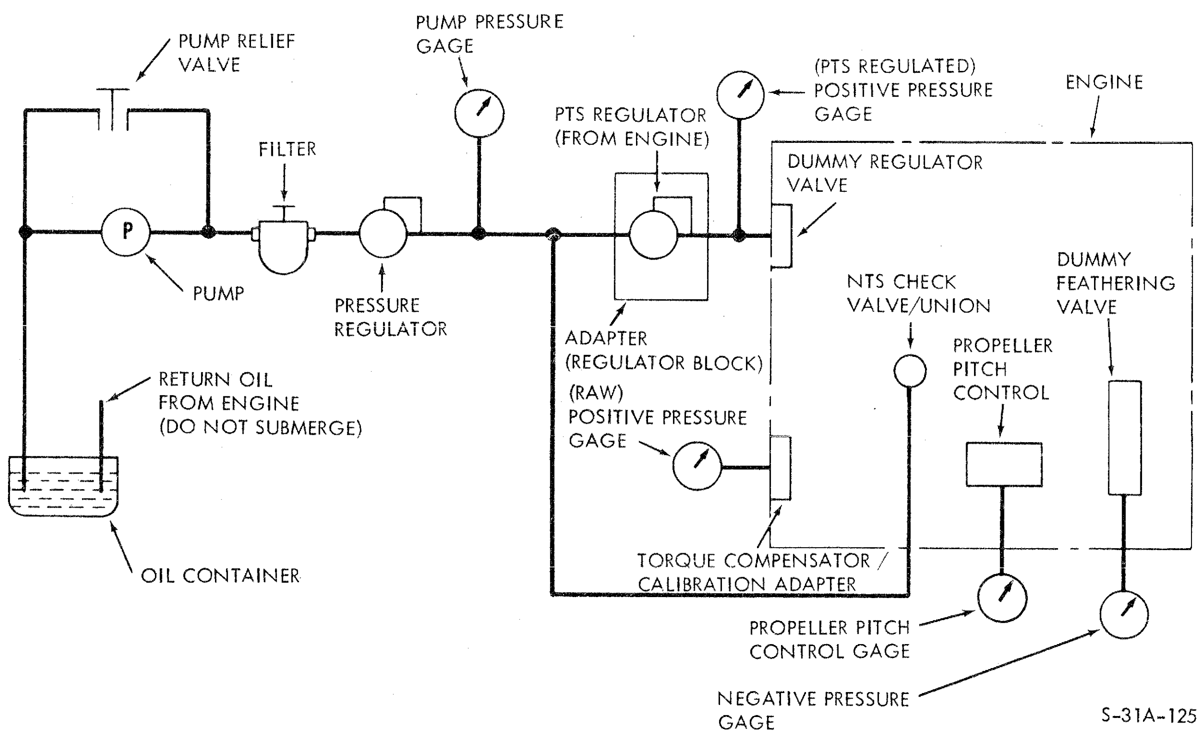
(a) Remove coupler only far enough to disengage splines.

CAUTION: IF TURBINE IS ROTATED TOO FAR DURING CALIBRATION (WITH COUPLER REMOVED) THE TORQUE SENSOR MOVABLE CAM GEAR WILL DISENGAGE FROM FIXED CAM GEAR. THIS WILL BE INDICATED BY NO POSITIVE PRESSURE INDICATION AND A HIGH (APPROXIMATELY 80 PSIG) NEGATIVE PRESSURE INDICATION WHICH CANNOT BE REDUCED REGARDLESS OF POSITION OF COUPLER. THE DIAPHRAGM MUST BE REMOVED AND MOVABLE CAM SET REENGAGED SUCH THAT PIN HOLES THROUGH THE FIXED AND MOVABLE CAM SET LINE UP. THE CAM SET IS BALANCED IN THIS MANNER AND ANY OTHER ORIENTATION MAY CAUSE IMBALANCE AND TORQUE SENSOR PRESSURE FLUCTUATION.

(b) Rotate impeller very slowly by hand in a counterclockwise (looking aft) direction until a rise of at least 50 psig is noted on positive pressure gage (17, figure 211). At this time negative pressure on gage (2) will be at a low reading. This indicates that the metering valve in the torque sensor is positioned to block dumping of positive pressure to gearcase and negative pressure dump to gearcase is open. Note negative pressure.

(c) Rotate impeller very slowly by hand in a clockwise (looking aft) direction until negative and positive pressures are approximately equal or until a slight rise is noted in negative pressure reading. Record positive pressure.

(d) Carefully insert coupler splines at any free position. After coupler is inserted, ensure that negative and positive pressures remain approximately same as in steps (b) and (c) to indicate that position of metering valve in torque sensor has not changed.



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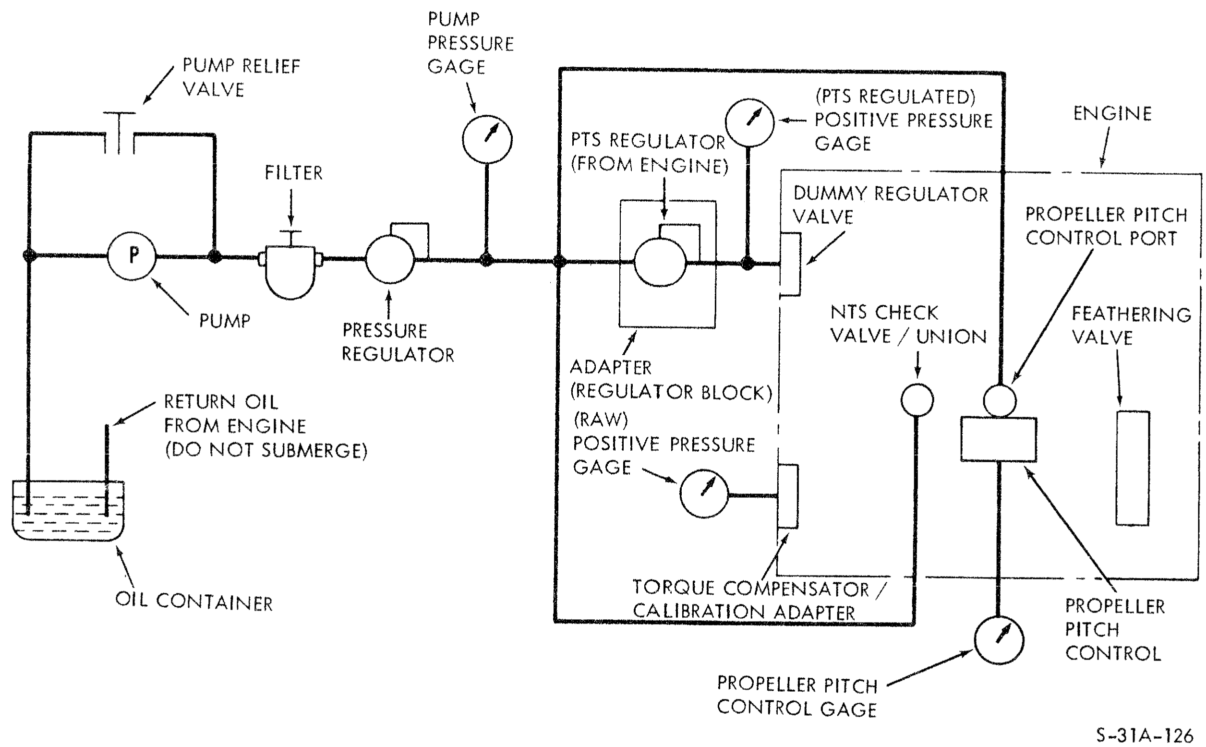
R Mini-Test Stand Schematic for Torque Sensor Calibration
Figure 212

R



Mini-Test Stand Schematic for Feathering Valve (NTS) Trip
Figure 213

NOTE: Negative pressure indicated by rotating impeller will vary depending upon force and speed at which impeller is rotated. The individual performing calibration should rotate impeller for several trials before taking final pressure reading to get feel for amount of rotational force required.

2\. B. (10) (e) Rotate impeller by hand clockwise (looking aft) and hold impeller firmly in clockwise direction. Note negative pressure which should be 20 to 35 psig with 30 psig as desired pressure. Relax force on impeller and move impeller by hand to firm clockwise (looking aft) position several times to get feel for amount of force required to get a consistent negative pressure reading. Record negative pressure in Table 204 if in desired range of 20 to 35 psig.

NOTE: Prior to removing coupler, rotate coupler back and forth slightly to locate a free center position so that coupler may be removed without drag.

(f) If negative pressure in step (e) is too low carefully disengage coupler splines, rotate coupler 140 degrees counterclockwise (looking aft), using pointer on 285159-1-1 or 284456-1-1 spline positioning wrench as a guide, and reinsert coupler. See Figure 214 for reference points for 140 degree rotation of coupler. Recheck negative pressure in step (e).

(g) If negative pressure in step (e) is too high (in the 50 to 60 psig range) disengage coupler splines, rotate coupler 140 degrees clockwise (looking aft), and reinsert coupler. Recheck negative pressure in step (e). If negative pressure is more than 60 psig, disengage coupler and repeat steps (b) and (c) inserting coupler when positive pressure is five psig greater than originally noted in step (c). Repeat steps (d) and (e).

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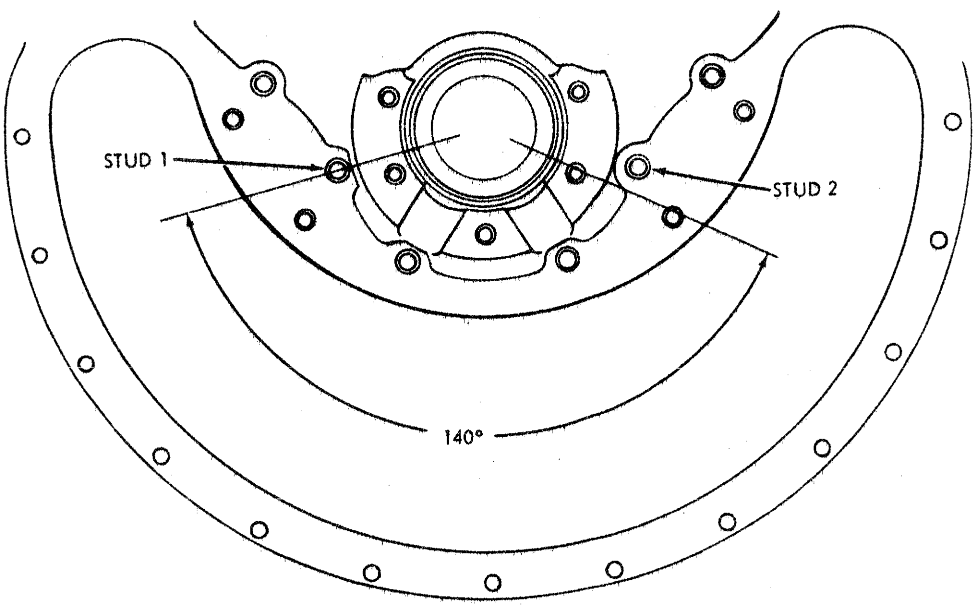


Reference Points for 140 Degree Rotation of Coupler
Figure 214

NOTE: Positive pressure indicated by rotating impeller will vary depending upon force and speed at which impeller is rotated. The individual performing calibration should rotate impeller for several trials before taking final pressure reading to get feel for amount of rotational force required.

2. B. (10) (h) Rotate impeller by hand counterclockwise (looking aft) and hold impeller firmly in counterclockwise direction. Note positive pressure which should be in the 18 to 25 psig range with a desired pressure of approximately 22 psig. Relax force on impeller and move impeller by hand to firm counterclockwise (looking aft) position several times to get feel for amount of force required to get a consistent positive pressure reading. This is base position for coupler in which metering valve in torque sensor is in a balance position between positive and negative pressure dump to gearcase.

Table 204. Desired Pressure Readings for Coupler Positioning

	Negative Pressure			Positive Pressure		
Step	Required	Desired	Actual	Typical Pressure Range	Desired	Actual
(10)(e)	20 to 35 psig	30 psig	___psig	-	-	
(h)	-	-	-	18 to 25 psig	22 psig	___psig
(j)	45 to 65 psig	55 psig	___psig	-	-	
(k)	-	-	-	15 to 22 psig	19 psig	___psig
(m)	60 to 80 psig	70 psig	___psig	-	-	-
(n)	-	-	-	13 to 20 psig	16 psig	___psig
(p)	70 to 100 psig	85 psig	___psig	-	-	-
(q)	-	-	-	11 to 18 psig	11 to 18 psig	___psig

NOTE: Prior to removing coupler, rotate coupler back and forth slightly to locate a free center position so that coupler can be removed without drag.

2. B. (10) (i) Carefully disengage coupler splines, rotate coupler 140 degrees counterclockwise (looking aft) and reinsert coupler.

(j) Rotate impeller by hand in clockwise (looking aft) direction and hold impeller firmly in clockwise direction. Note negative pressure which should now increase to 45 to 65 psig. Record negative pressure in Table 204.

(k) Rotate impeller by hand in counterclockwise (looking aft) direction and hold impeller firmly in counterclockwise direction. Note positive pressure which should now be 2 to 3 psig less than that recorded in step (h). Record positive pressure in Table 204.

NOTE: Prior to removing coupler, rotate coupler back and forth slightly to locate a free center position so that coupler can be removed without drag.

(l) Carefully disengage coupler splines, again rotate coupler 140 degrees counterclockwise (looking aft) and reinsert coupler.

(m) Rotate impeller by hand in clockwise (looking aft) direction and hold impeller firmly in clockwise direction. Note negative pressure which should now increase to 60 to 80 psig. Record negative pressure in Table 204.

(n) Rotate impeller by hand in counterclockwise (looking aft) direction and hold impeller firmly in counterclockwise direction. Note positive pressure which should be another 2 to 3 psig less than in step (k). Record positive pressure in Table 204. If negative pressure in step (m) was in the 60 to 80 psig range, with positive pressure typically 11 to 18 psig range, further positioning of the coupler will not be necessary, disregard steps (o), (p), and (q), and proceed to step (r).

NOTE: It should be observed that moving the coupler in a counterclockwise direction has increased negative pressure readings substantially while positive pressure had decreased a small amount with each coupler movement. The important objective is to get negative pressure of at least 60 psig with positive pressure typically in the 11 to 18 psig range.

2. B. (10) (o) If positive pressure is still not in the 11 to 18 psig range carefully disengage coupler splines, again rotate coupler 140 degrees counterclockwise (looking aft) and reinsert coupler.

(p) Rotate impeller by hand in clockwise (looking aft) direction and hold impeller firmly in clockwise direction. Note negative pressure which should now increase to 70 to 100 psig. Record negative pressure in Table 204.

(q) Rotate impeller by hand in counterclockwise (looking aft) direction and hold impeller firmly in counterclockwise direction. Note positive pressure which should be 2 to 3 psig less than in step (n) and should now be 11 to 18 psig. Record positive pressure in Table 204.

(r) Turn off pump on calibrator assembly (mini-test stand). If coupler was installed without spring, install spring at this time. Note position of pointer on coupler positioning wrench, then very carefully remove coupler fully. Install spring on coupler, then very carefully reinstall coupler in exactly same position from which it was removed. Turn on pump on calibrator assembly (mini-test stand) and recheck negative and positive pressure as in steps (p) and (q) to ensure coupler position has not changed. Turn off pump on calibrator assembly (mini-test stand).

NOTE: Failure to hold impeller firmly by hand in counterclockwise (looking aft) direction will cause coupler spring to push coupler out of engine. An additional technician may be required to hold impeller while 285159-1-1 or 284456-1-1 spline positioning wrench is removed and quill shaft installed. A 287221-1-1 coupling indexing holder may be used to hold coupler in engine while 285159-1-1 spline positioning wrench is still installed.

(s) Hold impeller by hand firmly in counterclockwise (looking aft) direction to remove backlash and to hold coupler in position. Remove 285159-1-1 or 284456-1-1 spline positioning wrench from coupler. Continue to hold impeller in counterclockwise direction to prevent coupler spring from pushing coupler out of engine.

2. B. (10) (t) Install splined torsion shaft (quill shaft) on 284455-1-1 quill shaft positioning wrench and insert quill shaft into any free position. Rotate quill shaft clockwise (looking aft) one small spline at a time until drag is felt on insertion of quill shaft.

CAUTION: SHARPLY TAPPING SPLINED TORSION (QUILL) SHAFT AFTER IT HAS BOTTOMED MAY PRODUCE BURRS WHICH CAN AFFECT PROPER CALIBRATION OF TORQUE SENSOR SYSTEM.

(u) Disengage quill shaft and carefully index quill shaft counterclockwise (looking aft) four small splines, engage small splines and then apply slight counterclockwise (looking aft) twist to quill shaft and insert first large splines of quill shaft by lightly tapping with slide hammer on 284455-1-1 quill shaft positioning wrench.

(11) Check feathering valve (NTS) trip as follows.

(a) Install 287277-1-1 internal spline adapter into high speed pinion gearshaft.

(b) Remove gage (2, figure 211), line (1), and dummy feathering valve (3) and install engine feathering valve.

(c) Install line (1, figure 211) from fitting on propeller pitch control to tee fitting (12).

(d) Install 287277-1-1 torque wrench adapter into high speed pinion.

(e) Remove 284689-1-1 gear train lock from starter drive pad.

(f) Turn on pump of calibrator assembly (mini-test stand) and note pressure on gage (22, figure 211) (gage which extends into propeller pitch control). Pressure should be 80 to 100 psig.

NOTE: The positive pressure value recorded in Table 204 is an indication of the amount of negative torque that will be required to trip feathering valve. The higher the positive pressure the higher the torque required to trip feathering valve.

Actuate feathering valve several times to purge air from feathering valve to obtain accurate feathering valve trip torque.

(g) Hold impeller by hand firmly in clockwise (looking aft) direction. Use torque wrench which indicates torque from 0 to 50 inch-pounds in 1 inch-pound increments and turn 287277-1-1 torque wrench adapter in high speed pinion counterclockwise (looking aft). Note torque reading on torque wrench when pressure on gage (22, figure 211) (center gage on mini-test stand) drops abruptly, indicating feathering valve (NTS) trip.

2. B. (11) (h) Rotate impeller 180 degrees and recheck trip torque as in step (g).

NOTE: If torque required for feathering valve trip is too high, refer to step (j). if torque is low, refer to step (k).

(i) If torque required for feathering valve trip is 28 to 35 inch-pounds in steps (g) and (h), torque sensor calibration is satisfactory. Proceed to step (l).

NOTE: Repositioning of quill shaft in order to lower torque required for feathering valve trip may be accomplished a maximum of two times. If torque required for feathering valve trip is still high after repositioning quill shaft the second time it will be necessary to reposition coupler in order to lower torque required for feathering valve trip.

(j) If more than 35 inch-pounds torque is required to trip feathering valve proceed as follows.

1 Install 284689-1-1 gear train lock onto starter pad.

2 Hold impeller firmly in counterclockwise (looking aft) direction to prevent coupler from ejecting from engine and remove 287277-1-1 torque wrench adapter from high speed pinion.

NOTE: Failure to hold impeller firmly by hand in counterclockwise (looking aft) direction will cause coupler spring to push coupler out of engine. An additional technician may be required to hold impeller.

3 Install 284455-1 1 quill shaft positioning wrench and while continuing to hold impeller firmly counterclockwise remove quill shaft only far enough to disengage large splines. Then index quill shaft counterclockwise (looking aft) one small spline and reinsert large splines by slightly twisting quill shaft counterclockwise and lightly tapping quill shaft into position.

4 Install 287277-1 1 internal spline adapter into high speed pinion.

2. B. (11) (j) 5 Remove 284689-1-1 gear train lock from starter pad.

6 Repeat feathering valve trip check. (See steps (f) through (i)).

7 If torque required for feathering valve trip is still too high, repeat step 1 through 6.

8 If trip torque is not within limits after positioning of quill shaft the maximum of two times, it will be necessary to remove quill shaft and reposition coupler 140 degrees counterclockwise (looking aft) and reaccomplish feathering valve trip check.

(k) If torque required for feathering valve trip is too low proceed as follows.

NOTE: Repositioning of quill shaft in order to raise torque required for feathering valve trip, may be accomplished a maximum of two times. If torque required for feathering valve trip is still low after repositioning quill shaft the second time, it will be necessary to reposition coupler in order to lower torque required for feathering valve trip.

1 Install 284689-1-1 gear train lock onto starter pad.

2 Hold impeller firmly in counterclockwise (looking aft) direction to prevent coupler from ejecting from engine and remove 287277-1-1 torque wrench adapter from high speed pinion.

NOTE: Failure to hold impeller firmly by hand in counterclockwise (looking aft) direction will cause coupler spring to push coupler out of engine. An additional technician may be required to hold impeller.

3 Install 294455-1-1 quill shaft positioning wrench and while continuing to hold impeller firmly counterclockwise, remove quill shaft far enough to disengage large splines and then index quill shaft clockwise (looking aft) one small spline and reinsert first large spline by twisting quill shaft slightly counterclockwise and lightly tapping quill shaft into position.

4 Install 287277-1-1 internal spline adapter into high speed pinion.

R 2. B (11) (k) 5 Remove 284689-1-1 gear train lock from starter pad.

R 6 Repeat feathering valve trip check. (See steps (f) through (i).

R 7 If torque required for feathering valve trip is still too low, repeat steps 1 through 6.

R 8 If trip torque is not within limits after positioning of quill shaft the maximum of two times, it will be necessary to remove quill shaft and reposition coupler 140 degrees clockwise (looking aft) and reaccomplish feathering valve trip check.

R (l) Remove special tools and test equipment from engine.

R (m) Screw 289318-1 ball lock wrench into shaft until it bottoms. Install spacer, spring and balls into ball lock retainer shaft. While holding balls in place, insert shaft with 289318-1 ball lock wrench spacer and balls (ball lock retainer) into high speed pinion gearshaft. While applying pressure inward on wrench, partially unscrew 289318-1 ball lock wrench and check to see if shaft is locked in gearshaft. Remove ball lock wrench. Shaft (ball lock retainer) should be nominally 0.27 inch depth from end of high speed pinion gearshaft.

3. Inspection/Check

R A. (Pre SB72-0061) Inspect Oil Transfer Manifold, Torque Sensor Assembly and Fittings (See Figure 201)

(1) Inspect torque sensor assembly for freedom of rotation of internal parts. Inspect tube assemblies and adapters for bends or dents that may affect oil flow.

(2) Replace part that does not meet Inspection/Check requirements.

R B (Post SB72-0061) Inspect Oil Transfer Manifold, Torque Sensor Assembly and Fittings (See Figure 202)

(1) Inspect torque sensor assembly for freedom of rotation of internal parts. Inspect tube assemblies, adapter and oil transfer manifold for damage or obstructions that may affect oil flow.

R (2) Visually inspect oil transfer adapter (170, figure 202) for fretting, wear or other damage that may cause leakage.

R (3) Visually inspect strainers in oil transfer adapter (170) for damage. Refer to Approved Repairs for strainer replacement.

3. B. (4) Replace part that does not meet Inspection/Check requirements or is damaged beyond repair.

R 4. Approved Repairs

R NOTE: Strainers Part No. 694752-1/-4 are used on Oil Transfer
R Adapter Part No. 3101708-1. Strainers Part No. 694752-
R 5/-8 are used on Oil Transfer Adapter Part No. 3101708-
R 2.

R (1) Collapse strainer and remove from oil transfer adapter. Ensure all
R pieces of strainer are removed from oil transfer adapter.

R (2) Position strainer on oil transfer adapter and press to bottom.

5. Cleaning/Painting

A. Clean Component Parts

(1) Refer to 72-00-00, CLEANING/PAINTING, for general cleaning instructions and description of cleaning methods specified in Table 205.

NOTE: Reference shall be made in Table 205 for recommended cleaning method.

Table 205. Cleaning Methods

Figure No.	Item No.	Nomenclature	Cleaning Methods 1	2	3	4	5	6	7	8	9	10	11	12
All standard metallic hardware			X	X										
201	35,105	Bracket					X	X						
	100,125 140,190, 235	Retainer					X	X						
	145,195, 240	Tube Assembly												X
	170	Manifold												X
	210	Fitting Assembly												X
	255	Strainer Element	X	X										
	260	Adapter					X	X						
	300	Torque Sensor Assembly					X	X						
	290	Shim	X	X										

Table 205. Cleaning Methods (Cont)

Figure No.	Item No.	Nomenclature	Cleaning Methods 1	2	3	4	5	6	7	8	9	10	11	12
202	100	Manifold					X	X						
	130	Retainer					X	X						
	135,160, 205	Tube Assembly												X
	155	Plug	X	X										
	170	Adapter					X	X						
	185	Lube Oil Tube												X
	225,250 255	Bushing	X	X										
	260	Torque Sensor Assembly					X	X						
	295	Shim	X	X										

(POST SB72-0061) DIRECT DRIVE FUEL CONTROL GEARSHAFT - MAINTENANCE PRACTICES

1. Removal/Installation

NOTE: Table 201 provides a list of special tools, fixtures and equipment required for Removal/Installation.

Table 201. Special Tools, Fixtures and Equipment

Item No.	Nomenclature	Use	Source/ Part No.
NOTE: Equivalent substitutes may be used for listed items.			
1.	Bearing Driver	Used to install bearing on gearshaft in direct drive fuel control gear train.	291788-1-1
2.	Mechanical Bearing Puller	Used to remove bearing from gearshaft in direct drive fuel control gear train.	291789-1-1
3.	Mechanical Gear Puller	Used to remove spur gearshaft and matched bearing set from spur gearshaft.	293044-1
4.	Gear Installing Holder and Driver	Used to hold spur gear-shaft while driving spur gearshaft and matched bearing set onto spur gearshaft.	293601-1

A. Remove Direct Drive Fuel Control Gearshaft (See Figure 201)

R NOTE: Removal of the intermediate gearbox assembly
R (diaphragm) requires determination of existing engine
R torque indicating system calibration values. Prior to
R removal of intermediate gearbox assembly (diaphragm),
R perform engine pre-teardown calibration. Refer to
R 72-00-00, ADJUSTMENT/TEST.

R (1) Remove beta tube. Refer to 72-10-01, MAINTENANCE PRACTICES.

1. A. (2) Remove propeller pitch control. Refer to 72-10-02, MAINTENANCE PRACTICES.

R (3) (Codes BA-BC, EA-LA) Remove start fuel pressure regulator. Refer to 73-10-03, MAINTENANCE PRACTICES.

(4) Remove nose cone assembly. Refer to 72-10-09, MAINTENANCE PRACTICES.

(5) Remove oil transfer tube, oil jet and lubrication nozzle. Refer to 72-10-10, MAINTENANCE PRACTICES.

(6) Remove torsion spline (quill) shaft and coupling. Refer to 72-10-11, MAINTENANCE PRACTICES.

(7) Remove diaphragm assembly. Refer to 72-10-13, MAINTENANCE PRACTICES.

(8) Remove torque sensor. Refer to 72-10-16, MAINTENANCE PRACTICES.

(9) Remove bolts and washers.

(10) Remove nut and washer. Using 293044-1 puller, remove spur gearshaft (15, figure 201), matched bearing set and lockplate as an asssembly.

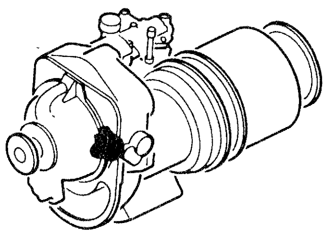
(11) Remove spring washer and washer.

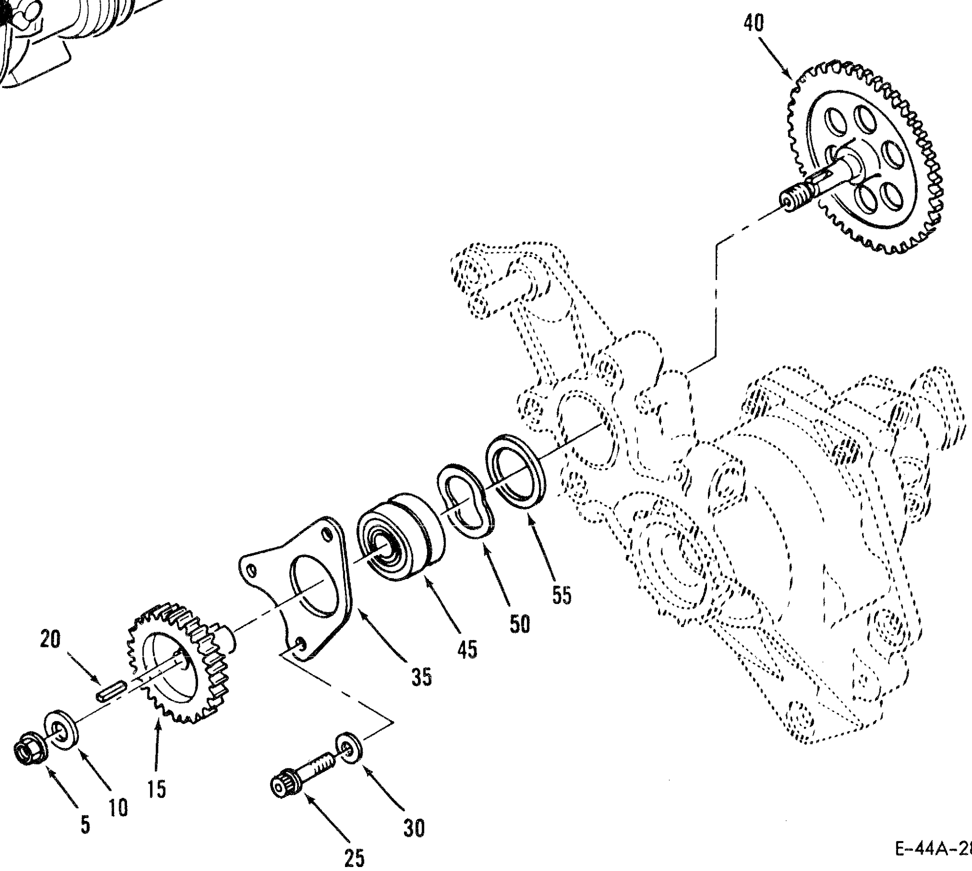
(12) Remove spur gearshaft (40) from torque sensor body. Remove key from spur gearshaft.

(13) Using 291789-1-1 puller, remove matched bearing set from spur gearshaft. Remove lockplate.

(14) Refer to 72-10-18, MAINTENANCE PRACTICES, for further disassembly of engine.

B. Install Direct Drive Fuel Control Gearshaft (See Figures 201 and 202)





R 5. NUT (IPC FIG. 160)
10. WASHER
15. SPUR GEARSHAFT
20. KEY
25. BOLT
30. WASHER
35. LOCKPLATE
40. SPUR GEARSHAFT
45. BEARING SET
50. SPRING WASHER
55. WASHER

R Direct Drive Fuel Control Gearshaft Installation
Figure 201

NOTE: Refer to 70-00-00, STANDARD PRACTICES, for recommended general torque values. Add frictional drag (run-down) torque of self-locking devices to recommended values.

1. B. (1) Determine spur gearshaft shimming requirements as follows. (See figure 202.)

(a) Using depth micrometer, measure from bearing seat in torque sensor assembly housing to face of torque sensor assembly housing and record as Dimension A.

(b) Measure height of bearing set and record as Dimension B.

(c) Subtract Dimension B from Dimension A, then subtract 0.033 inch from the remainder to determine quantity and thickness of special washers required to provide 0.031 to 0.036 inch gap.

NOTE: Ensure manufacturer's "V" mark on outer race of bearing set is aligned prior to installation.

(2) Install lockplate on spur gearshaft. Align manufacturer's "V" mark on bearing set then press matched bearing set onto gearshaft using 291788-1-1 driver.

(3) Install key into slot on gearshaft, then install gearshaft through torque sensor housing.

(4) Install quantity and thickness of washers (shims) determined in step (1) into torque sensor housing, then install spring tension washer.

(5) Using 293601-1 holder and driver, install spur gearshaft and matched bearing set onto spur gearshaft and align key slot in spur gearshaft with key. Secure with washers, nut and bolt. Tighten nut (5, figure 201) to 40 inch-pounds torque. Tighten bolt (25, figure 201) to 50 inch-pounds torque.

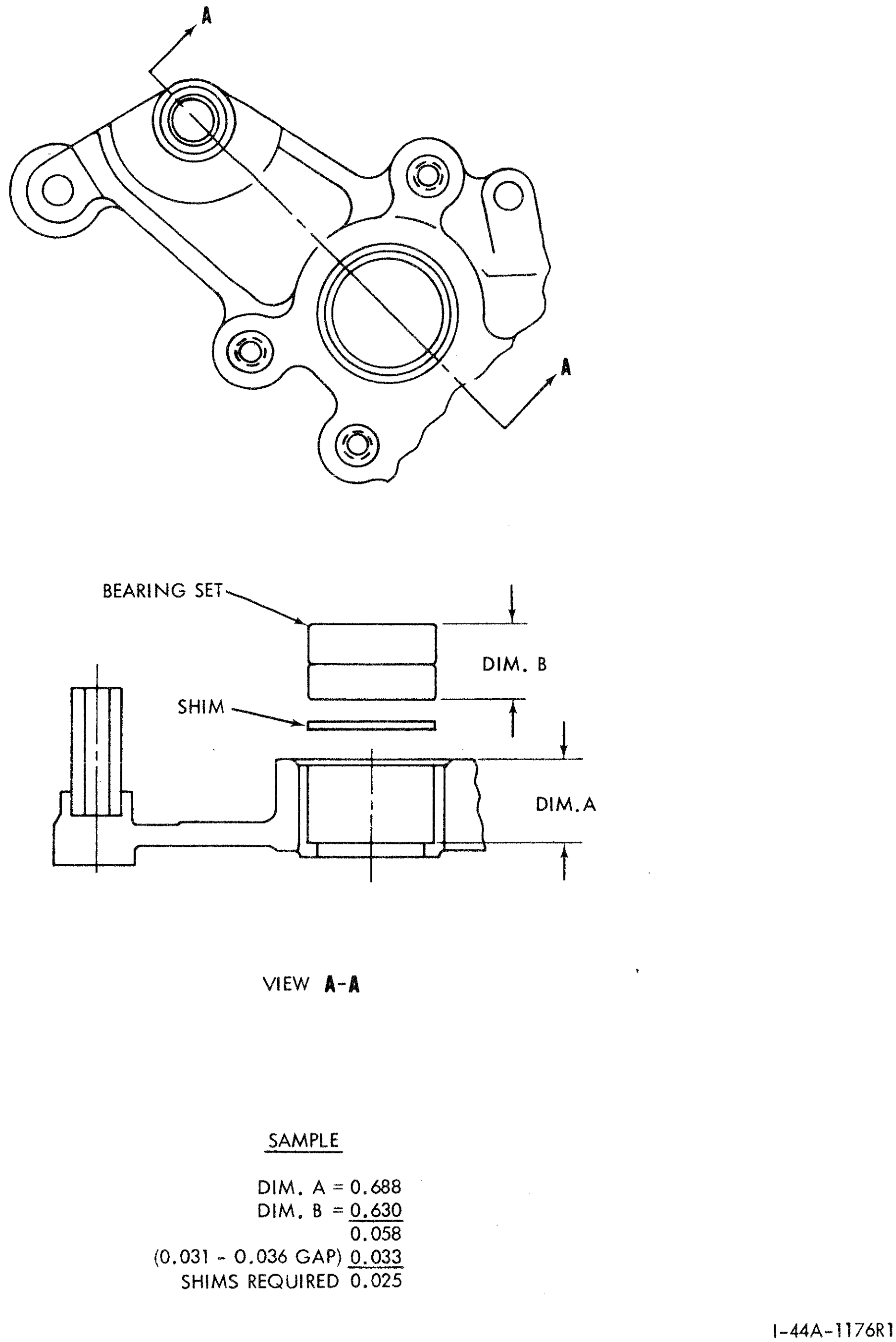
(6) Install oil transfer manifold and torque sensor assembly. Refer to 72-10-16, MAINTENANCE PRACTICES.

2. Inspection/Check

A. Inspect Direct Drive Fuel Control Gearshaft (See Figure 201)

(1) Inspect spur gear, bearing set and gearshaft for freedom of rotation. Inspect spur gear and gearshaft teeth for chips, cracks and uneven wear.

(2) Replace part that does not meet Inspection/Check requirements.



R

Direct Drive Fuel Control Gearshaft
Shimming Requirements
Figure 202

3. Cleaning/Painting

A. Clean Component Parts

(1) Refer to 72-00-00, GENERAL - CLEANING/PAINTING for general cleaning instructions and description of cleaning methods specified in Table 202.

NOTE: Reference shall be made to Table 202 for recommended cleaning method.

Table 202. Cleaning Methods

Figure No.	Item No.	Nomenclature	Cleaning Methods 1	2
All standard metallic hardware			X	X
201	15, 40	Spur Gearshaft	X	X
	35	Lockplate	X	X
	45	Bearing Set*		
	50	Spring Washer	X	X
	55	Washer	X	X

*Refer to 72-00-00, GENERAL - CLEANING/PAINTING, paragraph D. for special cleaning instructions.

OIL PRESSURE PUMP ASSEMBLY AND ROLLER BEARING - MAINTENANCE PRACTICES

1. Removal/Installation

NOTE: Table 201 provides a list of special tools, fixtures and equipment required for Removal/Installation. Table 202 provides a list of materials and compounds required for Removal/Installation.

Table 201. Special Tools, Fixtures and Equipment

	Item No.	Nomenclature	Use	Source/ Part No.
	NOTE: Equivalent substitutes may be used for listed items.			
R R	1.	Seal Pilot	Used to guide and protect seal during installation.	284173-4-1
	2.	Oil Pump Remover Driver	Used to remove oil pressure pump from accessory drive housing.	284183-1-1
R R	3.	Seal Puller	Used to remove oil pressure pump seal during disassembly.	285133-1-1
R R R	4.	Seal Puller	Used to install oil pump shaft seal into pump body with pump installed in gear case.	285134-2-1
	5.	Bearing Retainer	Used to bolt on rear of accessory drive housing to retain propeller shaft roller bearings when propeller shaft is removed.	284197-1-1
	6.	Bearing Puller	Used to remove bearing outer race from accessory drive housing.	285773-1-1

Table 202. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Any approved engine oil	Commercially available
Alternate lubricant, Lubricant (OS-124)	Monsanto Company, 800 N Lindbergh Blvd, St Louis, MO 63166
Grease (MIL-G-7421)	Commercially available

NOTE: If no maintenance is required in this area proceed to 72-10-19, MAINTENANCE PRACTICES, for further disassembly.

1. A. Remove Oil Pressure Pump Assembly and Roller Bearings (See Figure 201)

NOTE: Removal of the intermediate gearbox assembly (diaphragm) requires determination of existing engine torque indicating system calibration values. Prior to removal of intermediate gearbox assembly (diaphragm), perform engine pre-teardown calibration. Refer to 72-00-00, ADJUSTMENT/TEST.

(1) Remove beta tube assembly. Refer to 72-10-01, MAINTENANCE PRACTICES.

(2) Remove propeller pitch control. Refer to 72-10-02, MAINTENANCE PRACTICES.

(3) (Codes BA-BC, EA-LA) Remove start fuel pressure regulator. Refer to 73-10-03, MAINTENANCE PRACTICES.

(4) Remove nose cone assembly. Refer to 72-10-09, MAINTENANCE PRACTICES.

(5) Remove oil transfer tube, oil jet and lubrication nozzle. Refer to 72-10-10, MAINTENANCE PRACTICES.

(6) Remove torsion spline (quill) shaft and coupling. Refer to 72-10-11, MAINTENANCE PRACTICES.

R 1. A. (7) Remove diaphragm assembly. Refer to 72-10-13 MAINTENANCE
R PRACTICES.

(8) Remove screws and washers securing oil pressure pump assembly by aligning holes on gear of pump assembly with head of each screw to be removed.

(9) Remove oil pressure pump assembly using 284183-1-1 driver and remove packings.

(10) Remove oil pump shaft seal using 285133-1-1 puller.

(11) Remove screw and retainer securing outer race of starter-generator idler gear bearing and remove outer race using 285773-1-1 puller.

(12) Remove bolts and key washers securing flanged journal roller bearing outer race and remove outer race.

B. Install Oil Pressure Pump Assembly and Roller Bearings (See Figure 201)

R NOTE: Refer to 70-00-00, STANDARD PRACTICES, for recommended
R general torque values. Add frictional drag (run-down)
R torque of self-locking devices to recommended values.

R Lightly coat new packings with clean engine oil or lu-
R bricant (OS-124) prior to installation.

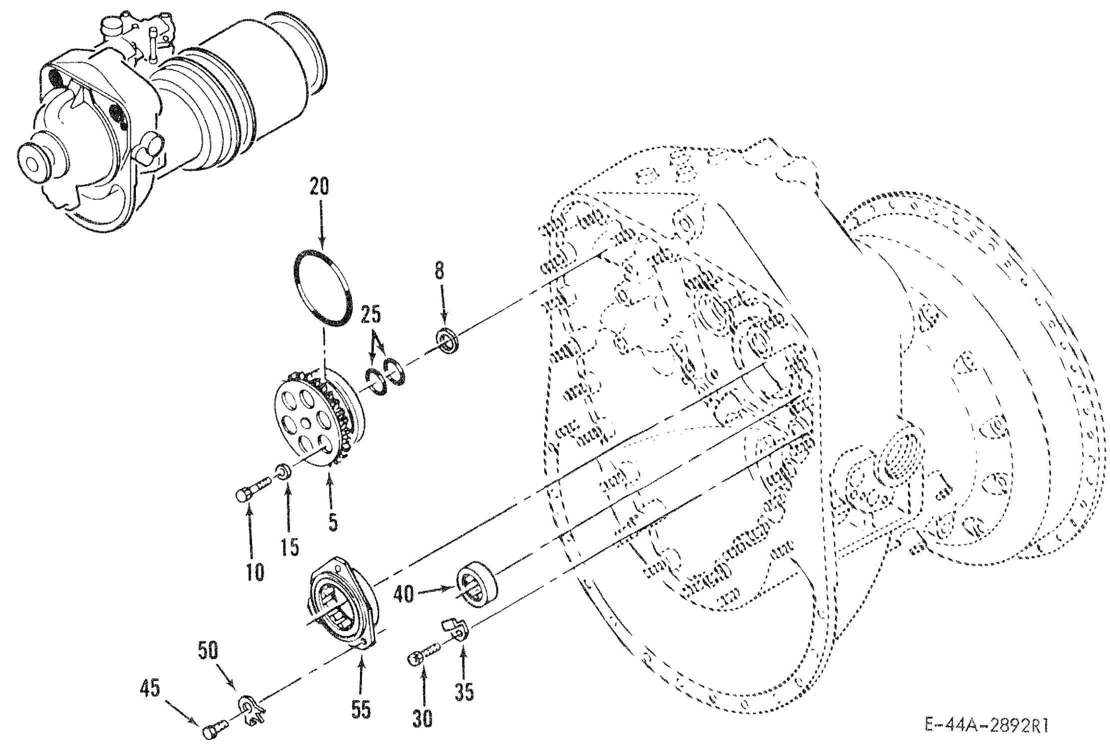
(1) Install oil pump shaft seal as follows.

(a) Coat lip of seal with grease (MIL-C-7421).

(b) Install seal using 284173-4-1 pilot and 285134-2-1 puller.

NOTE: When oil pressure pump is installed, the oil passage in pump must align with case oil passage.

(2) Install new packings on oil pressure pump assembly then install pump so pump outlet is aligned with case passage. Secure pump assembly with washers and screws. Tighten screws (10, figure 201) to 60 inch-pounds torque.



Oil Pressure Pump and Roller Bearing Installation
Figure 201

CAUTION: ALIGN BEARING DRAIN HOLES AT TOP AND BOTTOM.

NOTE: Inner race of bearing is installed on propeller shaft.

1. B. (3) Install outer race of flanged journal roller bearing in accessory housing. Make certain that drain holes are aligned with accessory housing at top and bottom.

(4) (Engines with roller bearing high speed pinion) Install plug, with new packing, and secure plug and bearing outer race to housing with key washer and bolt. Tighten bolts (45) to 60 inch-pounds torque. Install key washers and bolts.

R (5) (Engines with journal bearing high speed pinion) Install tube, with
R new packing, and secure plug and bearing outer race to housing with
R key washer and bolt. Tighten bolt (45) to 60 inch-pounds torque.
R Install key washers and bolts.

(6) Hold roller bearings in place with 284197-1-1 retainer. Install outer race of roller bearing in accessory housing with bearing serial number visible from front of gearbox. Secure race with retainers and screws. Tighten screws (30, figure 201) to 50 inch-pounds torque, back off and retighten to 40 inch-pounds torque.

(7) Install diaphragm. Refer to 72-10-13, MAINTENANCE PRACTICES.

2. Inspection/Check

A. Inspect Oil Pressure Pump Assembly and Roller Bearing (See Figure 201)

(1) Inspect bearing and pump assembly for freedom of rotation and any evidence of binding.

(2) Replace part that does not meet Inspection/Check requirements.

KEY TO FIGURE 201

5. OIL PRESSURE PUMP ASSY
R (IPC FIG. 155)
8. SEAL
10. SCREW
15. WASHER
20. PACKING
25. PACKING
30. SCREW
35. RETAINER
40. BEARING (OUTER RACE)
45. BOLT
50. KEY WASHER
55. BEARING (OUTER RACE)

3. Approved Repairs

NOTE: Table 203 provides a list of all materials and compounds required to perform Approved Repairs.

Table 204 provides a list of all special tools, fixtures and equipment required to perform Approve Repairs.

Table 203. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Grease (MIL-G-23827)	Commercially available
Any approved engine oil	Commercially available

R Table 204. Special Tools, Fixtures and Equipment

	Item No.	Nomenclature	Use	Source/ Part No.
R	NOTE: Equivalent substitutes may be used for listed items.			
R	1.	Seal Installing Pilot	Used with 284174-4-1 driver. seal pressing, to install seal into plate.	284173 4-1
R	2.	Seal Pressing Driver	Used with 284173-4-1 pilot, seal installing, to install seal into plate.	284174-4-1
R	3.	Holder	Used to hold seal retainer while seal is being installed.	284943-1-1
R	4.	Seal Puller	Used to remove seal from plate.	285133-1-1

R NOTE: Repair procedures outlined below are considered accept-
R able corrective action for oil pressure pumps ex-
R periencing low oil pressure output.

R 3. A. Repair Oil Pressure Pump Assembly

R (1) Remove oil pressure pump assembly in accordance with
R Removal/Installation.

R (2) Partially disassemble oil pressure pump assembly for inspection as
R follows. (See figure 202.)

R (a) Remove assembled plate assembly and seal.

R (b) Remove rotor set.

R (c) Place assmbled plate assembly and seal on 284943-1-1 holder.

R (d) Remove seal using 285133-1-1 seal puller.

R (3) Inspect oil pressure pump rotor set as follows. (See figure 203.)

R NOTE: Rotor sets are matched. Do not separate or in-
R termingle with rotors from other matched sets.

R (a) Visually inspect rotor set for nicks, scoring, burrs, pitting,
R gouges, and cracks. None are permitted.

R (b) Perform dimensional inspection if visual inspection indicates
R wear or damage. See Figure 203 for dimensional check.

R (c) Replace rotor set if Inspection/Check requirements are not
R met.

(4) Assemble oil pressure pump assembly as follows. (See figure 202.)

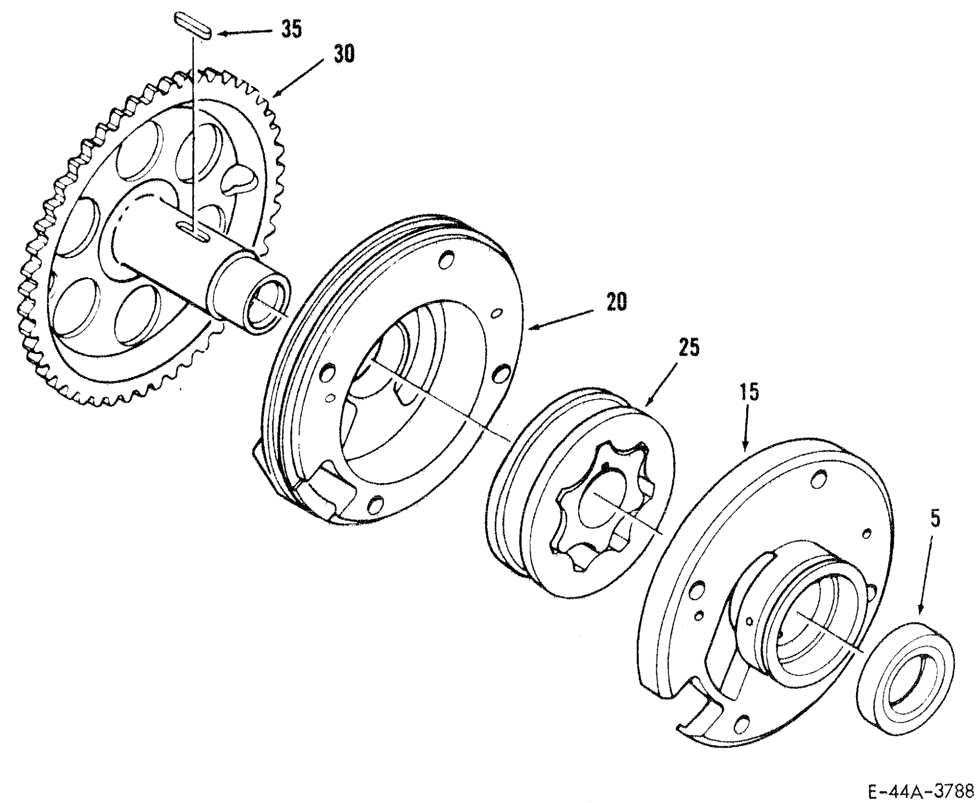
(a) Place plate assembly (15) on 284943-1-1 holder. Apply grease (MIL-G-23827) to outside surface of new seal (5) and position seal on plate assembly.

(b) Press seal to full bottom depth of plate assembly using 284174-4-1 driver. Remove driver.

(c) Fill area between plate assembly and seal with grease (MIL-G-23827). Remove assembled plate assembly and seal from holder.

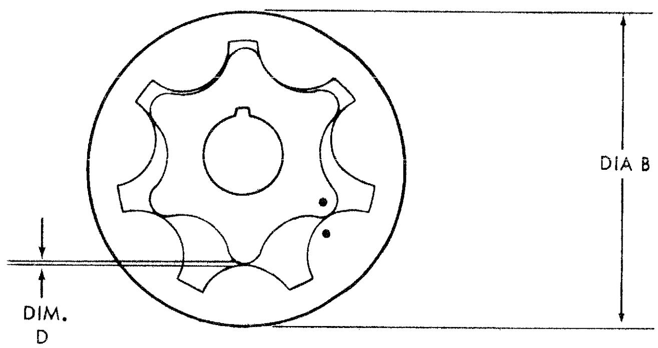
(d) Place assembled spur-gearshaft (30, 35) and body assembly (20) on bench with shaft end up.

R



5.	SEAL (SEE IPC FIG. 156)	25.	ROTOR SET
15.	PLATE ASSY	30.	SPUR - GEARSHAFT
20.	BODY ASSY	35.	KEY

Oil Pressure Pump Assembly
(Field Maintenance Breakdown)
Figure 202



R

B	D
2.2490 IN. MIN.	0.010 IN. MAX.

1-44A-2045

R Inspection of Oil Pressure Pump Rotor Set
R Figure 203

3. A. (4) (e) Apply a light coating of clean engine oil to rotor set (25) and install rotor set on spur-gearshaft insuring that slot in rotor set mates with key in spur-gearshaft.

(f) Position 284173-4-1 pilot into spur-gearshaft. Carefully install assembled plate assembly and seal over pilot onto spur-gearshaft. Remove pilot.

(g) Check for freedom of rotation of spur-gearshaft and rotor set. Remove oil pressure pump from holder.

4. Cleaning/Painting

A. Clean Component Parts

(1) Clean all standard metallic hardware in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 1 or 2.

(2) Clean oil pressure pump in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 5.

(3) Clean bearings in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, paragraph D.

COMPRESSOR BEARING CARRIER SUPPORT ASSEMBLY - MAINTENANCE PRACTICES

1. Removal/Installation

NOTE: Table 201 provides a list of special tools, fixtures and equipment required for Removal/Installation. Table 202 provides a list of materials and compounds required for Removal/Installation.

Table 201. Special Tools, Fixtures and Equipment

Item No.	Nomenclature	Use	Source/ Part No.
NOTE: Equivalent substitutes may be used for listed items.			
1.	Bearing Puller	Used to install bearing and carrier onto main shaft and into accessory drive housing.	284168-1-1
2.	Bearing Puller	Used to remove bearing from housing assembly and main shaft.	285154-1-1
3.	Seal Pressing Driver and Holder	Used to press seal out of carrier.	285806-1-1
4.	Torquing Holder and Adapter	Used to hold rotating group in a fixed position when removing or installing bearing retaining nut to main shaft.	287416-1-1
5.	Seal Pressing Driver	Used to align and install compressore shaft seal in the seal carrier.	287894-1-1

Table 202. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Any approved engine oil	Commercially available
Alternate lubricant, Lubricant (OS-124)	Monsanto Company, 800 N Linbergh Blvd, St Louis, MO 63166
Lubricating compound (Liqui-Moly, Grade NV)	Lockrey Co, Lubricants Div, Cedar Shores, Southampton, NY 11968

1. A. Remove Compressor Bearing Carrier Support Assembly (See Figure 201)

NOTE: Removal of the intermediate gearbox assembly (diaphragm) requires determination of existing engine torque indicating system calibration values. Prior to removal of inermediate gearbox assembly (diaphragm), perform engine pre-teardown calibration. Refer to 72-00-00, ADJUSTMENT/TEST.

(1) Remove beta tube assembly. Refer to 72-10-01, MAINTENANCE PRACTICES.

(2) Remove propeller pitch control. Refer to 72-10-02, MAINTENANCE PRACTICES.

R (3) (Codes BA-BC, EA-LA) Remove start fuel pressure regulator. Refer to 73-10-03, MAINTENANCE PRACTICES.

(4) Remove nose cone assembly. Refer to 72-10-09, MAINTENANCE PRACTICES.

(5) Remove oil transfer tube, oil jet and lubrication nozzle. Refer to 72-10-10, MAINTENANCE PRACTICES.

(6) Remove torsion spline (quill) shaft and coupling. Refer to 72-10-11, MAINTENANCE PRACTICES.

R 1. A. (7) (Post SB72-0061) Remove direct drive fuel control gear train.
R Refer to 72-10-15, MAINTENANCE PRACTICES.

R (8) Remove oil transfer manifold and torque sensor assembly. Refer to
R 72-10-16, MAINTENANCE PRACTICES.

CAUTION: DO NOT MOVE OR ROTATE ROTATING ASSEMBLY WHILE NUT IS REMOVED.

(9) Remove nut using 287416-1-1 holder and adapter, then remove gear from forward end of main shaft.

(10) Remove plugs from nut.

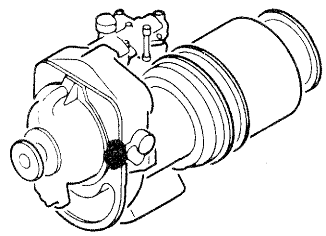
CAUTION: SHIMS INSTALLED BETWEEN FLANGES OF RETAINER AND CARRIER ESTABLISH A CRITICAL DIMENSION. RECORD EXACT NUMBER AND THICKNESS OF SHIMS REMOVED TO ENSURE SAME NUMBER AND THICKNESS ARE INSTALLED
R AT INSTALLATION. LOCKWIRE SHIMS (IN THEIR
R RELATIVE INSTALLATION LOCATION) TO RETAINER TO
R PREVENT LOSS OR INTERMINGLING WITH OTHER SHIMS.

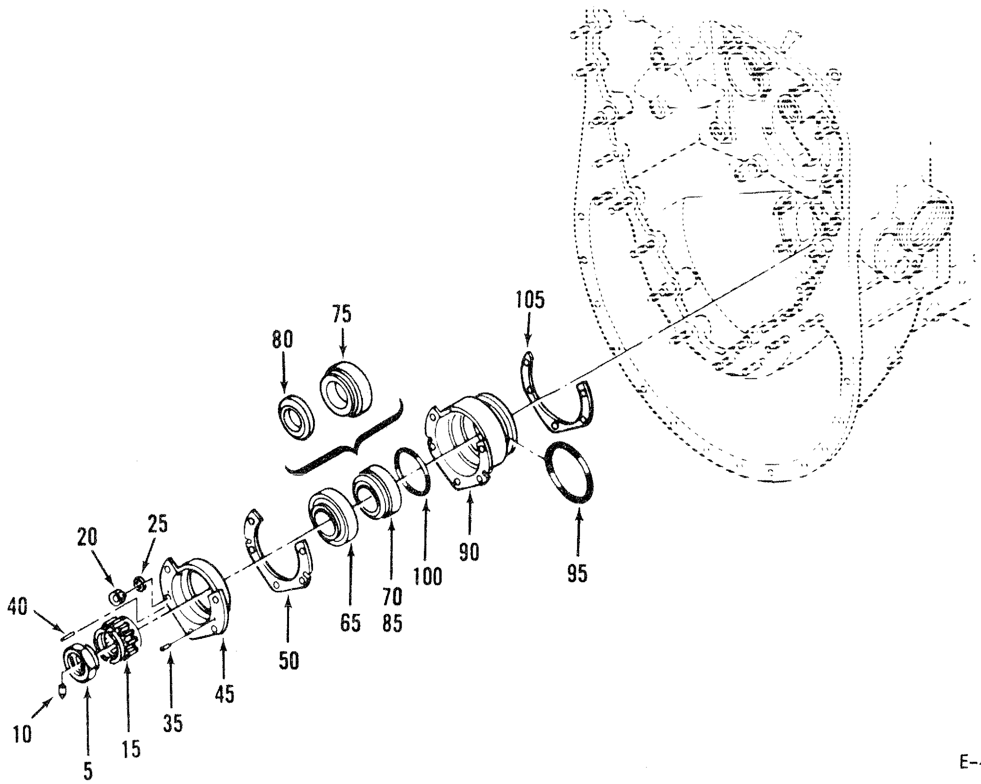
(11) Remove nuts securing assembly, then remove retainer and retainer shims.

(12) Using 285154-1-1 puller, remove bearing carrier and seal (rotor and stator). Separate components after removal. Press seal stator from carrier using driver and 285806-1-1 holder. Remove packings.

CAUTION: SHIMS INSTALLED BETWEEN CARRIER AND HOUSING ESTABLISH A CRITICAL DIMENSION. RECORD EXACT NUMBER AND THICKNESS OF SHIMS REMOVED TO ENSURE SAME NUMBER AND THICKNESS ARE INSTALLED AT
R INSTALLATION. LOCKWIRE SHIMS (IN THEIR RELA-
R TIVE INSTALLATION LOCATION) TO BEARING CARRIER
R TO PREVENT LOSS OR INTERMINGLING WITH OTHER
R SHIMS.

(13) Remove carrier shims.





R 5.	NUT (IPC FIG. 161)	65.	BEARING
10.	PLUG (NYLOC)	70.	AIR-OIL SEAL ASSY
15.	SPUR GEAR	75.	AIR-OIL SEAL
20.	NUT	80.	SEAL ROTOR
25.	WASHER	85.	AIR-OIL SEAL ASSY
35.	PIN	90.	BEARING CARRIER
R 40.	PIN	95.	PACKING
45.	RETAINER	100.	PACKING
50.	SHIM	105.	SHIM

Compressor Bearing Carrier Support Assembly Installation
Figure 201

NOTE: Lightly coat new packings with clean engine oil or lubricant (OS-124) prior to installation.

1. B. Install Compressor Bearing Carrier Support Assembly (See Figure 201)

R NOTE: Refer to 70-00-00, STANDARD PRACTICES, for recom-
R mended general torque values. Add frictional drag
R (run-down) torque of self-locking devices to
R recommended values.

Bearing inner race consists of two halves which are matched and scribed during manufacture. Halves must be positioned so scribe marks on inner diameter of inner race halves are aligned to facilitate checking alignment during assembly and installation of bearing carrier. (See figure 202.)

R Step (1) not required unless bearing, bearing
R retainer or bearing carrier has been replaced. If
R components were not replaced, use same thickness
R of shims as removed.

(1) Use a depth micrometer and measure from bearing seat to carrier flange face and record as Dimension A. (See figure 202.) Position bearing on retainer and using a micrometer measure from retainer flange to bearing surface and record as Dimension B. Subtract Dimension A from Dimension B. Subtract 0.002 inch from result. The remainder is required thickness of retainer shims to provide 0.001 to 0.003 inch pinch between retainer and carrier.

NOTE: Seal must bottom in carrier without excessive pressure or cutting packing.

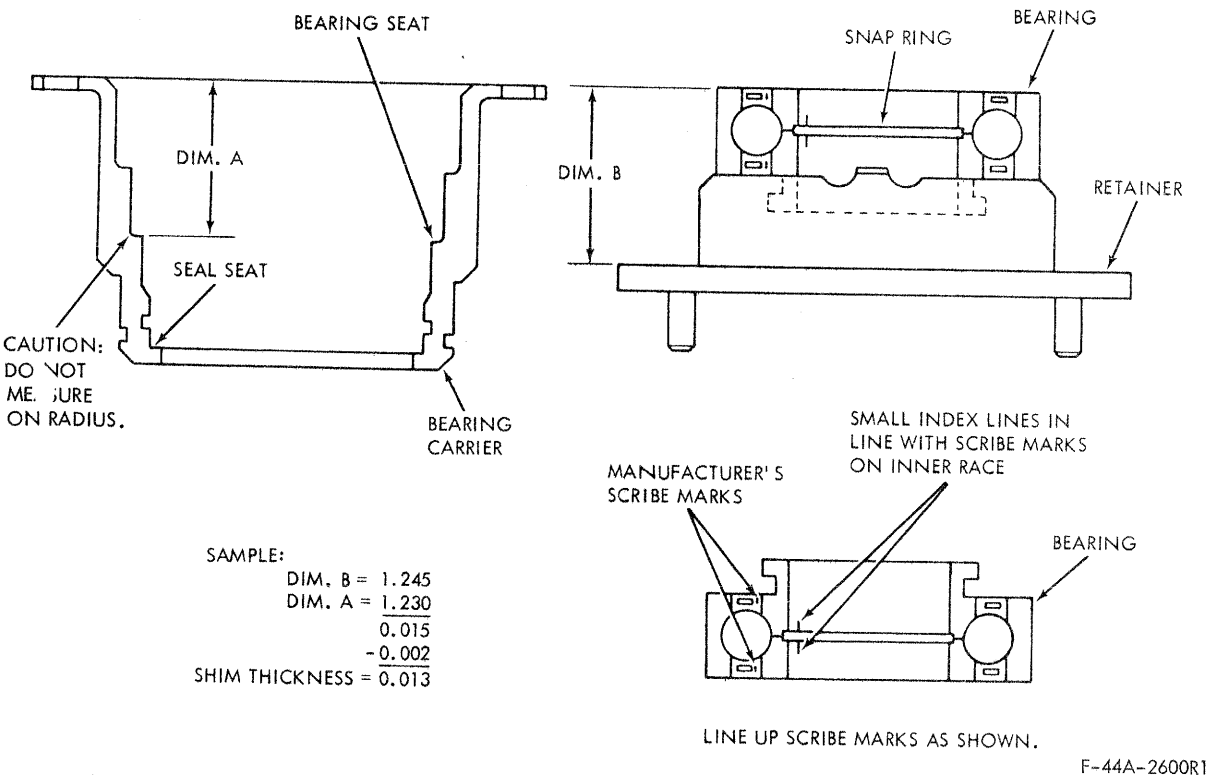
(2) Install new packing on inside and outside of carrier. Press seal into carrier using 287894-1-1 driver.

(3) Install bearing.

NOTE: Make certain that retainer anti-rotation tab locks in slot in bearing. (See figure 203.)

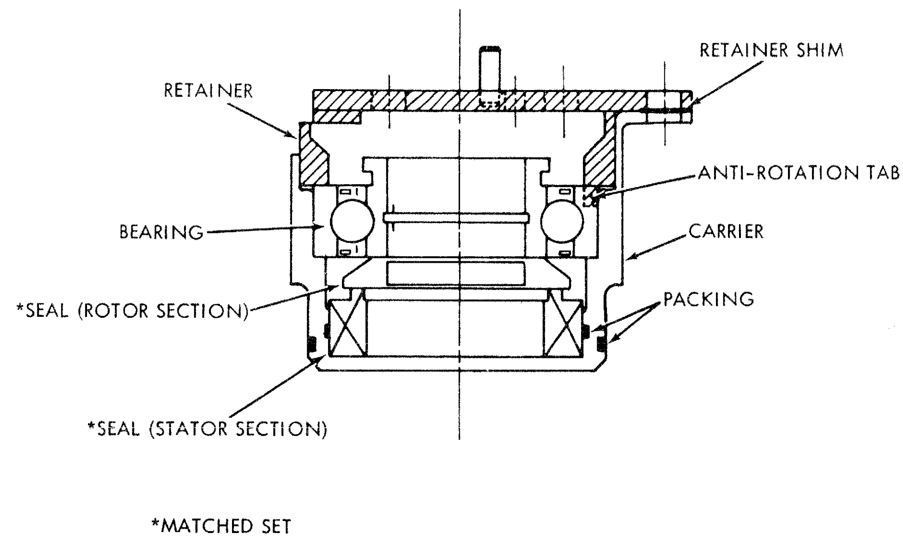
(4) Install thickness of retainer shims determined in step (1) and position retainer on carrier.

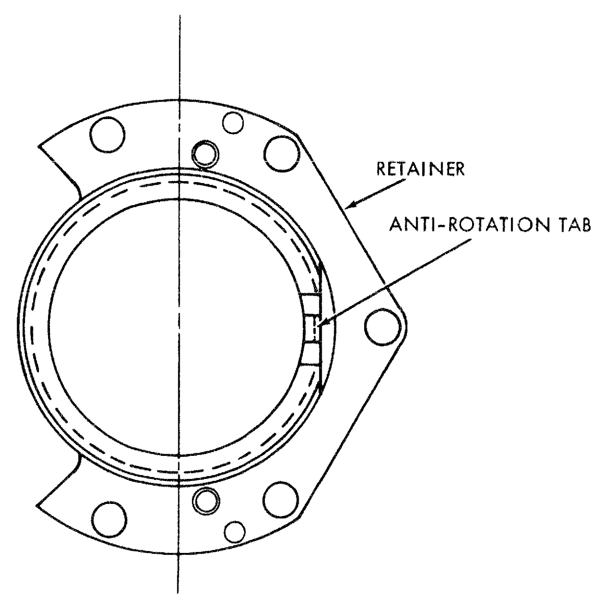
(5) Install same number and thickness of carrier shims removed in Removal. Press assembled carrier into place using 284168-1-1 puller. Secure with nuts. Tighten nuts (20, figure 201) to 80 inch-pounds torque.



Compressor Bearing Carrier - Retainer Shim Requirement
Figure 202

R





Assembly of Compressor Bearing Carrier
Figure 203

1. B. (6) Install plugs (nyloc inserts) to full depth of holes in nut and dress to 0.000 to 0.005 inch above threads of nut.

NOTE: Loosen and tighten nut three times. On third (final) torque, add the running torque to the required torque.

(7) Apply lubricating compound (Liqui-Moly, Grade NV) to face and threads of nut. Install spur gear on main shaft, then install nut. Install 287416-1-1 holder and adapter on gear and tighten nut (5, figure 201) to 900 inch-pounds torque. Remove adapter.

(8) Install oil transfer manifold and torque sensor assembly. Refer to 72-10-16, MAINTENANCE PRACTICES.

2. Inspection/Check

A. Inspect Compressor Bearing Carrier Support Assembly (See Figure 201)

(1) Inspect compressor bearing carrier components (installed).

Check for oil leakage from compressor seal at air inlet with engine not operating. Refer to 72-00-00, TROUBLE SHOOTING, for maximum allowable limits.

(2) Inspect compressor bearing carrier components (removed) as follows. (See figure 201.)

(a) Inspect bearing for binding. Inspect seal or seal stator section and seal rotor section for unusual wear or obvious damage. Inspect spur gear for unusual wear pattern or obvious damage.

(b) Replace part that does not meet Inspection/Check requirements.

3. Cleaning/Painting

A. Clean Component Parts

(1) Refer to 72-00-00, GENERAL - CLEANING/PAINTING for general cleaning instructions and for description of cleaning methods specified in Table 203.

NOTE: Reference shall be made to Table 203 for recommended cleaning method.

Table 203. Cleaning Methods

Figure No.	Item No.	Nomenclature	Cleaning Methods 1	2
All standard metallic hardware			X	X
201	5	Nut	X	X
	15	Spur Gear	X	X
	45	Retainer	X	X
	50, 105	Shim	X	X
	65	Bearing*		
	70, 75, 85	Air-Oil Seal	X	
	80	Seal Rotor	X	X
	90	Bearing Carrier	X	X

*Refer to 72-00-00, GENERAL - CLEANING/PAINTING, for special cleaning instructions.

R

INPUT HOUSING ASSEMBLY - MAINTENANCE PRACTICES

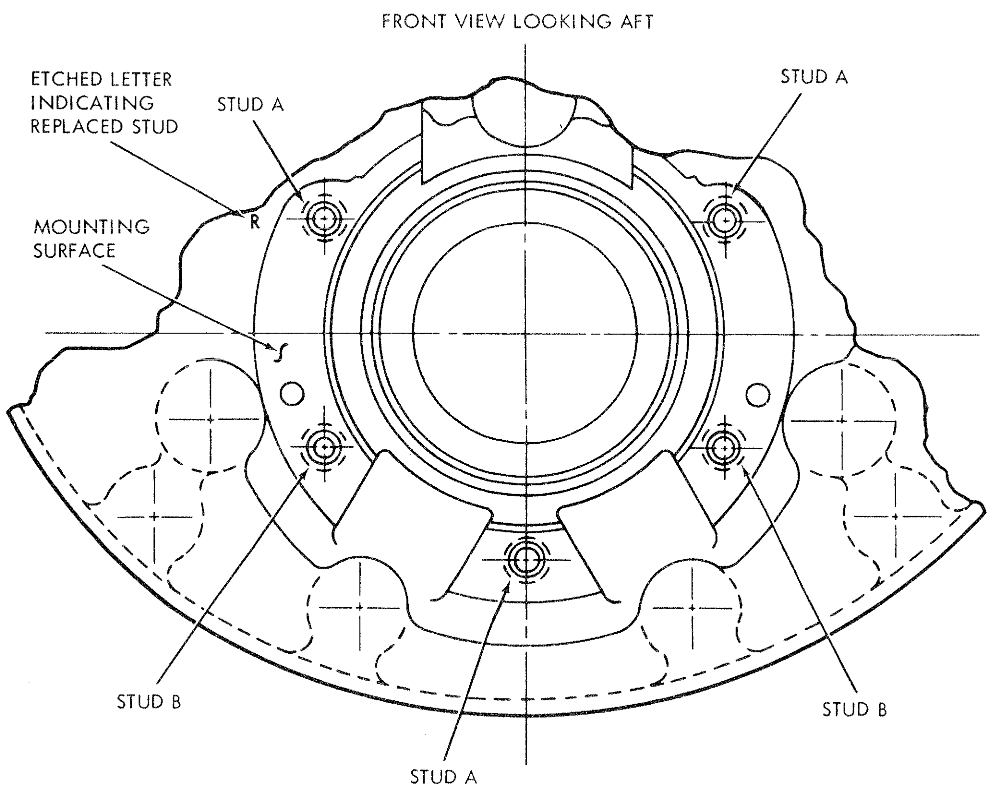
1. Inspection/Check

   A. Inspect Input Housing Assembly

      (1) Inspect studs. (See figure 201.)

         (a) Check adjacent mounting surface. Fretting of mounting surface is not allowed. Polish surface through anodize coating if required in accordance with Approved Repairs.

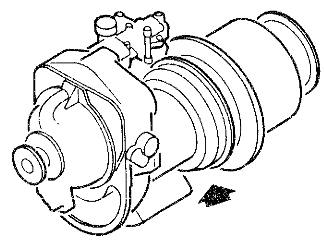
         (b) Check studs. Side movement is acceptable to a limit of 0.00005 inch, measured at stud end. Cracking or material breakout in mounting surface is not allowed. Refer to Approved Repairs.

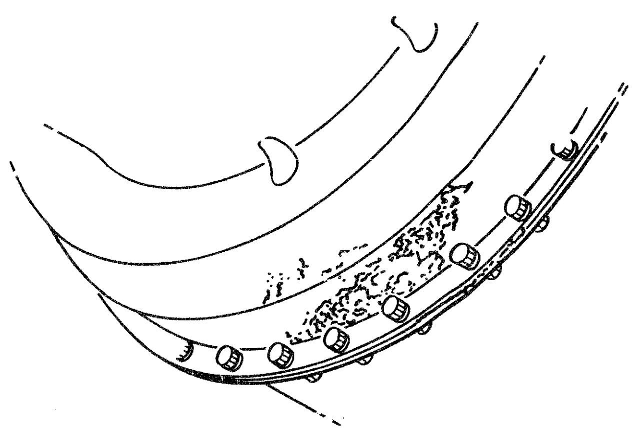


Replacement of Compressor Bearing Carrier Studs on
Input Housing Assembly
Figure 201

1. A. (2) Inspect input housing assembly moisture drain for external corrosion. If any corrosion is present which penetrates through the input gear housing wall in area indicated in Figure 202, return the engine to an overhaul facility.

(3) Inspect input housing for cracks. No cracks are allowed.





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Repair Input Gear Housing Corrosion
Figure 202

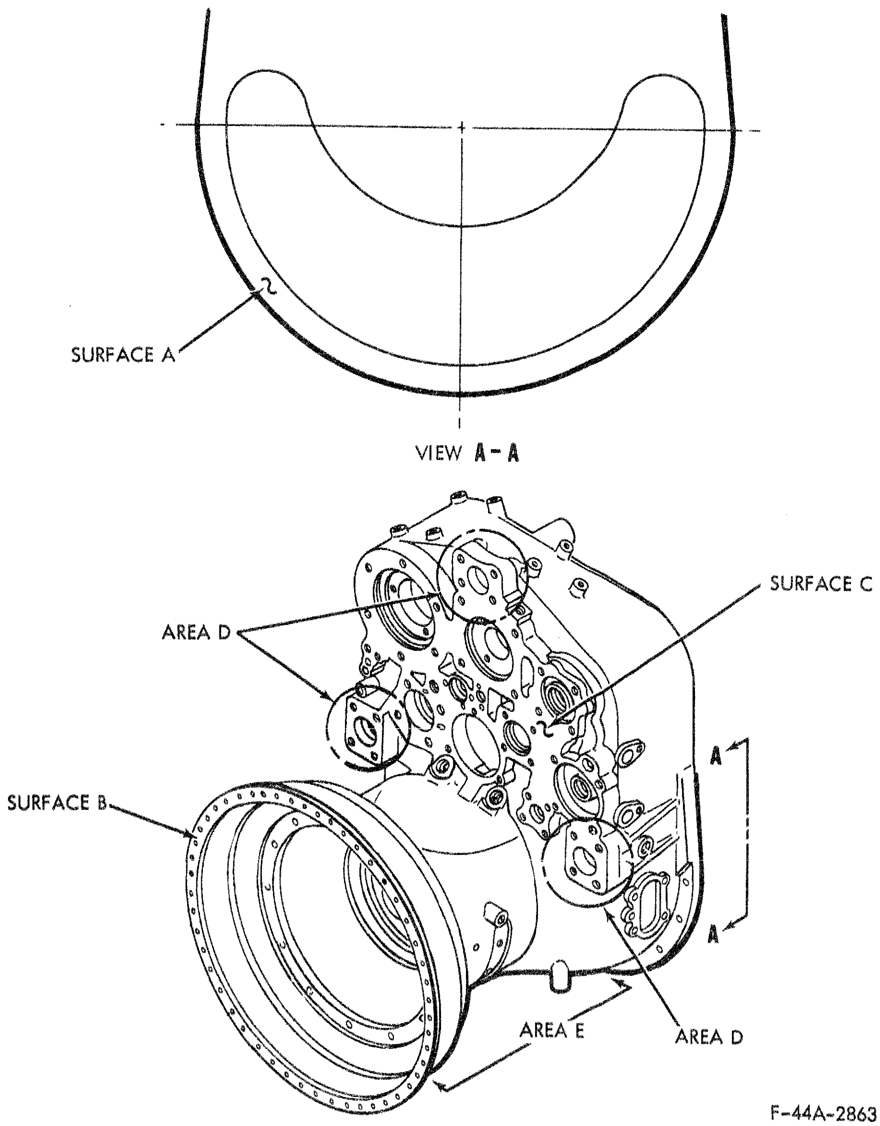
1. A. (4) Inspect input side accessory housing assembly for corrosion as follows. (See figures 203 and 204.)

(a) Inspect input side accessory housing (area E, figure 203) for evidence of corrosion or salt deposits. Particular attention must be given to areas where dissimilar metals contact the magnesium alloy faying surfaces such as forward flange area (surface A) rear flange area (surface B), accessory mounting area (surface C) and engine mounts (area D).

(b) All screw and bolt locations shall be checked for evidence of corrosion. Check for loose paint, scratches and gouges on surface of input side accessory housing (area E).

(c) Treat corrosion in accordance with Approved Repairs.

(d) If limits are exceeded (see figure 203), return engine to overhaul facility.



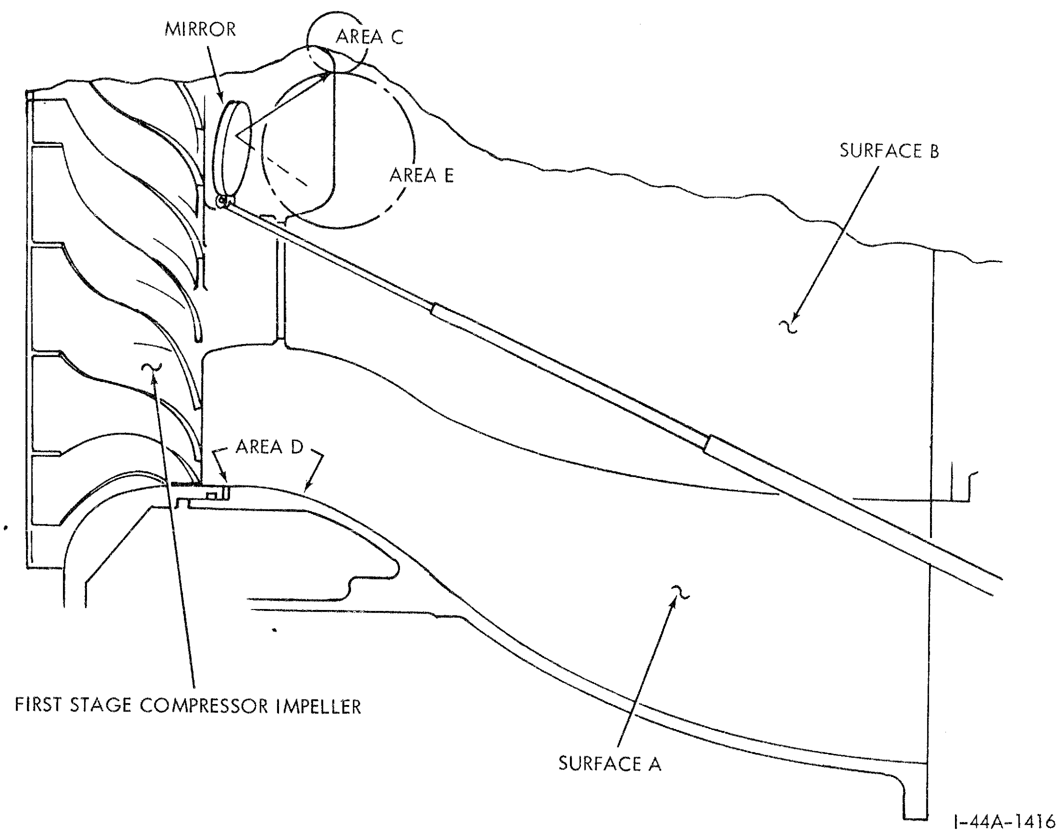
Surface or Area	Depth	Area	Places
A	0.015 in.	1/2 sq in.	3
B	0.040 in.	1/2 sq in.	6
C	0.040 in.	1/2 sq in.	6
D	0.020 in.	1/2 sq in. total area	
E	0.020 in.	6 sq in. total area	

Inspection of Input Side Accessory Housing Assembly
Figure 203

R

1. A. (4) (e) Inspect air intake surfaces (surfaces A and B, and areas C, D, and E, figure 204) for indication of corrosion or abrasion due to foreign object ingestion. See Figure 204 for corrosion limits. Treat corrosion in accordance with Approved Repairs.

(f) If limits are exceeded (see figure 204), return engine to overhaul facility.



Surface or Area	Depth	Area	Places
*A	0.040 in.	2 sq in.	3
*B	0.040 in.	2 sq in.	3
C	0.010 in.	1 sq in. total area	
D	0.050 in.	2 sq in. total area	
E	0.020 in.	2 sq in. total area	

*Wall thickness shall not be less than 0.090 inch after corrosion removal.

Inspection of Input Side Accessory Housing Assembly
Air Intake Surfaces
Figure 204

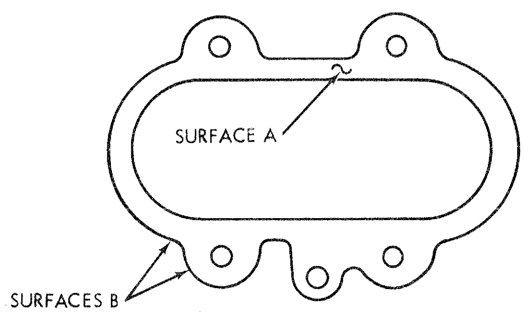
1. A. (5) Inspect inlet temperature sensor mounting pad as follows. (See figure 205.)

(a) Inspect input side accessory housing inlet temperature sensor mounting pad for evidence of corrosion or salt deposits. Particular attention must be given to area where dissimilar metals contact the magnesium alloy faying surface (surface A).

(b) All screw and bolt locations shall be checked for evidence of corrosion.

(c) Treat corrosion in accordance with Approved Repairs.

(d) If limits (see figure 205) are exceeded, return engine to overhaul facility.



CORROSION DAMAGE OF SURFACE A NOT EXCEEDING 0.02 INCH DEPTH IS ACCEPTABLE.

CORROSION DAMAGE OF ALL OTHER SURFACES (SURFACES B) NOT EXCEEDING 0.10 INCH DEPTH IS ACCEPTABLE.

F-44A-2425R1

Surface or Area	Depth	Area
A	0.020 in.	1/2 sq in. total area
B	0.010 in.	1/2 sq in. total area

Inspection of Inlet Temperature Sensor Mounting Pad
Figure 205

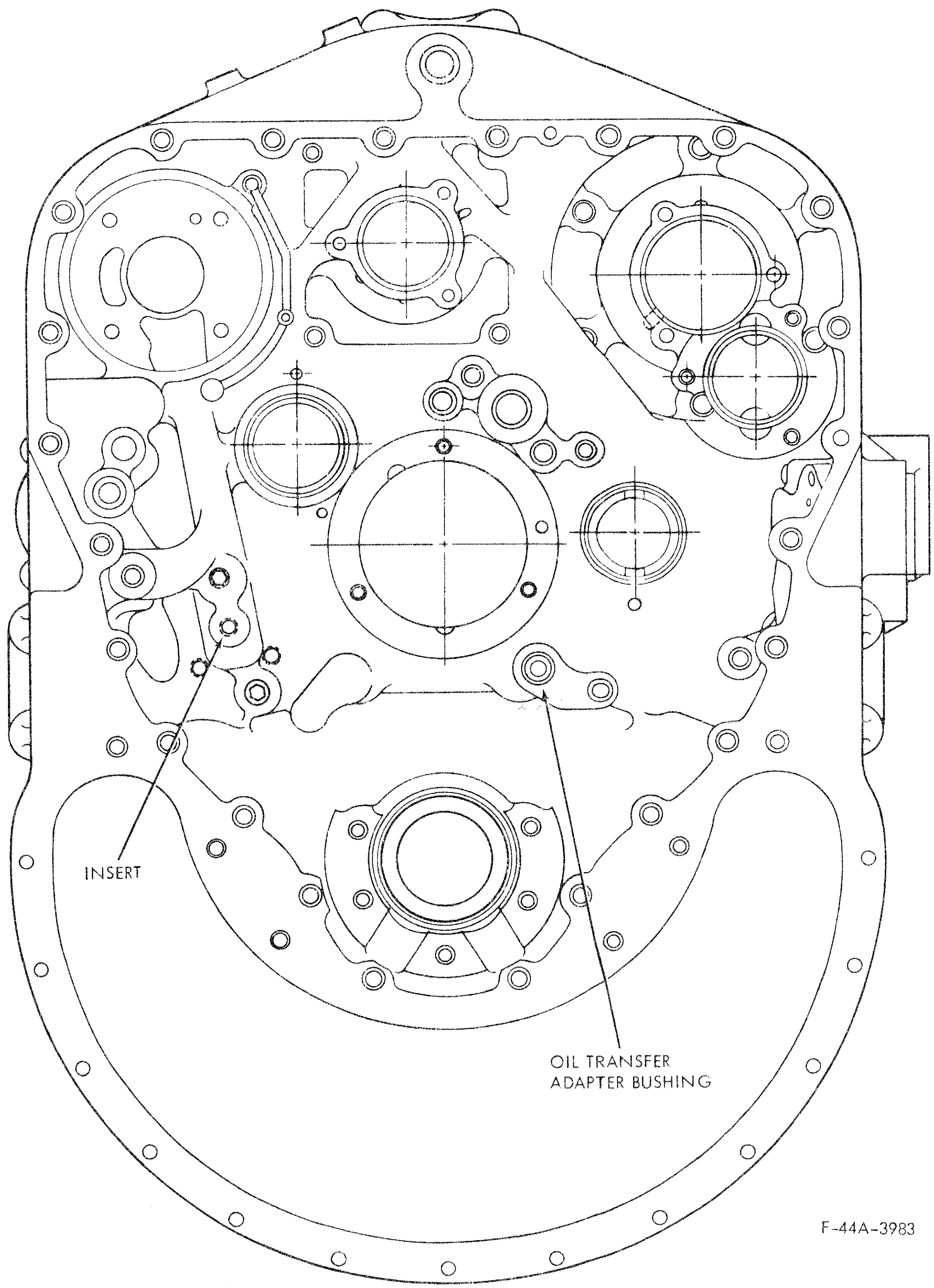
R

1. A. (6) (Input Housing Assembly Part No. 3101125-X) Visually inspect oil transfer adapter assembly bushing bore (figure 206) for wear grooves. If wear is estimated to be 0.035 inch or more bushing must be replaced. If depth of wear groove is undetermined or questionable the following pressure check may be performed. With oil transfer adapter asembly installed, connect NTS test stand as for calibration. Set pressure as high as attainable, but do not exceed 100 psi maximum. Block all oil drain ports at gearcase if oil leaks between bushing and adapter bushing must be replaced. Refer to Approved Repairs.

R (7) (Post SB72-0061) Inspect input side accessory housing assembly for
R loose or damaged insert at mount hole for torque sensor arm (see
R figure 206). Replace insert with oversized insert in accordance
R with Approved Repairs.

R (8) Inspect for oil leakage or weepage above engine air inlet where in-
R put housing studs extend through diaphragm for attachment of air-
R frame air inlet. If leakage or weepage is indicated, refer to Ap-
R proved Repairs.

R



R Inspection of Oil Transfer Adapter Bushing and
R Mounting Hole Insert for Torque Sensor Arm
Figure 206

2. Approved Repairs

NOTE: Table 201 provides a list of materials and compounds required for Approved Repairs.

Table 201. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Acid resistant brush	Commercially available
Calcium sulfate	Commercially available
Chromic acid flake	Commercially available
Clear coat (V92VC10)	Sherwin-Williams Co, Main Store, 2312 N 16st St, Phoenix, AZ 85006
Color coat (Andrew Brown A423-66 Enamel No. 051 and C-1178 Converter)	Griggs Paint and Hardware Co, 3602 S 16th Place, Phoenix, AZ 85040
Compound (Loctite 504 Gasket Eliminator)	Loctite Corp, 705 N Mountain Rd, Newington, CT 06111
Compound (Loctite 271)	Loctite Corp, 705 N Mountain Rd, Newington, CT 06111
Corrosion preventive compound (Rustlick 606)	Rustlick Inc, 755 Boylston St, Boston, MA 02116
Cotton applicator	Commercially available
Fine bristled brush	Commercially available
Heat gun	Commercially available
Methanol	Commercially available
Nitric acid	Commercially available

Table 201. Materials and Compounds (Cont)

Material or Compound	Manufacturer
Primer (P-415-66-611B with Catalyst C1178-66)	Griggs Paint, Subsidiary of Domcom Dist, 3602 S 16th Place, Phoenix, AZ 85040
Rubber gloves	Commercially available
Sandpaper (210 Grit Size)	Commercially available
Sealant (RTV731)	Dow Corning Corp, S Saginaw Rd, Midland, MI 48640
R Sealing compound (203 Epoxylite R and Catalyst No. 1)	Epoxylite Corp, 1265 N Kreamer Blvd, Anaheim, CA 92806
Sodium dichromate	Commercially available
Solvent, Stoddard (Federal Specification P-D-680, Type I)	Commercially available
Touch-up solution (Dow 1)	Dow Corning Corp, S Saginaw Rd, Midland, MI 48640
Touch-up solution (Dow 19)	Dow Corning Corp, S Saginaw Rd, Midland, MI 48640

2. A. Repair Input Housing Assembly

(1) Replace damaged studs as follows. (See figure 201.)

NOTE: Upon completion of engine reassembly following replacement of studs, perform functional check of engine to assure NTS operation, adjust torque compensator or torque transducer and check NTS calibration by flight test as specified in 72-00-00, ADJUSTMENT/TEST.

(a) Remove damaged stud if stud has not been previously replaced. Previously replaced studs have letter R etched adjacent to stud. (See figure 201.) If stud has been previously replaced, return engine to service center.

(b) Drill mounting holes for removed studs to 0.395 to 0.401 inch diameter, 0.750 to 0.760 inch deep. Tap drilled holes to bottom with 7/16-14UNC-2B special minor diameter threads.

2. A. (1) (c) Touch up threads with primer (P-415-66-611B with Catalyst C1178-66) mixed in equal parts by volume (let stand 30 minutes before use).

(d) Install Stud Part No. 868010-4 (stud A, figure 201) or Stud Part No. 868010-5 (stud B, figure 201) in prepared hole. While primer is still soft install replacement stud 0.01 to 0.03 inch below mounting surface Apply a thin even coat of primer (refer to step (c)) to area of stud to seal scratches and isolate dissimilar metal surfaces. Dry for 15 minutes with portable heat gun.

(e) Etch letter R adjacent to replacement stud as illustrated in Figure 201.

WARNING: SOLVENT IS TOXIC AND FLAMMABLE. USE IN WELL-VENTILATED AREA. AVOID BREATHING FUMES OR LONG CONTACT WITH SKIN TO PREVENT DAMAGE TO PHYSICAL HEALTH. KEEP AWAY FROM FLAME TO AVOID FIRE HAZARD.

(f) Thoroughly clean input housing assembly with solvent, Stoddard (Federal Specification P-D-680, Type I) and allow to air-dry.

R NOTE: Corrosion Treatment Kit Part No. 658532-1 containing
R materials required for corrosion treatment may be ordered
R from any AiResearch Aviation Company or from the Garrett
R Corporation AiResearch Manufacturing Company of Arizona,
R P.O. Box 29003, Phoenix, AZ 85038.

(2) Repair corrosion damaged areas.

(a) Repair external corrosion area as follows.

WARNING: METHANOL IS TOXIC AND FLAMMABLE. USE RUBBER GLOVES TO PREVENT SKIN CONTACT. USE IN WELL-VENTILATED AREA. AVOID BREATHING FUMES OR LONG CONTACT WITH SKIN TO PREVENT DAMGE TO PHYSICAL HEALTH. KEEP AWAY FROM FLAME TO AVOID FIRE HAZARD.

NOTE: Do not dilute methanol with water or use water (including distilled water) to wash any exposed surface. Water will cause spreading of corrosion.

1 Mechanically remove all corrosion by gently wire brushing or sanding. Clean areas to be treated by flushing or swabbing area with methanol to remove all traces of dirt, oil and foreign elements and drive out any residual moisture.

2. A. (2) (a) 2 Dry all areas to be treated with portable heat gun for five minutes, holding temperature to a maximum of 177C (350F) to prevent scorching the surrounding painted surfaces.

CAUTION: TOUCH-UP SOLUTION (DOW 1) SHALL NOT BE ALLOWED TO CONTACT ANODIC TREATED SURFACES. A RAPID DETERIORATION OF THE COATING WILL OCCUR.

3 Apply touch-up solution (Dow 1) to bare metal area using an acid resistant brush. Prepare by mixing 1.5 pounds of sodium dichromate and 1.5 pints of nitric acid with enough demineralized or distilled water to make one gallon of solution. Allow solution to stand for one to two minutes.

4 Rinse areas with methanol and blot dry.

5 Thoroughly dry areas with portable heat gun for five minutes, holding temperature to a maximum of 177C (350F). Touch up treated area with touch-up solution (Dow 19) using cotton applicators. Prepare by mixing 1.3 ounces of chromic acid flake and one ounce of calcium sulfate with enough demineralized or distilled water to make one gallon of solution. Allow solution to stand for five minutes, then wipe off excess.

6 Apply protective coating (clear coat, V92VC10) to treated areas using fine bristled brush or paint sprayer, overlap adjacent mating parts by a minimum of 0.20 inch. After application, heat cure for approximately 15 minutes at 177C (350F) using portable heat gun.

7 Following the application of the protective coating, the areas that were exposed and surface treated are to be painted in the following manner.

a First, apply one coat of primer (P-415-66-611B with Catalyst C1178-66) mixed in equal parts by volume (let stand 30 minutes before use), by either brushing or spraying. Dry for 15 minutes with portable heat gun.

b Next, apply one coat of color coat (Andrew Brown A423-66 Enamel No. 051 and C-1178 Converter) mixed in equal parts by volume (let stand 30 minutes before use), by either brushing or spraying. Dry for 15 minutes with portable heat gun.

8 Provide added protection to area found to be susceptible to the accumulation of corrosive moisture as follows.

CAUTION: DO NOT USE SEALANT IN AIR INTAKE OF ENGINE TO AVOID POSSIBLE INGESTION.

2. A. (2) (a) 8 a After the paint has dried, pockets and voids that are found to retain moisture may be filled by building up with sealant (RTV731) and allowing it to air cure. This can be painted with primer and finish paints to provide a uniform appearance.

(b) Repair internal corrosion area as follows.

CAUTION: CORROSION PREVENTIVE COMPOUND IS FLAMMABLE, ENGINE SHALL BE COOLED PRIOR TO APPLICATION.

NOTE: A plastic squeeze bottle may be used to inject the compound into housing.

1 Inject one pint of corrosion preventive compound (Rustlick 606) into the bottom of the input gear housing through the moisture drain hole. Allow excess compound to drain from housing into bucket.

(3) If indicatd by inspection, replace oil transfer adapter assembly bushing (figure 206) as follows.

CAUTION: TO PREVENT ENGINE OIL SYSTEM CONTAMINATION DURING REWORK USE ONE OF THE FOLLOWING PROCEDURES. CONNECT NTS TEST STAND AS FOR CALIBRATION AND FLUSH DRILL CHIPS OR REMOVE REAR BEARING LUBRICATION LINE AT INPUT HOUSING AND APPLY SHOP AIR AT THE BEARING LUBRICATION FITTING.

(a) Replace threaded bushing as follows.

1 Using drill size 0.5156 inch (33/64), drill ID of bushing and collapse walls. If bushing wall cannot be collapsed drill size 17/32 inch or rotary file may be used, however extreme caution must be used not to remove gearbox material.

2 In the possibility gearbox threads were damaged during bushing removal a 5/8-16 UN3B bottom tap may be used to repair threads.

3 Prior to installation of new bushing, preheat gearcase with heat lamp. Coat new bushing with sealing compound (203 Epoxylite and Catalyst No. 1) and install 0.01 to 0.03 inch below gearcase surface. Allow to dry for six hours utilizing heat lamp during drying period.

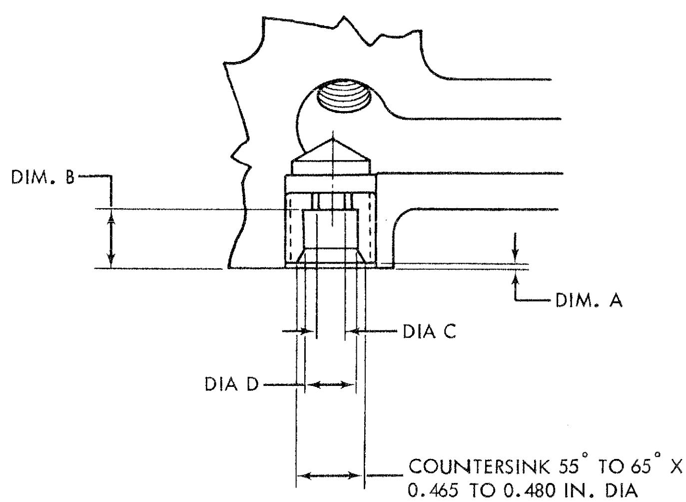
2. A. (3) (b) Replace non-threaded bushing as follows.

1 Using drill size 0.5312 inch (17/32) drill ID of bushing and collapse walls. If bushing wall cannot be collapsed drill size (35/64) or rotary file may be used; however, extreme caution must be used not to remove gearbox material.

2 Prior to installation of new plug preheat the gearcase with heat lamp. Coat new plug with sealing compound (203 Epoxylite and Catalyst No. 1) and press into gearcase to 0.01 to 0.03 inch below gearcase surface. Allow to dry for six hours utilizing heat lamp during drying period.

NOTE: If plug installed was Plug Part No. 869-651-1 (magnesium alloy) Dow 19 (refer to 2.A.(2)(a)5 must be used during rework.

3 Rework installed plug to specification illustrated in Figure 207.



A	B	C	D
0.01 TO 0.03 IN.	0.44 TO 0.45 IN.	0.249 TO 0.263 IN.	0.422 TO 0.425 IN.

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Repair of Oil Transfer Adapter Assembly Bushing
Figure 207

2. A. (4) Replace loose or damaged insert at mount hole for torque sensor arm with oversize insert as follows. (See figure 206.)

(a) Use long-nosed pliers to remove loose or damaged insert.

CAUTION: ENSURE THAT HOLE FOR OVERSIZE INSERT IS DRILLED PERPENDICULAR TO FORWARD FACE OF ACCESSORY DRIVE HOUSING AND CENTERED WITH EXISTING HOLE, TO ENSURE PROPER ALIGNMENT OF TORQUE SENSOR MOUNTING BOLT.

(b) Drill a 0.332 inch (drill size Q) hole at location of removed insert to a depth of 0.50 to 0.53 inch flat bottom.

(c) Flush drilled hole clean of all drill chips using solvent, Stoddard (Federal Specification P-D-680, Type I).

(d) Tap drilled hole to bottom with 3/8-16UNC-2B bottom tap. Countersink hole to 0.385 inch diamter by 0.037 inch deep.

(e) Flush threaded hole using solvent, Stoddard (Federal Specification P-D-680, Type I) and dry thoroughly.

(f) Touch up threads with primer (P-415-66-611B with Catalyst C1178-66) mixed in equal parts by volume (let stand 30 minutes before use).

NOTE: Use a modified screwdriver, or a rod, with the correct outside diameter to fit inside diameter of insert and slotted to fit over tang of insert, to install new insert.

(g) Install new oversize Insert Part No. MS51831-201L or NAS1395C-3L, while primer is wet, three-quarters to one and one-half turns below surface of countersink. Remove tang, if applicable, using long-nosed pliers or blunt tool and hammer.

(h) Touch up lead thread in accessory drive housing by wiping on thin coat of primer (P-415-66-611B with Catalyst C1178-66) to seal surface scratches and adjacent area around insert hole.

(i) Allow primer to cure four to six hours at room temperature or by baking for one hour at 82 to 135C (180 to 275F).

R CAUTION: ENSURE INTERIOR OF ACCESSORY DRIVE HOUSING IS CLEANED OF ALL DRILL CHIPS AND METAL PARTICLES TO PREVENT OIL SYSTEM CONTAMINATION.

R 2. A. (4) (j) Clean interior of accessory drive housing thoroughly to remove all metal particles before reassembling engine.

(5) Repair oil leakage or weepage around studs located above engine air inlet.

R (a) Temporary repair may be accomplished as follows.

R 1 Remove air frame air inlet.

R 2 Apply compound (Loctite 504 Gasket Eliminator) around leaking studs.

R 3 Reinstall airframe air inlet causing compound to extrude, forming an interim gasket.

R (b) Permanent repair may be accomplished as follows.

R 1 Remove output gearbox housing assembly (nose cone) in accordance with 72-10-09, MAINTENANCE PRACTICES.

R NOTE: Studs may be replaced without removal of intermediate gearbox housing (diaphragm) if care is used not to damage housing during stud removal.

R 2 Remove studs which indicate oil leakage or weepage in accordance with 70-00-00, STANDARD PRACTICES.

R 3 Coat threads of new keensert stud with compound (Locktite 271).

R 4 Turn stud into threaded hole until step is 0.010 to 0.030 inch below machined surface. Drive in locking keys using a hammer and keensert installation tool.

R 5 Install output gearbox housing assembly (nose cone) in accordance with 72-10-09, MAINTENANCE PRACTICES.

CHAPTER 72 - COMPRESSOR SECTION

TABLE OF CONTENTS

COMPRESSOR SECTION - DESCRIPTION AND OPERATION

The compressor section of the engine consists essentially of those components located in the center of the engine and enclosed by the compressor housing and a portion of the input housing. The principal components of the compressor section are the impellers, interstage diffuser assembly, impeller shroud, combustion transition liner and compressor housing. The compressor section furnishes the compressed air to the combustion section.

The transition liner assembly registers on the compressor housing. The assembly directs air to the turbine section and also provides support for the seal on the splined curvic coupling. The liner assembly supports the forward end of the combustion chamber. Small holes in the center section of the liner assembly direct cooling air to the front face of the first stage turbine wheel and through the curvic teeth to the center area between the turbine wheel hubs and the main drive shaft. The stator and liner assembly forms an inner register for the combustion chamber.

Inlet air enters the engine through an inlet air duct located at the bottom of the reduction gear section. From the inlet air duct, the air enters the compressor section at the first stage impeller, where it is compressed and forced through the interstage diffuser assembly to the second stage impeller. Air is further compressed by the second stage impeller and guided by the compressor housing and combustion transition liner into the combustion section.

FIRST STAGE IMPELLER - MAINTENANCE PRACTICES

R NOTE: First stage impeller is not removed from engine.
R Inspection/Check and Approved Repairs are performed with
R first stage impeller installed.

1. Inspection/Check

A. Inspect First Stage Impeller

(1) Check first stage impeller for blade damage as follows.

(a) Visually inspect first stage impeller through inlet air duct for deformed blades, dents, nicks, cracks, or other damage, using a strong light and mirror. Refer to Approved Repairs for rework of damaged blades.

(b) If any cracks are evident visually engine shall be removed and returned to overhaul facility for repair.

(c) Limits for deformed blades which do not require repair are as follows.

1 Deformed blades are restricted to the outer one-half of the leading edge.

2 The radius at the bend shall be greater than 0.2 inch and blade contour shall be within 0.1 inch of original projected blade contour.

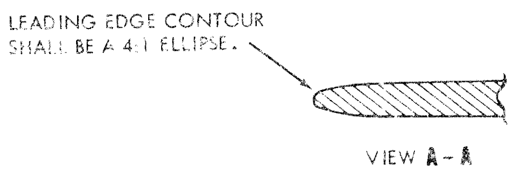
3 If the deformed blades are within the above limits, dye check the blades for cracks. Cracks are not allowable.

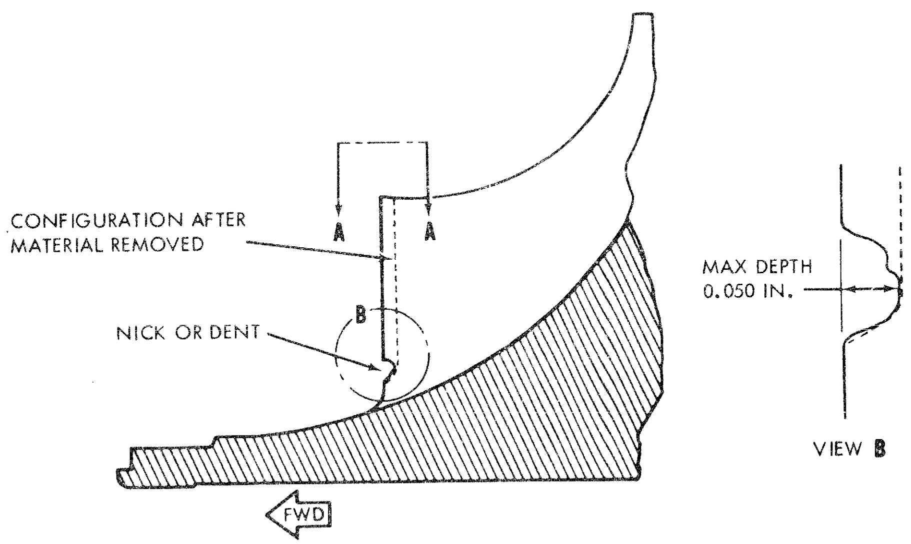
(d) If blades are deformed beyond limits, the engine shall be removed and returned to overhaul facility for repair.

(2) Check first stage impeller for rubbing as follows.

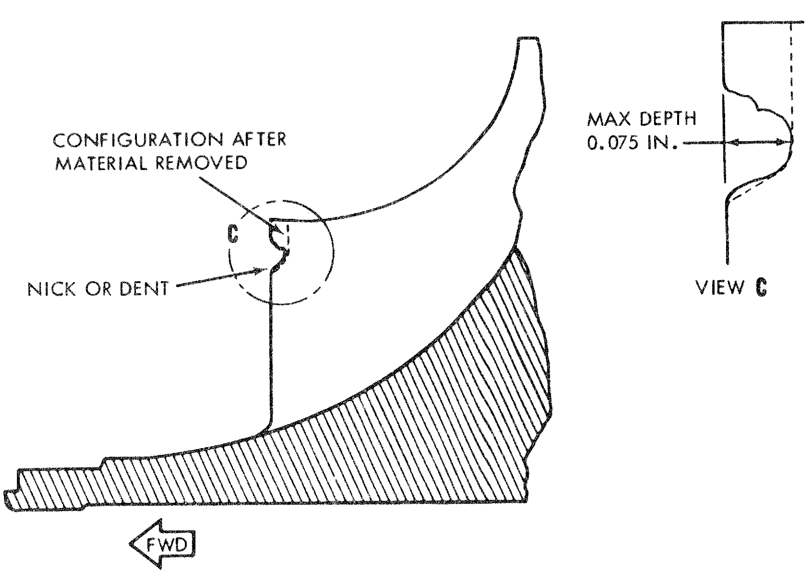
(a) Check around periphery of impeller and interior surface finish on shroud for rubbing.

(b) If rubbing is evident, contact AiResearch Field Service.





NICK OR DENT REMOVAL FROM INNER HALF OF LEADING EDGE



NICK OR DENT REMOVAL FROM OUTER HALF OF LEADING EDGE

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First Stage Compressor Impeller Nick or Dent Repair
Figure 201

R

2. Approved Repairs

A. Repair Nicked or Dented First Stage Impeller by Grinding

CAUTION: DO NOT EXCEED REWORK LIMITS OF FIGURE 201. PERFORMANCE MAY BE AFFECTED. BLADES MAY BE REWORKED MORE THAN ONCE IF LIMITATIONS SHOWN IN FIGURE 201 ARE NOT EXCEEDED.

(1) Dents or nicks may be removed from the inner one-half of the blade leading edge, and from the outer one-half of the leading edge. (See figure 201.)

(2) Removal of dents or nicks on the blade shall be accomplished by grinding out the nick or dent, and grinding material off the leading edge of the blade at an equal depth from the nick or dent to the shroud end of the leading edge.

(3) All places where material is removed shall fair smoothly, be finished, and not leave any corners or edges sharper than 0.1 inch radius.

(4) Make entry in permanent aircraft records noting engine operating time and compliance.

R
R
COMBUSTION TRANSITION LINER ASSEMBLY, SECOND STAGE IMPELLER AND COMPRESSOR HOUSING - MAINTENANCE PRACTICES

R
1. Removal/Installation

R
R
R
R
NOTE: Table 201 provides a list of special tools, fixtures and equipment required for Removal/Installation. Table 202 provides a list of materials and compounds required for Removal/Installation.

R
Table 201. Special Tools, Fixtures and Equipment

	Item No	Nomenclature	Use	Source/ Part No.
R R	NOTE: Equivalent substitutes may be used for listed items.			
R R R	1.	Gear Train Lock	Used to lock gear train when removing combustion transition liner.	284689-1-1
R R R	2.	Dummy Shaft	Used to secure turbine components when measuring assembly dimension.	285158-1-1

R
Table 202. Materials and Compounds

	Material or Compound	Manufacturer
R	NOTE: Equivalent substitutes may be used for listed items.	
R	Camel hair brush	Commercially available
R R R	High temperature compound (Fel-Pro C5-A)	Fel-Pro Inc, Div of Felt Products Mfg Co, 7450 N McCormick Blvd, Skokie, IL 60076
R R	Solvent, Stoddard (Federal Specification P-D-680, Type I)	Commercially available
R R	Violet master marker (Grade 127-1/2)	Pannier Corp 207 Sandusky St, Pittsburgh PA 15212

CAUTION: WHEN REMOVING BOLTS SECURING SEAL ASSEMBLY, ENSURE THAT NUT PLATES ARE NOT DISLODGED AND DROPPED INTO ENGINE. IF NUT PLATE IS DROPPED INTO ENGINE, RETURN ENGINE TO OVERHAUL FACILITY IF NUT PLATE CANNOT BE RECOVERED.

NOTE: Combustion transition liner Seal Assembly Part No. 868260-1 cannot be replaced without removal of combustion transition liner assembly. Seal Assembly Part No. 868260-1 is secured with bolts and nuts, with nuts toward aft end of engine. Seal Assembly Part No. 868260-2 can be replaced without removal of combustion transition liner assembly. Seal Assembly Part No. 868260-2 is secured with bolts and nut plates. To replace Seal Assembly Part No. 868260-2, disassemble engine in accordance with paragraph 1.A., only to extent necessary to gain access to seal assembly. Remove and install seal assembly in accordance with steps 1.A.(35) and 1.B.(1).

1. A. Remove Combustion Transition Liner Assembly (See Figure 201)

(1) Remove compensator and disconnect ITT sensor assembly. Refer to 77-20-03, MAINTENANCE PRACTICES.

(2) Remove rear turbine bearing oil line. Refer to 79-20-08, MAINTENANCE PRACTICES.

(3) Remove air anti-ice valve and plumbing. Refer to 75-10-01, MAINTENANCE PRACTICES.

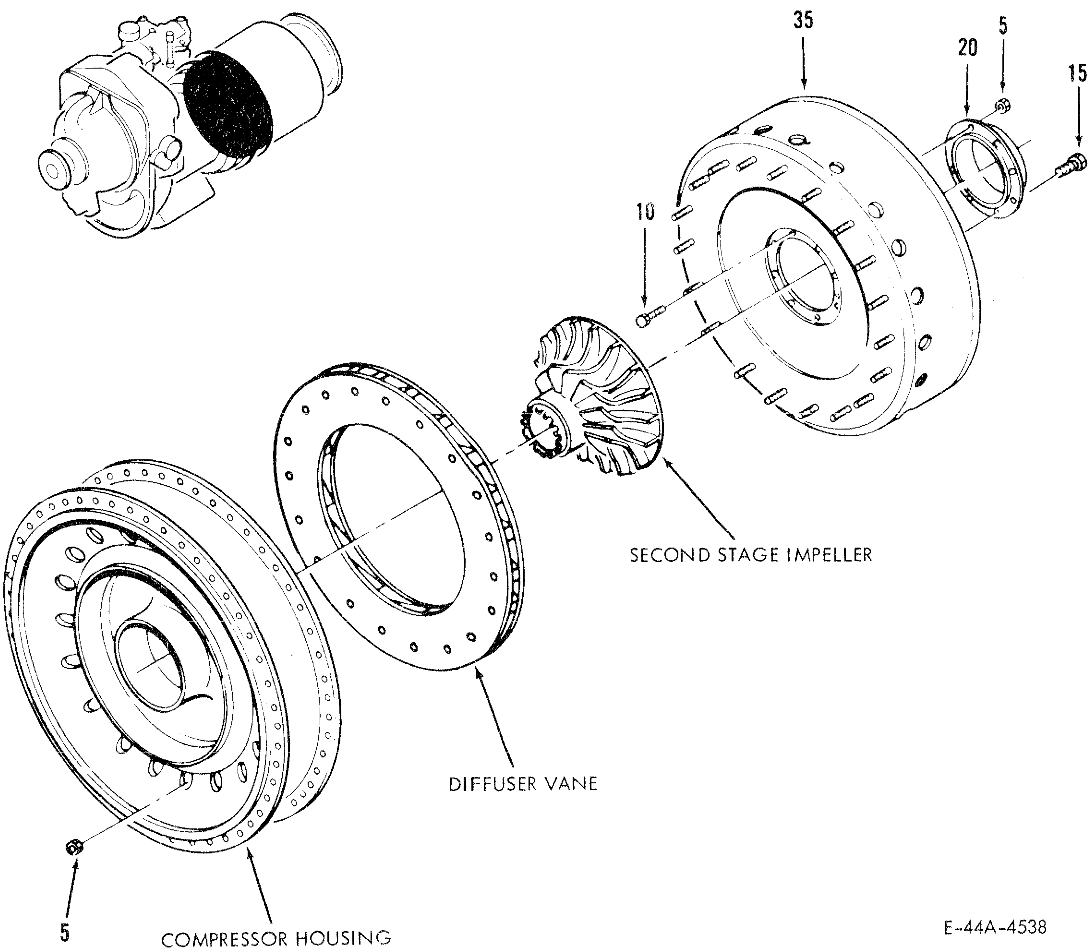
(4) Remove fuel flow divider and drain valve. Refer to 73-10-07, MAINTENANCE PRACTICES.

(5) Remove fuel manifold and nozzle assembly. Refer to 73-10-09, MAINTENANCE PRACTICES.

(6) Remove ignition leads and igniter plugs. Refer to 74-20-01, MAINTENANCE PRACTICES.

(7) (Codes BA-CC, EA, GA, KA) Remove fireshields. Refer to 71-30-01, MAINTENANCE PRACTICES.

R



R 5. NUT (IPC FIG. 172)
R 5. NUT (IPC FIG. 173)
R 10. BOLT

15. BOLT
20. SEAL ASSY
35. TRANSITION LINER ASSY

R Combustion Transition Liner Assembly Second Stage
R Impeller and Compressor Housing Installation
R Figure 201

CAUTION: ENSURE THAT COMPRESSOR BEARING IS INSTALLED TO RETAIN POSITION OF MAIN SHAFT.

NOTE: Engine must be removed from aircraft and placed in a suitable maintenance stand which will support the engine at the engine mounting pads with engine in a vertical position and propeller shaft end down.

1. A. (8) Place engine in maintenance stand with propeller shaft end down. Refer to 72-00-00, GENERAL - REMOVAL/INSTALLATION.

(9) Remove oil inlet retainer shield. Refer to 72-50-01, MAINTENANCE PRACTICES.

(10) Remove tail cone. Refer to 75-50-02, MAINTENANCE PRACTICES.

(11) Remove turbine oil inlet fitting and oil pressure jet. Refer to 72-50-03, MAINTENANCE PRACTICES.

(12) Remove turbine scavenge pump assembly. Refer to 72-50-04, MAINTENANCE PRACTICES.

(13) Remove exhaust pipe assembly. Refer to 72-50-05, MAINTENANCE PRACTICES.

(14) Remove turbine plenum and combustion chamber. Refer to 72-40-01, MAINTENANCE PRACTICES.

(15) Remove bearing support assembly components and bearing support assembly. Refer to 72-50-06, MAINTENANCE PRACTICES.

(16) Remove third stage stator and second and third stage turbine wheel assemblies. Refer to 72-50-07, MAINTENANCE PRACTICES.

(17) Remove first stage turbine wheel, first and second stage stator assemblies and interstage turbine temperature sensor assembly. Refer to 72-50-08, MAINTENANCE PRACTICES.

(18) Install 285258-1-1 dummy shaft over engine main shaft.

(19) Install 284689-1-1 gear train lock onto starter mount pad to lock engine gear train.

(20) Tighten all bolts between compressor housing forward flange and accessory drive housing to 60 inch-pounds torque.

1. A. (21) Fabricate suitable bridging tool (or use turbine plenum as alternate) to span compressor housing rear flange and to extend above center curvic coupling at a height to allow a depth measurement to be taken from bridging tool to high point of the center curvic coupling. (See figure 202.)

(22) Using depth micrometer, measure from upper surface of bridging tool to high point of center curvic coupling (high point of curvic coupling is tooth with "V" marking) and record as Dimension A. (See figure 202.)

(23) Using violet master marker (Grade 127-1/2), mark bolt holes on compressor housing flange where bridging tool is mounted so that bridging tool can be installed at same location during reassembly to ensure repeatability of Dimension A measurement.

CAUTION: DO NOT REMOVE CENTER CURVIC COUPLING UNTIL COUPLING IS INDEX MARKED.

(24) Remve 285158-1-1 dummy shaft from engine main shaft.

(25) Using violet master marker (Grade 127-1/2), index mark center curvic coupling to main shaft. This index mark is important to ensure that center curvic coupling is installed in same spline position during reassembly.

(26) Using violet master marker (Grade 127-1/2), index mark compressor housing flange, accessory drive housing rear flange and gasket for orientation at reassembly.

(27) Remove nuts, washers and bolts between compressor housing flange and accessory drive housing flange.

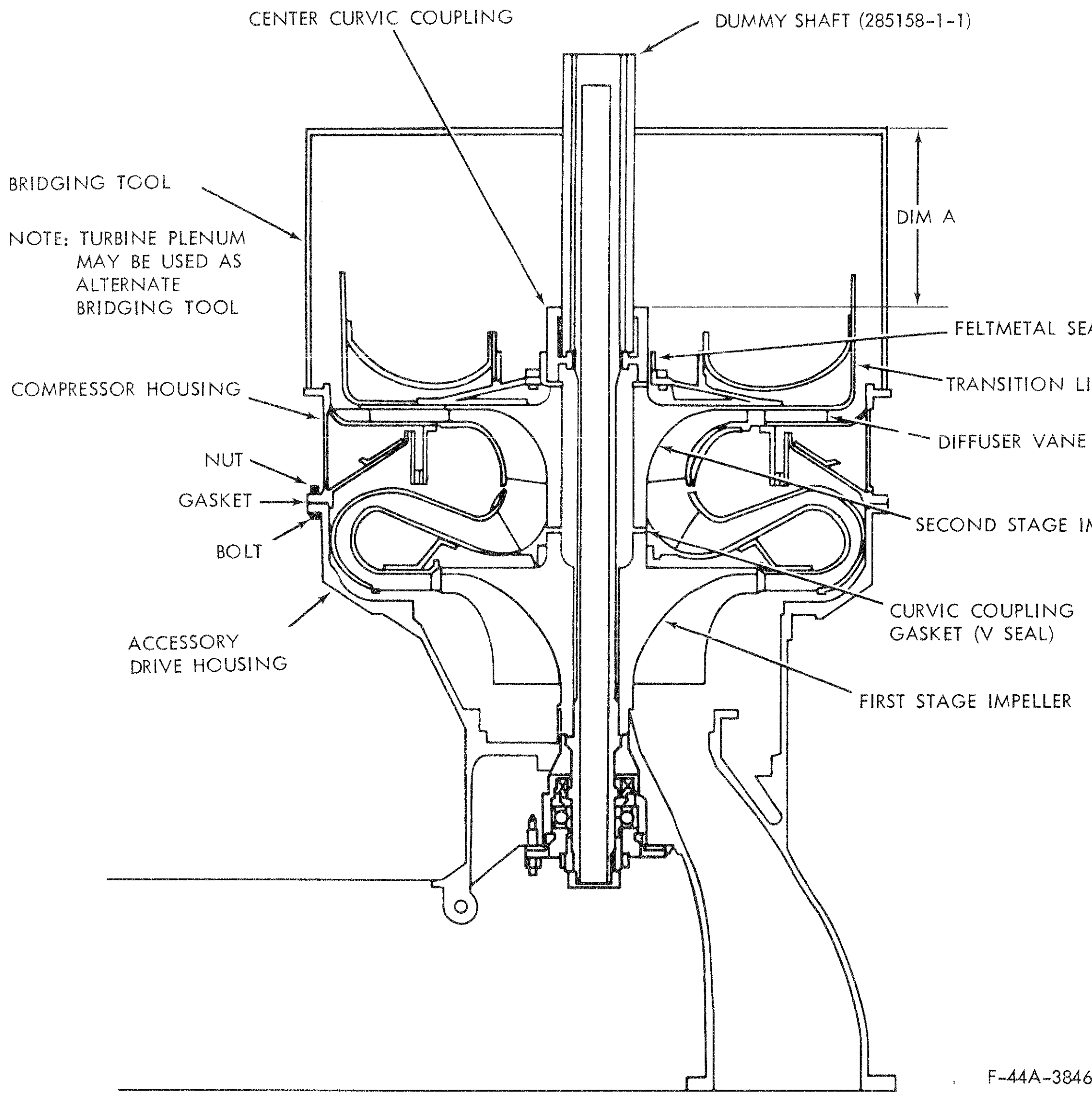
(28) Attach a lifting device to the compressor housing rear flange.

CAUTION: DO NOT DISENGAGE CENTER CURVIC COUPLING FROM SECOND STAGE IMPELLER UNTIL COUPLING AND IMPELLER HAVE BEEN INDEX MARKED.

(29) Carefully lift compressor housing with center curvic coupling and second stage impeller from engine.

(30) Cover exposed engine compressor section to prevent entry of foreign objects.

(31) With compressor housing still suspended from hoist and using violet master marker (Grade 127-1/2), carefully index mark on internal surfaces, orientation of curvic engagement between the aft curvic of second stage impeller and forward curvic of center curvic coupling.



R

R Measurement of Center Curvic Coupling Height
R Figure 202

1\. A. (32) Using violet master marker (Grade 127-1/2), select and index mark location of one of second stage impeller leading edge blade tips to compressor housing to facilitate orientation during reassembly.

(33) Remove center curvic coupling and place in protective covering to prevent damage to curvics.

(34) Support compressor housing on bench (forward end up) to gain access to nuts securing transition liner assembly. Remove nuts and lift compressor housing from transition liner assembly. Remove second stage impeller from compressor housing. Index mark diffuser vane to compressor housing.

(35) Remove screws and nuts or bolts and remove seal assembly from transition liner assembly.

(36) Refer to Inspection/Check and Approved Repairs for inspection and repair of components. If compressor housing is to have metal spray reapplied to shroud contour, index mark commpressor housing and accessory drive housing flanges with vibro-pencil for orientation at reassembly. The same compressor housing that was removed from engine shall be reinstalled in the engine.

B. Install Combustion Transition Liner Assembly (See Figures 201 and 202)

NOTE: Refer to 70-00-00, STANDARD PRACTICES, for recommended general torque values. Add frictional drag (run-down) torque of self-locking devices to recommended values.

(1) Install seal assembly into rear side of combustion transition liner and secure with screws and nuts or bolts. Tighten nuts (5, figure 201) to 20 inch-pounds torque or bolts (15) to 60 inch-pounds torque.

(2) Reinstall original second stage impeller and diffuser vane. Coat threaded studs of combustion transition liner assembly with high temperature compound (Fel-Pro C5-A). Install combustion transition liner assembly into compressor housing and secure with nuts. Tighten nuts (5) to 40 inch-pounds torque.

R CAUTION: SOLVENT IS TOXIC AND FLAMMABLE. USE IN WELL-
R VENTILATED AREA. AVOID BREATHING FUMES OR LONG
R CONTACT WITH SKIN TO PREVENT DAMAGE TO PHYSICAL
R HEALTH. KEEP AWAY FROM FLAME TO AVOID FIRE
R HAZARD.

R NOTE: Brush mating surfaces of curvics with a camel hair
R brush, then clean thoroughly with solvent, Stod-
R dard (Federal Specification P-D-680, Type I).

R 1. B. (3) Clean center curvic coupling forward curvic teeth and second stage
R impeller aft curvic teeth.

R (4) Support compressor housing and assembled components by a lifting
R device as in step 1.A.(28).

R (5) Install center curvic coupling using orientation index marks.

R (6) Align index mark on second stage impeller blade with index mark on
R compressor housing.

R CAUTION: SOLVENT IS TOXIC AND FLAMMABLE. USE IN WELL-
R VENTILATED AREA. AVOID BREATHING FUMES OR LONG
R CONTACT WITH SKIN TO PREVENT DAMAGE TO PHYSICAL
R HEALTH. KEEP AWAY FROM FLAME TO AVOID FIRE
R HAZARD.

R NOTE: Brush mating surfaces of curvics with a camel hair
R brush, then clean thoroughly with solvent, Stod-
R dard (Federal Specification P-D-680, Type I).

R (7) Clean forward curvic coupling teeth of second stage impeller to
R remove dust particles.

R (8) Remove protective covering from engine compressor section and clean
R aft curvic coupling teeth of first stage impeller to remove dust
R particles.

R (9) Ensure the curvic coupling gasket (V seal) is properly seated in
R the aft curvic coupling of first stage impeller.

R (10) Ensure that the compressor housing to accessory drive housing
R gasket is in place. If the gasket is replaced, the average thic-
R kness of the new gasket shall be within +0.001/-0.001 inch of the
R average thickness of the removed gasket.

R CAUTION: DO NOT DISENGAGE CURVIC COUPLING TEETH BETWEEN CENTER CURVIC COUPLING AND SECOND STAGE IMPELLER.

R 1. B. (11) Carefully lift and lower compressor housing, with assembled parts, over main shaft. Align center curvic coupling splines in accordance with index marks. Slowly lower assembly to engage first and second stage impeller curvics. At this point, compressor housing, accessory drive housing and gasket index marks should align.

R (12) Install 285158-1-1 dummy shaft over main shaft.

R (13) Install bolts, washers and nuts to secure compressor housing to accessory drive housing. Tighten bolts to 60 inch-pounds torque.

R (14) Install same bridging tool (see figure 202) at same location as marked in step 1.A.(23), then using depth micrometer, measure from upper surface of bridging tool to high point of center curvice coupling. Record dimension. Dimension shall be within +0.004/-0.000 inch of Dimension A recorded in step 1.A.(22). If dimension is not within tolerance, reassemble components and remeasure.

R (15) Remove bridging tool, 285158-1-1 dummy shaft and 284689-1-1 gear train lock.

R (16) Install first stage turbine wheel and first and second stage stator assemblies. Refer to 72-50-08, MAINTENANCE PRACTICES.

R 2. Inspection/Check

R A. Inspect Seal Assembly (20, Figure 201)

R (1) Visually inspect seal assembly for cracks, distortion and other obvious damage.

R (2) Visually inspect seal assembly for missing feltmetal material.

R (3) Replace part that does not meet Inspection/Check requirements.

R B. Inspect Combustion Transition Liner Assembly (See Figure 203)

R (1) Visually inspect liner assembly for cracks in material, distortion, loose studs, and other damage.

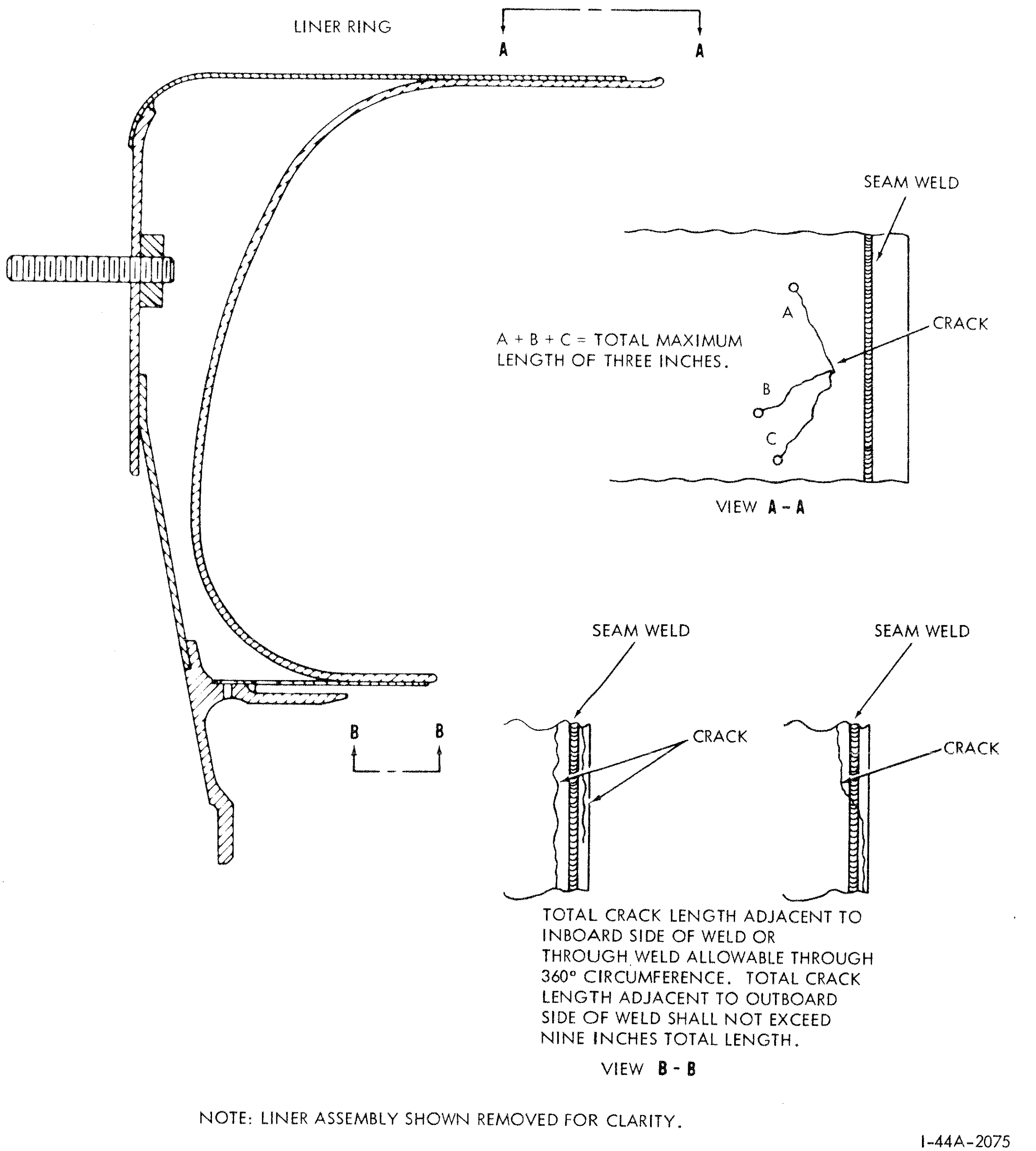
R (2) One "three legged" crack is allowed as shown in View A-A of Figure 203. Cracks shall not exceed a total maximum of three inches.

R (3) Cracks shall not exceed limits shown in View B-B of Figure 203.

R (4) Refer to Approved Repairs for repair procedures for liner assembly.

(5) Replace part that does not meet Inspection/Check requirements or is damaged beyond repair.

R



Inspection of Combustion Transition Liner Assembly
Figure 203

2. C. Inspect Compressor Housing

(1) Visually inspect aluminum shroud contour for rubs or wear. Light rubs are acceptable. Sections of abradable aluminum shroud missing with a cumulative area in excess of 0.5 square inch is not acceptable.

(2) Return housing to an approved overhaul facility for metal spray and contour finish. The same compressor housing that was removed from engine shall be reinstalled in engine.

R D. Inspect Second Stage Impeller

R (1) Visually inspect impeller blade tip radial edges for rubs or
R cracks. No cracks allowed. Refer to Approved Repairs for repair
R of blade rubs.

R (2) Visually inspect impeller blade leading edges for dents, nicks or
R other damage. Minor nicks are acceptable.

R (3) Visually inspect curvic coupling teeth for radial rub damage.
R Light rubs are acceptable. Heavy rubs, sufficient to smear metal
R and cause material temperature discoloration are not acceptable.
R If minor raised edges are evident, refer to Approved Repairs.

R 3. Cleaning/Painting

R A. Clean Component Parts

R (1) Clean all standard metallic hardware in accordance with 72-00-00,
R GENERAL - CLEANING/PAINTING, Cleaning Method No. 1 or 2.

R (2) Clean combustion transition liner in accordance with 72-00-00, GEN-
R ERAL - CLEANING/PAINTING, Cleaning Method No. 2 and 9.

R 4. Approved Repairs

R NOTE: Table 201 provides a list of materials and compounds
R required for Approved Repairs.

R Table 201. Materials and Compounds

R Material or Compound	Manufacturer
R NOTE: Equivalent substitutes may be used for listed items.	
R Abrasive (ST 70-ALO-512, R ST 70-ALO-801)	Brightboy, Weldon Roberts, Newark, NJ

R 4. A. Repair Second Stage Impeller

R R (1) Remove aluminum build up on impeller blade radial edges by hand finishing.

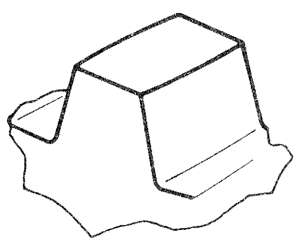
R R (2) Repair raised edges of curvic by polishing with abrasive (ST 70-ALO-512, ST 70-ALO-801) in accordance with Figure 204.

R B. Repair Cracks Found in Combustion Transition Liner (See Figure 203)

R R R (1) Using a 1/16 to 3/32 inch drill, stop drill cracks found in liner ring (section A-A of figure 203) of combustion transition liner assembly.

R R (2) Replace liner assembly if cracks exceed limits shown in View B-B of Figure 203.

R



REWORK ALLOWED ON EDGES AS DEPICTED BY DARK LINES ON SKETCH ABOVE.

RAISED METAL ON TOOTH EDGE SHALL NOT EXCEED 0.010 INCH PRIOR TO REWORK.

I-44A-1323

R Repair of Curvic Coupling Teeth
Figure 204

CHAPTER 72 - COMBUSTION SECTION

TABLE OF CONTENTS

COMBUSTION SECTION - DESCRIPTION AND OPERATION

The combustion section is located in the rear one-third of the engine and encompasses the turbine section. It provides an area where fuel and air are mixed and ignited. Principal components of the combustion section are the combustion chamber and turbine plenum assembly.

The annular combustion chamber assembly mates on one end with a slip joint on the transition liner assembly to form a combustion chamber. The other end is supported at the rear by three welded tabs and three special stud bolts in the turbine plenum assembly. The combustion chamber assembly contains ports for five primary fuel nozzles and ten secondary fuel nozzles, and ports for three igniter plugs (only two are used on any installation). Slots and holes are appropriately located on the inner and outer walls of the chamber assembly to control combustion during starting and operation.

The turbine plenum assembly, attached to the compressor housing assembly, encloses the entire combustion area, and provides a plenum for compressed air and consequently provides a relatively cool skin enclosure. The rear end of the plenum assembly provides a register for the turbine bearing support and for mounting the primary and secondary fuel nozzle and manifold assemblies. A flange on the rear face of the turbine plenum assembly provides mounting for the exhaust pipe assembly. An oil tube assembly passes through the exhaust pipe assembly and mates with an oil jet assembly supported on the oil scavenge pump assembly to provide lubricating oil to the turbine roller bearing.

TURBINE PLENUM ASSEMBLY AND COMBUSTION CHAMBER ASSEMBLY - MAINTENANCE PRACTICES

1. Removal/Installation

NOTE: Table 201 provides a list of materials and compounds required for Removal/Installation.

Table 201. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
High temperature compound (Fel-Pro C5-A)	Fel-Pro Inc, Div of Felt Products Mfg Co. 7450 N McCormick Blvd, Skokie IL 60076

A. Remove Plenum Assembly and Combustion Chamber Assembly (See Figure 201)

(1) Remove compensator and disconnect ITT sensor assembly or thermocouple harness from turbine plenum. Refer to 77-20-03, MAINTENANCE PRACTICES.

(2) Remove rear turbine bearing oil line. Refer to 79-20-08, MAINTENANCE PRACTICES.

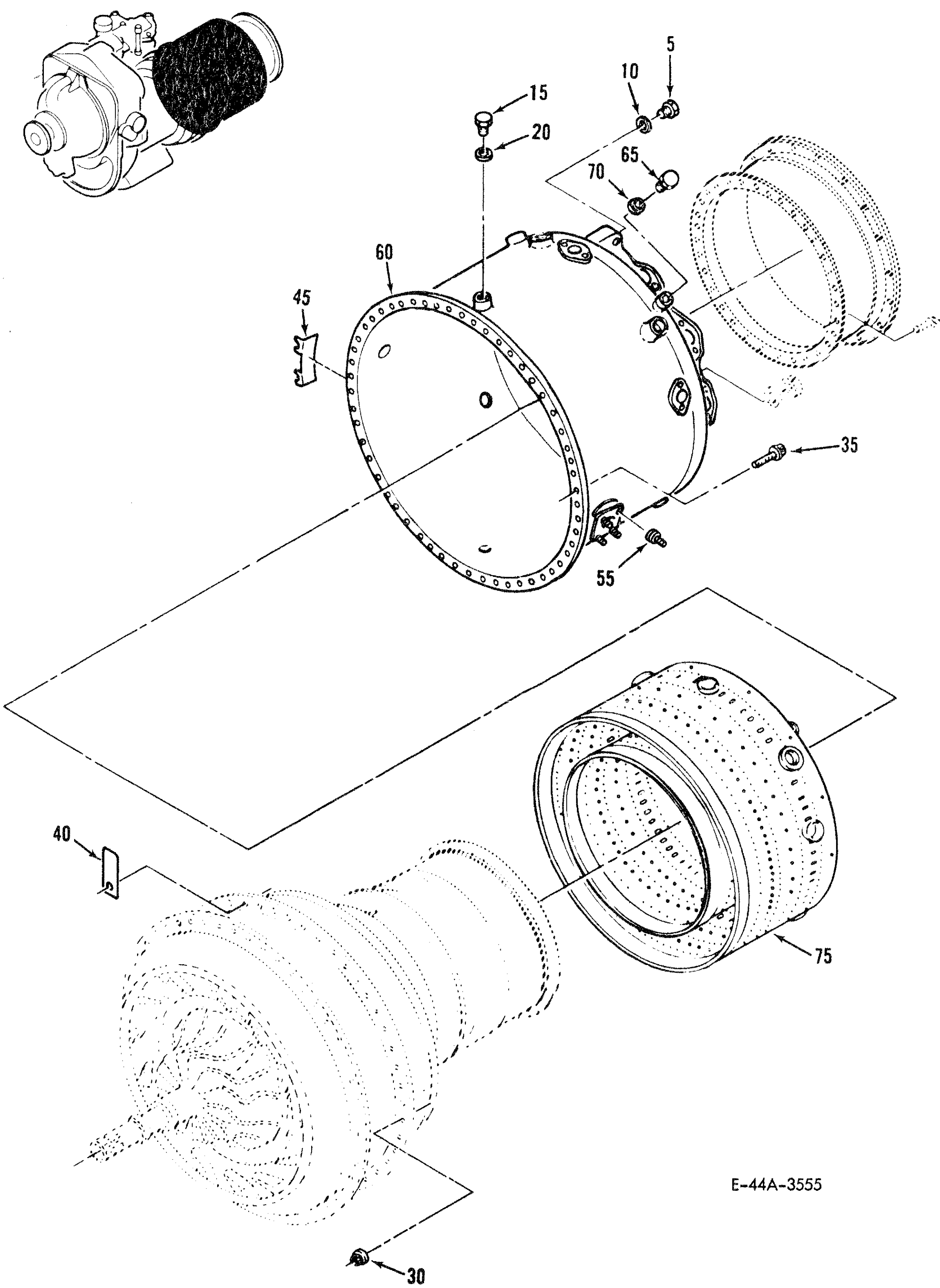
(3) Remove air anti-ice valve plumbing. Refer to 75-10-01, MAINTENANCE PRACTICES.

(4) Remove fuel flow divider and drain valve. Refer to 73-10-07, MAINTENANCE PRACTICES.

(5) Remove fuel manifold and nozzle assembly. Refer to 73-10-09, MAINTENANCE PRACTICES.

(6) Remove ignition leads and igniter plugs. Refer to 74-20-01, MAINTENANCE PRACTICES.

(7) (Codes BA-CC, EA, GA, KA) Remove fireshields. Refer to 71-30-01, MAINTENANCE PRACTICES.



R

Turbine Plenum and Combustion Chamber Installation
Figure 201

R 1. A. (8) Remove oil inlet retainer shield. Refer to 72-50-01, MAINTENANCE
R PRACTICES.

R (9) Remove tail cone. Refer to 72-50-02, MAINTENANCE PRACTICES.

R (10) Remove oil inlet fitting and oil pressure jet. Refer to 72-50-03
R MAINTENANCE PRACTICES.

R (11) Remove exhaust pipe assembly. Refer to 72-50-05, MAINTENANCE
R PRACTICES.

(12) (Pre SB72-0042) Remove nut securing thermocouple harness assembly to rear of turbine plenum assembly.

(13) (Post SB72-0042) Loosen jam nut on rear of plenum assembly where ITT sensor assembly passes through the plenum assembly.

(14) Remove plenum drain valves. Refer to 72-00-05, MAINTENANCE PRACTICES.

(15) Remove plenum plugs.

(16) Remove shouldered bolts and washers securing combustion chamber to plenum.

(17) Remove nuts and bolts securing plenum assembly, then remove plenum and combustion chamber.

B. Install Plenum Assembly and Combustion Chamber Assembly (See Figures 201, 202, 203, 204)

CAUTION: IF PLENUM ASSEMBLY (75, FIGURE 201) THAT WAS REMOVED IS NOT REINSTALLED, TURBINE BUILD DIMENSIONS WILL CHANGE. COMPLY WITH STEP (1) BELOW TO DETERMINE IF REPLACEMENT PLENUM ASSEMBLY CAN BE INSTALLED WITHOUT FURTHER DISASSEMBLY AND SHIMMING OF STATOR COMPONENTS.

(1) Determine if replacement plenum assembly can be installed without further disassembly and shimming of stator components as follows. (See figure 202.)

KEY TO FIGURE 201

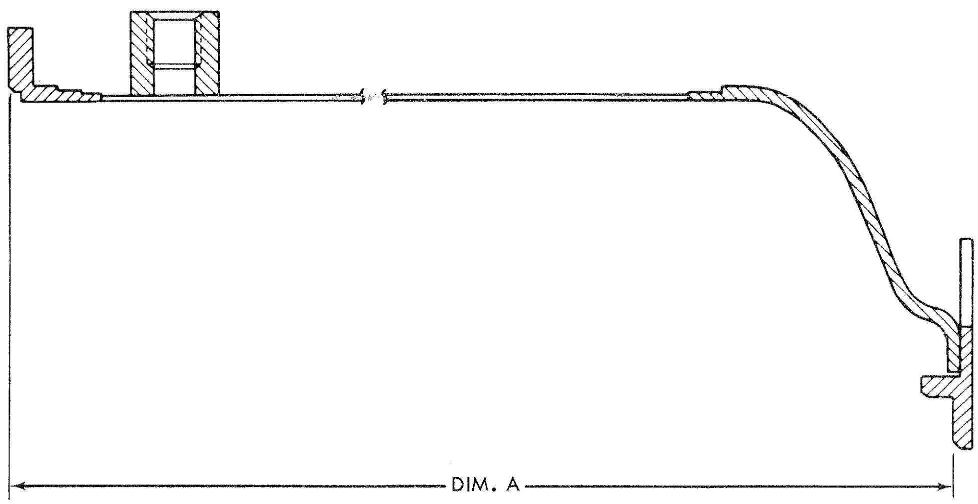
5. PLUG (IPC FIG. 174)
10. GASKET
15. PLUG
20. GASKET
30. NUT
35. BOLT
40. PLATE
45. PLATE
55. STUD
60. PLENUM
65. BOLT (SHOULDERED)
70. WASHER
75. COMBUSTION CHAMBER

1. B. (1) (a) Measure distance between plenum flanges (dimension A, figure 202) at three places approximately 120 degrees apart on OLD and NEW plenum assemblies. Average the three measurements for each plenum assembly.

(b) If difference in average measurements between OLD and NEW plenum assembly does not exceed +0.002/-0.002 inch, proceed with installation.

(c) If difference in average measurements between OLD and NEW plenum assembly does exceed +0.002/-0.002 inch refer to 72-50-06, MAINTENANCE PRACTICES, for instructions to obtain proper turbine build dimensions.

R



Measuring Replacement Turbine Plenum Assembly
Figure 202

NOTE: Apply high temperature compound (Fel-Pro C5-A) to threads of all bolts unless otherwise specified.

(Pre SB72-0042) Do not apply high temperature compound to threads of thermocouple harness or nut.

CAUTION: (POST SB72-0042) HOLD SENSOR ASSEMBLY WIRE AGAINST TURBINE BEARING SUPPORT ASSEMBLY WHILE BENDING. DO NOT APPLY FORCE TO CONNECTOR.

1. B. (2) Install combustion chamber assembly being careful not to cut or scratch ITT sensor assembly or ITT harness assembly.

R CAUTION: ALL BENDS IN ITT SENSOR ASSEMBLY SHALL BE
R FORMED TO A MINIMUM RADIUS OF 0.50 INCH. ALLOW
R A STRAIGHT SECTION OF ITT SENSOR ASSEMBLY FOR A
R MINIMUM OF 0.125 INCH WHERE THE HARNESS EXITS
R THE PLENUM CONNECTOR BEFORE BEGINNING THE FIRST
R BEND.

(3) (Post SB72-0042) After combustion chamber assembly is in place, use 291791-1-1 forming tool to bend ITT sensor assembly approximately as shown in Figure 203. Observe minimum bend radius. Make sure that ITT sensor assembly does not touch combustion chamber assembly.

(4) (Pre SB72-0042) Assure sufficient clearance exists between bus bar terminal screw heads and combustion chamber assembly inside diameter wall.

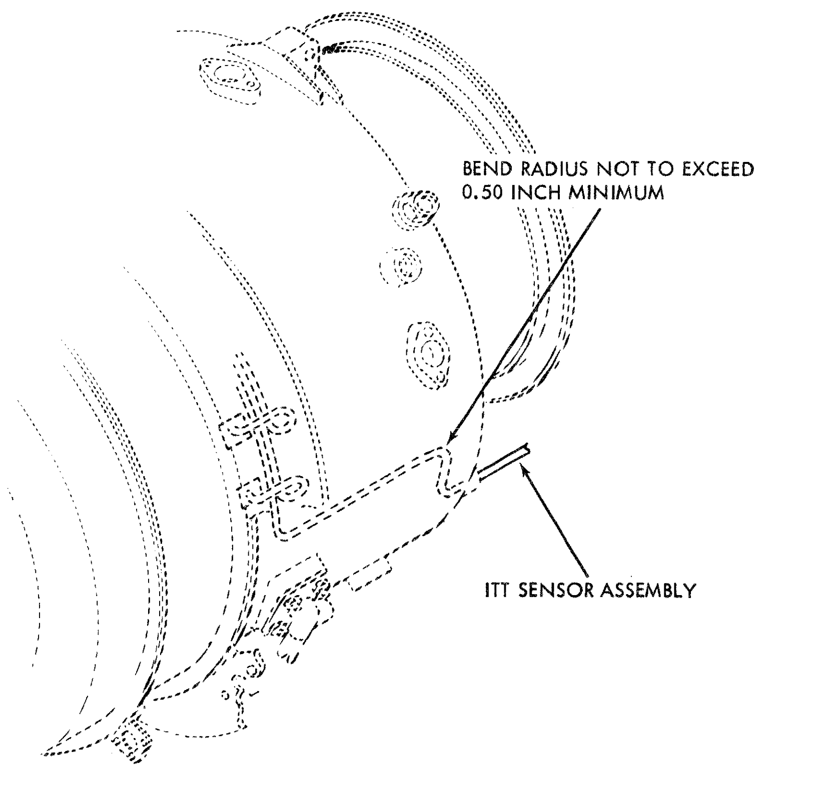
(5) Prior to further assembly, blend sharp edges of ITT sensor assembly boss on turbine plenum assembly if not previously accomplished, in accordance with Figure 204. This blending will avoid possible damage to ITT sensor assembly from sharp corners.

(6) Install plenum assembly as follows.

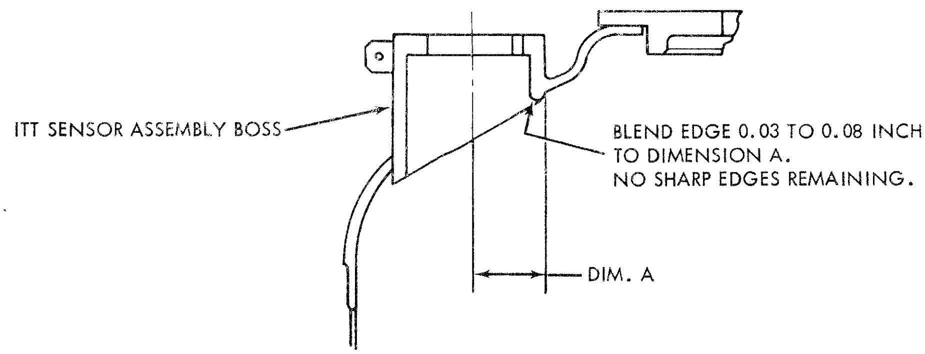
(a) (Pre SB72-0042) Ensure connector end of harness assembly protrudes through port in plenum assembly at the eight o'clock position.

(b) (Post SB72-0042) Make sure that ITT threaded connector anti-rotation tab engages slot in plenum assembly where ITT sensor assembly passes through the plenum assembly.

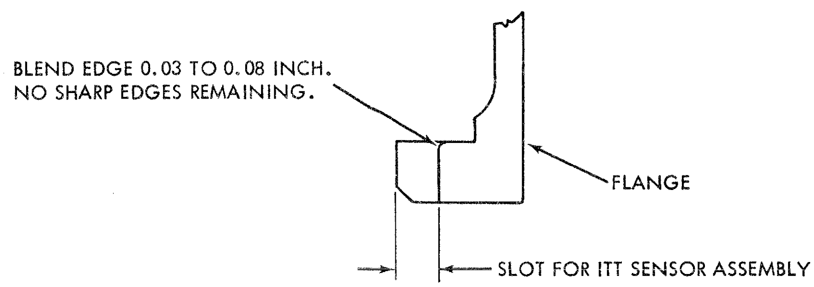
(c) Position combustion chamber assembly in plenum assembly. Align igniter plug holes in combustion chamber assembly with holes in plenum assembly, then secure with washers and bolts. Tighten bolts (65, figure 201) to 70 inch-pounds torque.



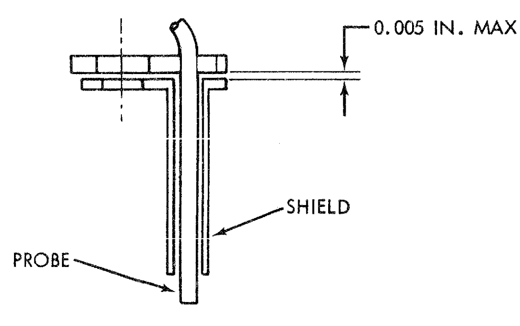
R (Post SB72-0042) ITT Sensor Assembly Bend Radius (Typical)
Figure 203



TURBINE PLENUM ASSEMBLY BLEND AREA



TURBINE BEARING SUPPORT ASSEMBLY BLEND AREA.



GAP BETWEEN SHIELD AND ITT PROBE.

SB-1506

R (Post SB72-0042) Installation Details for ITT Sensor Assembly
Figure 204

1. B. (6) (d) Install plugs into plenum assembly. Tighten plugs (5, 15, figure 201) to 65 to 70 inch-pounds torque.

(e) Position assembled combustion chamber assembly and plenum assembly on engine so that drain holes are to six o'clock engine position.

(f) Install bolts with head on aft side of compressor housing, install plates and secure plenum to compressor housing with nuts. Tighten nuts (30, figure 201) to 50 inch-pounds torque.

(7) (Post SB72-0042) Tighten washer and jam nut securing ITT sensor assembly to plenum at ITT sensor assembly boss. Tighten nut to 400 to 500 inch-pounds torque.

(8) (Post SB72-0042) Measure ITT sensor assembly circuit resistance
R from pin A to pin B. The resistance shall be 3.0 to 7.0 ohms.
Measure resistance from either pin to ground. Resistance shall be greater than 50 megohms. If resistance is not within these limits, reject ITT sensor assembly.

(9) (Pre SB72-0042) Tighten nut securing thermocouple harness assembly using caution to ensure alignment of key on harness. Tighten nut to 400 to 500 inch-pounds torque.

(10) (Pre SB72-0042) Measure thermocouple harness assembly circuit resistance as follows.

(a) Measure resistance from pin A to pin B on the harness assembly
R plenum connector. Resistance shall be 0.0 to 2.0 ohms.

(b) Measure resistance from either pin on the harness assembly to ground. Resistance shall be greater than 75,000 ohms.

(c) If resistance is not within limits disconnect lead wire terminals of harness assembly from bus bar assemblies and measure resistance from either bus bar to ground (any location). If resistance is now 75,000 ohms or greater, replace defective harness assembly. Reinstall assembled plenum and combustion chamber and repeat resistance check.

R (d) Install external harness assembly. Refer to 77-20-03, MAIN-
R TENANCE PRACTICES.

(11) Install exhaust pipe assembly. Refer to 72-50-04, MAINTENANCE PRACTICES.

2. Inspection/Check

A. Inspect Plenum Assembly (See Figure 201)

(1) Visually inspect plenum assembly for obvious damage. Cracks are not acceptable.

(2) Replace plenum assembly in Inspection/Check requirements are not met.

B. Inspect Combustion Chamber Assembly (See Figure 205)

(1) Inspect combustion chamber assembly for cracks, buckles, erosion, and deformation in accordance with Figure 205.

(2) Carefully inspect welded seams and spot welds for cracking.

(3) Refer to Approved Repairs for repair procedures for combustion chamber assembly.

(4) If limits are exceeded and cannot be repaired in accordance with Approved Repairs replace combustion chamber.

C. Inspect Shouldered Bolts (65, Figure 201)

(1) Inspect shank portion of shouldered bolts used to locate combustion chamber in turbine plenum for wear grooves. Wear grooves in bolt shank shall not exceed 0.040 inch in depth.

(2) Replace bolts that do not meet Inspection/Check requirements.

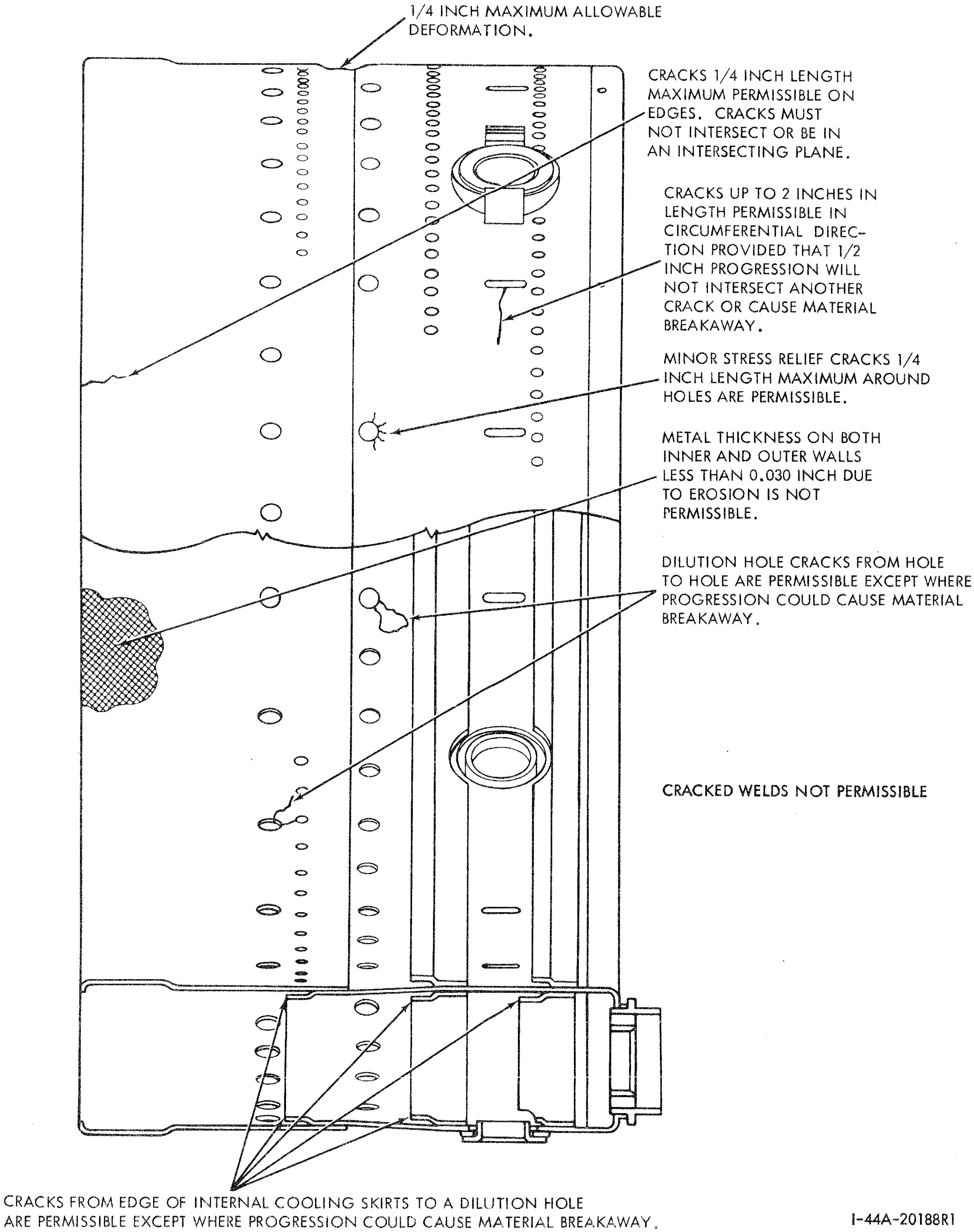
3. Cleaning/Painting

A. Clean Component Parts

(1) Clean all standard metallic hardware in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 1 or 2.

(2) Clean plenum in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 1 or 9.

(3) Clean combustion chamber assembly in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 1 or 9.



Inspection of Combustion Chamber Assembly
Figure 205

4. Approved Repairs

NOTE: Table 203 provides a list of materials and compounds required for Approved Repairs.

Table 203. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Filler rod (H525) (AMS5796)	Commercially available

A. Repair Cracks Found in Combustion Chamber Assembly

(1) Use a 1/16 to 3/32 inch diameter drill to stop drill cracks that do not exceed limits specified in Figure 205.

(2) Weld cracks that exceed limits specified in Figure 205, using filler rod (H525) in accordance with standard shop practices. Grind welded areas flush against base metal surface to eliminate airstream obstruction.

CHAPTER 72 - TURBINE SECTION

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R

CHAPTER 72 - TURBINE SECTION

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TURBINE SECTION - DESCRIPTION AND OPERATION

1. General

The turbine section contains three axial flow turbine wheels and three stator assemblies. Gases from the combustion section flow through the stator and wheels and exhaust to atmosphere through the space between the exhaust pipe assembly and the tail cone. The turbine section provides power to drive the compressor and through the reduction gear and shaft section to drive the propeller.

2. Oil Inlet Retainer Shield Assembly

The oil inlet retainer shield assembly is a metal sleeve that provides a heat shield for the oil inlet fitting assembly and oil pressure jet.

3. Tail Cone

The tail cone attaches to the rear end of the turbine bearing support assem bly and provides a protective cover for the turbine bearing scavenge pump and associated components.

4. Oil Inlet Fitting Assembly and Oil Pressure Jet

The oil inlet fitting assembly and oil pressure jet connects to the rear turbine bearing oil line and directs oil to the rear turbine bearing.

5. Oil Scavenge Pump Assembly

The oil scavenge pump is a three-gallon-per-minute geroter-type pump located inside the tail cone that forces oil from the rear turbine sump to the input housing assembly by pumping oil through the torsion shaft. The pump is driven by the spur gearshaft which is in turn driven by the torsion shaft.

6. Roller Bearing, Bearing Support Assembly, and Seal

The turbine bearing support assembly supports the roller bearing in a mount, and also supports the seal and rotor at the rear of the main shaft. The seal prevents entry of lubricating oil into the turbine gas area.

7. (Pre SB72-0042) Interstage Turbine Temperature Indicating System (ITT) (Multi-Piece)

The interstage turbine temperature (ITT) system thermocouples are located at the second stage stator inlet position. The thermocouples are ungrounded, enclosed, junction type and are connected in parallel by 1/8 inch Chromel and Alumel bus bars. Construction of the system is such that each temperature probe may be individually replaced. Internal leadwires attach to the bus bars and route the temperature signal to the plenum connector located at the rear of the engine. An external harness assembly connects to the plenum connector and routes the signal to the compensating resistor control. The ITT compensating resistor control is mounted on the left side of the engine and is connected to the external thermocouple harness assembly.

8. (Post SB72-0042) Interstage Turbine Temperature Indicating System (ITT) (Single Piece)

The interstage turbine temperature sensor assembly (ITT) is a one-piece assembly consisting of twelve sensing probes located at the second stage stator inlet position and a lead which connects to the compensating resistor control. The sensing probes are ungrounded and enclosed in shields which are attached to the second stage stator assembly. The ITT compensating resistor control is mounted on the left side of the engine.

OIL INLET RETAINER SHIELD ASSEMBLY - MAINTENANCE PRACTICES

1. Removal/Installation

   NOTE: Table 201 provides a list of materials and compounds required for Removal/Installation.

Table 201. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
High temperature compound (Fel-Pro C5-A)	Fel-Pro Inc, Div of Felt Products Mfg Co, 7450 N McCormick Blvd, Skokie, IL 60076

A. Remove Oil Inlet Retainer Shield Assembly (See Figure 201)

(1) Remove rear turbine bearing oil tube assembly. Refer to 79-20-08, MAINTENANCE PRACTICES.

(2) Remove oil inlet retainer shield assembly.

(3) Refer to 72-50-02, MAINTENANCE PRACTICES, for further disassembly of engine.

B. Install Oil Inlet Retainer Shield Assembly (See Figure 201)

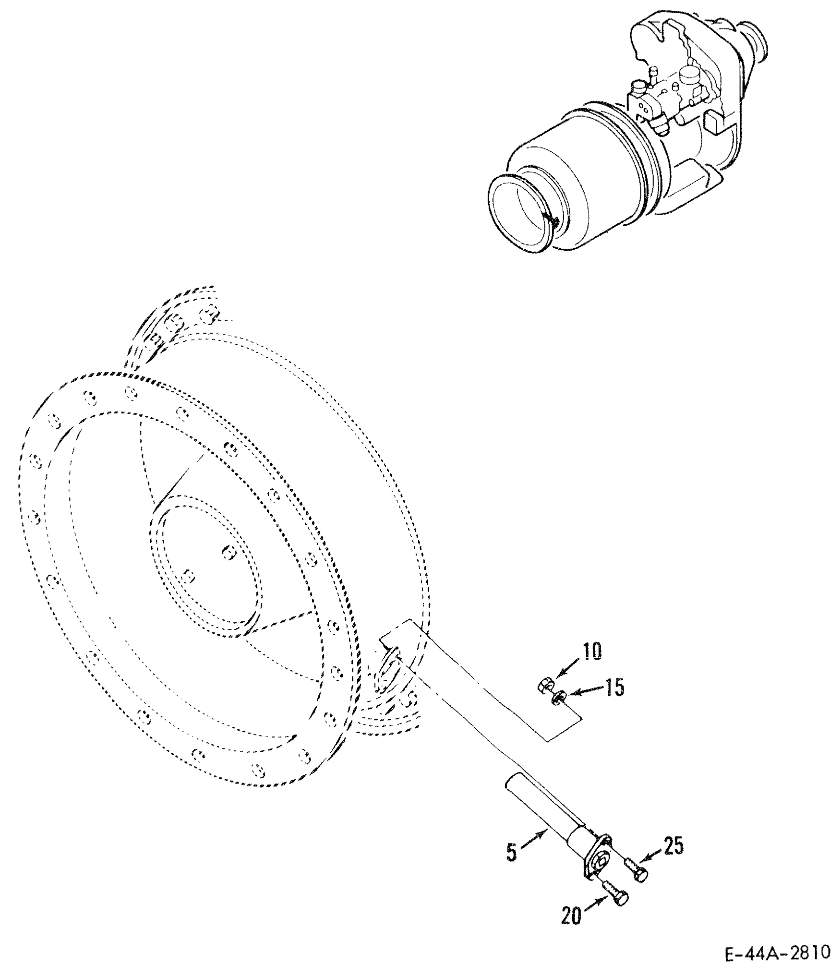
R NOTE: Refer to 70-00-00, STANDARD PRACTICES, for recommended
R general torque values. Add frictional drag (run-down)
R torque of self-locking devices to recommended values.

Apply high temperature compound (Fel-Pro C5-A) to threads of bolts prior to installation.

(1) Install shield assembly into exhaust pipe assembly.

NOTE: If force is required to install shield, improper size spacer may have been used to seat oil inlet fitting assembly. Refer to 72-50-03, MAINTENANCE PRACTICES, for instructions for selecting and installing proper size spacer.

(2) Tighten bolts (20, 25, figure 201) to 25 inch-pounds torque.



R 5. SHIELD ASSY (IPC FIG. 176)
10. NUT
15. WASHER
20. BOLT
25. BOLT

Oil Inlet Retainer Shield Assembly Installation
Figure 201

1. B. (3) Install rear turbine bearing oil tube assembly. Refer to 79-20-08, MAINTENANCE PRACTICES.

2. Inspection/Check

A. Inspect Oil Inlet Retainer Shield Assembly (See Figure 201)

(1) Inspect oil inlet retainer shield assembly for cracks, broken welds, and distortion. Replace shield assembly if cracked or distorted.

(2) Repair minor broken welds in accordance with Approved Repairs.

3. Cleaning/Painting

A. Clean Component Parts

(1) Clean all standard metallic hardware in accordance with 72-00-00, GENERAL - CLEANING/PAINTING.

(2) Clean shield assembly in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 2.

4. Approved Repairs

NOTE: Table 202 provides a list of materials and compounds required for Approved Repairs.

Table 202. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Filler rod (347, MIL-R-5031, Class 5A)	Commercially available

A. Repair Oil Inlet Retainer Shield Assembly (See Figure 201)

(1) Repair minor broken welds by rewelding in accordance with standard shop practices using filler rod (347, MIL-R-5031, Class 5A).

TAIL CONE - MAINTENANCE PRACTICES

1. Removal/Installation

NOTE: Table 201 provides a list of materials and compounds required for Removal/Installation.

