TECHNICAL MANUAL

MAINTENANCE INSTRUCTIONS

ORGANIZATIONAL

POWERPLANT SYSTEMS

A-7D

VOUGHT CORPORATION
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FOREWORD

THIS MANUAL.

This technical order has descriptions and organizational maintenance for the powerplant systems of the A-7D Corsair II airplane.

Included is maintenance data on the following:

Powerplant Installation	Section I
Airflow Control System	Section II
Engine Instrument System	Section III
Engine System	Section IV
Main Fuel System	Section V
Manual Fuel System	Section VI
Temperature Limiter Amplifier System	Section VII
Ignition and Starting System	Section VIII
Oil System	Section IX
Constant Speed Drive System	Section X

Except for T.O. 1A-7D-2-1, 1A-7D-2-16, 1A-7D-2-17, and 1A-7D-2-18, this series of T.O.s present organizational system and component maintenance in a standardized manner. A table listing all A-7D organizational maintenance manuals is provided herein. Refer to T.O. 1A-7D-2-1 for an introduction to the complete series of A-7D manuals.

ARRANGEMENT AND USE OF THIS MANUAL.

The maintenance information in this manual is divided into sections, each for a major system.

In the descriptions, all major components are described and a brief explanation of their primary functions is provided. All system indicators and controls necessary to operate a system are shown and described in a control and indicator figure. Major components not covered by the control and indicator figure are in a system arrangement illustration. Controls and indicators are not normally repeated in the system arrangement figure.

A complete description of the system's operation is provided. Schematics and diagrams supplement system theory. Where a system is complex, a block diagram is used for an overview, then detailed descriptions and schematics are given. Major components of a system are listed in a components table with description of function and location.

Operational checkout paragraphs provide a means of checking the status of the system. Where reference is made to controls and indicators, decal nomenclature is shown in capital letters for all test equipment and all airplane placard (decal) switch or control positions. All airplane system controls and indicators are referred to by their descriptive title in lowercase letters. Operational checkout procedural steps, which indicate a mandatory condition or result, are followed by numbers in braces. These numbers are keyed to a system troubleshooting (malfunction) table. This table shows corrective actions if a mandatory test conditions or result is not present. The corrective actions are in order of probable cause. When corrective actions call for the replacement of more than one component, replacement should be made in order of the listing. The operational checkout is usually repeated after each replacement until acceptable performance is obtained.

Removal and installation steps are given for each system component. These procedures reference access requirements with step by step instructions on how to accomplish the task. Also provided, as applicable, are repair and parts replacement, adjustment, cleaning, draining, or lubrication, extreme environmental condition procedures, and nonroutine servicing. Routine servicing instructions are in T.O. 1A-7D-2-1.

TOOLS AND TEST EQUIPMENT REQUIRED.

Tools and test equipment required for a specific maintenance procedure are listed at the start of the procedure. The list does not include tools and equipment needed for access or common hand tools. Support equipment, such as voltmeters and multimeters, are included in the list.

REFERENCE PUBLICATIONS.

Publications generally related to subject matter herein are listed in the table of reference publications.

TIME COMPLIANCE TECHNICAL ORDERS.

Time compliance technical orders for the systems covered in this manual are listed in a table. The listing, in technical order numerical sequence, includes the basic date, title, ECP number, and date of change or revision.

LIST OF SYSTEMS MAINTENANCE MANUALS

Publication No.	Title
T.O. 1A-7D-2-1	General Information and Airframe Group
T.O. 1A-7D-2-1CL-1	General Information and Airframe Group — Ground Handling Checklist
T.O. 1A-7D-2-1CL-2	General Information and Airframe Group — Servicing Checklist
T.O. 1A-7D-2-2	Egress and Survival Systems
T.O. 1A-7D-2-2CL-1	Egress and Survival Systems Seat Removal and Installation Checklist
T.O. 1A-7D-2-3	Mechanical Accessories Systems
T.O. 1A-7D-2-4	Pneudraulic Systems
T.O. 1A-7D-2-5	Powerplant Systems
T.O. 1A-7D-2-5CL-1	Powerplant Systems — Engine Removal and Installation Checklist
T.O. 1A-7D-2-5CL-2	Power Loss/Flameout Occurrences Checklist
T.O. 1A-7D-2-5CL-3	Engine Setup Procedures Checklist — TF41-A-1, -1A, or -1B Engine
T.O. 1A-7D-2-6	Fuel System
T.O. 1A-7D-2-7	Landing Gear Systems
T.O. 1A-7D-2-7CL-1	Landing Gear Systems — Rigging Checklist
T.O. 1A-7D-2-7CL-2	Main/Nose Wheel and Tire Assembly Removal and Installation Checklist
T.O. 1A-7D-2-8	Flight Control Systems
T.O. 1A-7D-2-8CL-1	Flight Control Systems — Rigging Procedures Checklist
T.O. 1A-7D-2-9	Automatic Flight Control System
T.O. 1A-7D-2-9CL-1	Automatic Flight Control System Checklist
T.O. 1A-7D-2-10	Instrument Systems
T.O. 1A-7D-2-10CL-1	Instrument Systems Statistical Accelerometer Data Collection and Reporting Checklist
T.O. 1A-7D-2-11	Electrical Power and Lighting Systems

LIST OF SYSTEMS MAINTENANCE MANUALS — CONT

Publication No.	Title
T.O. 1A-7D-2-12	Radio Communication and Navigation Systems
T.O. 1A-7D-2-13	Armament Systems
T.O. 1A-7D-2-13CL-1	Armament Systems Checklist
T.O. 1A-7D-2-13CL-2	Accessory Installation: MER-10N, TER-9A, SUU-20 Series Dispenser, LAU-88/A, LAU-88A/A, and LAU-117/A Missile Launcher, and AERO-3B Missile Launcher Checklist
T.O. 1A-7D-2-14	Weapon Control Systems
T.O. 1A-7D-2-14CL-1	Weapon Control Systems Checklist
T.O. 1A-7D-2-14-1	AN/APQ-126(V)8 and AN/APQ-126(V)11 Radar Sets, Theory of Operation
T.O. 1A-7D-2-14-3	AN/APQ-126(V)8 and AN/APQ-126(V)11 Radar Sets, Maintenance Procedures
T.O. 1A-7D-2-14-4	AN/APQ-126(V)8 and AN/APQ-126(V)11 Radar Sets, Diagrams
T.O. 1A-7D-2-14-5	AN/AAR-48 Forward Looking Infrared (FLIR) System
T.O. 1A-7D-2-14-6	AN/AAR-48 Forward Looking Infrared (FLIR) System Wiring Diagrams
T.O. 1A-7D-2-15	Electronic Countermeasure Systems (U) (Confidential)
T.O. 1A-7D-2-16	General Wiring Data
T.O. 1A-7D-2-17	Wiring Diagrams
T.O. 1A-7D-2-18-1	Integrated Avionic Systems, Theory of Operation (Airplanes with CP-952A/ASN-91(V) Tactical Computer)
T.O. 1A-7D-2-18-2	Integrated Avionic Systems, Troubleshooting Schematics
T.O. 1A-7D-2-18-3	Integrated Avionic Systems, Debriefing
T.O. 1A-7D-2-18-4	Integrated Avionic Systems Troubleshooting, Tactical Computer/HUD/FLR/TISL/FLIR/VMS/MUX
T.O. 1A-7D-2-18-5	Integrated Avionic Systems Troubleshooting, IMS/Doppler/Radar Altimeter/PMDS/INS
T.O. 1A-7D-2-18-6	Integrated Avionic Systems, Weapon Delivery and Release Troubleshooting
T.O. 1A-7D-2-18-7	Integrated Avionic Systems Troubleshooting, HMS/ADC/AOA
T.O. 1A-7D-2-18-8	Integrated Avionic Systems Troubleshooting, Operational Test Program (Airplanes Before T.O. 1A-7-562)
T.O. 1A-7D-2-18-9	Integrated Avionic Systems, Grooming
T.O. 1A-7D-2-18-11	Integrated Avionic Systems, Theory of Operation (Airplanes with CP-1775/A Tactical Computer)

LIST OF SYSTEMS MAINTENANCE MANUALS — CONT

Publication No.	Title
T.O. 1A-7D-2-18-12	Integrated Avionic Systems Troubleshooting, Operational Test Program (Airplanes After T.O. 1A-7-562)
T.O. 1A-7D-2-19	Cross Servicing Guide for A-7D Aircraft, Corsair II
T.O. 1A-7D-2-20	Testing and Troubleshooting Transmission Lines, Coaxial Cables, and Antennas

REFERENCE PUBLICATIONS

Publication No.	Title
T.O. 00-25-186	Local Manufacture of Non-Source Coded Items
T.O. 00-110N-11	Handling, Storage, and Disposal of Krypton 85 Radioactive Source
T.O. 1-1-1	Cleaning of Aerospace Equipment
T.O. 1-1-2	Corrosion Prevention and Control for Aerospace Equipment
T.O. 1-1A-8	Engineering Manual Series, Aircraft and Missile Repair, Structural Hardware
T.O. 1-1A-14	Installation Practices, Aircraft Electric and Electronic Wiring
T.O. 1A-7D-06	Work Unit Code Manual
T.O. 1A-7D-2-5CL-1	Powerplant Systems — Engine Removal and Installation Checklist
T.O. 1A-7D-2-5CL-2	Power Loss/Flameout Occurrences Checklist
T.O. 1A-7D-2-5CL-3	Engine Setup Procedures Checklist — TF41-A-1, -1A, or -1B Engine
T.O. 1A-7D-3	Structural Repair Instructions
T.O. 1A-7D-4-1	Illustrated Parts Breakdown Introduction
T.O. 1A-7D-6	Inspection Instructions Aircraft Scheduled Inspection and Maintenance Requirements
T.O. 1A-7D-6CL-1	Functional Check Flight Checklist
T.O. 2J-TF41-4	Illustrated Parts Breakdown, Turbofan Engine
T.O. 2J-TF41-6	Maintenance Instructions, Turbofan Engine
T.O. 33A1-13-94-1	Operation and Service Instructions, Vibration Analyzer P/N 1784471 and -901
T.O. 33D2-6-105-1	Operation and Service Instructions, Synchro Instrument Field Test Set, P/N 13819-2-A, Type No. TTU23/E

REFERENCE PUBLICATIONS — CONT

Publication No.	Title
T.O. 33D4-6-262-1	Operation and Service Instructions, Automatic Jetcal Engine Trimmer
T.O. 33D4-6-396-1	Operation and Service Instructions with Illustrated Parts Breakdown, Engine Limiter Test Set P/N 6872340
T.O. 33D4-6-467-1	Operation and Service Instructions with Illustrated Parts Breakdown, Engine Limiter Test Set, P/N 6872929
T.O. 33D7-3-117-2	Maintenance Instructions with Calibration Procedures and Illustrated Parts Breakdown, Air Data Simulator, SM-565A/ASM
T.O. 42E1-1-1	Aerospace Hose Assemblies

RECORD OF TIME COMPLIANCE TECHNICAL ORDERS

T.O. number	Date	Title	Change/revision date
1A-7-530	15 Mar 1988	Installation of Forward Looking Infrared System on A-7 Aircraft (ECP 622)	15 Nov 1986
1A-7-551	15 Feb 1989	Installation of Starter Battery System in A-7 Aircraft	15 Oct 1988
1A-7-562		Installation of Ring Laser Gyro Inertial Navigation System on A-7D/K Aircraft	15 Oct 1989
1A-7-596	18 Mar 1989	Replacement of A-7 Nucleonic Oil Quantity Indicating System (NOQIS)	1 Mar 1990
2J-TF41-643		Installation of Remote Magnetic Chip Detector System, TF41-A-1	15 Dec 1988

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SECTION I

POWERPLANT INSTALLATION

1-1. DESCRIPTION.

1-1.1. Powerplant Installation. The powerplant installation consists of a TF41-A-1, -1A, and -1B engine, air inlet extension, airframe to engine mounts (figure 1-1), tailpipe, engine drainage system, and engine control adapter. For a detail description of the TF41-A-1, -1A, and -1B engines, refer to paragraph 4-1.

1-1.1.1. Air Inlet Extension. The air inlet extension is a metal and fiberglass unit bolted to the front flange of the low pressure compressor. A metal seal bumper on the extension contacts the air inlet duct seal and forms an air seal between the duct and engine. The extension houses the T1 thermocouple and T1 phial probes and delivers air to the compressor through the air inlet duct.

1-1.1.2. Airframe Mounts. The intermediate compressor case is the main structural member of the engine. This case contains the right and left trunnion mounts which transfer all thrust loads to the airframe. In addition, the left trunnion accepts all radial expansion loads. A retaining plate over each mount prevents the bearings from falling out when the engine is not installed. The plates are removed when the engine is installed. The aft mount is for support only and carries no thrust loads to the airframe.

1-1.1.3. Tailpipe. The tailpipe is a reinforced, round, tapered welded sheet metal unit approximately 6 feet in length. The tailpipe bolts to the aft end of the engine at the turbine exhaust case.

1-1.1.4. Engine Drainage System. The engine drainage system (figure 1-2) provides overboard drainage for the engine and accessories. A residual fuel holding tank holds drainage from the high pressure fuel shutoff valve. Weep holes in the lower aft fuselage drain off combustibles that collect.

1-1.1.5. Engine Control Adapter. The engine control adapter is a flexible link from the throttle push-pull control assembly to the engine control cambox.

1-1.2. Access Panels. Panels (figure 1-3) on the sides and bottom of the aft fuselage give access for routine maintenance, inspection, and repair with the engine installed. The fuselage tail cone and lower half of the aft fuselage (access 5222-3) can be taken off for engine change and inspection. The engine may be run with the engine removal access and tail cone removed.

1-1.3. Air Inlet Duct Seal. An airframe air inlet duct seal mounted on station 526 bulkhead mates with a bumper on the engine. This forms a seal between the airframe and the engine. The seal must be properly seated to give maximum sealing and limit loss of engine inlet air. The correct technique to ensure proper seating of the seal is given in the engine installation paragraph.

1-2. OPERATION.

1-2.1. Engine Operation. Refer to paragraph 4-4 for operation of the TF41-A-1, -1A, and -1B engines.

1-2.2. Engine Drainage System. The engine drainage system ports combustible fluids overboard. Fuel drains from the HP fuel shutoff valve during engine shutdown into a residual fuel holding tank. Fuel in the tank is automatically siphoned through the fuel vent mast during flight.

1-2.3. Engine Control Adapter. The engine control adapter receives lateral movement from the throttle push-pull control and transmits this movement to the control cambox in the form of rotary motion.

1-2.4. Airframe Mounts. All engine vertical and drag loads are transmitted through the mount assemblies to the airframe structure. The left front support trunnion accepts all engine radial expansion and transmits half the engine vertical and drag loads to the airplane structure. The right front thrust trunnion accepts all engine side loads and transmits half the vertical and drag loads to the airplane structure. The left rear engine mount secures the aft portion of the engine and transmits that portion of the engine loads to the airplane structure.

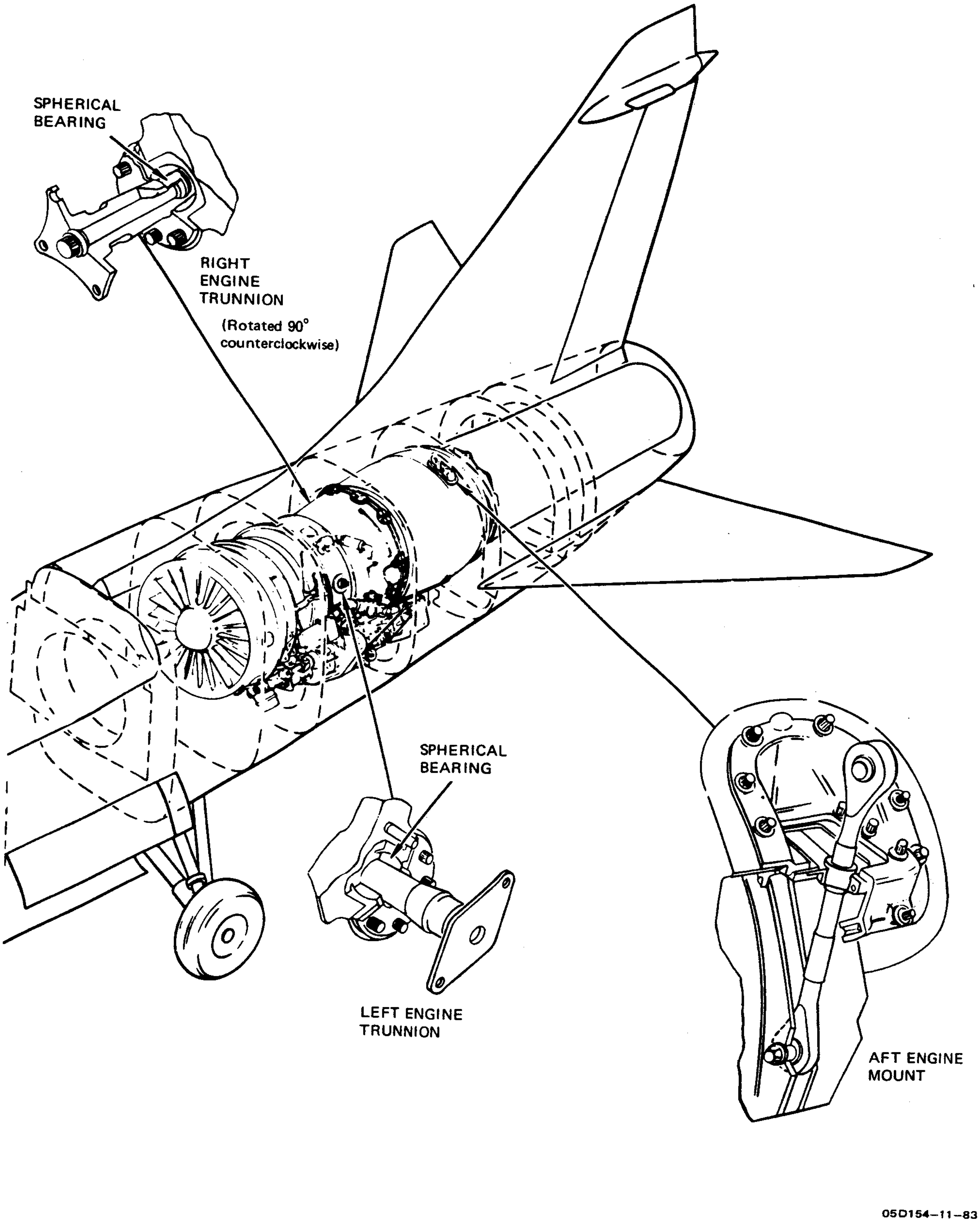

Figure 1-1. Mounting Arrangement; Engine

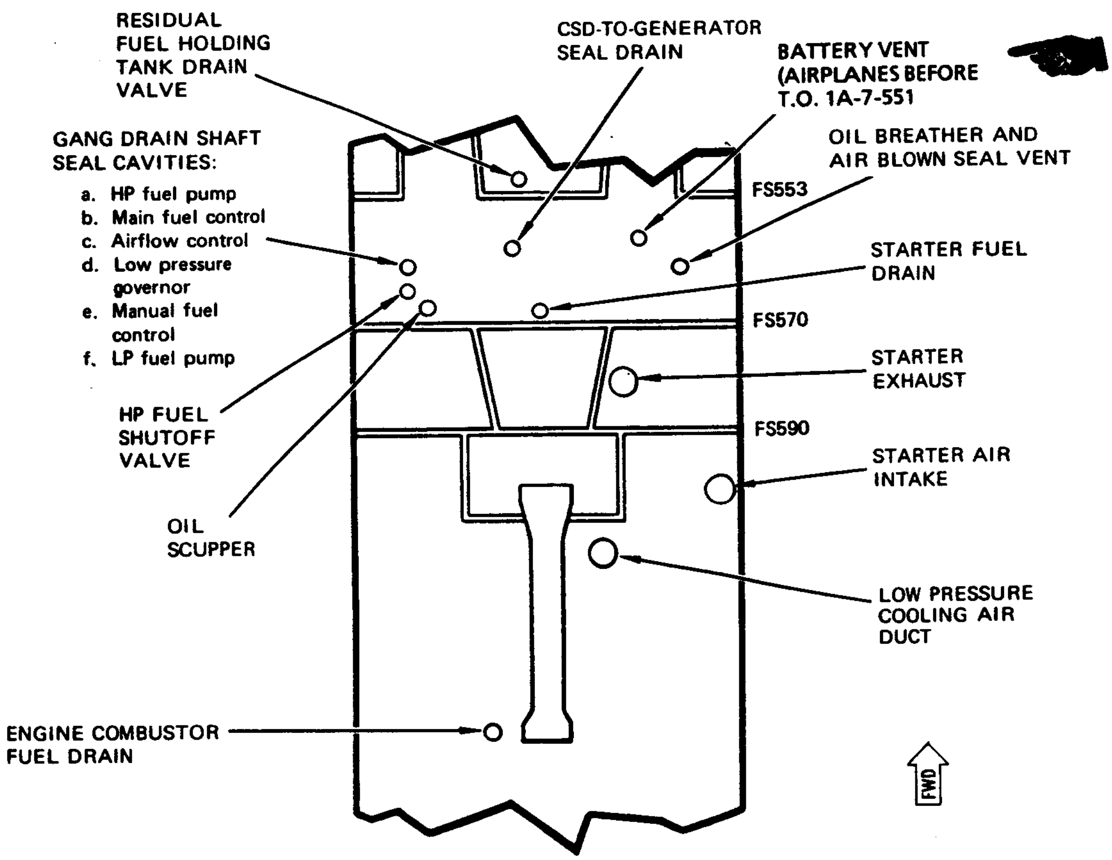

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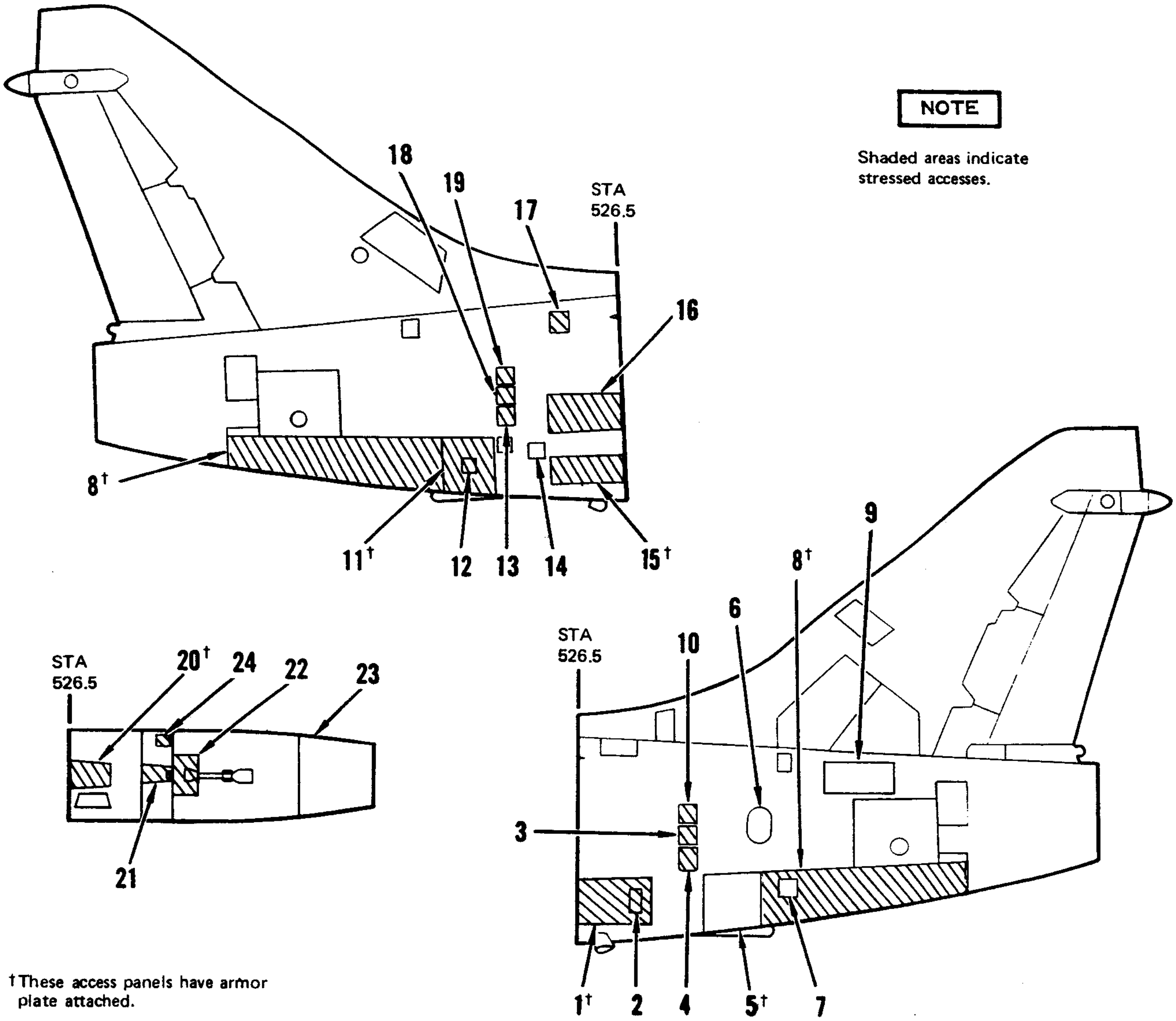
Figure 1-2. Drainage System; Engine



INDEX NO.	ACCESS NO.	ACCESS NOMENCLATURE	INDEX NO.	ACCESS NO.	ACCESS NOMENCLATURE
1†	5222–1	Engine Access	13	6122–3	Engine Access
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10	5122–5	Engine Access	22	5222–3–1	Oil Filter Access
11†	6222–2	Engine Access	23	A105133–1	Tail Cone
12	6222–2–1	Starter Oil Filler Access	24	5222–2–1	Oil Sampling Access

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Figure 1-3. Access Panels; Engine

1-3. COMPONENTS. For a list of system components, their location (accesses), and functions, refer to table 1-1.

1-4. ENGINE REMOVAL AND INSTALLATION.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
	GGG-W-686	Torque wrench, 0 to 250 foot-pounds	Measure torque
	GGG-W-686	Torque wrench, 10 to 150 inch-pounds	Measure torque
	MIL-M-7404	Maintenance stand, B-4A	Provide work platform for varying elevations
	MIL-T-26225	Airplane lift trailer, 4000A	Transport engine
	216-00253-5	Engine exhaust pipe cover	Protect engine from foreign matter
	216-00263-1	Engine air inlet shield	Protect engine from foreign matter
	216-00277-1	Trunnion puller	Remove trunnions
1-6	216-00300-1	Engine adapter set	Adapt engine to support set
1-6	216-00301-1	Engine support set	Support engine during removal and installation
	216-01578-1	Aft engine mount cover	Cover hole in engine and hold aft engine mount clear for removal and installation
	413-900-020 (American Tool and Engineering Co, Kalamazoo, Michigan)	Torque wrench, 100 to 750 inch-pounds	Measure torque
	6798370 (Allison Division of General Motors, Indianapolis, Indiana)	Oil baffle filling adapter	Service starter drive gear oil baffle
1-4	8035726-01 (Air Force Dwg)	Air inlet duct seal alignment tool	Assist in seating airframe-to-engine air inlet seal

CAUTION

Airplane must be fully serviced with fuel before engine removal or installation to prevent airplane from settling on fuselage aft section. If this is not feasible, secure airplane nose gear or install a jack under the arresting gear lug assembly. Then, raise jack until snug to stabilize the fuselage. Use suitable padded 2-inch by 6-inch plank between jack and lug assembly.

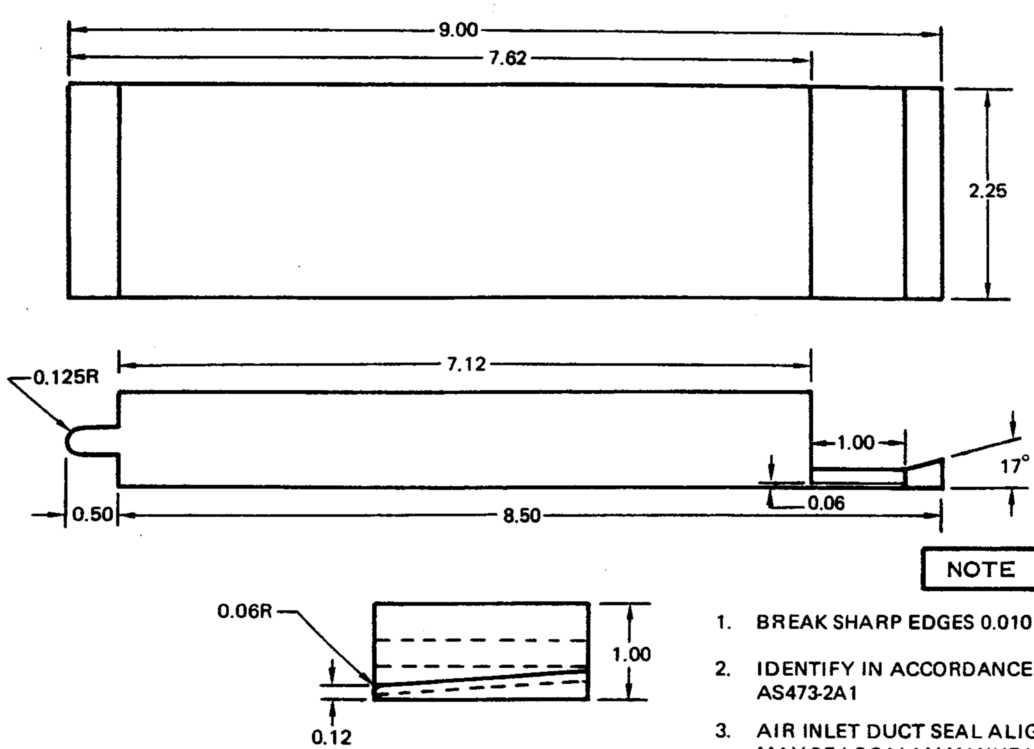
To prevent damage to airplane or engine, do not remove engine with airplane on jacks.

1-4.1. Removal. (Figures 1-5 and 1-6.)

a. Remove engine removal door (T.O. 1A-7D-2-1).

Table 1-1. Powerplant System Components

Component	Access	Function
Engine, TF41-A-1, -1A, and -1B	5222-3	Develops thrust for airplane motive power
Extension, air inlet	5222-1	Directs inlet air into low presure compressor
Mount, aft engine	5131-1	Provides attachment for aft section of engine
Tailpipe	A105133-1	Directs exhaust gas into atmosphere
Trunnion, left	6122-4	Provides attachment for left engine mount
Trunnion, right	5122-4	Provides attachment for right engine mount



NOTE

1. BREAK SHARP EDGES 0.010 TO 0.015
2. IDENTIFY IN ACCORDANCE WITH MIL-STD-130 AND AS473-2A1
3. AIR INLET DUCT SEAL ALIGNMENT TOOL SHOWN MAY BE LOCALLY MANUFACTURED USING AIR FORCE DRAWING 8035726–01.

05D270–11–83

Figure 1-4. Alignment Tool; Air Inlet Duct Seal

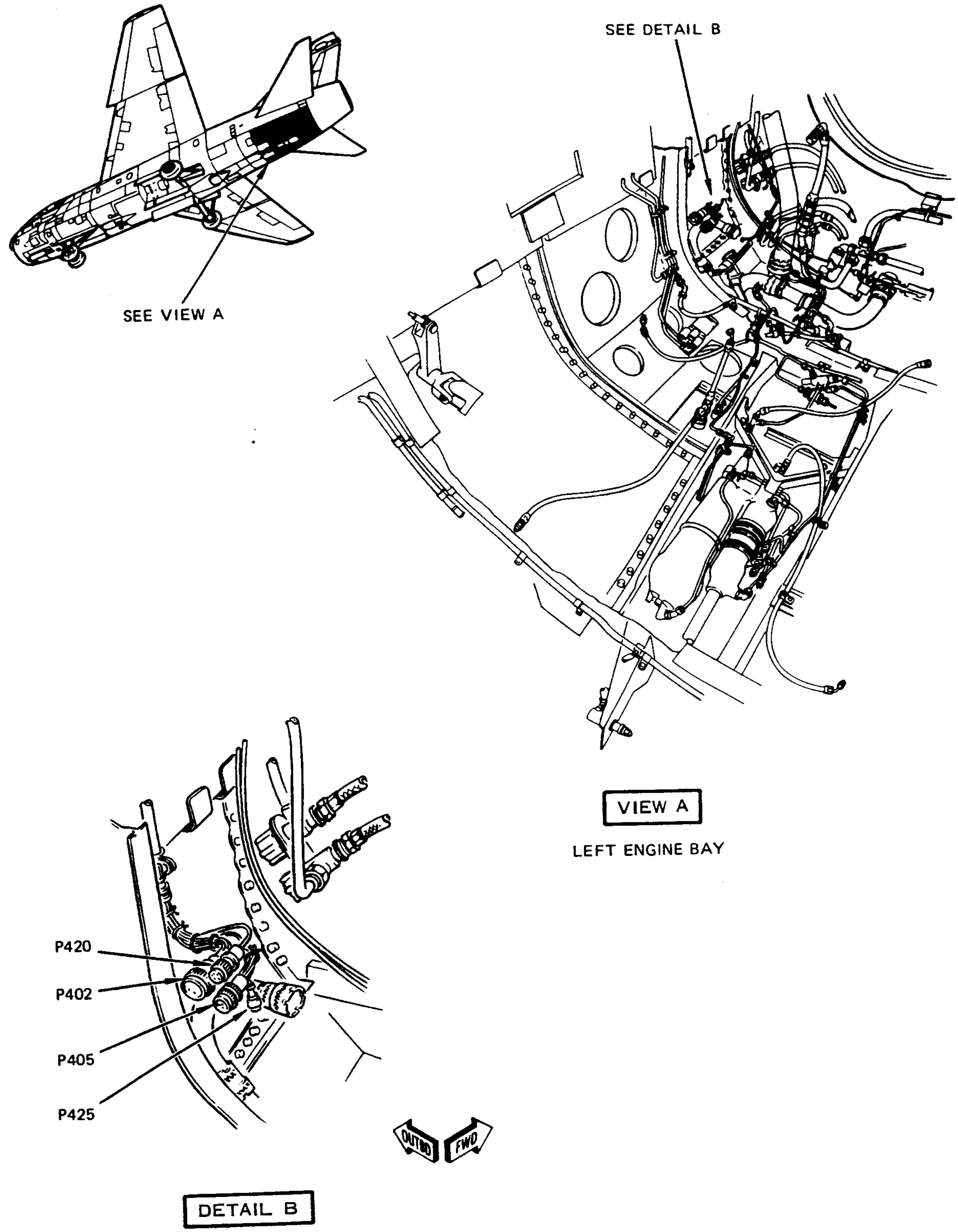


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Figure 1-5. Electrical Harness Clamping; Airframe to Engine (Sheet 1 of 2)

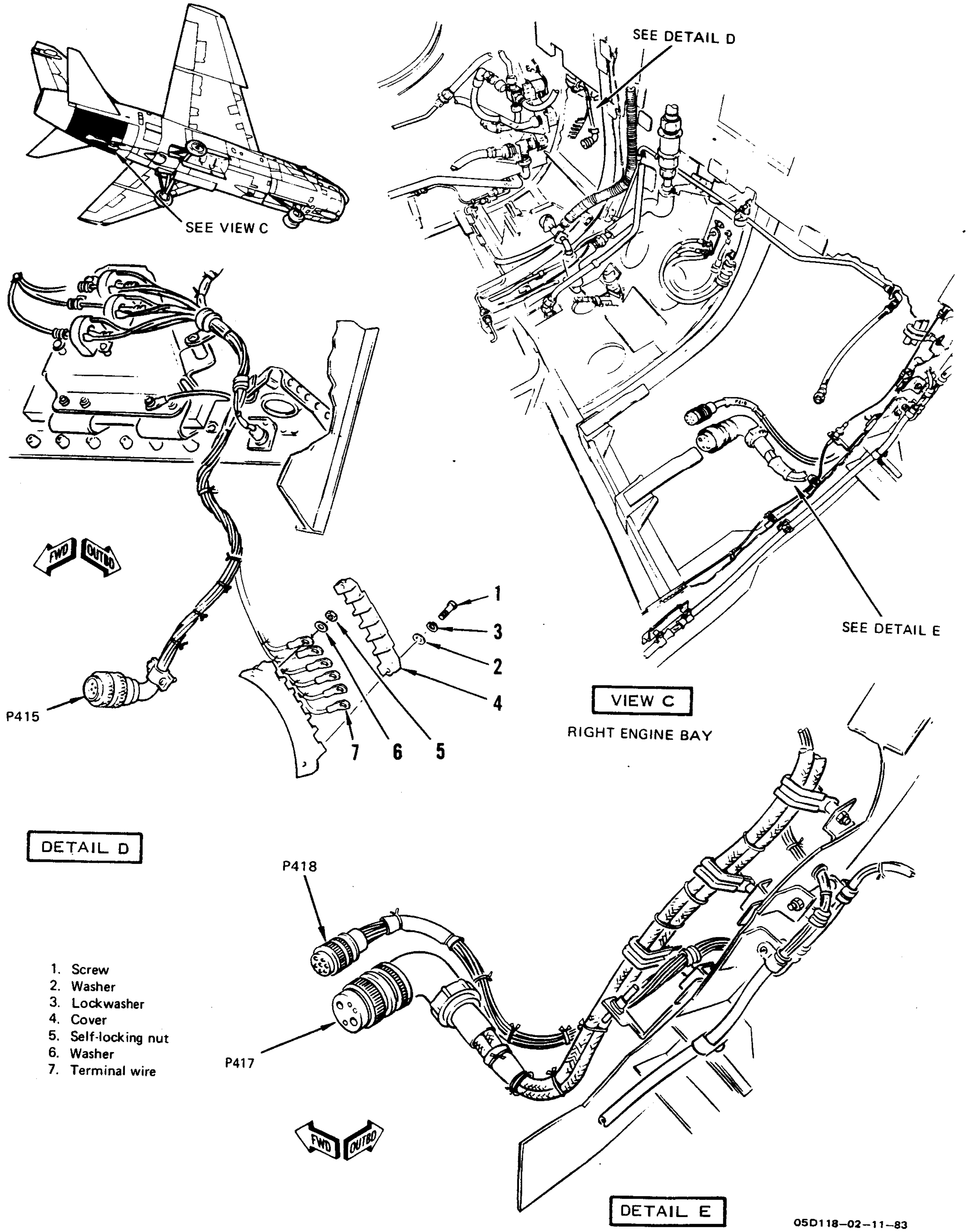


Figure 1-5. Electrical Harness Clamping; Airframe to Engine (Sheet 2)

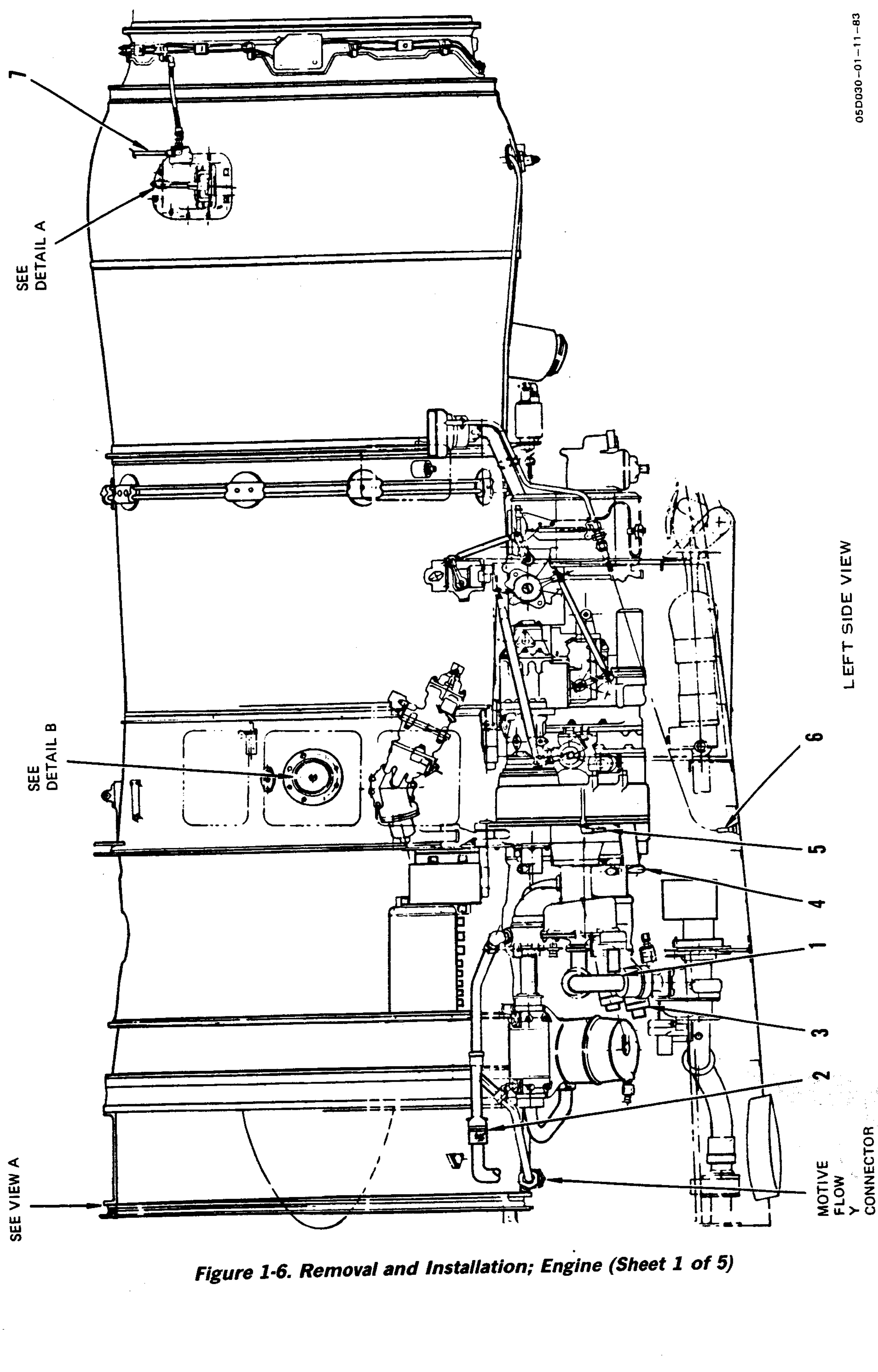


Figure 1-6. Removal and Installation; Engine (Sheet 1 of 5)

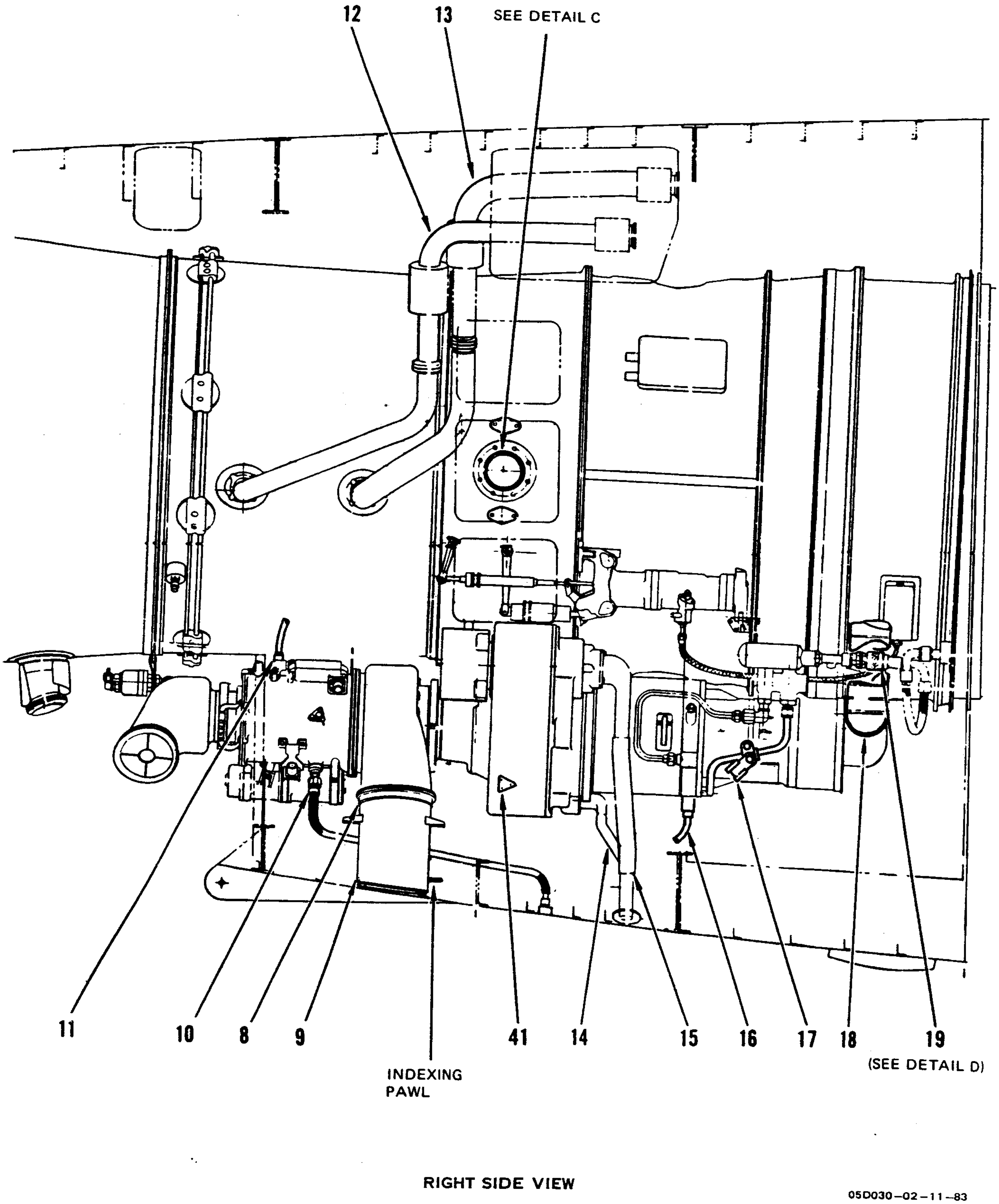


Figure 1-6. Removal and Installation; Engine (Sheet 2)

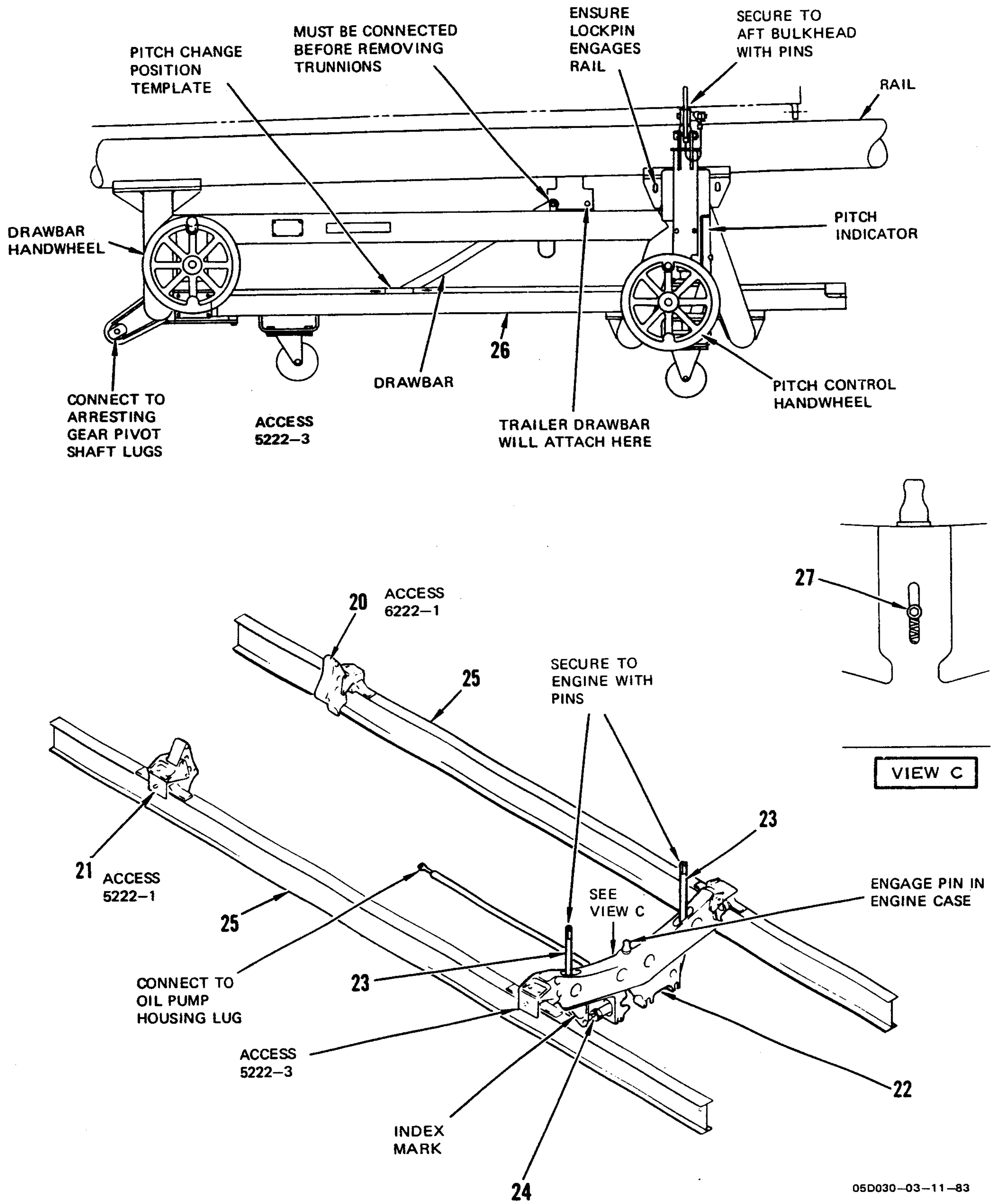


Figure 1-6. Removal and Installation; Engine (Sheet 3)

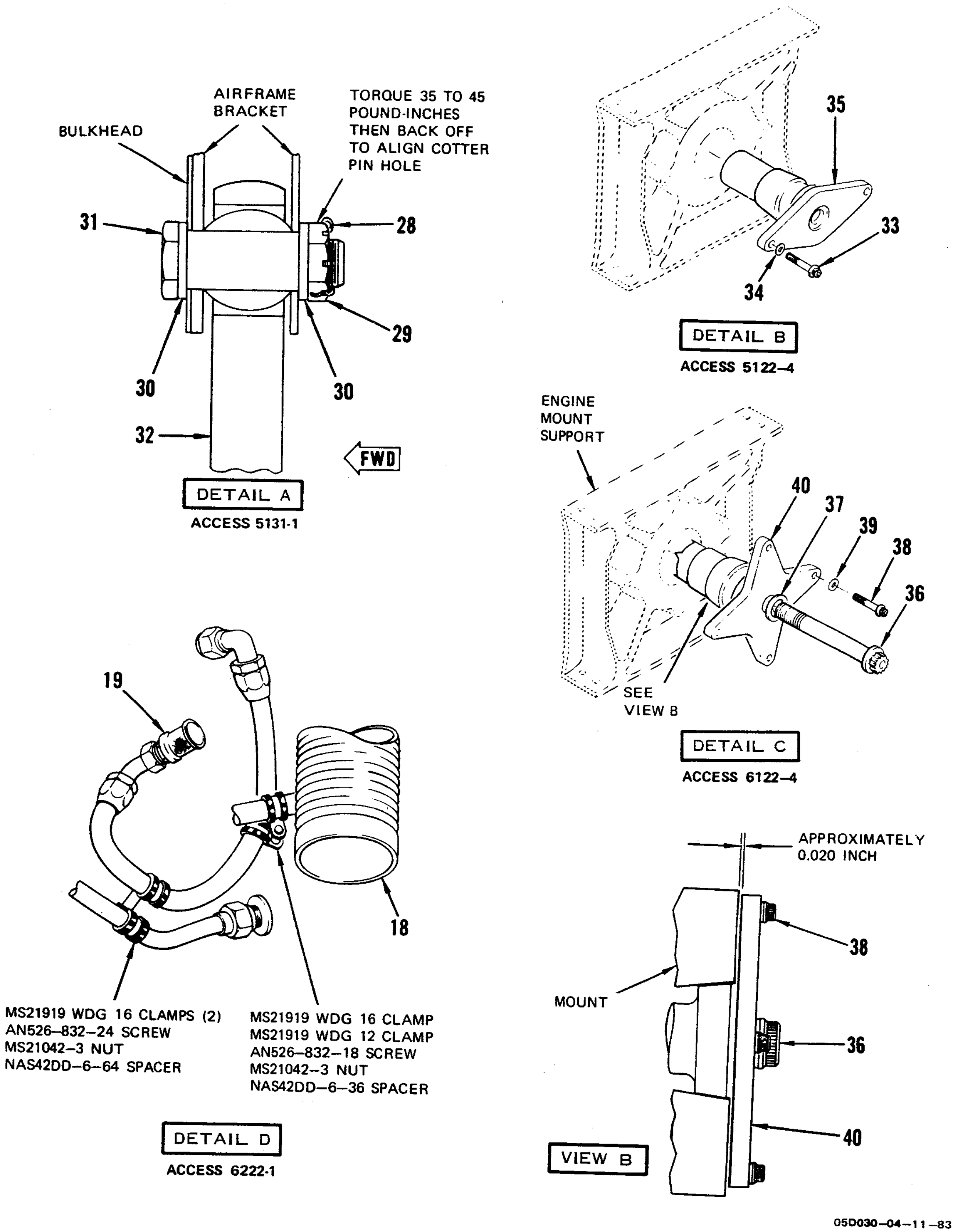
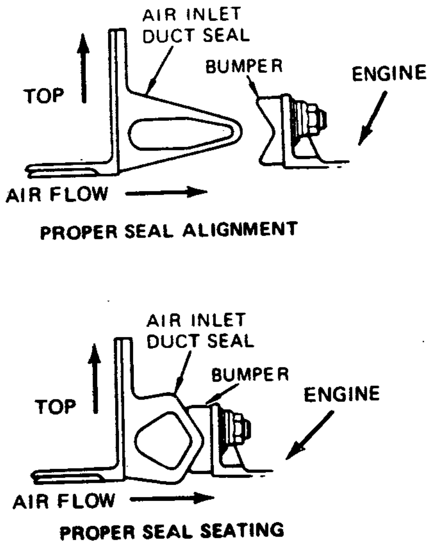
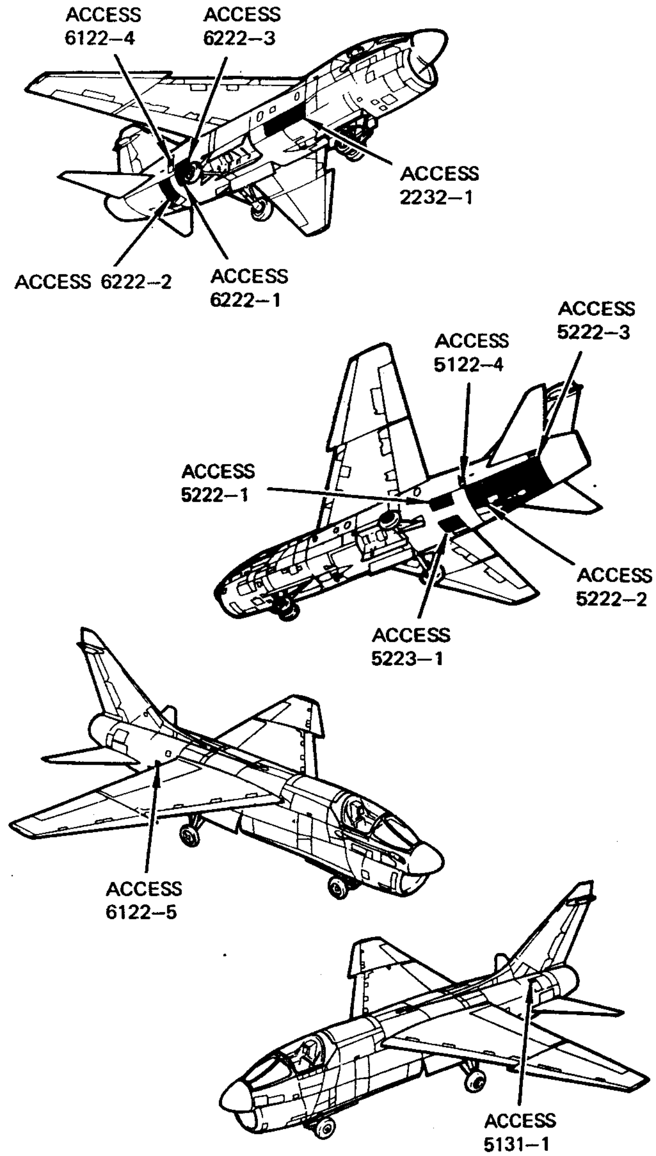


Figure 1-6. Removal and Installation; Engine (Sheet 4)



VIEW A



1. Fuel supply line
2. Motive flow quick-disconnect coupling
3. Hydraulic quick-disconnect coupling
4. Gang-drain hose
5. HP fuel shutoff valve drain hose
6. Oil filler scupper drain hose
7. Turbine outlet pressure sensing hose
8. Starter exhaust duct clamp
9. Starter exhaust duct
10. Starter drain hose
11. Starter fuel inlet hose
12. High pressure gimbal duct
13. Low pressure gimbal duct
14. Air blown seal drain hose
15. Oil breather hose
16. CSD-to-generator seal drain hose
17. Clamp
18. Cooling air duct
19. Motive flow quick-disconnect coupling
20. Right forward engine adapter
21. Left forward engine adapter
22. Aft engine adapter
23. Adapter link
24. Aft adapter turnbuckle
25. Rail
26. Support set
27. Screw
28. Cotter pin
29. Nut
30. Washer
31. Bolt
32. Link
33. Bolt
34. Washer
35. Left engine trunnion
36. Bolt
37. Washer
38. Bolt
39. Washer
40. Right engine trunnion
41. Plug

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Figure 1-6. Removal and Installation; Engine (Sheet 5)

WARNING

When bathtub section is removed, sharp edge of the UHT presents a hazard to workers. Guard the sharp edge by covering with cushioning material, FSN 8135-00-013-8962, or similar guarding material. When cutting cushioning material, ensure that wire edge does not present a sharp nip point.

b. Open accesses 2232-1, 5122-4, 5131-1, 5222-1, 5222-2, 5223-1, 6122-4, 6122-5, 6222-1, 6222-2, and 6222-3.

WARNING

To avoid fuel spillage and possible fire or explosion resulting in personnel injury, fuel master lever shall be placed in OFF during engine removal and installation.

c. Place fuel master lever in OFF.

CAUTION

To prevent damage to turbine outlet temperature indicator due to motor overheat, open circuit breaker CB316 before disconnecting thermocouple connector.

d. Open circuit breaker CB316.

e. Disconnect airframe-to-engine electrical connectors (figure 1-5) as follows:

CAUTION

Electrical connector P402 utilizes push-pull type coupling. To prevent damage, do not use tools or twist this coupling.

(1) Disconnect P402, P405, P425, and P420 from engine electrical interconnect bracket in left engine bay.

(2) Disconnect P415 from master ac generator in right engine bay.

(3) Cut lockwire and remove screws (1), washers (2), lockwashers (3), and cover (4).

(4) Remove self-locking nuts (5) and washers (6). Disconnect terminal wires (7). Tag for identification.

WARNING

To prevent fire or explosion, both cables must be disconnected from battery prior to connecting or disconnecting connector P417.

CAUTION

To prevent damage to battery charger, circuit breakers CB401 and CB402 must be open prior to connecting or disconnecting battery cables.

(5) Open circuit breakers CB401 and CB402.

(6) Disconnect both electrical connectors from battery receptacle.

(7) Disconnect connectors P417 and P418 from jet fuel starter.

f. Remove nut and lockwasher, disconnect electrical cable at starter motor, and position to allow starter to clear bulkhead during removal.

NOTE

Refer to paragraph 1-16 for instructions to disconnect Wiggins coupling.

g. Cut lockwire and disconnect Wiggins coupling. Remove clamps from fuel supply line (1, figure 1-6) located at LP fuel pump.

h. Disconnect motive flow quick-disconnect coupling (2). Tie flex line clear of engine.

CAUTION

Teflon hoses tend to conform to the shape of installed positions. Be careful when handling these hoses to prevent bending or straightening. This could result in kinking and subsequent hose failure. Refer to T.O. 42E1-1-1 for hose data.

Do not allow hose ends to fall or rest on electrical conduit, mechanics working engine bay will not use hose ends or conduit as a step damage can occur on hose end as well as electrical conduit.

i. Disconnect hydraulic quick-disconnect couplings (3).

j. Disconnect gang-drain hose (4) from housing.

k. Disconnect HP fuel shutoff valve drain hose (5) from elbow.

l. Disconnect oil filler scupper drain hose (6) from overboard fitting.

CAUTION

To prevent damage to engine throttle push-pull assembly, observe handling precautions in T.O. 1A-7D-2-1.

To prevent damage to engine throttle push-pull assembly, the engine control adapter must be removed from the airplane when disconnected from control cambox.

m. Remove engine control adapter (paragraph 1-10).

n. Disconnect turbine outlet pressure sensing hose (7) from elbow.

o. Loosen starter exhaust duct clamp (8).

p. Rotate starter exhaust duct (9) 90° counterclockwise (looking up) so indexing pawl is pointing outboard. Remove duct, clamp, and seal.

q. Inspect exhaust duct for damage (T.O. 1A-7D-3).

r. Disconnect starter drain hose (10) from starter.

s. Disconnect starter fuel inlet hose (11).

t. Remove low pressure bleed air gimbal duct (T.O. 1A-7D-2-3).

u. Remove high pressure bleed air gimbal duct (T.O. 1A-7D-2-3).

v. Remove oil breather hoses (14 and 15).

w. Disconnect CSD-to-generator seal drain hose (16) from CSD.

x. Remove clamp (17) securing harness to CSD oil cooler return line.

CAUTION

To prevent damage to generator, make sure that cooling air port is covered at all times except when duct is connected.

y. Loosen clamp and disconnect cooling air duct (19) from generator. Install cover on cooling air port.

z. Disconnect motive flow quick-disconnect coupling (19). Tie flex line clear of engine.

CAUTION

To prevent damage to CSD oil cooler due to fluid expansion, fuel must be drained from cooler whenever quick-disconnect is disconnected. Cooler and lines contain approximately 1-1/2 pints of fuel.

To prevent damage to quick-disconnect, do not use tools to depress poppet. Finger pressure will be sufficient.

aa. Drain fuel from CSD oil cooler by opening drain valve at motive flow Y-connector and depressing motive flow coupling quick-disconnect poppet.

CAUTION

Make sure that quick-release pin handles are in a vertical position to prevent structural damage to airplane during engine removal.

ab. Attach right forward engine adapter (20) to right side of engine with two quick-release pins.

ac. Attach left forward engine adapter (21) to left side of engine with two quick-release pins.

ad. Position aft engine adapter (22) with spring-loaded pin inserted in receptacle at bottom of engine. Attach two adapter links (23) to engine with two quick-release pins.

CAUTION

The adapter set brace assembly is offset to allow for clearance of lines attached to side of oil tank. Improper installation may result in damage to equipment.

ae. Connect adapter set brace assembly to oil pump housing lug and aft adapter with quick-release pins.

af. Using aft adapter turnbuckle (24), align index mark on left side of adapter with housing.

ag. With rails (25) removed, attach forward end of support set (26) to arresting gear pivot shaft lugs with two spring-loaded pins.

ah. Attach aft end of support set to aft bulkhead with two quick-release pins.

ai. Turn pitch control handwheel until pitch indicator pointer indicates 0°.

CAUTION

To avoid damage to equipment in engine bay area, make sure that rails clear engine and airframe while being positioned. Do not force rails beyond locking pins in slotted section of support set.

aj. Install two rails in slotted section of support set until each rail locks in place.

ak. Using drawbar handwheel, position drawbar full forward.

al. Adjust aft adapter turnbuckle to approximately center screw (27) in slot.

am. Adjust pitch control handwheel and aft adapter turnbuckle to transfer weight of engine from rear engine mount to support set.

an. Remove cotter pin (28), nut (29), washers (30), and bolt (31). Slide link (32) inboard and install aft engine mount cover.

CAUTION

To avoid damage to equipment, make sure that weight of engine is resting on support set rails at both forward and aft adapter rollers.

ao. Turn pitch control handwheel to transfer weight of engine from trunnions to support set rails.

WARNING

To prevent injury and avoid dropping the engine, make sure that support set drawbar is attached to aft adapter prior to removing trunnions.

ap. Connect support set drawbar to forward side of aft adapter with quick-release pin. Adjust drawbar handwheel to take out slack of drawbar mechanism.

CAUTION

To prevent damage to trunnions, do not use force or mechanical puller to remove trunnion unless trunnion is seized in mount.

The drawbar mechanism can be damaged if the handwheel or pitch control is adjusted while the drawbar is attached and engine trunnions installed.

aq. Cut lockwire and remove bolts (33), washer (34), and left engine trunnion (35).

ar. Cut lockwire and remove bolt (36) and washer (37).

as. Cut lockwire and remove bolts (38), washers (39), and right engine trunnion (40).

CAUTION

The trailing edge of the horizontal tail shall be in the up position to prevent damage as engine moves aft.

at. Manually rotate trailing edge of horizontal tail up to the maximum limit.

NOTE

Trailer rails may require readjustment.

au. Position trailer adjacent to aft end of airplane and parallel with support set rails.

av. Remove trailer rail elevating extension, if installed.

aw. Align trailer rails with support set rails obtaining equal distance between each support set rail and trailer rail.

ax. Move trailer toward engine until trailer rails overlap support set rails 20 to 22 inches.

ay. Lower trailer jacks and remove weight of trailer from wheels.

az. Secure trailer to support set.

ba. Lower trailer rails as required.

bb. Using aft adapter turnbuckle, align index mark on left side of adpater with housing.

bc. Turn drawbar handwheel. Move engine aft until pitch change pointer on traveling block is centered between arrows on PITCH CHANGE POSITION template.

bd. Turn pitch control handwheel until pitch indicator pointer indicates 3°.

CAUTION

To prevent damage to engine or airframe, make sure that engine clears all obstructions durng removal and that spring-loaded safety pins on support set rails are released.

be. Move engine aft until aft adapter is approximately 6 inches behind aft bulkhead.

bf. Attach two roller assemblies to aft adapter with four quick-release pins.

bg. Move engine aft until roller assemblies engage trailer rails.

bh. Engage both aft adapter roller locks.

WARNING

To prevent injury and avoid dropping the engine, make sure that locking pin on trailer drawbar is engaged prior to attaching drawbar to aft adapter.

bi. Attach trailer drawbar to aft side of aft adapter with quick-release pin.

bj. Disconnect support set drawbar from forward side of aft adapter.

bk. Slowly release aft adapter roller locks.

bl. Using trailer drawbar handcrank, move engine aft until limit of travel is obtained.

bm. Engage both aft adapter roller locks.

bn. Disconnect trailer drawbar from aft side of aft adapter.

bo. Move trailer drawbar forward and connect to forward side of aft adapter with quick-release pin.

bp. Slowly release aft adapter roller locks.

bq. Move engine aft by turning trailer drawbar handcrank until forward adapters are approximately 6 inches aft of aft bulkhead.

br. Engage aft adapter roller locks.

bs. Attach two roller assemblies to forward adapters with quick-release pins.

bt. Release aft adapter roller locks.

bu. Move engine aft until forward roller assemblies engage trailer rails.

bv. Move engine to center of trailer and engage forward and aft roller locks.

bw. Install dust caps, exhaust pipe cover, and air inlet shield on engine.

bx. Disconnect trailer from support set.

1-4.2. Installation. (Figures 1-5 and 1-6.)

CAUTION

If engine is to be transported on model 4000A trailer, do not exceed towing speed of 5 mph and do not tow over rough terrain.

NOTE

Engine must be resting on model 4000A trailer using engine adapter set.

a. If the 216-00301-1 support set has been removed from airplane since engine removal, install as follows:

(1) Using drawbar handwheel, move drawbar to aft end of support set.

(2) With rails (25, figure 1-6) removed, attach forward end of support set (26) to arresting gear pivot shaft lugs with spring-loaded pins.

(3) Attach aft end of support set to aft bulkhead with two quick-release pins.

(4) Turn pitch control handwheel until pitch indicator pointer indicates 3°.

CAUTION

To avoid damage to equipment in engine bay area, make sure that rails clear engine and airframe while being positioned. Do not force rails beyond locking pins in slotted section of support set.

(5) Install two rails in slotted section of support set until each rail locks in place.

b. Prime starter drive gear (if required) as follows:

(1) Note position of electrical harness bracket. Remove three nuts and one washer securing bracket and plug (41) to right side of high speed gearbox.

(2) Disconnect tube from starter drive gear oil baffle filling adapter. Insert tube in high speed gearbox. Secure tube to gearbox with nuts removed in substep (1).

(3) Fill suction gun with MIL-L-7808 or MIL-L-23699 engine oil, and connect gun to filling adapter. Inject oil into gearbox.

(4) Disconnect suction gun from filling adapter and remove tube from high speed gearbox.

(5) Using new packing, install plug on gearbox.

(6) Position electrical harness bracket as noted during removal. Secure bracket and plug to high speed gearbox using three nuts and one washer.

c. Check airframe-to-engine air inlet seal for damage (T.O. 1A-7D-3).

NOTE

The use of petrolatum or silicone compound will cause further deterioration of the seal. This fact must be weighed against maintenance man-hours and expected seal life to know if there is any advantage for using petroleum type lubricant.

d. Lubricate airframe-to-engine air inlet seal as follows:

WARNING

Silicone compound is slightly toxic to eyes and skin. Eye and skin protection required.

(1) If the seal surface is too tacky for easy seal seating, grease with VV-P-236 petrolatum or MIL-S-8660 silicone compound.

NOTE

Beaverwhite 325 talc is available from Thompson Hayward Co, 2627 Weir, Dallas, Texas 75222.

(2) If the seal is smooth, lubricate with Beaverwhite 325 talc or equivalent.

e. Engage forward and aft engine adapter roller locks.

CAUTION

The trailing edge of the horizontal tail shall be in the up position to prevent damage as engine moves forward.

f. Manually rotate horizontal tail trailing edge up to the maximum limit.

g. Locate trailer next to aft end of airplane, parallel with support set rails.

h. Align trailer rails with support set rails. Maintain equal distance between each support set rail and trailer rail.

i. Move trailer forward until trailer rails overlap support set rails 20 to 22 inches.

j. Lower trailer jacks and remove weight of trailer from wheels.

k. Secure trailer to support set.

l. Attach trailer drawbar to forward side of aft engine adapter (22).

m. Turn support set pitch control handwheel until pitch indicator pointer indicates 3°.

n. Ensure that motive flow Y-connctor drain is installed.

o. Ensure that link (32) is inboard and aft engine mount link cover is installed.

p. Remove engine air inlet shield.

q. Using aft adapter turnbuckle (24), align index mark on left side of adapter with housing.

r. Remove nut and lockwasher and disconnect electrical cable at starter motor. Locate cable to allow starter to clear bulkhead during installation.

s. Release forward and aft engine adapter roller locks.

t. Turn trailer drawbar handcrank until inner rollers on forward adapters are 6 to 8 inches forward of aft end of support set rails.

u. Lower trailer rails until forward engine weight is transferred to support set rails.

v. Remove roller assemblies from forward adapters by removing four quick-release pins.

CAUTION

To prevent damage to engine or airframe, make sure that engine clears all obstructions during installation.

w. Move engine forward until trailer drawbar reaches limit of travel.

x. Engage roller locks on aft adapter.

y. Disconnect trailer drawbar from forward side of aft adapter.

z. Move trailer drawbar aft and connect drawbar to aft side of aft adapter with quick-release pin.

aa. Release roller locks on aft adapter.

ab. Move engine forward until support set drawbar can be connected to forward side of aft adapter.

ac. Engage roller locks on aft adapter.

WARNING

To prevent injury and avoid dropping the engine, make sure that support set drawbar is attached to aft adapter prior to detaching trailer drawbar.

ad. Attach support set drawbar to aft adapter with quick-release pins.

ae. Disconnect trailer drawbar from aft adapter.

af. Release roller locks on aft adapter.

ag. Pull two safety pins on each side of rails (pull down and out of the way).

ah. Turn support set drawbar handwheel. Move engine forward until inner rollers on aft adapter are 6 to 8 inches forward of aft end of support set rails.

ai. Remove two roller assemblies from aft adapter by removing four quick-release pins.

aj. Disconnect trailer from support set and remove trailer.

ak. Move engine forward until pitch change pointer on traveling block is centered between arrows on PITCH CHANGE POSITION template.

al. Turn pitch control handwheel until pitch indicator pointer indicates 2-1/4°

am. Using drawbar handwheel, move engine forward to a position immediately prior to air inlet duct seal engagement.

NOTE

Air inlet duct seal should engage the seal bumper at approximately the center point.

an. Adjust pitch control handwheel and turnbuckle to align trunnions and air inlet duct seal.

CAUTION

Do not exert excessive force on drawbar handwheel. A load in excess of 32 foot-pounds on handwheel may cause failure of mechanism.

NOTE

As engine moves forward, check that air inlet duct seal seats properly (view A). If the seal does not seat properly, back the engine out slightly and use 8035726-01 alignment tool to aid in seating seal.

ao. Move engine to full forward position.

ap. Check that air inlet duct seal is properly seated.

NOTE

If trunnion mounts are not properly aligned, back engine out approximately 2 inches and repeat steps am through ap.

aq. Check that engine trunnion mounts are properly aligned.

ar. Wipe inside of the conical bore of engine trunnion mount supports and left forward (35) and right forward (40) engine trunnions with MIL-L-7870 oil prior to installation.

as. Install left engine trunnion (35) and secure with washers (34) and bolts (33). Tighten bolts to 175 (±10) inch-pounds torque. Secure with MS20995C32 lockwire.

at. Insert right engine trunnion (40). Rotate until points engage matng surface of lockring.

au. Secure trunnion with washers (39) and bolts (38). Tighten bolts to 175 (±10) inch-pounds torque.

av. Secure trunnion with washer (37) and bolt (36). Tighten bolt to 125 (±5) foot-pounds torque; then check torque on bolts (38).

NOTE

If clearance in step aw is not correct, trunnion is improperly installed. Remove trunnion and repeat steps at through av.

aw. Check for 0.020 (±0.010) inch clearance between trunnion and thrust mount to make sure that trunnion has engaged engine locknut. Secure bolts (38 and 36) with MS20995C32 lockwire.

CAUTION

To prevent damage to equipment, the support set drawbar shall be disconnected before installing aft engine mount.

ax. Disconnect support set drawbar from aft adapter.

ay. Remove aft engine mount cover and slide link (32) outboard.

az. Adjust pitch control handwheel and aft adapter turnbuckle to align aft engine mount with airframe bracket.

ba. Apply heavy coat of MIL-G-23827 grease to bolt (31).

NOTE

If using NAS 464-10-30 bolt, use one washer under bolthead and one under AN320-10 nut; then add or remove washers as required to torque and cotter pin nut.

If using NAS 1010-30 bolt, use two washers under bolthead and two under AN310-C-10 nut; then add or remove washers as required to torque and cotter pin nut.

bb. Install bolt (with head forward), washers (30), and nut (29). Tighten nut to 40 (±5) inch-pounds torque. Loosen nut to align first slot and install new cotter pin (28).

CAUTION

To prevent damage to air inlet seal, do not use sharp pointed tools to seat seal.

bc. Make sure air inlet duct seal is properly seated.

bd. Adjust pitch control handwheel to remove engine weight from support set rails.

be. Remove rails (25).

bf. Remove two quick-release pins securing aft end of support set (26) to aft bulkhead.

bg. Release two spring-loaded pins securing forward end of support set to arresting gear pivot shaft lugs. Remove support set.

bh. Remove quick release pins securing brace assembly to aft adapter and to oil pump housing lug. Remove brace.

bi. Remove two quick-release pins securing adapter links (23) to engine. Remove aft engine adapter (22).

bj. Remove left forward engine adapter (21).

bk. Remove right forward engine adapter (20).

bl. Connect electrical cable to starter with lockwasher and nut.

bm. Inspect motive flow quick-disconnect coupling (19) (paragraph 5-38).

bn. Connect motive flow quick-disconnect coupling as follows:

(1) Align halves and push together until locking fingers rest against locking ring.

(2) Pull sliding collar on female coupling half back to allow locking fingers to expand.

(3) Slide coupling halves together until locking fingers have passed over locking ring.

(4) Release sliding collar and observe that it passes over and compresses locking fingers.

NOTE

Do not grasp or hold sliding collar when checking coupling. Force required to unlock coupling is small and disconnect could result.

(5) Check that coupling is properly locked by pulling and pushing on 90° elbow attached to female coupling half.

(6) Check that positive clearance exists between motive flow hose and hydraulic lines. If proper clearance does not exist, reclamp hose as shown in detail D.

bo. Remove cover from cooling air port and position cooling air duct (18) on generator. Secure with clamp. Tighten clamp to 20 (±5) inch-pounds torque. Secure hose clamps with MS20995C32 lockwire.

bp. Install clamp (17) and secure wiring harness to CSD oil cooler return line.

bq. Connect CSD-to-generator seal drain hose (16) to CSD.

CAUTION

To prevent damage to air blown seal drain and oil breather hoses, ensure that hose is installed with minimum amount of twist and do not allow any twist to remain after clamping.

br. If installing new hoses (14 and 15), perform the following:

(1) Measure distance between outer edge of both fiberglass bands on each hose.

(2) If distance is more than 9.875 inches, peel equal amounts off each fiberglass band until 9.875 inches is reached.

(3) Measure overall length of each hose.

(4) If overall length is more than 12.125 inches, cut equal amounts off ends of hose until 12.125 inches is reached.

bs. Install hoses (14 and 15) with clamps.

bt. Install high pressure bleed air gimbal duct (12) (T.O. 1A-7D-2-3).

bu. Install low pressure bleed air gimbal duct (13) (T.O. 1A-7D-2-3).

bv. Tighten coupling nuts to 90 (±10) inch-pounds torque while tapping coupling lightly with plastic mallet. Retighten coupling to 90 (±10) inch-pounds. Continue tapping and tightening until torque remains 90 (±10) inch-pounds.

bw. Install insulation over couplings and secure with MS20995C32 lockwire. Lockwire must make two complete turns around capstan.

bx. Connect starter fuel inlet hose (11) to elbow.

by. Connect starter drain hose (10) to starter.

bz. Install new seal on starter exhaust duct (9).

ca. Position starter exhaust duct clamp (8) on exhaust duct. Position duct on starter with indexing pawl pointing outboard. Rotate duct 90° clockwise (looking up) until indexing pawl is pointing forward and support ears engage support springs.

CAUTION

To prevent improper installation, make sure indexing pawl is pointing forward to engage the slot in duct seal retainer ring on access 6222-2.

cb. Tighten nut on clamp to 115 (±5) inch-pounds torque.

cc. Connect turbine outlet pressure sensing hose (7) to elbow.

cd. Lubricate and install engine control adapter (paragraph 1-10).

ce. Connect oil filler scupper drain hose (6) to overboard drain fitting.

cf. Connect HP fuel shutoff valve drain hose (5) to elbow.

cg. Connect gang-drain hose (4) to housing.

ch. Connect hydraulic quick-disconnect couplings (3) to pumps.

ci. Connect motive flow quick-disconnect coupling (2) by threading couplings together until serrations engage.

CAUTION

To prevent chaffing of fuel line and PC-3 vent line, make sure clamps are installed back to back.

NOTE

Refer to paragraph 1-16 for instructions to connect Wiggins coupling.

cj. Connect fuel supply line (1) to LP fuel pump with Wiggins coupling. Install clamps on fuel line and PC-3 vent line.

ck. Make sure that airframe to engine electrical harness support clamps are installed as shown in figure 1-4.

cl. Connect airframe-to-engine electrical connectors (figure 1-5) as follows:

(1) Connect P402, P405, and P420 to engine electrical interconnect bracket. Secure P420 with MS20995C20 or MS20995C32 (option) to prevent tearing lockwire holes in worn or older connectors.

(2) Check that seal is installed in connector P425.

(3) Connect P425 to engine electrical interconnect bracket.

(4) Connect P415 to master ac generator.

NOTE

Use MS90415-4 nuts furnished with generator to connect terminal wires to generator.

(5) Remove tags and connect terminal wires (7) to generator with washers (6) and self-locking nuts (5).

(6) Place cover (4) over terminals and secure with lockwashers (3), washers (2), and screws (1). Secure screws with MS20995C32 lockwire.

(7) Connect P417 and P418 to jet fuel starter. Secure connectors with MS20995C20 or MS20995C32 lockwire.

(8) Connect both electrical connectors to battery receptacles.

cm. Close circuit breakers CB401 and CB402.

cn. Close turbine outlet temperature circuit breaker CB316.

co. Perform control cambox rigging (paragraph 5-21).

cp. Bleed engine fuel system and check for leaks (paragraph 5-19).

cq. Bleed PC No. 1, PC No. 2, and PC No. 3 hydraulic systems (T.O. 1A-7D-2-1).

NOTE

Apply external power to airplane check warning light(s) circuits for main fuel pump, 1 and 2 fuel boost pumps, and engine oil. (This check need not be done prior to every engine run - only prior to an initial (green run) engine run).

If same engine is installed and no maintenance was performed on oil quantity indicating system, calibration may be omitted.

cr. Perform oil quantity indicating system calibration (paragraph 3-12).

cs. Check starter oil (T.O. 1A-7D-2-1).

ct. Close accesses 5122-4, 6122-4, 6122-5, and 6222-3.

cu. Perform engine setup (paragraph 4-8).

cv. Perform PC No. 1, PC No. 2, and PC No. 3 hydraulic systems operational checkout (T.O. 1A-7D-2-4).

cw. Install engine removal door (T.O. 1A-7D-2-1).

cx. Close accesses 2232-1, 5131-1, 5222-1, 5222-2, 5223-1, 6222-1, and 6222-2.

1-5. ENGINE ADAPTER SET INSTALLATION AND REMOVAL.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
1-4	216-00300-1	Engine adapter set	Adapt engine to support set

1-5.1. Installation. (Figure 1-6.)

CAUTION

Make sure that quick-release pin handles are in a vertical position to prevent structural damage to airplane during engine removal.

a. Attach right forward engine adapter (20) to right side of engine with two quick-release pins.

b. Attach left forward engine adapter (21) to left side of engine with two quick-release pins.

c. Position aft engine adapter (22) with spring-loaded pin inserted in receptacle in bottom of engine. Attach two adapter links (23) to engine with two quick-release pins.

CAUTION

The adapter set brace assembly is offset to allow for clearance of lines attached to side of oil tank. Improper installation may result in damage to equipment.

d. Connect adapter set brace assembly to oil pump housing lug and aft adapter with quick-release pins.

e. Using aft adapter turnbuckle (24), align index mark on left side of adapter with housing.

1-5.2. Removal. (Figure 1-6.)

a. Remove quick-release pins securing brace assembly to aft adapter and to oil pump housing lug. Remove brace.

b. Remove two quick-release pins securing adapter links (23) to engine. Remove aft engine adapter (22).

c. Remove left forward engine adapter (21).

d. Remove right forward engine adapter (20).

1-6. ENGINE SUPPORT SET INSTALLATION AND REMOVAL.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
1-5	216-00301-1	Engine support set	Support engine during removal and installation

1-6.1. Installation. (Figure 1-6.)

a. With rails (25) removed, attach forward end of support set (26) to arresting gear pivot shaft lugs with two spring-loaded pins.

b. Attach aft end of support set to aft bulkhead with two quick-release pins.

c. Turn pitch control handwheel until pitch indicator pointer indicates 0°.

CAUTION

To avoid damage to equipment in engine bay area, make sure that rails clear engine and airframe while being positioned. Do not force rails beyond locking pins in slotted section of support set.

d. Install two rails in slotted sections of support set until each rail locks in place.

1-6.2. Removal. (Figure 1-6.)

a. Turn pitch control handwheel until pitch indicator pointer indicates 0°.

b. Using aft adapter turnbuckle (24), align index mark on left side of adapter with housing.

c. Remove two rails (25).

d. Remove two quick-release pins securing aft end of support set (26) to aft bulkhead.

e. Release two spring-loaded pins securing forward end of support set to arresting gear pivot shaft lugs. Remove support set.

1-7. SHIPPING ADAPTER REMOVAL AND INSTALLATION.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
	GGG-W-686	Torque wrench, 0 to 250 foot-pounds	Measure torque
1-6	6865331 (Allison Division of General Motors, Indianapolis, Indiana)	Engine shipping adapter assembly	Ship and transport engine
	6865385 (Allison Division of General Motors, Indianapolis, Indiana)	Engine transfer jackscrew	Jack engine to facilitate transfer to and from shipping adapter
	6866485 (Allison Division of General Motors, Indianapolis, Indiana)	Container closure tool	Close flexible engine container
1-6	216-00300-1	Engine adapter set	Adapt engine to rails of transportation trailer

1-7.1. Removal. (Figure 1-7.)

a. Open flexible engine container and remove upper half.

NOTE

Use bottom hole in aft engine flange as a reference point for centering.

b. Check that engine is centered (±1/8 inch) between trailer rails.

c. If engine is not centered, loosen aft shipping adapter roller locks. Manually shift engine laterally to center on rails. Engage roller locks. If roller flanges contact trailer rails, proceed as follows:

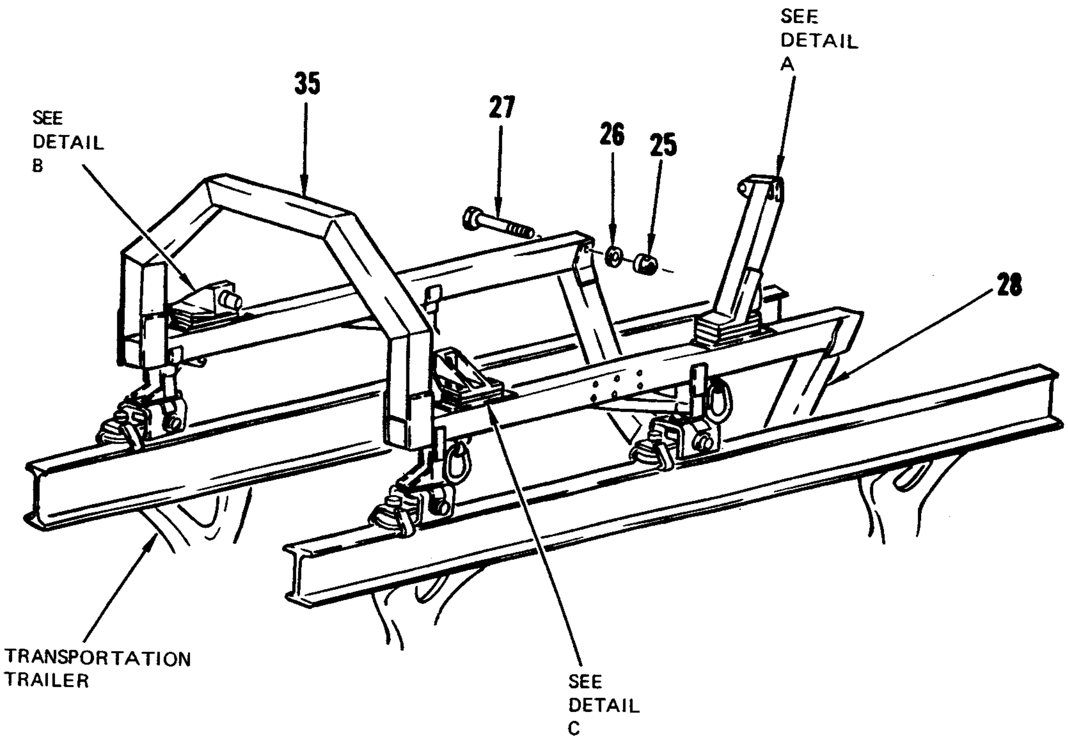
(1) Place engine transfer jackscrews immediately aft of shipping adapter rear rollers.

(2) Raise engine with jackscrews to remove load from rollers.

(3) Loosen bolts and adjust rear rollers as required. Tighten bolts.

(4) Remove engine transfer jackscrews.

(5) Repeat steps b and c.



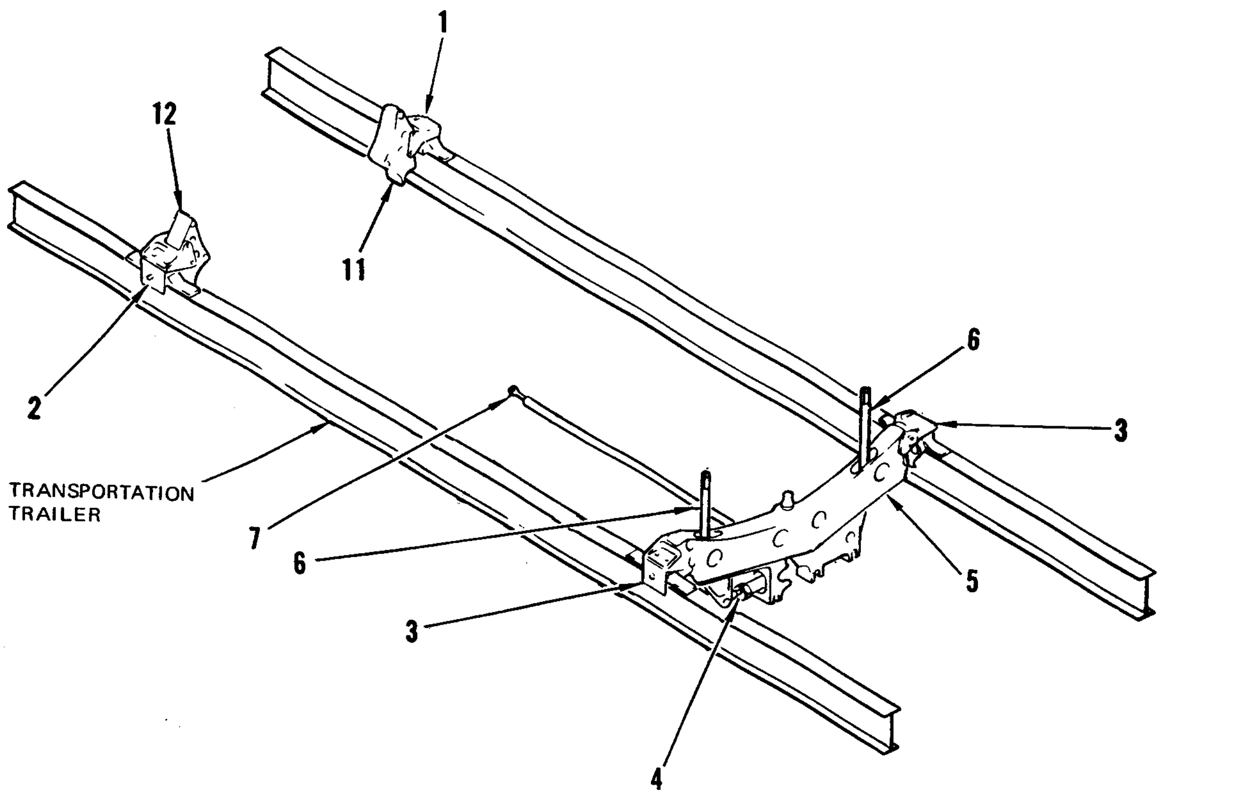
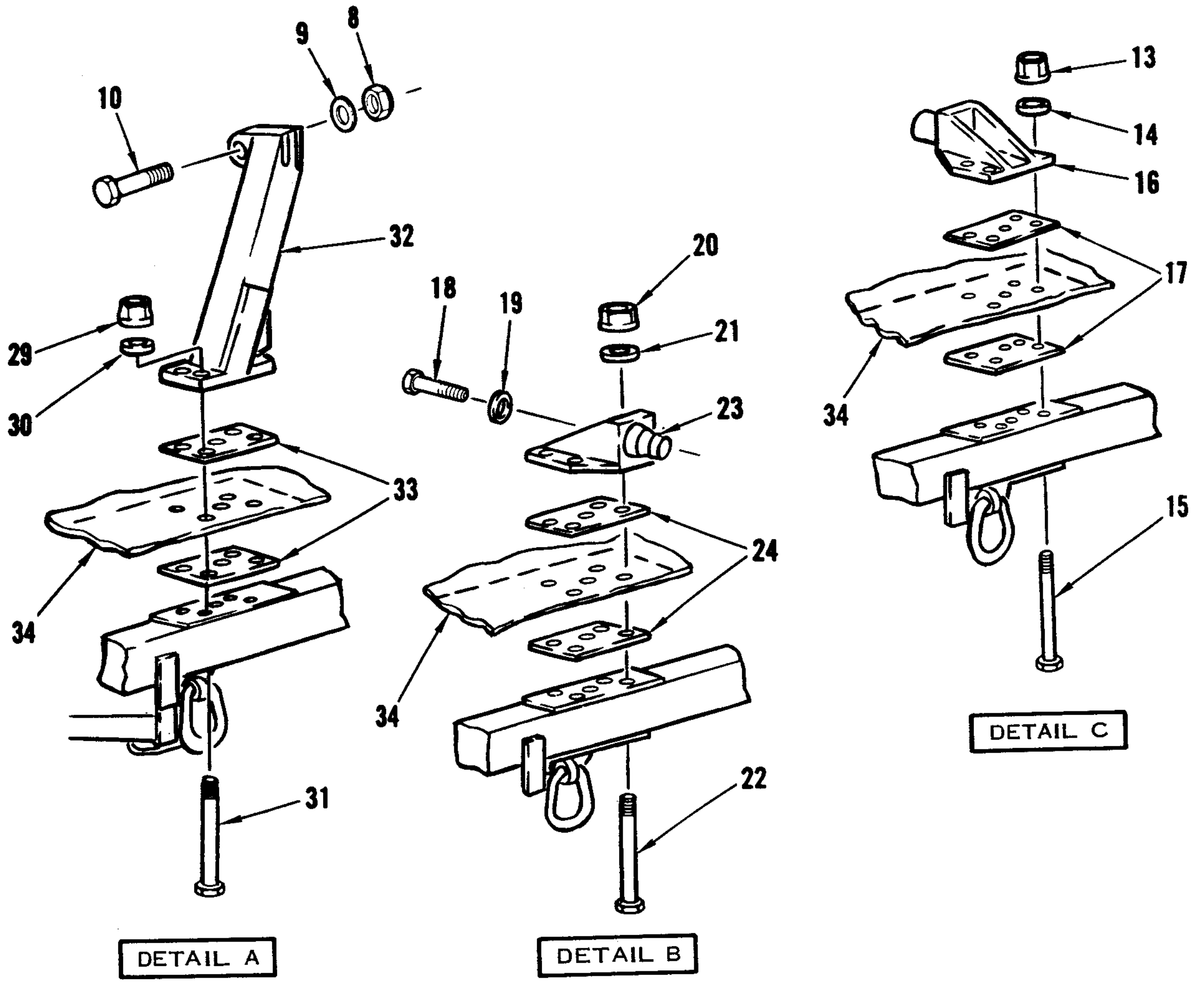


Figure 1-7. Removal and Installation; Shipping Adapter (Sheet 1 of 2)



1. Roller assembly
2. Roller assembly
3. Roller assembly
4. Aft adapter turnbuckle
5. Aft engine adapter
6. Adapter link
7. Adapter set brace
8. Nut
9. Washer
10. Bolt
11. Right forward engine adapter
12. Left forward engine adapter
13. Self-locking nut
14. Washer
15. Bolt
16. Left trunnion mount
17. Gasket
18. Bolt
19. Lockwasher
20. Self-locking nut
21. Washer
22. Bolt
23. Right trunnion mount
24. Gasket
25. Nut
26. Washer
27. Bolt
28. Lower yoke
29. Self-locking nut
30. Washer
31. Bolt
32. Rear support arm
33. Gasket
34. Flexible container lower half
35. Shipping adapter

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Figure 1-7. Removal and Installation; Shipping Adapter (Sheet 2)

d. Remove roller assemblies (1, 2, and 3) from engine adapter set.

e. Adjust aft adapter turnbuckle (4) until 2 inches of threads are exposed on each rod end.

f. Position aft engine adapter (5) with spring-loaded pin inserted in receptacle in bottom of engine, and attach adapter links (6) to engine with quick-release pins.

g. Adjust aft adapter turnbuckle until aft engine adapter contacts bottom of engine.

h. Attach roller assemblies (3) to aft engine adapter with quick-release pins.

i. Adjust aft adapter turntuckle until adapter clears bottom of engine and can be rocked forward and aft freely.

j. Connect adapter set brace (7) to oil pump housing lug and aft adapter with quick-release pins.

k. Adjust aft adapter turnbuckle until engine weight begins to load aft engine adapter. Engage roller locks.

l. Remove nut (8) and washer (9).

m. Adjust aft adapter turnbuckle as required to remove bolt (10).

n. Place engine transfer jackscrews immediately aft of shipping adapter forward rollers.

o. Loosen shipping adapter forward roller locks; then raise engine with jackscrews.

p. Attach right and left forward engine adapters (11 and 12) with quick-release pins.

CAUTION

To prevent damage to adapter set brace, release front and rear adapter roller locks before raising aft end of engine.

NOTE

If weight of engine does not shift to forward adapter roller when jackscrews are removed, adjust aft adapter turnbuckle to lift rear of engine.

q. Remove engine transfer jackscrews.

r. Remove self-locking nuts (13), washers (14), bolts (15), left trunnion mount (16), and gaskets (17).

s. Remove bolt (18) and lockwasher (19).

t. Remove self-locking nuts (20), washers (21), bolts (22), right trunnion mount (23), and gaskets (24).

u. Remove nuts (25), washers (26), bolts (27), and lower yoke (28).

v. Remove self-locking nuts (29), washer (30), bolt (31), rear support arm (32), gaskets (33), and flexible container lower half (34).

w. Release shipping adapter roller locks. Using suitable hoist, remove shipping adapter (35).

x. Adjust aft adapter turnbuckle to align index marks on left side of adapter.

y. Make sure that front and rear adapter roller locks are engaged.

1-7.2. Installation. (Figure 1-7.)

NOTE

Engine will be mounted on the transportation trailer with 216-00300-1 engine adapter set and roller locks engaged.

a. Using suitable hoist, place shipping adapter (35) on transportation trailer with upper yoke toward front.

b. Place lower yoke (28) in position and secure with bolts (27), washers (26), and nuts (25). Tighten nuts to 50 foot-pounds torque.

c. Place flexible container lower half (34) in position.

NOTE

Use aft adapter turnbuckle (4) to adjust vertical position of engine for installation of trunnions.

d. Insert left trunnion mount (16) in engine. Place gaskets (17) in position and secure mount with bolts (15), washers (14), and self-locking nuts (13). Tighten nuts to 50 foot-pounds torque.

e. Insert right trunnion mount (23) in engine. Place gaskets (24) in position and secure mount with bolts (22), washers (21), and self-locking nuts (20). Tighten nuts to 50 foot-pounds torque.

f. Secure right trunnion mount to engine with lockwasher (19) and bolt (18). Tighten bolt to 75 foot-pounds torque.

g. Place engine transfer jackscrews directly aft of shipping adapter forward rollers.

h. Loosen roller assemblies (1 and 2). Raise engine with jackscrews enough to remove roller assemblies and left and right forward engine adapters (12 and 11).

i. Remove jackscrews. Engage shipping adapter forward roller locks.

j. Place gaskets (33) and rear support arm (32) in position and secure with bolt (31), washer (30), and self-locking nut (29). Tighten nuts to 50 foot-pounds torque.

NOTE

Use aft adapter turnbuckle to align rear support arm with rear engine mount.

k. Install bolt (10), washer (9), and nut (8). Tighten nut to 23 (+2, −3) foot-pounds torque.

l. Adjust aft adapter turnbuckle until roller assemblies (3) are free of rail. Remove roller assemblies.

m. Remove quick-release pins to disconnect adapter set brace (7) and adapter links (6) from engine. Remove aft engine adapter (5).

n. Tighten shipping adapter forward and aft roller locks to 50 foot-pounds torque.

o. Preserve engine (T.O. 2J-TF41-6).

p. Place flexible container upper half in position and close container using closure tool slider.

1-8. RIGHT ENGINE TRUNNION REMOVAL AND INSTALLATION.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
	GGG-W-686	Torque wrench 0 to 250 foot-pounds	Measure torque
	GGG-W-686	Torque wrench 10 to 150 inch-pounds	Measure torque
	MIL-M-7404	Maintenance stand, B-4A	Provide work platform at varying elevations
	216-00277-1	Trunnion puller	Remove trunnions
	216-01578-1	Aft engine mount cover	Cover hole in engine and hold aft engine mount clear for removal and installation
	413-900-020	Torque wrench, 100 to 750 inch-pounds (American Tool and Engineering Co, Kalamazoo, Michigan)	Measure torque

1-8.1. <u>Removal.</u> (Figure 1-6.)

a. Open accesses 5222-1, 6122-4, and 6222-1.

b. Remove engine removal door (T.O. 1A-7D-2-1).

c. Remove engine control adapter (paragraph 1-10).

d. Install engine adapter set (paragraph 1-5).

e. Install engine support set (paragraph 1-6).

f. Adjust pitch control handwheel and aft adapter turnbuckle (24) to transfer engine weight from aft engine mount to support set rails.

g. Remove cotter pin (28), nut (29), washers (30), and bolt (31). Slide link (32) inboard and install aft engine mount cover.

h. Adjust aft adapter turnbuckle to approximately center screw (27) in slot.

CAUTION

To avoid damage to equipment, make sure that weight of engine is resting on support set rails at both forward and aft adapter rollers.

i. Turn pitch control handwheel to transfer weight of engine from trunnions to support set rails.

WARNING

To prevent injury and avoid dropping the engine, make sure support set drawbar is attached to aft adapter prior to removing trunnions.

j. Connect support set drawbar to forward side of aft adapter with quick-release pin. Adjust drawbar handcrank to take out slack in drawbar mechanism.

k. Cut lockwire and remove bolt (36) and washer (36).

CAUTION

Adjustment of pitch control or drawbar handwheels with drawbar attached and trunnions installed will damage drawbar mechanism.

To prevent damage to trunnion, do not use force or mechanical puller for removal unless trunnion is seized in mount.

l. Cut lockwire and remove bolts (38), washers (39), and right engine trunnion (40).

1-8.2. Installation. (Figure 1-6.)

a. Insert right engine trunnion (40) and rotate until points engage mating surface of lockring.

b. Secure trunnion with washers (39) and bolts (38). Tighten bolts to 175 (± 10) inch-pounds torque.

c. Secure trunnion to engine with washer (37) and bolt (36). Tighten bolt to 125 (±5) foot-pounds torque; then check torque on bolts (38).

NOTE

If clearance in step d is not correct, trunnion is improperly installed. Remove trunnion and repeat steps a through c.

d. Check for 0.020 (±0.010) inch clearance between trunnion and thrust mount to make sure that trunnion engaged engine locknut. Secure bolts (38) and (36) with MS20995C32 lockwire.

CAUTION

To prevent damage to equipment, the support set drawbar shall be disconnected prior to installing aft engine mount.

e. Disconnect support set drawbar from aft adapter.

f. Remove aft engine mount cover and slide link (32) outboard.

g. Adjust pitch control handwheel and aft adapter turnbuckle (24) to align aft engine mount with airframe bracket.

NOTE

If using NAS 464-10-30 bolt, use one washer under bolthead and one under AN320-10 nut; then add or remove washers as required to torque and cotter pin nut.

If using NAS 1010-30 bolt, use two washers under bolthead and two under nut; then add or remove washers as required to torque and cotter pin nut.

h. Apply heavy coat of MIL-G-23827 grease to bolt (31).

i. Install bolt (bolthead forward), washers (30), and nut (29). Tighten nut to 40 (±5) inch-pounds torque. Loosen nut to align first slot and install new cotter pin (28).

j. Adjust pitch control handwheel to remove engine weight from support set rails.

k. Remove engine support set (paragraph 1-6).

l. Remove engine adapter set (paragraph 1-5).

m. Lubricate and install engine control adapter (paragraph 1-10).

n. Install engine removal door (T.O. 1A-7D-2-1).

o. Close accesses 6222-1, 6122-4, and 5222-1.

1-9. LEFT ENGINE TRUNNION REMOVAL AND INSTALLATION.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
	GGG-W-686	Torque wrench, 0 to 250 foot-pounds	Measure torque
	GGG-W-686	Torque wrench, 10 to 150 inch-pounds	Measure torque
	MIL-M-7404	Maintenance stand, B-4A	Provide work platform at varying elevations
	216-00277-1	Trunnion puller	Remove trunnions
	216-01578-1	Aft engine mount cover	Cover hole in engine and hold aft engine mount clear for removal and installation
	413-900-020	Torque wrench, 100 to 750 inch-pounds (American Tool and Engineering Co, Kalamazoo, Michigan)	Measure torque

1-9.1. Removal. (Figure 1-6.)

a. Open accesses 5222-1, 5122-4, and 6222-1.

b. Remove engine removal door (T.O. 1A-7D-2-1).

c. Remove engine control adapter (paragraph 1-10).

d. Install engine adapter set (paragraph 1-5).

e. Install engine support set (paragraph 1-6).

f. Adjust pitch control handwheel and aft adapter turnbuckle (24) to transfer weight of engine from aft engine mount to support set rails.

g. Remove cotter pin (28), nut (29), washers (30), and bolt (31). Slide link (32) inboard and install aft engine mount cover.

h. Adjust aft adapter turnbuckle to approximately center screw (27) in slot.

CAUTION

To avoid damage to equipment, make sure that weight of engine is resting on support set rails at both forward and aft adapter rollers.

i. Turn pitch control handwheel to transfer weight of engine from trunnions to support set rails.

WARNING

To prevent injury and avoid dropping the engine, make sure support set drawbar is connected to aft adapter prior to removing trunnions.

j. Connect support set drawbar to forward side of aft adapter with quick-release pin. Adjust drawbar handcrank to take out slack in drawbar mechanism.

CAUTION

Adjustment of pitch control or drawbar handwheels with drawbar attached and engine trunnions installed will damage drawbar mechanism.

To prevent damage to trunnion, do not use force or mechanical puller to remove trunnion, unless trunnion is seized in mount.

k. Cut lockwire and remove bolts (33), washers (34), and left engine trunnion (35).

1-9.2. Installation. (Figure 1-6.)

a. Install left engine trunnion (35) and secure with washers (34) and bolts (33). Tighten bolts to 175 (± 10) inch-pounds torque. Secure with MS20995C32 lockwire.

CAUTION

To prevent damage to equipment, the support set drawbar shall be disconnected prior to installing aft engine mount.

b. Disconnect support set drawbar from aft adapter.

c. Remove aft engine mount cover and slide link (32) outboard.

d. Adjust pitch control handwheel and aft adapter turnbuckle (24) to align aft engine mount with airframe bracket.

e. Apply heavy coat of MIL-G-23827 grease to bolt (31).

NOTE

If using NAS 464-10-30 bolt, use one washer under bolthead and one under AN320-10 nut; then add or remove washers as required to torque and cotter pin nut.

If using NAS 1010-30 bolt, use two washers under bolthead and two under nut; then add or remove washers as required to torque and cotter pin nut.

f. Install bolt (bolthead forward), washers (30), and nut (29). Tighten nut to 40 (±5) inch-pounds torque. Loosen nut to align first slot and install new cotter pin (28).

g. Adjust pitch control handwheel to remove engine weight from support set rails.

h. Remove engine support set (paragraph 1-6).

i. Remove engine adapter set (paragraph 1-5).

j. Lubricate and install engine control adapter (paragraph 1-10).

k. Install engine removal door (T.O. 1A-7D-2-1).

l. Close accesses 6222-1, 5122-4, and 5222-1.

1-10. ENGINE CONTROL ADAPTER REMOVAL AND INSTALLATION.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
	GGG-W-686	Torque wrench, 5 to 50 inch-pounds	Measure torque

CAUTION

To prevent damage to engine throttle push-pull assembly, observe handling precautions in T.O. 1A-7D-2-1.

1-10.1. Removal. (Figure 1-8.)

a. Open access 5222-2.

NOTE

Press locking plunger in self-retaining bolt to remove.

b. Remove cotter pin (1), nut (2), counterbored washer (3), self-retaining bolt (4), washer (5), and disconnect throttle push-pull assembly.

c. Remove cotter pins (6), nuts (7), washers (8), and bolts (9).

CAUTION

To prevent damage to support bearing and lever shaft, avoid excessive misalignment and force on lever and coupling assembly.

Do not strike or apply high load to bearing or support. Always remove lever and coupling assembly from support after disconnecting from engine control adapter.

d. Carefully slide engine control adapter outboard against support. Rotate coupling 90° forward, move lever inboard, and remove adapter assembly.

1-10.2. Lubrication. (Figure 1-8.)

CAUTION

To prevent damage to engine control adapter parts, the following procedures should be performed in a clean area free of dust or sand.

a. Remove cotter pin (10), nut (11), washer (12), bolt (13), bushings (14), and coupling (15).

b. Remove pin (16) and trunnion (17) from lever (18).

c. Wipe outer diameter of pin (16) with MIL-G-23827 grease.

d. Wipe grip of bolt (13) with MIL-G-23827 grease.

e. Wipe outer diameter and bolt ends of two bushings (14) with MIL-G-23827 grease.

f. Place trunnion (17) in lever (18) and secure with pin (16).

g. Install two bushings (14) in coupling (15).