Table 201. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
High temperature compound (Fel-Pro C5-A)	Fel-Pro Inc. Div of Felt Products Mfg Co, 7450 N McCormick Blvd, Skokie, IL 60076

A. Remove Tail Cone (See Figure 201)

R (1) Remove rear turbine bearing oil line. Refer to 79-20-08, MAINTEN-
R ANCE PRACTICES.

R (2) Remove oil inlet retainer shield assembly. Refer to 72-50-01,
R MAINTENANCE PRACTICES.

(3) Remove bolts and washers. Remove tail cone and spacers.

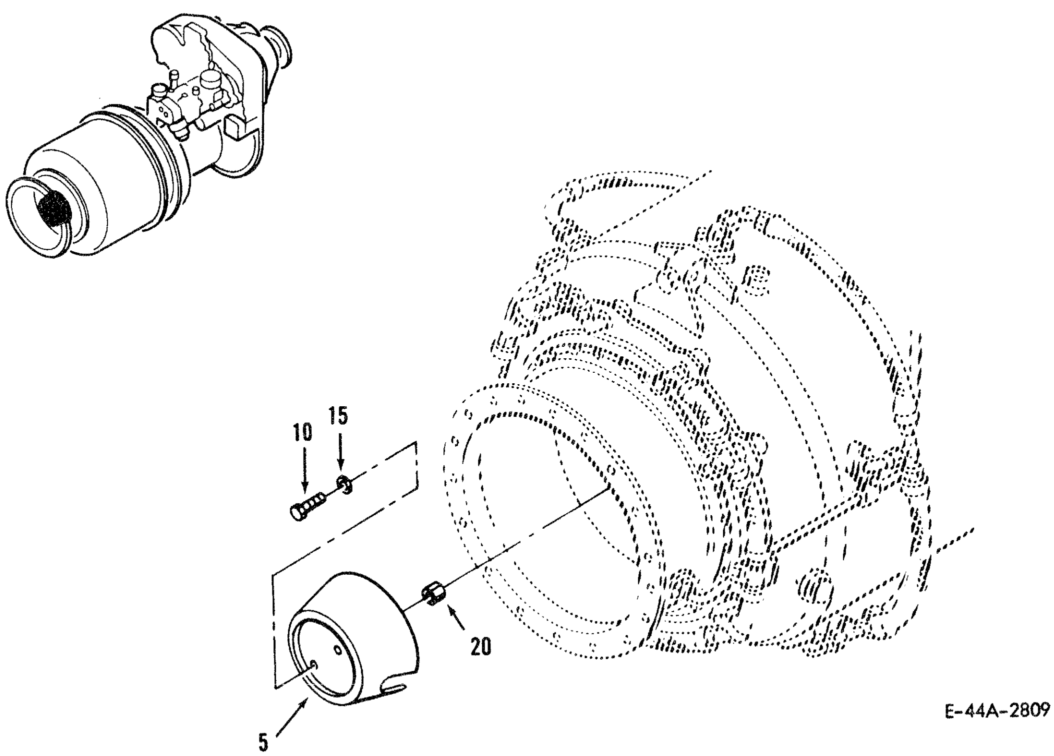
(4) Refer to 72-50-03, MAINTENANCE PRACTICES, for further disassembly of engine.

B. Install Tail Cone (See Figure 201)

NOTE: Apply high temperature compound (Fel-Pro C5-A) to threads of bolts prior to installation.

(1) Install spacers and tail cone. Secure with washers and bolts. Tighten bolts (10, figure 201) to 25 inch-pounds torque.

(2) Install oil inlet retainer shield. Refer to 72-50-01, MAINTENANCE PRACTICES.



R 5. TAIL CONE (IPC FIG. 177)
10. BOLT
15. WASHER
20. SPACER

Tail Cone Installation
Figure 201

2. Inspection/Check

A. Inspect Tail Cone (See Figure 201)

(1) Inspect tail cone for cracks and distortion. Replace if cracked or distorted.

(2) Repair minor broken welds in accordance with Approved Repairs.

3. Cleaning/Painting

A. Clean Component Parts

(1) Clean all standard metallic hardware in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 1 or 2.

(2) Clean tail cone in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 2.

4. Approved Repairs

NOTE: Table 202 provides a list of materials and compounds required for Approved Repairs.

Table 202. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Filler rod (347, MIL-R-5031, Class 5A)	Commercially available

A. Repair Tail Cone (See Figure 201)

(1) Repair minor broken welds by rewelding in accordance with standard shop practices using filler rod (347, MIL-R-5031, Class 5A).

OIL INLET TUBE AND OIL JET - MAINTENANCE PRACTICES

1. Removal/Installation

NOTE: Table 201 provides a list of materials and compounds required for Removal/Installation.

Table 201. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
High temperture compound (Fel-Pro C5-A) 60076	Fel-Pro Inc, Div of Felt Products Mfg Co, 7450 N McCormick Blvd, Skokie, IL
Lubricating compound (Liqui-Moly, Grade NV)	Lockrey Co, Lubricants Div, Cedar Shores, Southampton, NY 11968

A. Remove Oil Inlet Tube and Oil Jet (See Figure 201)

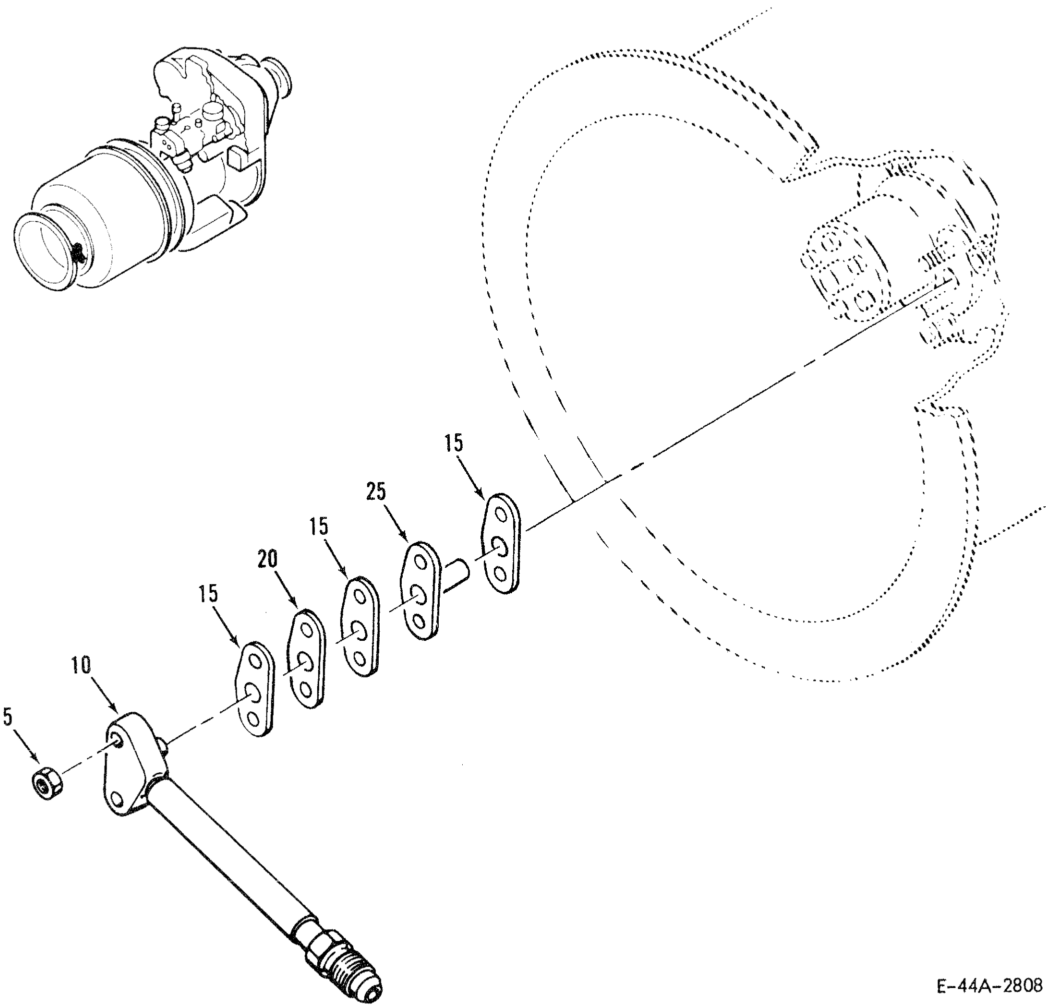
(1) Remove rear turbine bearing oil line. Refer to 79-20-08, MAINTENANCE PTACTICES.

(2) Remove oil inlet retainer shield assembly. Refer to 72-50-01, MAINTENANCE PRACTICES.

(3) Remove tail cone. Refer to 72-50-02, MAINTENANCE PRACTICES.

(4) Remove nuts securing inlet tube and remove inlet tube gaskets, spacer, and jet. Retain spacers for use during assembly.

(5) Refer to 72-50-04, MAINTENANCE PRACTICES, for further disassembly of engine.



R 5. NUT (IPC FIG. 178)
10. OIL INLET TUBE
15. GASKET
20. SPACER
35. OIL PRESSURE JET

Oil Inlet Tube and Oil Jet Installation
Figure 201

1. B. Install Oil Inlet Tube and Oil Jet (See Figure 201)

R NOTE: Refer to 70-00-00, STANDARD PRACTICES, for recommended
R general torque values. Add frictional drag (run-down)
R torque of self-locking devices to recommended values.

Apply high temperature compound (Fel-Pro C5-A) to threads of studs prior to installation

(1) Temporarily close lower end of tube and apply low pressure air to fitting end to check for leakage. There shall be no evidence of leakage.

(2) Install oil jet with new gaskets.

CAUTION: SELECTING OF IMPROPER SIZE SPACER IN THE FOLLOWING STEP MAY CAUSE MISALIGNMENT AND FAILURE OF OIL INLET TUBE.

(3) Select spacer thick enough so that oil inlet retainer shield assembly can be installed without binding. (Refer to 72-50-01, MAINTENANCE PRACTICES.)

(4) Apply a light coat of lubricating compound (Liqui-Moly, Grade NV) to gaskets. Install gaskets, spacer, and inlet tube. Tighten nuts (5, figure 201) to 70 inch-pounds torque. Recheck torque on nuts (5, figure 201) after engine run.

(5) Install tail cone. Refer to 72-50-02, MAINTENANCE PRACTICES.

2. Inspection/Check

A. Inspect Oil Inlet Tube and Oil Jet (See Figure 201)

(1) Visually inspect tube for cracks, nicks or scratches, and distortion. Inspect flanges for cracked or worn bolt holes. Inspect oil passages for obstructions. Inspect fitting surface for burrs, nicks or scratches.

(2) Visually inspect oil jet for bent or distorted mounting flanges or cracked bolt holes. Check orifice in end of jet for nicks, burrs and other irregularities.

(3) Repair minor broken welds in accordance with Approved Repairs.

3. Cleaning/Painting

A Clean Component Parts

(1) Clean all standard metallic hardware in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 1 or 2.

(2) Clean spacer in accordance with 72-00-00, GENERAL - CLEANING/PAINTING Cleaning Method No. 2 or 9.

(3) Clean oil inlet tube in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 2 or 9.

(4) Clean oil jet in accordance with 72-00-00, GENERAL CLEANING/PAINTING, Cleaning Method No. 2 or 9.

4. Approved Repairs

NOTE: Table 202 provides a list of materials and compounds required for Approved Repairs.

Table 202. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Filler rod (347, MIL-R-5031, Class 5A)	Commercially available

A. Repair Oil Inlet Tube and Oil Jet (See Figure 201)

(1) Polish out minor scratches. Repair minor broken welds by rewelding in accordance with standard shop practices using filler rod (347, MIL-R-5031, Class 5A).

TURBINE SCAVENGE PUMP ASSEMBLY - MAINTENANCE PRACTICES

1. Removal/Installation

NOTE: Table 201 provides a list of materials and compounds required for Removal/Installation.

Table 201. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
High temperature compound (Fel-Pro C5-A)	Fel-Pro Inc, Div of Felt Products Mfg Co, 7450 N McCormick Blvd, Skokie, IL 60076

A. Remove Turbine Scavenge Pump Assembly (See Figure 201)

R (1) Remove rear turbine bearing oil line. Refer to 79-20-08 MAINTEN-
R ANCE PRACTICES.

(2) Remove oil inlet retainer shield assembly. Refer to 72-50-01, MAINTENANCE PRACTICES.

(3) Remove tail cone. Refer to 72-50-02, MAINTENANCE PRACTICES.

(4) Remove oil inlet tube and jet. Refer to 72-50-03, MAINTENANCE PRACTICES.

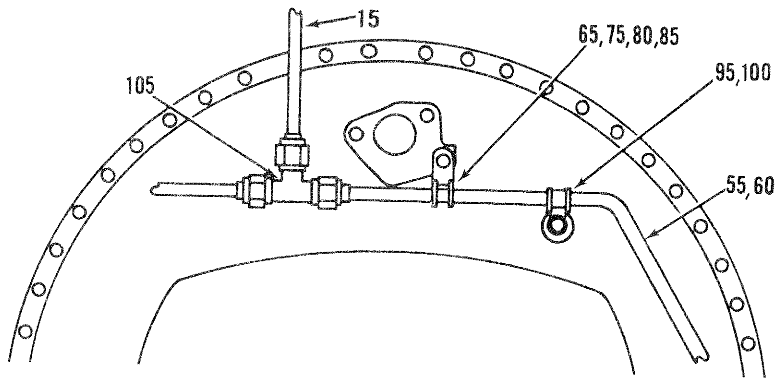
(5) Remove washers and nuts. Carefully remove pump assembly, gasket and spur gearshaft.

B. Install Turbine Scavenge Pump Assembly (See Figure 201)

CAUTION: ENSURE GASKET IS INSTALLED PROPERLY WITH HOLES AND NOTCHED AREAS ALIGNED WITH TURBINE SCAVENGE PUMP ASSEMBLY AND TURBINE BEARING SUPPORT ASSEMBLY.

NOTE: Apply high temperature compound (Fel-Pro C5-A) to threads of studs prior to installation.

(1) Install new gasket onto turbine bearing support assembly.



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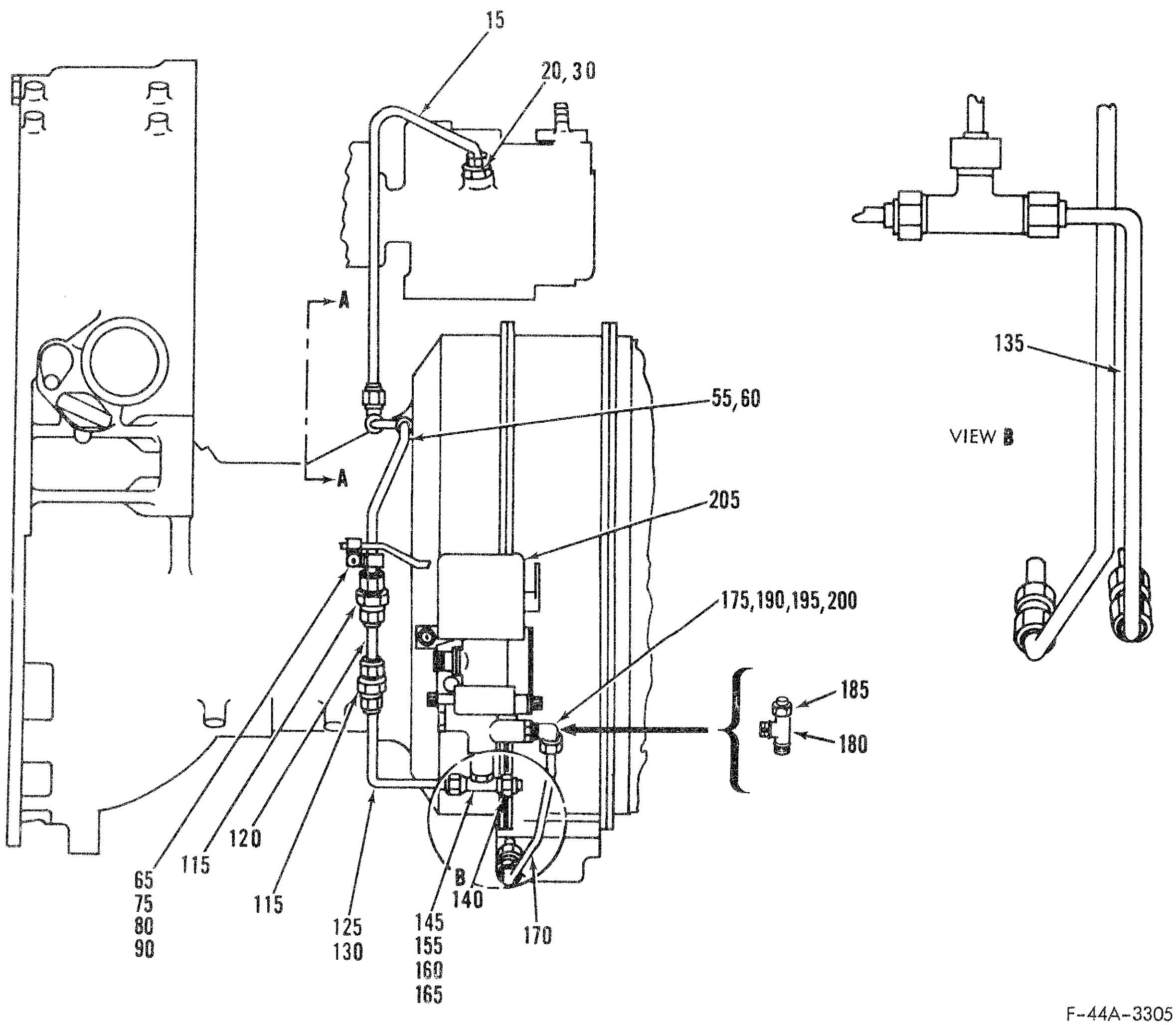


R 5. NUT (IPC FIG. 179)
10. WASHER
15. PUMP ASSY
20. GASKET
25. SPUR GEARSHAFT

Turbine Scavenge Pump Assembly Installation
Figure 201

1. B. (2) Install spur gearshaft and pump assembly using care so that splines mesh properly Install nuts and washers. Tighten nuts (5, figure 201) to 80 inch-pounds torque, back nuts off and retighten two additional times to seat gasket.

(3) Install oil inlet tube and jet. Refer to 72-50-03, MAINTENANCE PRACTICES.

2. Inspection/Check

A Turbine Scavenge Pump Assembly and Spur Gearshaft (See Figure 201)

(1) Visually inspect copper plating on splines of spur gearshaft for chipping, pitting, flaking, and wear through to base metal. If any of these conditions exist, replace spur gearshaft.

(2) Inspect pump assembly for chipped or broken gear teeth and for cracks. If any of these conditions exist, replace pump assembly.

(3) Closely inspect bushing in rear of pump assembly housing for evidence of wear or looseness. Replace pump assembly if wear or looseness is evident.

(4) Visually inspect pump assembly for evidence of oil leakage at pump
R cover. Replace pump assembly if oil leakage is evident.

R (5) Inspect turbine scavenge pump assembly for freedom of rotation of
R drive gear and shaft and gerotors. (See figure 202.)

R (a) Partially disassemble turbine scavenge pump assembly by remov-
R ing screws and cover.

R (b) Inspect cover, shear pins and studs as follows.

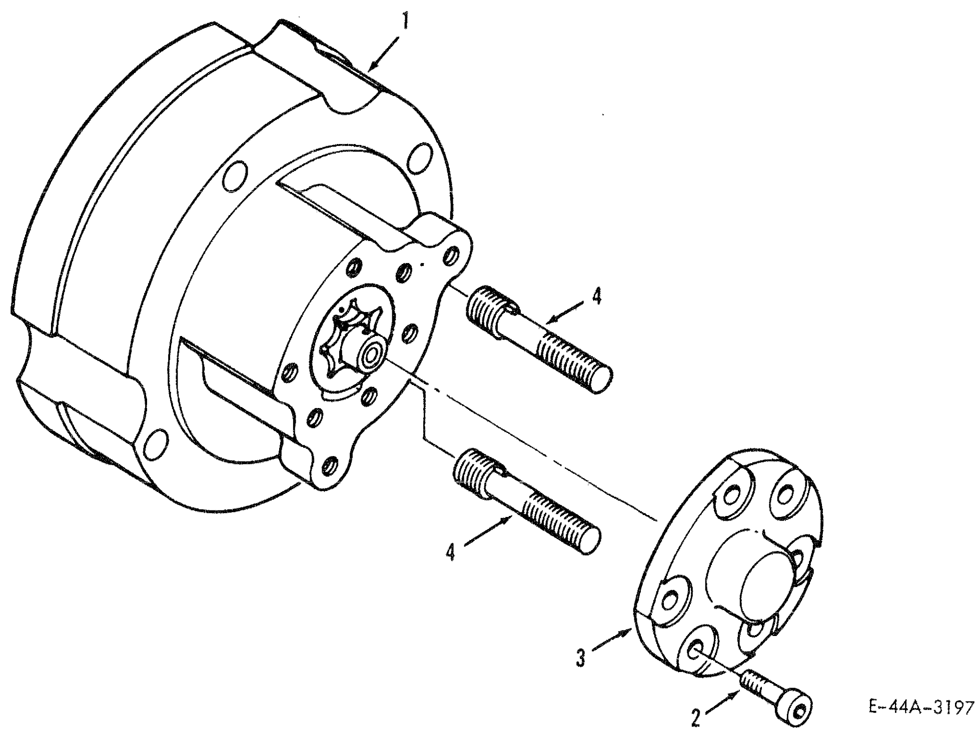
R 1 Visually inspect cover sealing surface for roughness, nicks
R or scratches. Replace cover if roughness, nicks or scrat-
R ches are evident.

R 2 Inspect for sheared pins in drive gear and rotor set
R retainer by rotating shaft assembly. Replace turbine sca-
R venge pump assembly if a pin is sheared or pump is binding.

R 3 Visually inspect studs for security and obvious damage.
R Replace studs in accordance with 70-00-00, STANDARD ENGINE
R PRACTICES.

R (c) Assemble turbine scavenge pump assembly as follows.

R 1 Install cover on pump assembly. Install screws hand tight.



R 1. PUMP ASSY (IPC FIG. 180)
2. SCREW
3. COVER
4. STUD

Turbine Scavenge Pump Assembly
(Field Maintenance Breakdown)
Figure 202

R 2. A. (5) (c) 2 Rotate shaft assembly while tightening screws. If any binding of the shaft is felt while tightening screws, loosen screws. reposition cover and repeat procedure.

R 3 Repeat step 2 until screws are tightened to 40 inch-pounds torque and shaft rotates without binding.

R 4 Lockwire screws in pairs.

3. Cleaning/Painting

A. Clean Component Parts

(1) Clean all standard metallic hardware in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 1 or 2.

(2) Clean spur gearshaft in accordance with 72-00-00, GENERAL - CLEANING/PAINTING Cleaning Method No. 1 or 9.

(3) Clean scavenge pump housing in accordance with 72-00-00, GENERAL - CLEANING/PAINTING Cleaning Method No. 1 or 2.

EXHAUST PIPE ASSEMBLY - MAINTENANCE PRACTICES

1. Removal/Installation

NOTE: Table 201 provides a list of materials and compounds required for Removal/Installation.

Table 201. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
High temperature compound (Fel-Pro C5-A)	Fel-Pro Inc, Div of Felt Products Mfg Co, 7450 N McCormick Blvd, Skokie, IL 60076

A. Remove Exhaust Pipe Assembly (See Figure 201)

R (1) Remove rear turbine bearing oil line. Refer to 79-20-08, MAINTEN-
R ANCE PRACTICES.

R (2) Remove oil inlet retainer shield assembly. Refer to 72-50-01,
R MAINTENANCE PRACTICES.

R (3) Remove tail cone. Refer to 72-50-02, MAINTENANCE PRACTICES.

R (4) Remove oil inlet tube and oil jet. Refer to 72-50-03, MAINTENANCE
R PRACTICES.

(5) Remove bolts, washers, and exhaust pipe assembly.

(6) Refer to 72-50-06, MAINTENANCE PRACTICES, for further disassembly of engine.

B. Install Exhaust Pipe Assembly (See Figure 201)

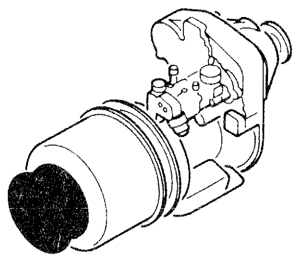
NOTE: Apply high temperature compound (Fel-Pro C5-A) to threads of bolts and nuts prior to installation.

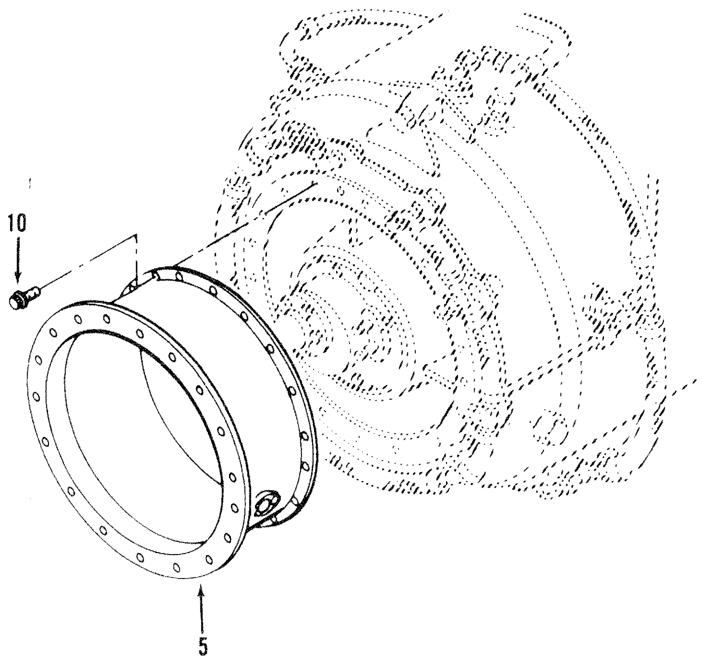
Ensure proper orientation of exhaust pipe assembly to allow installation of oil inlet fitting and retainer shield assembly.

(1) Install exhaust pipe assembly.

1\. B. (2) Install bolts to secure exhaust pipe assembly. Tighten bolts (10, figure 201) sequentially in 12 to 15 inch-pounds increments to 80 inch-pounds torque.

(3) Install oil inlet tube and oil jet. Refer to 72-50-03, MAINTENANCE PRACTICES.





R 5. EXHAUST PIPE ASSY (IPC FIG. 181) 10. BOLT

Exhaust Pipe Assembly Installation
Figure 201

2. Inspection/Check

A. Inspect Exhaust Pipe Assembly (See Figure 201)

(1) Inspect flanges for bolt hole cracks, weld cracks, nicks, scratches, and other damage.

(2) Inspect pipe body for cracks in parent metal, weld cracks, dents or buckling, and distortion.

(3) Replace if cracks, severe dents, or separated welds on flanges are evident.

(4) Repair minor broken welds and dents in accordance with Approved Repairs.

3. Cleaning/Painting

A. Clean Component Parts

(1) Clean all standard metallic hardware in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 1 or 2.

(2) Clean exhaust pipe assembly in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 1 or 9.

4. Approved Repairs

NOTE: Table 202 provides a list of materials and compounds required for Approved Repairs.

Table 202. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Filler rod (347, MIL-R-5031, Class 5A)	Commercially available

A. Repair Exhaust Pipe Assembly (See Figure 201)

(1) Hammer out small dents. Repair minor broken welds by rewelding in accordance with standard shop practices using filler rod (347, MIL-R-5031, Class 5A).)

INTERSTAGE TURBINE TEMPERATURE SENSOR ASSEMBLY (SINGLE PIECE), TURBINE BEARING AND BEARING SUPPORT (CARRIER) ASSEMBLY AND BEARING SUPPORT ASSEMBLY COMPONENTS - MAINTENANCE PRACTICES

1. Removal/Installation

R NOTE: If turbine bearing and bearing support (carrier) assembly
R is to be replaced without further disassembly of engine
R refer to 72-50-10, MAINTENANCE PRACTICES. If the turbine
R bearing and bearing support (carrier) assembly is being
R removed to accomplish further engine disassembly, the
R requirements of this section apply.

Table 201 provides a list of special tools, fixtures and equipment required for Removal/Installation. Table 202 provides a list of materials and compounds required for Removal/Installation.

Table 201. Special Tools, Fixtures and Equipment

Item No.	Nomenclature	Use	Source/ Part No.
NOTE: Equivalent substitutes may be used for listed items.			
1.	Spline and Socket Wrench	Used for tightening (or loosening) the turbine shaft retaining nut when assembling and stretching the main shaft. Use with 200 foot pounds standard torque wrench.	284196-2-1
2.	"C" Clamp Set	Used to hold stators together.	284496-1-1
3.	Bearing Puller	Used to remove turbine end bearing inner race from the main shaft when replacing bearing or seal.	284637-1-1

Table 201. Special Tools, Fixtures and Equipment (Cont)

Item No.	Nomenclature	Use	Source/ Part No.
4.	Shim Clearance Gage	Used to hold the compressor and turbine wheel shaft in the extreme axial positions when checking amount of shims required for proper first stage impeller clearance.	284988-1-1
5.	Bearing Puller	Used to remove turbine bearing carrier and outer race of bearing from support assembly.	287386-1-1
6.	Bearing Installation and Removal Kit	Used to remove support assembly rotor, seals, and bearing as a subassembly from turbine end of engine.	289492-1-1
7.	Retaining Ring Guide	Used to aid in installing thrust ring and spring washer in turbine bearing cavity.	291756-1-1
8.	Liner and Support Torquing Holder Assembly	Used with a standard Power-Dyne Torque Wrench to install or remove a TPE turbine support from the stator retaining nut.	*291900-1-1/ -2-1
R 9.	Splined Adapter	Used with 284196-2-1 wrench when tightening or loosening turbine shaft nut. Engages splines of main shaft on engines containing main shaft with internal threads in aft end.	294760-1

R *291900-1 1 does not include power-dyne torque wrench.
R 291900-2-1 includes power-dyne torque wrench.

Table 202. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Grease (Acryloid HF825)	Rohm and Haas Co, Independence Mall West, Philadelphia, PA 19105
High temperature compound (Fel-Pro C5-A)	Fel-Pro Inc, Div of Felt Products Mfg Co, 7450 N McCormick Blvd, Skokie, IL 84478
Lubricating compound (Liqui-Moly, Grade NV)	Lockrey Co, Lubricants Div, Cedar Shores, Southampton, NY 11968
Oil (WD-40)	Commercially available

1. A. Disassemble Engine to Accomplish Required Maintenance

(1) Disconnect ITT sensor assembly. Refer to 77-20-03, MAINTENANCE PRACTICES.

(2) Remove rear turbine bearing oil line. Refer to 79-20-08, MAINTENANCE PRACTICES.

(3) Remove air anti-ice valve and plumbing. Refer to 75-10-01, MAINTENANCE PRACTICES.

(4) (Codes AB-AC, BB-BC, CB-GA, KA, LA) Remove plenum pressure plumbing. Refer to 73-10-013, MAINTENANCE PRACTICES.

(5) Remove fuel flow divider and drain valve. Refer to 73-10-07, MAINTENANCE PRACTICES.

(6) Remove fuel manifold and nozzle assembly. Refer to 73-10-09, MAINTENANCE PRACTICES.

(7) Remove ignition leads and igniter plugs. Refer to 74-20-01, MAINTENANCE PRACTICES.

(8) (Codes BA-CC, EA, GA, KA) Remove fireshields. Refer to 71-30-01, MAINTENANCE PRACTICES.

(9) Remove turbine oil inlet retainer shield assembly. Refer to 72-50-01, MAINTENANCE PRACTICES.

R 1. A. (10) Remove tail cone. Refer to 72-50-02, MAINTENANCE PRACTICES.

R (11) Remove oil inlet tube and oil jet. Refer to 72-50-03, MAINTENANCE
R PRACTICES.

R (12) Remove turbine scavenge pump assembly. Refer to 72-50-04, MAINTEN-
R ANCE PRACTICES.

R (13) Remove exhaust pipe assembly. Refer to 72-50-05, MAINTENANCE
R PRACTICES.

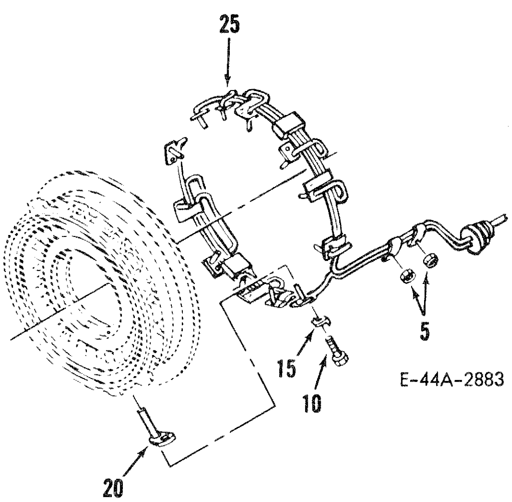
R (14) Remove turbine plenum assembly and combustion chamber assembly.
R Refer to 72-40-01, MAINTENANCE PRACTICES.

B. (Post SB72-0042) Remove Interstage Turbine Temperature (ITT) Sensor Assembly (Single Piece) (See Figure 201)

NOTE: Do not remove ITT system unless a malfunction or visible damage is indicated. Refer to Inspection/Check.

(1) Mark a line (orientation mark) on the second stage stator assembly midway between the open ends of the interstage turbine temperature (ITT) sensor assembly (two o'clock position).

(2) Remove bolts and washers securing ITT sensor assembly and probe shields to second stage stator assembly. Remove nuts securing ITT sensor assembly to turbine bearing support.



R 5. NUT (IPC FIG. 189)
10. BOLT
15. WASHER
20. PROBE SHIELD
25. ITT SENSOR ASSY

R (Post SB72-0042) Interstage Turbine Temperature (ITT) Sensor Assembly Installation
Figure 201

1. B. (3) Remove ITT sensor assembly from second stage stator assembly beginning with number 1 or 12 probe position (two o'clock position looking forward) and working around stator.

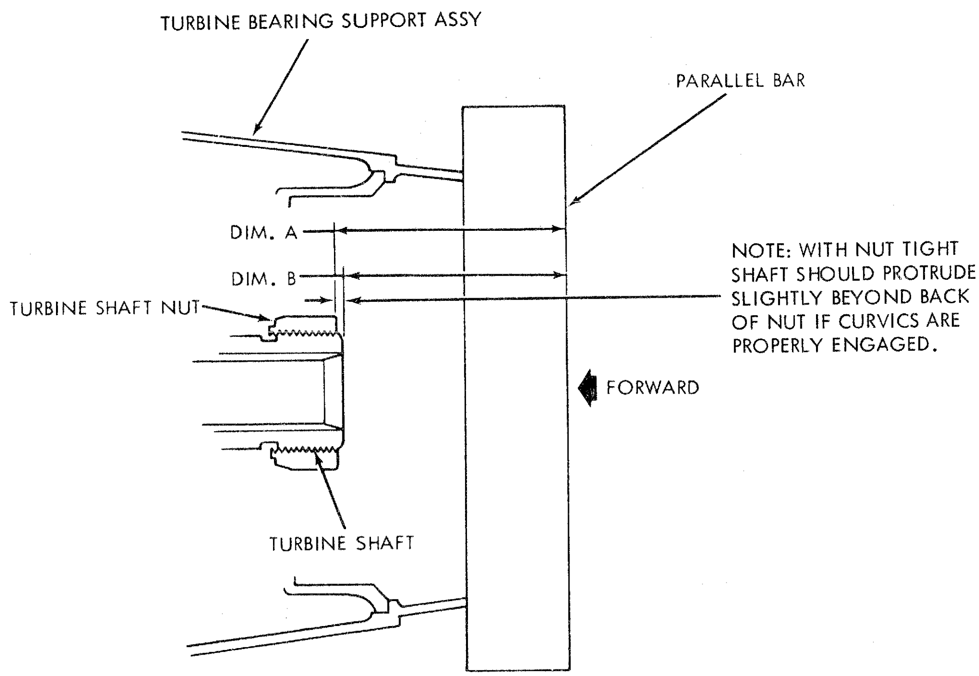
(4) Remove probe shields from second stage stator assembly.

C. Remove Turbine Bearing and Bearing Support (Carrier) Assembly Components (See Figures 202 and 203)

NOTE: Index marks on main shaft and nut are utilized as a reference for shaft stretch during engine production only, do not attempt reassembly using marks as guidelines.

(1) Prior to loosening turbine shaft nut, measure and record Dimensions A and B. (See figure 202.)

R (2) Remove nuts (10, figure 203) and retainer (15 or 20).



NOTE:

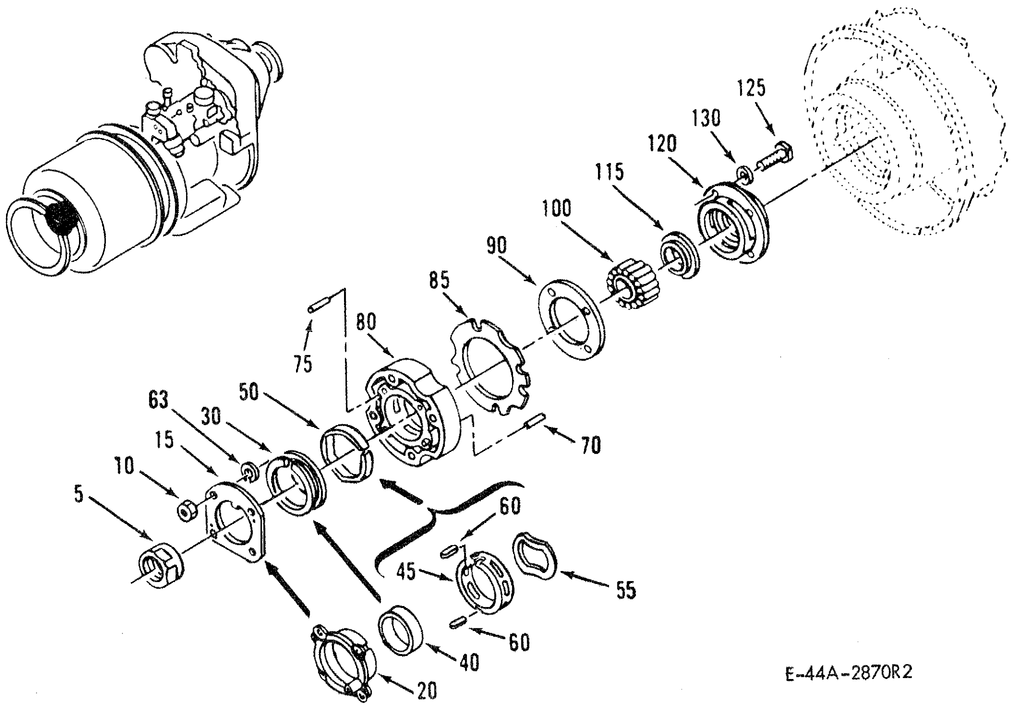
LOAD TURBINE SHAFT FORWARD AGAINST COMPRESSOR BEARING WITH 15 POUNDS FORCE.

IF ENGINE CAN BE ROTATED TO VERTICAL NOSE DOWN POSITION, FORWARD LOAD IS NOT NECESSARY.

1-44A-1513

Shaft Stretch Measurements
Figure 202

R



R 5.	NUT (IPC FIG. 182)	70.	PIN
10.	NUT	75.	PIN
15.	RETAINER	80.	BEARING SUPPORT (CARRIER) ASSY
20.	RETAINER	85.	SHIM
30.	BEARING (OUTER RACE)	90.	GASKET
40.	BEARING (OUTER RACE)	100.	BEARING (INNER RACE)
45.	THRUST RING	115.	SEAL ROTOR
50.	MOUNT	120.	AIR-OIL SEAL (STATOR)
55.	SPRING WASHER	125.	BOLT
60.	KEY	130.	GASKET
63.	RETAINER (DELETED)		

Turbine Bearing and Bearing Support (Carrier)
Assembly Installation
Figure 203

CAUTION: USE CARE TO PREVENT DAMAGE TO OR LOSS OF BEARING ROLLERS.

NOTE: If washer is broken, magnet may be used to remove parts. After removal, reconstruct washer to ensure all broken parts have been removed.

1. C. (3) (Post SB72-0089) Remove bearing outer race, keys, thrust ring, washer, and bearing support (carrier) using 287386-1-1 puller. Discard washer.

(4) (Pre SB72-0089) Remove bearing outer race, mount and bearing support (carrier) assembly using 287386-1-1 puller.

(5) Remove shims. Note quantity and thickness of shims removed to aid in reassembly.

(6) Remove gasket.

D. Remove Turbine Bearing Support Assembly (See Figure 204)

(1) Remove nuts and disconnect interstage turbine temperature (ITT) harness assembly or ITT sensor assembly from turbine bearing support assembly.

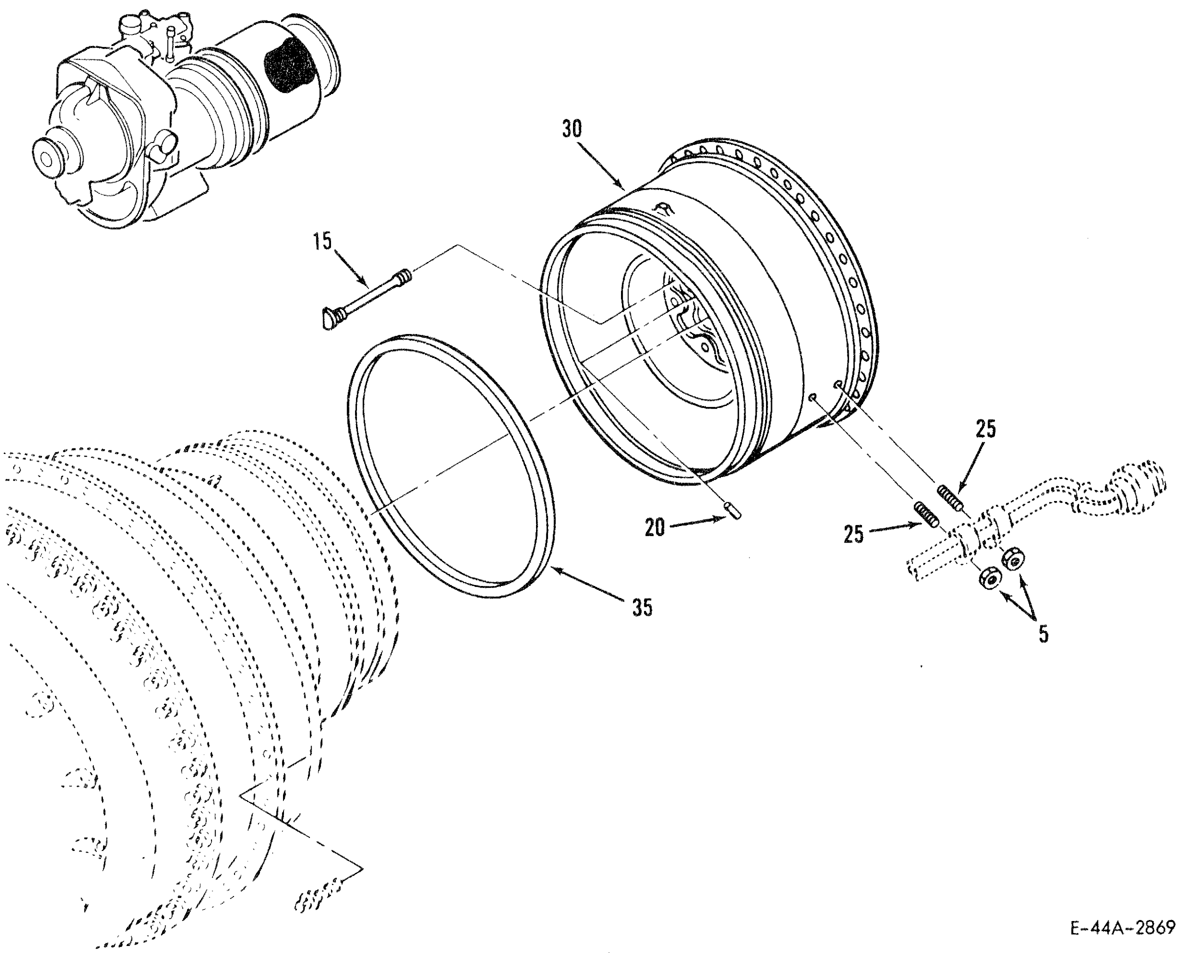
(2) Remove turbine bearing support assembly using 291900-1-1/-2-1 holder assembly as follows.

(a) Soak threads of turbine bearing support assembly generously with oil (WD-40) and tap sharply around the full circumference of the stator locking nut prior to installation of 291900-1-1/-2-1 holder assembly.

(b) Allow threaded joint to soak with oil for 15 to 20 minutes.

(c) Position base assembly of 291900-1-1/-2-1 holder around locking nut with phenolic pads on dish of stator and liner and secure. Turn the three jack screws in adapter until locking pins engage slots in locking nut.

(d) Place matched set ring (part of 291900-1-1/-2-1 holder) around turbine bearing support assembly with three notches in the inside diameter of holder engaging the three lugs on the outside diameter of the turbine bearing support assembly. Secure with two halves of the matched set ring with the two hinge pins located 180 degrees apart. The matched set ring is resting on the base plate adapter inside the four lugs on the base assembly.



R 5. NUT (IPC FIG. 183)
R 15. BOLT
20. PIN
25. STUD
30. SUPPORT ASSY
35. WASHER

Turbine Bearing Support Assembly Installation
Figure 204

1. D. (2) (e) Place torquing cylinder (part of 291900-1-1/-2-1 holder) on matched set ring (part of 291900-1-1/-2-1 holder) aligning holes in torquing cylinder with pins on matched set ring. Position reaction cylinder (part of 291900-1-1/-2-1 holder) over torquing cylinder and secure to base assembly.

(f) Install power-dyne on drive shaft (drive shaft is part of 291900-1-1/-2-1 holder).

(g) Operate power-dyne and attempt to loosen support assembly.

(h) If support assembly fails to loosen, repeat steps (a) through (g), extending the oil soaking of threads to one hour and sharply tapping the circumference of the locking nut at 15 minute intervals.

(i) If support assembly still fails to loosen, pack support assembly with dry ice and allow 15 to 20 minutes for support assembly to cool. Apply heat to outside diameter of locking nut using propane torch. Do not exceed temperature of 371C (700F). Using power-dyne attached to 291900-1-1/-2-1 holder, attempt to loosen support assembly.

(j) If support assembly still fails to loosen, repeat steps (a) through (i).

NOTE: Do not remove bolts, pins, or studs from support unless damage is indicated by inspection.

(k) If the above procedures fail to loosen the support assembly, it is recommended that the locking nut be split axially in two places 180 degrees apart to relieve torque on support assembly. Nut may be split by scoring with hand grinder and splitting with chisel. Remove support assembly and washers.

R (l) Install 284496-1-1 "C" clamp set to hold stators together. (See figure 205.)

R E. Remove Main Shaft Nut and Determine Existing Turbine Build Dimension (See Figure 205)

R (1) (Engines with main shaft with internal threads in aft end) Remove main shaft nut using 284196-2-1 wrench with 294760-1 adapter.

R (2) (Engines with main shaft without internal threads in aft end). Remove main shaft nut using 284196-2-1 wrench with 284196-21 adapter.

R (3) Prior to further disassembly, determine existing turbine build dimension as follows. (See figure 205.)

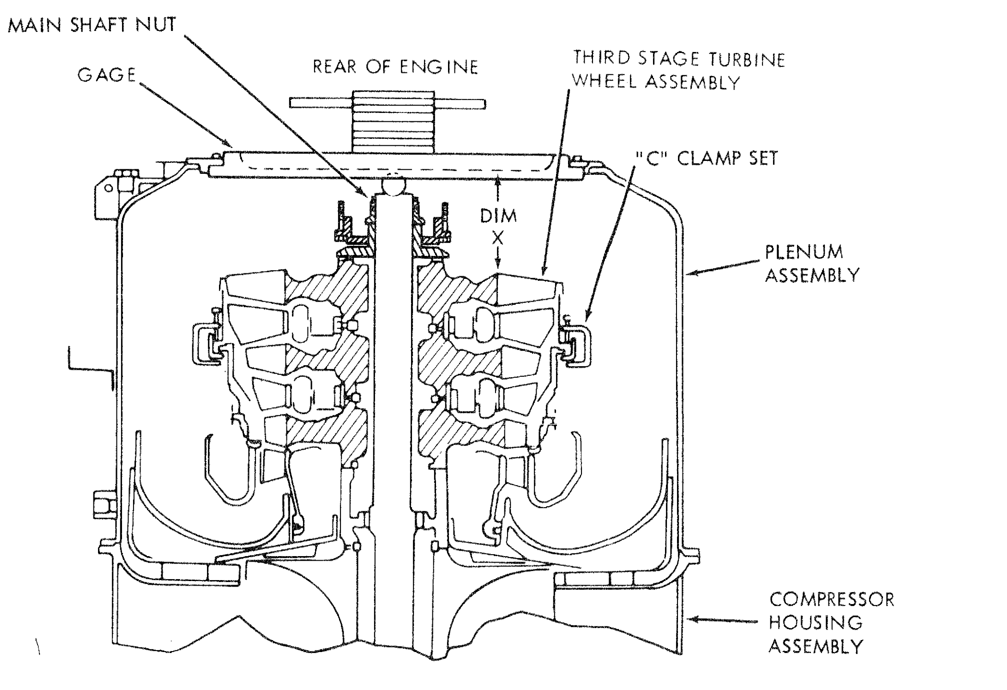
R 1. E. (3) (a) Lubricate threads and face of removed main shaft nut with lubricating compound (Liqui-Moly, Grade NV).

R (b) Thread nut onto main shaft and tighten hand tight.

R NOTE: Index mark main shaft and main shaft nut using master marker (Grade 127-1/2) for reference to ensure 1/2 turn of nut is accomplished.

R (c) (Engines with main shaft with internal threads in aft end) Using 284196-2-1 wrench with 294760-1 adapter, tighten main shaft nut 1/2 turn to ensure that curvic coupling gaskets are compressed and curvic couplings are seated.

R



Determining Turbine Build Dimension
Figure 205

NOTE: Index mark main shaft and main shaft nut, using master marker (Grade 127-1/2) for reference, to ensure 1/2 turn of nut is accomplished.

1\. E. (3) (d) (Engines with main shaft without internal threads in aft end) Using 284196-2-1 wrench with 284196-21 adapter, tighten main shaft nut 1/2 turn to ensure that curvic coupling gaskets are compressed and curvic couplings are seated.

(e) Place 284988-1-1 shim clearance gage on bench with "T" handle up, then place plenum assembly down over gage. Reach down through exhaust pipe assembly opening in plenum and lift gage up, and bolt to plenum assembly with exhaust pipe assembly bolts in every other hole. Tighten bolts to 80 inch-pounds torque.

(f) Temporarily set plenum assembly in place on compressor housing assembly so that drain valve bosses are at six o'clock position, and secure with bolts and nuts in every third hole. Tighten bolts to 50 to 60 inch-pounds torque.

CAUTION: DO NOT OVERTIGHTEN "T" HANDLE OF 284988-1-1 GAGE, OVERTIGHTENING COULD CAUSE ERRONEOUS DIMENSION X INDICATION AND DAMAGE TO COMPRESSOR BEARING. TIGHTEN ONLY ENOUGH TO ENSURE RADIAL CENTERING OF ROTOR GROUP.

(g) Turn "T" handle of gage until slight contact is made with main shaft and rotor group is centered. With a depth micrometer measure from face of gage to third stage turbine wheel assembly as shown in Figure 205, record as Dimension X for reference during assembly.

(h) Remove plenum assembly and 284988-1-1 gage from engine.

NOTE: Do not discard main shaft nut. Retain nut for use during preliminary assembly procedure to obtain Dimension X.

(i) (Engines with main shaft with internal threads in aft end) Remove main shaft nut using 284196-2-1 with 294760-1 adpater.

(j) (Engines with main shaft without internal threads in aft end) Remove main shaft nut using 284196-2-1 with 284196-21 adapter.

F. Remove Main Shaft Mounted Turbine Bearing and Bearing Support (Carrier) Assembly Components (See Figure 203)

(1) Remove bearing inner race using 284637-1-1 puller.

R 1. F. (2) Remove rotor seal and air oil seal from main shaft.

R (3) Remove bolts and gaskets (bolt seals) from air oil seal.

R (4) Refer to 72-50-07, MAINTENANCE PRACTICES, for further disassembly
R of engine.

CAUTION: MAINTAIN ENGINE IN VERTICAL POSITION (INTAKE DOWN) FOR ASSEMBLY PURPOSES AND TO MAINTAIN CURVIC RELATIONSHIP OF IMPELLERS.

NOTE: Apply high temperature compound (Fel-Pro C5-A) to threads of bolts, studs and nuts prior to installation.

G. Install Turbine Bearing Support Assembly (See Figure 204)

(1) Separate bearing outer race (figure 203) from bearing inner race. Place inner race to one side for later assembly.

(2) Using a micrometer, measure depth of bearing support assembly (figure 203) and record for later use as Dimension U on assembly data worksheet. (See figure 206 and table 203.)

(3) Install gaskets (130, figure 203) on bolts. Place gasket (90) on air-oil seal, then place bolts with gaskets through holes in air-oil seal and gasket (figure 203).

CAUTION: INSTALL SEAL ROTOR WITH FLAT SIDE AGAINST AIR-OIL SEAL.

(4) Install air-oil seal on main shaft on top of aft curvic coupling then place seal rotor (figure 203) down on air-oil seal.

(5) Apply light coat of grease (Acryloid HF825) to rollers of bearing inner race. Place bearing inner race with rollers onto main shaft and push down into position against seal rotor. Rollers can be held in place on inner race with use of plastic strap.

R NOTE: Use same nut as removed during removal. New nut
R shall be used at final assembly.

R (6) Lubricate threads and face of old main shaft nut with lubricating
R compound (Liqui-Moly, Grade NV).

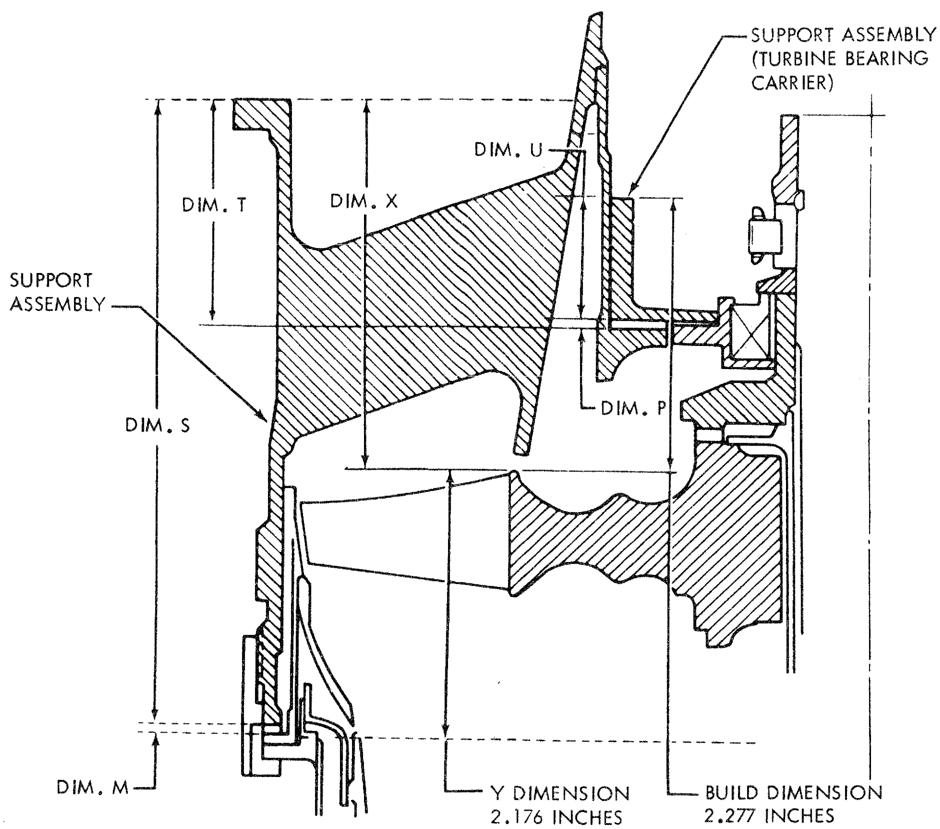
R (7) Thread main shaft nut onto main shaft. Tighten main shaft nut suf-
R ficiently to bottom bearing inner race and seal rotor. Back off
R nut, then tighten hand tight.

R NOTE: Index mark main shaft and main shaft nut using
R master marker (Grade 127-1/2) for reference to en-
R sure 1/2 turn of nut is accomplished.

R 1. G. (8) (Engines with main shaft with internal threads in aft end) Using
R 284196-2-1 wrench with 294760-1 adapter tighten main shaft nut 1/2
R turn to ensure that curvic coupling gaskets are compressed and that
R curvic couplings are seated.

R NOTE: Index mark main shaft and main shaft nut using
R master marker (Grade 127-1/2) for reference to en-
R sure 1/2 turn of nut is accomplished.

R (9) (Engines with main shaft without internal threads in aft end) Using
R 284196-2-1 wrench with 284196-21 adapter, tighten main shaft nut
R 1/2 turn to ensure that curvic coupling gaskets are compressed and
R that curvic couplings are seated.



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Turbine Build Dimensions
Figure 206

Table 203. Turbine Build Dimensions Assembly Data Sample Worksheet

R R	1.	Record Dimension S (Refer to steps (12) and (13) here.	______ in.
R R	2.	Record Dimension T (Refer to steps (13) and (14) here.	______ in.
R R	3.	Record Dimension U (Refer to steps (2) and (14) here.	______ in.
R	4.	Record Dimension X (Refer to step (12) here.	______ in.
	5.	Dimension Y	2.176 in.
R R	6.	Add lines 4 and 5 and record result here.	______ in.
R R R	7.	Subtract line 1 from line 6 and record result here. Result equals thickness of washers required for Dimension M (Figure 206).	______ in.
	8.	Subtract line 2 from line 4, then add line 3 and record results here.	______ in.
R R R R	9.	Subtract line 8 from 2.277. Result equals thickness of shims required for Dimension P (Figure 206).	______ in.

1. G. (10) Place 284988-1-1 shim clearance gage on bench with "T" handle up, then place plenum assembly down over gage. Reach down through exhaust pipe assembly opening in plenum and lift gage up, and bolt to plenum assembly with exhaust pipe assembly bolts in every other hole. Tighten bolts to 80 inch-pounds torque.

(11) Temporarily set plenum assembly in place on compressor housing assembly so that drain valve bosses are at the six o'clock position, and secure with bolts and nuts in every third hole. Tighten bolts to 50 to 60 inch-pounds torque.

CAUTION: DO NOT OVERTIGHTEN "T" HANDLE OF 284988-1-1 GAGE. OVERTIGHTENING SHALL CAUSE AN ERRONEOUS DIMENSION X INDICATION AND DAMAGE TO COMPRESSOR BEARING. TIGHTEN ONLY ENOUGH TO ENSURE CENTERING OF ROTOR GROUP.

R NOTE: If Dimension X taken on step (12) is within
R +0.002/-0.002 inch of Dimension X taken in step
R E.(3)(g) of disassembly, it is not necessary to
R calculate for thickness of washers for Dimension M
R (Figure 206) or Dimension P (Figure 206). Engine
R may be assembled using same thickness of washers
R and shims removed during disassembly.

R 1. G. (12) Turn "T" handle of gage until slight contact is made with main
R shaft and rotor group is centered. With a depth micrometer, meas-
R ure from face of gage to third stage turbine wheel assembly as
R shown in Figure 205, record as Dimension X. If Dimension X is not
R within +0.002/-0.002 inch of Dimension X taken in step E.(3)(g)
R during disassembly, calculations must be accomplished for Dimension
R M and P, Figure 206.

R (13) Record the following dimensions on assembly data worksheet. (See
R table 203.) Turbine bearing support assembly (see figure 204) and
R bearing support assembly (see figure 203) are not installed on the
R engine at this time. Determine measurements for Dimensions S and T
R with turbine bearing support assembly and bearing support assembly
R separated on bench. (See figure 206.)

R (14) Using following formulas, calculate washers and shims required for
R Dimensions M and P, Figure 206.

R S = Dimension determined in step (13).

R T = Dimension determined in step (13).

R U = Dimension determined in step (2).

R X = Dimension determined in step (12).

R Y = 2.176 inches.

R X + Y - S = M (M is the thickness of washers (figure 204) required
R between third stage stator assembly and turbine bearing support as-
R sembly (figure 204).

R 2.277 - (X - T + U) = P (P is the thickness of shims required
R between turbine bearing support assembly and bearing support
R assembly.

R (15) Remove plenum assembly from engine. Remove 284988-1-1 gage from
R plenum assembly.

R 1. G. (16) (Engines with main shaft with internal threads in aft end) Remove
R main shaft nut using 284196-2-1 wrench with 294760-1 adapter.

R (17) (Engines with main shaft without internal threads in aft end)
R Remove main shaft nut using 284196-2-1 wrench with 284196-21
R adapter.

R CAUTION: USE NEW MAIN SHAFT NUT FOR FINAL ASSEMBLY.

R (18) Lubricate face and threads of new nut with lubricating compound
R (Liqui-Moly. Grade NV). Install main shaft nut and tighten hand
R tight.

(19) Remove three 284496-1-1 clamps from second stage stator. Install required amount of washers.

NOTE: Align ITT securing studs on turbine bearing support assembly approximately four inches counterclockwise from ITT harness prior to tightening turbine bearing support assembly and locking nut to allow for proper final alignment of ITT harness.

(20) Position turbine bearing support assembly down over engine assembly and assemble locking nut to support assembly. Screw support assembly and nut together hand tight then install 291900-1-1/-2-1 holder as follows.

(a) Position base assembly 291900-1-1/-2 1 holder around locking nut with phenolic pads on dish of stator and liner and secure. Turn the three jack screws in adapter until locking pins engage slots in locking nut.

(b) Place matched set ring (part of 291900-1-1/-2-1 holder) around turbine bearing support assembly with three notches in the inside diameter of holder, engaging the three lugs on the outside diameter of the turbine bearing support assembly Secure with two halves of the matched set ring, with the two hinge pins located 180 degrees apart. The matched set ring is resting on the base plate adapter inside the four lugs on the base assembly.

(c) Place torquing cylinder (part of 291900-1-1/-2-1 holder) on matched set ring (part of 291900-1-1 holder) aligning holes in torque cylinder with pins on matched set ring. Position reaction cylinder (part of 291900-1-1/-2-1 holder) over torquing cylinder and secure to base assembly.

1. G. (20) (d) Install power-dyne on drive shaft (part of 291900-1-1/-2-1 holder). Operate power-dyne to thread turbine bearing support assembly into the inner transition liner. Tighten turbine bearing support assembly to 23,000 to 26,000 inch-pounds (1,900 to 2,150 foot-pounds) torque. Remove holder.

(21) Secure harness assembly to turbine bearing support assembly (see figure 204) using clamps and nuts. Tighten nuts (5, figure 204) to 20 inch-pounds torque.

H. Install Turbine Bearing and Bearing Support (Carrier) Assembly Components (See Figure 203)

NOTE: Air-oil seal, bolts and gaskets, seal rotor, turbine bearing inner race, and main shaft nut were previously installed onto main shaft.

R Do not install retainer (63, figure 203). Part
R has been deleted.

(1) (Pre SB72-0089) Install mount on bearing outer race.

(2) (Pre SB72-0089) Place bearing support assembly on work bench with retainer alignment pins facing up.

(3) (Pre SB72-0089) Place bearing outer race and mount in bearing support assembly with anti-rotation slots in alignment.

NOTE: Maintain relationship of anti-rotation slots in bearing outer race and mount with retainer anti-rotation tab while aligning drilled holes in retainer with alignment pins on face of bearing support assembly.

(4) (Pre SB72-0089) Place retainer on bearing outer race and push race and mount into bearing support assembly using retainer as a guide.

NOTE: Dowel pin in bearing support assembly shall locate in hole in turbine bearing support assembly.

(5) (Pre SB72-0089) Install required amount of shims (determined in step G.(14), then install bearing support assembly into turbine bearing support.

(6) (Pre SB72-0089) Install retainer so that anti-rotation tab engages anti-rotation slot in bearing outer ring (see figure 207, View A) and secure with nuts. Tighten nuts (10, figure 203) to 70 inch-pounds torque. Use caution during tightening of nuts to ensure heads of bolts do not hang up on air-oil seal.

NOTE: Dowel pin in bearing support assembly shall locate in hole in turbine bearing support assembly.

1. H. (7) (Post SB72-0089) Install required amount of shims (determined in step G.(14), then install bearing support assembly into turbine bearing support.

(8) (Post SB72-0089) Install spring washer and thrust ring into bearing support assembly using 291756-1-1 guide. Position key slot on thrust ring 45 degrees clockwise from vertical.

(9) (Post SB72-0089) Install keys in key slots on thrust ring, then install bearing outer race.

(10) Apply engine oil to bearing at this time to remove grease (Acryloid HF825).

CAUTION: ENSURE THAT MAIN SHAFT NUT IS LOOSENED SO THAT NUT IS NOT IN CONTACT WITH TURBINE BEARING PRIOR TO ACCOMPLISHING MEASUREMENT OF DIMENSION B (UNSTRETCHED). THIS WILL PREVENT INCORRECT DIMENSION B (UNSTRETECHED) MEASUREMENT AND SUBSEQUENT INCORRECT SHAFT STRETCH MEASUREMENT.

(11) Load rotating group toward forward end of engine. Loosen main shaft nut. Measure and record Dimension B (unstretched) (see figure 202).

CAUTION: WHEN PERFORMING THE FOLLOWING STEP, MAKE SHAFT STRETCH MEASUREMENT FREQUENTLY TO ENSURE SHAFT IS NOT OVERSTRETCHED. USE DIMENSION B RECORDED IN STEP C.(1) AS A GUIDE ONLY IN OBTAINING PROPER SHAFT STRETCH. IF
R DIMENSION B (INITIAL STRETCH) 0.038 to 0.041 INCH STRETCH TOLERANCE IS EXCEEDED, LOOSEN TURBINE SHAFT NUT AND REPEAT STEP (11). IF REPEAT DIMENSION B (UNSTRETCHED) EXCEEDS 0.002 INCH LESS THAN ORIGINAL DIMENSION B (UNSTRETCHED), RETURN ENGINE TO SERVICE CENTER BECAUSE SHAFT HAS BEEN OVERSTRETCHED.

R (12) (Engines with main shaft with internal threads in aft end) Using
R 284196-2-1 wrench with 294760-1 adapter tighten main shaft nut
R while frequently checking Dimension B until Dimension B (initial
R stretch) is 0.038 to 0.041 inch less than Dimension B
R (unstretched). Back off nut slightly to obtain Dimension B (final
R stretch) of 0.036 to 0.039 inch less than Dimension B
R (unstretched).

R (Engines with main shaft without internal threads in aft end) Us-
R ing 284196-2-1 wrench with 284196-21 adapter tighten main shaft nut
R while frequently checking Dimension B until Dimension B (initial
R stretch) is 0.038 to 0.041 inch less than Dimension B
R (unstretched). Back off nut slightly to obtain Dimension B (final
R stretch) of 0.036 to 0.039 inch less than Dimension B
R (unstretched).

R CAUTION: ENSURE THAT EXCESSIVE LUBRICATING COMPOUND
R (LIQUI-MOLY, GRADE NV) IS REMOVED FROM MAIN
R SHAFT NUT AREA TO PREVENT CONTAMINATING ENGINE
R OIL.

R 1. H. (13) Remove excess lubricating compound (Liqui-Moly, Grade NV).

(14) (Post SB72-0089) Position retainer so oil transfer boss is located approximately 120 degrees clockwise from vertical (see figure 207, View B) and aligns with keys in thrust ring. Secure with nuts. Tighten nuts (10, figure 203) to 70 inch-pounds torque. Use caution when tightening nuts to ensure heads of bolts do not hang up on air-oil seal.

(15) Ensure rotating assembly rotates freely. If interference is noted, remove and reinstall components as required to ensure bolts, seal, and shims are correctly installed and oriented.

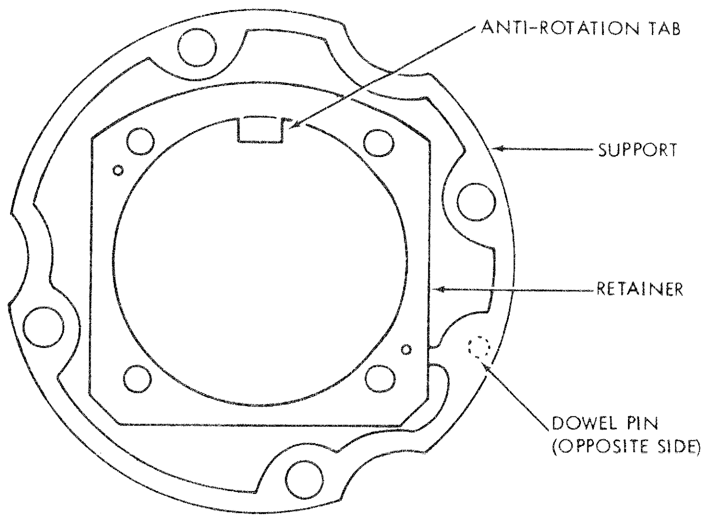
(16) (Pre SB72-0042) Install multi piece interstage turbine temperature sensor assembly. Refer to 72-50-08, MAINTENANCE PRACTICES.

I. (Post SB72-0042) Install interstage Turbine Temperature (ITT) Sensor Assembly (Single Piece) (See Figure 201)

(1) Install twelve probe temperature shields into twelve probe holes in second stage stator assembly.

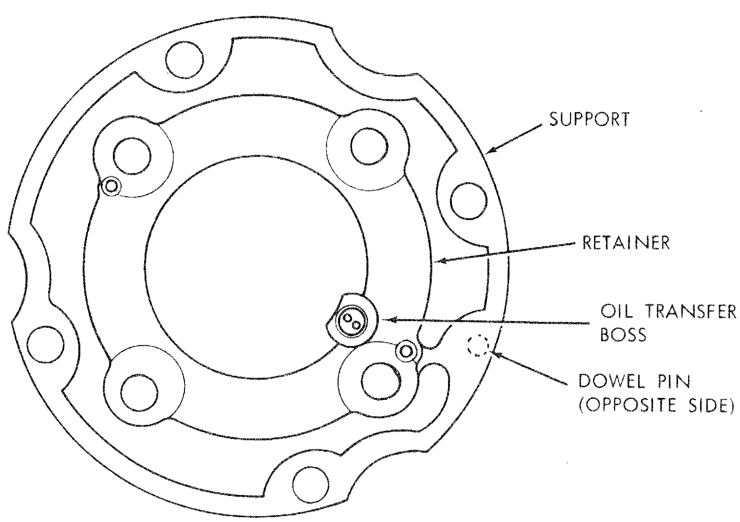
R CAUTION: AVOID EXCESSIVE BENDING OR SHARP RADIUS BENDS
R IN LEADS WHEN INSTALLING ITT SENSOR ASSEMBLY.
R RADIUS OF LEAD BENDS SHALL NOT BE LESS THAN
R 0.50 INCH.

(2) Install ITT sensor assembly into second stage stator assembly beginning with either probe number 1 or number 12. (Probes 1 and 12 are the two end probes in the sensor assembly.) Progressively install probes into shields from the starting probe (either 1 or 12) around the engine until all twelve probes are seated. If necessary, mounting clamps can be temporarily removed or relocated to aid installation of probes. After installation of sensor assembly relocate mounting clamps over probe mounting bolt holes.



VIEW A

R



VIEW B

F-44A-2854R1

Locating Anti-Rotation Tab or Oil Transfer Boss
Figure 207

NOTE: Apply high temperature compound (Fel-Pro C5-A) to threads of bolts.

1. I. (3) Secure ITT sensor assembly and shields to second stage stator assembly with washers and bolts. Tighten bolts (15, figure 201) to 50 inch-pounds torque. Check for existence of gap between each shield and probe as shown in Figure 204, 72-40-01, MAINTENANCE PRACTICES. Gap shall not exceed 0.005 inch. If gap exceeds maximum, seat probe by tapping with brass pin to bring gap within limits. Retighten bolts to 50 inch-pounds torque. Lock bolts by bending tab of washers over edge of sensor assembly clamps and up on bolts.

NOTE: Apply high temperature compound (Fel-Pro C5-A) to studs and nuts.

(4) Attach ITT sensor assembly to turbine bearing support assembly studs with nuts. Tighten nuts (5, figure 201) to 20 inch-pounds torque.

(5) Install plenum assembly and combustion chamber assembly. Refer to 72-40-01, MAINTENANCE PRACTICES.

2. Inspection/Check

A. (Post SB72-0042) Inspect Interstage Turbine Temperature (ITT System) (Single Piece) (See Figure 201)

(1) Inspect temperature probe shields (20) for wear through of shield wall. Replace shield that is completely worn through.

(2) Inspect interstage turbine temperature sensor assembly (25) for the following.

(a) Leads worn through sheathing is cause for replacement of sensor assembly.

(b) More than two probe tips burned off is cause for replacement of sensor assembly.

(c) Brazed joints at junctions that show cracks when inspected by 10X magnification are cause for replacement of sensor assembly.

(d) Connector having cracked or missing insulating material is cause for replacement of sensor assembly.

(e) Resistance from either pin to ground less than 50 megohms is cause for replacement of sensor assembly.

(f) Resistance from pin to pin of sensor assembly which is not 3.0 to 7.0 ohms is cause for replacement of sensor assembly.

2. B. Inspect Bearing Support (See Figure 203)

(1) Check bearing bore in bearing support carrier for scoring, grooves, or distortion. Scoring which does not exceed 0.005 inch depth is acceptable.

(2) Replace bearing support if damage is sufficient to affect sealing.

(3) Relace part that does not meet Inspection/Check requirements.

C. Inspect Turbine Bearing (See Figure 203)

(1) Visually inspect outer diameter of bearing outer race for evidence of varnishing. Thoroughly clean bearing outer race and inner race in accordance with 72-00-00, CLEANING/PAINTING.

NOTE: To determine the extent of any damage, 6X to 10X magnification may be used.

(2) Using a bright light source, inspect as follows.

(a) Bearing separator wear in the cage web that is through the silver plate and has exposed base metal in excess of 20 percent of its wear length.

(b) Nicks, dents, scoring, or other obvious damage to bearing rollers and raceway.

(3) Replace part that does not meet Inspection/Check requirements.

D. Inspect Bearing Retainer (See Figure 203)

(1) Visually inspect inside diameter of bearing retainer for evidence of varnishing. Refer to 72-00-00, CLEANING/PAINTING, for removal of varnishing.

(2) Visually inspect retainer for cracks, nicks or burrs.

(3) (Post SB72-0089) Inside diameter of retainer shall have a surface finish of AA16 or better.

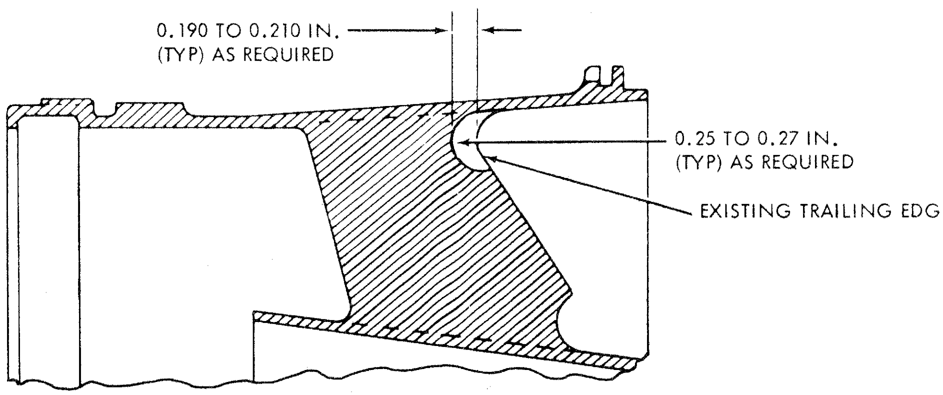
(4) Replace part that does not meet Inspection/Check requirements.

E. Inspect Seal Rotor (See Figure 203)

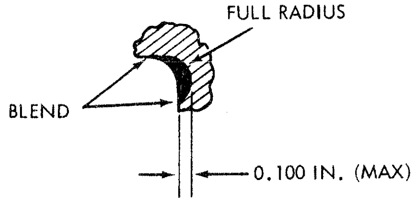
(1) Visually inspect rotor for wear or damage to chrome plate surface. No visible marks or scratches are permissible.

(2) Replace part that does not meet Inspection/Check requirements.

CAUTION: DO NOT CUT INTO OUTER WALL.



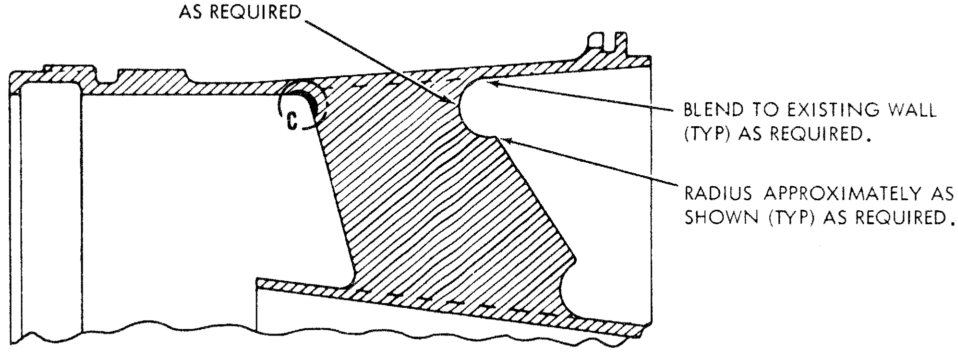
VIEW **A**



DETAIL **C**

NOTE: IF CRACKS DO NOT EXCEED 0.100 INCH MAXIMUM DEEP HAND FINISH TO REMOVE AS SHOWN (TYP) 12 PLACES.

CAUTION: DO NOT EXCEED MINIMUM WALL THICKNESS.



VIEW **B**

1. MACHINE PER VIEW A ON TRAILING EDGE.
2. HAND FINISH PER VIEW B IF CRACKS DO NOT EXCEED 0.100 INCH IN DEPTH.
3. MINIMUM WALL THICKNESS IS 0.070 INCH.

I-44A-1039

Repair of Rear Bearing Support Assembly Struts
Figure 208

2. F. Inspect Turbine Bearing Support Assembly (See Figure 204 and 208)

R NOTE: If the turbine bearing support assembly has two or more of the three struts cracked to the extent that the strut are separated from the inner cone, the engine must be returned to an overhaul facility for complete teardown.

R (1) Using following limiations, visually inspect support for cracks under strong light and 10X magnification.

R (a) If cracks are evident at junction of struts and inner cone in areas other than in rework areas shown in Figure 208, replace turbine bearing support assembly.

R (b) If any cracks extend through inner cone replace turbine bearing support assembly

R (c) Refer to Approved Repairs for allowable rework of cracks. Following rework of cracks, wall thickness of inner and outer cones shall not be less then 0.070 inch.

R (2) Visually inspect bolts, pins, nut and studs for security.

R (3) Replace part that does not meet Inspection/Check requirements.

R G. Visually Inspect Threads of Turbine Main Shaft For Damage.

R (1) If damage cannot be repaired by brushing with wire brush, return engine to overhaul facility for repair.

3. Cleaning/Painting

A. Clean Component Parts

(1) Refer to 72-00-00, GENERAL - CLEANING/PAINTING, for general cleaning instructions and for description of cleaning methods specified in Table 204.

NOTE: Reference shall be made to Table 204 for recommended cleaning method.

Table 204. Cleaning Methods

Figure No.	Item No.	Nomenclature	Cleaning Methods 1	2	3	4	5	6	7	8	9	10	11
All standard metallic hardware			X	X									
201	20	Probe Shield	X								X		
	25	ITT Sensor Assembly											X
203	15,20	Retainer		X									
	30,40	Bearing*											
	50	Mount		X									
	45	Thrust Ring		X									
	80	Support		X									
	85	Shim		X									
	100	Bearing*											
	115	Seal Rotor		X									
	120	Seal (PN 690279)	X										
	120	Seal (PN 896494)		X									
204	30	Support		X									
	35	Washer		X									

*Refer to 72-00-00, GENERAL - CLEANING/PAINTING, for special cleaning instructions.

4. Approved Repairs

A. Repair Turbine Bearing Support Assembly (See Figure 208)

(1) Polish out minor scoring on bearing support.

(2) Repair cracks in support assembly struts in accordance with Figure 208.

THIRD STAGE STATOR AND SECOND AND THIRD STAGE TURBINE WHEEL ASSEMBLIES - MAINTENANCE PRACTICES

1. Removal/Installation

NOTE: Table 201 provides a list of special tools, fixtures and equipment required for Removal/Installation. Table 202 provides a list of materials and compounds required for Removal/Installation.

Table 201. Special Tools, Fixtures and Equipment

Item No.	Nomenclature	Use	Source/ Part No.
NOTE: Equivalent substitutes may be used for listed items.			
1.	Mechanical Puller	Used to remove curvic from the main shaft.	284476-2-1
2.	Turbine Wheel Mechanical Puller	Used to remove third stage turbine wheel from second stage turbine wheel.	285845-1-1

Table 202. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Camel hair brush	Commercially available
High temperature compound (Fel-Pro C5-A)	Fel-Pro Inc, Div of Felt Products Mfg Co, 7450 N McCormick Blvd, Skokie, IL 60076
Plastic cap (NAS 816-268)	Commercially available
Solvent, Stoddard (Federal Specification P-D-680, Type I)	Commercially available
Violet master marker (Grade 127-1/2)	Pannier Corp, 207 Sandusky St, Pittsburgh, PA 15212

1. A. Remove Third Stage Stator Assembly and Second and Third Stage Turbine Wheel Assemblies (See Figure 201)

R (1) Disconnect ITT sensor assembly. Refer to 77-20-03, MAINTENANCE PRACTICES.

R (2) Remove rear turbine bearing oil line. Refer to 79-20-08, MAINTENANCE PRACTICES.

R (3) Remove air anti-ice valve and plumbing. Refer to 75-10-01, MAINTENANCE PRACTICES.

R (4) (Codes AB-AC, BB-BC, CB-GA, KA LA) Remove plenum pressure plumbing. Refer to 73-10-13, MAINTENANCE PRACTICES.

R (5) Remove fuel flow divider and drain valve. Refer to 73-10-07, MAINTENANCE PRACTICES.

R (6) Remove fuel manifold and nozzle assembly. Refer to 73-10-09 MAINTENANCE PRACTICES.

R (7) Remove ignition leads and igniter plugs. Refer to 74-20-01, MAINTENANCE PRACTICES.

R (8) (Codes BA-CC, EA, GA, KA) Remove fireshields. Refer to 71-30-01, MAINTENANCE PRACTICES.

R (9) Remove oil inlet retainer shield assembly. Refer to 72-50-01, MAINTENANCE PRACTICES.

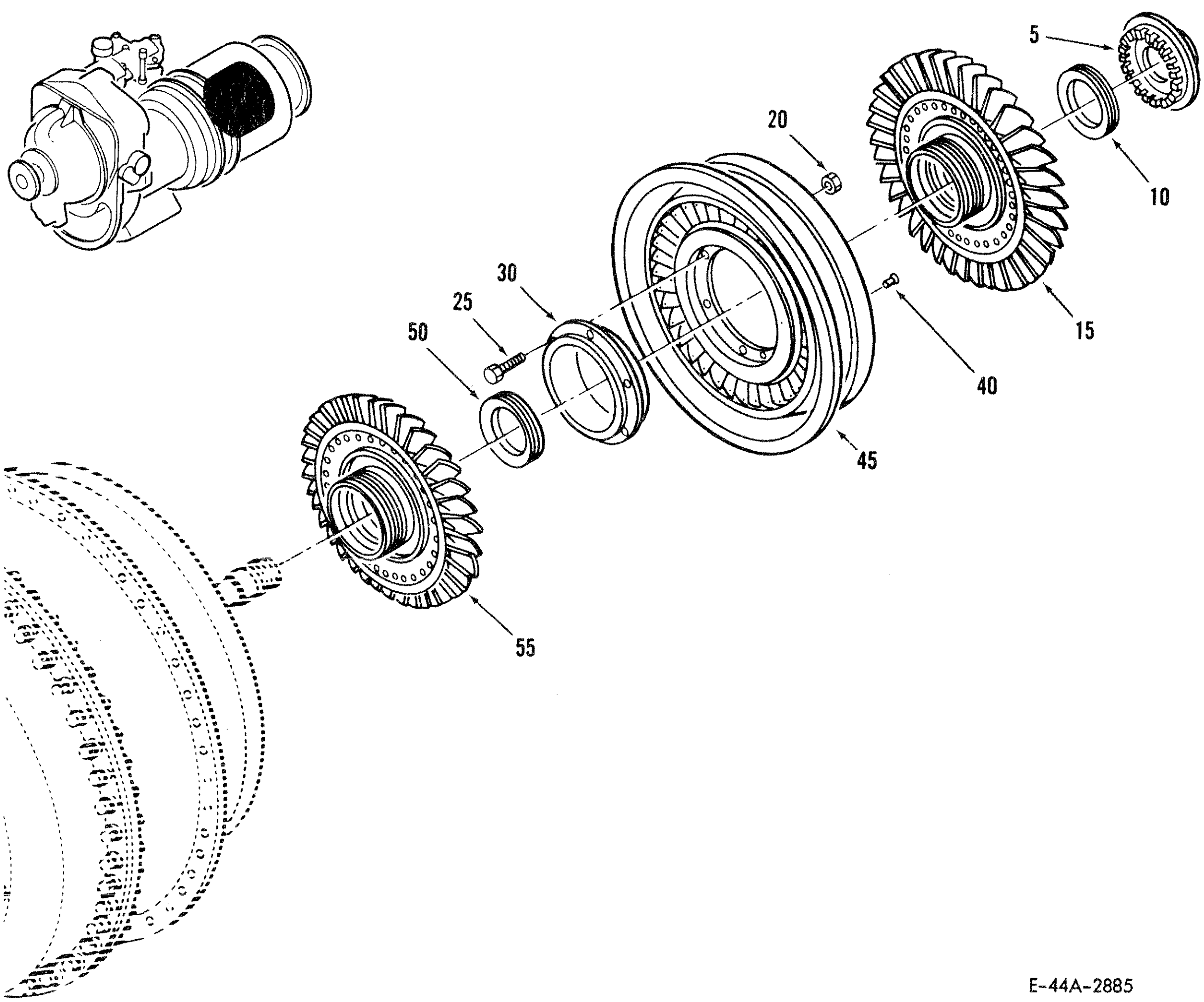
R (10) Remove tail cone. Refer to 72-50-02, MAINTENANCE PRACTICES.

R (11) Remove turbine oil inlet tube and oil jet. Refer to 72-50-03, MAINTENANCE PRACTICES.

R (12) Remove turbine scavenge pump assembly. Refer to 72-50-04, MAINTENANCE PRACTICES.

R (13) Remove exhaust pipe assembly. Refer to 72-50-05, MAINTENANCE PRACTICES.

R (14) Remove turbine plenum assembly and combustion chamber assembly. Refer to 72-40-01, MAINTENANCE PRACTICES.



R 5. CURVIC COUPLING (IPC FIG. 184)
10. GASKET
15. THIRD STAGE WHEEL ASSY
20. NUT
25. BOLT
30. SEAL ASSY
40. RIVET
45. STATOR ASSY
50. GASKET
55. SECOND STAGE WHEEL ASSY

Third Stage Stator and Second and Third
Stage Turbine Wheel Assembly Installation
Figure 201

R 1. A. (15) Remove ITT sensor assembly (single piece) turbine bearing and bearing support (carrier) assembly and bearing support assembly. Refer to 72-50-06, MAINTENANCE PRACTICES.
R
R

CAUTION: PRIOR TO REMOVAL OF CURVIC COUPLING OR TURBINE WHEEL ASSEMBLIES, MARK AN INDEX LINE USING MASTER MARKER (GRADE 127-1/2) BETWEEN EACH COMPONENT AND MAIN SHAFT TO SHOW RELATIONSHIP. ASSURE EACH PART IS REINSTALLED IN SAME RELATIVE POSITION TO MAIN SHAFT.

(16) Before removing each curvic coupling and turbine wheel, mark an index line using master marker (Grade 127-1/2) between each component and main shaft to show relationship. Indexing is necessary to assure that each part is reinstalled in same relative position to main shaft from which it was removed.

CAUTION: INSTALL PLASTIC CAP (NAS 816-268) OVER CURVIC FOR PROTECTION.

(17) Remove curvic coupling using 284476-2-1 puller. Remove curvic coupling gasket.

(18) Carefully remove third stage turbine wheel assembly using 285845-1-1 puller, if necessary.

(19) Carefully remove third stage stator assembly. Remove nuts and bolts securing seal assembly to third stage stator and remove seal assembly. Remove second stage turbine wheel assembly and curvic coupling gasket.

(20) Refer to 72-50-08, MAINTENANCE PRACTICES, for further disassembly of engine.

R NOTE: Refer to 70-00-00, STANDARD PRACTICES, for recom-
R mended general torque values. Add frictional drag
R (run-down) torque of self-locking devices to recom-
R mended values.

Apply high temperature compound (Fel-Pro C5-A) to threads of bolts, screws and nuts prior to installation.

1. B. Install Third Stage Stator Assembly and Second and Third Stage Turbine Wheel Assemblies (See Figure 201)

CAUTION: ENSURE THAT CURVIC COUPLING GASKET WITH FOUR HOLES IS INSTALLED INTO SECOND STAGE TURBINE WHEEL ASSEMBLY AND THAT HOLES IN GASKET FACE TOWARD REAR OF ENGINE.

R ENSURE THAT PROTECTIVE COVERINGS ARE REMOVED FROM
R TURBINE WHEEL KNIFE SEALS PRIOR TO INSTALLATION OF
R TURBINE WHEEL.

NOTE: Engine must be rotated in stand so that air inlet is down and turbine end up. This position is necessary to ensure that the rotating group is loaded forward during assembly.

(1) Install second stage turbine wheel over shaft using caution to align index marks. Install curvic coupling gasket with four holes facing turbine end of main shaft into second stage turbine wheel.

NOTE: Brush mating curvic surfaces of turbine wheels and curvic couplings with camel hair brush, rinse with soap and water or solvent, Stoddard (Federal Specification P-D-680, Type I).

(2) Install seal assembly into third stage stator assembly. Secure with bolts and nuts. Install nuts toward rear of engine. Tighten nuts (20, figure 201) to 20 inch-pounds torque.

(3) Install third stage stator assembly onto second stage stator assembly. It may be necessary to temporarily remove the three "C" clamps to allow flanges of the two stator assemblies to mate flush inside locking nut.

R CAUTION: ENSURE THAT PROTECTIVE COVERINGS ARE REMOVED
R FROM TURBINE WHEEL KNIFE SEALS PRIOR TO INSTAL-
R LATION OF TURBINE WHEEL.

(4) Install third stage turbine wheel to second stage turbine wheel using caution to align index marks.

CAUTION: ENSURE THAT CURVIC COUPLING GASKET WITH FOUR HOLES IS INSTALLED INTO THIRD STAGE TURBINE WHEEL ASSEMBLY AND THAT HOLES IN GASKET FACE TOWARD REAR OF ENGINE.

1. B. (5) Install curvic coupling gasket with four holes facing turbine end of main shaft into third stage turbine wheel.

(6) Heat aft curvic coupling at 149C (300F) for five minutes and assemble on shaft against third stage turbine wheel using caution to align index marks.

(7) Install interstage turbine temperature sensor assembly (single piece), turbine bearing and bearing support (carrier) assembly and bearing support assembly components. Refer to 72-50-06, MAINTENANCE PRACTICES.

2. Inspection/Check

A. Inspect Aft Curvic Coupling (See Figure 201)

(1) Visually inspect coupling. No visible damage is permitted. If damage is indicated refer to Approved Repairs.

B. Inspect Curvic Coupling Gaskets (See Figure 201)

R (1) Visually inspect curvic coupling gaskets for nicks, deformation,
R hanging burrs, kinks or other obvious damage.

(2) Replace part that does not meet Inspection/Check requirements.

C. Turbine Seal Assembly (See Figure 201)

(1) Inspect seal grooves. Adjacent grooves shall have no connecting paths.

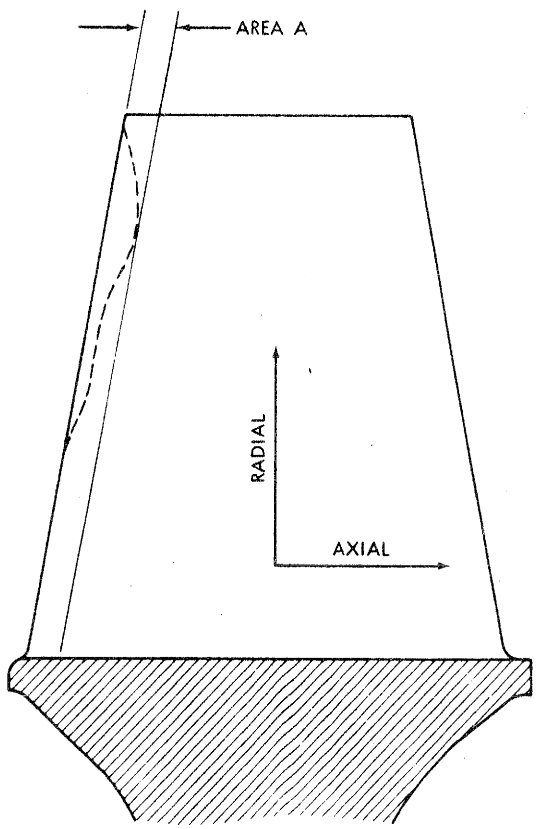
(2) Inspect for separation between felt metal and bonding surface. Evidence of separation is cause for rejection. Inspect for broken bonds or missing material. Evidence of either of these conditions is cause for rejection.

(3) Replace part that does not meet Inspection/Check requirements.

D. Inspect Third Stage Turbine Wheel Assembly (See Figures 201, 202, 203 and 204)

R (1) Visually inspect coupling teeth for damage. No visible damage is
R permissable. Refer to Approved Repairs.

R (2) Inspect for nicks and erosion on blade leading edges (see figures
R 202 and 203 for limits). Inspect for damage on blade trailing
R edges (see figure 203 for limits). Refer to Approved Repairs.



R

NOTE: EROSION OF ANY RADIAL LENGTH ON BLADE LEADING EDGE IN AREA A IS ACCEPTABLE PROVIDED IT DOES NOT EXCEED 0.125 INCH AXIAL.

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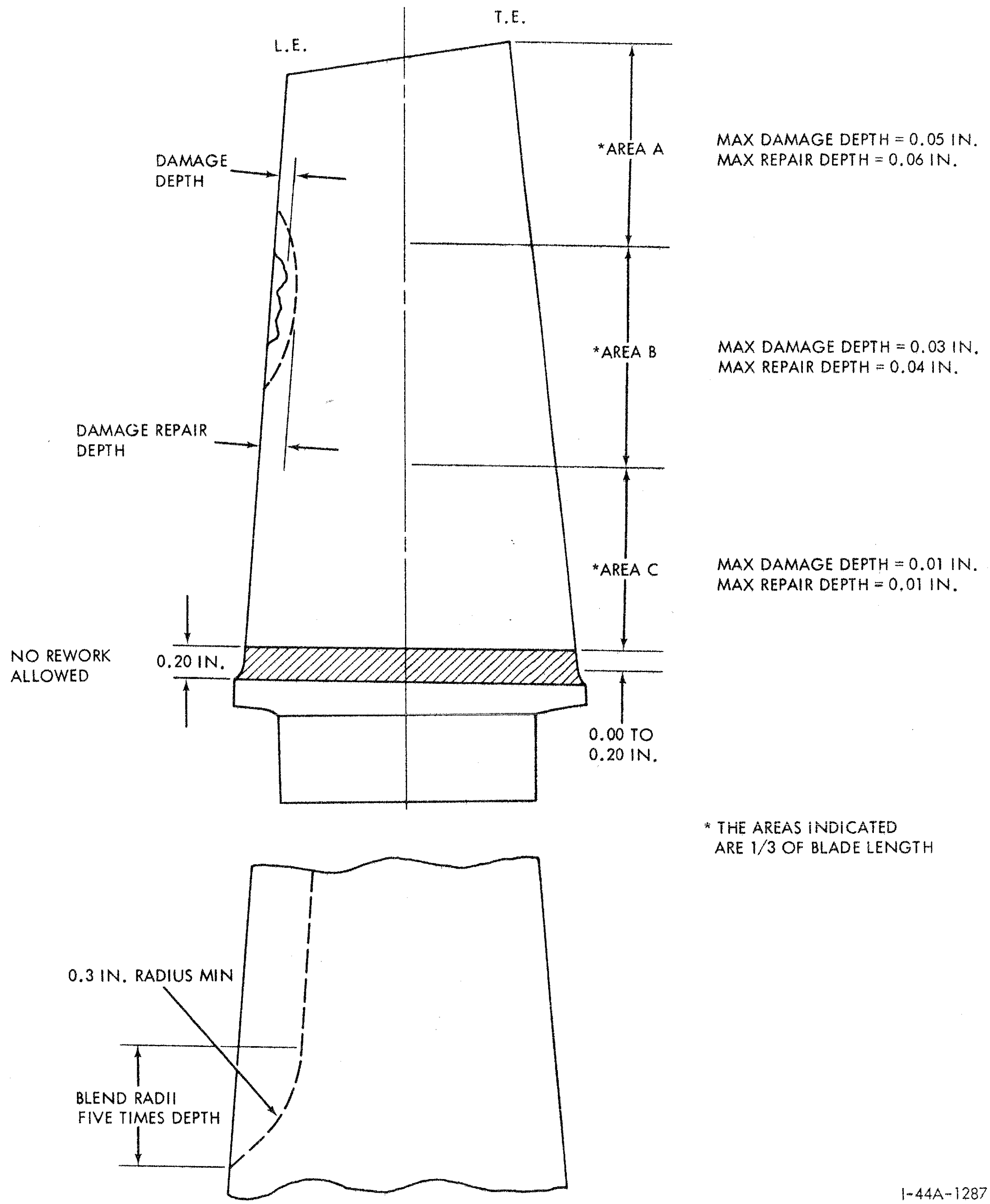
Inspection and Repair of Third Stage Turbine
Wheel Blade Leading Edge Erosion
Figure 202



Inspection and Repair of Second and Third Stage
Turbine Wheel Blades
Figure 203

NOTE: Clean turbine wheel assembly in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 9. Do not glass bead peen or abrasive blast.

2. D. (3) Visually inspect rivets. Loose or distorted rivets are acceptable unless flare of rivet is distorted over 50 percent of the diameter.

(4) Inspect for cracks adjacent to turbine wheel rivet holes as follows.

Reason: Analytical data indicated that for turbine wheels with a life determined by cycles, the conservative life cycle limits imposed on the turbine rotors obviates the requirement for detailed microscopic examination of the rivet hole areas.

(a) For turbine wheels with their life limit established by cycles, visually inspect for cracks adjacent to every rivet hole on both sides of turbine wheel. Observe susceptible area, Figure 204. No cracks allowed.

(b) For turbine wheels with their life limit established by operating hours, visually inspect for cracks adjacent to every rivet hole on both sides of turbine wheel. Observe crack susceptible area, Figure 204. Inspection shall be accomplished using high intensity light and 10 power magnification. No cracks allowed.

(5) Replace part that does not meet Inspection/Check requirements.

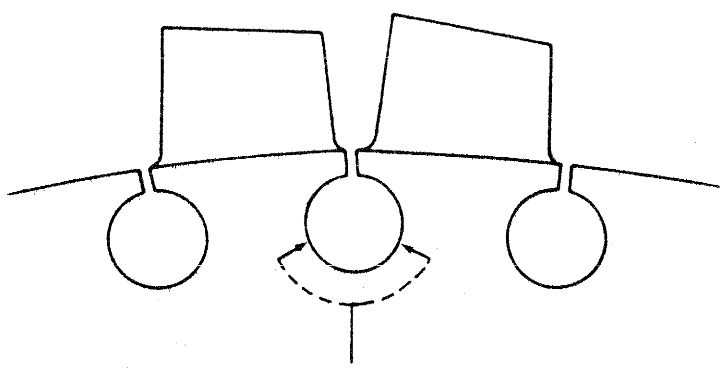
E. Inspect Second Stage Turbine Wheel Assembly (See Figure 201, 203, 204 and 205)

(1) Visually inspect coupling teeth for damage. No visible damage is permissible. Refer to Approved Repairs.

(2) Inspect for nicks and erosion on blade leading edges and blade tips. See Figures 203 and 205 for limits.

(3) Measure erosion on blade tips of second stage turbine wheel assembly from trailing edge to leading edge of blade (See View A-A, figure 205). Turbine wheel is acceptable provided 0.800 inch remains.

(4) Loose or distorted rivets are acceptable unless flare of rivet is distorted over 50 percent of the diameter.



NOTE: ABOVE ILLUSTRATION SHOWS CRACK SUSCEPTIBLE AREA. INSPECT FOR VERY FINE HAIRLINE CRACKS. NO CRACKS ARE PERMITTED IN ANY AREA OF TURBINE WHEEL ASSEMBLY.

I-44A-1309RI

Inspection of Second and Third Stage Turbine
Wheels for Cracks
Figure 204

R

NOTE: Clean turbine wheel assembly in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 9. Do not glass bead peen or abrasive blast.

1. E. (5) Inspect for cracks adjacent to turbine wheel rivet holes as follows.

Reason: Analytical data indicates that for turbine wheels with a life determined by cycles, the conservative life cycle limits imposed on the turbine rotors obviates the requirement for detailed microscopic examination of the rivet hole areas.

(a) For turbine wheels with a life limit established by cycles, visually inspect for cracks adjacent to every rivet hole on both sides of turbine wheel. Observe crack susceptible area, Figure 204. No cracks allowed.

(b) For turbine wheels with their life limit established by operating hours, visually inspect for cracks adjacent to every rivet hole on both sides of turbine wheel. Observe crack susceptible area, Figure 204. Inspection shall be accomplished using high intensity light and 10 power magnification. No cracks allowed.

(6) Replace part that does not meet Inspection/Check requirement or is damaged beyond repair.

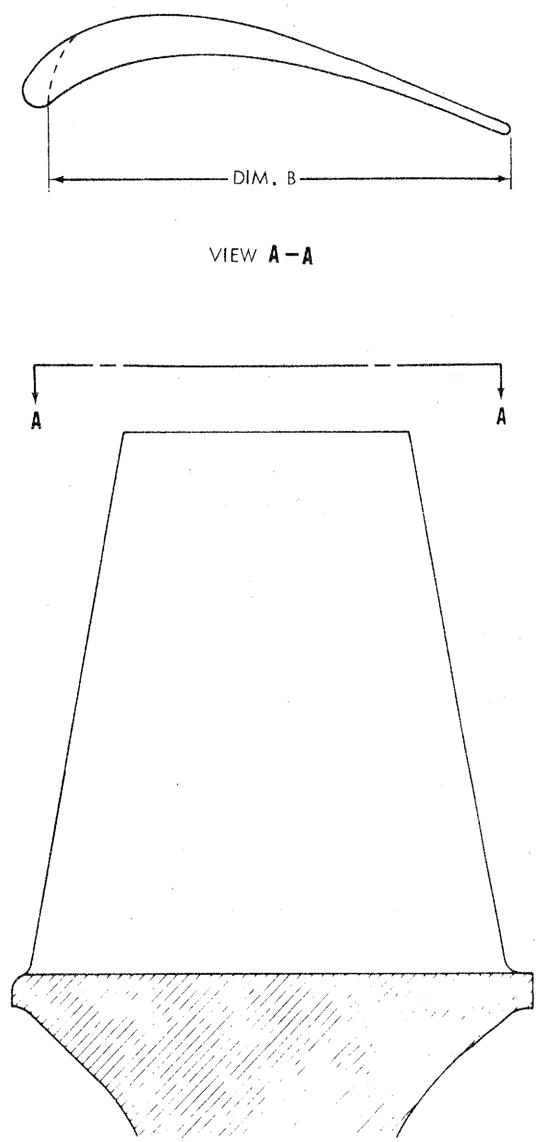
F. Inspect Third Stage Stator Assembly (See Figure 201, 206 and 207)

(1) Visually inspect stator assembly for cracks, warpage or distortion, and other damage. Warpage of vanes is acceptable as long as crack limitations are met. Cracks are not permitted in any portion of the stator except in the vanes.

(2) Inspect vanes for cracks. Any combination of crack pictorial geometry as shown in Figure 206 is acceptable. Observe following limits.

R (a) One crack in each of eight vanes maximum is permitted,
R provided any crack does not exceed 0.500 inch in length in ax-
R ial component.

R (b) Maximum of two cracks permitted in each of any of three vanes
R within the eight vanes provided cracks are non-intersecting
R and do not exceed 0.500 inch in length in axial component.

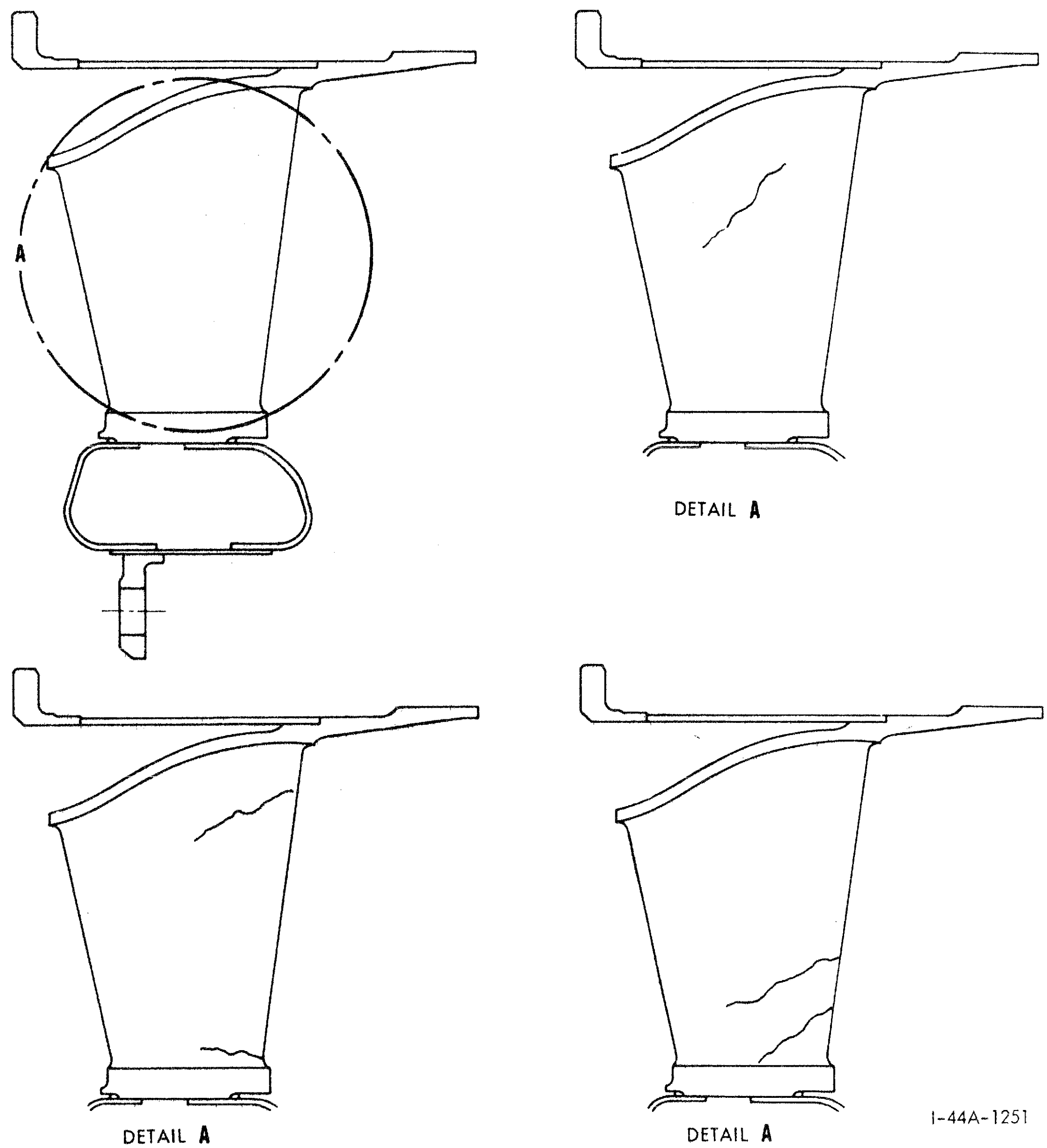


R

B
0.800 IN. MIN

1-44A-1845

Inspection of Second Stage Turbine Wheel Blade
Leading Edge Erosion
Figure 205



Inspection of Third Stage Turbine Stator
Assembly Crack Patterns
Figure 206

R 1. F. (3) Erosion at outer leading edges of all vanes, Figure 207, is acceptable, provided it does not exceed 0.250 inch axially and 0.250 inch radially.

R (4) Erosion on Surface D (convex side of vanes) is acceptable provided missing material limits of Dimensions B and C are not exceeded. (See figure 207.)

(5) Replace part that does not meet Inspection/Check requirements.

3. Cleaning/Painting

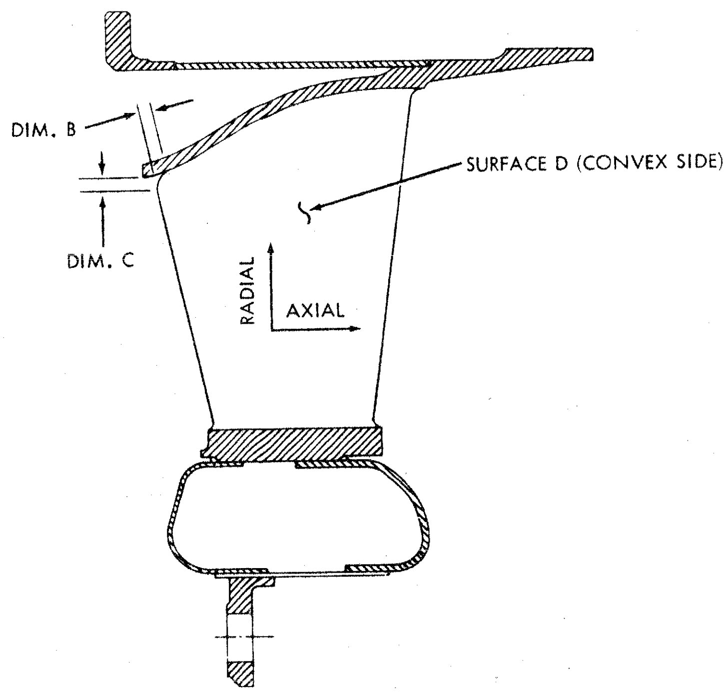
A. Clean Component Parts

(1) Refer to 72-00-00, GENERAL - CLEANING/PAINTING, for general cleaning instructions and for description of cleaning method specified in Table 203.

NOTE: Reference shall be made to Table 203 for recommended cleaning method.

Table 203. Cleaning Methods

Figure No.	Item No.	Nomenclature	Cleaning Method 1	2	3	9
All standard metallic hardware			X	X		
201	5	Curvic Coupling			X	
	10 50	Gasket	X			
	15	Third Stage Wheel Assembly				X
	30	Seal Assembly		X		
	45	Stator		X		
	55	Second Stage Wheel Assembly				X



R

EROSIONS OR MISSING MATERIAL 0.250 INCH AXIALLY AND 0.250 INCH RADIALLY MAXIMUM IS ACCEPTABLE IN OUTER LEADING EDGE OF ALL VANES.

EROSION ON SURFACE D (CONVEX SIDE OF VANES) IS ACCEPTABLE PROVIDED MISSING MATERIAL LIMITS OF DIMENSIONS B AND C ARE NOT EXCEEDED.

B	C
0.250 IN. MAX	0.250 IN. MAX

1-44A-1157R1

Inspection of Third Stage Turbine
Stator Assembly
Figure 207

4. Approved Repairs

NOTE: Table 204 provides a list of materials and compounds required for Approved Repairs.

Table 204. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed item.	
Abrasive (ST 70-ALO-512, ST 70-ALO-801)	Brightboy, Weldon Roberts, Newark. NJ

A. Repair Curvic Coupling (See Figure 201)

(1) Repair raised edged of coupling teeth by polishing with abrasive (ST 70-ALO-512, ST 70-ALO-801) in accordance with Figure 208.

B Repair Third Stage Turbine Wheel Assembly (See Figure 201)

(1) Repair raised edged of rear curvic by polishing with abrasive (ST 70-ALO-512, ST 70-ALO-801) in accordance with Figure 208.

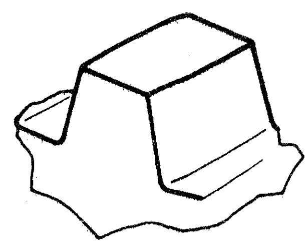
(2) Repair leading edge erosion by blending out eroded area. See Figure 202 for limits.

(3) Repair trailing edge nicks by blending out damaged area. See Figure 203 for limits.

C. Repair Second Stage Turbine Wheel Assembly (See Figure 201)

(1) Repair raised edges of rear curvic by polishing with abrasive (ST 70-ALO-512, ST 70-ALO-801) in accordance with Figure 208.

(2) Repair trailing edge nicks by blending out damaged area. See Figure 203 for limits.



REWORK ALLOWED ON EDGES AS DEPICTED BY DARK LINES ON SKETCH ABOVE.

RAISED METAL ON TOOTH EDGE SHALL NOT EXCEED 0.010 INCH PRIOR TO REWORK.

I-44A-1323

R

Repair of Curvic Coupling Teeth
Figure 208

FIRST STAGE TURBINE WHEEL FIRST AND SECOND STAGE STATOR ASSEMBLIES AND INTERSTAGE TURBINE TEMPERATURE SENSOR ASSEMBLY (MULTI-PIECE) - MAINTENANCE PRACTICES

1. Removal/Installation

NOTE: Table 201 provides a list of special tools, fixtures and equipment required for Removal/Installation. Table 202 provides a list of materials and compounds required for Removal/Installation.

Table 201. Special Tools, Fixtures and Equipment

Item No.	Nomenclature	Use	Source/ Part No.
NOTE: Equivalent substitutes may be used for listed items.			
1.	"C" Clamp Set	Used to hold support and combustor liner together when measuring wheel to shroud clearances.	284496-1-1
2.	Stator Puller	Used to separate the stator assembly from the liner assembly.	285524-1-1
3.	Bolt Retainer Ring Clamp	Used to retain bolts in stator and liner assembly while assembling second stage stator.	287423-1-1
4.	Shroud Puller	Used to remove shroud segments from stator and liner assembly.	287440-1-1
5.	Curvic Coupling Gage	Used to establish alignment between damaged center curvic coupling and new center curvic coupling.	291247-1-1

Table 202. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Camel hair brush	Commercially available
Emergy paper (320 Grit)	Commercially available
High temperature compound (Fel-Pro C5-A)	Fel-Pro Inc, Div of Felt Products Mfg, Co, 7450 N McCormick Blvd, Skokie, IL 60076
Hydrochloric acid (HCl)	Commercially available
Plastic cap (NAS 816-268)	Commercially available
Power (Sermetal PBX)	Teleflex Inc, Sermetal Div, P.O. Box 218, N Wales, PA 19454
Solvent (Sermetal P)	Teleflex Inc, Sermetal Div, P.O. Box 218, N Wales, PA 19454
R Solvent, Stoddard (Federal R Specification P-D-680, Type I)	Commercially available
Syringe	G.E. Electronics Div of Hydrometals Inc, Rockport, IL 61101
1,1,1-Trichloroethane (MIL-T-81533)	Commercially available
Violet master marker (Grade 127-1/2)	Pannier Corp, 207 Sandusky St, Pittsburgh, PA 15212

R 1. A. Disassemble Engine to Accomplish Required Maintenance

R (1) Disconnect ITT sensor assembly. Refer to 77-20-03, MAINTENANCE
R PRACTICES.

R (2) Remove rear turbine bearing oil line. Refer to 79-20-08, MAINTEN-
R ANCE PRACTICES.

R (3) Remove air anti-ice valve and plumbing. Refer to 75-10-01, MAIN-
R TENANCE PRACTICES.

R 1. A. (4) (Codes AB-AC BB-BC, CA-GA, KA, LA) Remove plenum pressure
R plumbing. Refer to 73-10-13, MAINTENANCE PRACTICES.

R (5) Remove fuel flow divider and drain valve. Refer to 73-10-07, MAIN-
R TENANCE PRACTICES.

R (6) Remove fuel manifold and nozzle assembly. Refer to 73-10-09, MAIN
R TENANCE PRACTICES.

R (7) Remove ignition leads and igniter plugs. Refer to 74-20-01, MAIN-
R TENANCE PRACTICES.

R (8) (Codes BA-CC, EA, GA, KA) Remove fireshields. Refer to 71-30-01,
R MAINTENANCE PRACTICES.

R (9) Remove oil inlet retainer shield assembly. Refer to 72-50-01,
R MAINTENANCE PRACTICES.

R (10) Remove tail cone. Refer to 72-50-02, MAINTENANCE PRACTICES.

R (11) Remove turbine oil inlet tube and oil jet. Refer to 72-50-03,
R MAINTENANCE PRACTICES.

R (12) Remove turbine scavenge pump assembly. Refer to 72-50-04, MAINTEN-
R ANCE PRACTICES.

R (13) Remove exhaust pipe assembly. Refer to 72-50-05, MAINTENANCE
R PRACTICES.

R (14) Remove turbine plenum assembly and combustion chamber assembly.
R Refer to 72-40-01, MAINTENANCE PRACTICES.

R (15) Remove ITT sensor assembly (single piece) turbine bearing and bear-
R ing support (carrier) assembly and bearing support assembly. Refer
R to 72-50-06, MAINTENANCE PRACTICES.

R (16) Remove third stage stator and second and third stage turbine wheel
R assemblies. Refer to 72-50-07, MAINTENANCE PRACTICES.

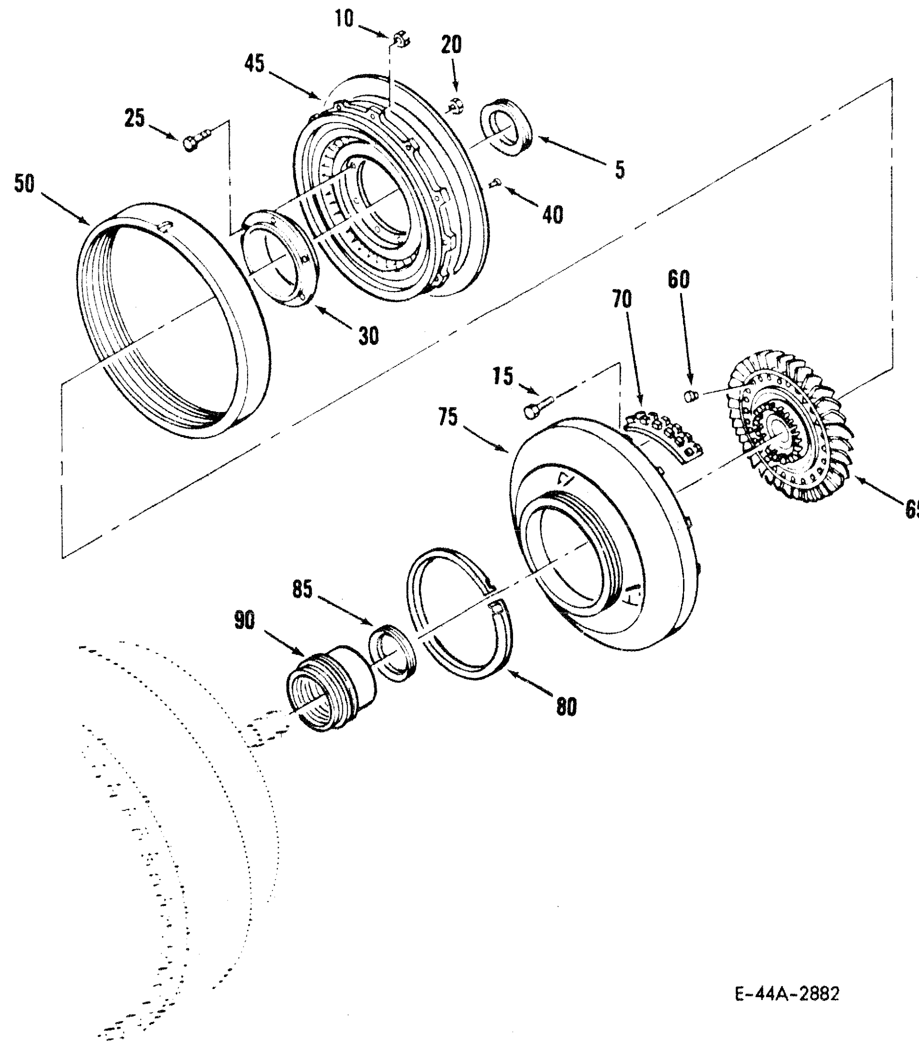
B. (Pre SB72-0052) Remove First Stage Turbine Wheel and First and Second Stage Stator Assemblies (See Figure 201)

(1) Remove curvic coupling gasket.

NOTE: Do not disassemble rivets from turbine wheel assemblies.

(2) Remove stator and liner assembly, first stage turbine wheel, and second stage stator assemblies as an assembly.

(3) Remove nuts and bolts securing second stage stator assembly and carefully remove stator using 285524-1-1 puller. Remove nuts and bolts securing seal assembly and remove seal assembly.



R 5. GASKET (IPC FIG. 190)
10. NUT
R 15. BOLT
R 20. NUT
25. BOLT
30. SEAL ASSY
40. RIVET
R 45. SECOND STAGE STATOR
R ASSY
50. NUT
60. RIVET
65. FIRST STAGE TURBINE WHEEL ASSY
70. SHROUD
75. STATOR AND LINER ASSY
80. SEAL RING
85. GASKET
90. CURVIC COUPLING

R (Pre SB72-0052) First Stage Turbine Wheel and First and Second Stage Stator Assembly Installation
Figure 201

1. B. (4) (Pre SB72-0042) Remove interstage turbine temperature (ITT) system (multi-piece) as follows. (See figure 202.)

NOTE: Do not remove ITT system unless a malfunction or visible damage is indicated. Refer to Inspection/Check.

(a) Locate the open ends of the bus bar assemblies (two o'clock position looking forward) and mark a line using master marker (Grade 127-1/2) (orientation mark) on the second stage stator midway between the open ends. This reference point is necessary to ensure orientation of the bus bars to clear the flanges on the first and second stage stators.

(b) Remove harness lead wire from clips. Remove screws and nuts from bus bar terminals, then remove ITT harness assembly. Remove bolts and washers securing probe sensors to second stage stator assembly, then remove clip rings.

(c) Remove probes and bus bar assemblies from second stage stator assembly beginning with number 1 or 12 probe position (two o'clock looking forward) and working around stator. As each probe is removed, normal cracking and/or crumbling of the ceramic cement potting material will occur. Remove probe gaskets. Separate clamps from probes and two bus bar assemblies.

WARNING: CLEANING SHALL BE PERFORMED IN A CLEAN, WELL-VENTILATED ROOM. RUBBER GLOVES AND PROTECTIVE CLOTHING SHALL BE WORN. EXTINGUISHERS AND VAT OR TANK COVERS SHALL BE ON HAND IN CASE OF FIRE.

(d) Completely remove old ceramic cement from terminals of each probe and from affected part of each bus bar assembly. Use suitable scraper and wire brush. After removal of old cement, thoroughly clean probe/bus areas with 1,1,1-Trichloroethane and swab contaminated surfaces with concentrated hydrochloric acid (HCl). Clean oxidation from all contact surfaces with emery paper (320 Grit), then swab with concentrated hydrochloric acid (HCl).

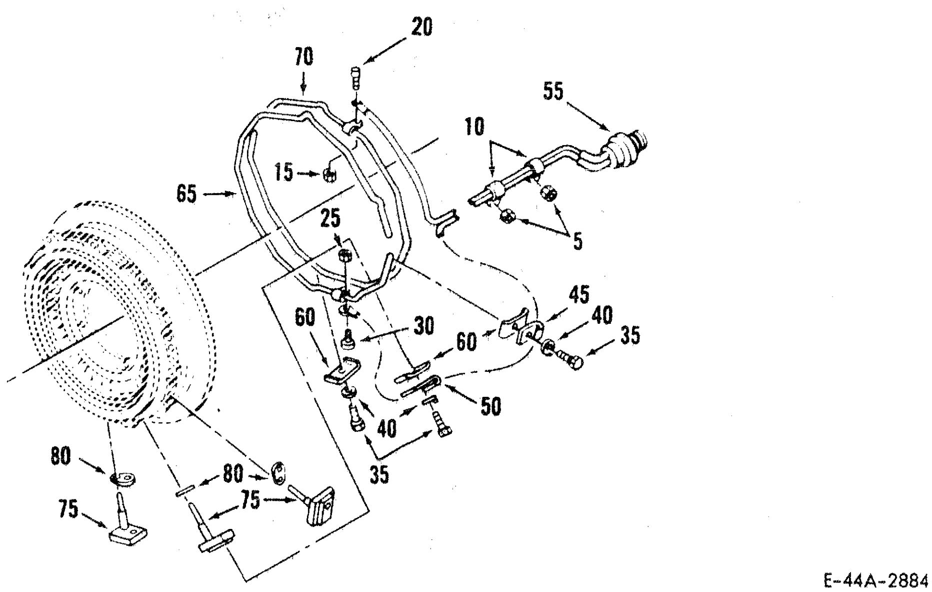
CAUTION: INSTALL A PLASTIC CAP (NAS 816-268) OVER TURBINE WHEEL CURVICS.

(5) Remove nut (50, figure 201). Remove first stage turbine wheel assembly and first stage stator and liner assembly. Remove shrouds from stator and liner assembly using 287440-1-1 puller

(6) Remove seal ring and gasket.

CAUTION: WHEN REMOVING CURVIC COUPLING FROM MAIN SHAFT FOR ANY REASON, INDEX CURVIC COUPLING SPLINE TO MAIN SHAFT WITH MASTER MARKER (GRADE 127-1/2).

1. B. (7) Index curvic coupling center spline to main shaft using master marker (Grade 127-1/2). Indexing is necessary to assure that the curvic coupling is reinstalled in the same relative position to the main shaft from which it was removed. Remove curvic coupling.



R 5.	NUT (IPC FIG. 187)	45.	CLIP
10.	CLAMP	50.	SUPPORT
15.	NUT	55.	WIRING HARNESS
20.	SCREW	60.	CLAMP
25.	NUT	65.	BUS BAR
30.	SCREW	70.	BUS BAR
35.	BOLT	75.	PROBE SENSOR
40.	WASHER	80.	GASKET

R (Pre SB72-0042) Interstage Turbine Temperature
Sensor Assembly Installation
Figure 202

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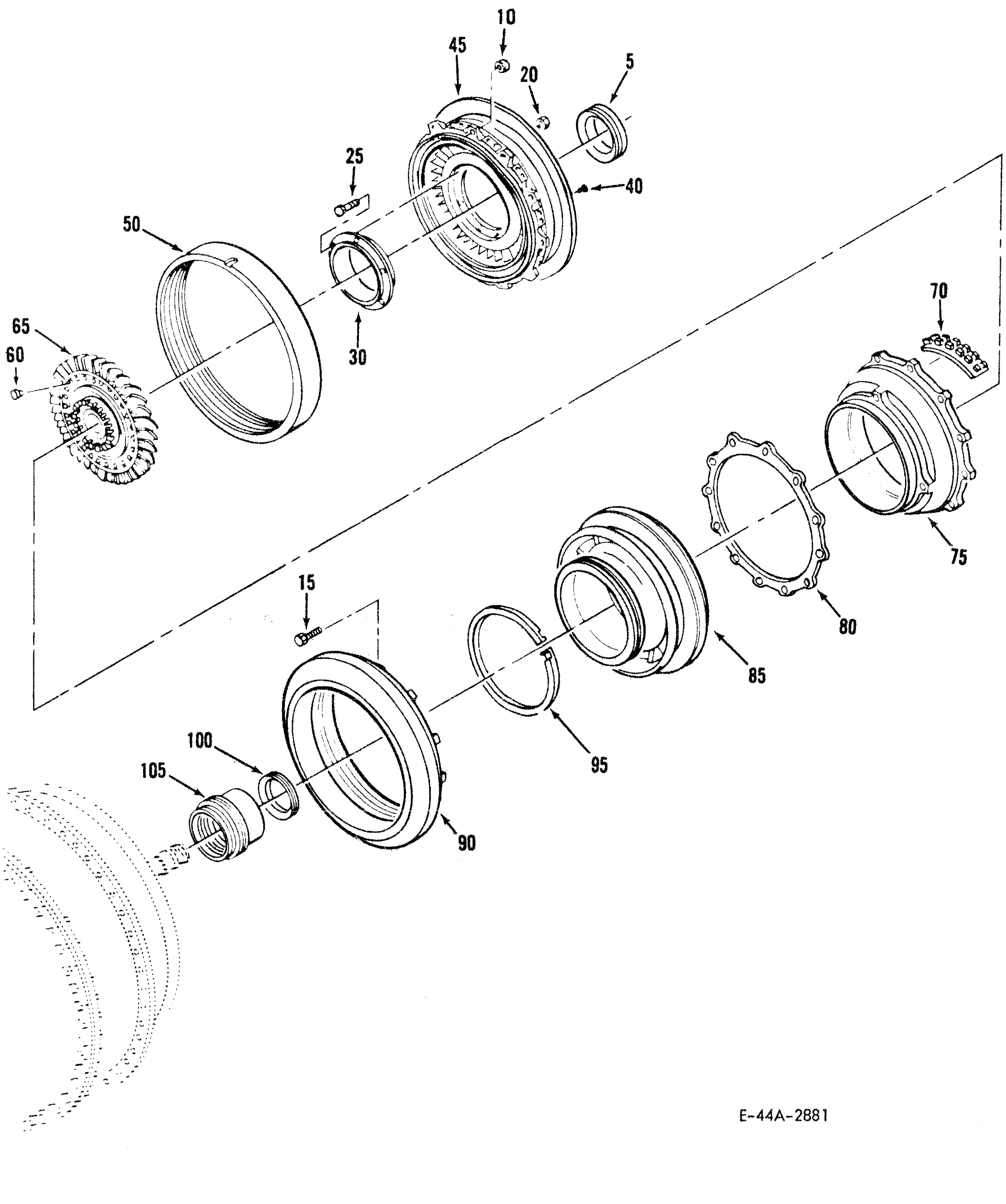


R

(Post SB72-0052) First Stage Turbine Wheel
and First and Second Stage
Stator Assembly Installation
Figure 203

1. C. (Post SB72-0052) Remove First Stage Turbine Wheel and First and Second Stage Stator Assemblies (See Figure 203)

(1) Remove gasket from first stage turbine wheel assembly.

(2) Remove all remaining components except curvic coupling and gasket as on assembly and separate as follows.

(a) Remove nuts and bolts securing second stage stator assembly and carefully remove second stage stator assembly using 285524-1-1 puller.

(b) Remove nuts and bolts securing seal assembly to second stage stator assembly and remove seal assembly.

CAUTION: INSTALL A PLASTIC CAP (NAS 816-268) OVER TURBINE WHEEL CURVICS.

(c) Remove nut (55). Remove first stage turbine wheel assembly.

(d) Remove shrouds from turbine stator liner using 287440-1-1 puller, then remove turbine support, shim and first stage stator from transition liner. Remove ring seal.

(3) Remove gasket.

CAUTION: WHEN REMOVING CURVIC COUPLING FROM MAIN SHAFT FOR ANY REASON, INDEX CURVIC COUPLING SPLINE TO MAIN SHAFT WITH MASTER MARKER (GRADE 127-1/2).

(4) Index curvic coupling center spline to main shaft using master marker (Grade 127-1/2). Indexing is necessary to assure that the curvic coupling is reinstalled in the same relative position to the main shaft from which is was removed. Remove curvic coupling.

KEY TO FIGURE 203

R 5. GASKET (IPC FIG. 191)
R 10. NUT
15. BOLT
20. NUT
25. BOLT
R 30. SEAL ASSY
40. RIVET
R 45. SECOND STAGE STATOR ASSY
50. NUT
60. RIVET
65. FIRST STAGE TURBINE WHEEL ASSY
70. SHROUD
75. TURBINE SUPPORT
80. SHIM
85. FIRST STAGE STATOR
90. TRANSITION LINER
95. RING SEAL
100. GASKET
105. CURVIC COUPLING

CAUTION: MAINTAIN ENGINE IN VERTICAL POSITION (INTAKE DOWN) FOR ASSEMBLY PURPOSES AND TO MAINTAIN CURVIC RELATIONSHIP OF IMPELLERS.

NOTE: Apply high temperature compound (Fel-Pro C5-A) to threads of bolts, studs, and nuts prior to installation.

1. D. (Post SB72-0052) Install First Stage Turbine Wheel, and First and Second Stage Stator Assemblies (See Figure 203)

(1) Install curvic coupling on main shaft. Carefully align index mark on curvic coupling with index mark on engine main shaft.

(2) When replacement of curvic coupling is required, observe the following procedures.

R CAUTION: SOLVENT IS TOXIC AND FLAMMABLE. USE IN
R WELL-VENTILATED AREA. AVOID BREATHING
R FUMES OR LONG CONTACT WITH SKIN TO PREVENT
R DAMAGE TO PHYSICAL HEALTH. KEEP AWAY FROM
R FLAME TO AVOID FIRE HAZARD.

R (a) Brush curvics of damaged curvic coupling and curvics of
R 291247-1-1 coupling alignment gage with camel hair brush, then
R clean thoroughly with solvent, Stoddard (Federal Specification
R P-D-680, Type I). Loosen locking screws on gage and place
R curvic coupling on gage with forward end against gage teeth.
R Position ring on gage at the position in which the coupling
R teeth will fully bottom on the gage. Tighten locking screws
R on gage to 25 inch-pounds torque.

R (b) Mark shaft of gage adjacent to index mark placed on coupling
R prior to removing curvic coupling from engine, using master
R marker (Grade 127-1/2).

R (c) Using depth micrometer, measure from top of shaft of 291247-
R 1-1 coupling alignment gage to high tooth of curvic coupling
R (high tooth has "V" marking). Record reading.

R (d) Do not loosen locking screws on gage. Remove curvic coupling
R from gage.

WARNING SOLVENT IS TOXIC AND FLAMMABLE USE IN WELL-VENTILATED AREA. AVOID BREATHING FUMES OR LONG CONTACT WITH SKIN TO PREVENT DAMAGE TO PHYSICAL HEALTH. KEEP AWAY FROM FLAME TO AVOID FIRE HAZARD.

1. D. (2) (e) Brush curvics of new curvic coupling with camel hair brush, then thoroughly clean with solvent Stoddard (Federal Specification P-D-680, Type I). Place new curvic coupling on gage with forward end against gage teeth at the position in which curvic coupling will fully bottom on gage teeth.

(f) Take measurement with depth micrometer from top of gage to high tooth mark of curvic coupling (high tooth has "V" marking). Measurement shall be within 0.003 inch of that obtained on measurement of old coupling in step (c). If measurements does not agree within 0.003 inch, replace curvic coupling with new coupling and repeat measurement. Mark new curvic coupling adjacent to mark on shaft of gage to ensure same angular alignment as old coupling. Remove curvic coupling from gage.

(3) Assemble three piece first stage stator and liner assembly as follows. (See figures 203 and 204.)

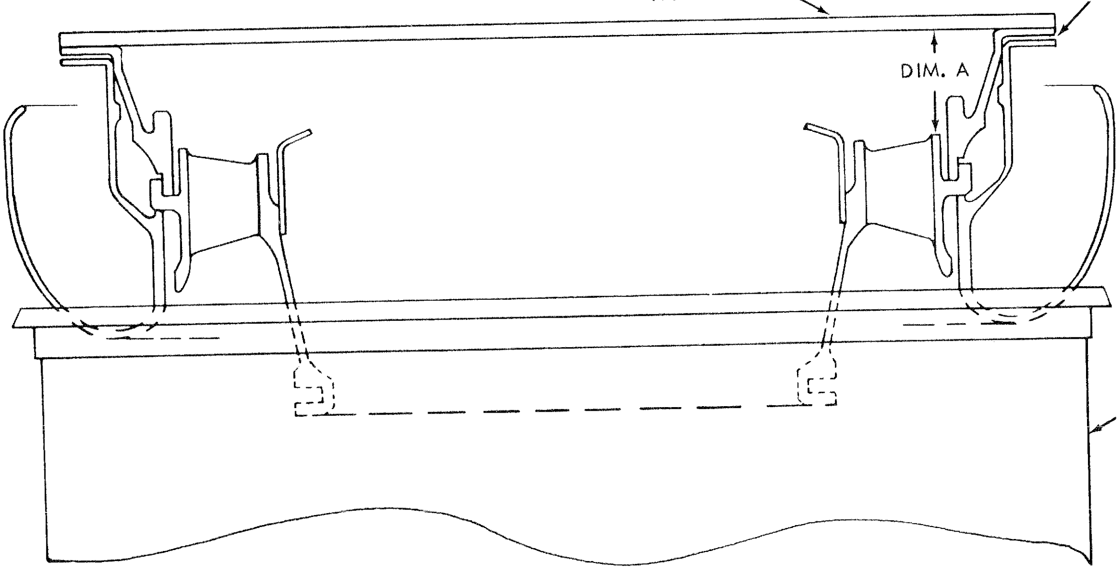
(a) Place transition liner, first stage stator and turbine support into position on exhaust pipe as shown in View A, Figure 204.

(b) With thickness gage, check space between flanges of turbine support and transition liner at three or more locations. Take the average of these readings and add 0.010 inch to that measurement (see figure 204, View A). Result equals total thickness of shims required to obtain 0.008 to 0.012 inch clearance between transition liner and first stage stator when all parts are finally assembled.

(c) Remove turbine support and install thickness of shims determined in step (b). Install turbine support on shims. Temporarily secure components using six bolts and nuts. Tighten nuts to approximately 20 inch-pounds torque.

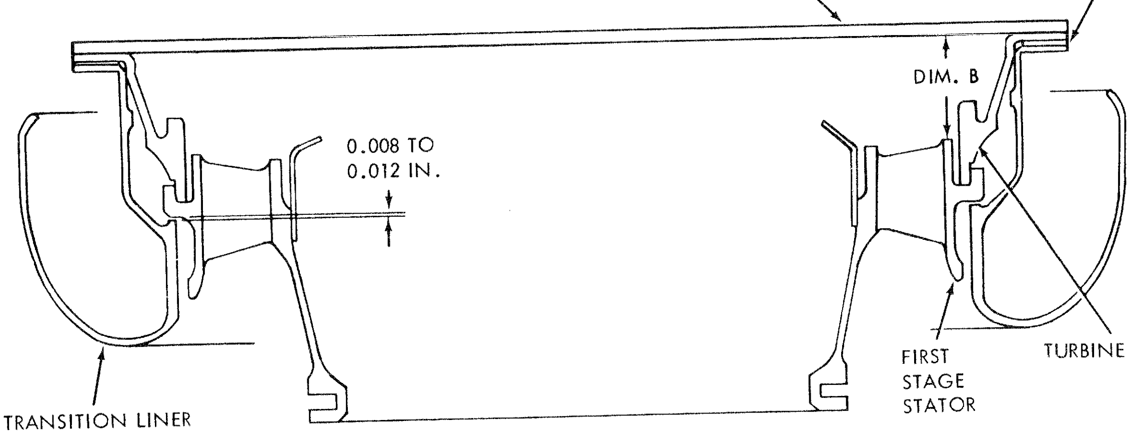
(d) Place a parallel bar across top of turbine support (see View A, figure 204). Measure from parallel bar to aft face of outer ring of first stage stator and record as Dimension A.

(e) Remove assembled components from exhaust pipe and position on work bench (see View B, figure 204). Again measure distance from parallel bar to aft face of outer ring of first stage stator and record as Dimension B.



R

VIEW A



VIEW B

1-44A-2067

R (Post SB72-00-52) Determining Shim Thickness for Three Piece First Stage Stator and Liner Assembly

Figure 204

R 1. D. (3) (f) Subtract Dimension B from Dimension A, obtained in step (d). Result equals clearance between transition liner and first stage stator. Required clearance is 0.008 to 0.012 inch. Remove bolts and nuts installed in step (c).

R (g) If clearance is not within limits, change thickness of shims as required.

R (h) Install shrouds in position on turbine support so that shrouds are placed at a pin location and centered. Install ring on first stage stator making sure that ends overlap lock ring in place.

R (i) Place all bolts through transition liner, shims and turbine support, then retain bolts in position using 287423-1-1 bolt retainer.

WARNING: SOLVENT IS TOXIC AND FLAMMABLE. USE IN WELL-VENTILATED AREA. AVOID BREATHING FUMES OR LONG CONTACT WITH SKIN TO PREVENT DAMAGE TO PHYSICAL HEALTH. KEEP AWAY FROM FLAME TO AVOID FIRE HAZARD.

(4) Brush mating curvic surfaces with a camel hair brush, then thoroughly clean with solvent, Stoddard (Federal Specification, P-D-680, Type I).

NOTE: If new aft curvic coupling and/or turbine wheel or wheels are installed, remove previously installed index marks on items to be reinstalled. Temporarily install the three turbine wheels and aft curvic coupling without gaskets using care to oppose "V" marks on mating curvic 180 degrees. Index curvic couplings on turbine wheels to main shaft using violet master marker.

(5) With stator and liner assembly still on work bench (impeller end down), place first stage turbine wheel into stator and liner assembly with thin part of blades up. Index mark on turbine wheel shall be visible.

(6) Install seal assembly into second stage stator assembly. Secure with bolts and nuts. Install nuts toward rear of engine. Tighten nut (20, figure 203) to 20 inch-pounds torque.

(7) Place stator locking nut with shouldered edge down and place second stage stator assembly with impeller end down inside locking nut. Lift up nut and secure to lip of second stage stator with three 284496-1-1 clamps.

1. D. (8) Install second stage stator assembly in first stage stator and liner assembly. Press down into correct position using hand pressure. Secure with bolts installed from bottom through mated flanges, and with nuts installed from top (toward rear of engine). Tighten nuts (10, figure 203) to 20 inch-pounds torque.

CAUTION: ENSURE THAT CURVIC COUPLING GASKET WITH NO HOLES IS INSTALLED INTO CURVIC COUPLING.

(9) Install curvic coupling gasket with no holes into curvic coupling, then place first stage stator and liner assembly, first stage turbine wheel and second stage stator assembly over shaft, using caution to align index marks on wheel assembly and curvic coupling.

CAUTION: ENSURE THAT CURVIC COUPLING GASKET WITH EIGHT HOLES IS INSTALLED INTO FIRST STAGE TURBINE WHEEL ASSEMBLY AND THAT HOLES IN GASKET FACE TOWARD REAR OF ENGINE.

(10) Install curvic coupling gasket with eight holes facing turbine end of main shaft into first stage turbine wheel.

(11) Install third stage stator and second and third stage turbine wheel assemblies. Refer to 70-50-07, MAINTENANCE PRACTICES.

E. (Pre SB72-0052) Install First Stage Turbine Wheel and First and Second Stage Stator Assemblies (See Figure 201)

(1) Install curvic coupling on main shaft. Carefully align index mark on curvic coupling with index mark on engine main shaft.

(2) When replacement of curvic coupling is required, observe the following procedures.

WARNING: SOLVENT IS TOXIC AND FLAMMABLE. USE IN WELL-VENTILATED AREA. AVOID BREATHING FUMES OR LONG CONTACT WITH SKIN TO PREVENT DAMAGE TO PHYSICAL HEALTH. KEEP AWAY FROM FLAME TO AVOID FIRE HAZARD.

R (a) Brush curvics of damaged curvic coupling and curvics of
R 291247-1-1 coupling alignment gage with camel hair brush, then
R clean thoroughly with solvent, Stoddard (Federal Specification
R P-D-680, Type I). Loosen locking screws on gage and place
R curvic coupling on gage with forward end against gage teeth.
R Position ring on gage at the position in which the coupling
R teeth will fully bottom on the gage. Tighten locking screws
R on gage to 25 inch-pounds torque.

R (b) Mark shaft of gage adjacent to index mark placed on coupling
R prior to removing curvic coupling from engine, using master
R marker (Grade 127-1/2).

1. E. (2) (c) Using depth micrometer, measure from top of shaft of 291247-1-1 coupling, alignment gage to high tooth of curvic coupling (high tooth has "V" marking). Record reading.

(d) Do not loosen locking screws on gage. Remove curvic coupling from gage.

WARNING: SOLVENT IS TOXIC AND FLAMMABLE. USE IN WELL-VENTILATED AREA. AVOID BREATHING FUMES OR LONG CONTACT WITH SKIN TO PREVENT DAMAGE TO PHYSICAL HEALTH. KEEP AWAY FROM FLAME TO AVOID FIRE HAZARD.

(e) Brush curvics of new curvic coupling with camel hair brush, then thoroughly clean with solvent, Stoddard (Federal Specification P-D-680, Type I). Place new curvic coupling on gage with forward end against gage teeth, at the position in which curvic coupling will fully bottom on gage teeth.

(f) Take measurement with depth micrometer from top of gage to high tooth mark of curvic coupling (high tooth has "V" marking). Measurement shall be within 0.003 inch of that obtained on measurement of old coupling in step (c). If measurements do not agree within 0.003 inch, replace curvic coupling with new coupling and repeat measurement. Mark new curvic coupling adjacent to mark on shaft of gage to ensure same angular alignment as old coupling. Remove curvic coupling from gage.

(3) Place first stage stator assembly on bench with impeller end up. Install seal ring on stator assembly making sure that ends overlap to lock the ring in place. Turn stator assembly over on work bench and install shrouds into stator with bolts.

WARNING: SOLVENT IS TOXIC AND FLAMMABLE. USE IN WELL-VENTILATED AREA. AVOID BREATHING FUMES OR LONG CONTACT WITH SKIN TO PREVENT DAMAGE TO PHYSICAL HEALTH. KEEP AWAY FROM FLAME TO AVOID FIRE HAZARD.

(4) Brush mating curvic surfaces with a camel hair brush, then clean thoroughly with solvent, Stoddard (Federal Specification P-D-680, Type I).

R CAUTION: TO PREVENT THE POSSIBILITY OF INSTALLING FIRST
R STAGE TURBINE WHEEL BACKWARDS, ENSURE THIN EDGE
R OF TURBINE BLADES FACE AFT.

NOTE: If new aft curvic coupling and/or turbine wheel or wheels are installed, remove previously installed index marks on items to be reinstalled. Temporarily install the three turbine wheels and aft curvic coupling without gaskets, using care to oppose "V" marks on mating curvic 180 degrees. Index curvic couplings on turbine wheels to main shaft using violet master marker (Grade 127-1/2).

1. E. (5) With stator and liner assembly still on work bench (impeller end down), place first stage turbine wheel into stator and liner assembly with thin part of blades up. Index marks on turbine wheel shall be visible.

(6) Install seal assembly into second stage stator assembly. Secure with bolts and nuts. Install nuts toward rear of engine. Tighten nuts (20, figure 201) to 20 inch-pounds torque.

(7) Place stator locking nut with shouldered edge down and place second stage stator assembly with impeller end down inside locking nut. Lift up nut and secure to lip of second stage stator with three 284496-1-1 clamps.

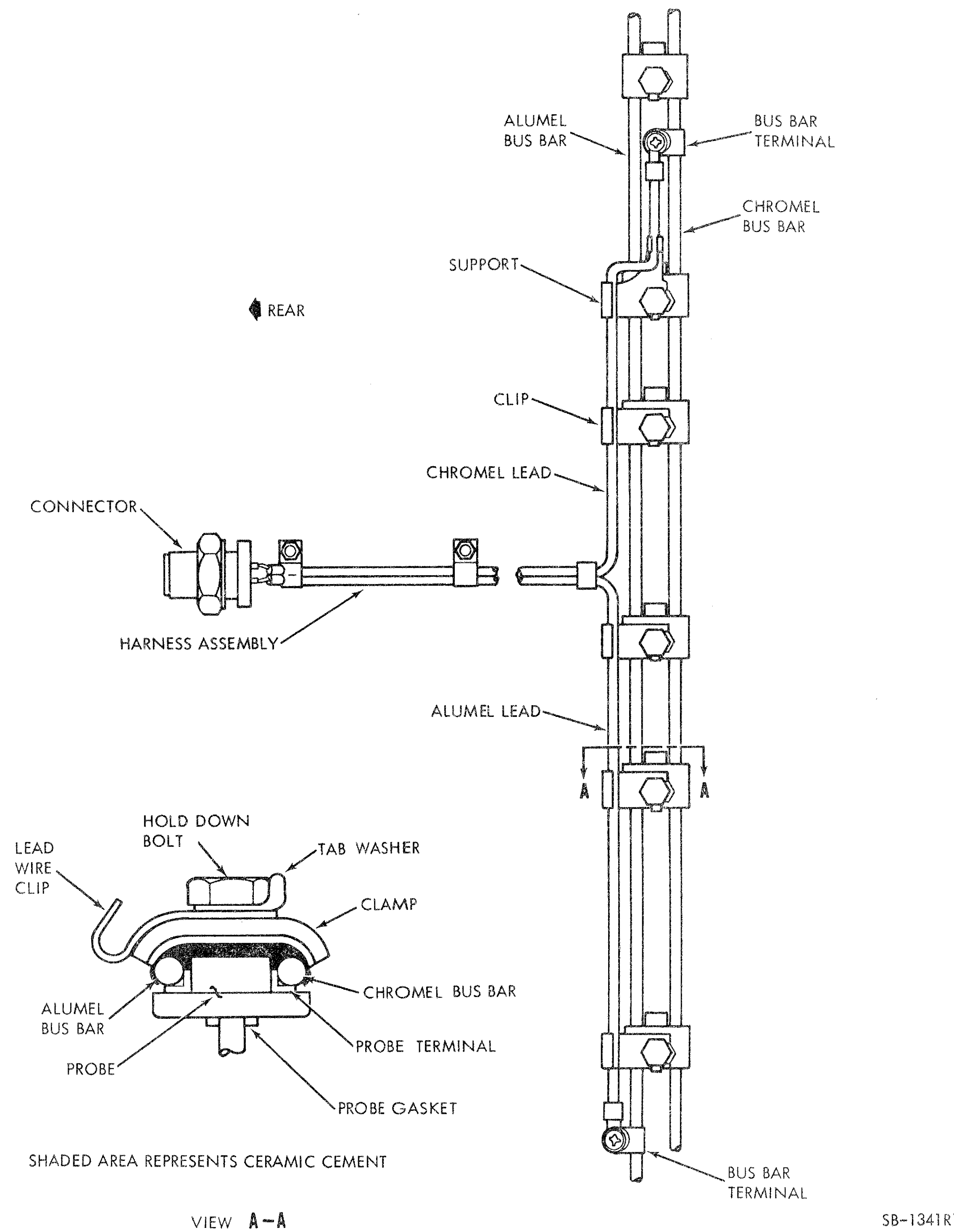
(8) (Pre SB72-0042) Install interstage turbine temperature (ITT) system in second stage stator assembly as follows. (See figure 202.)

CAUTION: MAKE SURE GASKETS COVER BOLT HOLES AND DO NOT SLIP OUT OF POSITION.

(a) Install twelve probe sensors with one gasket under each probe.

(b) Place the chromel non-magnetic bus bar assembly around the stator on the forward side of the probes with the terminal toward the rear of the engine as shown in Figure 205.

(c) Place the alumel magnetic bus bar assembly around the stator on the rear side of the probes with the terminal also toward the rear of the engine as shown in Figure 205. Open end of bus bar assembly shall be located adjacent to orientation mark placed on the stator during Removal/Installation.



R

(Pre SB72-0042) Installation of ITT Harness
and Bus Bars
Figure 205

NOTE: Coat hold down bolt with high temperature compound (Fel-Pro C5-A) prior to installation.

1 E. (8) (d) Position the two bus bars into the terminals of probe 7, Figure 206, and install one clamp and one clip with clip positioned toward rear of engine then install washer and bolt. Do not tighten bolt at this time. (See View A-A, figure 205.)

(e) Position the two bus bars into the terminals of probes 1 and 12, Figure 206. Install clamps (see figure 202), washers, and bolts. Probes 1 and 12 do not require clips.

(f) Position the two bus bars into terminals of remaining probes using clamps, washers, and bolts. Clips shall be positioned toward rear of engine.

(g) Before tightening probe hold down bolts, check the following.

1 That all probe gaskets are positioned properly.

2 That bus bars are positioned properly into probe terminal with respect to hold down clamps. Bus bar shall make 100 percent contact with both terminal and clamp.

3 That chromel (forward) bus bar has adequate clearance (0.080 inch minimum) between it and first stage stator bolt flange. (See View A-A, figure 206.)

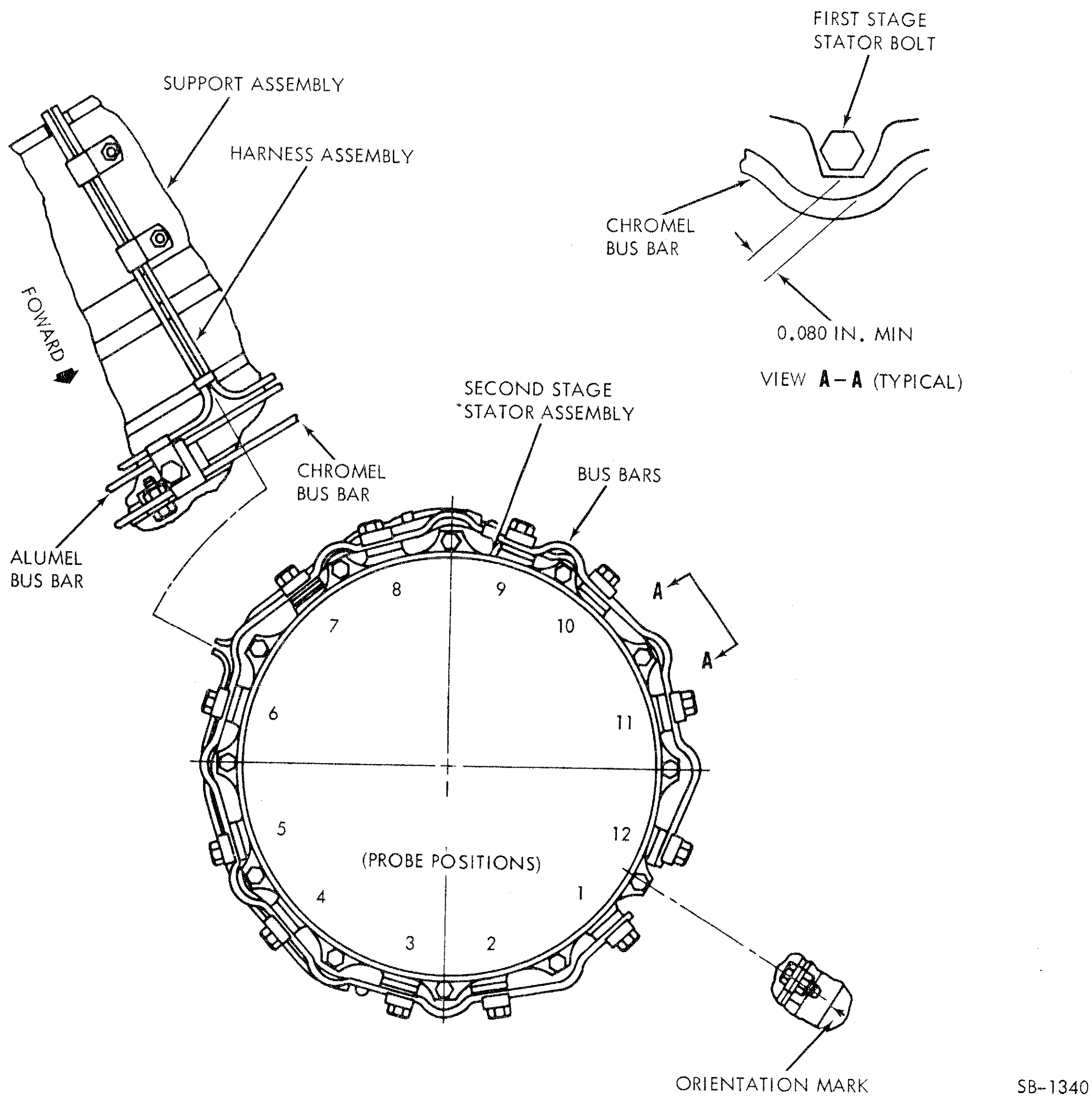
(h) Starting at probe 7 work toward both ends and tighten probe hold down bolts (35, figure 202) to 25 inch-pounds torque. Recheck conditions listed in step (g) above.

(i) Measure the resistance from the chromel bus bar terminal to the alumel bus bar terminal. Resistance shall be between 0.01 to 0.07 ohms. If resistance is within these limits, proceed to next step. If not, check the following.

1 Probe body sheet metal contacting bus bar. Correction: Remove metal from probe body to allow clearance to bus bar.

2 Bus bar not seated in terminal. Correction: Reposition bus bar.

3 Bus bar touching stator flange. Correction: Reposition bus bar.



R

(Pre SB72-0042) Installation of ITT
Probes and Bus Bars
Figure 206

1. E. (8) (j) Measure resistance from either bus bar terminal to ground. Resistance shall be greater than 75,000 ohms. If resistance meets this limit, proceed to next step. If not, check the following.

1 Remove, visually examine, clean, and replace each hold down clamp one at a time. Recheck resistance after each operation.

2 If resistance continues to read low, each probe shall be checked. A partially grounded probe will result in a low resistance reading. Probes shall have 75,000 ohms resistance or greater when measuring from either terminal to ground.

(k) Route the lead wires of harness assembly to terminals of bus bar assemblies. Crimp clips around each lead wire after proper positioning. Ensure that the lead wires are supported away from the bus bar assemblies. Any contact of the stainless steel overbraid of the lead wire with the bus bar will ground the system. Also, ensure that once the lead wires are securely crimped, they retain the lead wires and that light pressure applied to the leads in the area that spans between the clips cannot cause them to touch the bus bar.

(l) Secure the lead wire terminals of harness assembly to terminals of bus bar assemblies using screws and nuts. Use caution to install correct screws and nuts onto each bus bar since they are of dissimilar metal.

(m) Measure the resistance from Pin A to Pin B on the harness assembly connector. Resistance shall be 0.25 to 0.75 ohms. If resistance is within limits, proceed to next step. If not, check the following.

1 Lead wire touching alumel bus bar. Correction: Reposition lead wire so that is does not touch bus bar.

(n) Measure the resistance from either pin on the harness assembly to ground. The resistance shall be greater than 75,000 ohms. If resistance is within limits, proceed to next step. If not, check the following.

1 Disconnect lead wire terminals of harness assembly from bus bar assemblies and measure resistance from either bus bar to ground (any location). If resistance is now 75,000 ohms or greater, replace defective harness assembly. If resistance is still low (1,000 to 25,000 ohms), remove, visually examine, and replace each clamp one at a time. Check resistance each time.

R

1. E. (8) (n) 2 If resistance from the bus bar to ground continues to read low, then each probe sensor shall be checked. Any one probe sensor that is partially grounded will result in a low resistance reading. Probes shall have one megohm resistance or greater when measuring from either terminal to ground.

(o) Apply ceramic cement to fill cavities in probe/bus bar joint areas as follows.

WARNING: CLEANING SHALL BE PERFORMED IN A CLEAN WELL-VENTILATED ROOM. RUBBER GLOVES AND PROTECTIVE CLOTHING SHALL BE WORN. EXTINGUISHERS AND VAT OR TANK COVERS SHALL BE ON HAND IN CASE OF FIRE.

1 Clean probe/bus bar joint areas with 1,1,1-Trichloroethane (MIL-T-81533).

2 The ceramic cement is a two part compound consisting of an adhesive powder and a liquid solvent. Mix powder (Sermetal PBX) and solvent (Sermetal P) together in a proportion of three grams of adhesive to one cubic centimeter of solvent and mix thoroughly. Allow the compound to cure 30 to 60 minutes at room temperature. (A quantity of 30 grams of adhesive and 10 cc of solvent is sufficient to treat 12 probe/bus bar joints.) Stir the mixture periodically to prevent a separation.

3 Use a syringe and fill the cavities between the bus bars and probes with the compound. Fill the gaps between the hold down clamps and probe bodies. Refer to View A-A, Figure 205. The compound should completely fill the cavity but should be approximately flush with the end of the probe. Do not form a fillet around the bus bar.

4 After application, air-dry the compound at room temperature for one hour.

(9) Place the stator assemblies and ITT assembly in an air-ventilated oven. The oven temperature shall be less than 38C (100F) at loading. Raise the temperature in the oven to 93C (200F) over a five minute period. Cure the stator and probe assembly for one hour after the oven temperature reaches 93C (200F).

(10) Raise the oven temperature to 315C (600F) and cure the assembly for one hour after the 315C (600F) temperature is attained. At the end of this time cool the assembly by turning the heat off but maintaining the air circulation or by removing the assembly from the oven and cooling in still air.

1. E. (11) Repear resistance check specified in paragraph (8)(j).

(12) Install second stage stator assembly in first stage stator and liner assembly. Press down into correct position using hand pressure. Secure with bolts installed from bottom through mated flanges, and with nuts installed from top (toward rear of engine). Tighten nuts (10, figure 203) to 20 inch-pounds torque.

CAUTION: ENSURE THAT CURVIC COUPLING GASKET WITH NO HOLES IS INSTALLED INTO CURVIC COUPLING.

(13) Install curvic coupling gasket with no holes into curvic coupling, then place first stage stator and liner assembly first stage turbine wheel and second stage stator assembly over shaft using caution to align index marks on wheel assembly and curvic coupling.

CAUTION ENSURE THAT CURVIC COUPLING GASKET WITH EIGHT HOLES IS INSTALLED INTO FIRST STAGE TURBINE WHEEL ASSEMBLY AND THAT HOLES IN GASKET FACE TOWARD REAR OF ENGINE.

(14) Install curvic coupling gasket with eight holes facing turbine end of main shaft into first stage turbine wheel.

(15) Install third stage stator and second and third stage turbine wheel assemblies. Refer to 72-50-07, MAINTENANCE PRACTICES.

2. Inspection/Check

A. Inspect Curvic Coupling Gaskets (See Figure 201 or 203)

R (1) Visually inspect curvic coupling gaskets for nicks, deformation,
R hanging burrs, kinks or other obvious damage.

(2) Replace part that does not meet Inspection/Check requirements.

B. Curvic Coupling (See Figure 201 or 203)

(1) Visually inspect curvic coupling for cracks in the spline area. If cracks or damage is evident install new curvic coupling. If minor raised edges are evident refer to Approved Repairs.

(2) Visually inspect coupling. No visible damage is permitted. Refer to Approved Repairs.

2. C. (Pre SB72-0042) Inspect Interstage Turbine Temperature (ITT System (Multi-Piece) (See Figure 202)

NOTE: The following checks shall be accomplished with plenum and combustion chamber removed.

(1) Measure the resistance from Pin A to Pin B at the turbine plenum assembly connector. Resistance shall be 0.25 to 0.75 ohms. If resistance is within limits, proceed to next step. If not, check the following.

NOTE: Check for broken potting. None is allowable.

(a) Lead wire touching alumel bus bar. Correction: Reposition lead wire so that it does not touch bus bar.

(2) Measure the resistance from either pin on the harness assembly to ground. The resistance shall be greater than 75,000 ohms. If resistance is not within limits, check the following.

(a) Disconnect lead wire terminals of harness assembly from bus bar assemblies and measure resistance from either bus bar to ground (any location).

1 If resistance is now 75,000 ohms or greater, replace defective harness assembly.

2 If resistance is still low (1,000 to 25,000 ohms), refer to Removal/Installation, paragraph B.(4).

D. (Pre SB72-0042) Inspect Harness Assembly (See Figure 202)

(1) Visually inspect harness assembly for security of connectors and terminals; stripped, stretched, or galled threads on connector, and for condition of terminals and insulating sleeving. Refer to Approved Repairs.

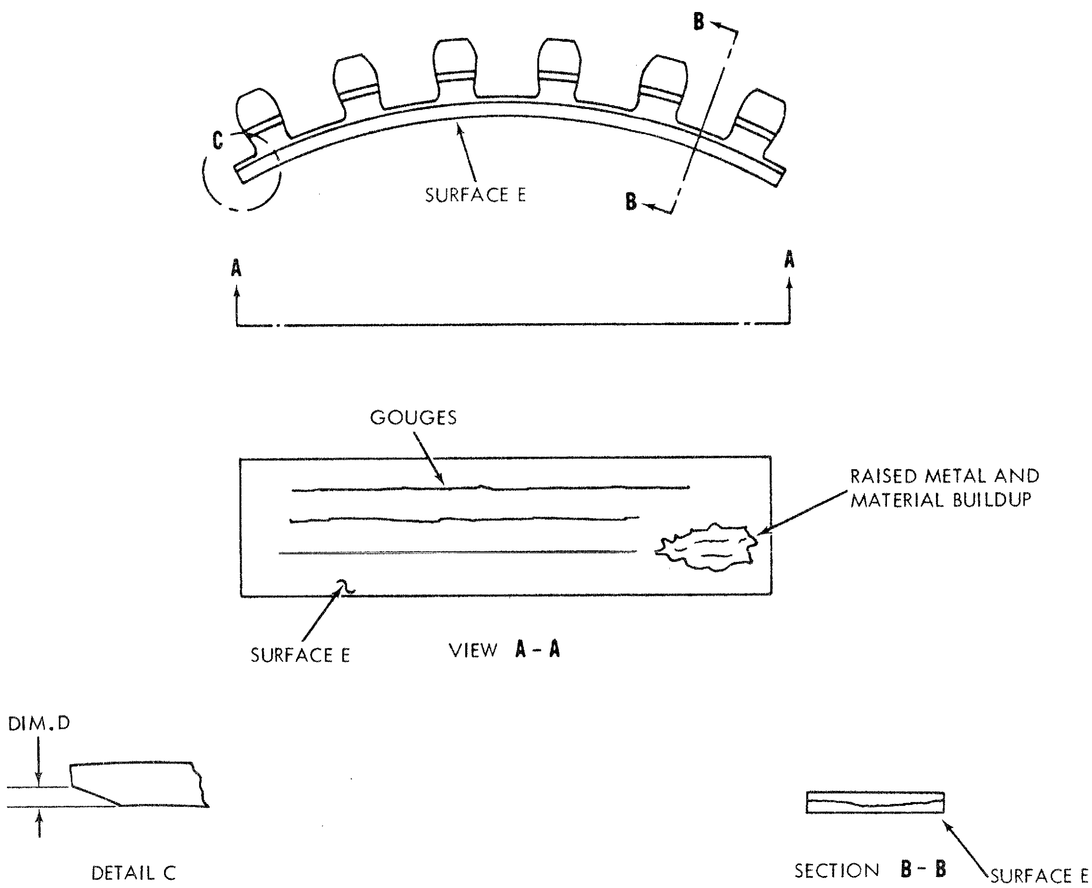
(2) Perform continuity check using a multimeter.

(3) Replace harness that does not meet Inspection/Check requirements.

E. Inspect Stator Locking Nut (See Figure 201 or 203)

Visually inspect nut for wear or damage. Thread damage in excess of one-half entrance thread is cause for replacement.

R



D
0.030 IN. MAX

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R Inspection of First Stage
R Turbine Segmented Shroud
Figure 207

R 2. F. Inspect First Stage Segmented Shroud (See Figure 201, 203 and 207)

R (1) Perform dimensional inspection of shroud as follows. (See Figure 207).

R (a) Gouges are acceptable in the full length of Surface E, provided gouges do not exceed 0.050 inch in depth.

R (b) Thinning of Surface E is acceptable in localized areas, provided thinning does not exceed 30 percent of material thickness (See View B-B).

R (c) Erosion of shroud edges is acceptable provided Dimension D is maintained (See Detail C, figure 207).

R (d) Raised metal and material build-up on Surface E shall be removed by hand finish. Nicks and gouges are acceptable after hand finish, provided nicks or gouges do not exceed 0.050 inch in depth.

R (2) Visually inspect shroud for cracks, bent or broken flanges.

R (3) Replace part that does not meet Inspection/Check requirement or is damaged beyond repair.

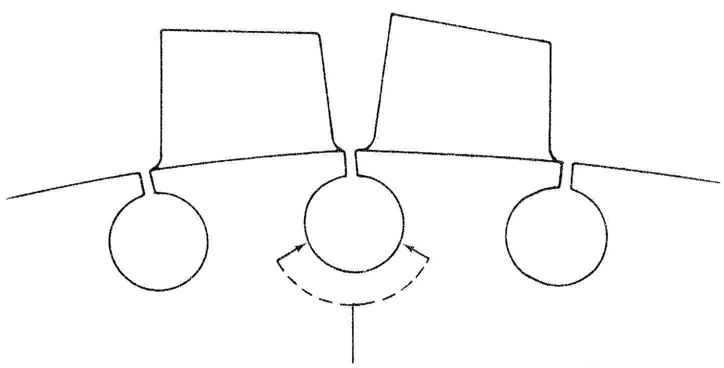
R 2. G. Inspect First Stage Turbine Wheel Assembly (See Figure 201, 203 or 208)

R (1) Visually inspect coupling teeth for damage. No visible damage is
R permissible. Refer to Approved Repairs.

R (2) Visually inspect diffused aluminized coating. Coating may be
R eroded from leading edge of blades. Leading edge corner radius may
R be eroded to 7/32 inch radius maximum.

R NOTE: Clean turbine wheel assembly in accordance with
R 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning
R Method No. 2. Do not glass bead peen or abrasive
R blast.

R (3) Loose or distorted rivets are acceptable unless flare of rivet is
R distorted over 50 percent of the diameter.



R Inspection of First Stage Turbine Wheel for Cracks
Figure 208

2\. G. (4) Inspect for cracks adjacent to turbine wheel rivet holes as follows.

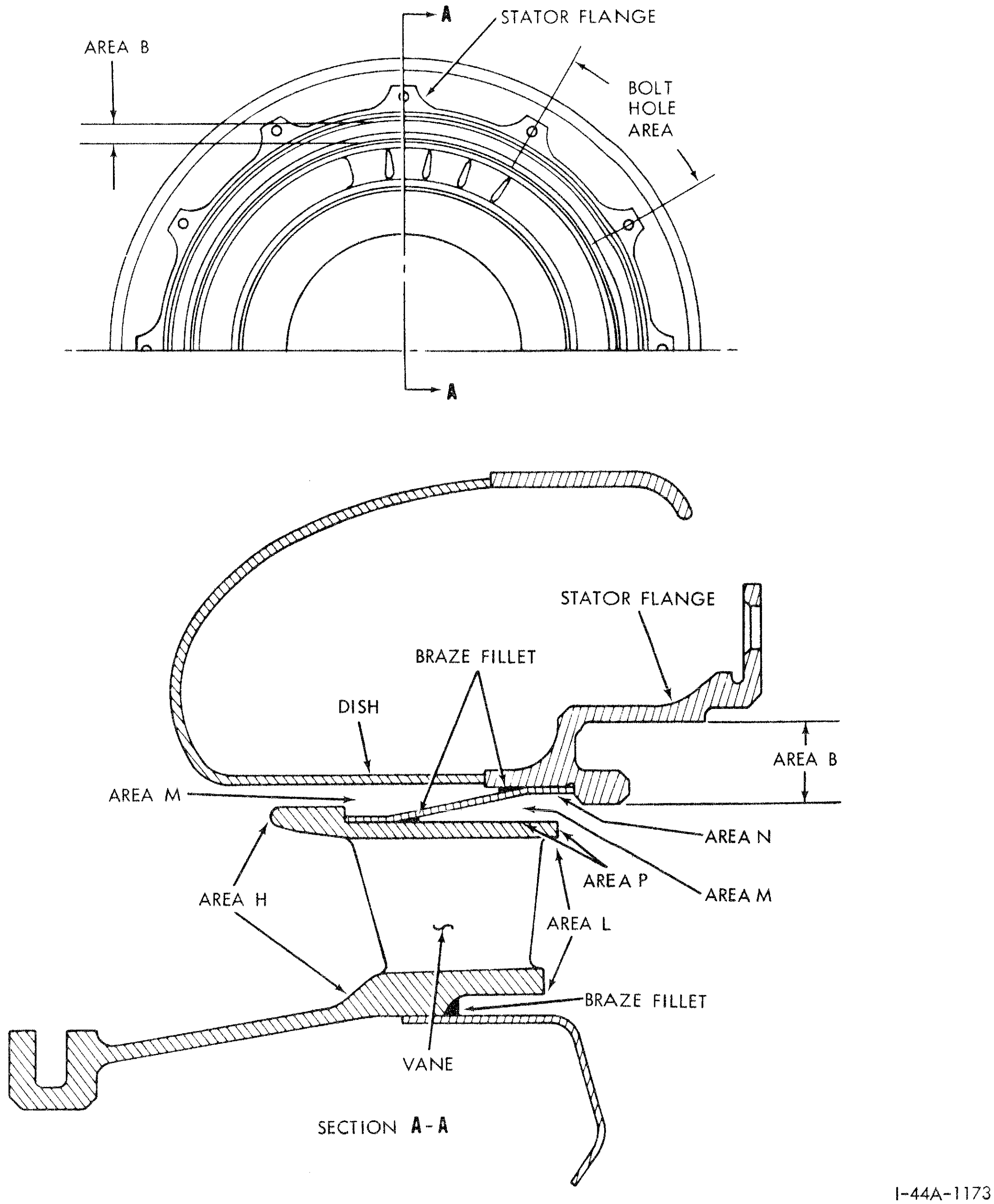
Reason: Analytical data indicates that for turbine wheels with a life determined by cycles, the conservative life cycle limits imposed on the turbine rotors obviates the requirement for detailed microscopic examination of the rivet hole areas.

(a) For turbine wheels with their life established by cycles, visually inspect for cracks adjacent to every rivet hole on both sides of turbine wheel. Observe crack susceptible area, Figure 208. No cracks allowed.

(b) For turbine wheels with their life limit established by operating hours, visually inspect for cracks adjacent to every rivet hole on both sides of turbine wheel. Observe crack susceptible area, Figure 208. Inspection shall be accomplished using high intensity light and 10 power magnification. No cracks allowed.

(5) Visually inspect turbine blades for burning, cracks or other obvious damage. No cracks allowed.

(6) Replace part that does not meet Inspection/Check requirements.



R (Pre SB72-0052) Inspection of First Stage Turbine Stator
and Liner Assembly
R Figure 209

2. H. (Pre SB72-0052) Inspect First Stage Stator and Liner Assembly (See Figures 201, 209 and 210)

(1) Visually inspect diffused aluminum coated Area H and L for chipping flaking, and wear through to base metal. (See figure 209.) Erosion on all vane leading edges extending full vane width radially is acceptable, provided it does not exceed 0.050 inch axially. Local erosion on all vane trailing edges is allowable, provided it does not exceed 50 percent of original metal thickness or 0.300 inch axially.

(2) Inspect Areas M and N (figure 209) for cracks in sheet metal by use of X-ray NDT. No cracks are allowed in these areas. AiResearch Quality Standard P-125 shall be used as a guide for X-ray facility capable of complying with AiResearch Quality Standard P-125 or returned to AiResearch for inspection.

(3) Visually inspect stator and liner assembly for cracks, warpage or distortion, and other damage. Warpage of vanes is acceptable as long as crack limitations are met. Cracks are not acceptable in any portion of the stator except as noted.

(4) Any vane with a piece missing is cause for rejection of the stator.

(5) Buckling at the trailing edge of each vane is permitted, provided it does not deviate more than 0.050 inch from normal contour.

(6) Inspect Area N for erosion (see figure 209). If erosion of sheet metal exceeds 0.005 inch, replace stator and liner assembly.

(7) Inspect for the following crack limitations. Any combination of cracks pictorial geometry as shown in Figure 210 is acceptable in a maximum of 20 vanes, provided crack limitations are met.

(a) Cracks shall not exceed 0.010 inch in width. A 0.010 inch diameter wire is recommended for checking crack width.

(b) One crack in each of ten vanes is permitted, provided any crack does not exceed 0.600 inch in length. One crack in each of five vanes is permitted, provided any crack does not exceed 0.300 inch in length. One crack in each of five additional vanes is permitted, provided any crack does not exceed 0.100 inch in length.

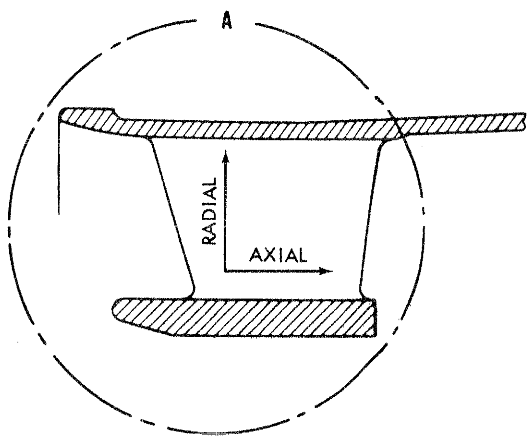
(c) A maximum of two cracks are permitted in each of any three vanes within 20 vanes mentioned above, provided cracks are parallel to each other and do not exceed 0.600 inch in length. A minimum separation distance of 0.200 inch between the two cracks in each vane is also required.

2. H. (7) (d) No cracks are allowed in the dish (see figure 209).

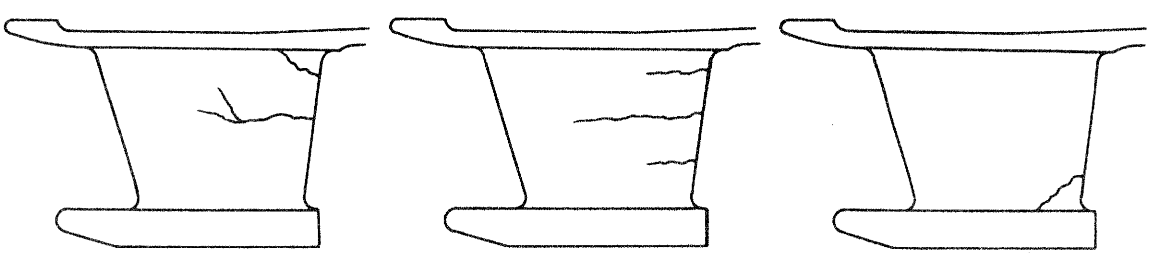
(e) A single radial crack in Area B (see figure 209) is acceptable within a one bolt hole area on the stator flange. Radial cracks are allowed in a maximum of five bolt hole areas.

(f) No cracks are allowed in Area P (see figure 209).

(8) If inspection of stator and liner assembly is not satisfactory, replace stator and liner assembly with three piece first stage stator and liner assembly in accordance with 72-50-08, Removal/Installation.



ACCEPTABLE VANE TRAILING EDGE CRACK PATTERNS

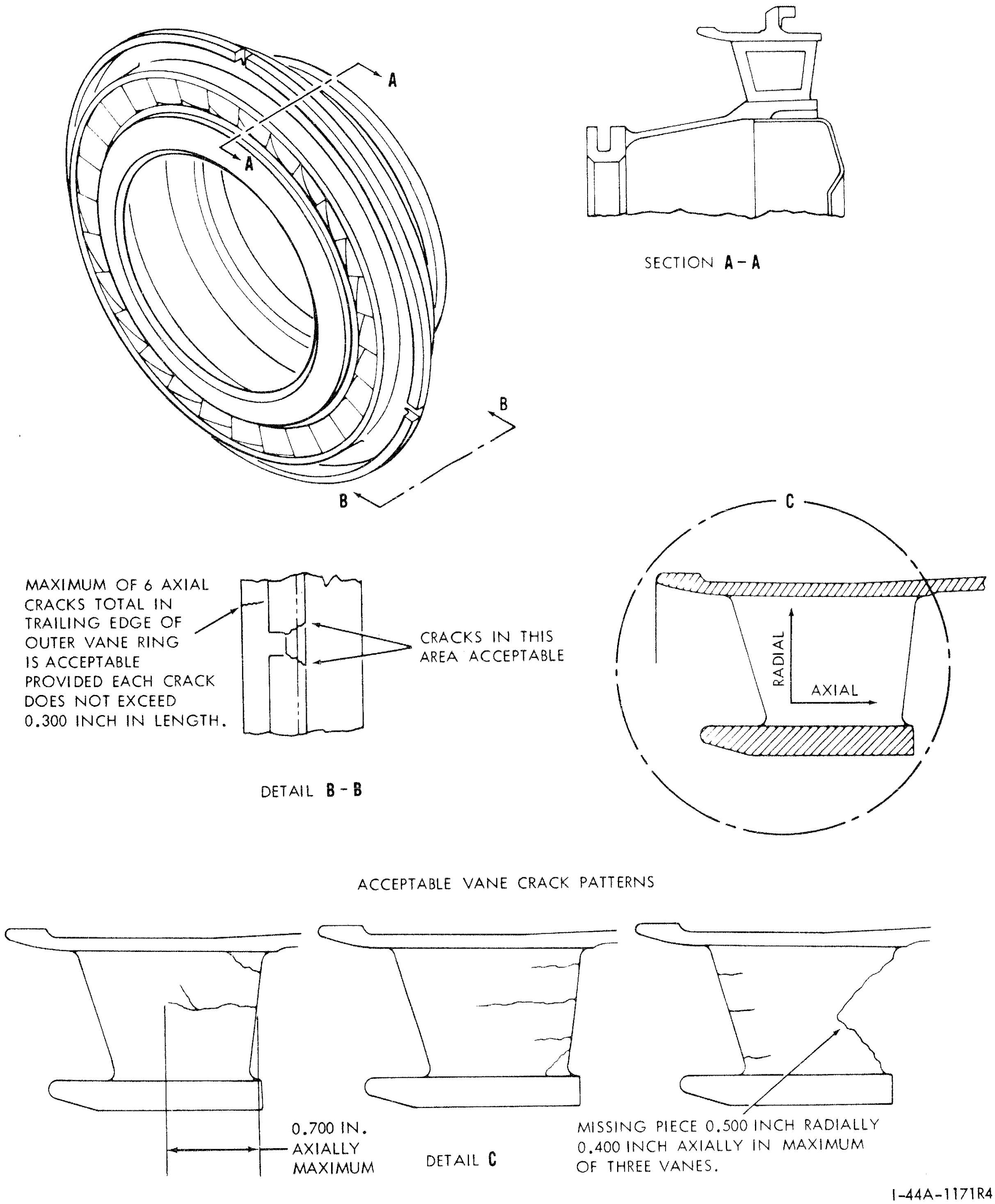


DETAIL A

I-44A-1174

(Pre SB72-0052) First Stage Turbine Stator Assembly Crack Pattern
Figure 210

R



R

(Post SB72-0052) First Stage Turbine Stator Vane
Section Crack Pattern
Figure 211

2. I. (Post SB72-0052) Inspect First Stage Turbine Stator Vane Section (See Figures 203 and 211)

(1) Visually inspect stator vane section for cracks, warpage or distortion, and other damage. Warpage of vanes is acceptable as long as crack limitations are met. Cracks are not acceptable in any portion of the stator except as noted.

(2) Erosion on all vane leading edges extending full vane width radially is acceptable, provided it does not exceed 0.050 inch axially.

(3) Cracks are acceptable in the leading edge of all vanes, provided the cumulative length of cracks per vane does not exceed 0.250 inch in length.

(4) Hot corrosion of all vane leading edges, extending the full width of vane radially, may be hand finished, provided the corrosion does not exceed 0.075 inch axially.

(5) A piece of the vane trailing edge may be missing from a maximum of three vanes, provided the missing piece does not exceed 0.500 inch radially and 0.400 inch axially.

(6) Inspect for the following crack limitations.

(a) Any combination of crack pictorial geometry as shown in Figure 211 is acceptable in all vanes.

(b) Cracks in the anti-rotation slots extending through the flange are acceptable for continued use. (See View B-B, figure 211.)

(c) A maximum of six axial cracks total in trailing edge of outer vane ring is acceptable provided each crack does not exceed 0.300 inch in length. (See View B-B, figure 211.)

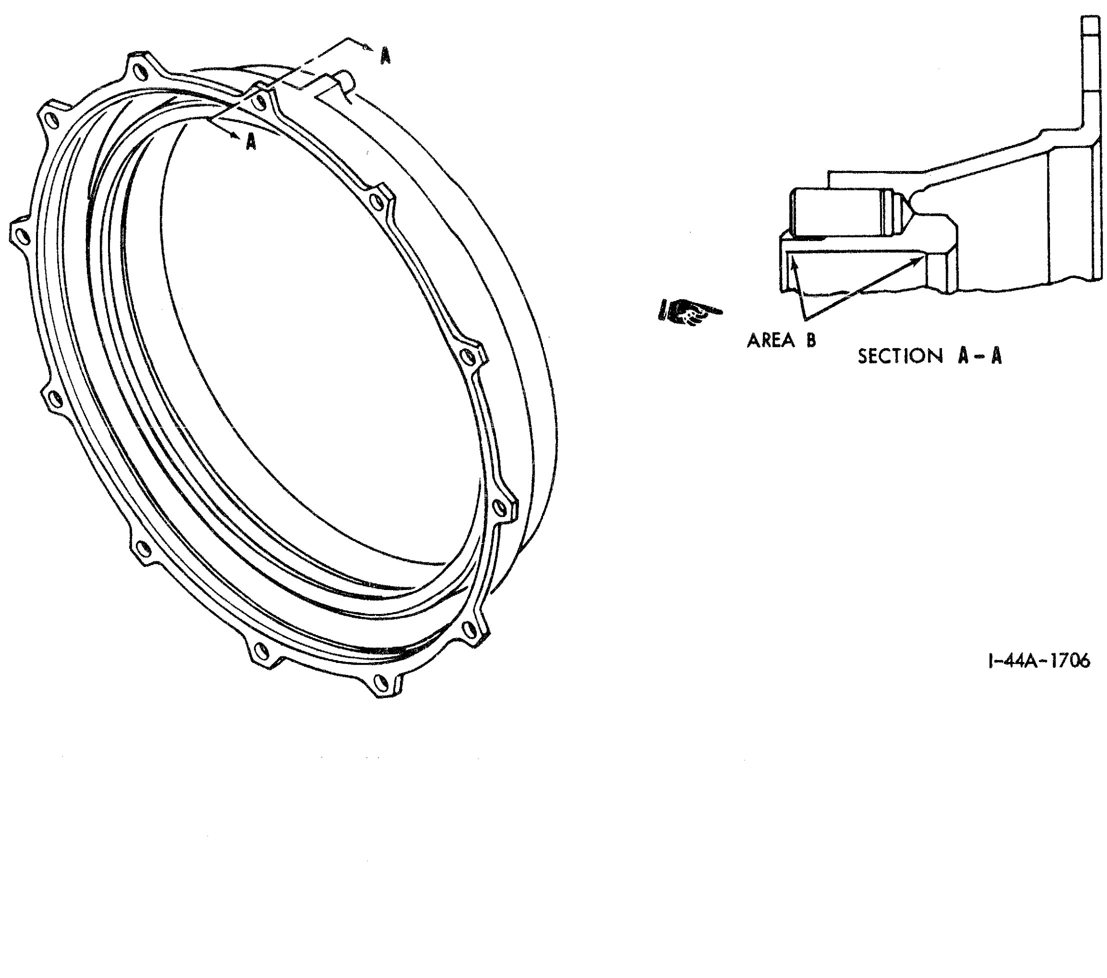
(7) Replace part that does not meet Inspection/Check requirements.

2. J. (Post SB72-0052) Inspect First Stage Turbine Support Assembly (See Figures 203 and 212)

(1) Visually inspect support assembly for cracks. No cracks are allowed in support assembly.

(2) Inspect Area B (figure 212) for erosion. If erosion of metal in the thin outer lip portion exceeds 0.015 inch in depth, or if erosion of metal in the thicker base portion exceeds 0.050 inch in depth, replace first stage turbine support assembly.

(3) Replace part that does not meet Inspection/Check requirements.



R

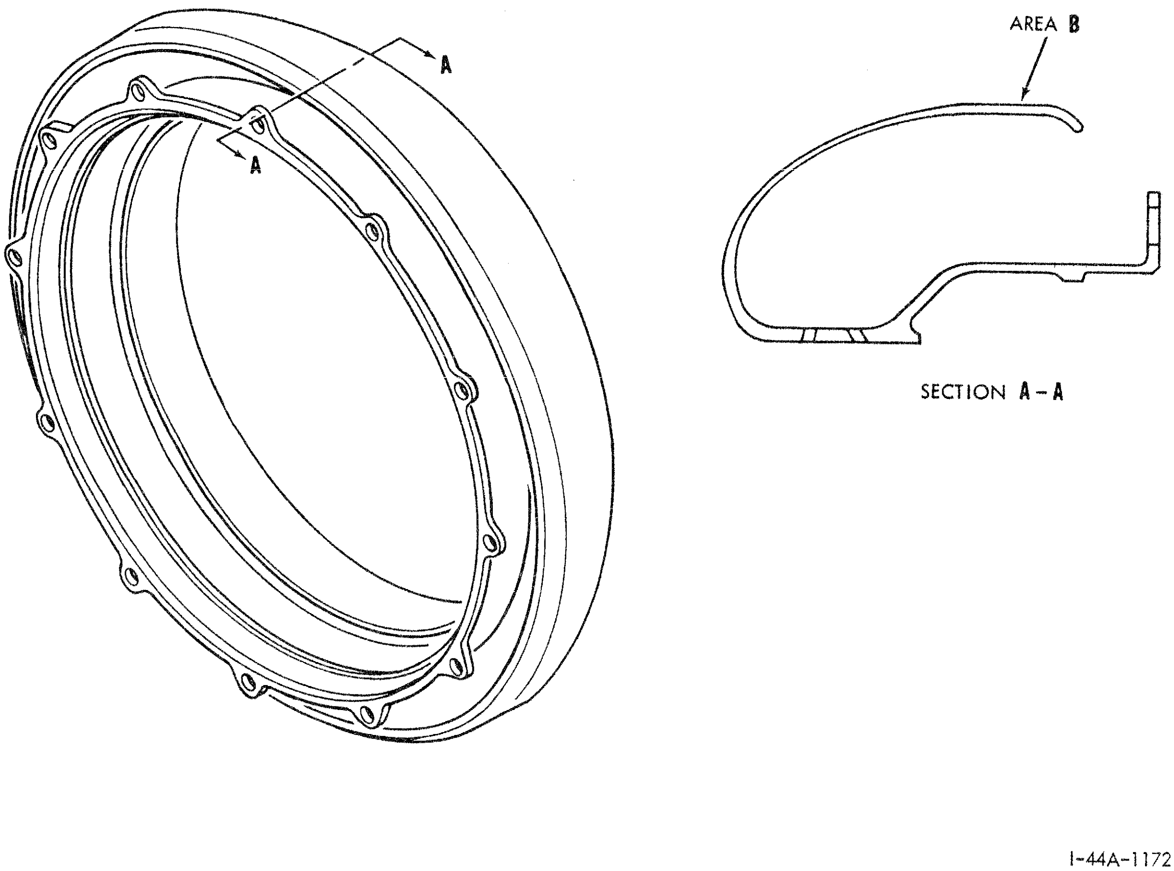
(Post SB72-0052) Inspection of First Stage Turbine Support Assembly
Figure 212

2. K. (Post SB72-0052) Inspect Combustor Transition Liner (See Figures 203 and 213)

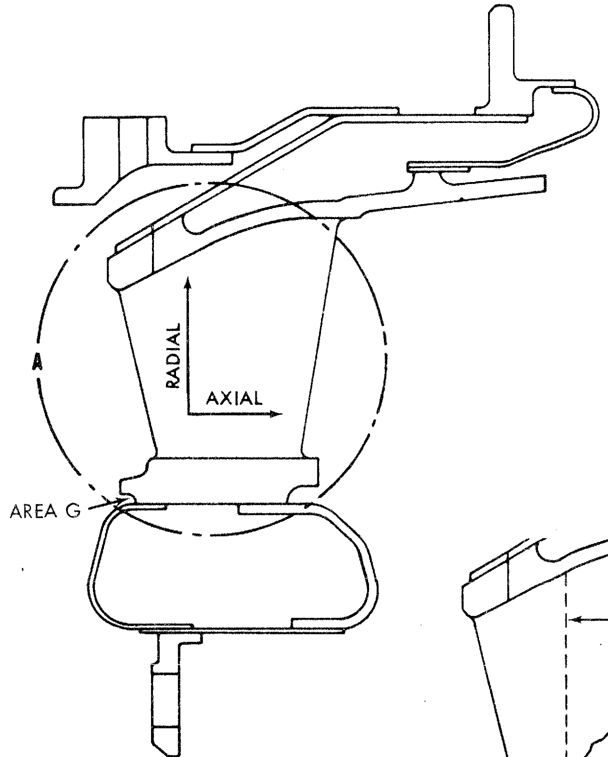
(1) Visually inspect transition liner for cracks. No cracks are allowed in transition liner.

(2) Minimum allowable thickness at the combustion chamber to combustor liner contact area (Area B, Figure 213) is 0.030 inch.

(3) Replace part that does not meet Inspection/Check requirements.



R (Post SB72-0052) Inspection of Combustor Transition Liner
Figure 213



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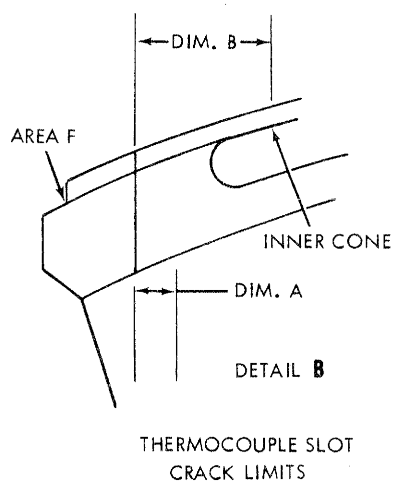
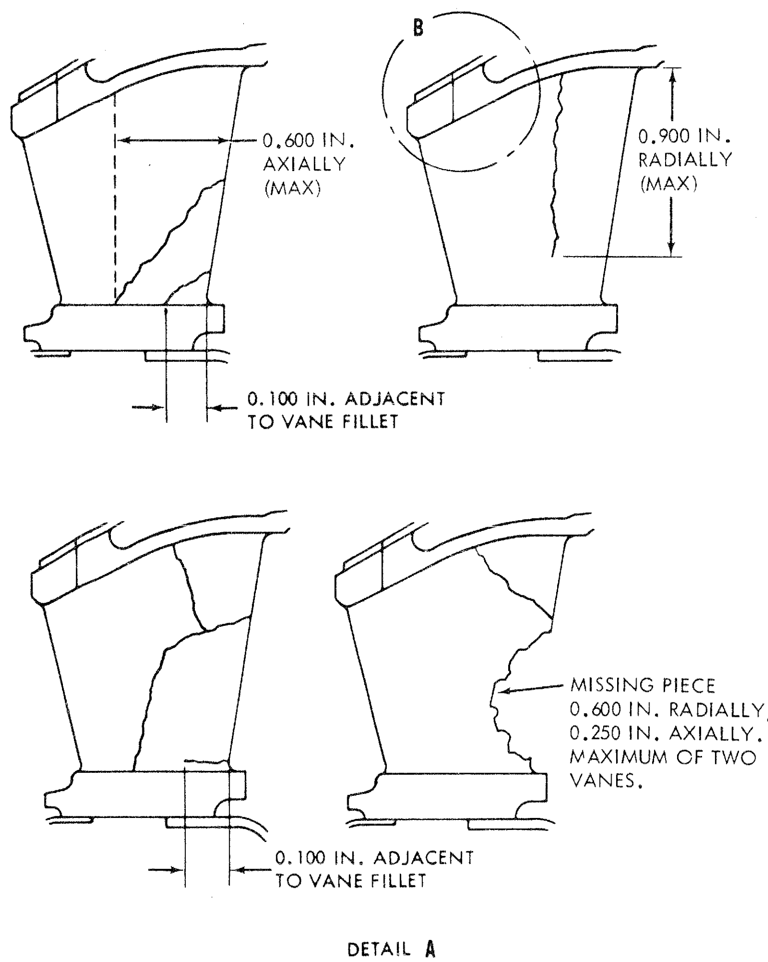


THERMOCOUPLE SLOT
CRACK LIMITS

A	B
0.100 IN. MAX	0.500 IN. MAX



STATOR VANE CRACK LIMITS

MAXIMUM RADIAL COMPONENT OF CRACK SHALL BE 0.900 INCH.

MAXIMUM AXIAL COMPONENT OF CRACK SHALL BE 0.600 INCH

I-44A-1843

Second Stage Turbine Stator Assembly
Crack Patterns
Figure 214

2. L. Second Stage Stator Assembly (See Figures 201, 203, 214 and 215)

(1) Visually inspect stator assembly for cracks, warpage or distortion and other damage. Warpage of vanes is acceptable as long as crack limitations are met. (See figure 214 for crack patterns.)

(2) Erosion at outer edge of all vane leading edges is acceptable, provided it does not exceed missing material in excess of 0.150 inch axially and 0.150 inch radially. (See Detail E, figure 215.)

(3) Hot corrosion on all vane leading edges extending full vane width radially may be hand finished, provided it does not exceed 0.075 inch axially.

(4) Gap limits for braze joints are as follows. (See figure 214.)

(a) Gap of 0.030 inch for 12 inches cumulative in circumference at Area F is acceptable.

(b) Gap of 0.005 inch maximum for circumference of 180 degrees at Area G is acceptable (leading edge stator side only).

(5) A piece of the vane trailing edge may be missing from a maximum of two vanes, provided the missing piece does not exceed 0.600 inch radially and 0.250 inch aximally. (See figure 214.)

(6) Inspect for crack limits. Any combination of crack pictorial geometry as shown in Figure 214 is acceptable, provided crack limitations are met.

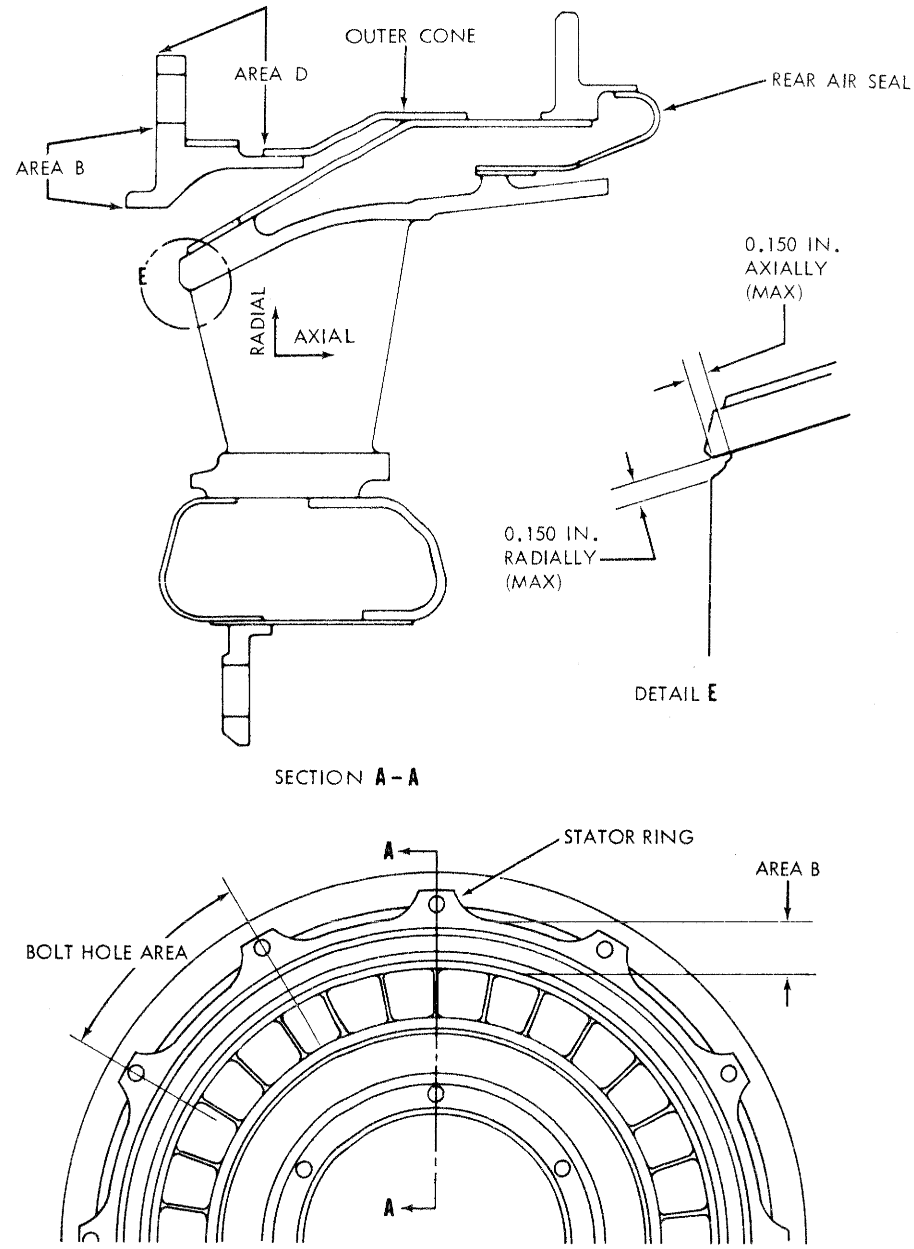
(7) Crack limits for thermocouple slots (slots cut out of outer shroud of vane section casting to allow thermocouples to extend into vane area) are as follows.

(a) Cracks may extend radially across the entire width of all the thermocouple slots, but shall not exceed 0.100 inch in depth in the axial direction (See Detail B, Dimension A, figure 214).

(b) Cracks in an axial direction from the outboard edge of the thermocouple slot may extend into the sheet metal portion of the inner cone provided cracks do not exceed 0.500 inch in length. (See Detail B, Dimension B, figure 214.)

(8) Inspect for cracked or bent mount lugs on stator ring. A maximum of two cracked or bent non-adjacent lugs are acceptable. Rework to remove defective lugs.

(9) Replace part that does not meet Inspection/Check requirements.



R

A SINGLE RADIAL CRACK IN AREA B NOT TO EXCEED 0.350 INCH IN LENGTH IS ACCEPTABLE WITHIN ONE BOLT HOLE AREA ON THE STATOR RING. RADIAL CRACKS ARE ALLOWED IN A MAXIMUM OF FIVE BOLT HOLE AREAS. CRACKS ALLOWED TO EXTEND 0.200 INCH IN AREA D.

ANY NUMBER OF CRACKS 0.050 INCH OR LESS ARE PERMISSIBLE IN ALL VANES.

NO CRACKS ARE ALLOWED IN THE OUTER CONE.

1-44A-1842R2

Inspection of Second State Turbine Stator
Figure 215

3. Cleaning/Painting

A. Clean Component Parts

(1) Refer to 72-00-00, GENERAL - CLEANING/PAINTING, for general cleaning instructions and for description of cleaning methods specified in Table 203.

NOTE: Reference shall be made to Table 203 for recommended cleaning method.

Table 203. Cleaning Methods

Figure No.	Item No.	Nomenclature	Cleaning Methods 1	2	3	4	5	6	7	8	9	10	11
All standard metallic hardware			X	X									
201	5, 85	Gasket		X									
	30	Seal Assembly		X									
	45	Stator		X									
	50	Locking Nut		X						X			
	65	First Stage Wheel Assembly		X									
	70	Shroud		X							X		
	75	Stator and Liner		X							X		
	80	Ring Seal		X									
	90	Curvic Coupling			X								
202	55	Wiring Harness											X
	65 70	Bus Bar											X
	75	Probe Sensor											X
203	5. 100	Gasket		X									
	30	Seal Assembly		X									
	45	Stator		X									
	50	Locking Nut		X						X			
	65	First Stage Wheel Assembly		X									
	70	Shroud		X							X		
	75	Turbine Support		X							X		
	80	Shim		X									
	85	Stator		X							X		
	90	Transition Liner		X							X		
	95	Ring Seal		X									
	105	Curvic Coupling			X								

4. Approved Repairs

NOTE: Table 204 provides a list of materials and compounds required for Approved Repairs.

Table 204. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Abrasive (ST 70-ALO-512, ST 70-ALO-801)	Brightboy Weldon Roberts, Newark NJ
Solder (Federal Specification QQ-S-571, Sn60)	Commercially available

A. Repair Curvic Coupling (See Figure 201 or 203)

(1) Repair raised edged of coupling teeth by polishing with abrasive (ST 70-ALO-512, ST 70-ALO-801) in accordance with Figure 216.

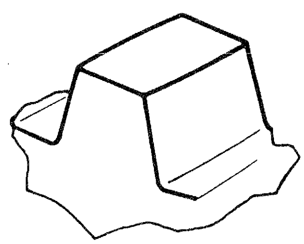
B. Repair First Stage Turbine Wheel Assembly (See Figure 201 or 203)

(1) Repair raised edges of curvic by polishing with abrasive (ST-70-ALO-512, ST 70-ALO-801) in accordance with Figure 216.

C. (Pre SB72-0042) Repair Wiring Harness Assembly (See Figure 202)

(1) Replace any connectors or terminals showing evidence of damage.

(2) Solder all connections in accordance with Specification MIL-S-6872, using solder (Federal Specification QQ-S-571, Sn60).



REWORK ALLOWED ON EDGES AS DEPICTED BY DARK LINES ON SKETCH ABOVE.

RAISED METAL ON TOOTH EDGE SHALL NOT EXCEED 0.010 INCH PRIOR TO REWORK.

I-44A-1323

Repair of Curvic Coupling Teeth
Figure 216

TURBINE BEARING AND BEARING SUPPORT (CARRIER) ASSEMBLY - MAINTENANCE PRACTICES

1. Removal/Installation

NOTE: Table 201 provides a list of special tools, fixtures and equipment required for Removal/Installation. Table 202 provides a list of materials and compounds required for Removal/Installation.

Table 201. Special Tools, Fixtures and Equipment

Item No.	Nomenclature	Use	Source/ Part No.
NOTE: Equivalent substitutes may be used for listed items.			
1.	Spline and Socket Wrench	Used for tightening (or loosening) the turbine shaft retaining nut when assembling and stretching the main shaft. Use with 200 foot-pounds standard torque wrench.	284196-2-1
2.	Bearing Puller	Used to remove turbine end bearing inner race from the main shaft when replacing bearing or seal.	284637-1-1
3.	Bearing Puller	Used to remove turbine bearing carrier and outer race of bearing from support assembly.	287386-1-1
4.	Bearing Installation and Removal Kit	Used to remove support assemble rotor, seals, and bearing as a subassembly from turbine end of engine.	289492-1-1
5.	Retaining Ring Guide	Used to aid in installing thrust ring and spring washer in turbine bearing cavity.	291756-1-1

Table 201. Special Tools, Fixtures and Equipment (Cont)

Item No.	Nomenclature	Use	Source Part No.
6.	Splined Adapter	Used with 284196-2-1 wrench when tightening or loosening turbine shaft nut. Engages splines of main shaft on engine containing main shaft with internal threads in aft end.	294760-1

Table 202. Materials and Compounds

Material or Compound	Manufacturer
NOTE Equivalent substitutes may be used for listed items.	
Grease (Acryloid HF825)	Rohm and Haas Co, Independence Mall West, Philadelphia, PA 19105
High temperature compound (Fel-Pro C5-A)	Fel-Pro Inc, Div of Felt Products Mfg Co, 7450 N McCormick Blvd, Skokie IL 60076
Lubricating compound (Liqui-Moly, Grade NV)	Lockrey Co, Lubricants Div, Cedar Shores Southampton, NY 11968

CAUTION: IF FURTHER DISASSEMBLY OF ENGINE IS REQUIRED AFTER REMOVAL OF TURBINE BEARING AND BEARING SUPPORT (CARRIER) ASSEMBLY, PRE-DISASSEMBLY DIMENSIONS MUST BE TAKEN. REFER TO 72-50-06, MAINTENANCE PRACTICES FOR REMOVAL OF TURBINE BEARING AND BEARING SUPPORT (CARRIER) ASSEMBLY.

TO PREVENT POSSIBLE DISENGAGEMENT OF CURVIC COUPLINGS, ENSURE ENGINE IS NOT ROTATED WHENEVER TURBINE BEARING AND BEARING SUPPORT (CARRIER) ASSEMBLY IS REMOVED. IF ENGINE IS NOT VERTICAL, NOSE DOWN POSITION, LOAD TURBINE (MAIN) SHAFT FORWARD AGAINST COMPRESSOR BEARING WITH 15 POUNDS FORCE.

NOTE: The following Removal/Installation instructions are to be used only for replacement of the turbine bearing and bearing support (carrier) assembly. If maintenance requires further disassembly of engine, refer to 72-50-06, MAINTENANCE PRACTICES for removal of interstage turbine temperature sensor assembly (single piece), turbine bearing and bearing support (carrier) assembly and bearing support assembly.

1. A. Remove Turbine Bearing and Bearing Support (Carrier) Assembly (See Figures 201 and 202)

(1) Remove rear turbine bearing oil line. Refer to 79-20-08, MAINTENANCE PRACTICES.

(2) Remove oil inlet retainer shield assembly. Refer to 72-50-01, MAINTENANCE PRACTICES.

(3) Remove tail cone. Refer to 72-50-02, MAINTENANCE PRACTICES.

(4) Remove oil inlet tube and oil jet. Refer to 72-50-03, MAINTENANCE PRACTICES.

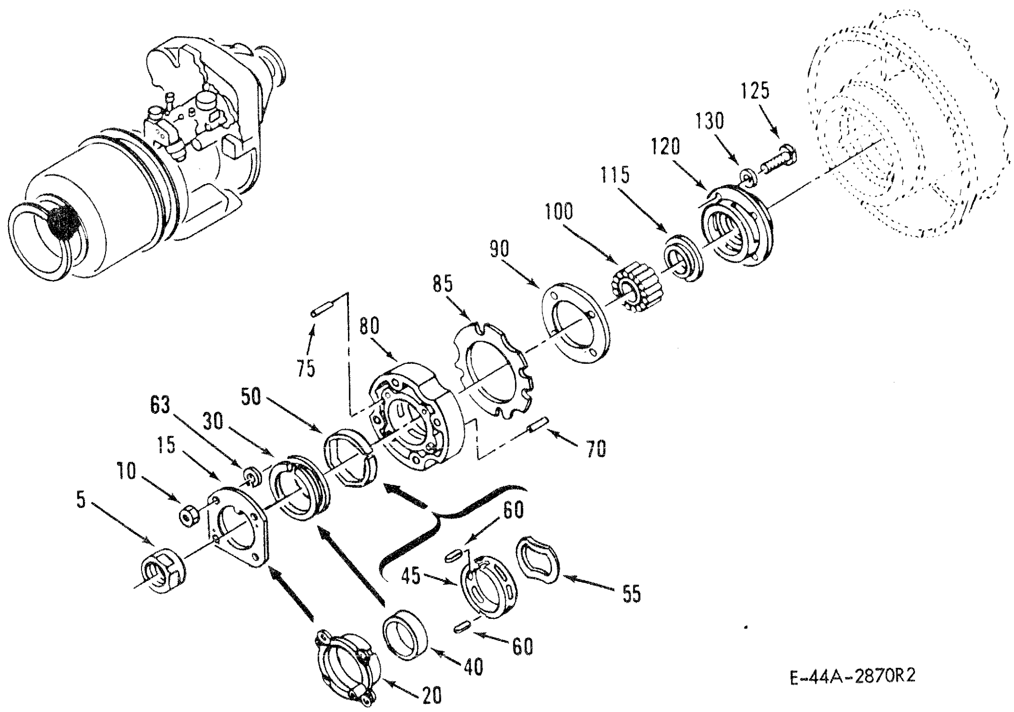
(5) Remove turbine scavenge pump assembly. Refer to 72-50-04, MAINTENANCE PRACTICES.

NOTE: Air-oil seal, rotor seal bearing (inner race) gasket, shims, bearing support assembly and mount or thrust ring and washer may be removed as an assembly using 289492-1-1 bearing installation and removal kit. If kit is used refer to step (6). If kit is not used refer to step (7).

(6) Remove turbine bearing and bearing support (carrier) assembly using 289492-1-1 bearing installation and removal kit as follows.

(a) Remove nuts and retainer. (See figure 201.)

(b) Carefully remove bearing (outer race) and install 291756-1-1 guide in bore of bearing support assembly.



R

R 5. NUT (IPC FIG. 182)
R 10. NUT
R 15. RETAINER
R 20. RETAINER
R 30. BEARING (OUTER RACE)
R 40. BEARING (OUTER RACE)
R 45. THRUST RING
R 50. MOUNT
R 55. SPRING WASHER
R 60. KEY
R 63. RETAINER (DELETED)

70. PIN
75. PIN
80. BEARING SUPPORT (CARRIER) ASSY
85. SHIM
90. GASKET
100. BEARING (INNER RACE)
115. SEAL ROTOR
120. AIR-OIL SEAL (STATOR)
125. BOLT
130. GASKET

Turbine Bearing and Bearing Support
(Carrier) Assembly Installation
Figure 201

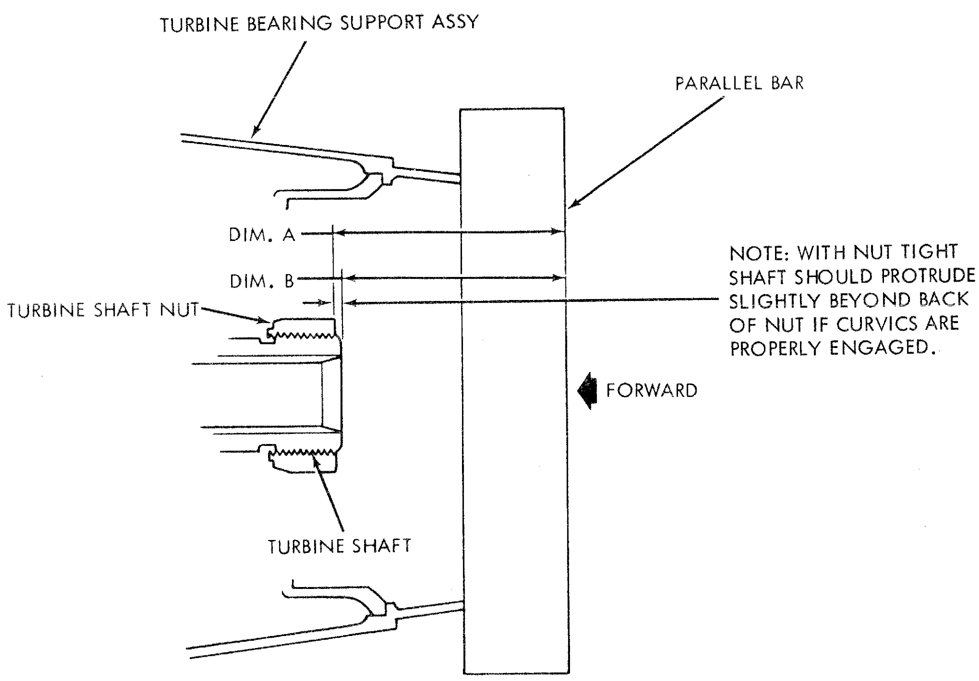
R

R NOTE: Index marks on turbine (main) shaft and nut are
R utilized as a reference for shaft stretch during
R engine production only, do not attempt reassembly
R using marks as guidelines.

R 1. A. (6) (c) Prior to loosening turbine (main) shaft nut, record Dimensions
R A and B. (See figure 202.)

R (d) (Engines with main shaft with internal threads in aft end.)
R Remove main shaft nut using 284196-2-1 wrench with 294760-1
R adapter. (See figure 201.)

R (e) (Engines with main shaft without internal threads in aft end.)
R Remove main shaft nut using 284196-2-1 wrench with 284196-21
R adapter.



R

NOTE:

LOAD TURBINE SHAFT FORWARD AGAINST COMPRESSOR BEARING WITH 15 POUNDS FORCE.

IF ENGINE CAN BE ROTATED TO VERTICAL NOSE DOWN POSITION, FORWARD LOAD IS NOT NECESSARY.

1-44A-1513

R Shaft Stretch Measurements
Figure 202

R 1. A. (6) (f) Place one-inch diameter tooling ball on end of main shaft.

R (g) Secure plate of 289492-1-1 kit to bolts with four nuts from kit.

R (h) Adapt standard puller to engage with tooling ball and plate of 289492-1-1 kit and pull assembled components as an assembly.

R (i) Remove tooling ball from end of main shaft and remove nuts and plate of 289492-1-1 kit from assembled components.

R (j) Separate assembled components as follows.

R 1 Remove 291756-1-1 guide, bearing (inner race) rotor seal and mount or thrust ring and washer.

R 2 Remove bearing support assembly, gasket, shims and bolts and gaskets from air-oil seal. Record thickness of shims for later use during assembly.

R (k) Install spacer of 289492-1-1 kit over main shaft and secure with main shaft nut. Tighten main shaft nut until snug.

R (7) Remove turbine bearing and bearing support (carrier) assembly using 289386-1-1 and 284637-1-1 pullers as follows.

R (a) Remove nuts and retainer. (See figure 201.)

R NOTE: Index marks on turbine (main) shaft and nut are utilized as a reference for shaft stretch during engine production only, do not attempt reassembly using mark as guidelines.

R (b) Prior to loosening main shaft nut, record Dimensions A and B. (See figure 202.)

R (c) (Engines with main shaft with internal threads in aft end.) Remove main shaft nut using 284196-2-1 wrench with 294760-1 adapter.

R (d) (Engines with main shaft without internal threads in aft end.) Remove main shaft nut using 284196-2-1 wrench with 284196-21 adapter.

R (e) Remove bearing support assembly, bearing (outer race) and mount or thrust ring and spring washer in one operation using 287386-1-1 puller.

R (f) Separate bearing (outer race) and mount or thrust ring and spring washer from bearing support assembly. Remove shims and record thickness of shims for use during assembly.

R 1. A. (7) (g) Move rollers of bearing (inner race) and remove rollers of bearing. Remove bearing (inner race) with 284637-1-1 puller.

R (h) Remove rotor seal and air-oil seal. Remove gasket and bolts and gaskets from air-oil seal.

R B. Install Turbine Bearing and Bearing Support (Carrier) Assembly (See Figure 201, 202 and 203)

R NOTE: Refer to 70-00-00, STANDARD PRACTICES, for recommended general torque values. Add frictional drag (run-down) torque of self-locking devices to recommended values.

R Apply high temperature compound (Fel-Pro C5-A) to threads of bolts and nuts prior to installation

R (1) Separate bearing outer race (figure 201) from bearing inner race. Place inner race to one side for later assembly.

R (2) Install gaskets (130) on bolts. Place gasket (90) on air-oil seal, then place bolts with gaskets through holes in air-oil seal and gasket.

R CAUTION: INSTALL SEAL ROTOR WITH FLAT SIDE AGAINST AIR-OIL SEAL.

R (3) Install air-oil seal on main shaft on top of aft curvic coupling, then place seal rotor down on air-oil seal.

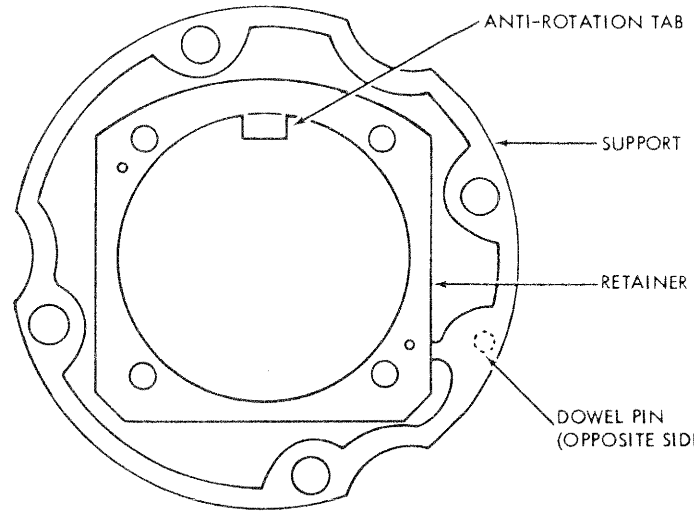
R (4) Apply light coat of grease (Acryloid HF825) to rollers of bearing inner race. Place bearing inner race with rollers onto main shaft and push down into position against seal rotor. Rollers can be held in place on inner race with use of plastic strap.

R CAUTION: INSTALL NEW MAIN SHAFT NUT. DO NOT REUSE NUT REMOVED AT DISASSEMBLY. LUBRICATE MAIN SHAFT THREADS WITH LUBRICATING COMPOUND (LIQUI-MOLY, GRADE NV).

R (5) Install main shaft nut on main shaft. Tighten main shaft nut only enough to pull inner race of bearing into position against rotor seal, then loosen main shaft nut. With nut hand tight, main shaft shall protrude slightly beyond back of nut.

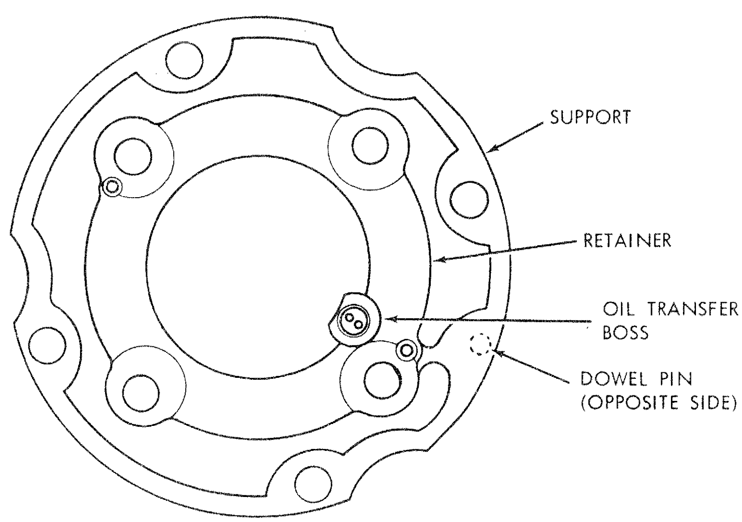
R (6) Measure Dimension A (see figure 202) and compare with Dimension A obtained in step A.(6)(c) or A.(7)(b). Comparison of measurements is used only as a guide to indicate whether curvics are properly engaged.

R (7) (Pre SB72-0089) Install mount on bearing outer race.



VIEW A

R



VIEW B

F-44A-2854R1

R Locating Anti-Rotation Tab or Oil Transfer Boss
R Figure 203

R NOTE: If new bearing support assembly is to be in-
R stalled, thickness of shims to be installed shall
R be determined to ensure proper alignment of tur-
R bine bearing. If original bearing support assem-
R bly is to be reinstalled, same thickness of shims
R removed during disassembly shall be reinstalled.

R 1. B. (8) If required, determine thickness of shims to be installed as
R follows.

R (a) Measure thickness of original bearing support assembly and add
R thickness of shims removed during disassembly. Record result.

R (b) Measure thickness of replacement bearing support assembly.

R (c) Subtract dimension obtained in step (b) from dimension ob-
R tained in step (a). Result is thickness of shim required to
R be used during assembly.

R (9) (Pre SB72-0089) Place bearing support assembly on work bench with
R retainer alignment pins facing up.

R (10) (Pre SB72-0089) Place bearing outer race and mount in bearing sup-
R port assembly with anti-rotation slots in alignment.

R NOTE: Maintain relationship of anti-rotation slots in
R bearing outer race and mount with retainer anti-
R rotation tab while aligning drilled holes in
R retainer with alignment pins on face of bearing
R support assembly.

R (11) (Pre SB72-0089) Place retainer on bearing outer race and push
R bearing (outer race) and mount into bearing support assembly using
R retainer as a guide. Remove retainer.

R NOTE: Dowel pin in bearing support assembly shall locate in
R hole in turbine bearing support assembly.

R (12) Install same thickness of shims noted during disassembly or
R thickness of shims determined in step (8), then install bearing
R support assembly into turbine bearing support.

R (13) (Post SB72-0089) Install spring washer and thrust ring into bear-
R ing support assembly using 291756-1-1 guide. Position key slot on
R thrust ring 45 degrees clockwise from vertical.

R (14) (Post SB72-0089) Install keys in key slots on thrust ring, then
R install bearing outer race.

R (15) Apply engine oil to bearing at this time to remove grease (Acryloid
R HF825).

CAUTION: ENSURE THAT MAIN SHAFT NUT IS LOOSENED SO THAT NUT IS NOT IN CONTACT WITH TURBINE BEARING PRIOR TO ACCOMPLISHING MEASUREMENT OF DIMENSION B (UNSTRETCHED). THIS WILL PREVENT INCORRECT DIMENSION B (UNSTRETCHED) MEASUREMENT AND SUBSEQUENT INCORRECT SHAFT STRETCH MEASUREMENT.

1. B. (16) Ensure rotating group is loaded toward forward end of engine and main shaft nut is hand tight. Measure and record Dimension B (unstretched). (See figure 202.)

CAUTION: WHEN PERFORMING THE FOLLOWING STEP, MAKE SHAFT STRETCH MEASUREMENTS FREQUENTLY TO ENSURE SHAFT IS NOT OVERSTRETCHED. IF DIMENSION B (INITIAL STRETCH) (0.038 TO 0.041 INCH) STRETCH TOLERANCE IS EXCEEDED, LOOSEN TURBINE SHAFT NUT AND REPEAT STEP (16). IF REPEAT DIMENSION B (UNSTRETCHED) EXCEEDS 0.002 INCH LESS THAN ORIGINAL DIMENSION B (UNSTRETCHED), RETURN ENGINE TO SERVICE CENTER BECAUSE SHAFT HAS BEEN OVERSTRETCHED.

(17) (Engines with main shaft with internal threads in aft end). Using 284196-2-1 wrench with 294760-1 adapter tighten main shaft nut while frequently checking Dimension B until Dimension B (initial stretch) is 0.038 to 0.041 inch less than Dimension B (unstretched). Back off nut slightly to obtain Dimension B (final stretch) of 0.036 to 0.039 inch less than Dimension B (unstretched).

CAUTION: WHEN PERFORMING THE FOLLOWING STEP, MAKE SHAFT STRETCH MEASUREMENTS FREQUENTLY TO ENSURE SHAFT IS NOT OVERSTRETCHED. IF DIMENSION B (INITIAL STRETCH) (0.038 TO 0.041 INCH) STRETCH TOLERANCE IS EXCEEDED, LOOSEN TURBINE SHAFT NUT AND REPEAT STEP (16). IF REPEAT DIMENSION B (UNSTRETCHED) EXCEEDS 0.002 INCH LESS THAN ORIGINAL DIMENSION B (UNSTRETCHED), RETURN ENGINE TO SERVICE CENTER BECAUSE SHAFT HAS BEEN OVERSTRETCHED.

(18) (Engines with main shaft without internal threads in aft end). Using 284196-2-1 wrench with 284196-21 adapter tighten main shaft nut while frequently checking Dimension B until Dimension B (initial stretch) is 0.038 to 0.041 inch less than Dimension B (unstretched). Back off nut slightly to obtain Dimension B (final stretch) of 0.036 to 0.039 inch less than Dimension B (unstretched).

R CAUTION: ENSURE THAT EXCESSIVE LUBRICATING COMPOUND
R (LIQUI-MOLY, GRADE NV) IS REMOVED FROM MAIN
R SHAFT NUT AREA TO PREVENT CONTAMINATING ENGINE
R OIL.

R 1. B. (19) Remove excess lubricating compound (Liqui-Moly, Grade NV).

R (20) (Pre SB72-0089) Install retainer (15, figure 201) so that anti-rotation tab engages anti-rotation slot in bearing outer ring (see View A, figure 203) and secure with nuts. Tighten nuts (10, figure 201) to 70 inch-pounds torque. Use caution during tightening of nuts to ensure heads of bolts do not hang up on air-oil seal.

R (21) (Post SB72-0089) Position retainer (20, figure 201) so oil transfer boss is located approximately 120 degrees clockwise from vertical (see View B, figure 203) and aligns with keys in thrust ring. Secure with nuts. Tighten nuts (10, figure 201) to 70 inch-pounds torque. Use caution when tightening nuts to ensure heads of bolts do not hang up on air-oil seal.

R (22) Ensure rotating assembly rotates freely. If interference is noted, remove and reinstall components as required to ensure bolts, seal, and shims are correctly installed and oriented.

R (23) Install turbine scavenge pump assembly. Refer to 72-50-04, MAINTENANCE PRACTICES.

R 2. Inspection/Check

R A. Inspect Bearing Support Assembly

R (1) Check bearing bore in bearing support assembly for scoring, grooves, or distortion. Scoring which does not exceed 0.005 inch depth is acceptable.

R (2) Replace bearing support assembly if damage is sufficient to affect sealing.

R (3) Replace part that does not meet Inspection/Check requirements.

R B. Visually inspect threads of turbine main shaft for damage.

R (1) If damage cannot be repaired by brushing with wire brush, return engine to overhaul facility for repair.

R C. Inspect Turbine Bearing

R (1) Visually inspect outer diameter of bearing outer race for evidence of varnishing. Thoroughly clean bearing outer race and inner race in accordance with 72-00-00, CLEANING/PAINTING.

AiResearch
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MAINTENANCE MANUAL

VOLUME II

TURBOPROP ENGINE

PART NO.	MODEL NO.
895720-1	TPE331-5-251K
895720-2	TPE331-5-251K
895720-3	TPE331-5-251K
896160-1	TPE331-6-251M
896160-3	TPE331-6-251M
896160-5	TPE331-6-251M
896950-1-1	TPE331-5-251C
896950-2	TPE331-5-251C
896950-3	TPE331-5-251C
3101300-2	TPE331-6-252M
3101630-1	TPE331-6-252M
3101840-1	TPE331-5-252M
3102450-1	TPE331-6A-251M
3102520-1	TPE331-5-252K
3102520-2	TPE331-5-254K

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Apr 1/74
Mar 28/80

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CHAPTER 73 - ENGINE FUEL AND CONTROL

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ENGINE FUEL AND CONTROL - DESCRIPTION AND OPERATION

The engine fuel and control system includes a fuel control unit, pumps, filters, valves, flow divider and drain valve, and fuel nozzle and manifold assemblies. The system provides fuel of proper pressure, weight flow, and spray characteristics to the combustion chamber to satisfy the speed and power demands of the engine. At a given power setting, the system automatically compensates for variations in compressor inlet temperature and pressure to maintain a constant turbine temperature. Temperature protection is provided during engine acceleration as well as overspeed protection resulting from loss of load.

ENGINE FUEL AND CONTROL - MAINTENANCE PRACTICES

1. Approved Repairs

A. Clean Fuel System Contamination with Fungus or Particulate Matter

(1) Clean or replace fuel pump filter as specified in 73-21-03, MAINTENANCE PRACTICES. and flow divider and drain valve filter as specified in 73-10-07, MAINTENANCE PRACTICES.

(2) Flush fuel shutoff valve.

(a) Manually actuate fuel shutoff valve while motoring engine to flush valve.

(3) Check fuel pump assembly deadhead pressure.

(a) Connect 0 to 1000 psi pressure gage to fuel pressure tap port. (See 72-00-00, GENERAL - TROUBLE SHOOTING.)

(b) With fuel shutoff valve in off position, motor engine. Indicated pressure shall be 300 psig minimum with engine speed above 16 percent.

(c) If pressure is low, refer to 72-00-00, GENERAL - TROUBLE SHOOTING.

(d) Remove pressure gage.

(4) Check fuel control unit.

(a) Initiate a normal engine start and run.

(b) If improper performance of fuel control unit is indicated, as demonstrated by poor engine start or power performance, replace fuel control unit.

NOTE: If indicated by fuel manifold and nozzle assembly functional check, inspect, clean or replace nozzles as required in accordance with 73-10-09, MAINTENANCE PRACTICES.

(5) Check fuel manifold assemblies. Refer to 72-00-00, GENERAL - ADJUSTMENT/TEST.

DISTRIBUTION (ENGINE FUEL AND CONTROL) - DESCRIPTION AND OPERATION

1. Fuel System Lines

The fuel system lines includes lines, fittings and other hardware necessary to interconnect components of the fuel system.

R 2. (Codes BA-BC, EA-LA) Fuel Pressure Regulator

The fuel pressure regulator is mounted on the right side of the input housing assembly. The fuel pressure regulator supplements fuel to ensure a pressure sufficient for atomization to the primary fuel nozzles. A solenoid valve actuated by a prime switch controls the operation of the fuel pressure regulator. A parallel enrichment orifice is incorporated in the fuel pressure regulator for use in starting above 25 percent engine speed.

R (Codes AA-AC, CA-CC) A fuel enrichment valve performs same function as the fuel pressure regulator. (Refer to 73-20-00 for description of fuel enrichment valve.)

R 3. (Codes BA-BC, EA-LA) Fuel Heater Lockout Valve

The fuel heater lockout valve is mounted on the right side of the front flange of the compressor housing assembly. The fuel heater lockout valve closes off the fuel flow through the oil to fuel heater to the fuel filter when engine speed is in the range of 0 to 50 percent. This assures adequate engine flow for starting with a cold engine where fuel filter anti-ice flow demand is high.

4. Fuel Shutoff Valve

The fuel shutoff valve, mounted on the left side of the compressor housing flange, acts as a shutoff valve in the line from the fuel control unit to the fuel nozzles. The valve has a dual solenoid and mechanically latches in either the fuel-on or fuel-off position. The fuel-on solenoid is energized by action of the speed switch and the fuel-off solenoid is energized by a switch in the aircraft cockpit. The valve may also be closed by manually overriding the mechanical latch from the ON position.

5. Fuel Flow Divider and Drain Valve

The fuel flow divider and drain valve, mounted at the bottom of the turbine section, directs fuel flow to the nozzles. The valve delivers metered fuel flow to the primary and secondary fuel nozzles. The drain valve provides a path for purging fuel from the fuel nozzles during roll-down when the fuel shutoff valve is closed. An inlet filter is provided to prevent valve or fuel nozzle blockage through all phases of operation. In the event the filter becomes clogged, fuel is bypassed to the primary and secondary fuel nozzle and manifold assemblies to sustain emergency engine operation.

6. Fuel Manifold and Nozzle Assemblies

The fuel manifold and nozzle assemblies, mounted on the turbine plenum, deliver fuel to the combustion chamber through five primary and ten secondary fuel nozzles The primary nozzles are for starting and initial acceleration. During all other phases of operation fuel is provided by both primary and secondary nozzles.

R 7. (Codes AA-AC, CA-CC) Fuel Anti-Icing Valve

The fuel anti-icing valve is temperature regulated to maintain a minimum fuel temperature of fuel supplied to the fuel control assembly. When the fuel temperature decreases to approximately 2C (35F), a thermostat moves the valve to route fuel through the oil to fuel heater which is mounted in the oil tank.

R (Codes AA-AC) To preclude fuel filter icing, heated fuel is routed to the boost pump. (Refer to 73-20-00 for fuel filter description.)

R (Codes CA-CC) To preclude fuel filter icing, heated fuel is routed to the inlet of the airframe fuel filter.

R 8. (Codes AB-AC, BB-BC, CB-LA) Manifold Purge System - Fuel

The engine fuel purge system includes a pneumatic accumulator, solenoid valve, check valves and filter. Fuel that remains in the flow divider and fuel manifold is purged into the combustor by a bleed air charge during shutodown cycle and burned. Bleed air is stored in an accumulator during normal run cycle and is discharged during shutdown cycle. The air is regulated by a normally closed solenoid valve which is opened by actuation of the stop switch. The purge system is self-testing during operation because burning of the residual manifold fuel causes a momentary increase in speed that can be observed during shutddown.

9. Fuel Control Heat

R (Codes AA-CC, EA) The fuel control heat consists of pneumatic tube assemblies which route compressor discharge heated air to the fuel control unit orifices to prevent icing conditions. The supply valve allowing heated air to enter the fuel control is open when the speed lever is in the minimum position and closed when the speed lever is in the maximim position.

FUEL SYSTEM PLUMBING - MAINTENANCE PRACTICES

1. Removal/Installation

NOTE: Table 201 provides a list of all materials and compounds required to perform Removal/Installation.

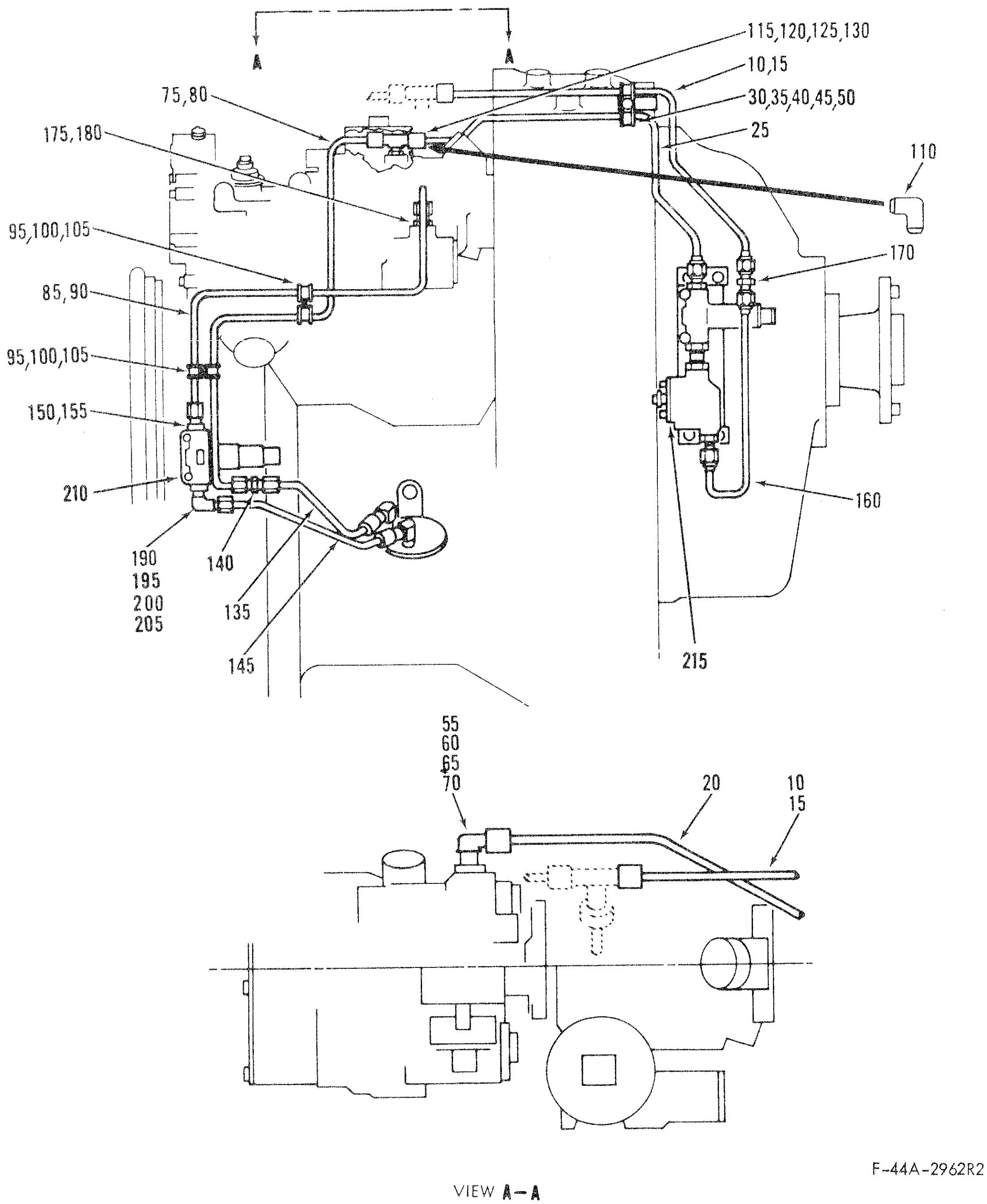
Table 201. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Any approved engine fuel	Commercially available
Any approved engine oil	Commercially available
Alternate packing lubricant Lubricant (OS-124)	Monsanto Company, 800 N Lindbergh Blvd, St. Louis, MO 63166
High temperature compound (Fel-Pro C5-A)	Fel-Pro Inc, Div of Felt Products Mfg Co, 7450 N McCormick Blvd, Skokie, IL 60076
Lubricating compound (Liqui-Moly, Grade NV)	Lockrey Co, Lubricants Div, Cedar Shores, Southampton, NY 11968

NOTE: Provide a suitable container to drain residual fuel from lines and fuel control assembly.

R A. (Codes BA-BC, EA) Remove Fuel System Plumbing, Attaching Parts, and Fittings (See Figure 201)

R B. (Codes BA-BC, EA) Install Fuel System Plumbing, Attaching Parts, and Fittings (See Figure 201)



(Codes BA-BC, EA)
Fuel System Plumbing Installation
Figure 201

NOTE: Prior to installation, unless otherwise specified, lubricate packings or gaskets with any type clean jet fuel. An alternate lubricant (OS-124) may be used; apply lubricant sparingly and spread evenly to a thin transparent film to minimize contamination. Apply lubricating compound (Liqui-Moly, Grade NV) to threads of bolts or screws, and apply clean engine oil to threads (except first two threads) of male plumbing fittings forward of fireshield unless otherwise specified.

R Refer to 70-00-00, STANDARD PRACTICES, for recommended
R general torque values. Add frictional drag (run-down)
R torque of self locking devices to recommended values.

1. B (1) Install elbow with ring and new gasket or packing into bottom of fuel heater lockout valve and secure with nut. Tighten nut (205) to 50 to 55 inch-pounds torque. Install tube assembly between elbow and oil-to-fuel cooler assembly.

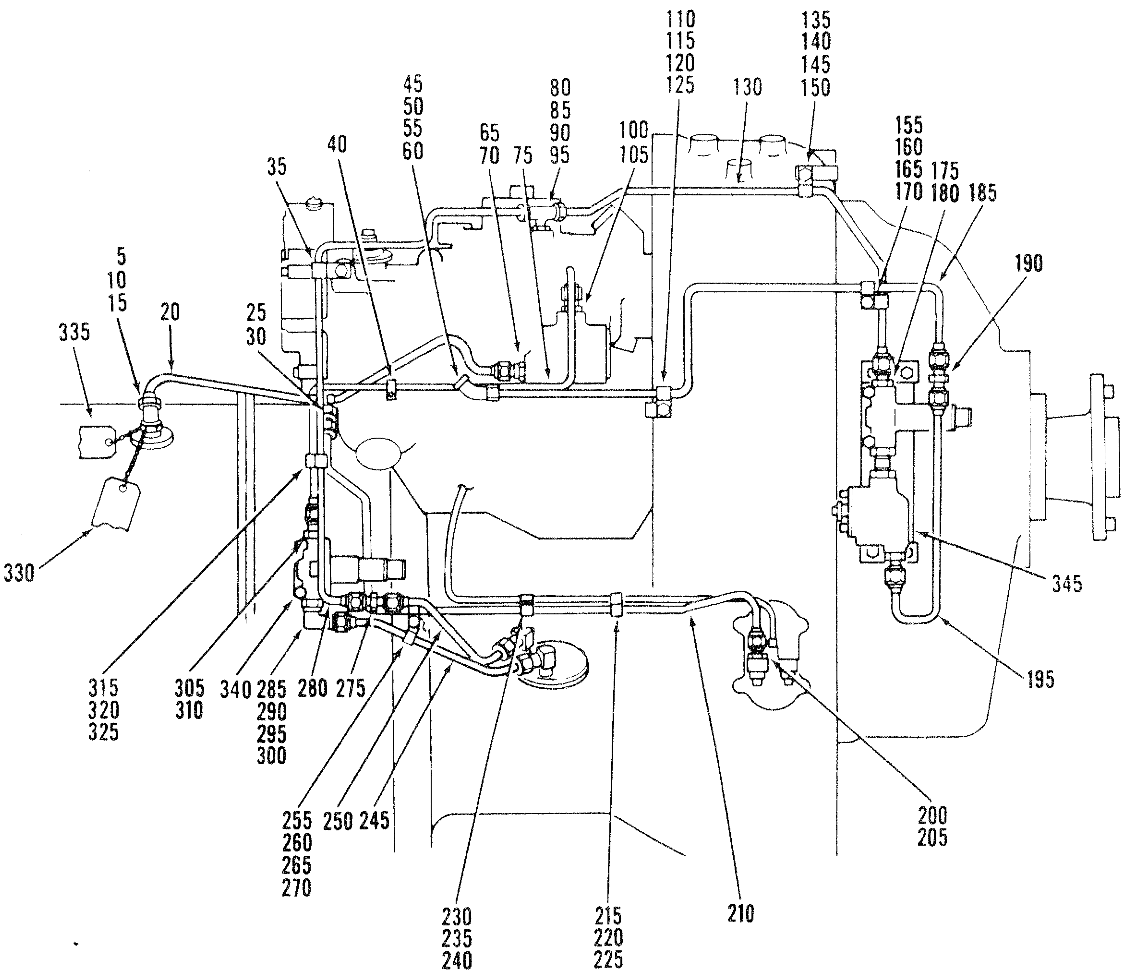
(2) Install reducer with new gasket or packing into top of fuel heater lockout valve. Tighten reducer (150) to 65 to 70 inch-pounds torque. Install union with new gasket into fuel pump assembly. Tighten union (175) to 35 to 40 inch-pounds torque. Install tube assembly between reducer and union.

(3) Install tee or fitting with ring and new gasket or packing into fuel pump assembly and secure with nut. Tighten nut (130) to 35 to 40 inch-pounds torque. Install tube assembly with attaching parts to tee or fitting. Tighten nut (95) to 20 inch-pounds torque. Install reducer in end of tube assembly. Install tube assembly between reducer and oil to fuel cooler assembly.

R (4) (Pre ENG CH6) Install fitting with ring and new gasket into fuel control unit and secure with nut. Tighten nut (70) to 50 to 55 inch-pounds torque. Install tube assembly between fitting and union on top of solenoid valve.

KEY TO FIGURE 201

10. TUBE (IPC FIG. 8)	60. RING	110. FITTING	160. TUBE
15. TUBE	65. GASKET	115. TEE	170. UNION
20. TUBE	70. NUT	120. GASKET	175. UNION
25. TUBE	75. TUBE	125. RING	180. GASKET
30. NUT	80. TUBE	130. NUT	190. ELBOW
35. BOLT	85. TUBE	135. TUBE	195. GASKET
40. CLAMP	90. TUBE	140. REDUCER	200. RING
45. CLAMP	95. NUT	145. TUBE	205. NUT
R 50. BRACKET	100. BOLT	150. REDUCER	210. LOCKOUT VALVE
R 55. FITTING	105. CLAMP	155. GASKET	215. FUEL REGULATOR
R			



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(Codes FA, LA) Fuel System Plumbing Installation
Figure 202

R 1. B. (5) (Post ENG CH6) Install tube assembly between tee installed in step 1.B.(3) and union on top of solenoid valve.

(6) Install bracket onto input housing assembly and secure with washer and nut. Tighten nut to 80 inch-pounds torque.

(7) Install tube assembly with attaching parts to tee from fuel control and attach to bracket. Tighten nut (30) to 20 inch-pounds torque. Install union in end of tube assembly. Install tube assembly between union and fitting on bottom of fuel pressure regulator.

NOTE: Provide a suitable container to drain residual fuel from lines and fuel control assembly.

R C. (Codes FA, LA) Remove Fuel System Plumbing, Pneumatic Lines, Attaching Parts, and Fittings (See Figure 202)

R D. (Codes FA, LA) Install Fuel System Plumbing Lines, Attaching Parts, and Fittings (See Figure 202)

CAUTION: WHEN PNEUMATIC LINES ARE INSTALLED, EXERCISE CARE THAT NO CONTAMINATION IS INTRODUCED NOR THREAD LUBRICATION COMPOUND IS USED. ASSURE PROPER ALIGNMENT AND THREAD ENGAGEMENT TO PREVENT NUT TO FITTING GALLING AND/OR CROSS THREADING.

KEY TO FIGURE 202

5.	ELBOW (IPC FIG. 9)	95.	NUT	180.	PACKING	265.	CLAMP
10.	GASKET	100.	UNION	185.	TUBE	270.	CLAMP
15.	NUT	105.	PACKING	190.	REDUCER	275.	REDUCER
20.	TUBE	110.	NUT	195.	TUBE	280.	TUBE
25.	UNION	115.	BOLT	200.	UNION	285.	ELBOW
30.	PACKING	120.	CLAMP	205.	PACKING	290.	PACKING
35.	CLAMP	125.	BRACKET	210.	TUBE	295.	RING
40.	CLAMP	130.	TUBE	215.	NUT	300.	NUT
45.	ELBOW	135.	NUT	220.	BOLT	305.	RUDUCER
50.	PACKING	140.	BOLT	225.	CLAMP	310.	PACKING
55.	RING	145.	CLAMP	230.	NUT	315.	NUT
60.	NUT	150.	BRACKET	235.	BOLT	320.	BOLT
65.	REDUCER	155.	NUT	240.	CLAMP	325.	CLAMP
70.	PACKING	160.	BOLT	245.	TUBE	330.	TAG
75.	TUBE	165.	NUT	250.	TUBE	335.	TAG
80.	TEE	170.	CLAMP	255.	NUT	340.	LOCKOUT VALVE
85.	PACKING	175.	REDUCER	260.	BOLT	345.	FUEL REGULATOR
90.	RING						

NOTE: Lubricate packings or gaskets used in fuel system with any type jet fuel prior to installation unless otherwise specified. Packings or gaskets used in pneumatic system may be installed dry. An alternate lubricant (OS-124) may be used on all packings or gaskets prior to installation unless otherwise specified. Apply lubricant sparingly and spread evenly to a thin transparent film to minimize contamination. Apply lubricating compound (Liqui-Moly, Grade NV) to threads of bolts and screws, and apply clean engine oil to threads (except first two threads) of male plumbing fittings used in fuel system located forward of the fireshield unless otherwise specified.

R Refer to 70-00-00, STANDARD PRACTICES, for recommended gen-
R eral torque values. Add frictional drag (run-down) torque
R of self locking devices to recommended values.

1. D. (1) Install reducer with new packing into solenoid valve. Tighten reducer (175) to 60 to 65 inch-pounds torque. Install fitting with ring and new packing into fuel pump assembly. Tighten nut(95) to 30 to 35 inch-pounds torque. Install tube assembly between reducer and fitting with attaching parts. Tighten mounting nut for bracket (150) to 80 inch-pounds torque. Tighten nut (135) to 27 inch-pounds torque.

(2) Install fitting with ring and new packing into fuel pressurizing valve. Tighten nut (60) to 30 to 35 inch-pounds torque. Install tube assembly onto fitting from fuel pressurizing valve with attaching parts. Tighten nut that attaches bracket (125) to 50 inch-pounds torque. Tighten nuts (110, 155) to 27 inch-pounds torque. Install reducer in end of tube. Install tube assembly between reducer and fitting on bottom of fuel pressure regulator.

(3) Install elbow with ring and new packing into bottom of fuel heater lockout valve. Tighten nut (300) to 50 to 55 inch-pounds torque. Install tube assembly from elbow to oil-to-fuel cooler.

(4) Install unions with new packings into fuel control unit and temperature sensor. Tighten unions (25, 200) to 35 to 40 inch-pounds torque. Install tube assembly between unions with attaching parts. Tighten nuts (215, 230, 255) to 27 inch-pounds torque.

(5) Install tube assembly on fitting from fuel pump assembly with attaching parts. Tighen bolt that attaches clamps (35) to 20 to 25 inch-pounds torque. Install reducer in end of tube assembly. Install tube assembly between reducer and oil-to-fuel cooler.

(6) Install reducer with new packing into top of fuel heater lockout valve. Tighten reducer (305) to 60 to 65 inch-pounds torque. Install union with new packing into fuel pump assembly. Tighten union (100) to 35 to 40 inch-pounds torque. Install tube assembly between reducer and union with attaching parts. Tighten nut (315) to 27 inch-pounds torque.

1. D. (7) Install reducer with new packing into fuel control unit. Tighten reducer (65) to 35 to 40 inch-pounds torque.

(8) Install elbow with new gasket into plenum and secure. Tighten nut (15) to 50 to 55 inch-pounds torque. Install tube assembly between elbow and reducer in fuel control unit.

NOTE: Provide a suitable container to drain residual fuel from lines and fuel contol assembly.

R E. (Codes GA, KA) Remove Fuel System Plumbing, Pneumatic Lines, Attaching Parts, and Fittings (See Figure 203)

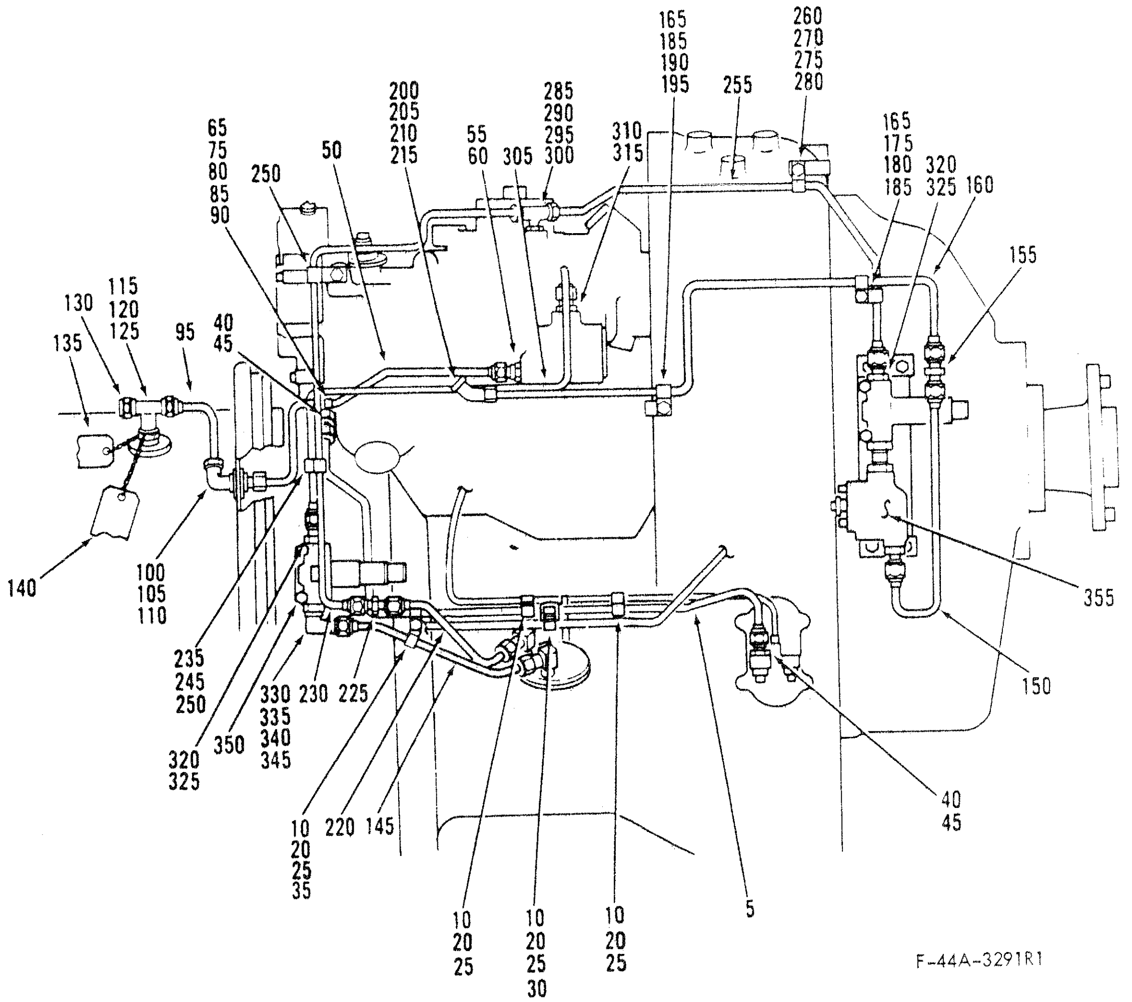
R F. (Codes GA, KA) Install Fuel System Plumbing, Pneumatic Lines, Attaching Parts, and Fittings (See Figure 203)

CAUTION: WHEN PNEUMATIC LINES ARE INSTALLED, EXERCISE CARE THAT NO CONTAMINATION IS INTRODUCED NOR THREAD LUBRICATION COMPOUND IS USED. ASSURE PROPER ALIGNMENT AND THREAD ENGAGEMENT TO PREVENT NUT TO FITTING GALLING AND/OR CROSS THREADING.

NOTE: Lubricate packings or gaskets used in fuel system with any type jet fuel prior to installation unless otherwise specfied. Packings or gaskets used in pneumatic system may be installed dry. An alternate lubricant (OS-124) may be used on all packings or gaskets prior to installation unless otherwise specified. Apply lubricant sparingly and spread evely to a thin transparent film to minimize contamination. Apply lubricating compound (Liqui-Moly, Grade NV) to threads of bolts and screws, and apply clean engine oil to threads (except first two threads) of male plumbing fittings used in fuel system located forward of the fireshield unless otherwise specified.

R Refer to 70-00-00, STANDARD PRACTICES, for recommended
R general torque values. Add frictional drag (run-down)
R torque of self locking devices to recommended values.

(1) Install reducer with new packing into solenoid valve. Tighten reducer (320) to 60 to 65 inch-pounds torque. Install fitting with ring and new packing into fuel pump assembly. Tighten nut (285) to 30 to 35 inch-pounds torque. Install tube assembly between reducer and fitting with attaching parts. Tighten mounting nut for bracket (280) to 80 inch-pounds torque. Tighten nut (260) to 27 inch-pounds torque.



(Codes GA, KA) Fuel System Plumbing Installation
Figure 203

1. F. (2) Install fitting with ring and new packing into fuel pressurizing valve. Tighten nut (205) to 30 to 35 inch-pounds torque. Install tube assembly onto fitting from fuel pressurizing valve with attaching parts. Tighten nut that attaches bracket (195) to 50 inch-pounds torque. Tighten nuts (165) to 27 inch-pounds torque. Install reducer in end of tube. Install tube assembly between reducer and fitting on bottom of fuel pressure regulator.

(3) Install elbow with ring and new packing into bottom of fuel heater lockout valve. Tighten nut (335) to 50 to 55 inch-pounds torque. Install tube assembly from elbow to oil-to-fuel cooler.

(4) Install unions with new packings into fuel control unit and temperature sensor. Tighten unions (40) to 35 to 40 inch-pounds torque. Install tube assembly between unions with attaching parts. Tighten nuts (10) to 27 inch-pounds torque.

(5) Install tube assembly of fitting from fuel pump assembly with attaching parts. Tighten bolt that attaches clamp (250) to 20 to 25 inch-pounds torque. Install reducer in end of tube assembly. Install tube assembly between reducer and oil-to-fuel cooler.

KEY TO FIGURE 203

R 5. TUBE (IPC FIG. 10)
10. NUT
20. BOLT
25. CLAMP
30. CLAMP
35. CLAMP
40. UNION
45. PACKING
50. TUBE
55. REDUCER
60. PACKING
65. NUT
75. BOLT
80. CLAMP
85. BOLT
90. BRACKET
95. TUBE
100. ELBOW
105. NUT
110. WASHER
115. TEE
120. NUT
125. GASKET
130. CAP
135. TAG
140. TAG
145. TUBE
150. TUBE
155. REDUCER
160. TUBE
165. NUT
175. BOLT
180. SPACER
185. CLAMP
190. BOLT
195. BRACKET
200. FITTING
205. NUT
210. PACKING
215. RING
220. TUBE
225. REDUCER
230. TUBE
235. NUT
245. BOLT
250. CLAMP
255. TUBE
260. NUT
270. BOLT
275. CLAMP
280. BRACKET
285. NUT
290. PACKING
295. FITTING
300. RING
305. TUBE
310. UNION
315. PACKING
320. REDUCER
325. PACKING
330. ELBOW
335. NUT
340. RING
345. PACKING
350. LOCKOUT VALVE
355. FUEL REGULATOR

1. F. (6) Install reducer with new packing into top of fuel heater lockout valve. Tighten reducer (320) to 60 to 65 inch-pounds torque. Install union with new packing into fuel pump assembly. Tighten union (310) to 35 to 40 inch-pounds torque. Install tube assembly between reducer and union with attaching parts. Tighten nut (235) to 27 inch-pounds torque.

(7) Install reducer with new packing into fuel control unit. Tighten reducer (55) to 35 to 40 inch-pounds torque. Install elbow with new washers into upper shield half assembly and secure. Tighten nut (105) to 110 to 130 inch-pounds torque. Install tube assembly between reducer and elbow with attaching parts. Tighten bracket attaching bolt (75) to 50 to 60 inch-pounds torque. Tighten nut (65) to 27 inch-pounds torque.

(8) Install tee with new gasket into plenum and secure. Tighten nut (120) to 50 to 55 inch-pounds torque. Install tube assembly between tee and elbow in upper shield half assembly. Install cap on tee. Tighten cap (130) to 65 to 70 inch-pounds torque. Safety wire cap in manner noted during removal.

NOTE: Provide a suitable container to drain residual fuel from lines and fuel control assembly.

R G. (Code HA) Remove Fuel Lines, Pneumatic Lines, Attaching Parts, and Fittings (See Figure 203)

R H. (Code HA) Install Fuel Lines, Pneumatic Lines, Attaching Parts, and Fittings (See Figure 203)

CAUTION: WHEN PNEUMATIC LINES ARE INSTALLED, EXERCISE CARE THAT NO CONTAMINATION IS INTRODUCED NOR THREAD LUBRICATION COMPOUND IS USED. ASSURE PROPER ALIGNMENT AND THREAD ENGAGEMENT TO PREVENT NUT TO FITTING GALLING AND/OR CROSS THREADING.

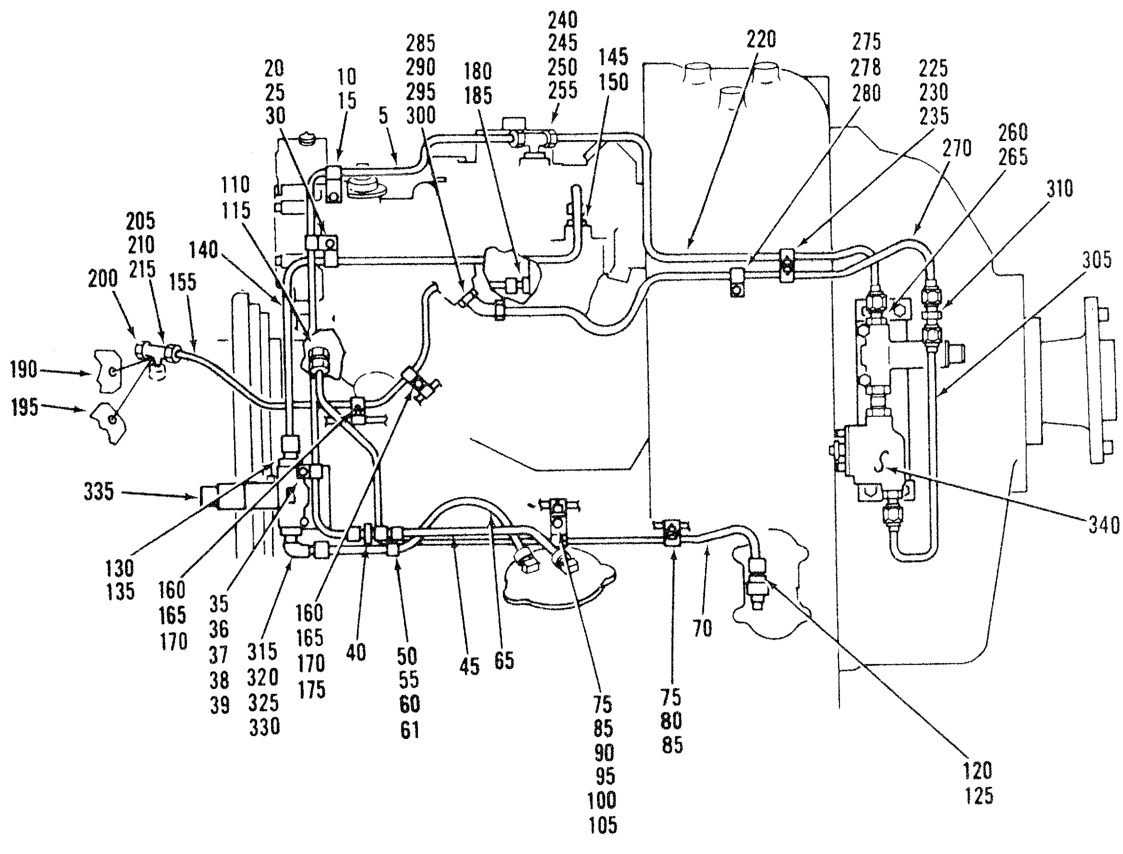
NOTE: Lubricate packings or gaskets used in fuel system with any type jet fuel prior to installation unless otherwise specified. Packings or gaskets used in pneumatic system may be installed dry An alternate lubricant (OS-124) may be used on all packings or gaskets prior to installation unless otherwise specified. Apply lubricant sparingly and spread evely to a thin transparent film to minimize contamination. Apply lubricating compound (Liqui-Moly, Grade NV) to threads of bolts and screws, and apply clean engine oil to threads (except first two threads) of male plumbing fittings used in fuel system located forward of the fireshield unless otherwise specified.

R Refer to 70-00-00, STANDARD PRACTICES, for recommended
R general torque values. Add frictional drag (run-down)
R torque of self locking devices to recommended values.

1. H (1) Install reducer with new packing into top of solenoid valve Tighten reducer (260) to 60 to 65 inch-pounds torque. Install tee with ring and new packings into fuel control. Tighten nut (255) to 30 to 35 inch-pounds torque. Install tube assembly between reducer and tee.

(2) Install fitting with ring and new packing into fuel pressurizing valve. Tighten nut (300) to 30 to 35 inch-pounds torque Install tube assembly in bottom of fuel pressure regulator valve. Install reducer in end of tube assembly. Install tube assembly between reducer and fitting in fuel pressurizing valve with attaching parts. Tighten bolt (275) to 25 inch-pounds torque. Tighten nut (225) to 27 inch-pounds torque.

(3) Install elbow with ring and new packingin bottom of fuel heater lockout valve. Tighen nut (330) to 50 to 55 inch-pounds torque. Install tube assembly between elbow and fuel-to-oil cooler.



(Codes HA) Fuel System Plumbing Installation
Figure 204

1. H. (4) Install tube assembly with attaching parts to tee in fuel control. Tighten bolt (15) to 20 to 25 inch-pounds torque. Tighten bolt (36) that secures clamp to fuel heater lockout valve to 35 inch-pounds torque.

(5) Install reducer in tube assembly. Install tube assembly between reducer and oil-to-fuel cooler.

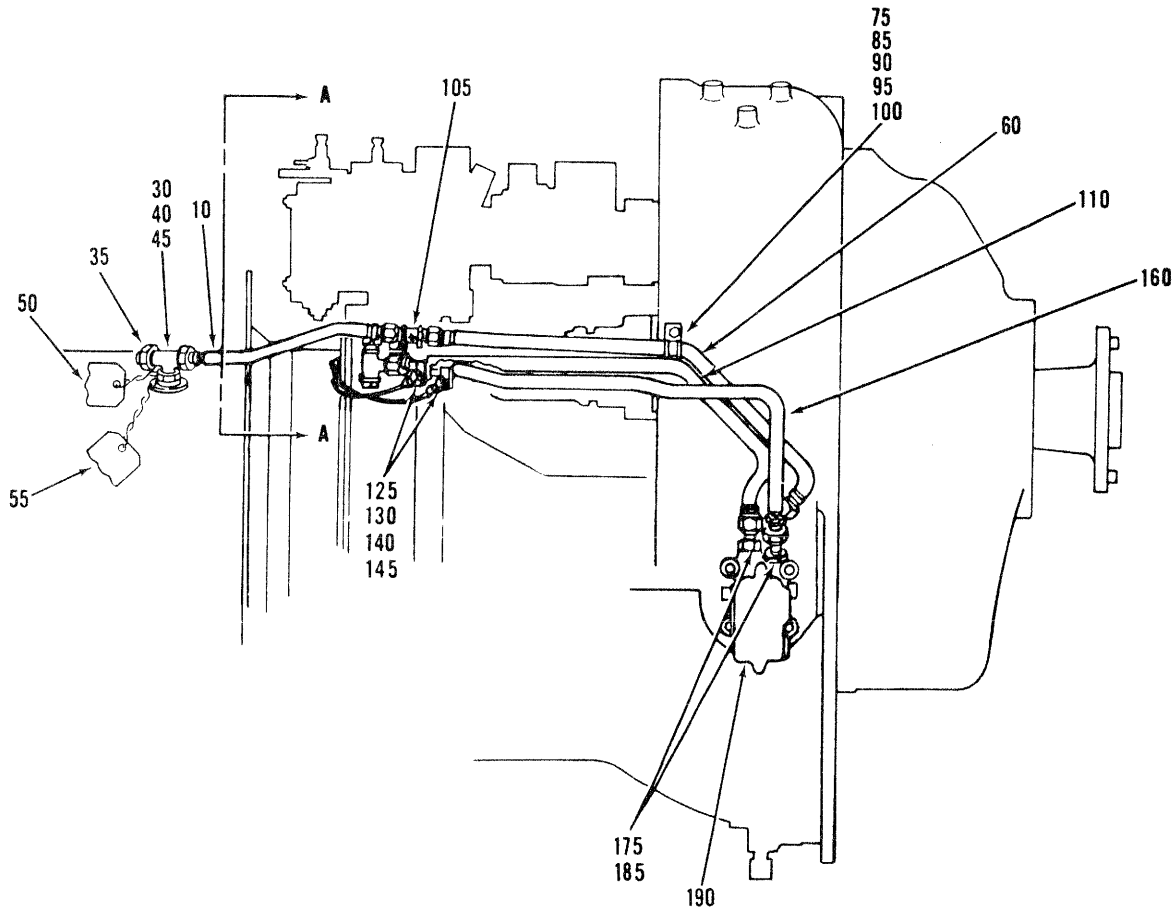
(6) Install unions with new packings into fuel control unit and temperature sensor. Tighten unions (110, 120) to 35 to 40 inch-pounds torque. Install tube assembly with attaching parts between unions. Tighten bolts (50, 75) to 27 inch-pounds torque. Tighten bracket attaching bolt (95) to 75 inch-pounds torque. Tighten nut (75) to 27 inch-pounds torque.

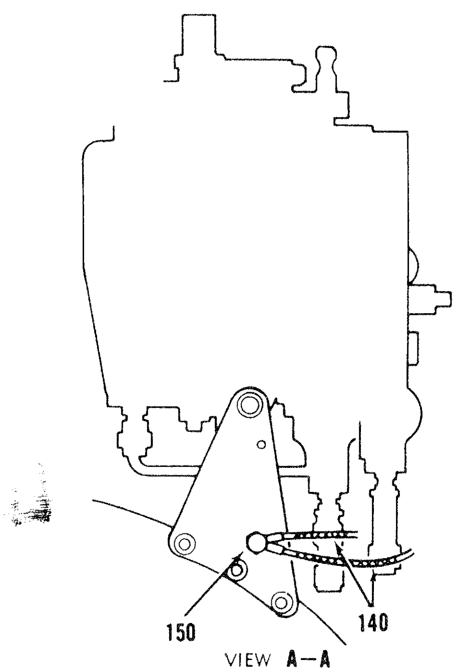
(7) Install reducer with new packing into top of fuel heater lockout valve. Tighten reducer (130) to 60 to 65 inch-pounds torque. Install union with new packing into fuel pump assembly. Tighten union (145) to 35 to 40 inch-pounds torque. Install tube assembly between reducer and union with attaching parts. Tighten nut (20) to 27 inch-pounds torque.

(8) Install reducer with new packing into fuel control unit. Tighten reducer (180) to 35 to 40 inch-pounds torque. Install tee with new gasket into plenum and secure. Tighten nut (215) to 50 to 55 inch-pounds torque. Install tube assembly between reducer and tee with attaching parts. Tighten nuts (165) to 27 inch-pounds torque. Install cap on tee. Tighten cap (200) to 65 to 70 inch-pounds of torque. Safety wire cap in manner noted during removal.

KEY TO FIGURE 204

R 5. TUBE (IPC FIG. 11)
10. CLAMP
15. BOLT
20. NUT
25. BOLT
30. CLAMP
35. CLAMP
40. REDUCER
45. TUBE
50. NUT
55. BOLT
60. CLAMP
65. TUBE
70. TUBE
75. NUT
80. BOLT
85. CLAMP
90. BOLT
95. BOLT
100. CLAMP
105. BRACKET
110. UNION
115. PACKING
120. UNION
125. PACKING
130. REDUCER
135. PACKING
140. TUBE
145. UNION
150. PACKING
155. TUBE
160. NUT
165. BOLT
170. CLAMP
175. CLAMP
180. REDUCER
185. PACKING
190. TAG
195. TAG
200. CAP
205. TEE
210. GASKET
215. NUT
220. TUBE
225. NUT
230. BOLT
235. CLAMP
240. TEE
245. PACKING
250. RING
255. NUT
260. REDUCER
265. PACKING
270. TUBE
275. BOLT
280. CLAMP
285. FITTING
290. PACKING
295. RING
300. NUT
305. TUBE
310. REDUCER
315. ELBOW
320. PACKING
325. RING
330. NUT
335. LOCKOUT VALVE
340. FUEL REGULATOR





VIEW A—A

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(Codes AA-AC) Inlet Temperature Sensor
Plumbing Installation
Figure 205

1. I. (Codes AA-AC) Remove Inlet Temperature Sensor Plumbing, Attaching Parts, and Fittings (See Figure 205)

J. (Codes AA-AC) Install Inlet Temperature Sensor Plumbing, Attaching Parts, and Fittings (See Figure 205)

CAUTION: WHEN LINES ARE INSTALLED, EXERCISE CARE THAT NO CONTAMINATION IS INTRODUCED NOR THREAD LUBRICATION COMPOUND IS USED. ASSURE PROPER ALIGNMENT AND THREAD ENGAGEMENT TO PREVENT NUT TO FITTING GALLING AND/OR CROSS THREADING.

NOTE: Packings or gaskets may be installed dry or lubricant (OS-124) may be used prior to installation unless otherwise specified; apply lubricant sparingly and spread evely to a thin transparent film to minimize contamination. Apply lubricating compound (Liqui-Moly, Grade NV) to threads of bolts and screws located forward of the fireshield unless otherwise specified.

R R R Refer to 70-00-00, STANDARD PRACTICES, for recommended general torque values. Add frictional drag (run-down) torque of self locking devices to recommended values.

(1) Install elbow or tee with new gasket or packing into turbine plenum and secure with nut. Tighten nut (45) to 50 to 55 inch-pounds torque.

(2) Install unions with new gaskets or packing into inlet temperature sensor. Tighten unions (175) to 60 to 65 inch-pounds torque.

(3) Install bracket on oil filter mounting stud. Tighten nut to 50 inch-pounds torque.

KEY TO FIGURE 205

R 10. TUBE ASSY (IPC FIG. 24)
30. TEE
35. CAP
40. GASKET
45. NUT
50. TAG
55. TAG
60. TUBE ASSY
75. NUT
85. BOLT
90. WASHER
R 95. CLAMP
100. BRACKET
105. FILTER
110. TUBE ASSY
125. NUT
130. BOLT
140. JUMPER ASSY
145. CLAMP
150. BOLT
160. TUBE ASSY
175. UNION
185. GASKET
190. INLET TEMPERATURE SENSOR

1. J. (4) Install tube assembly between plenum elbow or tee and air filter. Install air filter with arrow toward engine intake. Install tube assembly with attaching parts between air filter and inlet temperature sensor union. Tighten nut (75) to 20 inch-pounds torque.

(5) Install tube assemblies between tees in fuel control and unions in temperature sensor.

(6) (Engines with SB73-0009) Install clamps onto tube assemblies. Secure jumper assemblies to clamp with nuts and bolts. Tighten nuts (125) to 20 inch-pounds torque. Secure jumper assemblies to fuel control bracket support with bolt. Tighten bolt (150) to 25 inch-pounds torque.

(7) (Engines with Tube Assemblies Part No. 897055-2 and 895056-2) Secure jumper assemblies to tube assemblies with bolts and nuts. Tighten nuts (125) to 20 inch-pounds torque. Secure jumper assemblies to fuel control support bracket with bolt. Tighten bolt to 37 inch-pounds torque.

(8) Install cap on tee installed in turbine plenum. Tighten cap (35) to 65 to 70 inch-pounds torque. Safety wire cap in manner noted during removal.

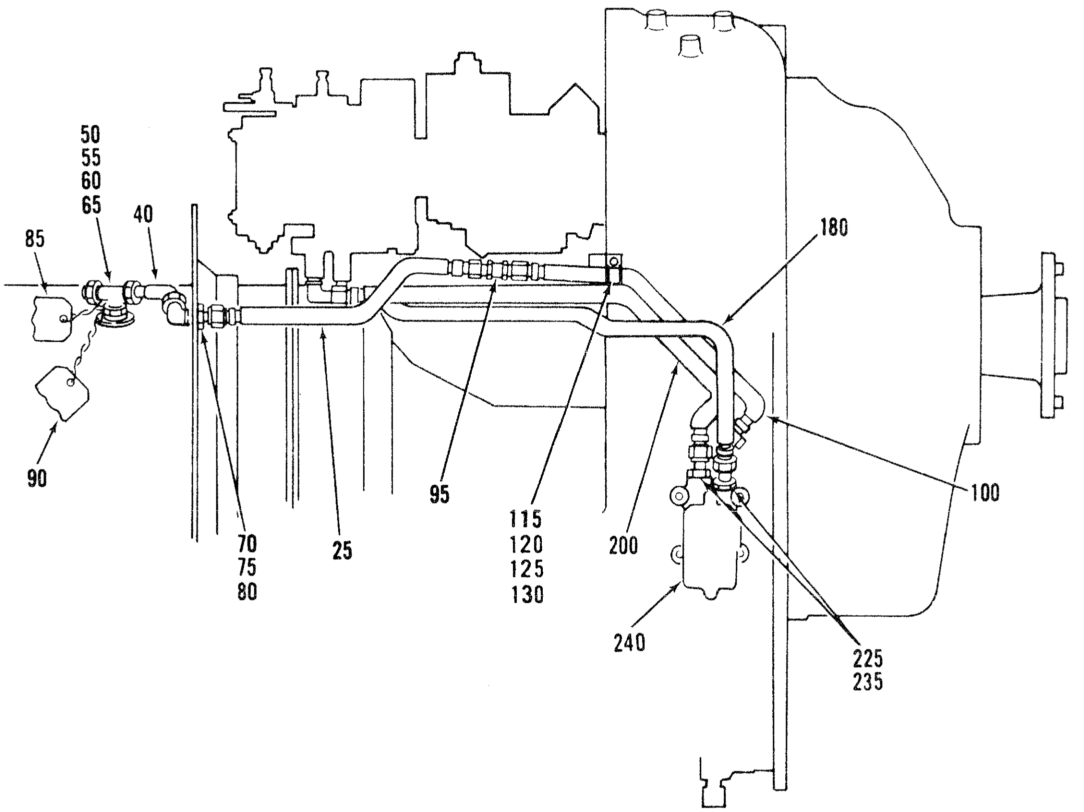
R K. (Codes BA-BC, EA) Remove Inlet Temperature Sensor Plumbing, Attaching Parts, and Fittings (See Figure 206)

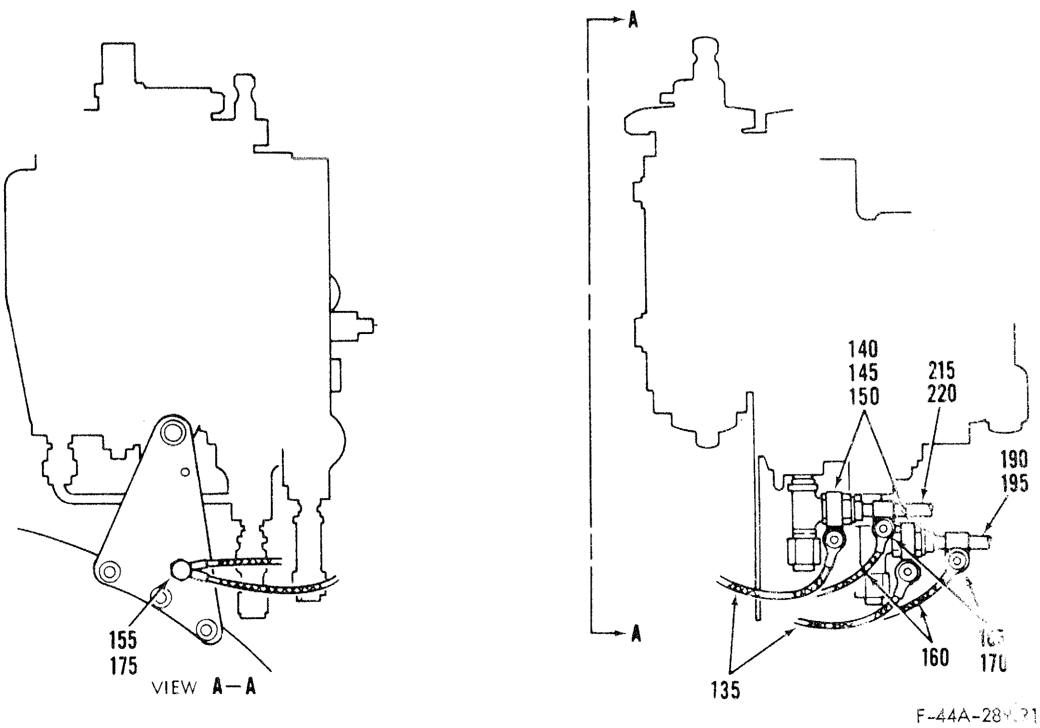
R L. (Codes BA-BC, EA) Install Inlet Temperature Sensor Plumbing, Attaching Parts, and Fittings (See Figure 206)

CAUTION: WHEN LINES AND FITTINGS ARE INSTALLED, EXERCISE CARE THAT NO CONTAMINATION IS INTRODUCED OR THREAD LUBRICATION COMPOUND IS USED. ASSURE PROPER ALIGNMENT AND THREAD ENGAGMENT TO PREVENT NUT FROM GALLING AND/OR CROSS THREADING.

KEY TO FIGURE 206 ➡

25. TUBE ASSY (IPC FIG. 25)
40. TUBE ASSY
50. TEE
55. CAP
60. GASKET
65. NUT
70. ELBOW
75. NUT
80. WASHER
85. TAG
90. TAG
95. FILTER
100. TUBE ASSY
115. NUT
120. BOLT
125. CLAMP
130. BRACKET
135. JUMPER ASSY
140. NUT
145. BOLT
150. CLAMP
155. BOLT
160. JUMPER ASSY
165. NUT
170. BOLT
175. BOLT
180. TUBE ASSY
190. PNEUMATIC LINE HEATER
195. PNEUMATIC LINE HEATER
200. TUBE ASSY
215. PNEUMATIC LINE HEATER
220. PNEUMATIC LINE HEATER
225. UNION
235. GASKET
240. INLET TEMPERATURE SENSOR





(Codes BA-BC, EA) Inlet Temperature Sensor
Plumbing Installation
Figure 206

R

NOTE: Packings or gaskets may be installed dry or lubricant (OS-124) may be used prior to installation unless otherwise specified; apply lubricant sparingly and spread evenly to a thin transparent film to minimize contamination. Apply lubricating compound (Liqui-Moly, Grade NV) to threads of bolts and screws located forward of the fireshield unless otherwise specified.

R Refer to 70-00-00, STANDARD PRACTICES, for recommended
R general torque values. Add frictional drag (run-down)
R torque of self locking devices to recommended values.

1. L. (1) Install unions with new packings or gaskets into temperature sensor. Tighten unions (225) to 60 to 65 inch-pounds torque.

(2) Install tube assemblies or pneumatic line heaters between tees in fuel control unit and unions in temperature sensor.

(3) (Engines with SB73-0012) Install clamps onto tube assemblies. Secure jumper assemblies to clamps with bolts and nuts. Tighten nuts (165) to 20 inch-pounds torque. Secure jumper assemblies to fuel control support bracket with bolt. Tighten bolt (155) to 25 inch-pounds torque.

(4) (Engines with Tube Assembly Part No. 897053-1/-2 and 897054-1/-2) Secure jumper assemblies to tube assemblies with bolts and nuts. Tighten bolts (170) to 20 inch-pounds torque. Secure jumper assemblies to fuel control support bracket with bolt. Tighten bolt (175) to 35 inch-pounds torque.

(5) Install tee with new gasket into plenum and secure with nut. Tighten nut (65) to 50 to 55 inch-pounds torque.

(6) Install cap on tee in plenum. Tighten cap (55) to 65 to 70 inch-pounds torque. Safety wire cap in manner noted during removal.

(7) Install elbow with new washer into upper shield half assembly and secure with nut. Tighten nut (75) to 50 to 55 inch-pounds torque.

(8) Install tube assembly between tee in plenum and elbow in upper shield half assembly.

(9) Install tube assembly between elbow in upper shield half assembly and filter.

CAUTION: P3 FILTER MUST BE INSTALLED WITH ARROW (FLOW DIRECTION INDICATION) TOWARD ENGINE INTAKE.

(10) Install filter.

1. L. (11) Install bracket on oil filter mounting pad. Tighten nut to 50 inch-pounds torque.

(12) Install tube assembly with attaching parts between filter and temperature sensor. Tighten nut (115) to 20 inch-pounds torque.

R M. (Codes CA-CC) Remove Inlet Temperature Sensor Plumbing, Attaching Parts, and Fittings (See Figure 207)

R N. (Codes CA-CC) Install Inlet Temperature Sensor Plumbings, Attaching Parts, and Fittings (See Figure 207)

CAUTION: WHEN LINES AND FITTINGS ARE INSTALLED, EXERCISE CARE THAT NO CONTAMINATION IS INTRODUCED OR THREAD LUBRICATION COMPOUND IS USED. ASSURE PROPER ALIGNMENT AND THREAD ENGAGEMENT TO PREVENT NUT FROM GALLING AND/OR CROSS THREADING.

NOTE: Packings or gaskets may be installed dry or lubricant (OS-124) may be used prior to installation unless otherwise specified; apply lubricant sparingly and spread evenly to a thin transparent film to minimize contamination. Apply lubricating compound (Liqui-Moly, Grade NV) to threads of bolts and screws located forward of the fireshield unless otherwise specified.

R Refer to 70-00-00, STANDARD PRACTICES, for recommended
R general torque values. Add frictional drag (run-down)
R torque of self locking devices to recommended values.

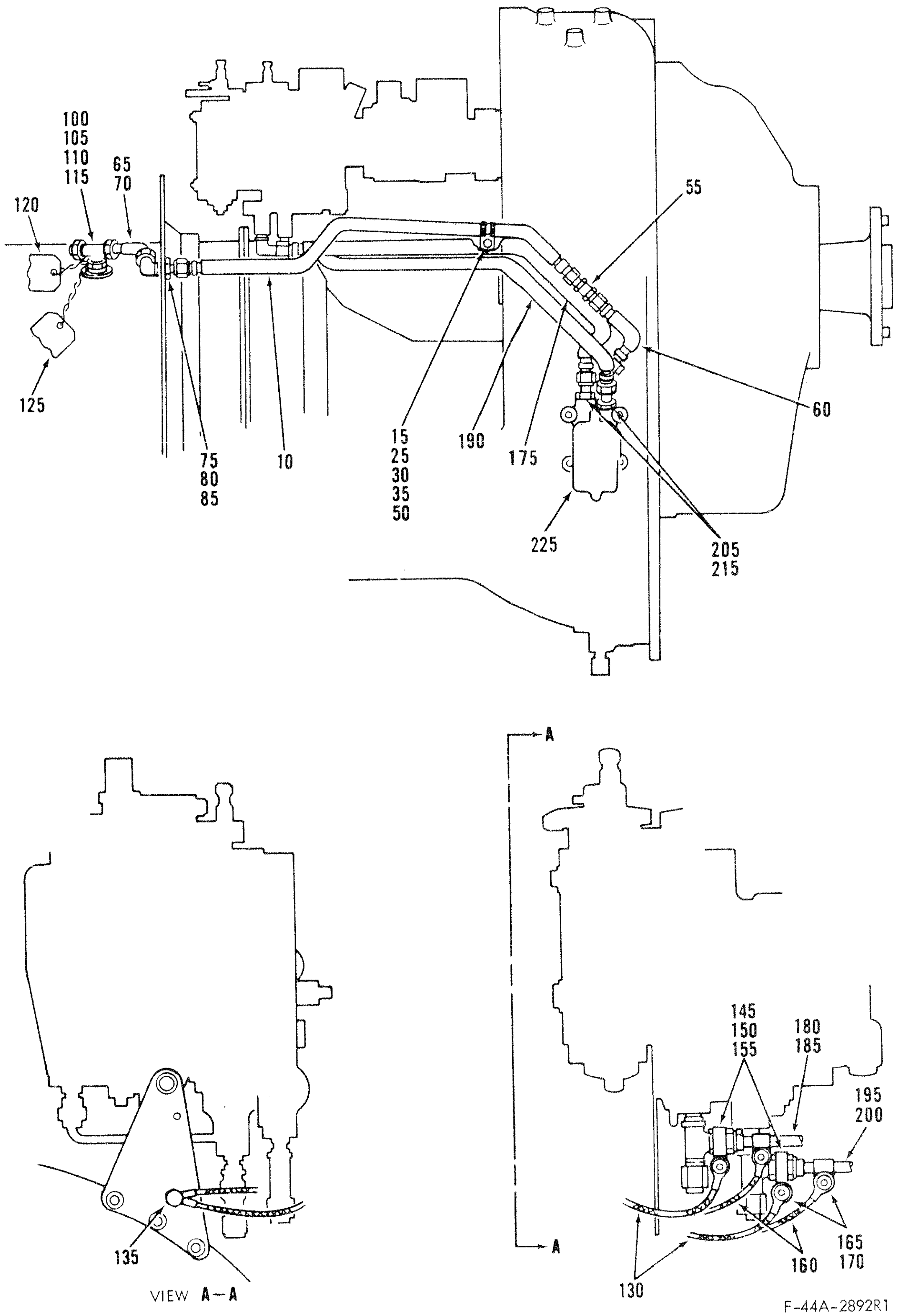
(1) Install unions with new packings or gaskets into temperature sensor. Tighten unions (205) to 60 to 65 inch-pounds torque.

(2) Install tube assemblies between tees in fuel control unit and unions in temperature sensor.

(3) (Engines with SB73-0009) Install clamps onto tube assemblies. Secure jumper assemblies to clamps with bolts and nuts. Tighten nuts (145) to 20 inch-pounds torque. Secure jumper assemblies to fuel control support bracket with bolt. Tighten bolt (135) to 25 inch-pounds torque.

(4) (Engines with Tube Assembly Part No. 897055-2 and 897056-2) Secure jumper assemblies to tube assemblies with bolts and nuts. Tighten bolts (165) to 20 inch-pounds torque. Secure jumber assemblies to fuel control support bracket with bolt. Tighten bolt (135) to 37 inch-pounds torque.

(5) Install tee with new gasket into plenum and secure with nut. Tighten nut (105) to 50 to 55 inch-pounds torque.



(Codes CA-CC) Inlet Temperature Sensor
Plumbing Installation
Figure 207

1. N. (6) Install cap on tee in plenum. Tighten cap (115) to 65 to 70 inch-pounds torque. Safety wire cap in manner noted during removal.

(7) Install elbow with new washer into upper shield half assembly and secure with nut. Tighten nut (75) to 50 to 55 inch-pounds torque.

(8) Install tube assembly between tee in plenum and elbow in upper shield half assembly.

(9) Install tube assembly between elbow in upper shield half assembly and filter with attaching parts. Tighten nut (15) to 20 inch-pounds torque.

CAUTION: P3 FILTER MUST BE INSTALLED WITH ARROW (FLOW DIRCTION INDICATION) TOWARD ENGINE INTAKE.

(10) Install filter.

(11) Install tube assembly between temperature sensor and filter.

KEY TO FIGURE 207

R 10. TUBE ASSY (IPC FIG. 26)
15. NUT
25. BOLT
30. WASHER
35. CLAMP
50. BRACKET
55. FILTER
60. TUBE ASSY
65. TUBE ASSY
70. TUBE ASSY
75. NUT
80. WASHER
85. ELBOW
100. TEE
105. NUT
110. GASKET
115. CAP
120. TAG
125. TAG
130. JUMPER ASSY
135. BOLT
145. NUT
150. BOLT
155. CLAMP
160. JUMPER ASSY
165. NUT
170. BOLT
175. TUBE ASSY
180. TUBE ASSY
185. TUBE ASSY
190. TUBE ASSY
195. TUBE ASSY
200. TUBE ASSY
205. UNION
215. GASKET
225. INLET TEMPERATURE SENSOR

2. Inspection/Check

NOTE: Table 202 provides a list of all materials and equipment required to perform Inspection/Check.

Table 202. Inspection/Check Equipment

Equipment	Description
NOTE: Equivalent substitutes may be used for listed items.	
Compressed air or nitrogen (clean, dry with pressure to 105 psig)	Commercially available
Detergent solution	American Gas and Chemical Company, 511 E 72nd Street, New York, NY 10021
Filter (10 micron)	Commercially available
Multimeter	Capable of measuring 0 to 100 ohms resistance with accuracy of +2/-2 percent
	Part No. 310C - Type 3-3022, Triplett Corporation, 286 Harmon Place, Bluffton, OH 45817
R Silicone rubber sealant	Commercially available

A. Inspect Tube Assemblies

(1) Inspect tube assemblies for bends, kinks, or cracks, Inspect threaded parts for crossed, galled, or peended threads, Check clamps for worn or missing cushions.

(2) Inspect tube assembly flares and flare sleeves as follows.

(a) Carefully remove enough of tube assembly insulation covering to slide tube nut back onto tube assembly to expose back of tube flare.

CAUTION: USE CARE TO PREVENT ANY CONTAMINATION FROM ENTERING PNEUMATIC TUBES DURING WIRE BRUSHING OR WHILE TUBES ARE DISCONNECTED. PRIOR TO INSTALLATION, CLEAN TUBES IN ACCORDANCE WITH CLEANING/PAINTING.

2. A. (2) (b) Inspect front and back of tube flare and flare sleeve for cracks or corrosion. No cracks allowed. Remove corrosion by brushing with wire brush.

(c) Following inspection, seal exposed end of insulation covering with silicone rubber sealant.

(3) Replace part that does not meet Inspection/Check requirements.

(4) Perform leakage check of pneumatic system lines as follows.

(a) Disconnect tube assembly at the turbine plenum tee. Connect clean, dry air or nitrogen source with filter and pressurize to 100 +5/-5 psig.

(b) Apply detergent solution to all pneumatic system connections. No leakage is allowed.

(c) If leakage is observed, apply proper torque values to the connecting nuts. If leakage is still observed, replace faulty parts and recheck for leakage.

R B. (Codes AA-CC, EA) Inspect P3 Filter for Contamination (Refer to Cleaning/Painting for Cleaning Procedures)

R C. (Codes AA-CC, EA) Inspect Pneumatic Line Heaters

(1) Inspect external coating for deterioration or damage.

(2) Inspect thermal switch covering for damage and for security fo thermal switch.

(3) Inspect external electrical leads and connectors for damage.

NOTE: Pneumatic line heater thermal switch must be closed for resistance check. Thermal switch shall open at 121 +3/-3C (250 +5/-5F) and close at 107C (225F) minimum.

(4) Measure resistance of each pneumatic line heater from pin to ground using multimeter. Resistance shall be 5 to 25 ohms.

(5) Replace pneumatic line heaters that do not meet Inspection/Check requirements.

3. Cleaning/Painting

NOTE: Table 203 provides a list of all materials and compounds required to perform Cleaning/Painting.

Table 203. Materials and Compounds

Material or Compound	Manufacturer
NOTE Equivalent substitutes may be used for listed items.	
Beaker (220 milliliter capacity)	Commercially available
Blackstone heated tank Ultrasonic cleaner (Model HT 1.9)	Blackstone Ultrasonics Inc, 1111 Allen St, Jamestown, NY 14701
Dowclene WR	Dow Chemical Corp, 2030 Dow Center Midland, MI 48640
Solvent, Stoddard (Federal Specification P-D-680, Type I)	Commercially available

A. Clean Parts

(1) Clean all standard metallic hardware in accordance with 72-00-00 GENERAL - CLEANING/PAINTING, Cleaning Method No. 1 or 2.

(2) Clean all fittings and plumbing in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 12.

R B. (Codes AA-CC, EA) Perform Special Cleaning

CAUTION: CLEANING SHALL BE PERFORMED IN A CLEAN, WELL-VENTILATED ROOM. RUBBER GLOVES AND PROTECTIVE CLOTHING SHALL BE WORN. EXTINGUISHERS AND VAT OR TANK COVERS SHALL BE ON HAND IN CASE OF FIRE.

NOTE: P3 filter may be cleaned as a temporary expedient by back flushing filter under light pressure using solvent, Stoddard (Federal Specification P-D-680, Type I). However, the sonic cleaning method should be employed for thorough cleaning.

(1) Clean P3 filter by sonic method as follows.

NOTE: Beaker is used in ultrasonic cleaner to conserve cleaning agent. Water is used in ultrasonic cleaner tank as transmitting fluid.

3. B. (1) (a) Place P3 filter in beaker and fill beaker with Dowclene WR to submerge P3 filter.

(b) Place beaker containing P3 filter in ultrasonic cleaner tank and fill ultrasonic cleaner tank to within three-eighths inch of top with water.

(c) Operate ultrasonic cleaner for five minutes.

(d) Discard contaminated WR and rinse P3 filter and beaker with clean Dowclene WR using plastic squeeze bottle.

(e) Refill beaker with clean Dowclene WR and operate ultrasonic cleaner for an additional five minutes.

(f) Repeat steps (d) and (e) until Dowclene WR remains clean after a five minute operation period.

(g) Remove the P3 filter from the beaker and blow dry using clean, low pressure air supply.

FUEL CONTROL HEAT PLUMBING - MAINTENANCE PRACTICES

1. Removal/Installation

Table 201. Materials and Compounds

Material or Compound	Manufacturer
NOTE Equivalent substitutes may be used for listed items.	
High temperature compound (Fel-Pro C-5A)	Fel-Pro, Division of Felt Products Mfg Co, 7450 North McCormick Blvd, Skokie, IL 60076

R A. (Codes AA-EA, Post SB73-0023/0024/0026) Remove Fuel Control Heat Plumbing (See Figure 201)

R (1) (Codes AA-AC) Remove clamp and bracket securing tube assembly. Remove tube assembly.

R (2) (Codes BA-EA) Remove tube assemblies. Remove elbow washers and nut from engine flange.

(3) Remove elbow and shim from turbine plenum. Remove bolt, elbow and washers from fuel control unit.

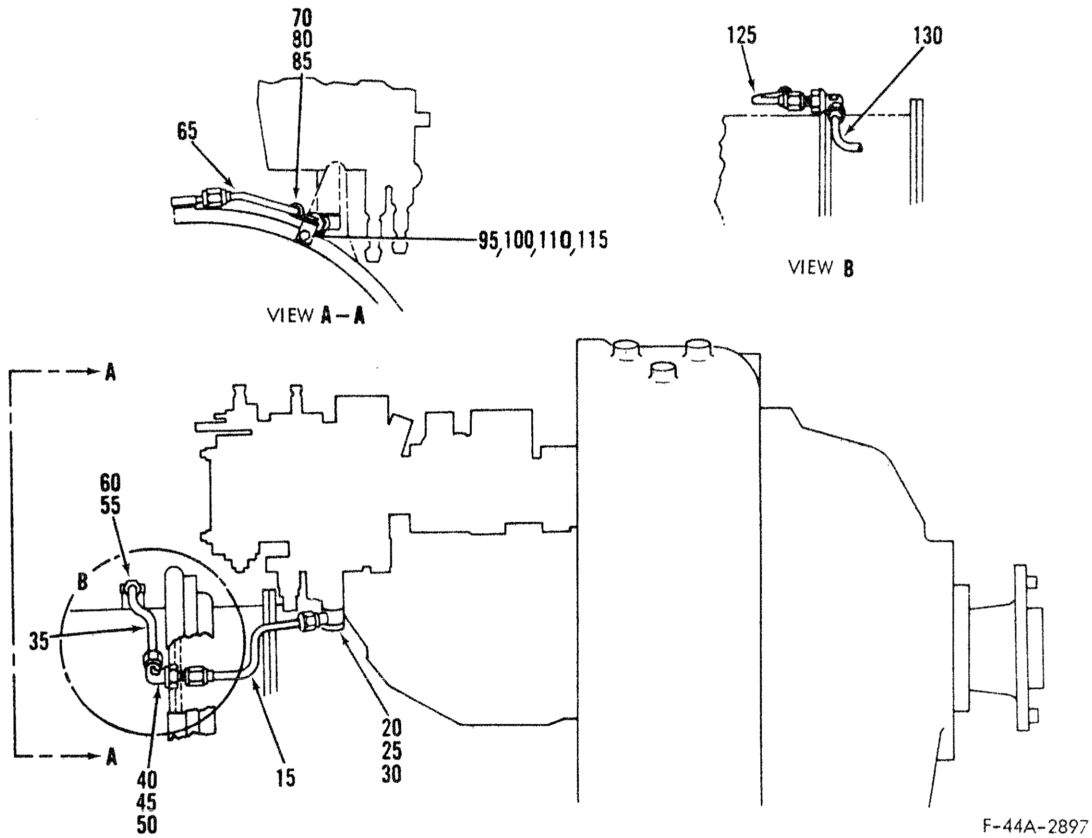
R B. (Codes AA-EA, Post SB73-0023/0024/0026) Install Fuel Control Heat Plumbing (See Figure 201)

CAUTION: WHEN LINES AND FITTING ARE INSTALLED, EXERCISE CARE THAT NO CONTAMINATION IS INTRODUCED OR THREAD LUBRICATION COMPOUND IS USED. ASSURE PROPER ALIGNMENT AND THREAD ENGAGEMENT TO PREVENT FITTINGS FROM GALLING AND/OR CROSS THREADING.

NOTE: Apply high temperature compound (Fel-Pro C5-A) to threads of bolts located aft of fireshields.

R Refer to 70-00-00, STANDARD PRACTICES, for recommended
R general torque values. Add frictional drag (run-down)
R torque of self locking devices to recommended values.

(1) Install elbow in turbine plenum with proper thickness of shim to orient elbow in proper position for tube assembly connection. Tighten elbow (55) to 55 to 75 inch-pounds torque.



R 15.	TUBE ASSY (IPC FIG. 27)	65.	TUBE ASSY
20.	BOLT	70.	NUT
25.	WASHER	80.	BOLT
30.	ELBOW	85.	CLAMP
35.	TUBE ASSY	95.	BRACKET
40.	NUT	100.	NUT
45.	WASHER	110.	WASHER
50.	ELBOW	115.	BOLT
55.	ELBOW	125.	TUBE ASSY
60.	SHIM	130.	TUBE ASSY

(Codes AA-EA, Post SB73-0023/0024/0026)
Fuel Control Heat Plumbing Installation
Figure 201

1. B. (2) Install elbow, washers and bolt in fuel control unit. Tighten bolt (20) to 60 to 65 inch-pounds torque.

R (3) (Codes AA-AC) Install tube assembly. Secure bracket and clamps with bolts, washer and nuts. Tighten bolt (115) to 50 to 60 inch-pounds torque. Tighten nut (70) to 20 inch-pounds torque.

R (4) (Codes BA-EA) Install elbow in engine flange and secure with washers and nut. Tighten nut (40) to 50 to 55 inch-pounds torque. Install tube assembly.

2. Inspection/Check

A. Perform Inspection of Fuel Control Heat Plumbing

(1) Inspect tube assemblies for cracks, dents, or other obvious damage.

(2) Inspect threaded parts for stripped, galled, or peened threads.

(3) Inspect laminated shim to ensure sufficient number of layers for proper orientation of elbow.

(4) Replace part that does not meet Inspection/Check requirements.

3. Cleaning/Painting

A. Clean Parts

(1) Clean all standard metallic hardware in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 1 or 2.

START FUEL PRESSURE REGULATOR - MAINTENANCE PRACTICES

1. Removal/Installation

NOTE: Table 201 provides a list of all materials and compounds required to perform Removal/Installation.

Table 201. Materials and Compounds

Material or Compound	Manufacturer
Any approved engine fuel	Commercially available
Any approved engine oil	Commercially available
Alternate packing lubricant Lubricant (OS-124)	Monsanto Company, 800 N Lindbergh Blvd, St. Louis, MO 63166
Lubricating compound (Liqui-Moly, Grade NV)	Lockrey Co, Lubricants Div, Cedar Shores, Southampton, NY 11968

R A. (Codes BA-BC, EA) Remove Start Fuel Pressure Regulator (See Figure 201)

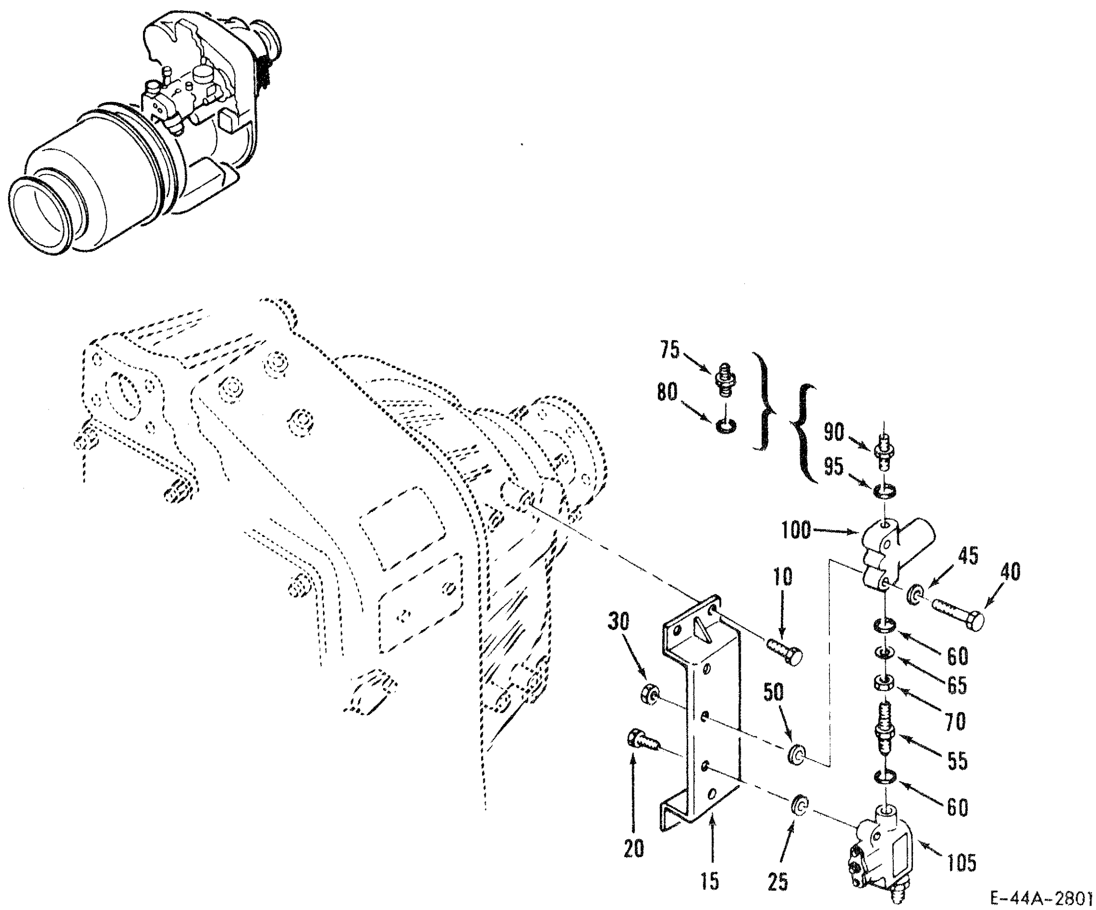
(1) Remove plumbing from start fuel pressure regulator and solenoid valve in accordance with 73-10-01, MAINTENANCE PRACTICES.

(2) Disconnect electrical connector from solenoid valve.

(3) Remove bolts attaching bracket to output housing assembly. Remove bracket.

(4) Remove start fuel pressure regulator and solenoid assembly from bracket.

(5) Separate start fuel pressure regulator and solenoid valve.



R 10. BOLT (IPC FIG. 42)
15. BRACKET
20. BOLT
25. WASHER
30. NUT
40. BOLT
45. WASHER
50. WASHER
55. FITTING
60. GASKET
65. RING
70. NUT
75. UNION
80. GASKET
90. FILTER
95. GASKET
100. SOLENOID VALVE
105. FUEL PRESSURE REGULATOR

(Codes BA-BC, EA) Start Fuel Pressure
Regulator Installation
Figure 201

R 1. B. (Codes BA-BC, EA) Install Start Fuel Pressure Regulator (See Figure 201)

NOTE: Prior to installation unless otherwise specified lubricate packings or gaskets with any type clean jet fuel. An alternate lubricant (OS-124) may be used; apply lubricant sparingly and spread evenly to a thin transparent film to minimize contamination. Apply lubricating compound (Liqui-Moly Grade NV) to threads of bolts or screws, and apply clean engine oil to threads (except first two threads) of male plumbing fittings unless otherwise specified.

R
R
R
Refer to 70-00-00, STANDARD PRACTICES, for recommended general torque values. Add frictional drag (run-down) torque of self locking devices to recommended values.

(1) Install fitting with new packing or gasket into start fuel pressure regulator. Tighten fitting.

(2) Install nut onto fitting followed by new ring and gasket.

(3) Install solenoid valve onto fitting with keyway in cannon plug facing start fuel pressure regulator. Tighten nut (70) to 50 to 55 inch-pounds torque.

(4) Install union or filter with new packing or gasket into solenoid valve. Tighten union (75) to 50 to 55 inch-pounds torque or filter (90) to 65 to 70 inch-pounds torque.

(5) Install start fuel pressure regulator and solenoid valve assembly onto bracket using washers under body of start fuel pressure regulator and under body of solenoid valve as required to level, and one washer under heads of bolts (40). Tighten bolts (20) to 25 inch-pounds torque. Tighten nut (30) to 25 inch-pounds torque.

(6) Install bracket onto output housing assembly and install washers and bolts. Tighten bolts (10) to 25 inch-pounds torque.

(7) Install plumbing on start fuel pressure regulator and solenoid valve in accordance with 73-10-01, MAINTENANCE PRACTICES.

(8) Connect electrical connector to solenoid valve.

R C. (Codes FA-LA) Remove Start Fuel Pressure Regulator (See Figure 202)

(1) Remove plumbing from start fuel pressure regulator and solenoid valve in accordance with 73-10-01, MAINTENANCE PRACTICES.

(2) Disconnect electrical connector from solenoid valve.

1. C. (3) Remove bolts attaching bracket to output housing assembly. Remove bracket.

(4) Remove start fuel pressure regulator and solenoid assembly from bracket.

(5) Separate start fuel pressure regulator and soleniod valve.

R D. (Codes FA-LA) Install Start Fuel Pressure Regulator (See Figure 202)

NOTE: Prior to installation unless otherwise specified lubricate packings or gaskets with any type clean jet fuel. An alternate lubricant (OS-124) may be used; apply lubricant sparingly and spread evenly to a thin transparent film to minimize contamination. Apply lubricating compound (Liqui-Moly, Grade NV) to threads of bolts or screws, and apply clean engine oil to threads (except first two threads) of male plumbing fittings unless otherwise specified.

R Refer to 70-00-00, STANDARD PRACTICES, for recommended
R general torque values. Add frictional drag (run-down)
R torque of self locking devices to recommended values.

(1) Install fitting with new packing or gasket into start fuel pressure regulator. Tighten fitting.

(2) Install nut onto fitting followed by new ring and gasket.

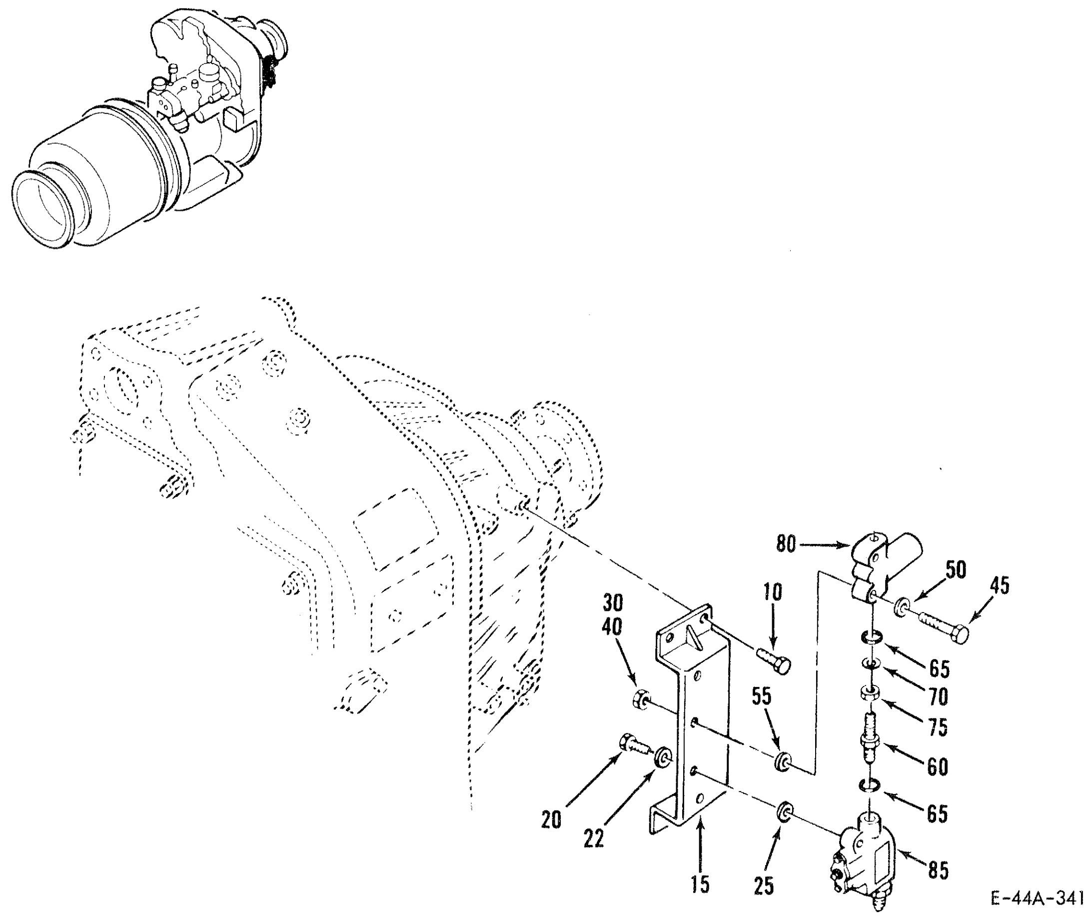
(3) Install solenoid valve onto fitting with keyway in cannon plug facing start fuel pressure regulator. Tighten nut (75) to 50 to 55 inch-pounds torque.

(4) Install start fuel pressure regulator and solenoid valve assembly onto bracket using washers under body of start fuel pressure regulator and under body heads of bolts (20, 45). Tighten bolts (20) to 25 inch-pounds torque. Tighten nut (30) to 27 inch-pounds torque.

(5) Install bracket onto output housing assembly and install bolts. Tighten bolts (10) to 25 inch-pounds torque.

(6) Install plumbing on start fuel pressure regulator and solenoid valve in accordance with 73-10-01, MAINTENANCE PRACTICES.

(7) Connect electrical connector to solenoid valve.



R 10. BOLT (IPC FIG. 43)
15. BRACKET
20. BOLT
22. WASHER
25. WASHER
30. NUT
40. NUT
45. BOLT
50. WASHER
55. WASHER
60. FITTING
65. PACKING
70. RING
75. NUT
80. SOLENOID VALVE
85. FUEL PRESSURE REGULATOR

(Codes FA-LA) Start Fuel Pressure
Regulator Installation
Figure 202

2. Adjustment/Test

A. Test Solenoid Valve

(1) Apply 24 volts dc across pins A and B of electrical connector. Valve shall open.

(2) Remove voltage. Valve shall close.

(3) Replace valve that does not meet requirements of steps (1) and (2) above.

3. Inspection/Check

A. Perform Inspection Check

(1) Check valve electrical connector for bent, broken, or burned pins.

(2) Check valve body for obvious damage.

(3) Check brackets for bends, cracks, or breaks.

(4) Inspect fittings for stripped, peened, or galled threads.

(5) Check for fuel leakage from drain connection on start fuel pressure regulator with parts installed. If leakage is noted, refer to 72-00-00, TROUBLE SHOOTING.

(6) Replace part that does not meet Inspection/Check requirements.

4. Cleaning/Painting

A. Clean Parts

(1) Clean all standard metallic hardware in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 1 or 2.

(2) Clean fittings in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 12

(3) Clean fuel pressure regulator and solenoid valve in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 11.

FUEL HEATER LOCKOUT VALVE - MAINTENANCE PRACTICES

1. Removal/Installation

   NOTE: Table 201 provides a list of all materials and compounds required to perform Removal/Installation.

Table 201. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Lubricating compound (Liqui-Moly, Grade NV)	Lockrey Co, Lubricants Div, Cedar Shores, Southampton, NY 11968

R A. (Codes BA-BC, EA-GA, KA, LA) Remove Fuel Heater Lockout Valve (See Figure 201)

(1) Remove plumbing from fuel heater lockout valve in accordance with 73-10-01, MAINTENANCE PRACTICES.

(2) Disconnect electrical connector from fuel heater lockout valve.

(3) Remove fuel heater lockout valve from bracket.

(4) Remove bracket.

R B. (Codes BA-BC EA-GA, KA, LA) Install Fuel Heater Lockout Valve (See Figure 201)

NOTE: Apply lubricating compound (Liqui-Moly, Grade NV) to threads of bolts or screws located forward of the fireshield unless otherwise specified.

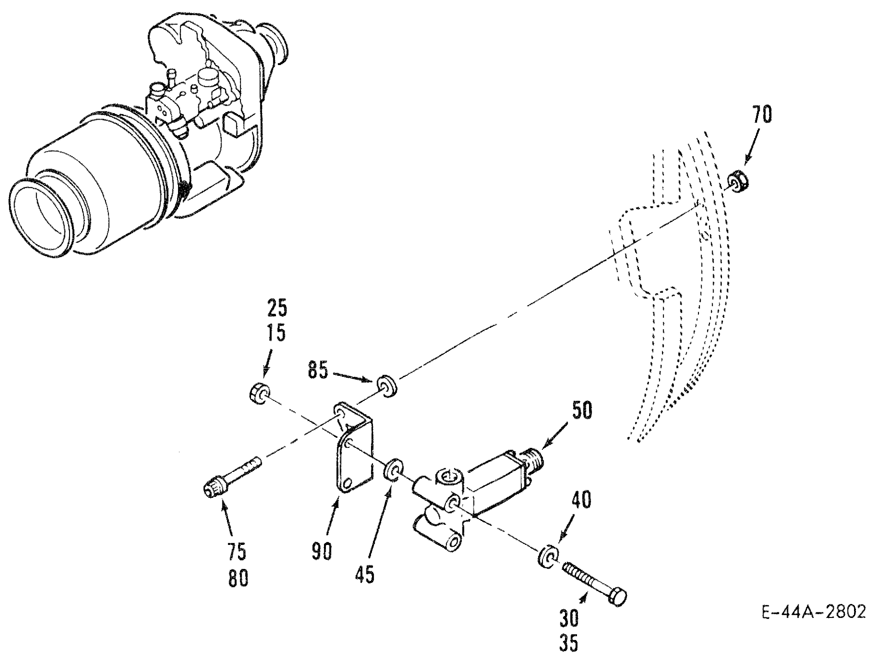
R
R
R
Refer to 70-00-00, STANDARD PRACTICES, for recommended general torque values. Add frictional drag (run-down) torque of self locking devices to recommended values.

(1) Install bracket onto compressor housing using washers between bracket and housing. Install bolts and nuts. Tighten bolts (75, 80) to 50 to 60 inch-pounds torque.

1. B. (2) Install fuel heater lockout valve, with arrow pointing up, onto bracket using washers under body of fuel heater lockout valve as required to level, and one washer under heads of bolts. Tighten nuts (15, 25) to 27 inch-pounds torque.

(3) Install plumbing onto fuel heater lockout valve in accordance with 73-10-01, MAINTENANCE PRACTICES.

(4) Connect electrical connector to fuel heater lockout valve.



R 15. NUT (IPC FIG. 44)
25. NUT
30. BOLT
35. BOLT
40. WASHER
45. WASHER
50. FUEL HEATER LOCKOUT VALVE
70. NUT
75. BOLT
80. BOLT
85. WASHER
90. BRACKET

(Codes BA-BC, EA-GA, KA, LA) Fuel Heater
Lockout Valve Installation
Figure 201

R 1. C. (Code HA) Remove Fuel Heater Lockout Valve (See Figure 202)

(1) Remove plumbing from fuel heater lockout valve in accordance with 73-10-01, MAINTENANCE PRACTICES.

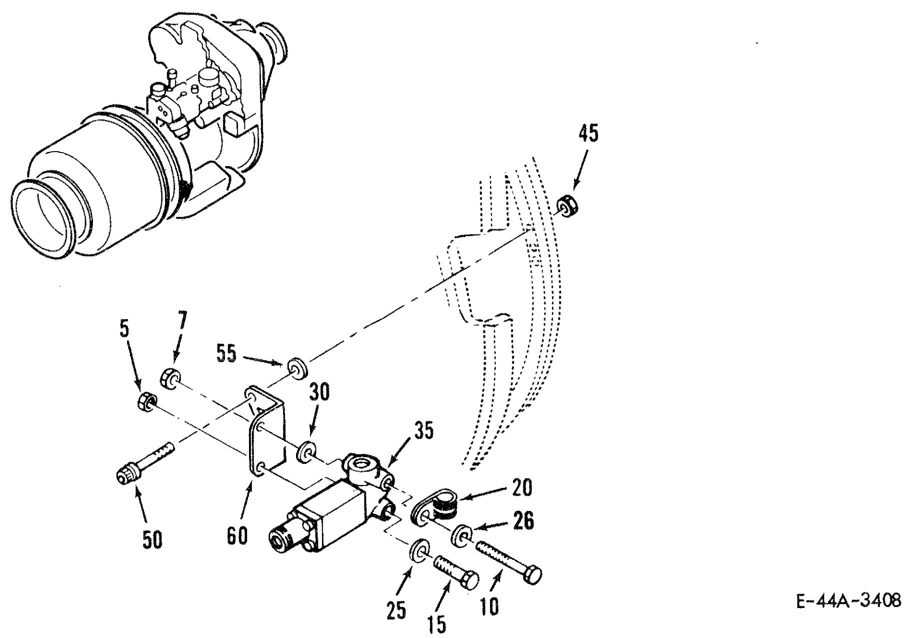
(2) Disconnect electrical connector from fuel heater lockout valve.

(3) Remove fuel heater lockout valve from bracket.

(4) Remove bracket.

R D. (Code HA) Install Fuel Heater Lockout Valve (See Figure 202)

(1) Install bracket onto compressor housing using washers between bracket and housing. Install bolts and nuts. Tighten bolts (50) to 50 to 60 inch-pounds torque.



R 5. NUT (IPC FIG. 45)	25. WASHER	45. NUT
7. NUT	26. WASHER	50. BOLT
10. BOLT	30. WASHER	55. WASHER
15. BOLT	35. FUEL HEATER LOCKOUT VALVE	60. BRACKET
20. CLAMP		

(Code HA) Fuel Heater Lockout
Valve Installation
Figure 202

1. D. (2) Install fuel heater lockout valve, with arrow pointing up, onto bracket using washers under body of fuel heater lockout valve as rquired to level, and one washer under heads of bolts. Tighten nuts (5, 7) to 27 inch-pounds torque.

(3) Install plumbing onto fuel heater lockout valve in accordance with 73-10-01, MAINTENANCE PRACTICES.

(4) Connect electrical connector to fuel heater lockout valve.

2. Adjustment/Test

A. Test Fuel Heater Lockout Valve

(1) Apply 24 volts dc across pins A and B of electrical connector. Valve shall close.

(2) Remove voltage from electrical connector. Valve shall open.

3. Inspection/Check

A. Inspect Fuel Heater Lockout Valve

(1) Visually inspect valve for cracks, evidence of leakage, and bent or broken connector pins.

(2) Visually inspect bracket for cracks.

B. Replace part that does not meet Inspection/Check requirements.

4. Cleaning/Pianting

A. Clean Parts

(1) Clean all standard metallic hardware in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 1 or 2.

(2) Clean fuel heater lockout valve in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 11.

FUEL SHUTOFF VALVE AND PLUMBING - MAINTENANCE PRACTICES

1. Removal/Installation

NOTE: Table 201 provides a list of all materials and compounds required to perform Removal/Installation.

Table 201. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Any approved engine fuel	Commercially available
Any approved engine oil	Commercially available
Alternate packing lubricant (OS-124)	Monsanto Company, 800 N Lindbergh Blvd, St. Louis, MO 63166
Lubricating compound (Liqui-Moly, Grade NV)	Lockrey Co, Lubricants Div, Cedar Shores, Southampton, NY 11968

R A. (Codes AA-AC) Remove Fuel Shutoff Valve and Plumbing (See Figures 201, 202)

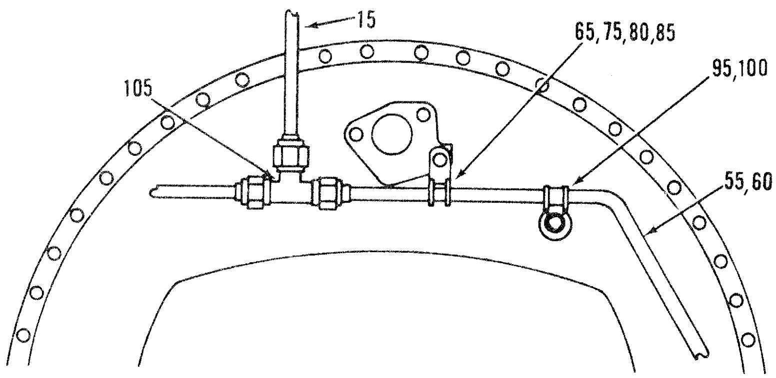
(1) Disconnect electrical connector and disconnect attached aircraft linkage.

(2) Remove tube assemblies, attaching parts, unions, fittings, and gaskets from fuel shutoff valve, fuel flow divider, and fuel control unit. (See figure 201.)

(3) Remove fuel shutoff valve and bracket from input housing assembly.

(4) Remove fuel shutoff valve from bracket.

(5) Remove actuating arm (manual override).



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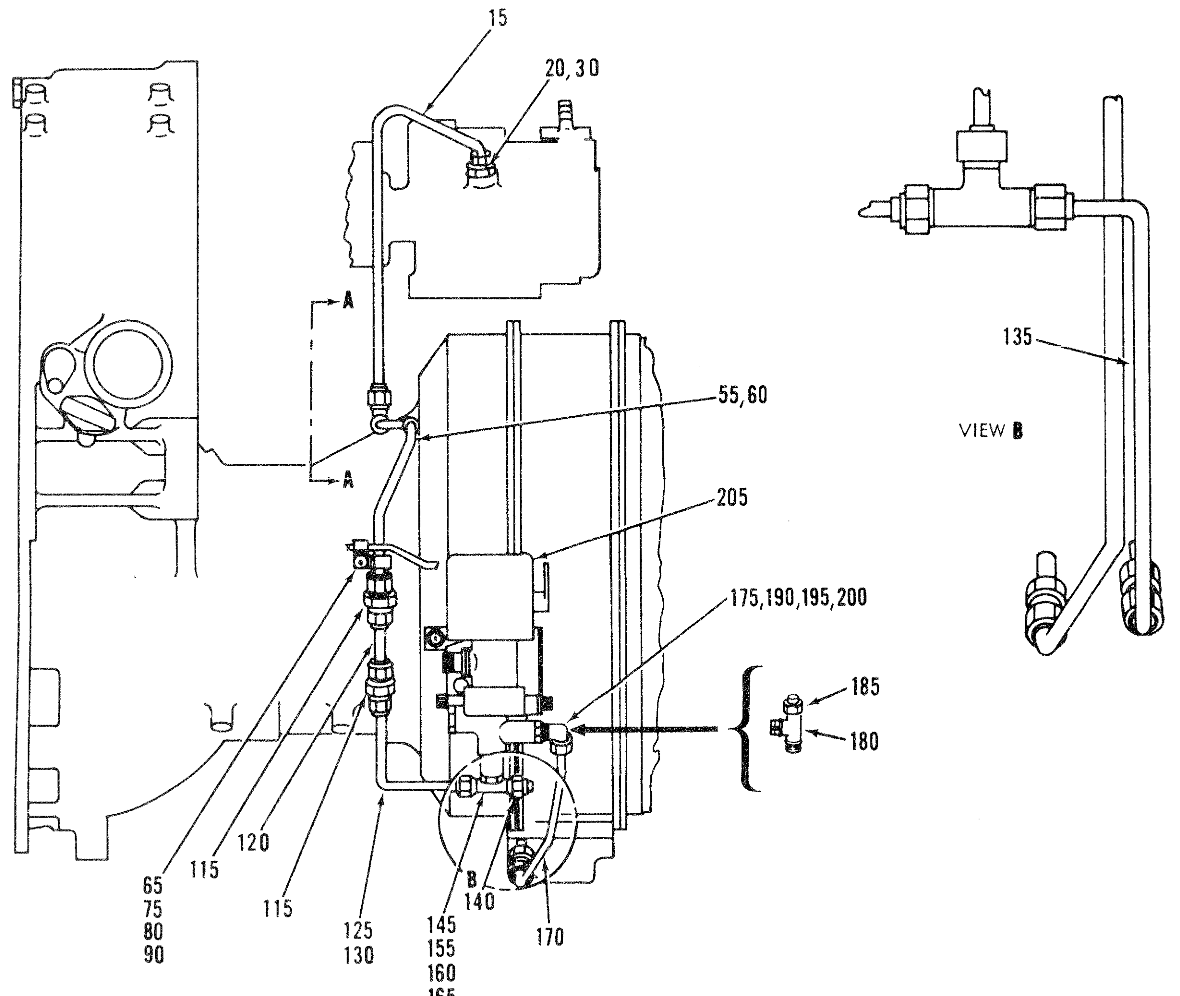

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(Codes AA-AC) Fuel Shutoff Valve
Plumbing Installation
Figure 201

R 1. B. (Codes AA-AC) Install Fuel Shutoff Valve and Plumbing (See Figures 201, 202, 203)

NOTE: Prior to installation unless otherwise specified lubricate packings or gaskets with any type clean jet fuel. An alternate lubricant (OS-124) may be used; apply lubricant sparingly and spread evenly to a thin transparent film to minimize contamination. Apply lubricating compound (Liqui-Moly Grade NV) to threads of bolts or sscrews, and apply clean engine oil to threads (except first two threads) of male plumbing fitting unless otherwise specified.

R
R
R
Refer to 70-00-00, STANDARD PRACTICES, for recommended general torque values. Add frictional drag (run-down) torque of self locking devices to recommended values.

(1) Ensure that fuel shutoff valve is in the AUTO position. Fuel shutoff valve is in AUTO position when index mark on end of fuel shutoff valve actuating shaft is in vertical position.

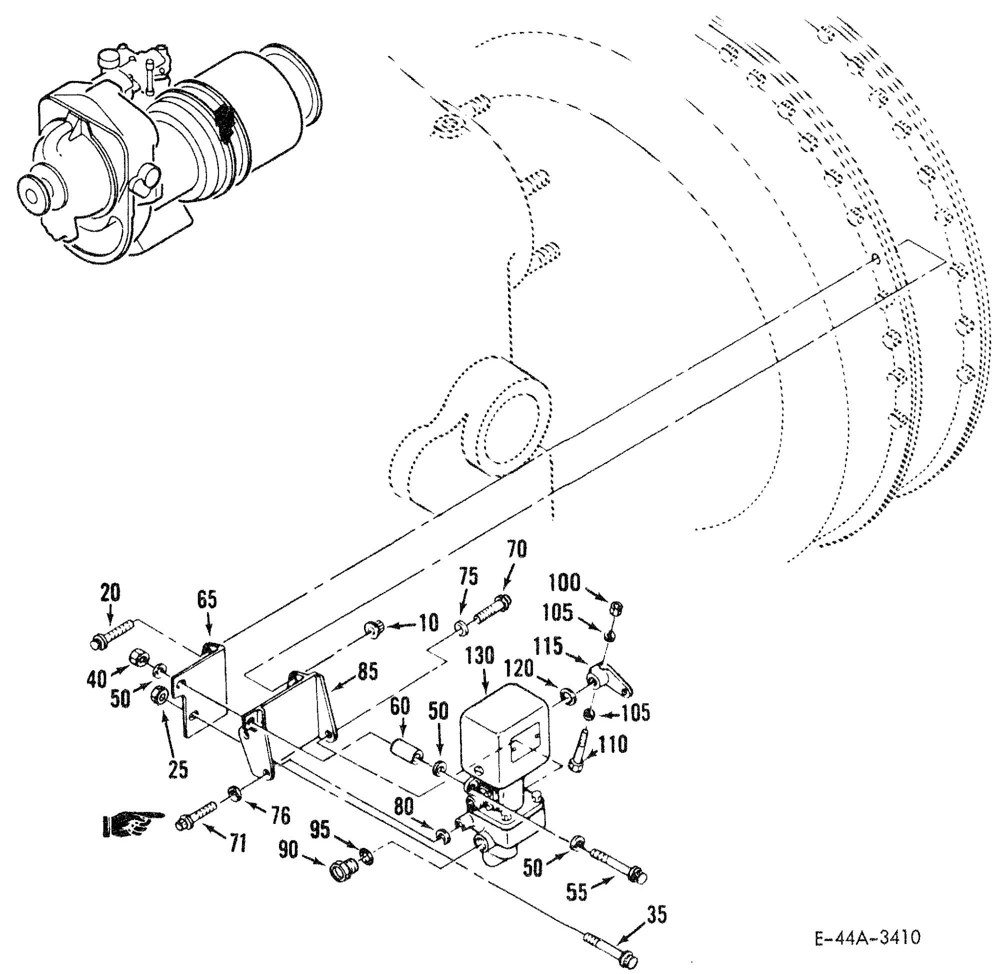
(2) Install actuating arm (manual override) on shaft extension of valve. Install 0.005 and 0.010 inch thickness of washers, as required, on shaft between actuating arm and valve body to obtain 0.001 to 0.006 inch shaft end play. Position actuating arm as shown in Figure 203.

(3) Install bolt, washers, and nut. Tighten nut (100, figure 202) to 20 inch-pounds torque.