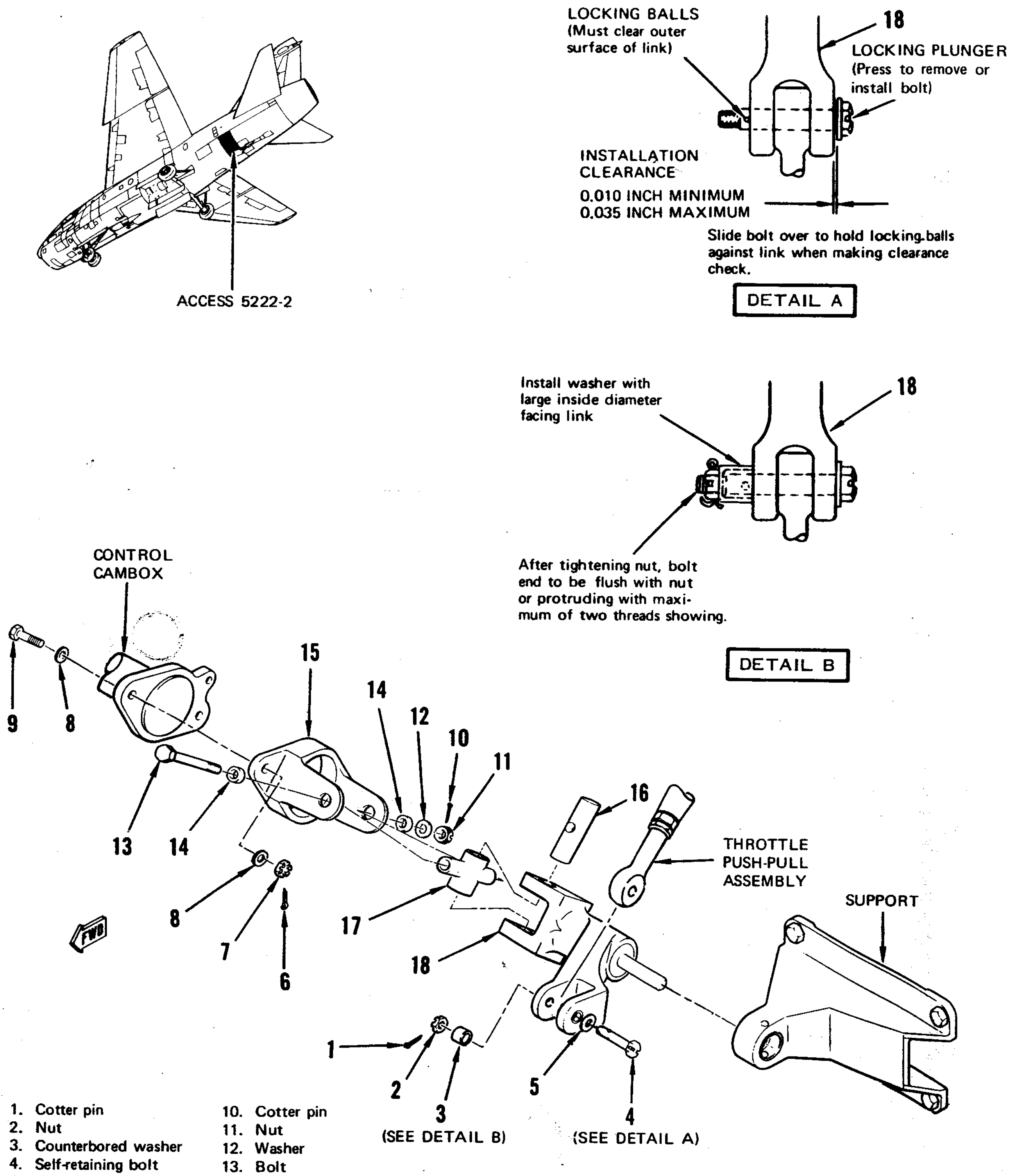
NOTE

It may be necessary to rotate pin (16) to align holes when bolt (13) is installed.

h. Assemble coupling to lever with bolt (13), washer (12), and new nut (11). Tighten nut finger-tight; then advance nut until it is just snug against washer. Make sure bolt and trunnion rotate freely. Secure nut using new cotter pin (10).

i. Check operation of assembled unit by manually working engine control adapter. Trunnion should move without binding.

j. Apply a light coat of MIL-L-7870 oil on control adapter bearing shaft.



1. Cotter pin
2. Nut
3. Counterbored washer
4. Self-retaining bolt
5. Washer
6. Cotter pin
7. Nut
8. Washer
9. Bolt
10. Cotter pin
11. Nut
12. Washer
13. Bolt
14. Bushing
15. Coupling
16. Pin
17. Trunnion
18. Lever

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Figure 1-8. Removal and Installation; Engine Control Adapter

1-10.3. Installation. (Figure 1-8.)

CAUTION

To prevent damage to support bearing and lever shaft, avoid excessive misalignment and force on lever and coupling assembly.

Do not strike or apply high load to bearing or support.

NOTE

If throttle control coupling holes have excessive tolerances, repair as indicated in step a.

a. Repair holes in throttle control coupling (15) as follows:

WARNING

Solvent P-D-680, Type II, is toxic to skin, eyes, and respiratory tract. Use in a well-ventilated area. Avoid prolonged breathing of vapors. Avoid eye and repeated skin contact. Keep away from sparks and flames.

(1) Clean throttle control coupling with P-D-680 drycleaning solvent.

(2) To build up holes as required, per QQ-N-290A, brush plate coupling holes with class 2 neutral nickel plating.

(3) Ream or hone hole to finish dimensions indicated in figure 1-15.

b. Rotate coupling at right angle to lever. Carefully engage lever shaft in bearing of support.

c. Slide adapter outboard against support. Using bolts (9, figure 1-7), washers (8), and new nuts (7), connect coupling to cambox. Tighten nuts to 25 (±5) inch-pounds torque. Secure with new cotter pins (6).

d. Install washer (5) on self-retaining bolt (4) and insert bolt through adapter and push-pull control. Check that clearance between washer and mating surface is 0.010 to 0.035 inch with locking balls clear of outer surface of lever.

NOTE

After tightening nut, self-retaining bolt must be flush with nut or extend no more than two threads through nut.

e. Install counterbored washer (3) and new nut (2). Tighten nut to 25 (±5) inch-pounds torque. Secure with new cotter pin (1).

f. Check that throttle operates smoothly and does not bind.

g. Close access 5222-2.

1-11. HIGH PRESSURE AND LOW PRESSURE BLEED AIR DUCTS REMOVAL AND INSTALLATION.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
	GGG-W-686	Torque wrench, 10 to 150 inch-pounds	Measure torque
	966A1	Micrometer, optical	Measure defects (nicks, scratches, etc)

1-11.1. Removal. (Figure 1-9.)

a. Remove engine (paragraph 1-4).

b. Remove cotter pin (1), bolt (2), washer (3), spring (4), spacer (5), spacer (6), and washers (7, 8, and 9).

c. Cut lockwire and remove insulation from ducts.

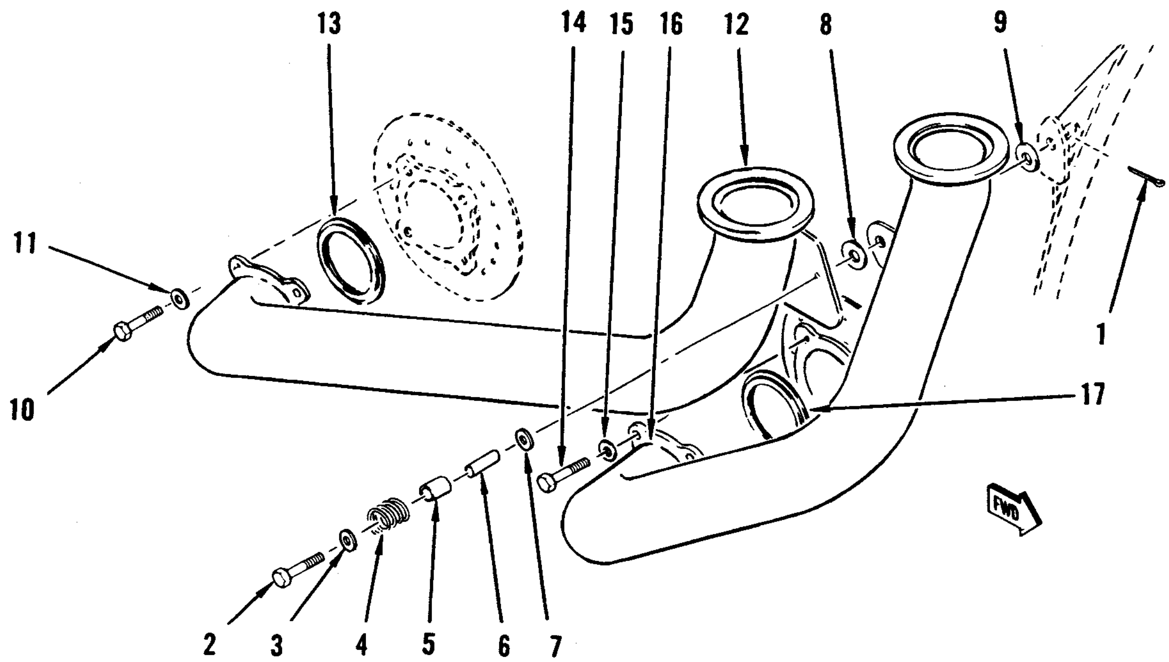
d. Cut lockwire and remove bolts (10), washers (11), high pressure duct (12), and gasket (13).

e. Cut lockwire and remove bolts (14), washers (15), low pressure duct (16), and gasket (17).

1-11.2. Installation. (Figure 1-9.)

a. Inspect high and low pressure bleed air ducts for damage using optical micrometer. Replace duct if damage exceeds limits set in T.O. 1A-7D-2-3.

b. Apply MIL-L-46010 antiseize compound to threads of bolts (10 and 14).



1. Cotter pin
2. Bolt
3. Washer
4. Spring
5. Spacer
6. Spacer
7. Washer
8. Washer
9. Washer
10. Bolt
11. Washer
12. High pressure duct
13. Gasket
14. Bolt
15. Washer
16. Low pressure duct
17. Gasket

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Figure 1-9. Removal and Installation; High Pressure and Low Pressure Bleed Air Ducts

NOTE

After tightening duct retaining bolts, a slight gap may exist between duct flange and engine bleed air duct flange.

c. Using new gasket (17), place low pressure duct (16) in position and secure with washers (15) and bolts (14). Tighten bolts to 45 (± 5) inch-pounds torque.

d. Using new gasket (13), place high pressure duct (12) in position and secure with washers (11) and bolts (10). Tighten bolts to 45 (± 5) inch-pounds torque.

e. Secure bolts (10 and 14) with MS20995C32 lockwire.

NOTE

Make sure that insulation blankets are securely laced and that lockwire makes two complete turns around each capstan.

f. Install insulation blankets on ducts. Secure with MS20995C32 lockwire.

g. Secure duct flanges to engine with washers (9, 8, and 7), spacer (6), spacer (5), spring (4), washer (3), bolt (2), and new cotter pin (1).

h. Install engine (paragraph 1-4).

1-12. RIGHT TRUNNION MOUNT ASSEMBLY REMOVAL AND INSTALLATION.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
1-9	6872438 (Allison Division of General Motors, Indianapolis, Indiana)	Trunnion mount puller	Remove trunnion mount assembly

1-12.1. Removal. (Figure 1-10.)

a. Remove engine (paragraph 1-4).

b. Remove nuts (1), brackets (2), and retaining plates (3).

c. Thread puller into nut and pull right engine mount trunnion (4).

d. Remove nut (5), lockring (6), and two-piece spherical bearing (7).

1-12.2. Installation. (Figure 1-10.)

a. Lubricate ID and OD of spherical bearing (7) with MIL-L-25681 lubricating oil.

b. Place two-piece spherical bearing, lockring (6), and nut (5) in right engine mount trunnion (4).

c. Install right engine mount trunnion in engine.

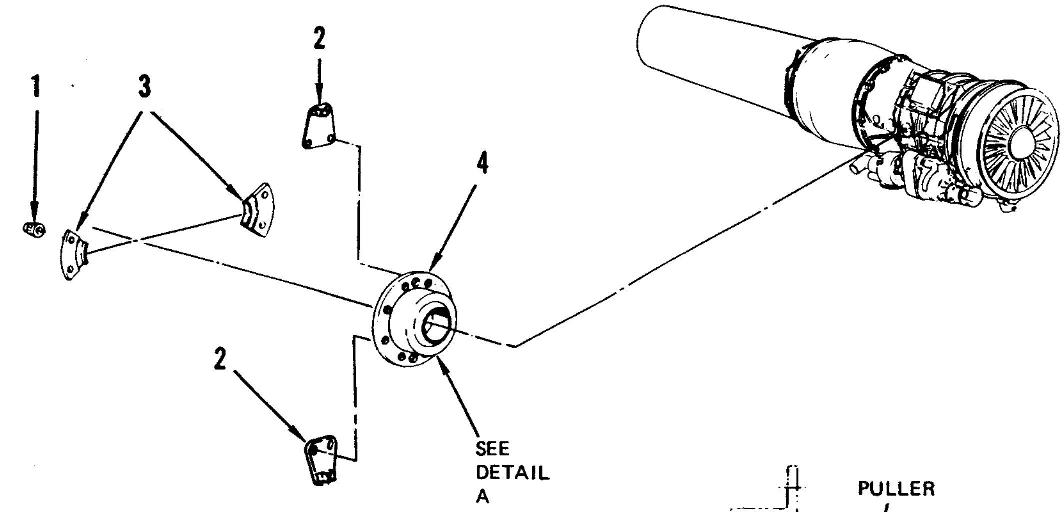
d. Place retaining plates (3) and brackets (2) in position and secure with nuts (1).

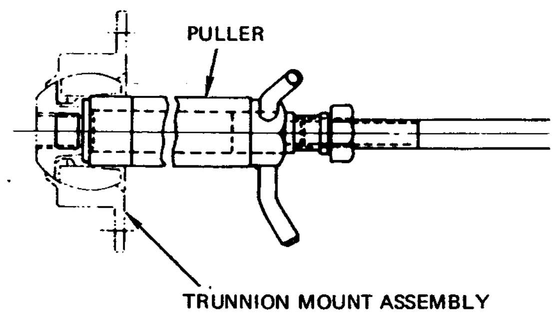
e. Install engine (paragraph 1-4).

1-13. LEFT TRUNNION MOUNT ASSEMBLY REMOVAL AND INSTALLATION.

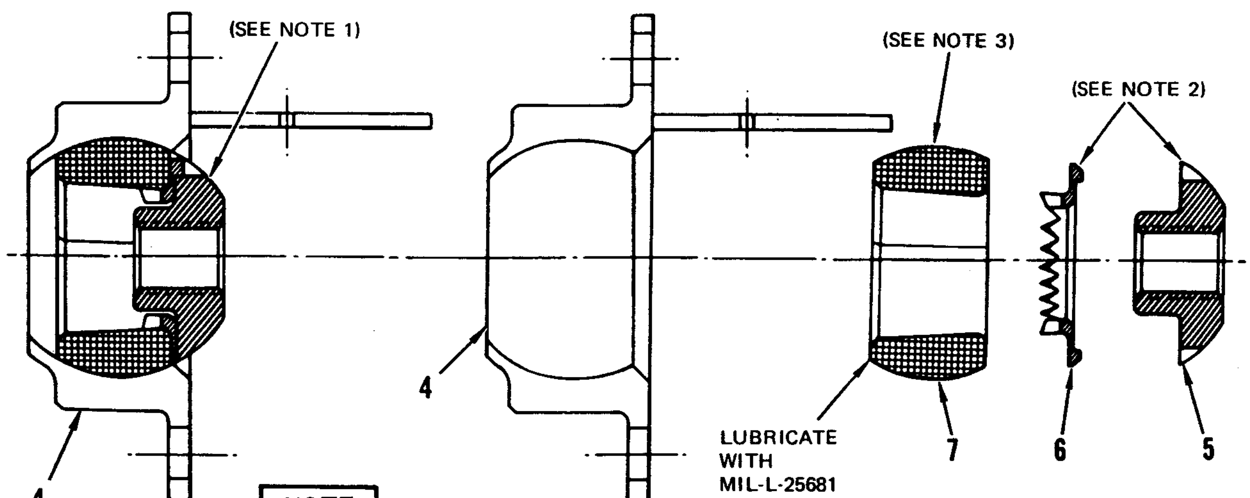
Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
1-10	6872438 (Allison Division of General Motors, Indianapolis, Indiana)	Trunnion mount puller	Remove trunnion mount assembly





1. Nut
2. Bracket
3. Retaining plate
4. Right engine mount trunnion
5. Nut
6. Locking ring
7. Bearing



NOTE

1. Turn internal parts 180° as shown.
2. Remove special nut and lock ring.
3. Remove spherical bearing (two halves).

DETAIL A

TO REASSEMBLE, REVERSE SEQUENCE.

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Figure 1-10. Removal and Installation; Right Trunnion Mount Assembly

1-13.1. Removal. (Figure 1-11.)

a. Remove engine (paragraph 1-4).

b. Remove nuts (1), retaining plates (2), and bracket (3).

c. Insert puller into bearing and tighten until rubber expander grips bearing. Remove left engine mount trunnion (4).

d. Remove two-piece shperical bearing (5).

1-13.2. Installation. (Figure 1-11.)

a. Lubricate ID and OD of spherical bearing (5) with MIL-L-25681 lubricating oil.

b. Place two-piece shperical bearing in left engine mount trunnion (4).

c. Install trunnion, retaining plates (3), and brackets (2) and secure with nuts (1).

d. Install engine (paragraph 1-4).

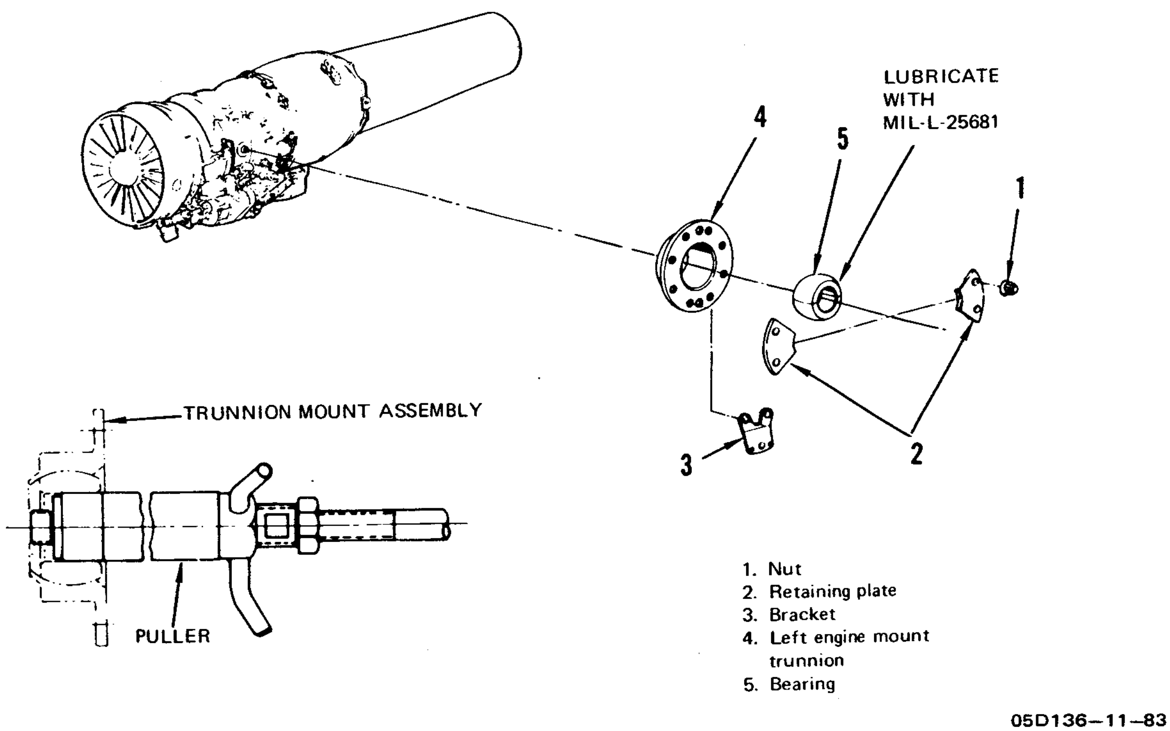


Figure 1-11. Removal and Installation; Left Trunnion Mount Assembly

1-14. AIR INLET EXTENSION REMOVAL AND INSTALLATION.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
	GGG-W-686	Torque wrench, 10 to 150 inch-pounds	Measure torque
	6798622 (Allison Division of General Motors, Indianapolis, Indiana)	Engine instrument protector	Provide protection against damage to temperature signals probe

1-14.1. Removal. (Figure 1-12.)

a. Remove engine (paragraph 1-4).

b. Remove bolts (1), lockwashers (2), and keeper plate (4).

CAUTION

To prevent damage to temperature signal probe capillary tube, use extreme care to prevent sharp bends or kinking. Damage to tube will cause failure of airflow control system.

c. Remove temperature signal probe (5) and joint washer (6). Place signal probe in engine instrument protector.

d. Remove bolts (7), lockwashers (8), and T1 thermocouple (9). Place thermocouple in engine instrument protector.

e. Remove nut, washer, spacer, and screw securing manifold clamp to bottom of extension. Leave clamp on manifold.

f. Remove two bolts, two washers, and two nuts securing manifold to bracket on bottom of extension.

g. Remove bolts (10), lockwashers (11), and air inlet extension (12).

h. Remove nuts (13), washers (14), screws (15), and air inlet seal bumper (16).

i. Remove nuts (17), screws (18), and bracket (19).

1-14.2. Installation. (Figure 1-12.)

a. Place bracket (19) in position and secure to air inlet extension (12) with screws (18) and nuts (17).

CAUTION

If improper hardware is used to install bumper or if washer is omitted, screws may work loose and be ingested into the engine causing FOD.

b. Secure air inlet seal bumper (16) to extension with screws (15), washers (14), and nuts (13).

c. Place extension in position and secure to engine with lockwashers (11) and bolts (10). Tighten bolts to 77 (+8, −7) inch-pounds torque.

d. Secure manifold clamp to bracket with screw, spacer, washer, and nut.

e. Secure manifold to bracket on bottom of extension with nuts, washers, and bolts.

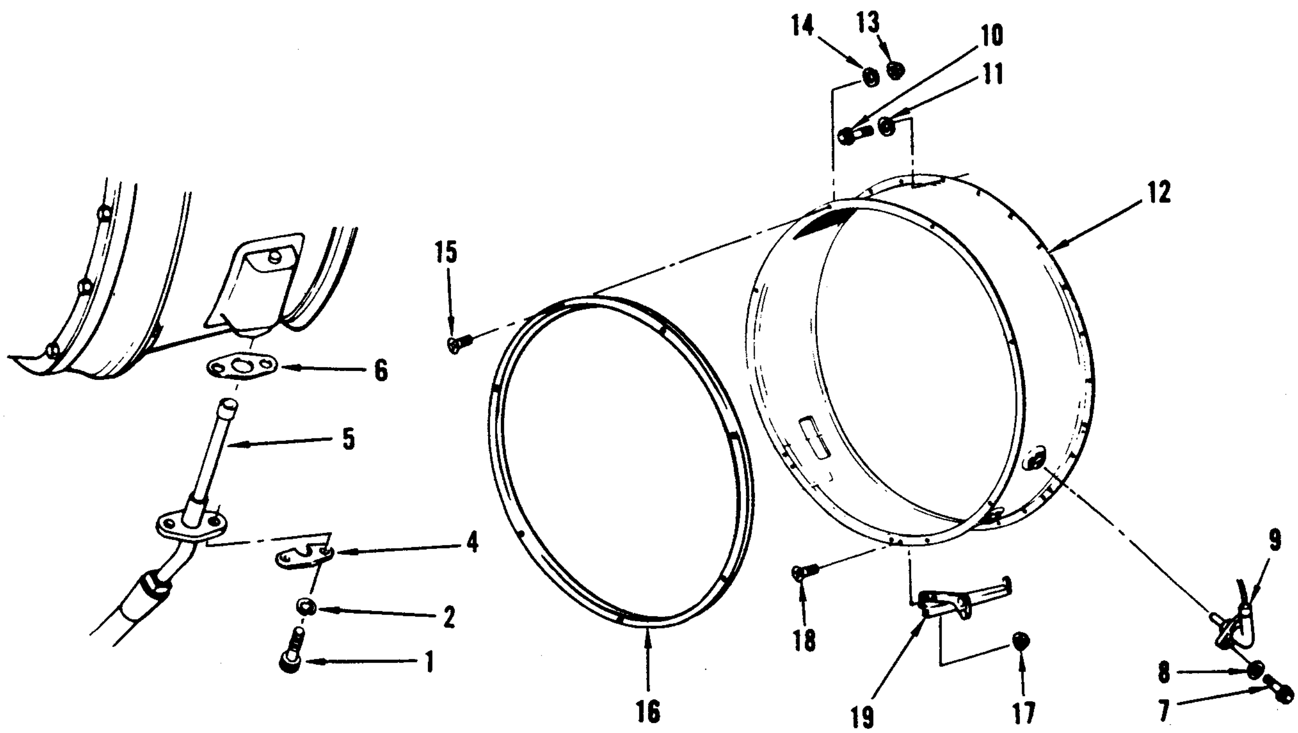
f. Place T1 thermocouple (9) in boss and secure to extension with lockwashers (8) and bolts (7).

CAUTION

To prevent damage to temperature signal probe capillary tube, use extreme care to prevent sharp bends or kinking. Damage to tube will cause failure of airflow control system.

g. Using new joint washer (6), install temperature signal probe (5) with keeper plate (4), lockwashers (2), and bolts (1).

h. Install engine (paragraph 1-4).



1. Bolt
2. Lockwasher
3. Deleted
4. Keeper plate
5. Temperature signal probe
6. Joint washer
7. Bolt
8. Lockwasher
9. T1 thermocouple
10. Bolt
11. Lockwasher
12. Air inlet extension
13. Nut
14. Washer
15. Screw
16. Air inlet seal bumper
17. Nut
18. Screw
19. Bracket

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Figure 1-12. Removal and Installation; Air Inlet Extension

1-15. TAILPIPE REMOVAL AND INSTALLATION.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
	GGG-W-686	Torque wrench, 10 to 150 inch-pounds	Measure torque

1-15.1. <u>Removal.</u> (Figure 1-13.)

a. Remove tail cone, access A105133-1 (T.O. 1A-7D-2-1).

CAUTION

Tailpipe should be supported during removal so that weight of tailpipe is evenly distributed.

b. Remove self-locking nuts (1), washers (2), bolts (3), and tailpipe (4).

1-15.2. <u>Installation.</u> (Figure 1-13.)

CAUTION

Tailpipe should be supported so that bypass duct flange does not support weight until load has been evenly distributed.

NOTE

Offset alignment hole is adjacent to top vertical centerline.

a. Position tailpipe (4) to engage mating flanges and support tailpipe.

CAUTION

Extreme care must be exercised in joining mating flanges of tailpipe, and fan bypass duct flanges must be seated evenly.

b. Install several bolts (3) (heads forward), washers (2), and self-locking nuts (1) at regular intervals. Tighten in a uniform stagger pattern (180°, 90°, 45°, etc.) to seat mating flanges.

c. Make sure that mating flanges are properly seated; then install remaining bolts, washers, and self-locking nuts.

CAUTION

To prevent damage to flanges, all nuts should be initially tightened to 75% of final torque.

d. Tighten all nuts to 50 (±3) inch-pounds torque in a uniform stagger pattern.

e. Tighten all nuts to 67 (±5) inch-pounds torque in a uniform stagger pattern.

f. Install tail cone, access A105133-1 (T.O. 1A-7D-2-1).

1-16. WIGGINS COUPLING REMOVAL AND INSTALLATION.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
	AN8514-1	Spanner wrench	Tighten and loosen couplings
	GGG-W-686	Torque wrench, 10 to 150 inch-pounds	Measure torque
	413-900-020 (American Tool and Engineering Co, Kalamazoo, Michigan)	Torque wrench, 100 to 750 inch-pounds	Measure torque
	57F890775-1	Adapter kit torque	Tighten couplings

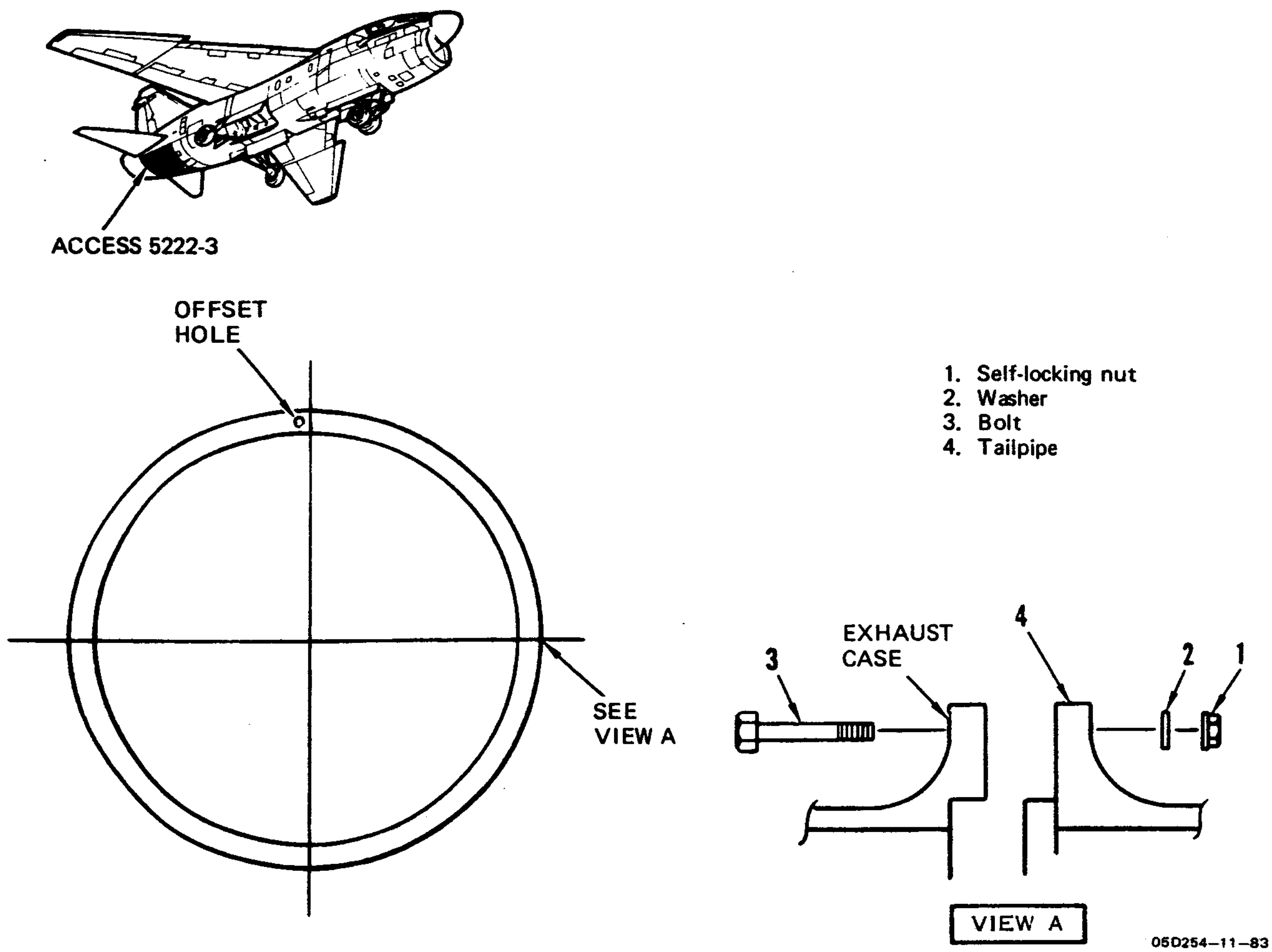


Figure 1-13. Removal and Installation; Tailpipe

1-16.1. Removal. (Figure 1-14.)

a. Cut lockwire and disconnect coupling body (1) from coupling nut (2).

b. Remove retainer halves (3), packings (4), and washers (5).

1-16.2. Installation. (Figure 1-14.)

a. Inspect inner diameter of retainer half (3) for wear. If retainer shows wear, replace coupling.

b. Check ends of tubes for excessive wear around beads. Maximum allowable depth of wear around the tube bead is 15% of tubing wall thickness extending no more than 180° around tubing circumference. If wear is excessive, replace tube.

c. Install coupling body (1) on one tube end and coupling nut (2) to other tube end.

d. Install washers (5) on tube ends between bead and coupling.

e. Install new packings (4) on each tube end between bead and washer.

f. Align tubes to within ±0.06 inch by adjusting position of clamps.

g. If tubes require alignment, remove nuts, screws, and spacers on any clamps installed on the tubes.

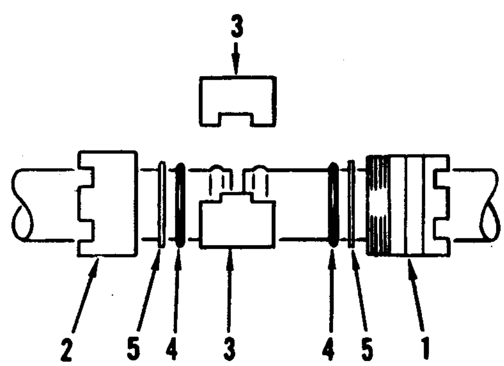
h. Make sure tubes are a maximum of 1/4-inch apart and install retainer halves (3) to enclose both tube beads.

i. Slide coupling body into position to engage threads and tighten to torque specified in table 1-2. Use strap or spanner wrench to secure ends; this allows Wiggins coupling to be properly torqued.

j. Secure coupling with MS20995C32 lockwire as shown.

k. Align tube clamps and install proper length NAS43 spacer between clamps if required to ensure no side load will be induced into tube installation when clamps are secured.

l. Secure clamps using length of spacer determined in step k and length of screw as required.



1. Coupling
2. Coupling nut
3. Retainer half
4. Packing
5. Washer

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Figure 1-14. Removal and Installation; Wiggins Coupling

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Table 1-2. Wiggins Coupling Torque

Coupling number	Packing, MS29513	Torque (inch-pounds) Minimum	Maximum
3608-8	-112	48	60
3608-10	-114	60	72
3605-12	-210	72	84
3605-16	-214	156	204
3605-20	-218	216	264
3605-24	-325	324	396
3605-28	-327	372	468
3605-32	-329	432	528
3605-40	-333	552	648
3605-48	-337	672	768

1-17. ENGINE CONTROL ADAPTER BACKLASH CHECK.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
		Spring scale, 0 to 10 pounds	Measure force applied to fuel control arm

a. Open access 5222-2.

b. Position throttle so that aft edge of throttle lever is 2.0 (±0.10) inches aft of MIL. Place throttle friction lever in maximum friction.

c. Secure dial indicator in a position so that plunger contacts rod end as shown in figure 1-15.

d. Using spring scale, apply 5-pound force forward on main fuel control lever to take up slack. Zero indicator. Apply 5-pound force aft on lever and record dial indicator indication.

e. Repeat step d twice to obtain an average of three measurements.

f. If average measurement does not exceed 0.050 inch, engine control adapter is satisfactory.

g. If average measurement exceeds 0.050 inch, proceed as follows:

(1) Check throttle control system for proper torque and safetying. If any part was found to be improperly torqued or safetied, rig engine throttle system (T.O. 1A-7D-2-1).

(2) If throttle system is satisfactory, remove engine control adapter (paragraph 1-10). Using micrometer set, check components for wear as shown in figure 1-16.

(3) Replace any components worn beyond limits.

NOTE

If throttle control coupling holes have excessive tolerances, repair as indicated in substep (4).

(4) Repair holes in throttle control coupling (15) as follows:

WARNING

Solvent P-D-680, Type II, is toxic to skin, eyes, and respiratory tract. Use in a well-ventilated area. Avoid prolonged breathing of vapors. Avoid eye and repeated skin contact. Keep away from sparks and flames.

(a) Clean throttle control coupling with P-D-680, Type II, drycleaning solvent.

(b) To build up holes as required per QQ-N-290A, brush plate coupling holes with class 2 neutral nickel plating.

(c) Ream or hone hole to finish dimensions indicated in figure 1-16.

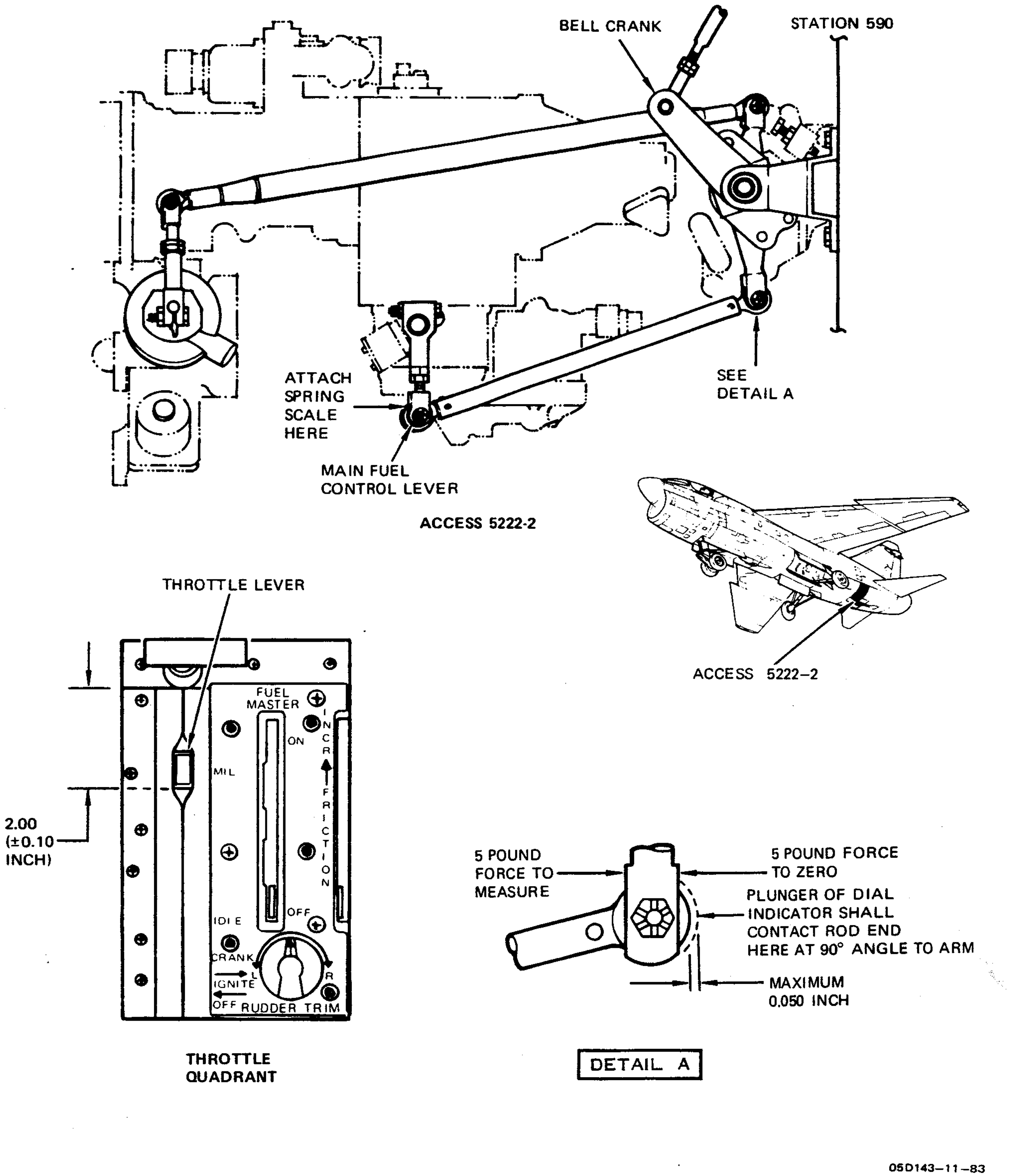


Figure 1-15. Backlash Check; Engine Control Adapter

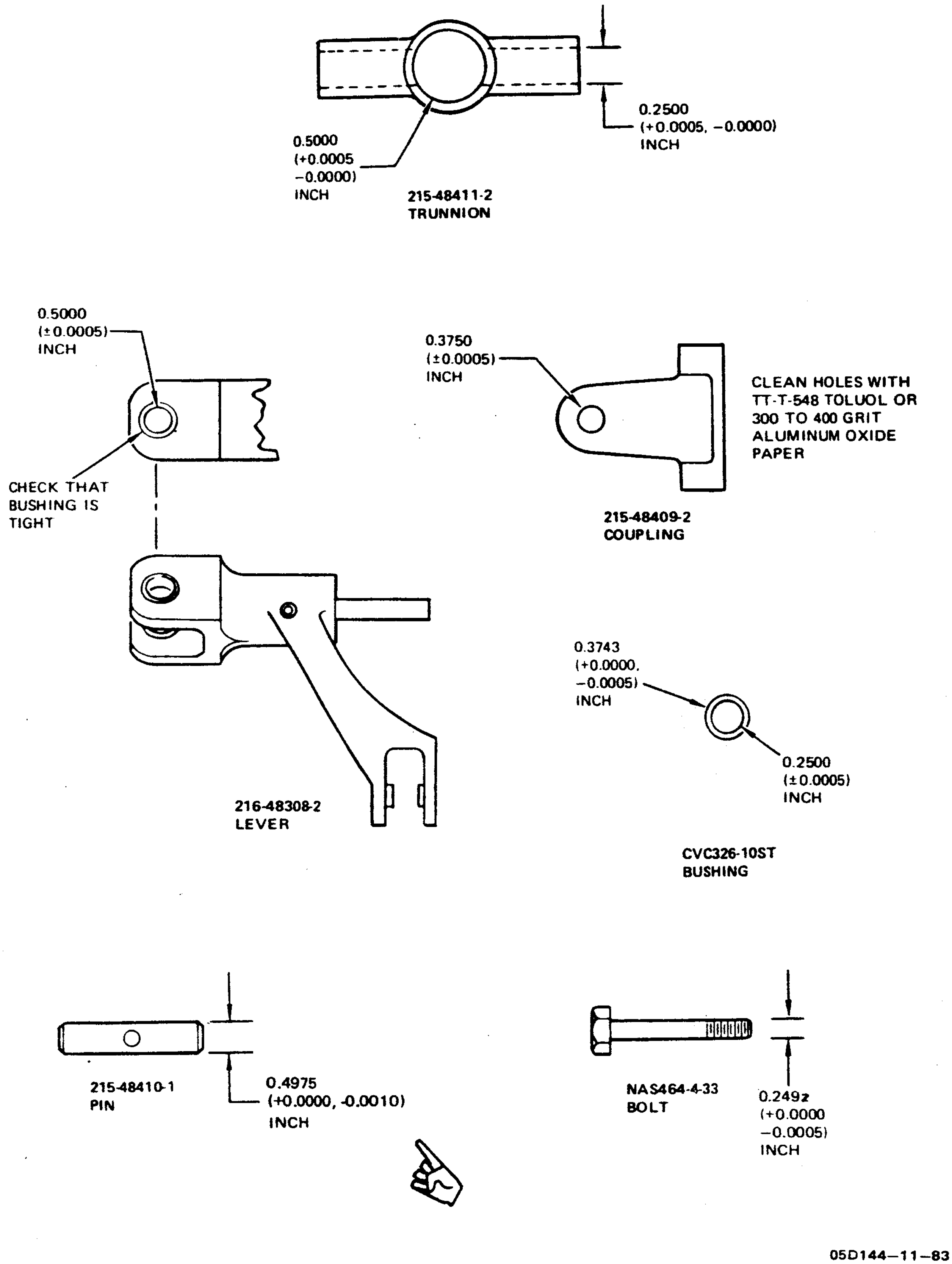


Figure 1-16. Component Tolerances; Engine Control Adapter

(5) Lubricate and install engine control adapter (paragraph 1-10).

(6) Repeat steps b through e to verify backlash is within limits.

h. Remove dial indicator.

i. Place throttle friction in OFF and place throttle in OFF.

j. Close access 5222-2.

1-18. ENGINE FUEL, OIL, AND AIR TUBING REMOVAL AND INSTALLATION PRECAUTIONS.

NOTE

The following instructions are intended to supplement data in T.O. 1-1A-8.

a. When removing tubing, exercise care to prevent bending or straining tube.

b. Definition of terms contained within damage limit tables are as follows:

(1) Wrinkle — corrugated surface at inner radius of bends.

(2) Corrosion — surface is broken, pitted, and discolored.

(3) Stain — surface discoloration other than that caused by heat.

(4) Dent — a depression which does not produce a raised edge or sharp corner.

(5) Nick — a depression which results in a raised edge or sharp corner or both.

(6) Scratch — a trough-like depression caused by drawing a sharp object across the surface.

(7) Chafe — a worn spot due to rubbing.

(8) Pit — small irregular cavity in surface, generally rough bottomed.

c. Inspect tubing for damage using the applicable damage limit table:

(1) Fuel tubes (table 1-3 or 1-4)

(2) Oil pressure tubes (table 1-5)

(3) Air pressure tubes (table 1-5)

(4) Oil scavenge tubes (table 1-6)

(5) Breather tubes (table 1-6)

Table 1-3. Fuel Tube Damage Limits (Working Pressure Greater Than 1,000 PSI)

Condition	Area	Damage limits
NOTE Refer to table 1-7 for list of tubes with working pressure greater than 1,000 psi.		
Corrosion, nicks, stains, pits, scratches, cracks, and damaged or loose end fittings	Overall tube	Reject tube for repair.
Dents	Within 1/4 inch of fitting	50% of nominal tube wall thickness
	Within bend area of 45° or greater	50% of nominal tube wall thickness
	Remainder of tube	20% of nominal tube OD

Table 1-3. Fuel Tube Damage Limits (Working Pressure Greater Than 1,000 PSI) — CONT

Condition	Area	Damage limits
	Overall tube	Maximum of four dents in any 3-inch section. If dents are in a line laterally or circumferentially, they must be at least 1/4 inch apart.
Chafing	Overall tube	15% of nominal tube wall thickness; no rough edges permitted
Wrinkles	Inner radius of bend	1/64-inch deep as measured from depth of valley to height of peak

Table 1-4. Fuel Tube Damage Limits (Working Pressure Less Than 1,000 PSI)

NOTE

Refer to table 1-7 for list of tubes with working pressure less than 1,000 psi.

Condition	Area	Damage limits
Corrosion, nicks, stains, pits, scratches, cracks, and damaged or loose end fittings	Overall tube	Reject tube for repair.
Dents	Within 1/4 inch of fitting	Maximum of three dents up to 75% of nominal tube wall thickness
	Within bend area of 60° or greater	Maximum of three dents up to 75% of nominal tube wall thickness
	Remainder of tube	20% of nominal tube OD
	Overall tube (except bend area)	Maximum of six dents in a 3-inch section. If dents are in a line laterally or circumferentially, they must be at least 1/4 inch apart.
Chafing	Overall tube	15% of nominal tube wall thickness; no rough edges permitted
Wrinkles	Inner radius of bend	1/64-inch deep as measured from depth of valley to height of peak

Table 1-5. Oil Pressure and Air Pressure Tube Damage Limits

Condition	Area	Damage limits
Corrosion, nicks, stains, pits, scratches, cracks, and damaged or loose end fittings	Overall tube	Reject tube for repair.

Table 1-5. Oil Pressure and Air Pressure Tube Damage Limits — CONT

Condition	Area	Damage limits
Dent	Within 1/4 inch of fitting	Maximum of four dents up to 100% of nominal tube wall thickness
	Within bend area 90° or greater	Maximum of four dents up to 100% of nominal tube wall thickness
	Remainder of tube	20% of nominal tube OD
	Overall tube	Maximum of eight dents within a 3-inch section. If dents are in a line laterally or circumferentially, they must be at least 1/4 inch apart.
Chafing	Overall tube	20% of nominal tube wall thickness; no rough edges permitted
Wrinkles	Inner radius of bend	1/64-inch deep as measured from depth of valley to height of peak

Table 1-6. Scavenge Oil and Breather Tube Damage Limits

Condition	Area	Damage limits
Corrosion, nicks, stains, pits, scratches, cracks, and damaged or loose end fittings	Overall tube	Reject tube for repair.
Dents	Within 1/4 inch of fitting	100% of nominal tube wall thickness; any number allowed
	Within bend area of 90° or greater	100% of nominal tube wall thickness; any number allowed
	Remainder of tube	25% of nominal tube OD; any numder allowed
Chafing	Overall tube	25% of nominal tube wall thickness; no rough edges permitted
Wrinkles	Inner radius of bend	1/32-inch deep as measured from depth of valley to height of peak

Table 1-7. Fuel Tube Working Pressure

Nomenclature	Greater than 1,000 psi	Less than 1,000 psi
Airflow control-to-drain block		X
Airflow control-to-LP filter		X
Cold start valve-to-tee	X	
Fuel flowmeter-to-LP fuel filter		X
HP fuel pump-to-airflow control	X	
HP fuel pump-to-drain block		X
HP fuel pump-to-fuel shutoff valve	X	
HP fuel pump-to-manual fuel control	X	
HP fuel pump-to-pressure switch	X	
HP fuel pump-to-velocity cleaned filter	X	
HP fuel pump internal servo line	X	
HP fuel shutoff valve-to-main manifold	X	
HP fuel shutoff valve-to-pilot manifold	X	
HP fuel shutoff valve-to-fuel drain		X
HP fuel shutoff valve-to-HP fuel pump inlet		X
HP fuel shutoff valve-to-HP fuel pump servo	X	
LP fuel filter-to-HP fuel pump		X
LP fuel pump-to-drain block		X
LP governor-to-cold start valve	X	
LP governor-to-drain block		X
LP governor-to-HP fuel shutoff valve	X	
Main fuel control-to-drain block		X
Main fuel control-to-HP fuel pump	X	
Main fuel control-to-LP governor	X	
Main fuel control-to-manual fuel control	X	
Manual fuel control-to-drain block		X
Manual fuel control-to-fuel cooled oil cooler	X	
Manual fuel control-to-HP fuel pump	X	
Manual fuel control-to-HP fuel shutoff valve	X	
Manual fuel control-to-main fuel control	X	
Velocity cleaned filter-to-cold start valve	X	
Velocity cleaned filter-to-airflow control	X	

d. Install packings, packing retainers, and gaskets as shown in figure 1-17.

e. When installing flanged tubes, observe the following:

(1) Do not apply torsional loads or attempt to bend welded or brazed areas.

(2) Total flange area contact must be achieved by flexing the tube by hand and without causing a permanent set to the tube.

(3) Flange holes must align so that bolts can be installed without subjecting the tube to a torsional load.

f. When installing flared tubes, observe the following:

(1) Do not force flared end onto its mating surface.

(2) Alignment must permit tube nut to be installed up to final 1/2 turn with finger pressure.

(3) Final tightening of coupling nut must not stretch tube.

(4) Flattening effect of tube cross section must not exceed 15% of tube OD.

g. Flexing of tube by hand is permitted to align tube clamps if it does not cause permanent set in tube.

h. Clearance must exist between rigid tubes and adajcent hardware. If lines are in contact, loosen end fittings and reposition clamps. If this does not provide clearance, lines must be removed and reformed.

i. Personnel must be familiar with provisions of T.O. 1-1A-8 before attempting to torque screws, nuts, bolts, or coupling nuts.

j. Apply MIL-L-25681 lubricant to male threads and rotating mating surfaces of all bolts and nuts.

k. If torque is not specified in text for bolt or nut, use standard torque (table 1-8).

l. When RTV-106 sealing compound is used, proceed as follows:

(1) Just prior to application of sealing compound, clean mating surfaces with MIL-C-81302A trichlorotrifluoroethane (Freon type 113) and clean, lint-free cloth. Remove any trace of oil, grease, or dirt.

CAUTION

Use extreme care in application of sealing compound to prevent its entry into seal cavities, blind holes, or passages.

(2) Apply RTV-106 sealing compound evenly to one surface of mating parts.

(3) Join surfaces and tighten to specified torque.

(4) Wait 30 minutes and retighten.

(5) Repeat substep (4) until at least 95% of torque is maintained.

(6) Remove all excess sealing compound.

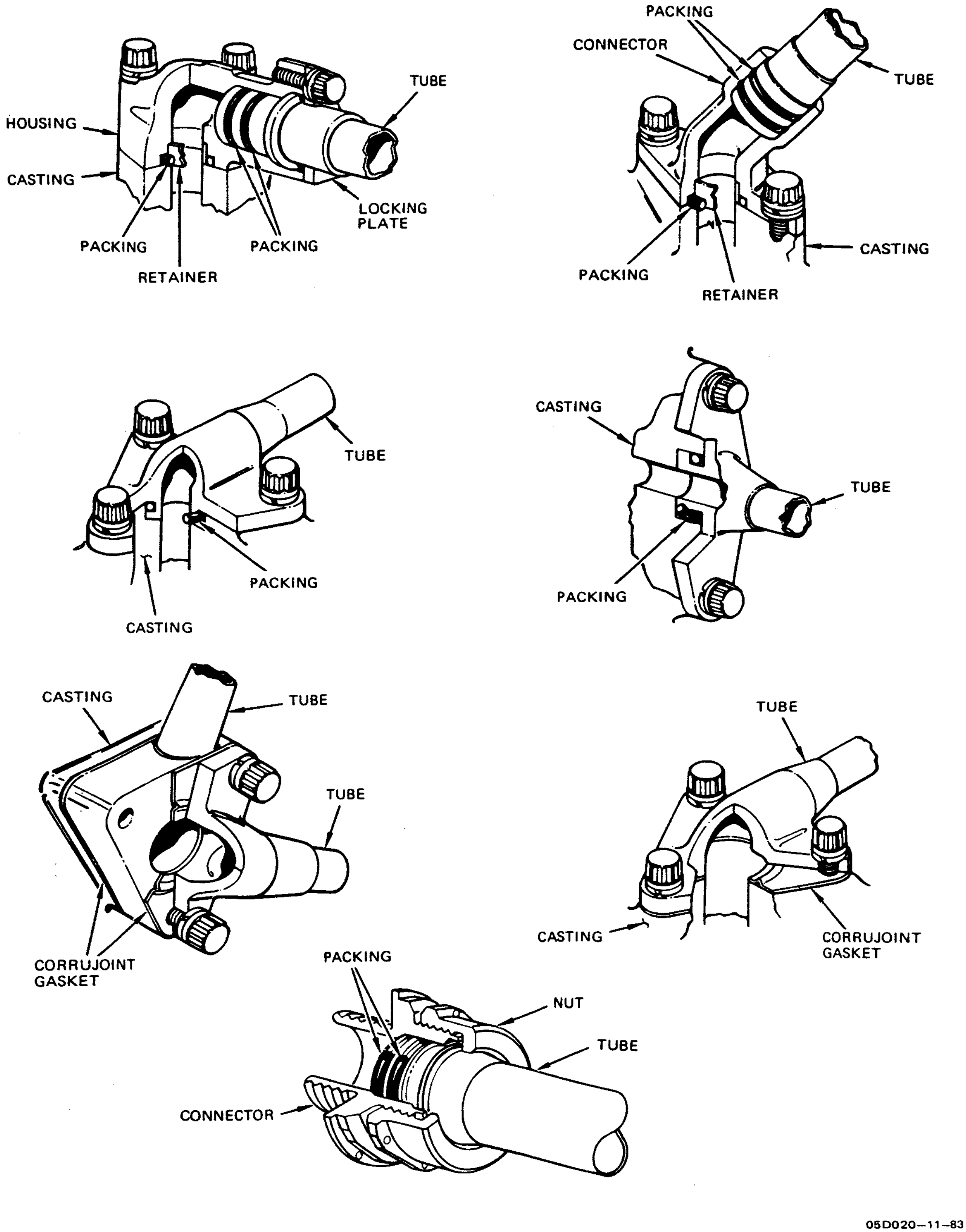


Figure 1-17. Tubing Connections; Typical

Table 1-8. Nut and Bolt Standard Torque

NOTE

All torques are inch-pounds unless otherwise specified.