(4) Install washer (50), spacer (60), and washers (80, as required 2 maximum) between fuel shutoff valve and bracket. (See figure 202.)

KEY TO FIGURE 201

R 15	TUBE ASSY (IPC FIG. 19)	100.	CLAMP	160.	RING
20.	FITTING	105.	TEE	165.	NUT
30.	GASKET	115.	UNION	170.	TUBE ASSY
55.	TUBE ASSY	120.	TUBE ASSY	175.	FITTING
60.	TUBE ASSY	125.	TUBE ASSY	180.	FITTING
65.	NUT	130.	TUBE ASSY	185.	CAP
75.	BOLT	135.	TUBE ASSY	190.	GASKET
80.	CLAMP	140.	CAP	195.	RING
85.	BRACKET	145.	TEE	200.	NUT
90.	CLAMP	155.	GASKET	205.	FUEL SHUTOFF VALVE
95.	NUT/BOLT				



R 10.	NUT (IPC FIG. 53)	76.	WASHER
20.	BOLT	80.	WASHER
25.	NUT	85.	BRACKET
35.	BOLT	90.	PLUG
40.	NUT	95.	PACKING
50.	WASHER	100.	NUT
55.	BOLT	105.	WASHER
60.	SPACER	110.	SCREW
65.	SUPPORT	115.	ARM
70.	BOLT	120.	WASHER
71.	BOLT	130.	FUEL SHUTOFF VALVE
75.	WASHER		

R (Codes AA-AC, FA, LA) Fuel Shutoff Valve Installation
Figure 202

1. B. (5) Install fuel shutoff valve on bracket and support. Install washers, bolts, and nuts. Washer (76) used with bolt (71), Part No. MS21280-06. Washer not used with Bolt Part No. MS21280-05. Tighten nut (25, figure 202) to 20 inch-pounds torque. Tighten nut (40) to 50 inch-pounds torque. Tighten bolts (70, 71) to 70 inch-pounds torque.

(6) Install assembled bracket, support, and fuel shutoff valve on engine and secure with bolts and nuts. Tighten bolts (20, figure 202) to 60 inch-pounds torque.

(7) Install plug with new packing into fuel shutoff valve. Tighten plug (90) to 65 to 70 inch-pounds torque.

(8) (Pre SB73-0026) Install fitting with ring and new packing or gasket into aft side of fuel shutoff valve and secure with nut. Tighten nut (200, figure 201) to 50 to 55 inch-pounds torque.

(9) (Post SB73-0026) Install fitting with ring and new packing or gasket into aft side of fuel shutoff valve and secure with nut. Tighten nut (200) to 50 to 55 inch-pounds torque. Install cap onto fitting. Tighten cap (185) to 100 to 120 inch-pounds torque.

(10) Install tube assembly between fitting in fuel shutoff valve and fuel flow divider.

(11) Install tee or fitting with ring and new packing or gasket into bottom of fuel shutoff valve and secure with nut. Tighten nut (165, figure 201) to 50 to 55 inch-pounds torque.

R (12) (Pre SB73-0017) Install tube assembly between tee in bottom of fuel shutoff valve and fuel flow divider.

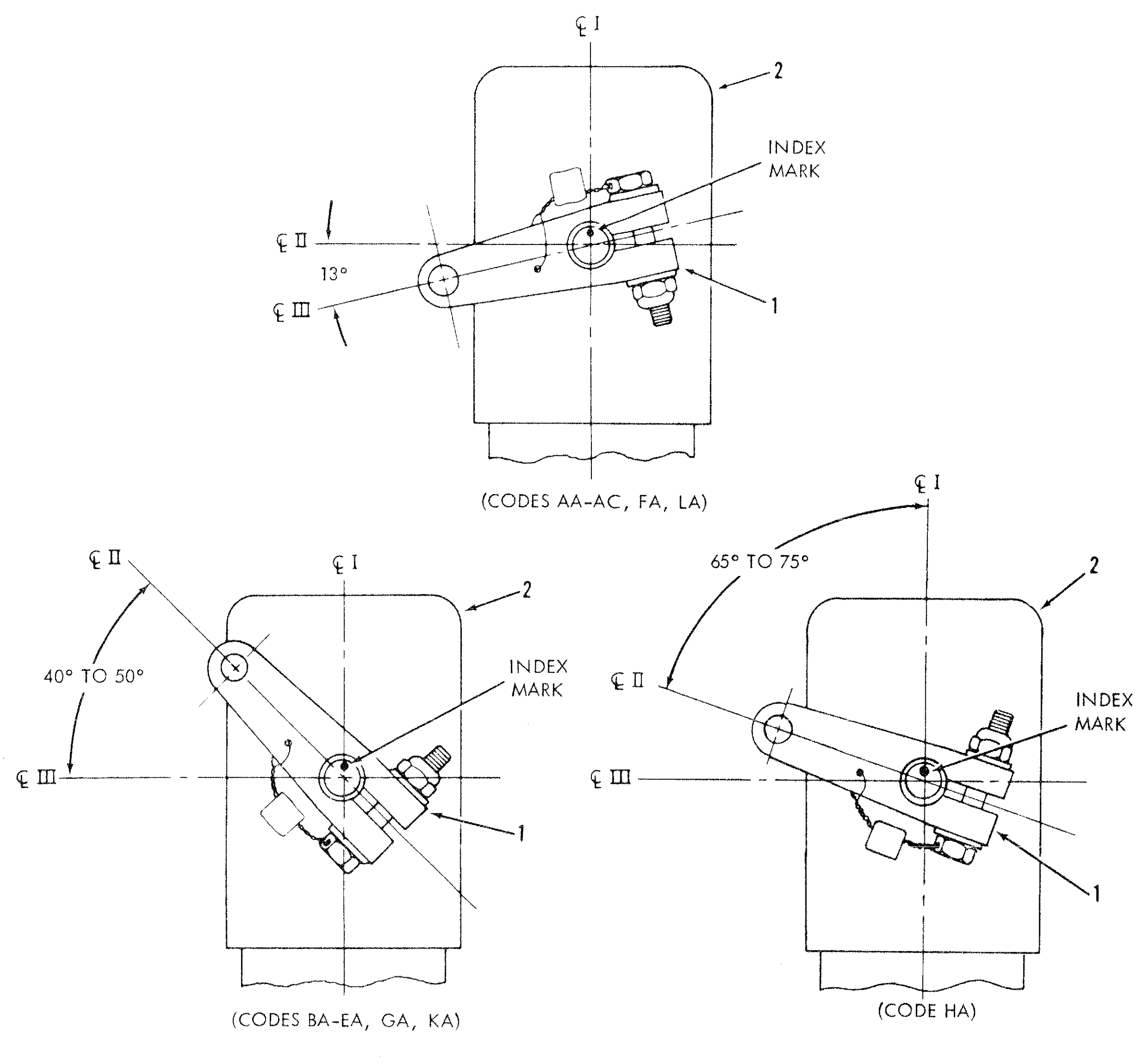
R (13) (Post SB73-0017) Install cap onto aft side of fitting. Tighten cap (140, figure 201) to 100 to 120 inch-pounds torque.

(14) Install reducer with new packing or gasket into fuel control unit. Tighten reducer (20, figure 201) to 65 to 70 inch-pounds torque.

(15) Assemble and install tube assemblies between reducer in fuel control unit and fitting in bottom of fuel shutoff valve with attaching parts. Tighten nut/bolt (95, figure 201) as applicable to 40 inch-pounds torque.

R C. (Codes BA-BC, EA GA, KA) Remove Fuel Shutoff Valve and Plumbing (See Figures 204, 205)

(1) Disconnect electrical connector and disconnect attached aircraft linkage.



R

INDEX MARK ON SHAFT OF FUEL SHUTOFF VALVE (2) SHALL BE ALIGNED WITH CENTERLINE I DURING INSTALLATION OF ARM (1).

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Fuel Shutoff Valve Arm Installation
Figure 203

1. C. (2) Remove tube assemblies, attaching parts, unions, fitting, and gaskets from fuel shutoff valve, fuel flow divider, and fuel control unit. (See figure 204.)

(3) Remove fuel shutoff valve and bracket from input housing assembly. (See figure 205.)

(4) Remove fuel shutoff valve from bracket.

(5) Remove actuating arm (manual override).

R D. (Codes BA-BC, EA, GA, KA) Install Fuel Shutoff Valve and Plumbing (See Figures 203, 204, 205)

NOTE: Prior to installation, unless otherwise specified lubricate packings or gaskets with any type clean jet fuel. An alternate lubricant (OS-124) may be used; apply lubricant sparingly and spread evenly to a thin transparent film to minimize contamination. Apply lubricating compound (Liqui-Moly Grade NV) to threads of bolts or screws, and apply clean engine oil to threads (except first two threads) of male plumbing fittings unless otherwise specified.

R Refer to 70-00-00, STANDARD PRACTICES, for recommended
R general torque values. Add frictional drag (run-down)
R torque of self locking devices to recommended values.

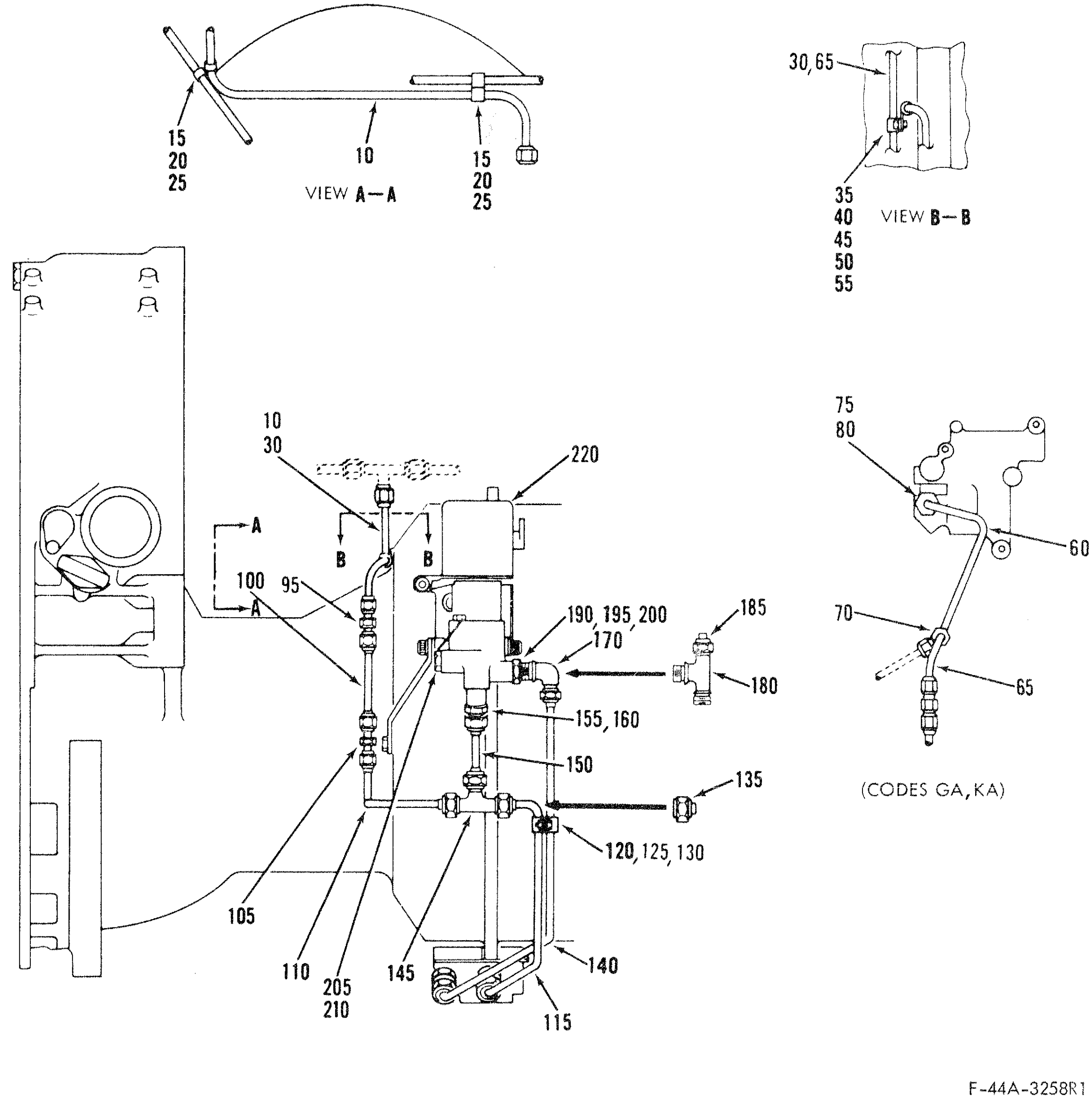
(1) Ensure that fuel shutoff valve is in the AUTO position Fuel shutoff valve is in AUTO position when index mark on end of actuating shaft is in vertical position.

(2) Install actuating arm (manual override) on shaft extension of fuel shutoff valve (see figure 203) and secure with washers, bolts, and locking nut. Tighten locking nut (65, figure 205) to 12 inch-pounds torque.

(3) Install washers (40, as required, two maximum) and spacer between fuel shutoff valve and bracket. (See figure 205.)

(4) Install fuel shutoff valve into bracket. Install support, washers, bolts, and nut. Tighten bolts (30) to 70 inch-pounds torque. Tighten nut (10) to 50 inch-pounds torque.

(5) Install fuel shutoff valve and bracket onto input housing assembly and secure with nuts and bolts. Tighten bolts (50) to 60 inch-pounds torque.



R

(Codes BA-BC, EA, GA, KA) Fuel Shutoff Valve
Plumbing Installation
Figure 204

1. D. (6) Install plug and bleeder with new packing or gasket into fuel shutoff valve. Tighten plug and bleeder (205) to 65 to 70 inch-pounds torque. (See figure 204.)

(7) Install fitting with ring and new packing or gasket into aft side of fuel shutoff valve and secure with nut. Tighten nut (200) to 50 to 55 inch-pounds torque. (See figure 204.)

(8) Install cap (used with Fitting Part No. 893007-9) on fitting. Tighten cap (185) to 100 to 120 inch-pounds torque.

(9) Install tube assembly between fitting in fuel shutoff valve and fuel flow divider.

(10) Install union with new packing or gasket into bottom of fuel shutoff valve. Tighten union (155) to 60 to 65 inch-pounds torque.

(11) Install tube assembly onto union in bottom of fuel shutoff valve.

(12) Install tee into tube assembly.

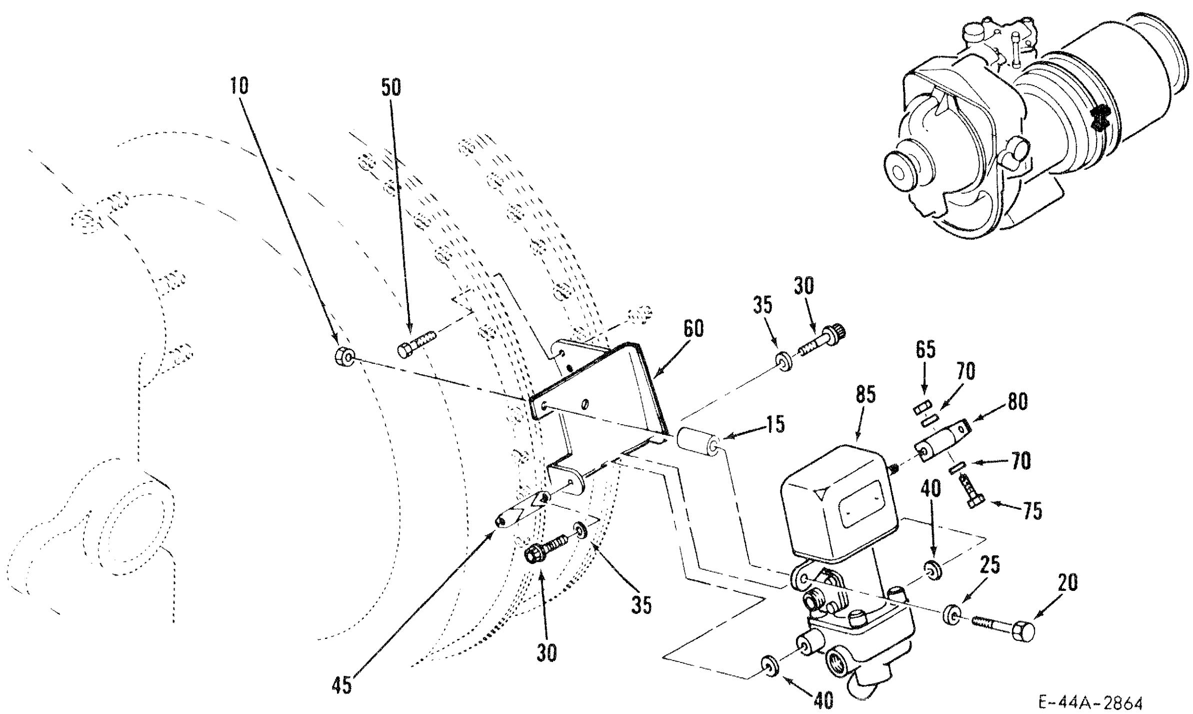
R (13) (Pre SB73-0017) Install tube assembly between tee and fuel flow divider with attaching parts. Tighten nut (120) to 20 inch-pounds torque.

R (14) (Post SB73-0017) Install cap onto aft side of tee. Tighten cap (135) to 100 to 120 inch-pounds torque.

(15) Install union with new packing or gasket into fuel control unit. Tighten union (75) to 60 to 65 inch-pounds torque.

KEY TO FIGURE 204

R 10.	TUBE ASSY (IPC FIG. 20)	75.	UNION	150.	TUBE ASSY
15.	NUT	80.	GASKET	155.	UNION
20.	BOLT	95.	UNION	160.	GASKET
25.	CLAMP	100.	TUBE ASSY	170.	FITTING
30.	TUBE ASSY	105.	UNION	180.	FITTING
35.	NUT	110.	TUBE ASSY	185.	CAP
40.	BOLT	115.	TUBE ASSY	190.	GASKET
45.	CLAMP	120.	NUT	195.	RING
50.	CLAMP	125.	BOLT	200.	NUT
55.	WASHER	130.	CLAMP	205.	PLUG AND BLEEDER
60.	TUBE ASSY	135.	CAP	210.	GASKET
65.	TUBE ASSY	140.	TUBE ASSY	220.	FUEL SHUTOFF VALVE
70.	TEE	145.	TEE		



R 10. NUT (IPC FIG. 54)
15. SPACER
20. BOLT
25. WASHER
30. BOLT
35. WASHER
40. WASHER
45. SUPPORT
50. BOLT
60. BRACKET
65. NUT
70. WASHER
75. SCREW
80. ARM
85. FUEL SHUTOFF VALVE

(Codes BA-BC, EA, GA, KA) Fuel Shutoff
Valve Installation
Figure 205

1. D. (16) Assemble and install tube assemblies between tee below fuel shutoff valve and fuel control unit with attaching parts.

R (17) (Codes BA-BC, EA with Tube Assembly Part No. 846548-1) Tighten nuts (15) to 25 inch-pounds torque.

(18) Install clamps onto pressure switch housing support and tube assembly. Install bolt and nut. Tighten nut (35) to 20 inch-pounds torque.

(19) Connect electrical connector.

(20) Connect linkage to fuel shutoff valve in accordance with Aircraft Maintenance Manual.

R E. (Codes CA-CC) Remove Fuel Shutoff Valve and Plumbing (See Figures 206, 207)

(1) Disconnect electrical connector and disconnect attached aircraft linkage.

(2) Remove tube assemblies, attaching parts, unions, fittings, and gaskets from fuel shutoff valve, fuel flow divider, and fuel control unit. (See figure 206.)

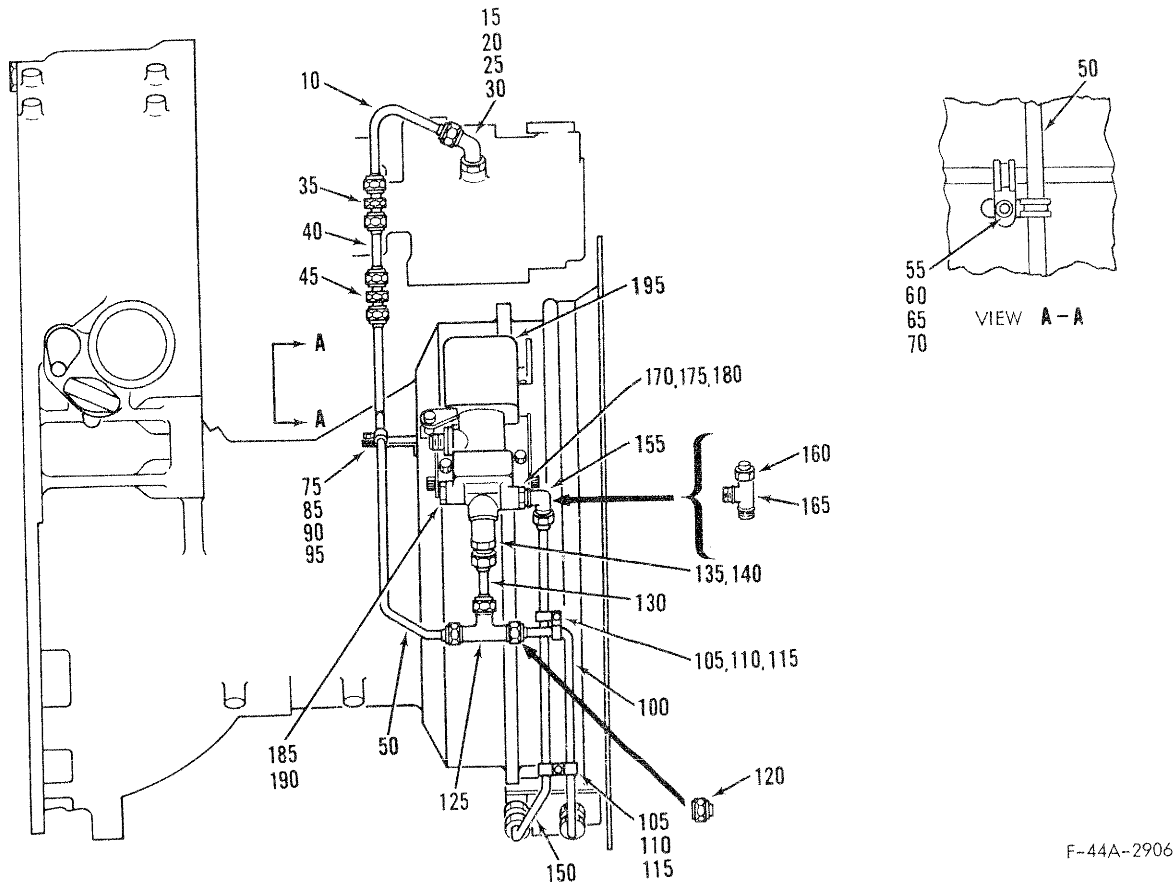
(3) Remove fuel shutoff valve, bracket, and supports from input housing assembly. (See figure 207.)

(4) Remove fuel shutoff valve from bracket and supports.

(5) Remove supports from bracket.

(6) Remove actuating arm (manual override).

R F. (Codes CA-CC) Install Fuel Shutoff Valve and Plumbing (See Figures 203, 206, 207)



R 10.	TUBE ASSY (IPC FIG. 21)	70.	CLAMP	135.	UNION
15.	FITTING	75.	NUT	140.	GASKET
20.	GASKET	85.	BOLT	150.	TUBE ASSY
25.	RING	90.	CLAMP	155.	FITTING
30.	NUT	95.	BRACKET	160.	CAP
35.	REDUCER	100.	TUBE ASSY	165.	FITTING
40.	TUBE ASSY	105.	NUT	170.	GASKET
45.	UNION	110.	BOLT	175.	RING
50.	TUBE ASSY	115.	CLAMP	180.	NUT
55.	NUT	120.	CAP	185.	PLUG
60.	BOLT	125.	TEE	190.	PACKING
65.	CLAMP	130.	TUBE ASSY	195.	FUEL SHUTOFF VALVE

(Codes CA-CC) Fuel Shutoff Valve
Plumbing Installation
Figure 206

NOTE: Prior to installation unless otherwise specified, lubricate packings or gaskets with any type clean jet fuel. An alternate lubricant (OS-124) may be used; apply lubricant sparingly and spread evenly to a thin transparent film to minimize contamination. Apply lubricating compound (Liqui-Moly, Grade NV) to threads of bolts or screws, and apply clean engine oil to threads (except first two threads) of male plumbing fittings unless otherwise specified.

R Refer to 70-00-00, STANDARD PRACTICES, for recommended
R general torque values. Add frictional drag (run-down)
R torque of self locking devices to recommended values.

1. F. (1) Ensure that fuel shutoff valve is in the AUTO position. Fuel shutoff valve is in AUTO position when index mark on end of fuel shutoff valve actuating shaft is in vertical position.

(2) Install actuating arm (manual override) on shaft extension of fuel shutoff valve (see figure 203) and secure with washers, bolt, and nut. Tighten nut (110, figure 207) to 20 inch-pounds torque.

(3) Install support onto bracket and secure with bolt, washers, and nuts. Tighten nuts (35) to 20 inch-pounds torque. (See figure 207.)

(4) Install washers (maximum two each place) between fuel shutoff valve and bracket.

(5) Install fuel shutoff valve and support onto bracket and secure with washers, bolts, and nut. Tighten bolts (85) to 70 inch-pounds torque. Tighten nut (60) to 50 inch-pounds torque.

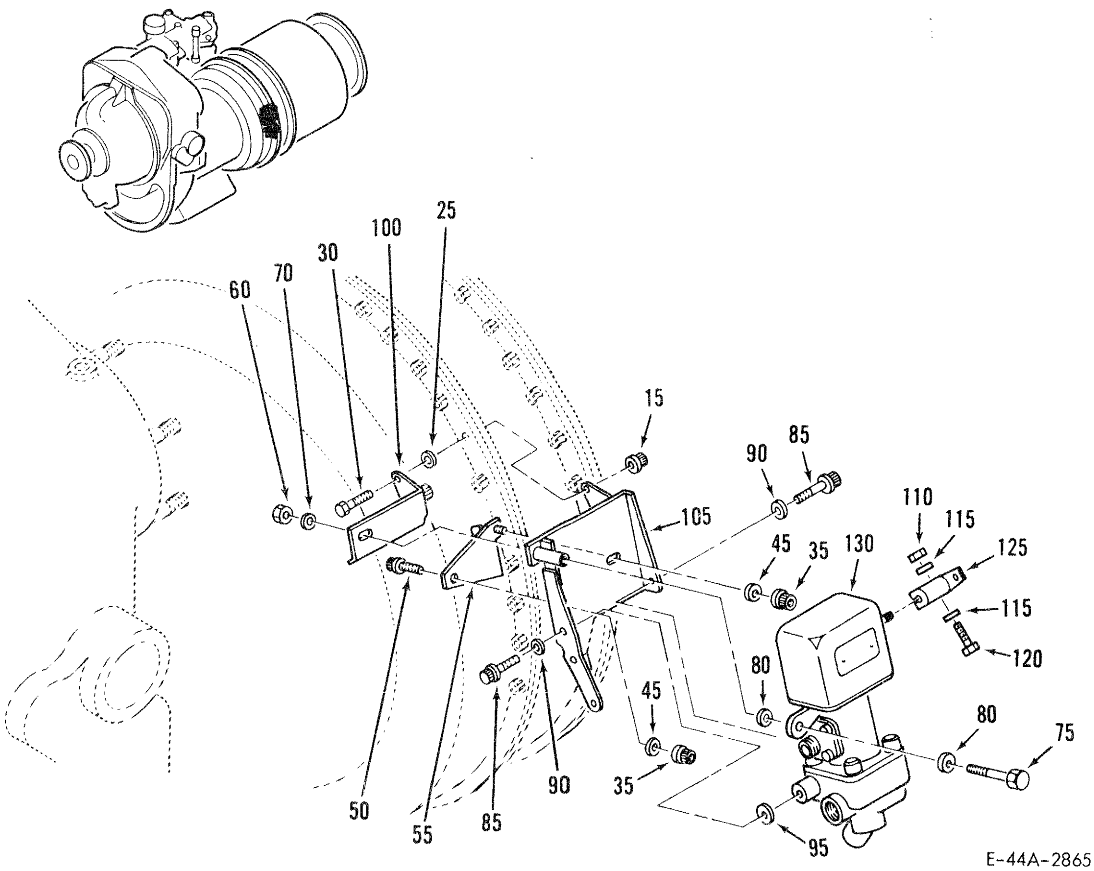
(6) Install fuel shutoff valve and bracket onto input housing assembly and secure with bolts and nuts. Tighten nuts (15) to 50 inch-pounds torque.

(7) Install plug and bleeder with new packing or gasket into fuel shutoff valve. Tighten plug and bleeder (185) to 65 to 70 inch-pounds torque. (See figure 206.)

(8) Install fitting with new packing or gasket and ring into aft side of fuel shutoff valve and secure with nut. Tighten nut (180) to 50 to 55 inch-pounds torque.

(9) (Post SB73-0026) Install cap onto fitting. Tighten cap (160) to 100 to 120 inch-pounds torque.

(10) Install tube assembly between fitting in fuel shutoff valve and fuel flow divider.



R 15. NUT (IPC FIG. 55)
25. WASHER
30. BOLT
35. NUT
45. WASHER
50. BOLT
55. SUPPORT
60. NUT
70. WASHER
75. BOLT
80. WASHER
85. BOLT
90. WASHER
95. WASHER
100. SUPPORT
105. BRACKET
110. NUT
115. WASHER
120. SCREW
125. ARM
130. FUEL SHUTOFF VALVE

(Codes CA-CC, HA) Fuel Shutoff Valve Installation
Figure 207

1. F. (11) Install union with new packing or gasket into bottom of fuel shutoff valve. Tighten union (135) to 60 to 65 inch-pounds torque.

(12) Install tube assembly onto union in bottom of fuel shutoff valve.

(13) Install tee into tube assembly.

R (14) (Pre SB73-0017) Install tube assembly between tee and fuel flow divider with attaching parts. Tighten nuts (105) to 20 inch-pounds torque.

R (15) (Post SB73-0017) Install cap onto aft side of tee. Tighten cap (120) to 100 to 120 inch-pounds torque.

(16) Install fitting with new packing or gasket and ring into fuel control unit and secure with nut. Tighten nut (30) to 65 to 70 inch-pounds torque.

(17) Assemble and install tube assemblies between tee below fuel shutoff valve and fuel control unit.

(18) Install bracket onto input housing assembly and secure with bolt. Tighten bolt that secures bracket (95) to 40 inch-pounds torque.

(19) Install clamps, bolts, and nuts. Tighten nuts (55, 75) to 20 inch-pounds torque.

(20) Connect electrical connector.

(21) Connect linkage to fuel shutoff valve in accordance with Aircraft Maintenance Manual.

R G. (Codes FA, LA) Remove Fuel Shutoff Valve and Plumbing (See Figures 202, 208)

(1) Disconnect electrical connector and disconnect attached aircraft linkage.

(2) Remove tube assemblies, attaching parts, unions, fittings, and gaskets from fuel shutoff valve, fuel flow divider and fuel control unit. (See figure 208.)

(3) Remove fuel shutoff valve, bracket, and supports from input housing assembly. (See figure 202.)

(4) Remove fuel shutoff valve from bracket and supports.

(5) Remove supports from bracket.

(6) Remove actuating arm (manual override).

1. H. (Codes FA, LA) Install Fuel Shutoff Valve and Plumbing (See Figures 202, 203, 208)

NOTE: Prior to installation unless otherwise specified lubricate packings or gaskets with any type clean jet fuel. An alternate lubricant (OS-124) may be used; apply lubricant sparingly and spread evenly to a thin transparent film to minimize contamination. Apply lubricating compound (Liqui-Moly, Grade NV) to threads of bolts or screws, and apply clean engine oil to threads (except first two threads) of male plumbing fittings unless otherwise specified.

R Refer to 70-00-00, STANDARD PRACTICES, for recommended
R general torque values. Add frictional drag (run-down)
R torque of self locking devices to recommended values.

(1) Ensure that fuel shutoff valve is in the AUTO position. Fuel shutoff valve is in AUTO position when index mark on end of fuel shutoff valve actuating shaft is in vertical position.

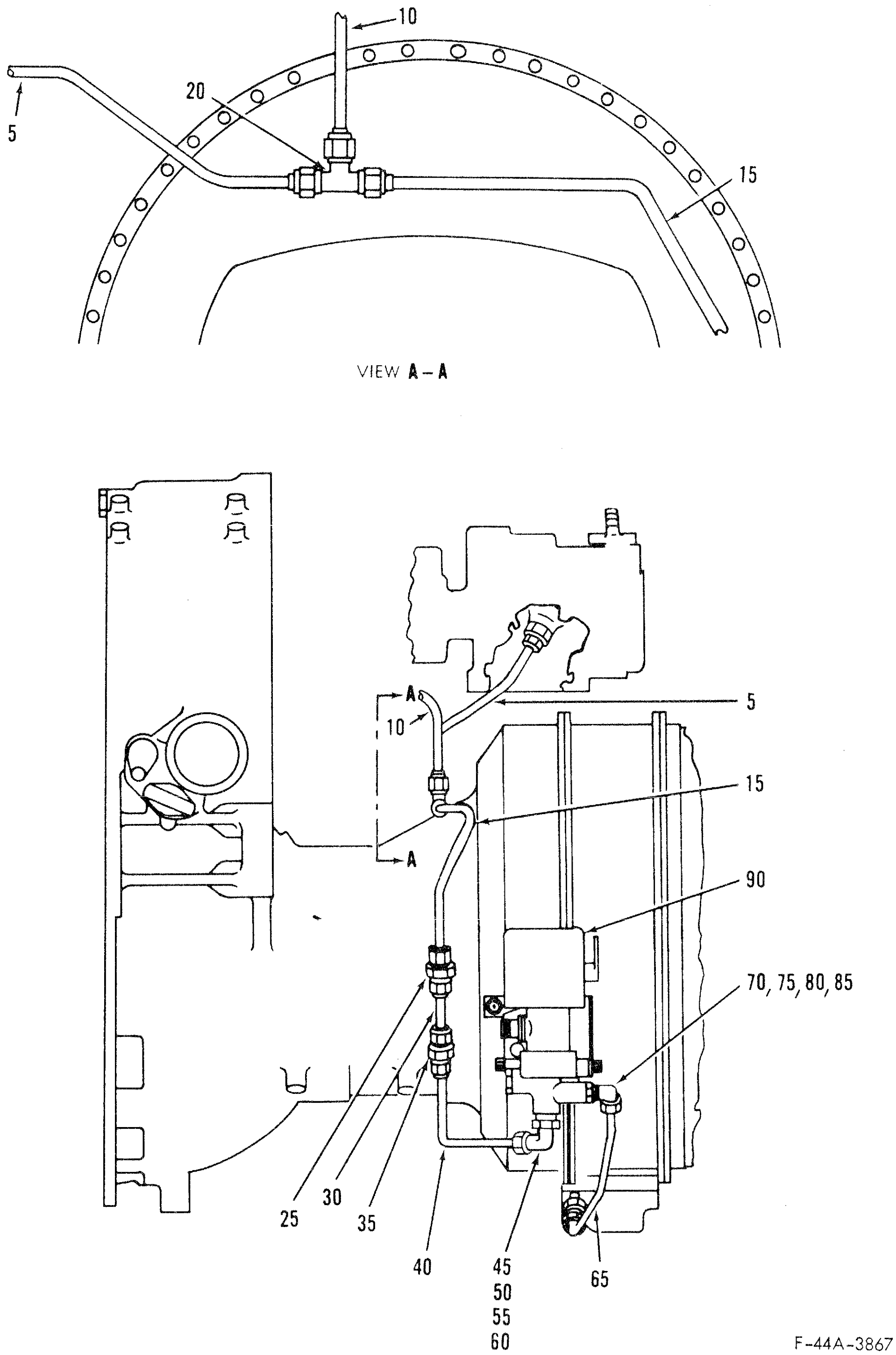
(2) Install actuating arm (manual override) on shaft extension of valve. Install 0.005 and 0.010 inch thickness of washers, as required, on shaft between actuating arm and valve body to obtain 0.001 to 0.006 inch shaft end play. Position actuating arm as shown in Figure 203.

(3) Install bolt, washers, and nut. Tighten nut (100, figure 202) to 20 inch-pounds torque.

(4) Install washer (50), spacer (60), and washers (80, as required, 2 maximum) between fuel shutoff valve and bracket. (See figure 202.)

KEY TO FIGURE 208

R 5. TUBE ASSY (IPC FIG. 22)
10. TUBE ASSY (TO TORQUE LIMITER BY-PASS VALVE)
15. TUBE ASSY
20. TEE
25. UNION
30. TUBE ASSY
35. UNION
40. TUBE ASSY
45. ELBOW
50. PACKING
55. RING
60. NUT
65. TUBE ASSY
70. ELBOW
75. PACKING
80. RING
85. NUT
90. FUEL SHUTOFF VALVE



(Codes FA, LA) Fuel Shutoff Valve
Plumbing Installation
Figure 208

1. H. (5) Install fuel shutoff valve on bracket and support. Install washers, bolts, and nuts. Washers (76) used with bolt (71), Part No. MS21280-06. Washer not used with Bolt Part No. MS21280-05. Tighten nut (25, figure 202) to 20 inch-pounds torque. Tighten nut (40) to 50 inch-pounds torque. Tighten bolts (70, 71) to 70 inch-pounds torque.

(6) Install assembled bracket, support, and fuel shutoff valve on engine and secure with bolts and nuts. Tighten bolts (20, figure 202) to 60 inch-pounds torque.

(7) Install plug with new packing into fuel shutoff valve. Tighten plug (90) to 65 to 70 inch-pounds torque.

(8) Install elbow with ring and new packing into aft side of fuel shutoff valve and secure with nut. Tighten nut (85, figure 208) to 50 to 55 inch-pounds torque.

(9) Install tube assembly between elbow in fuel shutoff valve and fuel flow divider.

(10) Install elbow with ring and new packing into bottom of fuel shutoff valve and secure with nut. Tighten nut (60, figure 208) to 50 to 55 inch-pounds torque.

(11) Assemble and install tube assemblies between fuel control unit and elbow in bottom of fuel shutoff valve with attaching parts.

I. (Code HA) Remove Fuel Shutoff Valve and Plumbing (See Figures 207, 209)

(1) Disconnect electrical connector and disconnect attached aircraft linkage.

(2) Remove tube assemblies, attaching parts, unions, fittings, and gaskets from fuel shutoff valve, fuel flow divider and fuel control unit. (See figure 209.)

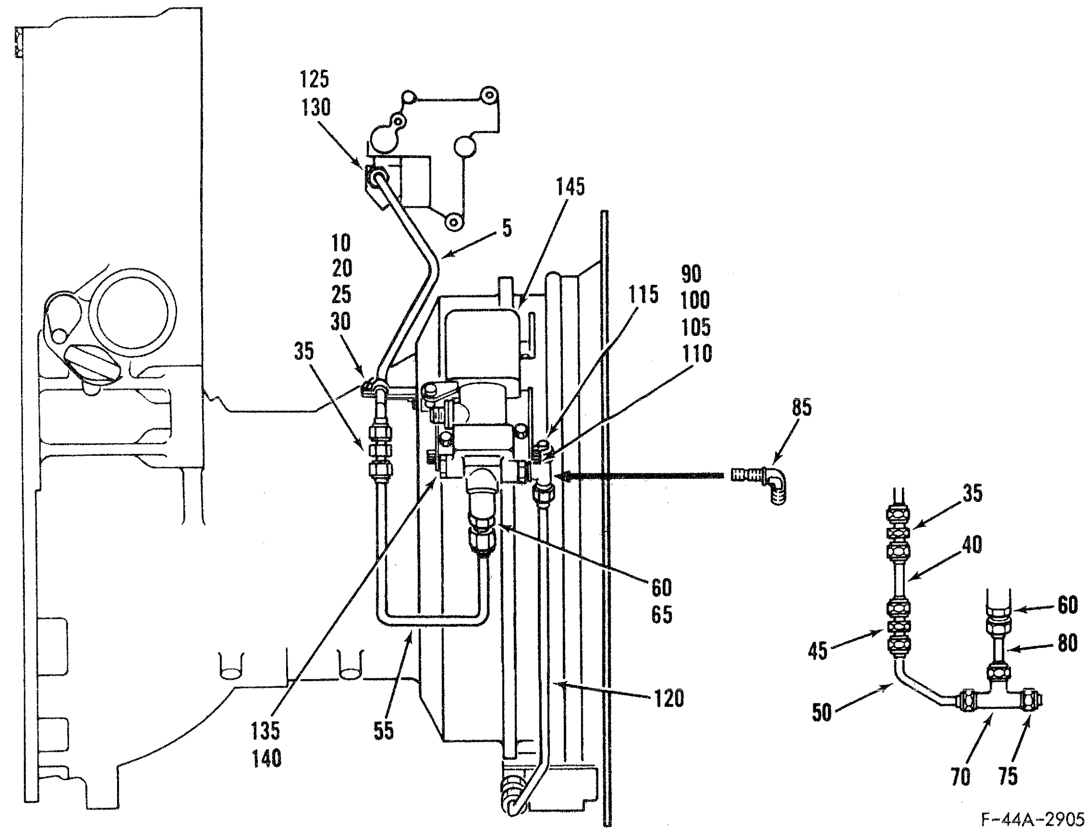
(3) Remove fuel shutoff valve, bracket, and supports from input housing assembly. (See figure 207.)

(4) Remove fuel shutoff valve from bracket and supports.

(5) Remove supports from bracket.

(6) Remove actuating arm (manual override).

R



R 5.	TUBE ASSY (IPC FIG. 23)	80.	TUBE
10.	NUT	85.	FITTING
20.	BOLT	90.	FITTING
25.	CLAMP	100.	PACKING
30.	BRACKET	105.	RING
35.	UNION	110.	NUT
40.	TUBE ASSY	115.	CAP
45.	UNION	120.	TUBE ASSY
50.	TUBE ASSY	125.	UNION
55.	TUBE ASSY	130.	PACKING
60.	UNION	135.	PLUG
65.	PACKING	140.	PACKING
70.	TEE	145.	FUEL SHUTOFF VALVE
75.	CAP		

(Code HA) Fuel Shutoff Valve Plumbing Installation
Figure 209

R 1. J. (Code HA) Install Fuel Shutoff Valve and Plumbing (See Figures 203, 207, 209)

NOTE: Prior to installation, unless otherwise specified, lubricate packings or gaskets with any type clean jet fuel. An alternate lubricant (OS-124) may be used; apply lubricant sparingly and spread evenly to a thin transparent film to minimize contamination. Apply lubricating compound (Liqui-Moly, Grade NV) to threads of bolts or screws, and apply clean engine oil to threads (except first two threads) of male plumbing fittings unless otherwise specified.

R Refer to 70-00-00, STANDARD PRACTICES, for recommended
R general torque values. Add frictional drag (run-down)
R torque of self locking devices to recommended values.

(1) Ensure that fuel shutoff valve is in the AUTO position. Fuel shutoff valve is in AUTO position when index mark on end of fuel shutoff valve actuating shaft is in vertical position.

(2) Install actuating arm (manual override) on shaft extension of fuel shutoff valve (see figure 203) and secure with washers, bolt, and nut. Tighten nut (110, figure 207) to 20 inch-pounds torque.

(3) Install support onto bracket and secure with bolt, washers, and nuts. Tighten nuts (35) to 20 inch-pounds torque. (See figure 207.)

(4) Install washers (maximum one each place) between fuel shutoff valve and bracket.

(5) Install fuel shutoff valve and support onto bracket and secure with washers, bolts, and nut. Tighten bolts (85) to 70 inch-pounds torque. Tighten nut (60) to 50 inch-pounds torque.

(6) Install fuel shutoff valve and bracket onto input housing assembly and secure with bolts and nuts. Tighten nuts (15) to 50 inch-pounds torque.

(7) Install plug and bleeder with new packing or gasket into fuel shutoff valve. Tighten plug and bleeder (135) to 65 to 70 inch-pounds torque. (See figure 209.)

(8) Install fitting with ring and new packing or gasket into aft side of fuel shutoff valve and secure with nut. Tighten nut (110) to 50 to 55 inch-pounds torque. (See figure 209.)

1. J. (9) Install cap (used with Fitting Part No. 893007-9) on fitting. Tighten cap (115) to 100 to 120 inch-pounds torque.

(10) Install tube assembly between fitting in aft side of fuel shutoff valve and fuel flow divider.

(11) Install union with new packing or gasket into bottom of fuel shutoff valve. Tighten union (60) to 60 to 65 inch-pounds torque.

(12) Install union with new packing or gasket into fuel control unit. Tighten union (125) to 60 to 65 inch-pounds torque.

(13) Install bracket onto input housing assembly using diffuser bolt. Tighten bolt to 40 inch-pounds torque.

(14) Install tube assembly with attaching parts to union in fuel control unit and attach to bracket. Tighten nut (10) to 20 inch-pounds torque. Install union in end of tube assembly.

(15) (Engines with Tube Assemblies Part No. 896349-1, 3101613-1, and 869710-1) Install tube assembly from union in bottom of fuel shutoff valve. Install tee in end of tube assembly. Install tube assemblies with attaching parts from tee to end of tube assembly from fuel control unit. Install cap on tee. Tighten cap (75) to 100 to 120 inch-pounds torque.

(16) (Engines with Tube Assembly Part No. 3101678-1) Install tube assembly between union in bottom of fuel shutoff valve and end of tube assembly from fuel control unit.

2. Adjustment/Test

A. Test Fuel Shutoff Valve

(1) Set manual override arm on valve on AUTO position. (See figure 203.) Check continuity across connector pins on electrical connector. Continuity across pins A and C indicates limit switch No. 2 is closed and valve is closed. Continuity across pins B and C indicates limit switch No. 1 is closed and valve is open. If valve is closed, perform steps (2) through (4) in sequence. If valve is open, perform step (3) then steps (2) through (4). If requirements are not met, proceed to paragraph B to reset valve internal switches.

CAUTION: WHEN PERFORMING STEPS (2) AND (3) DO NOT APPLY VOLTAGE TO ELECTRICAL CONNECTOR PINS FOR LONGER THAN ONE SECOND. IF SWITCHES ARE NOT PROPERLY ADJUSTED, VOLTAGE MAY REMAIN APPLIED TO ELECTROMAGNET COILS CAUSING OVERHEATING.

2. A. (2) Momentarily apply 24 volts dc maximum across pins A and C. Valve shall open and remain open when voltage is removed. There shall be continuity across pins B and C.

(3) Momentarily apply 24 volts dc maximum across pins B and C. Valve shall close and remain closed when voltage is removed There shall be continuity across pins A and C.

(4) Apply 24 volts dc maximum across pins A and C to open valve. With voltage maintained, measure force required to close valve using manual override arm. Apply force parallel to valve axis. Force required shall be 7.5 to 11 inch-pounds. Valve shall hold in closed position with force removed.

B. Adjust Microswitches.

NOTE: Perform the following procedure when switch adjustment is determined faulty during performance of test instructions, paragraph A.

(1) Set manual override arm shaft on fuel shutoff valve to MAN/OFF position, then to AUTO position (figure 203). Note position of manual override arm to aid reassembly.

(2) Remove bolt and nut securing manual override arm, then remove manual override arm.

(3) Remove three screws securing cover on fuel shutoff valve and remove cover and gasket.

(4) Connect continuity meter across pins B and C of fuel shutoff valve electrical connector.

(5) Loosen locking screw securing bracket for close limit switch (nearest to manual override arm shaft extension) one-fourth turn.

(6) Loosen locknut securing close limit switch positioning screw and turn screw counterclockwise to obtain continuity on continuity meter, then clockwise until continuity just breaks. Turn screw an additional 90 to 120 degree clockwise. Ensure there is clearance between close limit switch arm and pin which actuates switch by moving against arm. If required reposition close limit switch by turning screw clockwise to obtain clearance. Tighten locknut to 8 inch-pounds. Tighten locking screw to secure close limit switch bracket to 20 inch-pounds.

CAUTION: WHEN PERFORMING THE FOLLOWING STEPS, DO NOT APPLY VOLTAGE TO ELECTRICAL CONNECTOR PINS FOR LONGER THAN ONE SECOND UNTIL ASSURED THAT SWITCHES ARE PROPERLY ADJUSTED. IF SWITCHES ARE NOT PROPERLY ADJUSTED, VOLTAGE MAY REMAIN APPLIED TO ELECTROMAGNET COILS CAUSING OVERHEATING.

2. B. (7) Momentarily apply 24 volts dc across pins A and C of fuel shutoff valve electrical connector. Valve shall actuate open.

(8) Connect continuity meter to pins A and C of electrical connector.

(9) Loosen locking screw securing bracket for open position switch (farthest from manual override arm shaft extension) one-fourth turn.

(10) Loosen locknut securing open limit switch positioning screw and turn screw clockwise to obtain continuity, then counterclockwise until continuity just breaks. Turn screw an additional 90 to 120 degrees counterclockwise. Tighten locknut to 8 inch-pounds. Tighten locking screw to secure open limit switch bracket to 20 inch-pounds.

(11) Apply 24 volts dc to pins B and C of electrical connector. Valve shall actuate closed.

(12) Apply and maintain 24 volts dc to pins A and C of electrical connector. Valve shall actuate open.

(13) Rotate manual override arm shaft to MAN/OFF position. Valve shall close and remain closed when released. Remove voltage from electrical connector pins.

(14) Rotate manual override arm shaft to AUTO. Install cover and gasket of fuel shutoff valve and secure with screws. Reinstall manual override arm removed in step (2). Ensure manual override arm is installed in position noted in step (1).

3. Inspection/Check

A. Inspect Fuel Shutoff Valve Plumbing and Attaching Parts

(1) Inspect valve for cracks or obvious damage.

(2) Inspect electrical connector for bent, broken or burned pins.

(3) Inspect splined external shaft for worn or damaged splines.

(4) Inspect tube assemblies for bends, kinks, nicks, or cracks.

3. A. (5) Inspect threaded parts for crossed, galled, or peened threads.

(6) Check clamps for worn or missing cushions.

(7) Inspect brackets and supports for cracks or obvious damage.

(8) Replace part that does not meet Inspection/Check requirements.

4. Cleaning/Painting

A. Clean Parts

(1) Clean all standard metallic hardware in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 1 or 2.

(2) Clean all fittings and plumbing in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 12.

(3) Clean fuel shutoff valve in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 11.

FUEL FLOW DIVIDER AND DRAIN VALVE - MAINTENANCE PRACTICES

1. Removal/Installation

NOTE: Table 201 provides a list of all materials and compounds required to perform Removal/Installation.

Table 201. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Any approved engine fuel	Commercially available
Any approved engine oil	Commercially available
Alternate packing lubricant Lubricant (OS-124)	Monsanto Company, 800 N Lindbergh Blvd, St. Louis, MO 63166
High temperature compound (Fel-Pro C5-A)	Fel-Pro Inc, Division of Felt Products Mfg Co, 7450 N McCormick Blvd, Skokie, IL 60076
Lubricating compound (Liqui-Moly, Grade NV)	Lockrey Co, Lubricants Div, Cedar Shores, Southampton, NY 11968

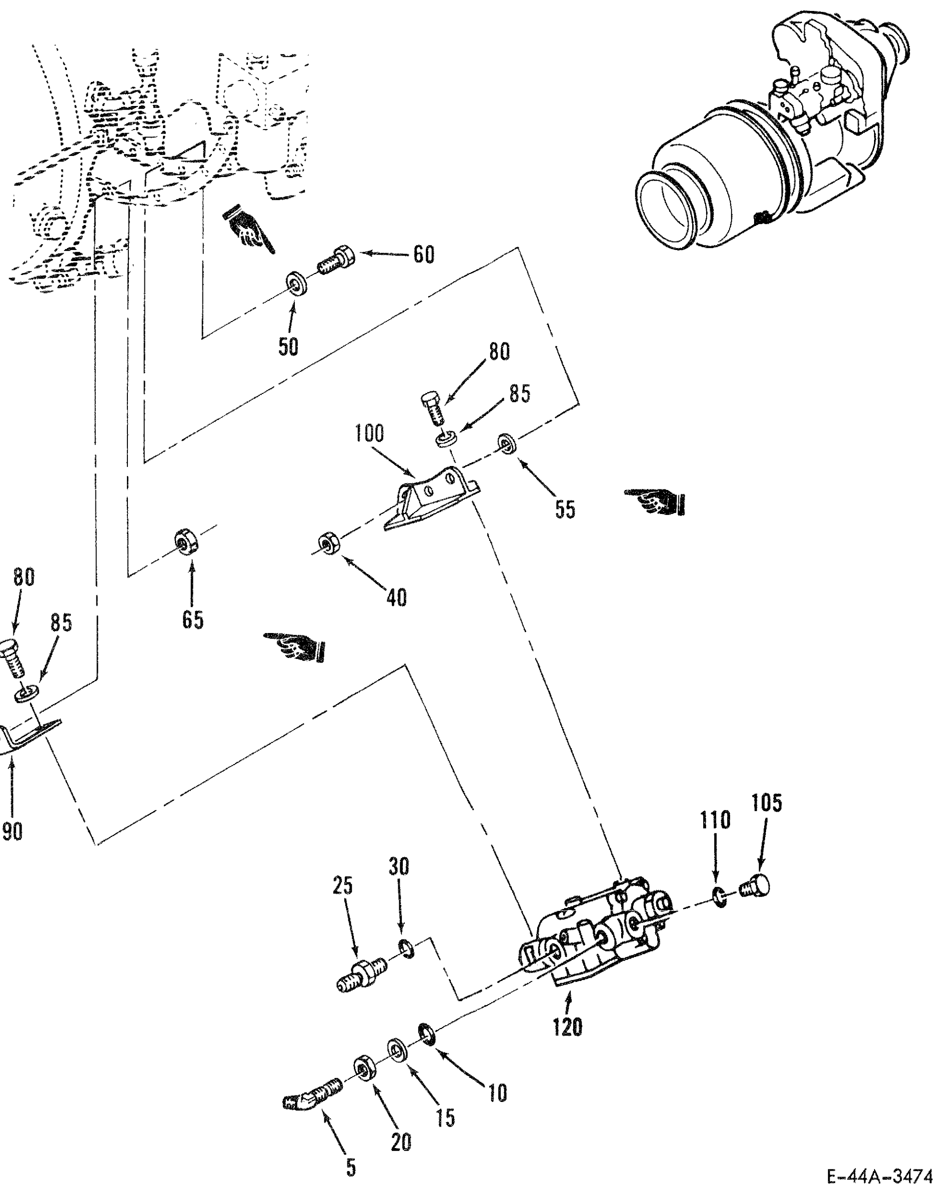
R A. (Codes AA-AC, FA, HA, LA) Remove Fuel Flow Divider and Drain Valve (See Figure 201)

(1) Disconnect tube assemblies from fuel flow divider and drain valve in accordance with 73-10-06, MAINTENANCE PRACTICES.

(2) Disconnect fuel manifold assemblies from fuel flow divider and drain valve in accordance with 73-10-09, MAINTENANCE PRACTICES.

(3) Remove fuel flow divider and drain valve and bracket from input housing assembly. (See figure 201.)

(4) Remove fuel flow divider and drain valve from bracket.



R 5. FITTING (IPC FIG. 68)	50. WASHER	90. BRACKET
10. GASKET	55. WASHER	95. BRACKET
15. RING	60. BOLT	100. BRACKET
20. NUT	65. NUT	105. PLUG AND BLEEDER
25. UNION	75. BOLT	110. GASKET
30. GASKET	80. BOLT	120. FLOW DIVIDER AND DRAIN VALVE
40. NUT	85. WASHER	

R (Codes AA-AC, FA, HA, LA) Fuel Flow Divider and Drain Valve Installation
Figure 201

R 1. B. (Codes AA-AC, FA, HA, LA) Install Fuel Flow Divider and Drain Valve (See Figure 201)

NOTE: Prior to installation, unless otherwise specified, lubricate packings or gaskets with any type clean jet fuel. An alternate lubricant (OS-124) may be used; apply lubricant sparingly and spread evenly to a thin transparent film to minimize contamination. Apply lubricating compound (Liqui-Moly, Grade NV) to threads of bolts or screws, and apply clean engine oil to threads (except first two threads) of male plumbing fittings located forward of the fireshield unless otherwise specified. Apply high temperature compound (Fel-Pro C5-A) to threads of bolts and screws and to threads (except first two threads) of male plumbing fittings located aft of the fireshields unless otherwise specified.

R Refer to 70-00-00, STANDARD PRACTICES, for recommended
R general torque values. Add frictional drag (run-down)
R torque of self locking devices to recommended values.

(1) Install plug and bleeder with new packing into fuel flow divider and drain valve. Tighten plug and bleeder (105) to 40 to 45 inch-pounds torque.

(2) Install fitting with ring and new packing into fuel flow divider and drain valve. Tighten nut (20) to 30 to 35 inch-pounds torque.

(3) Install union with new packing into fuel flow divider and drain valve. Tighten union (25) to 60 to 65 inch-pounds torque.

(4) Install brackets on fuel flow divider and drain valve and secure with bolts and washers. Tighten bolts (80) to 20 to 25 inch-pounds torque.

(5) Install brackets and fuel flow divider and drain valve onto input housing assembly and secure with washers and bolts. Tighten nuts (40, 65) to 50 inch-pounds torque.

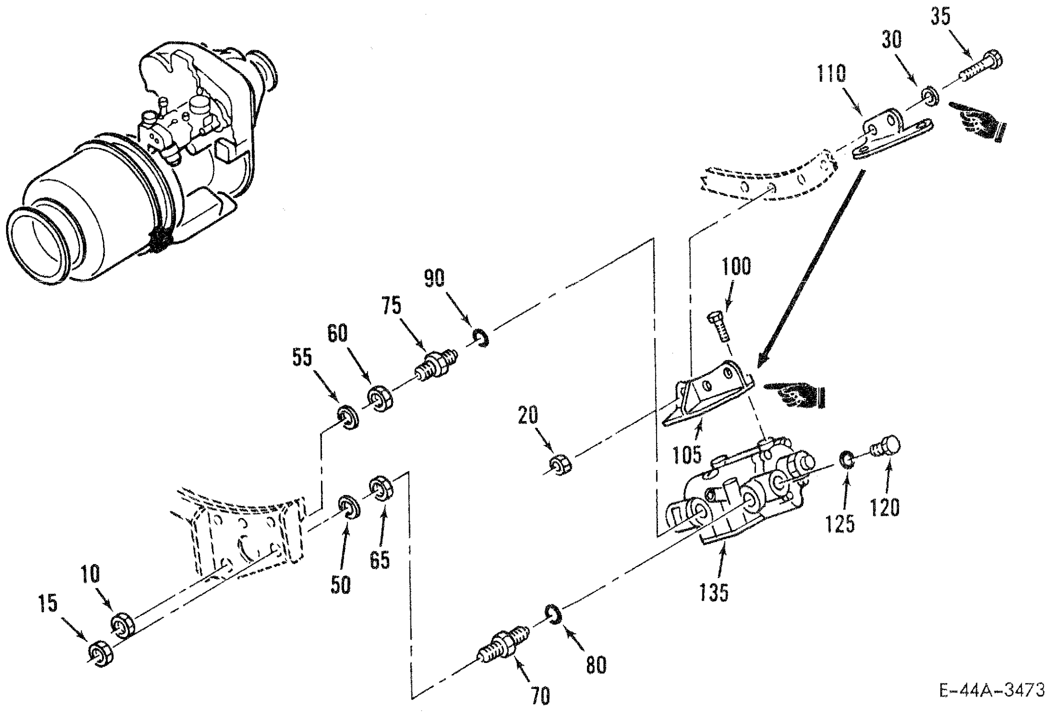
(6) Connect fuel manifold assemblies to union and fitting in fuel flow divider and drain valve in accordance with 73-10-09, MAINTENANCE PRACTICES.

R CAUTION: (PRE SB73-0017) ENSURE THAT HIGH PRESSURE SENSING LINE IS CONNECTED TO SENSING PORT OF FLOW DIVIDER ASSEMBLY. SENSING PORT IS BETWEEN FUEL IN AND DRAIN PORTS AND IS MARKED "S". INADVERTENT CONNECTION OF SENSING LINE TO DRAIN PORT WILL FLOOD THE ENGINE AND SUBSEQUENT ENGINE LIGHT OFF WILL RESULT IN HOT START WITH POSSIBLE DAMAGE TO TURBINE SECTION.

1. B. (7) Connect tube assemblies to fuel flow divider and drain valve in accordance with 73-10-06, MAINTENANCE PRACTICES.

R C. (Codes BA-EA, GA, KA) Remove Fuel Flow Divider and Drain Valve (See Figure 202)

(1) Disconnect tube assemblies from fuel flow divider and drain valve in accordance with 73-10-06, MAINTENANCE PRACTICES.



10.	NUT (IPC FIG. 69)	60.	NUT	105.	BRACKET
15.	NUT	65.	NUT	110.	BRACKET
20.	NUT	70.	UNION	120.	PLUG AND BLEEDER
30.	WASHER	75.	UNION	125.	GASKET
35.	BOLT	80.	GASKET	135.	FLOW DIVIDER AND DRAIN VALVE
50.	WASHER	90.	GASKET		
55.	WASHER	100.	BOLT		

R (Codes BA-EA, GA, KA) Fuel Flow Divider and Drain Valve Installation
Figure 202

1. C. (2) Disconnect fuel manifold assemblies from fuel flow divider and drain valve in accordance with 73-10-09, MAINTENANCE PRACTICES.

(3) Remove fuel flow divider and drain valve and bracket from input housing assembly. (See figure 202.)

(4) Remove fuel flow divider and drain valve from bracket.

R D. (Codes BA-EA, GA, KA) Install Fuel Flow Divider and Drain Valve (See Figure 202)

NOTE: Prior to installation, unless otherwise specified, lubricate packings or gaskets with any type clean jet fuel. An alternate lubricant (OS-124) may be used; apply lubricant sparingly and spread evenly to a thin transparent film to minimize contamination. Apply lubricating compound (Liqui-Moly, Grade NV) to threads of bolts or screws, and apply clean engine oil to threads (except first two threads) of male plumbing fittings located forward of the fireshield unless otherwise specified. Apply high temperature compound (Fel-Pro C5-A) to threads of bolts and screws and to threads (except first two threads) of male plumbing fittings located aft of the fireshield unless otherwise specified.

R Refer to 70-00-00, STANDARD PRACTICES, for recommended
R general torque values. Add frictional drag (run-down)
R torque of self locking devices to recommended values.

(1) Install plug and bleeder with new packing or gasket into fuel flow divider and drain valve. Tighten plug and bleeder (120) to 40 to 45 inch-pounds torque.

(2) Install unions with new packing or gaskets into fuel flow divider and drain valve. Tighten union (70) to 40 to 45 inch-pounds torque, and union (75) to 60 to 65 inch-pounds torque.

(3) Install bracket onto fuel flow divider and drain valve and secure with bolts. Tighten bolts (100) to 25 inch-pounds torque.

(4) (Codes CA-CC) Install two washers (55) onto larger union. Install washers (50) onto smaller union as required to shim.

R (5) (Codes BA-BC, EA, GA, KA) Install nuts (60, 65) on unions.

(6) Install fuel flow divider and bracket onto fuel flow divider and drain valve support and secure with bulkhead nuts.

R 1. D. (7) (Codes CA-CC) Tighten nut (15) to 30 to 35 inch-pounds torque. Tighten nut (10) to 50 to 55 inch-pounds torque.

R (8) (Codes BA-BC, EA, GA, KA) Tighten nuts (15, 65) to 30 to 35 inch-pounds torque. Tighten nuts (10, 60) to 50 to 55 inch-pounds torque.

(9) Observe alignment of bolt holes in fuel flow divider and drain valve bracket and input housing assembly. If holes are properly aligned, proceed to step (10). If holes are not properly aligned, remove fuel flow divider and drain valve and bracket and repeat steps (4) through (8).

(10) Install bolts, washers, and nuts. Tighten nuts (20) to 50 inch-pounds torque.

(11) Connect fuel manifold assemblies to unions in fuel flow divider in accordance with 73-10-09, MAINTENANCE PRACTICES.

R CAUTION: (Pre SB73-0017) ENSURE THAT HIGH PRESSURE SENSING LINE IS CONNECTED TO SENSING PORT OF FLOW DIVIDER ASSEMBLY. SENSING PORT IS BETWEEN FUEL IN AND DRAIN PORTS AND IS MARKED "S". INADVERTENT CONNECTION OF SENSING LINE TO DRAIN PORT WILL FLOOD THE ENGINE AND SUBSEQUENT ENGINE LIGHT OFF WILL RESULT IN HOT START WITH POSSIBLE DAMAGE TO TURBINE SECTION.

(12) Connect tube assemblies to fuel flow divider and drain valve in accordance with 73-10-06, MAINTENANCE PRACTICES.

2. Inspection/Check

A. Inspect Fuel Flow Divider and Drain Valve

(1) Inspect valve for cracks or obvious damage.

(2) Inspect threaded parts for damaged threads.

(3) Inspect for fuel leakage from drain with parts installed. Refer to 72-00-00, TROUBLE SHOOTING. Refer to Approved Repairs for repair procedure.

(4) Replace part that does not meet Inspection/Check requirements.

3. Cleaning/Panting

Table 202. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Beaker (200 milliliter capacity)	Commercially available
Blackstone heated tank ultrasonic cleaner Model HT 1.9	Blackstone Ultrasonics Inc, 1111 Allen Street, Jamestown, NY 14701
Altenate: Sonac Ultrasonic Cleaner Model S-2	Cooper Laboratories Inc, Wayne, NJ 07407
Dowclene WR	Dow Chemical Corporation, S Saginaw Rd, Midland, MI 48640
Electrocleaner (Wyandotte FS)	Wyandotte Chemicals Corp, Wyandotte, MI 48192
Muriatic acid (35 percent HCL, commercial grade)	Commercially available
Rust stripper (Oakite Rust Stripper)	Oakite Products Inc, 50 Valley Rd, Berkeley Heights, NY 07922
Solvent (Shell 360)	Shell Oil Co, 50 W 50th St, New York, NY 10020
Solvent, Stoddard (Federal Specification (P-D-680, Type I)	Commercially available

WARNING: CLEANING SHALL BE PERFORMED IN A CLEAN, WELL-VENTILATED ROOM. RUBBER GLOVES AND PROTECTIVE CLOTHING SHALL BE WORN. EXTINGUISHERS AND VAT OR TANK COVERS SHALL BE ON HAND IN CASE OF FIRE.

A. Clean Parts

(1) Clean all standard metallic hardware in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 1 or 2.

3. A. (2) Clean all fittings in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 12.

(3) Clean outside surfaces of fuel flow divider and drain valve in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 1.

(4) Clean internal parts of fuel flow divider and drain valve in accordance with Approved Repairs.

B. Perform Special Cleaning

NOTE: As a temporary expedient, clean filter element by dipping in solvent, Shell 360. Dry with filtered compressed air. To perform a thorough cleaning of the metallic filter, use the sonic method. If the sonic method is not available, use alternate method.

(1) Clean metallic filter element, sonic method, as follows.

NOTE: Beaker is used in ultrasonic cleaner to conserve cleaning agent. Water is used in ultrasonic cleaner tank as transmitting fluid.

(a) Place filter element in beaker and fill beaker with Dowclene WR to submerge strainer element of filter.

(b) Place beaker containing filter element in ultrasonic cleaner tank and fill ultrasonic cleaner tank to within three-eighths inch of top with water.

(c) Operate ultrasonic cleaner for five minutes.

(d) Discard contaminated Dowclene WR and rinse filter element and beaker with clean Dowclene WR using plastic squeeze bottle.

(e) Refill beaker with clean Dowclene WR and operate ultrasonic cleaner for an additional five minutes.

(f) Repeat steps (d) and (e) until Dowclene WR remains clean after a five minute operation period.

(g) Remove the filter element from the beaker and blow dry using clean, low pressure air supply.

(h) Install new packing in filter element.

3. B. (2) Clean metallic filter element, alternate method, as follows.

(a) Remove packing and degrease filter element in cold solvent, Shell 360.

(b) Prepare solution of Oakite rust stripper by combining three to five pounds rust stripper to each gallon of water. Maintain solution at 72 to 82C (161 to 180F) with air agitation. Soak filter in solution for one-half hour.

(c) Rinse and spray with tap water to remove residue.

(d) Prepare solution of electrocleaner (Wyandotte FS) by combining nine ounces of electrocleaner to each gallon of water. Maintain solution at 72 to 93C (161 to 200F). Immerse filter element in electrocleaner solution for four to six minutes. During this period, filter element shall be made an anode for one to two minutes at a potential of four to seven volts dc. Rinse filter element in cold running tap water.

(e) Immerse filter element in equal parts muriatic acid and water, by volume, at room temperature for one-half to one minute. Rinse element thoroughly in cold running tap water.

(f) Immerse filter element in electrocleaner (Wyandotte FS) maintained at temperature of 72 to 96C (161 to 205F) for four to six minutes. Rinse in cold running tap water.

(g) Rinse filter element in clean hot water. Dry filter element with filtered compressed air. If cleaned filter element is not to be used immediately in present assembly, place filter element in clean container.

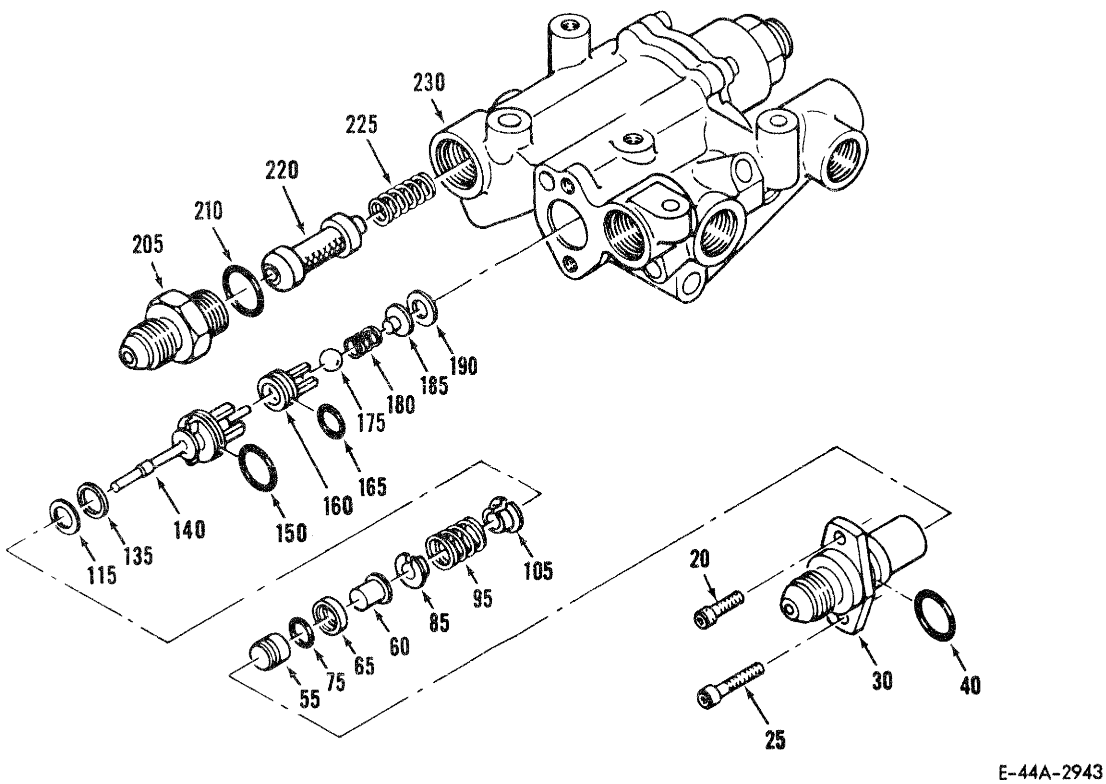
4. Approved Repairs

NOTE: Performance of the following procedure is recommended when leakage from the drain valve portion of the flow divider and drain valve is evident during engine starts.

R A. (Pre SB73-0017) Partially Disassemble Fuel Flow Divider and Drain Valve for Cleaning (See Figure 203)

CAUTION: USE SPECIAL CARE TO AVOID LOSING OR DAMAGING SMALL PRECISION PARTS.

(1) Remove nipple with installed packing, filter element, and filter spring from housing.



R 20.	SCREW (IPC FIG. 70)	140.	VALVE ASSY
25.	SCREW	150.	PACKING
30.	ADAPTER	160.	SEAT
40.	PACKING	165.	PACKING
55.	PISTON HALF	175.	BALL
60.	PISTON HALF	180.	SPRING
65.	GASKET	185.	RETAINER
75.	PACKING	190.	WASHER
85.	RETAINER	205.	NIPPLE
95.	SPRING	210.	PACKING
105.	RETAINER	220.	FILTER
115.	WASHER	225.	SPRING
135.	WASHER	230.	HOUSING

R (Pre SB73-0017) Flow Divider and Drain Valve
(Field Maintenance Breakdown)
Figure 203

4. A. (2) Remove screws securing adapter and remove adapter with packing.

NOTE: Record number and thickness of washers and shim washers removed in the following step to aid reassembly.

(3) Remove piston halves with gasket and packing, spring and spring retainers, washers, valve assembly with packing, seat with packing, ball, ball spring, retainer, and shim washers.

R B. (Post SB73-0017) Partially Disassemble Fuel Flow Divider and Drain Valve for Cleaning (See Figure 204)

CAUTION: USE SPECIAL CARE TO AVOID LOSING OR DAMAGING SMALL PRECISION PARTS.

(1) Remove nipple with installed packing, filter element, and filter spring from housing.

NOTE: Drain valve assembly is a matched set. Ensure parts are not interchangeable with parts from other drain valve assemblies. Record number and thickness of washers removed to aid in reassembly.

(2) Remove screws securing cover and remove cover and drain valve assembly.

(3) Remove retaining ring and separate components of drain valve assembly. Remove packings and washers.

C. Clean Fuel Flow Divider and Drain Valve Components.

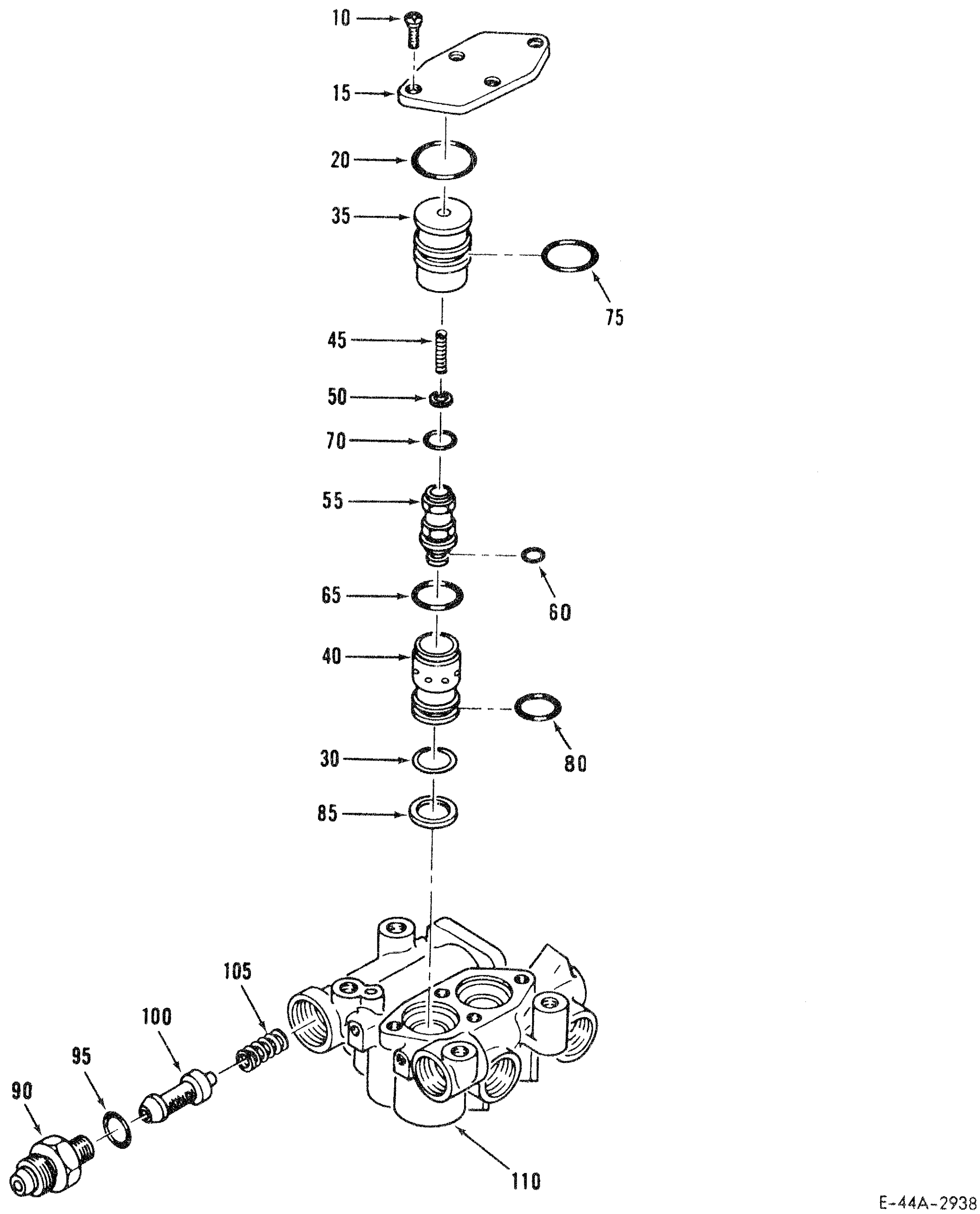
Clean filter element in accordance with Cleaning/Painting. Clean all other parts with solvent (Stoddard, Federal Specification P-D-680, Type I), then dry with clean low-pressure compressed air.

D. Inspect Fuel Flow Divider and Drain Valve Components

(1) Visually inspect all parts for damage or deterioration which could cause possible malfunction or leakage.

(2) Visually inspect filter element for cracks, tears, or deformation.

R (3) (Pre SB73-0017) Inspect inner diameter of adapter that mates with piston halves. Surface finish shall be free of scratches, burrs, or deformation. Restrictor orifice in threaded end of adapter shall be free and clear.



R 10. SCREW (IPC FIG. 71)
15. COVER
20. PACKING
30. RING
35. HOUSING
40. SLEEVE
45. SPRING
50. WASHER
55. PISTON
60. PACKING
65. PACKING
70. PACKING
75. PACKING
80. PACKING
85. WASHER
90. NIPPLE
95. PACKING
100. FILTER
105. SPRING
110. HOUSING

R (Post SB73-0017) Flow Divider and Drain Valve
(Field Maintenance Breakdown)
Figure 204

R 4. D. (4) (Pre SB73-0017) Inspect piston halves for scratches or burrs. Visually inspect sealing ring on outer piston half for evidence of damage or wear.

R (5) (Pre SB73-0017) Visually inspect valve assembly, ball, and seat. All parts shall be free of any obvious defects that could affect sealing. Pay particular attention to condition of ball and seat. These parts should be free of grooves, flat spots, or other defect which could cause leakage.

(6) Visually inspect threaded ports of housing for damaged threads. Check all exposed passages and bores in housing for obstructions and foreign matter.

R (7) (Post SB73-0017) Inspect drain valve assembly components for freedom from nicks, burrs, or scoring. Check drain valve piston for freedom of movement in drain valve sleeve.

E. (Pre SB73-0017) Assemble Fuel Flow Divider and Drain Valve (See Figure 203)

CAUTION: ENSURE THAT PISTON HALVES ARE NOT BINDING OR COCKED WHEN INSTALLED IN BORE OF ADAPTER. IMPROPERLY INSTALLED PISTON ASSEMBLY MAY CAUSE DRAIN VALVE MALFUNCTION RESULTING IN HOT START OR FAILURE TO START.

(1) Assemble piston halves with gasket and new packing into adapter, using suitable sleeve to guide piston halves into bore of adapter.

(2) Assemble new packing, same number and thickness of washers removed in step A.(3), and spring with spring retainers on valve assembly.

(3) Install valve assembly with assembled parts into adapter so that end of valve assembly rod is inserted into inner piston half.

(4) Install same number and thickness of shim washers removed in step A.(3), spring retainer, ball spring, ball, and seat with new packing into housing.

(5) Insert adapter with assembled parts into housing and secure with screws. Tighten screws (20, 25) to 13 inch-pounds torque.

(6) Install filter spring, filter element, and nipple with new packing. Tighten nipple (205) to 75 to 80 inch-pounds torque.

R 4. F. (Post SB73-0017) Assemble Fuel Flow Divider and Drain Valve (See Figure 204)

NOTE: Drain valve components are a matched set. Ensure that components are not interchanged with components of other drain valve assemblies.

(1) Install new packing on tube nipple and install spring, filter, and tube nipple. Tighten tube nipple (90) to 75 to 80 inch-pounds torque.

(2) Install same number and thickness of washers removed in step B.(3) into drain valve bore of flow divider and drain valve.

(3) Assemble drain valve assembly with new packings and install retaining ring. Install drain valve assembly.

(4) Install cover and secure with screws. Tighten screws (10) to 20 inch-pounds torque.

R G. (Pre SB73-0017) Test Flow Divider and Drain Valve After Repair

(1) With flow divider and drain valve installed on engine, perform a normal engine start in accordance with 72-00-00, ADJUSTMENT/TEST. Ensure acceleration time and starting temperature are within normal operating limits. Using ground observer, check for fuel leaks and verify proper draining during shutdown.

(2) If fuel leakage from the flow divider drain valve port is noted at any time other than engine shutdown, the following action shall be taken.

(a) Remove the necessary cowling, plumbing lines, etc., to gain access to the drain port side of the flow divider.

(b) If installed, remove drain line and union from flow divider and drain valve drain port.

(c) Install Plug Part No. AN814-4DL, in flow divider drain valve port and tighten to 65 to 70 inch-pounds torque. Lockwire. Cap customer drain line.

(d) Plug shall remain installed until the next scheduled engine inspection period, at which time the cause of fuel leakage shall be investigated and positive corrective action taken.

(e) Make an entry in engine log book noting engine operating time and compliance with Service Bulletin No. 644.

R 4. H. (Post SB73-0017) Test Flow Divider and Drain Valve After Repair

NOTE: The flow divider incorporates a shuttle type drain valve with soft packings for improved dirt tolerance. The drain valve opens during the last phase of engine shutdown and remains open until the final part of the following start cycle. If the engine/aircraft installation has any lines below the drain valve that prevent gravity drain of residual fuel trapped in low areas, this fuel will remain trapped until the engine is restarted.

When the engine is started, plenum air going through the secondary fuel manifold forces the residual fuel out the secondary drain until fuel flow occurs in the secondary manifold. At that time, the drain valve seats in the run (closed) position. Fuel forced out during engine starting is a result of the normal operation of the drain valve and should not be mistaken for leakage.

(1) With flow divider and drain valve installed on engine, perform a normal engine start in accordance with 72-00-00, ADJUSTMENT/TEST. Ensure acceleration time and starting temperature are within normal operating limits. Using ground observer, check for fuel leaks and verify proper draining during shutdown.

(2) If fuel leakage from the flow divider drain valve port is noted at any time other than engine shutdown, the following action shall be taken.

(a) Remove the necessary cowling, plumbing lines, etc., to gain access to the drain port side of the flow divider.

(b) If installed, remove drain line and union from flow divider and drain valve drain port.

(c) Install Plug Part No. AN814-4DL, in flow divider drain valve port and tighten to 65 to 70 inch-pounds torque. Lockwire. Cap customer drain line.

(d) Plug shall remain installed until the next scheduled engine inspection period, at which time the cause of fuel leakage shall be investigated and positive corrective action taken.

(e) Make an entry in engine log book noting engine operating time and compliance with Service Bulletin No. 644.

R 4. I. (Codes AB-AC, BB-BC, CB-LA) Test Flow Divider and Drain Valve After Repair

NOTE: The fuel manifold purge system incorporates a one-way check valve in the flow driver and drain valve drain port. The drain valve opens during the last phase of engine shutdown and remains open until the final part of the following start cycle. The check valve prevents any fuel from flowing into the pneumatic system of the fuel manifold purge system upon engine start and shutdown

Upon engine shutdown, the fuel purge solenoid valve is actuated simultaneously with the engine fuel shutoff valve. Bleed air that is stored in the accumulator is forced through the fuel flow divider and fuel manifolds into the combustor.

(1) With flow divider and drain valve installed on engine, perform a normal engine start in accordance with 72-00-00, ADJUSTMENT/TEST. Ensure acceleration time and starting temperature are within normal operating limits. Using observer, check for fuel leaks.

NOTE: An engine speed of 90 percent rpm is required to properly charge purge system.

(2) Upon engine shutdown, the operator should monitor the engine tachometer indicator for an increase of engine speed. Any increase of engine speed denotes a properly operating purge system.

(3) If no increase in engine speed is noted by the operator, the following action shall be taken.

NOTE: Ensure check valves are installed and functioning properly.

(a) Remove electrical connector at the fuel purge solenoid valve. Using voltmeter, check for voltage at the connector. If voltage is not available, refer to Aircraft Maintenance Manual.

(b) If step (a) is satisfactory, apply 24 volts dc across pins A and B of electrical connector of solenoid valve. Valve shall open. If valve is found defective, replace.

J. Replace Part That is Damaged Beyond Repair

FUEL MANIFOLD AND NOZZLE ASSEMBLIES - MAINTENANCE PRACTICES

1. Removal/Installation

NOTE: Table 201 provides a list of all materials and compounds required to perform Removal/Installation.

Table 201. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
High temperature compound (Fel-Pro C5-A)	Fel-Pro Inc, Division of Felt Products Mfg Co, 7450 North McCormick Blvd, Skokie, IL 60076

A. Remove Fuel Manifold and Nozzle Assembly (See Figure 201)

NOTE: The primary and secondary fuel manifold and nozzle assemblies are not matched sets and may be replaced individually. It is not necessary to remove both unless both are plugged or damaged.

Provide a suitable container to drain residual fuel from fuel manifold assemblies.

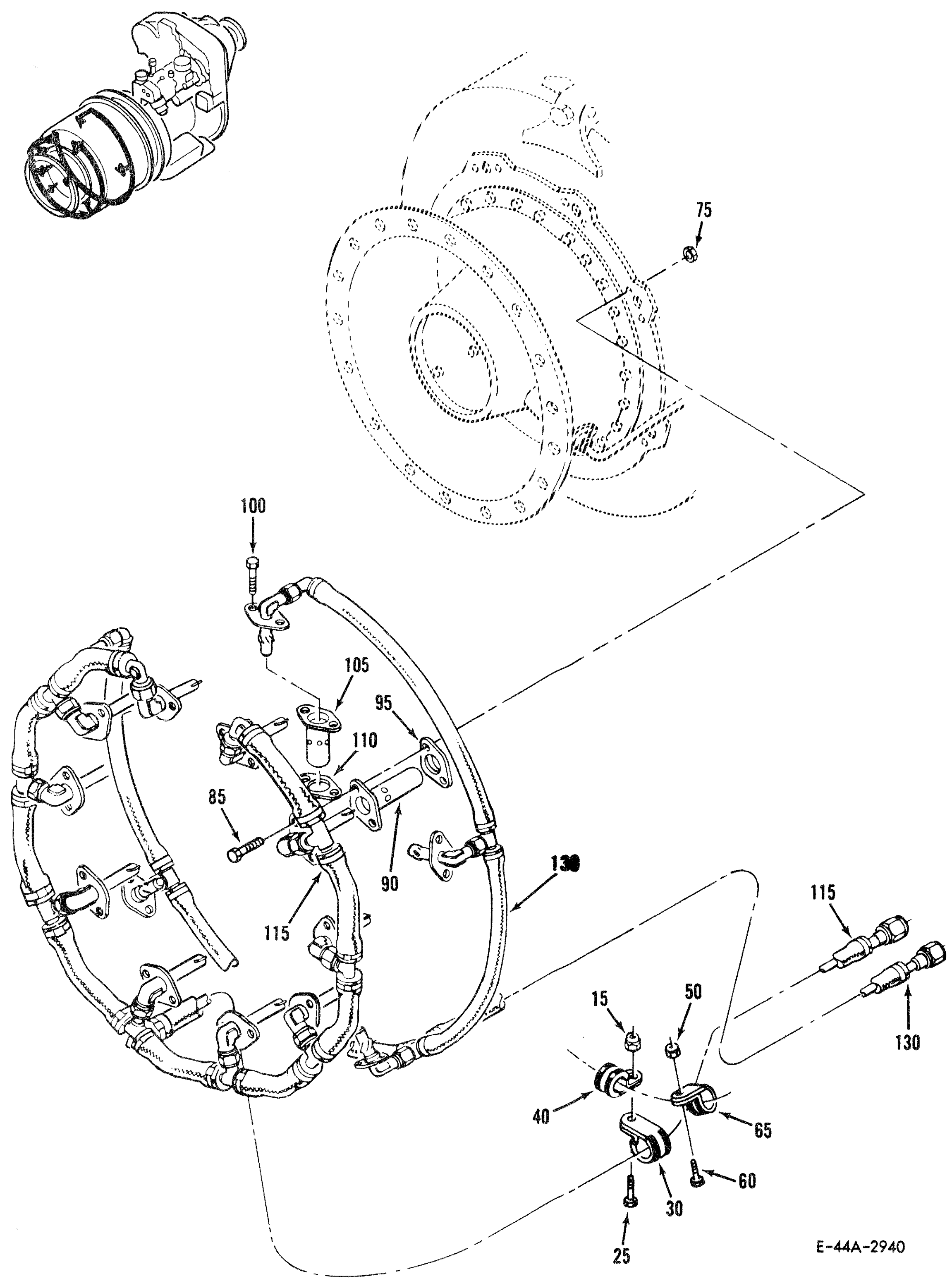
(1) Disconnect fuel manifold and nozzle assemblies from flow divider and drain valve.

(2) Remove bolts securing fuel manifold and nozzle assemblies to plenum assembly. Remove clamps, then remove fuel manifold and nozzle assemblies. Drain any residual fuel.

(3) Remove fuel nozzle shrouds and nozzle gaskets using care not to damage shroud mating flange or plenum boss.

NOTE: Do not mix primary and secondary nozzle assembly parts during disassembly, cleaning, and reassembly. The primary and secondary nozzle flow rates and spray patterns are different and assemblies must remain with their respective manifold assemblies.

(4) Remove nozzle assemblies and nozzles if damage or contamination is evident in accordance with Approved Repairs.



Fuel Manifold and Nozzle Assembly Installation
Figure 201

1. B. Install Fuel Manifold and Nozzle Assemblies (See Figure 201)

(1) Place gaskets and shrouds on nozzle body.

NOTE: Ensure that indexing pins on primary nozzles align with mating holes in shrouds when manifold and nozzle assemblies are installed.

(2) Install fuel manifold and nozzle assemblies on engine.

NOTE: Apply high temperature compound (Fel-Pro C5-A) to threads of bolts located aft of fireshields unless otherwise specified.

R Refer to 70-00-00, STANDARD PRACTICES, for recom-
R mended general torque values. Add frictional drag
R (run-down) torque of self locking devices to
R recommended values.

(3) Install bolts and nuts securing fuel manifold and nozzle assemblies to engine. Tighten bolts (85) to 70 inch-pounds torque, and bolts (100) to 35 inch-pounds torque.

(4) Install clamps with bolts and nuts. Tighten nut (15, 50) to 20 inch-pounds torque.

(5) Perform fuel manifold and nozzle assembly functional check in accordance with 72-00-00, ADJUSTMENT/TEST.

(6) Connect ends of manifold assemblies to flow divider and drain valve.

(7) Start and operate engine and check for fuel leaks at manifold tube nut connection points and at manifold gaskets.

(8) When engine temperature has stabilized, shut down engine and check torque on nuts and bolts securing manifold and nozzle assemblies to engine. Retighten as required.

KEY TO FIGURE 201

R 15. NUT (IPC FIG. 72)
25. BOLT
30. CLAMP
40. CLAMP
50. NUT
60. BOLT
65. CLAMP
75. NUT
85. BOLT
90. SHROUD
95. GASKET
100. BOLT
105. SHROUD
110. GASKET
115. SECONDARY MANIFOLD AND NOZZLE ASSY
135. PRIMARY MANIFOLD AND NOZZLE ASSY

2. Adjustment/Test

NOTE: Table 202 provides a list of all materials and equipment required to perform Adjustment/Test.

Table 202. Equipment and Materials

Equipment or Material	Description or Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Containers (10)	Capable of collecting measured amount of test fluid (1000 CC)
Filter	10 micron minimum
Flowmeter	Capable of measuring 0 to 500 pounds per hour with +2/-2 percent accuracy
Pressure gage (2)	Capable of measuring 0 to 500 psig with +2/-2 percent accuracy
Pressure regulator	Capable of regulating pressure at 0 to 500 psig
Pump	Capable of producing flow of 500 pounds per hour and 500 psig
Shutoff valve (2)	Manual shutoff valve
Solvent (Shell 360)	Shell Oil Co, 50 W 50th St, New York, NY 10020
Towel (Kim-wipe)	Commercially available

A. Flow Check Fuel Manifold and Nozzle Assembly (Fuel Manifold and Nozzle Assembly Removed)

NOTE: A nozzle assembly that does not conform to flow rate and spray pattern requirements may be disassembled and checked for contamination or plugging. Nozzles which cannot meet the flow rate and spray pattern specified shall be replaced.

(1) Construct test setup similar to that illustrated in Figure 202.

2. A. (2) Use solvent, Shell 360, or jet fuel in test setup at an inlet temperature of 24 to 29C (75 to 85F).

(3) Perform nozzle assembly flow rate and spray pattern test as follows.

NOTE: Refer to 72-00-00, ADJUSTMENT/TEST, for testing procedure for fuel manifold and nozzle assembly installed on engine.

(a) Install nozzle assembly in a nozzle adapter and connect nozzle adapter to test stand as schematically shown in View A, Figure 202.

NOTE: If spray pattern does not pass test, wipe nozzle tip with a clean Kim-Wipe towel, using a twisting motion. Do not touch nozzle tip with fingers.

(b) Apply pressure of 100 +2/-2 psig to nozzle assembly and check spray angle at a distance of one inch radius from the apex of the spray. The spray angle shall be in accordance with Table 203. Check spray pattern. The spray pattern shall be a fully developed cone with no discontinuities or solid streams of fuel. (See figure 203.)

(c) Apply pressure of 100 +2/-2 psig and check flow rate of primary nozzle assembly. Flow rate shall be in accordance with Table 203.

(d) Apply pressure of 400 +2/-2 psig and check flow rate of primary nozzle assembly. Flow rate shall be in accordance with Table 203.

(e) Reduce pressure to zero psig, and remove nozzle assembly from nozzle adapter.

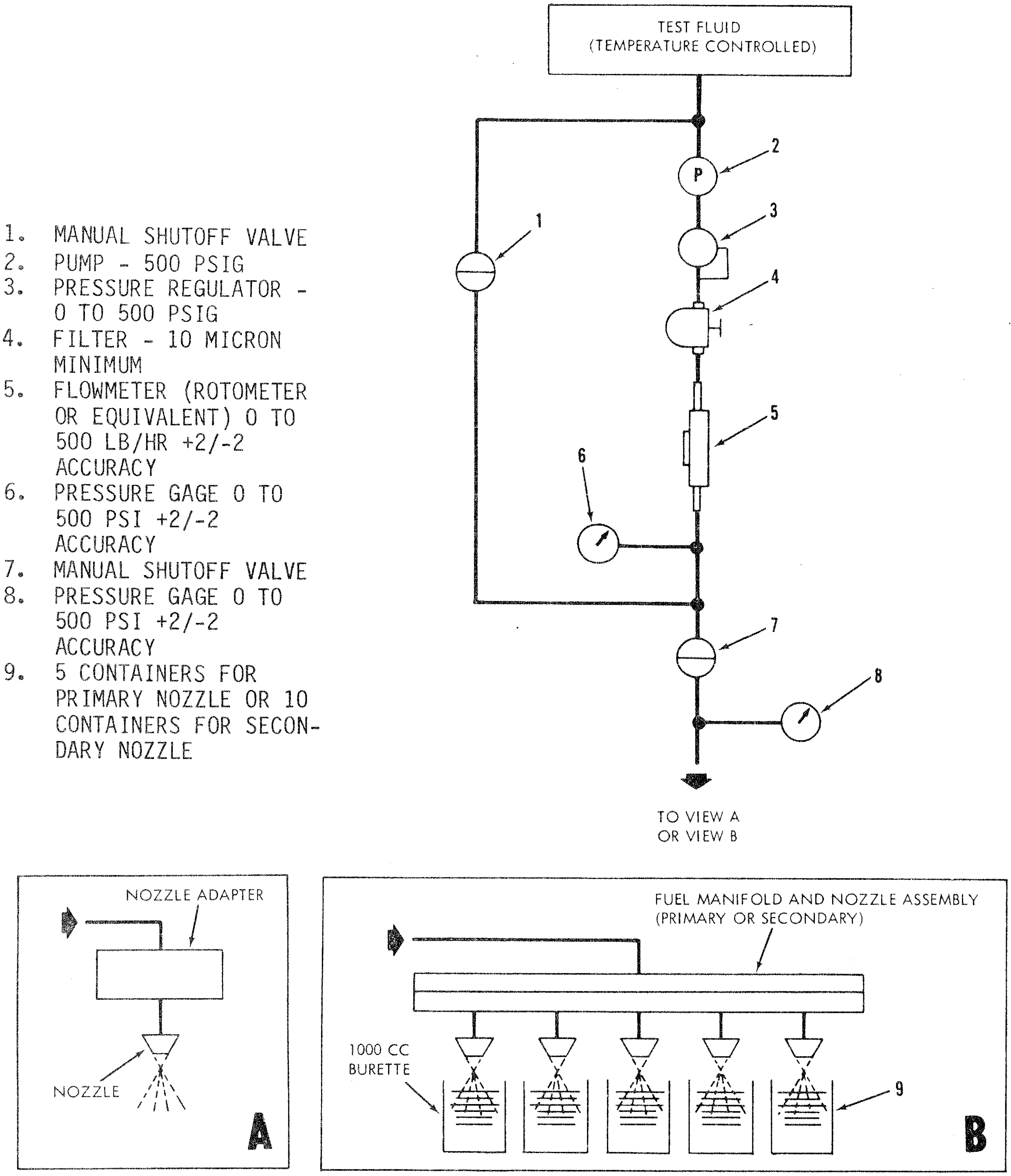
(4) Perform fuel manifold and nozzle assembly test as follows.

(a) Install fuel manifold and nozzle assemblies as schematically shown in View B, Figure 202.

CAUTION: MAKE CERTAIN TEST SETUP SYSTEM DOES NOT BECOME CONTAMINATED BY ENSURING THAT ALL PROTECTIVE COVERS ARE REPLACED WHEN NOT TESTING. MAKE CERTAIN SYSTEM FLUID IS PERIODICALLY SAMPLED AND EXAMINED AND VERIFY THAT 10-MICRON FILTER IS INSTALLED UPSTREAM OF ASSEMBLY BEING TESTED.

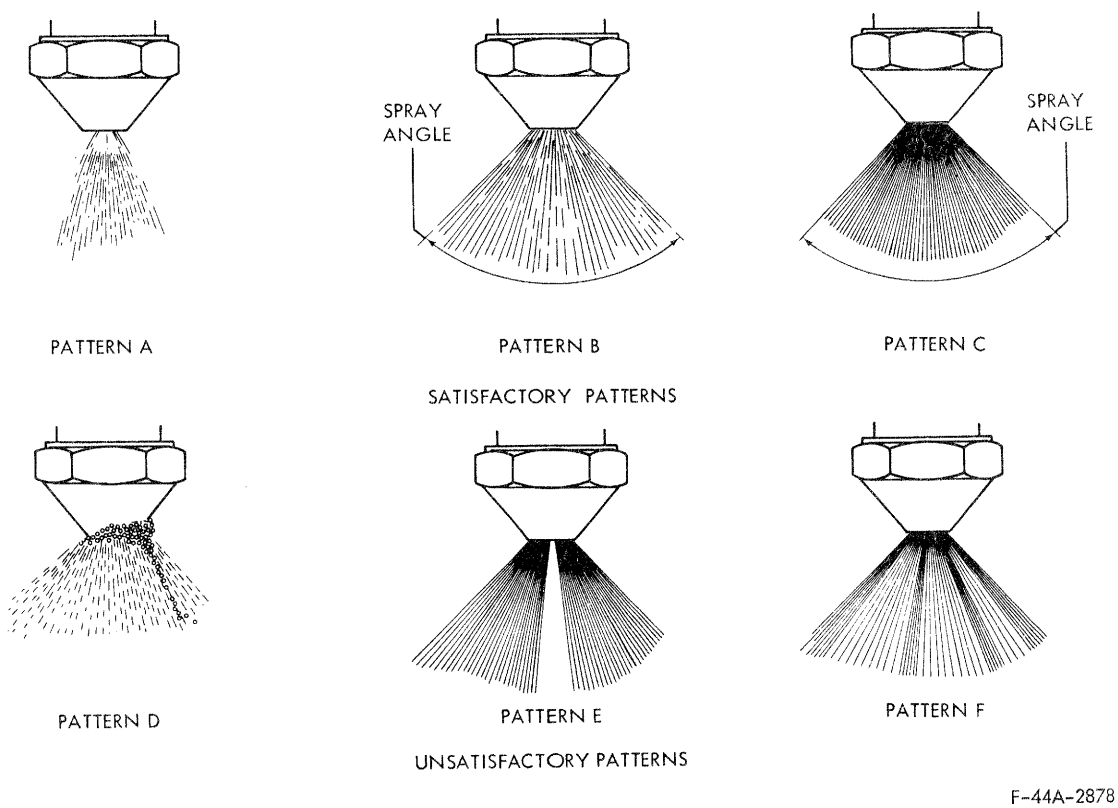
(b) Apply 100 +2/-2 psig to primary manifold and 400 +2/-2 psig to secondary manifold for a period of time required to obtain approximately one inch height of test fluid in each burette (view B). Record amount (in cubic centimeters) of test fluid contained in each burette.

1. MANUAL SHUTOFF VALVE
2. PUMP - 500 PSIG
3. PRESSURE REGULATOR - 0 TO 500 PSIG
4. FILTER - 10 MICRON MINIMUM
5. FLOWMETER (ROTOMETER OR EQUIVALENT) 0 TO 500 LB/HR +2/-2 ACCURACY
6. PRESSURE GAGE 0 TO 500 PSI +2/-2 ACCURACY
7. MANUAL SHUTOFF VALVE
8. PRESSURE GAGE 0 TO 500 PSI +2/-2 ACCURACY
9. 5 CONTAINERS FOR PRIMARY NOZZLE OR 10 CONTAINERS FOR SECONDARY NOZZLE



SB-1336R2

Fuel Manifold and Nozzle Assembly Test Setup
Figure 202



Fuel Nozzle Test Spray Patterns
Figure 203

Table 203. Flow Limits and Spray Angle

Part Name	Flow Limits (lb/hr)	Spray Angle Degrees
Primary Nozzle Assembly	11 +0.5/-0.5 at 100 +2/-2 psig	90 +10/-10 at 100 +2/-2 psig
Secondary Nozzle Assembly	40 +1.4/-1.4 at 400 +2/-2 psig	80 +10/-10 at 100 +2/-2 psig

2\. A. (4) (c) Reapply 100 +2/-2 psig to primary manifold and 400 +2/-2 psig to secondary manifold for period of time required to obtain an additional six inch height of test fluid in each burette. Record amount (in cubic centimeters) of test fluid contained in each burette.

NOTE: Observe spray characteristics of each nozzle assembly. Nozzle assembly spray characteristics shall consist of finely divided droplets in form of fully developed spray cones with no solid streams or discontinuities. (See figure 203.)

(d) Subtract amount of test fluid recorded in step (b) from amount recorded in step (c) to obtain relative quantity in each burette. Record relative quantities.

(e) Select largest and smallest relative quantity recorded in step (d) and determine percentage differential using the following formula. Percentage differential shall be in accordance with Table 204.

$$\text{PERCENTAGE DIFFERENTIAL} = 100 \times \frac{(\text{LARGEST RELATIVE QUANTITY} - \text{SMALLEST RELATIVE QUANTITY})}{\text{LARGEST RELATIVE QUANTITY}}$$

(f) Apply 100 +2/-2 psig of pressure and record flow through the primary fuel manifold and nozzle assemby. Flow shall be in accordance with Table 204.

(g) Apply 400 +2/-2 psig of pressure and record flow through secondary fuel manifold and nozzle assembly. Flow shall be in accordance with Table 204.

(h) Reduce pressure to zero psig and remove fuel manifold and nozzle assembly from test setup.

Table 204. Flow and Differential Limits

Part Name	Flow Limits (lb/hr)	Maximum Percentage Differential
Primary Fuel Manifold	55 +2.5/-2.5 at 100 +2/-2 psig	9 percent
Secondary Fuel Manifold	400 +12/-12 at 400 +2/-2 psig	6 percent

3. Inspection/Check

A. Check Fuel Manifold and Nozzle Assembly (Installed)

(1) Check fuel manifold and nozzle assembly for security and evidence of fuel leakage.

B. Check Fuel Manifold and Nozzle Assembly (Removed)

(1) Inspect for broken welds.

(2) Inspect for frayed or broken wires in flexible lines.

R (3) Inspect manifold assembly tube nuts for cracks or damaged threads.

R (4) Inspect fuel nozzle for cracks, broken welds, and obvious damage.

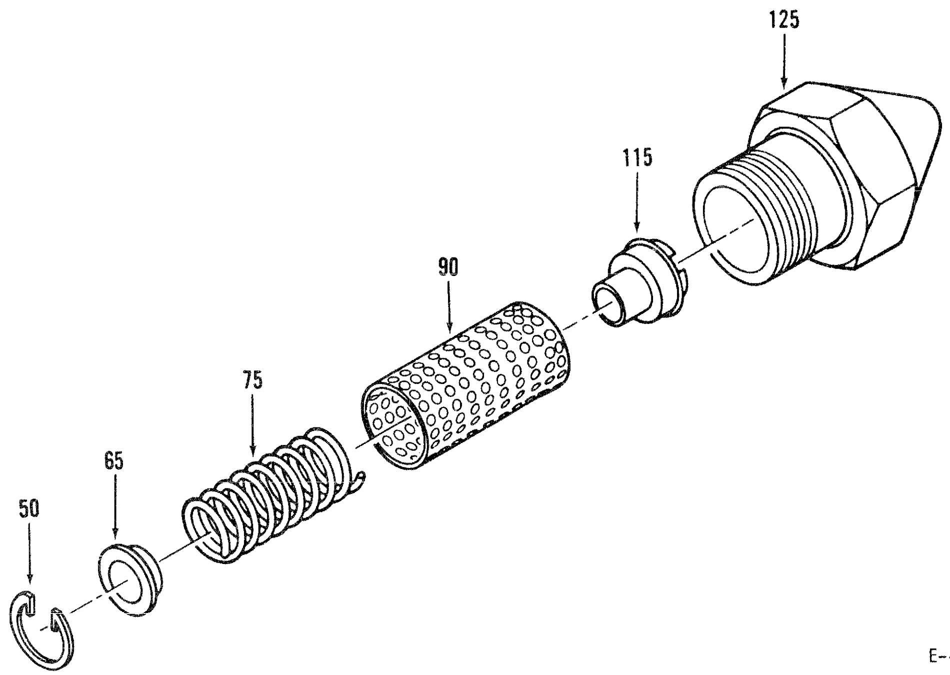
R (5) Inspect shrouds for cracks, excessive erosion, and burns.

C. Check Nozzle Assembly (Disassembled) (See Figure 204)

(1) Inspect body of nozzle assembly for cracks, pitting, and damaged threads.

NOTE: Perform following checks using strong light and 20-power magnifying glass.

(2) Using a magnifying glass and a good light source, examine the sealing surface and tapered cone inside body and the sealing surface and face of distributor for nicks, scratches, cracks, obstructions, or other visible damage that would affect sealing of the mated parts or a smooth flow of fuel through the nozzle. Replace entire nozzle assembly if distributor or body is damaged.



R 50. RETAINING RING (IPC FIG. 74)
65. RETAINER
75. SPRING
90. SCREEN
115. DISTRIBUTOR
125. BODY

Nozzle Assembly (Field Maintenance Breakdown)
Figure 204

3. C. (3) Replace snap ring.

(4) Inspect spring for distortion and length. Free length shall be 0.2480 inch or more. Load required to compress spring to test length of 0.2165 inch shall be one to two pounds.

(5) Inspect retainer for unobstructed fuel passage and distortion. Replace entire nozzle assembly if retainer is damaged.

D. Replace Part That Does Not Meet Inspection/Check Requirements.

4. Cleaning/Painting

Table 205. Materials and Compound

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Hydralox solution	Fortner Accessory Service Corp, 1320 Flower St, Glendale, CA 91201
Rust stripper (Oakite Rust Stripper)	Oakite Products Inc, 50 Valley Rd, Berkeley Heights, NJ 07922
Solvent, Stoddard (Federal Specification P-D-680, Type I)	Commercially available

A. Clean Parts

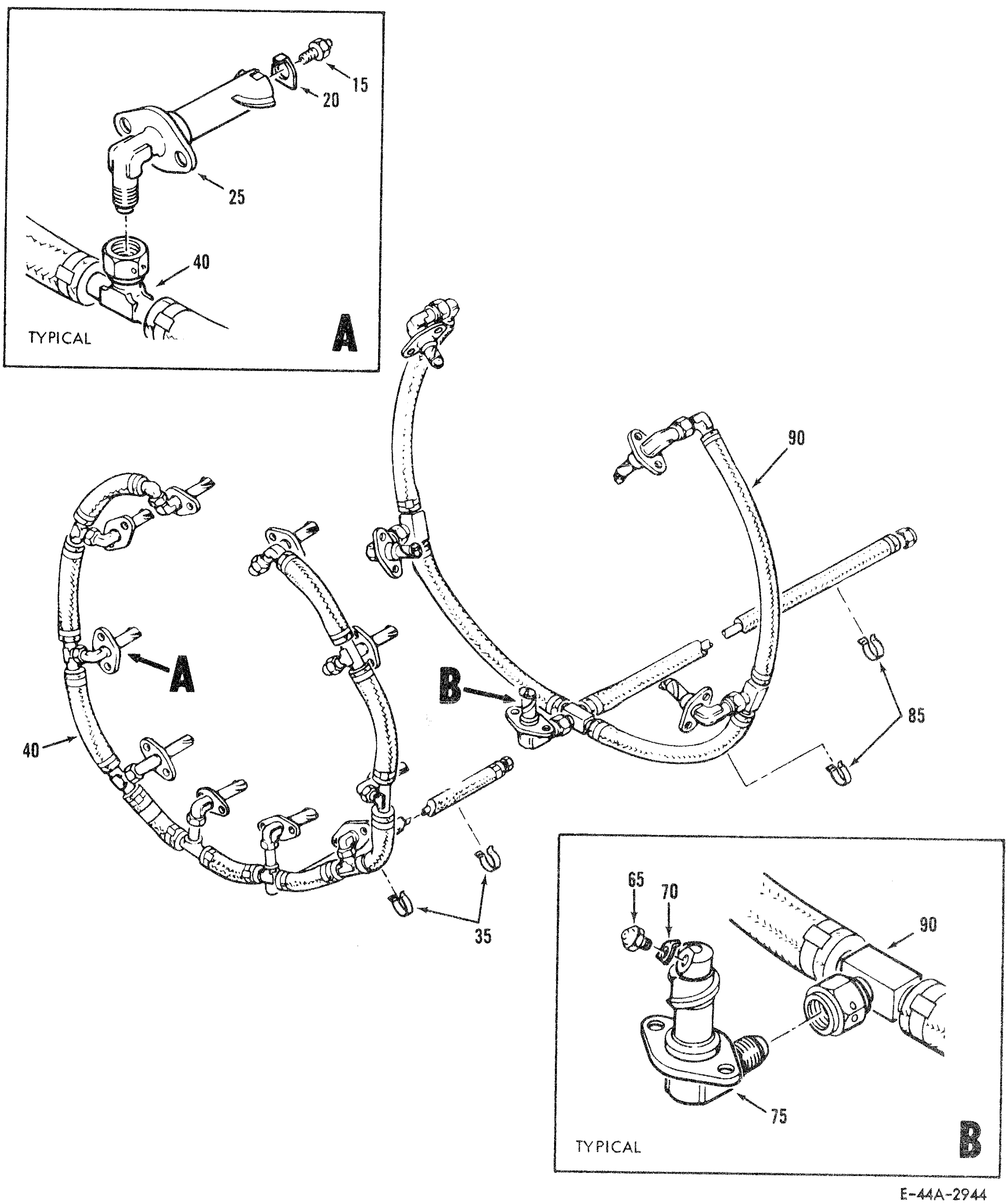
(1) Clean all standard metallic hardware in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 1 or 2.

(2) Clean manifold assembly in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 12.

B. Perform Special Cleaning

(1) Clean nozzle assembly shrouds using rust stripper (Oakite) and a suede brush.

(2) Disassemble fuel nozzles and nozzle assemblies in accordance with Approved Repairs.



Fuel Manifold and Nozzle Assembly
(Field Maintenance Breakdown)
Figure 205

4. B. (3) Clean fuel nozzles as follows.

NOTE: Bore of primary fuel nozzles cannot be adequately cleaned with brushes due to angle for mounting nozzle assembly.

(a) Scrub the external surface and bores of fuel nozzle with a stainless steel wire brush and wire bristled tube brush. Remove as much carbon contamination as possible with this operation.

(4) Clean fuel nozzles and nozzle assemblies as follows. (See figure 205.)

CAUTION: SOLVENT IS TOXIC AND FLAMMABLE. USE IN WELL-VENTILATED AREA. AVOID BREATHING FUMES OR LONG CONTACT WITH SKIN TO PREVENT DAMAGE TO PHYSICAL HEALTH. KEEP AWAY FROM FLAME TO AVOID FIRE HAZARD.

(a) If hydralox solution is used, perform following, then proceed to step (c).

1 Place components in wire mesh basket and immerse in hydralox solution and allow to soak for 15 to 30 minutes at room temperature.

NOTE: Container for hydralox solution shall be portable and suitable for hanging in the fluid compartment of an ultrasonic cleaning unit.

2 Transfer container with hydralox solution and components to fluid compartment of ultrasonic cleaning unit for minimum of 15 minutes. Agitate components in solution occasionally during 15 minute period.

KEY TO FIGURE 205

R 15. FUEL NOZZLE ASSY (IPC FIG. 73)
20. WASHER
25. NOZZLE
35. MARKER BAND
40. MANIFOLD ASSY
65. FUEL NOZZLE ASSY
70. WASHER
75. NOZZLE
85. MARKER BAND
90. MANIFOLD ASSY

4\. B. (4) (b) If rust stripper (Oakite) is used, perform following, then proceed to step (c).

1 Place components in a wire mesh basket and immerse in rust stripper (Oakite) (mix one gallon of water with three to five pounds of rust stripper) heated to 71 to 82C (160 to 180F). Soak components in solution for 15 to 30 minutes. Agitate occasionally.

(c) Remove basket from solution and rinse components in clean tap water. Power flush internal passages with filtered solvent, Stoddard (Federal Specification P-D-680, Type I), or jet fuel and allow parts to drain dry.

(d) Inspect components visually for cleanliness of surfaces and bores using a binocular microscope or an illuminated magnifying glass. There shall be no carbon particles on the internal passages.

(e) Components that are not completely cleaned shall be recycled through steps (a) through (e) until they are visually clean. Clean components shall be dried for one hour in an oven at 110 to 132C (230 to 270F).

(f) Allow parts to cool at room temperature.

5\. Approved Repairs

NOTE: Table 206 provides a list of all materials and compounds requried to perform Approved Repairs.

Table 207 provides a list of all special tools, fixtures, and equipment to perform Approved Repairs.

Table 206. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Plastic bags or sheeting (MIL-B-131)	Commercially available

Table 207. Special Tools, Fixtures, and Equipment

Item No.	Nomenclature	Use	Source/ Part No.
NOTE: Equivalent substitutes may be used for listed items.			
1.	Gage	Holds manifold at right angle to centerline during assembly	285220-1-1
2.	Ring Installing Holder	Holds body of nozzle assembly and inserts snap ring into place in body	285640-1-1
3.	Special Pliers	Bends tabs on lock washers to hold nozzle assembly	287129-1-1

NOTE: Maintenance options outlined in paragraph A below, are considered acceptable as corrective action for fuel manifold and nozzle assemblies that exceed specified pressure limits, as specified in Adjustment/Test.

R 5. A. Repair or Replace Fuel Manifold and Nozzle Assemblies

NOTE: When a precleaned and tested (or new) fuel manifold and nozzle assembly (primary or secondary) is installed flow checks are not required.

(1) Replace entire fuel manifold and nozzle assembly (primary or secondary) with a precleaned and tested assembly.

NOTE: If step (2) is used, visually inspect internal fuel passages of all fuel nozzles for carbon formation. If any present, clean fuel nozzles in accordance with Cleaning/Painting.

(2) Replace defective nozzle assembly and install precleaned and tested nozzle assembly as follows.

(a) Remove manifold and nozzle assembly in accordance with Removal/Installation.

(b) Perform fuel manifold and nozzle assembly flow check in accordance with Adjustment/Test.

5. A. (2) (c) Remove and install nozzle assembly in accordance with paragraphs B and E.

(3) Remove and clean all fuel nozzles and nozzle assemblies.

(a) Remove manifold and nozzle assembly in accordance with Removal/Installation.

(b) Remove, disassemble, clean, and assemble all fuel nozzles and nozzle assemblies in accordance with paragraphs B through E.

B. Remove Nozzle Assembly from Fuel Nozzle

(1) Bend locking tabs of key washer away from flats of nozzle assembly.

(2) Remove nozzle assembly and key washer from fuel nozzle. Discard key washer.

NOTE: Do not remove alignment pin from primary fuel nozzle housing.

(3) Remove fuel nozzle from manifold assembly and clean in accordance with Cleaning/Painting.

C. Disassemble Nozzle Assemblies (See Figure 204)

CAUTION: PRIMARY AND SECONDARY NOZZLE ASSEMBLIES ARE NOT INTERCHANGEABLE. COMPONENTS OF PRIMARY AND SECONDARY NOZZLE ASSEMBLIES SHALL NOT BE INTERMINGLED. DISTRIBUTOR OF DISC AND BODY ASSEMBLY SHALL REMAIN TOGETHER AS MATCHED SET. NOZZLE ASSEMBLY COMPONENTS MANUFACTURED BY THE SAME VENDOR ARE INTERCHANGEABLE. DO NOT INTERMINGLE COMPONENTS OF DIFFERENT VENDORS.

(1) Hold body firmly and remove ring.

NOTE: A small mesh corrosion-resistant steel wire basket, divided into small sections, may be used to keep nozzle assembly parts separated during disassembly, cleaning, and reassembly. Distributor and body or disc and body of each nozzle assembly are matched parts and are not interchangeable. Spring is compressed by retainer and can "pop out" when ring is removed. If parts cannot be removed by light tapping of body, a small piece of brass or copper wire may be used to push parts out of body.

(2) Remove retainer, spring, screen, and distributor or disc from body.

5. C. (3) Replace screen and snap ring with new part. Place remaining parts in wire basket and clean in accordance with Cleaning/Painting.

D. Replace Part That is Damaged Beyond Repair

E. Assemble Nozzle Assemblies (See Figure 206)

NOTE: Because of design location differences of snap ring groove in the nozzle assemblies manufactured by three different vendors, 285640-1-1 ring installing holder must be reworked by one of the following methods to ensure proper ring installation. (See figure 206.)

The shoulder of inserting pin may be machined to increase pin length to 0.72 to 0.78 inch.

Seating sleeve may be reworked by grinding 0.005 to 0.006 inch from tapered I.D. end.

(1) Place distributor or disc on end of spring. (See figure 206.) Place new screen over spring. Insert assembled parts into body.

(2) Place body in 285640-1-1 holder and position retainer in body.

(3) Install seating sleeve of 285640-1-1 holder in base and apply light pressure to depress spring and seat retainer in body.

CAUTION: DURING NOZZLE ASSEMBLY, ENSURE SNAP RING IS FULLY EXPANDED INTO GROOVE.

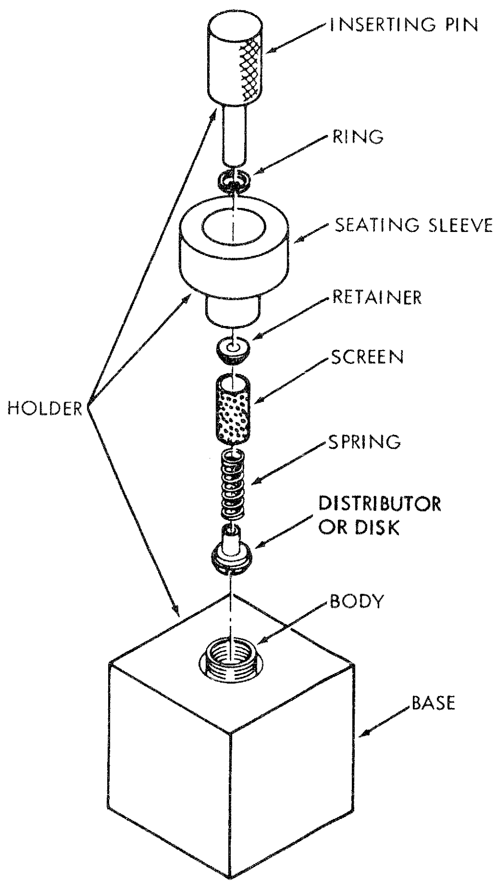
(4) Hold seating sleeve depressed, place new snap ring in hole of seating sleeve, and seat ring with inserting pin of 285640-1-1 holder.

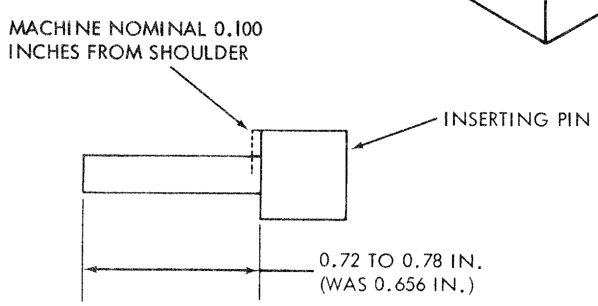
(5) Following assembly, test nozzle assemblies in accordance with Adjustment/Test, step 2.A.(3).

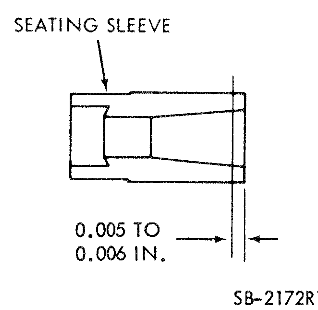
F. Install Fuel Nozzle and Nozzle Assembly

CAUTION: CARE SHALL BE EXERCISED NOT TO INTERCHANGE START NOZZLE ASSEMBLIES WHICH ARE MARKED "S" WITH RUN NOZZLE ASSEMBLIES.

(1) Install fuel nozzle on primary manifold assembly and tighten tube nut finger tight. (See figure 207.)

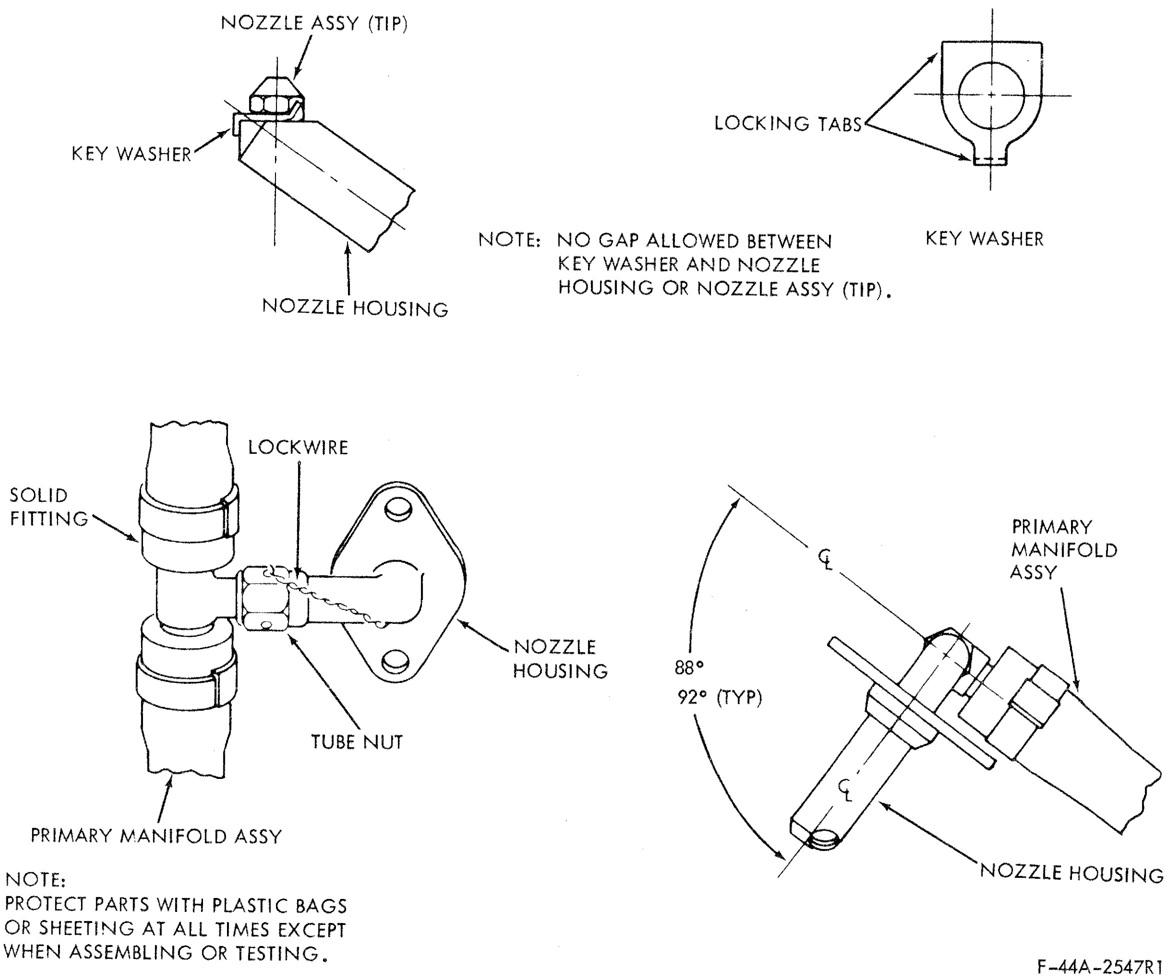






Assembly of Nozzle Assembly
Figure 206

R



Installation of Nozzle Assembly and Fuel Nozzle (Primary)
Figure 207

CAUTION: TO PREVENT SCORING OF FLARE ON FUEL MANIFOLD FITTINGS OR SEAT ON FUEL NOZZLE HOUSINGS, PREVENT ROTATION OF FUEL MANIFOLD FITTINGS WHEN TIGHTENING TUBE NUTS.

5. F. (2) Place assembled parts in 285220-1-1 gage and set position of installed nozzle within 88 to 92 degrees to centerline of manifold assembly. Tighten manifold assembly tube nuts securing fuel nozzle to 100 inch-pounds torque.

(3) Install lockwire on tube nut.

R (4) Install pre-cleaned and tested nozzle assembly (tip) with new key
R washer into fuel nozzle housing. Push pre-bent tab of key washer
R against flat surface of fuel nozzle housing and tighten nozzle as-
R sembly (tip) to 55 to 65 inch-pounds torque.

R CAUTION: FOLLOWING BENDING OF TABS, ENSURE LOCKING TABS
R ARE NOT CRACKED.

R (5) Use 287129-1-1 crimping tool to bend tab of key washer flush
R against nozzle housing. Check to ensure that pre-bent tab of key
R washer is flush against flat surface of nozzle housing. Close gap,
R if necessary, by tapping with plastic mallet and then bend locking
R tabs of key washer against wrench flats of nozzle assembly (tip).

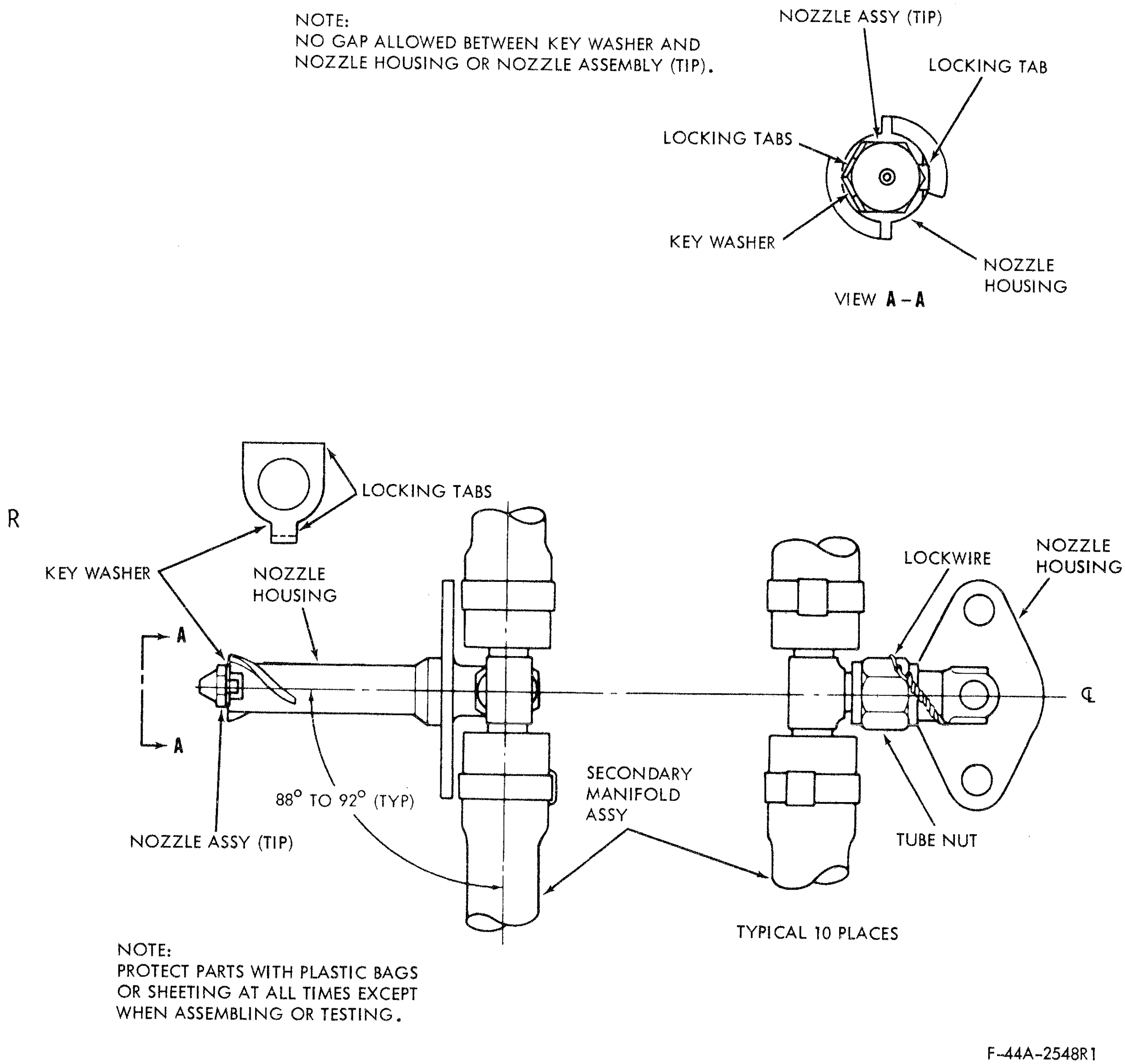
(6) Remove assembled parts from 285220-1-1 gage. Repeat steps (1) through (6) for each fuel nozzle and nozzle assembly removed from primary manifold assembly. Cover parts with plastic bags or sheeting (MIL-B-131) until installation or testing is performed.

(7) Install fuel nozzle on secondary manifold assembly and tighten tube nut finger tight. (See figure 208.)

CAUTION: TO PREVENT SCORING OF FLARE ON FUEL MANIFOLD FITTINGS OR SEAT ON FUEL NOZZLE HOUSINGS, PREVENT ROTATION OF FUEL MANIFOLD FITTINGS WHEN TIGHTENING TUBE NUTS.

(8) Place assembled parts in 285220-1-1 gage and set position of installed fuel nozzle within 88 to 92 degrees to centerline of manifold assembly. Tighten manifold assembly tube nuts securing fuel nozzle to 150 inch-pounds torque.

(9) Install lockwire on tube nut.



Installation of Nozzle Assembly and Fuel Nozzle (Secondary)
Figure 208

5. F. (10) Install pre-cleaned and tested nozzle assembly (tip) with new key washer into fuel nozzle housing. Push pre-bent tab of key washer against flat surface of fuel nozzle housing and tighten nozzle assembly (tip) to 55 to 65 inch-pounds torque.

CAUTION: FOLLOWING BENDING OF LOCKING TABS, ENSURE LOCKING TABS ARE NOT CRACKED.

(11) Use 287129-1-1 crimping tool to bend tab of key washer flush against nozzle housing. Check to ensure that pre-bent tab of key washer is flush against flat surface of nozzle housing. Close gap, if necessary, by tapping with plastic mallet and then bend locking tabs of key washers against wrench flats of nozzle assembly (tip).

(12) Remove assembled parts from 285220-1-1 gage.

Repeat steps (7) through (12) for each fuel nozzle and nozzle assembly removed from secondary manifold assembly. Cover parts with plastic bags or sheeting (MIL-B-131) until installation or testing is performed.

(13) Perform flow check of fuel manifold and nozzle assemblies in accordance with Adjustment/Test. If leakage is evident during flow check, install conical seals. Refer to 70-00-00, GENERAL - STANDARD PRACTICES.

FUEL ANTI-ICE VALVE AND PLUMBING - MAINTENANCE PRACTICES

1. Removal/Installation

NOTE: Table 201 provides a list of all materials and compounds required to perform Removal/Installation.

Table 201. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Any approved engine fuel	Commercially available
Any approved engine oil	Commercially available
Alternate packing lubricant Lubricant (OS-124)	Monsanto Company, 800 N Lindbergh Blvd, St. Louis, MO 63166
Lubricating compound (Liqui-Moly, Grade NV)	Lockrey Co, Lubricants Div, Cedar Shores, Southampton, NY 11968

R A. (Codes AA-AC) Remove Fuel Anti-Ice Valve and Plumbing (See Figure 201, 202)

(1) Remove tube assemblies, elbows, and attaching parts from fuel anti-ice valve and oil to fuel heater. (See figure 201.)

(2) Remove tube assemblies with attaching parts between fuel anti-ice valve and fuel control and fuel pump assemblies. (See figure 201.)

(3) Remove reducer and union with gaskets from fuel anti-ice valve.

(4) Remove fuel anti-ice valve and brackets from compressor housing. (See figure 202.)

(5) Remove fuel anti-ice valve from brackets.

R 1. B. (Codes AA-AC) Install Fuel Anti-Ice Valve and Plumbing (See Figures 201, 202)

NOTE: Prior to installation, unless otherwise specified, lubricate packings or gaskets with any type clean jet fuel. An alternate lubricant (OS-124) may be used; apply lubricant sparingly and spread evenly to a thin transparent film to minimize contamination. Apply lubricating compound (Liqui-Moly, Grade NV) to threads of bolts or screws, and apply clean engine oil to threads (except first two threads) of male plumbing fittings unless otherwise specified.

R Refer to 70-00-00, STANDARD PRACTICES, for recommended
R general torque values. Add frictional drag (run-down)
R torque of self locking devices to recommended values.

(1) Install fuel anti-ice valve onto bracket and support and secure with washers, bolts and nuts. Tighten nuts (35, figure 202) to 20 inch-pounds torque.

(2) Install fuel anti-ice valve and bracket onto input housing assembly and secure. Tighten nuts (5) to 50 inch-pounds torque.

(3) Install reducer, with new packing or gasket, into fuel anti-ice valve. Tighten reducer (55, figure 201) to 75 to 80 inch-pounds torque.

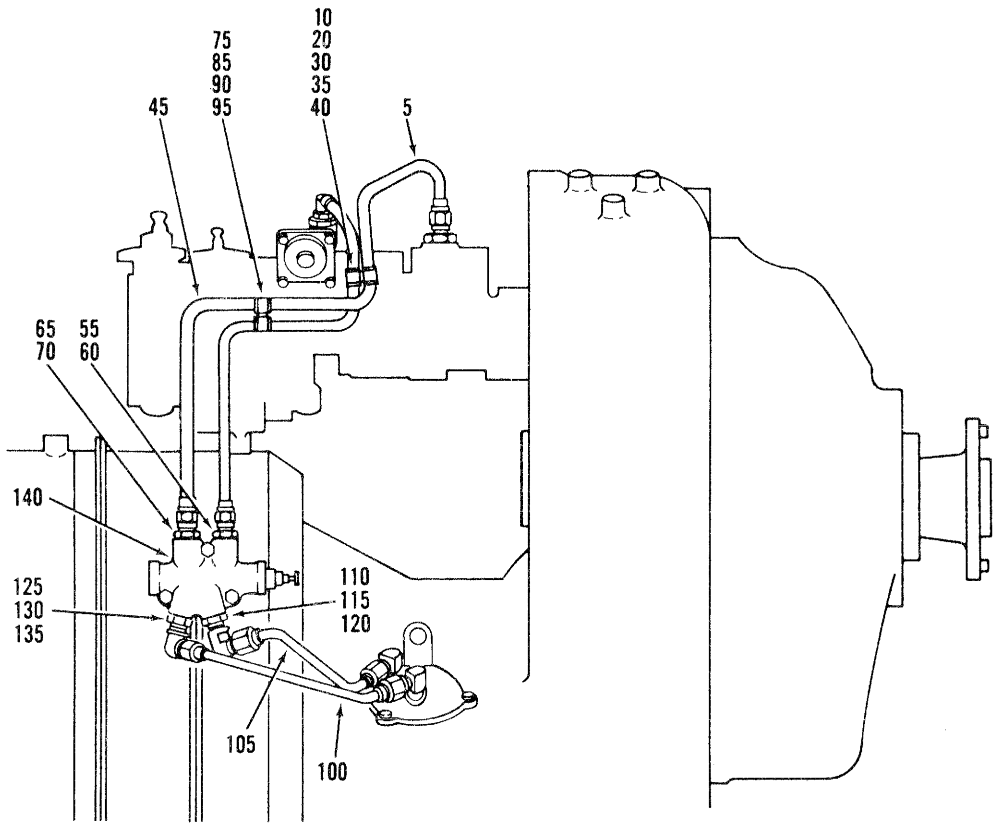
(4) Install union, with new packing or gasket, into fuel anti-ice valve. Tighten union (65) to 75 to 80 inch-pounds torque.

(5) Install tube assemblies, with attaching parts, between union on anti-ice valve and fuel pump assembly, and reducer on fuel anti-ice valve and fuel control assembly.

(6) Install clamps with three washers between clamps. Tighten nut (10) to 20 inch-pounds torque.

(7) Install tube assemblies between fuel anti-ice valve and oil to fuel heater.

R



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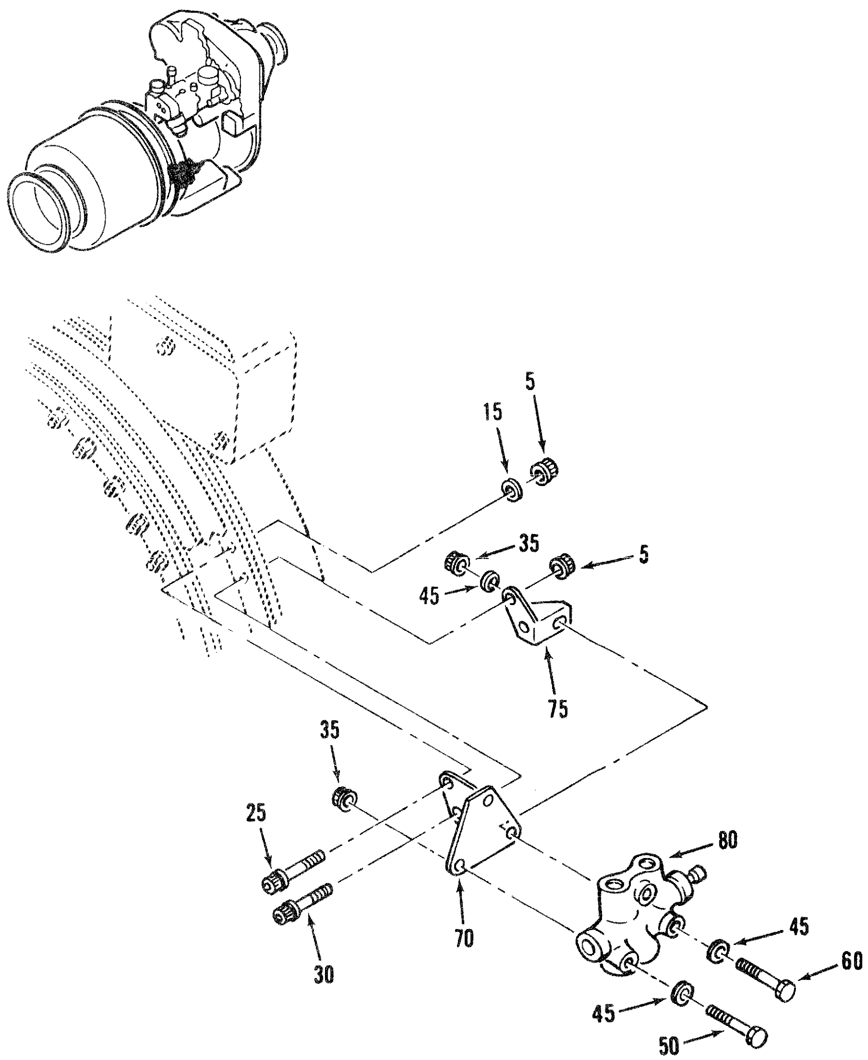
R 5.	TUBE (IPC FIG. 12)	85.	BOLT (PART DELETED)
10.	NUT	90.	CLAMP (PART DELETED)
20.	BOLT	95.	CLAMP (PART DELTED)
30.	WASHER	100.	TUBE
35.	CLAMP	105.	TUBE
40.	CLAMP	110.	ELBOW
45.	TUBE	115.	PACKING
55.	REDUCER	120.	NUT
60.	GASKET	125.	ELBOW
65.	UNION	130.	PACKING
70.	GASKET	135.	NUT
75.	NUT (PART DELETED)	140.	FUEL ANTI-ICE VALVE

(Codes AA-AC) Fuel Anti-Ice Valve
Plumbing Installation
Figure 201

R



R 5. NUT (IPC FIG. 46)
15. WASHER
25. BOLT
30. BOLT
35. NUT
45. WASHER
50. BOLT
60. BOLT
70. SUPPORT
75. BRACKET
80. ANTI-ICE VALVE

(Codes AA-AC) Fuel Anti-Ice Valve Installation
Figure 202

R 1. C. (Codes CA-CC) Remove Fuel Anti-Ice Valve and Plumbing (See Figures 203, 204)

(1) Remove tube assembly and elbow between fuel anti-ice valve and oil to fuel heater. (See figure 203.)

(2) Remove tube assemblies, attaching parts, elbow, unions, and gaskets from fuel anti-ice valve and fuel control and fuel pump assemblies. (See figure 203.)

(3) Remove fuel anti-ice valve and brackets from compressor housing. (See figure 204.)

(4) Remove fuel anti-ice valve from brackets.

R D. (Codes CA-CC) Install Fuel Anti-Ice Valve and Plumbing (See Figures 203, 204)

NOTE: Prior to installation, unless otherwise specified, lubricate packings or gaskets with any type clean jet fuel. An altenate lubricant (OS-124) may be used; apply lubricant sparingly and spread evenly to a thin transparent film to minimize contamination. Apply lubricating compound (Liqui-Moly, Grade NV) to threads of bolts or screws, and apply clean engine oil to threads (except first two threads) of male plumbing fittings unless otherwise specified.

R Refer to 70-00-00, STANDARD PRACTICES, for recommended
R general torque values. Add frictional drag (run-down)
R torque of self locking devices to recommended values.

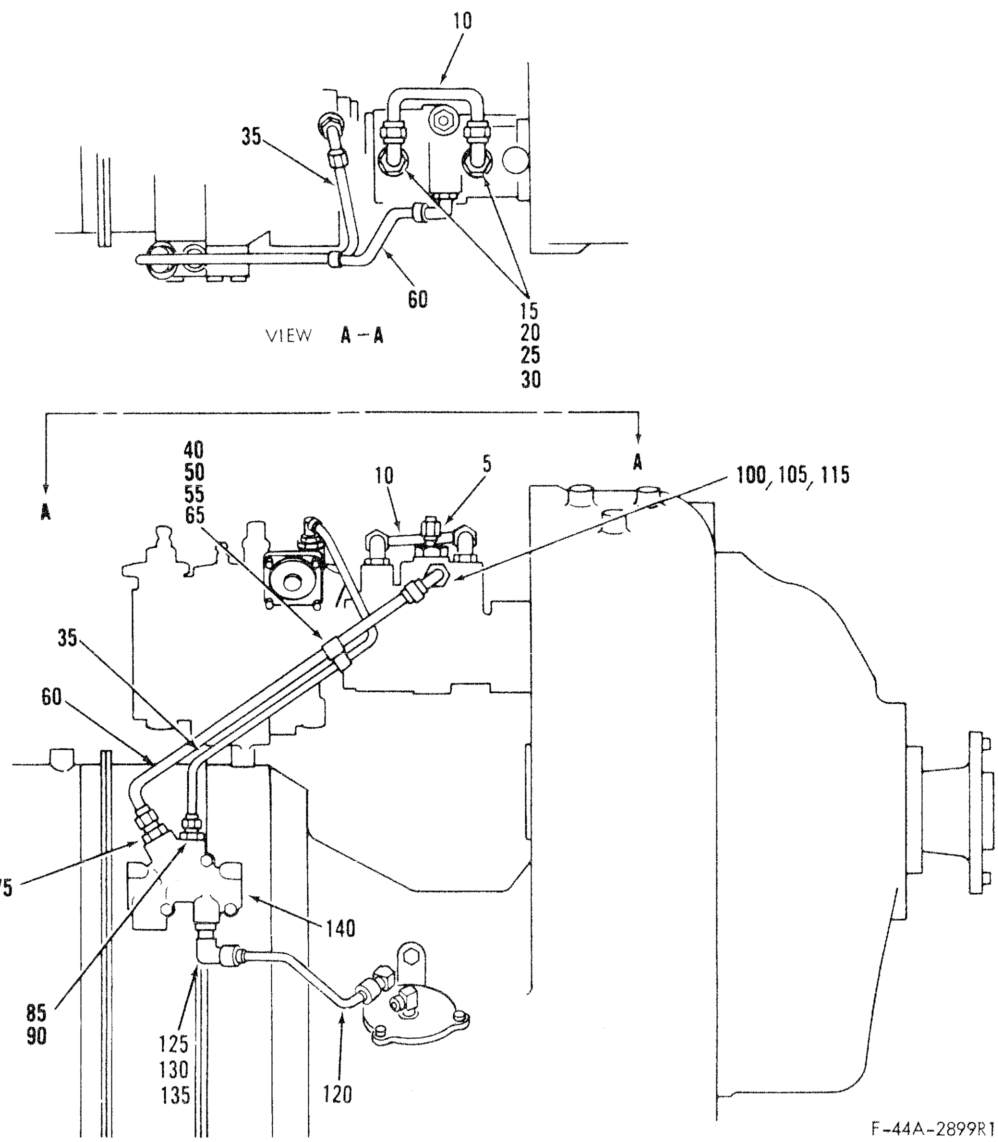
(1) Install fuel anti-ice valve onto brackets and secure with washers, bolts, and nuts. Tighten bolts (45, 50) to 25 inch-pounds torque. (See figure 204.)

(2) Install fuel anti-ice valve and brackets onto compressor housing and secure with bolts, washers, and nuts. Tighten nuts (5) to 50 inch-pounds torque.

(3) Install union, with new packings or gasket, into fuel anti-ice valve. Tighten union (85) to 60 to 65 inch-pounds torque. (See figure 203.)

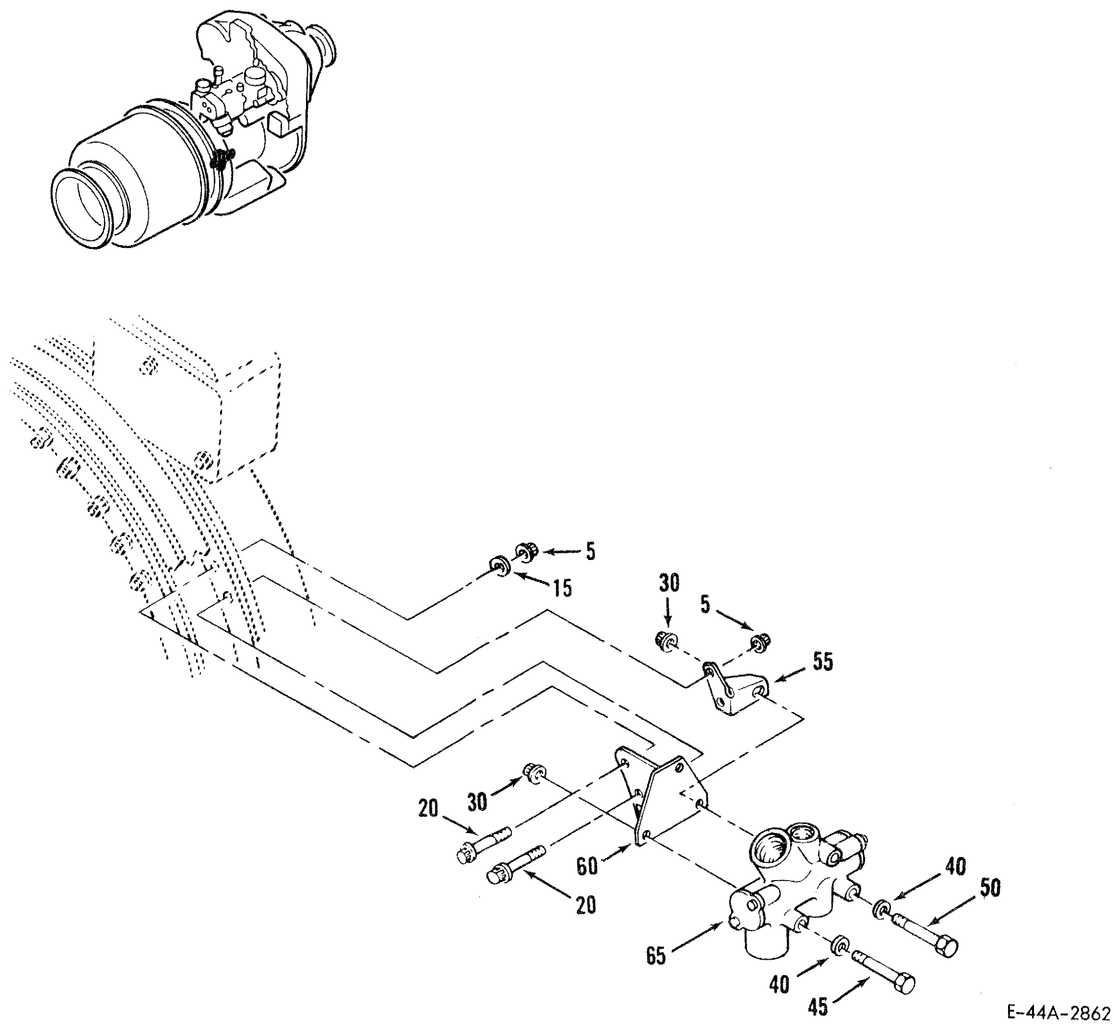
(4) Install tube assembly between elbow in fuel control unit and union in anti-ice valve.

R



R 5.	CAP (IPC FIG. 13)	70.	UNION
10.	TUBE	75.	PACKING
15.	FITTING	85.	UNION
20.	GASKET	90.	PACKING
25.	RING	100.	ELBOW
30.	NUT	105.	PACKING
35.	TUBE	115.	NUT
40.	BOLT	120.	TUBE
50.	BOLT	125.	ELBOW
55.	CLAMP	130.	PACKING
60.	TUBE	135.	NUT
65.	CLAMP	140.	FUEL ANTI-ICE VALVE

(Codes CA-CC) Fuel Anti-Ice Valve
Plumbing Installation
Figure 203



R 5. NUT (IPC FIG. 47)
15. WASHER
20. BOLT
30. NUT
40. WASHER
45. BOLT
50. BOLT
55. BRACKET
60. BRACKET
65. FUEL ANTI-ICE VALVE

(Codes CA-CC) Anti-Ice Valve Installation
Figure 204

1. D. (5) Install elbow, with new packing or gasket, into fuel pump assembly and secure with nut. Tighten nut (115) to 175 to 185 inch-pounds torque.

(6) Install union, with new packing or gasket, into fuel anti-ice valve. Tighten union (70) to 170 to 180 inch-pounds torque.

(7) Install tube assembly between elbow in fuel pump assembly and union in anti-ice valve. Install clamps, bolt, and nut. Tighten nut (40) to 20 inch-pounds torque.

(8) Install elbows, with new packing or gaskets and rings, into fuel pump assembly and secure with nuts. Tighten nuts (30) to 90 to 95 inch-pounds torque.

(9) Install tube assembly between elbows in fuel pump assembly.

(10) Install cap onto fuel pump assembly. Tighten cap (5) to 140 to 160 inch-pounds torque.

R (11) Install packing and nut onto elbow (125). Install elbow into fuel
R anti-ice valve. Tighten nut (135) to 60 to 70 inch-pounds torque.

(12) Install tube assembly between oil to fuel heater and elbow in fuel anti-ice valve.

2. Inspection/Check

A. Inspect Fuel Anti-Ice Valve and Plumbing

(1) Visually inspect anti-icing valve assembly for cracks, damaged adjustment screw, and peened threads. Replace damaged valve assembly.

(2) Visually inspect tube assemblies for cracks, dents, and damaged threads. Check clamps for worn or missing cushions.

(3) Visually inspect brackets and stiffener for cracks or obvious damage.

(4) Replace part that does not meet Inspection/Check requirements.

3. Cleaning/Painting

A. Clean Parts

(1) Clean all standard metallic hardware in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 1 or 2.

(2) Clean all fittings and plumbing in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 12.

(3) Clean anti-ice valve in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 11.

R (CODES AB-AC, BB-BC, CB-GA, KA, LA)
FUEL MANIFOLD PURGE SYSTEM - MAINTENANCE PRACTICES

1. Removal/Installation

NOTE: Table 201 provides a list of all materials and compounds required to perform Removal/Installation.

Table 201. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Alternate packing lubricant Lubricant (OS-124)	Monsanto Co, 800 N Lindbergh Blvd, St. Louis, MO 63166
High temperature compound (Fel-Pro C5-A)	Fel-Pro Inc, Div of Felt Products Mfg Co, 7450 N McCormack Blvd, Skolie, IL 60076
Lubricating compound (Liqui-Moly, Grade NV)	Lockrey Co, Lubricants Div, Cedar Shores, Southampton, NY 11968

R A. (Codes AB-AC, FA, LA) Remove Fuel Manifold Purge System Plumbing and
R Components (See Figures 201, 202)

(1) Remove fuel manifold purge system plumbing (Items 5 through 75, figure 201).

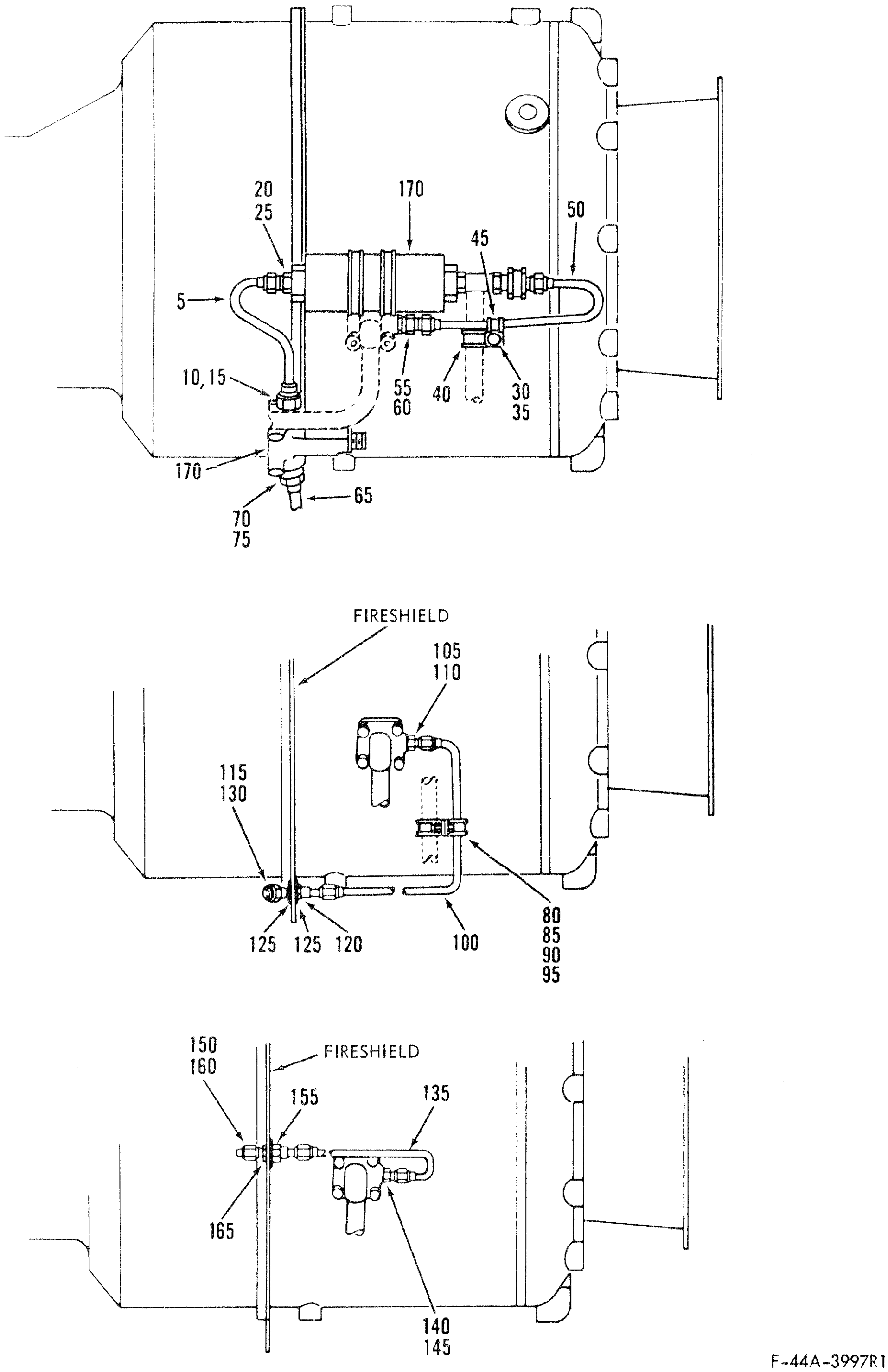
(2) Remove nuts, washers and bolts attaching solenoid valve bracket to engine. Remove nuts, washers and bolts attaching solenoid valve to bracket. Remove solenoid valve. (See figure 202.)

(3) Remove nuts and clamps securing accumulator to engine. Remove accumulator.

R (4) Remove filter and check valve from accumulator. Remove packings.

R (5) Remove check valve (75, figure 202) from fuel flow divider and
R drain valve. Remove packing.

R



(Codes AB-AC, BB-BC, CB-GA, KA, LA)
Fuel Manifold Purge System Plumbing Installation
Figure 201

R 1. B. (Codes AB-AC, FA, LA) Install Fuel Manifold Purge System and Plenum Pressure Plumbing (See Figures 201, 202)

NOTE: Packings or gaskets may be installed dry or lubricant (OS-124) may be used prior to installation unless otherwise specified; apply lubricant sparingly and spread evenly to a thin transparent film to minimize contamination. Apply lubrication compound (Liqui-Moly, Grade NV) to threads of bolts located forward of the fireshield unless otherwise specified. To prevent contamination, do not apply thread compounds to threads of plumbing fittings installed in fuel manifold purge system. Apply high temperature compound (Fel-Pro C5-A) to thread of bolts located aft of the fireshield unless otherwise specified.

R Refer to 70-00-00, STANDARD PRACTICES, for recommended
R general torque values. Add frictional drag (run-down)
R torque of self locking devices to recommended values.

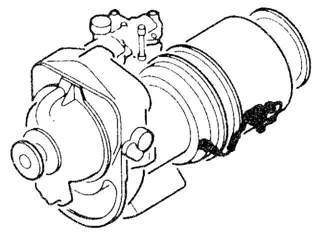
(1) Install solenoid valve onto bracket and secure with bolts, washers
R and nuts. Torque nuts (15, figure 202) to 27 inch-pounds torque.
R Install assembled solenoid valve and bracket onto engine and secure
R with bolts and nuts. Tighten nuts (5) to 50 inch-pounds torque.

(2) Install clamps on accumulator and install accumulator on anti-icing extraction boss on engine. Tighten nuts (60) to 20 inch-pounds torque.

(3) Install check valve with new packing into fuel flow divider and drain valve. Install with arrow pointing in direction of fuel flow divider and drain valve. Tighten check valve (75) to 60 to 65 inch-pounds torque.

KEY TO FIGURE 201

R 5. TUBE (IPC FIG. 7)
10. UNION
15. PACKING
20. UNION
25. PACKING
30. NUT
35. BOLT
40. CLAMP
45. CLAMP
50. TUBE
55. REDUCER
60. WASHER
65. TUBE
70. UNION
75. PACKING
80. NUT
85. BOLT
90. CLAMP
95. CLAMP
100. TUBE
105. REDUCER
110. WASHER
115. CAP
120. NUT
125. WASHER
130. ELBOW
135. TUBE
140. REDUCER
145. WASHER
150. CAP
155. NUT
160. UNION
165. WASHER
170. PURGE SYSTEM COMPONENTS



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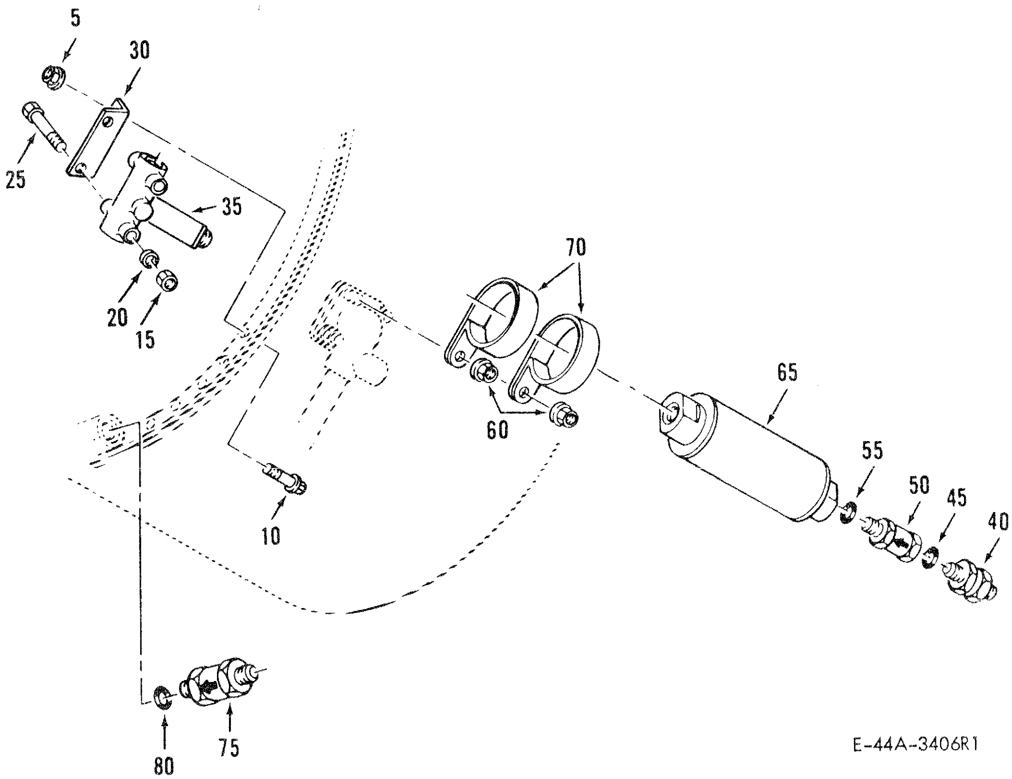


R 5. NUT (IPC FIG. 40)
10. BOLT
15. NUT
20. WASHER
25. BOLT
30. BRACKET
35. SOLENOID VALVE
40. FILTER
45. PACKING
50. CHECK VALVE
55. PACKING
60. NUT
65. ACCUMULATOR
70. CLAMP
75. CHECK VALVE
80. PACKING

(Codes AB, AC, FA, LA) Fuel Manifold Purge
System Components Installation
Figure 202

1. B. (4) Install unions with new packings into top and bottom of solenoid valve. Tighten unions (10, 70, figure 201) to 60 to 65 inch-pounds torque.

CAUTION: WHEN LINES ARE INSTALLED, EXERCISE CARE THAT NO CONTAMINATION IS INTRODUCED NOR THREAD LUBRICATION COMPOUND IS USED. ASSURE PROPER ALIGNMENT AND THREAD ENGAGEMENT TO PREVENT NUT TO FITTING GALLING AND/OR CROSS THREADING.

(5) Install tube assembly between check valve in fuel flow divider valve and bottom of solenoid valve.

(6) Install union with new packing into front of accumulator. Tighten union (20) to 60 to 65 inch-pounds torque.

(7) Install tube assembly between union in accumulator and top of solenoid valve.

(8) Install reducer with washer into anti-icing extraction port boss. Tighten reducer (55) to 35 to 40 inch-pounds torque.

(9) Install check valve with new packing into aft side of accumulator. Install check valve with arrow pointing toward front of engine. Tighten check valve (50, figure 202) to 60 to 65 inch-pounds torque.

(10) Install filter with new packing into check valve. Install filter with arrow pointing toward check valve. Tighten filter (40) to 60 to 65 inch-pounds torque.

(11) Install tube assembly, with attaching parts, between reducer in anti-icing extractor boss and filter on aft side of accumulator. Tighten nut (30, figure 201) to 27 inch-pounds torque.

R C. (Codes BB-BC, CB-EA, GA, KA) Remove Fuel Manifold Purge System Plumbing
R and Components (See Figures 201, 203, 204)

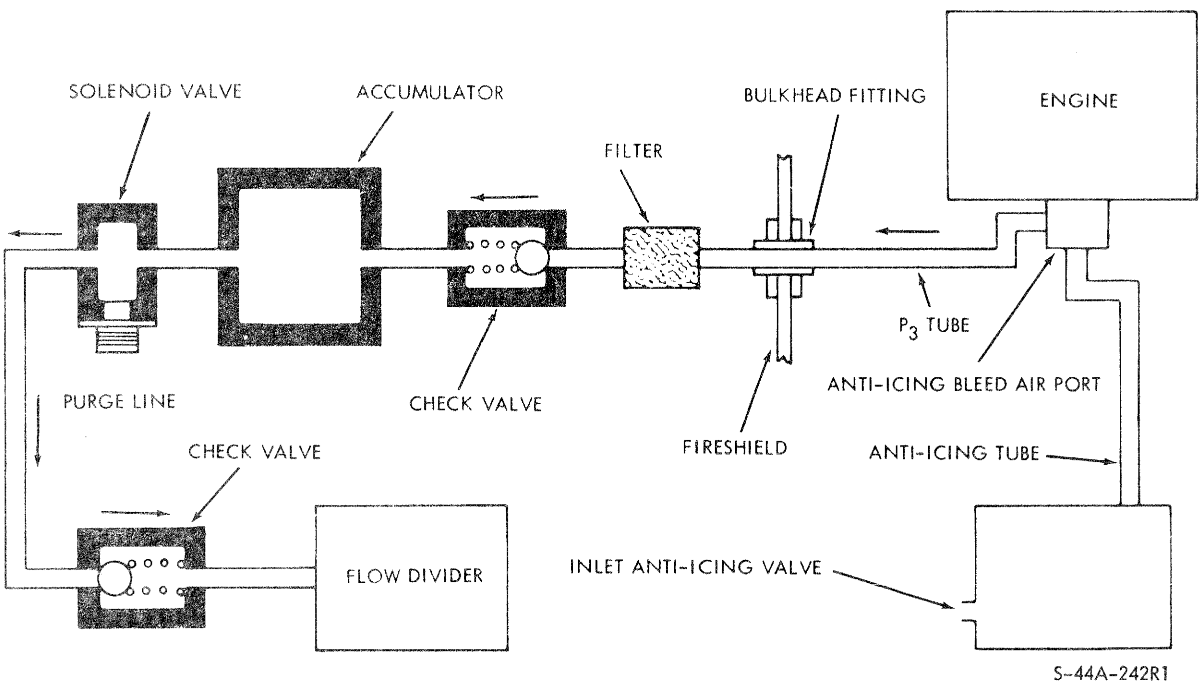
(1) Fuel manifold purge system components are remotely located. Refer
R to Aircraft Maintenance Manual for removal instructions. Refer to
R Figure 204 for list of airframe mounted components. Refer to
R Figure 203 for typical fuel manifold purge system schematic.

R (2) (Codes BB-BC, EA, GA, KA) Remove fuel manifold purge system
R plumbing. Refer to Figure 201, items 80 through 135.

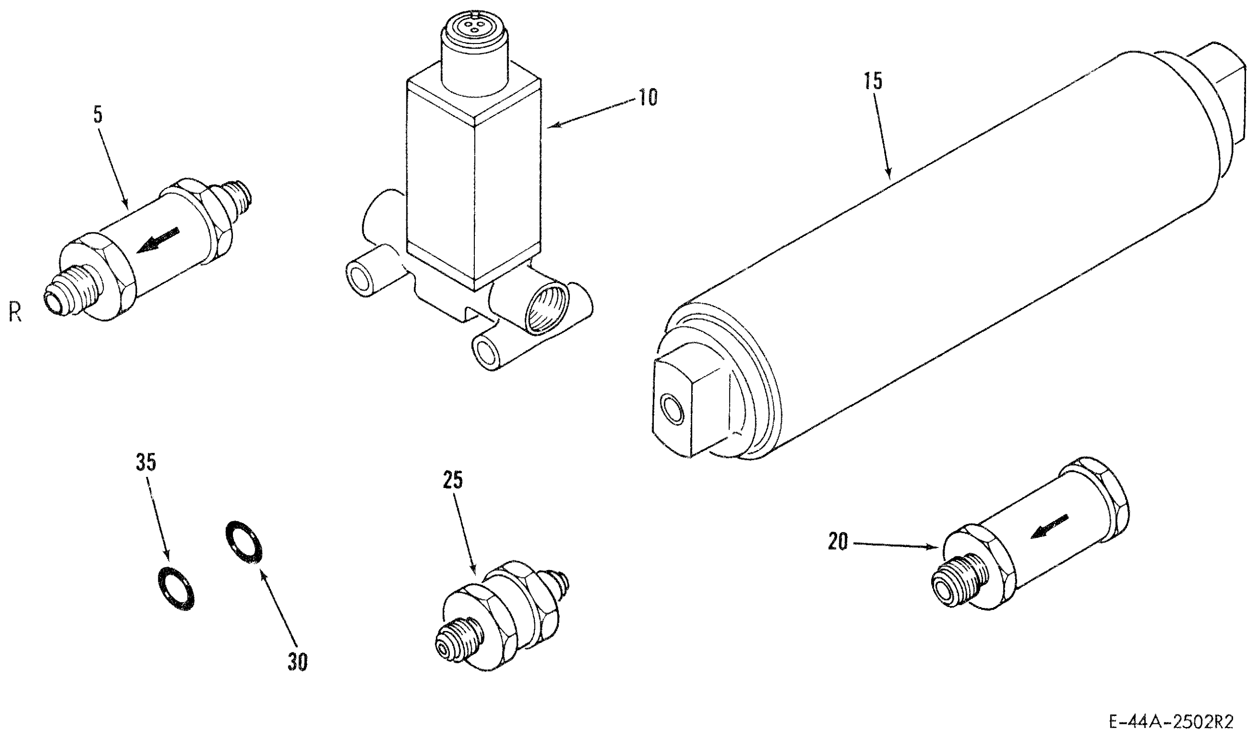
R (3) (Codes CB-CC) Remove fuel manifold purge system plumbing. Refer to
R Figure 201, items 140 through 165.

R 1. D. (Codes BB-BC, CB-EA, GA, KA) Install Fuel Manifold Purge System Plumbing
R and Components (See Figures 201, 203, 204)

R (1) Fuel manifold purge system components are remotely located. Refer
R to Aircraft Maintenance Manual for Installation instructions.
R Refer to Figure 204 for list of airframe mounted components. Refer
R to Figure 203 for typical fuel manifold purge system schematic.



Typical Fuel Manifold Purge System Schematic
Figure 203



R 5. CHECK VALVE (IPC FIG. 41)
10. SOLENOID VALVE
15. ACCUMULATOR
20. CHECK VALVE
25. FILTER
30. PACKING
35. PACKING

(Codes BB, BC, CB-EA, GA-KA) Fuel Manifold Purge
System Components Installation
Figure 204

CAUTION: WHEN LINES ARE INSTALLED, EXERCISE CARE THAT NO CONTAMINATION IS INTRODUCED NOR THREAD LUBRICATION COMPOUND IS USED. ASSURE PROPER ALIGNMENT AND THREAD ENGAGEMENT TO PREVENT NUT TO FITTING GALLING AND/OR CROSS THREADING.

NOTE: Apply high temperature compound (Fel-Pro C5-A) to threads of bolts located aft of the fireshields unless otherwise specified.

R R R Refer to 70-00-00, STANDARD PRACTICES, for recommended general torque values. Add frictional drag (run-down) torque of self locking devices to recommended values.

1. D. (2) Install reducer with washer into anti-icing extraction port boss. Tighten reducer (105 or 140, figure 201) to 40 to 45 inch-pounds torque.

R (3) (Codes BB-BC, EA, GA, KA) Install elbow and washers onto fireshield and secure with nut. Tighten nut (120) to 110 to 130 inch-pounds torque.

(4) (Codes CB-CC) Install union into fireshield and secure with washer and nut. Tighten nut (155) to 110 to 130 inch-pounds torque.

R (5) (Codes BB-BC, EA, GA, KA) Install tube assembly with attaching parts between elbow in the fireshield and reducer in anti-icing extraction port boss. Tighten nut (80) to 20 inch-pounds torque.

(6) (Codes CB-CC) Install tube assembly between bulkhead union in the fireshield and reducer in anti-icing extraction port boss.

(7) Install cap on elbow or union. Tighten cap (115 or 155) to 100 to 120 inch-pounds torque.

2. Adjustment/Test

A. Test Fuel Manifold Purge Valve Solenoid

(1) Apply 24 volts dc across Pins A and B of electrical connector. Valve shall open.

(2) Remove voltage from electrical connector. Valve shall close.

(3) Replace valve that does not meet requirements of (1) and (2) above.

3. Inspection/Check

A. Inspect Fuel Manifold Purge System Plumbing and Components

(1) Visually inspect solenoid valve electrical connector for bent, broken, or burned pins.

(2) Visually inspect body of solenoid valve for obvious damage and stripped or damaged threads.

(3) Visually inspect tube assemblies for nicks, cracks, dents, or other obvious damage.

(4) Visually inspect fittings, reducer, and check valves for stripped or peened threads.

(5) Visually inspect filter for damaged screen, stripped or peened threads and contamination. Refer to Cleaning/Painting for cleaning procedures.

(6) Visually inspect clamps for damage or cracks and condition of cushion.

(7) Visually inspect accumulator for dents, cracks, and stripped or peened threads.

(8) Visually inspect bracket for cracks.

(9) Replace parts that do not meet Inspection/Check requirements.

4. Cleaning/Painting

NOTE: Table 202 provides a list of all materials and compounds required to perform Cleaning/Painting.

Table 202. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Solvent, Stoddard (Federal Specification P-D-680, Type I)	Commercially available

A. Clean Parts

(1) Clean accumulator and check valves in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 12.

(2) Clean all fittings and plumbing in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 12.

(3) Clean solenoid valve in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 11.

B. Perform Special Cleaning

CAUTION: SOLVENT IS TOXIC AND FLAMMABLE. USE IN WELL-VENTILATED AREA. AVOID BREATHING FUMES OR LONG CONTACT WITH SKIN TO PREVENT DAMAGE TO PHYSICAL HEALTH. KEEP AWAY FROM FLAME TO AVOID FIRE HAZARD.

(1) Clean filter by back flushing filter with solvent, Stoddard (Federal Specification P-D-680, Type I) under light pressure.

CONTROLLING (ENGINE FUEL AND CONTROL) - DESCRIPTION AND OPERATION

1. Fuel Control and Pump Assembly

The fuel control and pump assembly provide metered fuel to the engine and are mounted on the fuel control drive pad on the input housing assembly and are driven through the fuel control drive gear in the reduction gear train. The units are comprised of the fuel pump assembly and the fuel control unit.

R (Codes AA-AC, CA-CC) The fuel control unit incorporates a fuel enrichment valve.

R (Codes FA-LA) The fuel control unit incorporates a fuel pressurizing valve.

2. Fuel Pump Assembly

R (Codes AA-AC, CA-CC) The engine driven fuel pump assembly is mounted on the fuel control drive pad on the input housing assembly and is driven through a fuel control drive gear in the reduction gear train. The fuel pump assembly incorporates a high pressure pump assembly (vane type), injector boost pump assembly and pressure relief valve. The fuel pump assembly delivers high pressure fuel to the fuel control unit for metering.

R (Codes BA-BC, EA-LA) The engine driven fuel pump assembly is mounted on the fuel control drive pad on the input housing assembly and is driven through a fuel control drive gear in the reduction gear train. The fuel pump assembly consists of a boost element and a high pressure element with a common drive train. The boost element of the fuel pump assembly is a centrifugal pump assembly which boosts inlet pressure to the high pressure element. The high pressure pump assembly incorporates a gear type pump and pressure relief valve, filter and anit-icing valve. The pump assembly delivers filtered fuel of required pressure to the fuel control unit for metering.

3. Fuel Filter

R (Codes AA-AC) The fuel filter is a separate unit located in the fuel line between the fuel pump assembly and fuel control unit to ensure clean fuel to the fuel control unit. In the event the filter becomes clogged, fuel is by-passed around the filter to sustain emergency engine operation.

R (Codes BA-BC, EA-LA) The fuel filter is a component of the fuel pump assembly. Inlet fuel to the high pressure fuel pump is routed through the fuel filter to ensure clean fuel through all phases of operation. In the event the filter becomes clogged, fuel is by-passed around the filter to sustain emergency engine operation.

(Codes CA-CC) The fuel filter is airframe mounted.

4. Fuel Control Unit

R (Codes AA-EA) The fuel control unit, attached to the rear of the fuel pump assembly is driven through the fuel pump assembly. The fuel control unit incorporates a pneumatic computer, metering valve positioned by a bellows assembly, by-pass valve, overspeed governor, speed lever shaft, (underspeed governor), and power lever shaft. Fuel is metered to the engine in accordance with sensed engine requirements and pilot inputs.

5. Fuel Control Unit

R (Codes FA-LA) The fuel control unit is attached to the rear of the fuel pump assembly. The control unit incorporates an underspeed governor, overspeed governor, by-pass valve, fuel metering valve, minimum and maximum limiting stops, input levers, and fuel specific gravity adjustment to meter fuel to the engine.

6. Fuel Enrichment Valve

R (Codes AA-AC, CA-CC) The fuel enrichment valve, attached to the fuel control unit, supplements fuel to ensure a pressure sufficient for atomization to primay fuel nozzles. A solenoid valve actuated by a prime switch controls operation of the fuel enrichment valve. A parallel enrichment orifice is incorporated for use in starting above 25 percent engine speed.

7. Fuel Pressurizing Valve

R (Codes FA-LA) The fuel control fuel pressurizing valve back pressures the fuel control during engine starting to assure servo pressure and accurate fuel control metering. The pressurizing valve is referenced to boost pump discharge pressure and thus drops out of the fuel circuit for all steady state operating conditions.

8. Temperature Sensor

R (Codes AA-EA) A sensing unit located in the compressor inlet section senses compressor inlet temperature and compensates the fuel flow schedule for changes in inlet total temperature.

9. Inlet Temperature and Pressure Sensor

R (Codes FA-LA) The inlet temperature and pressure sensor is part of the fuel control assembly. The sensing probe, located in the compressor inlet section, senses compressor inlet temperature and pressure then compensates the fuel flow schedules for changes in inlet total temperature and pressure.

FUEL CONTROL AND PUMP ASSEMBLY - MAINTENANCE PRACTICES

1. Removal/Installation

NOTE: Table 201 provides a list of all materials and compounds required to perform Removal/Installation.

Table 202 provides a list of all special tools, fixtures, and equipment required to perform Removal/Installation.

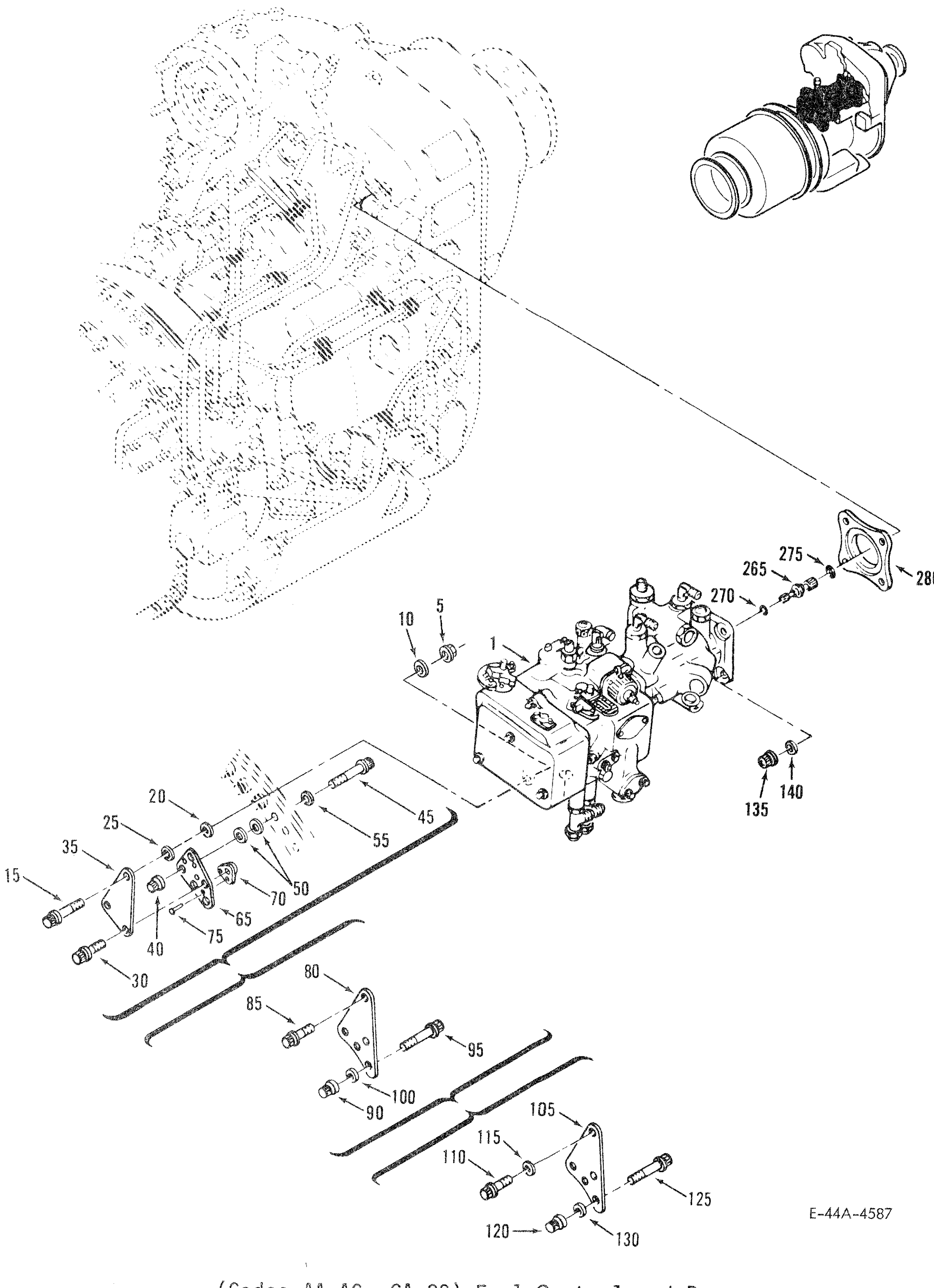
Table 201. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Alternate packing lubricant Lubricant (OS-124)	Monsanto Company, 800 N Lindbergh Blve, St. Louis, MO 63166
Any approved engine fuel	Commercially available
Any approved engine oil	Commercially available
Grease (Mobil 28)	Mobil Oil Corp, P.O. Box 54053, Los Angeles, CA 90054
Lubricating compound (Liqui-Moly, Grade NV)	Lockrey Co, Lubricants Div, Cedar Shores, Southampton, NY 11968
Syringe (Chemo-Jector) (GC No. 8887)	GC Electronics Div of Hydro Metals, Inc. 400 S Wyman St, Rockford, IL 61101

Table 202. Special Tools, Fixtures and Equipment

Item No.	Nomenclature	Use	Source/ Part No.
NOTE: Equivalent substitutes may be used for listed items.			
1.	Seal Installing Pilot	Used to install packing over end of drive coupling without damaging packing.	285843-1-1

R



(Codes AA-AC, CA-CC) Fuel Control and Pump
Assembly Installation
Figure 201

R 1. A. (Codes AA-AC, CA-CC) Remove Fuel Control and Pump Assembly (See Figure 201)

NOTE: Before replacing fuel control and pump assembly with another complete unit, ensure trouble has been isolated to this component. Refer to 73-21-05, MAINTENANCE PRACTICES, for replacement of fuel control unit, temperature sensor, or fuel enrichment valve assembly. Refer to 73-21-06, MAINTENANCE PRACTICES, for replacement of fuel pump assembly.

(1) Disconnect control linkage assembly. Refer to 76-10-01, MAINTENANCE PRACTICES.

(2) Disconnect tube assemblies from fuel control and pump assembly. Refer to 73-10-01, 73-10-02, 73-10-06, and 73-10-10, MAINTENANCE PRACTICES.

(3) Remove enrichment valve if required for maintenance. Refer to 73-21-04, MAINTENANCE PRACTICES.

(4) (Pre SB73-0028/-0029) Remove bracket and support from rear of fuel control and pump assembly.

(5) (Post SB73-0028/-0029) Remove support assembly from rear of fuel control and pump assembly.

(6) Remove nuts and washers securing fuel control and pump assembly to input housing.

KEY TO FIGURE 201

1.	FUEL CONTROL AND PUMP	50.	WASHER	110.	BOLT
R	ASSY (IPC FIG. 57)	55.	WASHER	115.	WASHER
5.	NUT	65.	SUPPORT	120.	NUT
10.	WASHER	70.	NUTPLATE	125.	BOLT
15.	BOLT	75.	RIVET	130.	WASHER
20.	WASHER	80.	SUPPORT	135.	NUT
25.	WASHER	85.	BOLT	140.	WASHER
30.	BOLT	90.	NUT	265.	COUPLING
35.	BRACKET	95.	BOLT	270.	PACKING
40.	NUT	100.	WASHER	275.	PACKING
45.	BOLT	105.	SUPPORT	280.	INSULATOR/ SPACER

R CAUTION: DO NOT USE SCREW DRIVER OR OTHER POINTED OBJECTS TO PRY FUEL CONTROL AND PUMP ASSEMBLY FROM ENGINE OR DAMAGE TO PUMP FLANGE OR ACCESSORY DRIVE HOUSING MAY OCCUR.

1. A. (7) Remove fuel control and pump assembly in a straight line to avoid damage to drive coupling.

(8) Remove drive coupling and fuel control and pump assembly insulator or spacer when applicable. Remove packings from drive coupling.

R B. (Codes AA-AC, CA-CC) Install Fuel Control and Pump Assembly (See Figures 201)

R NOTE: Refer to 70-00-00, STANDARD PRACTICES, for recommended general torque values. Add frictional drag (run-down) torque of self locking devices to recommended values.

Prior to installation, unless otherwise specified, lubricate packings or gaskets with any type clean jet fuel. An alternate lubricant (OS-124) may be used; apply lubricant sparingly and spread evenly to a thin transparent film to minimize contamination. Apply lubricating compound (Liqui-Moly, Grade NV) to threads of bolts or screws, and apply clean engine oil to threads (except first two threads) of male plumbing fittings unless otherwise specified.

(Pre SB72-0104) Grease (Mobil 28) is soluble in fuel, necessitating immediate correction of any fuel pump seal leakage. The drive coupling shall be inspected and lubricated at any time corrective action is required for fuel pump seal leakage.

(1) (Pre SB72-0104) Pack cavities of fuel pump assembly and reduction gear section with grease (Mobil 28), using syringe (Chemo-jector), so that no air spaces exist in the cavities. Coat new drive coupling packings with same grease and install on drive coupling using 285843-1-1 pilot, being careful not to damage packings. Remove 285843-1-1 pilot and apply grease to all splines of drive coupling. Pack internal passage of coupling, ensuring all air is expelled. Hold finger over opening and install coupling into fuel control allowing grease to egress through vent hole in coupling. Wipe off excess grease.

CAUTION: (POST SB73-0104) DO NOT PACK CAVITIES OF FUEL PUMP ASSEMBLY OR REDUCTION GEAR SECTION, OR COAT DRIVE COUPLING PACKINGS WITH GREASE.

1. B. (2) (Post SB72-0104) Lubricate new drive coupling packings with clean engine oil. Install packings on drive coupling using 285843-1-1 pilot, being carefull not to damage packings. Remove 285843-1-1 pilot and lubricate drive coupling with clean engine oil. Install drive coupling into fuel pump assembly.

(3) (Pre SB73-0054) Install insulator. (See figure 201.)

(4) (Post SB73-0054) Install spacer if Fuel Pump Part No. 893540-3 is to be installed. Do not install spacer if Fuel Pump Part No. 897385-1 is to be installed. (See figure 201.)

(5) Install fuel control and pump assembly, exercising care so that splines on drive coupling and fuel pump drive mesh properly.

(6) Install washers and nuts. Tighten nuts (135, figure 201) to 50 inch-pounds torque.

(7) (Pre SB73-0028) Install bracket and support.

(a) Install support onto compressor housing and secure with washers, bolts, and nuts. Tighten nuts (40, figure 201) to 50 inch-pounds torque.

(b) Install bracket onto support and secure with bolts. Tighten bolts (30, figure 201) to 55 inch-pounds torque.

(c) Install support, shimming as required from mounting boss on fuel control to bearing surface of support to avoid bending support. Tighten bolt (15, figure 201) to 60 inch-pounds torque.

(8) (Post SB73-0028) Install support assembly.

CAUTION: ATTACH SUPPORT ASSEMBLY TO FUEL CONTROL UNIT AND TIGHTEN PRIOR TO ATTACHING SUPPORT ASSEMBLY TO PLENUM FLANGE. NO WASHERS ARE ALLOWED BETWEEN SUPPORT ASSEMBLY AND FUEL CONTROL UNIT OR BETWEEN SUPPORT ASSEMBL AND PLENUM FLANGE. SUPPORT ASSEMBLY IS DESIGNED TO CONFORM TO TOLERANCE CONDITION THAT MAY EXIST BETWEEN FUEL CONTROL UNIT AND PLENUM FLANGE.

(a) (Pre SB73-0029) Install bolt, washers, and nuts. Tighten nut (5, figure 201) to 55 inch-pounds torque.

1. B. (8) (b) (Post SB73-0029) Install washer and bolt. Tighten bolt (110, figure 201) to 100 inch-pounds torque. Lockwire bolt.

(c) Install bolts, washers, and nuts. Tighten nuts (90 or 120, figure 201) to 50 inch-pounds torque.

(9) Install enrichment valve. Refer to 73-21-04, MAINTENANCE PRACTICES.

(10) Connect tube assemblies to fuel control and pump assembly. Refer to 73-10-01, 73-10-02, 73-10-06, and 73-10-10, MAINTENANCE PRACTICES.

(11) Connect controls linkage assembly in accordance with 76-10-01, MAINTENANCE PRACTICES.

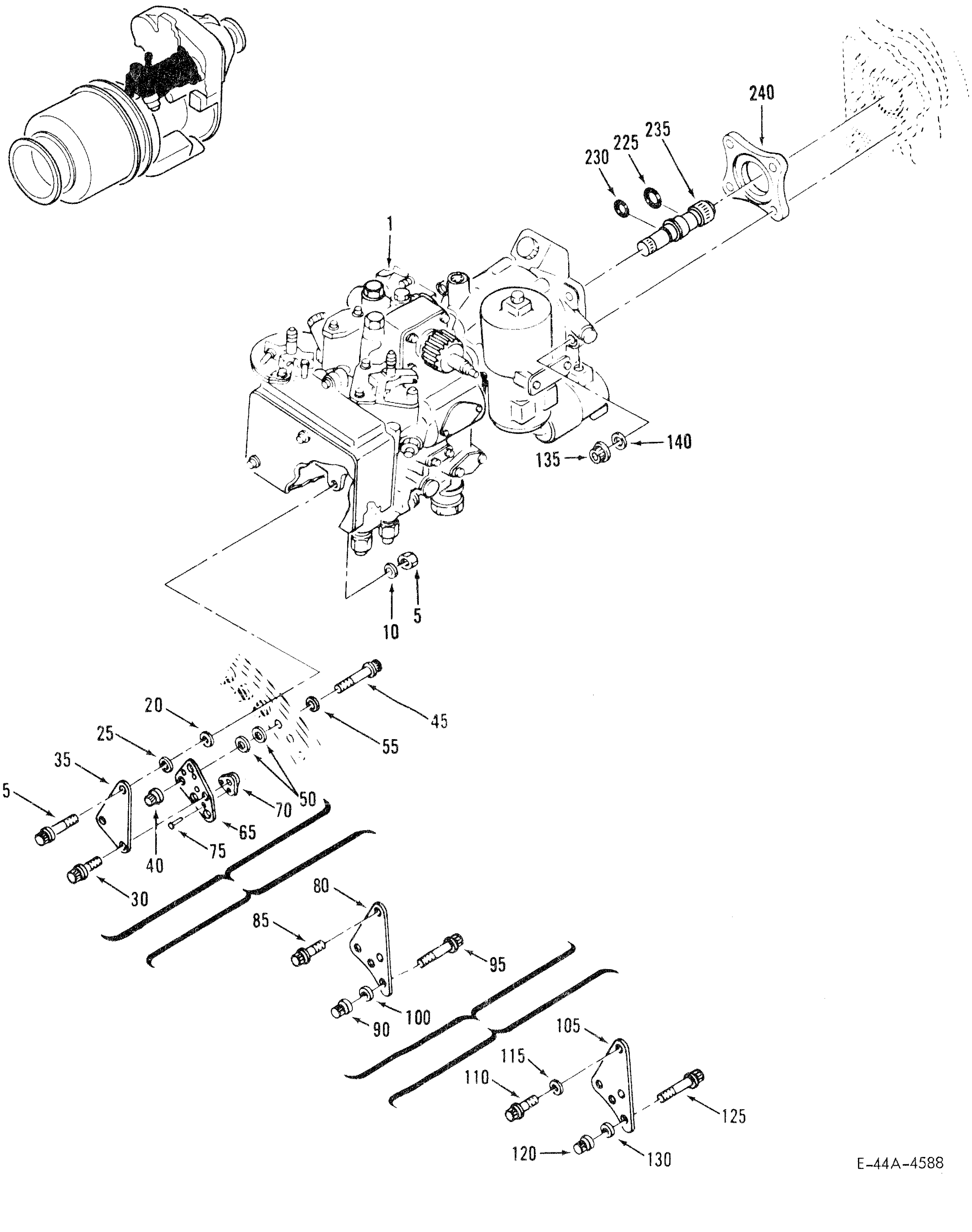
R C. (Codes BA-BC, EA) Remove Fuel Control and Pump Assembly (See Figure 201)

WARNING: IF SCREWS SECURING FUEL PUMP ANTI-ICING VALVE HOUSING MUST BE LOOSENED OR REMOVED FOR ANY REASON, USE EXTREME CARE TO ASSURE THAT THE ANTI-ICING VALVE ASSEMBLY REMAINS IN POSITION. IF THE ANTI-ICING VALVE IS REMOVED OR BECOMES DISLODGED, IT WILL BE NECESSARY TO DISASSEMBLE THE PUMP FOR COMPLETE INSPECTION IN ORDER TO LOCATE ANY SHIMS THAT MAY HAVE BEEN DISLODGED. REFER TO REPORT NO. 73-21-09 FOR DISASSEMBLY/ASSEMBLY PROCEDURES.

KEY TO FIGURE 202 ➡

1.	FUEL CONTROL AND PUMP	50.	WASHER	110.	BOLT
R	ASSY (IPC FIG. 58)	55.	WASHER	115.	WASHER
5.	NUT	65.	SUPPORT	120.	NUT
10.	WASHER	70.	NUTPLATE	125.	BOLT
15.	BOLT	75.	RIVET	130.	WASHER
20.	WASHER	80.	SUPPORT	135.	NUT
25.	WASHER	85.	BOLT	140.	WASHER
30.	BOLT	90.	NUT	225.	COUPLING
35.	BRACKET	95.	BOLT	230.	PACKING
40.	NUT	100.	WASHER	235.	PACKING
45.	BOLT	105.	SUPPORT	140.	INSULATOR/ SPACER

R



R

(Codes BA-BC, EA) Fuel Control and Pump
Assembly Installation
Figure 202

NOTE: Before replacing fuel control and pump assembly with another complete unit, ensure trouble has been isolated to this component. Refer to 73-21-05, MAINTENANCE PRACTICES, for replacement of fuel control unit. Refer to 73-21-06, MAINTENANCE PRACTICES, for replacemet of fuel pump assembly.

1. C. (1) Disconnect controls linkage assembly. Refer to 76-10-01, MAINTENANCE PRACTICES.

(2) Disconnect tube assemblies from fuel control and pump assembly in accordance with 73-10-01, 73-10-02, and 73-10-06, MAINTENANCE PRACTICES.

(3) Remove bracket and support or support assembly from rear of fuel control and pump assembly.

(4) Remove nuts and washers securing fuel control and pump assembly to input housing assembly.

R CAUTION: DO NOT USE SCREW DRIVER OR OTHER POINTED OB-
R JECTES TO PRY FUEL CONTROL AND PUMP ASSEMBLY
R FROM ENGINE OR DAMAGE TO PUMP FLANGE OR ACCES-
R SORY DRIVE HOUSING MAY OCCUR.

(5) Remove fuel control and pump assembly in a straight line to avoid damage to drive coupling.

(6) Remove drive coupling and fuel control and pump assembly insulator, when applicable. Remove packings from drive coupling.

R D. (Codes BA-BC, EA) Install Fuel Control and Pump Assembly (See Figure 201)

NOTE: Refer to 70-00-00, STANDARD PRACTICES, for recommended general torque values. Add frictional drag (run-down) torque of self locking devices to recommended values.

Prior to installation, unless otherwise specified, lubricate packings or gaskets with any type clean jet fuel. An alternate lubricant (OS-124) may be used; apply lubricant sparingly and spread evenly to a thin transparent film to minimize contamination. Apply lubriating compound (Liqui-Moly, Grade NV) to threads of bolts or screws, and apply clean engine oil to threads (except first two threads) of male plumbing fittings unless otherwise specified.

(Pre SB72-0104) Grease (Mobil 28) is soluble in fuel, necessitating immediate correction of any fuel pump seal leakage. The drive coupling shall be inspected and lubricated at any time corrective action is required for fuel pump seal leakage.

1. D. (1) (Pre SB72-0104) Pack cavities of fuel pump assembly and reduction gear section with grease (Mobil 28), using syringe (Chemo-jector), so that no air spaces exist in the cavities. Coat new drive coupling packings with same grease and install on drive coupling using 285843-1-1 pilot, being careful not to damage packings. Remove 285843-1-1 pilot and apply grease to all splines of drive coupling. Pack internal passage of coupling ensuring all air is expelled. Hold finger over opening and install coupling into fuel control allowing grease to egress through vent hole in coupling. Wipe off excess grease.

CAUTION: (POST SB73-0104) DO NOT PACK CAVITIES OF FUEL PUMP ASSEMBLY OR REDUCTION GEAR SECTION, OR COAT DRIVE COUPLING PACKINGS WITH GREASE.

(2) (Post SB72-0104) Lubricate new drive coupling packings with clean engine oil. Install packings on drive coupling using 285843-1-1 pilot, being careful not to damage packings. Remove 285843-1-1 pilot and lubricate drive coupling with clean engine oil. Install drive coupling into fuel pump assembly.

(3) (Pre SB73-0051) Install insulator. (See figure 202.)

(4) Install fuel control and pump assembly, exercising care so that splines on drive coupling and fuel pump drive mesh properly.

(5) Install washers and nuts. Tighten nuts (135, figure 202) to 50 inch-pounds torque.

1\. D. (6) (Pre SB73-0028) Install bracket and support.

(a) Install support onto compressor housing and secure with washers, bolts, and nuts. Tighten nuts that attach support to 50 inch-pounds torque. (See figure 202.)

(b) Install bracket onto support and secure with bolts. Tighten bolts (30, figure 202) to 55 inch-pounds torque.

(c) Install support, shimming as required from mounting boss on fuel control to bearing surface of support to avoid bending support. Tighten bolt (15, figure 202) to 60 inch-pounds torque.

(7) (Post SB73-0028) Install support assembly.

CAUTION: ATTACH SUPPORT ASSEMBLY TO FUEL CONTROL UNIT AND TIGHTEN PRIOR TO ATTACHING SUPPORT ASSEMBLY TO PLENUM FLANGE. NO WASHERS ARE ALLOWED BETWEEN SUPPORT ASSEMBLY AND FUEL CONTROL UNIT OR BETWEEN SUPPORT ASSEMBLY AND PLENUM FLANGE. SUPPORT ASSEMBLY IS DESIGNED TO CONFORM TO TOLERANCE CONDITION THAT MAY EXIST BETWEEN FUEL CONTROL UNIT AND PLENUM FLANGE.

(a) (Pre SB73-0029) Install bolts, washers, and nuts. Tighten nut (5, figure 202) to 55 inch-pounds torque.

(b) (Post SB73-0029) Install washer and bolt. Tighten bolt (110, figure 202) to 100 inch-pounds torque. Lockwire bolt.

(c) Install bolts, washers, and nuts. Tighten nuts (120, figure 202) to 50 inch-pounds torque.

(8) Connect tube assemblies to fuel control and pump assembly. Refer to 73-10-01, 73-10-02, and 73-10-06, MAINTENANCE PRACTICES.

(9) Connect controls linkage assembly. Refer to 76-10-01, MAINTENANCE PRACTICES.

R 1. E. (Codes FA-LA) Remove Fuel Control and Pump Assembly (See Figure 203)

NOTE: Before replacing fuel control and pump assembly with another complete unit, ensure trouble has been isolated to this component. Refer to 73-21-05, MAINTENANCE PRACTICES, for replacement of fuel control unit. Refer to 73-21-02, MAINTENANCE PRACTICES, for replacement of inlet temperature and pressure sensor. Refer to 73-21-04, MAINTENANCE PRACTICES, for replacement of fuel pressurizing valve assembly. Refer to 73-21-06, MAINTENANCE PRACTICES, for replacement of fuel pump assembly.

(1) Disconnect controls linkage assembly in accordance with 76-10-01, MAINTENANCE PRACTICES.

(2) Disconnect tube assemblies from fuel control and pump assembly in accordance with 73-10-01 and 73-10-06, MAINTENANCE PRACTICES.

(3) Disconnect tube assemblies from inlet temperature and pressure sensor in accordance with 73-10-01 and 75-10-01, MAINTENANCE PRACTICES.

CAUTION: HANDLE INLET TEMPERATURE AND PRESSURE SENSOR WITH CARE, AS UNIT IS PRECALIBRATED. THE SENSING ELEMENT AND BELLOWS ARE PRECISON PARTS. CAPILLARY TUBE JOINING SENSING ELEMENT AND BELLOWS MUST NOT BE KINKED, OR LEAKAGE MAY RESULT.

(4) Remove bolts, washers, bushings, and insulator to disconnect inlet temperature and pressure sensor from input housing assembly.

(5) Remove support and support assembly from rear of fuel control and pump assembly.

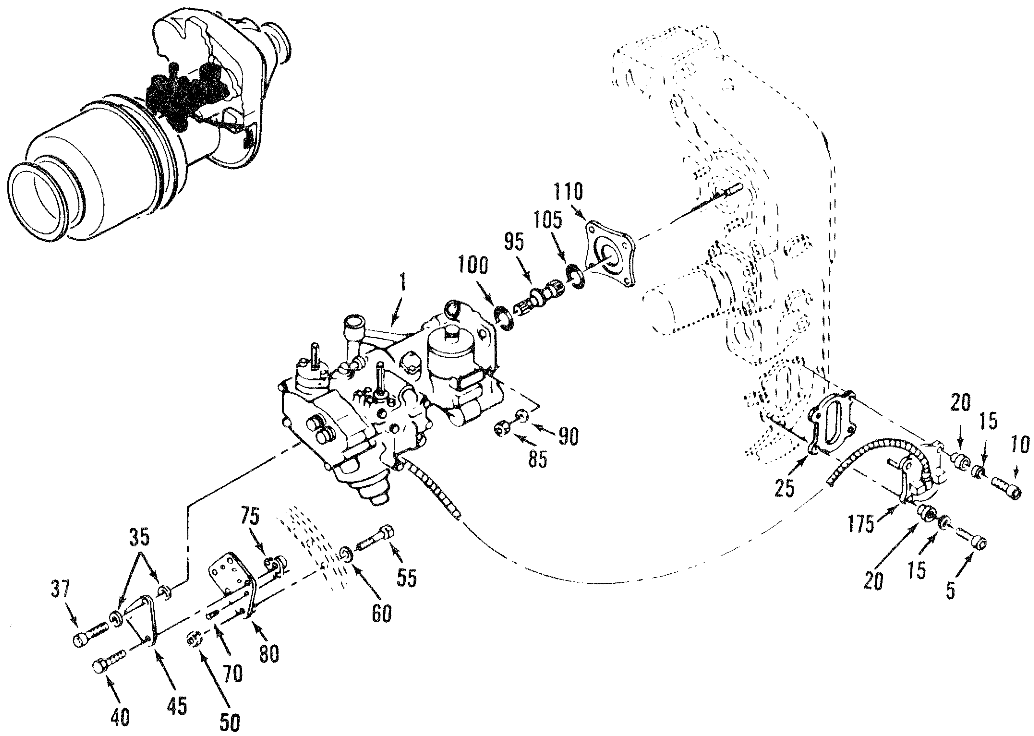
(6) Remove nuts and washers securing fuel control and pump assembly to input housing assembly.

R CAUTION: DO NUT USE SCREW DRIVER OR OTHER POINTED OB-
R JECTS TO PRY FUEL CONTROL AND PUMP ASSEMBLY
R FROM ENGINE OR DAMAGE TO PUMP FLANGE OR ACCES-
R SORY DRIVE HOUSING MAY OCCUR.

(7) Remove fuel control and pump assembly in a straight line to avoid damage to drive coupling.

(8) Remove drive coupling and fuel control and pump insulator when applicable. Remove packings from drive coupling.

R



1. FUEL CONTROL AND PUMP
R ASSY (IPC FIG. 59)
5. BOLT
10. BOLT
15. WASHER
20. INSULATOR
25. INSULATOR
35. WASHER
37. BOLT
40. BOLT
45. SUPPORT
50. NUT
55. BOLT
60. WASHER
70. RIVET
75. NUTPLATE
80. SUPPORT ASSY
85. NUT
90. WASHER
95. DRIVE COUPLING
100. PACKING
105. PACKING
110. INSULATOR/SPACER
175. INLET TEMPERATURE AND PRESSURE SENSOR

(Codes FA-LA) Fuel Control and Pump
Assembly Installation
Figure 203

R 1. F. (Codes FA-LA) Install Fuel Control and Pump Assembly (See Figure 203)

NOTE: Apply lubricating compound (Liqui-Moly, Grade NV) to threads of bolts and studs. Grease (Mobil 28) is soluble in fuel, necessitating immediate correction of any fuel pump seal leakage. The drive coupling shall be inspected and lubricated at any time corrective action is required for fuel pump seal leakage.

R Refer to 70-00-00, STANDARD PRACTICES, for recommended
R general torque values. Add frictional drag (run-down)
R torque of self locking devices to recommended values.

(1) (Pre SB72-0104) Pack cavities of fuel pump assembly and reduction gear section with grease (Mobil 28), using syringe (Chemo-jector) so that no air spaces exist in the cavities. Coat new drive coupling packings with same grease and install on drive coupling using 285843-1-1 pilot, being careful not to damage packings. Remove pilot and apply grease to all splines of drive coupling.
R Pack internal passage of coupling ensuring all air is expelled.
R Hold finger over opening and install coupling into fuel control al-
R lowing grease to egress through vent hole in coupling. Wipe off
R excess grease.

CAUTION: (POST SB73-0104) DO NOT PACK CAVITIES OF FUEL PUMP ASSEMBLY OR REDUCTION GEAR SECTION, OR COAT DRIVE COUPLING PACKINGS WITH GREASE.

(2) (Post SB72-0104) Lubricate new drive coupling packings with clean engine oil. Install packings on drive coupling using 285843-1-1 pilot, being careful not to damage packings. Remove 285843-1-1 pilot and lubricate drive coupling with clean engine oil. Install drive coupling into fuel pump assembly.

CAUTION: EXERCISE CARE WHEN HANDLING INLET TEMPERATURE AND PRESSURE SENSOR IN THE FOLLOWING STEPS. PERFORM PROCEDURE IN THE ORDER PRESENTED.

(3) (Pre SB73-0051) Install insulator/spacer.

(4) Install fuel control and pump assembly, exercising care so that splines on drive coupling and fuel pump drive mesh properly.

(5) Install washers and nuts. Tighten nuts (85, figure 203) to 50 inch-pounds torque.

1. F. (6) Install support assembly onto compressor housing and secure with washers, bolts, and nuts. Tighten nuts (50) to 50 inch-pounds torque.

(7) Install support onto support assembly and secure with bolts. Tighten bolts (40, figure 203) to 55 inch-pounds torque.

(8) Install support shimming as required from mounting boss on fuel control to bearing surface to support to avoid bending support. Use sufficient additional washers from surface of bolt to support to obtain 0.192 to 0.204 inch total between mounting boss on fuel control and bearing surface of bolt. Tighten bolt (37, figure 203, PN MS21280-11) to 60 inch-pounds torque.

CAUTION: HANDLE INLET TEMPERATURE AND PRESSURE SENSOR WITH CARE, AS UNIT IS PRECALIBRATED. THE SENSING ELEMENT AND BELLOWS ARE PRECISION PARTS. CAPILLARY TUBE JOINING SENSING ELEMENT AND BELLOWS MUST NOT BE KINKED, OR LEAKAGE MAY RESULT.

(9) Install inlet temperature and pressure sensor onto input housing assembly with insulators, washers, and bolts. Tighten bolts (5, 10, figure 203) to 25 inch-pounds torque.

(10) Connect tube assemblies to inlet temperature and pressure sensor in accordance with 73-10-01 and 75-10-01, MAINTENANCE PRACTICES.

(11) Connect tube assemblies to fuel control assembly in accordance with 73-10-01 and 73-10-06, MAINTENANCE PRACTICES.

(12) Connect controls linkage assembly in accordance with 76-10-01, MAINTENANCE PRACTICES.

2. Adjustment/Test

Perform Adjustment/Test as outlined in 72-00-00, ADJUSTMENT/TEST.

3. Inspection/Check

NOTE: Table 203 provides a list of all equipment required to perform Inspection/Check.

Table 203. Inspection/Check Equipment

Materials or Equipment	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Look/See kit (Part No. QC No. 1)	Quality Control Co, 3301 Beverly Blvd, Los Angles, CA 90004
Toolmakers microscope	Brown and Sharpe, North Kingston, RI 02852

A. Inspect Fuel Control and Pump Assembly

(1) (Pre SB72-0104) Thoroughly clean grease from female spline area on reduction gear section, fuel pump assembly cavity, and splines of drive coupling in accordance with Cleaning/Painting.

(2) Perform visual inspection of both external and internal splines for wear as follows. (See figure 204.)

NOTE: If indicated by inspection, drive coupling shall be replaced. Whenever wear is detected, thoroughly inspect mating part for similar condition.

(Pre SB73-0051 or SB73-0054 as applicable or SB72-0104) Replacement of drive coupling will require initiation of new inspection and lubrication cycle in accordance with 72-00-00, GENERAL - INSPECTION/CHECK.

(a) Perform visual inspection using strong light and 10X magnification.

(b) Minor burnish marks or discoloration are acceptable.

(c) Spline teeth showing no visible wear step when viewed from end of spline and parallel to spline teeth are acceptable.

3. A. (2) (d) All internal splines showing wear pattern types C, D, and E, Figure 204, shall require further inspection using Look/See kit (Part No. QC No. 1) or equivalent borescope type instrument.

(e) Spline teeth wear in excess of 0.003 inch is cause for replacement. Refer to SB72-0027 for detailed illustrations.

(3) Perform dimensional inspection of both external and internal splines for wear as follows.

(a) Splines with border line wear conditions detected during visual inspection shall be replaced or dimensionally inspected using a Toolmakers Microscope or equivalent. An impression mold may be required in conjunction with the Toolmakers Microscope for internal splines.

NOTE: Defective internal splines shall be replaced by replacement of the affected assembly (oil pump assembly or fuel pump assembly). If either assembly is replaced, a new drive coupling shall be installed.

(Pre SB73-0051 or SB73-0054 as applicable or SB72-0104) Replacement of oil pump assembly or fuel pump assembly will require a new inspection and lubrication cycle in accordance with 72-00-00, GENERAL - INSPECTION/CHECK.

(4) Prior to reinstallation of fuel control and pump assembly, lubricate drive coupling and fuel control and oil pump splines in accordance with Removal/Installation.

(5) Check fuel control and pump assembly for security, loose fittings, evidence of fuel leakage, and obvious damage. Refer to 72-00-00, GENERAL - TROUBLE/SHOOTING.

(6) Inspect threaded parts for crossed, galled, or peened threads.

(7) Replace part that does not meet Inspection/Check requirements.

4. Cleaning/Painting

NOTE: Table 204 provides a list of all materials and compounds required to perform Cleaning/Painting.

Table 204. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Solvent (Shell 360)	Commercially available

A. Clean Parts

(1) Clean all standard metallic hardware in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 1 or 2.

(2) Clean outside surfaces of fuel control assembly and inlet temperature and pressure sensor in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method, No. 1.

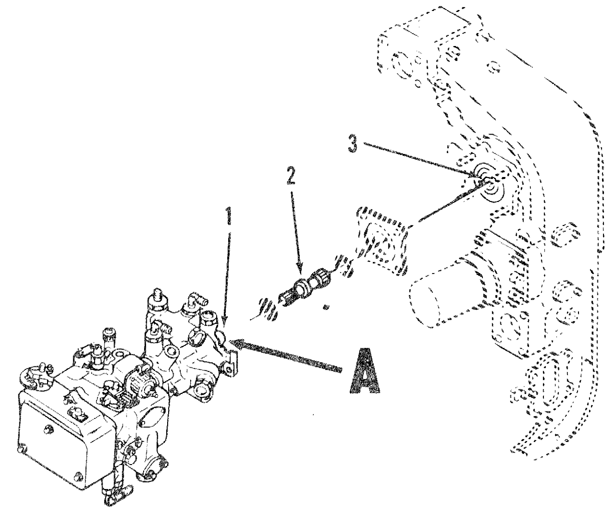
B. Perform Special Cleaning

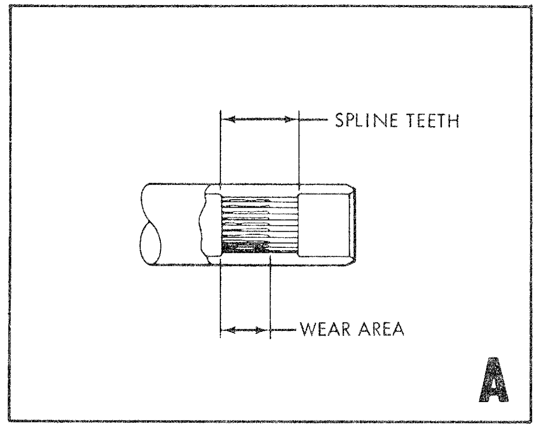
(1) Clean fuel pump assembly splines.

WARNING: SOLVENT IS TOXIC AND FLAMMABLE. USE IN WELL-VENTILATED AREA. AVOID BREATHING FUMES OR LONG CONTACT WITH SKIN TO PREVENT DAMAGE TO PHYSICAL HEALTH. KEEP AWAY FROM FLAME TO AVOID FIRE HAZARD.

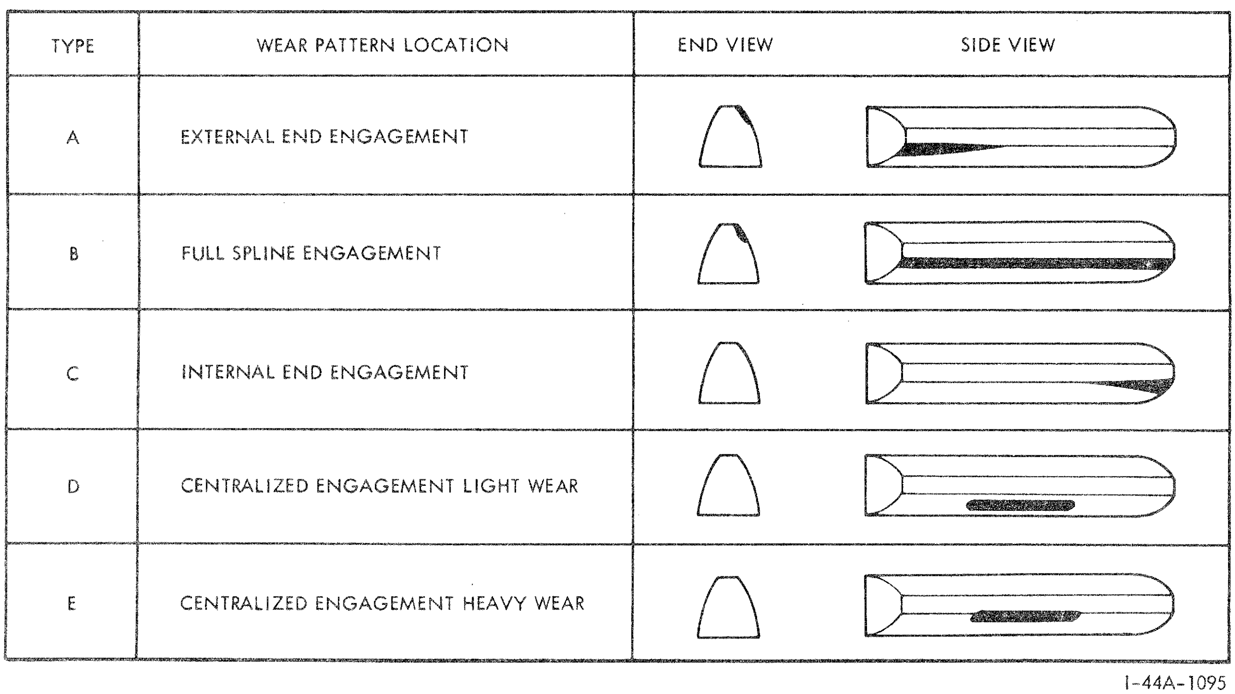
(a) (Pre SB72-0104) Remove grease from female spline area on reduction gear section and fuel pump assemby cavity.

(b) Thoroughly clean splines of both cavities plus splines of drive coupling with solvent. Use solvent (Shell 360) to clean splines lubricated with grease (Mobil grease 28).





KEY	ITEM	TYPE SPLINE	TYPE WEAR PATTERN
1	FUEL PUMP ASSEMBLY	INTERNAL	D or E
2	DRIVE COUPLING	EXTERNAL	B
3	OIL PUMP ASSEMBLY	INTERNAL	C



Spline Location and Wear Pattern (Typical)
Figure 204

INLET TEMPERATURE AND PRESSURE SENSOR AND TEMPERATURE SENSOR - MAINTENANCE PRACTICES

1. Removal/Installation

NOTE: Table 201 provides a list of all materials and compounds required to perform Removal/Installation.

Table 201. Materials and Compounds

Material or Compound	Manufacture
NOTE: Equivalent substitutes may be used for listed items.	
Any approved engine fuel	Commercially available
Alternate lubricant Lubricant (OS-124)	Monsanto Company, 800 N Lindbergh Blvd, St Louis, MO 63166
Lubricating compound (Liqui-Moly, Grade NV)	Lockrey Co, Lubricants Div, Cedar Shores, Southampton, NY 11968

R A. (Codes AA-EA) Remove Temperature Sensor (See Figure 201)

(1) Disconnect pneumatic line from temperature sensor in accordance with 73-10-01, MAINTENANCE PRACTICES.

(2) Remove bolts, washers and bushings securing temperature sensor to input housing assembly. Remove inlet temperature sensor and gasket.

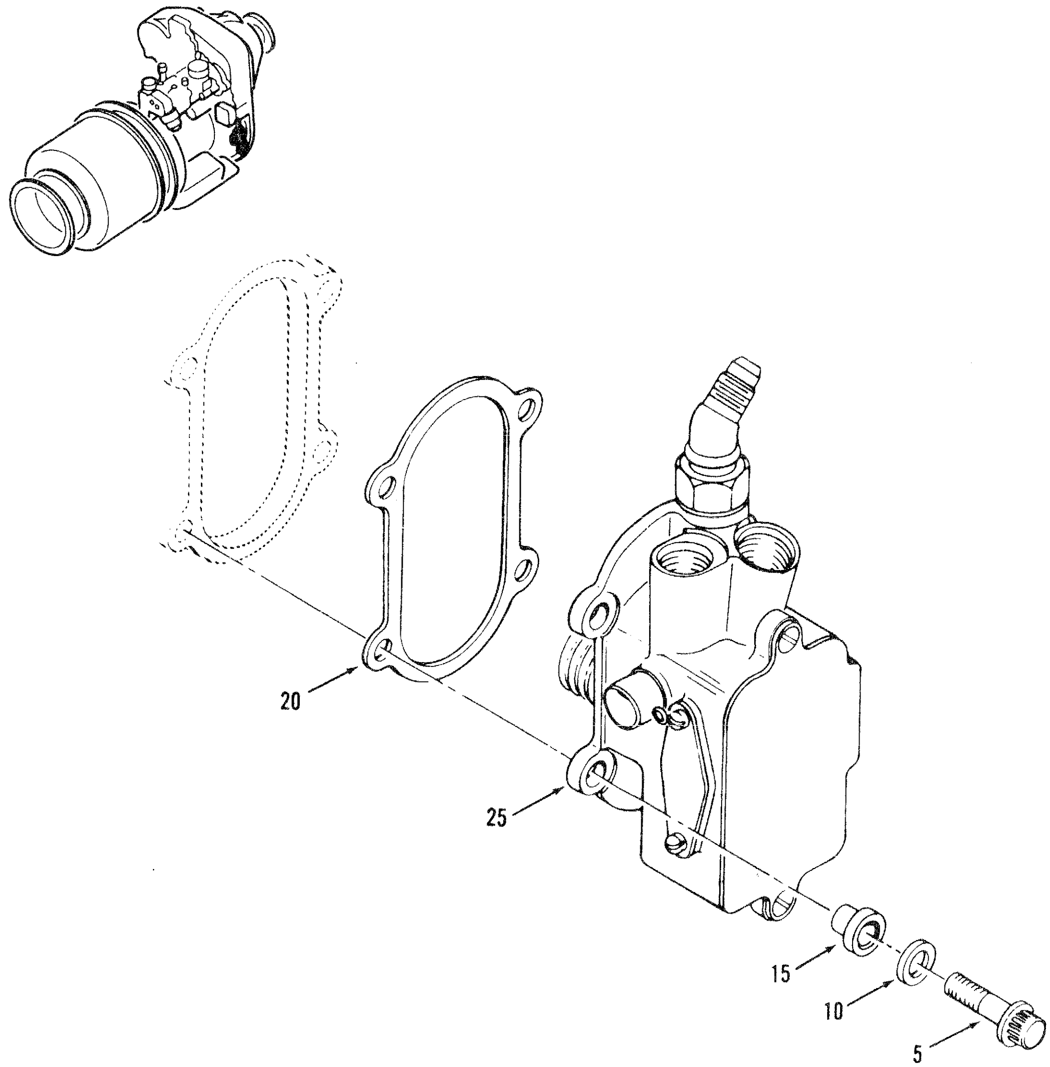
R B. (Codes AA-EA) Install Temperature Sensor (See Figure 201)

NOTE: Apply lubricating compound (Liqui-Moly, Grade NV) to threads of bolts prior to installation.

(1) Install gasket, bushings, washers, and bolts securing temperature sensor to input housing assembly. Tighten bolts (5) to 25 inch-pounds torque.

(2) Connect pneumatic lines to temperature sensor in accordance with 73-10-01, MAINTENANCE PRACTICES.

R



R 5. BOLT (IPC FIG. 56)
10. WASHER
15. BUSHINGS
20. GASKET
25. INLET TEMPERATURE SENSOR

R (Codes AA-EA) Inlet Temperature Sensor Installation
Figure 201

R 1. C. (Codes FA-LA) Remove Inlet Temperature and Pressure Sensor (See Figure 202)

(1) Disconnect tube assemblies from inlet temperature and pressure sensor in accordance with 73-10-01 and 75-10-01, MAINTENANCE PRACTICES.

CAUTION: HANDLE INLET TEMPERATURE AND PRESSURE SENSOR WITH CARE, AS UNIT IS PRE-CALIBRATED. THE SENSING ELEMENT AND BELLOWS ARE PRECISION PARTS. CAPILLARY TUBE JOINING SENSING ELEMENT AND BELLOWS MUST NOT BE KINKED, OR LEAKAGE MAY RESULT.

(2) Remove screws and washers securing bellows end of inlet temperature and pressure sensor to fuel control unit.

(3) Remove packing from bellows end of inlet temperature and pressure sensor.

(4) Remove bolts, washers, bushings, and insulator to disconnect sensor end of inlet temperature and pressure sensor from input housing assembly.

R D. (Codes FA-LA) Install Inlet Temperature and Pressure Sensor (See Figure 202)

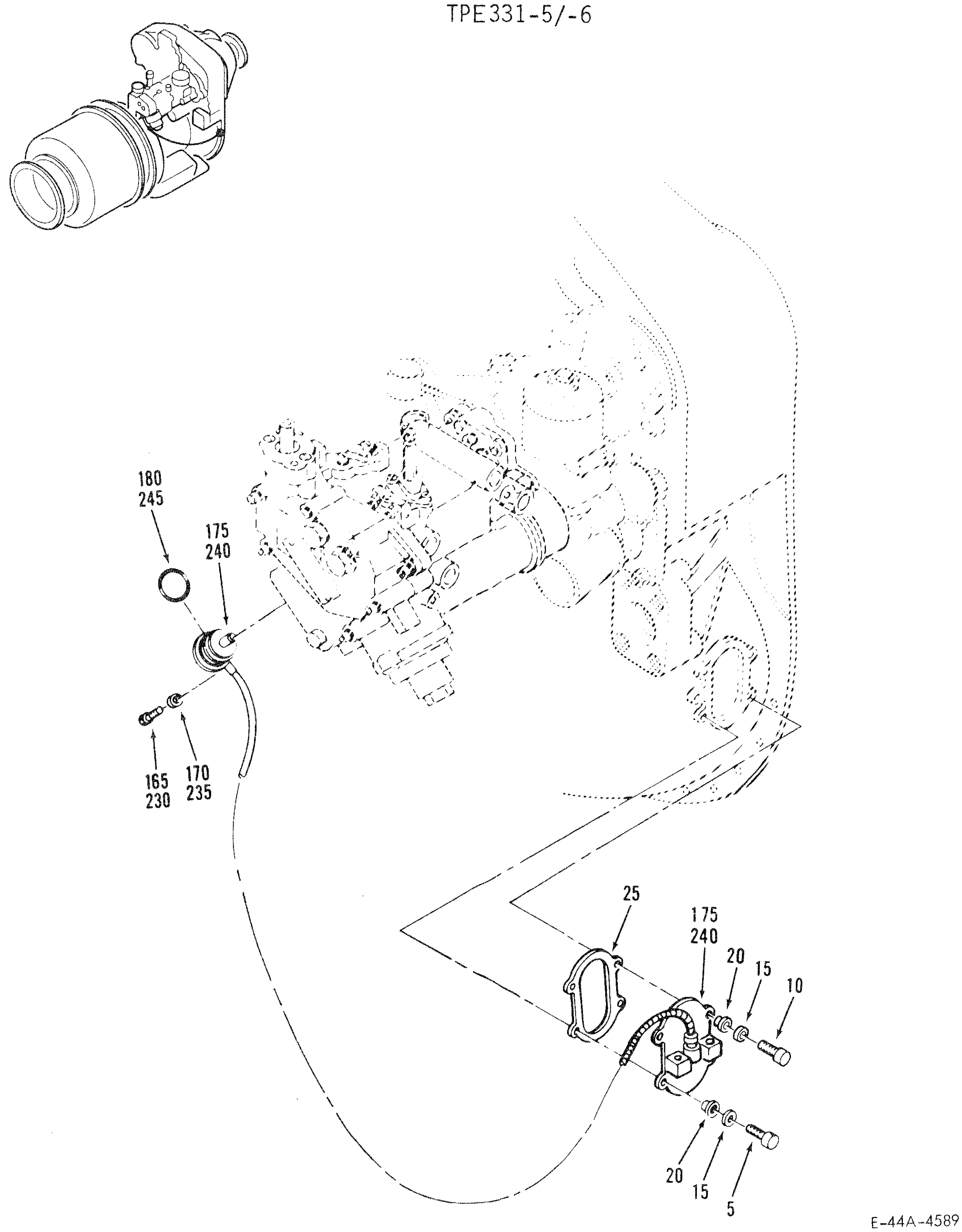
CAUTION: HANDLE INLET TEMPERATURE AND PRESSURE SENSOR WITH CARE, AS UNIT IS PRE-CALIBRATED. THE SENSING ELEMENT AND BELLOWS ARE PRECISION PARTS. CAPILLARY TUBE JOINING SENSING ELEMENT AND BELLOWS MUST NOT BE KINKED, OR LEAKAGE MAY RESULT.

R NOTE: Refer to 70-00-00, STANDARD PRACTICES, for recom-
R mended general torque values. Add frictional drag
R (run-down) torque of self-locking devices to
R recommended values.

Lightly coat new packings and gaskets with clean engine fuel or lubricant (OS-124) prior to installation. Apply lubricating compound (Liqui-Moly, Grade NV) to threads of bolts, screws, and studs.

(1) Install inlet temperature and pressure sensor onto input housing assembly with insulator, bushings, washers, and bolts. Tighten bolts (5, 10) to 25 inch-pounds torque.

R



R 5.	BOLT (IPC FIG. 59)	165.	SCREW	230.	SCREW
10.	BOLT	170.	WASHER	235.	WASHER
15.	WASHER	175.	INLET TEMPERATURE AND PRESSURE SENSOR	240.	INLET TEMPERATURE AND PRESSURE SENSOR
20.	INSULATOR (BUSHING)	180.	PACKING	245.	PACKING
25.	INSULATOR				

R (Codes FA-LA) Inlet Temperature and Pressure
Sensor Installation
Figure 202

1. D. (2) Install new packing onto bellows end of inlet temperature and pressure sensor and install into fuel control unit.

(3) Install washers and screws. Tighten screws (165, 230) to 25 inch-pounds torque.

(4) Connect tube assemblies to inlet temperature and pressure sensor in accordance with 73-10-01 and 75-10-01, MAINTENANCE PRACTICES.

R 2. Adjustment/Test

R Perform adjustment/test procedures as outlined in 72-00-00, ADJUSTMENT/TEST,
R for fuel control unit.

R 3. Inspection/Check

R A. Inspect Inlet Temperature and Pressure Sensor as Follows

R (1) Visually inspect inlet temperature and pressure sensor for security
R and evidence of damage.

R (2) Visually inspect tube in inlet end of inlet temperature and pres-
R sure sensor for dirt or obstructions.

R (3) Visually inspect bellows on inlet temperature and pressure sensor
R for collapsing, cracks or breaks. If bellows cannot be further
R compressed, unit is defective.

R (4) Visually inspect capillary tube for kinks, cracks or leakage.

R (5) Inspect output stroke of inlet temperature and pressure sensor bel-
R lows as follows. (See figure 203.)

R (a) Cool probe and bellows at approximately 4.4C (40F) to ensure
R insert retracts and Dimension A is less than 1.02 inches.

R (b) Maintain temperature of probe and bellows at 23.9C (75F).

R (c) Provide and install 0.150 inch diameter ball in end of insert
R and apply 15 pounds force against ball.

R (d) Measure Dimension A. Output stroke of bellows (dimension A)
R shall be approximately 1.02 inches.

R (6) Replace part that does not meet Inspection/Check requirements.

R 4. Cleaning/Painting

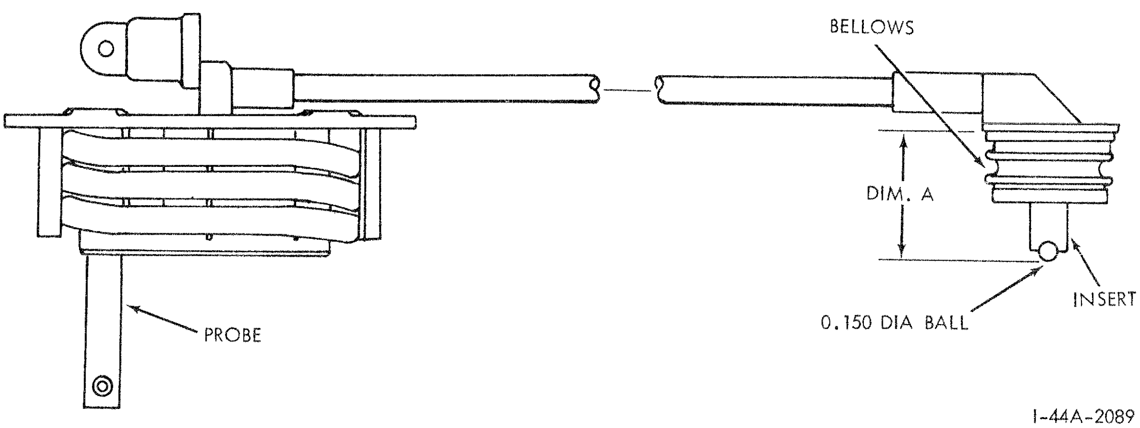
R A. Clean Parts

R (1) Clean all standard metallic hardware in accordance with 72-00-00,
R GENERAL - CLEANING/PAINTING, Cleaning Method No. 1 or 2.

R (2) Clean external surface of inlet temperature and pressure sensor, in
R accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning
R Method No. 1.

R (3) Clean electrical connector on fuel pressure regulator valve in ac-
R cordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning
R Method No. 11.

R



R Inlet Temperature and Pressure Sensor Installation
Figure 203

FUEL FILTER - MAINTENANCE PRACTICES

1. Removal/Installation

NOTE: Table 201 provides a list of all materials and compounds required to perform Removal/Installation.

Table 201. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Alternate packing lubricant Lubricant (OS-124)	Monsanto Company, 800 N Lindbergh Blvd, St. Louis, MO 63166
Any approved engine fuel	Commercially available
Any approved engine oil	Commercially available
High temperature compound (Fel-Pro C5-A)	Fel-Pro Inc, Div of Felt Prod Mfg Co, 7450 N McCormick Blvd, Skokie, IL 60076
Lubricating compound (Liqui-Moly, Grade NV)	Lockrey Co, Lubricants Div, Cedar Shores, Southampton, NY 11968

NOTE: Provide a suitable container to drain residual fuel from lines and fuel filter assembly.

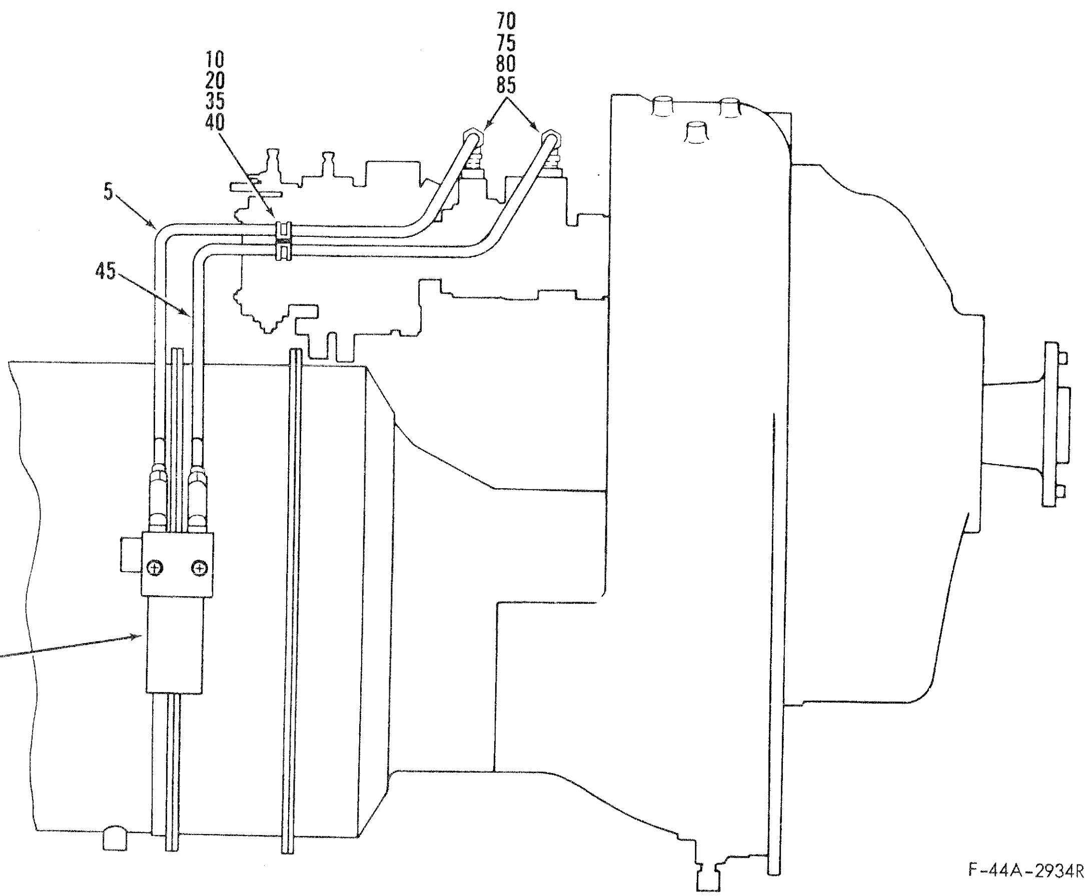
R A. (Codes AA-AC) Remove Fuel Filter and Plumbing (See Figures 201, 202, 203)

(1) Remove tube assemblies, attaching parts, fittings, elbows, and packings from fuel control assembly and fuel filter. (See figure 201.)

(2) Remove fuel filter, bracket and support from engine. (See figure 202.)

R (3) Remove cover from body. Remove filter element. Remove packings.
R (See figure 203.)

R



R 5.	TUBE ASSY (IPC FIG. 14)	40.	CLAMP	80.	RING
10.	NUT	45.	TUBE ASSY	85.	NUT
20.	BOLT	70.	FITTING	90.	FUEL FILTER
35.	WASHER	75.	PACKING		

(Codes AA-AC) Fuel Filter Plumbing Installation
Figure 201

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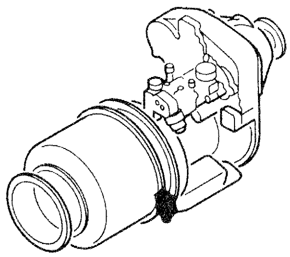

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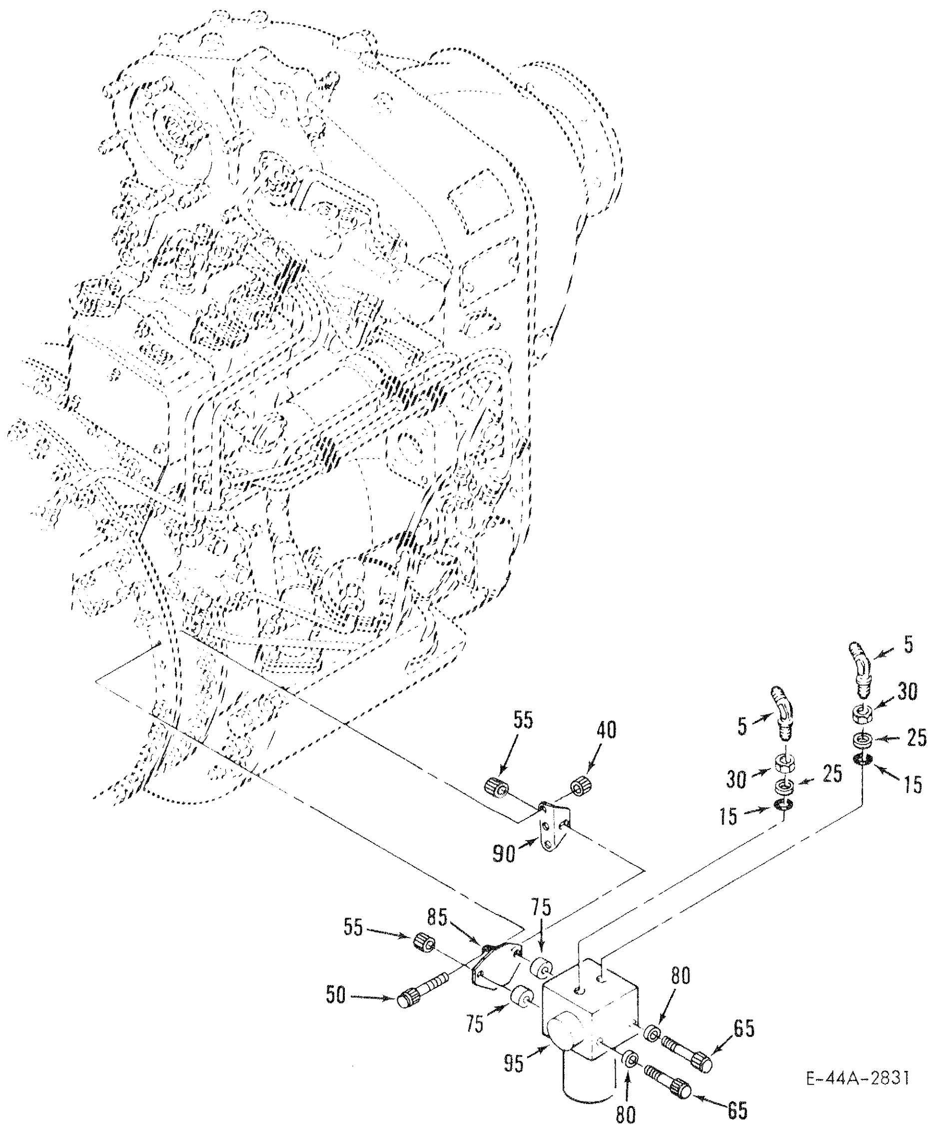


(Codes AA-AC) Fuel Filter Installation
Figure 202

R 1. B. (Codes AA-AC) Install Fuel Filter and Plumbing (See Figures 201, 202, 203)

NOTE: Prior to installation, unless otherwise specified, lubricate packings or gaskets with any type clean jet fuel. An alternate lubricant (OS-124) may be used; apply lubricant sparingly and spread evenly to a thin transparent film to minimize contamination. Apply lubricating compound (Liqui-Moly, Grade NV) to threads of bolts or screws, and apply clean engine oil to threads (except first two threads) of male plumbing fittings located forward of the fireshield unless otherwise specified. Apply high temperature compound (Fel-Pro C5-A) to threads of bolts and screws and to threads (except first two threads) of male plumbing fittings located aft of the fireshield unless otherwise specified.

R Refer to 70-00-00, STANDARD PRACTICES, for recommended
R general torque values. Add frictional drag (run-down)
R torque of self locking devices to recommended values.

(1) Secure fuel filter and bracket to engine support with bolts, washers, spacers, and nuts. Tighten nuts (40, 55) to 12 inch-pounds torque. (See figure 202.)

(2) Install elbows, with rings and new packings, into top of fuel filter and secure with nuts. Tighten nuts (30) to 55 to 60 inch-pounds torque.

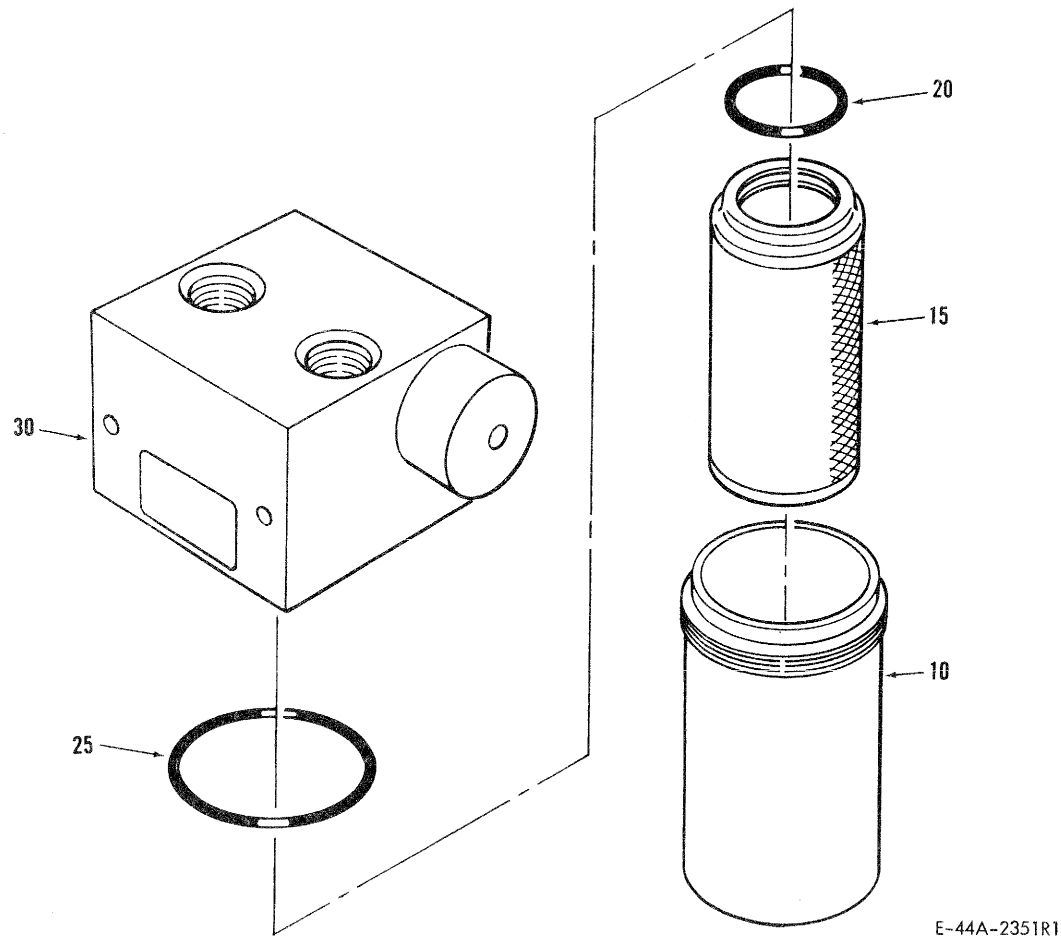
(3) Install fittings, with rings and new packings, into fuel control assembly and secure with nuts. Tighten nuts (85) to 55 to 60 inch-pounds torque. (See figure 201.)

(4) Install tube assemblies, with attaching parts, between fuel filter and fuel control assembly. Assemble clamps with maximum of three washers between clamps to prevent bending of tube assemblies during installation. Tighten nut (10) to 12 inch-pounds torque.

KEY TO FIGURE 202

R 5. ELBOW (IPC FIG. 48)
15. PACKING
25. RING
30. NUT
40. NUT
50. BOLT
55. NUT
65. BOLT
75. SPACER
80. WASHER
85. BRACKET
90. SUPPORT
95. FUEL FILTER

R



R 10. COVER (IPC FIG. 62)
15. FILTER ELEMENT
20. PACKING
25. PACKING
30. BODY

(Codes AA-AC) Fuel Filter Element Installation
Figure 203

R 1. B. (5) Install packing onto filter element, install filter element onto
R body. (See figure 203.)

R (6) Install packing onto cover, install cover onto body. Tighten
R cover.

R C. (Codes BA-BC, EA) Remove Fuel Filter (See Figure 204)

(1) Remove cap from fuel pump assembly.

(2) Remove clip, cup, spring, and filter element from cap.

(3) Remove washer from cup.

(4) Remove plug.

(5) Remove packings from cap, filter element and plug.

R D. (Codes BA-BC, EA) Install Fuel Filter (See Figure 204)

NOTE: Lubricate new packings with clean engine fuel or alternate lubricant (OS-124) prior to installation.

(1) Install plug, with new packing, into cap. Tighten plug (10, 65, figure 204) to 25 to 30 inch-pounds torque.

(2) Install washer into cup. Install new packing onto filter element and insert filter element into cup.

(3) Install spring into cap with small end up.

(4) Install cap over cup and secure with clip or clips.

CAUTION: ENSURE CAP THREADS ARE PROPERLY LUBRICATED TO PREVENT THREADS FROM SEIZING.

(5) Apply a thin coat of lubricating compound (Liqui-Moly, Grade NV) to threads of cap. Install assembled cap with new packing. Tighten cap (20, 75, figure 204) to 15 to 20 inch-pounds torque, and lockwire.

R E. (Codes FA-LA) Remove Fuel Filter (See Figure 205)

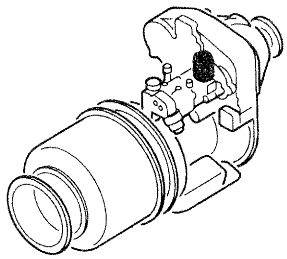
(1) Remove cap from fuel pump assembly.

(2) Remove clip, cup, spring, and filter element from cap.

(3) Remove washer from cup.

(4) Remove plug.

(5) Remove packings from cap, filter element and plug.



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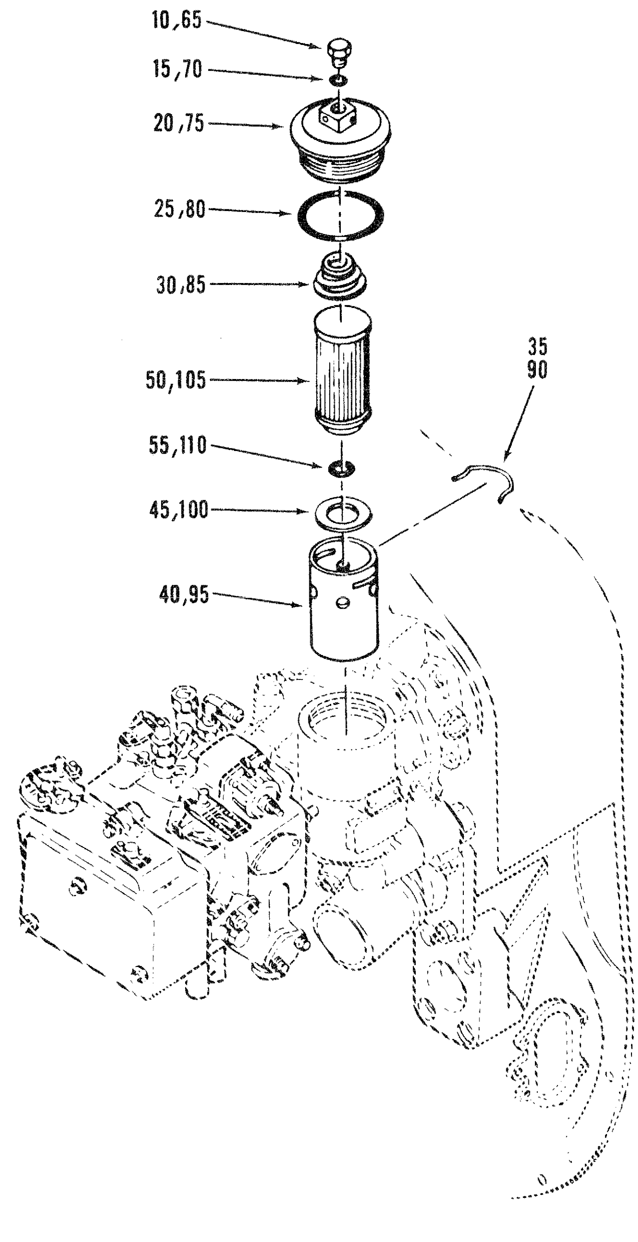


(Codes BA-BC, EA) Fuel Filter Installation
Figure 204

R 1. F. (Codes FA-LA) Install Fuel Filter (See Figure 205)

NOTE: Lubricate new packings with clean engine fuel or alternate lubricant (OS-124) prior to installation.

(1) Install plug, with new packing, into filter housing cap. Tighten plug (10, 65, figure 205) to 25 to 30 inch-pounds torque.

(2) Install washer into cup. Install new packing onto filter element and insert filter element into cup.

(3) Install spring into cap with small end up.

(4) Install cap over cup and secure with clip.

CAUTION: ENSURE CAP THREADS ARE PROPERLY LUBRICATED TO PREVENT FILTER HOUSING CAP THREADS FROM SEIZING.

(5) Apply a thin coat of lubrication compound (Liqui-Moly, Grade NV) to threads of cap. Install assembled cap with new packing. Tighten cap (10, 65, figure 205) to 15 to 20 inch-pounds torque, and lockwire.

2. Inspection/Check

A. Inspect Fuel Filter and Associated Components

(1) (Codes AA-AC) Inspect tube assemblies for cracks, damaged threads, or dents.

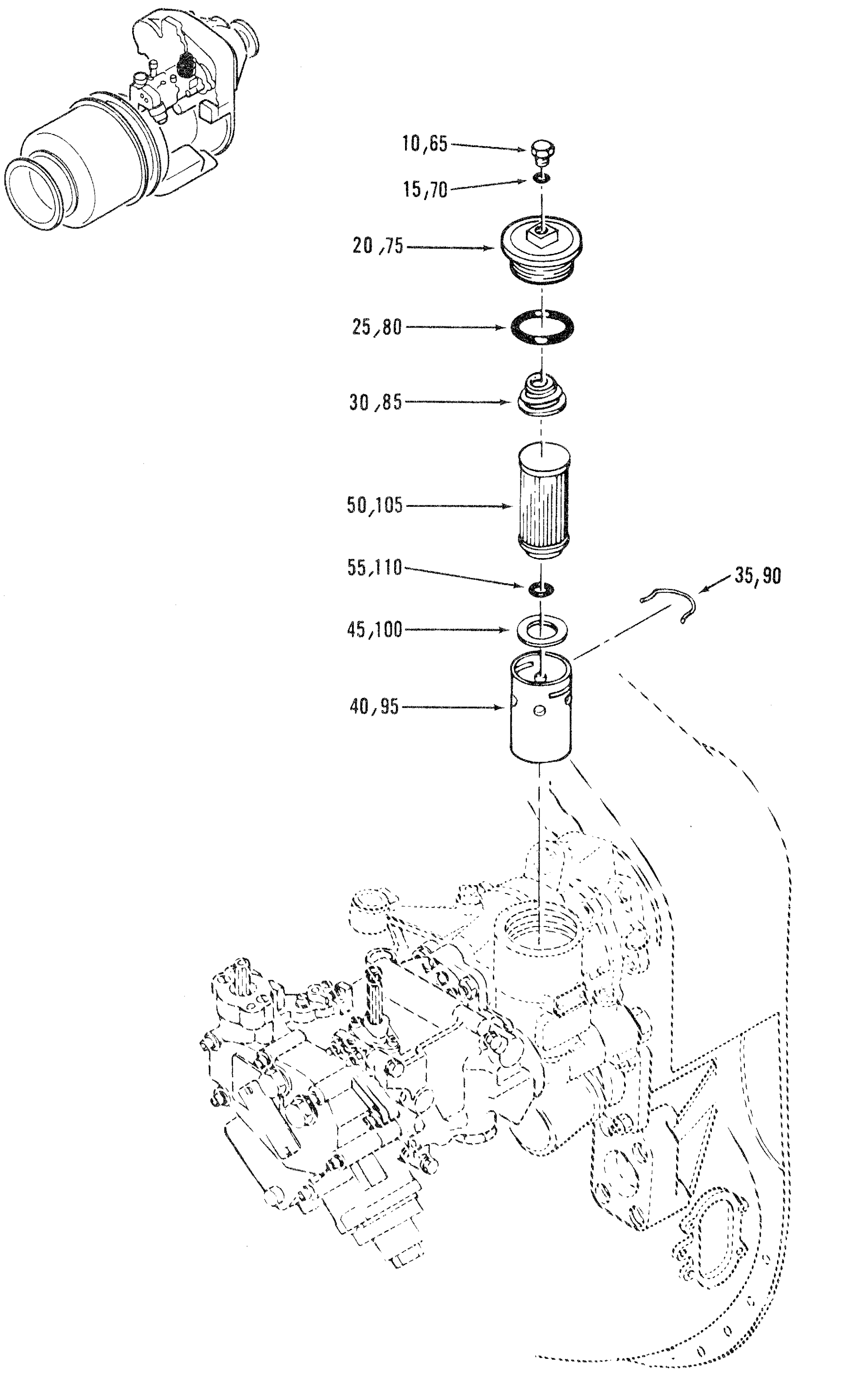
(2) Inspect fuel filter body and cover for damaged threads and other obvious damage.

(3) Inspect filter element for damage and cleanliness. Refer to Cleaning/Painting for filter element cleaning procedure.

(4) Replace part that does not meet Inspection/Check requirements.

KEY TO FIGURE 204

10.	PLUG (IPC FIG. 63)	45.	WASHER	85.	SPRING
15.	PACKING	50.	FILTER ELEMENT	90.	CLIP
20.	CAP	55.	PACKING	95.	CUP
25.	PACKING	65.	PLUG	100.	WASHER
30.	SPRING	70.	PACKING	105.	FILTER ELEMENT
35.	CLIP	75.	CAP	110.	PACKING
40.	CUP	80.	PACKING		



R

(Codes FA-LA) Fuel Filter Installation
Figure 205

3. Cleaning/Painting

NOTE: Table 202 provides a list of all materials and compounds required to perform Cleaning/Painting.

Table 202. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Beaker (200 milliliter capacity)	Commercially available
Blackstone heated tank ultrasonic cleaner (Model HT 1.9)	Blackstone Ultrasonics Inc, 1111 Allen St, Jamestown, NY 14701
Alternate Sonac Ultrasonic Cleaner (Model S-2)	Cooper Laboratories Inc, Wayne, NJ 07470
Dowclene WR	Dow Chemical Corp, S Saginaw Rd, Midland, MI 48640
Electrocleaner (Wyandotte FS)	Wyandotte Chemicals Corp, Wyandotte, MI 48192
Muriatic acid (35 percent HCL, commercial grade)	Commercially available
Rust stripper (Oakite Rust Stripper)	Oakite Prod Inc, 50 Valley Rd, Berkeley Heights, NY 07922

KEY TO FIGURE 205

R 10. PLUG (IPC FIG. 64)
15. PACKING
20. CAP
25. PACKING
30. SPRING
35. CLIP
40. CUP
45. WASHER
50. FILTER ELEMENT
55. PACKING
65. PLUG
70. PACKING
75. CAP
80. PACKING
85. SPRING
90. CLIP
95. CUP
100. WASHER
105. FILTER ELEMENT
110. PACKING

Table 202. Materials and Compounds (Cont)

Material or Compound	Manufacturer
Solvent (Shell 360)	Shell Oil Co, 50 W 50th St, New York, NY 10020
Solvent, Stoddard (Federal Specification P-D-680, Type I)	Commercially available

WARNING: CLEANING SHALL BE PERFORMED IN A CLEAN, WELL-VENTILATED ROOM. RUBBER GLOVES AND PROTECTIVE CLOTHING SHALL BE WORN. EXTINGUISHERS AND VAT OR TANK COVERS SHALL BE ON HAND IN CASE OF FIRE.

3. A. Clean Parts

(1) Clean all standard metallic hardware in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 1 or 2.

(2) Clean all fittings in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 12.

(3) Clean outside surfaces of fuel filter in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 1.

B. Perform Special Cleaning of Fuel Filter Element

NOTE: Filter element may be cleaned, as a temporary expedient, by dipping in solvent (Shell 360), and dried with filtered, compressed air. However, the cleaning method described below should be employed for a thorough cleaning.

(1) Clean filter element.

(a) Remove packing and thoroughly clean filter element in cold solvent, Stoddard (Federal Specification P-D-680, Type I).

(b) Prepare a solution of rust stripper (Oakite) by combining three to five pounds of rust stripper to each gallon of water. Maintain prepared solution at 72 to 82C (162 to 180F). Employ air agitation to keep solution in suspension.

(c) Soak filter element in rust stripper solution for 30 minutes.

(d) Remove filter element from solution and rinse thoroughly with clean water.

3. B. (1) (e) Prepare solution of electrocleaner (Wyandotte FS) by combining nine ounces of electrocleaner to each gallon of water. Maintain solution at 72 to 93C (160 to 200F). Immerse filter element in electrocleaner solution for four to six minutes. During this period, filter element shall be made an anode for one to two minutes at a potential of four to seven volts dc. Rinse filter element in cold running tap water.

(f) Immerse filter element in equal parts muriatic acid and water, by volume, at room temperature for one-half to one minute. Rinse filter element thoroughly in cold running tap water.

(g) Immerse filter element in electrocleaner solution prepared in step (e) maintained at temperature of 72 to 93C (160 to 200F) for four to six minutes. Rinse in cold running tap water.

(h) Pressure flush filter element (internal and external) using clean water.

NOTE: Beaker is used in ultrasonic cleaner to conserve cleaning agent. Water is used in ultrasonic cleaner tank as transmitting fluid.

(i) Place filter element in beaker with open end down and fill beaker with Dowclene WR to submerge filter element.

(j) Place beaker containing filter element in ultrasonic cleaner tank and fill ultrasonic cleaner tank to within three-eighths inch of top with water.

(k) Operate ultrasonic cleaner for five minutes.

(l) Discard contaminated Dowclene WR and rinse filter element and beaker with clean Dowclene WR using plastic squeeze bottle.

(m) Refill beaker with clean Dowclene WR and operate ultrasonic cleaner for an additional five minutes.

(n) Repeat steps (l) and (m) until Dowclene WR remains clean after a five minute operation period.

(o) Remove the filter element from beaker and pressure flush (internal and external) using clean water. Dry filter element with filtered, low pressure compressed air.

(p) Test filter element in accordance with Adjustment/Test.

(q) Install new packing in filter element. If cleaned filter element is not to be installed immediately, place in clean dry container.

FUEL ENRICHMENT VALVE ASSEMBLY AND FUEL PRESSURIZING VALVE ASSEMBLY - MAINTENANCE PRACTICES

1. Removal/Installation

NOTE: Table 201 provides a list of all materials and compounds required to perform Removal/Installation.

Table 201. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Any approved engine fuel	Commercially available
Alternate lubricant Lubricat (OS-124)	Monsanto Company, 800 N Lindbergh Blvd, St. Louis, MO 63166
Lubricating compound (Liqui-Moly, Grade NV)	Lockrey Co, Lubricants Div, Cedar Shores, Southampton, NY 11968

A. (Codes AA-AC, CA-CC) Remove Enrichment Valve Assembly (See Figure 201)

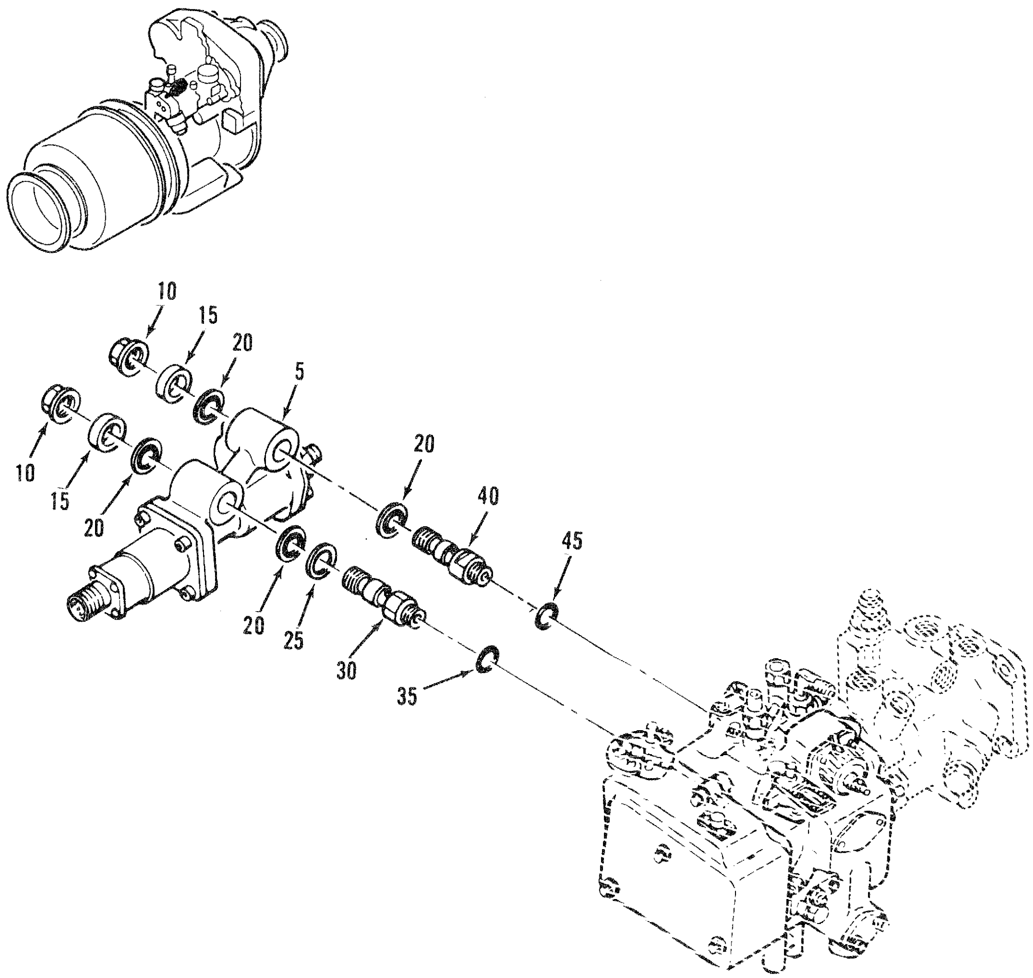
(1) Disconnect electrical connector from enrichment valve assembly.

NOTE: Record number and thickness of washer (25) removed from check valve fitting (30) to aid in assembly.

(2) Remove nuts, washers, enrichment valve assembly and retained packings.

(3) Remove check valve fitting (30) and fluid transfer fitting. Remove packings from fittings.

R



R . ENRICHMENT VALVE
R ASSY (IPC FIG. 60)
R 10. NUT
R 15. WASHER
R 20. RETAINING PACKING
25. WASHER
30. CHECK VALVE FITTING
35. PACKING
40. FLUID TRANSFER FITTING
45. PACKING

R (Codes AA-AC, CA-CC) Fuel Enrichment
R Valve Assembly Installation
R Figure 201

R 1. B. (Codes AA-AC, CA-CC) Install Enrichment Valve Assembly (See Figure 201)

R NOTE: Refer to 70-00-00, STANDARD PRACTICES, for recommended general torque values. Add frictional drag (run-down) torque of self locking devices to recommended values.

R Lightly coat new packings and gaskets with clean engine fuel or lubricant (OS-124) prior to installation.

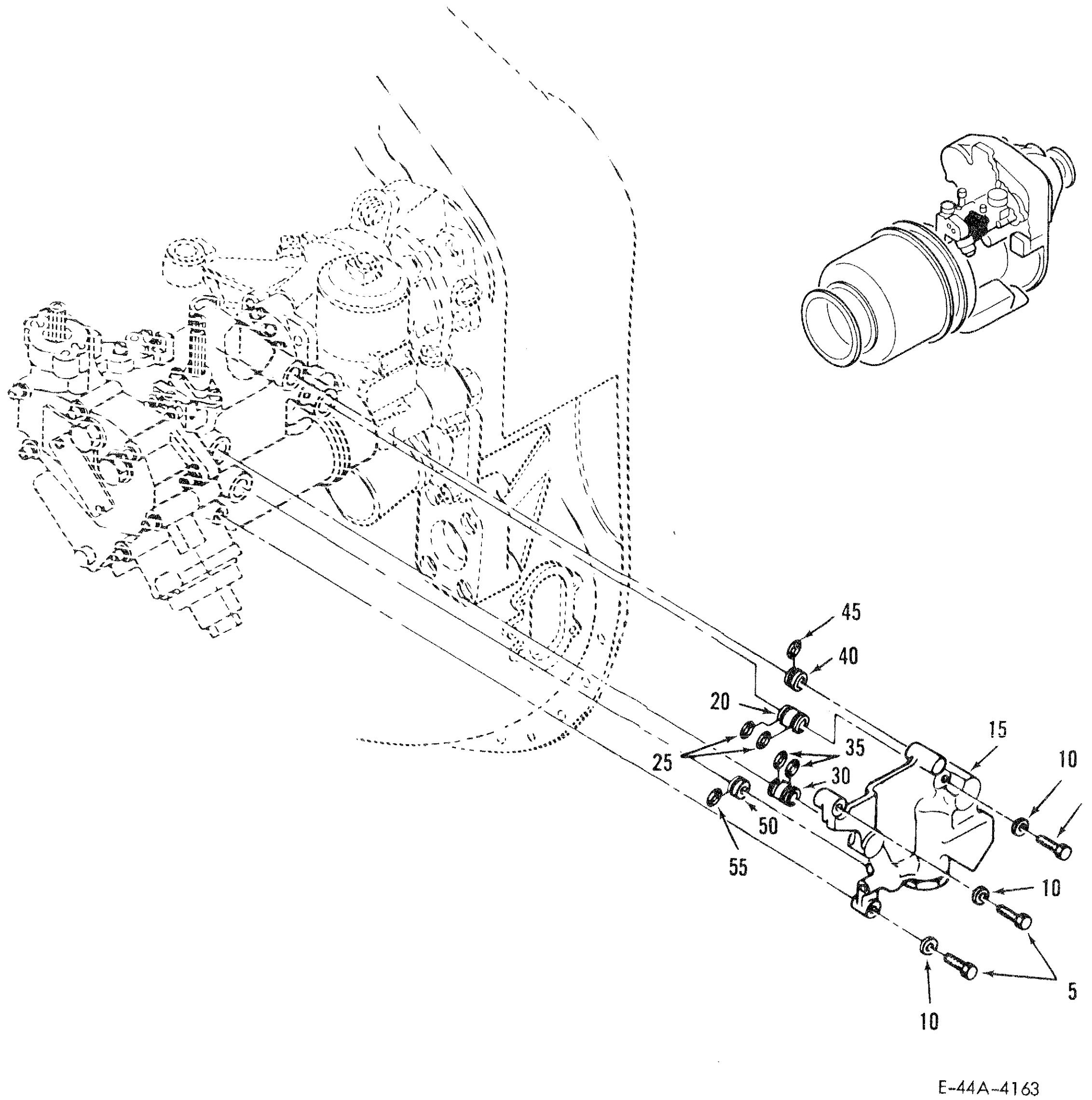
R (1) Install new packings on check valve and fluid transfer fittings. Install fittings into fuel control. Tighten fittings to 70 inch-pounds torque.

R (2) Install same number and thickness of washers (25), as noted during removal, onto check valve fitting.

R (3) Install retained packings, enrichment valve assembly, washers and nuts. Tighten nuts (10) to 65 inch-pounds torque.

R (4) Connect electrical connector to enrichment valve assembly in accordance with Aircraft Maintenance Manual.

R



R 5. BOLT (IPC FIG. 61)
R 10. WASHER
R 15. PRESSURIZING VALVE ASSY
R 20. TRANSFER TUBE
R 25. PACKING
R 30. TRANSFER TUBE
35. PACKING
40. PLUG
45. PACKING
50. PLUG
55. PACKING

R (Codes FA-LA) Fuel Pressurizing Valve
R Assembly Installation
R Figure 202

R 1. C. (Codes FA-LA) Remove Fuel Pressurizing Valve Assembly (See Figure 202)

R (1) Disconnect plumbing from fuel pressurizing valve assembly. Refer
R to 73-10-01 and 73-10-01, MAINTENANCE PRACTICES.

R (2) Remove bolts and washers securing fuel pressurizing valve assembly.

R (3) Remove pressurizing valve assembly, transfer tubes, plugs and
R packings. Refer to Approved Repairs for Field Maintenance
R Breakdown.

R D. (Codes FA-LA) Install Fuel Pressurizing Valve Assembly (See Figure 202)

R NOTE: Refer to 70-00-00, STANDARD PRACTICES, for recommended
R general torque values. Add frictional (run-down)
R torque of self locking devices to recommended values.

R Lightly coat new packings with clean engine fuel or lu-
R bricant (OS-124) prior to installation. Apply lubri-
R cating compound (Liqui-Moly) to threads of bolts.

R (1) Install new packings onto transfer tube and plugs. Install trans-
R fer tubes and plugs into fuel control.

R (2) Carefully align and install fuel pressurizing valve assembly onto
R transfer tubes, plugs and fuel control.

R (3) Secure fuel pressurizing valve assembly with bolts and washers.
R Tighten bolts (5) to 25 inch-pounds torque.

R (4) Install plumbing onto fuel pressurizing valve assembly. Refer to
R 73-10-01 and 73-10-01, MAINTENANCE PRACTICES.

R 2. Adjustment/Test

R A. (Codes AA-AC, CA-CC) Test Fuel Enrichment Valve Assembly

R (1) Apply 24 volts dc to pins A and B of electrical connector on fuel
R enrichment valve assembly.

R (2) Valve shall produce an audible click, indicating operation.

R 3. Inspection/Check

R A. Inspect Fuel Enrichment Valve and Pressurizing Valve Assemblies

R (1) Check for security, fuel leakage and obvious damage.

R 4. Cleaning/Painting

R A. Clean Parts

R (1) Clean all standard metallic hardware in accordance with 72-00-00,
R GENERAL - CLEANING/PAINTING, Cleaning Method No. 1 or 2.

R (2) Clean fuel pressurizing valve and fuel enrichment valve in accord-
R ance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method
R No. 11.

R 5. Approved Repairs

R A. (Codes FA-LA) Partially Disassemble Fuel Pressurizing Valve Assembly
R (See Figure 203)

R NOTE: Valve plunger is spring-loaded, and care must be exer-
R cised during removal to prevent inadvertent ejection of
R plunger, spring, and spring seat when plug is removed.

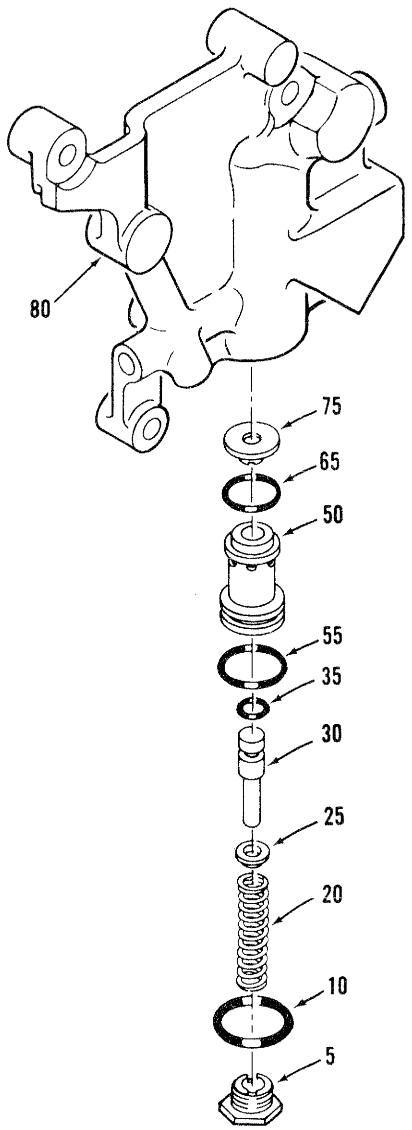
R (1) Remove plug, spring, spring seat, plunger, sleeve, and stop.

R (2) Remove and discard old packings and gaskets.

R B. (Codes FA-LA) Assemble Fuel Pressurizing Valve Assembly (See Figure
R 207)

R (1) Lubricate new packings and gaskets with clean engine fuel or lubri-
R cant (OS-124) and install onto valve components.

R (2) Install stop, sleeve, plunger, seat, spring, and plug into body.
R Tighten plug (5) to 150 to 250 inch-pounds torque.



R

R 5. PLUG (IPC FIG. 67)
R 10. PACKING
R 20. SPRING
R 25. SEAT
R 30. PLUNGER
R 35. PACKING

50. SLEEVE
55. PACKING
65. PACKING
75. STOP
80. BODY ASSY

R (Codes FA-LA) Fuel Pressurizing Valve Assembly
R (Field Maintenance Breakdown)
R Figure 203

FUEL CONTROL - MAINTENANCE PRACTICES

1. Removal/Installation

NOTE: Table 201 provides a list of all materials and compounds required to perform Approved/Repairs.

Table 201. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Alternate packing lubricant Lubricant (OS-124)	Monsanto Company, 800 N Lindbergh Blvd, St. Louis, MO 63166
Any approved engine fuel	Commercially available
Any approved engine oil	Commercially available
Lubricating compound (Liqui-Moly, Grade NV)	Lockrey Co, Lubricants Div, Cedar Shores, Southampton, NY 11968

NOTE: Before replacing fuel control unit with another complete unit, ensure trouble has been isolated to this component. Refer to Adjustment/Test for maintenance procedures which may correct malfunctions.

R A. (Codes AA-EA) Remove Fuel Control (See Figures 201, 202)

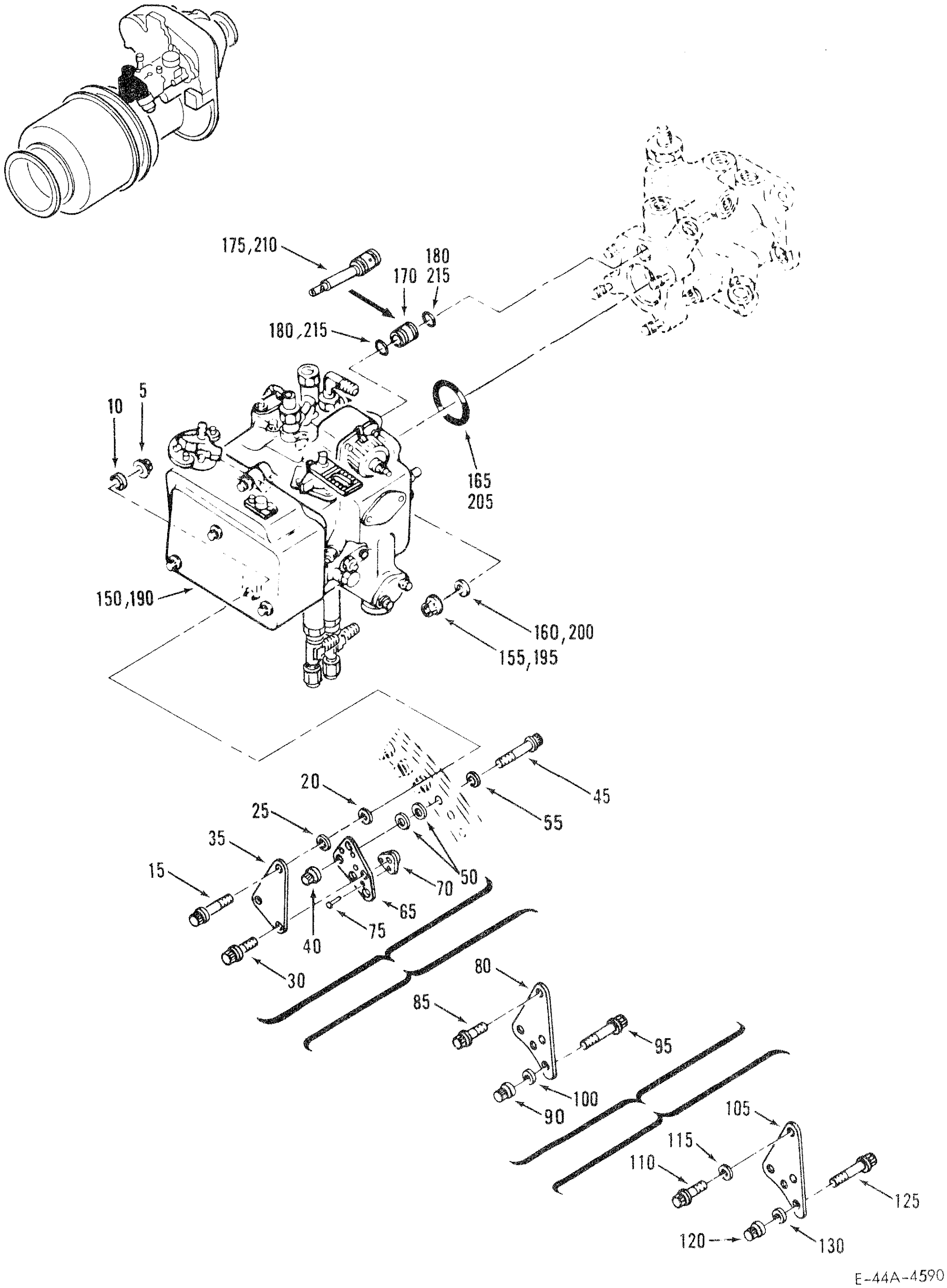
(1) Disconnect controls linkage assembly in accordance with 76-10-01, MAINTENANCE PRACTICES.

(2) Disconnect tube assemblies from fuel control unit in accordance with 73-10-01, 73-10-06, and 73-10-10, MAINTENANCE PRACTICES.

R (3) (Codes AA-AC, CA-CC) Disconnect electrical connector from fuel enrichment valve.

R (4) (Codes AA-AC, CA-CC) Remove fuel enrichment valve, if required. Refer to 73-21-04, MAINTENANCE PRACTICES.

(5) (Pre SB73-0028, SB73-0029) Remove bracket and support assembly from rear of fuel control unit.



R

R (Codes AA-AC, CA-CC) Fuel Control Installation
Figure 201

1. A. (6) (Post SB73-0028, SB73-0029) Remove support assembly from rear of fuel control unit.

(7) Remove nut and washers securing fuel control unit to fuel pump.

CAUTION: DO NOT USE SCREW DRIVER OR OTHER POINTED OBJECT TO REMOVE FUEL CONTROL OR DAMAGE TO FUEL CONTROL OR FUEL PUMP MAY OCCUR.

(8) Remove fuel control unit in a straight line to avoid damage to coupling splines.

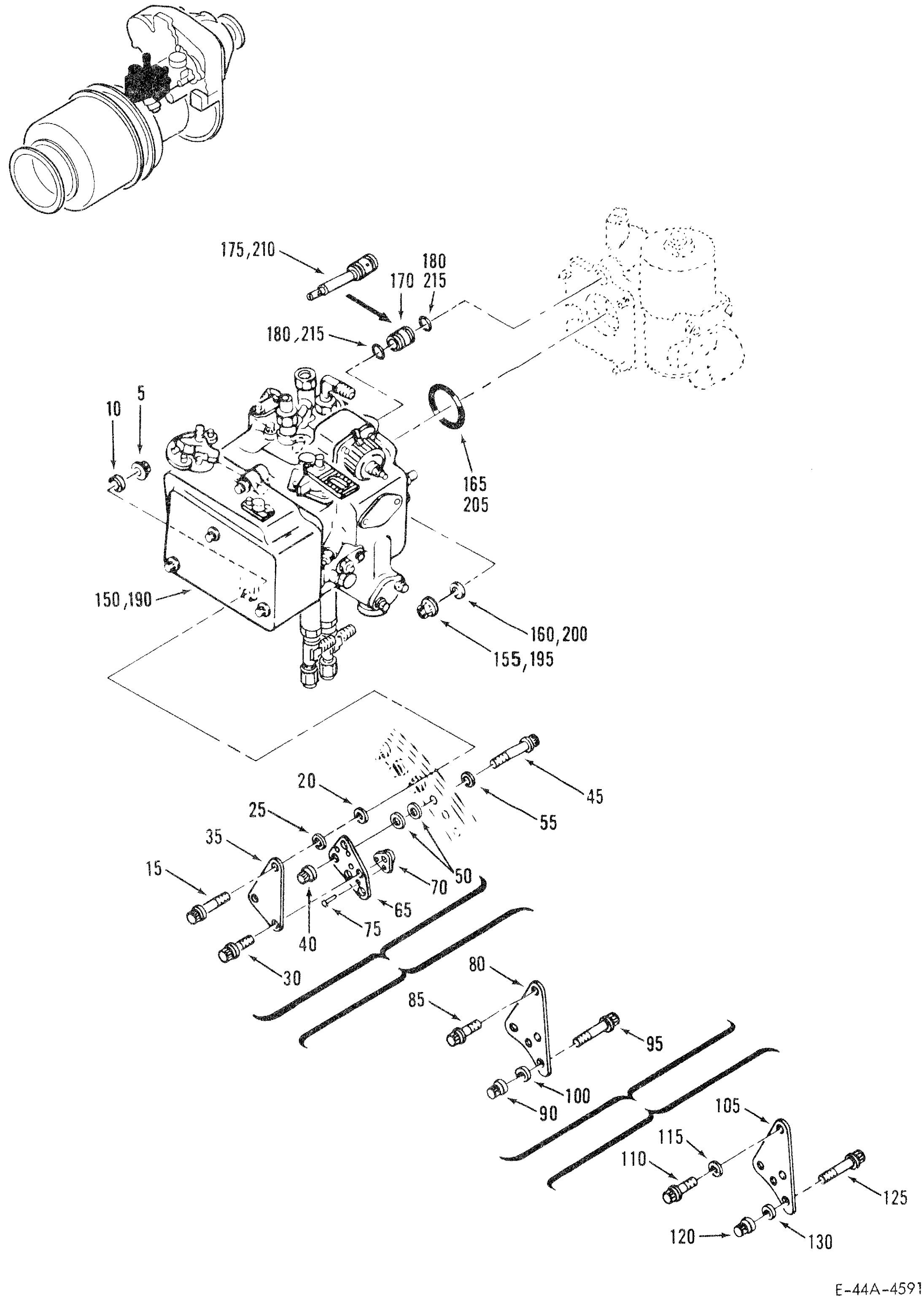
(9) Remove packings between fuel control unit and fuel pump assembly.

(10) Remove connector tube or filter assembly and packings.

(11) Refer to Approved Repairs for Field Maintenance Breakdown.

KEY TO FIGURE 201

R 5. NUT (IPC FIG. 57)
R 10. WASHER
R 15. BOLT
R 20. WASHER
R 25. WASHER
R 30. BOLT
R 35. BRACKET
R 40. NUT
R 45. BOLT
R 50. WASHER
R 55. WASHER
R 65. SUPPORT
R 70. NUTPLATE
R 75. RIVET
R 80. SUPPORT
R 85. BOLT
R 90. NUT
R 95. BOLT
R 100. WASHER
105. SUPPORT
110. BOLT
115. WASHER
120. NUT
125. BOLT
130. WASHER
150. FUEL CONTROL
155. NUT
160. WASHER
165. PACKING
170. TUBE
175. FILTER ASSY
180. PACKING
190. FUEL CONTROL
195. NUT
200. WASHER
205. PACKING
210. FILTER ASSY
215. PACKING



R

R (Codes BA-BC, EA) Fuel Control Installation
Figure 202

1. B. (Codes AA-EA) Install Fuel Control and Enrichment Valve Assembly (See Figures 201, 202)

CAUTION: WHEN PNEUMATIC TEES, RESTRICTORS, NUTS, AND CAPS ARE INSTALLED, EXERCISE CARE THAT NO CONTAMINATION IS INTRODUCED NOR THREAD LUBRICATION COMPOUND IS USED. ASSURE PROPER ALIGNMENT AND THREAD ENGAGEMENT TO PREVENT GALLING AND/OR CROSS THREADING.

NOTE: Lubricate packings or gaskets used in fuel system with any type jet fuel prior to installation unless otherwise specified. Packings or gaskets used in pneumatic system may be installed dry. An alternate lubricant (OS-124) may be used on all packings or gaskets prior to installation unless otherwise specified; apply lubricant sparingly and spread evenly to a thin transparent film to minimize contamination. Apply lubricating compound (Liqui-Moly, Grade NV) to threads of bolts and screws, and apply clean engine oil to threads (except first two threads) of male plumbing fittings used in fuel system located forward of the fireshield unless otherwise specified.

R Refer to 70-00-00, STANDARD PRACTICES, for recommended
R general torque values. Add frictional drag (run-down)
R torque of self locking devices to recommended values.

R (1) Ensure coupling has been installed. Refer to Approved Repairs for
R installation.

R KEY TO FIGURE 202

R	5.	NUT (IPC FIG. 58)	75.	RIVET	155.	NUT
R	10.	WASHER	80.	SUPPORT	160.	WASHER
R	15.	BOLT	85.	BOLT	165.	PACKING
R	20.	WASHER	90.	NUT	170.	TUBE
R	25.	WASHER	95.	BOLT	175.	FILTER ASSY
R	30.	BOLT	100.	WASHER	180.	PACKING
R	35.	BRACKET	105.	SUPPORT	190.	FUEL CONTROL
R	40.	NUT	110.	BOLT	195.	NUT
R	45.	BOLT	115.	WASHER	200.	WASHER
R	50.	WASHER	120.	NUT	205.	PACKING
R	55.	WASHER	125.	BOLT	210.	FILTER ASSY
R	65.	SUPPORT	130.	WASHER	215.	PACKING
R	70.	NUTPLATE	150.	FUEL CONTROL		

1. B. (2) Install connector tube or filter assembly as applicable, with new packings, into fuel control unit.

(3) Install new packing between fuel control unit and fuel pump assembly.

(4) Align the fuel control unit onto the fuel pump assembly, exercising care so that splines on coupling and fuel pump splines mesh properly.

(5) Install washers and nuts. Tighten nuts (155, 195, figure 201 or 202) to 65 inch-pounds torque.

(6) (Pre SB73-0028) Install bracket and support assembly.

(a) Install support assembly onto compressor housing and secure with washers, bolts, and nuts. Tighten nuts (40, figure 201 or 202) to 60 inch-pounds torque.

(b) Install bracket onto support assembly and secure with bolts. Tighten bolts (30, figure 201 or 202) to 55 inch-pounds torque.

(c) Install support, shimming as required from mounting boss on fuel control to bearing surface of support to avoid bending support. Tighten bolt (15, figure 201 or 202) to 60 inch-pounds torque.

(7) (Post SB73-0028) Install support assembly.

CAUTION: ATTACH SUPPORT ASSEMBLY TO FUEL CONTROL UNIT AND TIGHTEN PRIOR TO ATTACHING SUPPORT ASSEMBLY TO PLENUM FLANGE. NO WASHERS ARE ALLOWED BETWEEN SUPPORT ASSEMBLY AND FUEL CONTROL UNIT OR BETWEEN SUPPORT ASSEMBLY AND PLENUM FLANGE. SUPPORT ASSEMBLY IS DESIGNED TO CONFORM TO TOLERANCE CONDITION THAT MAY EXIST BETWEEN FUEL CONTROL UNIT AND PLENUM FLANGE.

(a) (Pre SB73-0029) Install bolts, washers, and nuts. Tighten nut (5, figure 201 or 202) to 55 inch-pounds torque.

(b) (Post SB73-0029) Install bolt and washer. Tighten bolt (110, figure 201 or 202) to 100 inch-pounds torque. Lockwire bolt.

(c) Install bolts, washers and nuts. Tighten bolts (95, 125, figure 201 or 202) to 60 inch-pounds torque.

R 1. B. (8) (Codes AA-AC, CA-CC) Install fuel enrichment valve assembly. Refer to 73-21-04, MAINTENANCE PRACTICES.

R (9) (Codes AA-AC, CA-CC) Connect electrical connector to fuel enrichment valve. Refer to Aircraft Maintenance Manual.

(10) Connect tube assemblies to fuel control. Refer to 73-10-01, 73-10-06, and 73-10-10, MAINTENANCE PRACTICES.

(11) Connect controls linkage assembly. Refer to 76-10-01, MAINTENANCE PRACTICES.

R C. (Codes FA-LA) Remove Fuel Control (See Figure 203)

(1) Disconnect controls linkage assembly. Refer to 76-10-01, MAINTENANCE PRACTICES.

(2) Disconnect tube assemblies from fuel control. Refer to 73-10-01 and 73-10-06, MAINTENANCE PRACTICES.

CAUTION: HANDLE INLET TEMPERATURE AND PRESSURE SENSOR WITH CARE, AS UNIT IS PRE-CALIBRATED. THE SENSING ELEMENT AND BELLOWS ARE PRECISION PARTS. CAPILLARY TUBE JOINING SENSING ELEMENT AND BELLOWS MUST NOT BE KINKED, OR LEAKAGE MAY RESULT.

R
R
R (3) Remove screws securing bellows end of inlet temperature and pressure sensor. Carefully remove bellows from fuel control. Remove packing.

(4) Remove fuel pressurizing valve, if required. Refer to 73-21-04, MAINTENANCE PRACTICES.

(5) Remove support and support assembly from rear of fuel control unit.

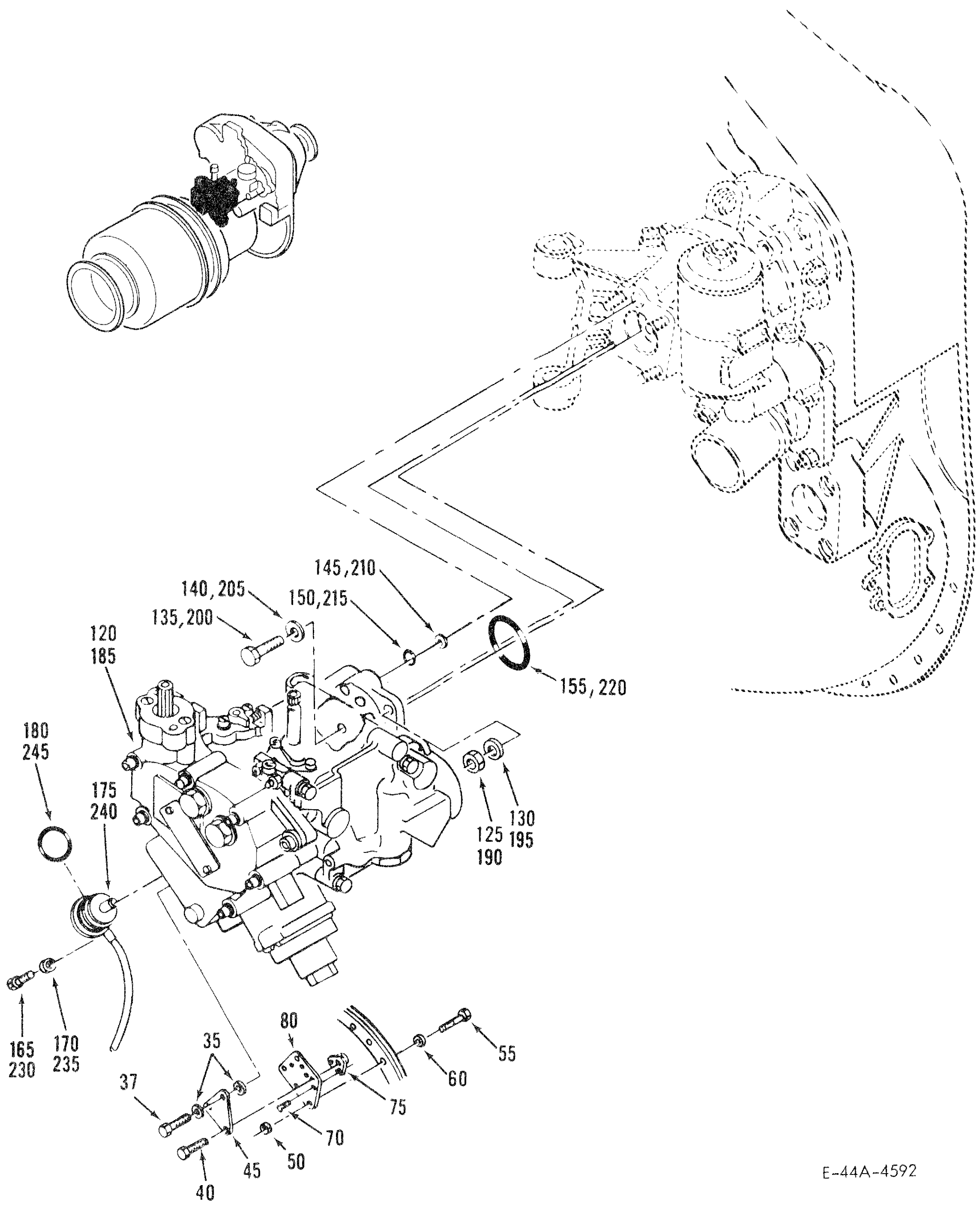
(6) Remove screw, nuts, and washers securing fuel control unit to fuel pump.

R
R
R
R CAUTION: DO NOT USE SCREWDRIVER OR OTHER POINTED OBJECT TO PRY FUEL CONTROL AWAY FROM FUEL PUMP AS THIS MAY DAMAGE FUEL CONTROL CASE OR P2 BELLOWS INSIDE END OF FUEL CONTROL.

(7) Remove fuel control unit in a straight line to avoid damage to drive splines.

(8) Remove packings and shims between fuel control unit and fuel pump assembly. Record number and thickness of shims.

R



R

(Codes FA-LA) Fuel Control Installation
Figure 203

R 1. D. (Codes FA-LA) Install Fuel Control (See Figure 203)

NOTE: Lubricate packings or gaskets used in fuel system with any type jet fuel prior to installation unless otherwise specified. Packings or gaskets used in pneumatic system may be installed dry. An alternate lubricant (OS-124) may be used on all packings or gaskets prior to installation unless otherwise specified; apply lubricant sparingly and spread evenly to a thin transparent film to minimize contamination. Apply lubricating compound (Liqui-Moly, Grade NV) to threads of bolts, screws, and studs unless otherwise specified.

R Refer to 70-00-00, STANDARD PRACTICES, for recommended
R general torque values. Add frictional drag (run-down)
R torque of self locking devices to recommended values.

(1) Install new packings between fuel control and fuel pump assembly.

(2) Install shims (145, 210, figure 203) into fuel pump assembly until Dimension A equals 0.250 to 0.270 inch. (See figure 204.)

(3) Align the fuel control unit onto the fuel pump assembly and secure with washers, nuts, and screw. Tighten nuts (125, 190, figure 203) and screw (135, 200, figure 203) to 65 inch-pounds torque.

KEY TO FIGURE 203

R	35.	WASHER (IPC FIG. 59)	130.	WASHER	190.	NUT
R	37.	BOLT (PN MS21280-11)	135.	SCREW	195.	WASHER
R	40.	BOLT	140.	WASHER	200.	SCREW
R	45.	SUPPORT	145.	WASHER	205.	WASHER
R	50.	NUT	150.	PACKING	210.	WASHER
R	55.	BOLT	155.	PACKING	215.	PACKING
R	60.	WASHER	165.	SCREW	220.	PACKING
R	70.	RIVET	170.	WASHER	230.	SCREW
R	75.	NUTPLATE	175.	INLET TEMPERATURE AND PRESSURE SENSOR	235.	WASHER
R	80.	SUPPORT ASSY			240.	INLET TEMPERATURE AND PRESSURE
R	120.	FUEL CONTROL				
R	125.	NUT	180.	PACKING	245.	PACKING
R			185.	FUEL CONTROL		

CAUTION: HANDLE INLET TEMPERATURE AND PRESSURE SENSOR WITH CARE, AS UNIT IS PRE-CALIBRATED. THE SENSING ELEMENT AND BELLOWS ARE PRECISION PARTS. CAPILLARY TUBE JOINING SENSING ELEMENT AND BELLOWS MUST NOT BE KINKED, OR LEAKAGE MAY RESULT.

1. D. (4) Install new packing onto bellows end of inlet temperature and pressure sensor and install into fuel control unit.

(5) Install washers and screws. Tighten screws (165, 230, figure 203) to 25 inch-pounds torque.

(6) Install support assembly onto compressor housing and secure with washers, bolts, and nuts. Tighten bolts (55) to 60 inch-pounds torque.

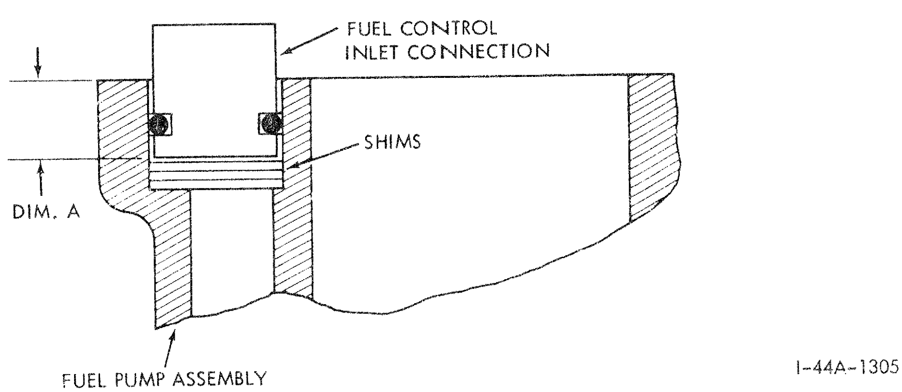
(7) Install support onto support assembly and secure with bolts. Tighten bolts (40) to 55 inch-pounds torque.

(8) Install support shimming as required from mounting boss on fuel control unit to bearing surface of support to avoid bending support. Use sufficient additional washers from surface of bolt to support to obtain 0.192 to 0.204 inch total between mounting boss on fuel control and bearing surface of bolt. Tighten bolt (37) to 60 inch-pounds torque.

(9) Connect tube assemblies to inlet temperature and pressure sensor in accordance with 73-10-01 and 75-10-01, MAINTENANCE PRACTICES.

(10) Connect tube assemblies to fuel control unit and fuel pressurizing valve in accordance with 73-10-01 and 73-10-06, MAINTENANCE PRACTICES.

R (11) Install fuel pressurizing valve assembly. Refer to 73-21-04, MAIN-
R TENANCE PRACTICES.



Shimming of Fuel Control Inlet Connection
Figure 204

2. Inspection/Check

A. Perform Inspection Check

(1) Check fuel control for security, loose fittings, fuel leakage, and obvious damage.

(2) Check fuel control for freedom of lever rotation.

CAUTION: IF FUEL FILTER ASSEMBLY IS BROKEN AND ALL BROKEN PIECES ARE NOT RECOVERED, REPLACE FUEL CONTROL UNIT.

(3) (Codes AA-EA) Visually inspect fuel filter assembly for cracks, breakage, corrosion, contamination, and obvious damage.

(4) Replace part that does not meet Inspection/Check requirements.

3. Cleaning/Painting

NOTE: Table 202 provides a list of all materials and compounds required to perform Cleaning/Painting.

Table 202. Materials and Compounds

Equipment or Material	Manufacturer
NOTE Equivalent substitutes may be used for listed items.	
Beaker (200 milliliter capacity)	Commercially available
Blackstone heated tank ultrasonic cleaner (Model HT 1.9)	Blackstone Ultrasonics Inc, 1111 Allen St, Jamestown, NY 14701
Alternate Sonac ultrasonic cleaner (Model S-2)	Cooper Laboratories Inc, Wayne, NJ 07470
Dowclene WR	Dow Chemical Corp, S Saginaw Rd, Midland, MI 48640
Solvent, Stoddard (Federal Specification P-D-680, Type I)	Commercially available

3. A. Clean Parts

(1) Clean all standard metallic hardware. Refer to 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 1 or 2.

(2) Clean fittings. Refer to 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 12.

(3) Clean outside surfaces of fuel control. Refer to 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 1.

B. Perform Special Cleaning

R (1) (Codes AA-EA) Clean inlet fuel filter assembly.

NOTE: Beaker is used in ultrasonic cleaner to conserve cleaning agent. Water is used in ultrasonic cleaner tank as transmitting fluid.

(a) Place inlet fuel filter open end down in beaker and fill beaker with Dowclene WR to submerge fuel inlet filter.

(b) Place beaker containing fuel inlet filter in ultrasonic cleaner tank and fill ultrasonic cleaner tank to within three-eighths inch of top with water.

(c) Operate ultrasonic cleaner for fifteen minutes.

(d) Discard contaminated Dowclene WR and rinse fuel inlet filter and beaker with clean Dowclene WR using plastic squeeze bottle.

(e) Refill beaker with clean Dowclene WR and operate ultrasonic cleaner for an additional fifteen minutes.

(f) Repeat steps (d) and (e) for one hour. Ensure that Dowclene WR remains clean after final operation period.

(g) Remove the inlet fuel filter from the beaker and blow dry using clean, low pressure air supply.

(h) Rinse the inlet fuel filter with solvent, Stoddard (Federal Specification P-D-680, Type I).

4. Approved Repairs

NOTE: Table 203 provides a list of all materials and compounds required to perform Approved Repairs.

Table 203. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Alternate packing lubricant Lubricant (OS-124)	Monsanto Company, 800 N Lindbergh Blvd, St. Louis, MO 63166
Any approved engine fuel	Commercially available
Penetrating oil (WD-40)	Commercially available
Plastic fiber bristled brush	Commercially available
Solvent, Stoddard (Federal Specification P-D-680, Type I)	Commercially available

R A. (Codes AA-EA) Perform Repair Procedures for No Engine Start and No Fuel Flow from Outlet of Fuel Control as Follows

(1) Remove, clean, and reinstall fuel control by-pass valve as follows. (See figure 205.)

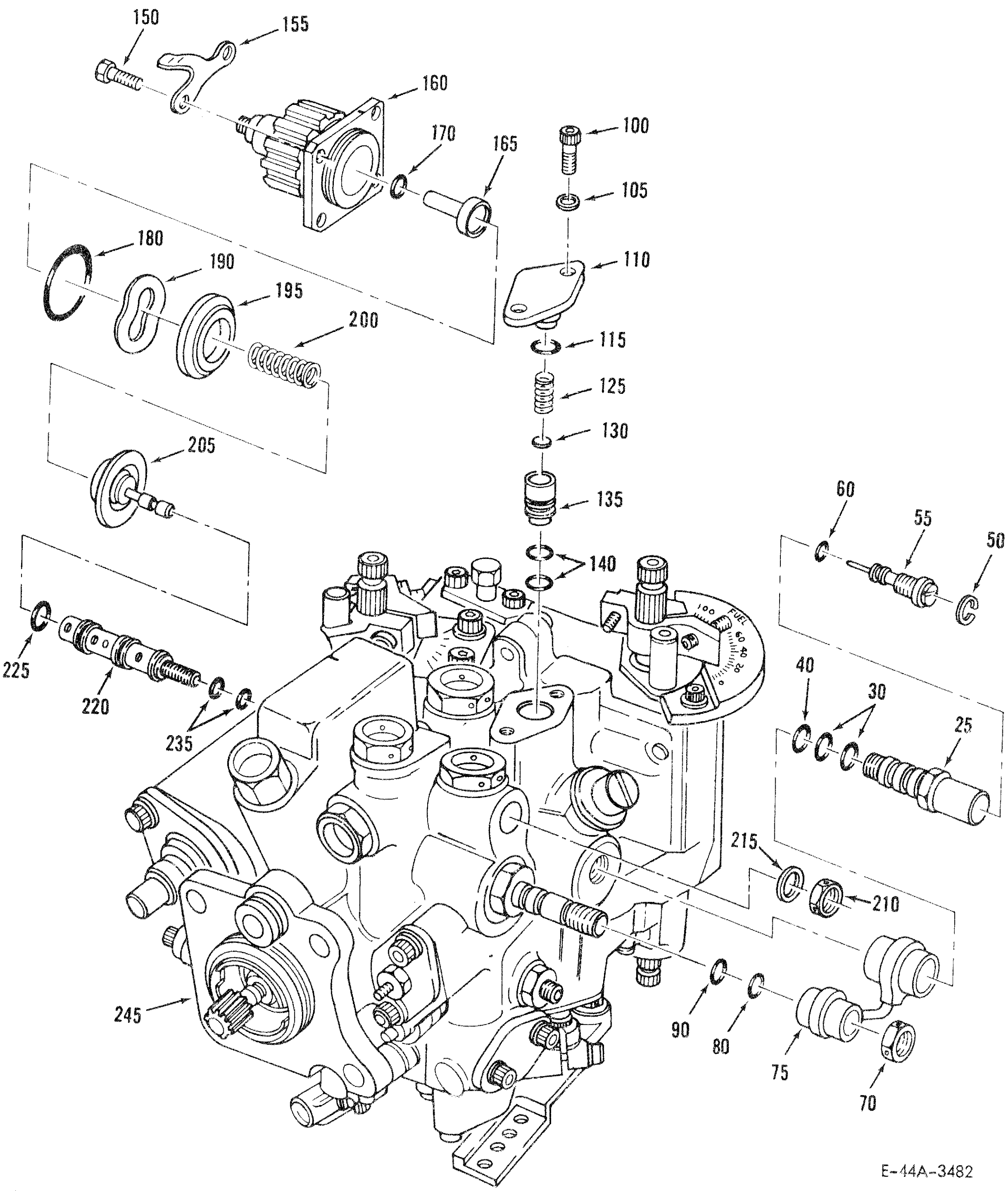
(a) Mark the by-pass valve flange and fuel control casting to keep same relative position.

(b) Measure distance from by-pass valve flange to top of specific gravity notched detent cap and record specific gravity setting. This measurement is a reference in case the specific gravity notched detent cap is rotated from its original setting.

(c) Remove screws securing by-pass valve to fuel control unit.

(d) Remove detent spring and remove bypass valve cover assembly by gently working back and forth. The spring under the cover may push cover assembly out. The spring is not attached to cover and is removed as a separate part.

R



(Codes AA-EA) Fuel Control
(Partial Field Maintenance Breakdown)
Figure 205

4. A. (1) (e) Remove the spring washer and diaphragm retainer ring.

R CAUTION: DO NOT DAMAGE DIAPHRAGM OF BY-PASS VALVE ASSEM-
R BLY DURING REMOVAL.

R NOTE: If diaphragm sticks during removal, use a wooden
R or plastic probe to release the diaphragm seal at
R outer diameter.

(f) Remove by-pass valve assembly by grasping the cap shaped diaphragm retainer on the by-pass valve assembly with needle nose pliers and gently pulling assembly from fuel control unit.

(g) Remove nut securing by-pass valve sleeve in fuel control body and remove by-pass valve sleeve from body.

(h) Remove packing from by-pass valve bore and packings from by-pass valve sleeve.

CAUTION: OPERATING BOOST PUMP WILL FLUSH A LARGE QUANTITY OF FUEL FROM BY-PASS VALVE AREA. OPERATE BOOST PUMP MOMENTARILY TO AVOID EXCESS FUEL DRAINAGE.

(i) Provide a container to catch fuel overflow and flush by-pass valve assembly cavity with fuel, using the electrically driven boost pump.

(j) Lubricate packing with clean engine fuel or lubricant (OS-124) and install in bottom of by-pass valve bore, making sure it is properly centered in bore.

KEY TO FIGURE 205

25.	SEAT (STARTING VALVE)	105.	WASHER	170.	PACKING
R	(IPC FIG. 65)	110.	RETAINER	180.	PACKING
30.	PACKING	115.	PACKING	190.	SPRING WASHER
40.	PACKING	125.	SPRING	195.	RETAINER
50.	RETAINING RING	130.	SHIM	200.	SPRING
55.	VALVE (START FLOW	135.	VALVE	205.	BY-PASS VALVE ASSY
	ADJUSTMENT NEELDE)		(PRESSURIZING)	210.	NUT
60.	PACKING	140.	PACKING	215.	WASHER
70.	NUT	150.	SCREW	220.	BY-PASS VALVE SLEEVE
75.	TUBE ASSY	155.	CLIP	225.	PACKING
80.	PACKING	160.	CAP AND COVER	235.	PACKING
90.	PACKING	165.	GUIDE	245.	FUEL CONTROL BODY
100.	SCREW				

4. A. (1) (k) Lubricate packings with clean engine fuel or lubricant (OS-124) and install on by-pass valve sleeve.

(l) Install by-pass valve sleeve into bore of fuel control body. Rotate by-pass valve sleeve slightly to ensure packing installed in bore seats properly. Secure by-pass valve sleeve with washer and nut. Tighten nut (210, figure 205) to 20 to 25 inch-pounds torque.

(m) Install by-pass valve assembly in fuel control unit.

(n) Install diaphragm retainer ring, spring washer, and spring.

(o) Install new packing on by-pass valve cover assembly.

(p) Install by-pass valve cover assembly and detent spring, aligning reference marks made in step (a). Secure with screws and tighten screws (150, figure 205) to 30 inch-pounds torque.

(q) Check for proper specific gravity setting and reference measurement made in step (b).

(2) Remove, clean, and reinstall fuel control pressurizing valve as follows. (See figure 205.)

(a) Remove two screws and washers securing cover.

(b) Gently move cover back and forth to remove. Inspect packing on cover to ensure that it is not chipped.

(c) Inspect small bleed hole in cover for obstruction. If bleed hole is plugged, pressurizing valve will not open.

NOTE: Use care not to damage or misplace laminated shims under spring.

(d) Remove spring. Using soft metal probe, move pressurizing valve up and down in sleeve, checking for freedom of movement. The pressurizing valve and packings may be removed and the area flushed as described in step (1)(i).

(e) Lubricate new packings with clean engine fuel or lubricant (OS-124) and install on pressurizing valve. Reinstall pressurizing valve, if removed. Install spring.

(f) Lubricate new packing with clean engine fuel or lubricant (OS-124) and install on cover. Install cover and secure with screws and washers. Tighten screws (100, figure 205) alternately in 5 inch-pounds increments to 30 inch-pounds torque.

R 4. B. (Codes AA-EA) Perform Repair Procedures for No Acceleration to Idle or Slow Acceleration to Underspeed Governor High as Follows.

(1) Remove, clean, and reinstall start fuel adjustment valve as follows. (See figure 205.)

(a) Remove start adjustment valve and seat assembly.

(b) Remove nut, and slide tube assembly off of adapter.

NOTE: Record number of clicks when removing starting bleed valve to aid in reassembly.

(c) Turn starting valve (start flow adjustment needle) counterclockwise, counting the number of clicks until valve contacts stop. Record number of clicks.

(d) Turn starting valve (start flow adjusting needle) a few turns clockwise in order to remove retaining ring. Remove retaining ring.

(e) Turn starting valve (start flow adjustment needle) counterclockwise as far as it will go. The valve only comes out flush with starting valve seat, so a push from the opposite side may be necessary for removal.

(f) With starting valve (start flow adjusting needle) removed, clean the contoured needle of starting bleed valve and orifice in starting valve seat with solvent, Stoddard (Federal Specification P-D-680, Type I), and clean, low pressure air.

(g) Lubricate new packing with clean engine fuel or lubricant (OS-124) and install on starting valve (start flow adjustment needle). Install valve in starting valve seat and turn in sufficient turns clockwise to install retaining ring.

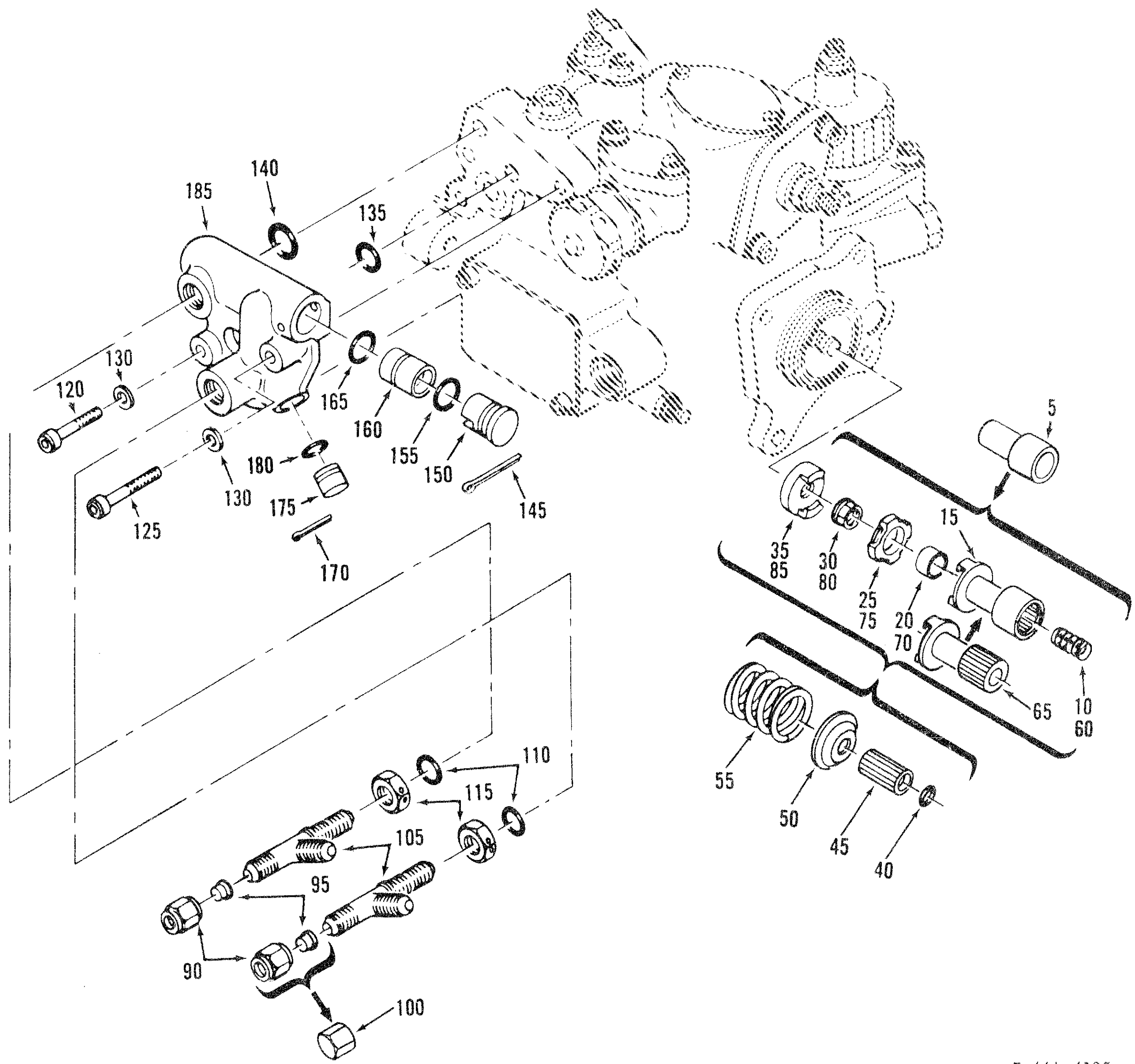
(h) Install retaining ring and turn starting valve (start flow adjustment needle) counterclockwise until it contacts stop.

(i) Turn starting valve (start flow adjustment needle) clockwise the same number of clicks recorded in step (c).

(j) Lubricate new packings with clean engine fuel or lubricant (OS-124) and install on start adjustment valve and seat assembly and adapter for tube assembly.

(k) Install tube assembly on adapter and install nut. Tighten nut (70, figure 205) to 35 to 40 inch-pounds torque.

R



(Codes AA-EA) Fuel Control
(Partial Field Maintenance Breakdown)
Figure 206

4. B. (1) (1) Install start adjustment valve and seat assembly (25, figure 205) and tighten to 45 to 50 inch-pounds torque.

R C. (Codes AA-EA) Perform Repair Procedure for Overspeed During Engine Start, Sudden Upward Change in Flight Idle Setting, Inability to Decelerate to Underspeed Governor Low, Inability to Reduce Torque with Power Lever, or a Change in Power Lever Relationship at High Power or in Cruise.

NOTE: Perform all other standard procedures contained in 72-00-00, TROUBLE SHOOTING prior to accomplishing the following procedure.

(1) Disassemble and clean check valve housing assembly. (See figure 206.)

(a) Disconnect pneumatic heater lines from fuel control unit tee fittings. Disconnect fuel control heat line.

(b) Remove screws and remove check valve housing assembly from fuel control unit. Remove packings.

(c) Thread a No. 6-32 screw into the plugs to remove plugs. Remove packings.

(d) Using a fitting with an AN-4 thread, remove check valve. Remove packing.

(e) Remove caps, bleeds, tee fittings, jam nuts, and packings. Check for signs of corrosion between tee fittings and housing.

(f) Reverse flush tee fittings with solvent, Stoddard (Federal Specification P-D-680, Type I). Clean check valve housing, check valve, and plugs, using solvent and a plastic fiber bristled brush. An ultrasonic cleaning method may be used, if available.

KEY TO FIGURE 206

R 5. COUPLING (IPC FIG. 66)
R 10. SPRING
R 15. COUPLING
R 20. SLEEVE
R 25. COUPLING
R 30. NUT
R 35. COUPLING
R 40. RING
R 45. COUPLING
R 50. RETAINER
R 55. SPRING
R 60. SPRING
R 65. COUPLING
70. SLEEVE
75. COUPLING
80. NUT
85. COUPLING
90. CAP NUT
95. RESTRICTOR
100. CAP
105. TEE
110. PACKING
115. NUT
120. SCREW
125. SCREW
130. WASHER
135. PACKING
140. PACKING
145. COTTER PIN
150. PLUG
155. PACKING
160. CHECK VALVE
165. PACKING
170. COTTER PIN
175. PLUG
180. PACKING
185. BODY ASSY

4. C. (1) (g) Lubricate new packings with clean engine fuel or lubricant (OS-124) and install packings and jam nuts on tee fittings. Spray ends of tee fittings lightly with penetrating oil (WD-40) to help prevent formation of corrosion. Install tee fittings in housing, orient in proper direction, and tighten jam nuts (115) to 50 inch-pounds torque. Install bleeds and caps. Tighten caps (90, 100) to 50 inch-pounds torque.

(h) Lubricate new packings with clean engine fuel or lubricant (OS-124) and install on parting surface of check valve housing. Install housing on fuel control unit.

CAUTION: THE CHECK VALVE HOUSING ALSO SERVES AS A BEARING RETAINER FOR CONDITION LEVER SHAFT. INSTALL RETAINING SCREWS EVENLY AND TIGHTEN ALTERNATELY SO BEARING REMAINS ALIGNED.

(i) Install screws (120, 125) and tighten alternately in 10 inch-pound increments to 30 inch-pounds torque.

(j) Lubricate new packings with clean engine fuel or lubricant (OS-124) and install packings, check valve, and plugs. Install cotter pins.

R D. Replace Damaged Couplings

R (1) (Codes AA-AC, CA-CC) Remove coupling or coupling assembly as
R follows. (See figure 206.)

R (a) (Fuel Controls Part No. 893528-16/-19/-28) Remove single piece
R coupling (5).

R NOTE: Do not remove nut (30) or coupling (35).

R (b) (Fuel Control Part No. 893528-24/-31) Remove spring (10),
R coupling (15), sleeve (20) and coupling (spider) (25).

R (2) (Codes AA-AC, CA-CC) Install coupling or coupling assembly as
R follows. (See figure 206.)

R (a) (Fuel Control Part No. 893528-16/-19/-28) Install single piece
R coupling.

R NOTE: Ensure lugs of couplings (15 and 35) lock
R onto coupling (spider) (25).

R (b) (Fuel Controls Part No. 893528-24/-31) Install coupling
R (spider) around nut and onto lugs of threaded coupling. In-
R stall sleeve, coupling and spring.

R 4. D. (3) (Codes BA-BC, EA) Remove coupling or coupling assembly as follows.
R (See figure 206.)

R (a) (Fuel Controls Part No. 895410-8 or 895410-9, Pre SB73-0027)
R Remove single piece coupling.

R (b) (Fuel Control Part No. 895410-9, Post SB73-0027) Push coupling
R against spring retainer and remove ring (40). Remove coupling
R (45), retainer (50) and spring (55).

R NOTE: Do not remove nut (80) or coupling (85).

R (c) (Fuel Control Part No. 895410-12/-15) Remove spring (60),
R coupling (65), sleeve (70) and coupling (spider) (75).

R (4) (Codes BA-BC, EA) Install coupling or coupling assembly as follows.
R (See figure 206.)

R (a) (Fuel Controls Part No. 895410-8 or 895410-9 Pre SB73-0027)
R Install single piece coupling.

R (b) (Fuel Control Part No. 895410-9, Post SB73-0027) Install
R spring (55), retainer (50) and coupling (45). Push coupling
R against retainer and compress spring, install ring (40),
R release coupling.

R NOTE: Ensure lugs of coupling (65 and 85) lock onto
R coupling (spider) (75).

R (c) (Fuel Control Part No. 895410-12/-15) Install coupling
R (spider) around nut and onto lugs of threaded coupling (85).
R Install sleeve, coupling and spring.

FUEL PUMP ASSEMBLY - MAINTENANCE PRACTICES

1. Removal/Installation

NOTE: Table 201 provides a list of all materials and compounds required to perform Removal/Installation.

Table 201. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Alternate packing lubricant Lubricant (OS-124)	Monsanto Company, 800 N Lindbergh Blvd, St. Louis, MO 63166
Any approved engine fuel	Commercially available
Any approved engine oil	Commercially available

R A. (Codes AA-EA) Remove Fuel Pump Assembly (See Figures 201, 202)

(1) Remove fuel control and pump assembly. Refer to 73-20-01, MAINTENANCE PRACTICES.

(2) Separate fuel control unit from fuel pump assembly. Refer to 73-21-05, MAINTENANCE PRACTICES.

R (3) (Codes AA-AC, CA-CC) Remove plugs from fuel pump assembly. Remove packings from plugs. (See figure 201.)

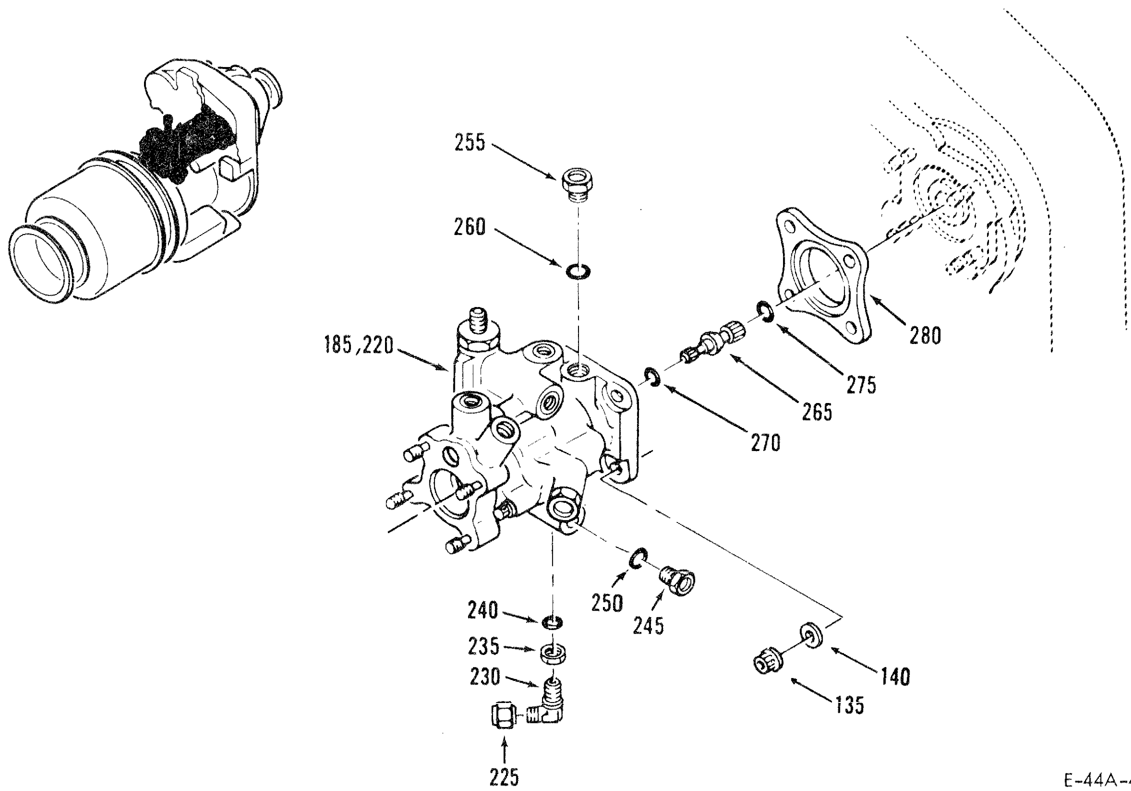
R (4) (Codes CA-CC) Remove cap, elbow, packing and nut. (See figure 201.)

R B. (Codes AA-EA) Install Fuel Pump Assembly (See Figures 201, 202)

NOTE: Lubricate new packings with clean engine fuel or alternate lubricant (OS-124) prior to installation. Apply clean engine oil to threads (except first two threads) of plugs and elbow.

R (1) (Codes AA-AC, CA-CC) Install new packings onto plugs and install into fuel pump assembly. Tighten plug (245, figure 201) to 25 to 30 inch-pounds torque. Tighten plug (255) to 65 to 75 inch-pounds torque.

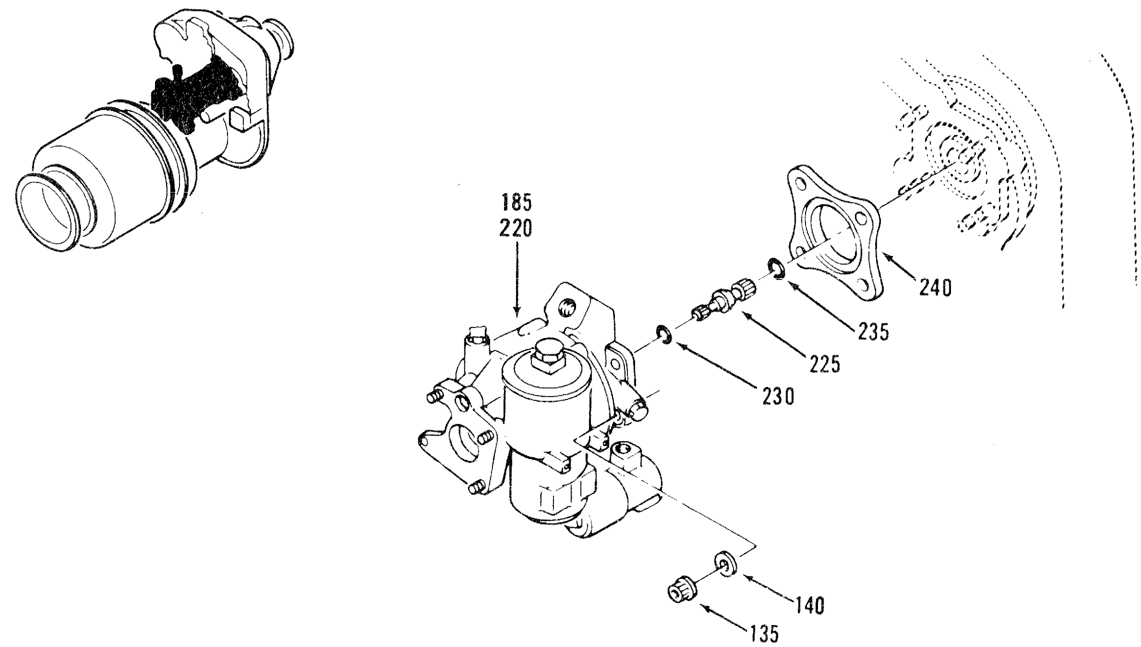
R



R 135. NUT (IPC FIG. 57)
140. WASHER
185. FUEL PUMP ASSY
220. FUEL PUMP ASSY
225. CAP
230. ELBOW
235. NUT
240. PACKING
245. PLUG
250. PACKING
255. PLUG
260. PACKING
265. COUPLING
270. PACKING
275. PACKING
280. INSULATOR/SPACER

R (Codes AA-AC, CA-CC) Fuel Pump Installation
Figure 201

R



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R 135.	NUT (IPC FIG. 58)	225.	COUPLING
R 140.	WASHER	230.	PACKING
R 185.	FUEL PUMP ASSY	235.	PACKING
R 220.	FUEL PUMP ASSY	240.	INSULATOR/SPACER

R (Codes BA-BC, EA) Fuel Pump Installation
Figure 202

R 1. B. (2) (Codes CA-CC) Install nut and packing onto elbow. Install elbow. Tighten nut (235, figure 201) to 50 inch-pounds torque. Install cap (225).

(3) Install fuel pump assembly on fuel control. Refer to 73-21-05, MAINTENANCE PRACTICES.

(4) Install fuel control and pump assembly. Refer to 73-20-01, MAINTENANCE PRACTICES.

R C. (Codes FA-LA) Remove Fuel Pump Assembly (See Figure 203)

(1) Remove fuel control and pump assembly. Refer to 73-20-01, MAINTENANCE PRACTICES.

(2) Separate fuel control from fuel pump assembly. Refer to 73-21-05, MAINTENANCE PRACTICES.

(3) (Code HA) Remove adapter, packing and nut.

R D. (Codes FA-LA) Install Fuel Pump Assembly (See Figure 203)

NOTE: Lubricate new packings with clean engine fuel or alternate lubricant (OS-124) prior to installation. Apply clean engine oil to threads (except first two threads) of adapter.

(1) (Code HA) Install adapter, with new packing, and secure with nut. Tighten nut (260, figure 203) to 40 to 45 inch-pounds torque.

(2) Install fuel pump assembly on fuel control. Refer to 73-21-05, MAINTENANCE PRACTICES.

(3) Install fuel control and pump assembly. Refer to 73-20-01, MAINTENANCE PRACTICES.