Thread	Without self-locking features *Torque*	With self-locking features *Torque*
6-32	7 to 9	8 to 10
6-40	9 to 11	10 to 12
8-32	12 to 15	13 to 17
8-36	17 to 20	19 to 22
10-24	25 to 30	27 to 32
10-32	35 to 40	37 to 42
1/4-20	60 to 65	65 to 70
1/4-28	70 to 85	74 to 89
5/16-18	105 to 115	113 to 123
5/16-24	120 to 150	127 to 157
3/8-16	205 to 245	217 to 257
3/8-24	240 to 280	250 to 290
7/16-14	350 to 390	367 to 407
7/16-20	400 to 465	414 to 479
1/2-20	47 to 54 ft-lb	49 to 55 ft-lb
9/16-12	60 to 65 ft-lb	63 to 68 ft-lb
9/16-18	65 to 75 ft-lb	67 to 77 ft-lb
5/8-18	90 to 100 ft-lb	93 to 103 ft-lb

m. When Permatex-1372 sealing compound is used, proceed as follows:

WARNING

To avoid injury when using trichloroethane, wear plastic or rubber gloves. Avoid repeated contact with skin and prolonged or repeated breathing of vapor. Never use in a confined area without mechanical ventilation or respiratory protection.

(1) Clean mating surfaces with O-T-620 trichloroethane or other suitable (nonoily) solvent to remove any trace of oil, grease, or dirt.

(2) Using O-M-232 methyl alcohol (Methanol), reduce Permatex-1372 sealing compound to a thin paste consistency.

CAUTION

Use extreme care in application of sealing compound to prevent its entry into seal cavities, blind holes, or passages.

(3) Apply Permatex-1372 sealing compound to both mating surfaces in a thin even coat with a No. 8 artist brush or equivalent.

(4) Allow sufficient drying time to thinning agent to evaporate and compound to set.

(5) Join surfaces and tighten to specified torque.

(6) Wait 10 minutes to retighten.

(7) Repeat substep (6) until at least 95% of torque is maintained.

(8) Remove excess sealing compound.

n. When corrujoint gasket is used, proceed as follows:

(1) Apply RTV-106 or Permatex-1372 to corrujoint gasket.

(2) Tighten joints to specified torque.

(3) Wait 10 minutes and retighten.

(4) Repeat substeps (2) and (3) until at least 95% of torque is maintained.

o. Lubricate male threads of coupling nuts and fittings as shown in table 1-9.

Table 1-9. Coupling Nuts and Fittings Lubrication

System	Lubricant
Oil	MIL-L-7808 or MIL-L-23699 engine oil
Fuel	MIL-L-6081 lubricating oil
Air	MIL-L-25681 lubricating oil

p. Table 1-10 provides standard torque limits for coupling nuts.

q. Table 1-11 provides standard torque limits for screws.

r. When screws are installed with nuts, apply torque specified for screw.

s. Table 1-12 provides electrical coupling nuts standard torque.

Table 1-10. Coupling Nuts and Fittings Standard Torque

Thread size	Wrench size (in.)	Torque
		NOTE All torques are inch-pounds unless otherwise specified.
Steel coupling nuts on steel fittings:		
5/16-24	3/8	35 to 40
3/8-24	7/16	65 to 100
7/16-20	9/16	80 to 120
1/2-20	5/8	150 to 200
9/16-18	11/16	200 to 250
3/4-16	7/8	325 to 400
7/8-14	1	475 to 575
1 1/16-12	1 1/4	55 to 65 ft-lb
1 5/16-12	1 1/2	60 to 80 ft-lb
1 5/8-12	2	100 to 125 ft-lb
Steel with aluminum or aluminum with aluminum coupling nuts on fittings:		
5/16-24	3/8	15 to 25
3/8-24	7/16	25 to 40
7/16-20	9/16	40 to 65
1/2-20	5/8	60 to 80
9/16-18	11/16	80 to 120
3/4-16	7/8	150 to 200
7/8-14	1	200 to 350
1 1/16-12	1 1/4	300 to 350
1 5/16-12	1 1/2	40 to 60 ft-lb
1 5/8-12	2	50 to 75 ft-lb
1 7/8-12	2 1/4	50 to 75 ft-lb

Table 1-10. Coupling Nuts and Fittings Standard Torque — CONT

Thread size	Wrench size (in.)	Torque
Aluminum or steel unions:		
5/16-24	9/16	18 to 25
3/8-24	5/8	50 to 75
7/16-20	11/16	55 to 80
1/2-20	3/4	75 to 110
9/16-18	13/16	100 to 150
3/4-16	1	200 to 300
7/8-14	1 1/8	300 to 450
1 1/16-12	1 3/8	420 to 600
1 5/16-12	1 5/8	50 to 70 ft-lb
1 5/8-12	1 7/8	65 to 85 ft-lb
1 5/8-12	1 15/16	65 to 85 ft-lb
Plugs and bleeders:		
5/16-24	9/16	10 to 16
3/8-24	5/8	30 to 40
7/16-20	11/16	40 to 65
1/2-20	3/4	60 to 80
9/16-18	13/16	80 to 120
3/4-16	1	150 to 200
7/8-14	1 1/8	200 to 350
1 1/16-12	1 3/8	300 to 500
Pipe plugs		Tighten enough to seal.
Plugs using copper or aluminum asbestos gaskets		Tighten as required, loosen, and retighten.

Table 1-11. Screw Standard Torque

Thread size	Torque
	NOTE All torques are inch-pounds unless otherwise specified.
6-32	8 to 10
6-40	8 to 10
8-32	12 to 15
8-36	14 to 16
10-24	18 to 22
10-32	22 to 26
1/4-20	35 to 40
1/4-28	50 to 58

Table 1-11. Screw Standard Torque — CONT

Thread size	Torque
5/16-18	75 to 90
5/16-24	95 to 110
3/8-16	135 to 165
3/8-24	170 to 210
7/16-14	240 to 275
7/16-20	290 to 335
1/2-13	370 to 410
1/2-20	450 to 500
9/16-12	43 to 47 ft-lb
9/16-18	46 to 50 ft-lb
5/8-11	56 to 60 ft-lb
5/8-18	60 to 65 ft-lb
3/4-10	77 to 82 ft-lb

t. Threaded parts with self-locking devices must be checked to make sure that inbuilt torque of self-locking device is adequate. Inbuilt torque is the torque required to start nut or bolt turning when:

(1) Nut or bolt is fully engaged with self-locking device.

(2) Full chamfer of bolt or stud extends beyond self-locking device.

(3) There is no axial load on self-locking device.

Table 1-12. Electrical Coupling Nuts Standard Torque

NOTE

All torques are inch-pounds unless otherwise specified.

Thread size	Wrench size (in.)	Mating parts of steel	One or both mating parts of nonsteel
		Torque	*Torque*
1/2-28	5/8 Hex	50 to 70	20 to 40
5/8-24	3/4 Hex	70 to 90	30 to 50
3/4-20	7/8 Hex	100 to 120	50 to 70
7/8-20	1 Hex	120 to 140	70 to 90
1-20	1 1/8 Hex	140 to 160	100 to 125
1-20	Spanner	140 to 160	100 to 125
1 1/8-18	Spanner	195 to 220	100 to 125
1 1/4-18	Spanner	245 to 270	100 to 125
1 3/8-18	Spanner	285 to 310	
1 1/2-18	Spanner	305 to 330	
1 5/8-18	Spanner	305 to 330	
1 3/4-18	Spanner	335 to 380	
1/2-28 thru 1 1/2-18 knurled		Tighten beyond finger-tight (20° max) until connecting parts are in solid contact without damage; then lock-wire.	

u. The range of acceptable inbuilt torque loads is provided in table 1-13. Self-locking devices having inbuilt torque loads outside this range should be rejected.

v. Altering inbuilt torque of self-locking device by crimping or by tapping is not permitted.

Table 1-13. Self-Locking Device Inbuilt Torque Limits

NOTE

All torques are inch-pounds unless otherwise specified.

Thread size	Inbuilt torque	
	Minimum	*Maximum*
No. 4-40	0.5	5
No. 4-48	0.5	5
No. 6-32	1.0	10
No. 6-40	1.0	10
No. 8-32	1.5	15
No. 8-36	1.5	15
No. 10-24	2.0	18
No. 10-32	2.0	18
1/4-20	4.5	30
1/4-28	3.5	30
5/16-18	7.5	60
5/16-24	6.5	60
3/8-16	12.0	80
3/8-24	9.5	80
7/16-14	16.5	100
7/16-20	14.0	100
1/2-13	24.0	150
1/2-20	18.0	150
9/16-12	30.0	200
9/16-18	24.0	200
5/8-11	40.0	300
5/8-18	32.0	300
3/4-10	60.0	400
3/4-16	50.0	400
7/8-9	82.0	50 ft-lb
7/8-14	70.0	50 ft-lb
1-8	110.0	67 ft-lb

Table 1-13. Self-Locking Device Inbuilt Torque Limits — CONT

Thread size	Inbuilt torque	
1-12	90.0	67 ft-lb
1 1/8-12	117.0	75 ft-lb
1 1/4-12	143.0	83 ft-lb

1-19. TF41-A-1 ENGINE BUILDUP WIRING HARNESS REMOVAL AND INSTALLATION.

1-19.1. Removal. (Figure FO-1.)

a. Open accesses 5222-1 and 5222-2.

b. Remove engine removal door (T.O. 1A-7D-2-1).

c. Remove clamps (1 through 19).

CAUTION

Electrical connectors P402, P501, P502, P508, and P511 have push-pull type coupling. To prevent damage, do not use tools, such as pliers, or twist these couplings.

d. Disconnect electrical connector P402 from J1 interface connector (20).

e. Remove jamnut (21) and disconnect connector J1.

f. Remove jamnut (22) and disconnect connector (23).

g. Disconnect connectors (24 through 30).

h. Remove electrical harness (31).

1-19.2. Installation. (Figure FO-1.)

NOTE

See figure 1-18 for wiring diagram of electrical harness.

a. Make continuity check of electrical harness (31).

b. Repair damaged harness in accordance with T.O. 1-1A-14.

c. Position electrical harness (31) on engine.

NOTE

Check that seal is installed in connector P501 (33) before connecting to detector unit.

d. Connect connectors (30 through 24).

e. Secure connector (23) with jamnut (22).

f. Secure connector (21) with jamnut (20).

g. Secure harness to engine with clamps (19 through 1).

h. Start engine (T.O. 1A-7D-2-1) and check that all engine instruments operate. Shut down engine.

i. Install engine removal door (T.O. 1A-7D-2-1).

j. Close accesses 5222-2 and 5222-1.

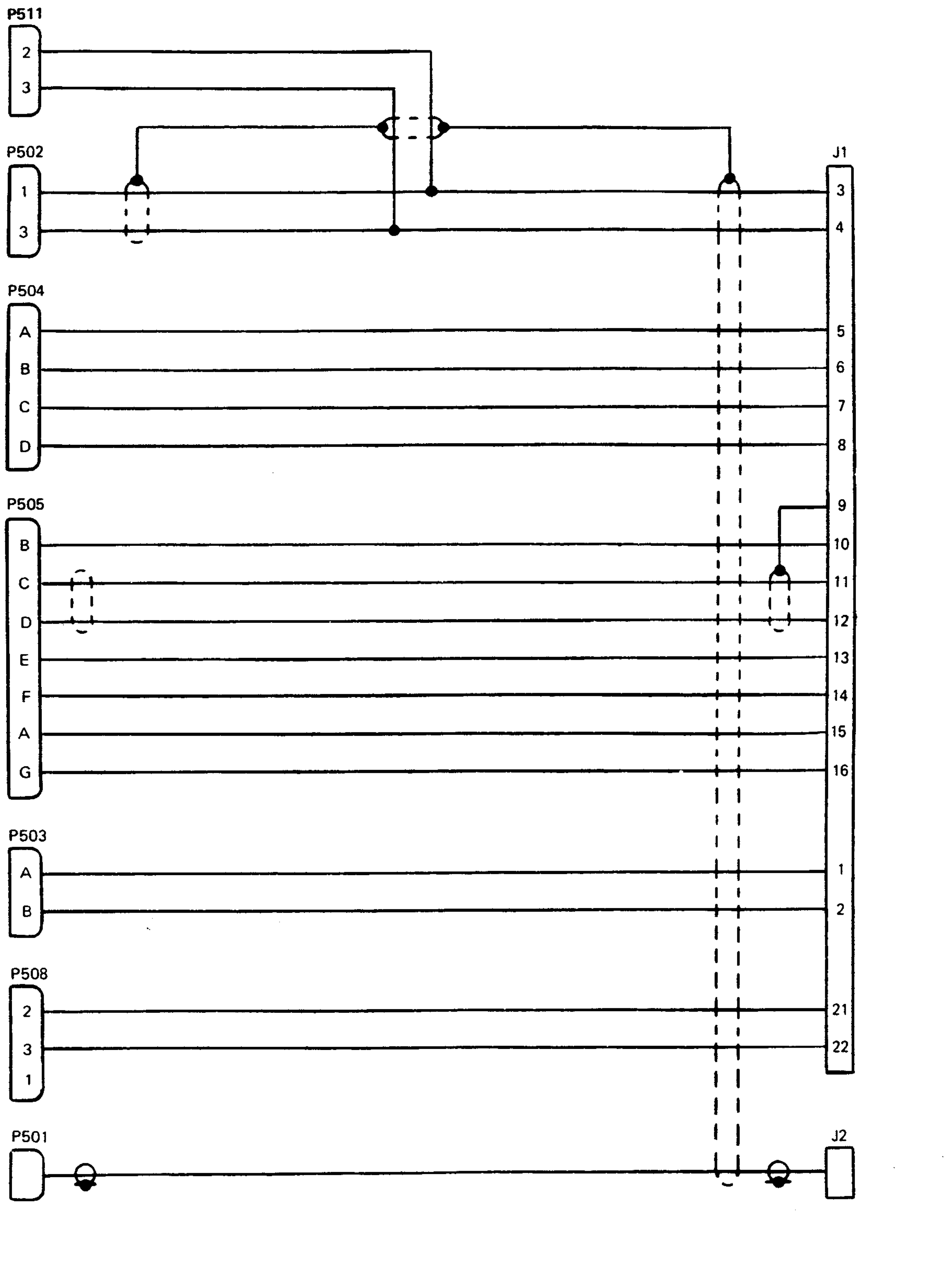


Figure 1-18. Wiring Harness Diagram; TF41-A-1 Engine Buildup

SECTION II

AIRFLOW CONTROL SYSTEM

2-1. DESCRIPTION.

2-1.1. Purpose. The system (figure 2-1) prevents compressor surges in engine low rpm ranges. The stages of the high pressure compressor are matched for stability at maximum compressor ratios. A set of variable inlet guide vanes (IGV) and a seventh stage bleed valve are used for stability at reduced compression ratios. The IGV increase the angle of attack of the airflow onto the front stage of the high pressure compressor as the compression ratio decreases. This prevents blade stall and compressor surge. The bleed valve opens at the lower compression ratios to route air from the seventh stage high pressure compressor to the bypass duct. These actions will increase the airflow through the front stages, preventing them from stalling. It also decreases airflow through the rear stages, preventing them from choking. The system includes an airflow control, surge cylinder, bleed valve cylinder, bleed valve, and inlet guide vanes.

2-1.2. Input Signals. Signals proportional to engine air inlet temperature (T1) and high pressure compressor rotor speed schedule the IGV and bleed valve. Fuel pressure from the HP fuel pump is used as a hydraulic force to operate the IGV and bleed valve. T1 is sensed by a fluid filled temperature signal probe. The rotor speed signal is supplied by a hydromechanical governor within the HP fuel pump.

2-2. OPERATION. (Figure 2-2.)

2-2.1. Static Condition. With the engine static (shutdown), the airflow control piston is held fully extended by spring force. This will hold the inlet guide vanes in the minimum airflow position (+35°) and the bleed valve in the open position.

2-2.2. Engine Running. Signals proportional to T1 and high pressure compressor rotor speed are received by the airflow control. With T1 temperature increased or decreased, the fluid within the temperature signal probe will expand or contract. This will change the pressure on the relief valve and establish reference pressure. This reference pressure is applied to one side of the airflow control diaphragm. The hydromechanical governor (HMG) will produce a fuel pressure signal that is proportional to high pressure compressor rotor speed. A variable orifice is provided to bleed high pressure fuel to low pressure fuel. The greater the orifice opening, the lower the signal pressure. This opening is controlled by the position of the weighted valve. In the static condition, the orifice is held closed by spring pressure. When the engine is running, centrifugal and spring forces act against fuel pressure in the diaphragm chamber. Pressure in the chamber, acting on one side of the hinge plate, holds the valve open at low speeds. When engine speed increases, centrifugal force will overcome the fuel pressure. This reduces the variable orifice opening, increasing the signal pressure. The pressure signal is proportional to centrifugal force on the valve. It is not affected by fuel density or viscosity. This speed signal is applied to the diaphragm in opposition to the reference pressure.

2-2.3. Low Engine Speed. With the engine running in the low rpm range, the pressure signal from the HMG is not enough to overcome reference pressure. The combination of servo and spring pressure will hold the piston extended. This, in turn, will hold the inlet guide vanes in the minimum airflow position (+35°) and the bleed valve in the open position.

2-2.4. Engine Speed Increase. As high pressure compressor rotor speed is increased, the pressure signal from the HMG will increase until pressure is enough to overcome reference pressure. At this point, the diaphragm will shift, opening the servo metering valve. This will reduce servo pressure by permitting a flow through the opened restrictor. This permits high pressure fuel acting on the small area of the piston to overcome the reduced servo pressure and spring force. This will move the piston in the retract direction. It also will move the inlet guide vanes toward the maximum airflow position (0°) and the bleed valve toward the closed position. As the piston retracts, it will compress the piston spring and increase pressure on the diaphragm. This increased spring pressure causes the servo metering valve to

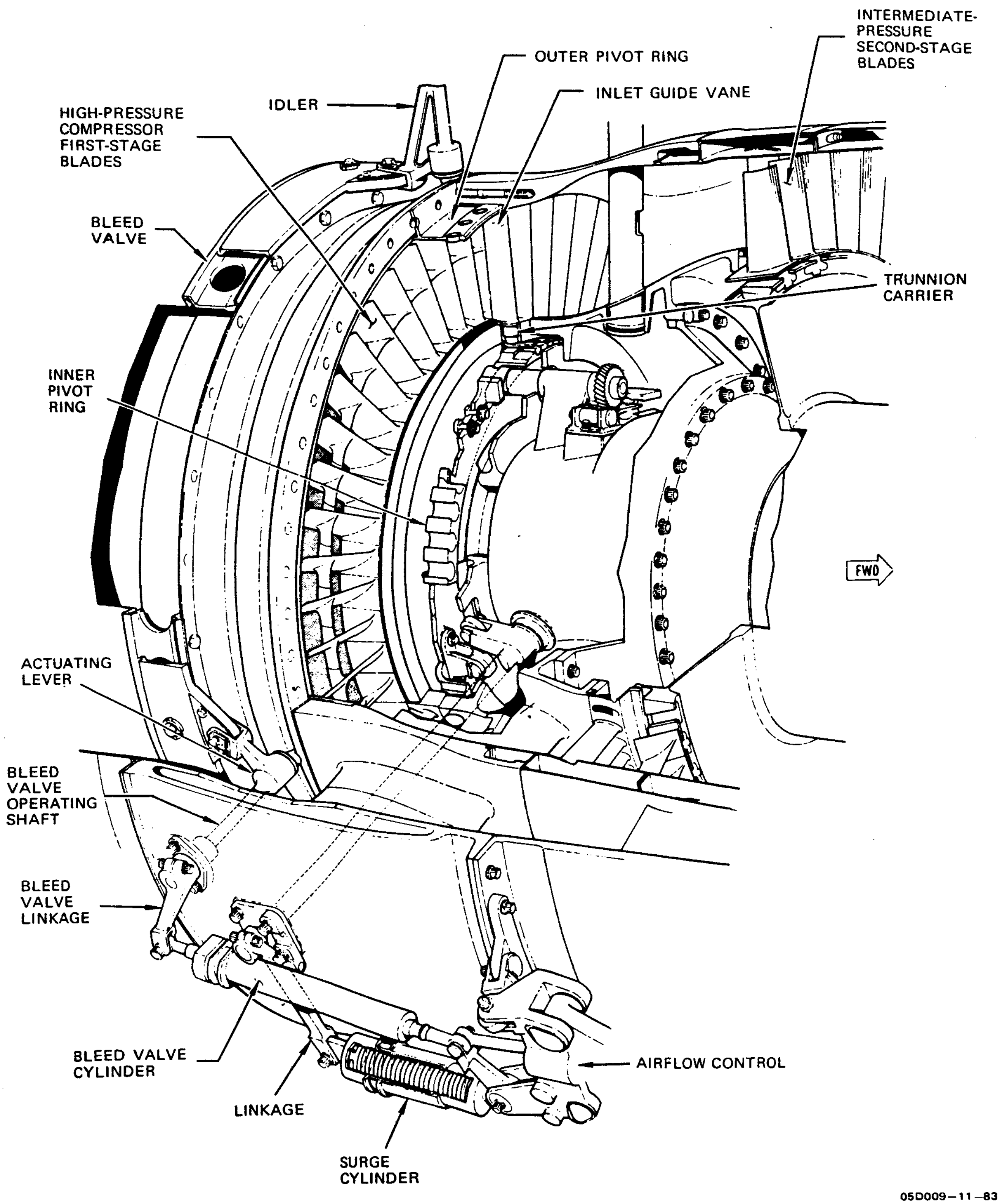


Figure 2-1. Control System; Airflow

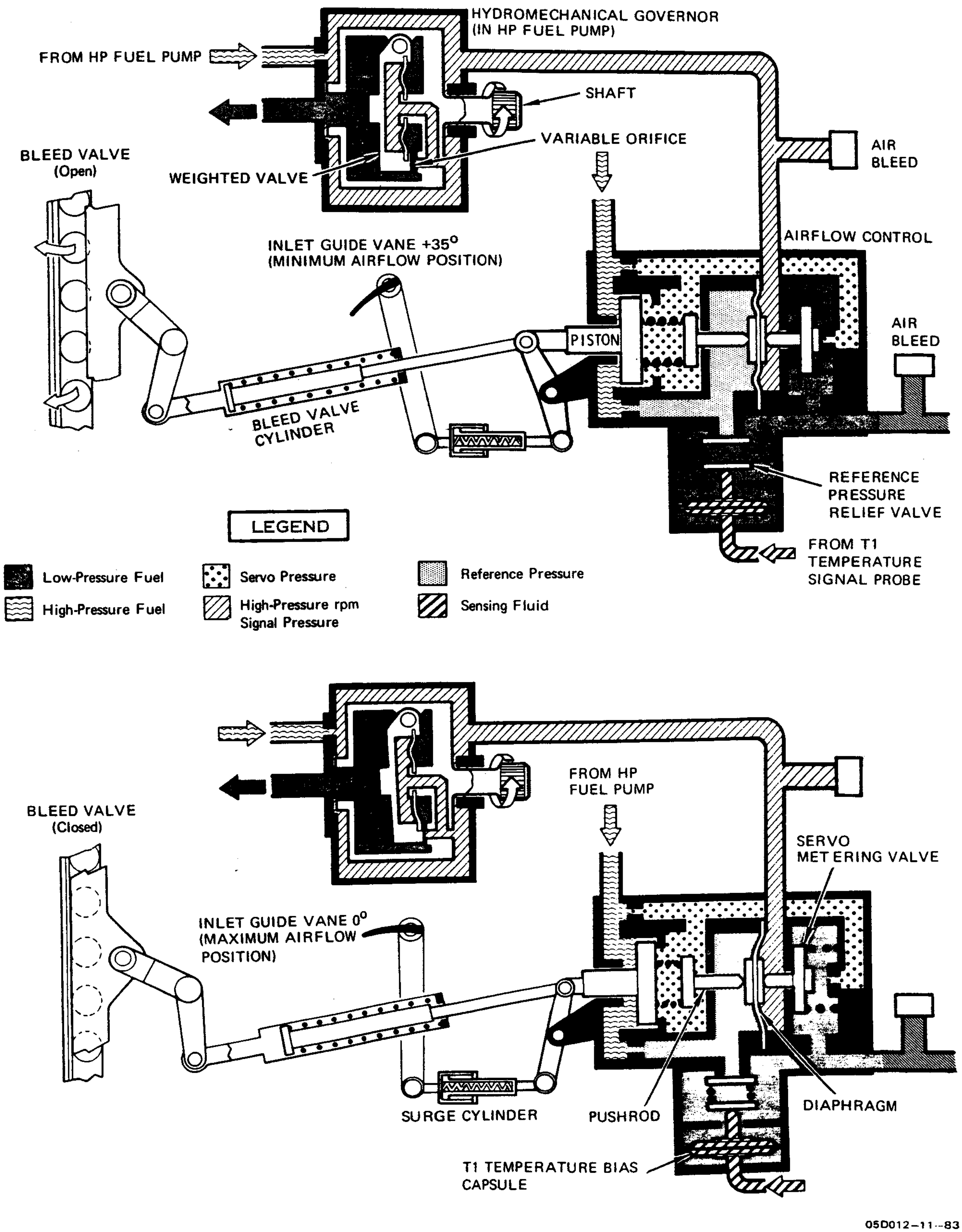


Figure 2-2. System Schematic; Airflow Control

move toward the closed position until fuel pressure and spring forces are in equilibrium. This will hold the inlet guide vanes and bleed valve in an intermediate position. If high pressure rotor speed is above control system operating range, the piston will continue to move until internal stops are contacted.

2-2.5. Mechanical Linkage. Piston movement is transmitted by a mechanical linkage to the inlet guide vanes and bleed valve. The bleed valve will close first and the spring loaded bleed valve cylinder will absorb the linkage overtravel as the vanes move to the maximum airflow position (0°). The surge cylinder is normally a fixed link in the linkage system. It is spring loaded to absorb pressures exerted on the inlet guide vanes during compressor stalls.

2-2.6. Engine Speed Decrease. As high pressure compressor rotor speed is decreased, the pressure signal from the HMG will decrease. If the decrease continues, reference pressure will overcome HMG pressure. At that point, the diaphragm will shift and close the servo metering valve. Servo pressure acting on the large area of the piston will increase. This action, in combination with spring force, will overcome high pressure fuel acting on the small area of the piston. This extends the piston and causes the IGV to move toward +35°. The bleed valve then moves toward open.

2-3. COMPONENTS.

For a list of system components, locations (accesses), and functions, refer to table 2-1.

Table 2-1. Airflow Control System Components

Component	Access	Function
Airflow control	6122-3	Controls inlet guide vane and bleed valve movement
Cylinder, bleed valve	6222-2	Acts as fixed link in linkage system to operate bleed valve and absorbs overtravel of inlet guide vane linkage
Cylinder, IGV surge	6222-2	Acts as fixed link in linkage system to operate variable inlet guide vanes
Hydromechanical governor	Integral component of HP fuel pump	Provides engine rpm signal to airflow control

2-4. OPERATIONAL CHECKOUT (USING 6872929 TEST SET).

Test Equipment Required

Figure & index No.	Name	AN type designation	Use and application
	Equipment required for engine operation		Operate engine
	Equipment required for connecting 115-volt, 400-hertz, single-phase ac electrical power		Connect external electrical power to test set
	Engine limiter test set cable assembly	6872490 (Allison Division of General Motors, Indianapolis, Indiana)	Connect test set to engine and external power source
	Engine limiter test set	6872929 (Allison Division of General Motors, Indianapolis, Indiana)	Measure engine rpm, temperature, and angle of inlet guide vanes in degrees
	Power cable adapter	6872727 (Allison Division of General Motors, Indianapolis, Indiana)	Connect test set power cable to airplane ARW-77 connector
	Thermometer	TIC-2-6354	Measure air temperature

NOTE

A number enclosed in braces at the end of a step in the following test corresponds to a number in troubleshooting table 2-2.

2-4.1. Preparation. (Figure 2-3.)

a. Open accesses 6122-3, 6221-1, and 6222-2.

NOTE

To get accurate temperature readings, keep thermometer out of direct sunlight and high velocity air. Also, keep away from engine or air-conditioning exhaust air.

b. Place thermometer in vicinity of fuselage under left wing.

c. Determine part number of airflow control installed on engine.

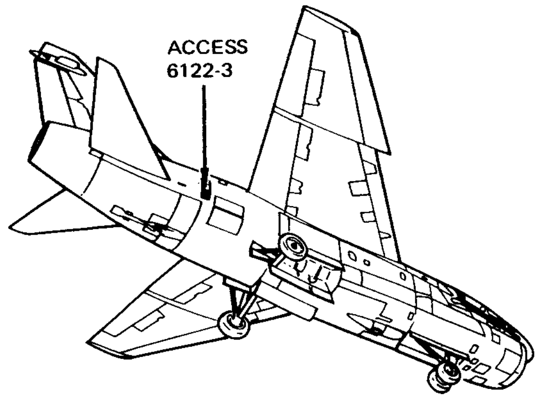
d. Secure angle test probe (1) to airflow control (2) and aft mount (3) with captive hex head bolt (4). Spring-loaded lever (5) must be positioned aft of airflow control bellcrank (6).

e. Set switches and controls on test set as follows:

Control	*Position*
POWER switch	OFF
TACH SIM switch	OFF
SIM SIGNAL control	Full decrease
T1 control	Midrange
T3/T5.1 control	Full decrease
T5.1 switch	NORMAL
T3 switch	NORMAL
LP SPEED switch	OFF
SQUAT switch	OFF
METER switch	USE
T1 SIM switch	OFF
TACHOMETER switch	USE
READ/CAL switch	CAL
ZERO ADJ control	Full decrease
RPM SELECT switch	NHP
PROBE TRIM control	Full decrease
TEMP SELECTOR switch	CAL
T3/T5.1 SIM switch	OFF
MODE switch	RESET
ACCEL START PRESET control	Centered

f. Disconnect electrical connector from high pressure compressor tachometer generator.

1. Angle test probe (−203)
2. Airflow control
3. Aft mount
4. Captive hex head bolt
5. Spring loaded lever
6. Airflow control bellcrank
7. T_1 bias adjustment



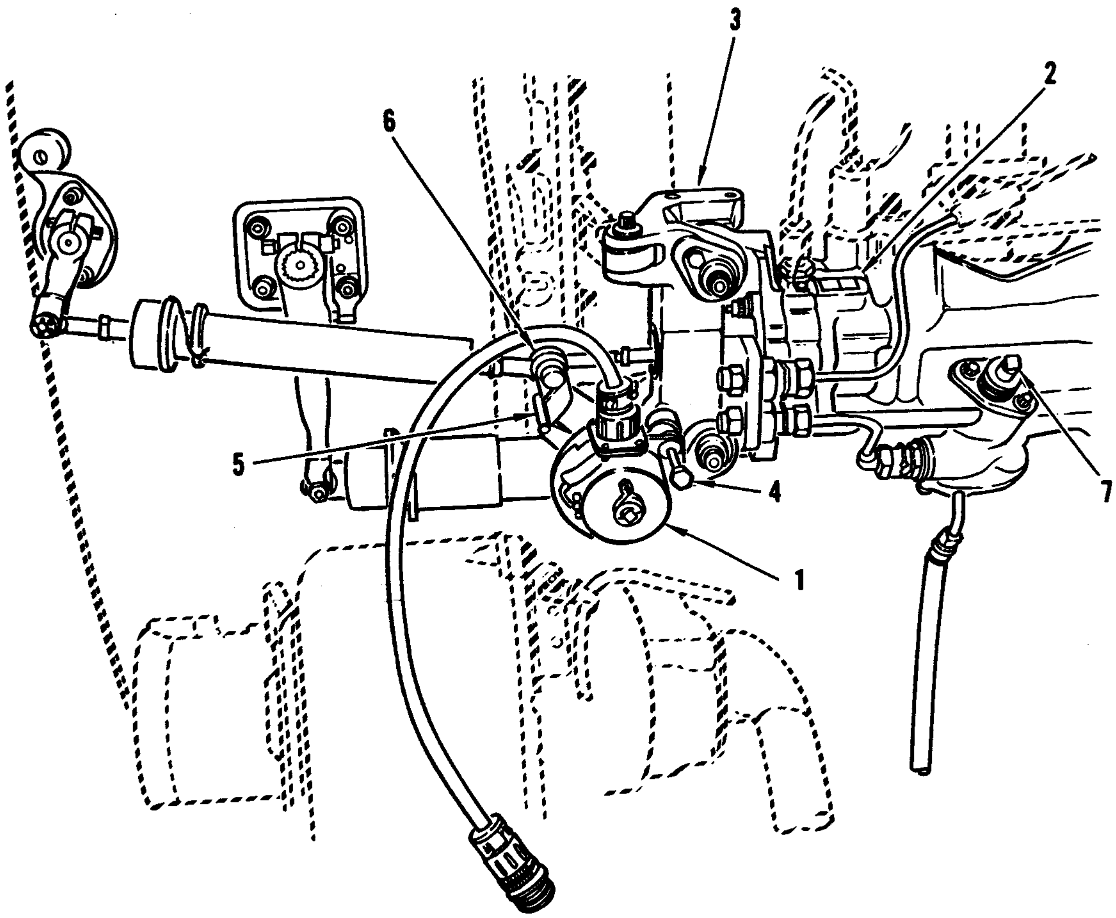


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Figure 2-3. Test Probe Installation (Using 6872929 Test Set); IGV Angle

CAUTION

To prevent damage to engine components and test set, make sure that test set is connected to 115-volt, 400-hertz, single-phase ac power source. Make a pin-to-pin voltage check of the power source before connecting the test set.

g. Connect engine limiter test set to airplane and external power source as shown in figure 2-4.

h. Place test set POWER switch in ON. Warm up for 10 minutes.

i. Check engine limiter test set as follows:

(1) Place METER switch in CHECK. Check milliammeter for 210 (±20) milliamperes. Place METER switch in USE.

(2) Check TEMP meter for 575° (±1°)C (1067° (±2°)F).

(3) Place TACHOMETER switch in CHECK and RPM SELECT switch in NLP. Check % RPM meter for 16.7% (±0.3%).

(4) Place RPM SELECT switch in NHP. Check % RPM meter for 100.0% (±0.3%). Place TACHOMETER switch in USE.

j. Place TEMP SELECTOR switch in T1.

k. Make sure READ/CAL switch is in CAL.

l. Adjust PROBE TRIM control until +30° is indicated on IGV angle meter.

m. Place READ/CAL switch in READ.

n. Start engine (T.O. 1A-7D-2-1) and stabilize at IDLE.

o. Adjust ZERO ADJ control until +35° is indicated on IGV angle meter.

p. Repeat steps k through o until IGV ANGLE meter indicates +35° with READ/CAL switch in READ, and +30° with READ/CAL switch in CAL. Leave READ/CAL switch in READ after adjustments.

q. Slowly accelerate and decelerate engine through first 10° to 15° of inlet guide vane angle range (as shown on IGV ANGLE meter) to make sure guide vane operates. Retard throttle to IDLE. {1}

2-4.2. Operational Checkout (Airflow Control Part No. 6878166 or 6878284).

NOTE

If an angle checkpoint is exceeded, retard throttle; then approach the checking angle again from a lower speed.

a. Slowly advance throttle until +7° is shown on IGV ANGLE meter. Record high pressure compressor rotor speed shown on test set. {2}

b. Record T1 temperature from thermometer under left wing.

c. Retard throttle to IDLE.

d. See figure 2-5 and record minimum and maximum % RPM for +7° inlet guide vane angle.

e. Check that high pressure compressor rotor speed is between minimum and maximum % rpm value.

f. If rotor speed is not within limits, proceed as follows:

CAUTION

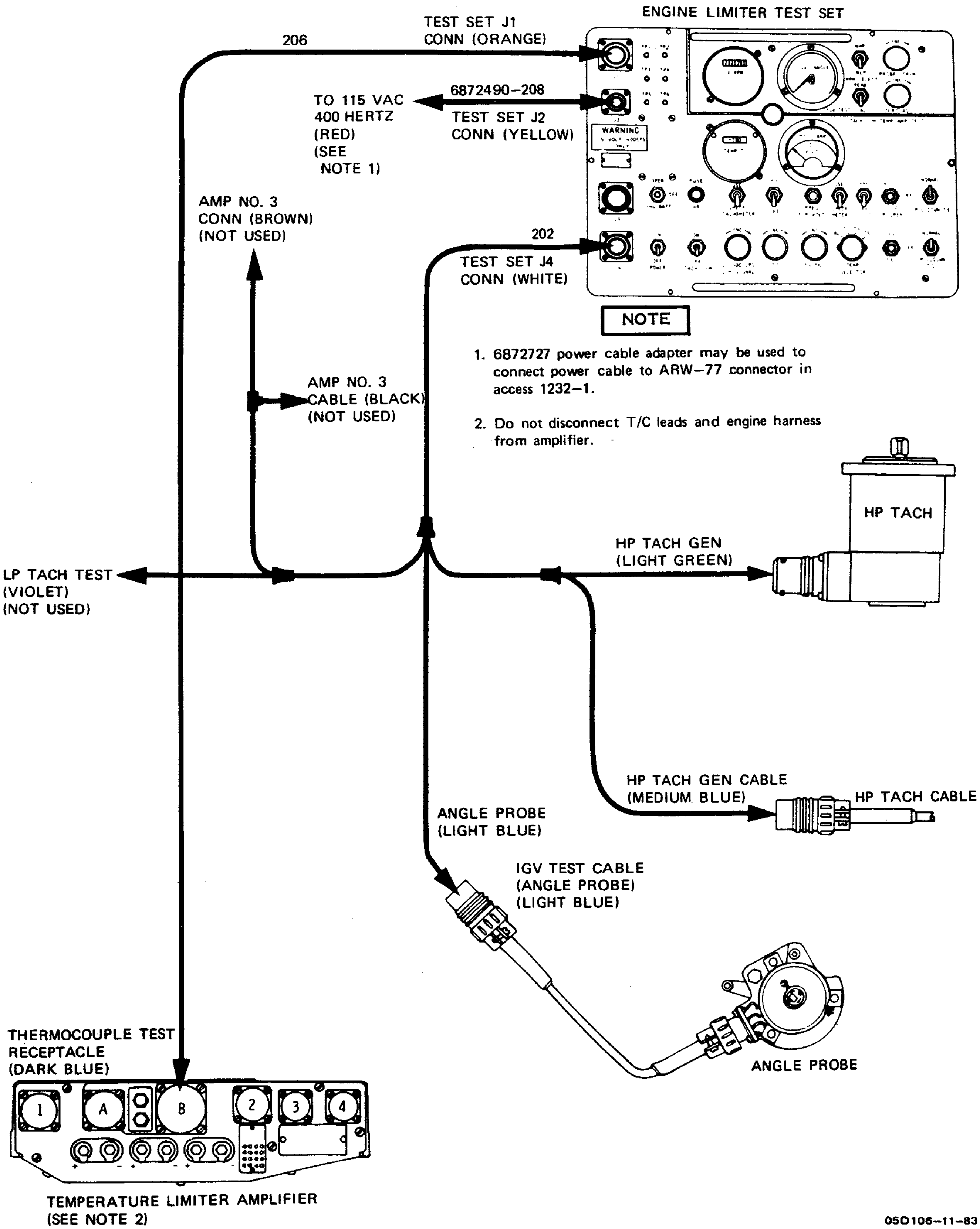
To prevent damage to airflow control, do not attempt to set speed by adjusting rod end of airflow control.

NOTE

During T1 bias adjustment, the total adjustment must not exceed ±7 marks from the yellow calibration line. Record amount and direction of adjustment in engine log.

Turn T1 bias adjustment clockwise to increase rpm. One mark equals approximately 0.5% rpm.

(1) Adjust T1 bias adjustment (7, figure 2-3) as required.



NOTE

1. 6872727 power cable adapter may be used to connect power cable to ARW–77 connector in access 1232–1.

2. Do not disconnect T/C leads and engine harness from amplifier.

Figure 2-4. System Test (Using 6872929 Test Set); Airflow Control

T1		INLET GUIDE VANE ANGLE +7°	
(°C)	(°F)	Minimum % RPM	Maximum % RPM
−41	−41.8	80.9	83.9
−40	−40.0	81.0	84.0
−39	−38.2	81.2	84.2
−38	−36.4	81.4	84.4
−37	−34.6	81.6	84.6
−36	−32.8	81.8	84.8
−35	−31.0	81.9	84.9
−34	−29.2	82.1	85.1
−33	−27.4	82.3	85.3
−32	−25.6	82.5	85.5
−31	−23.8	82.6	85.6
−30	−22.0	82.8	85.8
−29	−20.2	83.0	86.0
−28	−18.4	83.2	86.2
−27	−16.6	83.3	86.3
−26	−14.8	83.5	86.5
−25	−13.0	83.7	86.7
−24	−11.2	83.9	86.9
−23	− 9.4	84.0	87.0
−22	− 7.6	84.2	87.2
−21	− 5.8	84.4	87.4
−20	− 4.0	84.5	87.5
−19	− 2.2	84.7	87.7
−18	− 0.4	84.9	87.9
−17	1.4	85.1	88.1
−16	3.2	85.2	88.2
−15	5.0	85.4	88.4
−14	6.8	85.6	88.6
−13	8.6	85.7	88.7
−12	10.4	85.9	88.9
−11	12.2	86.1	89.1
−10	14.0	86.2	89.2
− 9	15.8	86.4	89.4
− 8	17.6	86.6	89.6
− 7	19.4	86.7	89.7
− 6	21.2	86.9	89.9
− 5	23.0	87.1	90.1
− 4	24.8	87.2	90.2
− 3	26.6	87.4	90.4
− 2	28.4	87.6	90.6
− 1	30.2	87.7	90.7
0	32.0	87.9	90.9
1	33.8	88.1	91.1
2	35.6	88.2	91.2
3	37.4	88.4	91.4
4	39.2	88.5	91.5
5	41.0	88.7	91.7
6	42.8	88.9	91.9
7	44.6	89.0	92.0
8	46.4	89.2	92.2
9	48.2	89.4	92.4
10	50.0	89.5	92.5
11	51.8	89.7	92.7
12	53.6	89.8	92.8
13	55.4	90.0	93.0
14	57.2	90.2	93.2
15	59.0	90.3	93.3
16	60.8	90.5	93.5
17	62.6	90.6	93.6
18	64.4	90.8	93.8
19	66.2	91.0	94.0
20	68.0	91.1	94.1
21	69.8	91.3	94.3
22	71.6	91.4	94.4
23	73.4	91.6	94.6
24	75.2	91.8	94.8
25	77.0	91.9	94.9
26	78.8	92.1	95.1
27	80.6	92.2	95.2
28	82.4	92.4	95.4
29	84.2	92.5	95.5
30	86.0	92.7	95.7
31	87.8	92.9	95.9
32	89.6	93.0	96.0
33	91.4	93.2	96.2
34	93.2	93.3	96.3
35	95.0	93.5	96.6
36	96.8	93.6	96.7
37	98.6	93.8	96.8
38	100.4	93.9	96.9
39	102.2	94.1	97.1
40	104.0	94.2	97.2
41	105.8	94.4	97.4
42	107.6	94.6	97.6
43	109.4	94.7	97.7
44	111.2	94.9	97.9
45	113.0	95.0	98.0
46	114.8	95.2	98.2
47	116.6	95.3	98.3
48	118.4	95.5	98.5
49	120.2	95.6	98.6
50	122.0	95.8	98.8
51	123.8	95.9	98.9
52	125.6	96.1	99.1
53	127.4	96.2	99.2
54	129.2	96.4	99.4
55	131.0	96.5	99.5
56	132.8	96.7	99.7
57	134.6	96.8	99.8
58	136.4	97.0	100.0
59	138.2	97.1	100.1
60	140.0	97.3	100.3

% Speed is based on 12,915 N_H rpm = 100% as indicated on engine limiter test set.

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Figure 2-5. Limits for Checking; Airflow Control Part No. 6878166 or 6878284

(2) Slowly advance throttle until +33° is on IGV ANGLE meter. Record high pressure compressor rotor speed indicated on test set. {2}

(3) Slowly advance throttle for +7° on IGV ANGLE meter. Record high pressure compressor rotor speed indicated on test set. {2}

(4) Record T1 temperature from thermometer under left wing.

(5) Retard throttle to IDLE.

(6) See figure 2-6 and record minimum and maximum % RPM for +33° and +7° inlet guide vane angles.

(7) Check that high pressure compressor rotor speed is within limits.

(8) If rotor speed is not within limits, adjust T1 bias adjustment (7) as required and repeat substeps (2) through (7).

g. Perform postcheck (subparagraph 2-4.3).

2-4.3. Postcheck.

a. Shut down engine (T.O. 1A-7D-2-1).

b. Place test set POWER switch in OFF.

c. Disconnect test set from airplane and external power source.

d. Connect electrical connector to high pressure compressor tachometer generator.

e. Close accesses 6122-3, 6221-1, and 6222-2.

f. Remove thermometer from left wing.

2-5. OPERATIONAL CHECKOUT (USING 6893706 TEST SET).

Test Equipment Required

Figure & index No.	Name	AN type designation	Use and application
	Equipment required for engine operation		Operate engine
2-8	Engine limiter test set	6893706 (Allison Division of General Motors, Indianapolis, Indiana)	Measure engine rpm, temperature, and angle of inlet guide vanes in degrees
	Thermometer	T1C-2-6354	Measure air temperature

NOTE

A number enclosed in braces at the end of a step in the following test corresponds to a number in troubleshooting table 2-2.

2-5.1. Preparation. (Figure 2-7.)

a. Open accesses 5222-1 and 6122-3.

NOTE

To get accurate temperature readings, keep thermometer out of direct sunlight and high velocity air. Also, keep away from engine or air-conditioning exhaust air.

b. Place thermometer in vicinity of fuselage under left wing.

c. Determine part number of airflow control installed on engine.

T1		INLET GUIDE VANE ANGLE			
		+33°		+7°	
(°C)	(°F)	Minimum % RPM	Maximum % RPM	Minimum % RPM	Maximum % RPM
–41	–41.8	57.5	61.5	81.9	82.9
–40	–40.0	57.8	61.8	82.0	83.0
–39	–38.2	58.0	62.0	82.2	83.2
–38	–36.4	58.2	62.2	82.4	83.4
–37	–34.6	58.5	62.5	82.6	83.6
–36	–32.8	58.7	62.8	82.8	83.8
–35	–31.0	59.0	63.0	82.9	83.9
–34	–29.2	59.2	63.2	83.1	84.1
–33	–27.4	59.4	63.4	83.3	84.3
–32	–25.6	59.7	63.7	83.5	84.5
–31	–23.8	59.9	63.9	83.6	84.6
–30	–22.0	60.1	64.1	83.8	84.8
–29	–20.2	60.4	64.4	84.0	85.0
–28	–18.4	60.6	64.6	84.2	85.2
–27	–16.6	60.8	64.8	84.3	85.3
–26	–14.8	61.1	65.1	84.5	85.5
–25	–13.0	61.3	65.3	84.7	85.7
–24	–11.2	61.5	65.5	84.9	85.9
–23	– 9.4	61.8	65.8	85.0	86.0
–22	– 7.6	62.0	66.0	85.2	86.2
–21	– 5.8	62.2	66.2	85.4	86.4
–20	– 4.0	62.4	66.4	85.5	86.5
–19	– 2.2	62.7	66.6	85.7	86.7
–18	– 0.4	62.9	66.9	85.9	86.9
–17	1.4	63.1	67.1	86.1	87.1
–16	3.2	63.3	67.3	86.2	87.2
–15	5.0	63.6	67.6	86.4	87.4
–14	6.8	63.8	67.8	86.6	87.6
–13	8.6	64.0	68.0	86.7	87.7
–12	10.4	64.2	68.2	86.9	87.9
–11	12.2	64.4	68.4	87.1	88.1
–10	14.0	64.7	68.6	87.2	88.2
– 9	15.8	64.9	68.9	87.4	88.4
– 8	17.6	65.1	69.1	87.6	88.6
– 7	19.4	65.3	69.3	87.7	88.7
– 6	21.2	65.5	69.5	87.9	88.9
– 5	23.0	65.7	69.7	88.1	89.1
– 4	24.8	65.9	69.9	88.2	89.2
– 3	26.6	66.2	70.2	88.4	89.4
– 2	28.4	66.4	70.4	88.6	89.6
– 1	30.2	66.6	70.6	88.7	89.7
0	32.0	66.8	70.8	88.9	89.9
1	33.8	67.0	71.0	89.1	90.1
2	35.6	67.2	71.2	89.2	90.2
3	37.4	67.4	71.4	89.4	90.4
4	39.2	67.6	71.6	89.5	90.5
5	41.0	67.8	71.8	89.7	90.7
6	42.8	68.1	72.1	89.9	90.9
7	44.6	68.3	72.3	90.0	91.0
8	46.4	68.5	72.5	90.2	91.2
9	48.2	68.7	72.7	90.4	91.4

T1		INLET GUIDE VANE ANGLE			
		+33°		+7°	
(°C)	(°F)	Minimum % RPM	Maximum % RPM	Minimum % RPM	Maximum % RPM
10	50.0	68.9	72.9	90.5	91.5
11	51.8	68.1	73.1	90.7	91.7
12	53.6	68.3	73.3	90.8	91.8
13	55.4	69.5	73.5	91.0	92.0
14	57.2	69.7	73.7	91.2	92.2
15	59.0	69.9	73.9	91.3	92.3
16	60.8	70.1	74.1	91.5	92.5
17	62.6	70.3	74.3	91.6	92.6
18	64.4	70.5	74.5	91.8	92.8
19	66.2	70.7	74.7	92.0	93.0
20	68.0	70.9	74.9	92.1	93.1
21	69.8	71.1	75.1	92.3	93.3
22	71.6	71.3	75.3	92.4	93.4
23	73.4	71.5	75.5	92.6	93.6
24	75.2	71.7	75.7	92.8	93.8
25	77.0	71.9	75.9	92.9	93.9
26	78.8	72.1	76.1	93.1	94.1
27	80.6	72.3	76.3	93.2	94.2
28	82.4	72.5	76.5	93.4	94.4
29	84.2	72.7	76.7	93.5	94.5
30	86.0	72.9	76.9	93.7	94.7
31	87.8	73.1	77.1	93.9	94.9
32	89.6	73.3	77.3	94.0	95.0
33	91.4	73.5	77.5	94.2	95.2
34	93.2	73.6	77.6	94.3	95.3
35	95.0	73.8	77.8	94.5	95.5
36	96.8	74.0	78.0	94.6	95.6
37	98.6	74.2	78.2	94.8	95.8
38	100.4	74.4	78.4	94.9	95.9
39	102.2	74.6	78.6	95.1	96.1
40	104.0	74.8	78.8	95.1	96.2
41	105.8	75.0	79.0	95.4	96.4
42	107.6	75.2	79.2	95.6	96.6
43	109.4	75.4	79.4	95.7	96.7
44	111.2	75.5	79.5	95.9	96.9
45	113.0	75.7	79.7	96.0	97.0
46	114.8	75.9	79.9	96.2	97.2
47	116.6	76.1	80.1	96.3	97.3
48	118.4	76.3	80.3	96.5	97.5
49	120.2	76.5	80.5	96.6	97.6
50	122.0	76.7	80.7	96.8	97.8
51	123.8	76.8	80.8	96.9	97.9
52	125.6	77.0	81.0	97.1	98.1
53	127.4	77.2	81.2	97.2	98.2
54	129.2	77.4	81.4	97.4	98.4
55	131.0	77.6	81.6	97.5	98.5
56	132.8	77.8	81.8	97.7	98.7
57	134.6	77.9	81.9	97.8	98.8
58	136.4	78.1	82.1	98.0	99.0
59	138.2	78.3	82.3	98.1	99.1
60	140.0	78.5	82.5	98.3	99.3

% Speed is based on 12,915 N_H rpm = 100% as indicated on engine limiter test set.

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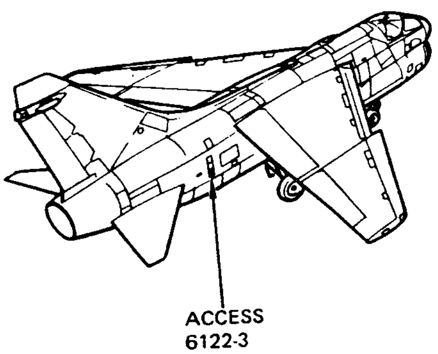
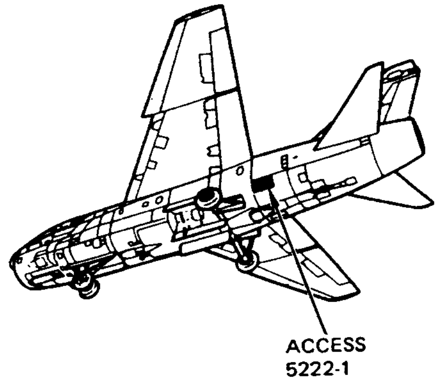
Figure 2-6. Limits for Setting; Airflow Control Part No. 6878166 or 6878284





1. Angle test probe
2. Airflow control
3. Aft mount
4. Captive hex head bolt
5. Spring loaded lever
6. Airflow control bellcrank
7. T_1 bias adjustment

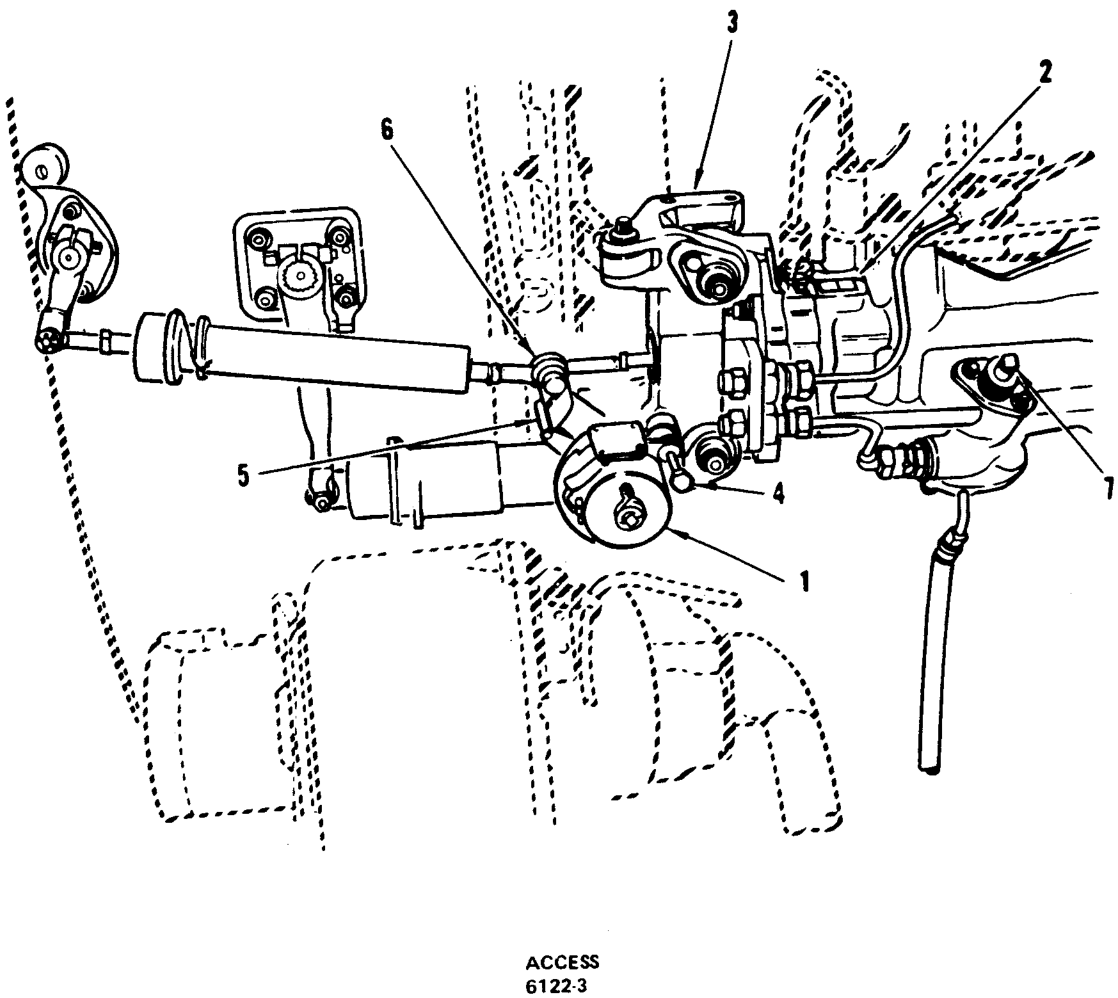


Figure 2-7. Test Probe Installation (Using 6893706 Test Set); IGV Angle

d. Secure angle test probe (1) to airflow control (2) and aft mount (3) with captive hex head bolt (4). Spring-loaded lever (5) must be positioned aft of airflow control bellcrank (6).

e. Set switches and controls on test set as follows:

Control	*Position*
POWER switch	OFF
SQUAT switch	OFF
IGV/CAL switch	IGV
TACH SIMULATED INPUTS control	Fully counter-clockwise
T1 SIMULATED INPUTS control	Fully counter-clockwise
T5 SIMULATED INPUTS control	Fully counter-clockwise
T5 switch	NORMAL
LP SP switch	Center position

f. Disconnect electrical connector from high pressure compressor tachometer generator.

g. Connect engine limiter test set to airplane as shown in figure 2-8.

NOTE

When the test set POWER switch is placed in ON, the numerals 00 will appear in the lower portion of the test set display window. This 00 display indicates that SELF TEST has been selected.

When the test set has warmed up (maximum time of 20 minutes), it will begin the self-test function automatically.

After completion of self-test, the numbers 88.88 will be sequenced through the three rows in the display window. This sequencing will continue until a specific test is selected or test set POWER switch is placed in OFF.

h. Place POWER switch in ON. Warm up test set.

i. Start engine (T.O. 1A-7D-2-1) and stabilize at IDLE.

2-5.2. Operational Checkout (Airflow Control Part No. 6878166 or 6878284).

NOTE

If an angle checkpoint is exceeded, retard throttle; then approach the checking angle again from a lower speed.

a. Slowly advance throttle until +7° is shown in RP display window. Record high pressure compressor rotor speed shown in NH display window. {2}

b. Record T1 temperature from thermometer under left wing.

c. Retard throttle to IDLE.

d. See figure 2-5 and record minimum and maximum % RPM for +7° inlet guide vane angle.

e. Check that high pressure compressor rotor speed is between minimum and maximum % rpm value.

f. If rotor speed is not within limits, proceed as follows:

CAUTION

To prevent damage to airflow control, do not attempt to set speed by adjusting rod end of airflow control.

NOTE

During T1 bias adjustment, the total adjustment must not exceed ±7 marks from the yellow calibration line. Record amount and direction of adjustment in engine log.

Turn T1 bias adjustment clockwise to increase rpm. One mark equals approximately 0.5% rpm.

(1) Adjust T1 bias adjustment (7, figure 2-7) as required.

(2) Slowly advance throttle until +33° is shown in RP display widow. Record high pressure compressor rotor speed shown in NH display window. {2}

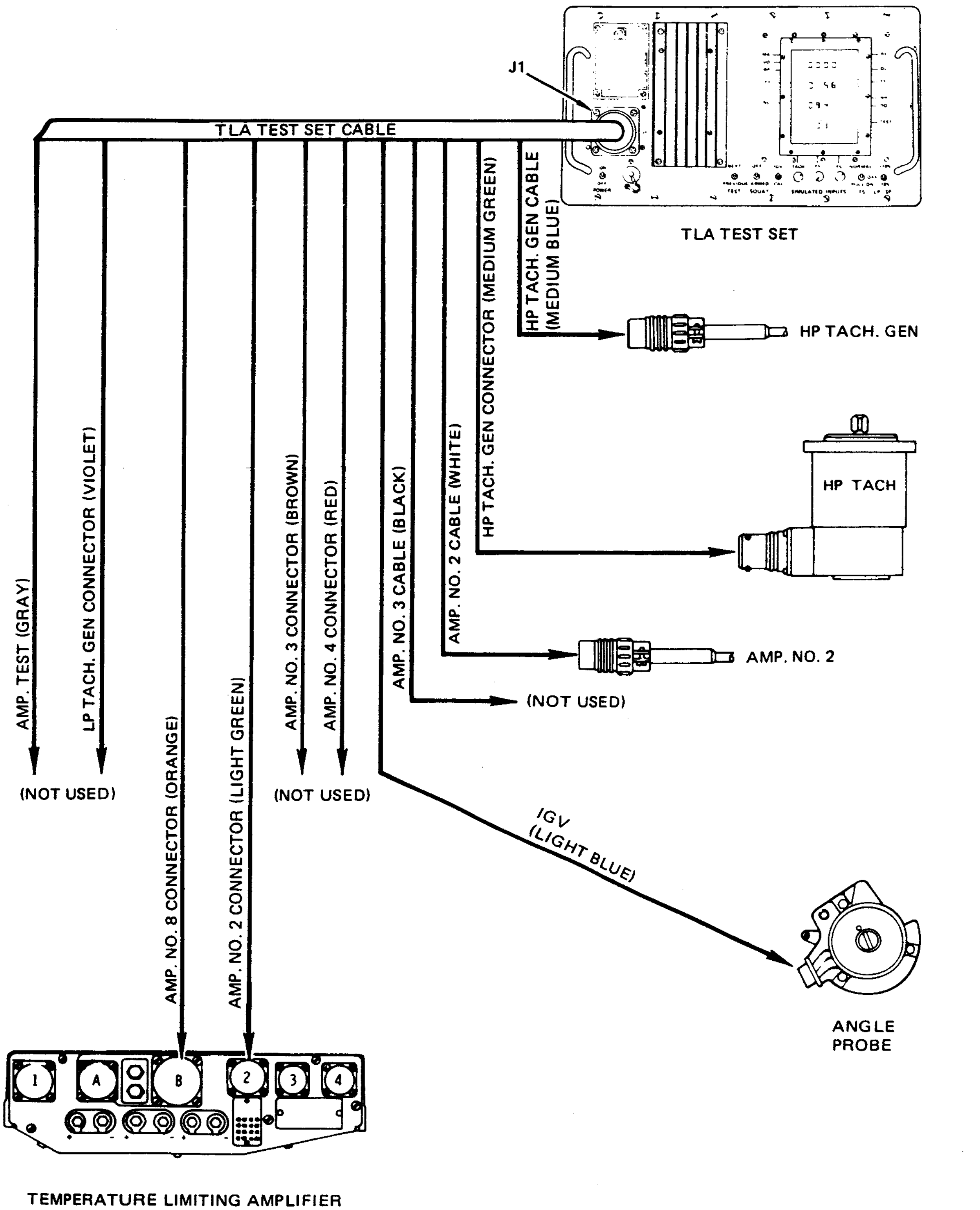


Figure 2-8. System Test (Using 6893706 Test Set); Airflow Control

(3) Slowly advance throttle until +7° is shown in RP display window. Record high pressure compressor rotor speed shown in NH display window. {2}

(4) Record T1 temperature from thermometer under left wing.

(5) Retard throttle to IDLE.

(6) See figure 2-6 and record minimum and maximum % RPM for +33° and +7° inlet guide vane angles.

(7) Check that high pressure compressor rotor speed is within limits.

(8) If rotor speed is not within limits, adjust T1 bias adjustment (7, figure 2-7) as required and repeat substeps (2) through (7).

g. Perform postcheck (subparagraph 2-5.3).

2-5.3. Postcheck.

a. Shut down engine (T.O. 1A-7D-2-1).

b. Place test set POWER switch in OFF.

c. Disconnect test set from airplane.

d. Connect electrical connector to high pressure compressor tachometer generator.

e. Close accesses 6122-3 and 5222-1.

f. Remove thermometer from left wing.

2-6. TROUBLESHOOTING. Refer to table 2-2 for troubleshooting data. Malfunctions are numbered corresponding to numbers following steps in the operational checkout.

Table 2-2. Airflow Control System Troubleshooting

Probable cause	Isolation procedure	Remedy
1. No operation of inlet guide vanes during acceleration or deceleration.		
Leaking fuel tubes	Check fuel tubes to airflow control for leakage.	Replace leaking fuel tubes.
Sticking linkage	Perform IGV and bleed valve linkage force check (paragraph 2-8).	If force required exceeds 40 pounds, clean linkage.
Defective airflow control	Perform hydromechanical governor pressure test (paragraph 2-17).	Replace airflow control (paragraph 2-9).
Defective HP fuel pump	None	Replace HP fuel pump (paragraph 5-27).
2. RPM, fuel flow, and TOT fluctuate during acceleration. (Refer to table 4-9, probable causes 4 and 5.)		
3. T1 bias screw adjustment will not bring rpm within limits.		
Air in fuel system	None	Bleed engine fuel system (paragraph 5-19).
Defective airflow control	None	Replace airflow control (paragraph 2-9).

2-7. IGV CONTROL ARM CLEARANCE MEASUREMENT.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
	GGG-W-686	Torque wrench, 10 to 150 inch-pounds	Measure torque
2-5(6)	6872934 (Allison Division of General Motors, Indianapolis, Indiana)	Airflow control piston retainer	Hold airflow control piston in extended position

a. Open access 6122-3.

b. Remove two bolts and lockwashers securing inlet guide vane reference button (1, figure 2-9) in stowed position. Remove reference button.

c. Place reference button (1) in rigging position and install bolts and lockwashers.

NOTE

Reference button must be installed in a free state position. Do not apply pressure to reference button while tightening bolts as this will preload button against locating dowels. This will result in temporary distortion of the dowels.

d. Tighten bolts with reference button in free state position.

e. Remove cotter pin (2), nut (3), spacer (4), and bolt (5). Disconnect bleed valve cylinder from bleed valve arm. This is necessary to remove cylinder spring preload on IGV linkage.

f. Push bleed valve cylinder toward airflow control until at least 1/2-inch movement is noted; then pull back until piston bottoms against internal stop of airflow control.

g. Install airflow control piston retainer (6) as follows:

(1) Place retainer on airflow control rear mount and install bolt (7). Do not tighten bolt.

(2) Adjust screw (8) until end firmly contacts control rear mount and tighten nut (9).

(3) Tighten bolt (7).

h. Measure clearance between IGV control arm 10 and reference button (1). Record clearance.

i. Perform maintenance tasks as required.

j. Loosen nut (9) and backoff screw (8). Remove bolt (7) and airflow control piston retainer (6).

k. Connect bleed valve cylinder to bleed valve arm with bolt (5), spacer (4), and nut (3).

l. Tighten nut (3) to 75 (+25, −50) inch-pounds torque. Secure nut with new cotter pin (2).

m. Remove bolts and lockwashers and remove reference button (1).

n. Place reference button in stowed position and secure with lockwashers and bolts.

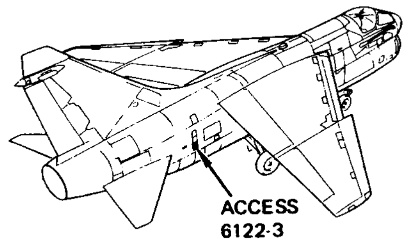
o. Close access 6122-3.

2-8. IGV AND BLEED VALVE LINKAGE FORCE CHECK.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
	GGG-W-686	Torque wrench, 10 to 150 inch-pounds	Measure torque
	0013 (John Chatillon and Sons, Kew Garden, New York)	Spring scale, 0 to 50 pounds	Check IGV and bleed valve linkage

1. Reference button
2. Cotter pin
3. Nut
4. Spacer
5. Bolt
6. Airflow control piston retainer
7. Bolt
8. Screw
9. Nut
10. Inlet guide vane control arm



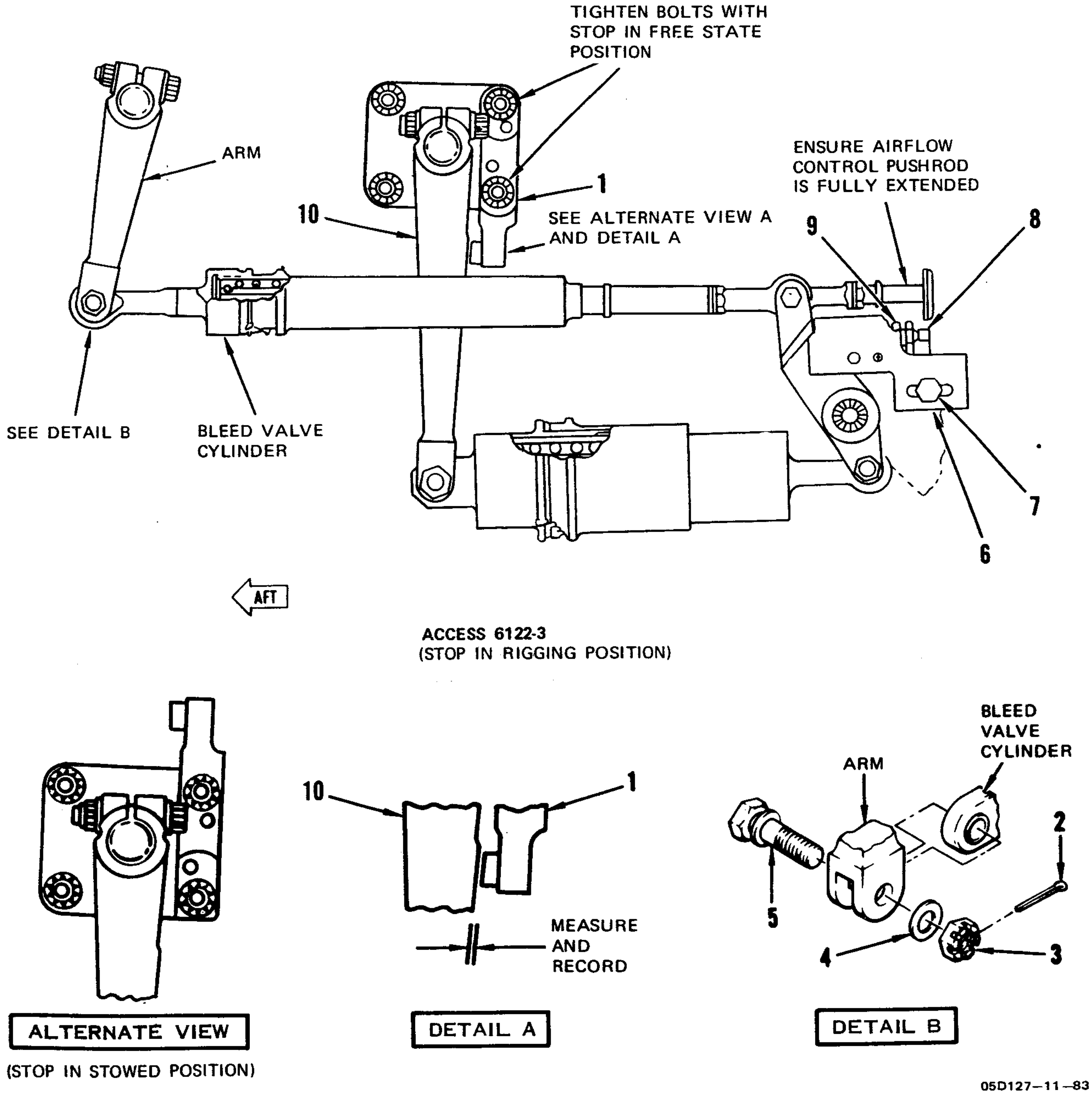


Figure 2-9. Clearance Measurement; IGV Control Arm

NOTE

This check shall be made within 2 hours after engine shutdown.

a. Open access 6122-3.

b. Remove cotter pins (1, figure 2-10), nuts (2), spacers (3), and bolts (4). Disconnect inlet guide vane surge cylinder and bleed valve cylinder from control arms.

NOTE

If force required to move inlet guide vane control arm exceeds 40 pounds, clean IGV linkage (paragraph 2-16). If force exceeds 40 pounds after cleaning, replace engine (paragraph 1-4).

c. Attach spring scale at inlet guide vane control arm. Check that force required to move control arm from stop to stop does not exceed 40 pounds.

NOTE

If force required to move bleed valve control arm exceeds 40 pounds, perform bleed valve linkage cleaning (paragraph 2-14). If force exceeds 40 pounds after cleaning, replace engine (paragraph 1-4).

d. Attach spring scale at bleed valve control arm. Check that force required to move control arm from stop to stop does not exceed 40 pounds.

e. Connect bleed valve cylinder and inlet guide vane surge cylinder to control arms with bolts (4), spacers (3), and nuts (2).

f. Tighten nuts (2) to 75 (+25, −50) inch-pounds torque. Secure nuts with new cotter pins (1).

g. Close access 6122-3.

2-9. AIRFLOW CONTROL REMOVAL AND INSTALLATION.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
	GGG-W-686	Torque wrench, 0 to 50 inch-pounds	Measure torque
	GGG-W-686	Torque wrench, 10 to 150 inch-pounds	Measure torque
	6798622 (Allison Division of General Motors, Indianapolis, Indiana)	Engine instrument protector	Provide protection against damage to temperature signal probe

CAUTION

To prevent damage to tubes and decrease the possibility of leakage, take precautions (paragraph 1-18) when removing or installing fuel, oil, or air tubing.

2-9.1. Removal. (Figure FO-2.)

a. Open accesses 6122-3, 6222-2, and 6222-1.

NOTE

Clearance between IGV control arm and reference button will differ between engines.

b. Measure clearance between IGV control arm linkage and stop (paragraph 2-7).

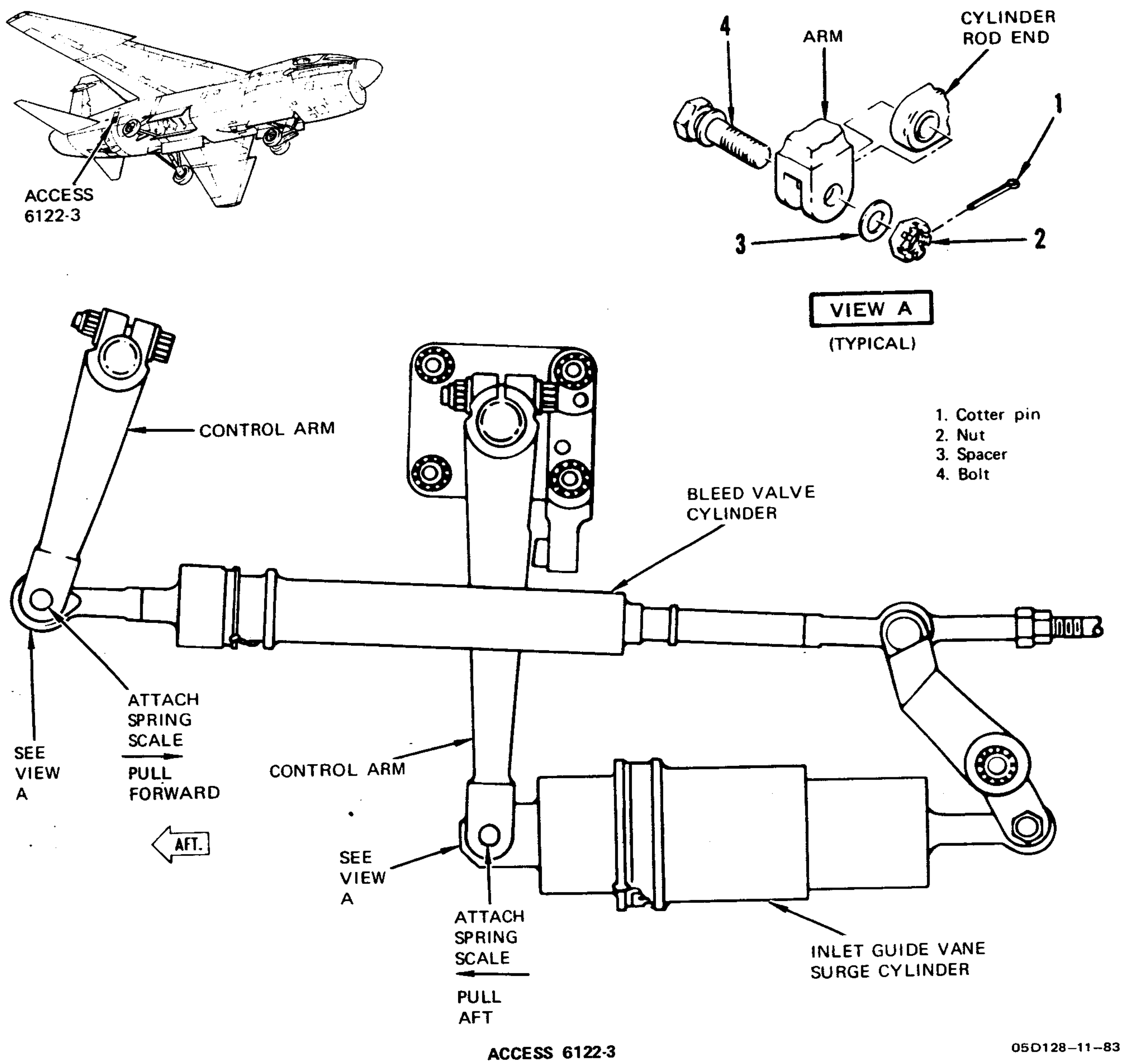


Figure 2-10. Force Check; IGV and Bleed Valve Linkage

c. Remove three bolts (1) and three lockwashers (2).

d. Cut lockwire and disconnect fuel tubes (3 and 4).

NOTE

Bracket must be retained with airflow regulator.

e. Remove bolt securing electrical harness and tube clamps to bracket at bottom of regulator.

f. Remove two bolts (5) and lockwashers (6). Disconnect bonding wire (7), disengage fuel tube (8), and remove housing (9). Remove packings (10 and 11) and packing retainer (12).

g. Remove two bolts (13), two lockwashers (14), two flat washers (15), and spacer (16) securing temperature signal probe capillary tube to support brackets.

CAUTION

To prevent damage to temperature signal probe capillary tube, use extreme care to prevent sharp bends or kinking. Damage to tube will cause failure of airflow control system.

Temperature signal probe is a part of the airflow control. No attempt shall be made to disconnect it from airflow control. If probe is disturbed, control will be damaged and must be returned to depot for overhaul.

h. Remove two bolts (17), lockwashers (18), and keeper plate (20).

i. Remove temperature signal probe (21) and joint washer (22). Install signal probe in engine instrument protector.

j. Remove cotter pin (23), nut (24), spacer (25), and bolt (26) securing rod end to bellcrank.

k. Remove two bolts (27) and two pins (28) securing airflow control to rear mount.

l. Remove three bolts (29) and three lockwashers (30), and remove airflow control (31). Remove packing (32) from fuel tube (33).

m. If airflow control is to be replaced with a new unit, proceed as follows:

(1) Remove three bolts (34), three lockwashers (35), and three flat washers (36).

(2) Remove housing (37), packing (38), and seal retaining ring (39).

(3) Remove nut (40) and bolt (41). Slide bushing (42) aft until it disengages front bracket (43) and ball assembly (44).

(4) Remove union (45) and seal washer (46).

(5) Drain fuel and gravity fill all accessible fuel cavities with clean filtered MIL-L-6081, Grade 1010, oil. Plug openings.

2-9.2. Installation. (Figure FO-2.)

CAUTION

Temperature signal probe is a part of the airflow control. No attempt shall be made to disconnect it from airflow control. If probe is disturbed, control will be damaged and must be returned to depot for overhaul.

If airflow control is not to be replaced with a new unit, proceed to step h.

a. Install union (45) on airflow control (31) using new seal washer (46).

NOTE

The two halves of ball assembly are a matched set and shall not be interchanged with other ball assembly halves.

b. Assemble ball assembly (44) in front bracket (43). Match marks on ball asssembly halves shall be aligned.

c. Assemble front bracket and ball assembly on airflow control and engage bushing (42).

d. Secure front bracket to airflow control with bolt (41) and nut (40).

e. Install seal retaining ring (39) and new packing (38) in housing (37).

f. Secure housing to airflow control using three flat washers (36), three lockwashers (35), and three bolts (34).

g. Place new packing (32) on fuel tube (33).

CAUTION

To prevent damage to temperature signal probe capillary tube, use extreme care to prevent sharp bends or kinking. Damage to tube will cause failure of airflow control system.

h. Align airflow control on engine.

i. Secure front bracket to engine using three lockwashers (30) and three bolts (29).

j. Secure airflow control to rear mount using two pins (28) and two bolts (27).

k. Perform IGV external linkage adjustment (paragraph 2-11).

l. Perform bleed valve cylinder adjustment (paragraph 2-13).

m. Secure rod ends to bellcrank using bolt (26), spacer (25), and nut (24). Tighten nut to 75 (+25, −50) inch-pounds torque. Secure with new cotter pin (23).

n. Using new joint washer (22), install temperature signal probe (21) with keeper plate (20), two lockwashers (18), and two bolts (17).

o. Secure temperature signal probe capillary tube to support brackets using spacer (16), two washers (15), two lockwashers (14), and two bolts (13).

NOTE

If a worn spot is found on 6861520 fuel tube (8), measure outside diameter of tube at worn spot. If tube measures less than 0.239 inch, replace tube.

p. Install two new packings (10) on fuel tube (8).

q. Install seal retaining ring (12) and new packing (11) in housing (9).

r. Secure housing, fuel tube, and bonding lead (7) to airflow control using two lockwashers (6) and two bolts (5).

s. Secure fuel tubes (3 and 4) to unions. Secure with MS20995C32 lockwire.

t. Secure electrical harness and tube clamps to bracket at bottom of regulator with bolt.

u. Secure fuel tube (33) to airflow control with three lockwashers (2) and three bolts (1).

v. Place IGV reference button on stowed position (paragraph 2-7).

w. Bleed engine fuel system (paragraph 5-19). Check installation for leaks.

x. Perform airflow control system operational checkout (paragraph 2-4).

y. Close accesses 6122-3, 6222-2, and 6222-1.

2-10. IGV SURGE CYLINDER REMOVAL AND INSTALLATION.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
	GGG-W-686	Torque wrench, 10 to 150 inch-pounds	Measure torque

2-10.1 Removal. (Figure 2-11.)

a. Open access 6122-3.

NOTE

Clearance between IGV control arm and reference button will differ between engines.

b. Perform IGV control arm clearance measurement (paragraph 2-7).

c. Remove airflow control (paragraph 2-9).

d. Remove cotter pin (1), nut (2), spacer (3), and bolt (4).

e. Remove nut (5), bolts (6), and lockwashers (7) securing upper and lower brackets to compressor case flange. Remove IGV surge cylinder (8) and rear airflow control mount (9) as a unit.

f. Remove cotter pin (10), nut (11), spacer (12), and bolt (13), and separate surge cylinder from mount.

2-10.2. Installation. (Figure 2-11.)

a. Connect IGV surge cylinder (8) to rear airflow control mount (9) with bolt (13), spacer (12), and nut (11). Tighten nut to 75 (+25, −50) inch-pounds torque. Secure with new cotter pin (10).

b. Secure lower and upper brackets to compressor case flange with lockwashers (7), bolts (6), and nut (5).

c. Temporarily secure IGV surge cylinder to arm with bolt (4), spacer (3), and nut (2).

d. Install airflow control (paragraph 2-9).

e. Perform IGV external linkage adjustment (paragraph 2-11).

f. Tighten nut to 75 (+25, −50) inch-pounds torque. Secure with new cotter pin (1).

g. Place inlet guide vane reference button in stowed position (paragraph 2-7).

h. Perform airflow control system operational checkout (paragraph 2-4).

i. Close access 6122-3.

2-11. IGV EXTERNAL LINKAGE ADJUSTMENT. (Figure 2-12.)

Tools Required

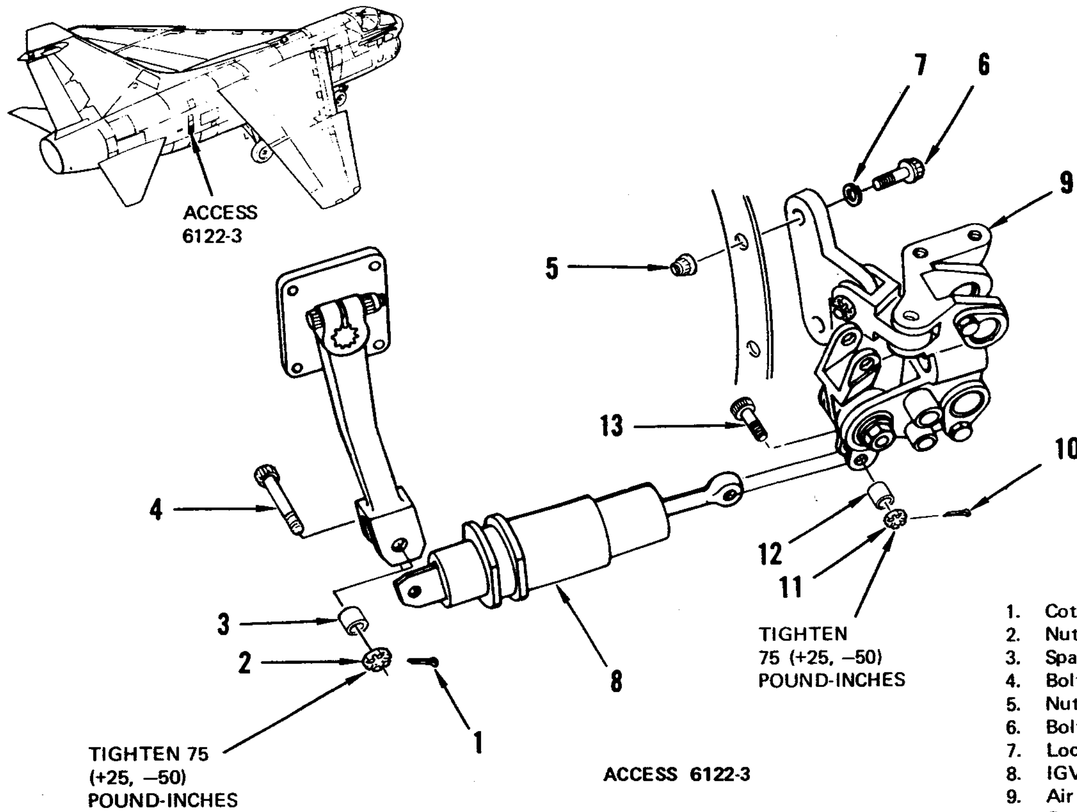
Figure & index No.	Part number	Nomenclature	Use and application
	GGG-W-686	Torque wrench, 10 to 150 inch-pounds	Measure torque
	413-900-020 (American Tool and Engineering Co, Kalamazoo, Michigan)	Torque wrench, 100 to 750 inch-pounds	Measure torque

a. Open access 6122-3.

NOTE

Clearance between IGV control arm and reference button will differ between engines.

b. Perform inlet guide vane control arm clearance measurement (paragraph 2-7).



1. Cotter pin
2. Nut
3. Spacer
4. Bolt
5. Nut
6. Bolt
7. Lockwasher
8. IGV surge cylinder
9. Air flow control mount
10. Cotter pin
11. Nut
12. Spacer
13. Bolt

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Figure 2-11. Removal and Installation; IGV Surge Cylinder

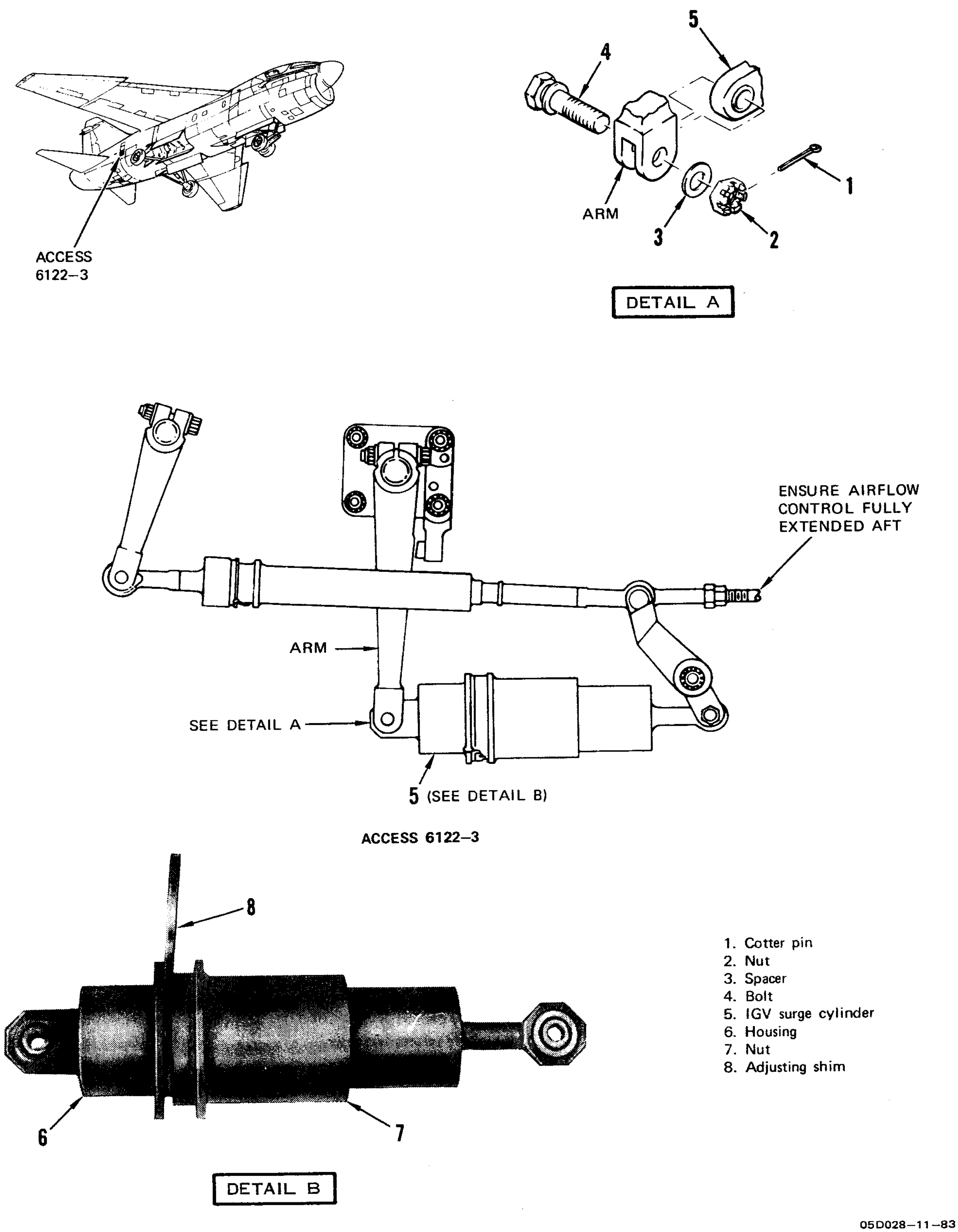


Figure 2-12. Adjustment; IGV External Linkage

NOTE

If an adjusting shim is not installed on IGV surge cylinder, proceed to step d.

c. Remove adjusting shim from IGV surge cylinder as follows:

(1) Remove cotter pin (1), nut (2), spacer (3), and bolt (4) securing IGV surge cylinder (5) to arm.

(2) While holding housing (6), unscrew nut (7) until it is free of housing. Remove housing and adjusting shim (8).

(3) Apply MIL-L-25681 lubricating oil to nut threads.

(4) Install nut on housing until gap is approximately 0.25 inch between nut and housing flange.

(5) Temporarily secure IGV surge cylinder (5) to arm using bolt (4), spacer (3), and nut (2). Do not tighten nut.

d. With airflow control fully extended aft, hold housing (6) and adjust nut (7) until clearance recorded in step b is obtained between IGV control arm and reference button.

NOTE

Shims are available in 0.010-inch increments from 0.050- to 0.250-inch thick. A 0.010 shim will change gap approximately 0.002 inch.

e. Select an adjusting shim (8) by inserting different thickness shims between nut and housing flange that will provide the clearance in step d.

f. If step c was not performed, remove cotter pin (1).

g. Remove nut (2), spacer (3), and bolt (4) securing IGV surge cylinder (5) to arm.

h. While holding housing (6), unscrew nut (7) until it is free of housing. Remove housing and install adjusting shim (8) selecte in step e.

i. Tighten nut (7) on housing (6) to 150 (±30) inch-pounds torque. Secure nut to housing with MS20995C32 lockwire.

j. Secure IGV surge cylinder (5) to arm using bolt (4), spacer (3), and nut (2).

k. Tighten nut (2) to 75 (+25, −50) inch-pounds torque. Secure with new cotter pin (1).

l. Close access 6122-3.

2-12. BLEED VALVE CYLINDER REMOVAL AND INSTALLATION.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
	GGG-W-686	Torque wrench, 10 to 150 inch-pounds	Measure torque

2-12.1. Removal. (Figure 2-13.)

a. Open access 6122-3.

b. Remove cotter pin (1), nut (2), spacer (3), and bolt (4).

c. Remove cotter pin (5), nut (6), spacer (7), and bolt (8).

d. Remove bleed valve cylinder (9).

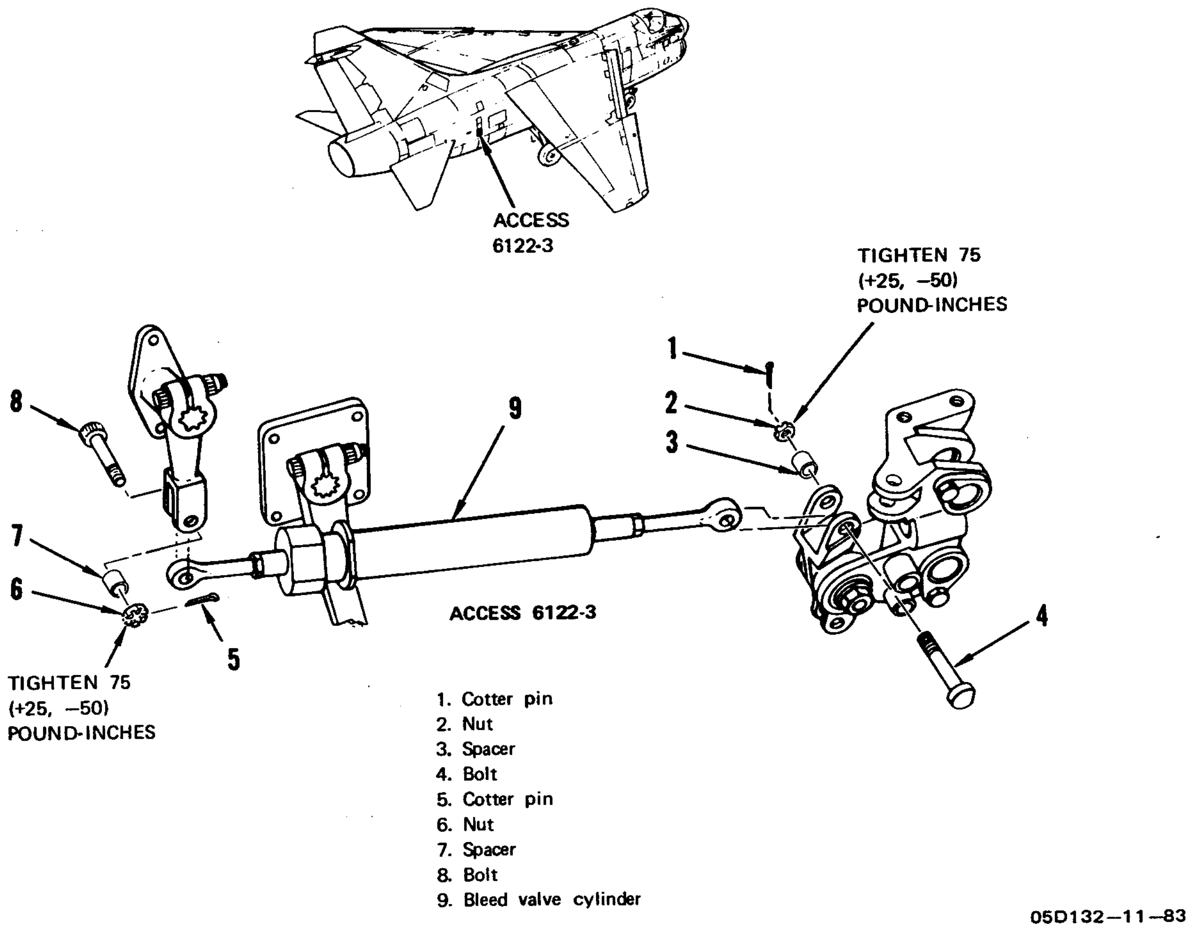


Figure 2-13. Removal and Installation; Bleed Valve Cylinder

2-12.2. Installation. (Figure 2-13.)

a. Perform bleed valve cylinder adjustment (paragraph 2-13).

b. Secure aft end of bleed valve cylinder (9) to arm with bolt (8), spacer (7), and nut (6). Tighten nut 75 (+25, −50) inch-pounds torque. Secure with new cotter pin (5).

c. Secure forward end of bleed valve cylinder to bellcrank with bolt (4), spacer (3), and nut (2). Tighten nut to 75 (+25, −50) inch-pounds torque. Secure with new cotter pin (1).

d. Perform airflow control system operational checkout (paragraph 2-4).

e. Close access 6122-3.

2-13. BLEED VALVE CYLINDER ADJUSTMENT. (Figure. 2-14.)

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
	413-900-020 (American Tool and Engineering Co, Kalamazoo, Michigan)	Torque wrench, 100 to 750 inch-pounds	Measure torque
2-14	6798594 (Allison Division of General Motors, Indianapolis, Indiana)	Bleed valve rod spacer selection fixture	Determine spacer thickness for bleed valve cylinder adjustment

a. Remove bleed valve cylinder (paragraph 2-12).

b. Adjust bleed valve cylinder to its minimum length as follows:

(1) Cut lockwire and remove cover assembly (1) from body (2).

(2) Remove adjusting shim (10) from cover assembly.

(3) Apply MIL-L-25681 lubricating oil to threads and install cover assembly on body. Make sure that body is tight against cover assembly.

(4) Align bleed valve cylinder with fixture by adjusting rod assembly (3) until adjustable pin (9) and fixed pin (4) can easily be inserted.

c. Using bleed valve rod spacer selection fixture, check bleed valve cylinder length as follows:

(1) Loosen thumbscrew (6).

(2) Slide block (5) and shaft (7) together until shoulder on shaft (7) is against block; then tighten thumbscrew (6).

(3) Loosen knob (8).

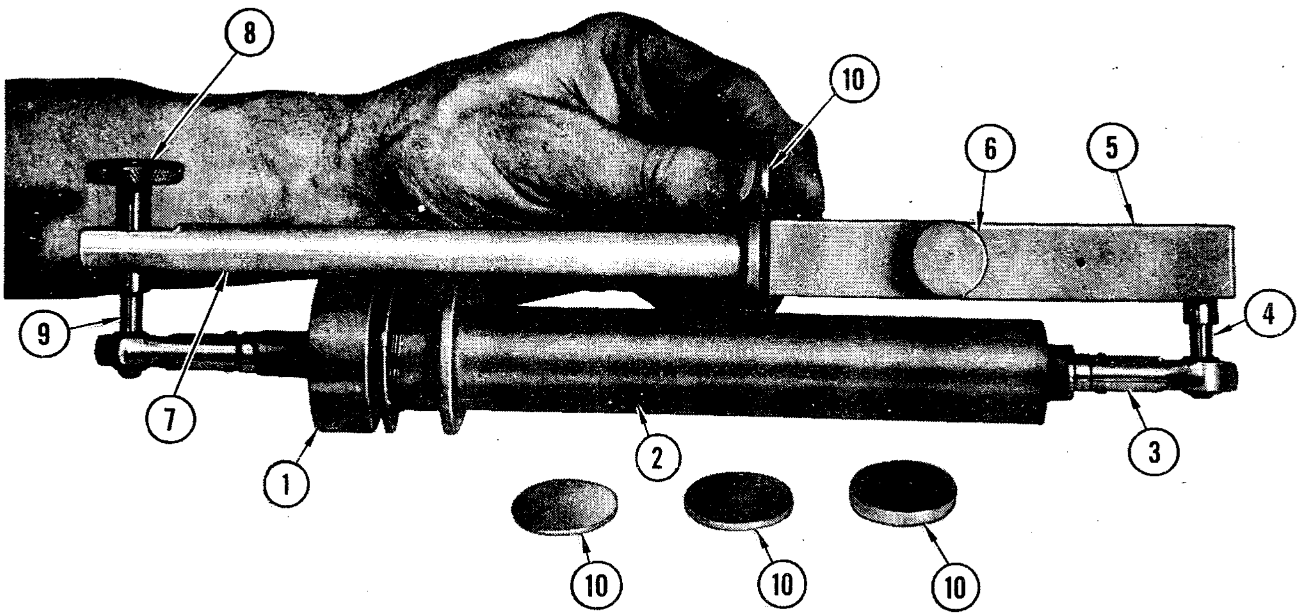
(4) Insert fixed pin (4) and adjustable pin (9) in bleed valve cylinder rod ends; then tighten knob (8).

(5) Remove fixture from bleed valve cylinder.

d. Temporarily install bleed valve cylinder (paragraph 2-12). (Do not tighten nuts and do not install new cotter pins.)

e. With airflow control pushrod fully extended aft, hold cover assembly (1) and unscrew body (2) until bleed valve is fully open (control arm aft).

f. Remove bleed valve cylinder (paragraph 2-12).



1. Cover assembly
2. Body
3. Rod assembly
4. Fixed pin
5. Block
6. Thumbscrew
7. Shaft
8. Knob
9. Adjustable pin
10. Adjusting shim

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Figure 2-14. Adjustment; Bleed Valve Cylinder

g. Determine correct bleed valve cylinder adjusting shim thickness as follows:

(1) Loosen thumbscrew (6).

(2) Insert fixed pin (4) and adjustable pin (9) in bleed valve cylinder rod ends; then tighten thumbscrew (6). Do not change position of adjustable pin (9) or length of bleed valve cylinder.

(3) Measure gap between block (5) and shoulder on shaft (7).

(4) Add 0.028 inch to gap measurement to obtain required adjusting shim thickness.

NOTE

The adjusting shim (10) is a laminated assembly incorporating peelable shims (0.0027- to 0.0033-inch thick).

(5) Peel laminates from adjusting shim (10) until thickness determined in substep (4) is obtained.

h. Remove cover assembly (1) from body (2).

i. Install adjusting shim (10) selected in step g substep (5) in cover assembly (1).

j. Tighten cover assembly on body to 150 (±30) inch-pounds torque. Align bleed valve cylinder rod ends with adjustable pin (9) and fixed pin (4) by turning rod assembly (3) in body (2).

k. Secure cover assembly (1) to body (2) with MS20995C32 lockwire.

l. Install bleed valve cylinder (paragraph 2-12).

2-14. BLEED VALVE LINKAGE CLEANING.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
	GGG-W-686	Torque wrench, 10 to 150 inch-pounds	Measure torque

NOTE

This procedure will be utilized whenever force required to actuate bleed valve exceeds limits.

a. Open accesses 5122-5, 5222-2, 6122-3, and 6222-2.

b. Remove cotter pin (1, figure 2-15), nut (2), spacer (3), and bolt (4).

c. Remove nut (5) and bolt (6) and remove bleed valve control arm (7).

CAUTION

Be careful when removing bearing housing assembly from shaft to prevent damage to ID of bearing surface.

NOTE

Retain bearing housing and shim as a set.

d. Remove bolts (8), washers (9), and lockwashers (10) and remove actuating bearing housing (11) and shim (12).

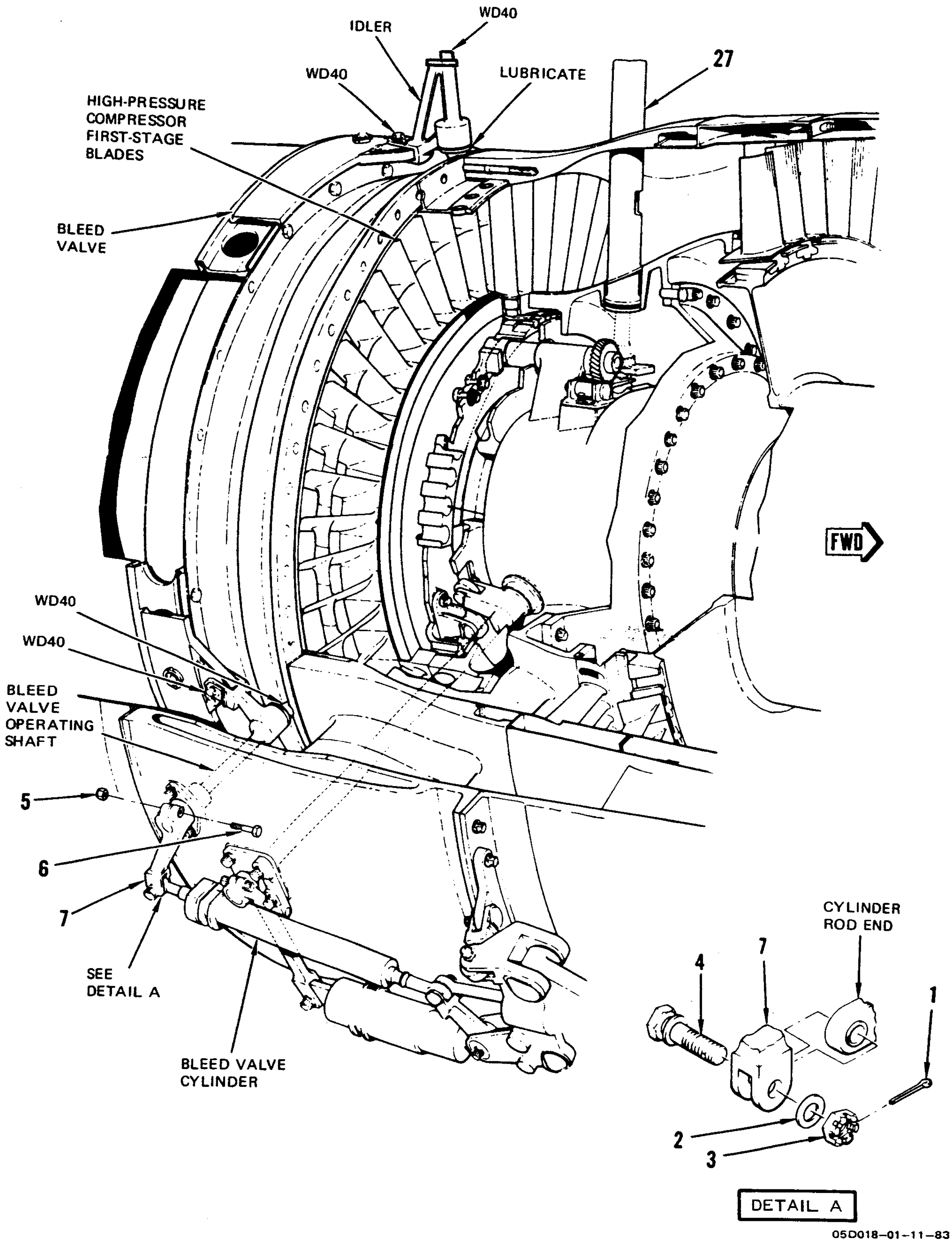
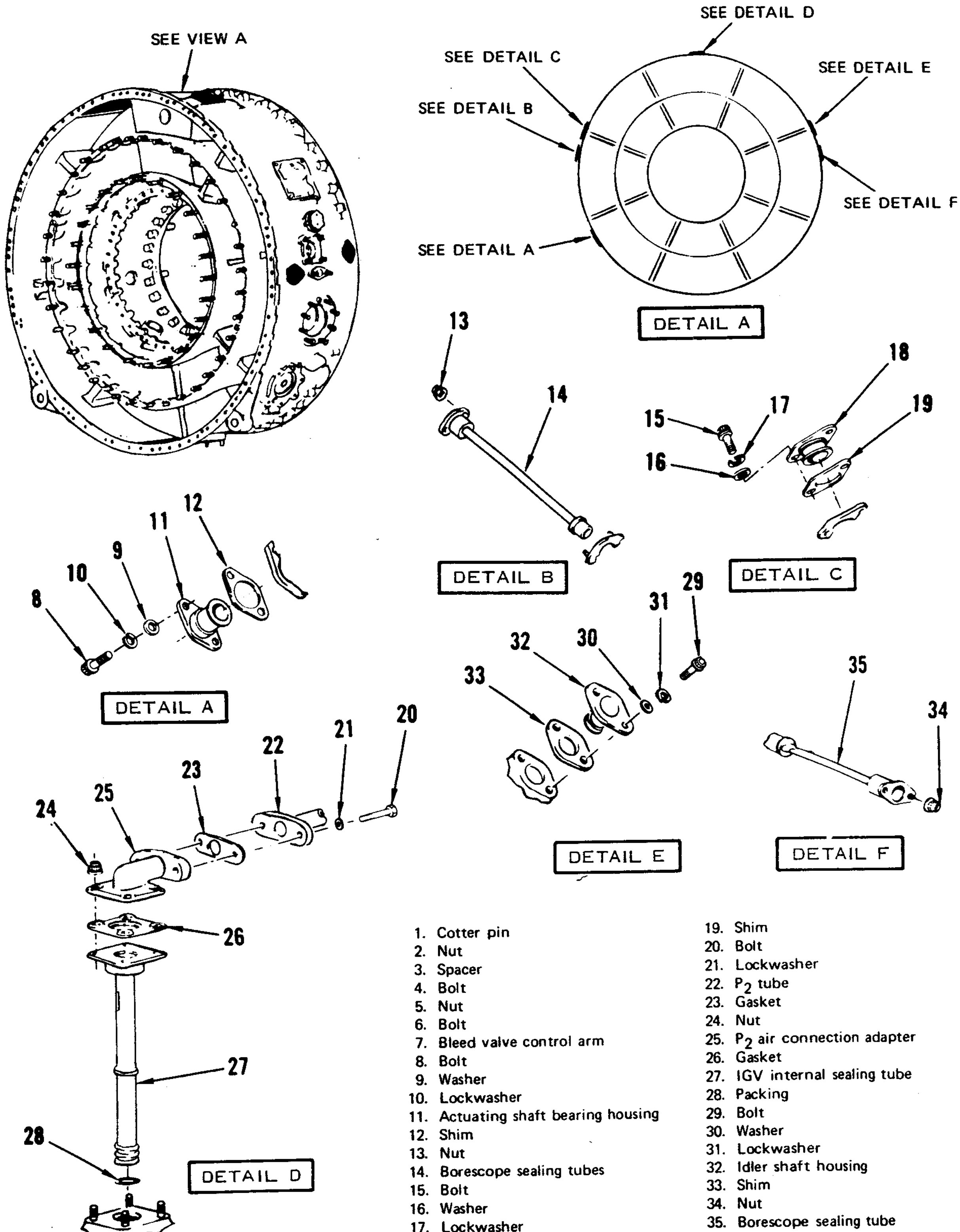


Figure 2-15. Cleaning; Bleed Valve Linkage (Sheet 1 of 2)



1. Cotter pin
2. Nut
3. Spacer
4. Bolt
5. Nut
6. Bolt
7. Bleed valve control arm
8. Bolt
9. Washer
10. Lockwasher
11. Actuating shaft bearing housing
12. Shim
13. Nut
14. Borescope sealing tubes
15. Bolt
16. Washer
17. Lockwasher
18. Idler shaft bearing housing
19. Shim
20. Bolt
21. Lockwasher
22. P_2 tube
23. Gasket
24. Nut
25. P_2 air connection adapter
26. Gasket
27. IGV internal sealing tube
28. Packing
29. Bolt
30. Washer
31. Lockwasher
32. Idler shaft housing
33. Shim
34. Nut
35. Borescope sealing tube

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Figure 2-15. Cleaning; Bleed Valve Linkage (Sheet 2)

e. Inspect ID surface and thrust face of bearing housing for damage. Smooth surfaces by lightly polishing with crocus cloth.