2. Adjustment/Test

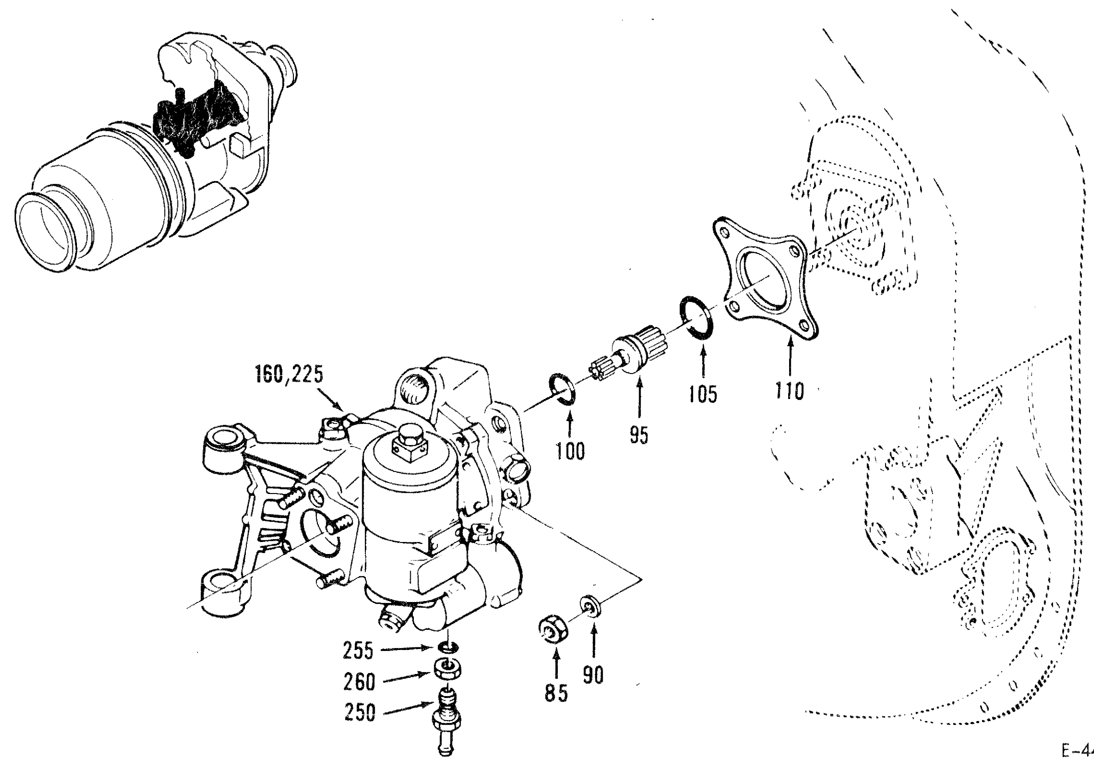
A. Perform Adjustment/Test of Fuel Pump as Outlined in 72-00-00, GENERAL - ADJUSTMENT/TEST

3. Inspection/Check

A. Inspect Fuel Pump Assembly

(1) Check fuel pump assembly for security, fuel leakage, loose fittings, or obvious damage.

R



R 85.	NUT (IPC FIG. 59)	160.	FUEL PUMP ASSY
R 90.	WASHER	225.	FUEL PUMP ASSY
R 95.	COUPLING	250.	ADAPTER
R 100.	PACKING	255.	PACKING
R 105.	PACKING	260.	NUT
R 110.	INSULATOR/SPACER		

R (Codes FA-LA) Fuel Pump Installation
Figure 203

3. A. (2) Inspect splines of reduction gear section cavity, fuel pump assembly cavity, and drive coupling in accordance with 73-20-01, Inspection/Check.

(3) Replace part that does not meet Inspection/Check requirements.

4. Cleaning/Painting

A. Clean Parts

(1) Clean all standard metallic hardware in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 1 or 2.

(3) Clean outside surfaces of fuel pump assembly in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 1.

(3) Clean fuel pump splines. Refer to 73-20-01, Cleaning/Painting.

R (CODES AA-BC, EA-GA, KA-LA) TORQUE/TEMPERATURE LIMITER
R (BY-PASS VALVE) - DESCRIPTION AND OPERATION

The torque limiter (by-pass valve) is essentially a fuel by-pass valve inserted in the fuel system between the fuel control and the engine fuel nozzles. The assembly consists of a torque motor with two coils wound in parallel. When electrically energized, the torque motor moves a beam to uncover a plate valve which receives high pressure fuel from the fuel control. When the torque motor receives the appropriate electrical signal from the electronic controller the beam is moved away from the plate valve permitting fuel to by-pass back to fuel pump inlet. By-passing the fuel reduces the amount to the fuel nozzles and accordingly reduces engine torque. During normal starting, acceleration, and engine torque settings the torque limiter plate valve is closed.

R TORQUE/TEMPERATURE LIMITER (BY-PASS VALVE) - MAINTENANCE PRACTICES

1. Removal/Installation

NOTE: Table 201 provides a list of all materials and compounds required to perform Removal/Installation.

Table 201. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Alternate packing lubricant Lubricant (OS-124)	Monsanto Company, 800 N Lindbergh Blvd, St. Louis, MO 63166
Any approved engine oil	Commercially available
Lubricating compound (Liqui-Moly, Grade NV)	Lockrey Co, Lubricants Div, Cedar Shores, Southampton, NY 11968

R A. (Codes AA-AC) Remove Torque Limiter (By-Pass Valve) and Plumbing (See Figures 201, 202)

(1) Remove tube assemblies and attaching hardware. (See figures 201.)

(2) Remove reducer and gasket from fuel control.

(3) Remove electrical connector from torque limiter. Refer to Aircraft Maintenance Manual.

(4) Remove bolts securing torque limiter to bracket and remove bracket from engine. (See figure 202.)

(5) Remove reducer and gasket from torque limiter.

(6) Refer to Approved Repairs for removal and installation of filter.

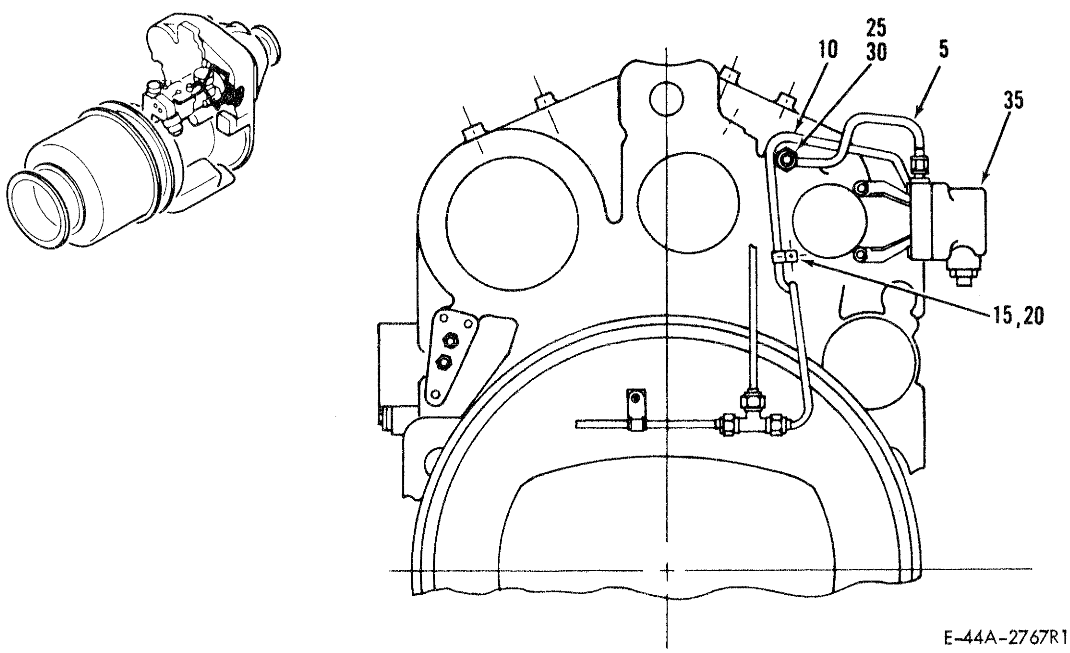
R 1. B. (Codes AA-AC) Install Torque Limiter (By-Pass Valve) and Plumbing (See Figures 201, 202)

NOTE: Lightly coat new packings or gaskets with clean engine oil or fuel as applicable or alternate lubricant (OS-124) prior to installation unless otherwise specified. Apply lubricating compound (Liqui-Moly, Grade NV) to threads of bolts or screws, and apply clean engine oil to threads (except first two threads) of male plumbing fittings located forward of the fireshield unless specified.

R Refer to 70-00-00, STANDARD PRACTICES, for recommended
R general torque values. Add frictional drag (run-down)
R torque of self locking devices to recommended values.

(1) Install bracket on engine and secure with nuts. Tighten nuts (15, figure 202) to 50 inch-pounds torque.

R



R 5. TUBE ASSY
R (IPC FIG. 15)
R 10. TUBE ASSY
R 15. NUT
20. CLAMP
25. GASKET
30. REDUCER
35. TORQUE LIMITER

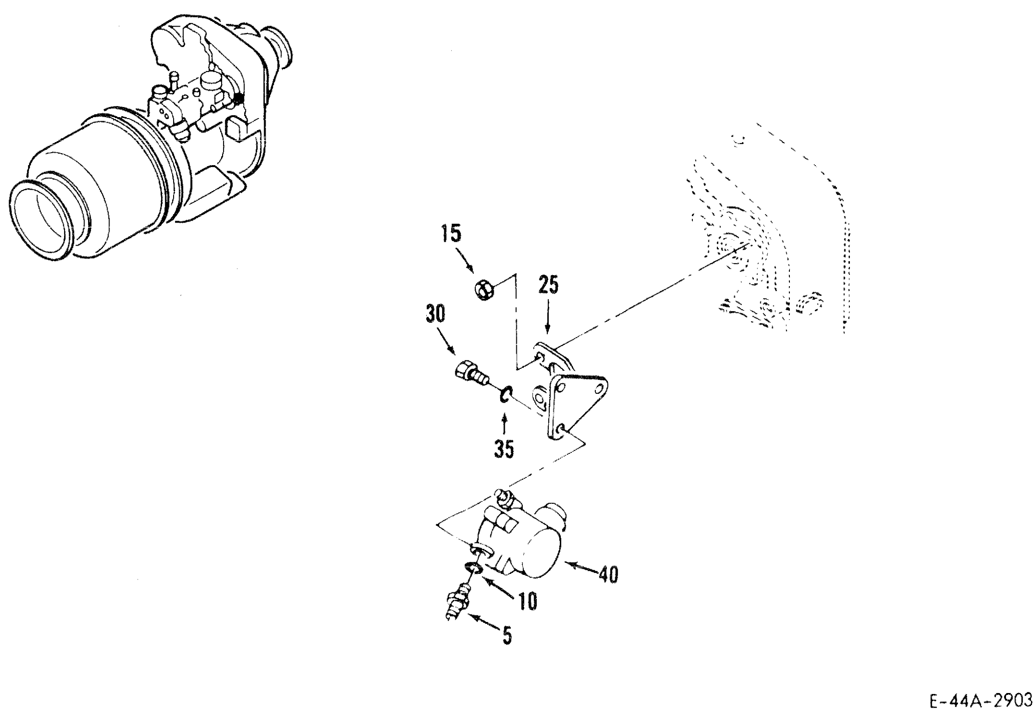
(Codes AA-AC) Torque Limiter Plumbing Installation
Figure 201

1. B. (2) Install limiter on bracket and secure with bolts and washers. Tighten bolts (30) to 15 inch-pounds torque.

(3) Install reducer, with new gasket, into torque limiter assembly. Tighten reducer (5) to 12 to 15 inch-pounds torque.

(4) Install reducer, with new gasket, into fuel control. Tighten reducer (30, figure 201) to 60 to 65 inch-pounds torque.

(5) Install tube assemblies, with attaching hardware. Tighten nut (15) to 50 inch-pounds torque.



R 5. REDUCER (IPC FIG. 49)
10. GASKET
15. NUT
25. BRACKET
30. BOLT
35. WASHER
40. TORQUE LIMITER

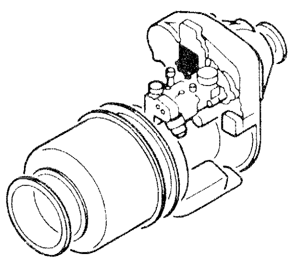
R (Codes AA-AC) Torque Limiter Installation
Figure 202

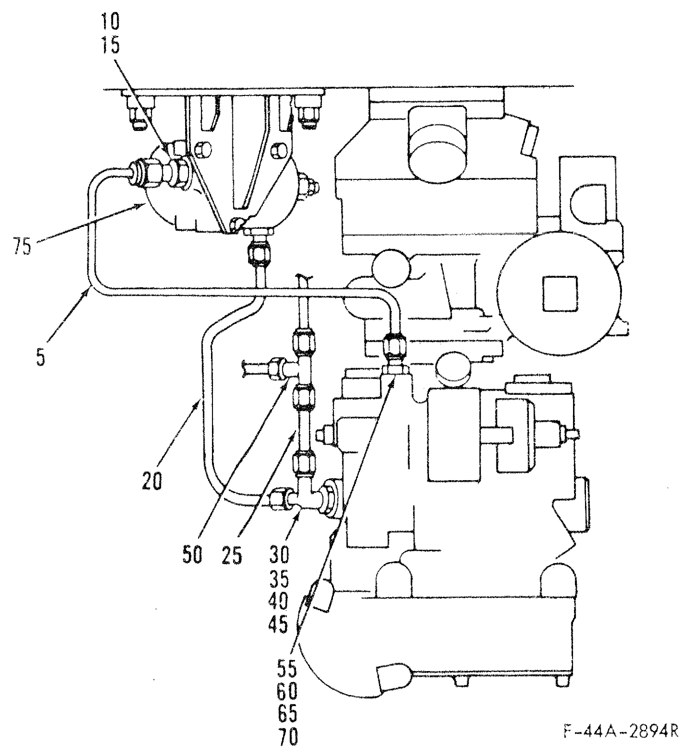
R 1. C. (Codes BA-BC, EA) Remove Torque and Temperature Limiter (By-Pass Valve) and Plumbing (See Figures 203, 204)

(1) Remove tube assemblies. (See figure 203.)

(2) Remove reducer and gasket from torque limiter assembly.

R





R 5. TUBE ASSY (IPC FIG. 16)
R 10. REDUCER
R 15. PACKING
R 20. TUBE ASSY
R 25. TUBE ASSY
R 30. ELBOW/TEE
35. GASKET
40. RING
45. NUT
50. TEE
55. FITTING/UNION
60. PACKING
65. RING
70. NUT
75. TORQUE AND TEMPERATURE LIMITER (BY-PASS VALVE)

(Codes BA-BC, EA) Torque and Temperature Limiter Plumbing Installation
Figure 203

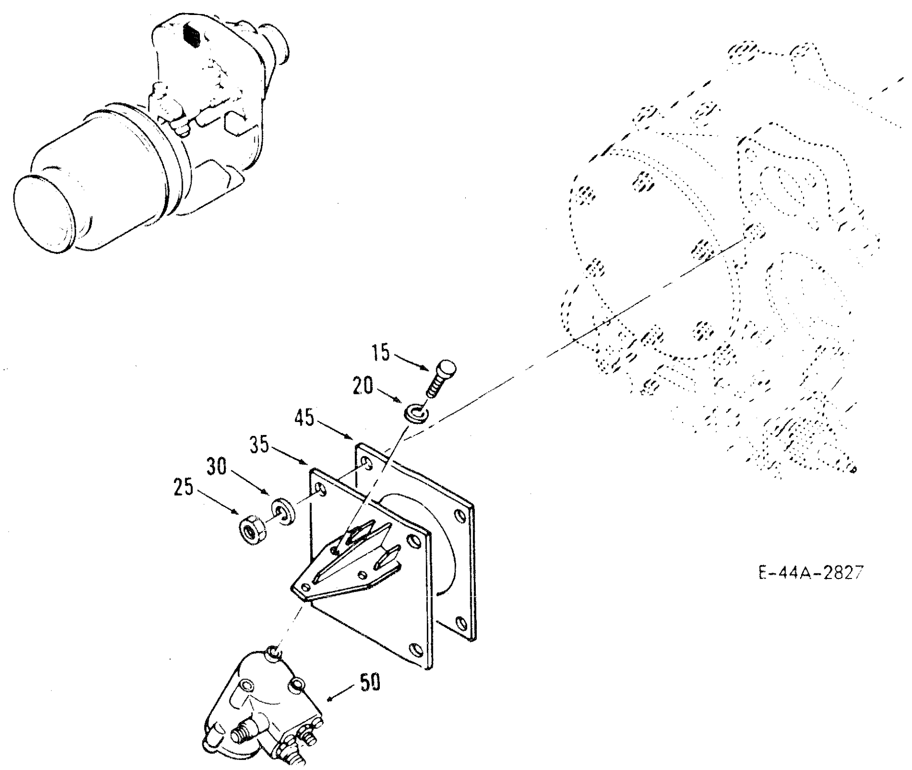
1. C. (3) Remove fitting, gasket, ring and nut or union and gasket from fuel control. Remove elbow/tee, gasket, ring and nut from fuel control.

(4) Remove electrical connector from torque limiter assembly. Refer to Aircraft Maintenance Manual.

(5) Remove torque limiter from bracket. (See figure 204.)

(6) Remove bracket and gasket from engine.

(7) Refer to Approved Repairs for removal and installation of filter.



R 15. BOLT (IPC FIG. 50)
20. WASHER
25. NUT
30. WASHER
35. BRACKET
45. GASKET
50. TORQUE AND TEMPERATURE LIMITER

R (Codes BA-BC, EA, GA, KA) Torque and Temperature Limiter Installation
Figure 204

R 1. D. (Codes BA-BC, EA) Install Torque and Temperature Limiter (By-Pass Valve) and Plumbing (See Figures 203, 204)

NOTE: Lightly coat new packings or gaskets with clean engine oil or fuel as applicable or alternate lubricant (OS-124) prior to installation unless otherwise specified. Apply lubricating compound (Liqui-Moly, Grade NV) to threads of bolts or screws, and apply clean engine oil to threads (except first two threads) of male plumbing fittings located forward of the fireshield unless otherwise specified.

R
R
R Refer to 70-00-00, STANDARD PRACTICES, for recommended general torque values. Add frictional drag (run-down) torque of self locking devices to recommended values.

(1) Install bracket with gasket onto engine and secure with washers and nuts. Tighten nuts (25, figure 204) to 100 inch-pounds torque.

(2) Install torque limiter on bracket and secure with bolts and washers. Tighten bolts (15) to 15 inch-pounds torque.

(3) Install reducer, with new gasket, into torque limiter. Tighten reducer (10, figure 203) to 12 to 15 inch-pounds torque.

(4) Install union with new gasket, or fitting with new gasket and ring into fuel control. Secure fitting with nut. Tighten union or nut (70) to 60 to 65 inch-pounds torque.

(5) Install elbow, with new gasket, and ring into fuel control and secure with nut. Tighten nut (45) to 65 to 70 inch-pounds torque.

(6) Install tube assembly between torque limiter and elbow in fuel control.

(7) Install tube assembly between reducer in torque limiter and union or fitting in fuel control.

(8) Install electrical connector on torque limiter. Refer to Aircraft Maintenance Manual.

R
R E. (Codes FA, LA) Remove Torque and Temperature Limiter (By-Pass Valve) and Plumbing (See Figures 205, 206)

R (1) Remove tube assemblies and attaching parts. (See figure 205.)

R (2) Remove electrical connector. Refer to Aircraft Maintenance Manual.

R
R (3) Remove elbow, packing, ring and nut from torque and temperature limiter (by-pass valve).

R (4) Remove special bolt and elbow from fuel pump. Remove packings.

1. E. (5) Remove assembled bracket and torque and temperature limiter from fuel pump. (See figure 206.)

(6) Remove torque and temperature limiter from bracket.

(7) Refer to Approved Repairs for removal and installation of filter.

F. (Codes FA, LA) Install Torque and Temperature Limiter (By-Pass Valve) and Plumbing (See Figures 205, 206)

NOTE: Lightly coat new packings or gaskets with clean engine oil or fuel as applicable or alternate lubricant (OS-124) prior to installation unless otherwise specified. Apply lubricating compound (Liqui-Moly, Grade NV) to threads of bolts or screws, and apply clean engine oil to threades (except first two threads) of male plumbing fittings located forward of the fireshield unless otherwise specified.

Refer to 70-00-00, STANDARD PRACTICES, for recommended general torque values. Add frictional drag (run-down) torque of self locking devices to recommended values.

(1) Install torque and temperature limiter onto bracket. Tighten bolts (20, figure 206) to 15 inch-pounds torque.

(2) Install assembled bracket and torque and temperature limiter onto fuel pump. (See figure 206.) Tighten bolts (5, 10) to 35 inch-pounds torque.

(3) Install special bolt and elbow, with new packings, onto fuel pump. Tighten bolt (40, figure 205) to 27 to 35 inch-pounds torque.

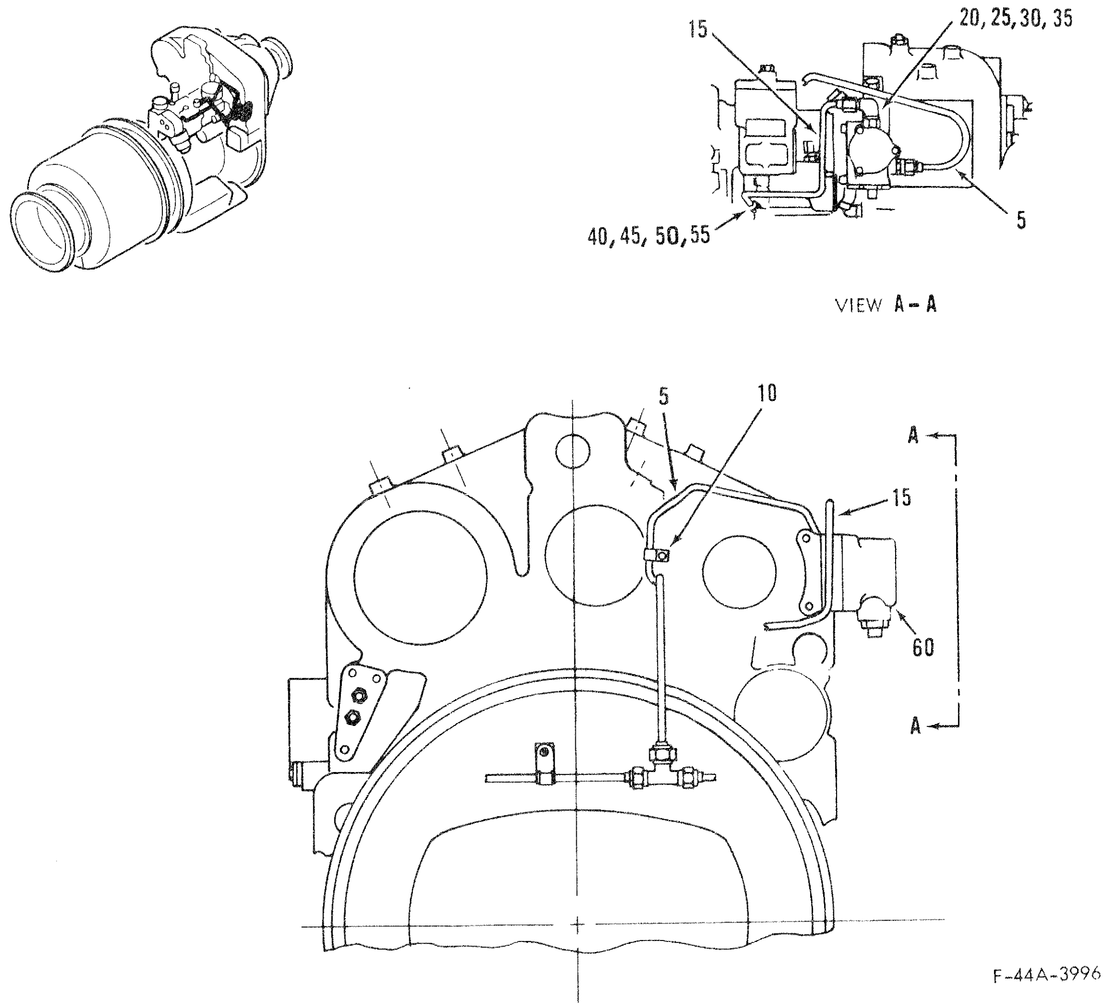
(4) Install nut, ring and new packing onto elbow. Install elbow onto torque and temperature limiter. Tighten nut (35) to 20 to 25 inch-pounds torque.

(5) Install filter. Refer to Approved Repairs.

(6) Install tube assemblies and attaching parts. (See figure 205.)

(7) Install electrical connector. Refer to Aircraft Maintenance Manual.

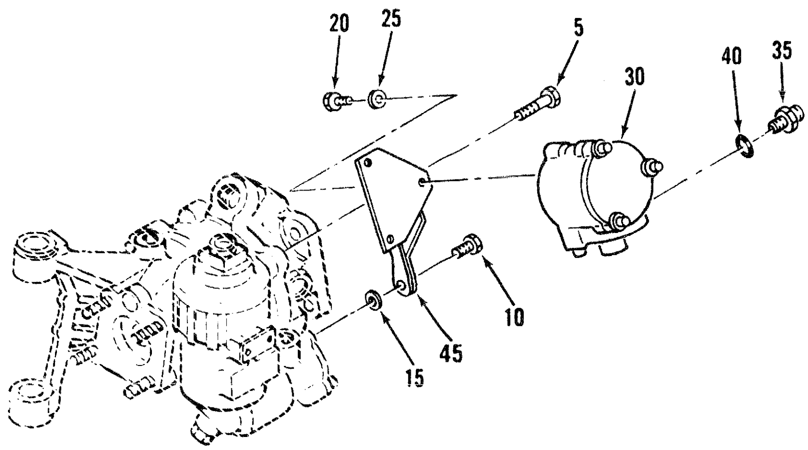
R



R 5. TUBE ASSY (IPC FIG. 17)
R 10. CLAMP
R 15. TUBE ASSY
R 20. ELBOW
R
25. PACKING
30. RING
35. NUT
40. BOLT
45. ELBOW
50. PACKING
55. PACKING
60. TORQUE LIMITER (BY-PASS VALVE)

(Codes FA, LA) Torque Limiter Plumbing Installation
Figure 205

R



R 5. BOLT (IPC FIG. 51)	30. TORQUE AND TEMPERATURE LIMITER (BY-PASS VALVE)
R 10. BOLT	35. FILTER
R 15. WASHER	40. PACKING
R 20. BOLT	45. BRACKET
R 25. WASHER	

(Codes FA, LA) Torque and Temperature
Limiter Installation
Figure 206

R 1. G. (Codes GA, KA) Remove Torque and Temperature Limiter (By-Pass Valve) and Plumbing (See Figures 204, 207)

(1) Remove tube assemblies and attaching parts. (See figure 207.)

(2) Remove universal bolt and elbow with packings from fuel pump assembly.

(3) Remove elbow from torque limiter.

(4) Remove bracket from fuel pump flange.

(5) Remove electrical connector from torque limiter. Refer to Aircraft Maintenance Manual.

(6) Remove torque limiter from bracket. (See figure 204.)

(7) Remove bracket and gasket from engine.

R H. (Codes GA, KA) Install Torque and Temperature Limiter (By-Pass Valve) and Plumbing (See Figures 204, 207)

NOTE: Lightly coat new packings or gaskets with clean engine oil or fuel as applicable or alternate lubricant (OS-124) prior to installation unless otherwise specified. Apply lubricating compound (Liqui-Moly, Grade NV) to threads of bolts or screws, and apply clean engine oil to threads (except first two threads) of male plumbing fittings located forward of the fireshield unless otherwise specified.

R Refer to 70-00-00, STANDARD PRACTICES, for recommended
R general torque values. Add frictional drag (run-down)
R torque of self locking devices to recommended values.

(1) Install bracket with gasket onto engine and secure with washers and nuts. Tighten nut (25, figure 204) to 100 inch-pounds torque.

(2) Install torque limiter on bracket and secure with bolts and washers. Tighten bolts (15) to 15 inch-pounds torque.

(3) Install elbow, with new packing, and ring into torque limiter and secure with nut. Tighten nut (85, figure 207) to 20 to 25 inch-pounds torque.

(4) Install universal bolt and elbow, with new packings into fuel pump assembly. Tighten bolt (30) to 27 to 35 inch-pounds torque.

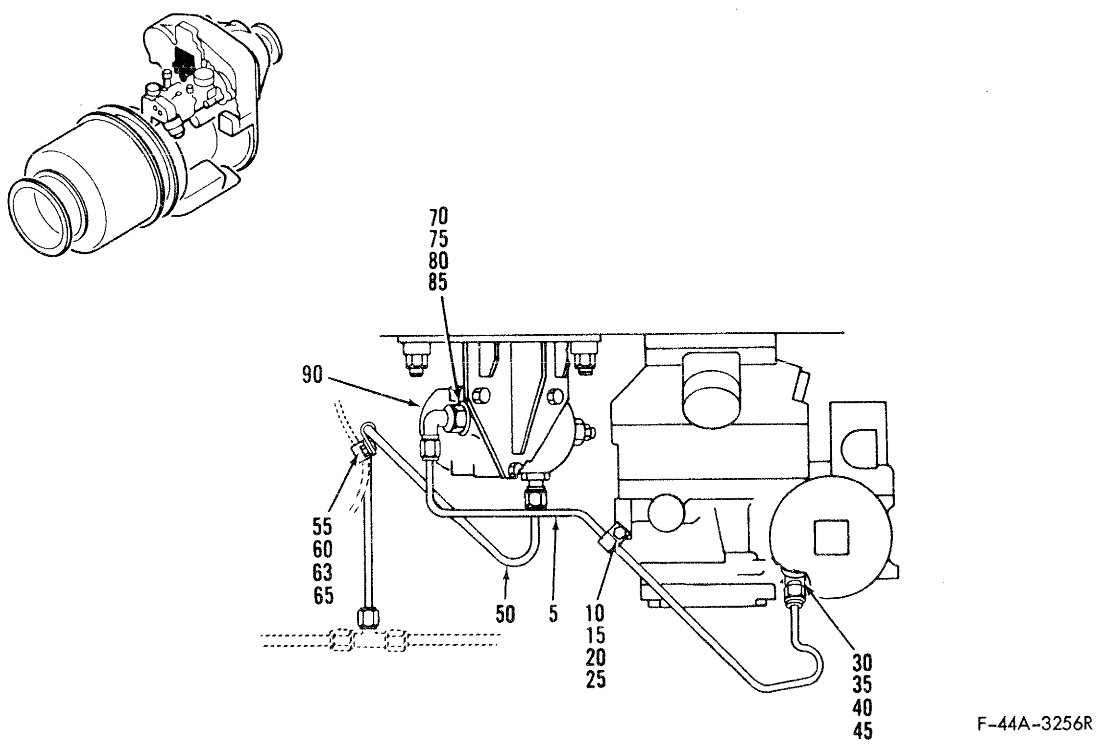
1. H. (5) Install bracket onto fuel pump flange and secure with bolt. Tighten bolt to 30 inch-pounds torque.

(6) Install tube assembly with attaching parts between elbow in torque limiter assembly and elbow in fuel pump assembly. Tighten nut (10) to 27 inch-pounds torque.

(7) Install tube assembly with attaching parts between torque limiter and tee in fuel shutoff valve plumbing. Tighten nut (55) to 27 inch-pounds torque.

(8) Install electrical connector on torque limiter. Refer to Aircraft Maintenance Manual.

R



R 5. TUBE ASSY
R (IPC FIG. 18)
R 10. NUT
R 15. BOLT
R 20. CLAMP
R 25. BRACKET
R 30. BOLT
R 35. PACKING
40. PACKING
45. ELBOW
50. TUBE ASSY
55. NUT
60. BOLT
63. WASHER
65. CLAMP
70. ELBOW
75. PACKING
80. RING
85. NUT
90. TORQUE AND TEMPERATURE LIMITER (BY-PASS VALVE)

(Codes GA, KA) Torque and Temperature Limiter
Plumbing Installation
Figure 207

2. Adjustment/Test

NOTE: Procedures in this section require special equipment and procedures. Prior to performing these procedures determine that trouble has been isolated to these components. Refer to 70-00-00, GENERAL - TROUBLE SHOOTING and GENERAL - ADJUSTMENT/TEST.

Table 202 provides a list of all equipment and materials required to perform Adjustment/Test.

Table 202. Equipment and Materials

Equipment or Material	Description
NOTE: Equivalent substitutes may be used for listed items.	
Multimeter	Capable of indicating continuity and 0 to 300 ohms resistance with accuracy of +2/-2 percent.

A. Perform Continuity Check of Torque Limiter

(1) Set the multimeter on RX 10 ohm scale and check for shorts between all terminals and case of torque limiter. There shall be no observable deflection.

(2) Check for continuity between terminals A and C. The multimeter shall read 180 to 210 ohms.

3. Inspection/Check

A. Perform Inspection of Torque and Temperature Limiting Components

(1) Inspect threaded parts for damaged or stripped threads.

(2) Inspect torque limiter mounting bracket for cracks and security.

(3) Inspect filter in reducer fitting in torque limiter assembly for contamination or clogging. The filter should be removed for servicing or replacement when inability to control engine torque or temperature indicate a clogged condition, or at interval specified in 72-00-00, INSPECTION/CHECK. If a clogged condition is indicated, the filter fitting should be replaced but sonic cleaning or backflushing with solvent is permissible. Refer to Cleaning/Painting for cleaning procedure. The filter shall be replaced at the next engine inspection period.

3. A. (4) Inspect electrical connector of torque limiter for bent or broken pins.

(5) Replace part that does not meet Inspection/Check requirements.

4. Cleaning/Painting

Table 203. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Beaker (200 milliliter capacity)	Commercially available
Blackstone heated tank ultrasonic cleaner (Model HT 1.9)	Blackstone Ultrasonics Inc, 1111 Allen Street, Jamestown, NY 14701
Alternate Sonac Ultrasonic Cleaner (Model S-2)	Cooper Laboratories Inc, Wayne, NJ 07470
Degreaser and cleaner (MS-180 Freon)	Miller-Stephensen Chemical Co, Inc, P.O. Box 628, 16 Sugar Hollow Rd, Danbury, CT 06810
Dowclene WR	Dow Chemical Corporation, S Saginaw Rd, Midland, MI 48640
Lint-free cloth	Commercially available
Solvent, Stoddard (Federal Specification P-D-680, Type I)	Commercially available
Trichloroethylene (0-T-634)	Commercially available

WARNING: CLEANING SHALL BE PERFORMED IN A CLEAN, WELL-VENTILATED ROOM. RUBBER GLOVES AND PROTECTIVE COTHING SHALL BE WORN. EXTINGUISHERS AND VAT OR TANK COVERS SHALL BE ON HAND IN CASE OF FIRE.

A. Clean Parts

(1) Clean all standard metallic hardware in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 1 or 2.

4. A. (2) Clean all fittings in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 12.

(3) Clean electrical connector of torque limiter using degreaser and cleaner (MS-180 Freon) or trichloroethylene (O-T-634). Wipe torque limiter clean with lint-free cloth.

B. Perform Special Cleaning

NOTE: As a temporary expedient, clean and backflush the torque limiter filter using solvent, Stoddard (Federal Specification P-D-680, Type I).

(1) Clean torque limiter filter, sonic method.

NOTE: Beaker is used in ultrasonic cleaner to conserve cleaning agent. Water is used in ultrasonic cleaner tank as transmitting fluid.

(a) Place filter in beaker and fill beaker with Dowclene WR to submerge filter.

(b) Place beaker containing filter in ultrasonic cleaner tank and fill ultrasonic cleaner tank to within three-eighths inch of top with water.

(c) Operate ultrasonic cleaner for five minutes.

(d) Discard contaminated Dowclene WR and rinse filter and beaker with clean Dowclene WR using plastic and squeeze bottle.

(e) Refill beaker with clean Dowclene WR and operate ultrasonic cleaner for an additional five minutes.

(f) Repeat steps (d) and (e) until Dowclene WR remains clean after a five minute operation period.

(g) Remove the filter from the beaker and blow dry using clean, low pressure air supply.

5. Approved Repairs

A. Partially Disassemble Torque Limiter Assembly (See Figure 208)

(1) Remove filter and gasket or packing from torque limiter assembly.

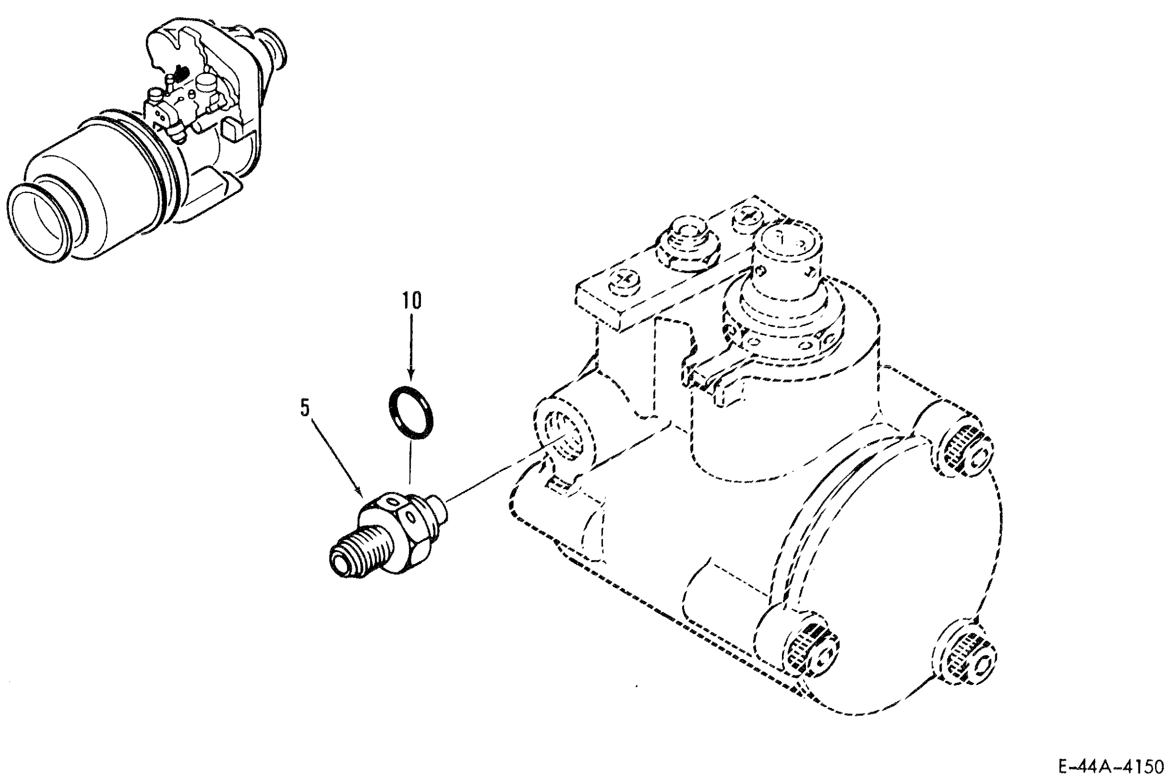
(2) Remove gasket from filter.

B. Assemble Torque Limiter Assembly (See Figure 208)

(1) Lightly coat new gasket or packing with clean engine fuel or alternate lubricant (OS-124) and install on filter.

(2) Install filter into torque limiter assembly. Tighten filter (5) to 20 to 25 inch-pounds torque.

R



R 5. FILTER (IPC FIG. 52)   10. PACKING

Torque Limiter Assembly
(Field Maintenance Breakdown)
Figure 208

LIST OF EFFECTIVE PAGES
72-00-95

RECORD OF TEMPORARY REVISIONS

REV NO.	CHAP/SEC/ SUBJ / PAGE NO.	DATE ISSUED	DATE INSERTED	BY	DATE REMOVED	BY	INCORPO-RATED INTO MANUAL BY REV NO.

CHAPTER 74 - IGNITION

TABLE OF CONTENTS

IGNITION - DESCRIPTION AND OPERATION

The ignition system is designed to operate on 24 volts dc power. It consists of an ignition unit, ignition leads, igniter plugs, and speed switch.

IGNITION SYSTEM - DESCRIPTION AND OPERATION

1. Ignition Leads

   The ignition leads are shielded, high tension, flexible leads connecting the ignition unit and igniter plugs.

2. Igniter Plugs

   The igniter plugs, mounted in the plenum assembly, are the air gap type with center electrode and ground electrode.

3. Ignition Unit

   The ignition unit, mounted on the lower left side of the input housing assembly, is a radio noise suppressed, high voltage, capacitor discharge, intermittent sparking type unit. The ignition unit utilizes a dc input to provide approximately 18,000 volts output to the igniter plugs.

IGNITION SYSTEM - MAINTENANCE PRACTICES

1. Removal/Installation

NOTE: Table 201 provides a list of all materials and compounds required to perform Removal/Installation.

Table 201. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Grease (Graphite Free)	Commercially available
High temperature compound (Fel-Pro C5-A)	Fel-Pro Inc, Div of Felt Products Mfg Co, 7450 N McCormick Blvd, Skokie, IL 60076
Light machine oil	Commercially available
Lubricating compound (Liqui-Moly, Grade NV)	Lockrey Co, Lubricants Div, Cedar Shores, Southampton, NY 11968
Oil (WD-40)	Commercially available

R A. (Codes AA-Ac, CA-CC, FA, LA) Remove Ignition System Components (See Figure 201)

(1) Shut off electrical sypply to engine.

(2) Disconnect aircraft electrical connector from ignition unit. Refer to Aircraft Maintenance Manual.

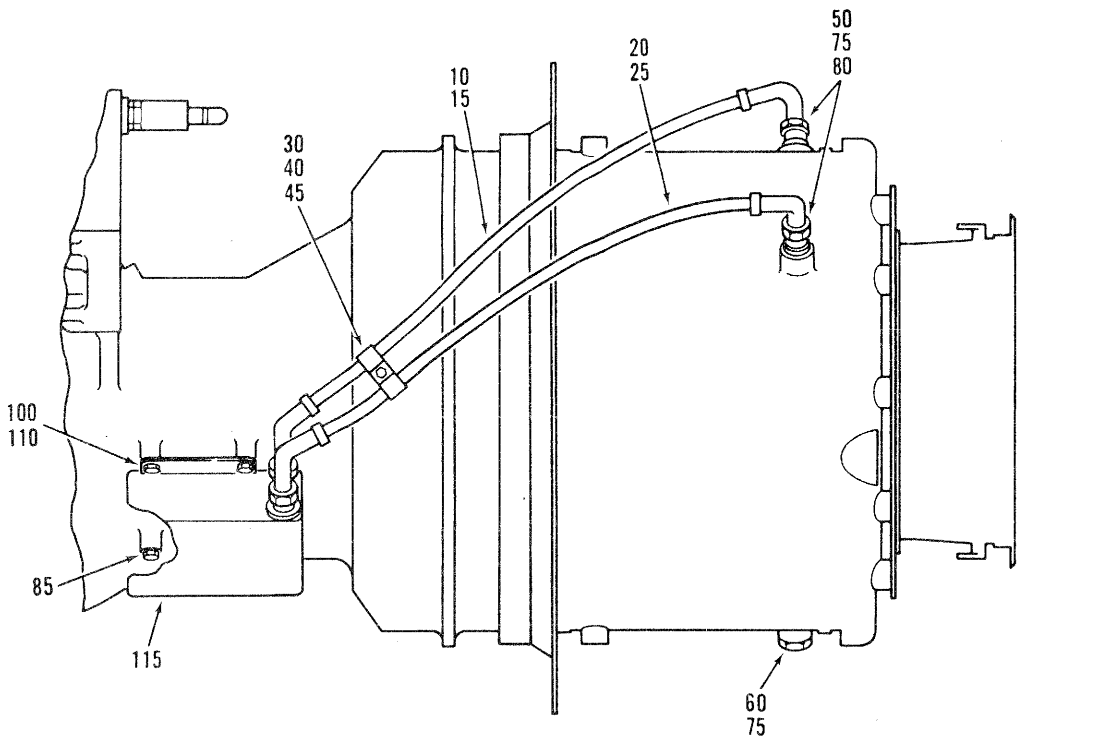
(3) Remove clamps securing ignition leads.

(4) Disconnect ignition leads from igniter plugs and ignition unit. Remove ignition leads.

(5) Remove igniter plugs, gaskets and washers.

(6) Remove dummy igniter plug and gasket.

(7) Remove ignition unit from input housing assembly.



R 10. IGNITION LEAD (IPC FIG. 76)
15. IGNITION LEAD
20. IGNITION LEAD
25. IGNITION LEAD
30. NUT
40. BOLT
45. CLAMP
50. IGNITER PLUG
60. DUMMY IGNITER PLUG
75. GASKET
80. WASHER
85. BOLT
100. BOLT
110. WASHER
115. IGNITION UNIT

R (Codes AA-AC, CA-CC, FA, LA) Ignition System
Installation
Figure 201

R NOTE: Refer to 70-00-00, STANDARD PRACTICES, for recommended general torque values. Add frictional drag (run-down) torque of self locking devices to recommended values.

R 1. B. (Codes AA-AC, CA-CC, FA, LA) Install Ignition Systm Components (See Figure 201)

(1) Apply coat of lubricating compound (Liqui-Moly, Grade NV) to threads of bolts.

(2) Install ignition unit onto input housing assembly.

(3) Install mount bolts. Tighten bolts (85, 100) to 25 inch-pounds torque.

CAUTION: DO NOT USE SCREWDRIVER TO FREE GROMMET. POSSIBLE BREAKAGE OR DAMAGE OF GROMMET RETENTION TANGS COULD RESULT.

(4) Prior to installation of igniter plugs, check the floating grommet on combustion chamber assembly to insure that it is free. If necessary, free grommet by using oil (WD-40) or light machine oil and carefully move grommet sideways to achieve floating action. Align grommet by using small amount of any graphite free grease.

(5) Apply light coat of high temperature compound (Fel-Pro C5-A) to threads (electrode end) of igniter plugs, then install plugs with gaskets and washers. Tighten igniter plugs (50) to 445 inch-pounds torque.

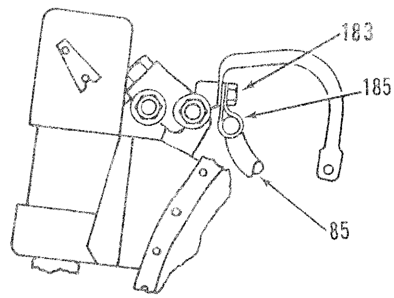
(6) Apply light coat of high temperature compound (Fel-Pro C5-A) to threads of dummy igniter plug, then install plug with gasket. Tighten dummy igniter plug (60) to 445 inch-pounds torque and lockwire.

NOTE: Apply lubricating compound (Liqui-Moly, Grade NV) to threads of bolts or screws located forward of the fireshield unless otherwise specified.

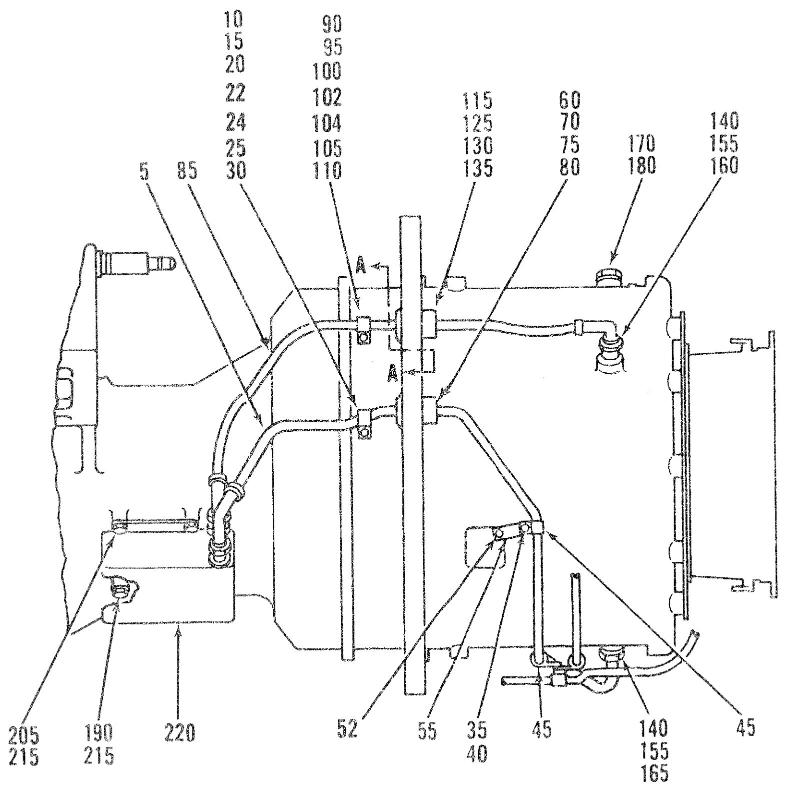
(7) Install ignition leads into igniter plugs and ignition unit, and tighten connectors to 150 inch-pounds torque.

(8) Install clamp, bolt and nut. Tighten nut (30) to 20 inch-pounds torque.

(9) Connect aircraft electrical connector to ignition unit. Refer to Aircraft Maintenance Manual.



VIEW A-A



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5. IGNITION LEAD
R (IPC FIG. 77)
10. NUT
15. BOLT
20. CLAMP
22. NUT
24. WASHER
25. BOLT
30. BRACKET
35. NUT
40. BOLT
45. CLAMP
52. NUT
55. BRACKET
60. NUT
70. BOLT
75. FLANGE
80. FLANGE
85. IGNITION LEAD
90. NUT
95. BOLT
100. CLAMP
102. NUT
104. WASHER
105. BOLT
110. BRACKET
115. NUT
125. BOLT
130. FLANGE
135. FLANGE
140. IGNITER PLUG
155. GASKET
160. WASHER
165. WASHER
170. DUMMY IGNITER PLUG
180. GASKET
185. CLAMP
190. BOLT
205. BOLT
215. WASHER
220. IGNITER UNIT

R (Codes BA-BC, EA, GA, KA) Ignition System Installation
Figure 202

R 1. C. (Codes BA-BC, EA, GA, KA) Remove Ignition System Components (See Figure 202)

(1) Shut off electrical supply to engine.

(2) Disconnect aircraft electrical connector from ignition unit. Refer to Aircraft Maintenance Manual.

CAUTION: TO PREVENT DAMAGE TO INGITION LEAD, REMOVE CLAMP NEAR BOTTOM IGNITER PLUG PRIOR TO REMOVING IGNITION LEAD FROM IGNITER PLUG.

(3) Remove nuts, bolts, clamps, flanges, and brackets securing ingition leads.

(4) Disconnect ignition leads from igniter plugs and ignition unit. Remove ignition leads.

(5) Remove igniter plugs, gaskets, and washers.

(6) Remove dummy igniter plug and gasket.

(7) Remove ignition unit from input housing assembly.

R
R D. (Codes BA-BC, EA, GA, KA) Install Ignition System Components (See Figure 202)

NOTE: Apply lubricating compound (Liqui-Moly, Grade NV) to threads of bolts or screws located forward of the fireshield, and apply high temperature compound (Fel-Pro C5-A) to threads of bolts or screws located aft of the fireshield unless otherwise specified.

R
R
R Refer to 70-00-00, STANDARD PRACTICES, for recommended general torque values. Add frictional drag (run-down) torque of self locking devices to recommended values.

(1) Install ignition unit onto input housing assembly and secure with bolts. Tighten bolts (190, 205) to 25 inch-pounds torque.

CAUTION: DO NOT USE SCREWDRIVER TO FREE GROMMET. POSSIBLE BREAKAGE OR DAMAGE OF GROMMET RETENTION TANGS COULD RESULT.

(2) Prior to installation of igniter plugs, check the floating grommet on combustion chamber assembly to insure that it is free. If necessary, free grommet by using oil (WD-40) or light machine oil and carefully move grommet sideways to achieve floating action. Align grommet by using small amount of any graphite free grease.

1. D. (3) Apply light coat of high temperature compound (Fel-Pro C5-A) to threads (electrode end) of igniter plugs, then install plugs with gaskets and washers. Tighten igniter plugs (140) to 445 inch-pounds torque.

(4) Apply light coat of high temperature compound (Fel-Pro C5-A) to threads of dummy igniter plug, then install plug with gasket. Tighten dummy igniter plug (170) to 445 inch-pounds torque, and lockwire.

(5) Install ignition leads into igniter plugs and ignition unit, and tighten connectors to 150 inch-pounds torque. Lockwire connectors.

(6) Install flanges onto fireshield and secure with bolts and nuts. Tighten nuts (60, 115) to 20 inch-pounds torque.

(7) Install brackets and clamps and secure with bolts, washers, and nuts. Tighten nuts (10, 35, 90) to 20 inch-pounds torque. Tighten bolt (25, 105) to 60 inch-pounds torque.

R (8) Connect aircraft electrical connector to igntion unit. Refer to
R Aircraft Maintenance Manual.

R E. (Codes HA, Pre SB74-0002) Remove Ignition System Components (See Figure 203)

(1) Shut off electrical supply to engine.

(2) Disconnect aircraft electrical connector from ignition unit. Refer to Aircraft Maintenance Manual.

(3) Remove clamps securing ignition leads.

(4) Disconnect ignition leads from igniter plugs and ignition unit. Remove ignition leads.

(5) Remove igniter plugs, gaskets and washers.

(6) Remove dummy igniter plug and gasket.

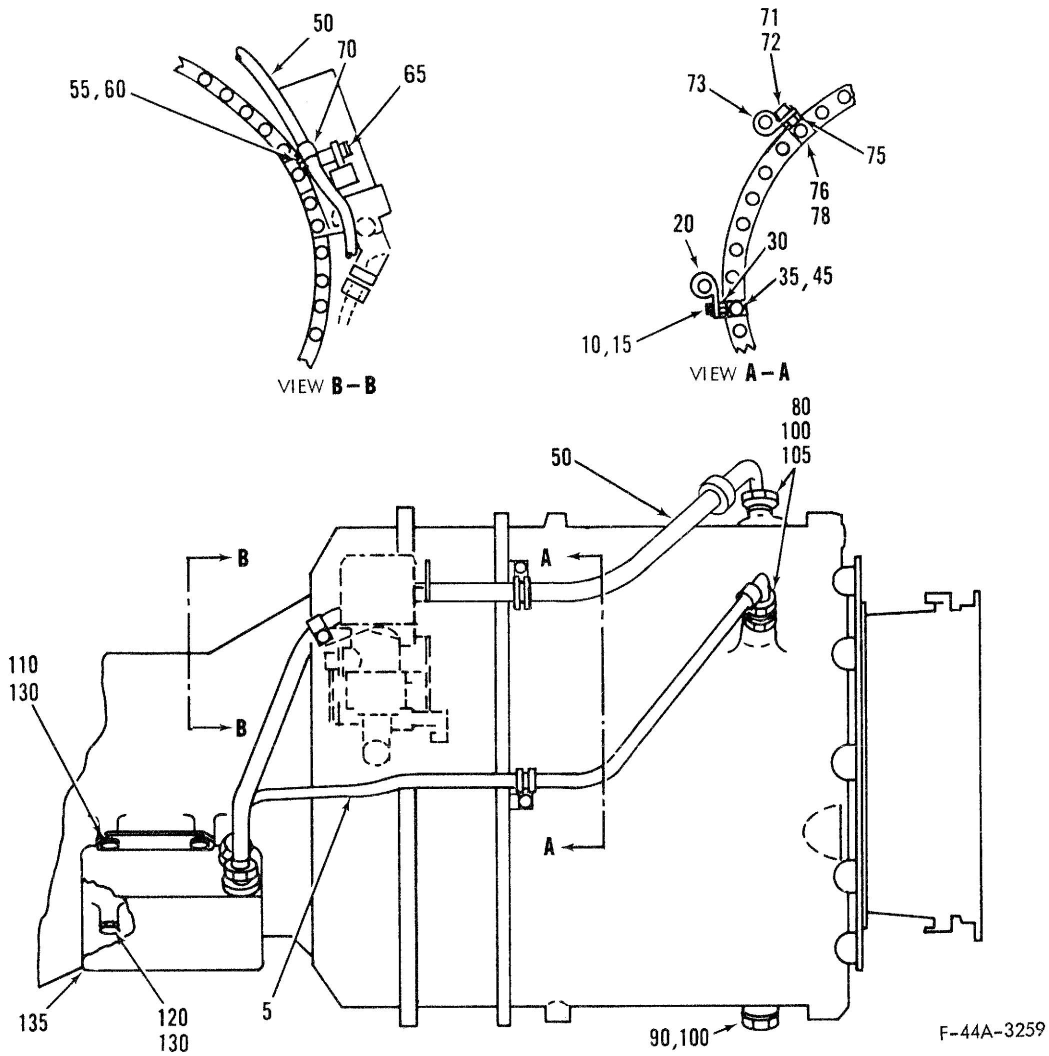
(7) Remove ignition unit from input housing assembly.

R NOTE: Refer to 70-00-00, STANDARD PRACTICES, for recommended
R general torque values. Add frictional drag (run-down)
R torque of self locking devices to recommended values.

R F. (Codes HA, Pre SB74-0002) Install Ignition System Components (See Figure 203)

(1) Apply coat of lubricating compound (Liqui-Moly, Grade NV) to threads of bolts.

(2) Install ignition unit onto input housing assembly.



5. IGNITION LEAD
R (IPC FIG. 78)
10. NUT
15. BOLT
20. CLAMP
30. BRACKET
35. NUT
45. BOLT
50. IGNITON LEAD
55. NUT
60. WASHER
65. BOLT
70. CLAMP
71. NUT
72. BOLT
73. CLAMP
75. BRACKET
76. NUT
78. BOLT
80. IGNITER PLUG
90. DUMMY IGNITER PLUG
100. GASKET
105. WASHER
110. BOLT
120. BOLT
130. WASHER
135. IGNITON UNIT

R (Codes HA, Pre SB74-0002) Ignition Unit Installation
Figure 203

1. F. (3) Install mount bolts. Tighten bolts (110, 120) to 25 inch-pounds torque.

CAUTION: DO NOT USE SCREWDRIVER TO FREE GROMMET. POSSIBLE BREAKAGE OR DAMAGE OF GROMMET RETENTION TANGS COULD RESULT.

(4) Prior to installation of igniter plugs, check the floating grommet on combustion chamber assembly to insure that it is free. If necessary, free grommet by using oil (WD-40) or light machine oil and carefully move grommet sideways to achieve floating action. Align grommet by using small amount of any graphite free grease.

(5) Apply light coat of high temperature compound (Fel-Pro C5-A) to threads (electrode end) of igniter plugs, then install plugs with gaskets and washers. Tighten igniter plugs (80) to 445 inch-pounds torque.

(6) Apply light coat of high temperature compound (Fel-Pro C5-A) to threads of dummy igniter plug, then install plug with gasket. Tighten dummy igniter plug (90) to 445 inch-pounds torque and lockwire.

NOTE: Apply lubricating compound (Liqui-Moly, Grade NV) to threads of bolts or screws located forward of the fireshield unless otherwise specified.

(7) Install ignition leads into igniter plugs and ignition unit, and tighten connectors to 150 inch-pounds torque.

(8) Install clamp on fuel shutoff valve mounting bracket and secure with bolt, washer, and nut. Tighten nut (55) to 60 inch-pounds torque.

(9) Install brackets on engine and secure with bolts and nuts. Tighten nuts (35, 76) to 60 inch-pounds torque.

(10) Install clamps on ignition leads and secure to brackets with bolts and nuts. Tighten nut (10, 71) to 20 inch-pounds torque.

(11) Connect aircraft electrical connector to ignition unit. Refer to Aircraft Maintenance Manual.

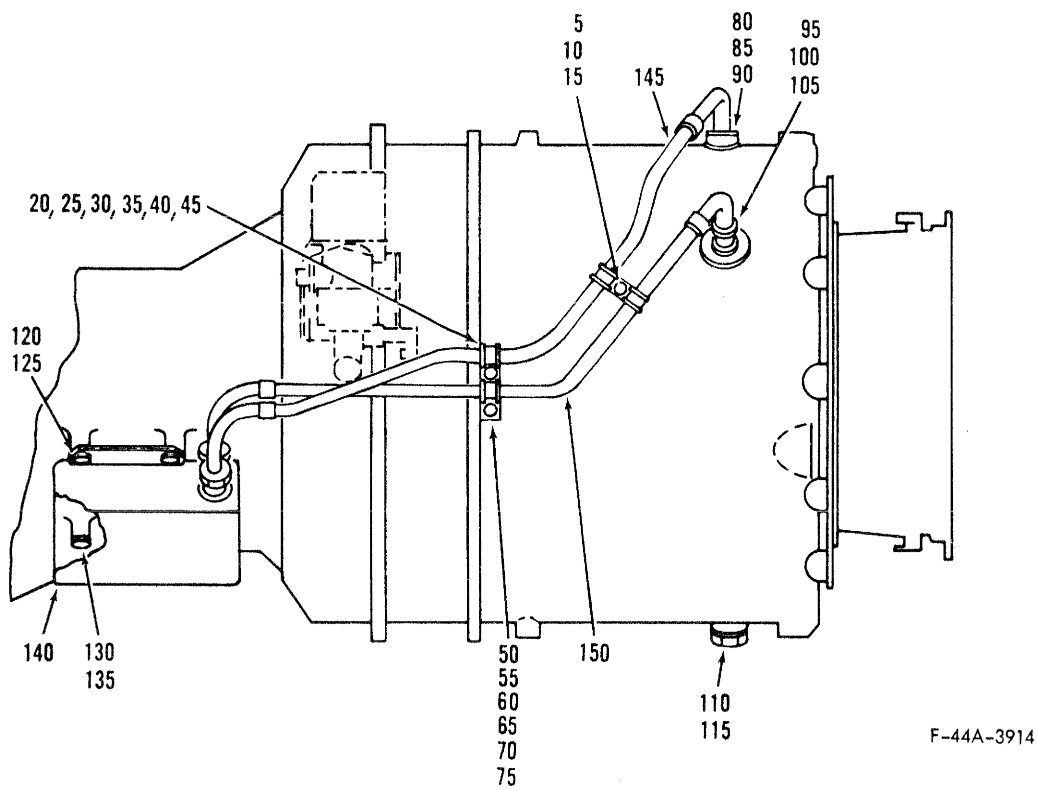
R 1. G. (Codes HA, Post SB74-0002) Remove Ignition System Components (See
R Figure 204)

R (1) Shut off electrical supply to engine.

R (2) Disconnect aircraft electrical connector from ignition unit. Refer
R to Aircraft Maintenance Manual.

R (3) Remove clamp securing ignition leads.

R



R 5. NUT (IPC FIG. 79)
R 10. BOLT
R 15. CLAMP
R 20. NUT
R 25. BOLT
R 30. CLAMP
R 35. NUT
R 40. BOLT
R 45. BRACKET
R 50. NUT
R 55. BOLT

60. CLAMP
65. NUT
70. BOLT
75. BRACKET
80. IGNITER PLUG
85. GASKET
90. WASHER
95. IGNITER PLUG
100. GASKET
105. WASHER

110. DUMMY IGNITER PLUG
115. GASKET
120. BOLT
125. WASHER
130. BOLT
135. WASHER
140. IGNITION UNIT
145. IGNITION UNIT
150. IGNITION UNIT

(Code HA, Post SB74-0002)
Ignition System Installation
Figure 204

1. G. (4) Disconnect ignition leads from igniter plugs and ignition unit.

(5) Remove igniter plugs, gaskets and washers.

(6) Remove dummy igniter plug and gasket.

(7) Remove ignition unit from input housing assembly.

NOTE: Refer to 70-00-00, STANDARD PRACTICES, for recommended general torque values. Add frictional drag (run-down) torque of self locking devices to recommended values.

H. (Code HA, Post SB74-0002) Install Ignition System Components (See Figure 204)

(1) Apply coat of lubricating compound (Liqui-Moly, Grade NV) to threads of bolts.

(2) Install ignition unit onto input housing assembly.

(3) Install mount bolts and washers. Tighten bolts (120, 130) to 25 inch-pounds torque.

CAUTION: DO NOT USE SCREWDRIVER TO FREE GROMMET. POSSIBLE BREAKAGE OR DAMAGE OF GROMMET RETENTION TANGS COULD RESULT.

(4) Prior to installation of igniter plugs, check the floating grommet on combustion chamber assembly to insure that it is free. If necessary, free grommet by using oil (WD-40) or light machine oil and carefully move grommet sideways to achieve floating action. Align grommmet by using small amount of any graphite free grease.

(5) Apply light coat of high temperature compound (Fel-Pro C5-A) to threads (electrode end) of igniter plugs, then install plugs with gaskets and washers. Tighten igniter plugs (80, 95) to 445 inch-pounds torque.

(6) Apply light coat of high temperature compound (Fel-Pro C5-A) to threads of dummy igniter plugs, then install plug with gasket. Tighten dummy igniter plug (110) to 445 inch-pounds torque and lockwire.

(7) Install ignition leads into igniter plugs and ignition unit, and tighten connectors to 150 inch-pounds torque.

(8) Install clamps on ignition leads and secure with bolt and nut. Tighten nut (5) to 20 inch-pounds torque.

R 1. H. (9) Install brackets on engine and secure with bolts and nuts. Tighten
R nuts (35, 65) to 60 inch-pounds torque.

R (10) Install clamps on ignition leads and secure to brackets with bolts
R and nuts. Tighten nuts (50, 65) to 20 inch-pounds torque.

R (11) Connect aircraft electrical connector to ignition unit. Refer to
R Aircraft Maintenance Manual.

2. Adjustment/Test

A. Perform Ignition Unit Adjustment/Test

(1) Connect two serviceable igniter plugs with serviceable ignition leads to ignition unit.

CAUTION: SPARKS AT IGNITER PLUGS ARE DANGEROUS. DO NOT COME INTO CONTACT WITH IGNITER PLUGS WHEN IGNITER PLUGS ARE CONNECTED TO IGNITION UNIT WITHOUT FIRST REMOVING POWER TO IGNITION UNIT AND SHORTING ACROSS SPARK GAPS OF IGNITER PLUGS TO REMOVE STATIC CHARGE FROM IGNITION UNIT. USE SCREWDRIVER OR OTHER TOOL HAVING A WELL INSULATED HANDLE WHEN SHORTING ACROSS SPARK GAPS. PERFORM THE FOLLOWING STEPS IN A WELL-VENTILATED AREA.

(a) Apply 10 volts dc to ignition unit and observe igniter plugs. Igniter plugs shall fire.

(b) Apply 13 volts dc source to ignition unit and observe spark rate of igniter plugs. Both plugs shall spark simultaneously at a minimum rate of one spark per second per plug. Plug spark shall be indicated by a sharp report and a blue discharge.

(c) Apply 40 volts dc source to ignition unit and observe spark rate of igniter plugs. Both plugs shall spark simultaneously at a minimum rate of two sparks per second.

(2) Replace igniter plug that does not spark properly.

(3) Replace ignition unit that does not produce proper spark rate.

3. Inspection/Check

A. Inspect Ignition System Components

(1) Visually inspect ignition unit for cracks, burns, broken, bent, or burned pins, or obvious damage.

(2) Visually inspect ignition leads for cracks, burns, or frayed
R covering. Repair damaged covering. Refer to Approved Repairs.

(3) Inspect igniter plug as follows. (See figures 205 or 206.)

(a) Visually inspect igniter plug for broken or missing parts. Shake plug and listen for rattling noise. If igniter plug is broken, parts missing, or noise is present, replace plug.

(b) (Part No. 369949-1) Visually inspect center electrode and outer shell for erosion. If electrode is eroded below 0.030 inch of the ceramic insulator as shown in Figure 205, replace plug. Uniform erosion on electrode and outer shell is acceptable.

(c) (Part No. 369949-3) Visually inspect center electrode and outer shell for erosion. If electrode is eroded below 0.090 inch of the ceramic insulator as shown in Figure 206, replace plug. Uniform erosion on electrode and outer shell is acceptable.

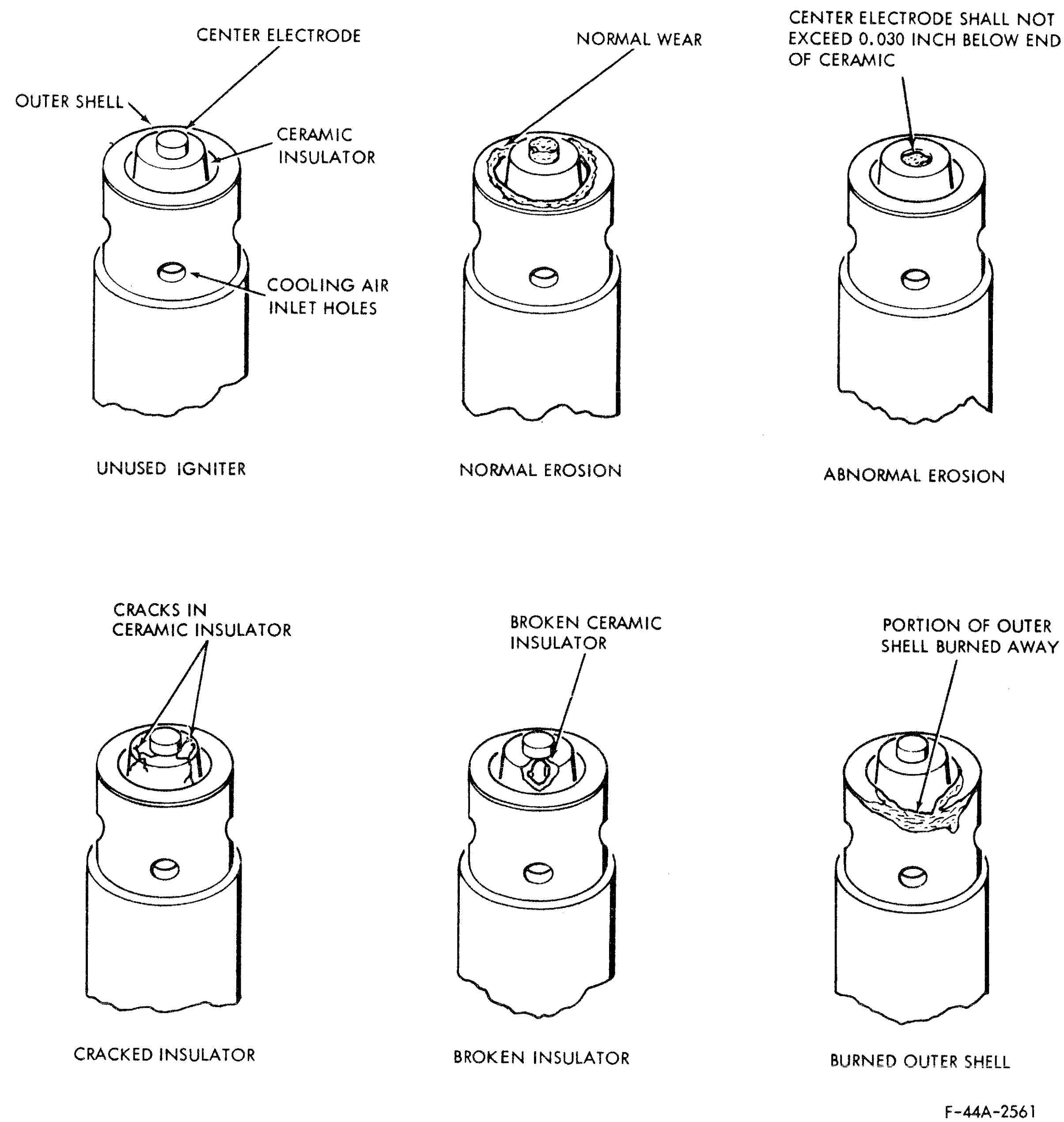
(d) Visually inspect ceramic insulator for cracks or chipped area as shown in Figures 205 or 206. Replace igniter plug if ceramic insulator is damaged.

(e) Visually inspect outer shell for burned or flowed metal as shown in Figures 205 or 206. Replace plug if metal is burned or flowed.

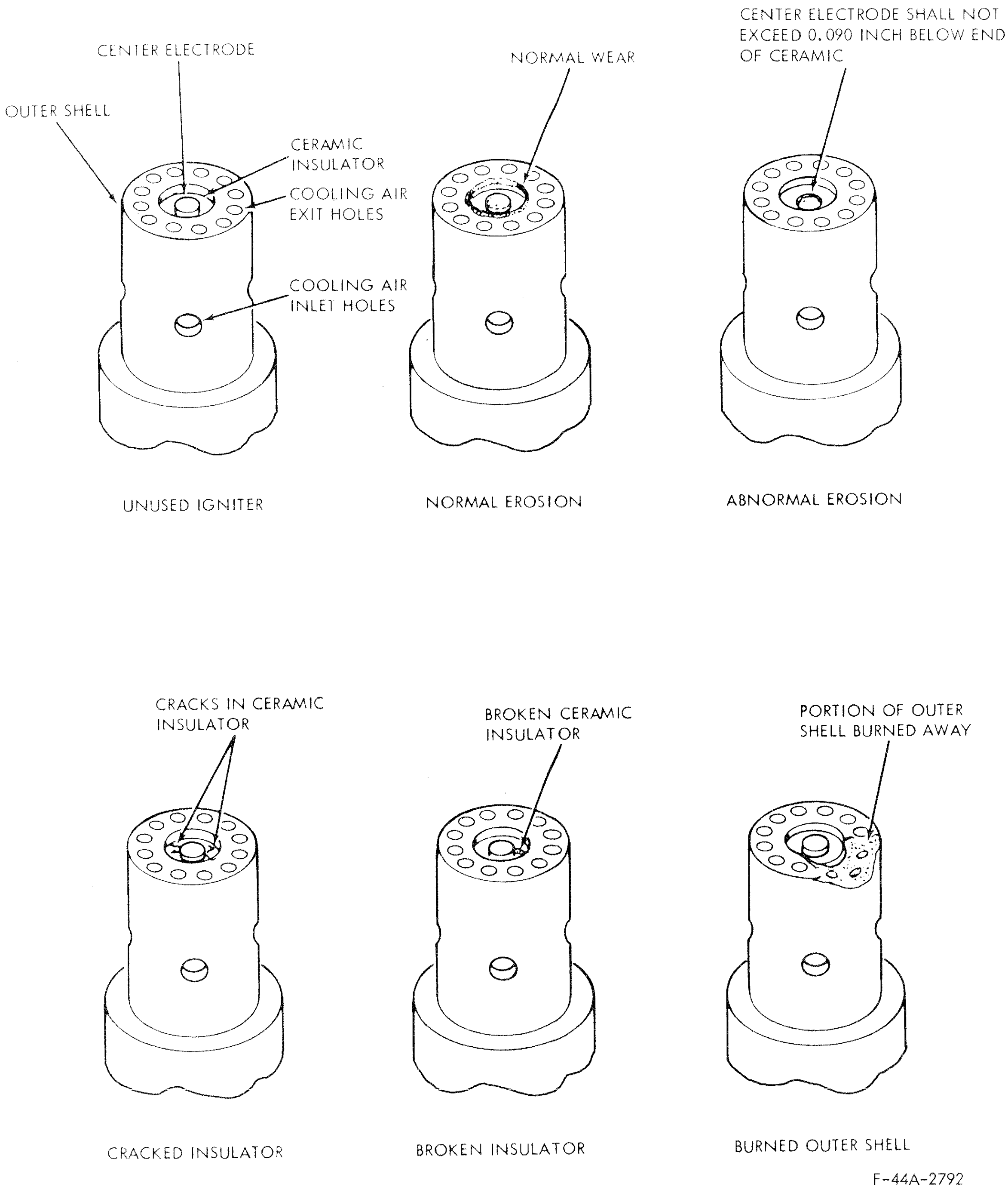
(f) Visually inspect grommet mating flange of igniter plug for grooving. If grooved on one side of 0.030 inch deep or more, replace plug.

(g) Visually inspect for clogged annular passage between insulator and outer shell. If clogged, abrasive blast in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 4.

(4) Replace part that does not meet Inspection/Check requirements or is damaged beyond repair.



Inspection of Igniter Plug PN 369949-1
Figure 205



Inspection of Igniter Plug PN 369949-3
Figure 206

4. Cleaning/Painting

A. Clean Parts

(1) Clean all standard metallic hardware in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 1 or 2.

(2) Clean ignition unit and ignition leads in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 11.

(3) Clean electrical connector on igniter plugs in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 11.

(4) Clean igniter plug electrodes in accordance with Inspection/Check.

5. Approved Repairs

NOTE: Table 202 provides a list of all materials and compounds required to perform approved repairs.

Table 202. Materials and Compounds

	Material or Compound	
	NOTE: Equivalent substitutes may be used for listed items.	
	Solder 50/50 Tin/Lead (Federal Specification QQ-S-571)	Commercially available
R	Sleeving (Part No. S9352-010-9-XXX) (XXX=first digit is length in inches, second and third digits are length in sixteenths of inch)	Available from: AiResearch Mfg. Co. of Arizona, P.O. Box 29003, Phoenix, AZ 85038
R	Tape (Part No. 722-022-9105)	Available from: AiResearch Mfg. Co. of Arizona, P.O. Box 29003, Phoenix, AZ 85038

A. Repair Cracks of Solder Seal on Ignition Unit

(1) Using normal soldering procedures re-solder cracks in solder seal as necessary.

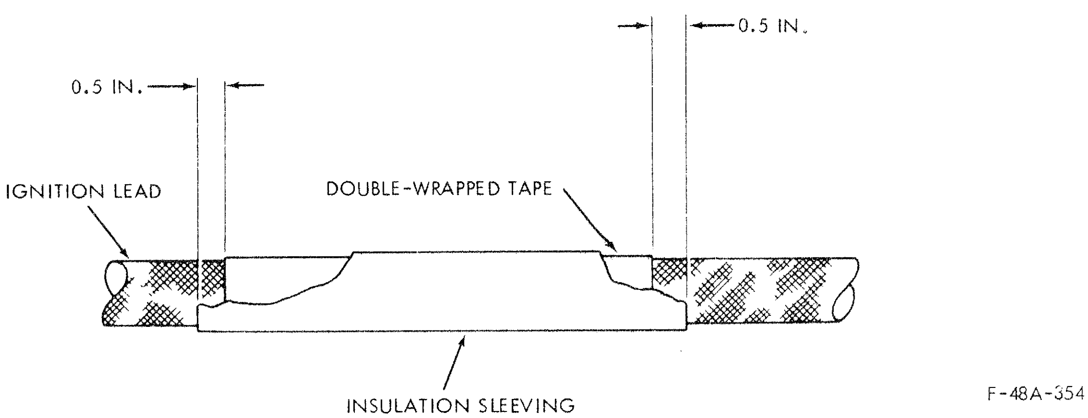
R 5. B. Repair Damaged Ignition Lead Covering as Follows (See Figure 207)

R (1) Double wrap ignition lead with tape. Tape wrap shall cover damaged
R area and be positioned so ends of tape will not be exposed after
R installation of insulation sleeving.

R (2) Install length of insulation sleeving required to extend one-half
R inch beyond each end of tape wrap.

R (3) Shrink insulation sleeving in place using hot air.

R



Tape and Insulating Sleeving
Figure 207

SWITCHING - DESCRIPTION AND OPERATION

The speed switch consists of a dual relay activated by integral solid state circuity. Control signals received from the tachometer-generator pass through a signal conditioner which is integral to the speed switch. This determines the open or closed condition of the two relay sections of the dual relay which, in turn, determines the operational condition of the ignition system, the fuel-on portion of the fuel shutoff valve, and the starter-generator. The normally open lightoff relay is activated to close at approximately 10 percent engine speed and applies electrical power to the ignition system and the fuel-on portion of the fuel shutoff valve through the aircraft relay system. The normally closed starter cutout relay, oil vent valve and fuel anti-icing lockout valve are activated to open at approximately 50 percent engine speed and power is cut to the aircraft start relay.

R (Codes AA-AC, CA-CC, FA, LA) The speed switch also contains a normally closed relay which opens at approximately 90 percent engine speed which may be used for customer equipment.

SPEED SWITCH - MAINTENANCE PRACTICES

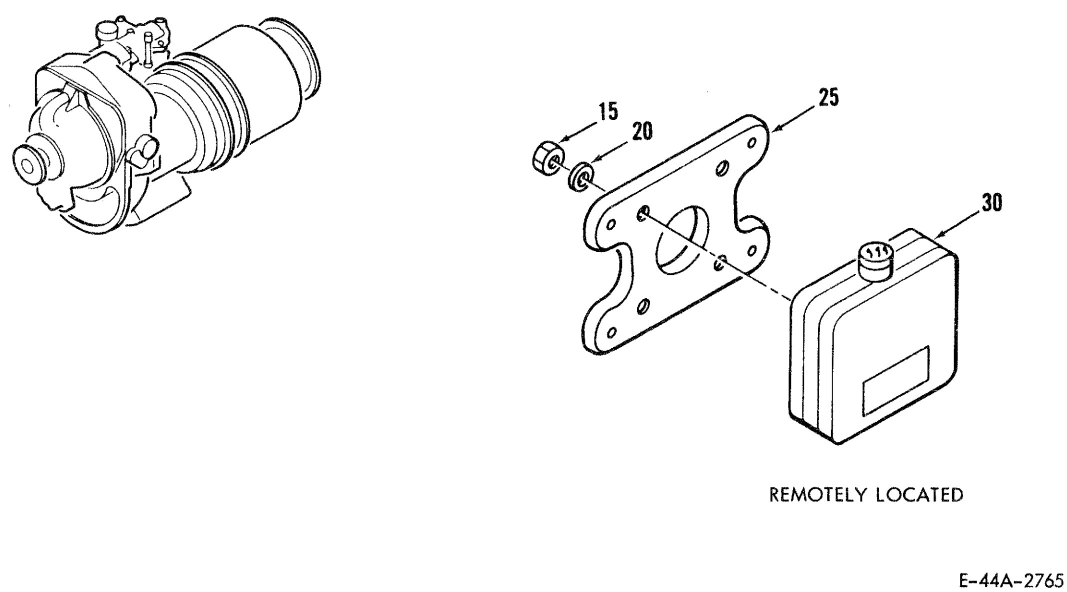
1. Removal/Installation

A. Remove Speed Switch (Airframe Mounted) (See Figure 201)

(1) Speed switch is remotely installed. Refer to Aircraft Maintenance Manual for speed switch removal instructions.

B. Install Speed Switch (Airframe Mounted) (See Figure 201)

(1) Speed switch is remotely installed. Refer to Aircraft Maintenance Manual for installation instructions.



R 15. NUT (IPC FIG. 75)
20. WASHER
25. PLATE
30. SPEED SWITCH

Speed Switch Installation
Figure 201

2. Inspection/Check

Check electrical connector for bent, broken or burned pins. Replace speed switch if damaged. Functions of pins on speed switch electrical connector are as follows:

A - 24 volts dc power from aircraft
B - Return for 24 volts dc
C - Input signal ground
D, H - Tachometer generator input signal
E - Power to 10 percent engine speed switch
F - Power from 10 percent engine speed switch to fuel and ignition system components
G - Power from 50 percent engine speed switch to starter relays
R J - (Codes AA-AC, CA-CC, FA, LA) 24 volts dc output after 50 percent engine speed
R K - (Codes AA-AC, CA-CC, FA, LA) 24 volts dc output until 90 percent engine speed

3. Cleaning/Painting

A. Clean Parts

(1) Clean all standard metallic hardware in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 1 or 2.

(2) Clean speed switch in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No.11.

LIST OF EFFECTIVE PAGES
72-00-95

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RECORD OF TEMPORARY REVISIONS

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CHAPTER 75 - AIR

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AIR - DESCRIPTION AND OPERATION

The inlet anti-ice system consists of an inlet anti-ice valve and inlet anti-icing shield. High temperature air is bled through a boss on the turbine plenum assembly and is routed forward to a normally closed anti-ice valve. The anti-ice valve is opened by manual actuation of a switch in the cockpit. Cockpit indication of valve position is provided by a microswitch. When opened, air from the valve is routed to the anti-icing shield, inlet temperature and pressure sensor, and to a port where the customer may obtain air for anti-icing other forward areas of the engine nacelle.

ENGINE INLET ANTI-ICE (AIR) - DESCRIPTION AND OPERATION

1. Anti-Ice Valve

   The anti-ice valve, mounted on the left side of the compressor housing is a normally closed poppet-type valve actuated by a separate switch in the aircraft cockpit. Plumbing lines connect the valve to the compressor air discharge tap on the turbine plenum assembly and to the inlet air anti-icing shield. A plumbing line also connects the valve to the inlet temperature and pressure sensor when Bendix fuel control used. When the valve is open it permits flow of hot compressed air into the anti-icing shield and to the sensor (when applicable), to prevent formation of ice.

2. Anti-Icing Shield

   The anti-icing shield is contoured around the lower portion of the inlet air duct. An airspace passage between the shield and the lower outer surface of the air inlet provides the annulus for bleed airflow which is discharged to atmosphere at the rear end of the shield. Ports in the inlet housing casting also provide for bleed air entry into the compressor cavity located between the aft portion of the compressor inlet housing and the forward portion of the compressor for further anti-icing of the engine air inlet. Bleed air admitted through the anti-ice valve into the air passage between the compressor air inlet and the shield raises the temperature of the engine air inlet casting surface and provides the required anti-icing. The entire upper portion of the compressor air inlet is integral with the input housing assembly and is kept free of ice formation by heat transfer from engine oil to the inlet surface.

INLET ANTI-ICE VALVE AND PLUMBING - MAINTENANCE PRACTICES

1. Removal/Installation

NOTE: Table 201 provides a list of all materials and compound required to perform Removal/Installation.

Table 201. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
High temperature compound (Fel-Pro C5-A)	Fel-Pro Inc, Div of Fel Products Mfg Co, 7450 N McCormick Blvd, Skokie, IL 60076
Lubricating compound (Liqui-Moly, Grade NV)	Lockrey Co, Lubricants, Div, Cedar Shores, Southampton, NY11968
Alternate packing lubricant Lubricant (OS-124)	Monsanto Company, 800 N Lindbergh Blvd, St. Louis, MO 63166

R A. (Codes AA-AC, FA, LA) Remove Inlet Anti-Ice Valve and Plumbing (See Figures 201, 202)

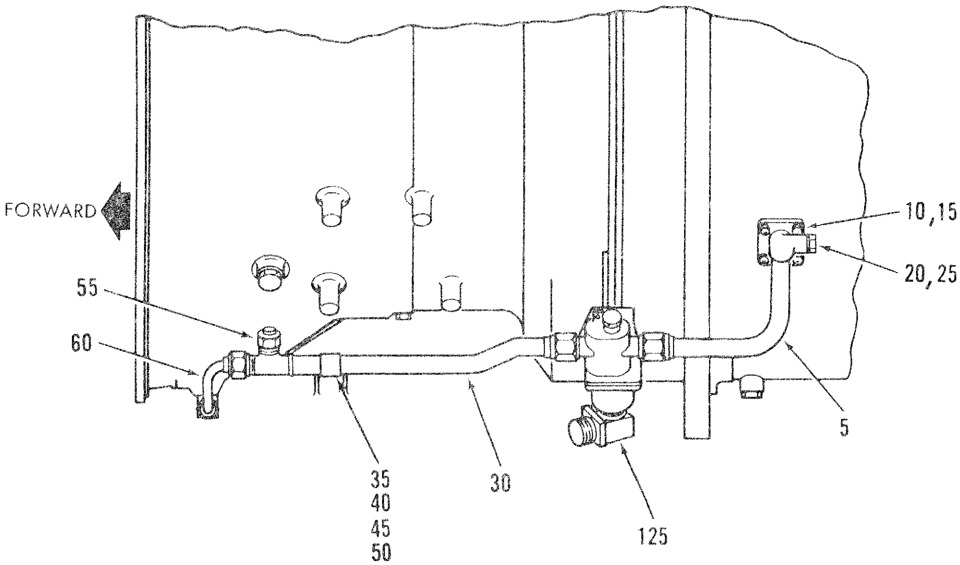
(1) Disconnect electrical connector. Refer to Aircraft Maintenance Manual.

(2) Remove tube assemblies with attaching parts. (See figure 201.)

(3) Remove plug and caps from turbine plenum and anti-icing shield.

(4) Remove bracket and anti-ice valve from engine. (See figure 202.)

(5) Remove anti-ice valve from bracket.



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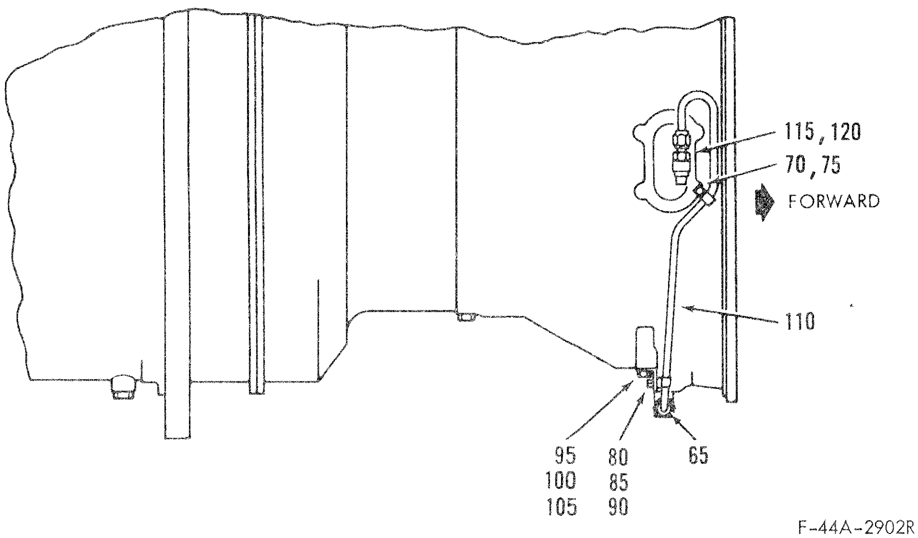


(Codes AA-AC, FA, LA) Inlet Anti-Ice Valve
Plumbing Installation
Figure 201

R 1. B. (Codes AA-AC, FA, LA) Install Inlet Anti-Ice Valve and Plumbing (See Figures 201, 202)

CAUTION: WHEN LINES AND FITTINGS ARE INSTALLED, EXERCISE CAPE THAT NO CONTAMINATION IS INTRODUCED OR THREAD LUBRICATION COMPOUND IS USED. ASSURE PROPER ALIGNMENT AND THREAD ENGAGEMENT TO PREVENT NUT FROM GALLING AND/OR CROSS THREADING.

NOTE: Apply lubricating compound (Liqui-Moly, Grade NV) to threads of bolts or screws located forward of the fireshield unless otherwise specified. Apply high temperature compound (Fel-Pro C5-A) to threads of bolts and studs located aft of the fireshield unless otherwise specified.

R Refer to 70-00-00, STANDARD PRACTICES, for recom-
R mended general torque values. Add frictional drag
R (run-down) torque of self locking devices to
R recommended values.

(1) Install anti-ice valve onto bracket with washers and bolts. Tighten bolts (25) to 25 inch-pounds torque. (See figure 202.)

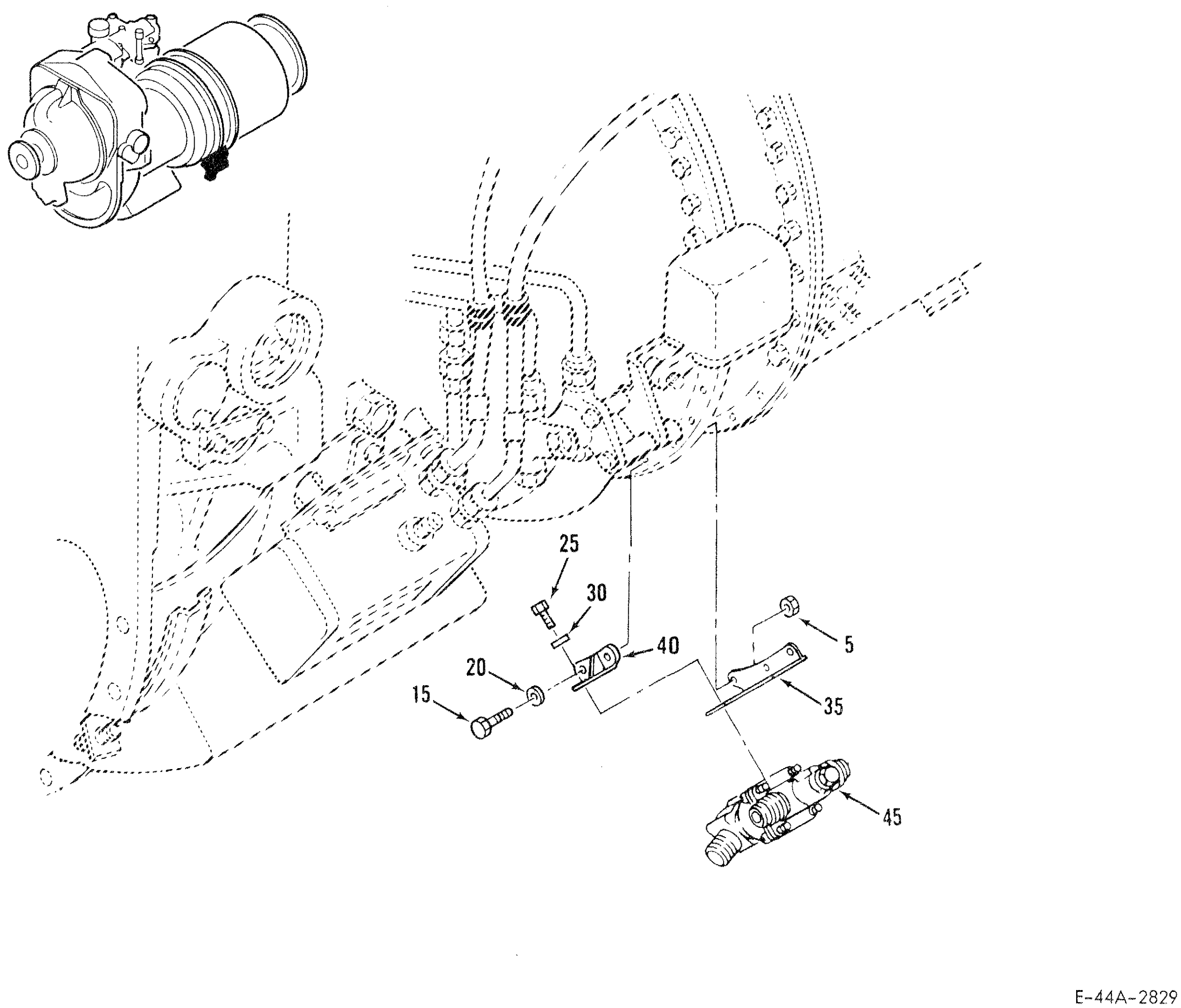
(2) Install anti-ice valve and bracket onto engine with washers, bolts and nuts. Tighten nuts (5) to 50 inch-pounds torque.

(3) Install tube assembly between anti-ice valve inlet and turbine plenum with new gasket and nuts. Tighten nuts (10) to 20 inch-pounds torque. (See figure 201.)

(4) Install plug with washer into tube assembly. Tighten plug (20) to 45 to 50 inch-pounds torque and lockwire.

R KEY TO FIGURE 201

R	5.	TUBE ASSY (IPC FIG. 28)	50.	BRACKET	95.	BOLT
R	10.	NUT	55.	CAP	100.	WASHER
R	15.	GASKET	60.	TUBE ASSY	105.	BRACKET
R	20.	PLUG	65.	CAP	110.	TUBE ASSY
R	25.	WASHER	70.	BOLT	115.	UNION
R	30.	TUBE ASSY	75.	CLAMP	120.	PACKING
R	35.	NUT	80.	BOLT	125.	ANTI-ICE VALVE
R	40.	BOLT	85.	NUT		
R	45.	CLAMP	90.	CLAMP		



R 5. NUT (IPC FIG. 80)
R 15. BOLT
R 20. WASHER
R 25. BOLT
30. WASHER
35. BRACKET
40. BRACKET
45. ANTI-ICE VALVE

R (Codes AA-AC, FA, LA) Anti-Ice Valve Installation
Figure 202

1. B. (5) Attach bracket to ignition unit with ingition unit mounting bolt.

(6) Install tube assembly onto anti-ice valve outlet. Secure tube assembly to bracket with clamp, bolt and nut. Tighten nut (35) to 20 inch-pounds torque.

(7) Install cap on tube assembly. Tighten cap (75) to 270 to 300 inch-pounds torque.

(8) Install tube assembly between anti-ice valve outlet tube assembly and anit-icing shield assembly.

(9) (Codes AA-AC) Install cap on fitting in anti-icing shield. Tighten cap (65) to 70 to 80 inch-pounds torque and lockwire.

NOTE: New packings may be installed dry or apply alternate lubricant (OS-124) sparingly and spread evenly to a thin transparent film to minimize contamination.

(10) (Codes FA, LA) Install union, with new packing, into inlet temperature and pressure sensor. Tighten union (115) to 35 to 40 inch-pounds torque.

(12) (Codes FA, LA) Install tube assembly, with attaching parts, between union in inlet temperature and pressure sensor and fitting in anti-icing shield assembly. Tighten bolt (70) to 25 inch-pounds torque. Tighten nut (95) to 70 inch-pounds torque. Tighten nut (85) to 20 inch-pounds torque.

C. (Codes BA-EA, GA-KA) Remove Inlet Anti-Ice Valve and Plumbing (See Figures 203, 204, 205, 206)

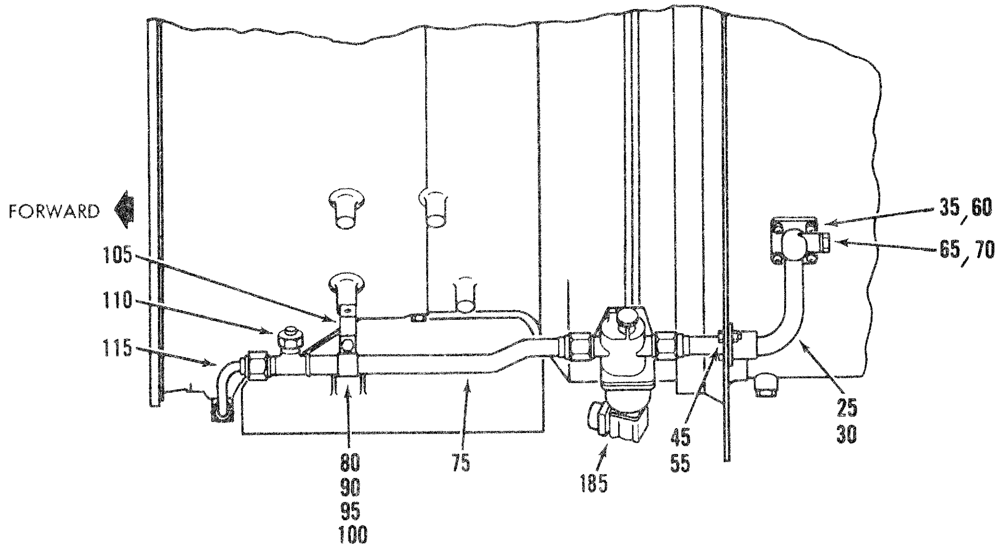
(1) Disconnect electrical connector. Refer to Aircraft Maintenance Manual.

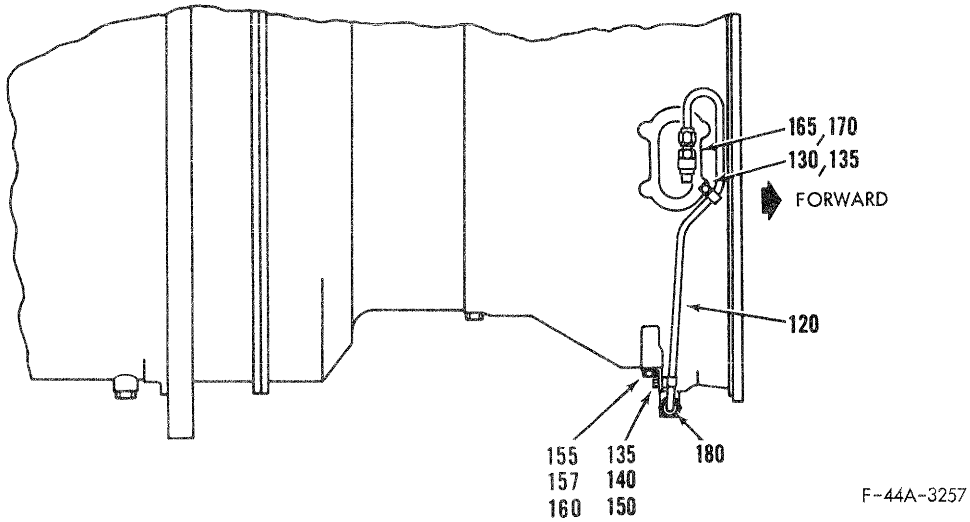
(2) (Codes BA-EA, GA, KA) Remove nuts and bolts from fireshield flange of inlet tube assembly. (See figure 203.)

(3) Remove tube assemblies, attaching parts, plug and caps from anti-ice valve, anti-icing shield assembly, and turbine plenum.

(4) (Codes GA-KA) Remove tube assembly, with attaching parts, between anti-icing shield assembly and inlet temperature pressure sensor.

(5) (Codes BA-EA, GA, KA; HA, Pre SB72-0195) Remove compensating resistor from bracket in accordance with 77-20-03, MAINTENANCE PRACTICES.





R 25.	TUBE ASSY (IPC FIG. 29)	80.	NUT	140.	NUT
30.	TUBE ASSY	90.	WASHER	150.	BOLT
35.	NUT	95.	BOLT	155.	BOLT
45.	NUT	100.	CLAMP	157.	WASHER
55.	BOLT	105.	BRACKET	160.	BRACKET
60.	GASKET	110.	CAP	165.	UNION
65.	PLUG AND BLEEDER	115.	TUBE ASSY	170.	GASKET
70.	WASHER	120.	TUBE ASSY	180.	CAP
75.	TUBE ASSY	130.	BOLT	185.	ANTI-ICE VALVE
		135.	CLAMP		

R (Codes BA-EA, GA-KA) Inlet Anti-Ice Valve Plumbing Installation
Figure 203

R 1. C. (6) (Codes BA-EA, GA, KA; HA, Pre SB72-0195) Remove bracket and anti-ice valve from engine. Remove anti-ice valve from bracket. (See figures 204, 205.)

R (7) (Code HA, Post 72-0195) Remove assembled anti-ice valve, brackets and supports for engine. Remove brackets and supports from anti-ice valve. (See figure 206.)

R D. (Codes BA-EA, GA-KA) Install Inlet Anti-Ice Valve and Plumbing (See Figures 203, 204)

CAUTION: WHEN LINES AND FITTINGS ARE INSTALLED, EXERCISE CARE THAT NO CONTAMINATION IS INTRODUCED OR THREAD LUBRICATION COMPOUND IS USED. ASSURE PROPER ALIGNMENT AND THREADS ENGAGEMENT TO PREVENT NUT FROM GALLING AND/OR CROSS THREADING.

NOTE: Apply lubricating compound (Liqui-Moly, Grade NV) to threads of bolts or screws located forward of the fireshield unless otherwise specified. Apply high temperature compound (Fel-Pro C5-A) to threads of bolts and studs located aft of the fireshield unless otherwise specified.

R Refer to 70-00-00, STANDARD PRACTICES, for recommended general torque values. Add frictional drag (run-down) torque of self locking devices to recommended values.

R (1) (Codes BA-EA, GA, KA; HA, Pre SB72-0195) Install anti-ice valve onto brackets with washer and bolt. Tighten bolts (65, figure 204 or 20, figure 205) to 25 inch-pounds torque.

R (2) (Codes BA-EA, GA, KA; HA, Pre SB72-0195) Install anti-ice valve and brackets onto engine with washers, bolts, and nuts. Tighten nuts (25, figure 204 or 5, figure 205) to 50 inch-pounds torque.

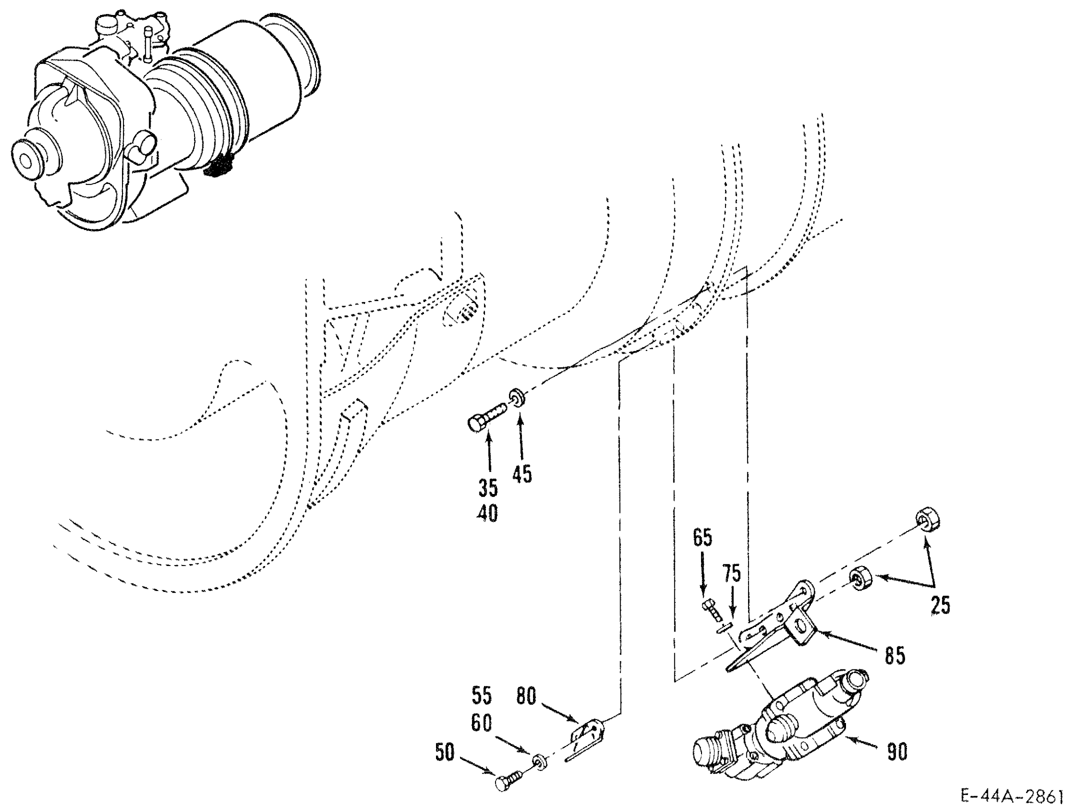
R (3) (Code HA, Post SB72-0195) Install brackets and supports onto anti-ice valve and secure with bolts and washers. Tighten bolts (5, 15, figure 206) to 25 inch-pounds torque.

R (4) (Code HA, Post SB72-0195) Install assembled anti-ice valve, brackets and supports onto engine. Tighten nuts (35, 55) to 50 inch-pounds torque.

R (5) (Codes BA-EA, GA, KA; HA, Pre SB72-0195) Install compensating resistor onto bracket in accordance with 77-20-03, MAINTENANCE PRACTICES.

(6) Install tube assembly between anti-ice valve inlet and turbine plenum with a new gasket, bolts, and nuts. Tighten nuts (35) to 20 inch-pounds torque. (See figure 203.)

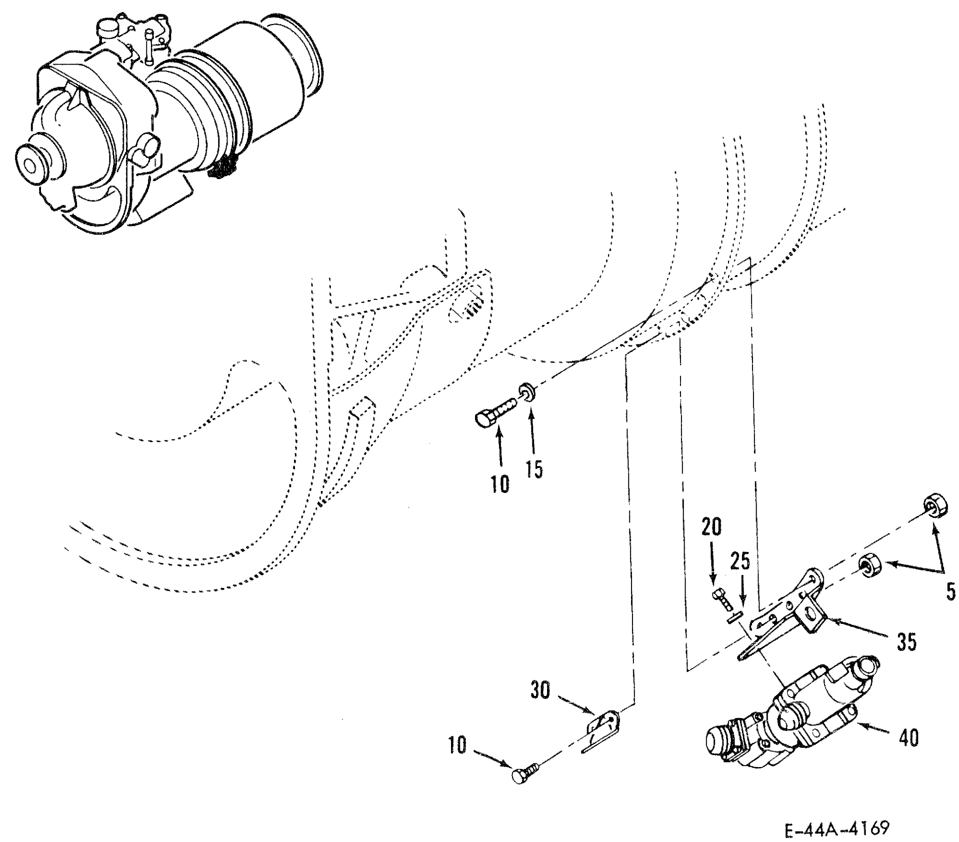
1. D. (7) Install plug and bleeder, with washer, into tube assembly. Tighten plug and bleeder (65) to 40 to 45 inch-pounds torque and lockwire.



R 25. NUT (IPC FIG. 81)
35. BOLT
40. BOLT
45. WASHER
50. BOLT
55. WASHER
60. WASHER
65. BOLT
75. WASHER
80. BRACKET
85. BRACKET
90. ANTI-ICE VALVE

R (Codes BA-EA, GA, KA) Anti-Ice Valve Installation
Figure 204

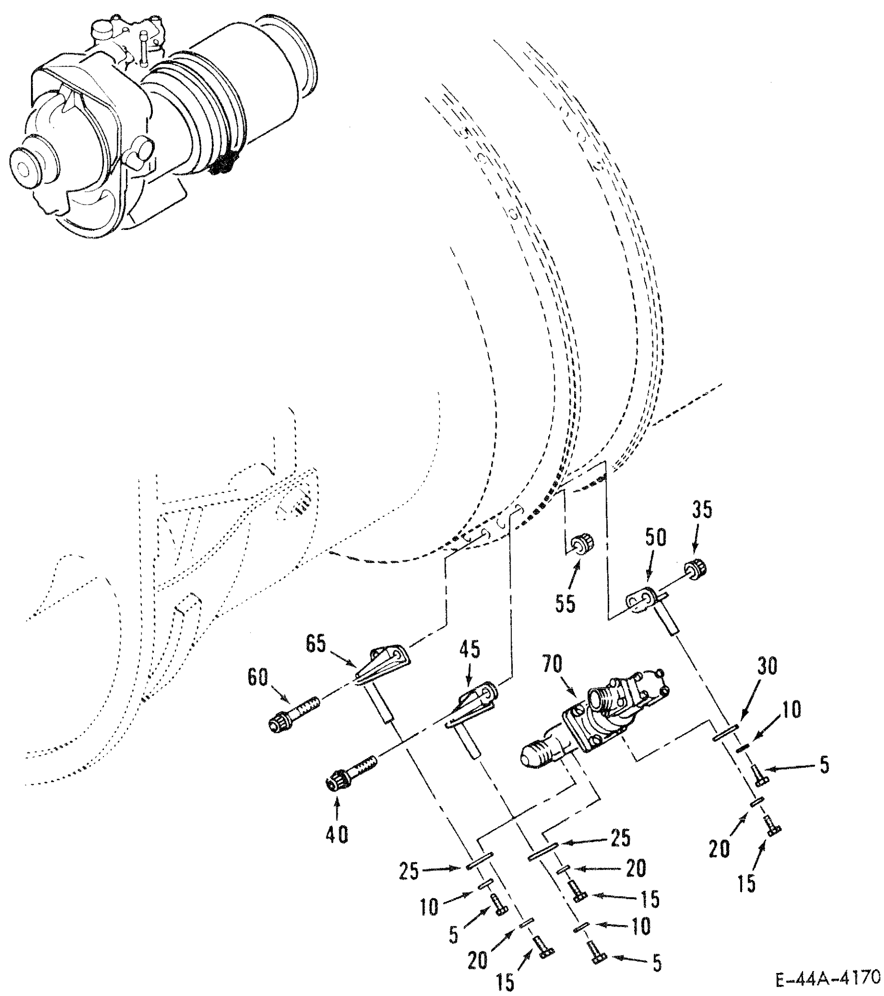
R



R 5. NUT (IPC FIG. 82)	25. WASHER
R 10. BOLT	30. BRACKET
R 15. WASHER	35. BRACKET
R 20. BOLT	40. ANTI-ICE VALVE

(Code HA, Pre SB72-0195) Inlet Anti-Ice Valve Installation
Figure 205

R



R 5.	BOLT (IPC FIG. 83)	40.	BOLT
R 10.	WASHER	45.	BRACKET
R 15.	BOLT	50.	BRACKET
R 20.	WASHER	55.	NUT
R 25.	SUPPORT	60.	BOLT
R 30.	SUPPORT	65.	BRACKET
R 35.	NUT	70.	ANTI-ICE VALVE

(Code HA, Post SB72-0195) Inlet Anti-Ice Valve Installation
Figure 206

R 1. D. (8) (Codes BA-EA, GA, KA) Attach inlet tube assembly flange to fireshield with bolts and nuts. Tighten nuts (45) to 20 inch-pounds torque.

(9) Install tube assembly to anti-ice valve outlet with attaching parts. Tighten nut (80) to 20 inch-pounds torque.

(10) Install cap on tube assembly. Tighten cap (110) to 190 to 200 inch-pounds torque and lockwire.

(11) Install tube assembly between anti-icing outlet tube assembly and anti-icing shield assembly.

R (12) (Codes BA-EA) Install cap on fitting in anti-icing shield assembly. Tighten cap (180) to 40 to 60 inch-pounds torque and lockwire.

NOTE: New packings may be installed dry or apply alternate lubricant (OS-124) sparingly and spread evenly to a thin transparent film to minimize contamination.

R (13) (Codes GA-KA) Install union, with new gasket, into inlet temperature and pressure sensor. Tighten union (165) to 35 to 40 inch-pounds torque.

R (14) (Codes GA-KA) Install tube assembly, with attaching parts, between union in inlet temperature and pressure sensor and fitting in anti-icing shield assembly. Tighten bolt (130) to 25 inch-pounds torque. Tighten bolt (155) to 70 inch-pounds torque. Tighten nut (140) to 20 inch-pounds torque.

R (15) Connect electrical connector. Refer to Aircraft Maintenance
R Manual.

2. Adjustment/Test

A. Test Inlet Anti-Ice Valve

(1) Check for continuity across Pins C and D of electrical connector. Continuity shall be indicated. Check that there is no continuity from Pin E to any other pin of electrical connector.

(2) Apply 24 volts dc across Pins A and B of electrical connector to energize electromagnet assembly and activate switch. There shall be continuity from Pin E to Pin C. There shall be no continuity from Pin D to any other pin of electrical connector.

(3) Install anti-ice valve on engine and perform functional test of anti-ice valve with engine operating.

3. Inspection/Check

A. Inspect Inlet Anti-Ice Valve and Plumbing

(1) Visually inspect anti-ice valve body for dents, cracks, or obvious damage.

(2) Visually inspect electrical connector for bent, broken, or burned pins.

(3) Visually inspect threaded parts for stripped, galled, or peened threads.

(4) Visually inspect tube assemblies for cracks, dents, or obvious damage.

(5) Replace part that does not meet Inspection/Check requirements.

4. Approved Repairs

NOTE: Table 202 provides a list of all materials and compounds required to perform Approved Repairs.

Table 202. Materials and Compounds

Material or Compound	
NOTE: Equivalent substitutes may be used for listed items.	
Crocus cloth (Federal Specification (P-C-458)	Commercially available
Dry-film lubricant (Lube-Lok No. 2006)	Electrofilm Inc, 7116-21 Laurel Canyon Blvd, North Hollywood, CA 96105
Lint-free cloth	Commercially available
Soft bristled brush	Commercially available
R 1,1,1-Trichloroethane R (MIL-T-81533)	Commercially available

4. A. Partially Disassemble Anti-Ice Valve for Cleaning (See Figure 207)

(1) Mark flanges of valve body and electromagnet assembly to show orientation of parts to aid assembly.

(2) Remove screws and washers securing valve body to electromagnet assembly and remove electromagnet assembly.

(3) Remove armature assembly, then remove rod, washers, and spring as an assembly.

NOTE: Use care not to lose or misplace washers. Record quantity and thickness of washers to aid assembly.

(5) Remove spring retainer assembly and packing.

(6) Remove spring and washer(s) from spring retainer assembly.

B. Clean Anti-Ice Valve Components

(1) Wipe surfaces of all parts except electrical connector on elec-
R tromagnet assembly with clean lint-free cloth dipped in 1,1,1-
R Trichloroethane (MIL-T-81533).

(2) (Part No. 319980-5-1 Valve Only) Using crocus cloth (Federal Specification P-C-458), lightly polish armature assembly, and internal surfaces of electromagnet assembly.

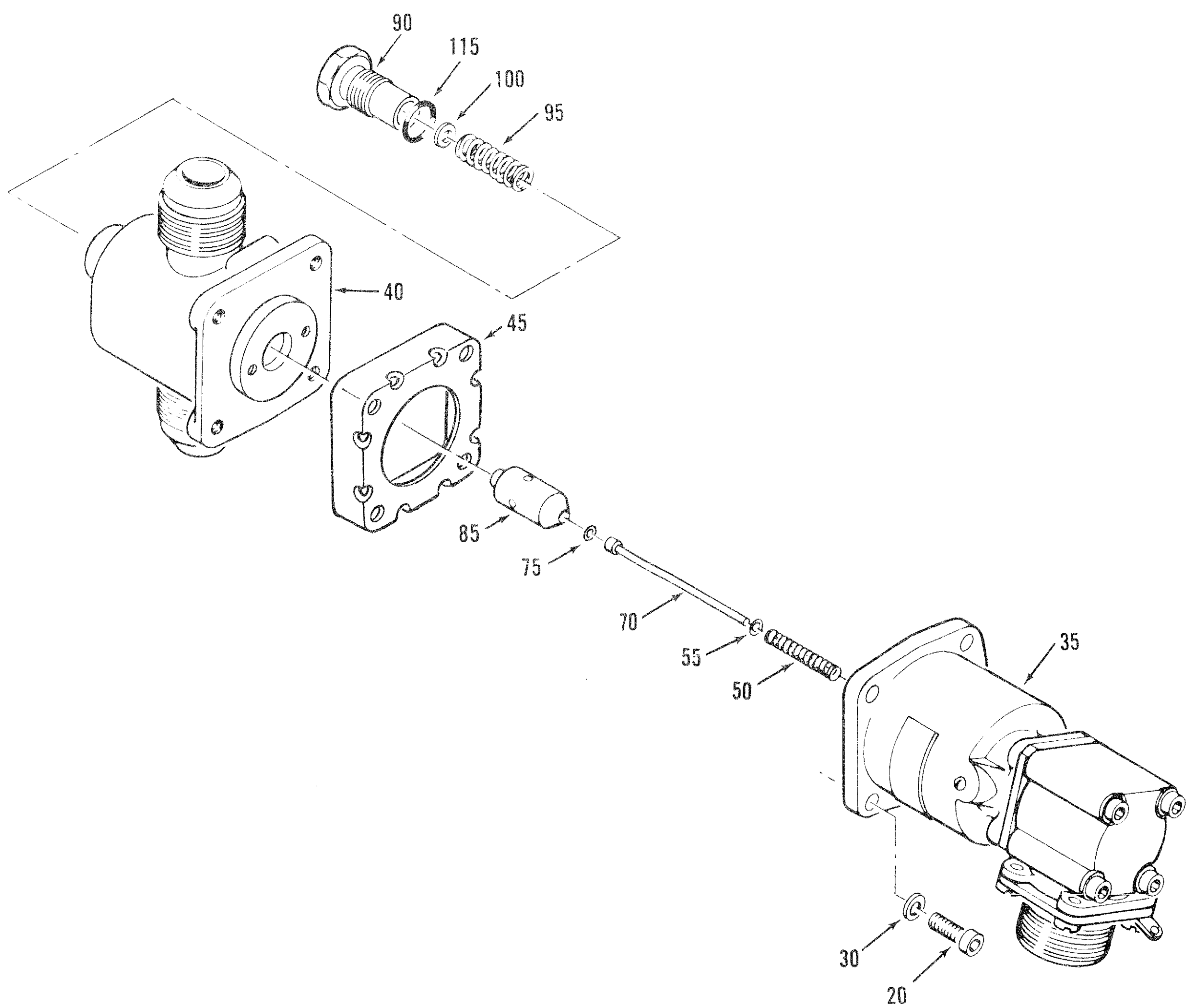
R (3) Flush all parts with 1,1,1-Trichloroethane (MIL-T-81533). Remove
R oil substances with cotton swab dipped in 1,1,1-Trichloroethane
R (MIL-T-81533). Dry parts with clean low pressure compressed air.

(4) Clean electrical connector on electromagnet assembly of dirt,
R grease or other contaminants using 1,1,1-Trichloroethane (MIL-T-
R 81533) and a soft bristled brush. Remove oily substance with cot-
R ton swab dipped in 1,1,1-Trichloroethane (MIL-T-81533).

C. Assemble Anti-Ice Valve (See Figure 207)

NOTE: New packings may be installed dry or apply alternate lubricant (OS-124) sparingly and spread evenly to a thin transparent film to minimize contamination.

(1) Install new packing on spring retainer assembly.



R 20.	SCREW (IPC FIG. 84)	70.	ARMATURE (ROD)
30.	WASHER	75.	WASHER
35.	ELECTROMAGNET ASSY	85.	ARMATURE
40.	BODY	90.	RETAINER
45.	FLANGE	95.	SPRING
50.	SPRING	100.	WASHER
55.	WASHER	115.	PACKING

R Anti-Ice Valve
R (Field Maintenance Breakdown)
Figure 207

4. C. (2) Install washer(s) and spring on spring retainer assembly and install spring retainer assembly in valve body.

(3) Apply a light coat of dry-film lubricant (Lube-Lok No. 2006) to surfaces of assembled poppet valve which mates with armature assembly when installed in valve body. Apply dry-film lubricant by spraying small amount directly into inlet port of valve body.

(4) Apply dry-film lubricant (Lube-Lok No. 2006) to armature assembly and rod.

(5) Install armature assembly, rod, same quantity and thickness of washers noted in disassembly, and spring.

(6) Check valve assembly for freedom of movement by depressing armature rod.

(7) Install electromagnet assembly on valve body, aligning scribe marks made during disassembly. Secure with screws and washers. Tighten screws (20) to 15 inch-pounde torque.

(8) Test anti-ice valve in accordance with Adjustment/Test.

5. Cleaning/Painting

A. Clean Parts

(1) Clean all standard metallic hardware in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 1. or 2.

(2) Clean all plumbing and fittings in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 12.

(3) Clean anti-ice valve in accordance with Approved Repairs.

INLET ANTI-ICING SHIELD ASSEMBLY - MAINTENANCE PRACTICES

1. Removal/Installation

NOTE: Table 201 provides a list of all materials and compounds required to perform Removal/Installation.

Table 201. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
R Any approved engine oil	Commercially available
Lubricating compound (Liqui-Moly, Grade NV)	Lockrey Co, Lubricants Div, Cedar Shores, Southampton, NY 11968

A. Remove Inlet Anti-Icing Shield Assembly (See Figure 201)

(1) Disconnect oil tank plumbing in accordance with 79-10-01, MAINTENANCE PRACTICES.

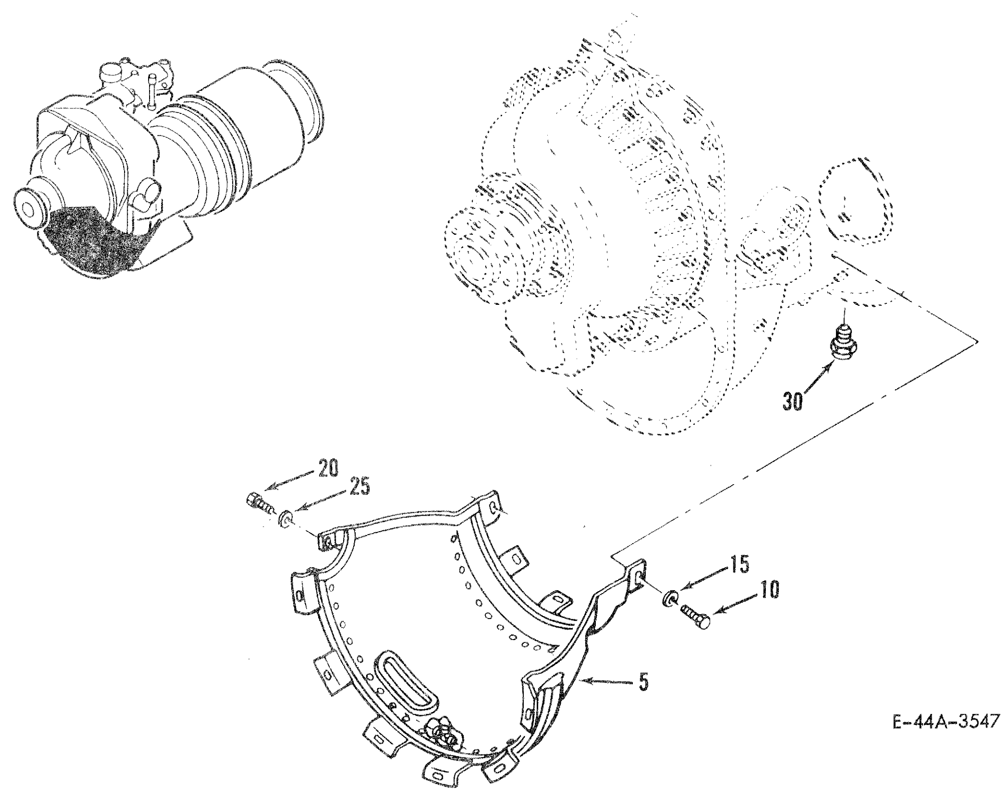
(2) Remove oil tank assembly in accordance with 79-10-01, MAINTENANCE PRACTICES.

(3) Remove ignition unit in accordance with 74-10-01, MAINTENANCE PRACTICES.

(4) Disconnect anti-ice valve plumbing from inlet anti-icing shield assembly in accordance with 75-10-01, MAINTENANCE PRACTICES.

(5) Remove inlet anti-icing shield assembly.

(6) Remove plug.



R 5. ANTI-ICING SHIELD (IPC FIG. 85)
10. BOLT
15. WASHER
20. BOLT
25. WASHER
30. DRAIN PLUG

Anti-Icing Shield Assembly Installation
Figure 201

1. B. Install Inlet Anti-Icing Shield Assembly (See Figure 201)

NOTE: Apply lubricating compound (Liqui-Moly, Grade NV) to threads of bolts, and clean engine oil to threads (except first two threads) of male plumbing fittings unless otherwise specified.

(1) If removed, install plugs, tighten and lockwire.

(2) Install inlet anti-icing shield with bolts and washers. Tighten bolts (15) to 30 inch-pounds torque, and tighten bolt (5) to 25 inch-pounds torque.

(3) Connect anti-ice valve plumbing to inlet anti-icing shield assembly in accordance with 75-10-01, MAINTENANCE PRACTICES.

(4) Install ignition unit in accordance with 74-10-01, MAINTENANCE PRACTICES.

(5) Install oil tank assembly in accordance with 79-10-01, MAINTENANCE PRACTICES.

(6) Connect oil tank plumbing in accordance with 79-10-01, MAINTENANCE PRACTICES.

2. Inspection/Check

R A. Inspect Inlet Anti-Icing Shield Assembly

(1) Visually inspect for cracks, distortion, peeling of insulation material, or obvious damage.

(2) Refer to Approved Repairs for repair of shield assembly if insulation material is peeling. Replace shield assembly if damaged.

3. Cleaning/Painting

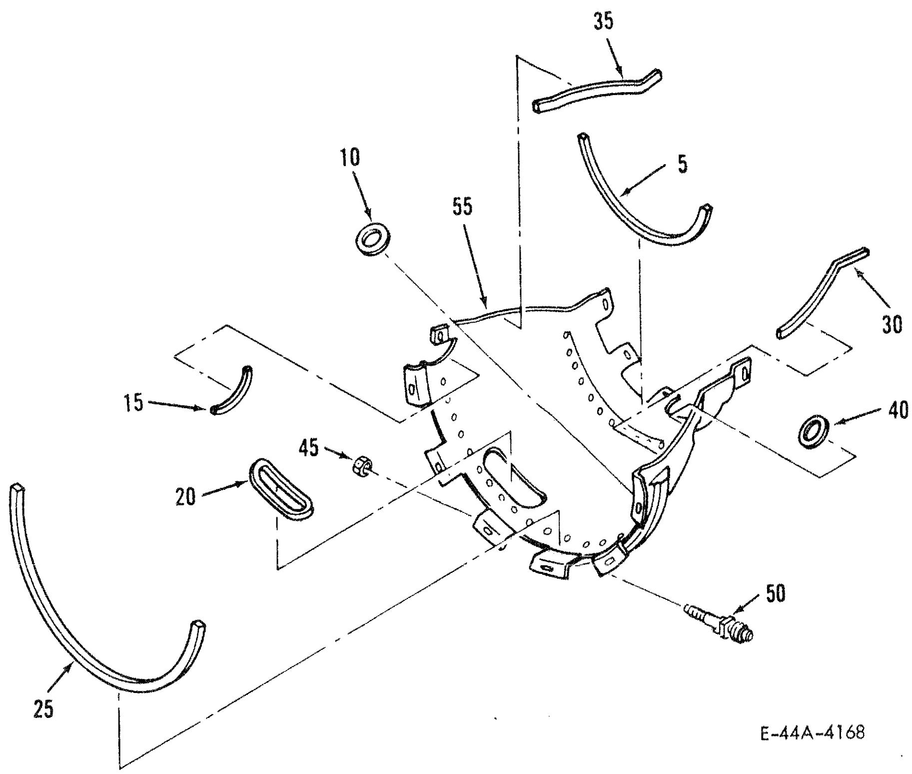
A. Clean Inlet Anti-Icing Shield

CAUTION: TO PREVENT DETERIORATION OF SILICONE RUBBER BASE SEALS AND GASKETS, DO NOT ALLOW SEALS OR GASKETS TO COME IN CONTACT WITH ACETONE BASE SOLVENT. ENSURE THAT SURFACES WHICH CONTACT SEALS AND GASKETS ARE FREE OF RESIDUE WHEN ACETONE BASE SOLVENT IS USED.

(1) Clean all standard metallic hardware in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 1 or 2.

(2) Clean anti-icing shield assembly in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 1.

R



R 5. GASKET (IPC FIG. 86)
R 10. GASKET
R 15. GASKET
R 20. GASKET
R 25. GASKET
R 30. GASKET
35. GASKET
40. GASKET
45. NUT
50. FITTING
55. SHIELD

Anti-Icing Shield Assembly
(Field Maintenance Breakdown)
Figure 202

4. Approved Repairs

NOTE: Table 202 provides a list of all materials and compounds required to perform Approved Repairs.

Table 202. Materials and Compounds

Material or Compound	Maufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Paint (Andrew Brown A423-66 Epoxy Enamel No. 051 and C-1178 Converter)	Griggs Paint and Hardware Co, 3602 S 16th Pl, Phoenix, AZ 85040
R Primer (P-415A-66-611B with R Catalyst C1178-66)	Griggs Paint, Subsidiary of Domcom Dist, 3602 S 16th Pl, Phoenix, AZ 85040
1,1,1-Trichloroethane (MIL-T-81533)	Commercially available
Sealant (RTV731)	Commercially available

A. Repair Inlet Anti-Icing Shield Assembly (See Figure 202)

NOTE: Shield assembly with peeling paint does not affect engine function but may be unsightly. If desired, repaint shield as described in the following procedure.

(1) Clean anti-icing shield.

(a) Strip off silicone sponge gasket material and paint to bare metal of shield.

(b) Thoroughly clean shield using 1,1,1-Trichloroethane (MIL-T-81533).

(2) Paint anti-icing shield assembly.

(a) Prepare primer (P-415A-66-611B with Catalyst C1178-66) by mixing equal parts, by volume, of P-415A-66-611B and catalyst. Allow to stand 30 minutes before use. Apply primer and allow to air-dry for 15 to 30 minutes, then bake for one hour at 79 to 107C (175 to 225F).

4. A. (2) (b) Prepare color coat (Andrew Brown A423-66 Epoxy Enamel, No. 051 and C1178 Converter). Allow to stand 30 minutes before use. Apply color coat and allow to air-dry 15 to 30 minutes, then bake for one hour at 79 to 107C (175 to 225F).

(3) Install silicone sponge gaskets. (See figure 202.)

(a) Thoroughly clean interfacing surfaces of gasket and shield using 1,1,1-Trichloroethane (MIL-T-81533). Apply uniform layer of sealant (RTV731) to cleaned surfaces. Press gasket in place. Use sufficient pressure to displace air between gasket and shield. Allow bonded joints to cure at room temperature at least 24 hours. Do not apply heat.

R (4) (Post SPB-TPE0106) Install fitting into shield. Tighten nut (45,
R figure 202) to 70 to 80 inch-pounds.

LIST OF EFFECTIVE PAGES
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RECORD OF TEMPORARY REVISIONS

REV NO.	CHAP/SEC/SUBJ PAGE NO.	DATE ISSUED	DATE INSERTED	BY	DATE REMOVED	BY	INCORPORATED INTO MANUAL BY REV NO.
76-1	76-10-01 220	May 11/77					4
76-2	76-10-01 221	May 11/77					4
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CHAPTER 76 - ENGINE CONTROLS

TABLE OF CONTENTS

POWER CONTROL (ENGINE CONTROLS) - DESCRIPTION AND OPERATION

1. The power control of the engine is accomplished by means of the controls linkage assembly, and the various control components. The controls linkage assembly on the engine serves to interconnect the control components and coordinate their function. The manual fuel valve shaft that positions the main metering valve protrudes from the fuel control unit. Mechanical linkage connects the manual fuel valve shaft to the propeller pitch control cam shaft, and coordinated into a single cockpit control, provides for pilot control of the propeller blade pitch-angle during beta mode and power in the propeller governing mode. Mechanical linkage connects the speed lever shaft to the propeller governor speed control shaft and, coordinated into a single cockpit control, provides for pilot control of the underspeed governor speed-setting during beta mode and pilot control of the propeller governor speed-governor point during propeller-governor mode. The underspeed governor is set slightly below the propeller governor setting to prevent governing interference between the two speed control governors.

R 2. (Codes AA-AC, FA, HA, LA) The control bracket and cable support bracket installation provides mounting for airframe furnished engine control linkage.

CONTROL LINKAGE ASSEMBLY - MAINTENANCE PRACTICES

NOTE: Refer to Table 201. Maintenance Instructions Paragraph Index, to determine applicable paragraphs for each engine code.

Table 201. Maintenance Instructions Paragraph Index

	Task	Engine Effectivity Codes	Paragraph	Figure No.
	Removal/Installation	(ALL)	1.	
R	Remove Control Linkage Assembly	(AA-EA)	1.A.	201
R R	Install Control Linkage Assembly	(AA-EA)	1.B.	201 thru 203
R R	Remove Control Linkage Assembly	(FA-LA)	1.C.	204 thru 208
R R	Install Control Linkage Assembly	(FA-LA)	1.D.	204 thru 211
	Adjustment/Test (Rigging)	(ALL)	2.	
	Position Beta Tube	(ALL)	2.A.	
R	Rigging Control Linkage Assembly	(AA-EA)	2.B.	
R	Adjust Underspeed Governor Stops	(AA-EA)	2.B.(1)	212
R R	Adjust Propeller Governor Stop Settings	(AA-EA)	2.B.(2)	212
R	Rigging Control Linkage Assembly	(FA-LA)	2.C.	
R	Adjust Underspeed Governor Stops	(FA-LA)	2.C.(1)	213
R	Adjust Propeller Governor Stops	(FA-LA)	2.C.(2)	213
R	Rigging Propeller Governor to Underspeed Governor	(FA-LA)	2.C.(3)	213 and 214

1. Removal/Installation

NOTE: Procedures are provided for complete disassembly and reassembly; however, the linkage should be disassembled only to the extent required for the component being replaced. Do not remove rod end bearings and associated nuts unless replacement is required. If rigging check only is required, refer to Adjustment/Test. Refer to Table 201 for specific maintenance instructions. Table 202 provides a list of materials and compounds required for Removal/Installation.

Table 202. Materials and Compounds

NOTE: Equivalent substitutes may be used for listed items.

Compound (EC1252)	Minnesota Mining and Mfg Co, Adhesives, Coatings and Sealers Division, 3M Center, St Paul, MN 55101
Violet master marker (Grade 127-1/2)	Pannier Corp, 207 Sandusky St, Pittsburgh, PA 15212

R A. (Codes AA-EA) Remove Control Linkage Assembly (See Figure 201)

(1) Remove pin, nut, bolt, and washers. Separate rod assembly from adjustable arm on propeller pitch control.

(2) Remove pin, nut, washer, serrated plate, and bolt. Separate rod assembly from power lever shaft arm.

(3) Remove pin, nut, washers, and bolt. Separate rod assembly from fuel control arm.

(4) Remove pin, nut, washers, and bolt. Separate rod assembly from propeller governor adjustable arm. Remove nut, washer, bolt, and adjustable arm.

NOTE: Complete steps (5) through (7) only if further disassembly is required.

(5) Remove nut, screw, adjustable arm, arm assembly, and spacer from propeller pitch control shaft.

1. A. (6) Remove screws, washers, quadrant plate, and plate from propeller pitch control.

(7) Remove nut, washer, bolt, and arm from power lever shaft.

R NOTE: Refer to 70-00-00, STANDARD PRACTICES, for recommended general torque values. Add frictional drag (run-down) torque of self locking devices to recommended values.

R B. (Codes AA-EA) Install Control Linkage Assembly (See Figures 201 through 203)

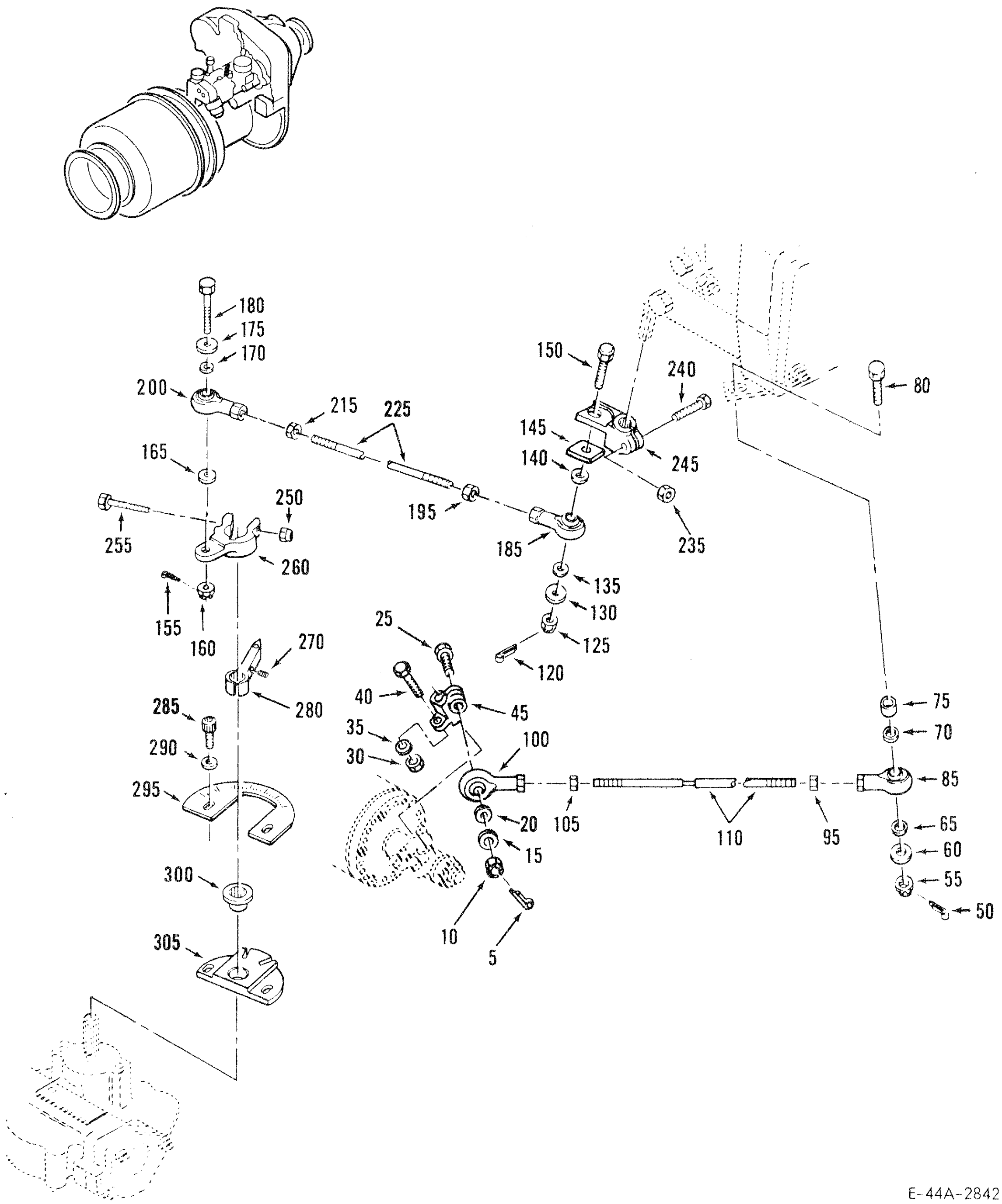
NOTE: Minimum running torque values have been established for several sizes of bolts and self-locking female threads. Bolts and inserts with running torques less than the below minimums shall be replaced:

Bolt/Insert Size	Minimum Running Torque
No. 8	4 in.-lb
No. 10-32	6 in.-lb
0.250 (1/4 inch)	6 in.-lb

(1) Install rigging plate, quadrant plate, and spacer on propeller pitch control shaft. Secure plates with screws and washers. Do not tighten screws (285, figure 201) to torque value at this time.

(2) Assemble serrated arm assembly, linkage adjust arm, screw and nut. Rotate propeller pitch control shaft to full clockwise position. Center serrated arm assembly in linkage adjust arm, and install onto shaft with rigging hole aligned with ZERO degree rigging slot in rigging plate and indicate ZERO degrees on quadrant plate. Slight adjustment of quadrant plate, rigging plate, and linkage adjustment arm may be necessary for ease of rigging pin installation. Tighten nut (250, figure 201) to 35 inch-pounds torque. Ensure rig pin engages freely in zero and 40 degree positions. Tighten screws (285) to a torque value of 33 inch-pounds. Apply compound (EC1250) stripe across nut and arm assembly.

(3) Measure distance from centerline of fuel control power lever shaft and propeller pitch control shaft as shown in Figure 202. Record as Dimension A.



R (Codes AA-EA) Speed and Power Setting Rod and
R Lever Installation
Figure 201

NOTE: Each time rod assemblies are adjusted, tighten jam nuts to torque value of 20 inch-pounds.

1. B. (4) Adjust length of Rod Assembly A (measured) from centerline to centerline of bolt hole in rod end (bearings) to Dimension A noted in step (3) +0.020/-0.020 inch. Connect Part No. 895187-2, rod end bearing end of rod assembly to linkage adjust arm on propeller pitch control shaft with bolt, washers, spacer, and nut. Tighten nut (160, figure 201) to 12 inch-pounds torque. Install cotter pin.

(5) Remove rigging pin installed in step (2). Move assembled propeller pitch control serrated arm assembly so that pointer is at the 40 degree position. Insert rigging pin. Insert a rigging pin in power lever shaft quadrant plate at the 40 degree position. Install serrated arm on power lever shaft. Align rod end bearing, of rod assembly installed in previous step, with center of slot in serrated arm. Secure serrated arm (figure 201) with bolt, washer, and nut. Tighten nut (235, figure 201) to 40 inch-pounds torque. Connect rod assembly to serrated arm with bolt, washer, plate, and nut. Tighten nut (125, figure 201) to 12 inch-pounds torque. Install cotter pin.

KEY TO FIGURE 201

R 5. COTTER PIN (IPC FIG. 88)
10. NUT
15. WASHER
20. WASHER
25. BOLT
30. NUT
35. WASHER
40. SCREW
45. ADJUSTING ARM
50. COTTER PIN
55. NUT
60. WASHER
65. WASHER
70. WASHER
75. WASHER
80. BOLT
85. ROD END BEARING
95. NUT
100. ROD END BEARING
105. NUT
110. THREADED ROD
120. COTTER PIN
125. NUT
130. WASHER
135. WASHER
140. WASHER
145. SERRATED PLATE
150. BOLT
155. COTTER PIN
160. NUT
165. WASHER
170. WASHER
175. WASHER
180. BOLT
185. ROD END BEARING
195. NUT
200. ROD END BEARING
215. NUT
225. THREADED ROD
235. NUT
240. BOLT
245. SERRATED ARM
250. NUT
255. SCREW
260. LINKAGE ADJUST ARM
270. INSERT
280. SERRATED ARM ASSY
285. SCREW
290. WASHER
295. QUADRANT PLATE
300. SPACER
305. RIGGING PLATE

1. B. (6) Remove both rigging pins and move power lever shaft to the maximum degree position. Ensure 100 +1/-1 degree lever travel is indicated on the propeller pitch control quadrant plate when power lever shaft is at maximum position. First adjustment to obtain correct travel shall be accomplished by adjusting length of rod assembly "A". If adjustment of rod assembly does not attain correct position, adjust serrated plate position on power lever serrated arm.

(7) Recheck linkage adjustment as follows.

(a) Move power lever serrated arm until pointer is at the 40 degree position, then insert rigging pin to establish the flight idle position. If necessary, adjust rod assembly "A" to allow insertion of rigging pin through the propeller pitch control arm assembly pointer and slot in plate at the 40 degree position.

CAUTION: DO NOT MAKE ANY ADJUSTMENT TO POWER LEVER MAXIMUM STOP.

(b) Remove rigging pins and move the linkage assembly to establish zero degrees on the propeller pitch quadrant plate, then insert rigging pin. Adjust the power lever minimim stop, if necessary, for insertion of rigging pin. The final angle indicated on the power lever quadrant plate (protractor) shall be 0 +3/-3 degrees.

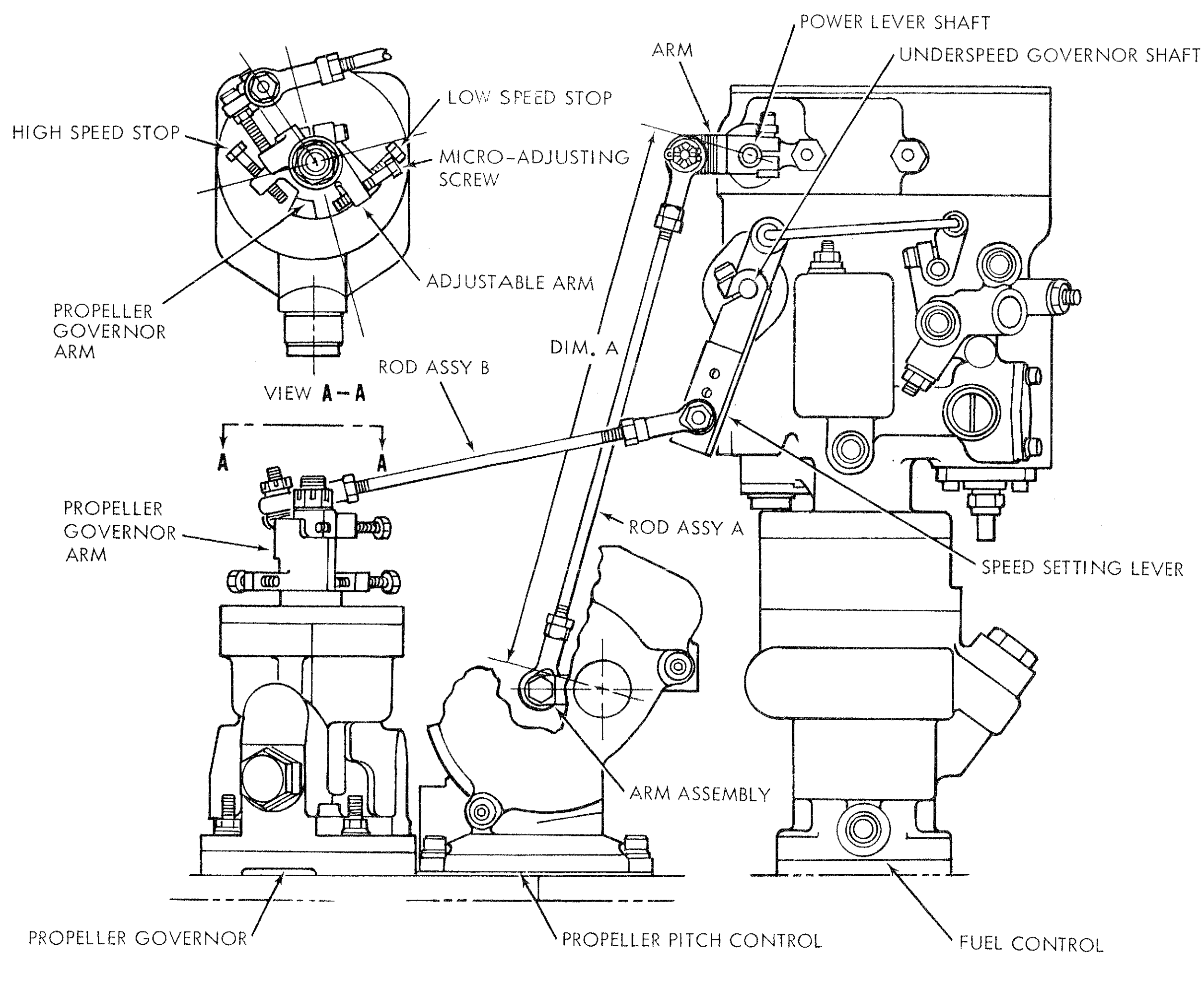
(8) If final results are not as specified in step (7), repeat steps (6) and (7).

(9) Ensure jam nuts (195, 215, figure 201) on Rod Assembly "A" are tightened to 20 inch-pounds torque. Install lockwire on rod assembly rod end bearing at pitch control end. Apply compound (EC1252) stripe across stud and jam nuts.

(10) Install one end of Rod Assembly "B" on speed setting lever at the third hole from the underspeed governor shaft as shown in Figure 202. Secure with bolt, washers and nut. Tighten nut (55, figure 201) to 12 inch-pounds torque.

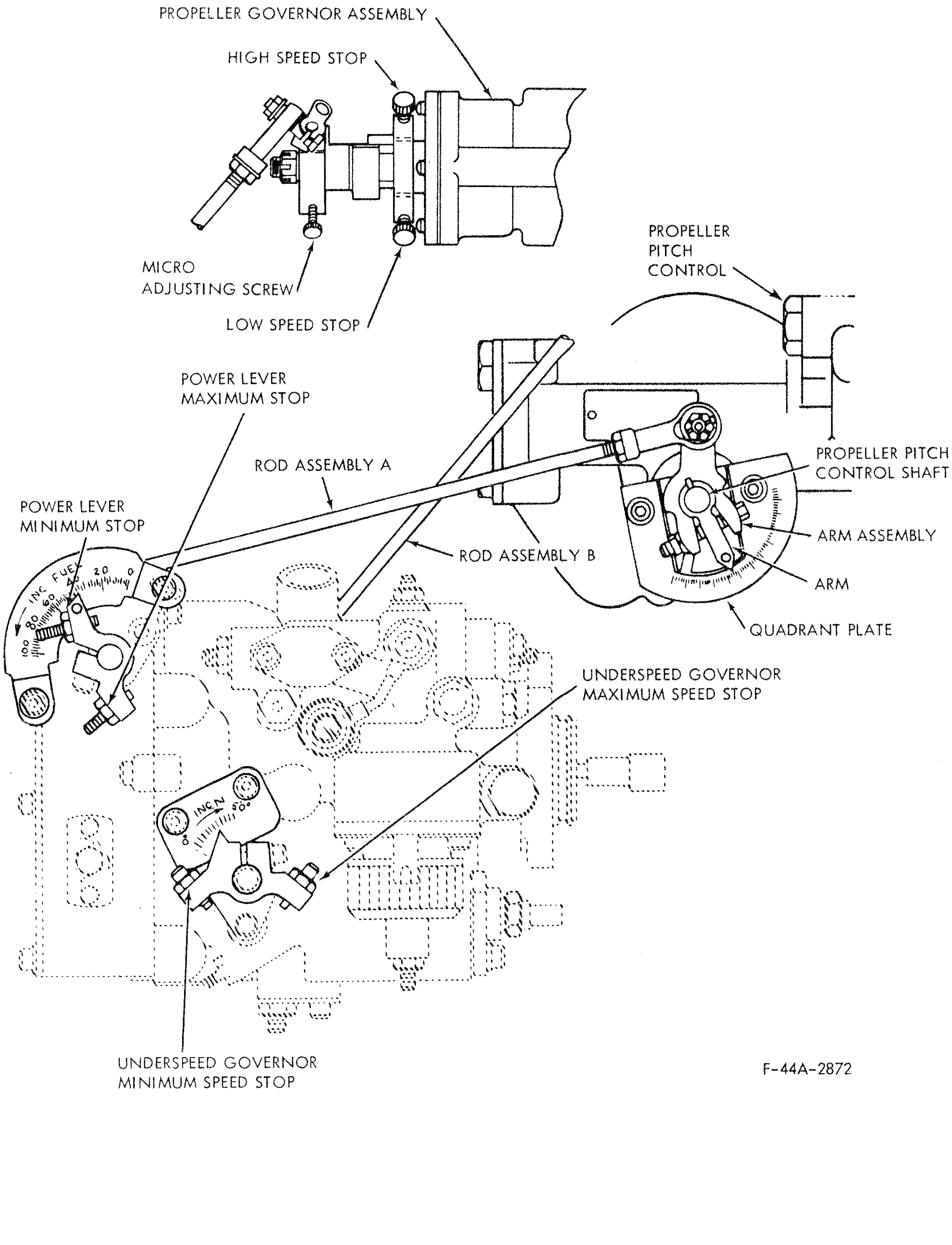
(11) Install adjusting arm on propeller governor lever so that it is cetered within the total adjustment range, then secure with screw, washer and nut.

(12) Connect end of rod assembly "B" to adjusting arm with bolt, washers and nut.



R

(Codes AA-EA) Installation of Control Linkage Assembly
Figure 202



R

(Codes AA-EA) Controls Linkage
Installation and Adjustment
Figure 203

1. B. (13) Adjust micro adjusting screw (figure 202) to its mid adjustment position, then adjust threaded rod until the maximum (high speed) stops are contacted simultaneously at the propeller governor and fuel control under speed governor. Tighten nuts to secure adjustment of threaded rod.

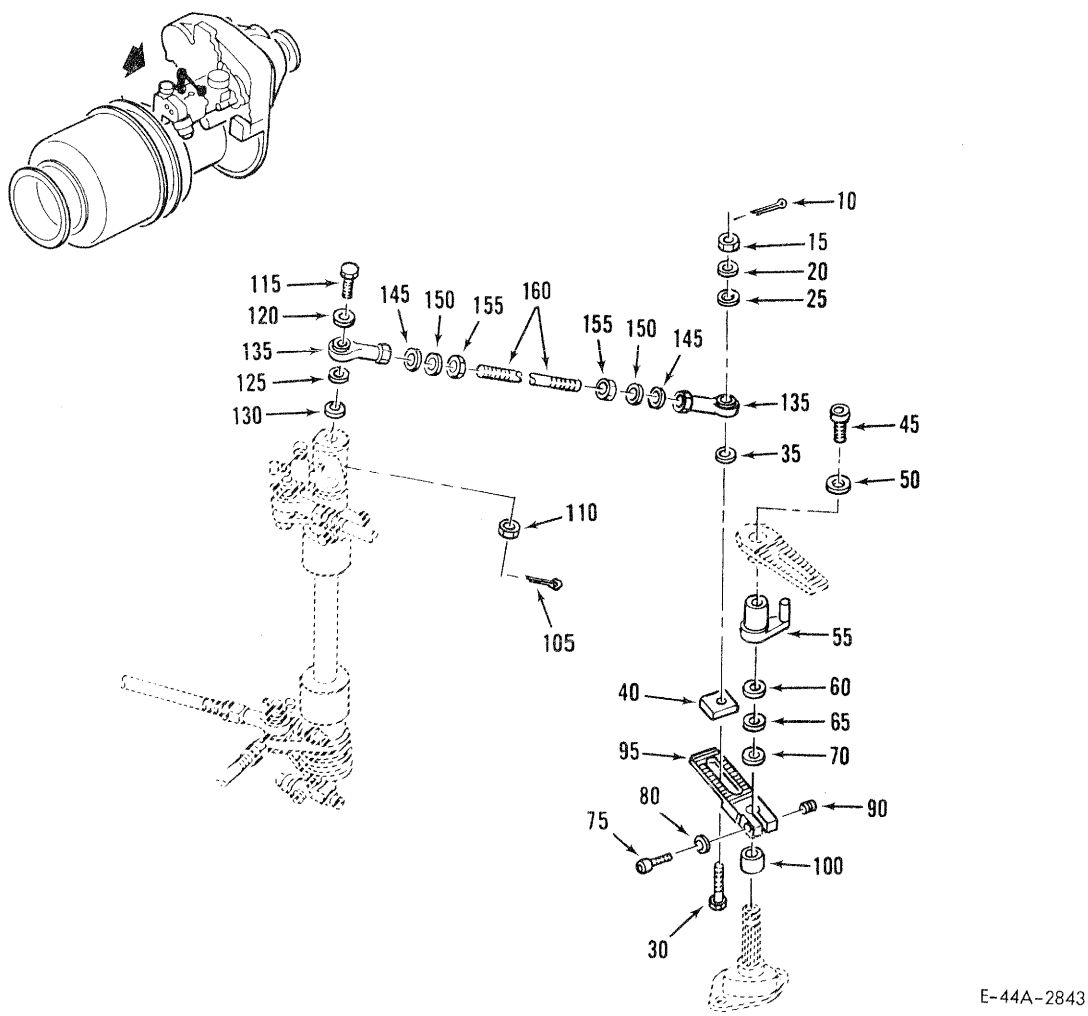
(14) Move linkage rod assembly until the propeller governor arm contacs the low speed (minimum) stop. Adjust micro adjusting screw until it contacts the arm. The underspeed governor protractor reading shall be 27 to 33 degrees.

NOTE: Repeat following sub-steps (a) and (b) until requirements of step (14) are accomplished. The 27 to 33 degrees setting is a starting point, not a final rigging tolerance.

(a) If protractor reading is less than 27 degrees, reset adjusting arm on propeller governor shaft to increase travel and repeat step (14) to readjust micro adjusting screw.

(b) If protractor reading is more than 33 degrees, reset adjusting arm on propeller governor shaft to decrease travel and repeat step (14) to readjust micro adjusting screw.

(15) Make certain that at least one thread can be observed in the rod assembly inspection hole and that a 0.050 inch diameter rod or wire will not pass through inspection hole to ensure sufficient thread engagement between threaded rod and rod end bearings. Install cotter pins and apply compound (EC1252) stripe across rod, nuts, washers, and rod end bearings.



R

(Codes FA-LA) Speed Setting Lever and Rod Installation
Figure 204

R 1. C. (Codes FA-LA) Remove Control Linkage Assembly (See Figures 204 through 208)

NOTE: Procedures are provided for complete disassembly and reassembly; however, the linkage should be disassembled only to the extent required for the component being replaced. Do not remove rod end bearings and associated nuts unless replacement is required. If rigging check only is required, refer to Adjustment/Test.

Mark an index line using violet master marker (Grade 127-1/2) to show relationship of lever to speed setting lever shaft for reassembly.

(1) Remove pin, nut, washers, serrated plate and bolt. Separate rod assembly from speed setting lever assembly. (See figure 204.)

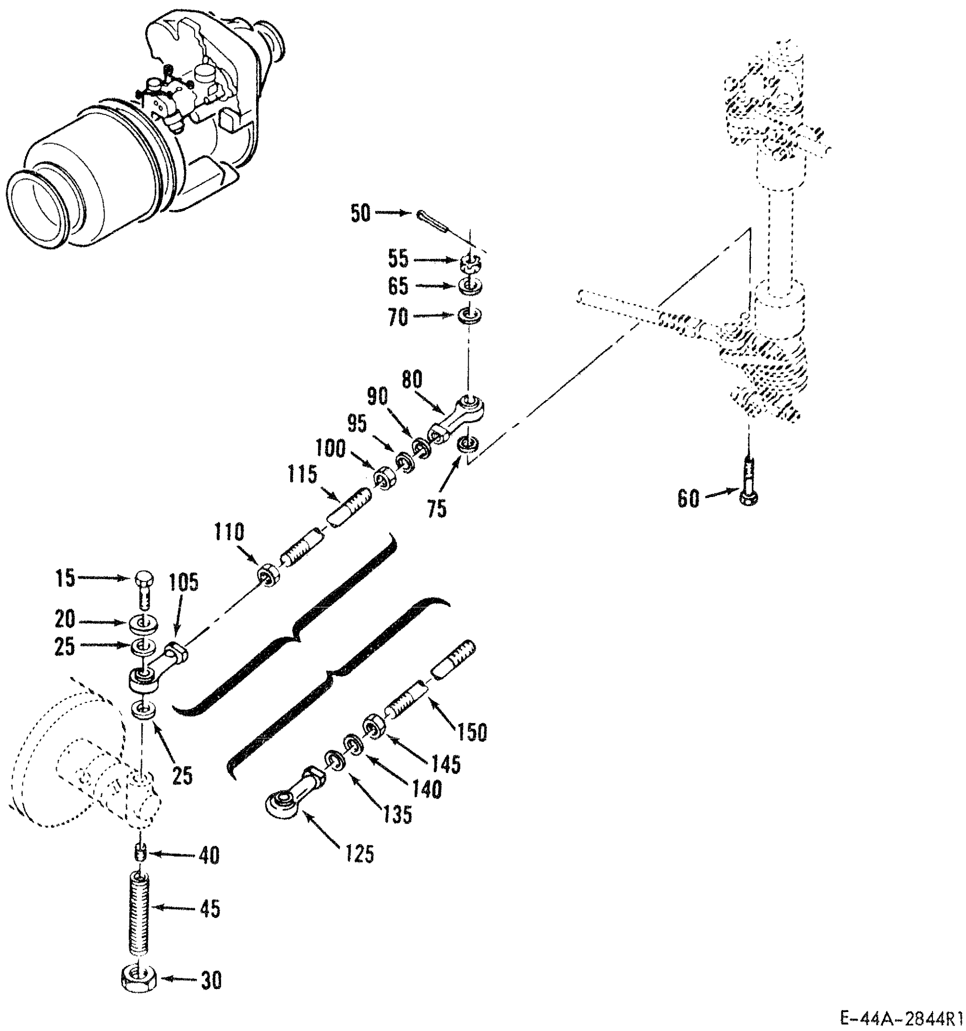
(2) Remove screw, washers and arm from speed setting lever shaft.

(3) Remove screw and washer from speed setting lever assembly. Remove serrated lever assembly and spacer from speed setting lever shaft.

(4) Remove pin, nut, washers, and bolt to separate rod assembly from outer upper arm assembly.

KEY TO FIGURE 204

R 10. COTTER PIN (IPC FIG. 89)
15. NUT
20. WASHER
25. WASHER
30. BOLT
35. WASHER
40. SERRATED PLATE
45. SCREW
50. WASHER
55. SERRATED ARM
60. SPACER
65. SPACER
70. SPACER
75. SCREW
80. WASHER
90. INSERT
95. SERRATED LEVER ASSY
100. SPACER
105. COTTER PIN
110. NUT
115. BOLT
120. WASHER
125. WASHER
130. WASHER
135. ROD END BEARING
145. WASHER
150. WASHER
155. NUT
160. STUD (VARIOUS LENGTHS, REFER TO IPC)



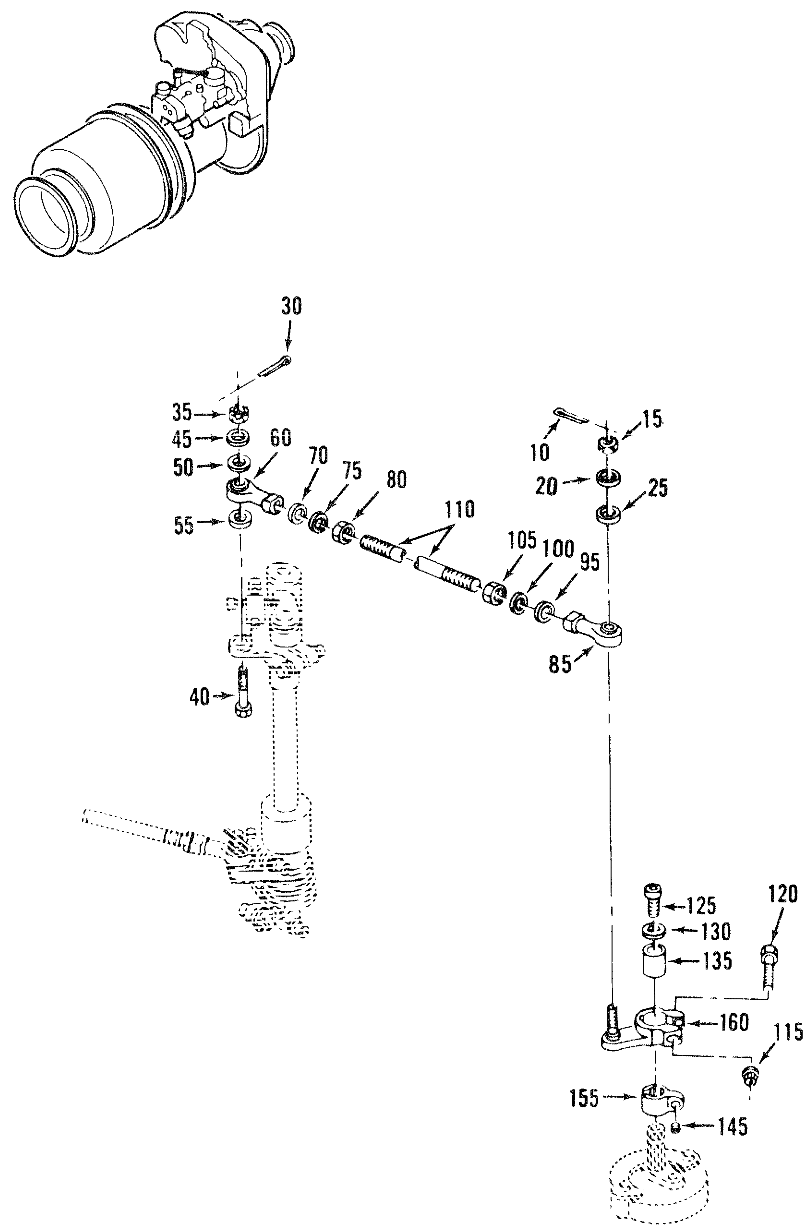
R (Codes FA-LA) Propeller Governor Rod Installation
Figure 205

1. C. (5) Remove bolt, washers, spacers, nut and screw assembly. Separate rod assembly from propeller governor. (See figure 205.)