WARNING

Solvent P-D-680, Type II, is toxic to skin, eyes, and respiratory tract. Use in a well-ventilated area. Avoid prolonged breathing of vapors. Avoid eye and repeated skin contact. Keep away from sparks and flames.

f. Clean bearing housing with P-D-680, Type II, drycleaning solvent or MIL-M-7752 metal cleaner silicate soap.

g. Clean any deposits from bearing surface of actuating shaft with MIL-C-23411 (Americal Rocket) WD-40.

h. Remove nuts (13) and borescope sealing tube (14).

i. Spray WD-40 through borescope port aft and radially inward to soak bearing bushing and bearing while cycling bleed valve six or more times. Make sure bearings are thoroughly coated.

NOTE

Flat side of borescope sealing tube flange must be toward rear of engine. Use hand pressure only to seat tube.

j. Place borescope sealing tube (14) in position with flat side rearward. Secure with nuts (13).

CAUTION

Be careful when installing bearing housing over shaft splines to prevent damage to ID of bearing surface.

NOTE

Shim and bearing housing must be retained as a set.

k. Place shim (12) and bearing housing (11) in position and secure with lockwashers (10), washers (9), and bolts (8).

l. Place bleed valve control arm (7) in position and secure with bolt (6) and nut (5).

NOTE

Shim and bearing housing must be retained as a set.

m. Remove bolts (15), washers (16), and lockwashers (17) and remove idler shaft bearing housing (18) and shim (19).

n. Inspect ID surface and thrust face of bearing housing for damage. Smooth surfaces by lightly polishing with crocus cloth.

o. Clean bearing housing with P-D-680 drycleaing solvent or MIL-M-7752 metal cleaner silicate soap.

p. Clean any deposits from bearing surface of idler shaft with WD-40.

q. Remove bolts (20) and lockwashers (21). Disengage P2 tube (22) and remove gasket (23).

r. Remove nuts (24) and remove P2 air connection adapter (25), gasket (26), and IGV internal sealing tube (27). Remove packing (28).

s. Spray WD-40 through opening in intermediate case to clean idler shaft bushing and bearing while cycling bleed valve six or more times.

t. Place new packing (28) on IGV internal sealing tube (27) and place tube in position.

u. Place new gasket (26) on tube and place P2 air connection adapter (25) in position. Secure with nuts (24).

v. Using new gasket (23), secure P2 tube (22) to adapter with lockwashers (21) and bolts (20).

NOTE

Shim and bearing housing must be retained as a set.

w. Place shim (19) and bearing housing (18) in position and secure with lockwashers (17), washers (16), and bolts (15).

NOTE

Shim and bearing housing must be retained as a set.

x. Remove bolts (29), washers (30), and lockwashers (31), and remove idler shaft bearing housing (32) and shim (33).

y. Inspect ID surface and thrust face of bearing housing for damage. Smooth surfaces by lightly polishing with crocus cloth.

WARNING

Solvent P-D-680, Type II, is toxic to skin, eyes, and respiratory tract. Use in a well-ventilated area. Avoid prolonged breathing of vapors. Avoid eye and repeated skin contact. Keep away from sparks and flames.

z. Clean bearing housing with P-D-680 drycleaning solvent or MIL-M-7752 metal cleaner silicate soap.

aa. Clean any deposits from bearing surface of idler shaft with WD-40.

ab. Remove nuts (34) and remove borescope sealing tube (35).

ac. Spray WD-40 through borescope port aft and radially inward to soak bearing bushing and bearing while cycling bleed valve six or more times. Make sure bearings are thoroughly coated.

NOTE

Flat side of borescope sealing tube flange must be toward rear of engine. Use hand pressure only to seat tube.

ad. Place borescope sealing tube (35) in position with flat side rearward. Secure with nuts (34).

NOTE

Shim and bearing housing must be retained as a set.

ae. Place shim (33) and bearing housing (32) in position and secure with lockwashers (31), washers (30), and bolts (29).

af. Perform IGV linkage force check (paragraph 2-8).

ag. Connect bleed valve cylinder to arm (7) with bolt (4), washer (3), and nut (2).

ah. Tighten nut (2) to 75 (+25, −50) inch-pounds torque. Secure with new cotter pin (1).

ai. Close accesses 5122-5, 5222-2, 6122-3, and 6222-2.

2-15. IGV CONTROL ARM CLEARANCE DETERMINATION.

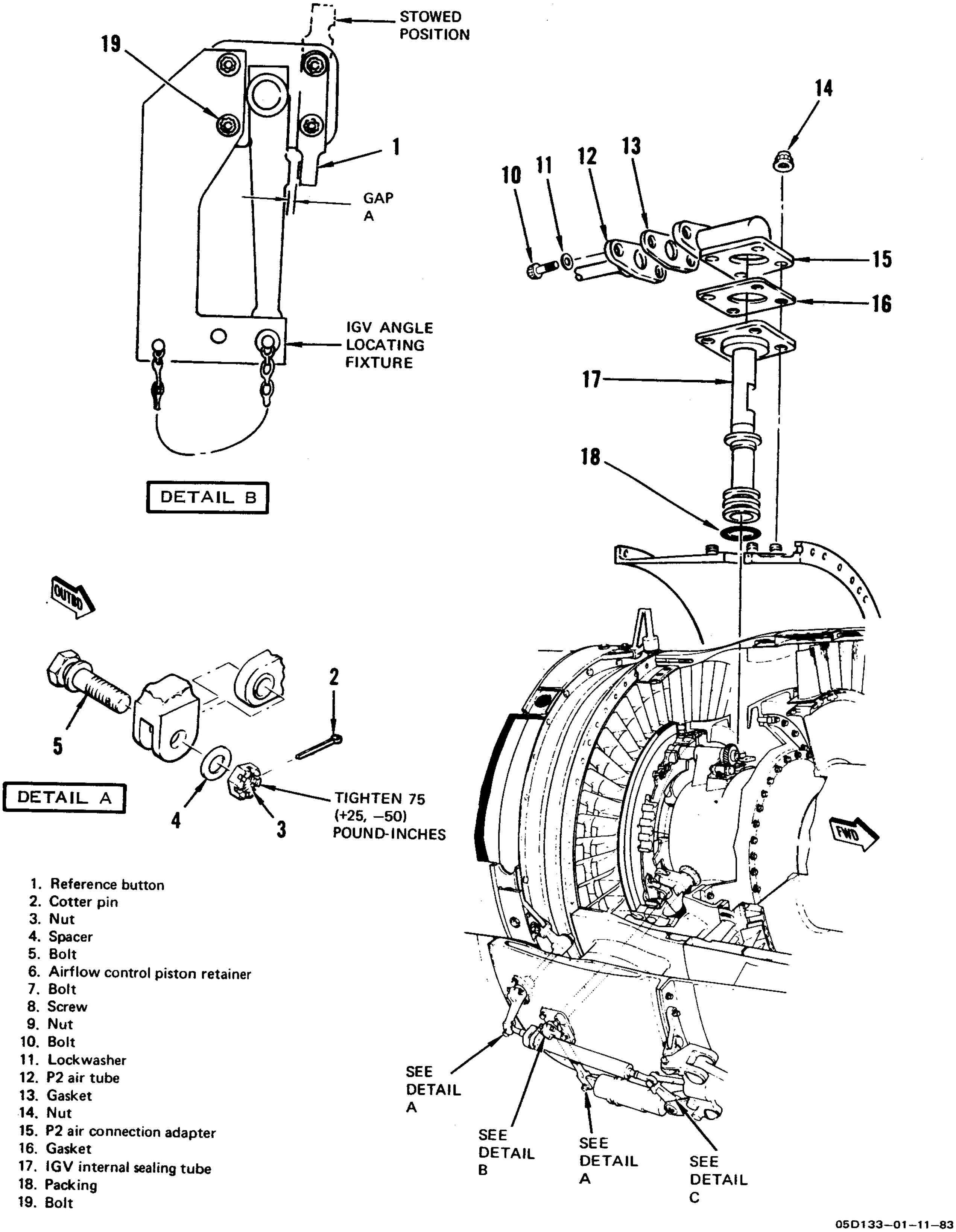
Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
	GGG-W-686	Torque wrench 10 to 150 inch-pounds	Measure torque
	6798561 or 6886210 (Allison Division of General Motors, Indianapolis, Indiana)	IGV angle setting tool	Rotate inlet guide vanes
2-15	6872726 (Allison Division of General Motors, Indianapolis, Indiana)	IGV angle locating fixture	Locate −5° and +35° IGV angles
2-15	6872934 (Allison Division of General Motors, Indianapolis, Indiana)	Airflow control piston retainer	Hold airflow control piston in extended position

NOTE

This procedure will be used to determine stop gap dimension if linkage has been disturbed before gap measurement has been performed or when troubleshooting for compressor stall.

a. Open access 5222-2 and 6122-3.



1. Reference button
2. Cotter pin
3. Nut
4. Spacer
5. Bolt
6. Airflow control piston retainer
7. Bolt
8. Screw
9. Nut
10. Bolt
11. Lockwasher
12. P2 air tube
13. Gasket
14. Nut
15. P2 air connection adapter
16. Gasket
17. IGV internal sealing tube
18. Packing
19. Bolt

Figure 2-16. Clearance Determination; IGV Control Arm (Sheet 1 of 2)

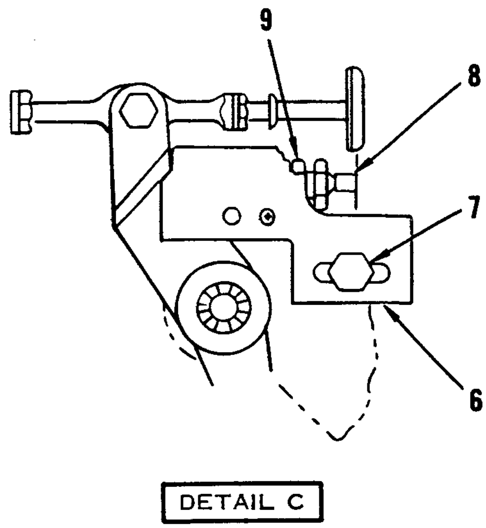


Figure 2-16. Clearance Determination; IGV Control Arm (Sheet 2)

b. Remove bolts and lockwashers and remove reference button (1, figure 2-16).

NOTE

Reference button must be installed in a free state position. If pressure is applied to reference button when tightening retaining bolts, it will be preloaded against the locating dowels. This will result in temporary distortion of dowels and inability to attain correct clearance measurement.

c. Place reference button in rigging position and secure with lockwashers and bolts. Ensure reference button is in free state position.

d. Remove cotter pin (2), nut (3), spacker (4), and bolts (5) and disconnect bleed valve cylinder from arm.

e. Push bleed valve cylinder toward airflow control until at least 1/2-inch movement is noted; then pull back until piston bottoms against internal stop of airflow control.

f. Install airflow control piston retainer (6) as follows:

(1) Place retainer on airflow control rear mount and install bolt (7). Do not tighten bolt.

(2) Adjust screw (8) until end firmly contacts control rear mount and tighten nut (9).

(3) Tighten bolt (7).

g. Measure and record gap A.

h. Disconnect surge cylinder from arm by removing cotter pin, nut, spacer, and bolt.

i. Remove bolts (10) and lockwashers (11) and disconnect P2 air tube (12). Remove gasket (13).

j. Remove nuts (14), P2 air connection adapter (15), gasket (16), IGV sealing tube (17), and packing (18).

k. Install IGV angle setting tool and secure with nuts (14).

l. Press center plunger of tool to disengage internal locking device. Lock tool in this position with knurled pin.

m. Record tool pointer position.

n. Rotate tool counterclockwise to full minus (DECREASE) angle position.

o. Remove knurled pin from IGV angle setting tool. Center plunger of tool will pop out when internal lock engages.

p. Remove bolts (19) and lockwashers and place IGV angle locating fixture in position. Install bolts finger-tight.

q. Move IGV control arm to full aft position; then move the fixture and align bolthole in arm with −5° hole in fixture and install rigging pin. Maintain pressure in aft direction and tighten bolts.

r. Remove rigging pin.

s. Move IGV arm forward to align bolthole in arm with +35° hole in fixture. Install rigging pin.

t. Measure gap A and record in engine log.

u. Remove rigging pin. Move IGV arm aft to align bolthole in arm with −5° hole in fixture. Check that rigging pin can be inserted. If unable to insert pin, repeat steps p through u.

v. Remove IGV angle locating fixture and install lockwashers and bolts (19).

w. Press center plunger of tool and rotate clockwise to setting recorded in step m.

x. Remove nuts and IGV angle setting tool.

y. Place new packing (18) on IGV internal sealing tube (17). Insert this assembly through bypass duct.

z. Using new gasket (16), secure P2 air connection adapter (15) to engine with nuts (14).

aa. Using new gasket (13), secure P2 air tube (12) to adapter with lockwashers (11) and bolts (10).

ab. Loosen nut (9) and backoff screw (8). Remove bolt (7) and airflow control piston retainer (6).

ac. If the gaps measured in steps g and t are not within 0.005 inch, perform inlet guide vane external linkage rigging (paragraph 2-11).

ad. Connect surge cylinder and bleed valve cylinder to their respective arms with bolts (5), spacers (4), and nuts (3).

ae. Tighten nuts to 75 (+25, −50) inch-pounds torque. Secure with new cotter pin (2).

af. Remove reference button (1) and secure in stowed position.

ag. Perform airflow control operational checkout (paragraph 2-14).

ah. Close accesses 5222-2 and 6122-3.

2-16. IGV LINKAGE CLEANING.

NOTE

This procedure will be utilized whenever force required to actuate inlet guide vane exceeds limits.

a. Open access 6122-3.

b. Remove cotter pin (1, figure 2-17), nut (2), spacer (3), and bolt (4) and disconnect inlet guide vane surge cylinder.

c. Remove nut (5) and bolt (6) and remove inlet guide vane control arm (7).

CAUTION

Use care when removing bearing housing to prevent damage to ID of bearing surface.

d. Remove bolts (8), lockwashers (9), reference button (10), and bearing housing (11).

e. Check ID and thrust face of bearing houing for damage. Smooth surfaces by polishing with crocus cloth.

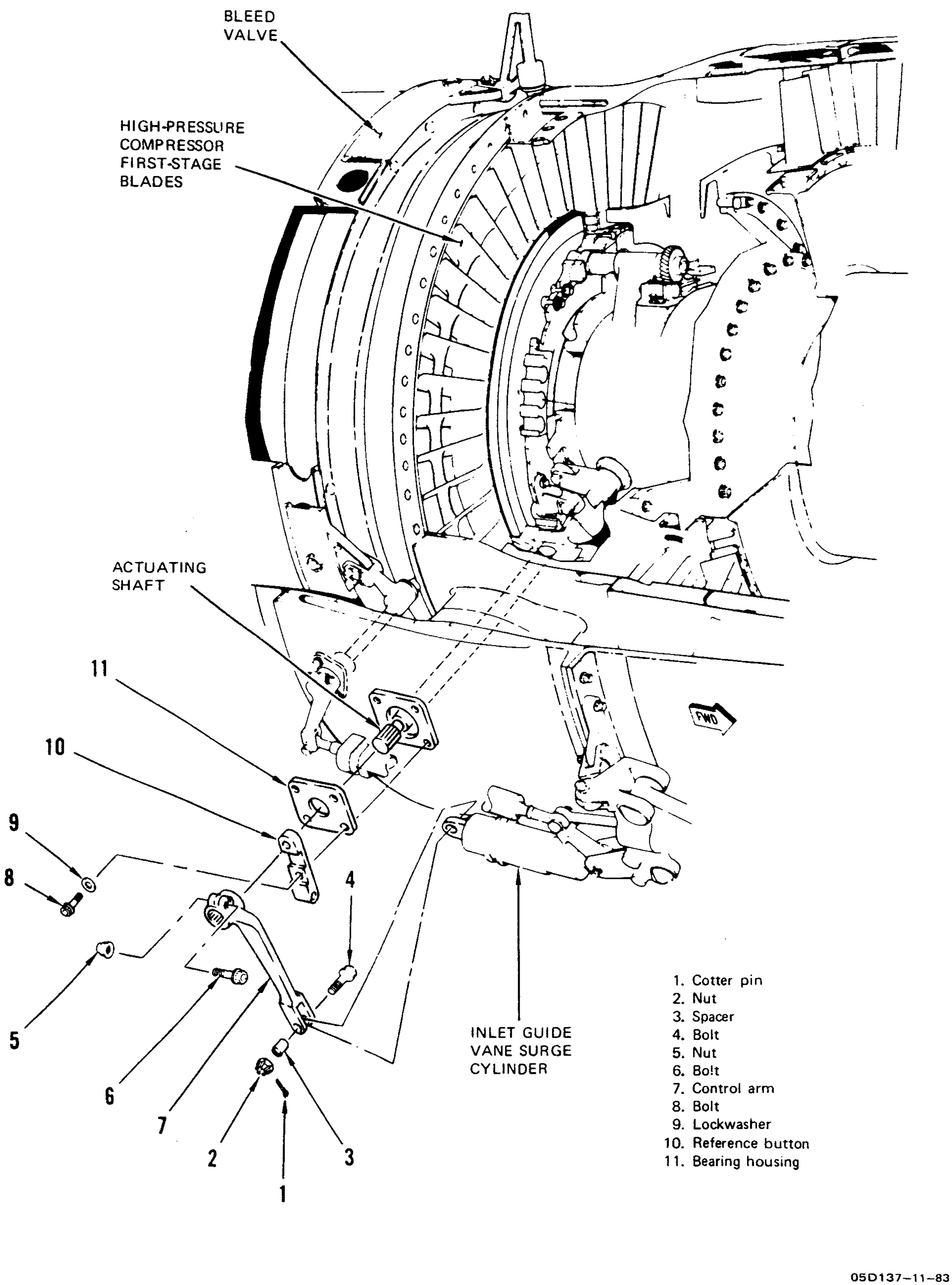


Figure 2-17. Cleaning; IGV Linkage

WARNING

Solvent P-D-680, Type II, is toxic to skin, eyes, and respiratory tract. Use in a well-ventilated area. Avoid prolonged breathing of vapors. Avoid eye and repeated skin contact. Keep away from sparks and flames.

f. Clean housing with P-D-680, Type II, drycleaning solvent or MIL-M-7752 metal cleaner silicate soap.

g. Clean deposits from actuating shaft with WD-40. Lightly polish shaft with crocus cloth.

h. Apply light coat of MIL-S-8660 silicone compound to bearing surface of actuating shaft.

i. Secure bearing housing (11) and reference button (10) to engine with lockwashers (9) and bolts (8).

j. Place inlet guide vane control arm (7) on actuating shaft so that bolt (6) may be inserted into arm without applying force. Secure bolt with nut (5).

k. Actuate control arm from stop to stop several times.

l. Perform inlet guide vane linkage force check (paragraph 2-8).

2-17. HYDROMECHANICAL GOVERNOR (HMG) PRESSURE TEST.

Test Equipment Required

Figure & index No.	Name	AN type designation	Use and application
	Equipment required for engine operation		Operate engine
	Torque wrench, 10 to 150 inch-pounds	GGG-W-686	Tighten bleed port cap nuts
	Pressure gage, 0 to 300 psi (2)	460KR (Helicoid Gage Division of American Chain and Cable Company, Bridgeport, Connecticut)	Indicate HMG and LP pump fuel pressure
	Engine fuel system air bleed valve (2)	6798863 (Allison Division of General Motors, Indianapolis, Indiana)	Perform HMG pressure test
	or		
	Engine fuel system air bleed valve (2)	6872296	Perform HMG pressure test
	or		
	Engine fuel system air bleed valve (2)	6872547	Perform HMG pressure test

a. Open access 6122-3.

b. Cut lockwire and remove two cap nuts (1, figure 2-18) from airflow control.

c. Install engine fuel system air bleed valves on airflow control.

NOTE

Pressure gages must be of known calibration.

d. Attach pressure gages to bleed tools using No. 4 hoses.

e. Start engine (T.O. 1A-7D-2-1) and stabilize at IDLE.

f. Open valves on air bleed tools.

g. Bleed air from hoses by loosening fittings on gages. Tighten fittings.

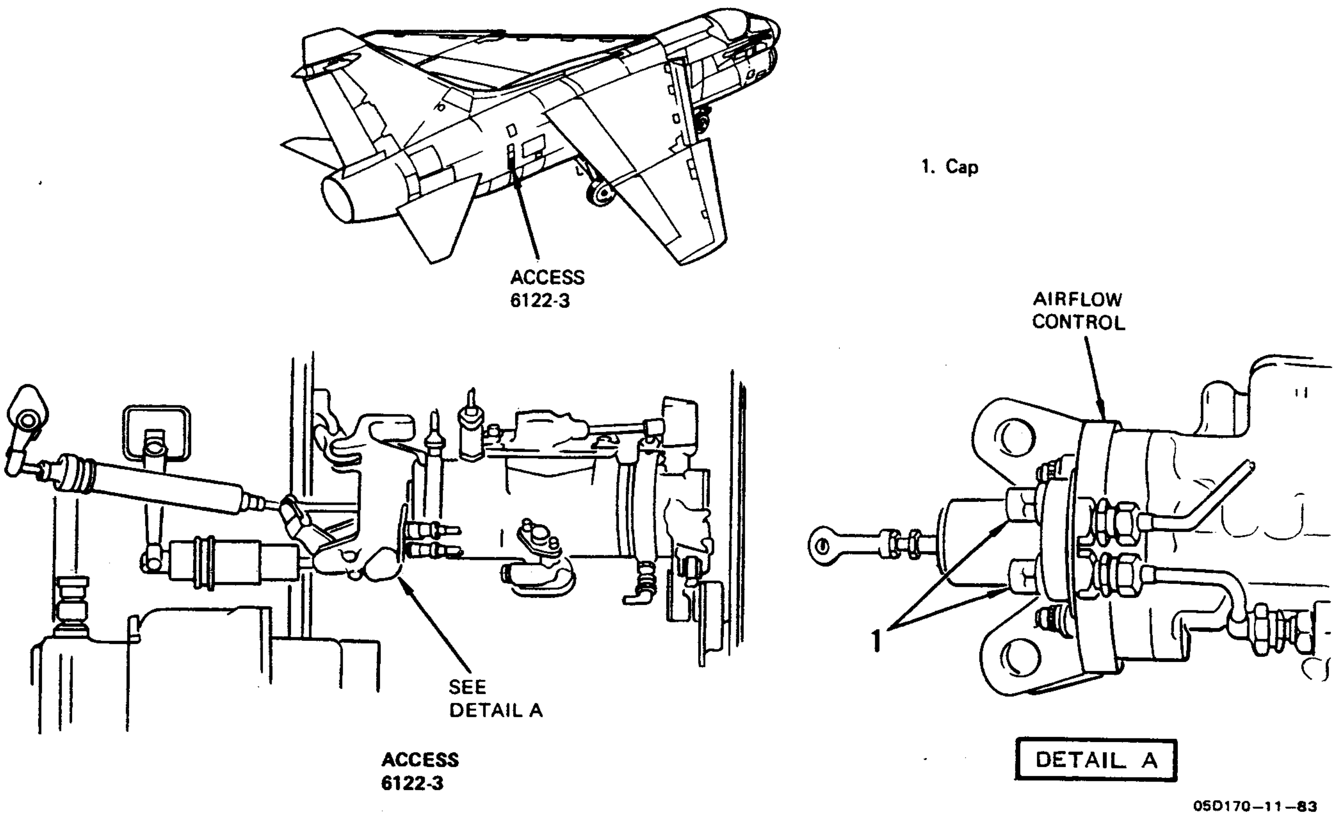


Figure 2-18. Pressure Test; Hydromechanical Governor (HMG)

NOTE

Pressure gage attached to upper bleed port will indicate HMG pressure. Pressure gage attached to lower bleed port will indicate LP pump pressure.

h. Slowly advance throttle to MIL and back to IDLE. Check that indications on both pressure gages increase together with no sudden, large displacements. Any change in engine speed must have proportional changes in pressure on both gages. Also, any change in pressure on one gage must have a proportional change in pressure on the other gage.

NOTE

It may not be possible to attain 100% rpm at MIL. If it cannot be attained, the 100% rpm checkpoint may be omitted.

i. Slowly advance throttle and stabilize at check points of 60%, 70%, 80%, 90%, and 100% rpm. Record indications from both gages at each point.

j. Retard throttle to IDLE.

k. Close valves on air bleed tools.

l. Shut down engine (T.O. 1A-7D-2-1).

m. Correct the indications recorded in step i for gage calibration error.

n. Obtain a value of differential pressure for each engine check point speed. This is done by subtracting LP fuel pump pressure (lower gage) indication from HMG pressure (upper gage) indication.

o. Values of HMG differential pressure must be within the following limits.

Engine speed (% rpm)	HMG differential pressure (psi corrected)
60	27.7 to 37.7
70	36.6 to 46.6
80	47.0 to 57.0
90	58.5 to 68.5
100[1]	72.5 to 82.5

[1]Values apply only if 100% engine rpm is attained.

p. If HMG differential pressure is not within limits, replace high pressure fuel pump (paragraph 5-27) and repeat test. Also, replace pump and retest if pressure in step d did not increase together or had sudden, large displacements.

q. If HMG differential pressure is still not within limits, replace airflow control (paragraph 2-9) and repeat test.

r. If HMG differential pressure is within limits after performing step p, the high pressure fuel pump is not defective and should be retained as serviceable.

s. Remove pressure gages and hoses from bleed tools.

t. Remove bleed tools from airflow control.

u. Install caps (1) on bleed ports. Tighten caps to 120 inch-pounds torque. Secure with MS20995C32 lockwire.

v. Close access 6122-3.

SECTION III
ENGINE INSTRUMENT SYSTEM

3-1. DESCRIPTION.

3-1.1. Engine Instrument System. The engine instrument system provides visual cockpit display of turbine outlet pressure, oil pressure, oil quantity, turbine outlet temperature, and fuel flow. Caution lights warn of high turbine outlet temperature, low fuel pressure, low oil pressure, low oil quantity, and excessive oil filter pressure differential. Refer to respective subsystem for description. For location and function of instruments, see figure 3-1.

3-1.2. Turbine Outlet Pressure Indicating System. The turbine outlet pressure indicating system measures the total pressure of the air at the outlet of the engine turbine. This includes air from the fan bypass duct as well as from the turbine. The system consists of a turbine outlet pressure indicator, transmitter, and nine P5 air probes. The indicator is graduated in 0.5-inch Hg increments and has a range from 25 to 45 inches Hg. A movable index on the outer circumference of the indicator may be preset by the pilot prior to takeoff to provide a reference point for minimum TOP.

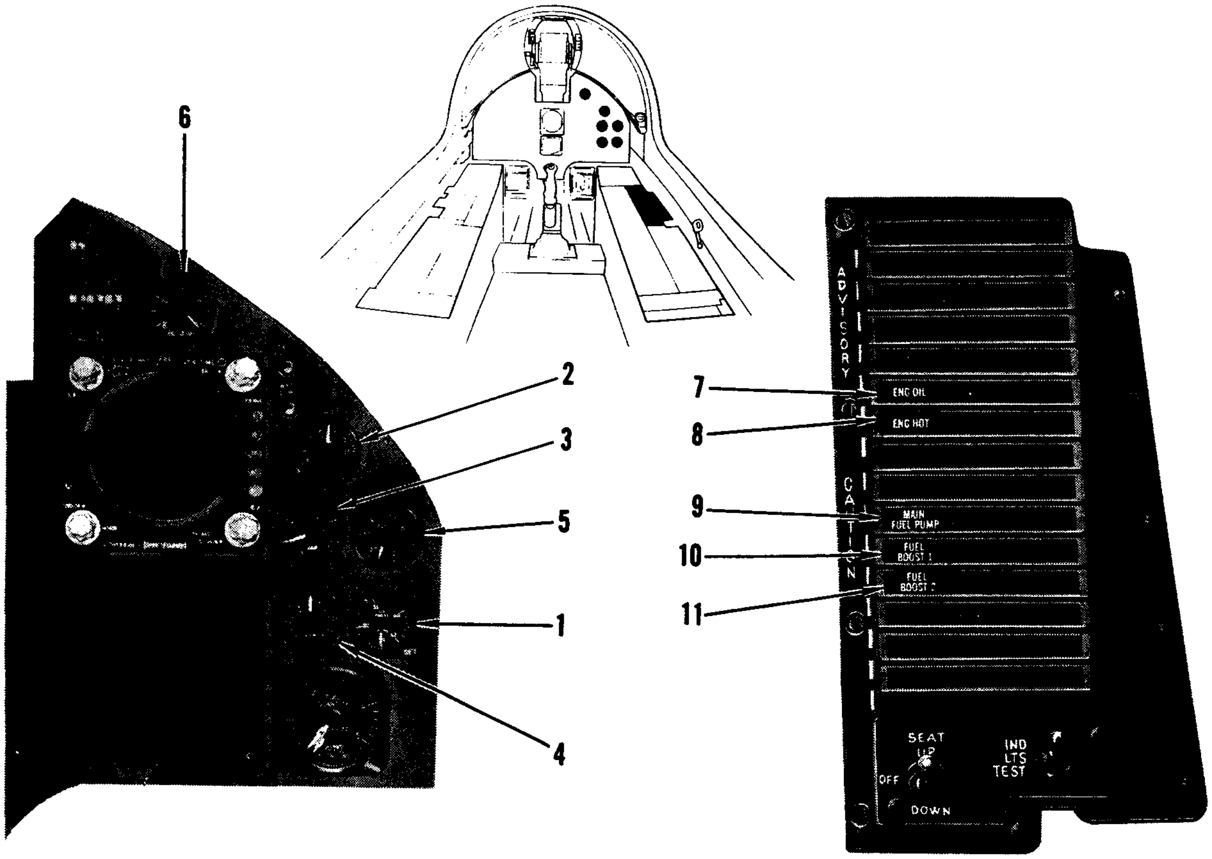
3-1.3. Oil Pressure Indicating System. The oil pressure indicating system measures the differential pressure between oil pump discharge pressure and high speed gearbox pressure. The system consists of an oil pressure indicator and transmitter. The indicator has a range from 0 to 60 psi with graduations of 5 psi.

3-1.4. Oil Quantity Indicating System. The oil quantity indicating system measures the mass of oil within the tank and not the volume. It does not measure oil trapped in the engine or gearbox. The system is designed to measure the mass of oil within the tank; the quantity indication for a stated weight of oil will be the same regardless of oil temperature or airplane attitude. The system consists of a source unit containing Krypton 85 gas, and a detector unit (Geiger-Muller tube). It also has coaxial cabling and an oil quantity indicator. The source unit contains 300 millicurries of Krypton 85. It emits a strength of 2 milliroentgens per hour at 1 foot from the source. If the source tube should rupture, the gas will dissipate harmlessly into the atmosphere. The indicator is adjustable at both the empty and full positions. It has a range from E to F with graduations of 1/16. Each graduation is equal to approximately 1 pint of oil. A low oil quantity warning circuit is also provided. Refer to subparagraph 3-1.5 for description.

3-1.4.1. Oil Quantity Indicating System. (Airplanes After T.O. 1A-7-596.) The system measures oil quantity only within the tank, not oil trapped in the engine or gearbox. The system is designed as a float system which measures the volume of oil in the tank. The system consists of a sending unit; a circuit board with a magnetic channeled float encased within the tank sight glass. It also has coaxial cabling and an oil quantity indicator. The indicator range is from E to F with graduations from 1/2 to F of approximately 2 pints of oil per graduation. A low oil quantity warning circuit is also provided. Refer to subparagraph 3-1.5 for description.

3-1.5. Oil Caution Light System. The oil caution light system is energized by one of three units. These units are low oil pressure switch, oil quantity indicator, and oil filter bypass switch. The system consists of a differential pressure switch and an oil filter bypass switch. It also includes circuits within the oil quantity indicator and engine oil caution light.

3-1.6. Turbine Outlet Temperature Indicating System. The turbine outlet temperature indicating system measures the temperature of exhaust gases just aft of the turbine outlet. The system consists of a turbine outlet temperature indicator, nine temperature sensing probes, engine over-temperature caution light, and turbine outlet temperature (TOT) test switch. In addition to the normal pointer display, the indicator provides a digital readout. The indicator has a range from 0° to 1,000°C (32° to 1,832°F); graduations are 50°C (122°F). The TOT test switch permits the indicator to be driven up-scale past the caution light setting. The caution light setting is adjustable.



INDEX NO.	CONTROL/INDICATOR	FUNCTION
1	Turbine outlet pressure indicator (T.O. PRESS)	Indicates turbine outlet pressure in inches Hg.
2	Fuel flow indicator (FUEL FLOW)	Measures fuel flow in pounds per hour.
3	Turbine outlet temperature indicator (T O T)	Indicates turbine outlet temperature in degrees Centigrade.
4	Tachometer indicator (PERCENT RPM)	Indicates high pressure compressor rotor speed in percent rpm.
5	Oil pressure indicator (OIL PRESS)	Indicates engine oil pressure in psid.
6	Oil quantity indicator (OIL QTY)	Indicates oil tank quantity in sixteenths tank volume.
7	Engine oil caution light (ENG OIL)	Comes on in event of low pressure, low oil quantity, or impending oil filter bypass.
8	Engine overtemperature caution light (ENG HOT)	Comes on during engine hot conditions.
9	Main fuel pump low pressure caution light (MAIN FUEL PUMP)	Comes on when fuel pressure decreases below 185 psi.
10	Fuel boost pump number 1 caution light (FUEL BOOST 1)	Comes on during low fuel pressure conditions at pump outlet.
11	Fuel boost pump number 2 caution light (FUEL BOOST 2)	Comes on during low fuel pressure conditions at pump outlet.

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Figure 3-1. Indicator; Engine Instrument System

3-1.7. Fuel Flow Indicating System. The fuel flow indicating system measures the rate that fuel is delivered to the engine fuel system for consumption. The system consists of a fuel flow indicator and transmitter. The indicator has a range of 0 to 15,000 pounds per hour (pph).

3-1.8. High Pressure Rotor Tachometer Indicating System. The tachometer indicating system measures the speed of the high pressure compressor rotor. The system consists of a tachometer generator and indicator. The indicator has a range of 0% to 100% rpm and is graduated in increments of 1%.

3-1.9. Low Fuel Pressure Indicating System. The low fuel pressure indicating system provides cockpit warning of fuel pump failure. The system consists of a main fuel pump caution light, fuel boost pump No. 1 caution light, fuel boost pump No. 2 caution light, and four pressure switches.

3-2. OPERATION.

3-2.1. Turbine Outlet Pressure Indicating System. Turbine outlet pressure (figure FO-3) is sensed by nine P5 air probes aft of the engine turbine section. This pressure is sensed at the pressure bellows in the turbine outlet pressure transmitter. A second bellows in the transmitter is vented to the atmosphere. Both bellows are connected to a rocker arm. Variations in the pressure differential between turbine and atmospheric pressures cause the rocker arm to mechanically move the transmitter rotor. This routes a signal to the turbine outlet pressure indicator causing an error signal to be amplified and applied to the motor. The motor drives a gear train which positions the indicator pointer and drives the synchro to a null position. When the synchro is nulled, the signal is nulled and the pointer movement is stopped.

3-2.2. Oil Pressure Indicating System. Engine oil pressure (figure FO-4) is applied to the oil pressure transmitter pressure bellows. High speed gearbox vent pressure is applied to the transmitter vent bellows. Both bellows are connected to a rocker arm. Variations in the pressure differential between oil and vent pressure cause the rocker arm to mechanically move the synchro assembly rotor. This provides a signal to the oil pressure indicator synchro assembly. This signal causes the synchro rotor to rotate to a null position, nulling the signal and stopping pointer movement.

3-2.3. Oil Quantity Indicating System. Krypton 85 radioactive gas in the source unit emits Beta and Gamma photons in all directions (figure 3-2). The Beta photons are completely absorbed by the walls of the source tube. The Gamma photons pass through the source tube and metal tank walls, the oil, and the detector tube walls The oil within the tank acts as a partial barrier to the Gamma photons, preventing some of the photons from passing through the oil. The number of photons reaching the detector tube is inversely proportional to oil quantity. The half-life of Krypton 85 gas is approximately 10.2 years. During this time period, the radiation decay rate is approximately 0.75% per month. Due to radiation decay, periodic calibrations are used to ensure system accuracy.

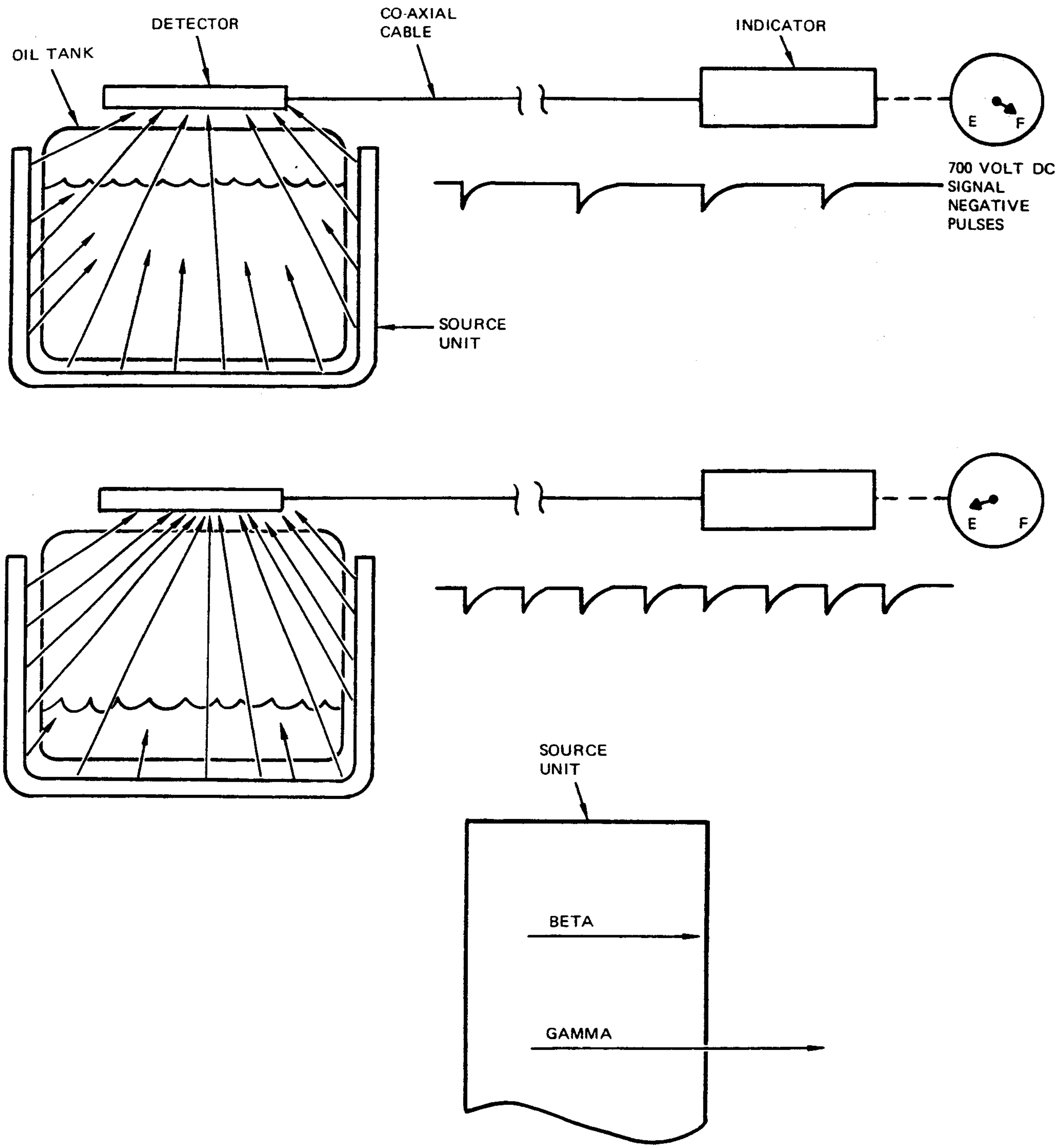
3-2.3.1. Detector. The detector, a Geiger-Muller tube, receives about 700 volts dc from the oil quantity indicator. This voltage is used to charge the Geiger-Muller tube within the detector. The Geiger-Muller tube uses a gas mixture for a dielectric. When a Gamma photon ionizes the dielectric, the Geiger-Muller tube will discharge. This produces a negative pulse. The number of negative pulses is proportional to the Gamma photons reaching the detector; it is inversely proportional to the oil mass within the tank.

3-2.3.1.1. Detector (Oil Quantity Indicating System). (Airplanes After T.O. 1A-7-596.) The detector unit consists of magnetically activated reed switches and discrete wire-wound resistors mounted on a printed circuit board (PCB). A magnet/float assembly tracks liquid level and actuates the reed switches. The oil tank sight glass assembly is the housing for sending unit.

3-2.3.2. Oil Quantity Indicator. The oil quantity indicator counts the number of negative pulses. It then applies a 12-second nominal time constant to get a statistical measurement of the pulses. The indicator provides a signal that is proportional to the number of negative pulses received. It directs this signal to the meter. The meter is temperature compensated, having a range of 0 to 1 milliampere. It is graduated in 1/16 increments from E to F. The indicator generates 700 volts dc for detector use. Adjustments on the back of the indicator are used to compensate for varying amounts of radiation strength. They also adjust for differences between components. The empty adjustment nulls out the mass of the oil tank.

3-2.3.2.1. Oil Quantity Indicator. (Airplanes After T.O. 1A-7-596.) The indicator mechanism is a dc selsyn. The current in the two coils sets up a magnetic field in which pointer direction is sensed by the permanent-magnet rotor to which it is attached. The rotor acts as a magnetic compass needle in that it aligns itself with the magnetic flux produced by the coils.

3-2.3.3. System Anomolies. (Airplanes After T.O. 1A-7-596.) The oil quantity indicating system exhibits three operating anomolies that are considered normal. First, indicators with a 1002-00-060-1A rate meter module have needle movement that is of a slow and hunting nature. The 1002-00-060-1 rate meter module used a single capacitor to perform the time constant function. Indicators using this module show rapid excursions of the indicator needle. An additional capacitor and filter was included in 1002-00-060-1A rate meter module to increase the time constant value. This increased time constant causes the indicator needle to have slow, hunting movements. Second, the indicator needle may stick in the power off (10° past F) position when power is applied to the indicator. This condition is caused by the proximity of the indicator needle to an integral magnet. This is a temporary condition that will correct itself just after engine start when the oil tank quantity decreases. Third, at engine start or when power is applied to the system, the indicator needle may go to E and then return to a normal indication. This is caused by a current surge and is not cause for rejection.



AIRPLANES BEFORE T.O. 1A-7-596

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Figure 3-2. Schematic Diagram; Oil Quantity Indicating System (Sheet 1 of 2)

AIRPLANES AFTER T.O. 1A-7-596

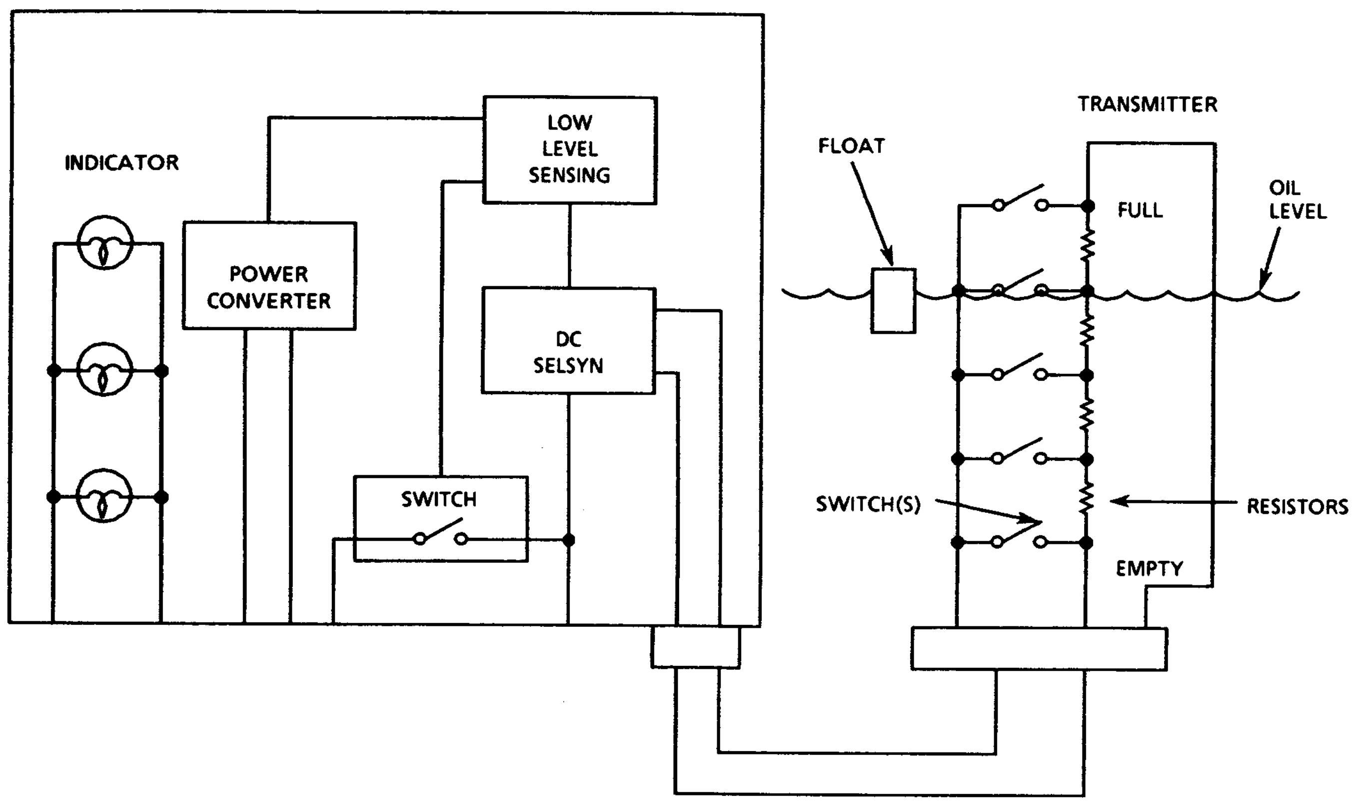

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Figure 3-2. Schematic Diagram; Oil Quantity Indicating System (Sheet 2)

3-2.3.4. System Failure. Any system failure that causes a decrease in pulse rate (such as a loss of high voltage) will cause the indicator to drive toward F. If the pulse rate decreases to zero, the indicator will drive to a position 10° past F. Any system failure that increases the pulse rate (such as an intermittent connection) will cause the indicator to drive toward E. In troubleshooting, a low pulse rate results in a high oil quantity indication, and a high pulse rate, a low oil quantity indication. The pulse rate for a given mass of oil is constant, regardless of airplane attitude or oil volume.

3-2.4. Oil Caution Light System. The oil caution light (figure FO-4) may be turned on by any of the three switches. The differential oil pressure switch, the low oil quantity switch, and the oil filter bypass switch. If indicated oil pressure decreases to 11 (±1) psid, oil quantity decreases to 1/2 (±1/32, −0), or differential pressure across the oil filter increases to approximately 30 psid, a circuit is completed to the ENG OIL light on the caution panel causing it to come on. A thermal lockout prevents actuation of the oil filter switch when engine is cold. This will prevent a false warning due to cold engine. Refer to Section IX for operation of oil filter switch.

3-2.5. Turbine Outlet Temperature Indicating System. Nine single element Alumel-Chromel temperature probes (figure FO-5), located immediately aft of the engine turbine, generate an electrical signal that is proportional to the temperature of the turbine outlet gases. This temperature signal is used for the temperature limiter amplifier as well as for temperature indication. A ballast resistor is placed between the Alumel and Chromel leads to act as a shunt. The resistor is used to provide a common TOT indication for all engines at the same thrust. The value is selected at time of manufacture or overhaul. It is recorded in the engine log. If the ballast resistor is replaced, it must be replaced with a resistor or combination of resistors resulting in equal value. The temperature signal is routed to the turbine outlet temperature indicator cold junction compensator. This has the effect of referencing and stabilizing the cold junction within the indicator to 0°C (32°F), so indications are true thermocouple hot junction temperatures. Any change in thermocouple signal will cause an unbalance signal in the bridge. The unbalance signal is fed through an amplifier to drive a servomotor. The motor shaft is coupled to a gear train which positions the wiper arm of the bridge circuit and simultaneously positions the pointer and counter. When the bridge circuit is in balance, inputs to the amplifier are zero and the servomotor is stopped. When the test switch is closed, a fixed voltage is applied to the bridge circuit which will simulate a thermocouple input of approximately 845° (±30°)C (1,553° (±54°)F). The indicator overtemperature switch is mechanically coupled to the counter and is closed at 622° (+3°, −2°)C (1,152° (+5°, −4°)F).

3-2.6. Fuel Flow Indicating System. The fuel flow indicating system (figure 3-3) uses 115-volt ac, single-phase, 400-hertz power. When power is applied, a 34-volt rms ac, 8-hertz, 2-phase, solid state power supply in the indicator is energized. This power is supplied to the fuel flow transmitter. It is used to drive an impeller operating in the fuel stream at a constant speed. Rotation of the fuel by the impeller deflects a stationary outlet turbine against the action of a restraining spring. The angular deflection is proportional to the mass rate of fuel flow. A synchro transmitter, magnetically coupled to the turbine, rotates in proportion to turbine deflection and changes the output signal to the synchro receiver in the indicator. The synchro receiver rotates its position by a corresponding amount, thereby deflecting the indicator pointer.

3-2.7. High Pressure Rotor Tachometer Indicating System. The tachometer generator (figure 3-4) supplies a 3-phase voltage with a frequency of 1 cycle per revolution. A tachometer rpm rating of 4,200 equals 100% engine rpm. The tachometer indicator, using a magnetic drag type indicating mechanism that is driven by a self-starting, 3-phase, synchronous motor, senses generator output and gives a visual display of engine speed in % rpm.

3-2.8. Low Fuel Pressure Indicating System. The HP fuel pump installation (figure FO-6) has two pressure switches connected in parallel. The switches are set to close at approximately 185 psig. When either of the switches close, the MAIN FUEL PUMP caution light will come on. The fuel boost pump low-pressure switch (S502 or S407) will open when differential pressure between pump inlet and outlet reaches 7.0 (±0.5) psid. It will close when pressure drops to 6.0 (±1.5) psid. When the switch closes, the BOOST PUMP 1 caution light will come on. The LP fuel pump low pressure switch (S503) will open when differential pressure between pump inlet and outlet

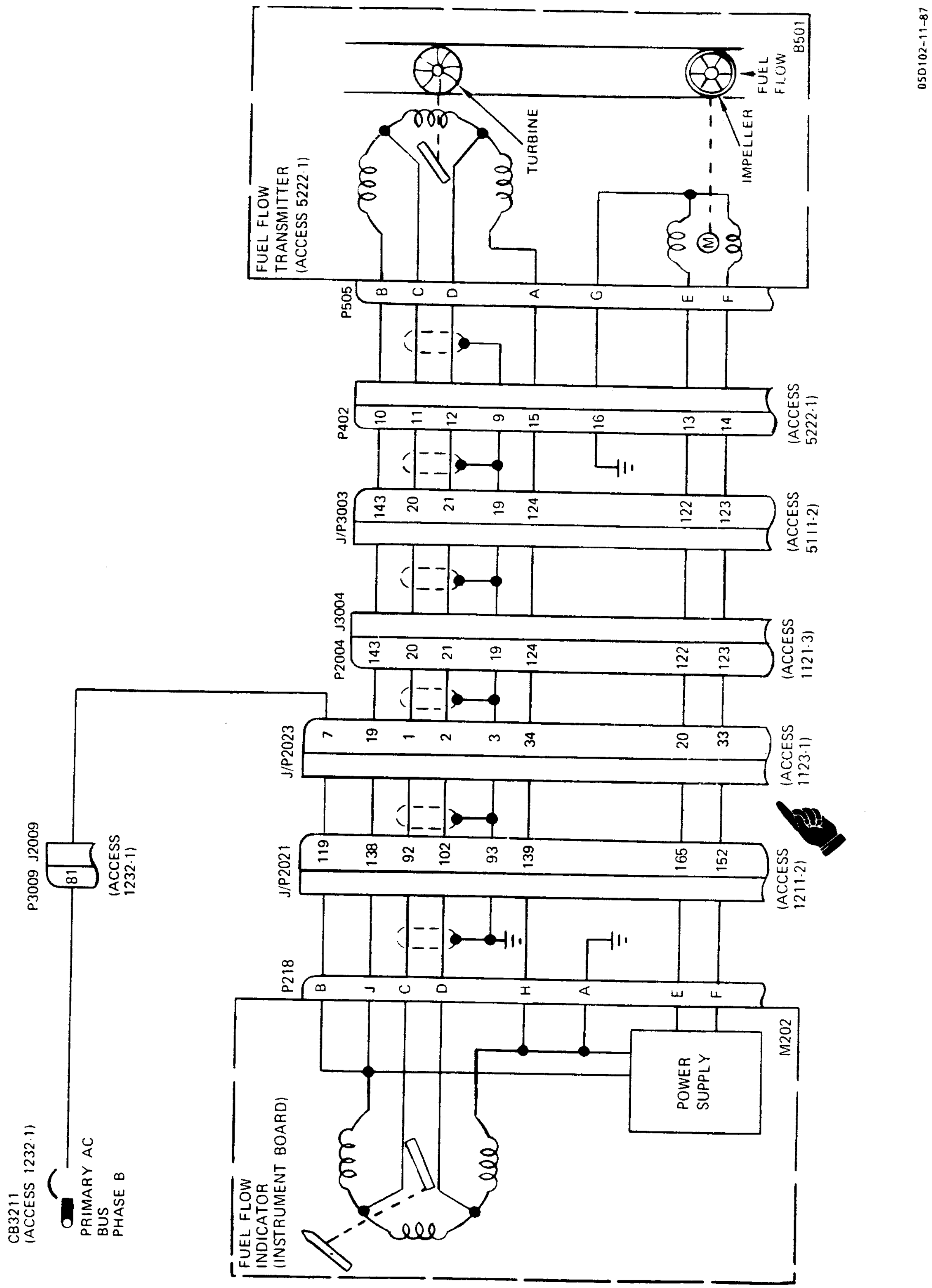

Figure 3-3. Schematic Diagram; Fuel Flow Indicating System

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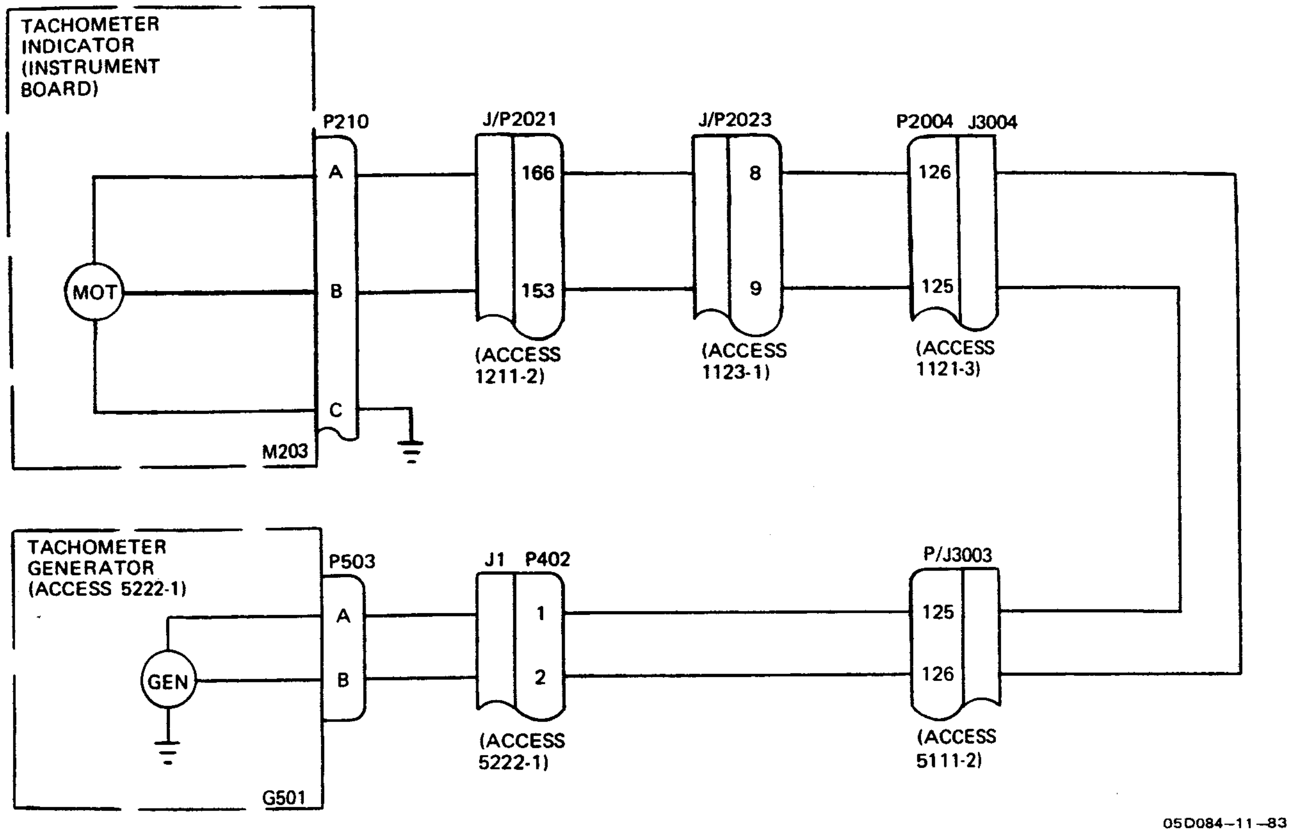


Figure 3-4. Schematic Diagram; High Pressure Rotor Tachometer Indicating System

reaches 14 (±1.0) psid. It will close when pressure drops to 12.5 (±2.5) psid. When the switch closes, the BOOST PUMP 2 caution light will come on.

3-3. COMPONENTS. For a list of system components, locations (accesses), and functions, refer to table 3-1.

Table 3-1. Engine Instrument System Components

Component	Access	Function
	Turbine Outlet Pressure Indicating System	
Circuit breaker CB3197	1232-1	Applies 26-volt ac power to turbine outlet pressure transmitter
Indicator, turbine outlet pressure	Instrument panel	Indicates turbine outlet pressure
Probes, pressure sensing	Aft engine section	Sense turbine outlet pressure
Transmitter, turbine outlet pressure	5131-1	Transmits pressure sensing signals to the turbine outlet pressure indicator

Table 3-1. Engine Instrument System Components — CONT

Component	Access	Function
	Oil Pressure Indicating System	
Circuit breaker CB3202	1232-1	Applies 26-volt ac power to oil pressure transmitter
Indicator, oil pressure	Instrument panel	Indicates oil pressure
Transmitter, oil pressure	5222-3-1	Transmits oil pressure signals to oil pressure indicator
	Oil Quantity Indicating System	
Circuit breaker CB395	2232-1	Applies 115-volt ac power to oil quantity indicator
Circuit breaker CB3150	1232-1	Applies 28-volt dc power to oil quantity indicator
Detector unit	5222-2	Senses radiation
Indicator, oil quantity	Instrument panel	Indicates engine oil tank quantity
Source unit	5222-2 and 5222-3-1	Emits gamma radiation
Transmitter unit (airplanes after T.O. 1A-7-596)	5222-3	Tank-oil level
	Oil Pressure Caution Light System	
Circuit breaker CB3149	1232-1	Applies 28-volt dc power to pressure differential switch and oil filter bypass switch
Circuit breaker CB3150	1232-1	Applies 28-volt dc power to oil quantity indicator for engine oil caution light operation
Indicator, oil quantity	Instrument panel	Causes engine oil caution light to come on when oil quantity is low
Light, engine oil caution	Caution panel	Comes on when engine oil pressure is low, oil quantity is low, or differential oil pressure across oil filter is high indicating impending oil filter bypass
Switch, pressure differential	5222-3-1	Causes engine oil caution light to come on when oil pressure is low
Switch, oil filter bypass	5222-2	Causes engine oil caution light to come on when differential oil pressure across oil filter is approaching oil filter bypass point
	Turbine Outlet Temperature Indicating System	
Circuit breaker CB316	2232-1	Applies 28-volt dc power to turbine outlet temperature indicator

Table 3-1. Engine Instrument System Components — CONT

Component	Access	Function
Indicator, turbine outlet temperature	Instrument panel	Indicates turbine outlet temperature
Light, engine overtemperature caution	Caution panel	Comes on when engine temperature is excessive
Switch, turbine outlet temperature test	1222-3	Tests engine overtemperature caution light
Probes, temperature sensing	5222-3	Sense engine temperature
	Fuel Flow Indicating System	
Circuit breaker CB3211	1232-1	Applies 115-volt ac power to fuel flow indicator and fuel flow transmitter
Indicator, fuel flow	Instrument panel	Indicates fuel flow in pounds per hour
Transmitter, fuel flow	5222-1	Transmits fuel flow sensing signals to the fuel flow indicator
	High Pressure Rotor Tachometer Indicating System	
Generator, tachometer	5222-1	Produces electrical signals proportional to engine speed in rpm
Indicator, tachometer	Instrument panel	Indicates engine speed in rpm
	Low Fuel Pressure Indicating System	
Circuit breaker CB3167	1232-1	Applies 28-volt dc power to fuel boost and LP pump pressure switches
Circuit breaker CB3168	1232-1	Applies 28-volt dc power to HP fuel pump low-pressure switches
Light, main fuel pump low pressure caution	Caution panel	Comes on when HP fuel pump outlet pressure is excessively low
Light, fuel boost pump No. 1 caution	Caution panel	Comes on when fuel boost pump outlet pressure is excessively low
Light, fuel boost pump No. 2 caution	Caution panel	Comes on when LP fuel pump outlet pressure is excessively low
Switches (2), HP fuel pump low-pressure	6222-2	Causes main fuel pump low pressure caution light to come on when HP fuel pump outlet pressure is below approximately 185 psig

Table 3-1. Engine Instrument System Components — CONT

Component	Access	Function
Switch, fuel boost pump pressure	5222-1	Causes fuel boost pump No. 1 caution light to come on when fuel boost pump outlet pressure is below 6.0 (±1.5) psid
Switch, LP fuel pump pressure	5222-1	Causes fuel boost pump No. 2 caution light to come on when LP fuel pump outlet pressure is below 125 (±1.5) psid

3-4. OPERATIONAL CHECKOUT.

Test Equipment Required

Figure & index No.	Name	AN type designation	Use and application
	Equipment required for engine operation		Operate engine
	Equipment required for connecting external electrical power		Supply electrical power
	Engine maximum power test set	E2452-3	Indicate turbine outlet pressure
	Engine limiter test cable assembly (used with 6872929 test set)	6872490 (Allison Division of General Motors, Indianapolis, Indiana)	Connect engine limiter test set to power source and engine
	Engine limiter test set	6872929 (Allison Division of General Motors, Indianapolis, Indiana)	Indicate turbine outlet temperature
		or	
		6893706 (Allison Division of General Motors, Indianapolis, Indiana)	Indicate turbine outlet temperature

Test Equipment Required — CONT

Figure & index No.	Name	AN type designation	Use and application
	Power cable adapter (used with 6872929 test set)	6872727 (Allison Division of General Motors, Indianapolis, Indiana)	Connect test set power cable to airplane ARW-77 connect
	Adapter cable	23002227 (Allison Division of General Motors, Indianapolis, Indiana)	Connect test set cable to amplifier after T.O. 2J-TF41-641

NOTE

Refer to appropriate subsystem for operational checkout procedure.

Refer to table 3-2 for allowable instrument fluctuations.

Table 3-2. Allowable Instrument Fluctuations

Indicator	Fluctuation allowable
Turbine outlet temperature	±3°C (±37°F)
Turbine outlet pressure	±1/4 inch Hg
Oil pressure	±2 psid
Oil quantity	±1/32
Fuel flow	±25 pph to 6,000 pph ±100 pph over 6,000 pph
Tachometer	±0.2% rpm

3-4.1. Turbine Outlet Pressure Indicating System.

NOTE

A number enclosed in braces at the end of a step in the following test corresponds to a number in troubleshooting table 3-3.

a. Open access 5222-4.

b. Cut lockwire, and remove cap from turbine outlet pressure (TOP) line. Connect line to test set.

c. Start engine (T.O. 1A-7D-2-1).

d. Advance throttle to MIL and stabilize for 5 minutes. Check that TOP does not fluctuate beyond limits of table 3-2. Record cockpit TOP indication (inches Hg gage) and test set indication (inches Hg absolute). {1, 2}

e. Retard throttle to IDLE.

f. Correct test set indication as follows:

$$\begin{bmatrix}\text{Test set}\\ \text{pressure}\\ \text{indication}\\ \text{(inches Hg}\\ \text{absolute)}\end{bmatrix} - \begin{bmatrix}\text{Ambient}\\ \text{pressure}\\ \text{(inches Hg}\\ \text{absolute)}\end{bmatrix} = \begin{bmatrix}\text{TOP}\\ \text{(inches}\\ \text{Hg gage)}\end{bmatrix}$$

g. Check that cockpit TOP indication recorded in step d is within +0.6, −0.9 inch Hg of corrected test set indication. {3}

h. Shut down engine (T.O. 1A-7D-2-1).

i. Disconnect test set hose. Install cap on TOP line. Secure cap with MS20995C32 lockwire.

j. Close access 5222-4.

3-4.2. Oil Pressure Indicating and Oil Caution Light System.

NOTE

A number enclosed in braces at the end of a step in the following test corresponds to a number in troubleshooting table 3-4.

a. Connect external electrical power (T.O. 1A-7D-2-1).

b. Open access 1232-1 and open circuit breaker CB3150. Check that oil caution light is on. {1}

c. Close circuit breaker CB3150.

d. Close access 1232-1.

e. Start engine (T.O. 1A-7D-2-1).

f. Check that oil caution light goes out and that oil pressure indication is steady and exceeds 15 psig at idle. {2, 3, 4}

g. Shut down engine (T.O. 1A-7D-2-1).

h. Disconnect external electrical power (T.O. 1A-7D-2-1).

3-4.3. Oil Quantity Indicating System.

NOTE

A number enclosed in braces at the end of a step in the following test corresponds to a number in troubleshooting table 3-5.

a. Connect external electrical power (T.O. 1A-7D-2-1).

b. Open access 1232-1.

c. Open circuit breaker CB3149.

d. Check that oil caution light is not on. {1}

e. Check that oil quantity indicator indicates known oil tank quantity. {2, 3}

f. Close circuit breaker CB3149.

g. Close access 1232-1.

3-4.4. Turbine Outlet Temperature Indicating System (Using 6872929 Test Set).

NOTE

A number enclosed in braces at the end of a step in the following test corresponds to a number in troubleshooting table 3-6.

a. Open access 5222-1.

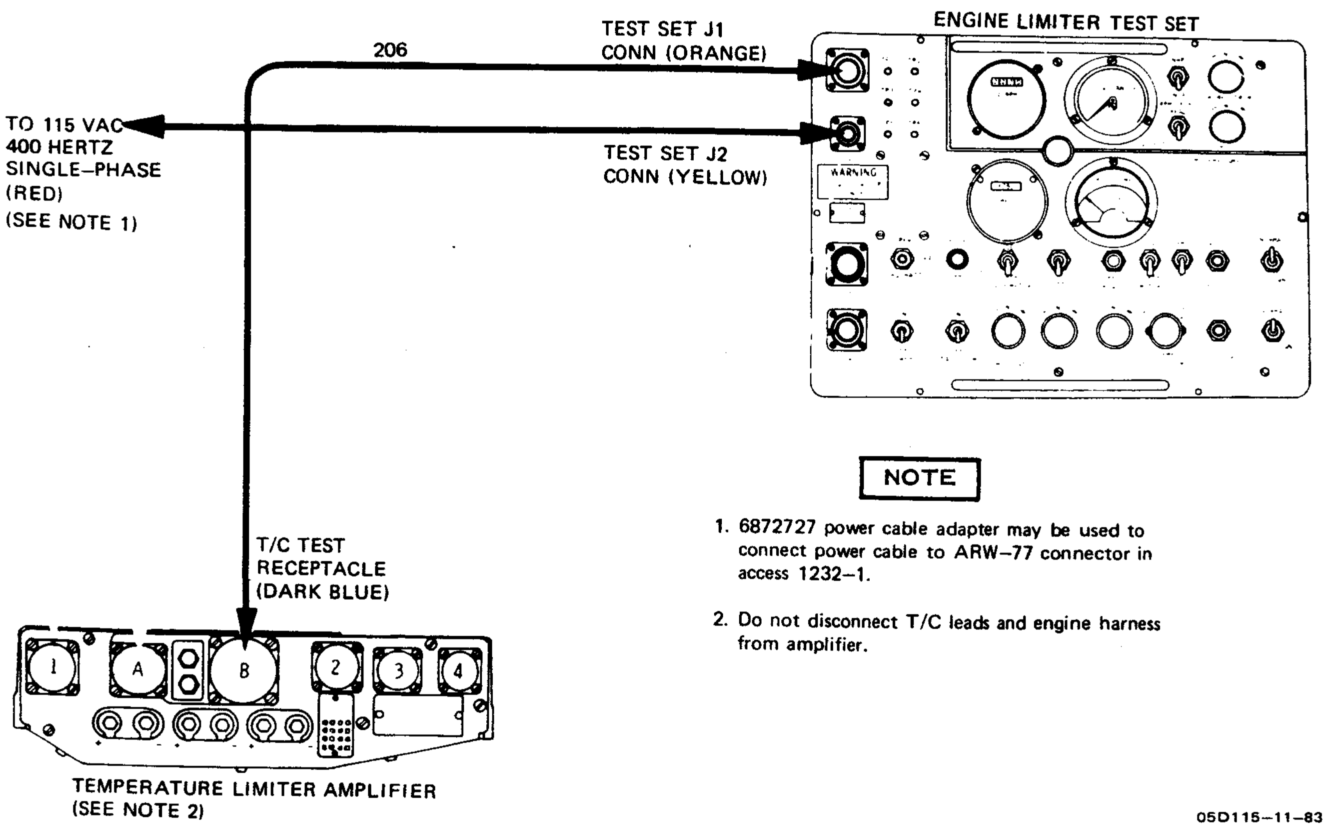
b. Set switches and controls on engine limiter test set as follows:

Control	*Position*
POWER switch	OFF
TACH SIM switch	OFF
SIM SIGNAL control	Full decrease
T1 control	Midrange
T3/T5.1 control	Full decrease
TEMP SELECTOR switch	CAL
T3/T5.1 SIM switch	OFF
T5.1 switch	NORMAL
T3 switch	NORMAL
LP SPEED switch	OFF
SQUAT switch	OFF
METER switch	USE
T1 SIM switch	OFF
TACHOMETER switch	USE
READ/CAL switch	CAL
ZERO ADJ control	Full decrease
RPM SELECT switch	NHP
PROBE TRIM control	Full decrease
MODE switch	RESET
ACCEL START PRESET control	Centered

CAUTION

To prevent damage to engine components and test set, make sure that test set is connected to 115-volt, 400-hertz, single-phase, ac power source. Make a pin-to-pin voltage check of the power source connector before connecting the test set.

c. Connect engine limiter test set to airplane and external power source as shown in figure 3-5.



NOTE

1. 6872727 power cable adapter may be used to connect power cable to ARW–77 connector in access 1232–1.
2. Do not disconnect T/C leads and engine harness from amplifier.

Figure 3-5. Operational Checkout (Using 6872929 Test Set); Turbine Outlet Temperature Indicating System

d. Place test set power switch in ON. Warm up for 10 minutes.

e. Check engine limiter test set as follows:

   (1) Place METER switch in CHECK. Check that milliammeter indicates 210 (±20) milliamperes. Place METER switch in USE.

   (2) Check that TEMP meter indicates 575° (±1°)C (1,067° (±2°)F).

   (3) Place TACHOMETER switch in CHECK. Place RPM SELECT switch in NLP. Check that % RPM meter indicates 16.7% (±0.3%).

   (4) Place RPM SELECT switch in NHP. Check that % RPM meter indicates 100.0% (±0.3%). Place TACHOMETER switch in USE.

f. Place airplane battery switch in BATT.

g. Check that turbine outlet temperature indicator OFF flag is not visible. {1}

NOTE

If engine has recently been operated, temperature indication will be above ambient.

h. Check that turbine outlet temperature indicator indicates ambient temperature ±10°C (±18°F). {2}

i. Open access 1222-3.

j. Place and hold TOT test switch in ON. Check that engine hot caution light comes on as indicator pointer passes through 620° to 625°C (1,148° to 1,157°F). Release switch. {3, 4}

k. Close access 1222-3.

l. Start engine (T.O. 1A-7D-2-1) and stabilize at IDLE.

m. Advance throttle to MIL and let temperature stabilize. Check that cockpit turbine outlet temperature indicator is steady and indicates ±7°C (±13°F) of indication on test set TEMP °C indicator. {2}

n. Retard throttle to IDLE.

o. Shut down engine.

p. Place test set POWER switch in OFF.

q. Disconnect test set from temperature limiter amplifier and external electrical power.

r. Close access 5222-1.

3-4.5. Turbine Outlet Temperature Indicating System (Using 6893706 Test Set).

NOTE

A number enclosed in braces at the end of a step in the following test corresponds to a number in troubleshooting table 3-6.

a. Open access 5222-1.

b. Set switches and controls on engine limiter test set as follows:

Control	*Position*
POWER switch	OFF
SQUAT switch	OFF
IGV/CAL switch	IGV
TACH SIMULATED INPUTS control	Fully counter-clockwise
T1 SIMULATED INPUTS control	Fully counter-clockwise
T5 SIMULATED INPUTS control	Fully counter-clockwise
T5 switch	NORMAL
LP SP switch	Center position

NOTE

Ensure external electrical power is disconnected from airplane.

c. Connect engine limiter test set to airplane as shown in figure 3-6.

d. Place airplane BATTERY switch in BATT.

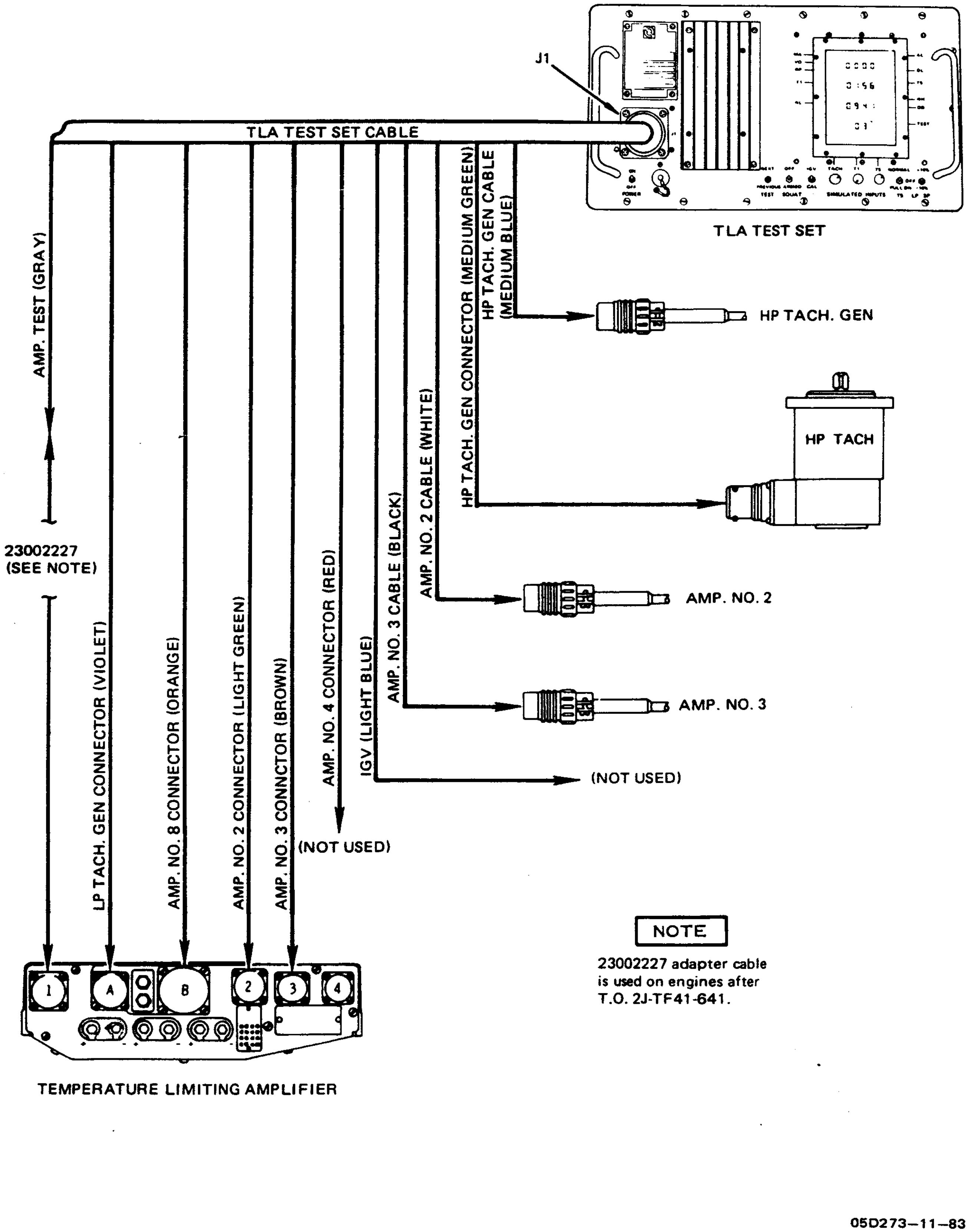


Figure 3-6. Operational Checkout (Using 6893706 Test Set); Turbine Outlet Temperature Indicating System

NOTE

When the test set POWER switch is placed in ON, the numerals 00 will appear in the lower portion of the test set display window. This 00 display indicates that SELF TEST has been selected.

When the test set has warmed up (maximum time of 20 minutes), it will begin the self-test function automatically.

After completion of self-test, the numbers 88.88 will be sequenced through the three rows in the display window. This sequencing will continue until a specific test is selected or test set POWER switch is placed in OFF.

e. Place POWER switch in ON. Warm up test set.

f. Check that turbine outlet temperature indicator OFF flag is not visible. {1, 2}

NOTE

If engine has recently been operated, temperature indication will be above ambient.

g. Check that turbine outlet temperature indicator indicates ambient temperature ±10°C (±18°F). {3, 4}

h. Open access 1222-3.

i. Place and hold TOT test switch in ON. Check that engine hot caution light comes on as indicator pointer passes through 620° to 625°C (1,148° to 1,157°F). Release switch. {5, 6, 7}

j. Close access 1222-3.

k. Start engine (T.O. 1A-7D-2-1) and stabilize at IDLE.

l. Place TEST switch in NEXT until 17 is indicated in TEST display window.

m. Check that indicator lights for T5, MA, and NH come on.

n. Advance throttle to MIL and allow temperature to stabilize. Check that turbine outlet temperature indicator is steady and indicates within ±7°C (±13°F) of indication on test set T5 display window. {3, 4}

o. Retard throttle to IDLE.

p. Shut down engine (T.O. 1A-7D-2-1).

q. Place test set POWER switch in OFF.

r. Disconnect test set from temperature limiter amplifier.

s. Close access 5222-1.

3-4.6. Fuel Flow Indicating System.

NOTE

A number enclosed in braces at the end of a step in the following test corresponds to a number in troubleshooting table 3-7.

a. Start engine (T.O. 1A-7D-2-1) and stabilize at IDLE.

b. Check that fuel flow indication is approximately 800 to 1,300 pounds per hour. {1}

c. Advance and retard throttle. Check that fuel flow indication increases and decreases smoothly with engine acceleration and deceleration. {2}

d. Shut down engine (T.O. 1A-7D-2-1).

3-4.7. High Pressure Rotor Tachometer Indicating System.

NOTE

A number enclosed in braces at the end of a step in the following test corresponds to a number in troubleshooting table 3-8.

a. Start engine (T.O. 1A-7D-2-1).

b. Advance and retard throttle smoothly. Check that tachometer indication follows engine acceleration and deceleration smoothly. {1, 2, 3}

c. Shut down engine (T.O. 1A-7D-2-1).

3-4.8. Low Fuel Pressure Warning System.

NOTE

A number enclosed in braces at the end of a step in the following test corresponds to a number in troubleshooting table 3-9.

a. Connect external electrical power (T.O. 1A-7D-2-1).

b. Check that fuel boost 1, fuel boost 2, and main fuel pump caution lights are on. {1, 2, 3}

c. Start engine (T.O. 1A-7D-2-1) and stabilize at IDLE.

d. Check that fuel boost 1, fuel boost 2, and main fuel pump caution lights go out. {4, 5, 6}

e. Shut down engine (T.O. 1A-7D-2-1).

3-5. TROUBLESHOOTING.

Test Equipment Required

Figure & index No.	Name	AN type designation	Use and application
	Equipment required for connecting external electrical power		Supply electrical power

Test Equipment Required — CONT

Figure & index No.	Name	AN type designation	Use and application
	Equipment required for engine operation		Operate engine
	Multimeter	AN/PSM-6	Measure continuity, resistance, and voltage

3-5.1. Procedures. Refer to tables 3-3 through 3-9 for troubleshooting data. Malfunctions are numbered corresponding to numbers following steps in the operational checkout. Avoid troubleshooting difficulties caused by false indications. In most cases, a false indication can be detected by checking it against other system indications. For example, a faulty TOT indication should be suspected if TOT is high, low, or fluctuating with no change in fuel flow or turbine outlet pressure.

3-5.2. Schematics. For system troubleshooting schematics, see figures 3-2 through 3-4 and FO-3 through FO-5.

Table 3-3. Turbine Outlet Pressure Indicating System Troubleshooting

Probable cause	Isolation procedure	Remedy
1. Turbine outlet pressure indicator inoperative.		
Defective turbine outlet pressure indicator	Perform turbine outlet pressure indicator test (paragraph 3-7).	If indicator does not perform within limits, replace indicator (paragraph 3-16).
Defective turbine outlet pressure transmitter	Perform turbine outlet pressure transmitter test and calibration (paragraph 3-8).	If transmitter cannot be calibrated, replace transmitter (paragraph 3-17).
Defective wiring	Check wiring for continuity.	If continuity is not indicated, replace defective wiring.
2. Turbine outlet pressure fluctuates excessively.		
Leaking turbine outlet pressure connectors or tubes	Open engine removal door (T.O. 1A-7D-2-1). Start engine (T.O. 1A-7D-2-1). Using soap and water solution, check turbine outlet pressure tube and connectors for leaks.	If leakage is indicated, tighten connectors or replace tubes or manifold.
Cracked P5 air probe	Check P5 air probes for cracks.	Replace cracked P5 air probes (paragraph 3-18).
3. Turbine outlet pressure indicator does not indicate +0.6, −0.9 inch Hg of corrected test set indication.		
Defective turbine outlet pressure indicator	Perform turbine outlet pressure indicator test (paragraph 3-7).	If indicator does not perform within limits, replace indicator (paragraph 3-16).
Defective turbine outlet pressure transmitter	Perform turbine outlet pressure transmitter test and calibration (paragraph 3-8).	If transmitter cannot be calibrated, replace transmitter (paragraph 3-17).
4. No or low turbine outlet pressure.		
Defective HP fuel pump	Perform HMG Δ P check.	If pressure is low, replace HP fuel pump.
Defective bleed valve and/or IGV system	Perform HMG Δ P check.	If pressure is normal, troubleshoot airflow control system (table 2-2).

Table 3-4. Oil Pressure Indicating and Oil Caution Light System Troubleshooting

Probable cause	Isolation procedure	Remedy
1. Oil caution light is not on with CB3150 opened and external electrical power applied.		
CAUTION: Pressure differential switch electrical connector utilizes push-pull type coupling. To prevent damage to switch and connector, do not apply tools, such as pliers, or twist this coupling.		
Defective pressure differential switch	Open access 5222-3. Disconnect electrical connector P502 from pressure differential switch. Check for continuity between pins 1 and 3 of switch receptacle.	If continuity is not indicated, replace defective pressure differential switch (paragraph 3-21).
Defective wiring	Check wiring for continuity.	If continuity is not indicated, replace defective wiring.
2. Oil caution light on with oil pressure above 14 psid (figure FO-24, trouble 2 or 3).		
3. Fluctuating oil pressure (figure FO-24, trouble 4).		
4. Low oil pressure (figure FO-24, trouble 5 or 6).		

Table 3-5. Oil Quantity Indicating System Troubleshooting

Probable cause	Isolation procedure	Remedy
1. Oil caution light is on with circuit breaker CB3149 open.		
Low oil quantity	Check oil quantity (T.O. 1A-7D-2-1).	Service oil tank (T.O. 1A-7D-2-1).
Defective oil quantity indicator	Perform oil quantity indicating system test (paragraph 3-11).	Replace defective oil quantity indicator (paragraph 3-23).
2. Oil quantity indicator does not indicate known oil quantity.		
Oil quantity indicator not properly calibrated	Perform oil quantity indicating system test (paragraph 3-11).	If oil quantity indicator does not perform within limits, calibrate indicator (paragraph 3-12).
Defective detector unit	Perform oil quantity indicating system test (paragraph 3-11).	If detector unit does not perform within limits, replace defective detector (paragraph 3-25).
Defective source unit	Perform oil quantity indicating system test (paragraph 3-11).	If source unit does not perform within limits, replace defective source unit (paragraph 3-24).
O-ring missing in Cinch-Nuline connectors	Check connectors for presence of O-ring.	Install O-ring.
Loose connections on coaxial cable	Perform coaxial cable test (paragraph 3-13).	Tighten nut on back of connector or replace loose connectors.
3. Indicator needle remains 10° past F.		
Engine oil tank overserviced	Check oil tank servicing (T.O. 1A-7D-2-1).	Properly service oil tank (T.O. 1A-7D-2-1).
Defective oil quantity indicator	Perform oil quantity indicating system test (paragraph 3-11).	If oil quantity indicator does not perform properly, replace defective indicator (paragraph 3-23).
Defective detector unit	Perform oil quantity indicating system test (paragraph 3-11).	If detector does not perform properly, replace defective detector (paragraph 3-25).
Defective source unit	Perform oil quantity indicating system test (paragraph 3-11).	If source unit does not perform properly, replace defective source (paragraph 3-24).
Defective wiring or connector	Check wiring for continuity.	If continuity is not indicated, replace defective wiring or connector.
4. Oil quantity indicator displays intermittent indications toward E (increased pulse count).		
O-ring missing in Cinch-Nuline connectors	Check connectors for presence of O-ring.	Install O-ring.
Loose connections on coaxial cable	Perform coaxial cable test (paragraph 3-13).	Tighten nut on back of connector or replace loose connectors.

Table 3-5. Oil Quantity Indicating System Troubleshooting – CONT

Probable cause	Isolation procedure	Remedy
Defective coaxial cable	Disconnect connectors P242 and P501 and perform continuity and resistance checks as shown in figure FO-4. With connector P242 isolated from ground, check resistance between outer conductor of P501 to airplane ground for minimum of 10 megohms.	If resistance is not within limits, replace coaxial cable.
Defective oil quantity detector	None	Replace defective detector (paragraph 3-25).
Defective oil quantity indicator	None	Replace defective indicator (paragraph 3-23).
5. Oil quantity indicator has intermittent indications toward or past FULL (decreased pulse count).		
Loose connection on power cable	Disconnect connector P241 from indicator and check for loose pins on connector and indicator.	Replace connector or indicator as required.
Defective oil quantity indicator	None	Replace defective indicator (paragraph 3-23).
Defective oil quantity detector	None	Replace defective detector (paragraph 3-25).

NOTE

On airplanes after T.O. 1A-7-596, the oil quantity indicating system has no troubleshooting procedures, with the exception of checking coaxial cable, if system does not function. System is removed as complete kit item for repair by manufacturer.

Table 3-6. Turbine Outlet Temperature Indicating System Troubleshooting

Probable cause	Isolation procedure	Remedy
1. Turbine outlet temperature indicator OFF flag is visible with battery switch in BATT.		
Defective turbine outlet temperature indicator	Remove turbine outlet temperature indicator from instrument panel. Disconnect electrical connector P259 from indicator. Check for 28 volts dc between pins K and L of connector P259.	If voltage is indicated, replace defective turbine outlet temperature indicator (paragraph 3-26).
Defective wiring	Check wiring for continuity.	If continuity is not indicated, replace defective wiring.
2. Turbine outlet temperature indicator does not indicate ambient temperature ±10°C (±18°F) with engine not operating, is not within limits with engine operating, is sluggish, or is fluctuating with all other engine indications normal.		
Defective T5.1 thermocouple system	Perform T5.1 thermocouple system static checks (paragraph 3-14).	If T5.1 thermocouple system does not perform within limits, replace defective component.
Defective turbine outlet temperature indicator	Perform turbine outlet temperature indicator check (subparagraph 3-14.5).	Replace turbine outlet temperature indicator (paragraph 3-26).
Corroded terminals	Disconnect terminals and check for presence of corrosion.	Clean terminals.
3. Engine hot caution light does not come on at 620° to 625°C (1,148° to 1,157°F) with TOT test switch held in ON.		
Defective turbine outlet temperature indicator	Place and hold TOT test switch in ON. When indicator readout is in excess of 625°C (1,157°F), open circuit breaker CB316. Remove indicator and disconnect electrical connector P259. Check for continuity between pins J and M of indicator.	If continuity is not indicated, replace defective turbine outlet temperature indicator (paragraph 3-26).
Defective wiring	Check wiring for continuity.	If continuity is not indicated, replace defective wiring.
4. Turbine outlet temperature indicator indication does not increase with TOT test switch held in ON.		
Defective turbine outlet temperature indicator	Check for defective TOT test switch and defective wiring.	If TOT test switch or wiring is not defective, replace defective turbine outlet temperature indicator (paragraph 3-26).
Defective wiring	Check wiring for continuity.	If continuity is not indicated, replace defective wiring.
Defective TOT test switch	Remove turbine outlet temperature indicator and disconnect electrical connector P259. Hold TOT test switch in ON and check for continuity between pins D and E.	If continuity is not indicated, replace defective TOT test switch.

Table 3-7. Fuel Flow Indicating System Troubleshooting

Probable cause	Isolation procedure	Remedy
1. Fuel flow indicator inoperative.		
Defective fuel flow indicator	Remove fuel flow indicator, connect serviceable indicator, and perform operational checkout.	If serviceable indicator operates satisfactorily, replace defective fuel flow indicator (paragraph 3-31).
Defective fuel flow transmitter	Check for defective wiring.	If wiring is not defective, replace defective fuel flow transmitter (paragraph 3-32).
Defective wiring	Check wiring for continuity.	If continuity is not indicated, replace defective wiring.
2. Fuel flow indication erratic or sticking with engine operation normal.		
Defective fuel flow indicator	Remove fuel flow indicator, connect serviceable indicator, and perform operational checkout.	If serviceable indicator operates satisfactorily, replace defective fuel flow indicator (paragraph 3-31).
Defective fuel flow transmitter	Check for defective wiring.	If wiring is not defective, replace defective fuel flow transmitter (paragraph 3-32).
Defective wiring	Check wiring for continuity.	If continuity is not indicated, replace defective wiring.

Table 3-8. High Pressure Rotor Tachometer Indicating System Troubleshooting

Probable cause	Isolation procedure	Remedy
1. Tachometer indicator is slow, sticks, or oscillates.		
Defective tachometer indicator	None	Replace defective tachometer indicator (paragraph 3-33).
2. Tachometer indicates 0 at all times.		
Defective high pressure rotor tachometer generator	Perform high pressure rotor tachometer system test (paragraph 3-15).	If jetcal analyzer does not indicate engine speed, replace defective tachometer generator (paragraph 3-34).
Defective tachometer indicator	Perform high pressure rotor tachometer system test (paragraph 3-15).	If tachometer indicator does not perform within limits, replace defective indicator (paragraph 3-33).
Defective wiring	Check wiring for continuity.	If continuity is not indicated, replace defective wiring.
3. Tachometer indication inaccurate (indicates high or low).		
Defective tachometer indicator	Perform high pressure rotor tachometer system test (paragraph 3-15).	If not within limits, replace tachometer indicator (paragraph 3-33).
Defective high pressure rotor tachometer generator	Perform high pressure rotor tachometer system test (paragraph 3-15).	If tachometer indicator is within limits but a large error between engine speed and throttle position is apparent, replace tachometer generator (paragraph 3-34).
4. Tachometer indication is unstable (all other indications normal).		
Defective high pressure rotor tachometer generator	Perform high pressure rotor tachometer system test (paragraph 3-15).	If test set indication is unstable, replace tachometer generator (paragraph 3-34).
Defective high pressure rotor tachometer indicator	Perform high pressure rotor tachometer system test (paragraph 3-15).	If test set indication is stable, replace indicator (paragraph 3-33).

Table 3-9. Low Fuel Pressure Warning System Troubleshooting

Probable cause	Isolation procedure	Remedy
1. Fuel boost 1 caution light is not on with external power applied.		
	CAUTION Fuel boost pump low pressure switch electrical connector utilizes push-pull type coupling. To prevent damage to switch and connector, do not apply tools, such as pliers, or twist this coupling.	
Defective fuel boost pump low pressure switch	Open access 5222-1. Disconnect electrical connector P427 from pressure switch. Check for continuity between pins 2 and 3 of switch receptacle.	If continuity is not indicated, replace defective fuel boost pump low pressure switch (T.O. 1A-7D-2-6).
Defective wiring	Check wiring for continuity.	If continuity is not indicated, replace defective wiring.
2. Fuel boost 2 caution light is not on with external power applied.		
	CAUTION LP fuel pump low pressure switch electrical connector utilizes push-pull type coupling. To prevent damage to switch and connector, do not apply tools, such as pliers, or twist this coupling.	
Defective LP fuel pump low pressure switch	Open access 5222-1. Disconnect electrical connector P508 from pressure switch. Check for continuity between pins 2 and 3 of switch receptacle.	If continuity is not indicated, replace defective fuel pump low pressure switch (paragraph 3-36).
Defective wiring	Check wiring for continuity.	If continuity is not indicated, replace defective wiring.
3. Main fuel pump caution light is not on with external power applied.		
Defective HP fuel pump low pressure switch	Open access 6222-2. Disconnect electrical connector from switch. Check for continuity between pins 1 and 2.	If continuity is not indicated, replace defective switch (paragraph 3-37).
Defective wiring	Check wiring for continuity.	If continuity is not indicated, replace defective wiring.

Table 3-9. Low Fuel Pressure Warning System Troubleshooting — CONT

Probable cause	Isolation procedure	Remedy
4. Fuel boost 1 caution light is on with engine operating.		
CAUTION Fuel boost pump low pressure switch electrical connector utilizes push-pull type coupling. To prevent damage to switch and connector, do not apply tools, such as pliers, or twist this coupling.		
Defective wiring	Check wiring for continuity and shorted circuit.	If continuity is not indicated or shorted circuit is indicated, replace defective wiring.
Defective fuel boost pump low pressure switch	Open access 5222-1. Disconnect electrical connector P427 from pressure switch. With engine operating, check for continuity between pins 2 and 3 of switch receptacle.	If continuity is indicated, replace defective fuel boost pump low pressure switch (T.O. 1A-7D-2-6).
Defective fuel boost pump	None	Replace defective fuel boost pump (paragraph 5-23).
Fuel boost pump hydraulic motor shutoff valve closed	Open access 5122-5 and check valve position.	Open valve.
Fuel boost pump hydraulic motor inoperative	Troubleshoot hydraulic system (T.O. 1A-7D-2-4).	Replace defective component.
5. Fuel boost 2 caution light is on with engine operating.		
CAUTION LP fuel pump low pressure switch electrical connector utilizes push-pull type coupling. To prevent damage to switch and connector, do not apply tools, such as pliers, or twist this coupling.		
Defective LP fuel pump low pressure switch	Open access 5222-1. Disconnect electrical connector P508 from pressure switch. With engine operating, check for continuity between pins 2 and 3 of switch receptacle.	If continuity is indicated, replace defective fuel pump low pressure switch (paragraph 3-36).
Defective wiring	Check wiring for continuity and short circuit.	If continuity is not indicated or short circuit is indicated, replace defective wiring.
Defective LP fuel pump	None	Replace defective LP fuel pump (paragraph 5-24).

Table 3-9. Low Fuel Pressure Warning System Troubleshooting — CONT

Probable cause	Isolation procedure	Remedy
6. Main fuel pump caution light is on with engine operating.		
Defective HP fuel pump low pressure switch	Open access 6222-2. With engine operating, disconnect electrical connector from either pressure switch and check caution light. Connect electrical connector to switch. Disconnect electrical connector from other switch and check caution light.	If caution light goes out, replace defective switch (paragraph 3-37).
Defective wiring	Check wiring for continuity and shorted circuits.	If continuity is not indicated or short circuit is indicated, replace defective wiring.
Defective HP fuel pump	None	Replace defective HP fuel pump (paragraph 5-27).

3-6. TURBINE OUTLET PRESSURE INDICATING SYSTEM TEST.

Test Equipment Required

Figure & index No.	Name	AN type designation	Use and application
	Equipment required for connecting external electrical power		Connect electrical power to airplane and test set
	Air data simulator	SM-565A/ ASM	Provide pressure source to turbine outlet pressure transmitter

NOTE

Refer to T.O. 33D7-3-117-2 for air data simulator operating details.

a. Set air data simulator switches and controls as follows:

Control	*Setting*
POWER ON/OFF	OFF
MACH LIMIT	1.30
MODE	MANUAL/START
ALTITUDE-RATE FEET/MIN X 100	350
ALTITUDE-MANUAL	0
AIRSPEED-RATE KNOTS/MIN	350

AIRSPEED-MANUAL 0

Altimeter..29.92

BLEED valve ....Clockwise
(altitude) (closed)

BLEED valve ....Clockwise
(airspeed) (closed)

b. Open accesses 1232-1 and 5131-1.

c. Disconnect turbine outlet pressure sensing hose from elbow at aft engine mount.

d. Connect air data simulator as shown in figure 3-7.

CAUTION

In order to avoid damage, technicians must know how to perform emergency rundown (step e) prior to starting the simulator. Do not use this procedure unless totally necessary. It must be done if power to simulator is interrupted and pneumatic hoses must be disconnected. It is also necessary when the simulator fails and electrical control is lost. A pronounced variance in the altimeter and airspeed readings of the simulator with digital displays shows a sensor calibration fault.

e. If during test, perform following steps for emergency rundown of simulator:

(1) If indication changes cannot be controlled and power is present, leave POWER switch in ON. In all other cases, place POWER switch in OFF.

(2) Rotate Ps and Pt BLEED valves counterclockwise to open.

(3) When simulator altimeter shows local altitude and airspeed indicator reads 60 knots, disconnect simulator from airplane.

f. Connect external electrical power to airplane (T.O. 1A-7D-2-1).

g. Place simulator POWER switch in ON. If PROGRAM light comes on, briefly hold PROGRAM START/STOP switch in STOP to turn light off.

h. Rotate DIM control for desired brilliance.

CAUTION

Do not disconnect test hose from simulator or system under test when lines are pressurized. Damage to instrument or simulator may occur.

NOTE

Do not adjust airspeed below 42 knots as LIMIT light will come on. If LIMIT light comes on during checkout, it will be necessary to adjust airspeed above 60 knots, place POWER switch in OFF, and repeat startup procedure.

i. Adjust AIRSPEED-MANUAL control until AIRSPEED digital display equals airspeed indication and A/S BALANCE light comes on. Return AIRSPEED-MANUAL control to zero. If light does not come on, perform the following procedure:

(1) Adjust AIRSPEED-MANUAL control to approximately 60 on AIRSPEED digital display.

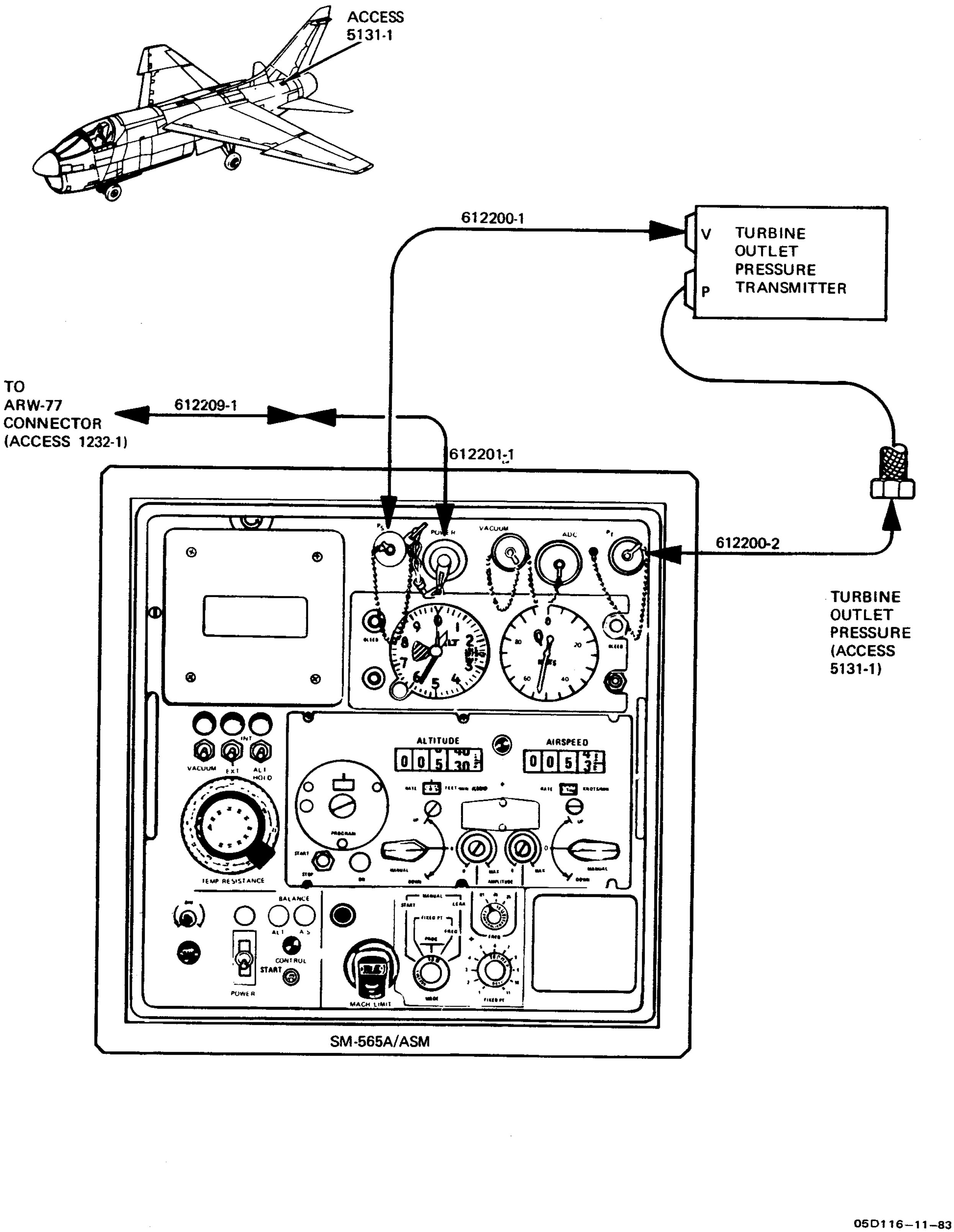


Figure 3-7. Indicating System Test; Turbine Outlet Pressure

(2) Disconnect hose from Pt fitting on simulator.

(3) Open Ps BLEED valve.

(4) Adjust AIRSPEED-MANUAL control to drive AIRSPEED digital display toward airpseed indication; then continue adjusting control in the same direction until A/S BALANCE light comes on.

(5) Close Ps BLEED valve. If A/S BALANCE light goes off, repeat substep (4).

(6) Perform steps j and K immediately, and then perform substeps (7) and (8).

(7) Adjust AIRSPEED-MANUAL control until AIRSPEED digital display indicates above 60 knots.

(8) Connect hose to Pt fitting on simulator and proceed to step 1.

j. Verify that ALT BALANCE light is on. If light is off, adjust ALTITUDE-MANUAL control until ALTITUDE digital display is equal to altimeter indication and ALT BALANCE light comes on.

k. With both ALT and A/S BALANCE lights on, momentarily place START switch in up position. After a 7-second delay, CONTROL light will come on indicating the simulator is ready for use.

CAUTION

To prevent damage to simulator, do not exceed 850 knots on digital AIRSPEED indicator.

l. Adjust ALTITUDE-MANUAL control until ALTITUDE digital display indicates 1,000 feet. Return control to zero.

m. Adjust AIRSPEED-MANUAL control to provide airspeed indications on digital display as specified in table 3-10. Allow each AIRSPEED indication to stabilize.

n. Check that turbine outlet pressure indicator in cockpit indicates correct pressure for each airspeed setting as specified in table 3-10. Perform this check up scale; then down scale.

Table 3-10. Turbine Outlet Pressure Indicating System Test

Air data simulator airspeed digital display (knots)	Cockpit TOP indicator indication (+0.6, −0.9 inch Hg)
644	25
693	30
737	35
778	40
816	45

o. Adjust AIRSPEED-MANUAL control for AIRSPEED digital display of 60.

p. Adjust ALTITUDE-MANUAL control for ALTITUDE digital display of local altitude.

q. Place POWER switch in OFF.

r. Disconnect external electrical power from airplane (T.O. 1A-7D-2-1).

s. Disconnect pneumatic hose and electrical cables from airplane and simulator. Make sure that vent port (V) on turbine outlet pressure transmitter is open to atmosphere.

t. Connect turbine outlet pressure hose to elbow at aft engine mount.

u. Close accesses 1232-1 and 5131-1.

3-7. TURBINE OUTLET PRESSURE INDICATOR TEST.