(6) Remove pin, nut, washers, and bolt to separate rod assembly from inner shaft lower lever assembly.

KEY TO FIGURE 205

R 15. BOLT (IPC FIG. 90)
R 20. WASHER
R 25. SPACER
30. NUT
40. INSERT
45. SCREW
50. COTTER PIN
R 55. NUT
R 60. BOLT
R
65. WASHER
70. WASHER
75. WASHER
80. ROD END BEARING
90. WASHER
95. WASHER
100. NUT
105. ROD END BEARING
110. NUT
115. STUD (VARIOUS LENGTHS, REFER TO IPC)
125. ROD END BEARING
135. WASHER
140. WASHER
145. NUT
150. STUD (VARIOUS LENGTHS, REFER TO IPC)



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R (Codes FA-LA) Power Setting Lever and Rod Installation
Figure 206

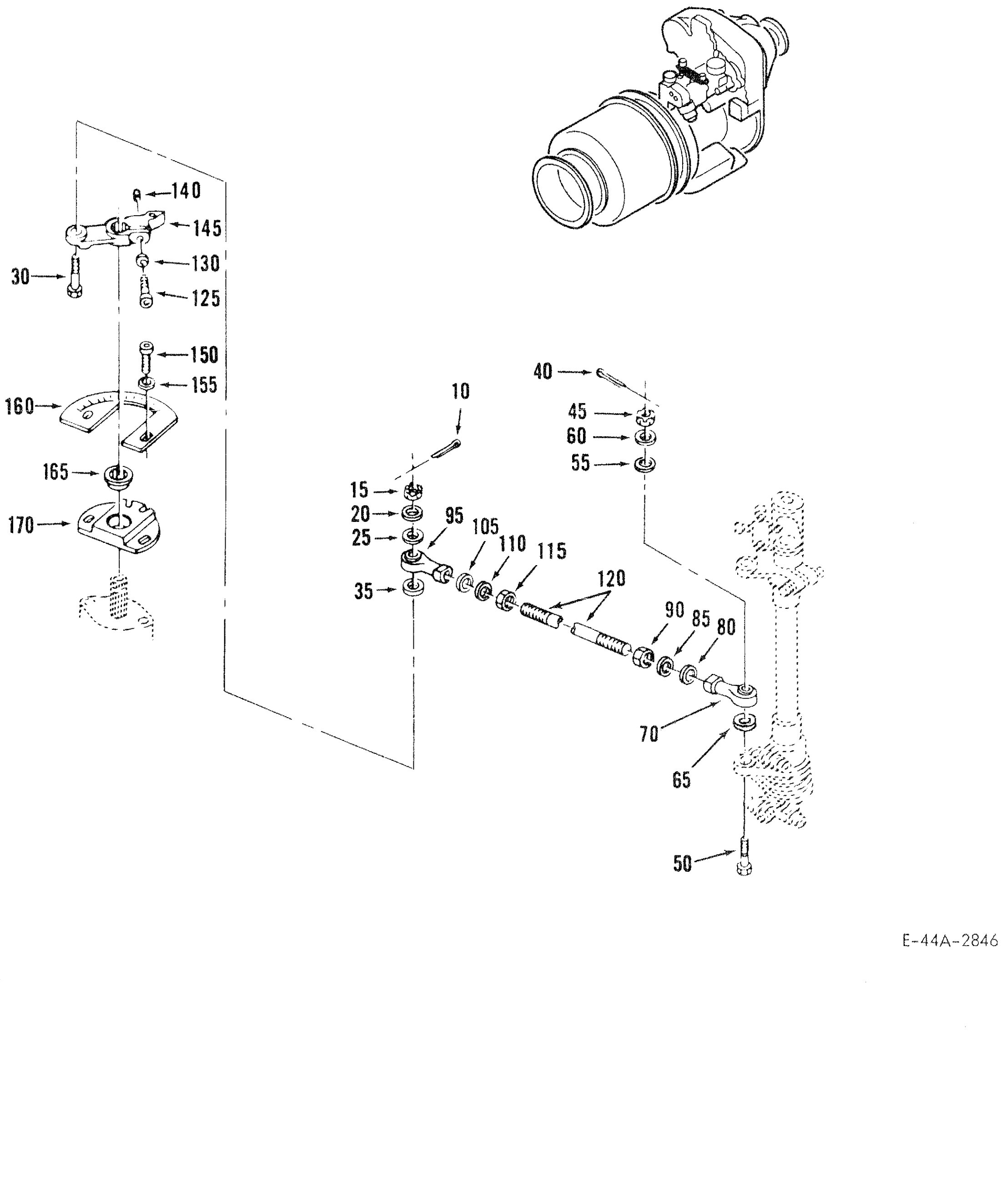
1. C (7) Remove pin, nut and washers to separate rod assembly from linkage adjust arm assembly. (See figure 206.)

(8) Remove screw, washers, spacer, linkage adjust arm and serrated arm assembly from power lever shaft.

(9) Remove pin, nut, washers, and bolt to separate rod assembly from serrated lever.

KEY TO FIGURE 206

10. COTTER PIN
R (IPC FIG. 91)
15. NUT
20. WASHER
25. WASHER
30. COTTER PIN
35. NUT
40. BOLT
45. WASHER
50. WASHER
55. WASHER
60. ROD END BEARING
70. WASHER
75. WASHER
80. NUT
85. ROD END BEARING
95. WASHER
100. WASHER
105. NUT
110. STUD
115. NUT
120. SCREW
125. SCREW
130. WASHER
135. SPACER
145. INSERT
155. SERRATED ARM ASSY
160. LINKAGE ADJUST ARM ASSY



R (Codes FA-LA) Propeller Pitch Control Lever and Rod Installation
Figure 207

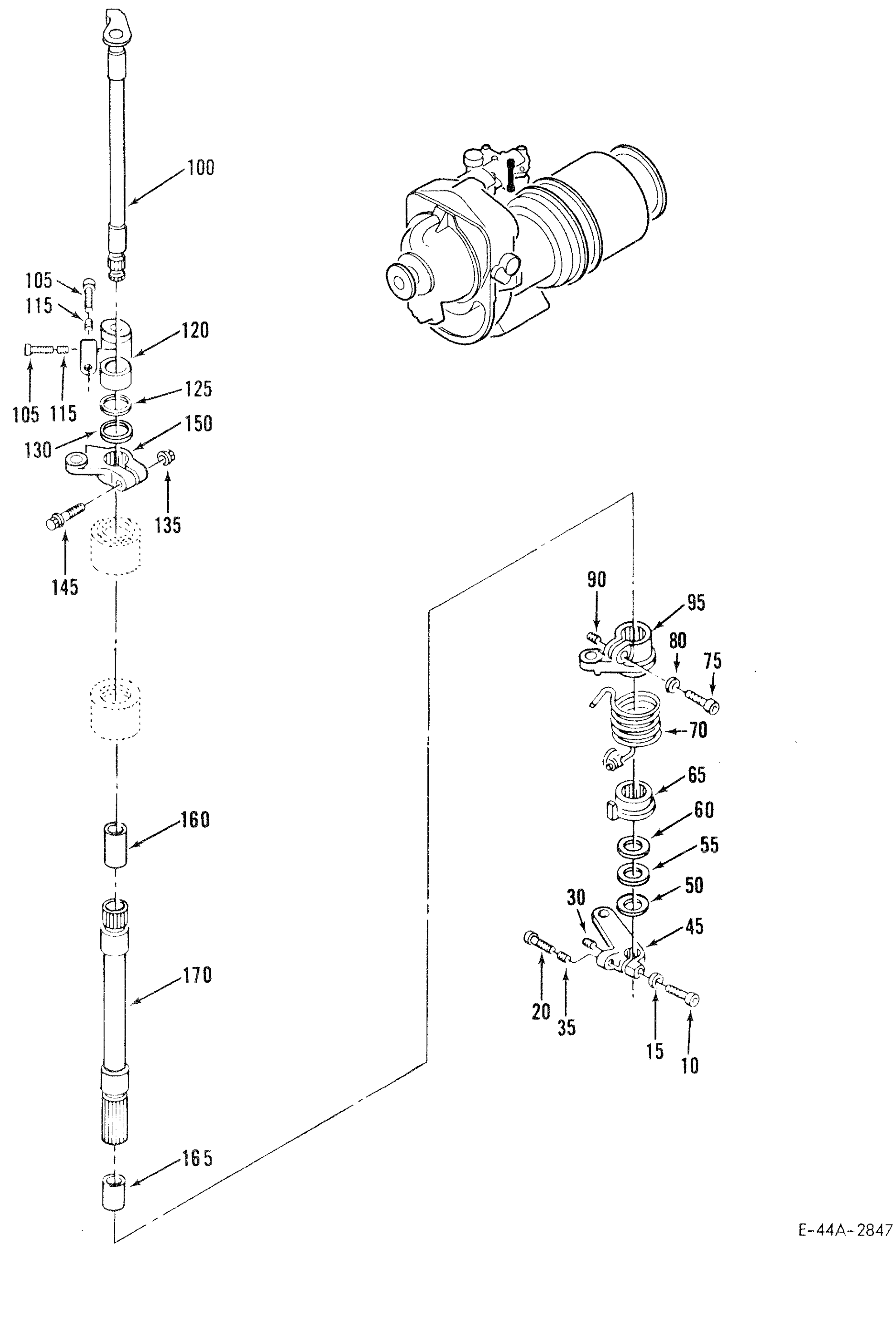
1. C. (10) Remove pin, washers and bolt to separate rod assembly from serrated lever on propeller pitch control shaft. (See figure 207.)

(11) Remove screw and washer from propeller pitch control serrated lever. Remove serrated lever.

(12) Remove screws, washers, quadrant plate, spacer, and plate from propeller pitch control.

KEY TO FIGURE 207

10.	COTTER PIN	60.	WASHER	120.	STUD
R	(IPC FIG. 92)	65.	WASHER	125.	SCREW
15.	NUT	70.	ROD END BEARING	130.	WASHER
20.	WASHER	80.	WASEHR	140.	INSERT
25.	WASHER	85.	WASHER	145.	SERRATED LEVER
30.	BOLT	90.	NUT	150.	SCREW
35.	WASHER	95.	ROD END BEARING	155.	WASHER
40.	COTTER PIN	105.	WASHER	160.	QUADRANT PLATE
45.	NUT	110.	WASHER	165.	SPACER
50.	BOLT	115.	NUT	170.	PLATE
55.	WASHER				



R

(Codes FA-LA) Concentric Shaft Assembly Installation
Figure 208

1. C. (13) Remove pin, nut, washers, and bolt to separate rod assembly from inner shaft lower lever assembly. (See figure 208.)

NOTE: Complete steps (14) through (17) only if further disassembly is required.

(14) Remove screws, washer, inner shaft lower lever assembly, washers, outer shaft lower serrated arm and spring assembly. Remove screw and washer securing outer shaft lower lever assembly and remove lever assembly.

NOTE: Do not remove bushings from outer shaft assembly unless indicated by inspection.

(15) Remove inner and outer shaft assemblies by sliding shaft assemblies up through fuel control linkage support brackets. Separate inner and outer shaft assemblies.

(16) Remove screws from outer shaft upper arm assembly. Separate arm assembly from outer shaft bushing and remove washers.

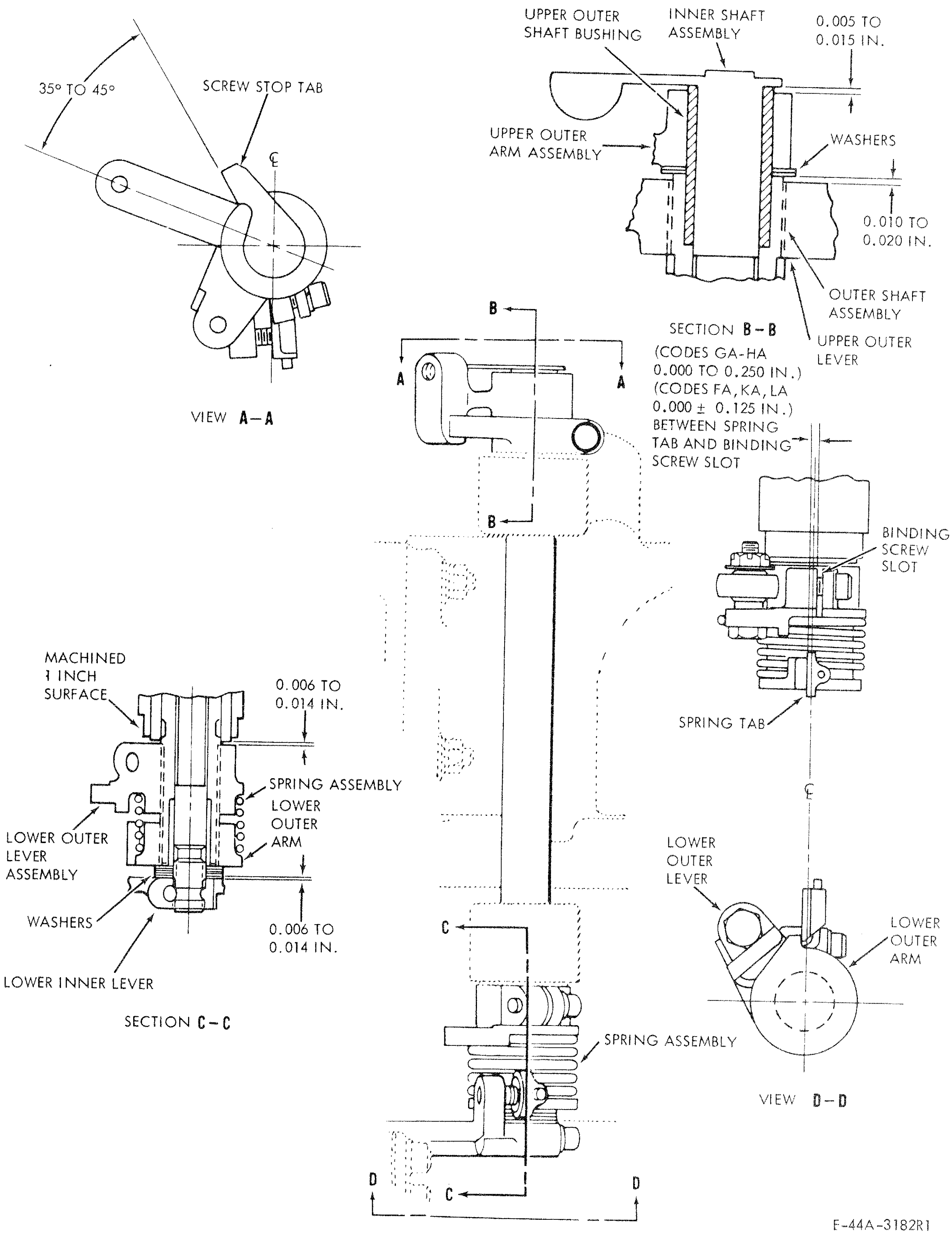
(17) Remove nut and bolt securing serrated lever. Separate lever from outer shaft assembly.

R
R
R
R NOTE: Refer to 70-00-00, STANDARD PRACTICES, for recommended general torque values. Add frictional drag (run-down) torque of self locking devices to recommended values.

R D. (Codes FA-LA) Install Control Linkage Assembly (See Figures 204 through 211)

KEY TO FIGURE 208

R 10. SCREW (IPC FIG. 93)
15. WASHER
20. SCREW
30. INSERT
35. INSERT
45. INNER SHAFT LOWER LEVER ASSY
50. WASHER
55. WASHER
60. WASHER
65. OUTER SHAFT LOWER SERRATED ARM
70. SPRING
75. SCREW
80. WASHER
90. INSERT
95. OUTER SHAFT LOWER LEVER
100. SHAFT ASSY
105. SCREW
115. INSERT
120. OUTER SHAFT UPPER LINKAGE ARM
125. WASHER
130. WASHER
135. NUT
145. BOLT
150. SERRATED LEVER
160. BUSHING
165. BUSHING
170. SHAFT



R

R

(Codes FA-LA) Control Linkage
Installation and Adjustment
Figure 209

NOTE: Minimum running torque values have been established for several sizes of bolts and self locking female threads. Bolts and inserts with running torques less than the below minimums shall be replaced:

Bolt/Insert Size	Minimum Running Torque
No. 8	4 in.-lb
No. 10-32	6 in.-lb
0.250	6 in.-lb

1. D. (1) Install serrated lever on outer shaft assembly so that spline of shaft protrudes 0.010 to 0.020 inch above top surface of lever. (See figure 209.) Secure lever with bolt and nut. Tighten nut (135, figure 208) to 35 inch-pounds torque. Apply compound (EC1252) stripe across head of bolt and lever.

(2) Install assembled outer shaft and upper outer lever into bracket assembly.

NOTE: Lower outer lever assembly shall be installed so that when looking down through bolt hole in upper outer lever, bolt hole in lower outer lever assem-
R bly is aligned within ten degrees clockwise relative to bolt hole in upper outer lever.

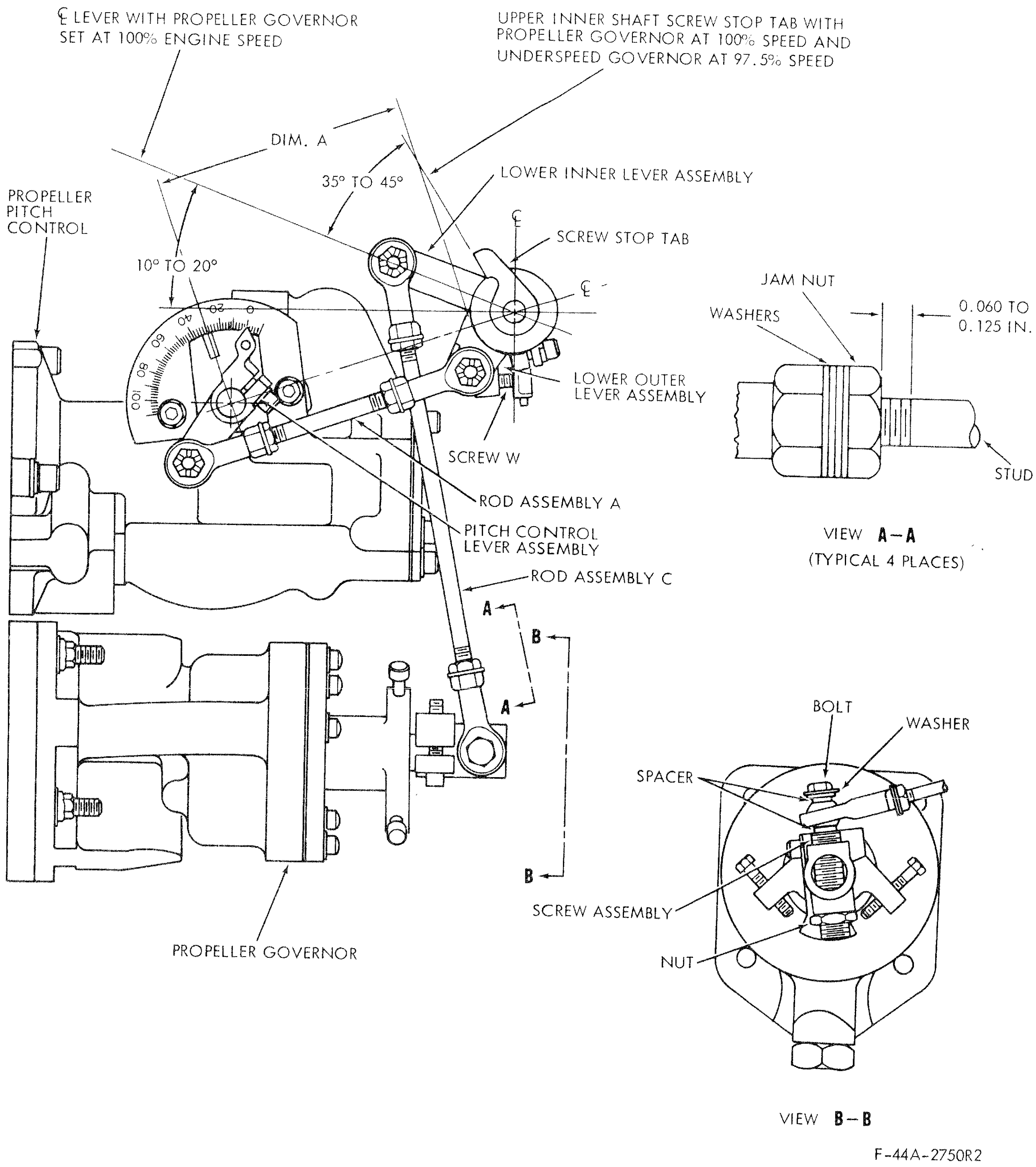
(3) Install lower outer lever assembly on outer shaft assembly. Ensure 0.006 to 0.014 inch end play is maintained between lever assembly and bushing installed in bottom of bracket assembly. (See figure 209.) Secure lever assembly with screw and washer. Tighten screw (75, figure 208) to 33 inch-pounds torque. Apply compound (EC1252) stripe across head of screw, washer and lever.

(4) Install washers over bushing in top end of outer shaft. Install upper outer arm assembly and ensure 0.005 to 0.015 end play is maintained between to of arm assembly and end of bushing as shown in Figure 209. Add or remove washers under upper outer arm assembly as required.

(5) Insert inner shaft assembly into assembled outer shaft and bracket assemblies from top end. Flange of inner shaft will ride on end of upper bushing of outer shaft.

(6) Install spring assembly on lower outer lever assembly. Install lower outer arm over end of spring assembly. Do not engage spline of outer shaft at this time.

R (7) (Codes GA-HA) Utilizing lower outer arm, rotate spring assembly clockwise until face of spring tab lines up with binding screw slot in lower outer lever assembly. Spring tab shall be aligned with binding screw slot within 0.00 to 0.25 inch. Engage splines of lower outer arm and outer shaft. (See figure 209.)



R

(Codes FA-LA) Controls Linkage
Installation and Adjustment
Figure 210

R 1. D. (7A) (Codes FA, KA, LA) Utilizing lower outer arm, rotate spring assembly clockwise until face of spring tab lines up with binding scew slot in lower outer lever assembly. Spring tab shall be aligned with binding screw slot within 0.000 +0.125/-0.125 inch. Engage splines of lower outer arm and outer shaft. (See figure 209.)

NOTE: Maintain contact between flange of inner shaft assembly and end of upper outer shaft bushing when performing steps (8) through (10).

(8) Position lower inner lever assembly on inner shaft assembly so bottom of lever is flush with inner shaft end chamfer. Determine dimension between lower bushing in outer shaft and lower inner lever assembly.

(9) Remove lower inner lever assembly and install washers as required to maintain 0.006 to 0.014 inch clearance between outer shaft lower bushing and lower inner lever assembly.

(10) Reinstall and lock lower inner lever assembly in place with screw and washer ensuring that an angle of 35 to 45 degrees is established between centerline of lower inner lever assembly and screw stop tab of inner shaft assembly. (See figure 210.) Tighten screw (10, figure 208) to 33 inch-pounds torque. Apply compound (EC1252) stripe across screw head, washer, and lever.

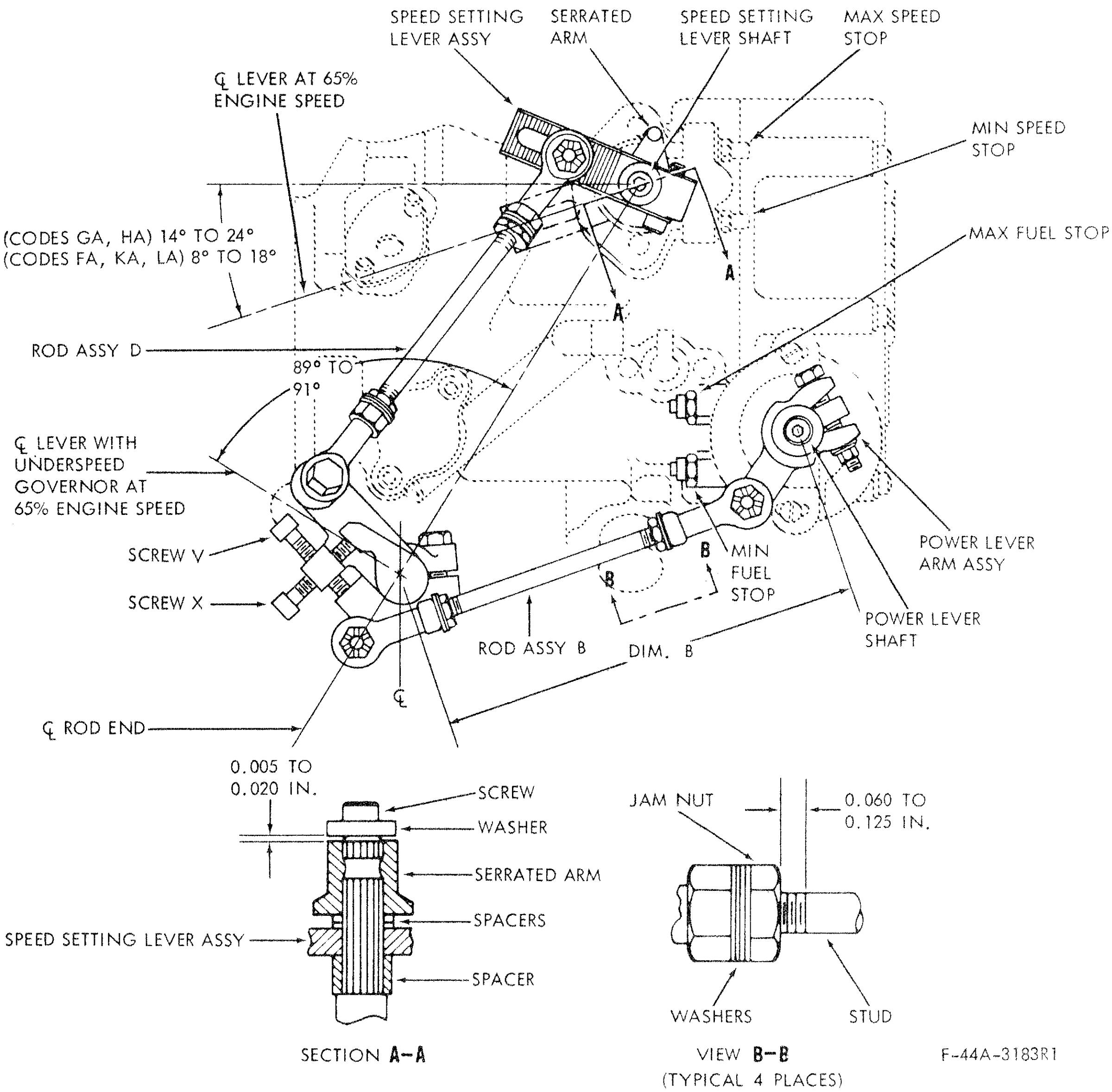
(11) Install plate (figure 207), quadrant plate and spacer on propeller pitch control shaft. Install washers and screws in plates but do not tighten at this time.

(12) Hold propeller pitch control shaft to full clockwise position. Install pitch control lever assembly on propeller pitch control shaft while aligning rig pin holes in lever assembly and rigging plate and aligning zero on quadrant plate with tip of pointer on lever.

(13) Adjust quadrant plate and rigging plate as necessary to ensure ease of rigging pin installation at both the zero and 40 degree positions. Tighten plate retaining screws (150, figure 207) to 33 inch-pounds torque.

(14) Remove rigging pin and check for freedom of lever rotation. Lever shall have a quadrant movement of 100 +1/-1 degrees.

(15) Return pointer of lever to ZERO degree position and reinstall rigging pin. Install screw and washers to secure lever to shaft. Tighten screw (125) to 33 inch-pounds torque. Apply compound (EC1252) stripe across screw head, washers, and lever.



R

R (Codes FA-LA) Control Linkage
Installation and Adjustment
Figure 211

1. D. (16) Measure distance from center of propeller pitch control shaft to machined one-inch diameter surface of bracket assembly. Record as Dimension A. (See figure 210.)

(17) Adjust length of Rod Assembly A (measured from centerline to centerline of bolt hole in rod end bearings) to 0.500 inch +0.020/ -0.020 inch greater than dimension noted in step (16) above. Ensure that length of exposed threads of rod assembly stud are within dimension shown in Figure 210. Add or remove washers as required. Tighten jam nuts (90, 115, figure 207) to 20 inch-pounds torque. Remeasure rod assembly to ensure length has not been changed. Connect one end of rod assembly to lower outer lever assembly with bolt, washers, and nut. Connect other end of rod assembly to pitch control lever with bolt, washers, and nut. Tighten nut (15, 45) to 12 inch-pounds torque. Install cotter pins. Apply compound (EC1252) stripe across rod assembly stud and jam nuts.

(18) Measure and note distance from centerline of top of inner shaft assembly (figure 211) and centerline of manual fuel valve shaft. Record as Dimension B.

(19) Adjust length of Rod Assembly B (measured from centerline to centerline of bolt hole in rod end bearings) to Dimension B noted in step (18) +0.020/-0.020 inch. Ensure that length of exposed threads of rod assembly stud are within dimensions shown in Figure 211. Add or remove washers as required. Tighten jam nuts (80, 105, figure 206) to 20 inch-pounds torque; remeasure rod assembly to ensure rod length has not been changed. Connect one end of rod assembly to upper outer lever with bolt, washers, and nut. Tighten nut (35) to 12 inch-pounds torque. Install cotter pin. Apply compound (EC1252) stripe across rod assembly stud and jam nuts.

CAUTION: DO NOT ADJUST MINIMUM OR MAXIMUM FUEL STOPS.

(20) Hold the power lever shaft on the manual fuel valve in contact with its minimum stop (reverse) and determine that the pointer on the arm assembly lines up with the zero degree position on the quadrant. Rotate the power lever shaft to its maximum stop (take off position) and determine that the pointer lines up with the 100 +1/-1 degree position on the quadrant.

(21) Rotate power lever shaft pointer to the zero degree position on the quadrant and maintain this position during installation of assembled manual fuel valve arm assembly.

(22) Assemble serrated arm assembly (figure 206) and adjustable arm assembly with bolt and nut. Center serrated arm by adjusting bolt. Do not tighten nut at this time.

(23) Connect assembled power lever arm assembly to other end or rod assembly. Secure with washers and nut. Tighten nut (15) to 12 inch-pounds torque. Install cotter pin.

1. D. (24) Install assembled power lever arm assembly on power lever shaft. Slight adjustment may be necessary to adjusting arm for ease of installation. Tighten nut (115) on arm assembly adjusting bolt to 35 inch-pounds torque. Apply compound (EC1252) stripe across bolt head and arm assembly.

(25) Remove rigging pin installed in step (15) on propeller pitch control lever and advance the power lever to the maximim power position and verify the pointers on the propeller pitch control and manual fuel valve are at 100 +1/-1 degree on their respective quadrants.

CAUTION: POWER LEVER ADJUSTMENT AT FLIGHT IDLE POSITION IS CONSIDERED CRITICAL. ENSURE THAT 40 DEGREE QUADRANT POSITIONS ARE EXACTLY ALIGNED.

NOTE: Repeat steps (11) through (24) if rigging pin cannot be inserted as required by step (26).

(26) Move the power lever rapidly to the flight idle position and verify that the pointer on the manual fuel valve and propeller pitch control are at 40 degrees on their respective quadrants and that the propeller pitch control can be pinned at this position.

(27) Check travel from maximum power to full reverse position. Manual fuel valve shaft shall be within zero to three degrees of the stop in full reverse and maximum positions.

(28) Position lower inner lever assembly at an angle of 10 to 20 degrees clockwise from a line parallel to centerline of fuel control assembly. Place propeller governor arm to 100 percent engine speed position.

R NOTE: Propeller governor (rod assembly C) and speed set-
R ting rod (rod assembly D) may require various len-
R gth studs to obtain proper settings. Refer to Il-
R lustrated Parts Catalog (IPC), Report No. 72-00-
R 94, for approved alternate lengths.

(29) Connect one end of Rod Assembly C to lower inner lever assembly (figure 210) and secure with bolt, washers, and nut. Tighten nut (55, figure 205) to 12 inch-pounds torque. Install cotter pin. Connect outer end of rod assembly to propeller governor arm with bolt, washer, and spacers. Adjust screw assembly on propeller governor arm as required to maintain position of lever and arm established in step (28). Tighten bolt (15) and nut (30, figure 205) to 20 inch-pounds torque. Lockwire nut. If required, readjust length of rod assembly. Tighten jam nuts (100, 110, 145) to 20 inch-pounds torque. Apply compound (EC1252) stripe across rod assembly, stud, and jam nuts.

NOTE: Underspeed governor shaft is spring loaded to minimum position (65 percent engine speed). Maintain this position during steps (30), (30A), and (31).

R 1. D. (30) (Codes GA, HA) Install spacer (figure 204) and speed setting lever assembly on underspeed governor shaft. Position lever at an angle of 14 to 24 degrees counterclockwise from a line parallel to centerline of fuel control assembly as shown in Figure 211. Secure lever assembly with washer and screw. Tighten screw (75, figure 204) to 28 to 33 inch-pounds torque. Apply compound (EC1252) stripe across head of screw, washer, and lever.

R (30A) (Codes FA, KA, LA) Install spacer (figure 204) and speed setting lever assembly on underspeed governor shaft. Position lever at an angle of 8 to 18 degrees counterclockwise from a line parallel to centerline of fuel control assembly as shown in Figure 211. Secure lever assembly with washer and screw. Tighten screw (75, figure 204) to 28 to 33 inch-pounds torque. Apply compound (EC1252) stripe across head of screw, washer, and lever.

(31) Install spacers and serrated arm on underspeed governor shaft.

(32) Secure serrated arm to speed setting lever shaft with washer and screw. Maintain a 0.005 to 0.020 inch clearance between washer and serrated arm as shown in View A-A, Figure 211. Tighten screw (45, figure 204) to 30 to 40 inch-pounds torque.

(33) Connect one end of Rod Assembly D (figure 211) to upper outer arm assembly. Secure with bolt, washers, and nut. Tighten nut (110, figure 204) to 12 inch-pounds torque. Install cotter pin. Position upper outer arm assembly so that an angle of 89 to 91 degrees is formed between centerline of arm assembly and a centerline between top of inner shaft assembly and underspeed governor speed. (See figure 211.)

R (34) (Codes GA, HA) Ensure that speed setting lever assembly is at the 14 to 24 degree position established in step (30). Position serrated plate (figure 204) midway in slot of speed setting lever assembly. Adjust serrated plate or rod assembly as required. Secure rod assembly to serrated plate and lever with bolt, washers, and nut. Tighten nut (15) to 12 inch-pounds torque. Install cotter pin. Ensure that length of exposed threads of rod assembly stud is within dimensions shown in View B-B, Figure 211. Tighten jam nuts (155, figure 204) to 20 inch-pounds torque. Apply compound (EC1252) stripe across rod assembly stud and jam nuts.

R (34A) (Codes FA, KA, LA) Ensure that speed setting lever assembly is at the 8 to 18 degree position established in step (30). Position serrated plate (figure 204) midway in slot of speed setting lever assembly. Adjust serrated plate or rod assembly as required. Secure rod assembly to serrated plate and lever with bolt, washers and nut. Tighten nut (15) to 12 inch-pounds torque. Install cotter pin. Ensure that length of exposed threads of rod assembly stud is within dimensions shown in View B-B, Figure 211. Tighten jam nuts (155, figure 204) to 20 inch-pounds torque. Apply compound (EC1252) stripe across rod assembly stud and jam nuts.

1. D. (35) If removed, install two adjustment screws (figure 208) in upper outer arm assembly and one adjustment screw in lower inner lever assembly so that approximately five threads are extended after installation.

(36) Adjust Screw V (figure 211) as necessary so that contact is made with upper outer lever when manual fuel valve shaft power lever pointer is 13 to 15 degrees from full reverse position and speed setting lever assembly is against minimum stop.

R (37) (Codes GA, HA) Adjust Screw W (figure 210) as necessary so that contact is made with spring tab when propeller governor arm is against low speed stop and manual fuel valve shaft power lever pointer is one to three degrees below (toward reverse position) flight idle position.

R (37A) (Codes FA, KA, LA) Adjust Screw W (figure 210) as necessary so that contact is made with spring tab when propeller governor arm is against low speed stop and manual fuel valve shaft power lever pointer is at 12 degrees.

(38) Adjust Screw X (figure 211) so that contact is made with screw stop tab on inner shaft assembly when speed setting lever assembly is against maximum speed stop and propeller governor lever is against the high speed stop.

(39) Refer to Adjustment/Test for final adjustment of control linkage rigging.

2. Adjustment/Test (Rigging)

A. Position Beta Tube

Install and position oil flow metal tube (beta tube). Refer to 72-10-01, MAINTENANCE PRACTICES.

NOTE: Proper rigging means that the arms of the shafts of each component and the length of the connecting rod assemblies are such that a movement of either arm produces an identical movement in the other.

For the proper operation of the aircraft it is imperative that the fuel flow and propeller blade angle be coordinated so that when flight idle is reached the propeller pitch angle and engine power are of a predictable and related amount. Likewise, in selecting reverse pitch, the engine must be provided with adequate fuel compared with the amount of reverse pitch used.

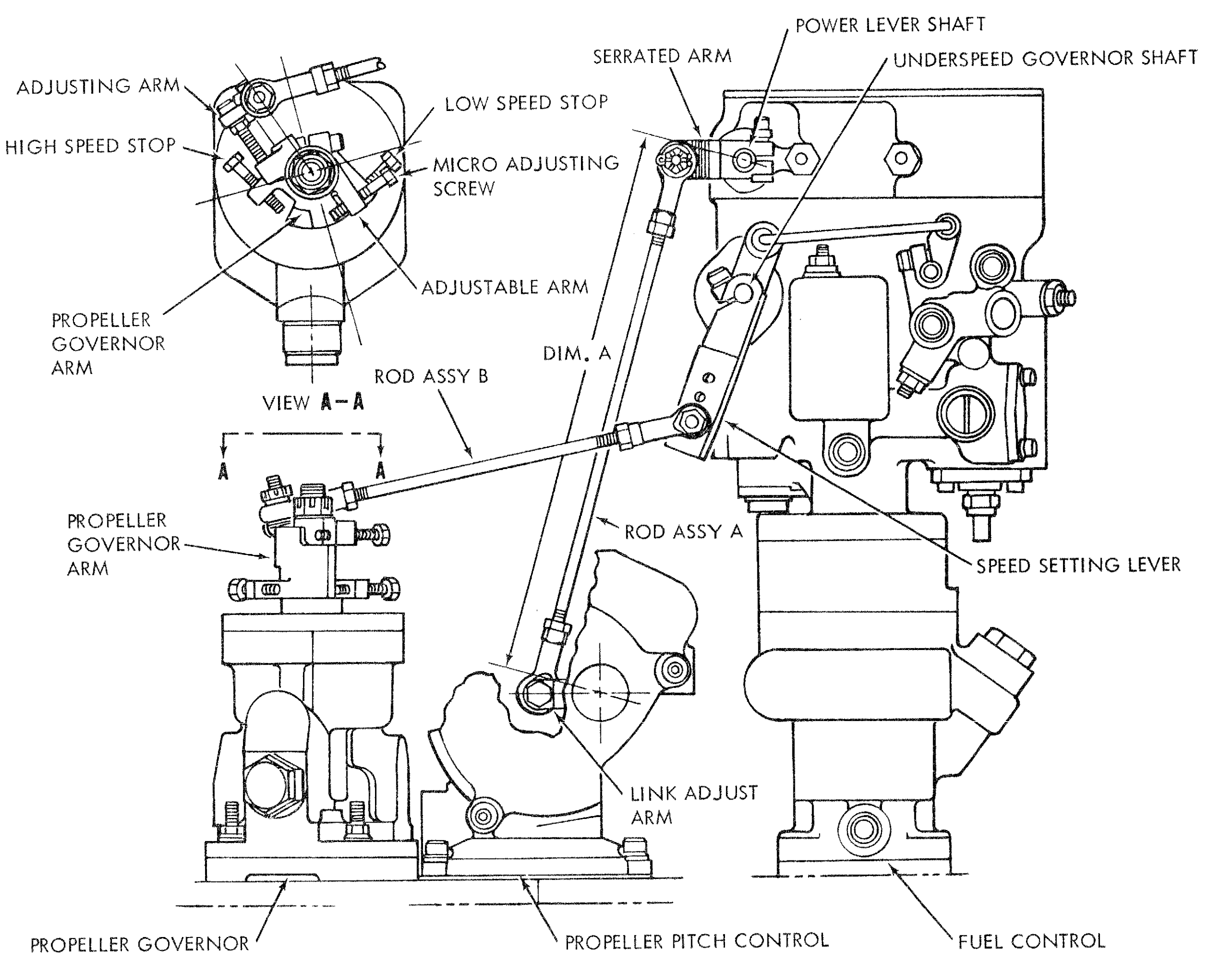
A rigging check must be performed whenever a fuel pump/fuel control assembly, propeller pitch control, linkage assembly, studs or rod ends, etc, are replaced.

R B. (Codes AA-EA) Rigging Control Linkage Assembly

(1) Adjust underspeed governor stops as follows. (See figure 212.)

NOTE: The underspeed governor is connected to the propeller governor by linkage so that movement of engine speed lever resets both devices. The relative movement of each governor arm is adjusted so the full travel of engine speed lever produces full variation of each governor setting. Proper rigging also ensures that full travel of the system is limited by stops on the fuel control rather than by stops in the propeller governor, thus ensuring no distortion of the linkage system from excessive force input. The linkage is not connected until the stops have been set. After stops have been set, it will not be necessary to check and reset stops if the fuel control or propeller governor are removed from the engine to provide access to some other component and then reinstalled without disturbing the stops.

(a) With Rod Assembly "B" disconnected at speed setting lever, place propeller governor arm against the high speed stop and secure. (See figure 212.)



R

(Codes AA-EA) Control Linkage
Installation and Adjustment
Figure 212

2. B. (1) (b) Place the aircraft quadrant speed lever to the high speed position.

(c) Move the fuel control underspeed governor to the maximum speed stop and connect the aircraft control linkage. Refer to Aircraft Maintenance Manual.

(d) Place the aircraft quadrant speed lever to the low speed position and make certain the fuel control underspeed governor low speed stop is contacted.

(e) Adjust the aircraft linkage as required. Refer to Aircraft Maintenance Manual.

(f) Place power lever in start position and speed lever in low speed position, then start engine. Unlatch propeller.

NOTE: To check stop settings, set power lever at the minimum fuel flow point by moving lever slowly toward reverse until an increase in interstage turbine temperature of 10C is observed. Speed shall be as specified in steps (g) and (h).

(g) Advance engine speed lever slowly to high speed position. If maximum engine speed is not within range of 96.0 to 97.0 percent, record the maximum engine speed.

(h) Retard engine speed lever to low speed position. If minimum
R speed is not within range of (Codes AA-AC, CA-CC) 69.0 to 71.0
R percent, (Codes BA-BC, EA) 64.0 to 66.0 percent, record the
minimum engine speed.

(i) Adjust maximum or minimum speed stops that are not as specified in steps (g) and (h) as follows.

1 Shut down engine.

2 Adjust maximum speed stop. One turn clockwise results in approximately one percent decrease in engine speed. One turn counterclockwise results in approximately one percent increase in engine speed.

3 Adjust minimum speed stop. One turn clockwise results in approximately two percent increase in engine speed. One turn counterclockwise results in approximately two percent decrease in speed.

4 Start engine and check underspeed governor maximum and minimum settings by moving engine speed lever through its extremes of travel.

NOTE: Make certain that aircraft quadrant stops do not interfere with setting of fuel control underspeed governor stops by unduly limiting engine speed lever movement.

2. B. (1) (i) 5 Reset the underspeed governor protractor to indicate 42 +1/-1 degrees when the lever is against the maximum stop.

(2) Adjust propeller governor stops as follows. (See figure 212.)

(a) With Rod Assembly "B" (figure 212) disconnected at speed setting lever, secure propeller governor arm against the high speed stop.

(b) Start the engine.

(c) Ensure that oil temperature has stabilized at its normal operating value before adjusting propeller governor. (Cold oil makes speed setting higher than hot oil.)

(d) Place engine speed lever in high speed position.

(e) Move the power lever slightly aft of start position to release propeller blade locks.

CAUTION: DURING FOLLOWING CHECK DO NOT EXCEED MAXIMUM TURBINE SPEED, MAXIMUM ALLOWABLE INTERSTAGE TURBINE TEMPERATURE OR MAXIMUM TORQUE LIMITS.

(f) Move power lever slowly toward maximum position while observing engine speed. As lever is advanced, a point will be reached at which speed fails to increase with power lever movement. Note maximum speed which can be attained regardless of amount of advancement of power lever.

(g) Return power lever to a position slightly aft of start position, operate engine at taxi condition for three minutes for cooling, then stop engine.

(h) For each percent of speed more than 100.5 percent reached in step (f), turn propeller governor high speed stop one turn clockwise. For each percent of speed less than 100 percent reached in step (f), turn propeller governor high speed stop one turn counterclockwise.

(i) Restart engine and repeat steps (c) through (h). Continue adjustment until propeller governor maintains engine speed at 99 to 100.5 percent regardless of amount of power lever advancement.

2. B (2) (j) Operate engine at taxi condition for three minutes for cooling, then stop the engine and secure the propeller governor arm in the low speed position.

(k) Start the engine and move the speed lever to the maximum position. Move the power lever until maximum torque or 885C (1625F) interstage turbine temperature is attained. The propeller governor shall maintain engine speed at desired minimum setting so that speed does not drop further with a small reduction in speed lever setting. Adjust propeller governor low speed stop as necessary.

(l) Reconnect Rod Assembly "B" to speed setting lever in same hole as removed.

R C. (Codes FA-LA) Rigging Control Linkage Assembly

(1) Adjust underspeed governor stops as follows. (See figure 213.)

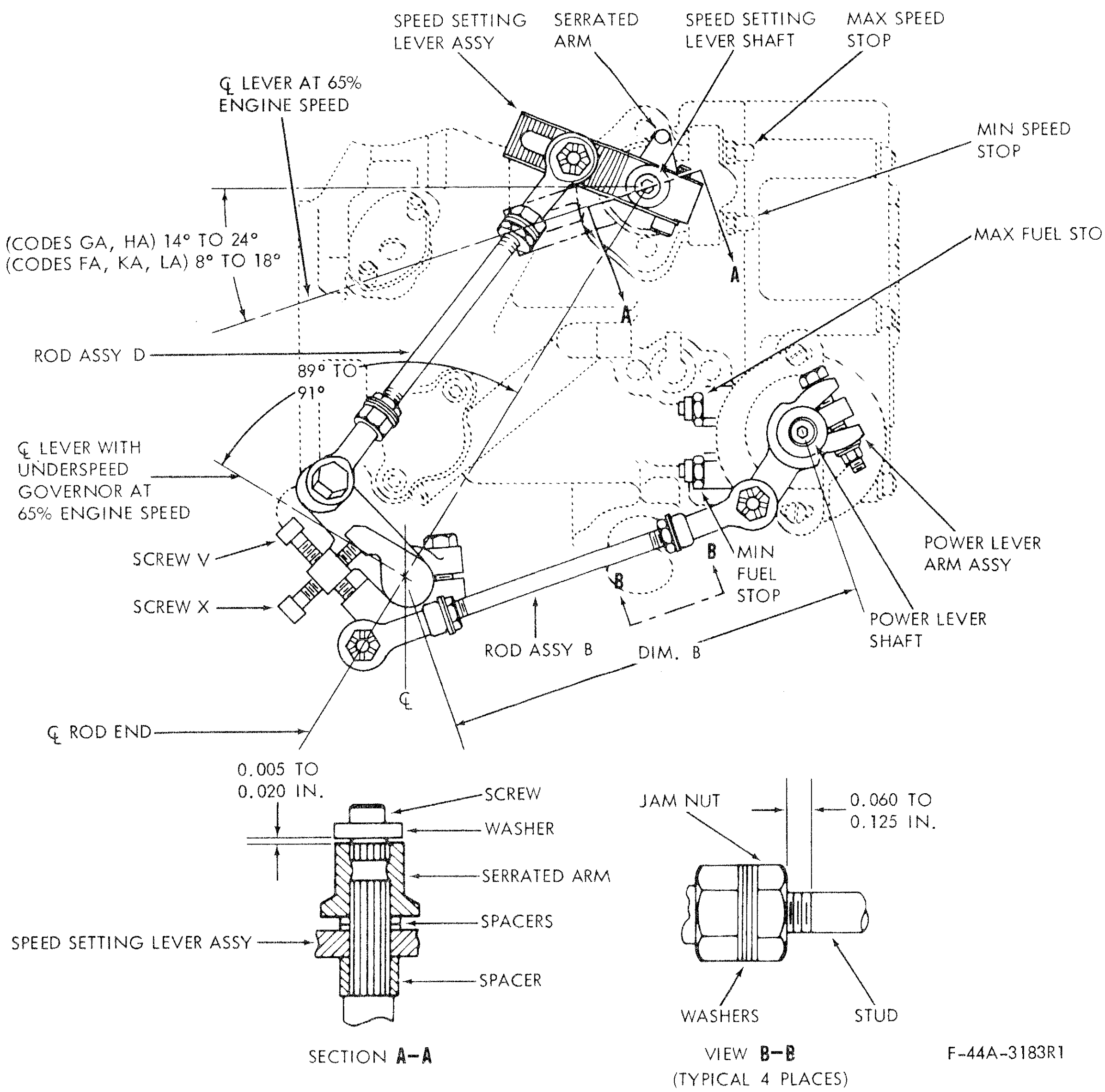
NOTE: The underspeed governor is connected to the propeller governor by linkage so that movement of the engine speed lever resets both devices. It is necessary that the high and low speed stops on each governor be adjusted so full travel of engine speed lever produces full variation of each governor setting; proper rigging also ensures that full travel of the system is limited by stops on the fuel control rather than by stops in the propeller governor (thus ensuring no distortion of control linkage system from excessive force input). The linkage is not connected until the stops have been set. After the stops have been set, it will not be necessary to check and reset the stops if the fuel control assembly or propeller governor are removed from the engine to provide access to some other components and then reinstalled without disturbing the stops.

(a) With Rod Assembly "D" disconnected at upper outer arm assembly, secure propeller governor lever against its high speed stop.

(b) Place engine speed lever in mid-position.

(c) Place power lever between three and five degrees forward of normal start position.

(d) Start engine. Remove propeller from locks.



R

R (Codes FA-LA) Control Linkage Installation and Adjustment
Figure 213

NOTE: To make certain that position of engine speed lever in steps (e) and (f) is actually the minimum speed setting, and not an increased engine speed due to excess fuel; move power lever slowly toward reverse until a point of minimum fuel flow is found, and then position engine speed lever for desired minimum speed.

R 2. C. (1) (e) (Codes GA, HA) Retard engine speed lever to low speed stop. Engine speed should stabilize between 64 to 66 percent. If rpm does not stabilize between 64 to 66 percent, record rpm obtained.

R (f) (Codes FA, KA, LA) Retard engine speed lever to low speed stop. Engine speed should stabilize between 72 to 74 percent. If rpm does not stabilize between 72 to 74 percent, record rpm obtained.

(g) If engine rpm does not stabilize within the limits specified above, adjust the minimum stop on the underspeed governor. Turning the adjustment screw in will increase engine rpm. One turn on stop changes rpm by approximately 2.6 percent.

R (h) (Codes GA, HA) With the engine speed lever against high speed stop, move the power lever slowly towards reverse, observing fuel flow indication. When minimum fuel flow is indicated, tighten friction lock on power lever. If rpm does not stabilize between 96.0 and 96.5 percent, record rpm obtained.

R (i) (Codes FA, KA, LA) With the engine speed lever against high speed stop, move the power lever slowly towards reverse, observing fuel flow indication. When minimum fuel flow is indicated, load the engine in reverse until an increase of 15 pounds per hour is observed. Tighten friction lock on power lever. If rpm does not stabilize at 96.0 to 96.5 percent, record rpm obtained.

(j) If engine rpm does not stabilize at the limit specified above, adjust the maximum stop on the underspeed governor. Turning the adjustment screw in will reduce engine rpm. Turning the screw out one turn will increase rpm by approximately 2.6 percent.

(k) Check underspeed governor stop settings by moving engine speed lever through its extremes of travel. Adjust as necessary.

(l) Connect Rod "D" at upper outer arm assembly.

NOTE: Make certain that stops on quadrant do not interfere with setting of underspeed governor stops by unduly limiting engine speed lever movement.

2. C. (2) Adjust propeller governor stops as follows. (See figure 213.)

(a) With Rod Assembly "D" disconnected at upper outer arm assembly, and propeller governor lever secured against high speed stop.

(b) Start the engine.

(c) Ensure that oil temperature has stabilized at 82 +5.5/-5.5C (180 +10/-10F) before adjusting propeller governor. (Cold oil makes the speed setting higher than hot oil.)

(d) Place engine speed lever against maximum stop position.

(e) Move power lever slight aft of start position to release propeller blade locks.

CAUTION: DO NOT EXCEED A TURBINE SPEED OF 42,830 RPM (102.6 PERCENT), THE MAXIMUM ALLOWABLE Tt4.1, OR TORQUE LIMITS DURING THIS CHECK.

(f) Slowly advanve the power lever toward the maximum position. As the power lever is advanced, the engine rpm should stabilize at 99.0 - 100.5 percent. Advanve power lever only far enough to assure that propeller governor is controlling, not to exceed 850C (1562F) ITT. If the propeller governor does not control engine rpm within the limits specified above, reset propeller governor maximum stop and reset Screw X (figure 213) until lever contacts stop. Turning the maximum stop screw one turn counterclockwise will increase engine rpm approximately one percent. After adjustment, ensure high speed stop screw has a minimum of 0.280 inch threads exposed to prevent rod end damage.

R (g) (Codes GA, HA) With the speed lever low, advance power lever until propeller governing occurs (fuel flow increases but rpm does not). Oil temperature should be in normal operating range. Observe ITT - do not exceed cruise limit. Engine speed should stabilize at 94.0 +0.5/-0.5 percent. If the propeller governor does not control engine rpm within the limits specified, adjust the low speed stop of the propeller governor. Turning the adjustable stop screw in will increase engine rpm. Turning the screw counterclockwise will decrease rpm approximately one percent.

2. C. (2) (h) (Codes FA, KA, LA) With the speed lever low, advance power lever until propeller governing occurs (fuel flow increase but rpm does not). Oil temperature should be in normal operating range. Observe ITT - do not exceed cruise limit. Engine speed should stabilize at 95.5 +0.5/-0.5 percent. If the propeller governor does not control engine rpm within the limits specified, adjust the low speed stop on the propeller governor. Turning the adjustable stop screw in will increase engine rpm. Turning the screw counterclockwise will decrease rpm approximately one percent.

(i) Recheck propeller governor stop settings by moving power lever and engine speed lever, steps (d) through (g) or (h). Adjust as necessary.

(j) Connect Rod "D" at upper outer arm assembly.

(3) Rigging propeller governor to underspeed governor. (See figures 213, 214.)

(a) Determine and note underspeed governor rotation in degrees. Reinstall Rod Assembly "D". (See figure 213.)

R (b) (Codes GA, HA) Utilizing engine speed lever, rotate fuel control speed lever clockwise from minimum speed stop to a position 16 +2/-2 degrees from the maximum speed stop.

R (c) (Codes FA, KA, LA) Utilizing engine speed lever, rotate fuel control speed lever clockwise from minimum speed stop to a position 8 to 10 degrees from the maximum speed stop.

NOTE: No overtravel or distortion should occur at this stop when adjustment is made on a hot engine.

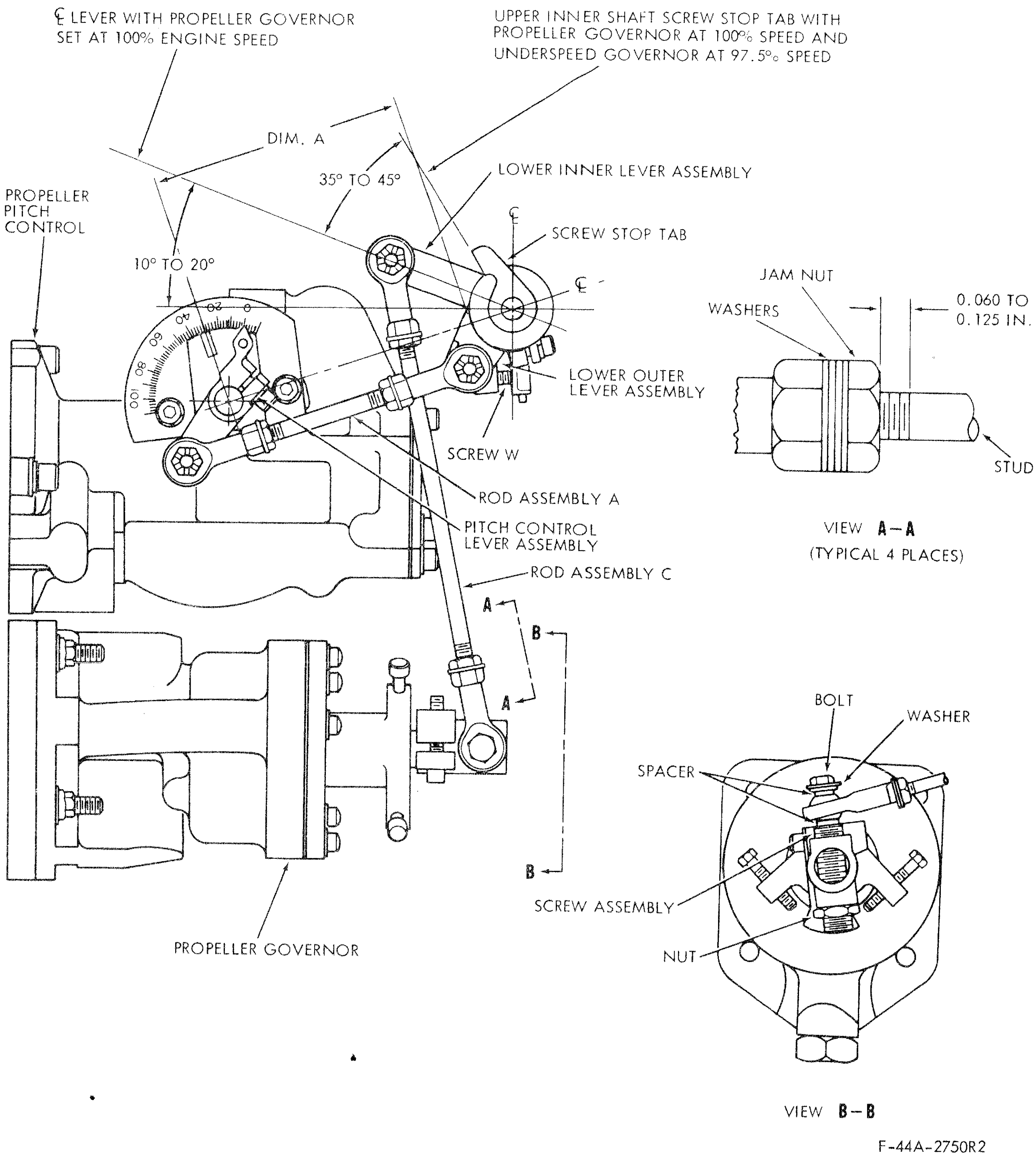
R Propeller governor (rod assembly C) and speed
R setting rod (rod assembly D) may require
R various length studs to obtain proper
R settings. Refer to Illustrated Parts Catalog
R (IPC), Report No. 72-00-94, for approved al-
R ternate length.

(d) Adjust Rod Assembly "D" and speed setting lever until propeller governor low speed stop is contacted.

(e) Move engine speed lever to MAXIMUM rpm position.

(f) Visually check that speed governor shaft stop plate contacts maximum stop.

(g) Adjust Screw X until propeller governor high speed stop is contacted. Repeat steps (b) through (f) and readjust linkage as required.



R

R

(Codes FA-LA) Control Linkage
Installation and Adjustment
Figure 214

2. C. (3) (h) Ensure angular requirements are satisfied after final linkage adjustment. (See figures 213 and 214.)

R (i) (Codes GA, HA) With the speed lever at minimum speed position,
R set manual fuel valve at 35 to 38 degrees and adjust Screw W (figure 214) to touch stop.

R (j) (Codes FA, KA, LA) With the speed lever at minimum speed posi-
R tion, set manual fuel valve at 12 degrees and adjust Screw W (figure 214) to touch stop.

R (k) Set manual fuel valve at 13 to 15 degrees and adjust Screw V (figure 213) to touch stop (underspeed governor reset).

(l) With engine running, verify that the stops are contacted at
R the proper engine speed. Adjust Screw X to obtain takeoff speed and the propeller governor minimum stop to obtain cruise speed.

R (m) (Codes GA, HA) With engine running at ground idle and minimum fuel flow, verify that a reverse power lever movement initiates underspeed governor reset.

R (n) (Codes FA, KA, LA) With engine running at ground idle and minimum fuel flow, verify that underspeed governor resets to 78.0 +1.0/-1.0 percent at full reverse.

R (o) (Codes GA, HA) With the engine shutdown and speed lever at low position, move the power lever to full reverse. With power lever in full reverse, adjust propeller governor maximum stop to contact the governor lever.

R INPUT LEVER - MAINTENANCE PRACTICES

1. Removal/Installation

R A. (Codes AA-AC, FA, LA) Remove Control Lever (See Figure 201)

(1) Remove lever and serrated arm by removing screws and washers.

(2) Remove plates, if required, by removal of nuts, washers, and bolts.

R B. (Codes AA-AC, FA, LA) Install Control Lever (See Figure 201)

(1) Position lever assembly and serrated arm on control shafts as specified in the Aircraft Maintenance Manual and secure with washer and screws. Tighten screw (30) to 28 to 33 inch-pounds torque. Tighten screw (60) to 35 to 40 inch-pounds torque.

(2) Install plates with bolts, washers, and nuts. Tighten bolts (20, 50) to 20 inch-pounds torque.

2. Inspection/Check

A. Inspect Lever Assembly and Serrated Arm (See Figure 201)

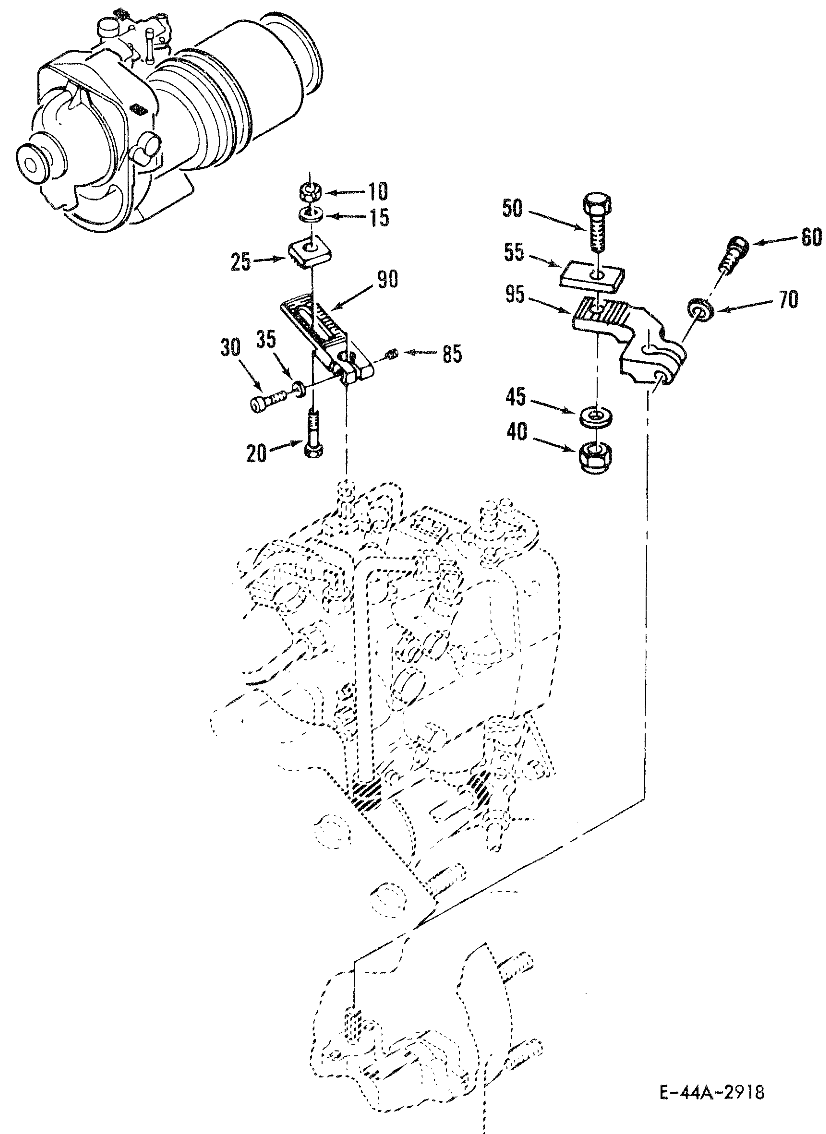
(1) Inspect lever and serrated arm for distortion and obvious damage.

(2) Inspect lever and serrated arm for damage to splined and serrated areas.

(3) Replace part that does not meet Inspection/Check requirements.

3. Cleaning/Painting

A. Clean all parts in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 1 or 2.



R 10.	NUT (IPC FIG. 87)	50.	BOLT
15.	WASHER	55.	PLATE
20.	BOLT	60.	SCREW
25.	PLATE	70.	WASHER
30.	SCREW	85.	INSERT
35.	WASHER	90.	LEVER
40.	NUT	95.	SERRATED ARM
45.	WASHER		

R (Codes AA-AC, FA, LA) Input Lever Installation
Figure 201

CONTROL BRACKETS - MAINTENANCE PRACTICES

1. Removal/Installation

NOTE: Table 201 provides a list of materials and compounds required for Removal/Installation.

Table 201. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
High temperature compound (Fel-Pro C5-A)	Fel-Pro Inc, Div of Felt Products Mfg Co, 7450 N McCormick Blvd, Skokie, IL 60076
Lubricating compound (Liqui-Moly, Grade NV)	Lockrey Co, Lubricants Div, Cedar Shores, Southampton, NY 11968

R A. (Codes AA-AC, FA, LA) Remove Control Brackets (See Figure 201)

(1) Remove nuts, washers and bolts from supports.

(2) Remove supports.

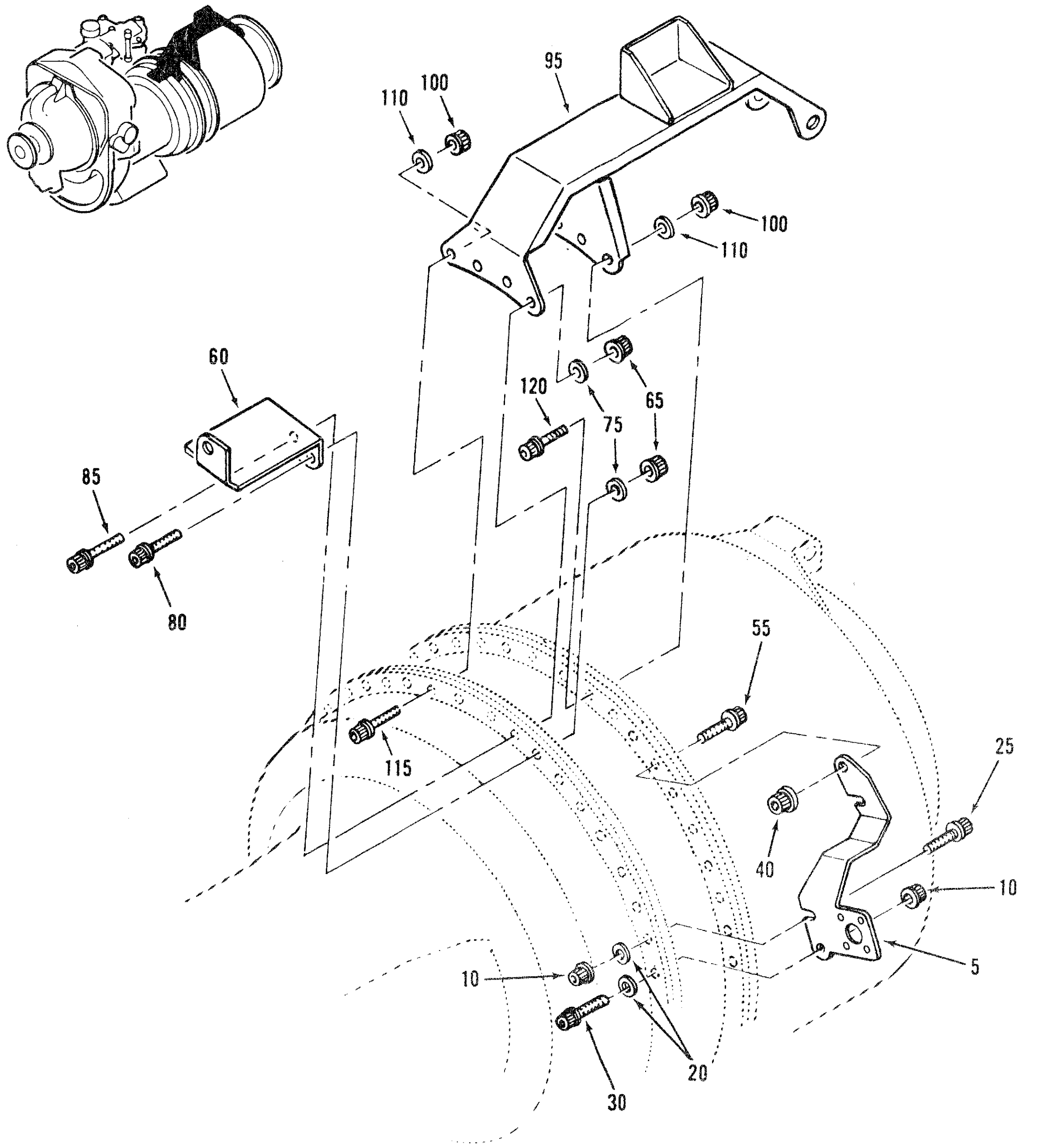
R NOTE: Refer to 70-00-00, STANDARD PRACTICES, for recommended
R general torque values. Add frictional drag (run-down)
R torque of self locking devices to recommended values.

R B. (Codes AA-AC, FA, LA) Install Control Brackets (See Figure 201)

NOTE: Apply lubricating compound (Liqui-Moly, Grade NV) to threads of bolts located forward of fireshield unless otherwise specified. Apply high temperature compound (Fel-Pro C5-A) to threads of bolts located aft of the fireshield unless otherwise specified.

(1) Install supports and secure with bolts, washers and nuts. Tighten bolts (25, 30, 55, 80, 85, 115, 120) to 60 inch-pounds torque.

R



(Codes AA-AC, FA, LA) Control Bracket Installation
Figure 201

R 1. C. (Code HA) Remove Control Brackets (See Figure 202)

(1) Remove nuts, washers and bolts from support and support assemblies.

(2) Remove support and support assemblies.

R NOTE: Refer to 70-00-00, STANDARD PRACTICES, for recommended
R general torque values. Add frictional drag (run-down)
R torque of self locking devices to recommended values.

R D. (Code HA) Install Control Brackets (See Figure 202)

NOTE: Apply lubricating compound (Liqui-Moly, Grade NV) to threads of bolts located forward of fireshield unless otherwise specified. Apply high temperature compound (Fel-Pro C5-A) to threads of bolts located aft of the fireshield unless otherwise specified.

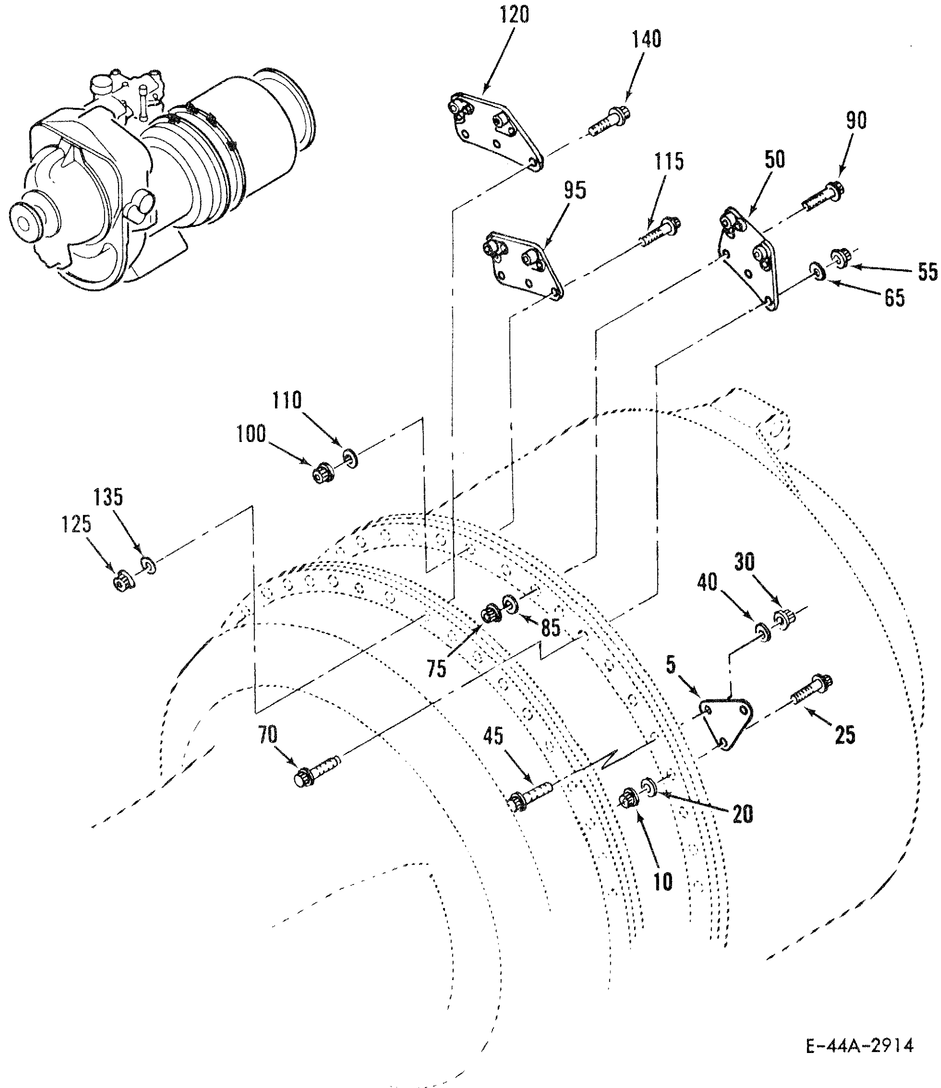
(1) Install supports and secure with bolts, washers and nuts. Tighten bolts (25, 45, 70, 90, 115, 140) to 60 inch-pounds torque.

2. Inspection/Check

A. Inspect Supports and Support Assemblies for Cracks or Other Obvious Damage. Replace Part That is Damaged.

KEY TO FIGURE 201

R 5. SUPPORT (IPC FIG. 94)
10. NUT
20. WASHER
25. BOLT
30. BOLT
40. NUT
50. WASHER
55. BOLT
60. SUPPORT
65. NUT
75. WASHER
80. BOLT
85. BOLT
95. SUPPORT
100. NUT
110. WASHER
115. BOLT
120. BOLT



R 5. SUPPORT (IPC FIG. 95)
10. NUT
20. WASHER
25. BOLT
30. NUT
40. WASHER
45. BOLT
50. SUPPORT
55. NUT
65. WASHER
70. BOLT
75. NUT
85. WASHER
90. BOLT
95. SUPPORT ASSY (PART DELETED)
100. NUT (PART DELETED)
110. WASHER (PART DELETED)
115. BOLT (PART DELETED)
120. SUPPORT (PART DELETED)
125. NUT (PART DELTED)
135. WASHER (PART DELETED)
140. BOLT (PART DELETED)

R (Code HA) Control Brackets Installation
Figure 202

TORQUE/TEMPERATURE LIMITER CONTROLLER - MAINTENANCE PRACTICES

1. Removal/Installation

   A. (Codes AA-BC, EA-GA, KA-LA) Remove and Install Torque/Temperature Limiter Controller (See Figure 201)

      (1) Removal/Installation instructions for the temperature limiter controller is contained in the Aircraft Maintenance Manual.

2. Adjustment/Test

   A. (Codes BA-BC, EA, GA, KA) Adjust Temperature Limiter Controller

      (1) Remove datum trim cover.

      (2) Adjust datum trim as required to limit maximum ITT to 923C plus 2C minus 2C.

      (3) Install datum trim cover.

3. Inspection/Check

   A. Inspect Temperature Limiter Controller

      (1) Inspect external connectors and fittings for bent or burned pins or damaged threads.

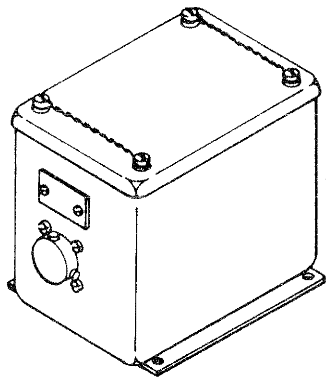
      (2) Replace temperature limiter controller if external connectors or fittings have bent or burned pins or damaged threads.

4. Cleaning/Painting

   A. Clean Parts

      (1) Clean temperature limiter controller and electrical harness assembly in accordance with 72-00-00, GENERAL - CLEANING/PAINITNG, Cleaning Method No. 11.

R



R 5. TORQUE LIMITER CONTROLLER
R (IPC FIG. 96)
R 10. TORQUE AND TEMPERATURE
R LIMITER CONTROLLER

15. TORQUE AND TEMPERATURE
LIMITER CONTROLLER

(Codes AA-BC, EA-GA, KA-LA) Torque and Temperature
Limiter Controller Installation
Figure 201

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72-00-95

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	234	Blank			

RECORD OF TEMPORARY REVISIONS

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CHAPTER 77 - ENGINE INDICATING

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CHAPTER 77 - ENGINE INDICATING

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R

POWER (ENGINE INDICATING) - DESCRIPTION AND OPERATION

R 1. Recessed Plug/Torque Sensor Compensator Assembly

R (Codes AA-BC, EA-LA) The recessed plug is located on the left side of the accessory housing and is used to port torque sensing oil for use of other components of the torque indicating system.

R (Codes CA-CC) The torque sensor compensator assembly, located on the left side of the accessory housing and converts pressure signals from the torque sensor assembly into consistent magnitude pressure for use by the torque indicating system.

R 2. (Codes CA-CC, HA) Propeller Pitch Control (BETA) Pressure Switch

The beta pressure switch is mounted on the left side of the compressor and connected by plumbing and a wiring harness assembly. The beta pressure switch provides an electrical ground for operation of a remote indicator in the cockpit when propeller pitch is being controlled manually in the beta mode.

R 3. (Codes CA-CC, HA) Negative Torque Sensing (NTS) Pressure Switch

The NTS pressure switch is mounted on the left side of the compressor in the pressure switch housing and connected by plumbing and a wiring harness assembly. The NTS pressure switch provides an electrical ground for operation of a remote indicator in the cockpit during ground test of the NTS system.

R 4. (Codes AA-BC, EA-GA, KA-LA) Pressure Switch Housing and Negative Torque Sensor Pressure Switch

The propeller pitch control (beta pressure) and negative torque sensor pressure switch housing and plumbing is mounted on the left side of the engine. The beta pressure switch and negative torque sensing pressure switch are customer furnished.

R 5. (Codes CA-CC) Torque Sensor Transmitter

The torque sensor transmitter receives differential pressure consisting of the torque compensated oil pressure and a negative pressure from the gearcase. An electrical signal created from this pressure is transmitted to the torque indicator.

R 6. (Codes AA-BC, EA-GA, KA-LA) Torque Pressure Adapter

The adapter consists of a plate containing two fittings which provide sensing connections between the gearcase and aircraft plumbing to the transducer. The smaller fitting located uppermost with adapter installed, covers oil passage in gearcase from torque sensor while the lower fitting covers the gearcase cavity vent.

R 7. (Codes AA-BC, EA-LA) Torque Transducer

The transducer receives a differential pressure, the difference of the torque sensor oil pressure and the gearcase pressure (a negative pressure), from the engine and transmits an electrical signal to the torque indicator. An electrical output is also directed to the electronic controller.

R 8. (Codes AA-AC, FA, LA) Torque Indicator

The torque indicator receives an electrical signal from the torque transducer and converts signal to an indication of torque.

R RECESSED PLUG/TORQUE SENSOR COMPENSATOR ASSEMBLY - MAINTENANCE PRACTICES

1. Removal/Installation

NOTE: Table 201 provides a list of all special tools, fixtures and equipment required to perform Removal/Installation.

Table 202 provides a list of all materials and compounds required to perform Removal/Installation.

Table 201. Special Tools, Fixtures and Equipment

Item No.	Nomenclature	Use	Source/ Part No.
NOTE: Equivalent substitutes may be used for listed items.			
1.	Torque Wrench Adapter	Used to remove and install compensator assembly.	284694-1-1
R 2.	Wrench	Used to remove and install recessed plug. (R)	287888-1-1

Table 202. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Alternate packing lubricant Lubricant (OS-124)	Monsanto Company, 800 N Lindbergh Blvd, St. Louis, MO 63166
Any approved engine oil	Commercially available

A. Remove Recessed Plug/Torque Sensor Comensator Assembly (See Figure 201)

R (1) (Codes AA-BC, EA-LA) Remove recessed plug as follows.

R (a) Using 287888-1-1 wrench, remove recessed plug from housing.

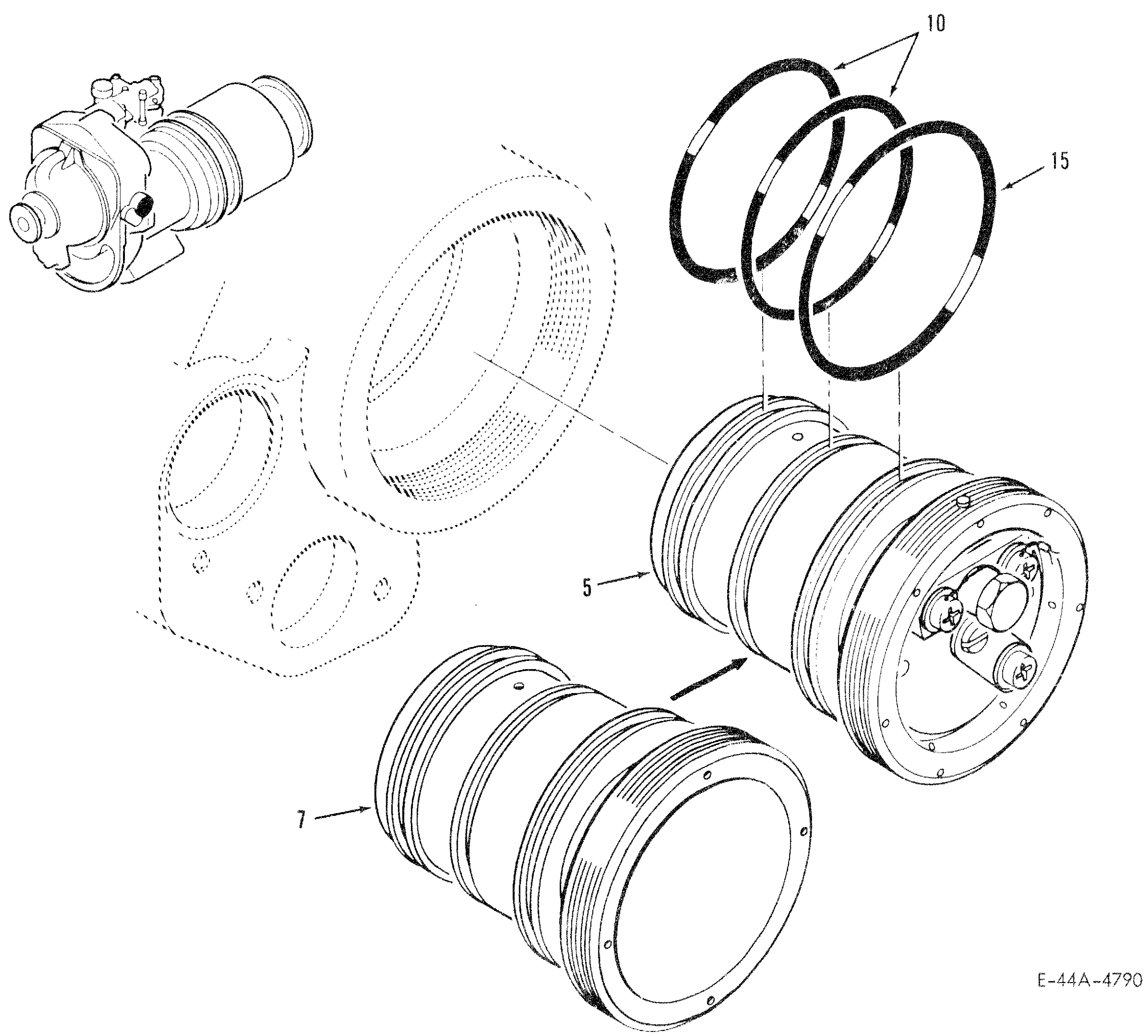
R (b) Remove and discard packings.

NOTE: Prior to removal of torque sensor compensator assembly, perform pre-teardown calculation in accordance with 72-00-00, ADJUSTMENT/TEST.

R 1. A. (2) (Codes CA-CC) Remove torque sensor compensator as follows.

R (a) Using 284694-1-1 adapter, rotate compensator body clockwise
R until it bottoms. Record number of turns.

R



R 5. TORQUE SENSOR COMPENSATOR
R (IPC FIG. 98)
R 7. RECESSED PLUG

10. PACKING
15. PACKING

R Recessed Plug/Torque Sensor Compensator Assembly Installation
Figure 201

1. A. (2) (b) Remove screw, washer, and retainer securing center screw. Rotate center screw clockwise until it bottoms. Record number of turns.

(c) Remove compensator by rotating counterclockwise. Remove 284694-1-1 adapter.

R B. Install Recessed Plug/Torque Sensor Compensator Assembly (See Figure 201)

NOTE: Lightly coat new packings with clean engine oil or lubricant (OS-124) prior to installation.

R (1) (Codes AA-BC, EA-LA) Install recessed plug as follows.

R (a) Lubricate and install packings onto recessed plug.

R (b) Using 287888-1-1 wrench, install recessed plug into housing.
R Tighten recessed plug to 10 inch-pounds torque.

R (2) (Codes CA-CC) Install torque sensor compensator as follows.

(a) Install new packings onto compensator body.

(b) Using 284694-1-1 adapter, install compensator body and rotate clockwise until it bottoms.

(c) Rotate compensator body counterclockwise the same number of turns recorded in removal. Remove 284694-1-1 adapter.

(d) Rotate center screw counterclockwise the same number of turns recorded in removal and secure with retainer washer and screw. Tighten screw 7 to 9 inch-pounds torque.

(e) Steps (1) through (d) are not a substitute for calibration. Refer to 72-00-00, ADJUSTMENT/TEST, for calibration of torque sensor compensator assembly.

2. Adjustment/Test

Refer to 72-00-00, ADJUSTMENT/TEST.

3. Inspection/Check

Check for security or evidence of oil leaks and obvious damage.

4. Cleaning/Painting

A. Clean Parts

(1) Clean all standard metallic hardware in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 1 or 2.

(2) Clean torque sensor compensator in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 1.

PROPELLER PITCH CONTROL (BETA) AND NEGATIVE TORQUE SENSING (NTS) PRESSURE SWITCH - MAINTENANCE PRACTICES

1. Removal/Installation

NOTE: Table 201 provides a list of all materials and compounds required to perform Removal/Installation.

Table 201. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Alternate packing lubricant Lubricant (OS-124)	Monsanto Company, 800 N Lindbergh Blvd, St. Louis, MO 63166
Any approved engine oil	Commercially available
Lubricating compound (Liqui-Moly, Grade NV)	Lockrey Co, Lubricants Div, Cedar Shores, Southampton, NY 11968

R A. (Codes AA-AC, FA, LA) Remove Pressure Switch Plumbing (See Figure 201)

(1) Remove tube assemblies, unions, elbows, and gaskets from accessory housing assembly, propeller pitch control, solenoid valve and switch housing.

R B. (Codes AA-AC, FA, LA) Remove Solenoid Valve and Switch Housing Assembly (See Figure 202)

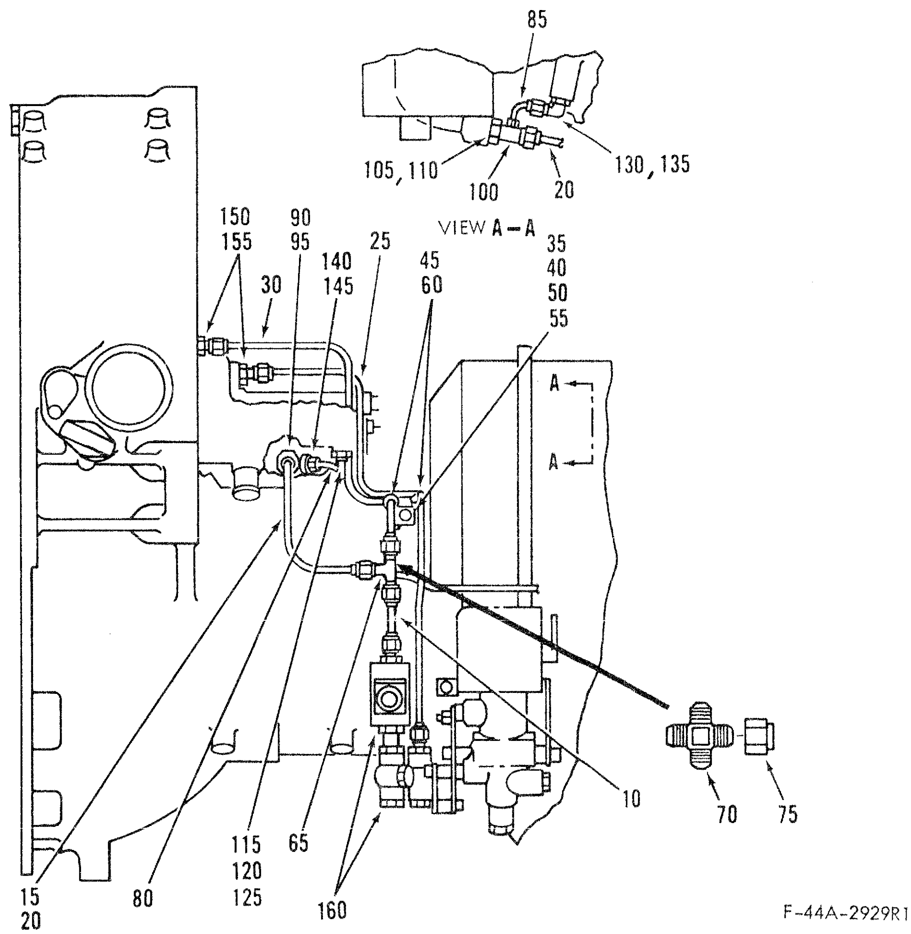
NOTE: Note direction of arrows on check valves to aid in reassembly.

(1) Disconnect fuel shutoff valve plumbing and remove fuel shutoff valve in accordance with 73-10-06, MAINTENANCE PRACTICES.

(2) Remove solenoid valve, switch housing and support.

(3) Remove switch housing from support.

(4) Remove plug and bleeder, unions, check valves, and packings.



R

R 10.	TUBE ASSY (IPC FIG. 30)	90.	UNION
15.	TUBE ASSY	95.	PACKING
20.	TUBE ASSY	100.	TEE
25.	TUBE ASSY	105.	PACKING
30.	TUBE ASSY	110.	NUT
35.	NUT	115.	ELBOW
40.	BOLT	120.	PACKING
45.	CLAMP	125.	NUT
50.	NUT	130.	ELBOW
55.	BOLT	135.	PACKING
60.	CLAMP	140.	UNION
65.	TEE	145.	PACKING
70.	CROSS	150.	UNION
75.	CAP	155.	PACKING
80.	TUBE ASSY	160.	SWITCH HOUSING AND SOLENOID VALVE
85.	TUBE ASSY		

R (Codes AA-AC, FA, LA) Beta and NTS Pressure
R Switch Plumbing Installation
Figure 201

R 1. C. (Codes AA-AC, FA, LA) Install Switch Housing and Solenoid Valve (See Figure 202)

NOTE: Lightly coat new packings with clean engine oil or lubricant (OS-124) prior to installation unless otherwise specified. Apply lubricating compound (Liqui-Moly, Grade NV) to theads of bolts or screws and apply clean engine oil to threads (except first two threads) of male plumbing fittings located forward of the compressor housing unless otherwise specified.

R Refer to 70-00-00, STANDARD PRACTICES, for recommended general
R torque values. Add frictional drag (run-down) torque of self
R locking devices to recommended values.

(1) Install plug and bleeders, with new packings or gaskets into switch housing. Tighten plug and bleeders (10) to 60 to 65 inch-pounds torque.

(2) Install union, with new packing, into switch housing. Tighten union (105) to 60 to 65 inch-pounds torque.

(3) Install check valve, with new packings, into switch housing. Tighten check valve (20) to 60 to 65 inch-pounds torque.

(4) Connect solenid valve and switch housing with union, new packings and nut. Tighten union (115) to 60 to 65 inch-pounds torque. Tighten nut (125) to 50 to 55 inch-pounds torque.

(5) Install check valve, with new packings, into soleniod valve with arrow pointing away from solenoid valve. Tighten check valve (35) to 60 to 65 inch-pounds torque.

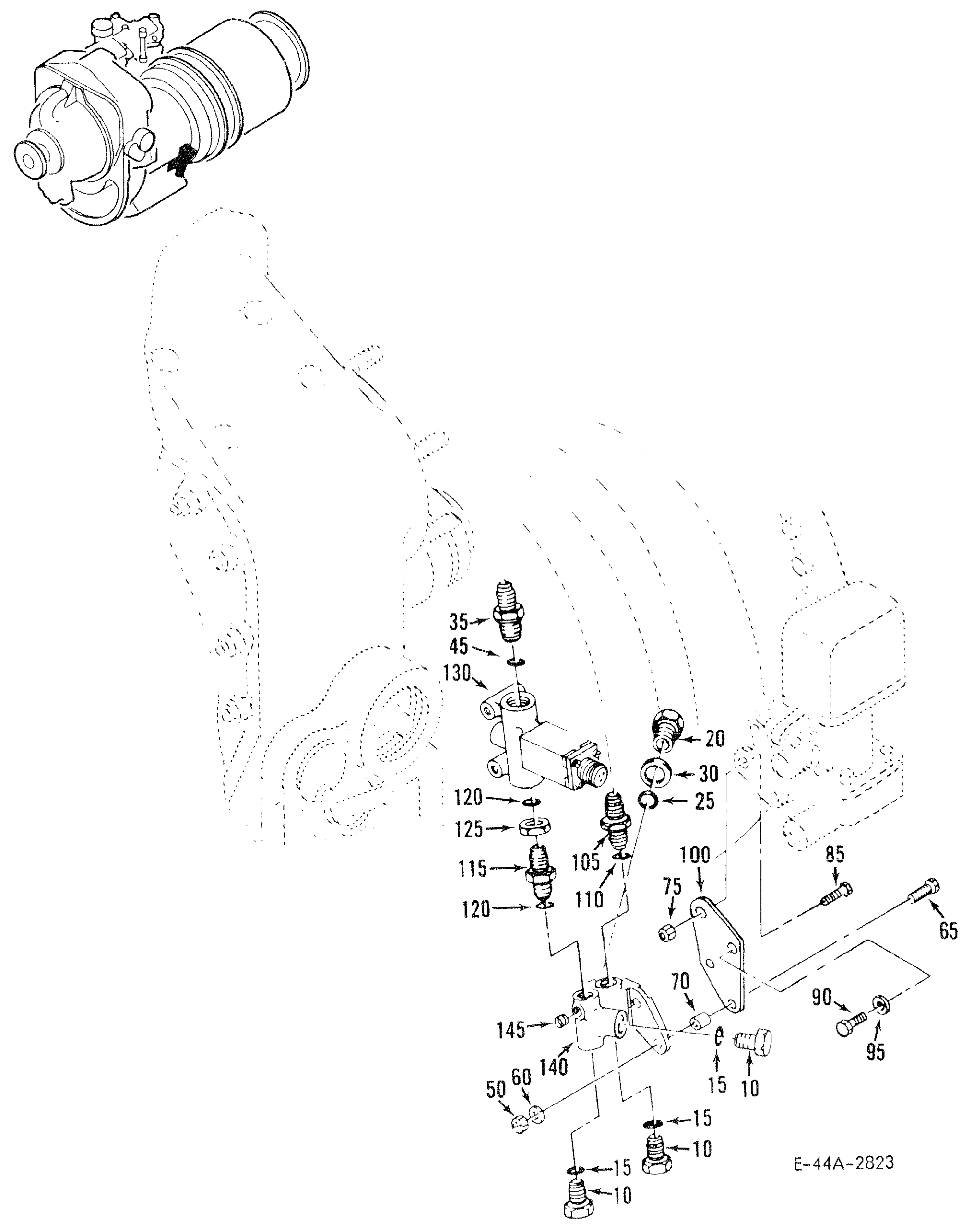
(6) Install support onto switch housing and secure with bolts, spacers, washers and nuts. Tighten nuts (50, 75) to 65 inch-pounds torque. Tighten bolt (90) to 70 inch-pounds torque.

(7) Install fuel shutoff valve and connect plumbing in accordance with 73-10-06, MAINTENANCE PRACTICES.

R D. (Codes AA-AC, FA, LA) Install Pressure Switch Plumbing (See Figure 201)

NOTE: Lightly coat new packings with clean engine oil or lubricant (OS-124) prior to installation unless otherwise specified. Apply clean engine oil to treads (except first two threads) of male plumbing fittings located forward of the compressor housing unless otherwise specified.

(1) Install tee or union, with new packings, into propeller pitch control. Secure tee with nut. Tighten union (90) to 60 to 65 inch-pounds torque or nut (110) to 50 to 55 inch-pounds torque.



R (Codes AA-AC, FA, LA) Beta and NTS Switch Housing and
R Solenoid Valve Installation
Figure 202

1. D. (2) Install elbow, with new packing, into propeller governor and secure with nut. Tighten nut furnished with elbow (130) or nut (125) to 20 to 25 inch-pounds torque.

(3) Install tube assembly between elbow in propeller governor and tee or union in propeller pitch control.

(4) Install tube assembly onto check valve in top of solenoid valve. Install tee or cross onto tube assembly.

(5) Install tube assembly between tee or cross, and union in propeller pitch control.

(6) Install cap on cross. Tighten cap (75) to 100 to 120 inch-pounds torque. Lockwire cap.

(7) Install unions, with new packings, into accessory housing and propeller pitch control. Tighten unions (150) to 60 to 65 inch-pounds torque.

(8) Install tube assembly between union in accessory housing and tee. Install tube assembly between union in propeller pitch control and switch housing and secure with clamps, bolts and nuts. Tighten nut (35, 50) to 20 inch-pounds torque.

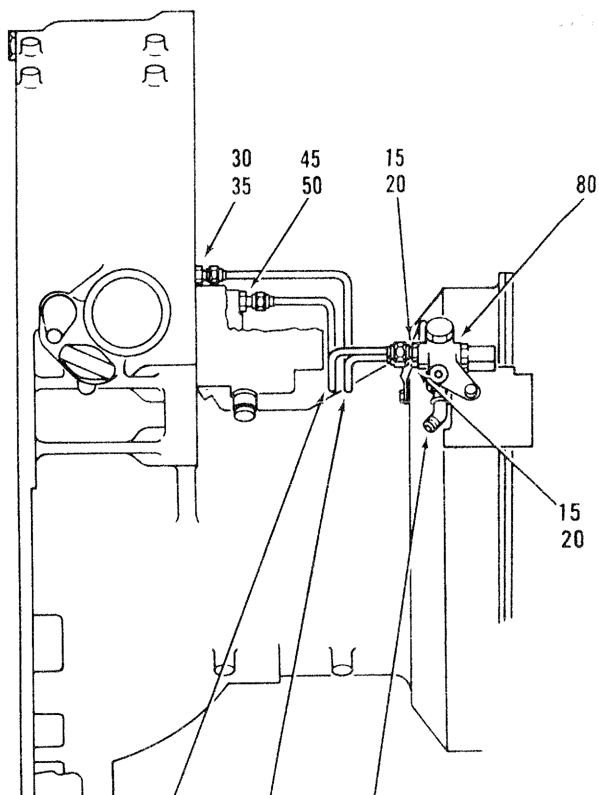
R E. (Codes BA-BC, EA, GA) Remove Beta and NTS Pressure Switch Plumbing (See Figure 203)

(1) Remove tube assemblies, unions, check valve, elbow and gaskets from accessory housing assembly, propeller pitch control and switch housing.

KEY TO FIGURE 202

R 10. PLUG AND BLEEDER (IPC FIG. 101)
15. PACKING
20. CHECK VALVE
25. PACKING
30. PACKING
35. CHECK VALVE
45. PACKING
50. NUT
60. WASHER
65. BOLT
70. SPACER
75. NUT
85. BOLT
90. BOLT
95. WASHER
100. SUPPORT
105. UNION
110. PACKING
115. UNION
120. PACKING
125. NUT
130. SOLENOID VALVE
140. SWITCH HOUSING
145. INSERT

R



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R 5.	TUBE ASSY (IPC FIG. 31)	45.	UNION
R 10.	TUBE ASSY	50.	PACKING
R 15.	UNION	60.	ELBOW
R 20.	GASKET	65.	PACKING
R 30.	CHECK VALVE	75.	NUT
R 35.	PACKING	80.	SWITCH HOUSING

R (Codes BA-BC, EA, GA) Beta and NTS Pressure
R Switch Plumbing Installation
Figure 203

R 1. F. (Codes BA-BC, EA, GA) Remove Beta and NTS Pressure Switch Housing (See Figure 204)

(1) Disconnect fuel shutoff valve plumbing in accordance with 73-10-06, MAINTENANCE PRACTICES.

(2) Remove fuel shutoff valve from bracket in accordance with 73-10-06, MAINTENANCE PRACTICES.

(3) Remove support.

(4) Remove switch housing from fuel shutoff valve bracket.

(5) Remove check valve.

R G. (Codes BA-BC, EA, GA) Install Beta and NTS Presssure Switch Housing (See Figure 204)

NOTE: Lightly coat new packings with clean engine oil or lubricant (OS-124) prior to installation unless otherwise specified. Apply lubricating compound (Liqui-Moly, Grade NV) to threads of bolts or screws and apply clean engine oil to threads (except first two threads) of male plumbing fittings located forward of the compressor housing unless otherwise specified.

R Refer to 70-00-00, STANDARD PRACTICES, for recommended
R general torque values. Add frictional drag (run-down)
R torque of self locking devices to recommended values.

(1) Install check valve with new packings into switch housing. Tighten check valve (35) to 90 to 95 inch-pounds torque and lockwire.

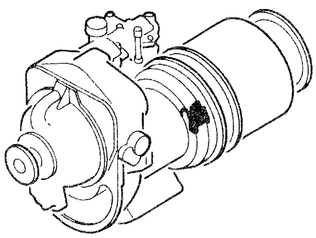
(2) Install plug and bleeders with new packings into switch housing. Tighten plug and bleeders (60) to 65 to 70 inch-pounds torque.

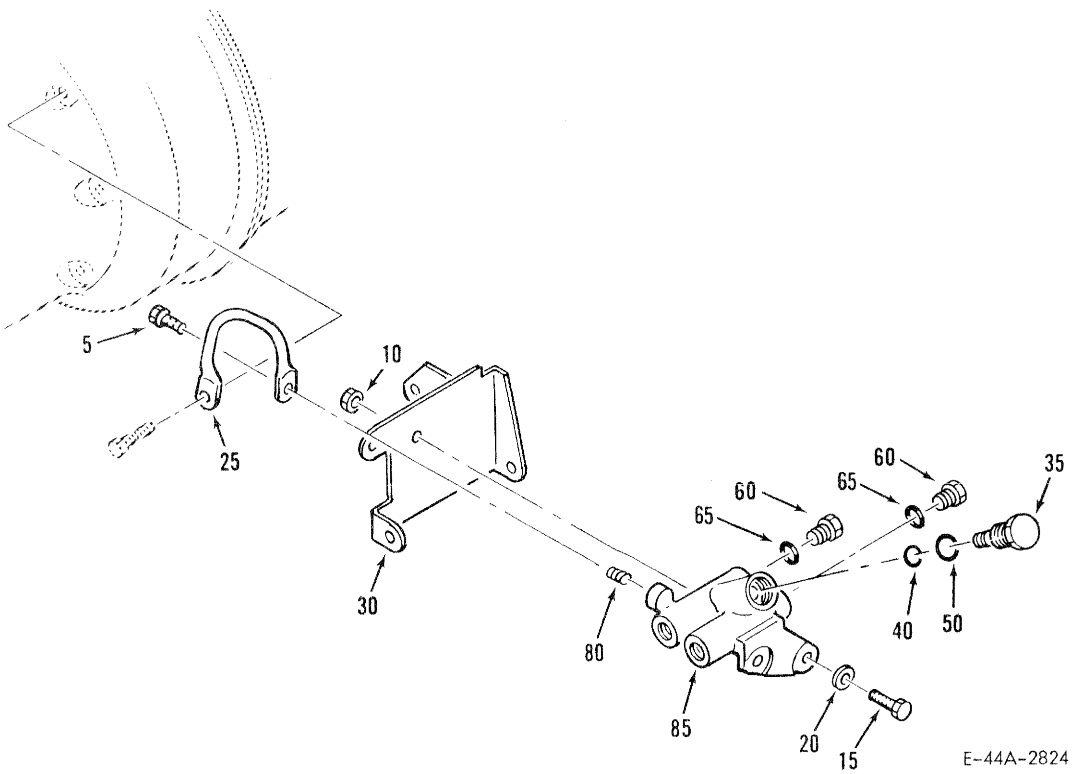
(3) Install housing onto fuel shutoff valve bracket with washer, bolt and nut. Tighten bolt (15) to 70 inch-pounds torque.

(4) Install support onto switch housing and accessory housing assembly. Tighten bolt (5) to 25 inch-pounds torque. Tighten bolt that secures support to accessory housing assembly to 40 inch-pounds torque.

(5) Install fuel shutoff valve onto bracket in accordance with 73-10-06, MAINTENANCE PRACTICES.

(6) Connect fuel shutoff valve plumbing in accordance with 73-10-06, MAINTENANCE PRACTICES.





R 5. BOLT (IPC FIG. 102)
10. NUT
15. BOLT
20. WASHER
25. SUPPORT
30. BRACKET
35. CHECK VALVE
40. PACKING
50. PACKING
60. PLUG AND BLEEDER
65. PACKING
80. INSERT
85. SWITCH HOUSING

R (Codes BA-BC, EA, GA) Beta and NTS Pressure Switch
R Housing Installation
Figure 204

R 1. H. (Codes BA-BC, EA, GA) Install Beta and NTS Pressure Switch Plumbing (See Figure 203)

NOTE: Lightly coat new packings with clean engine oil or lubricant (OS-124) prior to installation unless otherwise specified. Apply clean engine oil to threads (except first two threads) of male plumbing fittings located forward of the compressor housing unless otherwise specified.

(1) Install check valve with new packing into accessory housing assembly with arrow pointing forward. Install union with new packing into propeller pitch control. Tighten check valve (30) and union (45) to 60 to 65 inch-pounds torque

(2) Install unions with new packings into pressure switch housing. Tighten unions (15) to 60 to 65 inch-pounds torque.

(3) Install elbow, with new packing, into pressure switch housing and secure with nut. Tighten nut (75) to 50 to 55 inch-pounds torque.

(4) Install tube assembly between check valve in accessory housing assembly and inboard union in pressure switch housing.

(5) Install tube assembly between union in propeller pitch control and outboard union in pressure switch housing.

R I. (Codes CA-CC) Remove Beta and NTS Pressure Switch Plumbing (See Figure 205)

(1) Remove tube assemblies, elbows, unions, and packings from input housing assembly, propeller pitch control, solenoid valve and switch housing.

R J. (Codes CA-CC) Remove Beta and NTS Pressure Switches (See Figure 206)

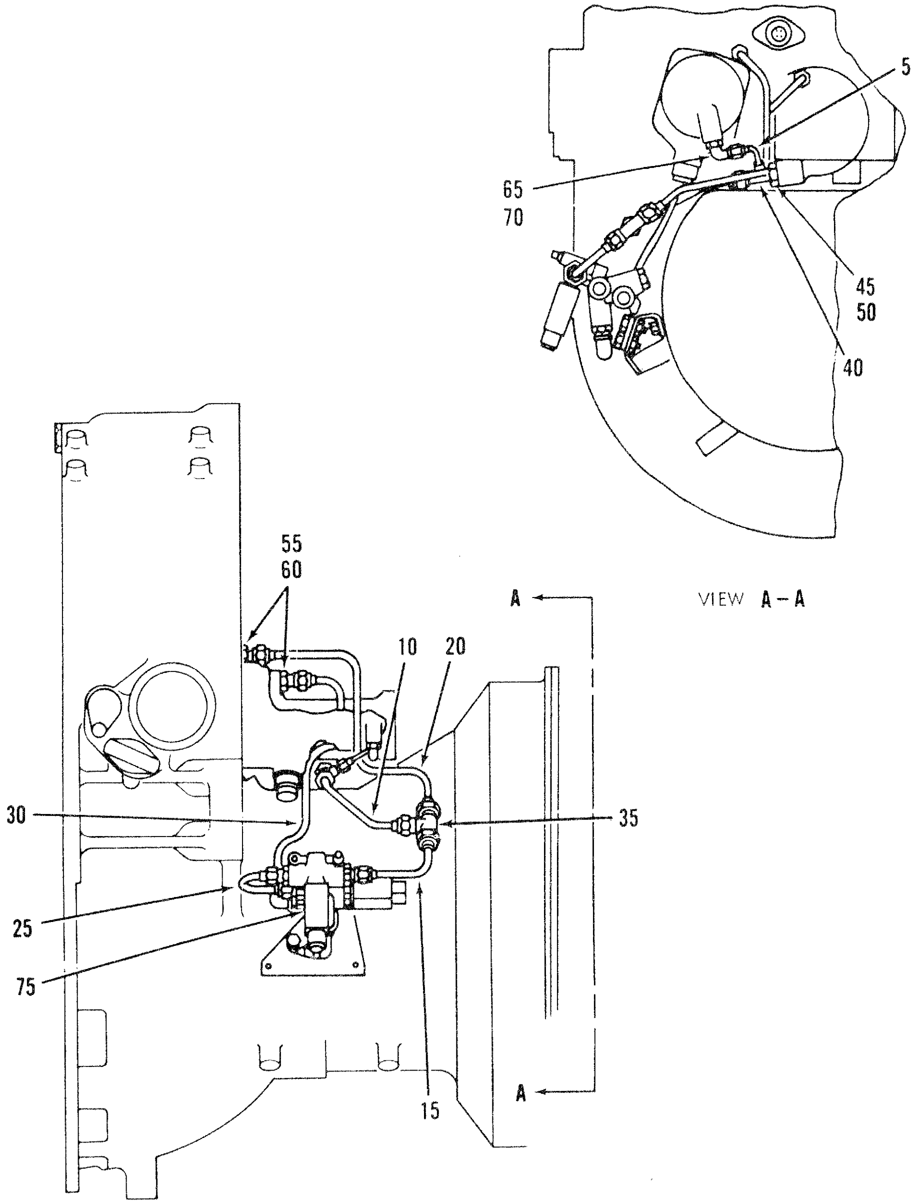
(1) Remove aircraft electrical connectors from pressure switches. Refer to Aircraft Maintenance Manual.

(2) Remove pressure switches and packings.

R K. (Codes CA-CC) Remove Beta and NTS Pressure Switch Housing and Solenoid Valve (See Figure 206)

(1) Remove bracket with switch housing and solenoid valve from accessory housing assembly.

(2) Remove solenoid valve from switch housing.



R

R 5. TUBE ASSY (IPC FIG. 32)
10. TUBE ASSY
15. TUBE ASSY
20. TUBE ASSY
25. TUBE ASSY
30. TUBE ASSY
35. TEE
40. TEE
45. PACKING
50. NUT
55. UNION
60. PACKING
65. ELBOW
70. PACKING
75. SWITCH HOUSING

R (Codes CA-CC) Beta and NTS Pressure Switch
Plumbing Installation
Figure 205

1. K. (3) Remove switch housing from bracket.

(4) Remove elbows, check valves, unions, and packings from solenoid valve and switch housing.

R L. (Codes CA-CC) Install Beta and NTS Pressure Switch Housing and Solenoid Valve (See Figure 206)

NOTE: Lightly coat new packings with clean engine oil or lubricant (OS-124) prior to installation unless otherwise specified. Apply lubricating compound (Liqui-Moly, Grade NV) to threads of bolts or screws and apply clean engine oil to threads (except first two threads) of male plumbing fittings located forward of the compressor housing unless otherwise specified.

R Refer to 70-00-00, STANDARD PRACTICES, for recommended
R general torque values. Add frictional drag (run-down)
R torque of self locking devices to recommended values.

(1) Install elbows with new packings into switch housing and secure with nuts. Tighten nuts (30) to 50 to 55 inch-pounds torque.

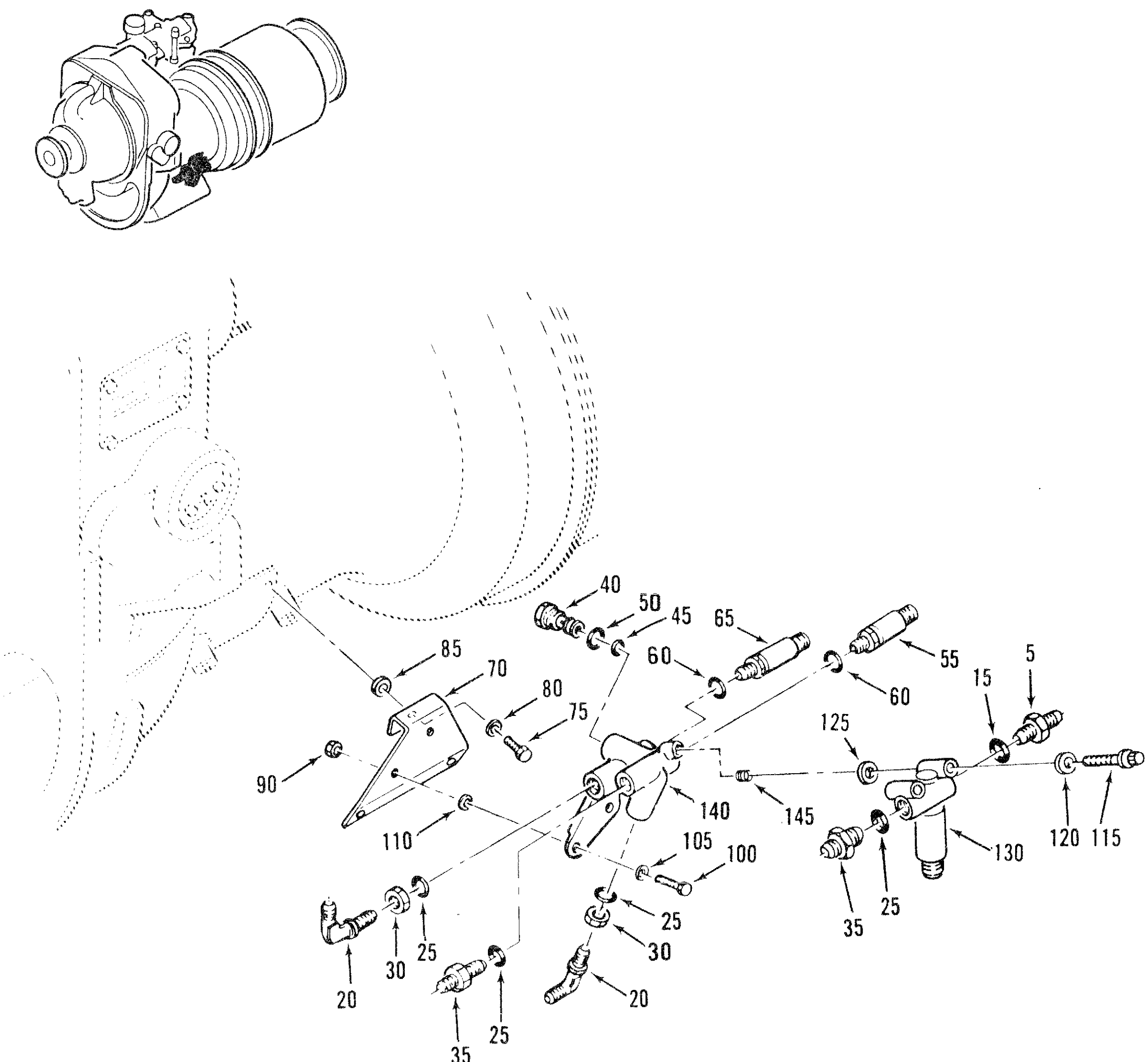
(2) Install unions with new packings into switch housing and solenoid valve. Tighten unions (35) to 60 to 65 inch-pounds torque.

(3) Install check valve with new packing into solenoid valve with arrow pointing away from solenoid valve. Tighten check valve (5) to 60 to 65 inch-pounds torque.

(4) Install check valve with new packings into switch housing. Tighten check valve (40) to 60 to 65 inch-pounds torque.

(5) Install solenoid valve and switch housing onto bracket and secure with nuts, washers, and bolts. Tighten bolt (115) to 25 inch-pounds torque. Tighten bolts (100) to 70 inch-pounds torque.

(6) Install assembled bracket, solenoid valve and switch housing onto accessory housing assembly with washer between bracket and accessory housing assembly. Secure with washer and bolt. Tighten bolt (75) to 25 inch-pounds torque.



R 5.	CHECK VALVE (IPC FIG. 103)	75.	BOLT
15.	PACKING	80.	WASHER
20.	ELBOW	85.	WASHER
25.	PACKING	90.	NUT
30.	NUT	100.	BOLT
35.	UNION	105.	WASHER
40.	CHECK VALVE	110.	WASHER
45.	PACKING	115.	BOLT
50.	PACKING	120.	WASHER
55.	PRESSURE SWITCH (NTS)	125.	WASHER
60.	PACKING	130.	SOLENOID VALVE
65.	PRESSURE SWITCH (BETA)	140.	SWITCH HOUSING
70.	BRACKET	145.	INSERT

R (Codes CA-CC) Beta and NTS Pressure Switch
Housing Installation
Figure 206

R 1. M. (Codes CA-CC) Install Beta and NTS Pressure Switches (See Figure 206)

NOTE: Lightly coat new packings with clean engine oil or lubricant (OS-124) prior to installation unless otherwise specified. Apply clean engine oil to threads (except first two threads) of male plumbing fittings located forward of the compressor housing unless otherwise specified.

(1) Install beta pressure switch, with new gasket, into switch housing. Tighten beta pressure switch (65) to 60 to 65 inch-pounds torque and lockwire.

(2) Connect aircraft electrical connector to beta pressure switch. Refer to Aircraft Maintenance Manual.

(3) Install NTS pressure switch, with new packing, into switch housing. Tighten NTS pressure switch (55) to 60 to 65 inch-pounds torque and lockwire.

(4) Connect aircraft electrical connector to NTS pressure switch. Refer to Aircraft Maintenance Manual.

R N. (Codes CA-CC) Install Beta and NTS Pressure Switch Plumbing (See Figure 205)

NOTE: Lightly coat new packings with clean engine oil or lubricant (OS-124) prior to installation unless otherwise specified. Apply clean engine oil to threads (except first two threads) of male plumbing fittings located forward of the compressor housing unless otherwise specified.

(1) Install unions with new packings into accessory housing assembly and propeller pitch control. Tighten unions (55) to 60 to 65 inch-pounds torque.

(2) Install tube assemblies onto union in accessory housing and check valve in solenoid valve and join with tee.

(3) Install tee with new packing into propeller governor and secure with nut. Tighten nut (50) to 50 to 55 inch-pounds torque.

(4) Install tube assembly between tees installed in steps (2) and (3).

(5) Install elbow with new packing into propeller governor and secure with nut furnished with elbow. Tighten nut on elbow (65) to 20 to 25 inch-pounds torque.

(6) Install tube assembly between elbow in propeller governor and tee installed in propeller pitch control.

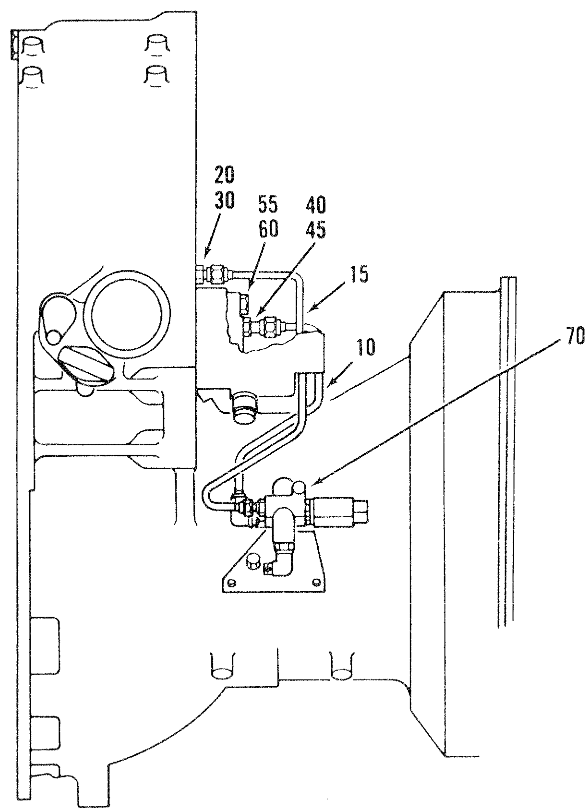
1\. N. (7) Install tube assembly between union in propeller pitch control and elbow in switch housing.

(8) Install tube assembly between unions in solenoid valve and switch housing.

O. (Code HA) Remove Beta and NTS Pressure Switch Plumbing (See Figure 207)

(1) Remove tube assemblies, unions, elbows, check valve, and plug and bleeder from accessory housing assembly and propeller pitch control.

R



R 10. TUBE ASSY (IPC FIG. 33)
15. TUBE ASSY
20. CHECK VALVE
30. PACKING
40. UNION
45. PACKING
55. PLUG
60. PACKING
70. SWITCH HOUSING

(Code HA) Beta and NTS Pressure Switch Plumbing Installation
Figure 207

R 1. P. (Code HA) Remove Beta and NTS Pressure Switches (See Figure 208)

(1) Disconnect aircraft electrical connectors from pressure switches.

(2) Remove NTS pressure switch.

(3) Remove beta pressure switch.

R Q. (Code HA) Remove Housing (See Figure 208)

(1) Remove bracket and switch housing from accessory housing assembly.

(2) Remove switch housing from bracket.

(3) Remove check valve, union, elbows and gaskets from switch housing.

R R. (Code HA) Install Beta and NTS Pressure Switch Housing (See Figure 208)

NOTE: Lightly coat new packings with clean engine oil or lubricant (OS-124) prior to installation unless otherwise specified. Apply lubricating compound (Liqui-Moly, Grade NV) to threads of bolts or screws and apply clean engine oil to threads (except first two threads) of male plumbing fittings located forward of the compressor housing unless otherwise specified.

R Refer to 70-00-00, STANDARD PRACTICES, for recommended
R general torque values. Add frictional drag (run-down)
R torque of self locking devices to recommended values.

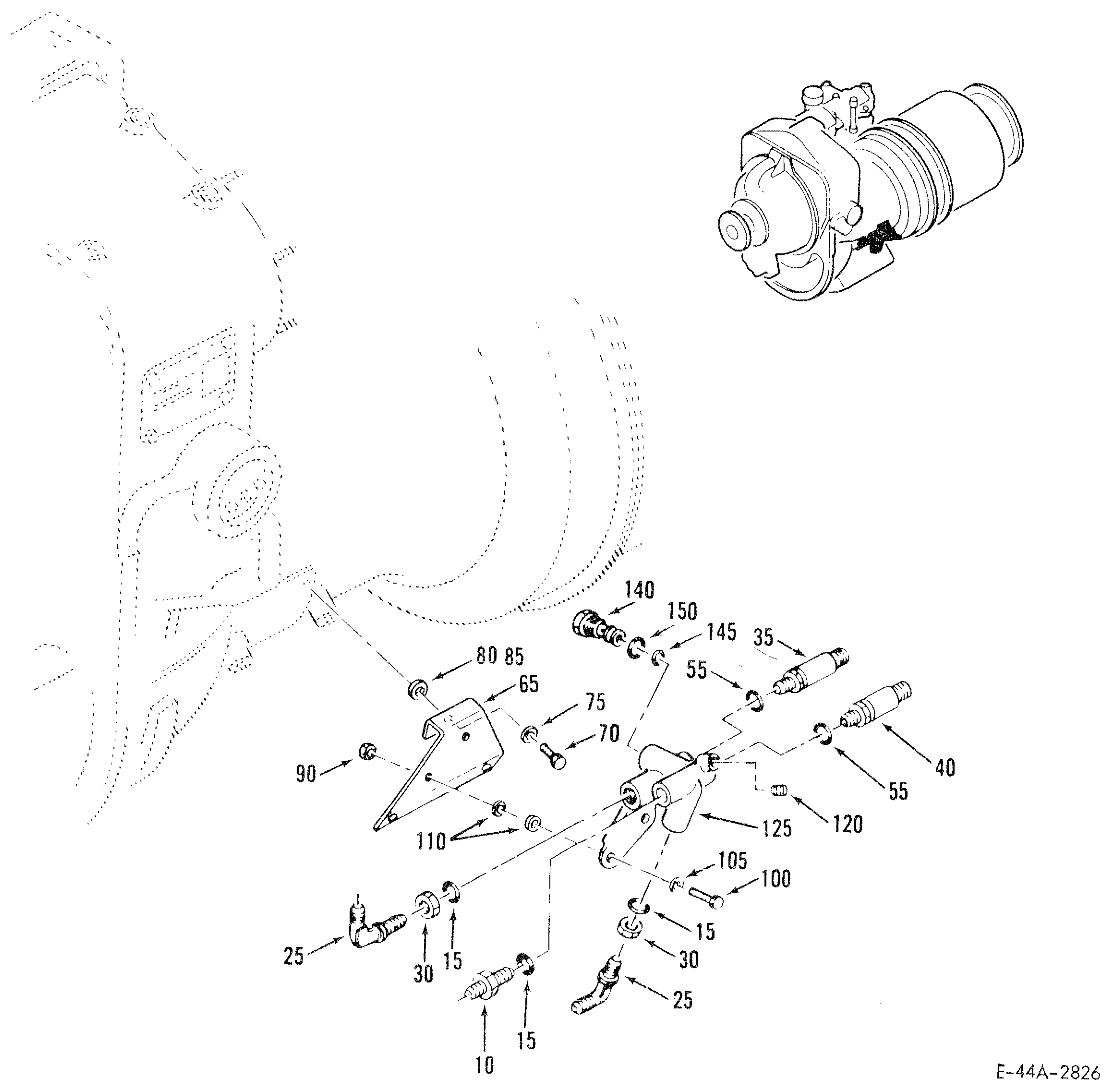
(1) Install check valve, with new packings into switch housing. Tighten check valve (140) to 60 to 65 inch-pounds torque and lockwire.

(2) Install elbows with new packings into switch housing and secure with nuts. Tighten nuts (30) to 50 to 55 inch-pounds torque.

(3) Install union with new packings into switch housing. Tighten union (10) to 60 to 65 inch-pounds torque.

(4) Install switch housing onto bracket with washers, bolts, and nuts. Tighten nuts (90) to 50 inch-pounds torque.

(5) Install bracket and housing onto accessory housing assembly with washers, thrust washer, and bolts. Tighten bolts (70) to 25 inch-pounds torque.



R 10.	UNION (IPC FIG. 104)	85.	WASHER
15.	GASKET	90.	NUT
25.	ELBOW	100.	BOLT
30.	NUT	105.	WASHER
35.	PRESSURE SWITCH (BETA)	110.	WASHER
40.	PRESSURE SWITCH (NTS)	120.	INSERT
55.	GASKET	125.	SWITCH HOUSING
65.	BRACKET	140.	CHECK VALVE
70.	BOLT	145.	PACKING
75.	WASHER	150.	GASKET
80.	WASHER		

R (Code HA) Beta and NTS Pressure Switch
Housing Installation
Figure 208

R 1. S. (Code HA) Install Beta and NTS Pressure Switches (See Figure 208)

NOTE: Lightly coat new packings with clean engine oil or lubricant (OS-124) prior to installation unless otherwise specified. Apply clean engine oil to threads (except first two threads) of male plumbing fittings located forward of the compressor housing unless otherwise specified.

(1) Install beta pressure switch, with new packing into switch housing. Tighten beta pressure switch (35) to 60 to 65 inch-pounds torque and lockwire.

(2) Install NTS pressure switch, with new packing into switch housing. Tighten NTS pressure switch (40) to 60 to 65 inch-pounds torque and lockwire.

(3) Connect aircraft electrical connectors to pressure switches. Refer to Aircraft Maintenance Manual.

R T. (Code HA) Install Beta and NTS Pressure Switch Plumbing (See Figure 207)

NOTE: Lightly coat new packings with clean engine oil or lubricant (OS-124) prior to installation unless otherwise specified. Apply clean engine oil to threads (except first two threads) of male plumbing fittings located forward of the compressor housing unless otherwise specified.

(1) Install plug with new packing into propeller pitch control. Tighten plug (55) to 60 to 65 inch-pounds torque.

(2) Install check valve, with new packing into accessory housing assembly with arrow pointing forward. Install union, with new packing into propeller pitch control. Tighten check valve (20) and union (40) to 60 to 65 inch-pounds torque.

(3) Install tube assembly between check valve in accessory housing assembly and union in switch housing.

(4) Install tube assembly between union in propeller pitch control and elbow in switch housing.

R 1. U. (Code KA) Remove Beta and NTS Pressure Switch Plumbing (See Figure 209)

(1) Remove tube assemblies, unions, elbows, tees and packings from input housing assembly, propeller pitch control, propeller governor, solenoid valve and switch housing.

R V. (Code KA) Remove Beta and NTS Pressure Switch Housing and Solenoid Valve (See Figure 210)

(1) Disconnect fuel shutoff valve plumbing in accordance with 73-10-06, MAINTENANCE PRACTICES.

(2) Remove fuel shutoff valve from bracket in accordance with 73-10-06, MAINTENANCE PRACTICES.

(3) Remove support.

(4) Remove switch housing from fuel shutoff valve bracket.

(5) Remove check valve, plug and packings from switch housing.

(6) Remove solenoid valve bracket.

(7) Remove solenoid valve from bracket.

R W. (Code KA) Install Beta and NTS Pressure Switch Housing and Solenoid Valve (See Figure 210)

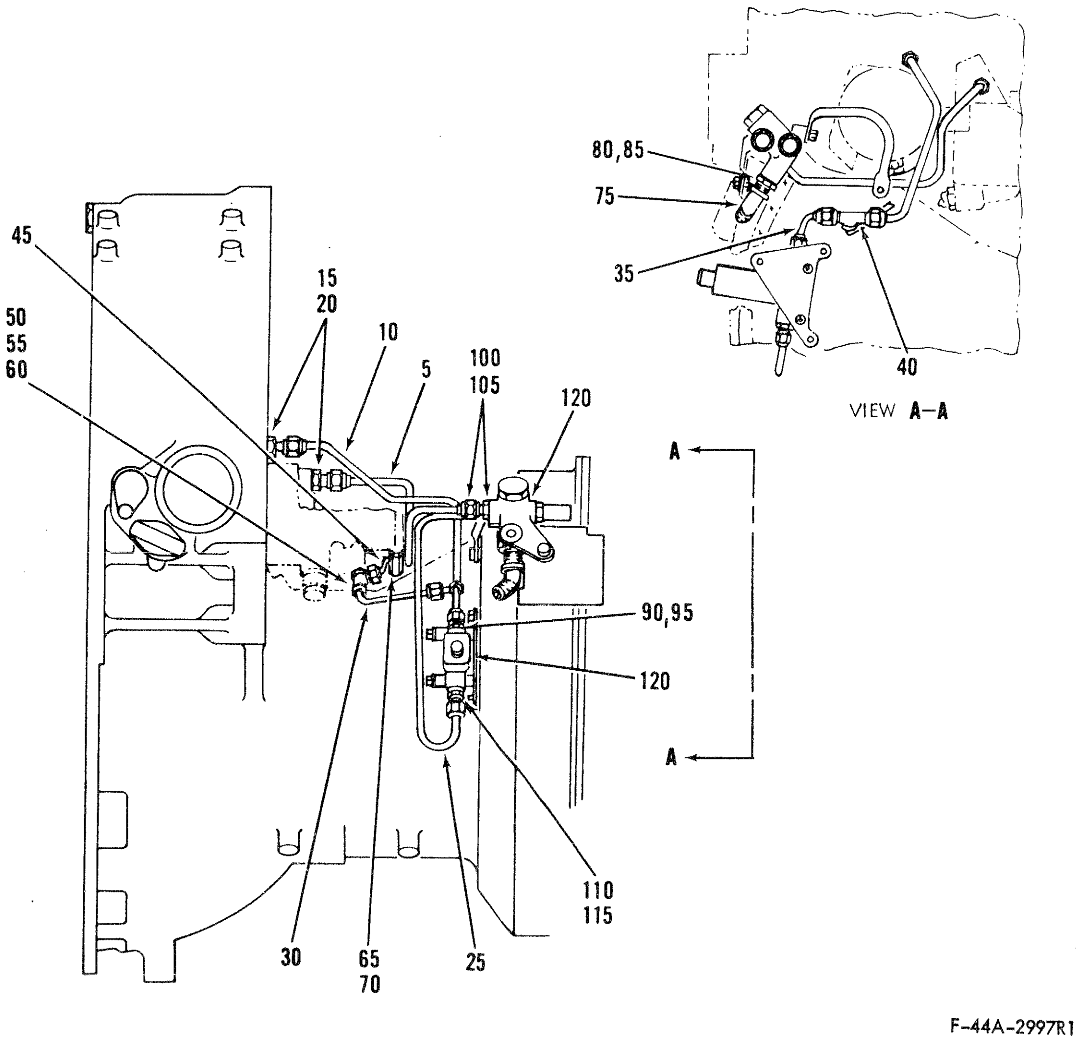
NOTE: Lightly coat new packings with clean engine oil or lubricant (OS-124) prior to installation unless otherwise specified. Apply lubricating compound (Liqui-Moly, Grade NV) to threads of bolts or screws and apply clean engine oil to threads (except first two threads) of male plumbing fittings located forward of the compressor housing unless otherwise specified.

R Refer to 70-00-00, STANDARD PRACTICES, for recommended
R general torque values. Add frictional drag (run-down)
R torque of self locking devices to recommended values.

(1) Install check valve and plug with new packings into switch housing. Tighten check valve (85) to 90 to 95 inch-pounds torque. Tighten plug (75) to 65 to 70 inch-pounds torque.

(2) Install switch housing onto fuel shutoff valve bracket with washer, bolt and nut. Tighten bolt (55) to 80 inch-pounds.

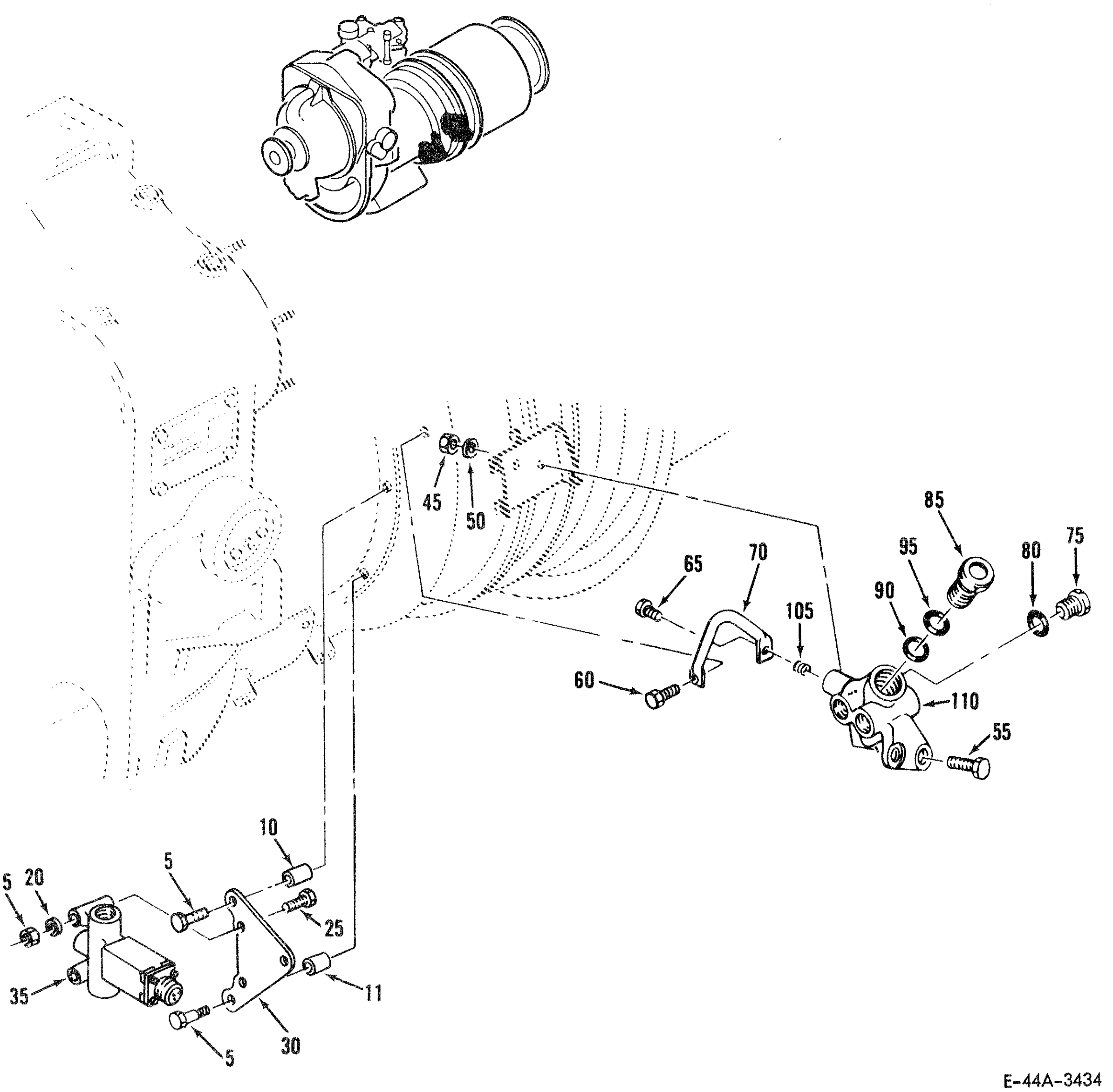
(3) Install support onto switch housing and accessory housing assembly and secure with bolts. Tighten bolt (60) to 40 inch-pounds torque. Tighten bolt (65) to 35 inch-pounds torque.



R

R 5.	TUBE ASSY (IPC FIG. 34)	65.	ELBOW
10.	TUBE ASSY	70.	PACKING
15.	UNION	75.	ELBOW
20.	PACKING	80.	PACKING
25.	TUBE ASSY	85.	NUT
30.	TUBE ASSY	90.	CHECK VALVE
35.	TUBE ASSY	95.	PACKING
40.	TEE	100.	UNION
45.	TUBE ASSY	105.	PACKING
50.	TEE	110.	UNION
55.	PACKING	115.	PACKING
60.	NUT	120.	SWITCH HOUSING AND SOLENOID VALVE

R (Code KA) Beta and NTS Pressure Switch
Plumbing Installation
Figure 209



5.	BOLT	35.	SOLENOID VALVE	75.	PLUG
R	(IPC FIG. 105)		(LOCKOUT)	80.	PACKING
10.	SPACER	45.	NUT	85.	CHECK VALVE
11.	SPACER	50.	WASHER	90.	PACKING
15.	NUT	55.	BOLT	95.	PACKING
20.	WASHER	60.	BOLT	105.	INSERT
25.	BOLT	65.	BOLT	110.	SWITCH HOUSING
30.	BRACKET	70.	SUPPORT		

R (Code KA) Beta and NTS Pressure Switch Housing and Lockout Valve Installation
Figure 210

1. W. (4) Install solenoid valve onto bracket and secure with bolts, washers, and nuts. Tighten nut (15) to 27 inch-pounds torque.

(5) Install solenoid valve and bracket onto engine with spacers and bolts. Tighten bolts (5) to 40 inch-pounds torque.

(6) Install fuel shutoff valve onto bracket in accordance with 73-10-06, MAINTENANCE PRACTICES.

(7) Connect fuel shutoff valve plumbing in accordance with 73-10-06, MAINTENANCE PRACTICES.

R X. (Code KA) Install Beta and NTS Pressure Switch Plumbing (See Figure 209)

NOTE: Lightly coat new packings with clean engine oil or lubricant (OS-124) prior to installation unless otherwise specified. Apply clean engine oil to threads (except first two threads) of male plumbing fittings located forward of the compressor housing unless otherwise specified.

(1) Install unions with new packings into switch housing. Tighten unions (100) to 60 to 65 inch-pounds torque.

(2) Install unions with new packings into accessory housing assembly and propeller pitch control. Tighten unions (15) to 60 to 65 inch-pounds torque.

(3) Install check valve with new packing into top of solenoid valve with arrow pointing away from solenoid valve. Tighten check valve (90) with 60 to 65 inch-pounds torque.

(4) Install unions with new packing into solenoid valve. Tighten union (110) to 60 to 65 inch-pounds torque.

(5) Install tee with new packing into propeller pitch control and secure with nut. Tighten nut (60) to 50 to 55 inch-pounds torque.

NOTE: When installing new elbow (65), discard packing furnished with elbow. Install packing (70) with elbow.

(6) Install elbow with new packing into propeller governor. Tighten nut on elbow (65) to 20 to 25 inch-pounds torque.

(7) Install elbow, with new packing into housing and secure with nut. Tighten nut (85) to 50 to 55 inch-pounds torque.

(8) Install tube assemblies between union in input housing assembly and check valve in top of solenoid valve and join with tee.

1. X. (9) Install tube assembly between tee installed in step (7) and tee in propeller pitch control.

(10) Install tube assembly between tee in propeller pitch control and elbow in propeller governor.

(11) Install tube assembly between union in propeller pitch control and union in housing.

(12) Install tube assembly between union in bottom of solenoid valve and union in housing.

2. Adjustment/Test

R A. (Codes CA-CC, HA) Test Beta Pressure Switch

(1) Connect variable oil pressure source to pressure fitting on pressure switch.

(2) Slowly apply pressure to pressure switch until switch closes as evidenced by continuity across pins A and B of electrical connector. Note pressure applied.

(3) Pressure switch shall close within the range of 310 to 320 psig as pressure is increased.

(4) Slowly decrease applied pressure to pressure switch until switch opens as evidenced by no continuity across pins A and B of electrical connector. Note pressure applied.

(5) Pressure switch shall open within 50 psig of closing pressure as noted in step (2).

(6) Replace switch that does not meet Test requirements.

R B. (Codes CA-CC, HA) Test NTS Pressure Switch

(1) Connect variable oil pressure source to pressure fitting on pressure switch.

(2) Slowly apply pressure to pressure switch until switch opens as evidenced by no continuity across pins A and B of electrical connector. Note pressure applied.

(3) Pressure switch shall open with increasing pressure before 120 psig.

(4) Slowly decrease pressure to pressure switch until switch closes as evidenced by continuity across pins A and B of electrical connector. Note pressure applied.

2. B. (5) Pressure switch shall close before 100 psig with decreasing pressure.

(6) Replace switch that does not meet Test requirements.

R C. (Codes AA-AC, CA-CC, FA, KA, LA) Perform Adjustment/Test on Solenoid Valve

(1) Connect electrical source to pins A and B.

(2) Apply 28 volts to solenoid valve and check for proper opening of valve.

(3) Disconnect electrical source and check for valve closing.

3. Inspection/Check

A. Inspect Beta and NTS Switches and Associated Components

(1) Inspect tube assemblies for bends, kinks, cracks, or nicks.

(2) Inspect threaded parts for peened, galled, or stripped threads.

(3) Inspect housing for security, cracks, or obvious damage.

(4) Inspect pressure switch electrical connector for burned, broken, or bent pins.

(5) Inspect solenid valve electrical connector for burned, broken, or bent pins or obvious damage.

(6) Replace part that does not meet Inspection/Check requirements.

4. Cleaning/Painting

A. Clean Parts

(1) Clean all standard metallic hardware in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 1 or 2.

(2) Clean all plumbing and fittings in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 12.

(3) Clean housing in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 1.

(4) Clean pressure switches in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 11.

(5) Clean solenoid valve in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 11.

R TORQUESENSOR TRANSMITTER, TRANSDUCER AND TORQUE INDICATOR - MAINTENANCE PRACTICES

1. Removal/Installation

NOTE: Table 201 provides a list of all materials and compounds required to perform Removal/Installation.

Table 201. Materials and Compounds

NOTE: Equivalent substitutes may be used for listed items.

Alternate packing lubricant Lubricant (OS-124)	Monsanto Company, 800 N Lindbergh Blvd, St. Louis, MO 63166
Any approved engine oil	Commercially available
Lubricating compound (Liqui-Moly, Grade NV)	Lockrey Co, Lubricants Div, Cedar Shores, Southampton, NY 11968

R A. (Codes CA-CC) Remove Torque Sensor Transmitter (See Figure 201)

(1) Disconnect aircraft electrical connector. Refer to Aircraft Maintenance Manual.

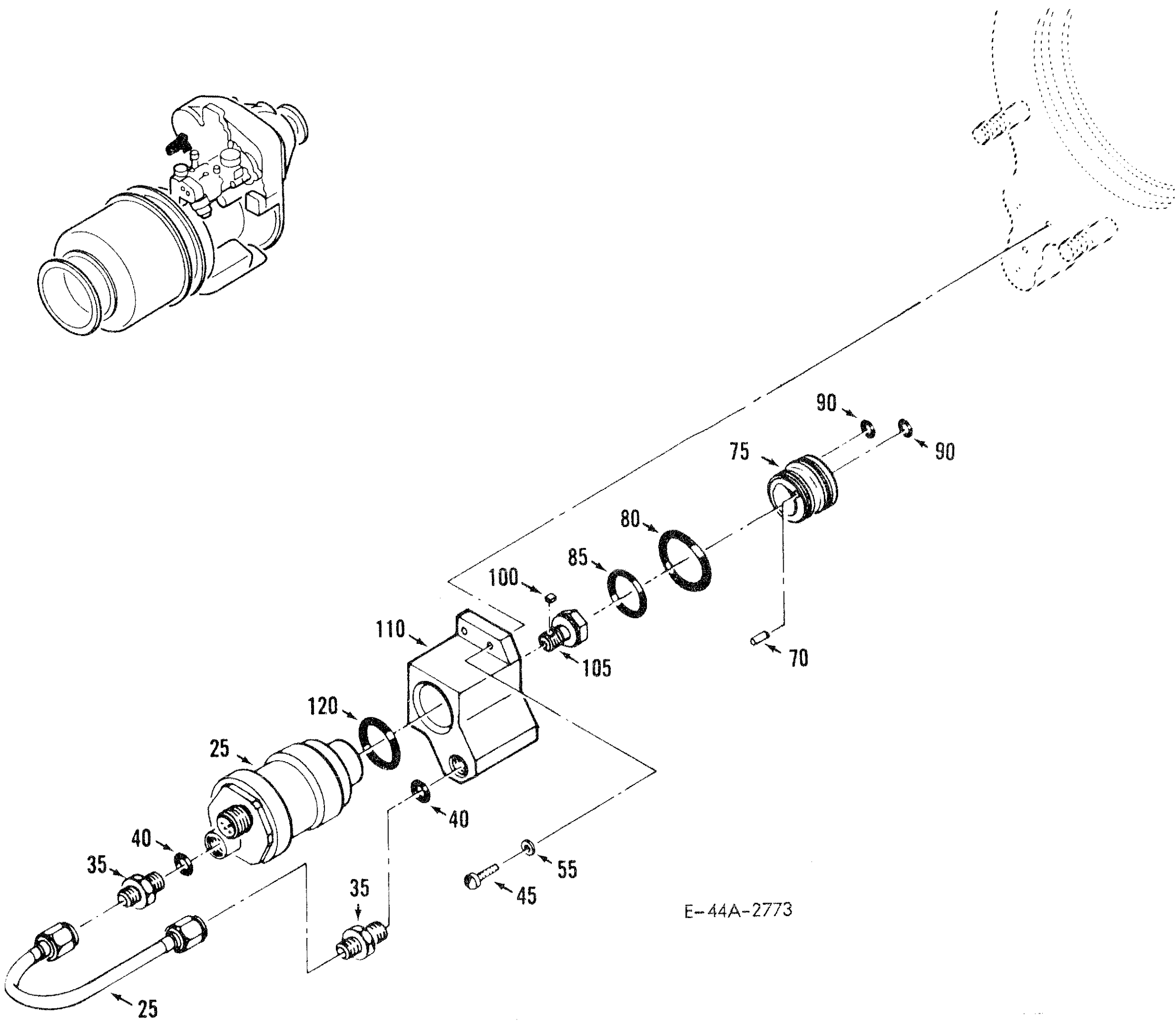
(2) Remove torque sensor transmitter and adapter from input housing assembly.

(3) Remove tube assembly, unions, and packings.

(4) Remove plug, pin, and packings.

(5) Remove bolt and plug.

(6) Remove torque sensor transmitter from adapter.



R 25. TUBE ASSY (IPC FIG. 100)	85. PACKING
35. UNION	90. PACKING
40. PACKING	100. PLUG
45. SCREW	105. BOLT
55. WASHER	110. ADAPTER
70. PIN	120. PACKING
75. PLUG	125. PRESSURE TRANSMITTER
80. PACKING	

R (Codes CA-CC) Torque Sensor Transmitter Installation
Figure 201

R 1. B. (Codes CA-CC) Install Torque Sensor Transmitter (See Figure 201)

NOTE: Lightly coat new packings with clean engine oil or lubricant (OS-124) prior to installation unless otherwise specified. Apply lubricating compound (Liqui-Moly, Grade NV) to threads of bolts or screws and apply clean engine oil to threads (except first two threads) of male plumbing fittings located forward of the compressor housing unless otherwise specified.

(1) Install torque sensor transmitter, with new packing, into adapter and secure with plug and bolt. Tighten bolt (105) to 40 inch-pounds torque.

(2) Install pin and plug, with new packings, into adapter.

(3) Install unions, with new packing, into torque sensor transmitter and adapter. Tighten unions (35) to 40 to 45 inch-pounds torque.

(4) Install tube assembly.

(5) Install torque sensor transmitter and adapter, with new packing, onto input housing assembly and secure with bolts and washers. Tighten bolts (45) to 30 inch-pounds torque.

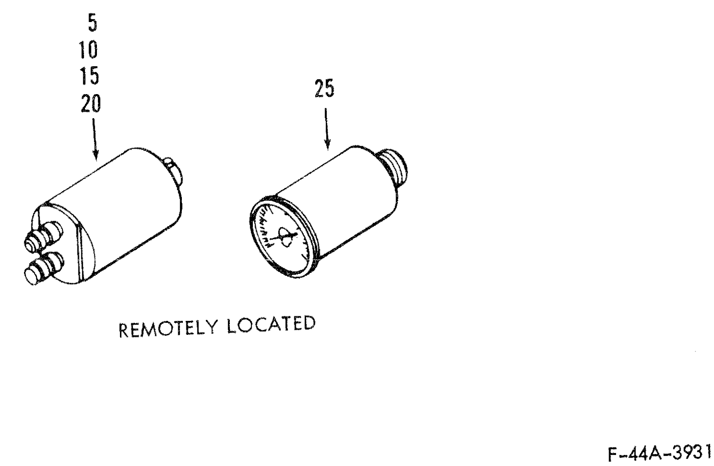
R C. (Codes AA-BC, EA-LA) Remove and Install Torque Transducer (See Figure
R 202)

R (1) Removal/Installation instructions for torque transducer are con-
R tained in Aircraft Maintenance Manual

R D. (Codes AA-AC, FA, LA) Remove and Install Torque Indicator (See Figure
R 202)

R (1) Removal/Installation instructions for torque indicator are con-
R tained in Aircraft Maintenance Manual.

R



R 5. TORQUE TRANSDUCER
R (IPC FIG. 97)
R 10. TORQUE TRANSDUCER
15. TORQUE TRANSDUCER
20. TORQUE TRANSDUCER
25. TORQUE INDICATOR

R (Codes AA-BC, EA-LA) Torque Pressure Transducer and
Torque Indicator Installation
Figure 202

R 2. (Codes AA-BC, EA-LA) Adjustment/Test

NOTE: Procedures in this section require special equipment and procedures. Prior to performing these procedures determine that trouble has been isolated to these components. Refer to 72-00-00, TROUBLE SHOOTING and ADJUSTMENT/TEST.

Table 202 provides a list of all equipment and materials required to perform Adjustment/Test.

Table 202. Equipment and Materials

Equipment or Material	Description
NOTE: Equivalent substitutes may be used for listed items.	
Air or oil pressure source	Adjustable from 0 to 100 psig
DC power source	Adjustable 0 to 28 volts dc
Digital voltmeter	Capable of range from -1 to +10 volts dc with accuracy of +0.005/-0.005 volts
Multimeter	Capable of indicating continuity and 0 to 300 ohms resistance with accuracy of +2/-2 percent
Pressure gage	Capable of pressure reading from 0 to 100 psig with +0.1/-0.2 percent accuracy
Pressure regulator	Capable of regulating air or oil pressure from 0 to 100 psig

A. Connect Test Setup for Torque Transducer (See Figure 203)

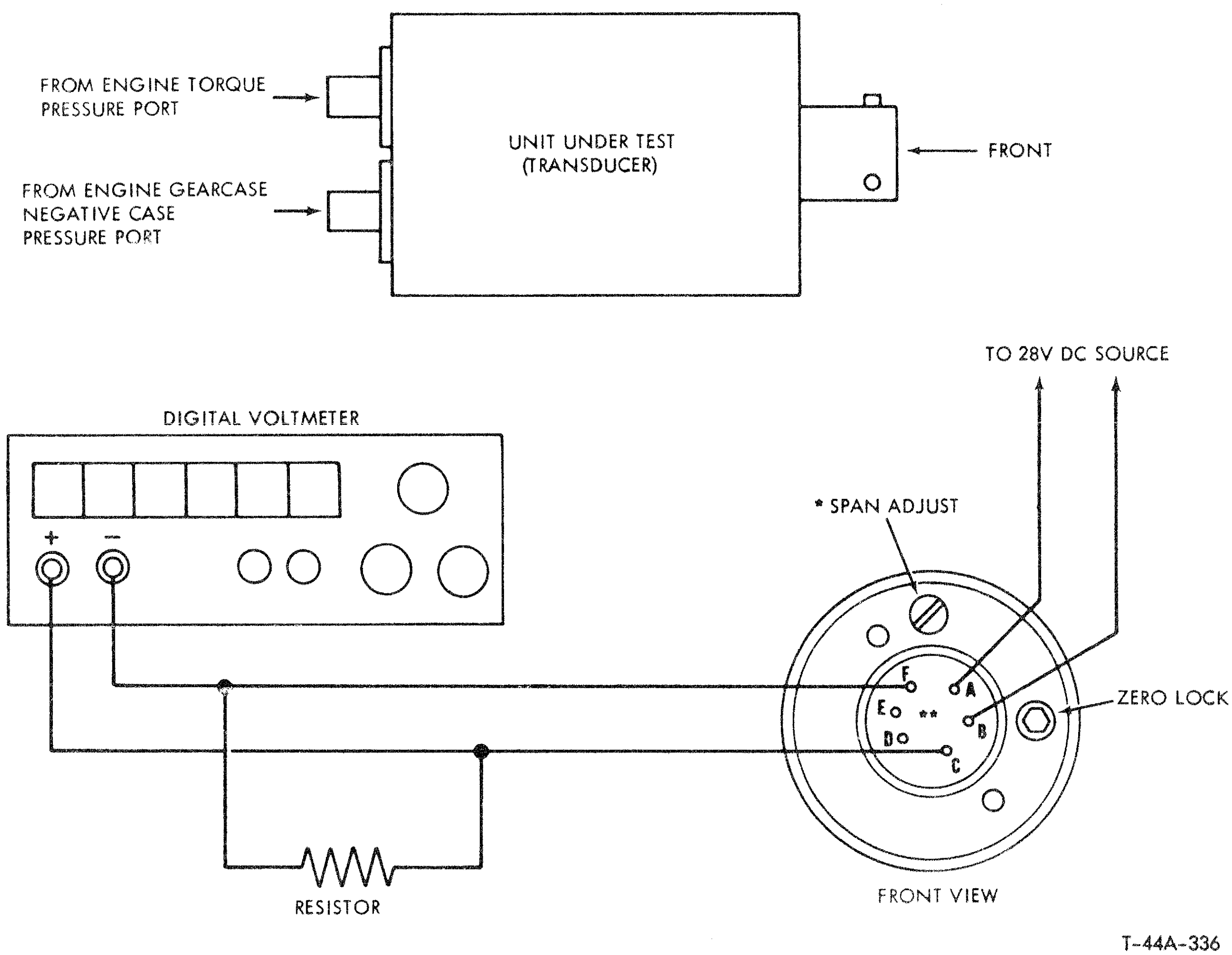
(1) Assemble equipment required for test setup (see table 202).

CAUTION: ENSURE AIR OR OIL PRESSURE SOURCE IS CONNECTED TO HIGH PRESSURE PORT OF TRANSDUCER AND NOT TO LOW PRESSURE PORT.

(2) Connect adjustable air or oil pressure source to high pressure port of transducer. Vent low pressure port to ambient.

NOTES:
*CAUTION; THE SPAN-ADJUST CAP SHALL BE INSTALLED FINGER TIGHT. DO NOT OVER TIGHTEN.

**TERMINALS D AND C ARE COMMON AND TERMINALS E AND F ARE COMMON.



R NOTE: (Codes AA-AC, FA, KA, LA) Use 4.20K +0.2/-0.2 Ohm resistor.
R (Codes BA-BC, EA, GA, HA) Use 3.96K +0.2/-0.2 Ohm resistor.

R (Codes AA-BC, EA-LA) Test Setup for Torque Transducer Calibration
Figure 203

2. A. (3) Connect power supply and digital voltmeter. Do not turn power supply on at this time.

R (4) (Codes AA-AC, FA, KA, LA) Connect the 4.20K resistor.

R (5) (Codes BA-BC, EA, GA, HA) Connect the 3.96K resistor.

B. Perform Continuity Check for Torque Transducer

(1) Set the multimeter on the RX 1 ohm scale and check for shorts between all terminals of the transducer and the transducer case. There shall be no observable deflection.

(2) Check for continuity between terminals D and C and between terminals E and F. Continuity shall be indicated.

C. Calibrate Torque Transducer

CAUTION: DO NOT ADJUST TORQUE TRANSDUCER FOR LOW TORQUE READINGS UNLESS FAULTY TRANSDUCER CALIBRATION HAS BEEN DETERMINED.

(1) Torque sensor oil pressure will vary from engine to engine, making it necessary to use the torque sensor transducer calibration differential pressure data furnished for the individual engine in the Customer Data Sheet (see tables 203 through 208). If a torque data sheet is not available, plot a line through the two plotted points of differential pressure versus inch pounds torque furnished with the engine data sheet customer (DSC) and determine pressure requirements for five intermediate points of inch-pounds torque required for voltage readings in Table 203 through 208.

(2) Turn on power source and allow a five minute warmup for power source and digital voltmeter.

R (3) (Codes AA-AC, FA, LA) Test and adjust torque transducer as follows. (See table 203.)

(a) Apply a regulated air or oil pressure to the transducer equal to the differential pressure for 27,700 inch-pounds torque/700 shaft horsepower.

(b) Using an Allen wrench, loosen the zero adjust lockscrew on the right face of the transducer. Insert a spanner wrench in the two holes in the face and rotate the inner body of the transducer relative to the case until digital voltmeter indicates 0 +0.03/-0.03 volts. Tighen the Allen head locking screw to 10 to 15 inch-pounds torque while holding the inner body of the transducer with the spanner wrench.

2. C. (3) (c) Reduce the regulated air or oil pressure to that corresponding to 2,300 inch-pounds torque/58 shaft horsepower.

(d) Adjust the span adjust on the transducer to obtain a reading of 3.851 +0.03/-0.03 volts on the digital voltmeter.

(e) Check five other pressure and voltage settings. The five other points shall be linear within +0.08/-0.08 volts of given values.

CAUTION: THE SPAN-ADJUST DUST CAP SHALL BE INSTALLED FINGER TIGHT. DO NOT OVER TIGHTEN

(f) Install the span adjust dust cap and tighten finger tight. Lockwire the cap to the zero adjustment. Recheck the transducer setting after lockwire.

R Table 203. (Codes AA-AC, FA, LA) Torque Transducer Calibration Data

CAUTION: FOR USE WITH 1590 RPM ENGINES ONLY.

Transducer Calibration Differential Pressure PSI	Torque IN.-LB	SHP*	Volts - DC +0.08/-0.80
(Obtain differential pressure from Customer Data Sheet for individual engine)	0.0	0.0	4.200
	2,300	58.0	3.851**
	8,000	202.0	2.990
	13,000	328.0	2.230
	18,000	455.0	1.470
	23,000	581.00	0.710
	27,700	700.0	0.00**
	30,800	778.0	-0.470

*At 1590 propeller shaft rpm.
**Voltage tolerance at these points only: +0.03/-0.03 vdc.

R Table 204. (Codes BA-BC, EA, GA) (665 SHP Engine)
Torque Transducer Calibration Data

CAUTION: FOR USE WITH 2000 RPM ENGINES ONLY.

Transducer Calibration Differential Pressure PSI	Torque IN.-LB	% HP*	Volts - DC +0.80/-0.80
(Obtain differential pressure from Customer Data Sheet for individual engine)	0.0	0.0	3.960
	1,800	8.5	3.620**
	6,000	28.5	2.830
	11,000	52.0	1.894
	16,000	76.0	0.940
	19,000	90.5	0.375
	21,000	100.0	0.00**
	22,500	107.0	-0.275
	25,000	119.0	-0.740

*At 2,000 propeller shaft rpm.
**Voltage tolerance for these points only: +0.03/-0.03 vdc.

R 2. C. (4) (Codes BA-BC, EA, GA) (665 SHP Engine) Test and adjust torque transducer as follows (see table 204).

(a) Apply a regulated air or oil pressure to the transducer equal to the differential pressure for 21,000 inch-pounds torque/100 percent torque.

(b) Using an Allen wrench, loosen the zero adjust lockscrew on the right face of the transducer. Insert a spanner wrench in the two holes in the face of the transducer and rotate the inner body of the transducer relative to the case until digital voltmeter indicates 0 +0.03/-0.03 volts. Tighten the Allen head locking screw to 10 to 15 inch-pounds torque while holding the inner body of the transducer with the spanner wrench.

2. C. (4) (c) Reduce the regulated air or oil pressure to that corresponding to 1,800 inch-pounds torque/8.5 percent torque.

(d) Adjust the span adjust on the transducer to obtain a reading of 3.620 +0.03/-0.03 volts on the digital voltmeter.

(e) Check five other pressure and voltage settings. The five other points shall be linear within +0.08/-0.08 volts of given values.

CAUTION: THE SPAN-ADJUST DUST CAP SHALL BE INSTALLED FINGER TIGHT. DO NOT OVER TIGHTEN.

(f) Install the span adjust dust cap and tighten finger tight. Lockwire the cap to the zero adjustment. Recheck the transducer setting after lockwire.

R (5) (Codes BA-BC, EA, GA) (715 SHP Engine) Test and adjust torque transducer as follows (see table 205).

(a) Apply a regulated air or oil pressure to the transducer equal to the differential pressure for 22,500 inch-pounds torque/100 percent torque.

(b) Using an Allen wrench, loosen the zero adjust lockscrew on the right face of the transducer. Insert a spanner wrench in the two holes in the face of the transducer and rotate the inner body of the transducer relative to the case until digital voltmeter indicates 0 +0.03/-0.03 volts. Tighten the Allen head locking screw to 10 to 15 inch-pounds torque while holding the inner body of the transducer with the spanner wrench.

(c) Reduce the regulated air or oil pressure to that corresponding to 1,900 inch-pounds torque/8.5 percent torque.

(d) Adjust the span adjust on the transducer to obtain a reading of 3.620 +0.03/-0.03 volts on the digital voltmeter.

(e) Check five other pressure and voltage settings. The five other points shall be linear within +0.08/-0.08 volts of given values.

CAUTION: THE SPAN-ADJUST DUST CAP SHALL BE INSTALLED FINGER TIGHT. DO NOT OVER TIGHTEN.

(f) Install the span adjust dust cap and tighten finger tight. Lockwire the cap to the zero adjustment. Recheck the transducer setting after lockwire.

R Table 205. (Codes BA-BC, EA, GA) (715 SHP Engine)
Torque Transducer Calibration Data

CAUTION: FOR USE WITH 2000 RPM ENGINES ONLY.

Transducer Calibration Differential Pressure PSI	Torque IN.-LB	% HP*	Volts - DC +0.08/-0.08
(Obtain differential pressure from Customer Data Sheet for individual engine)	0.0	0.0	3.960
	1,900	8.5	3.620**
	6,400	28.5	2.830
	11,700	52.0	1.900
	17,100	76.0	0.950
	20,400	90.5	0.376
	22,500	100.0	0.00**
	26,800	119.0	-0.791

*At 2,000 propeller shaft rpm.
**Voltage tolerance for these points only +0.03/-0.03 vdc.

R 2. C. (6) (Code HA) Test and adjust torque transducer as follows (see table 206).

(a) Apply a regulated air or oil pressure to the transducer equal to the differential pressure for 22,500 inch-pounds torque/1,875 foot-pounds torque.

(b) Using an Allen wrench, loosen the zero adjust lockscrew on the right face of the transducer. Insert a spanner wrench in the two holes in the face and rotate the inner body of the transducer relative to the case until digital voltmeter indicates 0 +0.03/-0.03 volts. Tighten the Allen head locking screw to 10 to 15 inch-pounds torque while holding the inner body of the transducer with the spacer wrench.

(c) Reduce the regulated air or oil pressure to that corresponding to 1,800 inch-pounds torque/150 foot-pounds torque.

2. C. (6) (d) Adjust the span adjust on the transducer to obtain a reading of 3.643 +0.03/-0.03 volts on the digital voltmeter.

(e) Check five other pressure and voltage settings. The five other points shall be linear within +0.08/-0.08 volts of given values.

CAUTION: THE SPAN-ADJUST DUST CAP SHALL BE INSTALLED FINGER TIGHT. DO NOT OVER TIGHTEN.

(f) Install the span adjust dust cap and tighten finger tight. Lockwire the cap to the zero adjustment. Recheck the transducer setting after lockwire.

R Table 206. (Code HA) Torque Transducer Calibration Data

CAUTION: FOR USE WITH 2000 RPM ENGINE ONLY.

Transducer Calibration Differential Pressure PSI	Torque IN.-LB	FT-LB.	Volts - DC +0.08/-0.08
(Obtain differential pressure from Customer Data Sheet for individual engine)	0.0	0.0	3.960
	1,800	150.0	3.643**
	6,000	498.8	2.904
	11,000	916.9	2.024
	16,000	1333.1	1.144
	19,000	1584.4	0.616
	22,500	1875.0	0.00**
	25,000	2081.3	-0.440

*At 2,000 propeller shaft rpm.
**Voltage tolerance for these points only +0.03/-0.03 vdc.

R 2. C. (7) (Code KA) (665 SHP Engine) Test and adjust torque transducer as follows (see table 207.)

(a) Apply a regulated air or oil pressure to the transducer equal to the differential pressure for 26,300 inch-pounds torque/100 percent torque.

(b) Using an Allen wrench, loosen the zero adjust lockscrew on the right face of the transducer. Insert a spanner wrench in the two holes in the face and rotate the inner body of the transducer relative to the case until digital voltmeter indicates 0 +0.03/-0.03 volts. Tighten the Allen head locking screw to 10 to 15 inch-pounds torque while holding the inner body of the transducer with the spanner wrench.

(c) Reduce the regulated air or oil pressure to that corresponding to 2,260 inch-pounds torque/8.6 percent torque.

(d) Adjust the span adjust on the transducer to obtain a reading of 3.610 +0.03/-0.03 volts on the digital voltmeter.

(e) Check five other pressure and voltage settings. The five other points shall be linear within +0.08/-0.08 volts of given values.

CAUTION: THE SPAN-ADJUST DUST CAP SHALL BE INSTALLED FINGER TIGHT. DO NOT OVER TIGHTEN.

(f) Install the span adjust dust cap and tighten finger tight. Lockwire the cap to the zero adjustment. Recheck the transducer setting after lockwire.

R Table 207. (Code KA) (665 SHP Engine)
Torque Transducer Calibration Data

CAUTION: FOR USE WITH 1590 RPM ENGINES ONLY.

Transducer Calibration Differential Pressure PSI	Torque IN.-LB	% HP*	Volts - DC +0.08/-0.08
(Obtain differential pressure from Customer Data Sheet for individual engine)	0.0	0.0	4.200
	2,260	8.6	3.610**
	8,000	30.4	2.750
	13,000	49.5	1.975
	18,000	68.5	1.225
	23,000	87.5	0.475
	26,300	100.0	0.00**
	28,300	107.5	-0.350
	30,000	114.0	-0.620

*At 1590 propeller shaft rpm.
**Voltage tolerance for these points only: +0.03/-0.03 vdc.

R 2. C. (8) (Code KA) (715 SHP Engine) Test and adjust torque transducer as follows (see table 208).

(a) Apply a regulated air or oil pressure to the transducer equal to the differential pressure for 28,300 inch-pounds torque/100 percent torque.

(b) Using an Allen wrench, loosen the zero adjust lockscrew on the right face of the transducer. Insert a spanner wrench in the two holes in the face of the transducer and rotate the inner two holes in the face of the transducer and rotate the inner body of the transducer relative to the case until digital voltmeter indicates 0 +0.03/-0.03 volts. Tighten the Allen head locking screw to 10 to 15 inch-pounds torque while holding the inner body of the transducer with the spanner wrench.

2. C. (8) (c) Reduce the regulated air or oil pressure to that corresponding to 2,260 inch-pounds torque/8.0 percent torque.

(d) Adjust the span adjust on the transducer to obtain a reading of 4,200 +0.03/-0.03 volts on the digital voltmeter.

(e) Check five other pressure and voltage settings. The five other points shall be linear within +0.08/-0.08 volts of given values.

CAUTION: THE SPAN-ADJUST DUST CAP SHALL BE INSTALLED FINGER TIGHT. DO NOT OVER TIGHTEN.

(f) Install the span adjust dust cap and tighten finger tight. Lockwire the cap to the zero adjustment. Recheck the transducer setting after lockwire.

R Table 208. (Code KA) (715 SHP Engine)
Torque Transducer Calibration Data

CAUTION: FOR USE WITH 1590 RPM ENGINES ONLY.

Transducer Calibration Differential Pressure PSI	Torque IN.-LB	% HP*	Volts - DC +0.08/-0.08
(Obtain differential pressure from Customer Data Sheet for individual engine)	0.0	0.0	4.200
	2,430	8.6	3.610**
	8,600	30.4	2.750
	14,010	49.5	1.975
	19,385	68.5	1.225
	24,760	87.5	0.475
	28,300	100.0	0.00**
	32,260	114.0	-0.620

*At 1.590 propeller shaft rpm.
**Voltage tolerance for these points only +0.03/-0.03 vdc.

R 2. D. (Codes AA-AC, FA, LA) Test and Calibrate Torque Indicator

(1) Perform continuity check of torque indicator.

(a) Set the multimeter on the RX 100 ohm scale. Check for shorts between all pins and the case. There shall be no observable deflection.

(b) Check for continuity between pins A and B. The multimeter shall read approximately 4200 ohms.

(2) Connect torque indicator in test setup with power source connected to torque indicator with pin A normally positive and pin B normally negative. Connect digitial voltmeter across pins A and B to provide precision voltage input.

(3) Calibrate torque indicator (see table 209).

(a) With indicator in normal mounting position, check zero input setting of the needle for a reading of 700 horsepower. If necessary, set the adjustment on the front face of the indicator.

(b) Turn on the power source and allow five minute warmup of power source, digital voltmeter and indicator.

(c) Set the dc power input to required test voltage. Horsepower readings on the torque indicator shall be as specified.

(d) If readings are not as specified, adjust torque indicator as follows.

1 Remove cover screw on back on indicator.

2 Ensure indicator reading is 700 horsepower with zero input voltage.

3 Apply 4.2 volts input to pin A (+) and pin B (-).

4 Adjust the calibration screw until the indicator reads zero horsepower.

5 Remove the input voltage and reset the indicator needle to 700 horsepower with the adjustment on the front of the indicator.

6 Repeat procedure 3 through 5 between zero and 4.2 volts input until the readings are repeatable with no further adjustment of either the calibration screw on the back of indicator or the zero voltage adjustment on the front of indicator. Disconnect power power source and voltmeter.

Table 209. (Codes AA-AC, FA, LA) Torque Indicator Calibration

Input Voltage	Torque Indicator Reading (HP)
4.2	0 +21/-21
2.1	350 +7/-7
1.2	500 +7/-7
0.0	700 +7/-7
0.0630 (pin B positive and pin A negative)	800 +21/-21

R 2. E. (Codes BA-BC, EA, GA-KA) Test and Calibrate Torque Indicator

(1) Test and calibrate torque indicator in accordance with Aircraft Maintenance Manual.

2. Inspection/Check

A. Perform Inspection/Check

(1) Inspect components for security or oil leakage.

(2) Inspect threaded parts for galled, peened, or stripped threads.

(3) Inspect electrical connector for bent, broken, or burned pins.

(4) Replace part that does not meet Inspection/Check requirements.

3. Cleaning/Painting

A. Clean Parts

(1) Clean all standard metallic hardware in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 1 or 2.

(2) Clean Plumbing and fittings in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 12.

(3) Clean electrical components in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 11.

TORQUE PRESSURE ADAPTER - MAINTENANCE PRACTICES

1. Removal/Installation

NOTE: Table 201 provides a list of all materials and compounds required to perform Removal/Installation.

Table 201. Materials and Compounds

Materials or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Any approved engine oil	Commercially available
Alternate lubricant Lubricant (OS-124)	Monsanto Company, 800 N Lindbergh Blvd, St. Louis, MO 63166
Lubricating compound (Liqui-Moly, Grade NV)	Lockrey Co, Lubricants Div, Cedar Shores, Southampton, NY 11968

R A. (Codes AA-BC, EA-GA, KA-LA) Remove Torque Pressure Adapter (See Figure 201)

(1) Remove caps.

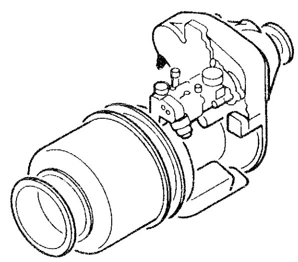
(2) Remove torque sensor adapter from input housing assembly and remove packings.

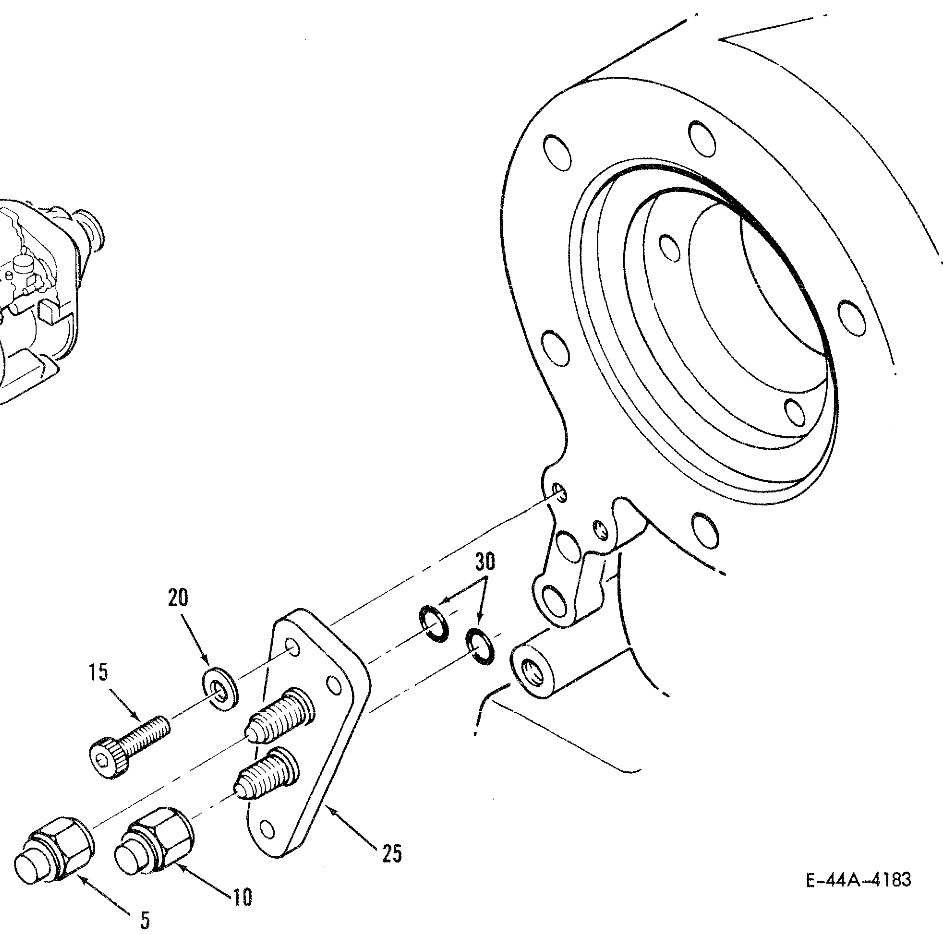
R B. (Codes AA-BC, EA-GA, KA-LA) Install Torque Pressure Adapter (See Figure 201)

NOTE: Lightly coat new packings with clean engine oil or lubricant (OS-124) prior to installation. Apply lubricating compound (Liqui-Moly, Grade NV) to threads of screws, and apply clean engine oil to threads (except first two threads) of male plumbing fittings.

(1) Install torque sensor adapter, with new packings, onto input housing assembly and secure with washers and screws. Tighten screws (15) to 30 inch-pounds torque.

R





R 5. CAP (IPC FIG. 99)
R 10. CAP
R 15. SCREW
20. WASHER
25. TORQUE PRESSURE ADAPTER
30. PACKING

(Codes AA-BC, EA-GA, KA-LA) Torque Pressure
Adapter Installation
Figure 201

1. B. (2) Install caps onto torque sensor adapter. Tighten cap (5) to 125 to 140 inch-pounds torque and lockwire. Tighten cap (10) to 135 to 150 inch-pounds torque and lockwire.

2. Inspection/Check

R A. Inspect Torque Sensor Adapter

(1) Inspect torque sensor adapter for security, evidence of oil leakage and cracks.

(2) Inspect threaded parts for galled, peened, or stripped threads.

(3) Replace part that does not meet Inspection/Check requirements.

3. Cleaning/Painting

Clean all parts in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 1 or 2.

TEMPERATURE (ENGINE INDICATING) - DESCRIPTION AND OPERATION

1. Engine Temperature Indicating

R (Pre SB72-0042, Multi-Piece ITT) The interstage turbine temperature (ITT) system thermocouples are located at the second stage stator inlet position. The thermocouples are ungrounded, enclosed, junction type and are connected in parallel by 1/8 inch chromel and alumel bus bars. Construction of the system is such that each temperature probe may be individually replaced. Internal leadwires attach to the bus bars and route the temperature signal to the plenum assembly connector located at the rear of the engine. An external harness assembly connects to the plenum assembly connector and routes the signal to the control assembly (compensating resistor). The ITT control assembly (compensating resistor) is mounted on the left side of the engine and is connected to the external thermocouple harness assembly. A specific dash number or setting number control assembly (compensating resistor) is installed at time of engine manufacture or overhaul to compensate for any deviation of performance above the specific minimum and to establish a maximum turbine temperature value at rated torque.

R (Post SB72-0042, Single-Piece ITT) The interstage turbine temperature (ITT) sensor is a one piece assembly consisting of twelve shielded probes located at the second stage stator inlet position with a continous lead which extends through the turbine plenum and connects to the control assembly (compensating resistor). The ITT control assembly (compensating resistor) is mounted on the left side of the engine. A specific dash number or setting number control assembly (compensating resistor) is installed at engine manufacture or overhaul to compensate for deviations of performance above the specific minimum and to establish a maximum turbine temperature value at rated torque.

THERMOCOUPLE HARNESS AND COMPENSATING RESISTOR ASSEMBLIES - MAINTENANCE PRACTICES

1. Removal/Installation

NOTE: Table 201 provides a list of all materials and compounds required to perform Removal/Installation.

Table 201. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
High temperature compound (Fel-Pro C5-A)	Fel-Pro Inc, Div of Felt Products Mfg Co, 7450 N McCormick Blvd, Skokie, IL 60076
Powder (SermeTel PBX)	Teleflex Corp, SermeTel Div, P.O. Box 218, N Wales, PA 19454
Solvent (SermeTel P)	Teleflex Corp, SermeTel Div, P.O. Box 218, N Wales, PA 19454
Syringe (Chemo-Jector)	G.C. Electronics Div of Hydra-Metals Inc, 400 S Wyman St, Rockford, IL 61101

R A. (Code AA, Pre SB72-0042) Remove Compensating Resistor and Thermocouple Harness (See Figures 201, 202)

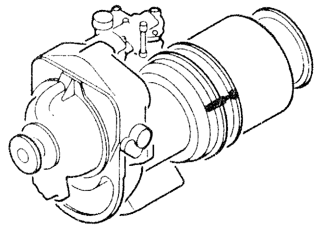
CAUTION: COMPENSATING RESISTOR IS SECURED TO ENGINE WITH SAME SCREWS SECURING END PLATE ON RESISTOR ASSEMBLY BODY. USE CARE WHEN HANDLING WITH SCREWS REMOVED, AS INTERNAL DAMAGE MAY RESULT.

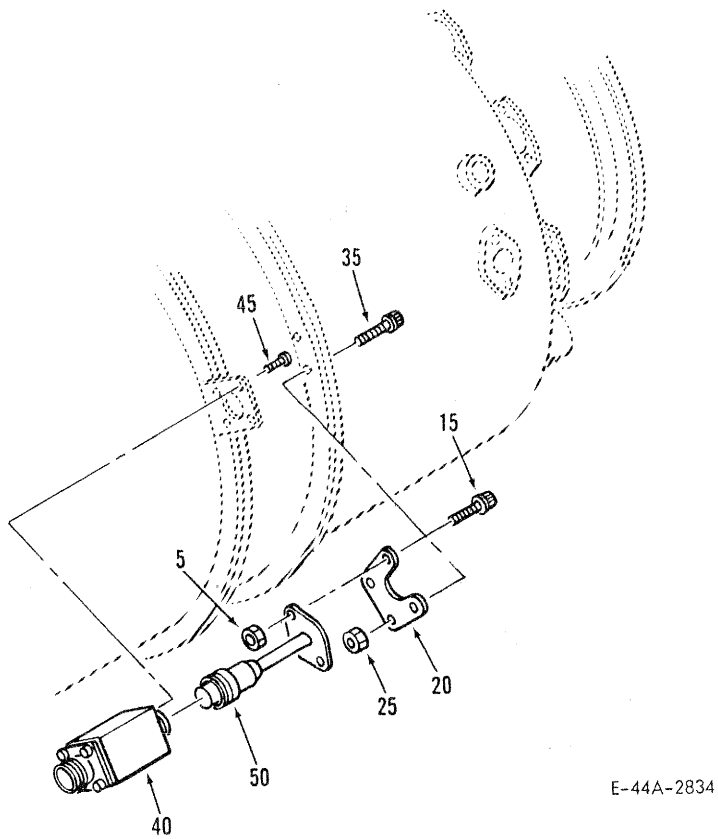
(1) Disconnect harness and remove compensating resistor.

NOTE: (Post SB77-0001) Do not disconnect external harness at plenum assembly connector unless damage is indicated by inspection.

(2) Disconnect external harness at plenum assembly connector. (See figure 202.)

(3) Remove bracket (figure 201) and attaching hardware. (See figure 202.)

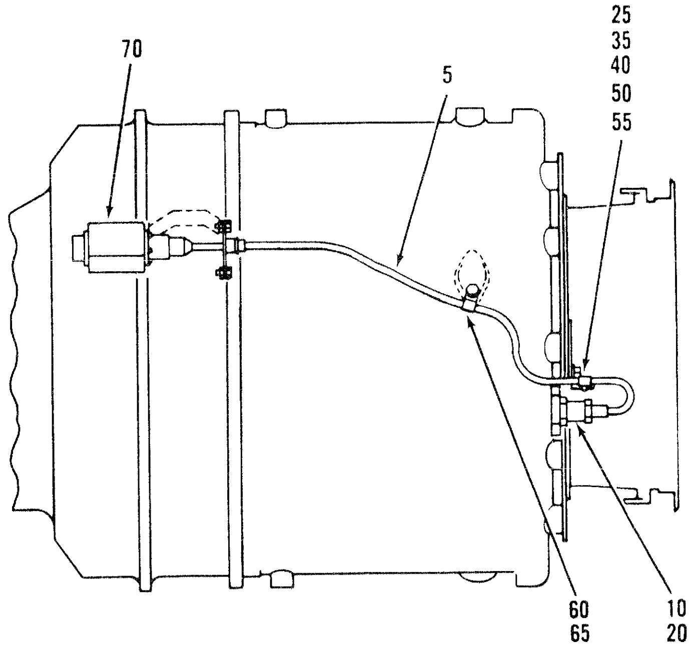




R 5. NUT (IPC FIG. 107)
15. BOLT
20. BRACKET
25. NUT
35. BOLT
40. COMPENSATING RESISTOR
45. SCREW
50. THERMOCOUPLE HARNESS

(Code AA, Pre SB72-0042) Compensating Resistor
Control Assembly Installation
Figure 201

R



R 5.	THERMOCOUPLE HARNESS	50.	BRACKET
R	(IPC FIG. 106)	55.	BOLT
R 10.	ADAPTER	60.	BOLT
R 25.	NUT	65.	CLAMP
R 35.	BOLT	70.	COMPENSATING RESISTOR
R 40.	CLAMP		

(Code AA, Pre SB72-0042) Multi-Piece Thermocouple
Harness Installation
Figure 202

R 1. B. (Code AA, Pre SB72-0042) Install Compensating Resistor and Thermocouple Harness (See Figure 201, 202)

NOTE: Apply high temperature compound (Fel-Pro C5-A) to threads of bolts or screws located aft of the fireshield unless otherwise specified.

(1) Install control assembly (compensating resistor) and secure with screws. Tighten screws (45, figure 201) to 7 inch-pounds torque.

(2) (Without SB77-0001) Connect external thermocouple harness to plenum assembly connector. Tighten adapter connector (10, figure 202) to 400 to 500 inch-pounds torque.

(3) (With SB77-0001) Connect external thermocouple harness to plenum assembly connector.

(a) Use a magnet to determine which of two leads on harness assembly is magnetic. (Socket "A" will exhibit slight magnetism.) Connect magnetic socket to pin "A" and nonmagnetic socket to pin "B".

(b) Prepare potting compound as follows.

1 Mix 16 grams of powder (SermeTel PBX) with five cubic centimeters of solvent (SermeTel P).

CAUTION: MIX POTTING COMPOUND IN CLEAN PAPER CUP WITH CLEAN STIR STICK.

2 Stir the mixture until a uniform, thick, creamy liquid is obtained (add powder or solvent as required to produce desired consistency).

3 Allow the mixture to react for 30 to 60 minutes prior to application.

(c) Slide nut and adapter back on harness to provide clearance and working space, then using syringe (Chemo-Jector) inject as much potting compound as possible into plenum connector. Quickly slide adapter into place with hole located on top and screw nut onto connector. Tighten adapter (10) nut to 400 to 500 inch-pounds torque. Inject remainder of potting compound through hole in adapter until compound flows out of hole in plenum connector. Wipe off excess compound.

(d) Connect forward end of harness to resistor.

NOTE: In order to ensure proper cure, step (e) must be complied with prior to step (f).

1\. B. (3) (e) Allow potting compound to cure at room temperature 21C (70F minimum) without disturbing for one hour, then cure with heat lamp at approximately 93C (200F) for four hours.

(f) Final cure by running engine at gound idle for period of 15 minutes.

(g) After cure disconnect forward end of harness from resistor, then check resistance between each socket and ground. Resistance shall be greater than 75,000 ohms. Reconnect harness to resistor.

(h) Check resistance between pins A and B. Resistance shall be 0.25 to 1.25 ohms.

(4) Install bracket onto plenum assembly and secure with bolt and nut. Tighten bolt (55, figure 202) to 70 inch-pounds torque.

(5) Install clamp and secure with bolt. Tighten bolt (60) to 20 inch-pounds torque.

(6) Install bracket onto engine and secure with bolts and nuts. Tighten nut (25, figure 201) to 50 inch-pounds torque.

(7) Secure harness to bracket with bolts and nuts. Tighten nut (5) to 20 inch-pounds torque.

R C. (Codes AA-AC, FA, LA, Post SB72-0042) Disconnect Thermocouple Harness Assembly (See Figure 203)

(1) Disconnect thermocouple harness from compensating resistor.

CAUTION: COMPENSATING RESISTOR IS SECURED TO BRACKET WITH SAME SCREWS SECURING END PLATE ONTO COMPENSATING RESISTOR BODY. USE CARE WHEN HANDLING COMPENSATING RESISTOR WITH SCREWS REMOVED AS INTERNAL DAMAGE MAY RESULT.

(2) Remove attaching parts.

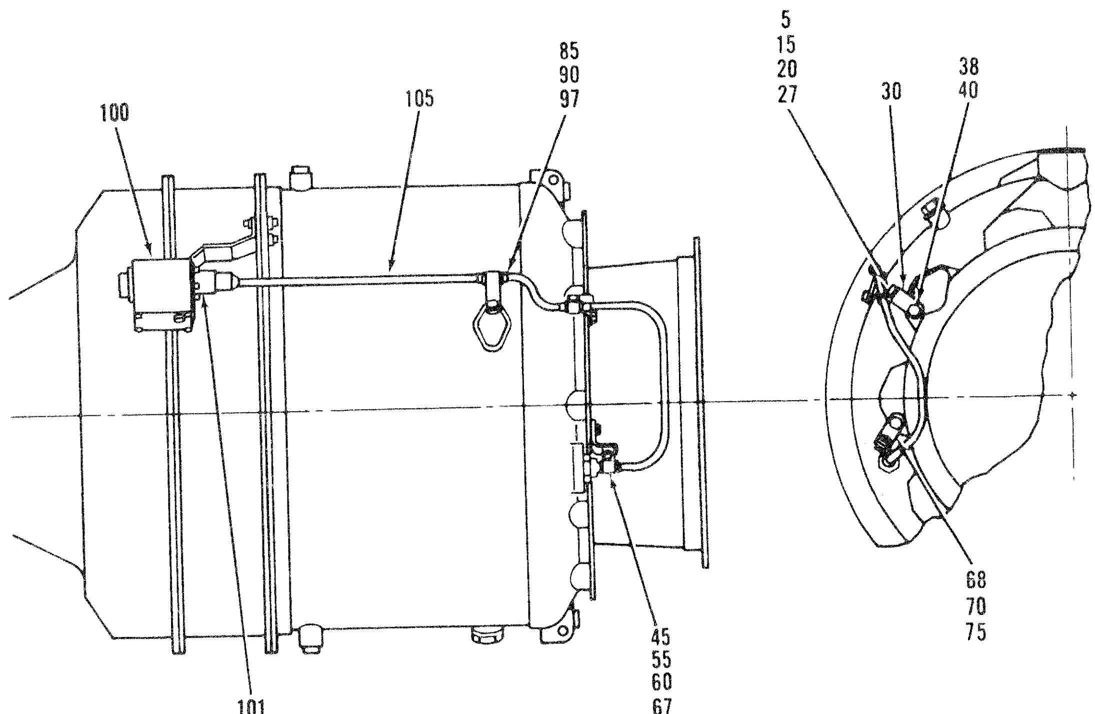
(3) Remove compensating resistor.

R CAUTION: ALL BENDS IN THERMOCOUPLE HARNESS LEAD SHALL BE FORMED TO A MINIMUM RADIUS OF 0.500 INCH. ALLOW A STRAIGHT SECTION OF THERMOCOUPLE HARNESS LEAD FOR A MINIMUM OF 0.125 INCH WHERE LEAD EXITS PLENUM CONNECTOR BEFORE BEGINNING THE FIRST BEND.

R NOTE: Refer to 70-00-00, STANDARD PRACTICES, for recommended general torque values. Add fractional drag (run-down) torque of self locking devices to recommended values.

R 1. D. (Codes AA-AC, FA, LA, Post SB72-0042) Connect Thermocouple Harness Assembly (See Figure 203)

R



R 5.	NUT (IPC FIG. 109)	67.	TAPE
15.	BOLT	68.	NUT
20.	CLAMP	70.	BOLT
27.	TAPE	75.	BRACKET
30.	BRACKET	85.	BOLT
38.	NUT	90.	CLAMP
40.	BOLT	97.	TAPE
45.	NUT	100.	COMPENSATING RESISTOR
55.	BOLT	101.	SCREW
60.	CLAMP	105.	ITT SENSOR ASSY

R (Codes AA-AC, FA, LA, Post SB72-0042) Compensating Resistor and Thermocouple Harness Installation
Figure 203

NOTE: Apply high temperature compound (Fel-Pro C5-A) to threads of bolts or screws located aft of the fireshield unless otherwise specified.

1. D. (1) Install brackets onto plenum assembly and secure with bolts and nuts. Tighten bolts (40, 70) to 70 inch-pounds torque.

(2) Install compensating resistor. Tighten screws (101) to 7 inch-pounds torque.

R (3) (Pre SB77-0007/SPB-TPE0119) Wrap thermocouple harness with glass cloth tape to fill clearance between attaching hardware and thermocouple harness. Tape shall extend from ends of clamps a minimum of 0.12 inch.

(4) Install clamps, bolts, and nuts. Tighten bolt (85) to 20 inch-pounds torque. Tighten nuts (5, 45) to 20 inch-pounds torque.

(5) Connect thermocouple harness to compensating resistor and lockwire.

R E. (Codes BA-BB, CA-CB, EA, Pre SB72-0042) Remove Thermocouple Harness Compensating Resistor (See Figure 204)

CAUTION: COMPENSATING RESISTOR IS SECURED TO BRACKET WITH SAME SCREWS SECURING END PLATE ONTO COMPENSATING RESISTOR BODY. USE CARE WHEN HANDLING COMPENSATING RESISTOR WITH SCREWS REMOVED AS INTERNAL DAMAGE MAY RESULT.

Note: Do not disassemble thermocouple harness assembly. If thermocouple harness assembly does not meet Inspection/Check requirements, the assembly shall be replaced.

(1) Disconnect thermocouple harness from compensating resistor and remove compensating resistor.

(2) Remove attaching parts.

NOTE: (Post SB77-0001) Do not disconnect thermocouple harness at plenum assembly connector unless damage is indicated by inspection.

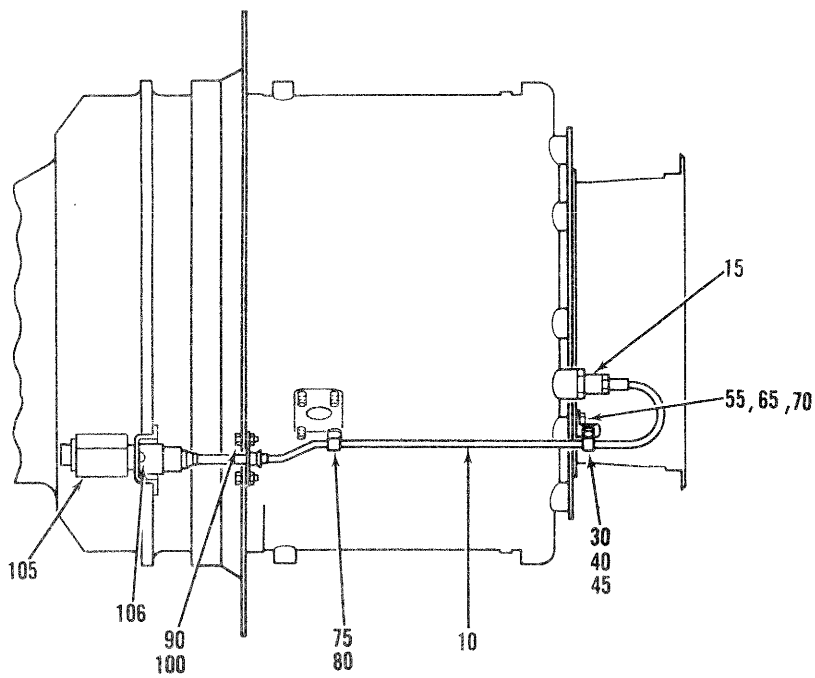
(3) Disconnect thermocouple harness at plenum assembly connector.

R 1. F. (Codes BA-BB, CA,-CB, EA, Pre SB72-0042) Install Thermoccouple Harness and Compensating Resistor (See Figure 204)

NOTE: Apply high temperature compound (Fel-Pro C5-A) to threads of bolts or screws located aft of the fireshield unless otherwise specified.

(1) Install compensating resistor and secure with screws. Tighten screws (106) to 7 inch-pounds torque.

(2) (Pre SB77-0001) Connect external thermocouple harness to plenum assembly connector. Tighten adapter connector (15) to 400 to 500 inch-pounds torque.



10.	THERMOCOUPLE HARNESS	70.	BRACKET
R	(IPC FIG. 108)	75.	NUT
15.	ADAPTER	80.	CLAMP
30.	NUT	90.	NUT
40.	BOLT	100.	BOLT
45.	CLAMP	105.	COMPENSATING RESISTOR
55.	NUT	106.	SCREW
65.	BOLT		

R (Codes BA-BB, CA-CB, EA, Post SB72-0042) Compensating
R Resistor and Thermocouple Harness Installation
Figure 204

R 1. F. (3) (Post SB77-0001) Connect external thermocouple harness to plenum connector.

(a) Use a magnet to determine which of two leads on harness assembly is magnetic. (Socket "A" will exhibit slight magnetism.) Connect magnetic socket to pin "A" and nonmagnetic socket to pin "B".

(b) Prepare potting compound as follows.

1 Mix 16 grams of powder (SermeTel PBX) with five cubic centimeters of solvent (SermeTel P).

CAUTION: MIX POTTING COMPOUND IN CLEAN PAPER CUP WITH CLEAN STIR STICK.

2 Stir the mixture until a uniform, thick, creamy liquid is obtained (add powder or solvent as required to produce desired consistency).

3 Allow the mixture to react for 30 to 60 minutes prior to application.

(c) Slide nut and adapter back on harness to provide clearance and working space, then using syringe (Chemo-Jector) inject as much potting compound as possible into plenum connector. Quickly slide adapter into place with hole located on top and screw nut onto connector. Tighten adapter (15) nut to 400 to 500 inch-pounds torque. Inject remainder of potting compound through hole in adapter until compound flows out of hole in plenum connector. Wipe off excess compound.

(d) Connect forward end of harness to resistor.

NOTE: In order to ensure proper cure, step (e) must be completed prior to step (f).

(e) Allow potting compound to cure at room temperature 21C (70F minimum) without disturbing for one hour, then cure with heat lamp at approximately 93C (200F) for four hours.

(f) Final cure by running engine at ground idle for period of 15 minutes.

(g) After cure disconnect forward end of harness from resistor, then check resistance between each socket and ground. Resistance shall be greater than 75,000 ohms. Reconnect harness to resistor.

1. F. (3) (h) Check resistance between pins A and B. Resistance shall be 0.25 to 1.25 ohms.

(4) Install bracket onto plenum assembly and secure with bolt and nut. Tighten bolt (65) to 70 inch-pounds torque.

(5) Install clamps, bolts, and nuts. Tighten nuts (30, 75, 90) to 20 inch-pounds torque.

(6) Connect thermocouple harness to compensating resistor and lockwire.

R G. (Codes BA-EA, GA, KA, Post SB72-0042) Disconnect Thermocouple Harness and Compensating Resistor (See Figure 205)

(1) Disconnect thermocouple harness from compensating resistor.

CAUTION: COMPENSATING RESISTOR IS SECURED TO BRACKET WITH SAME SCREWS SECURING END PLATE ONTO COMPENSATING RESISTOR BODY. USE CARE WHEN HANDLING COMPENSATING RESISTOR WITH SCREWS REMOVED AS INTERNAL DAMAGE MAY RESULT.

(2) Remove attaching parts.

(3) Remove compensating resistor.

R CAUTION: ALL BENDS IN THERMOCOUPLE HARNESS LEAD SHALL BE
R FORMED TO A MINIMUM RADIUS OF 0.500 INCH. ALLOW A
R STRAIGHT SECTION OF THERMOCOUPLE HARNESS LEAD FOR A
R MINIMUM OF 0.125 INCH WHERE LEAD EXITS PLENUM CON-
R NECTOR BEFORE BEGINNING THE FIRST BEND.

R NOTE: Refer to 70-00-00, STANDARD PRACTICES, for recommended
R general torque values. Add fractional drag (run-down)
R torque of self locking devices to recommended values.

R H. (Codes BA-EA, GA, KA, Post SB72-0042) Connect Thermocouple Harness and Compensating Resistor (See Figure 205)

NOTE: Apply high temperature compound (Fel-Pro C5-A) to threads of bolts or screws located aft of the fireshield unless otherwise specified.

(1) Install compensating resistor and secure with screws. Tighten screws (166) to 7 inch-pounds torque.

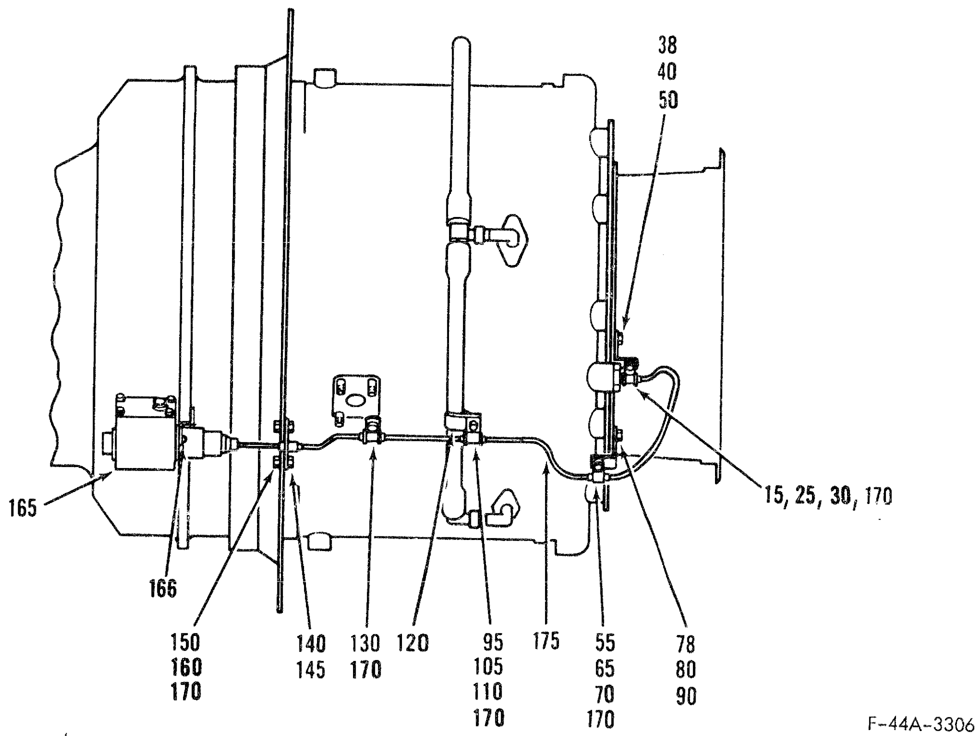
(2) Install brackets onto plenum assembly and secure with bolts and nuts. Tighten bolts (40, 80) to 70 inch-pounds torque.

R 1. H. (3) (Pre SB77-0007/SPB-TPE0119) Wrap thermocouple harness with glass top to fill clearance between attaching hardware and thermocouple harness. Tape shall extend from ends of clamps a minimum of 0.12 inch.

(4) Install clamps, bolts, and nuts. Tighten nuts (15, 55, 95) to 20 inch-pounds torque.

(5) Install flanges onto fireshield and secure with bolts and nuts. Tighten nuts (150) to 20 inch-pounds torque.

(6) Connect thermocouple harness to compensating resistor and lockwire.



R 15. NUT (IPC FIG. 110)
25. BOLT
30. CLAMP
38. NUT
40. BOLT
50. BRACKET
55. NUT
65. BOLT
70. CLAMP
78. NUT
80. BOLT
90. BRACKET
95. NUT
105. BOLT
110. CLAMP
120. CLAMP
130. CLAMP
140. FLANGE
145. FLANGE
150. NUT
160. BOLT
165. COMPENSATING RESISTOR
166. SCREW
170. TAPE
175. ITT SENSOR ASSY

R (Codes BA-EA, GA, KA, Post SB72-0042) Thermocouple Harness Installation
Figure 205

R 1. I. (Code HA) Disconnect Thermocouple Harness and Comensating Resistor (See
R Figure 206 for Pre SB72-0195, See Figures 207 and 208 for Post SB72-
R 0195)

(1) Disconnect thermocouple harness from compensating resistor.

CAUTION: COMPENSATING RESISTOR IS SECURED TO BRACKET WITH SAME SCREWS SECURING CONNECTOR ONTO COMPENSATING RESISTOR BODY. USE CARE WHEN HANDLING COMPENSATING RESISTOR WITH SCREWS REMOVED AS INTERNAL DAMAGE MAY RESULT.

(2) Remove attaching parts.

(3) Remove compensating resistor.

R (4) (Post SB72-0195) Remove compensating resistor mounting bracket.

R CAUTION: ALL BENDS IN THERMOCOUPLE HARNESS LEAD SHALL BE
R FORMED TO MINIMUM RADIUS OF 0.500 INCH. ALLOW A
R STRAIGHT SECTION OF THERMOCOUPLE HARNESS LEAD FOR A
R MINIMUM OF 0.125 INCH WHERE LEAD EXITS PLENUM CON-
R NECTOR BEFORE BEGINNING THE FIRST BEND.

R NOTE: Refer to 70-00-00, STANDARD PRACTICES, for recommended
R general torque values. Add fractional drag (run-down)
R torque of self locking devices to recommended values.

R J. (Code HA) Connect Thermocouple Harness and Compensating Resistor (See
R Figure 206 for Pre SB72-0195, See Figures 207 and 208 for Post SB72-
R 0195)

NOTE: Apply high temperature compound (Fel-Pro C5-A) to threads of bolts or screws located aft of compressor housing unless otherwise specified.

R (1) (Post SB72-0195) Install compensating resistor mounting bracket.
R Tighten nuts (20, figure 208) to 50 inch-pounds torque.

(2) Install compensating resistor and secure with screws. Tighten mounting screws (100, figure 206, or 10, figure 208) to 7 inch-pounds torque.

(3) Install brackets onto plenum assembly and secure with bolts and nuts. Tighten bolts (25, 55, figure 206 or 30, 55, figure 207) to 70 inch-pounds torque.

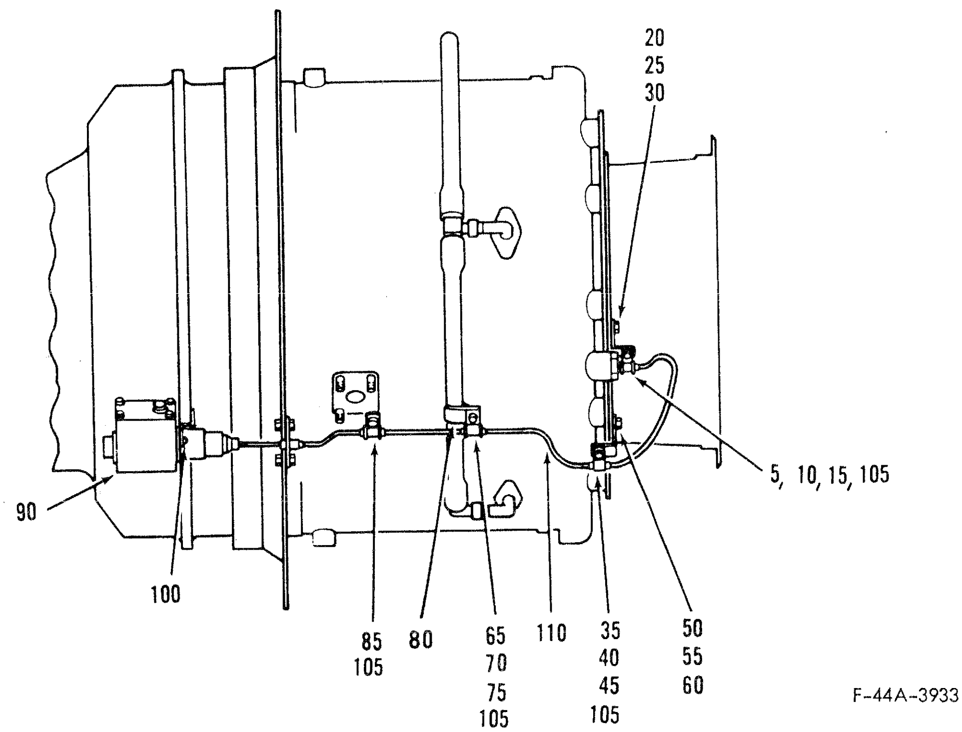
(4) (Pre SB77-0007/SPB-TPE0119) Wrap thermocouple harness with glass cloth tape to fill clearance between attaching hardware and thermocouple harness. Tape shall extend from ends of clamps a minimum of 0.12 inch.

R 1. J. (5) (Pre SB72-0195) Install clamps, bolts, and nuts. Tighten nuts (5, 35, 65, figure 206) to 20 inch-pounds torque.

R R R (6) (Post SB72-0195) Install clamps, bolts, and nuts. Tighten nuts (5, 35, figure 207) to 20 inch-pounds torque. Tighten bolt (65) to 35 inch-pounds torque.

(7) Connect thermocouple harness to compensating resistor and lockwire.

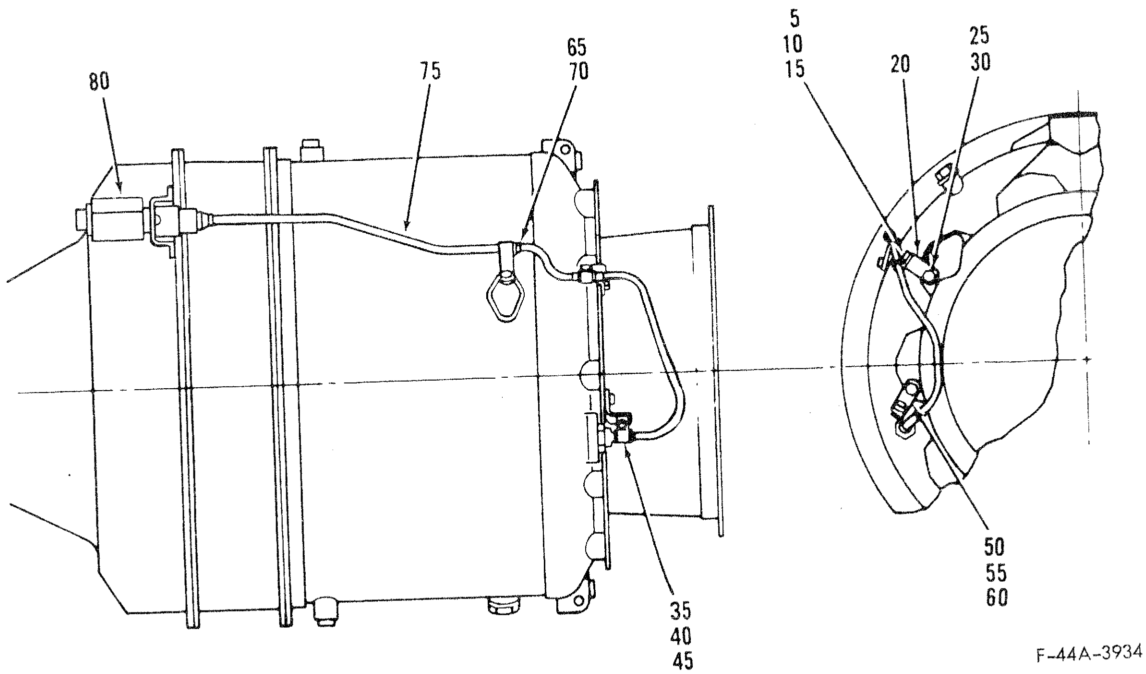
R



R 5.	NUT (IPC FIG. 111)	60.	BRACKET
R 10.	BOLT	65.	NUT
R 15.	CLAMP	70.	BOLT
R 20.	NUT	75.	CLAMP
R 25.	BOLT	80.	CLAMP
R 30.	BRACKET	85.	CLAMP
R 35.	NUT	90.	COMPENSATING RESISTOR
R 40.	BOLT	100.	SCREW
R 45.	CLAMP	105.	GLASS TAPE
R 50.	NUT	110.	ITT SENSOR ASSY
R 55.	BOLT		

(Code HA, Pre SB72-0195) Single Piece Thermocouple
Harness and Compensating Resistor Control Installation
Figure 206

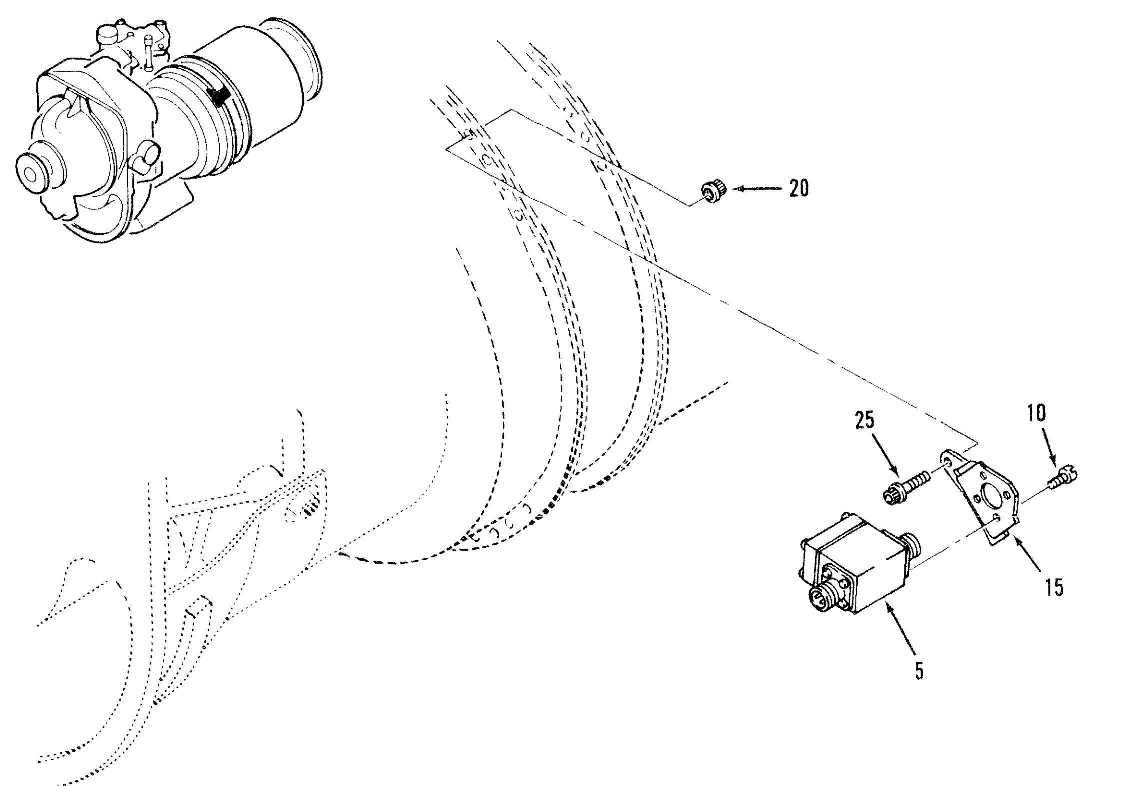
R



R 5. NUT (IPC FIG. 112)
R 10. BOLT
R 15. CLAMP
R 20. BRACKET
R 25. NUT
R 30. BOLT
R 35. NUT
R 40. BOLT
45. CLAMP
50. NUT
55. BOLT
60. BRACKET
65. BOLT
70. CLAMP
75. ITT SENSOR ASSY
80. COMPENSATING RESISTOR

(Code HA, Post SB72-0195) Single Piece
Thermocouple Harness Installation
Figure 207

R



R 5. COMPENSATING RESISTOR
R (IPC FIG. 113)
R 10. SCREW
15. BRACKET
20. NUT
25. BOLT

(Code HA, Post SB72-0195) Compensating
Resistor Control Installation
Figure 208

2. Adjustment/Test

NOTE: Table 202 provides a list of all special tools, fixtures, and equipment required to perform Adjustment/Test of the ITT sensor assembly.

Table 202. Special Tools, Fixtures and Equipment

Item No.	Nomenclature	Use	Source/ Part No.
NOTE: Equivalent substitutes may be used for listed items.			
1.	Temperature Indicating System Tester	Provides temperature indications of heat generated during functional heat testing.	287656-1-1

NOTE: Table 203 provides a list of equipment and materials required to perform Adjustment/Test of the thermocouple harness and control assembly (compensating resistor).

Table 203. Equipment and Materials

Equipment or Material	Description
NOTE: Equivalent substitutes may be used for listed items.	
Funciontal Check of Thermocouple Harness Assembly	
Volt-ohmmeter R (Simpson Model 260) R Simpson Electric Co, 5200 W. R Kinzie St, Chicago, IL 60644	Capable of measuring resistance from zero to two mehohms with an accuracy of +2/-2 percent

Table 203. Equipment and Materials (Cont)

Equipment and Material	Description
Functional Check of Compensating Resistor	
Digital Voltmeter R (Dana 5500/130 Module) R Dana Laboratories Inc, 2401 R Campus Drive, Irvine, CA R 92664 R or R (Hewlitt Packard Model 3465A) R Hewlit Packard Co, 1501 Page R Mill Road Palo Alto, CA 94304 R or R (Data Technology Model 3212) R Data Technology Inc, 6134 Edith R Blvd, N.E. Albuquerque, NM 87107	Capable of indicating polarity and scale range to 10 millivolts with an accuracy of +0.05/-0.05 volts.
R Fixed Resistor	10 K ohms with stability of 0.25 percent
Power Supply	28 vdc
R Resistance Bridge	Rubicon Bridge, Rubicon Div of Thermo Electric, Saddle River, NJ
R Wheatstone Bridge	Capable of measuring zero to 10 ohms.

2. A. (Pre SB72-0042) Test of Multi-Piece ITT System (Sensor and Removable Harness)

NOTE: Resistance values are average levels used in checking system for shorts or potential shorts to ground.

(1) Disconnect external harness at control assembly (compensating resistor).

(2) Measure resistance between Sockets A and B of external harness.
R Resistance shall be 0.0 to 2.0 ohms at 20C (65F).

(3) Measure insulating resistance between each socket and case of external harness. Resistance shall be greater than 75,000 ohms.

R NOTE: (With potted plenum connector) If resistance values in steps (2) and (3) are not as specified it will be necessary to disconnect the potted connection at the turbine plenum and proceed with steps (4) through (7).

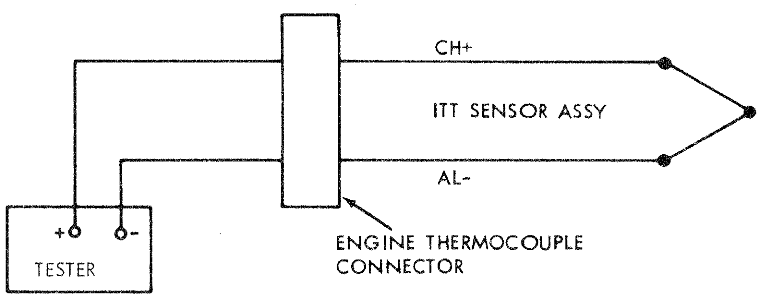
R 2. A. (4) (Without potted plenum connector) Disconnect external harness at turbine plenum connector.

R (5) (Without potted plenum connector) Measure resistance between pins A and B of internal harness. Resistance shall be 0.25 to 0.75 ohms at 20C (68F).

R (6) (Without potted plenum connector) Measure insulation resistance between each pin and case of internal harness. Resistance shall be greater than 75,000 ohms.

R (7) (Without potted plenum connector) If resistance limits of internal harness do not meet requirements, refer to 72-50-08, MAINTENANCE PRACTICES.

R



SETUP FOR MEASURING ENGINE ITT SENSOR ASSEMBLY RESISTANCE

W-44A-312R1

ITT Sensor Asembly (Single-Piece) Test
Figure 209

R 2. B. (Post SB72-0042) Test Resistance of One Piece ITT Sensor System, Part No. 896911

R (1) Obtain ITT sensor assembly resistance using 287656-1-1 temperature indication system tester and volt-ohmmeter.

R (a) Disconnect ITT sensor assembly at control assembly (compensating resistor).

R (b) Connect tester leads to engine thermocouple connector. (See figure 209.)

R (c) Select BRIDGE position with test select knob.

R (d) Press BRIDGE button switch and adjust BALANCE control until nullmeter reads zero.

R (e) Read resistance value on BALANCE counter dial.

R (f) Subtract test lead resistance from resistance value obtained in steps (c), (d), and (e) to obtain actual thermocouple harness resistance. Circuit resistance shall be 3.0 to 7.0 ohms at 20C (68F).

R NOTE: Refer to Aircraft Maintenance Manual to obtain aircraft loop resistance and to simulate engine temperature to check aircraft indicator and system.

R (g) Measure insulation resistance between each socket and case using Simpson 260 volt-ohmmeter. Resistance shall be greater than one megohm.

R (h) Replace ITT sensor assembly which does not meet resistance requirements. Refer to 72-50-06, MAINTENANCE PRACTICES.

R (2) Obtain ITT sensor assembly resistance using volt-ohmmeter.

R (a) Disconnect ITT sensor assembly at control assembly (compensating resistor).

R (b) Measure resistance between Sockets A and B and ITT sensor assembly. Resistance shall be 3.0 to 7.0 ohms at 20C (68F).

R (c) Measure insulation resistance between each socket and case using Simpson 260 volt-ohmmeter. Resistance shll be greater than one megohm.

R (d) Replace ITT sensor assembly which does not meet resistance requirements. Refer to 72-50-06, MAINTENANCE PRACTICES.

2. C. (Post SB72-0042) Trouble Shooting ITT Indicating System

NOTE: Table 204 contains procedures to isolate the source of ITT indicating problems.

Table 204. Trouble Shooting ITT Indicating System

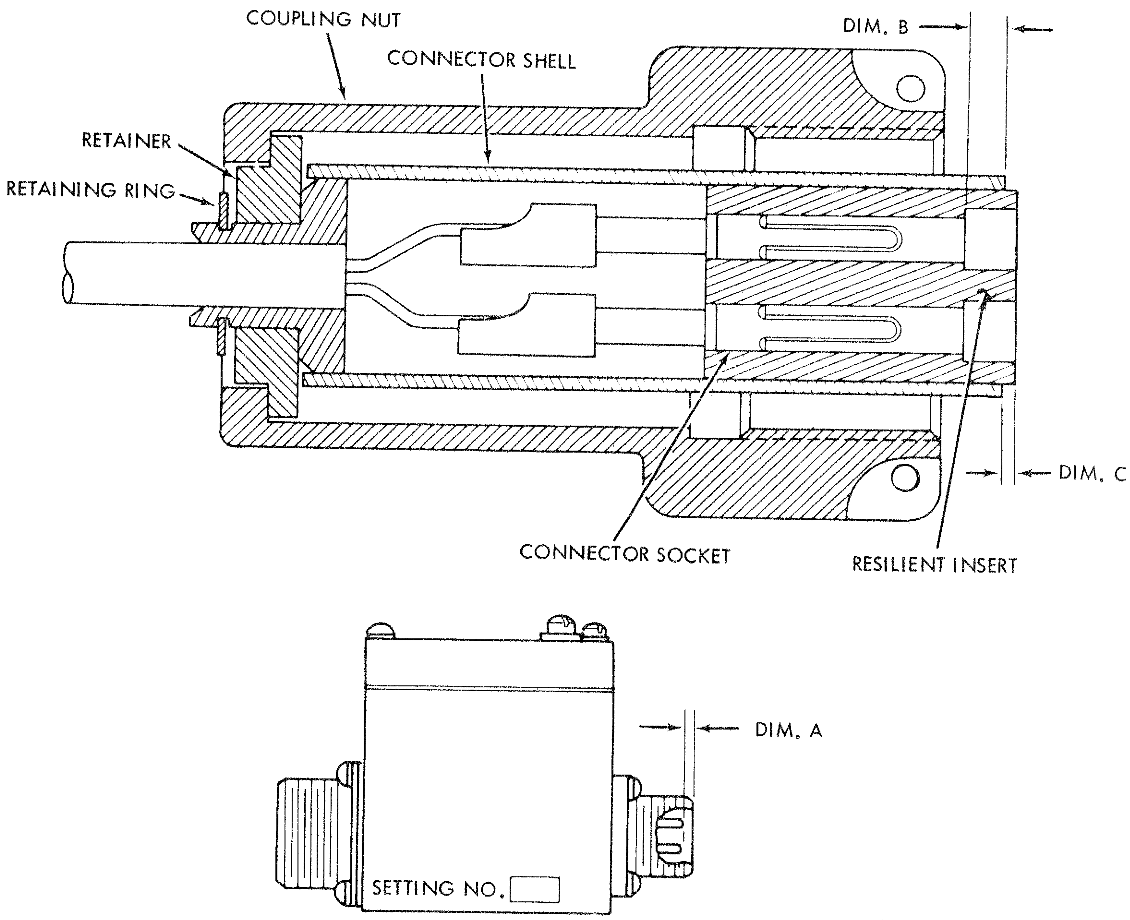
Symptom	Problem	Corrective Action
Fluctuations ot 50C or greater or no indication.	Mismatch in dimension of pins between the compensating resistor and sensor assembl connectors.	Measure depth from top of pin to top surface on connector (Dim. A, figure 210). Measure depth of socket of connector on sensor assembly connector (Dim. B, figure 210). Add these two dimensions. If greater than 0.200 inch correct as follows. *1. Identify ITT sensor assembly manufacturer. 2. If Gulton, replace the retaining ring and retainer within the connector with **Retaining Ring and Retainer Part No. 121-295. 3. If Temptron, replace the compensator.
	Insufficient tension provided by connector sockets of sensor assembly.	Insert 0.0615 +0.0001/ -0.0001 inch diameter pin into each socket of the connector. Attach a 2.5 ounce weight to the pin and position the connector so that the force

R *ITT sensor assembly is identified by ink-stamped number on the connector
R body. Assembly manufactured by Gulton is 07228; assembly manufactured by
R Temptron is 20219.
R **For information regarding procurement of Retaiing Ring and Retainer Part
R No. 121-295, refer to Service Bulletin TPE331-77-0002.

Table 204. Trouble Shooting ITT Indicating System (Cont)

Symptom	Problem	Corrective Action
Fluctuation of 50C or greater or no inciation. (Cont)	Insufficient tension provided by connector sockets of sensor assembly. (Cont)	of gravity will tend to remove the pin from the socket. If the force of 2.5 ounces removed the pin from the socket, correct as follows. 1. Identify Tye ITT sensor connector (see figure 212.) 2. If Type I, refer to Approved Repairs. 3. If Type II, replace ITT sensor assembly.
Fluctuations of 50C or greater.	Interference of connector with screw heads on the compensating resistor connector.	Identify ITT sensor assembly manufacturer and correct as in previous steps.
Contaminated or fretted electrical contacts.	Improper seal between connector of ITT harness and compensator.	Measure amount of rubber insert protrusion on connector of ITT harness Dim. C (figure 210). If dimension is not a minimum of 0.005 inch, replace resilient washer in accordance with Approved Repairs.
Fluctuations of 50C or less or loss of compensation.	Internal failure of compensating resistor.	Replace compensator.
Control Assembly Part No. 305520. Indicated readings approximately 30 - 60C high or low with minor fluctuations.	False indication.	Replace with Compensating Resistor Part No. 897069.

R



A	B	C
0.062 TO 0.125 IN. (TYP)	0.06 TO 0.09 IN. (TYP)	0.005 TO 0.025 IN. (TYP)

I-44A-1261R2

Dimension Check of ITT Sensor Assembly (Single Piece) and
Compensating Resistor
Figure 210

2. D. Test Control - Compensating Resistor (Part No. 305520-1 through -43)

NOTE: Resistance value is predetermined for each engine and identified by dash number to basic part number stamped on control - compensating resistor body halves. Refer to this dash number and locate identical dash number on Table 205 to establish correct voltage output value.

(1) Perform as insulation check between all connector pins and case using volt-ohmmeter on the Rx 10,000 scale. The indication shall not be less than 1 megohm.

(2) Perform functional check as follows.

(a) Connect control - compensating resistor to test equipment (figure 211). Turn on digital voltmeter.

(b) With the dc power supply turned off, note the voltage and polarity displayed on the digital voltmeter.

(c) Turn on the dc power supply and adjust the voltage level to 28 volts. Note the voltage and polarity displayed on the digital voltmeter. As indicated in the following examples, algebraically subtract and record the values in each step.

Example 1 A - 21 unit indicates -0.035 mv with power off and -0.185 mv with power on.

Therefore (-0.185) - (0.035) = -0.150 mv.

Example 2 A - 11 unit indicates -0.035 mv with power off and 1.150 mv with power on.

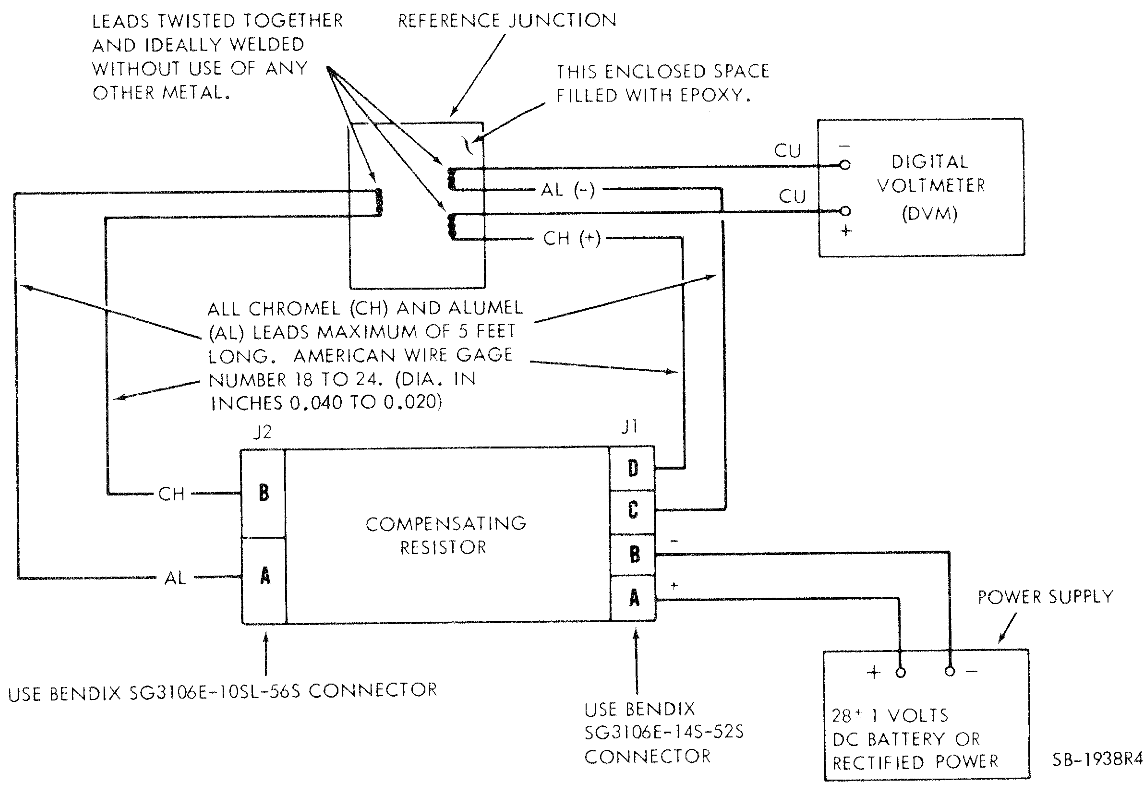
Therefore (1.150) - (-0.035) = 1.185 mv.

R R (d) Replace compensating resistor with like dash number compensating resistor if functional check is not satisfactory.

R E. Test Compensating Resistor (Part No. 897069-1/-2)

NOTE: Compensating resistor setting is predetermined for each engine and identified by a setting number recorded on the engine DSC (Data Sheet, Customer). Refer to this setting number and locate identical setting number in Table 206 to establish correct voltage output value.

(1) Perform an insulating check between all connector pins and case using volt-ohmmeter on the Rx 10,000 scale. The incication shall not be less than 1 megohm.



R

Compensating Resistor Control Assembly
Test Setup Diagram
Figure 211

Table 205. Control - Compensating Resistor (Part No. 305520-1 through -43) Output Requirements

Dash No.	Voltage Output Limit (MV)	Nominal Temperature Compensation Temperature Base of 923C (1693F)	
1	1.630 to 1.830	+43.34C	(+78F)
2	1.352 to 1.528	+36.39C	(+65.5F)
3	1.228 to 1.332	+33.00C	(+59.5F)
4	1.039 to 1.165	+27.78C	(+50.0F)
5	0.874 to 0.974	+23.00C	(+41.5F)
6	0.708 to 0.808	+19.16C	(+34.5F)
7	0.531 to 0.631	+14.72C	(+26.5F)
8	0.353 to 0.453	+10.00C	(+18.0F)
9	1.453 to 1.629	+38.90C	(+70.0F)
10	1.275 to 1.451	+34.44C	(+62.0F)
11	1.110 to 1.260	+29.71C	(+53.5F)
12	0.956 to 1.082	+26.11C	(+47.0F)
13	0.791 to 0.891	+21.11C	(+38.0F)
14	0.614 to 0.714	+16.38C	(+29.5F)
15	0.448 to 0.548	+12.49C	(+22.5F)
16	0.270 to 0.370	+ 8.05C	(+14.5F)
17	0.175 to 0.275	+ 5.56C	(+10.0F)
18	0.092 to 0.192	+ 3.34C	(+ 6.0F)
19	0.086 to -0.014	+ 1.11C	(+ 2.0F)
20	-0.021 to -0.121	- 1.67C	(- 3.0F)
21	-0.128 to -0.228	- 4.44C	(- 8.0F)
22	-0.270 to -0.370	- 7.51C	(-14.5F)
23	-0.353 to -0.453	-10.00C	(-18.0F)
24	-0.448 to -0.548	-12.51C	(-22.5F)
25	-0.531 to -0.631	-14.44C	(-26.0F)
26	-0.640 to -0.740	-17.22C	(-31.0F)
27	1.530 to 1.730	+41.11C	(+74.0F)
28	1.710 to 1.910	+45.84C	(+82.5F)
29	1.857 to 2.083	+49.72C	(+89.5F)
30	1.975 to 2.225	+53.05C	(+95.5F)
31	2.075 to 2.325	+55.56C	(+100.0F)
32	2.243 to 2.427	+59.71C	(+107.5F)
33	2.350 to 2.650	+62.22C	(+112.0F)
34	2.520 to 2.864	+67.23C	(+121.0F)
35	2.634 to 2.994	+70.00C	(+126.0F)
36	2.774 to 3.166	+73.89C	(+133.0F)
37	2.896 to 3.308	+76.94C	(+138.5F)
38	2.966 to 3.398	+78.88C	(+142.0F)

R

Table 205. Control - Compensating Resistor (Part No. 305520-1 through -43) Output Requirements (Cont)

Dash No.	Voltage Output Limit (MV)	Nominal Temperature Compensation Temperature Base of 923C (1693F)	
39	3.045 to 3.489	+81.11C	(+146.0F)
40	3.239 to 3.615	+85.00C	(+153.0F)
41	3.377 to 3.777	+88.89C	(+160.0F)
42	3.476 to 3.892	+91.10C	(+164.0F)
43	3.555 to 3.983	+93.33C	(+168.0F)

NOTE: If the output reading does not correspond to a listed setting number, use the most positive setting number

R Table 206. Compensating Resistor (Part No 897069-1/-2) Output Requirements

Setting No.	Millivolt Output (+0.020/-0.020 MV)	Nominal Temperature Compensation Temperature Base of 923C (1693F)	
1	0	0 C	(+ 0F)
2	0.066	+ 1.67C	(+ 3F)
3	0.132	+ 3.34C	(+ 6F)
4	0.199	+ 5.00C	(+ 9F)
5	0.265	+ 6.67C	(+12F)
6	0.331	+ 8.34C	(+15F)
7	0.398	+10.00C	(+18F)
8	0.464	+11.67C	(+21F)
9	0.530	+13.34C	(+24F)
10	0.597	+15.00C	(+27F)
11	0.663	+16.67C	(+30F)
12	0.730	+18.34C	(+33F)
13	0.796	+20.00C	(+36F)
14	0.863	+21.67C	(+39F)
15	0.929	+23.34C	(+42F)
16	0.996	+25.00C	(+45F)
17	1.063	+26.67C	(+48F)
18	1.129	+28.34C	(+51F)
19	1.196	+30.00C	(+54F)
20	1.263	+31.67C	(+57F)
21	1.330	+33.34C	(+60F)
22	1.396	+35.00C	(+63F)
23	1.463	+36.67C	(+66F)

R

Table 206. Compensating Resistor (Part No. 897069-1/-2)
Output Requirements (Cont)

Setting No.	Millivolt Output (+0.020/-0.020 MV)	Nominal Temperature Compensation Temperature Base of 923C (1693F)	
24	1.530	+38.34C	(+ 69F)
25	1.597	+40.00C	(+ 72F)
26	1.664	+41.67C	(+ 75F)
27	1.731	+43.34C	(+ 78F)
28	1.798	+45.00C	(+ 81F)
29	1.865	+46.67C	(+ 84F)
30	1.932	+48.34C	(+ 87F)
31	1.999	+50.00C	(+ 90F)
32	2.066	+51.67C	(+ 93F)
33	2.133	+53.34C	(+ 96F)
34	2.200	+55.00C	(+ 99F)
35	2.267	+56.68C	(+102F)
36	2.335	+58.33C	(+105F)
37	2.402	+60.01C	(+108F)
38	2.469	+61.67C	(+111F)
39	2.536	+63.35C	(+114F)
40	2.604	+65.01C	(+117F)
41	2.671	+66.67C	(+120F)
42	2.738	+68.35C	(+123F)
43	2.806	+70.00C	(+126F)

NOTE: If the output reading does not correspond to a listed setting number, use the more positive setting number.

2. E. (2) Perform functional check as follows.

(a) Connect compensating resistor to test equipment (figure 211). Turn on digitial voltmeter.

(b) With the dc power supply turned off, note the voltage and polarity displayed on the digital voltmeter.

(c) Turn the dc power supply and adjust the voltage level to 28 volts. Note the voltage and polarity displayed on the digital voltmeter. As indicated in the following examples, algebraically subtract and record the values in each step.

Example 1 A compensating resistor with a setting of 19 indicates 1.400 mv with power off and 0.204 mv with power on.

Therefore (1.400) - (0.204) = 1.196 mv.

Example 2 A compensating resistor with a setting of 2 indicates -0.020 mv with power off and 0.046 mv with power on.

Therefore (0.046) - (-0.020) = 0.066 mv.

NOTE: Ensure that malfunction has been isolated to compensating resistor before and/or adjusting compensating resistor. Compensating Resistor Part No. R 897069-1/-2 may be adjusted by use of test setup in Figure 211 and compensation value in Table 212 or may be adjusted by engine operation, and observing temperature indications with cmpensating resistor powered and un-powered.

2. E. (3) Perform adjustment of replacement compensating resistor using test setup as follows.

(a) Connect the compensating resistor into the test setup (see figure 211). Note the reference junction is to provide a minimum temperature difference of the three dissimilar metal (chromel-alumel, chromel-copper, and alumel-copper) connections; and thus, to minimize generated errors. The connections inside the junction should occupy a small volume and the excess space filled with a compound (epoxy) to achieve a constant temperature. Ideally the reference junction should be submerged in an ice-bath solution.

(b) With dc power supply turned off, turn on digital voltmeter and record voltage and sign either 0 (+) or (-) displayed. This voltage is a function of the dissimilar metals.

(c) Turn on dc power and ensure the voltage level of the power supply is 28 +1/-1 volts. The compensating resistor is set by removing the sealing screw to gain access to the setting adjustment screw. Clockwise rotation of setting screw incrases the setting number and (+) F degrees compensation. Total range approximately 25 turns. Turn the setting screw with the power supply turned on until the desired voltage is displayed. To determine this voltage the following algebraic equation is used:

(VOLTAGE) SETTING + (VOLTAGE) POWER OFF = (VOLTAGE) POWER ON

See Table 206 which correlates setting number and voltage. The following examples show typical values that may occur when setting the compensating resistor, keeping in mind that these are examples and there is a tolerance on the setting voltage:

Example 1 A compensating resistor with a setting number of 19 requires a setting voltage of 1.196 mv. With power off the voltage indicated is 0.020 mv.

Therefore: VSET + VOFF = VON

1.196 + 0.020 = 1.216mv

Adjust the setting screw until 1.216 mv is displeyed.

Example 2 A compensating resistor with a setting number of 2 requires a setting voltage of 0.066 mv. With power off the voltage indicated is -0.020 mv.

Therefore: VSET + VOFF = VON

0.066 + (-0.020) = 0.046 mv

Adjust the setting screw until 0.046 mv is displayed.

2. E. (3) (d) After setting is accomplished lock setting screw with a drop of 1201 Red Glyptal (General Electric Corp). Record setting number in space provided on compensating resistor by means of an ink stamp or stencil. If compensating resistor is being recalibrated, obliterate existing number before reidentifying. Replace sealing screw and lockwire.

(4) Perform adjustment of replacement resistor using engine operation as follows.

CAUTION: DO NOT EXCEED ENGINE RPM LIMITS, OR THE MAXIMUM ALLOWABLE INTERSTAGE TURBINE TEMPERATURE OF 923C (1693F) OR TORQUE LIMITS DURING THIS CHECK.

(a) Remove the sealing screw for access to the setting adjustment screw.

(b) Operate the engine at takeoff power, but not exceeding 923C (1693F.

(c) Observe the ITT indicator reading with the compensating resistor powered and with the compensating resistor un-powered. Record the difference which is the value of compensation.

(d) Refer to the engine DSC to determine the setting number of the compensating resistor required for the engine. Refer to Table

206 to determine the amount of compensating the setting number is to provide.

2. E. (4) (e) If the value of compensating determined in step (c) does not agree with the compensation required in step (d), adjust the setting screw of the compensating resistor to obtain the required compensation, and recheck the compensation by engine operation.

(f) After the required temperature compensation is obtained, lock the setting screw with a drop of staking compound (1201 Red Enamel Glyptal). Replace the sealing screw.

(g) Record the setting number in the engine log book.

3. Inspection/Check

A. Check Thermocouple Harness Assembly

R (1) (Pre SB72-0042) Check thermocouple harness assembly for evidence of damage due to overheating, chafing, and separation at connectors.

(2) Check compensating resistor and thermocouple harness assembly for bent, broken, or burned pins on electrical connectors.

(3) Check connectors elements and pins for foreign materials, none is allowed.

(4) Replace harness assembly or resistor if damaged beyond simple repair.

4. Cleaning/Painting

NOTE: Table 207 provides a list of all materials and compounds required to perform Cleaning/Painting.

Table 207. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Degreaser and cleaner (MS-180 Freon)	Miller-Stephensen Chemicl Co Inc, P.O. Box 628, 16 Sugar Hollow Rd, Danbury, CT 06810
1,1,1-Trichloroethane (MIL-T-81533)	Commercially available

4. A. Clean Parts

(1) Clean all standard metallic hardware in accordance with 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 1 or 2.

R B. Perform Special Cleaning of Thermocouple Harness Assembly and
R Control Assembly Connectors.

(1) Clean thermocouple harness assembly and control assembly (compensating resistor) connectors as follows.

WARNING: SOLVENT IS TOXIC AND FLAMMABLE. USE IN WELL-VENTILATED AREA. AVOID BREATHING FUMES OR LONG CONTACT WITH SKIN TO PREVENT DAMAGE TO PHYSICAL HEALTH. KEEP AWAY FROM FLAME TO AVOID FIRE HAZARD.

(a) Clean electrical connectors of dirt, grease, or other contaminants using degreaser and cleaner (MS-180 Freon).

(b) Remove oil substance with cotton swab dipped in degreaser and cleaner (MS-180 Freon) or 1,1,1-trichloroethane (MIL-T-81533).

5. Approved Repairs

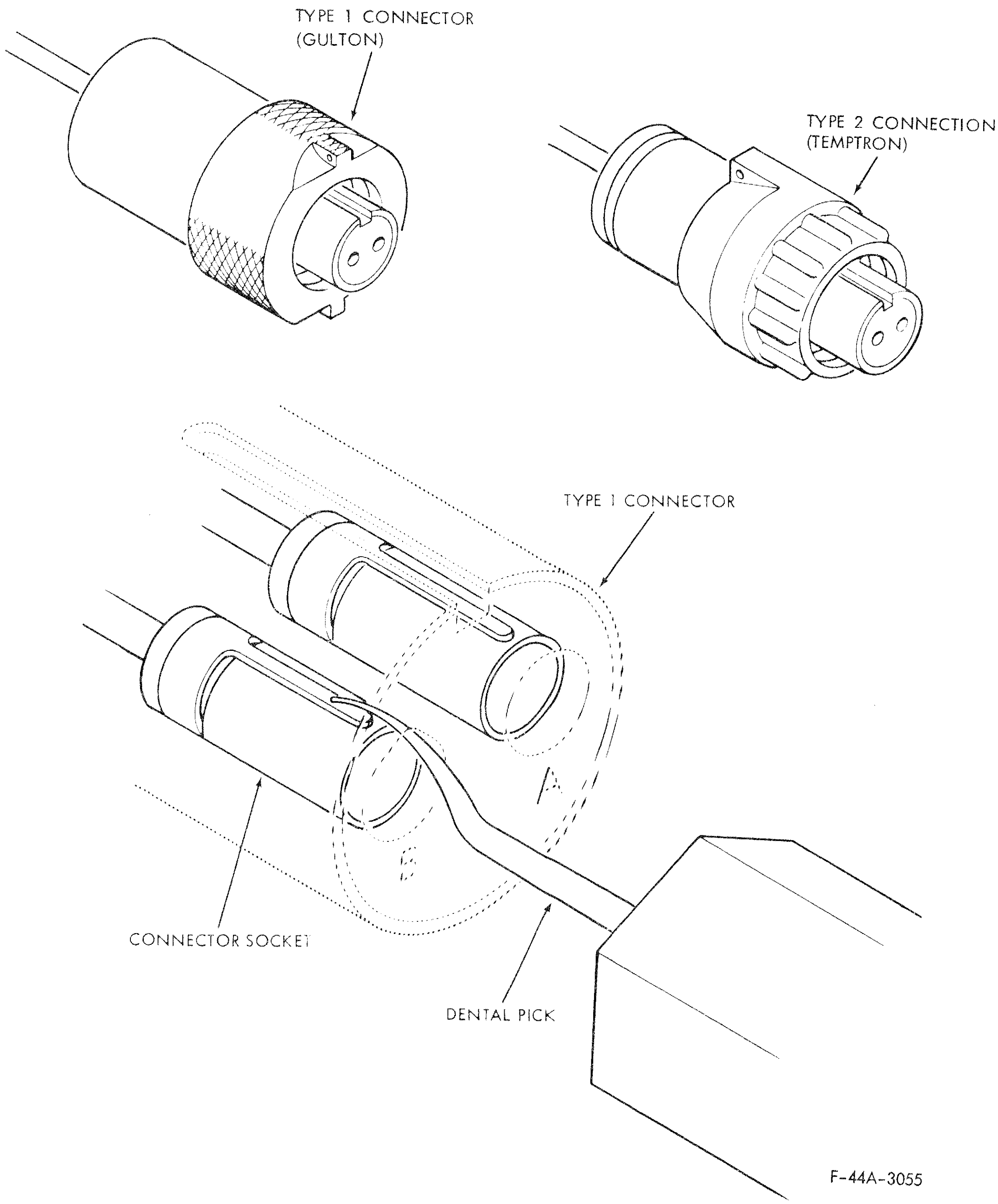
NOTE: Table 208 provides a list of all materials and compounds required to perform Approved Repairs.

Table 208. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Acetone (Federal Specification O-A-51C)	Commercially available
Adhesive (140 RTV)	Dow Corning Crop, S Saginaw Rd, Midland, MI 48640
Detal pick	Commercially available

A. Repair Type I Connector Socket (See Figure 212)

5. A. (1) Locate spring portion of connector socket by rotating the point of a needle around interior diameter of socket approximately one-eighths inch from edge of socket. Spring portion of socket is located at position where needle point feels obstructed. Note position of spring portion of socket in relation of connector.



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Identifier and Repair of Type I ITT
Sensor Connector Socket
Figure 212

CAUTION: PERMANENT DAMAGE TO SOCKET CONTACTS AND/OR RESILIENT INSERT OF CONNECTOR MAY RESULT IF EXCESSIVE FORCE IS APPLIED. APPLY FORCE GRADUALLY. REWORK TOOL (DENTAL PICK) SHALL HAVE MINIMUM TIP RADIUS OF 0.005 INCH.

NOTE: If entire socket deflects as force is applied or point of rework tool (dental pick) is visible inside socket, carefully remove rework tool and repeat step.

5. A. (2) Carefully position tip of rework tool (dental pick) over spring portion of socket as shown in Figure 212. Apply sufficient force to depress spring towards center of socket. Remove rework tool and test socket in accordance with Table 204.

(3) Repeat steps (1) and (2) for each socket until minimum separation force of 2.5 ounces is satisfied.

(4) Replace ITT sensor assembly if minimum separation force cannot be met.

B. Procedure for Application of Resilient Washer to Resilient Insert (Type I and Type II Connector) (See Figure 210)

NOTE: Part No. SK120-347 resilient washer (one per unit) may be procured through any AiResearch approved service center.

(1) Clean resilient insert and resilient washer with acetone (Federal Specification O-A-51C) and allow to dry.

(2) Sand mating surfaces to remove residue and raised markings.

(3) Apply thin coat (10 to 15 mils) of adhesive (140 RTV) to mating surfaces and allow to dry one-half hour to one hour.

NOTE: Alignment tool consists of two 0.0615 +0.0001/-.0001 inch diameter pins to be used as an aid to proper resilient washer positioning.

(4) Using alignment tool, apply resilient washer to resilient insert with keyway notches aligned.

(5) Allow to air-dry for 24 hours minimum.

LIST OF EFFECTIVE PAGES
72-00-95

AiResearch
Phoenix

MAINTENANCE MANUAL
TPE331-5/-6

RECORD OF TEMPORARY REVISIONS

REV NO.	CHAP/SEC/SUBJ PAGE NO.	DATE ISSUED	DATE INSERTED	BY	DATE REMOVED	BY	INCORPORATED INTO MANUAL BY REV NO.

R

CHAPTER 79 - OIL

TABLE OF CONTENTS

CHAPTER 79 - OIL

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OIL - DESCRIPTION AND OPERATION

The lubrication system includes an internal pressure pump and three internal scavenge pump. The pressure pump provides regulated and filtered oil for jet and mist lubrication of engine bearings and gears. The scavenge pumps, two in the reduction gear section (in a single housing), and one in the turbine section, return lubricating oil to oil cooling system and oil tank assembly, and the oil-to-fuel heater for fuel filter anti-icing. An oil vent valve unloads the oil pumps during starting. The lubricating system also supplies actuating oil to the propeller control system and to the torque sensing components. The system also includes a magnetic drain plug and an oil temperature bulb.

STORAGE - DESCRIPTION AND OPERATION

The oil tank assembly is mounted on the right side and bottom of the reduction gear section and provides an oil reservoir for the engine lubrication system, engine propeller control system, and customer-furnished propeller unfeathering pump. The oil tank assembly includes an oil dipstick assembly, air-oil separator assembly and an oil-to-fuel heater. The oil tank assembly is vented to the reduction gear section and to atmosphere.

OIL TANK ASSEMBLY AND PLUMBING - MAINTENANCE PRACTICES

1. Removal/Installation

NOTE: Table 201 provides a list of all materials and compounds required to perform Removal/Installation.

Table 201. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Alternate packing lubricant Lubricant (OS-124)	Monsanto Company, 800 N Lindbergh Blvd, St. Louis, MO 63166
Any approved engine fuel	Commercially available
Any approved engine oil	Commercially available
Lubricating compound (Liqui-Moly, Grade NV)	Lockrey Co, Lubricants Div, Cedar Shores, Southampton, NY 11968

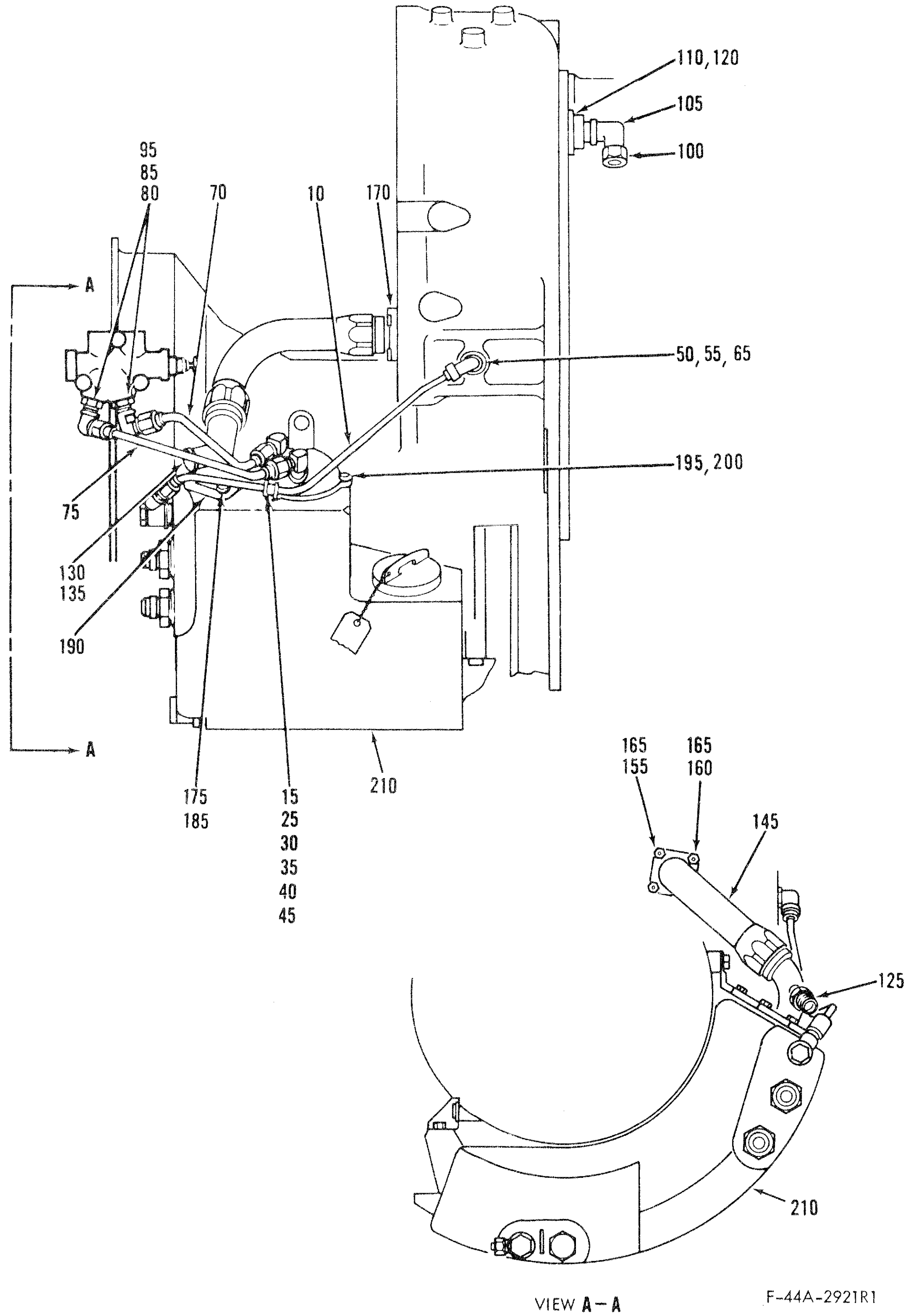
R A. (Codes AA-AC, FA, LA) Remove Oil Tank Assembly and Plumbing (See Figures 201, 202)

NOTE: Procedures are provided for complete disassembly and reassembly of the oil tank assembly components. However, disassemble only to the extent required for th components being replaced.

(1) Remove plug at lower rear end of oil tank assembly and drain oil into a suitable container. Examine oil for chips and metal flakes indicating internal engine damage and discard drained oil.

(2) Disconnect aircraft connections from oil tank assembly, if applicable.

(3) Remove tube and hose assemblies with attaching parts from input housing assembly, oil tank assembly and anti-ice valve. Remove elbows and packings from input housing assembly and anti-ice valve. (See figure 201.)



(Codes AA-AC, FA, LA) Oil Tank
Plumbing Installation
Figure 201

1. A. (4) Remove bolts, washers, nut and support securing oil tank assembly to input housing assembly. Remove oil tank assembly. (See figure 202.)

(5) Remove cap, elbows, metal gaskets, plug, union and separator assembly from oil tank assembly.

(6) Remove oil to fuel cooler and packings from oil tank assembly.

R B. (Codes AA-AC, FA, LA) Install Oil Tank Assembly and Plumbing (See Figures 201, 202)

NOTE: Lightly coat new packings with clean engine oil or lubricant (OS-124) prior to installation unless otherwise specified. Apply lubricating compound (Liqui-Moly, Grade NV) to threads of bolts or screws and apply clean engine oil to threads (except first two threads) of male plumbing fittings located forward of the compressor housing unless otherwise specified.

R Refer to 70-00-00, STANDARD RPACTICES, for recommended
R general torque values. Add frictional drag (run-down)
R torque of self locking devices to recommended values.

(1) Install oil to fuel cooler, with new packings, into oil tank assembly and secure with bolts. Tighten bolts (195, figure 201) to 30 inch-pounds torque.

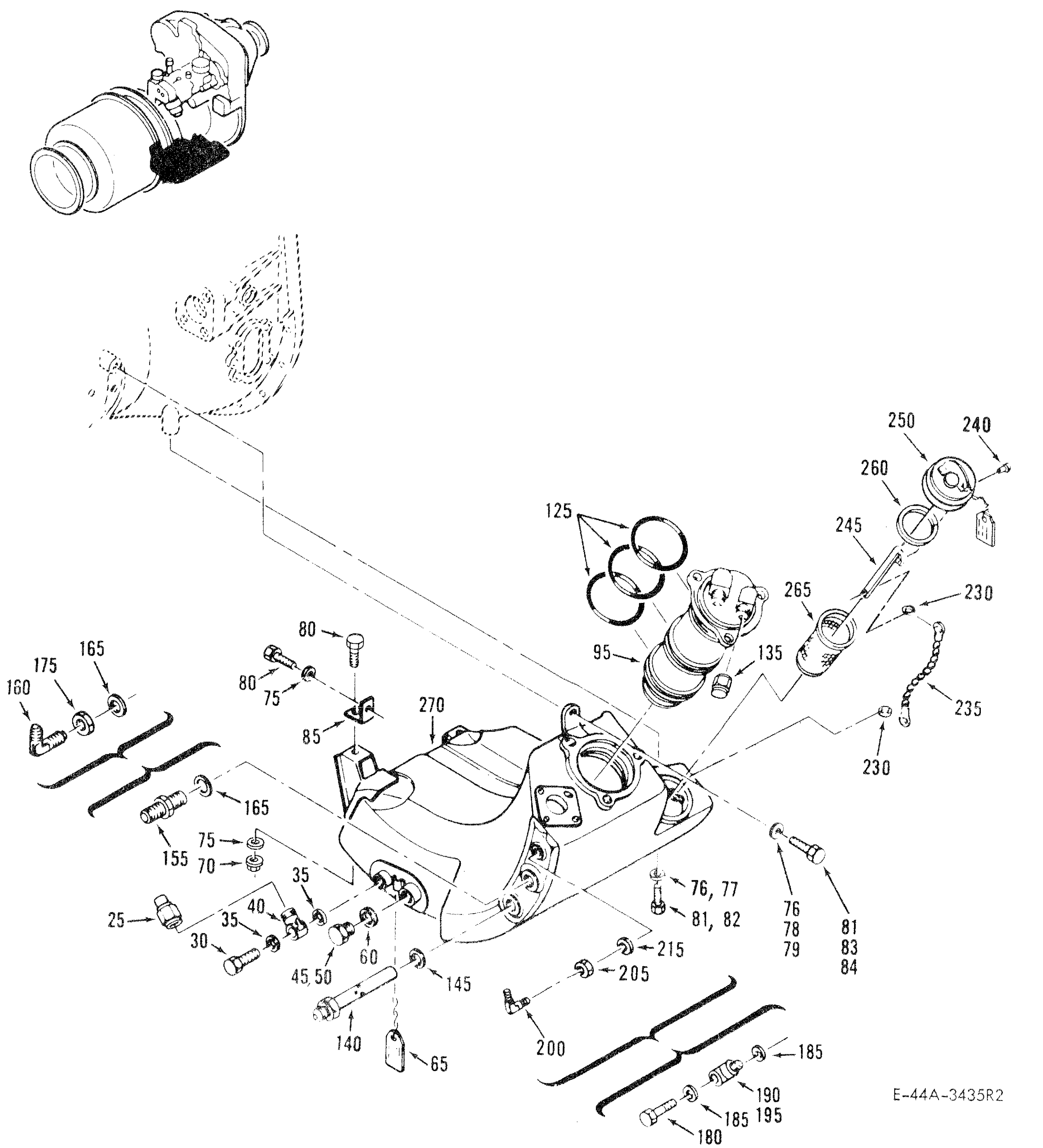
KEY TO FIGURE 201

R 10. TUBE ASSY (IPC FIG. 35)
15. BOLT
25. WASHER
30. CLAMP
35. NUT
40. BOLT
45. BRACKET
50. ELBOW
55. PACKING
65. NUT
70. TUBE ASSY
75. TUBE ASSY
80. ELBOW
85. PACKING
95. NUT
100. CAP
105. ELBOW
110. PACKING
120. NUT
125. TEMPERATURE BULB
130. PLUG
135. PACKING
145. HOSE
155. NUT
160. NUT
165. WASHER
170. SEAL
175. BOLT
185. WASHER
190. SEAL
195. BOLT
200. WASHER
210. OIL TANK ASSY

1. B. (2) Install screen assembly into oil tank assembly. (See figure 202.)

(3) Install gasket and dipstick onto filler cap.

R



Oil Tank Installation
Figure 202

1. B. (4) Install assembled filler cap into oil tank assembly and secure with chain links and chain.

(5) Install separator assembly, with new packing, into oil tank assembly. Tighten separator assembly (140, figure 202) to 295 to 315 inch-pounds torque.

(6) Install union, with new packing, into oil tank assembly. Tighten union (155) to 105 to 115 inch-pounds torque.

(7) Install bolt and elbow, with metal gaskets, into oil tank assembly. Tighten bolt (180) to 65 to 70 inch-pounds torque and lockwire.

(8) Install plug, with new packing, into oil tank assembly. Tighten plug (45) to 220 to 240 inch-pounds torque and lockwire.

(9) Install elbow and bolt, with metal gaskets into oil tank assembly. Tighten bolt (30) to 120 to 130 inch-pounds torque and lockwire. Install cap onto elbow. Tighten cap (25) to 190 to 220 inch-pounds torque and lockwire.

(10) Install support onto engine and secure with bolt and washer. Tighten bolt (80) to 75 inch-pounds torque.

(11) Install oil tank assembly onto input housing assembly and secure with washers, bolts, and nuts. Tighten bolts (81) to 75 inch-pounds torque. Tighten nut (70) to 50 inch-pounds torque.

KEY TO FIGURE 202

R 25. CAP (IPC FIG. 114)
30. BOLT
35. METAL GASKET
40. ELBOW
45. PLUG
50. PLUG
60. PACKING
65. WARNING TAG
70. NUT
75. WASHER
76. WASHER
77. WASHER
78. WASHER
79. WASHER
80. BOLT
81. BOLT
82. BOLT
83. BOLT
84. BOLT
85. SUPPORT
95. OIL-TO-FUEL COOLER ASSY
125. PACKING
135. CAP
140. SEPARATOR ASSY
145. PACKING
155. UNION
160. ELBOW
165. PACKING
175. NUT
180. BOLT
185. METAL GASKET
190. ELBOW
195. ELBOW
200. ELBOW
205. NUT
215. PACKING
230. CHAIN LINK
235. CHAIN
240. RIVET
245. DIPSTICK
250. FILLER CAP
260. GASKET
265. SCREEN
270. OIL TANK ASSY

1. B. (12) Install hose, with new seals, between input housing assembly and oil tank assembly, and secure with washers, bolts, and nuts. Tighten bolts (175) to 25 inch-pounds torque and lockwire. Tighten nuts (155, 160) to 20 inch-pounds torque and lockwire. (See figure 201.)

(13) Install plug, with new packing, into hose assembly. Tighten plug (130) to 65 inch-pounds torque.

(14) Lightly coat new packings (85) with clean engine fuel or lubricant (OS-124) and install onto elbows. Install elbows with packings into anti-ice valve and secure with nuts. Tighten nuts (95) to 65 to 70 inch-pounds torque.

(15) Install elbow, with new packing, into input housing assembly and secure with nut. Tighten nut (65) to 50 to 55 inch-pounds torque.

(16) Install tube assemblies between elbows in anti-ice valve and oil-to-fuel cooler assembly.

(17) Install tube assembly between elbow in input housing assembly and elbow in oil tank assembly. Secure tube assembly with clamp, washer, and bolt. Tighten bolt (15) to 30 inch-pounds torque.

(18) Install elbow, with new packing, into intermediate housing assembly and secure with nut. Tighten nut (120) to 175 to 185 inch-pounds torque. Install cap onto elbow. Tighten cap (100) to 300 to 350 inch-pounds torque and lockwire.

(19) Connect aircraft connections to oil tank assembly, if applicable.

(20) Fill oil tank assembly to proper level with clean engine oil. Refer to 72-00-00, GENERAL - SERVICING.

R C. (Codes BA-BC, EA, GA, KA) Remove Oil Tank Assembly and Plumbing (See Figures, 202, 203)

NOTE: Procedures are provided for complete disassembly and reassembly of the oil tank assembly components. However, disassemble only to the extent required for the components being replaced.

(1) Remove plug at lower rear end of oil tank assembly and drain oil into a suitable container. Examine oil for chips and metal flakes indicating internal engine damage and discard drained oil.

(2) Disconnect aircraft connections from oil tank assembly, if applicable.

(3) Remove oil temperature bulb and packing from hose. (See figure 203.)

1. C. (4) Remove tube and hose assemblies and attaching parts from input housing assembly and oil tank assembly.

(5) Remove caps, plug, union, elbows, and separator assembly. (See figure 202.)

(6) Lift filler cap off oil tank assembly, remove chain links and chain.

(7) Remove dipstick and gasket from filler cap.

(8) Remove screen assembly.

(9) Remove bolts, washers, nut and support assembly securing oil tank assembly to input housing assembly. Remove oil tank assembly.

(10) Remove oil to fuel cooler and packings.

R D. (Codes BA-BC, EA, GA, KA) Install Oil Tank Assembly and Plumbing (See Figures 202, 203)

NOTE: Lightly coat new packings with clean engine oil or lubricant (OS-124) prior to installation unless otherwise specified. Apply lubricating compound (Liqui-Moly, Grade NV) to threads of bolts or screws and apply clean engine oil to threads (except first two threads) of male plumbing fittings located forward of the compressor housing unless otherwise specified.

R Refer to 70-00-00, STANDARD PRACTICES, for recommended
R general torque values. Add frictional drag (run-down)
R torque of self locking devices to recommended values.

(1) Install oil to fuel cooler, with new gaskets, into oil tank assembly and secure with washers and bolts. Tighten bolts (130) to 30 inch-pounds torque. (See figure 203.)

(2) Install screen assembly into oil tank assembly. (See figure 202.)

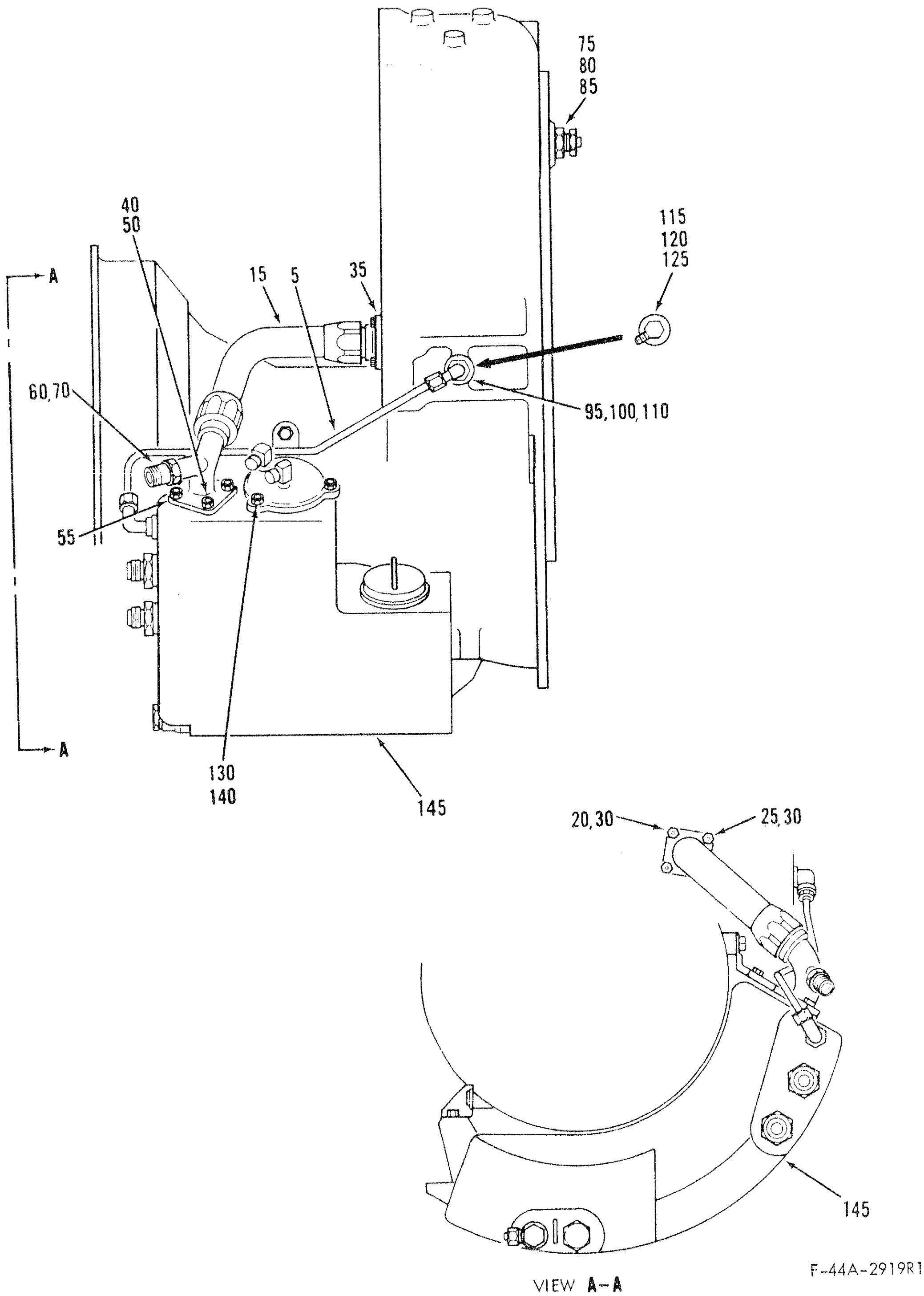
(3) Install gasket and dipstick into filler cap.

(4) Install assembled filler cap into oil tank assembly and secure with chain links and chain.

(5) Install separator assembly, with new gasket, into oil tank assembly. Tighten separator assembly (140) to 295 to 315 inch-pounds torque.

(6) Install union, with new gasket, into oil tank assembly. Tighten union (155) to 105 to 115 inch-pounds torque.

R



(Codes BA-BC, EA, GA, KA) Oil Tank
Plumbing Installation
Figure 203

1. D. (7) Install elbow, with new gasket, into oil tank assembly and secure with nut. Tighten nut (205) to 50 to 55 inch-pounds torque.

(8) Install elbow and bolt, with metal gaskets, into oil tank assembly. Tighten bolt (30) to 120 to 130 inch-pounds torque. Install cap onto elbow. Tighten cap (25) to 190 to 220 inch-pounds torque and lockwire.

(9) Install plug, with new packing, into oil tank assembly. Tighten plug (45) to 220 to 240 inch-pounds torque.

(10) Install support onto engine and secure with bolt. Tighten bolt (80) to 75 inch-pounds torque.

R (11) (Codes BA-BC, EA) Install oil tank assembly onto input housing assembly and secure with washers, bolts, and nut. Tighten bolts (81) to 75 inch-pounds torque. Tighten nut (70) to 50 inch-pounds torque.

R (11A) (Codes GA, KA) Install oil tank assembly onto input housing assembly and secure with washers, bolts, and nut. Tighten bolt (83) to 75 inch-pounds torque. Tighten bolt (82) to 70 inch-pounds torque. Tighten nut (70) to 50 inch-pounds torque.

(12) Install elbow with new packing into input housing assembly and secure with nut. Tighten nut (110, figure 203) to 50 to 55 inch-pounds torque.

(13) Install tube assembly between elbows in oil tank assembly and input housing assembly. (See figure 203.)

(14) Install hose, with new seals, between input housing assembly and oil tank assembly, and secure with washers, bolts, and nuts. Tighten bolts (40) to 25 inch-pounds torque and lockwire, and tighten nuts (20, 25) to 20 inch-pounds torque and lockwire.

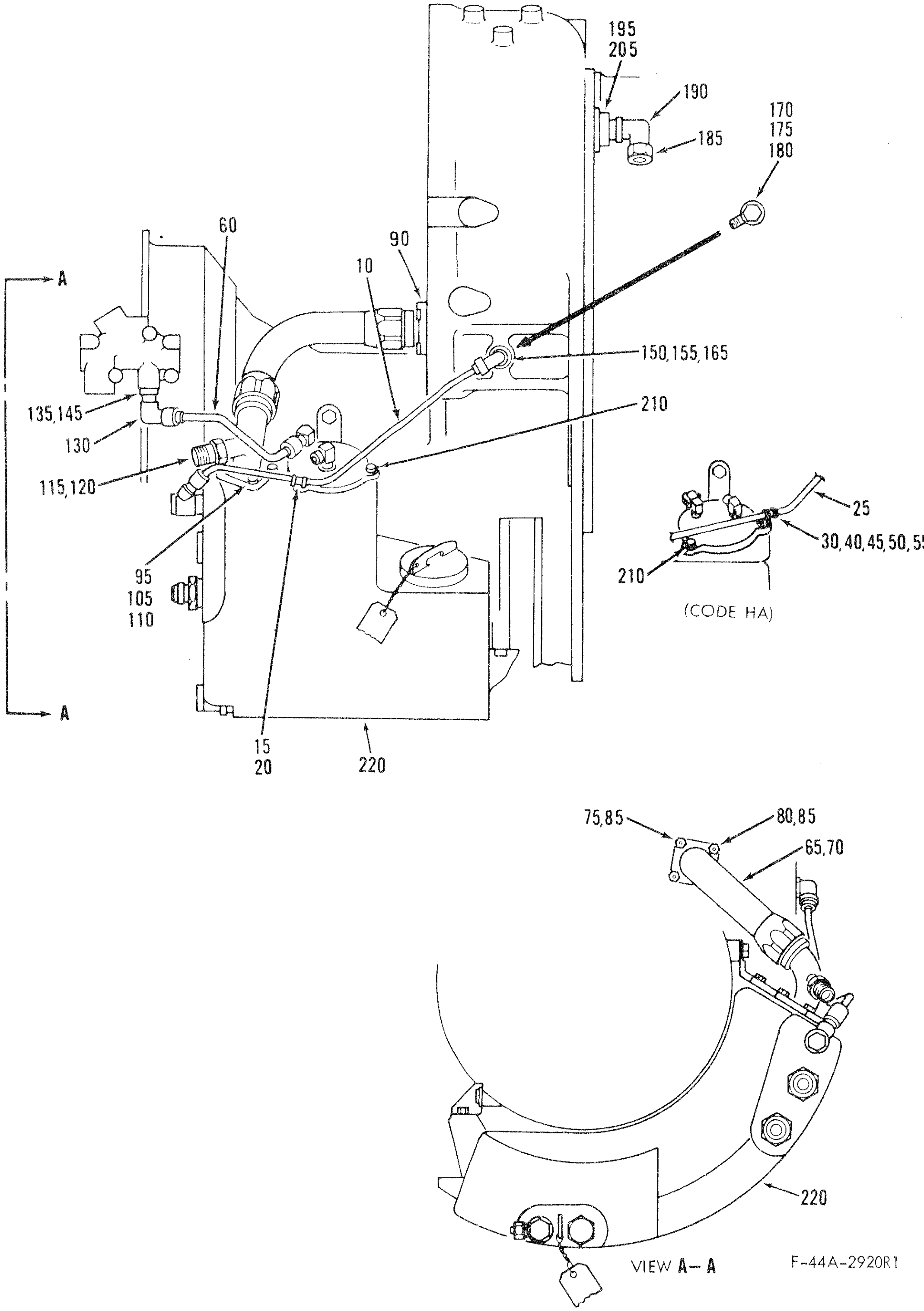
NOTE: Oil temperature bulb is supplied with a metal washer. Discard washer and use packing.

(15) Install oil temperature bulb, with new packing, into hose. Tighten oil temperature bulb (60) to 65 inch-pounds torque and lockwire.

◄ KEY TO FIGURE 203

5. TUBE ASSY
R (IPC FIG. 36)
15. TUBE ASSY
20. NUT
25. NUT
30. WASHER
35. SEAL
40. BOLT
50. WASHER
55. SEAL
60. TEMPERATURE BULB
70. PACKING
75. CAP
80. UNION
85. PACKING
95. ELBOW
100. PACKING
110. NUT
115. BOLT
120. METAL GASKET
125. ELBOW
130. BOLT
140. WASHER
145. OIL TANK ASSY

R



(Codes CA-CC, HA) Oil Tank Plumbing Installation
Figure 204

1. D. (16) Install union with new packing into intermediate housing assembly. Tighten union (80) to 105 to 115 inch-pounds torque. Install cap on union. Tighten cap (75) to 300 to 350 inch-pounds torque.

(17) Connect aircraft connections to oil tank assembly, if applicable.

(18) Fill oil tank assembly to proper level with clean engine oil in accordance with 72-00-00, GENERAL - SERVICING.

R E. (Codes CA-CC, HA) Remove Oil Tank Assembly and Plumbing (See Figures 202, 204)

NOTE: Procedures are provided for complete disassembly and reassembly of the oil tank assembly components. However, disassemble only to the extent required for the components being replaced.

(1) Remove plug at lower rear end of oil tank assembly and drain oil into a suitable container. Examine oil for chips and metal flakes indicating internal engine damage and discard drained oil.

(2) Disconnect aircraft connections from oil tank assembly, if applicable.

(3) Remove oil temperature bulb and packing from hose. (See figure 204.)

KEY TO FIGURE 204

R 10. TUBE ASSY (IPC FIG. 37)
15. BOLT
20. CLAMP
25. TUBE ASSY
30. NUT
40. BOLT
45. CLAMP
50. BRACKET
55. BOLT
60. TUBE ASSY
65. TUBE ASSY
70. TUBE ASSY
75. NUT
80. NUT
85. WASHER
90. SEAL
95. BOLT
105. WASHER
110. SEAL
115. TEMPERATURE BULB
120. PACKING
130. ELBOW
135. PACKING
145. NUT
150. ELBOW
155. PACKING
165. NUT
170. BOLT
175. ELBOW
180. METAL GASKET
185. CAP
190. ELBOW
195. PACKING
205. NUT
210. BOLT
220. OIL TANK ASSY

1. E. (4) Remove tube and hose assemblies and attaching parts from input housing, oil tank assembly, and anti-ice valve.

(5) Remove caps, plugs, bolts, elbows, and separator assembly. (See figure 202.)

(6) Lift filler cap off oil tank assembly, remove chain links and chain.

(7) Remove dipstick and gasket from filler cap.

(8) Remove screen assembly.

(9) Remove bolts, washers, nut, and support securing oil tank assembly to input housing assembly. Remove oil tank assembly.

(10) Remove oil to fuel cooler and packings.

R F. (Codes CA-CC, HA) Install Oil Tank Assembly and Plumbing (See Figures 202, 204)

NOTE: Lightly coat new packings with clean engine oil or lubricant (OS-124) prior to installation unless otherwise specified. Apply lubricating compound (Liqui-Moly, Grade NV) to threads of bolts or screws and apply clean engine oil to threads (except first two threads) of male plumbing fittings located forward of the compressor housing unless otherwise specified.

R Refer to 70-00-00, STANDARD PRACTICES, for recommended
R general torque values. Add frictional drag (run-down)
R torque of self locking devices to recommended values.

(1) Install screen assembly into oil tank assembly. (See figure 202.)

(2) Install gasket and dipstick onto filler cap.

(3) Install assembled filler cap into oil tank assembly and secure with chain links and chain.

(4) Install plug, with new packing, into oil tank assembly. Tighten plug (50) to 220 to 240 inch-pounds torque and lockwire.

(5) Install bolt and elbow, with metal gaskets, into oil tank assembly. Tighten bolt (30) to 120 to 130 inch-pounds torque and lockwire. Install cap onto elbow. Tighten cap (25) to 190 to 220 inch-pounds torque and lockwire.

R 1. F. (6) (Codes CA-CC) Install elbow, with new packing, into oil tank assembly and secure with nut. Tighten nut (175) to 175 to 185 inch-pounds torque.

(7) Install elbow and bolts, with metal gaskets, into oil tank assembly. Tighten bolt (180) to 65 to 70 inch-pounds torque and lockwire.

(8) Install separator assembly, with new packing, into oil tank assembly. Tighten separator assembly (140) to 295 to 315 inch-pounds torque.

(9) Install support onto engine and secure with bolt and washer. Tighten bolt (80) to 75 inch-pounds torque.

(10) Install oil-to-fuel cooler, with new packings, into oil tank assembly and secure with bolts. Tighten bolts (210) to 30 inch-pounds torque. (See figure 204.)

R (11) (Codes CA-CC) Install oil tank assembly onto input housing assembly and secure with washers, bolts, and nut. Tighten bolts (81, figure 202) to 75 inch-pounds torque. Tighten nut (70) to 50 inch-pounds torque.

R (12) (Code HA) Install oil tank assembly onto input housing assembly and secure with washers, bolts, and nut. Tighten bolt (82, figure 202) to 70 inch-pounds torque. Tighten bolt (84) to 75 inch-pounds torque. Tighten nut (70) to 50 inch-pounds torque.

R (13) (Code HA) Install bracket on oil-to-fuel cooler assembly and secure with bolt. Tighten bolt (55, figure 204) to 30 inch-pounds torque.

(14) Install hose, with new seals, between input housing assembly and oil tank assembly, and secure with washers, bolts, and nuts. Tighten nuts (75, 80) to 20 inch-pounds torque and lockwire. Tighten bolts (95) to 25 inch-pounds torque and lockwire.

NOTE: Oil temperature bulb (115) is supplied with a metal washer. Discard washer and use packing (120).

(15) Install oil temperature bulb, with new packing, into hose. Tighten oil temperature bulb (115) to 65 inch-pounds torque and lockwire.

(16) Lightly coat new packing (135) with clean engine fuel or lubricant (OS-124) and install onto elbow. Install elbow with packing into anti-ice valve and secure with nut. Tighten nut (145) to 65 to 70 inch-pounds torque.

1\. F. (17) Install tube assembly between FUEL IN port of oil-to-fuel cooler assembly, and elbow in anti-ice valve.

(18) Install cap onto FUEL OUT port of oil-to-fuel cooler assembly. Tighten cap (135, figure 202) to 140 to 160 inch-pounds torque.

(19) Install elbow and bolt, with metal gaskets, or elbow, with new packing, into input housing assembly. Tighten bolt (170) to 65 to 70 inch-pounds torque and lockwire, or tighten nut (165) to 50 to 55 inch-pounds torque. (See figure 204.)

R (20) (Codes CA-CC) Install tube assembly between elbows in oil tank assembly and input housing assembly. Install bolt and clamp. Tighten bolt (15) to 25 inch-pounds torque.

R (21) (Code HA) Install tube assembly between elbows in oil tank assembly and input housing assembly. Install clamp, bolt, and nut onto bracket. Tighten nut (30) to 20 inch-pounds torque.

(22) Install elbow, with new packing, into intermediate housing assembly and secure with nut. Tighten nut (205) to 175 to 185 inch-pounds torque. Install cap onto elbow. Tighten cap (185) to 300 to 350 inch-pounds torque and lockwire.

(23) Connect aircraft connections to oil tank assembly, if applicable.

(24) Fill oil tank assembly to proper level with clean engine oil. Refer to 72-00-00, GENERAL - SERVICING.

2\. Inspection/Check

A. Inspect Oil Tank Assembly

(1) Check tank assembly for cracks, dents, or evidence of leakage.

(2) Check separator assembly for cracks or dents.

(3) Check screen assembly for damaged screen.

(4) Check oil-to-fuel cooler for cracks, dents, or evidence of fuel leakage.

(5) Check hose or tube assembly for cracks, ruptures, or chaffing.

(6) Inspect threaded parts for stripped, galled, or peened threads.

(7) Inspect oil temperature bulb for burned, bent, or broken pins.

(8) Visually inspect oil temperature bulb for cracks, damage, corrosion, or contamination that would affect temperature sensing.

2. A. (9) Check resistance across pins of temperature bulb electrical connector. Resistance shall be 100 +0.4/-0.4 ohms with bulb temperature at room ambient.

(10) Replace part that does not meet Inspection/Check requirements.

3. Cleaning/Painting

A. Clean Parts

(1) Clean all standard metallic hardware. Refer to 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 1 or 2.

(2) Clean oil tank assembly and oil-to-fuel cooler assembly. Refer to 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 1 or 2.

(3) Clean oil temperature bulb. Refer to 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 11.

(4) Clean all fittings and plumbing. Refer to 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 12.

DISTRIBUTION (OIL) - DESCRIPTION AND OPERATION

1. Oil Filter and Adapter Assembly

   The oil filter element is a ten micron filter element enclosed in a metal housing and functions to filter all oil entering the oil system from the oil pressure pump.

2. Oil Filter By-Pass Valve

   The oil filter by-pass valve is located on the upper right side of the input housing assembly and is connected in parallel with the oil filter. Should an excessive accumulation of impurities clog the oil filter to the extent that the pressure drop across the filter exceeds 55 to 70 pounds per square inch, the normally closed by-pass valve will crack open, allowing oil to by-pass the filter to avoid possible bearing starvation. When the oil filter by-pass valve is in the by-pass condition, an indicator pin will extend from the oil filter by-pass valve flange.

3. Oil Pressure Regulator Valve Assembly

   The oil pressure regulator valve assembly is located on the upper right side of the input housing assembly below the oil filter by-pass valve and regulates oil pressure in the lubrication system.

4. Oil Vent Valve

   The oil vent valve is mounted on the front face of the reduction gear section and is electrically actuated. The oil vent valve allows air to enter the pressure pump and the two main oil scavenge pumps during starts. This unloads the pumps, reducing the load on the engine. The valve is actuated automatically from zero to 50 percent engine speed during normal ground starts.

5. Oil Pump Suction Tube

   The oil pump suction tube located in the output gearbox housing returns oil to the scavenge pump.

6. Rear Turbine Bearing Oil Line Assembly

   The rear turbine bearing oil tube assembly is an externally mounted tube which connects the oil supply to the rear turbine bearing.

OIL FILTER AND ADAPTER - MAINTENANCE PRACTICES

1. Removal/Installation

NOTE: Table 201 povides a list of all materials and compounds required to perform Removal/Installation.

Table 201. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Alternate packing lubricant Lubricant (OS-124)	Monsanto Company, 800 N Lindbergh Blvd, St. Louis, MO 63166
Any approved engine oil	Commercially available

A. Remove Oil Filter and Adapter (See Figure 201)

NOTE: Do not remove adapter if removal of filter element only is required. If filter element is broken or damaged on removal, ensure that all particles are removed from oil filter adapter.

(1) Remove bushing and cover. Remove oil filter element.

B. Install Oil Filter and Adapter (See Figure 201)

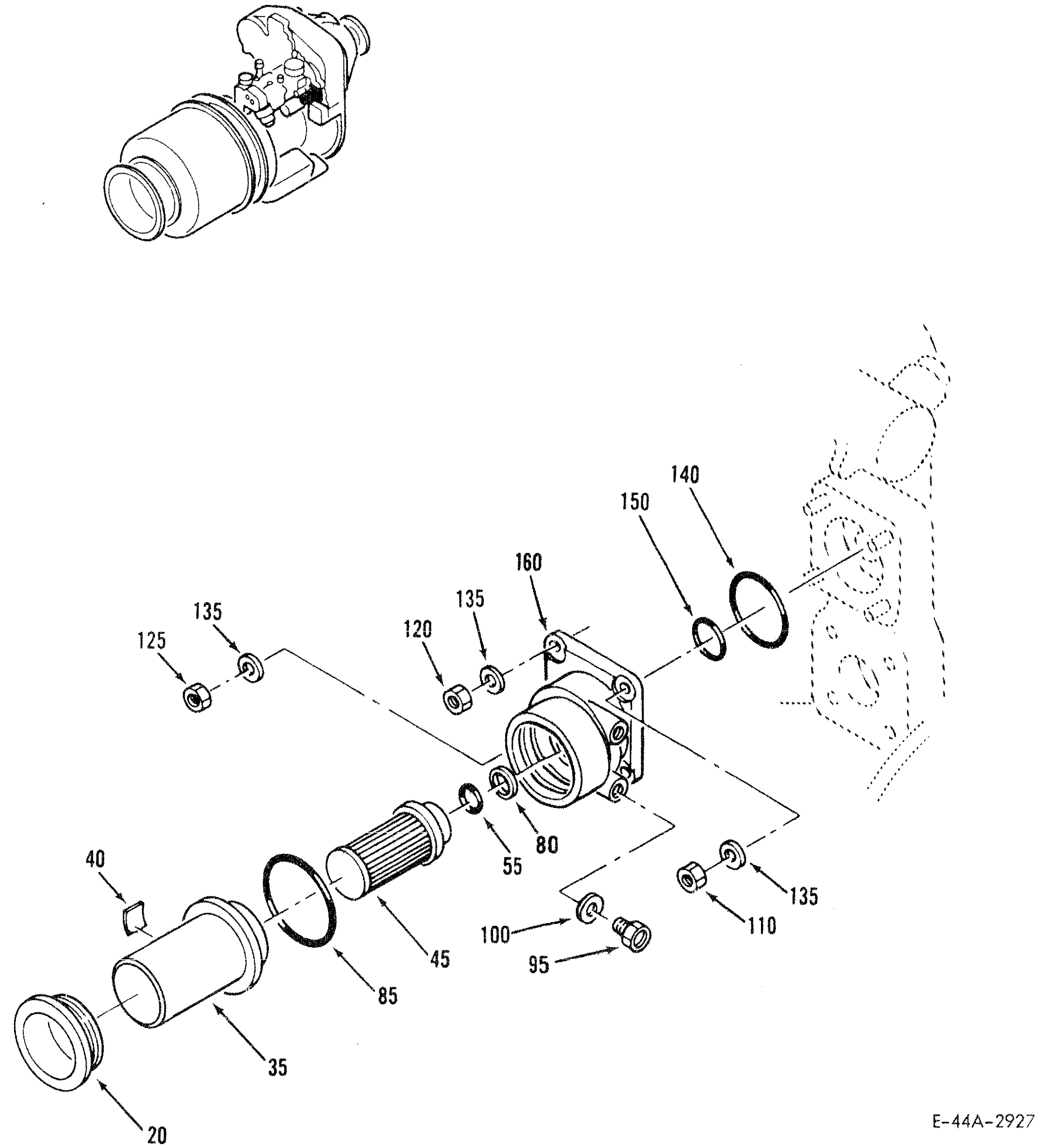
NOTE: Lightly coat new gaskets with clean engine oil or lubricant (OS-124) prior to installation.

R Refer to 70-00-00, STANDARD PRACTICES, for recommended
R general torque values. Add frictional drag (run-down)
R torque of self locking devices to recommended values.

(1) Install new packings onto adapter, oil filter element, and cap assembly.

NOTE: Adapter must be tightened evenly to prevent warpage and damage that may cause leakage.

(2) Install adapter onto input housing assembly and secure with washers and nuts. Tighten nuts (110, 120, 125) to 50 inch-pounds torque.



R 20.	BUSHING (IPC FIG. 115)	100.	GASKET
35.	CAP	110.	NUT
40.	DECAL	120.	NUT
45.	OIL FILTER ELEMENT	125.	NUT
55.	PACKING	135.	WASHER
80.	WASHER (TEFLON)	140.	PACKING
85.	PACKING	150.	PACKING
95.	PLUG AND BLEEDER	160.	ADAPTER

Oil Filter and Adapter Installation
Figure 201

1. A. (3) (Code BA) Install new packing on plug and bleeder. Install plug and bleeder. Tighten plug and bleeder (95) to 40 to 45 inch-pounds torque.

NOTE: Ensure that teflon washer is installed on filter nipple in adapter to prevent metal-to-metal contact between filter element and adapter.

(4) Install washer and oil filter element into adapter.

(5) Install cap over oil filter element and secure with bushing. Tighten bushing (20) hand tight and lockwire.

2. Inspection/Check

A. Inspect Oil Filter and Adapter

(1) Inspect oil filter element for tears, breaks, or distortion. Replace contaminated or damaged filter element.

(2) Inspect adapter for cracks, distortion, stripped, peened, or galled threads, or evidence of oil leakage.

(3) Inspect cap for cracks, dents, or obvious damage.

(4) Inspect bushing for stripped, peened, or galled threads.

(5) Replace part that does not meet Inspection/Check requirements.

3. Cleaning/Painting

A. Clean Parts

(1) Clean all standard metallic hardware. Refer to 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 1 or 2.

(2) Clean adapter, cap, and bushing. Refer to 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 1.

FILTER BY-PASS VALVE ASSEMBLY - MAINTENANCE PRACTICES

1. Removal/Installation

NOTE: Table 201 provides a list of all materials and compounds required to perform Removal/Installation.

Table 201. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Alternate packing lubricant Lubricant (OS-124)	Monsanto Company, 800 N Lindbergh Blvd, St. Louis, MO 63166
Any approved engine oil	Commercially available
Lubricating compound (Liqui-Moly, Grade NV)	Lockrey Co, Lubricants Div, Cedar Shores, Southampton, NY 11968

A. Remove Filter By-Pass Valve Assembly (See Figure 201)

B. Install Filter By-Pass Valve Assembly (See Figure 201)

NOTE: Lightly coat new packings with clean engine oil or lubricant (OS-124) prior to installation unless otherwise specified. Apply lubricating compound (Liqui-Moly, Grade NV) to threads of bolts and screws prior to installation unless otherwise specified.

(1) Install filter by-pass valve assembly, with new packings, into input housing assembly, and secure with washer, screw, or bolt.

(2) Tighten bolt (5) to 40 inch-pounds torque.

2. Inspection/Check

R A. Inspect Filter By-Pass Valve Assembly

R (1) Check filter by-pass valve assembly for cracks, dents, evidence of
R leakage, or obvious damage.

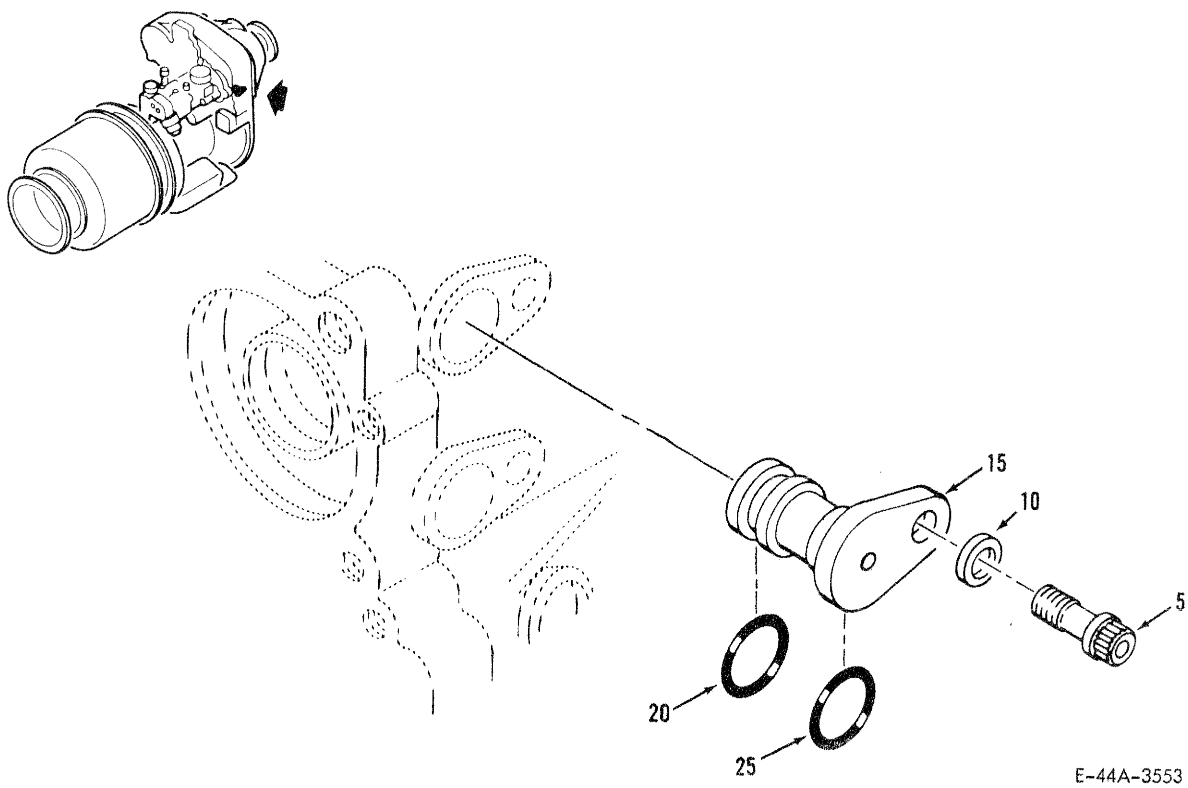
R (2) Replace part that does not meet Inspection/Check requirements.

3. Cleaning/Painting

A. Clean Parts

(1) Clean all parts. Refer to 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 1.

R



R 5. BOLT (IPC FIG. 118)
R 10. WASHER
R 15. FILTER BY-PASS VALVE ASSY
20. PACKING
25. PACKING

Oil Filter By-Pass Valve Installation
Figure 201

OIL PRESSURE REGULATOR VALVE ASSEMBLY - MAINTENANCE PRACTICES

1. Removal/Installation

NOTE: Table 201 provides a list of all materials and compounds required to perform Removal/Installation.

Table 201. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Alternate packing lubricant Lubricant (OS-124)	Monsanto Company, 800 N Lindbergh Blvd, St. Louis, MO 63166
Any approved engine oil	Commercially available
Lubricating compound (Liqui-Moly, Grade NV)	Lockrey Co, Lubricants Div, Cedar Shores, Southampton, NY 11968

A. Remove Oil Pressure Regulator Valve Assembly (See Figure 201)

B. Install Oil Pressure Regulator Valve Assembly (See Figure 201)

NOTE: Lightly coat new packings with clean engine oil or lubricants (OS-124) prior to installation unless otherwise specified. Apply lubricating compound (Liqui-Moly, Grade NV) to threads of bolts and screws prior to installation unless otherwise specified.

(1) Install oil pressure regulator valve assembly, with new packings, into input housing assembly, and secure with washer, screw, or bolt.

(2) Tighten screw (10) to 70 inch-pounds torque.

2. Inspection/Check

R A. Inspect Oil Pressure Regulator Valve Assembly

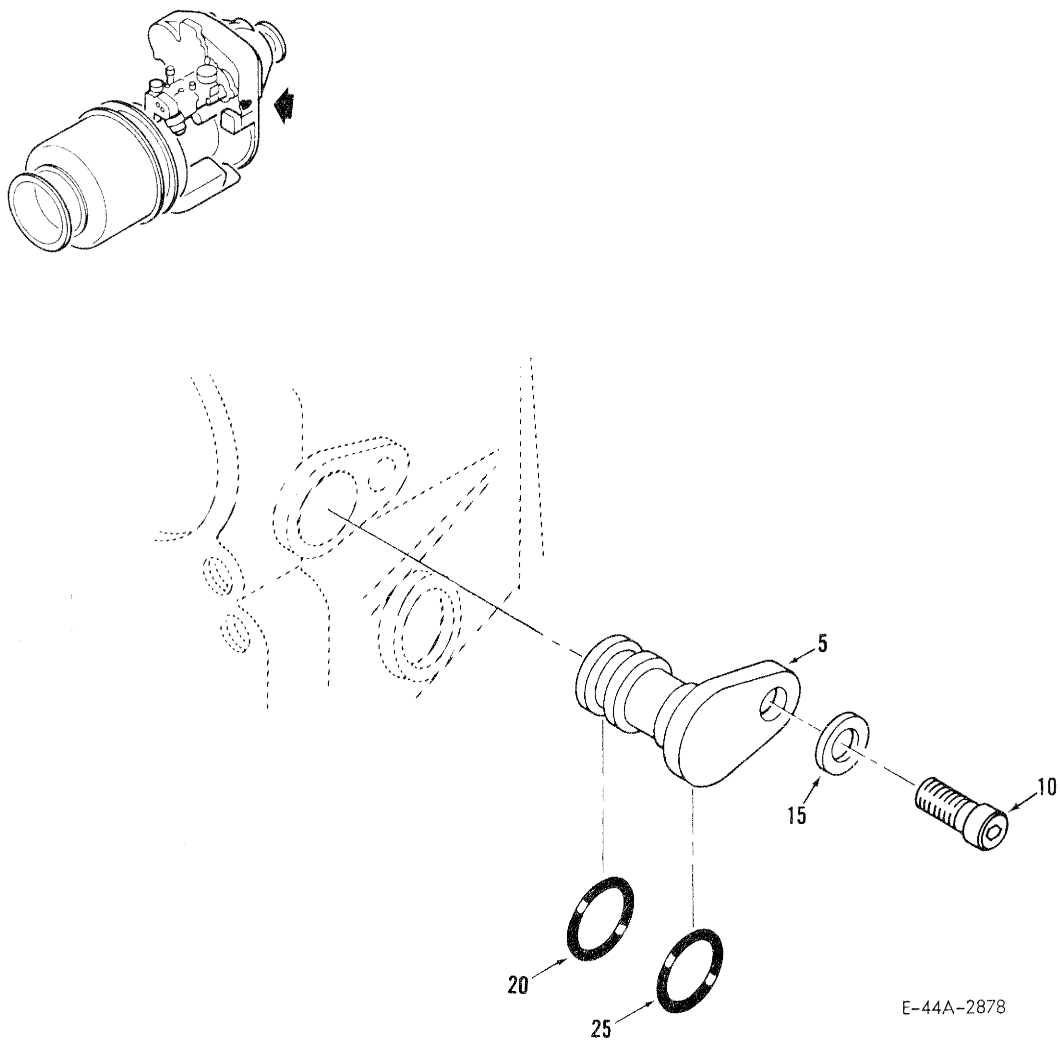
(1) Check oil pressure regulator valve assembly for cracks, dents, evidence of leakage, or obvious damage.

(2) Replace part that does not meet Inspection/Check requirements.

3. Cleaning/Painting

A. Clean Parts

(1) Clean all parts. Refer to 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 1.



5. PRESSURE REGULATOR VALVE ASSY (IPC FIG. 117)	15. WASHER
10. SCREW	20. PACKING
	25. PACKING

Oil Pressure Valve Assembly Installation
Figure 201

OIL VENT VALVE - MAINTENANCE PRACTICES

1. Removal/Installation

NOTE: Table 201 provides a list of all materials and compounds required to perform Removal/Installation.

Table 201. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Alternate packing lubricant Lubricant (OS-124)	Monsanto Company, 800 N Lindbergh Blvd, St. Louis, MO 63166
Any approved engine oil	Commercially available
Lubricating compound (Liqui-Moly, Grade NV)	Lockrey Co, Lubricants Div, Cedar Shores, Southampton, NY 11968

A. Remove Oil Vent Valve and Fittings (See Figure 201)

NOTE: Procedures are provided for complete disassembly and reassembly of the oil vent valve and components. However, the disassembly shall be to the extent required for the maintenance being accomplished.

(1) Disconnect aircraft wiring harness assembly. Refer to Aircraft Maintenance Manual.

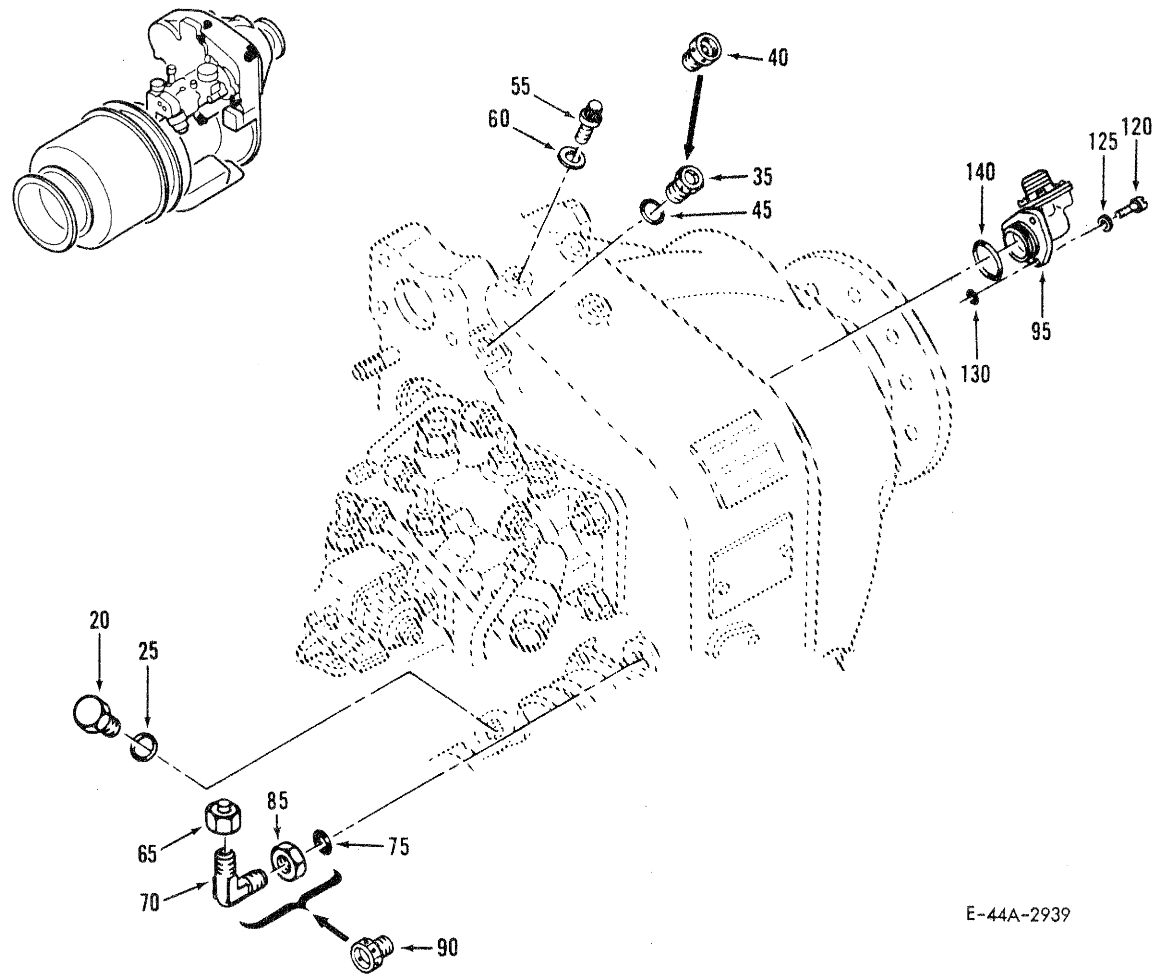
(2) Remove oil vent valve and packings.

(3) Remove bolt and washer.

(4) Remove plug and bleeder and gasket.

R (5) (Codes BA-EA, GA-KA) Remove cap and elbow.

R (6) (Codes AA-AC, FA, LA) Remove plug and bleeder.



R 20. PLUG AND BLEEDER (IPC FIG. 116)	75. PACKING
25. PACKING	85. NUT
35. PLUG AND BLEEDER	90. PLUG AND BLEEDER
40. PLUG	95. SOLENOID VALVE
45. PACKING	120. SCREW
55. BOLT	125. WASHER
60. WASHER	130. PACKING
65. CAP	140. PACKING
70. ELBOW	

Oil Vent Valve and Fittings Installation
Figure 201

1. B. Install Oil Vent Valve and Fittings (See Figure 201)

NOTE: Lightly coat new packings with clean engine oil or lubricant (OS-124) prior to installation unless otherwise specified. Apply lubricating compound (Liqui-Moly, Grade NV) to threads of bolts or screws and apply clean engine oil to threads (except first two threads) of male plumbing fittings located forward of the compressor housing unless otherwise specified.

(1) Install bolt and washer. Tighten bolt (55) to 25 inch-pounds torque.

(2) Install plug and bleeder with new packing. Tighten plug and bleeder (20) to 65 to 70 inch-pounds torque.

R (3) (Codes BA-EA, GA-KA) Install elbow with new packing and secure with nut. Tighten nut (85) to 50 to 55 inch-pounds torque. Install cap on elbow. Tighten cap (65) to 135 to 150 inch-pounds torque.

R (4) (Codes AA-AC, FA, LA) Install plug and bleeder with new packing. Tighten plug and bleeder (90) to 65 to 70 inch-pounds torque.

R (5) (Codes AA-BC, EA-GA, KA-LA) Install plug with new packing. Tighten plug (40) to 40 to 45 inch-pounds torque.

R (6) (Codes CA-CC, HA) Install plug and bleeder with new packing. Tighten plug and bleeder (35) to 60 to 65 inch-pounds torque.

CAUTION: ENSURE OIL VENT VALVE FLANGE IS PROPERLY SEATED AGAINST REDUCTION GEAR HOUSING. GAP OF AS MUCH AS 0.020 INCH MAY BE PRESENT. TIGHTEN MOUNTING SCREWS EVENLY TO PREVENT DAMAGE TO OIL VENT VALVE FLANGE.

(7) Install oil vent valve, with new packings, and secure with washers and screws. Tighten screws (120) to 11 inch-pounds torque.

(8) Connect aircraft wiring harness assembly. Refer to Aircraft Maintenance Manual.

2. Adjustment/Test

A. Test Oil Vent Valve Operation

(1) Apply 24 volts dc across pins A and B of valve electrical connector. Valve shall open.

(2) Remove voltage. Valve shall open.

3. Inspection/Check

A. Inspect Oil Vent Valve

(1) Check body of oil vent valve for cracks, breaks, evidence of leakage, or obvious damage.

(2) Check electrical connector for bent, broken, or burned pins.

B. Inspect Threaded Parts

(1) Inspect threaded parts for stripped, galled, or peened threads.

(2) Replace part that does not meet Inspection/Check requirements.

4. Cleaning/Painting

A. Clean Parts

(1) Clean all fittings. Refer to 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 12.

(2) Clean oil vent valve. Refer to 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 11.

OIL PUMP SUCTION TUBE - MAINTENANCE PRACTICES

1. Removal/Installation

NOTE: Table 201 provides a list of all materials and compounds required to perform Removal/Installation.

Table 201. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Alternate packing lubricant Lubricant (OS-124)	Monsanto Company, 800 N Lindbergh Blvd, St. Louis, Mo 63166
Any approved engine oil	Commercially available
Lubricating compound (Liqui-Moly, Grade NV)	Lockrey Co, Lubricants Div, Cedar Shores, Southampton, NY 11968

A. Remove Oil Pump Suction Tube (See Figure 201)

(1) Remove bolts and washers.

(2) Remove oil pump suction tube and packings.

B. Install Oil Pump Suction Tube (See Figure 201)

NOTE: Lightly coat new packings with clean engine oil or lubricant (OS-124) prior to installation unless otherwise specified. Apply lubricating compound (Liqui-Moly, Grade NV) to threads of bolts and screws prior to installation unless otherwise specified.

(1) Install oil pump suction tube, with new packings, into housing and secure with bolts and washers. Tighten bolts (75) to 25 inch-pounds torque.

2. Inspection/Check

A. Inspect Oil Pump Suction Tube

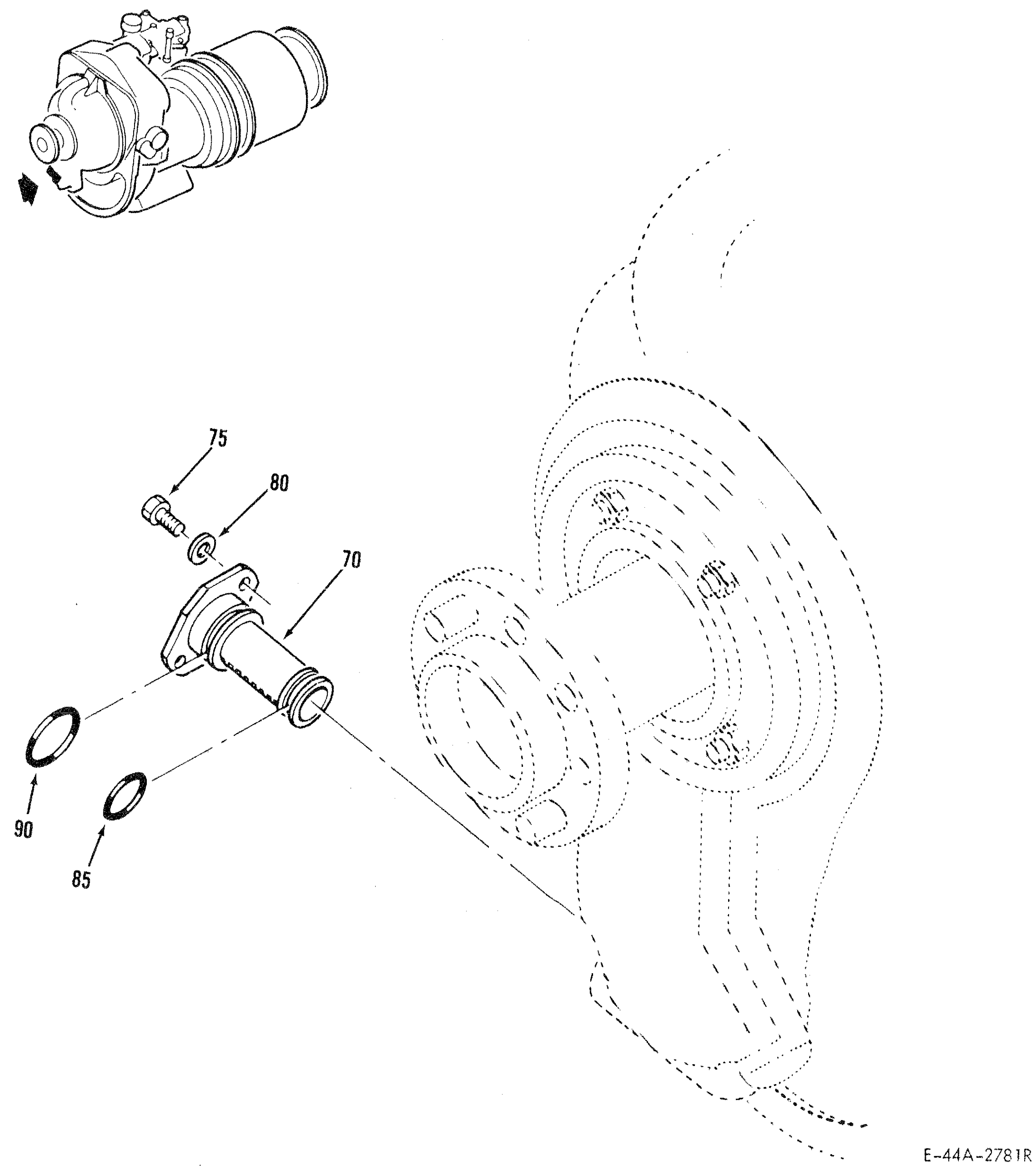
(1) Inspect oil pump suction tube for cracks, dents, evidence of leakage, or obvious damage.

3. Cleaning/Painting

A. Clean Parts

(1) Clean all parts. Refer to 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 1 or 2.

R



R 70. OIL PUMP SUCTION TUBE
R (IPC FIG. 130)
R 75. BOLT
80. WASHER
85. WASHER
90. PACKING

Oil Pump Suction Tube Installation
Figure 201

REAR TURBINE BEARING OIL LINE - MAINTENANCE PRACTICES

1. Removal/Installation

NOTE: Table 201 provides a list of all materials and compounds required to perform Removal/Installation.

Table 201. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Alternate packing lubricant Lubricant (OS-124)	Monsanto Company, 800 N Lindbergh Blvd, St. Louis, MO 63166
Any approved engine oil	Commercially available
High temperature compound (Fel-Pro C5-A)	Fel-Pro Inc, Div of Fel Products Mfg Co, 7450 N McCormick Blvd, Skokie, IL 60076
Lubricating compound (Liqui-Moly, Grade NV)	Lockrey Co, Lubricants Div, Cedar Shores, Southampton, NY 11968

R A. (Codes AA-AC, FA, HA, LA) Remove Rear Turbine Bearing Oil Line (See Figure 201)

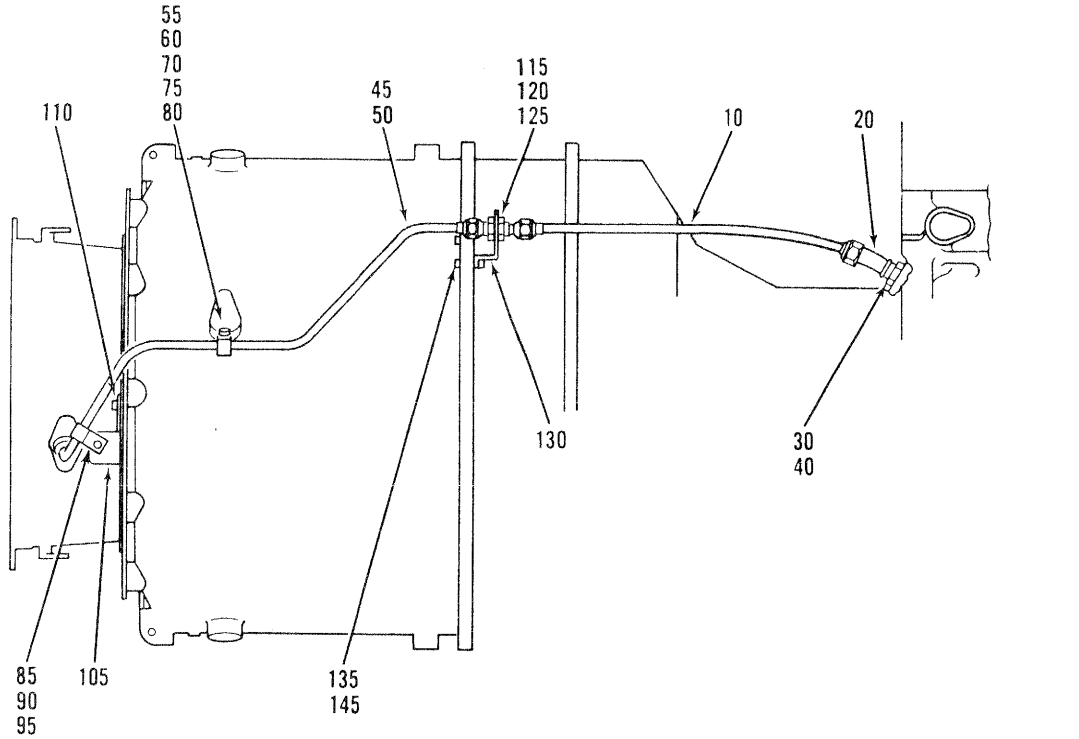
(1) Remove aft tube assembly and attaching parts.

(2) Remove forward tube assembly and attaching parts.

(3) (Post SB79-0005) Remove bracket from turbine plenum.

(4) Remove nut, bolt and bracket from engine flange.

(5) Remove elbow from input housing assembly.



R 10. TUBE ASSY (IPC FIG. 38)
20. ELBOW
30. GASKET
40. NUT
45. TUBE ASSY
50. TUBE ASSY
55. BOLT
60. CLAMP
70. NUT
75. BOLT
80. BRACKET
85. NUT
90. BOLT
95. CLAMP
105. BRACKET
110. BOLT
115. NUT
120. WASHER
125. UNION
130. BRACKET
135. NUT
145. BOLT

R (Codes AA-AC, FA, HA, LA) Rear Turbine Bearing
Plumbing Installation
Figure 201

R 1. B. (Codes AA-AC, FA, HA, LA) Install Rear Turbine Bearing Oil Line (See Figure 201)

NOTE: Lightly coat new packings with clean engine oil or lubricant (OS-124) prior to installation unless otherwise specified. Apply lubricating compound (Liqui-Moly, Grade NV) to threads of bolts or screws, and apply clean engine oil to threads (except first two threads) of male plumbing fittings located forward of the fireshield unless otherwise specified. Apply high temperature compound (Fel-Pro C5-A) to threads of bolts and screws and to threads (except first two threads) of male plumbing fittings located aft of the fireshield unless otherwise specified.

R Refer to 70-00-00, STANDARD PRACTICES, for recommended
R general torque values. Add frictional drag (run-down)
R torque of self locking devices to recommended values.

(1) Install elbow, with new gasket, into input housing assembly and secure with nut. Tighten nut (40) to 50 to 55 inch-pounds torque.

(2) Install bracket onto engine flange and secure with bolt and nut. Tighten nut (135) to 50 inch-pounds torque.

(3) Install union and washers onto bracket and secure with nut. Tighten nut (115) to 50 to 55 inch-pounds torque.

(4) Install tube assembly between union and elbow in input housing assembly.

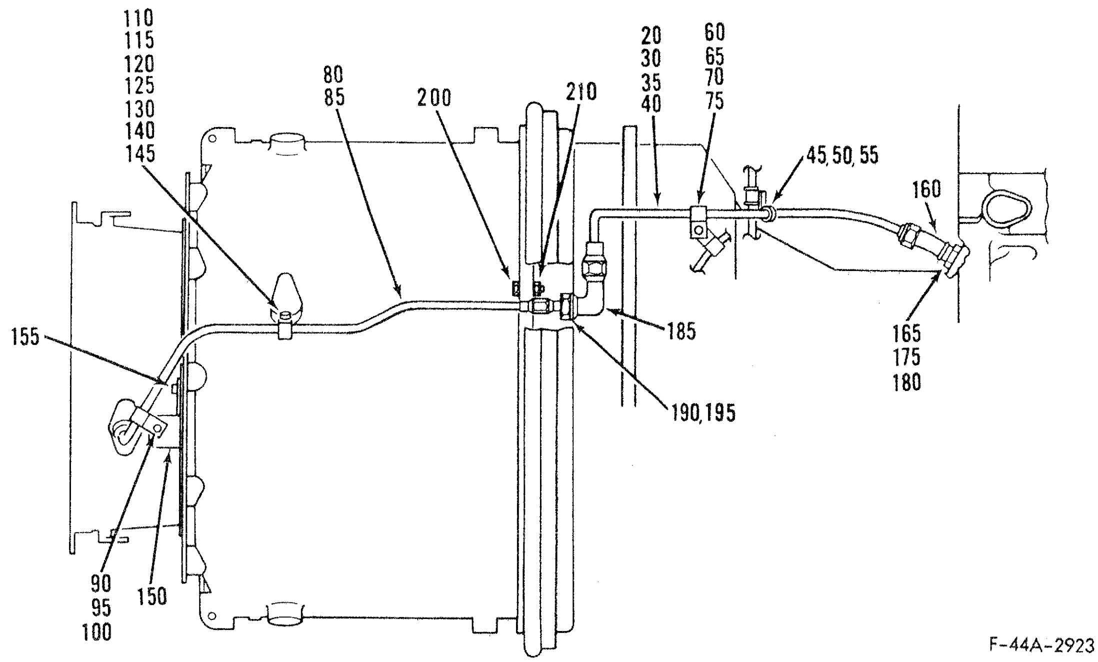
(5) (Post SB79-0005) Install bracket onto turbine plenum and secure with bolts. Tighten bolts (110) to 80 inch-pounds torque.

(6) Install tube assembly between union in bracket on engine flange and oil inlet tube.

(7) (Post SB79-0005) Secure tube assembly with clamp, bolt and nut. Tighten nut (85) to 20 inch-pounds torque.

R (8) (Code HA) Secure tube assembly with bolt and clamp. Tighten bolt (55) to 25 inch-pounds torque.

R (9) (Codes AA-AC, FA, LA) Install bracket onto engine and secure with bolt. Tighten bolt (55) to 25 inch-pounds torque. Secure tube assembly to bracket with clamp bolt and nut. Tighten nut (70) to 20 inch-pounds torque.



R 20.	TUBE ASSY (IPC FIG. 39)	115.	BOLT
30.	TUBE ASSY	120.	WASHER
35.	TUBE ASSY	125.	BOLT
40.	TUBE ASSY	130.	CLAMP
45.	NUT	140.	BOLT
50.	BOLT	145.	BRACKET
55.	CLAMP	150.	BRACKET
60.	NUT	155.	BOLT
65.	BOLT	160.	ELBOW
70.	CLAMP	165.	GASKET
75.	CLAMP	175.	NUT
80.	TUBE ASSY	180.	NUT
85.	TUBE ASSY	185.	ELBOW
90.	NUT	190.	NUT
95.	BOLT	195.	WASHER
100.	CLAMP	200.	BOLT
110.	NUT	210.	NUT

R (Codes BA-EA, GA, KA) Rear Turbine Bearing
Plumbing Installation
Figure 202

R 1. C. (Codes BA-EA, GA, KA) Remove Rear Turbine Bearing Oil Line (See Figure
R 202)

R (1) Remove aft tube assembly and attaching parts.

R (2) Remove forward tube assembly and attaching parts.

R (3) (Post SB79-0005) Remove bracket from turbine plenum.

R (4) Remove elbow, bolt, and nut from fireshield.

R (5) Remove elbow from input housing assembly.

NOTE: Lightly coat new packings with clean engine oil or lubricant (OS-124) prior to installation unless otherwise specified. Apply lubricating compound (Liqui-Moly, Grade NV) to threads of bolts or screws, and apply clean engine oil to threads (except firt two threads) of male plumbing fittings located forward of the fireshield unless otherwise specified. Apply high temperature compound (Fel-Pro-C5-A) to threads of bolts and screws, and to threads (except first two threads) of male plumbing fittings located aft of the fireshield unless otherwise specified.

R Refer to 70-00-00, STANDARD PRACTICES, for recommended
R general torque values. Add frictional drag (run-down)
R torque of self locking devices to recommended values.

R D. (Codes BA-EA, GA, KA) Install Rear Turbine Bearing Oil Line (See Figure 202)

(1) Install elbow, with new gasket, into input housing assembly and secure with nut. Tighten nut (175 or 180) to 50 to 55 inch-pounds torque.

(2) Install elbow, with washers, into fireshield and secure with nut. Tighten nut (190) to 50 to 55 inch-pounds torque.

(3) Install tube assembly between elbows in input housing assembly and fireshield. Install clamps, bolt, and nut. Tighten nut (45) to 20 inch-pounds torque, or tighten nut (60) to 20 inch-pounds torque.

R (4) (Codes BA-BC, EA, GA, KA) Install bolt and nut into fireshield. Tighten bolt (200) to 60 inch-pounds torque.

1. D. (5) Install tube assembly between elbow in fireshield and oil inlet tube and lockwire both ends. Install bracket onto turbine plenum and secure with bolt. Tighten bolt (115) to 25 inch-pounds torque. Install clamp, bolt, and nut. Tighten nut (110) to 20 inch-pounds torque.

(6) (Post SB79-0005) Install bracket onto turbine plenum and secure with bolts. Tighten bolts (155) to 80 inch-pounds torque and lockwire. Install clamp, bolt, and nut. Tighten nut (90) to 20 inch-pounds torque.

2. Inspection/Check

A. Inspect Turbine Bearing Plumbing and Attaching Parts

(1) Inspect tube assemblies for security, bends, kinks, cracks, or evidence to leakage.

(2) Inspect threaded parts for galled, stripped, or peened threads.

(3) Replace part that does not meet Inspection/Check requirements.

3. Cleaning/Painting

A. Clean Parts

(1) Clean all standard metallic hardware. Refer to 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 1 or 2.

(2) Clean all plumbing and fittings. Refer to 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 12.

INDICATION - DESCRIPTION AND OPERATION

1. Magnetic Drain Plug

The magnetic drain plug, located on the lower left front of the reduction gear section, attracts ferrous particles which may be present in the sump area. Metal particles attracted by the plug short out the insulator and provide a ground circuit, usually for a chip detector light.

MAGNETIC DRAIN PLUG - MAINTENANCE PRACTICES

1. Removal/Installation

Table 201. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Alternate packing lubricant Lubricant (OS-124)	Monsanto Company, 800 N Lindbergh Blvd, St. Louis, MO 63166
Any approved engine oil	Commercially available
Lubricating compound (Liqui-Moly, Grade NV)	Lockrey Co, Lubricants Div, Cedar Shores, Southampton, NY 11968

A. Remove Magnetic Drain Plug (See Figure 201)

NOTE: Removal of entire magnetic plug is not required for inspection. Remove knurled plug from body to inspect for metal particles.

(1) Remove plug and packings.

(2) Remove body and packing.

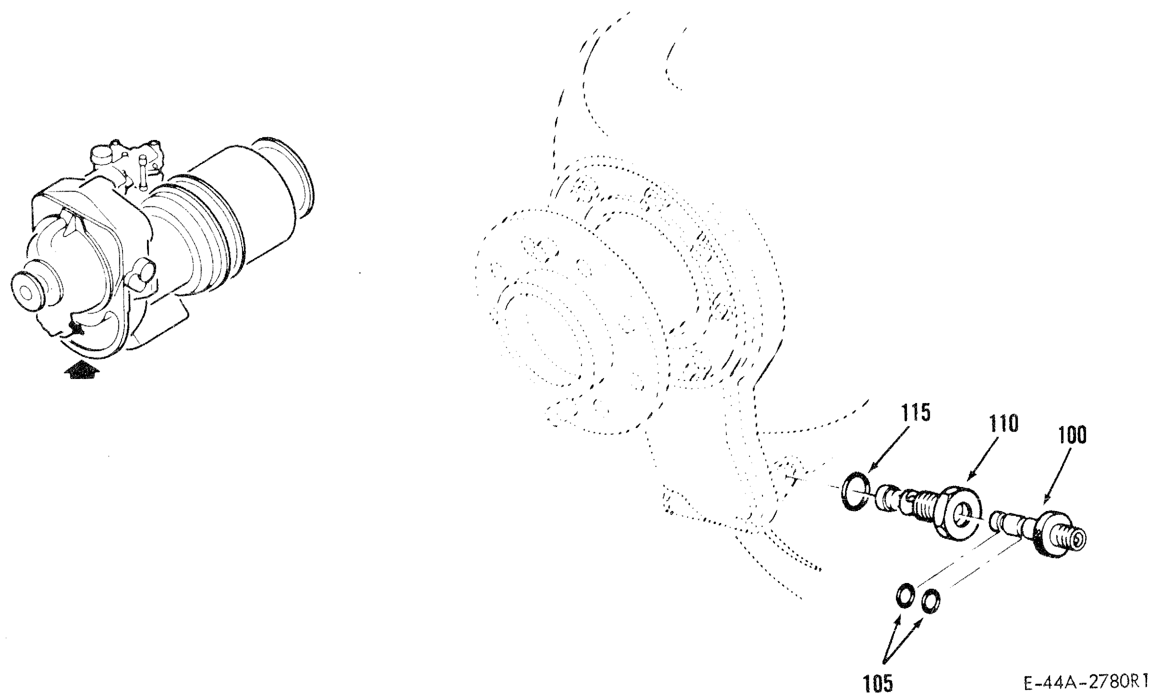
B. Install Magnetic Drain Plug (See Figure 201)

NOTE: Lightly coat new packings with clean engine oil or lubricant (OS-124) prior to installation unless otherwise specified, and apply lubricating compound (Liqui-Moly, Grade NV) to threads of plug and body, prior to installation.

(1) Install body, with new packing, into output housing assembly. Tighten body (110) to 75 inch-pounds torque.

(2) Install plug, with new packings, into body.

R



R 100. MAGNETIC PLUG (IPC FIG. 130)
R 105. PACKING
110. BODY
115. PACKING

Magnetic Drain Plug Installation
Figure 201

2. Inspection/Check

A. Inspect Magnetic Drain Plug

(1) Visually inspect plug for metal particles.

(2) Inspect body for cracks or damaged threads.

(3) Inspect electrical connector for bent, broken, or burned pin.

(4) Check resistance from pin to ground. Magnetic drain plug shall not indicate continuity to ground.

(5) Inspect body and pin for evidence of oil leakage.

(6) Replace part that does not meet Inspection/Check requirements.

3. Cleaning/Painting

A. Clean Parts

CAUTION: DO NOT CLEAN PLUG WITH CHLORINATED SOLVENT.

(1) Clean body. Refer to 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method. No. 1.

(2) Clean plug. Refer to 72-00-00, GENERAL - CLEANING/PAINTING, Cleaning Method No. 11.