Test Equipment Required

Figure & index No.	Name	AN type designation	Use and application
	Equipment required for connecting external electrical power		Provide electrical power for test set
	Synchro instrument test set	13819-2A (Eclipse Pioneer Division of Bendix Corp, Teterboro, New Jersey)	Perform turbine outlet pressure indicator test
	Cable assembly	215-00366-5	Provide airplane electrical power to test set
	Cable assembly	216-01967-1	Connect turbine outlet pressure indicator to synchro test set
	AC voltmeter	403B	Check voltage

WARNING

The following steps involve voltage which may cause severe shock or injury. Do not touch energized components. Take off rings, watches, and other metallic objects which may cause shock or burns.

a. Remove turbine outlet pressure indicator (paragraph 3-16).

b. Open access 1232-1.

c. Set test set switches and controls as follows:

Control	*Position*
POWER switch	OFF
AMPLIFIER control	Fully counterclockwise
MOTOR VOLTS switch	FULL
MOTOR VOLTS VAR Ø control	Fully counterclockwise
MOTOR VOLTS FXD Ø control	Fully counterclockwise
SYN IND switch	CAL
TEST SEL switch	OFF

d. Connect test set as shown in figure 3-8.

e. Connect external electrical power to airplane (T.O. 1A-7D-2-1).

f. Place test set POWER switch in ON. Allow 1 minute for test set warmup.

g. Check that POWER light comes on.

NOTE

If voltages in steps h and i are not within limits, reject test set.

h. Check for 26.0 (±2.6) volts ac between test set posts 18 and 19.

i. Check for 10.80 (±1.08) volts ac between test set posts 19 and 20.

j. Place test set TEST SEL switch in SYND IND.

k. Place SYN IND switch in CAL.

l. Rotate test set transmitter 1 to obtain each of the turbine outlet pressure indicator values specified in table 3-11. If values are incorrect, replace indicator (paragraph 3-16).

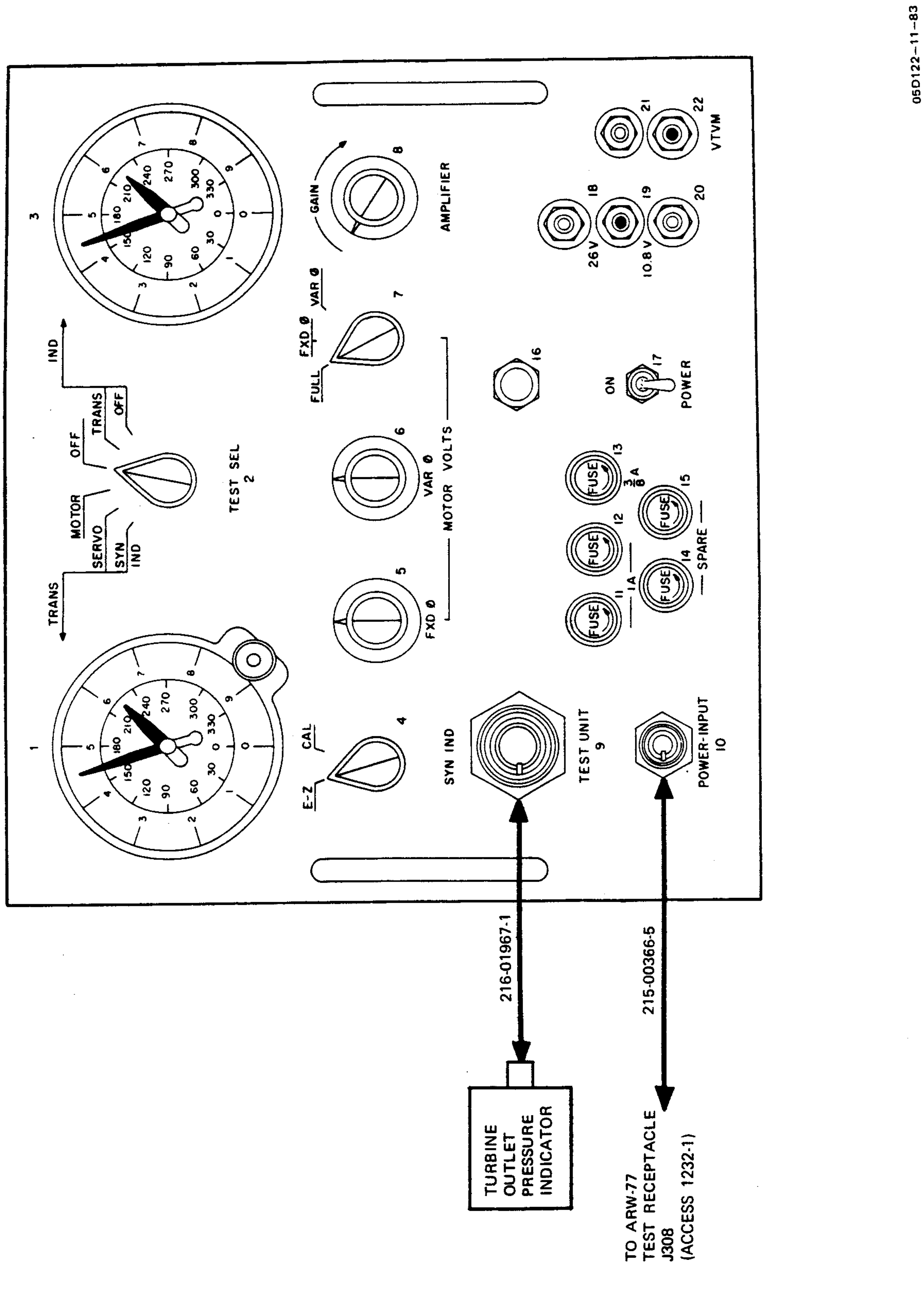


Figure 3-8. Indicator Test; Turbine Outlet Pressure

Table 3-11. Turbine Outlet Pressure Indicator Test Values

Turbine outlet pressure indicator (inches Hg)	Synchro instrument test set value (degrees ±0°20′)
25	148
30	164
35	180
40	196
45	212

m. Place test set POWER switch in off (down) position.

n. Place test set switches in OFF. Rotate all controls fully counterclockwise.

o. Disconnect external electrical power (T.O. 1A-7D-2-1).

p. Disconnect test set from indicator and ARW-77 test receptacle J308.

q. Install turbine outlet pressure indicator (paragraph 3-16).

r. Close access 1232-1.

3-8. TURBINE OUTLET PRESSURE TRANSMITTER TEST AND CALIBRATION.

Test Equipment Required

Figure & index No.	Name	AN type designation	Use and application
	Equipment required for connecting external electrical power		Provide electrical power for test set and airplane
	Air data simulator	SM-565A/ ASM	Provide pressure source to turbine outlet pressure transmitter
	Synchro instrument test set	13819-2A (Eclipse Pioneer Division of Bendix Corp, Teterboro, New Jersey)	Provide angular indications of turbine outlet pressure transmitter

Test Equipment Required — CONT

Figure & index No.	Name	AN type designation	Use and application
	Cable assembly	216-01967-1	Connect turbine outlet pressure transmitter to synchro test set
	Voltmeter	403B	Check voltage

3-8.1. Preparation.

a. Remove turbine outlet pressure transmitter (paragraph 3-17).

b. Open access 1232-1.

NOTE

Refer to T.O. 33D7-117-2 for air data simulator operating details.

c. Set air data simulator switches and controls as follows:

Control	*Setting*
POWER ON/OFF	OFF
MACH LIMIT	1.30
MODE	MANUAL/START
ALTITUDE-RATE FEET/MIN X 100	350
ALTITUDE-MANUAL	0
AIRSPEED-RATE KNOTS/MIN	350
AIRSPEED-MANUAL	0
ALTIMETER	29.92
BLEED VALVE (altitude)	Clockwise (closed)
BLEED VALVE (airspeed)	Clockwise (closed)

d. Place synchro instrument test set switches in OFF. Rotate controls fully counterclockwise.

e. Connect air data simulator as shown in figure FO-7.

CAUTION

In order to avoid damage, technicians must know how to perform emergency rundown (step f) prior to starting the simulator. Do not use this procedure unless totally necessary. It must be done in case power to simulator is interrupted and pneumatic hoses must be disconnected. It is also necessary when the simulator fails and electrical control is lost. A pronounced variance in the altimeter and airspeed readings of the simulator with digital displays shows a sensor calibration fault.

f. If necessary during test, perform following steps for emergency rundown of simulator:

(1) If indication changes cannot be controlled and power is present, leave POWER switch in ON. In all other cases, place POWER switch in OFF.

(2) Rotate Ps and Pt BLEED valves counterclockwise to open.

(3) When simulator altimeter displays local altitude and airspeed indicator shows 60 knots, disconnect simulator from transmitter.

g. Connect external electrical power to airplane (T.O. 1A-7D-2-1).

h. Place simulator POWER switch in ON. If PROGRAM light comes on, momentarily hold PROGRAM START/STOP switch in STOP to turn light off.

i. Rotate DIM control for desired brilliance.

CAUTION

Do not disconnect test hose from simulator or system when lines are pressurized. Damage to transmitter or simulator may occur.

NOTE

Do not adjust airspeed below 42 knots or LIMIT light will come on. If LIMIT light comes on during checkout, airspeed must be adjusted above 60 knots, POWER switch set in OFF, and startup procedure repeated.

j. Adjust AIRSPEED-MANUAL control until AIRSPEED digital display equals airspeed indication and A/S BALANCE light comes on. Return AIRSPEED-MANUAL control to zero. If light does not come on, perform the following:

(1) Adjust AIRSPEED-MANUAL control to approximately 60 on AIRSPEED digital display.

(2) Disconnect hose from Pt fitting on simulator.

(3) Open Ps BLEED valve.

(4) Adjust AIRSPEED-MANUAL control to drive AIRSPEED digital display toward airspeed indication; then continue adjusting control in the same direction until A/S BALANCE light comes on.

(5) Close Ps BLEED valve. If A/S BALANCE light goes off, repeat substep (4).

(6) Perform steps k and l immediately, and then substeps (7) and (8).

(7) Adjust AIRSPEED-MANUAL control until AIRSPEED digital display indicates above 60 knots.

(8) Connect hose to Pt fitting on simulator and proceed to step m.

k. Verify that ALT BALANCE light is on. If light is off, adjust ALTITUDE-MANUAL control for ALTITUDE digital display equal to altimeter indication; ALT balance light will then come on.

l. With both ALT and A/S BALANCE lights on, momentarily place START switch in up position. After a 7-second delay, CONTROL light will come on to indicate the simulator is ready for use.

CAUTION

To prevent damage to simulator, do not exceed 850 knots on digital AIRSPEED indicator.

m. Adjust ALTITUDE-MANUAL control until ALTITUDE digital display indicates 1,000 feet. Return control to zero.

n. Place synchro instrument test set TEST SET switch in TRANS.

WARNING

The following steps involve voltage which may cause severe shock or injury. Do not touch energized components. Take off rings, watches, and other metallic objects which may cause shock or burns.

o. Place test set POWER switch in ON. Allow 1 minute for test set warmup.

NOTE

If voltage checks in steps p and q are not within limits, reject synchro instrument test set.

p. Check for 26.0 (±2.6) volts ac between posts 18 and 19 on test set.

q. Check for 10.80 (±1.08) volts ac between posts 19 and 20 on test set.

r. Rotate AMPL GAIN control on test set fully clockwise.

3-8.2. Transmitter Test.

a. Adjust air data simulator AIRSPEED-MANUAL control for airspeed indications on digital display as specified in table 3-12. Allow each airspeed indication to stabilize.

NOTE

Tap transmitter lightly before checking synchro instrument test set indication.

b. Check that indication on test set is within limits specified in table 3-12 for each simulator AIRSPEED digital display. Perform this check up scale; then down scale.

Table 3-12. Turbine Outlet Pressure Transmitter Test Values

Air data simulator airspeed digital display indication (knots)	Synchro instrument test set indication (degrees +1° 36′, −2° 36′)
644	148
693	164
737	180
778	196
816	212

c. If test set readings are within limits specified in table 3-12, perform shutdown (subparagraph 3-8.4).

d. If test set readings are not within limits in table 3-12, calibrate transmitter (subparagraph 3-8.3).

3-8.3. Transmitter Calibration.

a. Remove dust cover (figure FO-7) from turbine outlet pressure transmitter.

b. Turn insert (lock) out approximately one-quarter turn to free nylon washer.

c. Adjust air data simulator AIRSPEED-MANUAL control until airspeed digital display is 737 knots.

d. Turn screw (zero adjust shaft) in turbine outlet pressure transmitter until synchro test set indicates 180° (+1°36′, −2°36′).

e. Turn screw out slightly to remove any force on transmitter drive arm.

f. Tighten insert (lock) and install dust cover.

g. Adjust air data simulator AIRSPEED-MANUAL control for airspeed digital displays specified in table 3-12. Allow each airspeed indication to stabilize.

NOTE

Tap transmitter lightly before checking test set indication.

h. Check that indication on test set is within limits specified in table 3-12 for each simulator airspeed digital display. Perform this check up scale; then down scale.

i. If synchro test set indications are not within limits, replace turbine outlet pressure transmitter (paragraph 3-17).

3-8.4. Shutdown.

a. Adjust simulator AIRSPEED-MANUAL control until AIRSPEED digital display is 60.

b. Adjust simulator ALTITUDE-MANUAL control until ALTITUDE digital display shows local altitude.

c. Place simulator POWER switch in OFF.

d. Place test set POWER switch in off (down) position.

e. Disconnect external electrical power from airplane (T.O. 1A-7D-2-1).

f. Disconnect external power source from test set.

g. Disconnect simulator and synchro test set from turbine outlet pressure transmitter.

h. Install turbine outlet pressure transmitter (paragraph 3-17).

i. Close access 1232-1.

3-9. OIL PRESSURE INDICATOR TEST.

Test Equipment Required

Figure & index No.	Name	AN type designation	Use and application
	Equipment required for connecting external power		Provide electrical power for test set
	Synchro instrument test set	13819-2A (Eclipse Pioneer Division of Bendix Corp, Teterboro, New Jersey)	Perform oil pressure indicator test
	Cable assembly	215-00366-5	Provide airplane electrical power to test set
	Cable assembly	215-00380-1	Adapt indicator to test set
	AC voltmeter	403B	Check voltage

a. Remove oil pressure indicator (paragraph 3-19).

b. Open access 1232-1.

c. Set test set switches and controls as follows:

Control	*Position*
POWER switch	OFF
AMPLIFIER control	Fully counterclockwise
MOTOR VOLTS switch	FULL
MOTOR VOLTS VAR Ø control	Fully counterclockwise
MOTOR VOLTS FXD Ø control	Fully counterclockwise

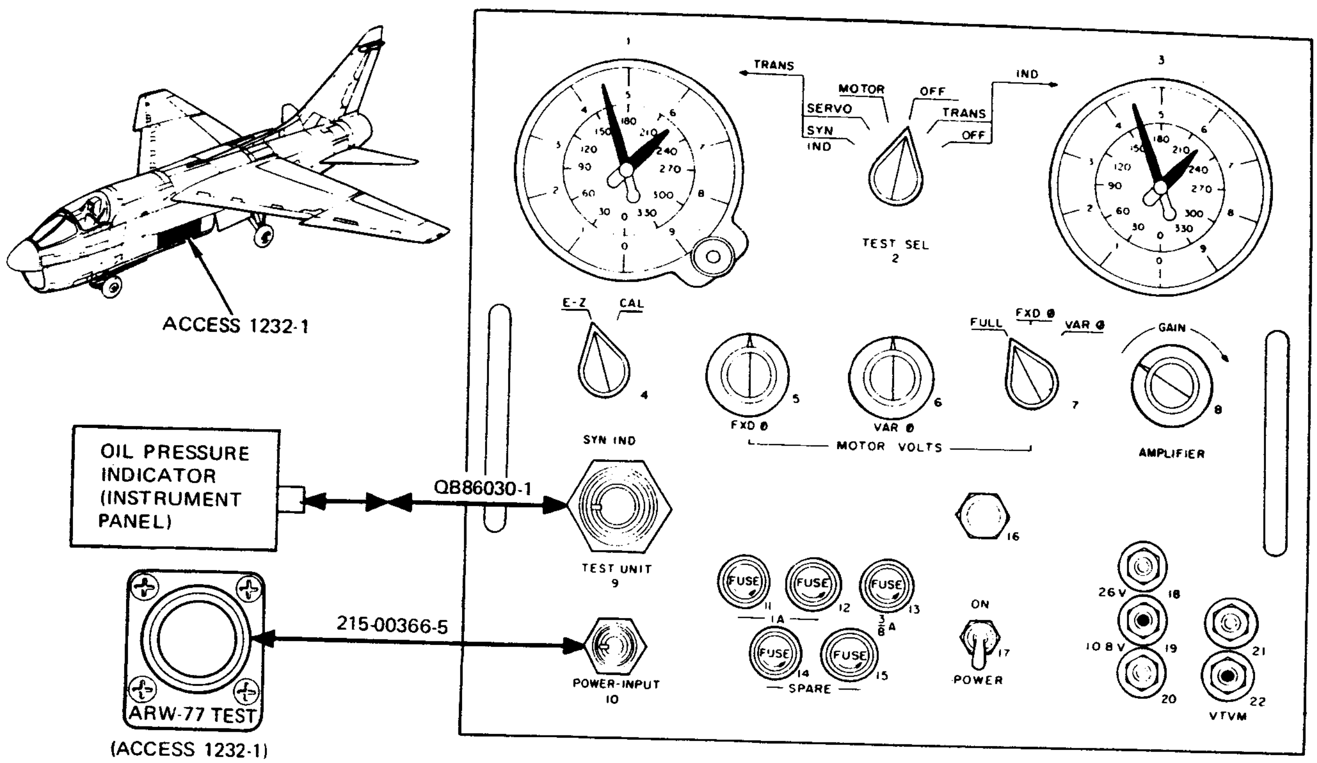


Figure 3-9. Indicator Test; Oil Pressure

SYN IND switch.......................................CAL

TEST SEL switch.......................................OFF

d. Connect test set as shown in figure 3-9.

e. Connect external electrical power (T.O. 1A-7D-2-1).

f. Place test set POWER switch in ON. Warm up test set for 1 minute.

g. Check that POWER light comes on.

NOTE

If voltages in steps h and i are not within limits, reject test set.

h. Check for 26.0 (±2.6) volts ac between test set posts 18 and 19.

i. Check for 10.80 (±1.08) volts ac between test set posts 19 and 20.

j. Place TEST SEL switch 2 in SYN IND.

k. Place SYN IND switch in CAL.

l. Rotate test set transmitter 1 to obtain each of the oil pressure indicator values in table 3-13. For each indication, check that test set dial indicates angles shown within ±4°. If values are not within limits, replace indicator (paragraph 3-19).

Table 3-13. Oil Pressure Indicator Test Values

Oil pressure indicator pressure (psi)	Test set value (degrees)
0	20
20	126
30	180
40	232
50	285
60	340

m. Place POWER switch in off (down) position.

n. Place all test set switches in OFF. Rotate all controls fully counterclockwise.

o. Disconnect external electrical power (T.O. 1A-7D-2-1).

p. Disconnect test set from indicator and ARW-77 test receptacle J308.

q. Install oil pressure indicator (paragraph 3-19).

r. Close access 1232-1.

3-10. OIL PRESSURE TRANSMITTER TEST.

Test Equipment Required

Figure & index No.	Name	AN type designation	Use and application
	Equipment required for connecting external electrical power		Provide electrical power for test set
	Jet oil servicing unit	MS54930-3	Provide oil pressure
	Synchro instrument test set	13819-2A (Eclipse Pioneer Division of Bendix Corp, Teterboro, New Jersey)	Perform test
	Cable assembly	215-00366-5	Provide airplane electrical power to test set
	Cable assembly	215-00380-1	Adapt indicator to test set
	AC voltmeter	403B	Check voltage

WARNING

Avoid radiation contamination by adhering to exposure limits. For physical contact with the oil tank source tube, maximum safe exposure time is 15 minutes at one time or a total of 20 minutes per week. At a distance of 12 inches from the source tube, maximum time is 3.3 hours per week. There is no exposure time limit 3 feet from source tube. Deviations from these limits shall be approved by the base medical service. Personnel working with or near this source tube shall become familiar with the procedures in T.O. 00-110N-11.

a. Extend arresting gear (T.O. 1A-7D-2-7).

b. Open accesses 5222-3-1 and 1232-1.

c. Cut lockwire and disconnect electrical connector P504 from oil pressure transmitter.

d. Place test set switches and controls as follows:

Control	*Position*
POWER switch	OFF
AMPLIFIER control	Fully counterclockwise
MOTOR VOLTS switch	FULL
MOTOR VOLTS VAR ⌀ control	Fully counterclockwise
MOTOR VOLTS FXD ⌀ control	Fully counterclockwise
SYN IND switch	CAL
TEST SEL switch	OFF

e. Connect test set as shown in figure 3-10.

f. Disconnect engine oil pressure tube from transmitter. Connect jet oil servicing unit to transmitter.

g. Connect external electrical power (T.O. 1A-7D-2-1).

h. Place POWER switch in ON. Warm up test set for 1 minute. Check that POWER light comes on.

NOTE

If voltages in steps i and j are not within limits, reject test set.

i. Check for 26.0 (±2.6) volts ac between test set posts 18 and 19.

j. Check for 10.80 (±1.08) volts ac between test set posts 19 and 20.

k. Place TEST SEL switch 2 in TRANS.

l. Rotate AMPLIFIER control fully clockwise.

m. Operate jet oil servicing unit to obtain each of the oil pressure values specified in table 3-14. Check that test set dial indicates angles within tolerances. If values are not within limits, replace transmitter (paragraph 3-20).

Table 3-14. Oil Pressure Transmitter Test Values

Oil pressure indicator pressure (psi)	Test set value (degrees)
0	20 (±6)
10	73 (±6)
20	126 (±7)
30	180 (±7)
40	232 (±7)
50	285 (±7)
60	340 (±7)

n. Place POWER switch in off (down) position.

o. Place all test set switches in OFF. Rotate all controls fully counterclockwise.

p. Disconnect external electrical power (T.O. 1A-7D-2-1).

q. Bleed pressure and disconnect jet oil servicing unit from transmitter. Connect engine oil pressure tube to transmitter.

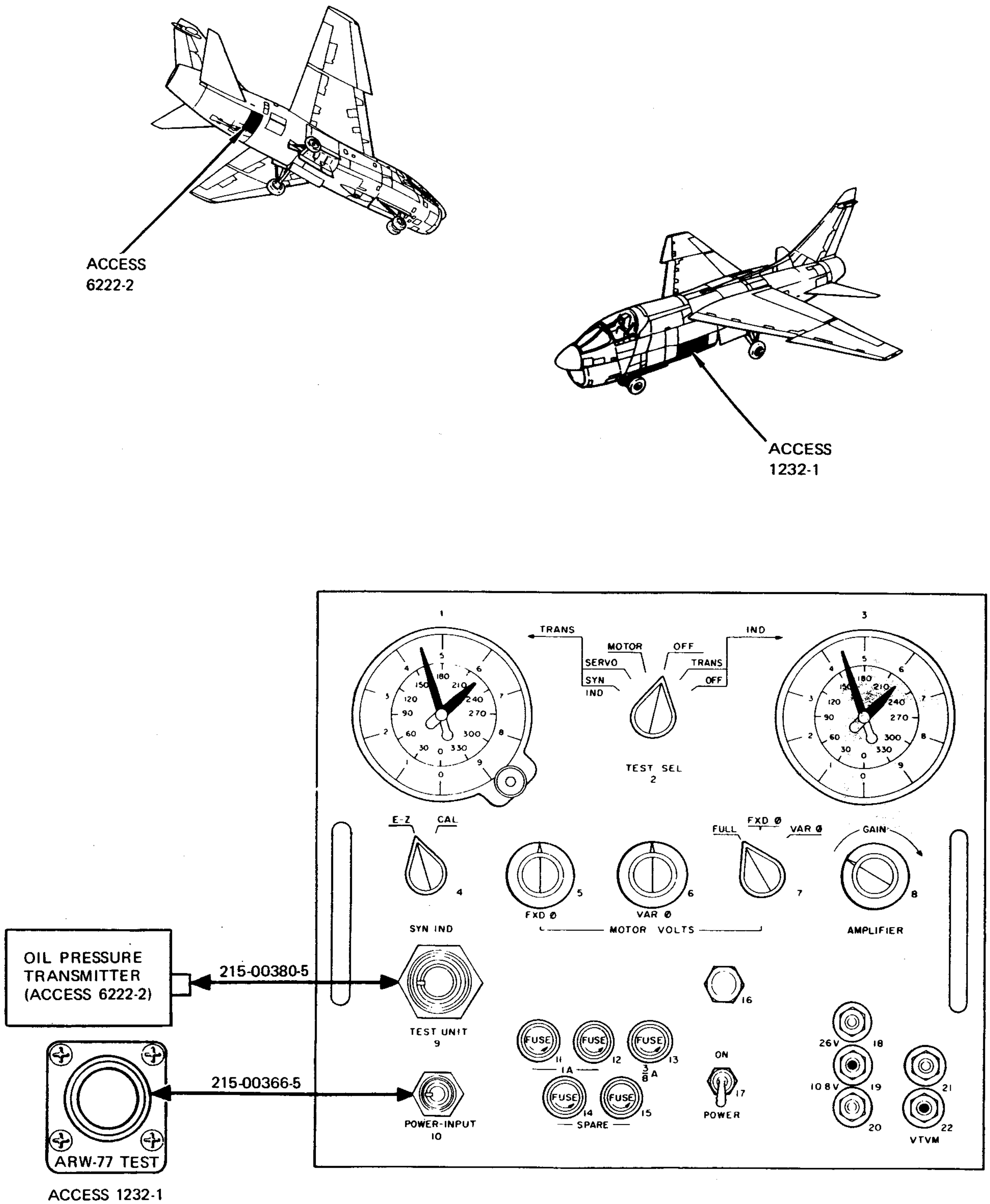


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Figure 3-10. Transmitter Test; Oil Pressure

r. Disconnect test set from transmitter and ARW-77 test receptacle J308.

s. Connect electrical connector P504 to transmitter. Secure with MS20995C32 lockwire.

t. Perform oil pressure indications system operational checkout (paragraph 3-4). Do not shut down engine.

u. With engine operating at idle, open engine oil pressure tube at transmitter and bleed air from tube.

v. Tighten pressure tube and check for leaks.

w. Shut down engine (T.O. 1A-7D-2-1).

x. Close accesses 5222-3-1 and 1232-1.

y. Retract arresting gear (T.O. 1A-7D-2-7).

3-11. OIL QUANTITY INDICATING SYSTEM TEST.

Test Equipment Required

Figure & index No.	Name	AN type designation	Use and application
	Equipment required for connecting external electrical power		Provide electrical power to test set
	Multimeter	AN/PSM-6	Check voltage
	Nucleonic oil quantity indicating system test set	1001-01-000 (General Nucleonics Corporation)	Ensure that oil quantity indicating system is adjusted and operating properly
	Nucleonic cable set	1002-01-099 (General Nucleonics Corporation)	Connect test set to airplane system

WARNING

Avoid radiation contamination by adhering to exposure limits. For physical contact with the oil tank source tube, maximum safe exposure time is 15 minutes at one time or a total or 20 minutes per week. At a distance of 12 inches from the source tube, maximum time is 3.3 hours per week. There is no exposure time limit 3 feet from source tube. Deviations from these limits shall be approved by the base medical service. Personnel working with or near this source tube shall become familiar with the procedures in T.O. 00-110N-11.

Dangerous voltages exist when using test set. Make sure external grounding clip is properly attached to a suitable ground before applying power to test set.

High/lethal voltages may cause severe shock or death. Use caution and do not touch energized components.

a. Open access 5222-2.

b. Disconnect electrical connector P501 from detector. Check that seal is installed in connector.

c. Make sure that test set INPUT POWER switch is in OFF.

d. Connect test set to detector as shown in figure 3-11.

e. Place test set INPUT POWER switch in STAND BY. Check that POWER ON light comes on.

NOTE

If test set warmup has been completed and test set shut down for less than 30 minutes, warmup is not required.

f. Warm up test set as shown in table 3-15.

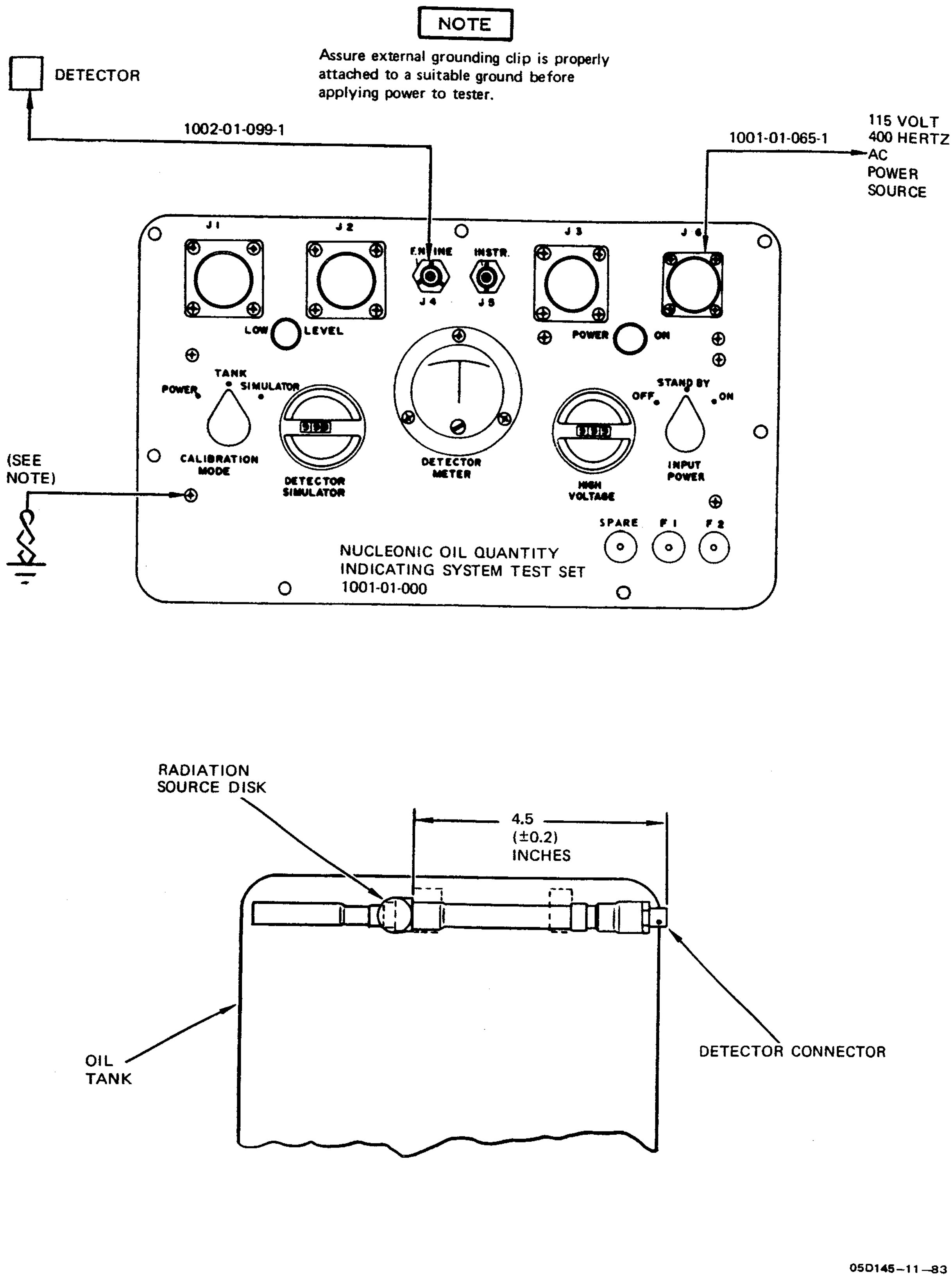


Figure 3-11. Indicating System Test; Oil Quantity

Table 3-15. Nucleonic Oil Quantity Test Set Warmup Time

Ambient temperature (F)	Minimum warmup time (minutes)
−40 to 31	20
32 to 67	16
68 to 103	12
103 to 130	7
Over 131	2

g. Place test set INPUT POWER switch in ON. Check that POWER ON light remains on.

h. Place CALIBRATION MODE switch in TANK.

i. Set HIGH VOLTAGE control (digital dial) to reading on calibration card for 760 volts dc.

j. Adjust DETECTOR SIMULATOR control for null on DETECTOR METER. If null is obtained and detector and source tube are operating properly, proceed to step l.

k. If null cannot be obtained, proceed as follows:

NOTE

Radiation source disk supplied with test set is not a radiation hazard.

(1) Place radiation source disk against detector at 4.5 (±0.2) inches from electrical connector end of detector (figure 3-11). Adjust DETECTOR SIMULATOR control to obtain null.

(2) If null is obtained on DETECTOR METER, replace source unit (paragraph 3-24).

(3) If null is not obtained on DETECTOR METER, replace detector unit (paragraph 3-25).

l. Place INPUT POWER switch in OFF.

m. Disconnect test set from detector and power source.

n. Connect electrical connector P501.

o. Remove oil quantity indicator from instrument panel (paragraph 3-23).

p. Disconnect electrical connectors P241 and P242 from oil quantity indicator.

q. Connect test set to airplane and oil quantity indicator as shown in figure 3-12.

r. Connect external electrical power to airplane (T.O. 1A-7D-2-1).

s. Place test set INPUT POWER switch in STANDBY. Check that POWER ON light comes on.

t. Allow test set to warm up as shown in table 3-15.

u. Place test set INPUT POWER switch in ON. Check that POWER ON light remains on.

v. Set HIGH VOLTAGE control (digital dial) to reading on calibration card for 760 volts dc.

w. Place test set CALIBRATION MODE switch in TANK. Adjust DETECTOR SIMULATOR control to obtain null signal on DETECTOR METER. If null is obtained, proceed to step y.

NOTE

If wiring does not check within limits, replace defective section or connector. Repeat oil quantity indicating system test.

x. If null is not obtained, check airplane wiring as follows:

(1) Place test set INPUT POWER switch in OFF.

(2) Disconnect electrical connector P501 and isolate from ground. Check that seal is installed in connector.

(3) Place test set INPUT POWER switch in ON. Make sure HIGH VOLTAGE digital dial is adjusted to setting on calibration card for 760 volts dc.

NOTE

The following voltage check must be made with an AN/PSM-6 multimeter.

(4) Place AN/PSM-6 multimeter RANGE switch in 1000 VOLT and SELECTOR switch in DCV 20K OHMS/VOLT. Check that voltage between center pin of P501 and shield is greater than 400 volts dc.

(5) Place INPUT POWER switch in OFF.

(6) Disconnect electrical connector P242 and isolate from ground.

(7) Perform continuity and resistance checks between P242 and P501 as shown in figure FO-4.

(8) Check resistance between outer conductor of P501 to airplane ground for minimum of 10 megohms.

(9) Connect electrical connectors P241 and P501.

y. Make sure INPUT POWER switch is in OFF.

z. Disconnect test cable connector P4 at test set connector J4 to remove detector tube load.

aa. Place INPUT POWER switch in ON.

ab. Place test set CALIBRATION MODE switch in POWER.

ac. Adjust HIGH VOLTAGE control for null on the DETECTOR METER.

ad. Compare HIGH VOLTAGE indication (digital dial) with test set calibration card.

ae. If HIGH VOLTAGE indication is outside of acceptable voltage range on card (660 to 760 volts dc), replace oil quantity indicator (paragraph 3-23).

af. Check indicator as follows:

(1) Place CALIBRATION MODE switch in SIMULATOR. Adjust DETECTOR SIMULATOR control to a digital dial indication of 0.

(2) Slowly increase DETECTOR SIMULATOR control and check for smooth movement of indicator needle from F toward E.

(3) If digital dial displays 500 without needle movement, hold setting of 500 and adjust EMPTY adjustment screw on indicator fully counterclockwise as viewed from rear (10 turns maximum). If there is no needle movement, replace oil quantity indicator (paragraph 3-23); if there is movement, calibrate system (paragraph 3-12).

ag. If no fault has been found in the steps above, perform oil quantity indicating system calibration (paragraph 3-12).

ah. Place INPUT POWER switch in OFF.

ai. Disconnect external electrical power from airplane (T.O. 1A-7D-2-1).

aj. Disconnect test set from airplane.

ak. Connect electrical connectors P241 and P242 to indicator.

al. Install oil quantity indicator in instrument panel (paragraph 3-23).

am. Close access 5222-2.

3-12. OIL QUANTITY INDICATING SYSTEM CALIBRATION.

Test Equipment Required

Figure & index No.	Name	AN type designation	Use and application
	Equipment required for connecting external electrical power		Provide electrical power to test set
	Nucleonic oil quantity indicating test set	1001-01-000 (General Nucleonics Corporation)	Ensure that oil quantity indicating system is adjusted and operating properly

Test Equipment Required — CONT

Figure & index No.	Name	AN type designation	Use and application
	Nucleonic cable set	1002-01-099 (General Nucleonics Corporation)	Connect test set to airplane system
	Torque wrench, 10 to 150 inch-pounds	GGG-W-686	Measure torque

WARNING

Avoid radiation contamination by adhering to exposure limits. For physical contact with the oil tank source tube, maximum safe exposure time is 15 minutes at one time or a total of 20 minutes per week. At a distance of 12 inches from the source tube, maximum time is 3.3 hours per week. There is no exposure time limit 3 feet from source tube. Deviations from these limits shall be approved by the base medical service. Personnel working with or near this source tube shall become familiar with the procedures in T.O. 00-110N-11.

Dangerous voltages exist when using test set. Make sure external grounding clip is properly attached to a suitable ground before applying power to test set.

High/lethal voltages may cause severe shock or death. Use caution and do not touch energized components.

NOTE

Oil quantity system calibration is required when engine is removed and replaced with a substitute engine, or every 6 months. Calibration is also required when a component fails (source tube, detector, or indicator).

3-12.1. Preparation. (Figure 3-12.)

a. Check oil level in tank. Mark level with a temporary marking (pencil, tape, etc); then drain oil tank as follows:

NOTE

Above procedure prevents over servicing of oil tank; 1 to 2 pints of oil may have drained into engine.

(1) Open access 5222-2-1.

(2) Remove oil sampling drain valve cap.

CAUTION

To prevent damage to drain valve and subsequent loss of engine oil, do not use tools on drain valve handle.

(3) Open valve and drain oil.

(4) Install cap on oil sampling drain valve. Torque to 75 inch-pounds.

b. Remove oil quantity indicator from instrument panel (paragraph 3-23).

c. Disconnect electrical connectors P241 and P242 from oil quantity indicator.

WARNING

Avoid radiation contamination by adhering to exposure limits. For physical contact with the oil tank source tube, maximum safe exposure time is 15 minutes at one time or a total of 20 minutes per week. At a distance of 12 inches from the source tube, maximum time is 3.3 hours per week. There is no exposure time limit 3 feet from source tube. Deviations from these limits hsall be approved by the base medical service. Personnel working with or near this source tube shall become familiar with the procedures in T.O. 00-110N-11.

Dangerous voltages exist when using test set. Make sure external grounding clip is properly attached to a suitable ground before applying power to test set.

d. Connect test set to airplane and oil quantity indicator as shown in figure 3-12.

e. Connect external electrical power to airplane (T.O. 1A-7D-2-1).

f. Disconnect test cable connector P4 at test set connector J4 to remove detector tube load.

g. Place test set INPUT POWER switch in STAND BY. Check that POWER ON light comes on.

NOTE

If test set warmup has been completed and test set shut down for less than 30 minutes, warmup is not required.

h. Warm up test set as shown in table 3-15.

i. Place test set INPUT POWER in ON. Check that POWER ON light comes on.

j. Place test set CALIBRATION MODE switch in POWER.

CAUTION

During the time test set shows null and indications are recorded, all engine access doors shall be closed. Also, all personnel shall be at least 3 feet away from the engine oil tank to avoid variations in indications.

k. Adjust HIGH VOLTAGE control for a null on DETECTOR METER. High voltage control shall remain at this setting during calibration procedure.

l. Compare HIGH VOLTAGE indication (digital dial) with test set calibration card. Reject oil quantity indicator if HIGH VOLTAGE indication is outside of required voltage range (660 to 760 volts dc) on calibration card.

m. Place INPUT POWER switch in OFF.

n. Reconnect test cable connector P4 to test set connector J4.

o. Place INPUT POWER switch in ON.

3-12.2. Calibration.

a. Place CALIBRATION MODE switch in TANK.

b. Adjust test set DETECTOR SIMULATOR control for null on DETECTOR METER.

NOTE

Due to the built-in damping of the null meter, let meter stabilize for 30 seconds before taking final reading.

c. Record DETECTOR SIMULATOR indication (digital dial) when null is obtained.

NOTE

If a CAL position is marked on oil level window, this position is to be disregarded. This level has no function in the present oil quantity indicating system calibration procedures.

d. Service oil tank (T.O. 1A-7D-2-1) to 1 pint low mark on sight glass.

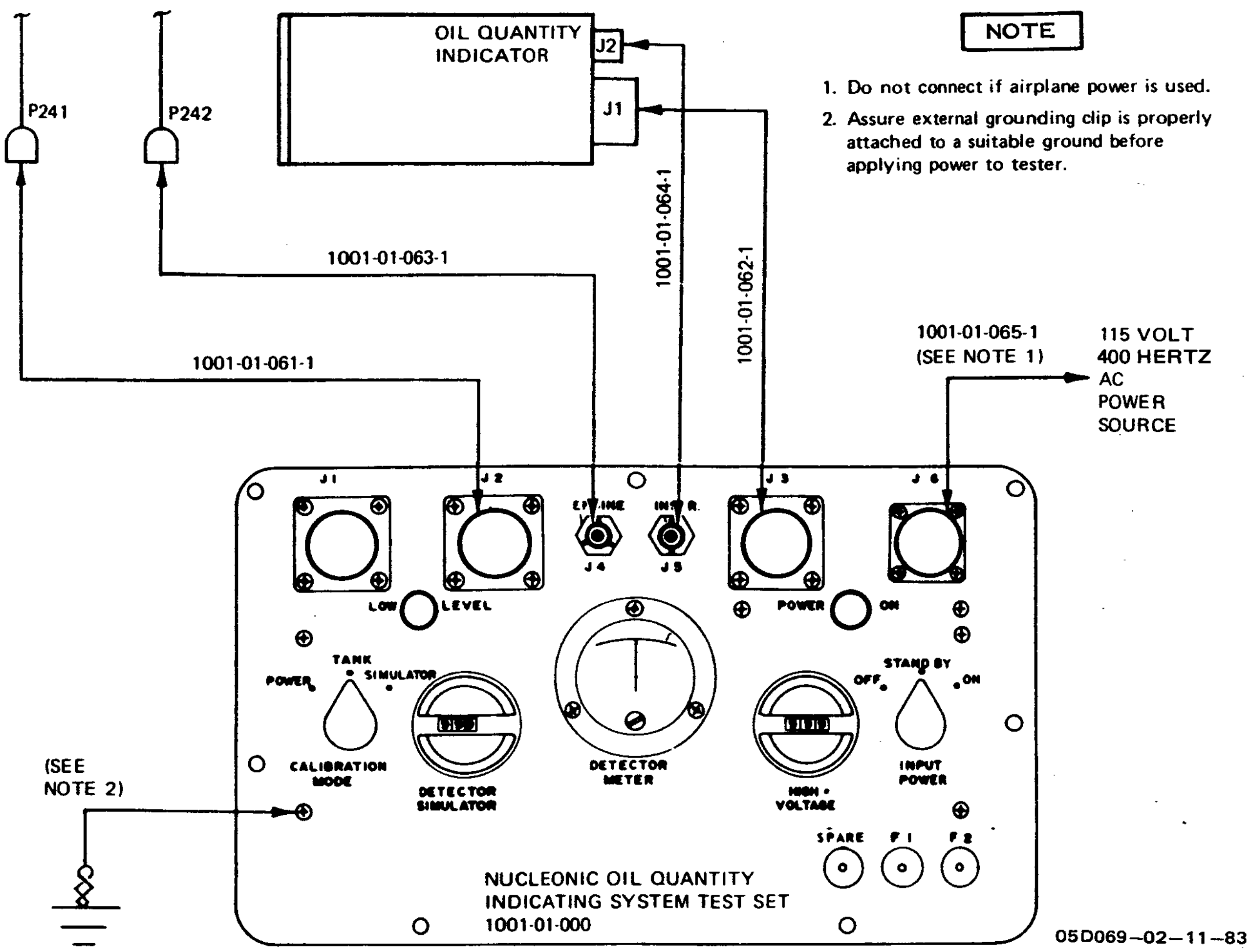


Figure 3-12. Indicating System Calibration; Oil Quantity

e. Adjust DETECTOR SIMULATOR control for null on DETECTOR METER.

f. Record DETECTOR SIMULATOR (digital dial) when null is reached.

g. Place CALIBRATION MODE switch in SIMULATOR. Adjust DETECTOR SIMULATOR for value recorded in step f.

NOTE

Turning adjustment screw on oil quantity indicator clockwise (viewed from rear) will drive point toward F; counterclockwise, toward E. Due to system time constant, allow a minimum of 1 minute for stabilization.

h. Adjust FULL adjustment screw on back of oil quantity indicator until pointer indicates F.

i. Adjust test set DETECTOR SIMULATOR to value recorded in step c.

j. Adjust EMPTY adjustment screw on back of the indicator until pointer indicates E.

k. Repeat steps g through j until no further adjustment is required.

l. Open access 1232-1 and open circuit breaker CB3149.

NOTE

Engine oil caution light in cockpit and LOW LEVEL light on test set will come on at the same time.

m. Adjust DETECTOR SIMULATOR control until oil quantity indicator pointer indicates 1/2 of full scale.

n. If oil warning light on caution panel is on, turn WARN adjustment screw counterclockwise until light goes out; then clockwise until light comes on.

o. If oil warning light on caution panel is out, turn WARN adjustment screw clockwise until light comes on.

p. Simulate increasing oil level by decreasing DETECTOR SIMULATOR setting until light goes out.

q. Simulate decreasing oil level by increasing DETECTOR SIMULATOR setting until engine oil warning light comes on. The quantity indicator pointer shall be at 1/2 (+1/32, −0) of full scale.

r. Repeat step p. Light shall go out at 5/8 (±1/32) of pointer full scale.

3-12.3. Post Calibration.

a. Place test set INPUT POWER switch in OFF.

b. Shut down but do not disconnect external electrical power.

c. Disconnect test set from airplane.

d. Using varnish MIL-V-173B or equivalent, paint slippage mark on indicator adjustment screws.

e. Connect electrical connectors P241 and P242 to indicator.

f. Install oil quantity indicator in instrument panel (paragraph 3-23).

NOTE

The oil quantity indicator tolerance is in addition to the allowable pointer fluctuation.

g. Apply external electrical power and verify that oil quantity indicator indicates F (±1/32).

h. Disconnect external electrical power from airplane (T.O. 1A-7D-2-1).

i. Remove oil sampling drain valve cap and open valve. Drain oil to temporary mark determined in subparagraph 3-12.1.

j. Close circuit breaker CB3149.

k. Close accesses 1232-1 and 5222-2-1.

3-13. OIL QUANTITY INDICATING SYSTEM COAXIAL CABLE TEST.

Test Equipment Required

Figure & index No.	Name	AN type designation	Use and application
	Multimeter	AN/PSM-6	Check voltage
	Nucleonic oil quantity indicating system test set	1001-01-000 (General Nucleonics Corporation)	Input voltage into coaxial cable
	Equipment required for connecting external electrical power		Provide electrical power for test set

WARNING

Avoid radiation contamination by adhering to exposure limits. For physical contact with the oil tank source tube, maximum safe exposure time is 15 minutes at one time or a total of 20 minutes per week. At a distance of 12 inches from the source tube, maximum time is 3.3 hours per week. There is no exposure time limit 3 feet from source tube. Deviations from these limits shall be approved by the base medical service. Personnel working with or near this source tube shall become familiar with the procedures in T.O. 00-110N-11.

Dangerous voltages exist when using test set. Make sure external grounding clip is properly attached to a suitable ground before applying power to tester.

a. Open accesses 1121-8, 2211-2, 5111-2, 5222-1, and 5222-2.

b. Remove oil quantity indicator (paragraph 3-23).

c. Make sure that test set INPUT POWER switch is in OFF and CALIBRATION MODE switch is in POWER.

d. Connect test set and multimeter to coaxial cable as shown in figure 3-13.

e. Place test set INPUT POWER switch in STAND BY. Check that POWER ON light comes on.

NOTE

If test set warmup has been completed and test set shut down for less than 30 minutes, warmup is not required.

f. Warm up test set as shown in table 3-15.

g. Place test set INPUT POWER switch in ON. Check that POWER ON light remains on.

h. Set HIGH VOLTAGE control (digital dial) to 999.

i. Shake and rotate each connector and coaxial cable in turn while monitoring voltage reading on multimeter. Change of voltage indicates faulty coaxial cable.

j. Place INPUT POWER switch in OFF.

k. Disconnect test set and multimeter from coaxial cable.

l. Install oil quantity indicator (paragraph 3-23).

m. Close accesses 1121-8, 2211-2, 5111-2, 5222-1, and 5222-2.

NOTE

1. Assure external grounding clip is properly attached to a suitable ground before applying power to tester.
2. Connect negative lead to cable shield.
3. If power is not connected to airplane, connect 1001-01-065-1 to J6.
4. If power is connected to airplane, connect 1001-01-061-1 to J2.

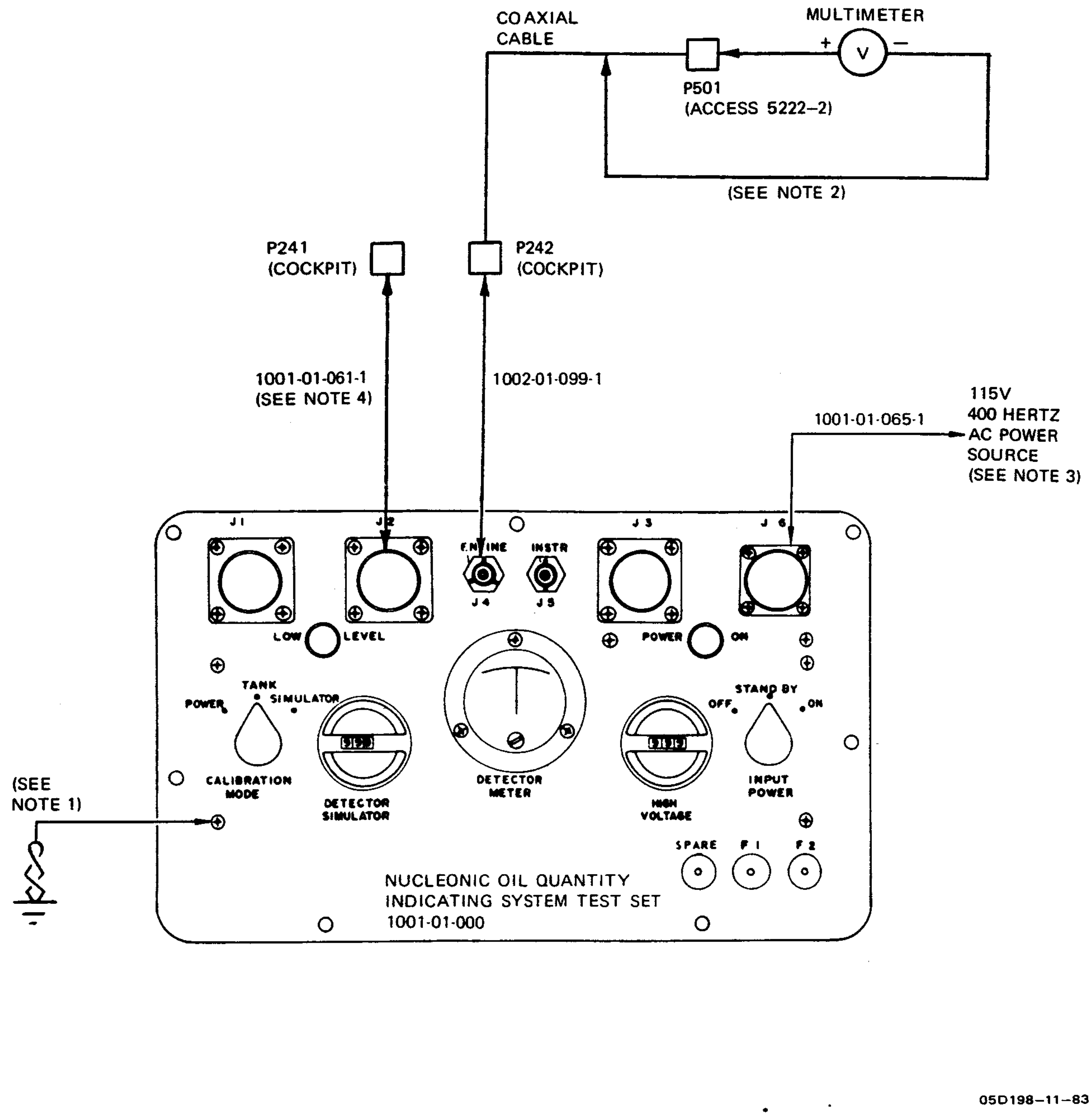


Figure 3-13. Coaxial Cable Test; Oil Quantity Indicating System

3-14. T5.1 THERMOCOUPLE SYSTEM STATIC CHECKS.

Test Equipment Required

Figure & index No.	Name	AN type designation	Use and application
	Equipment required for connecting external electrical power		Provide electrical power for airplane and test set
	Multimeter	AN/PSM-6	Measure continuity and resistance
	Bridge	AN/URM-90	Measure resistance
3-15	Cable assembly	BH10554 (216-01983-1)	Adapt Jetcal analyzer cable to TOT indicator
3-15	Jetcal analyzer trim set	H119M (Howell Instruments, Inc, Fort Worth, Texas)	Measure turbine outlet temperature, and supply electrical power to heater probes
	Torque wrench, 0 to 15 inch-pounds	GGG-W-686	Measure torque
	Torque wrench, 5 to 50 inch-pounds	GGG-W-686	Measure torque
	Extension handle	BH492B-3 (Howell Instruments Inc, Fort Worth, Texas)	Hold heater probes for installation
3-15	Heater probe (9)	BH7447-70 (Howell Instruments Inc, Fort Worth, Texas)	Heat T5.1 thermocouple probes
3-15	Junction box	BH361-12 (Howell Instruments Inc, Fort Worth, Texas)	Connect heater probe cables

NOTE

The following checks may be performed either individually or sequentially. If checks are to be made sequentially, do not close access doors or disconnect equipment that will be required in a later check.

3-14.1. <u>Turbine Outlet Temperature Indicating System Check.</u> (Figure 3-14.)

NOTE

This check tests the overall performance of the turbine outlet temperature indicating system.

a. Remove engine removal door (T.O. 1A-7D-2-1).

b. Remove junction box cover (1).

CAUTION

To prevent damage to ballast resistor, use extreme care when removing. Altering the value of the resistor will cause low TOP or undetected overtemperature. Refer to engine logbook for value of ballast resistor.

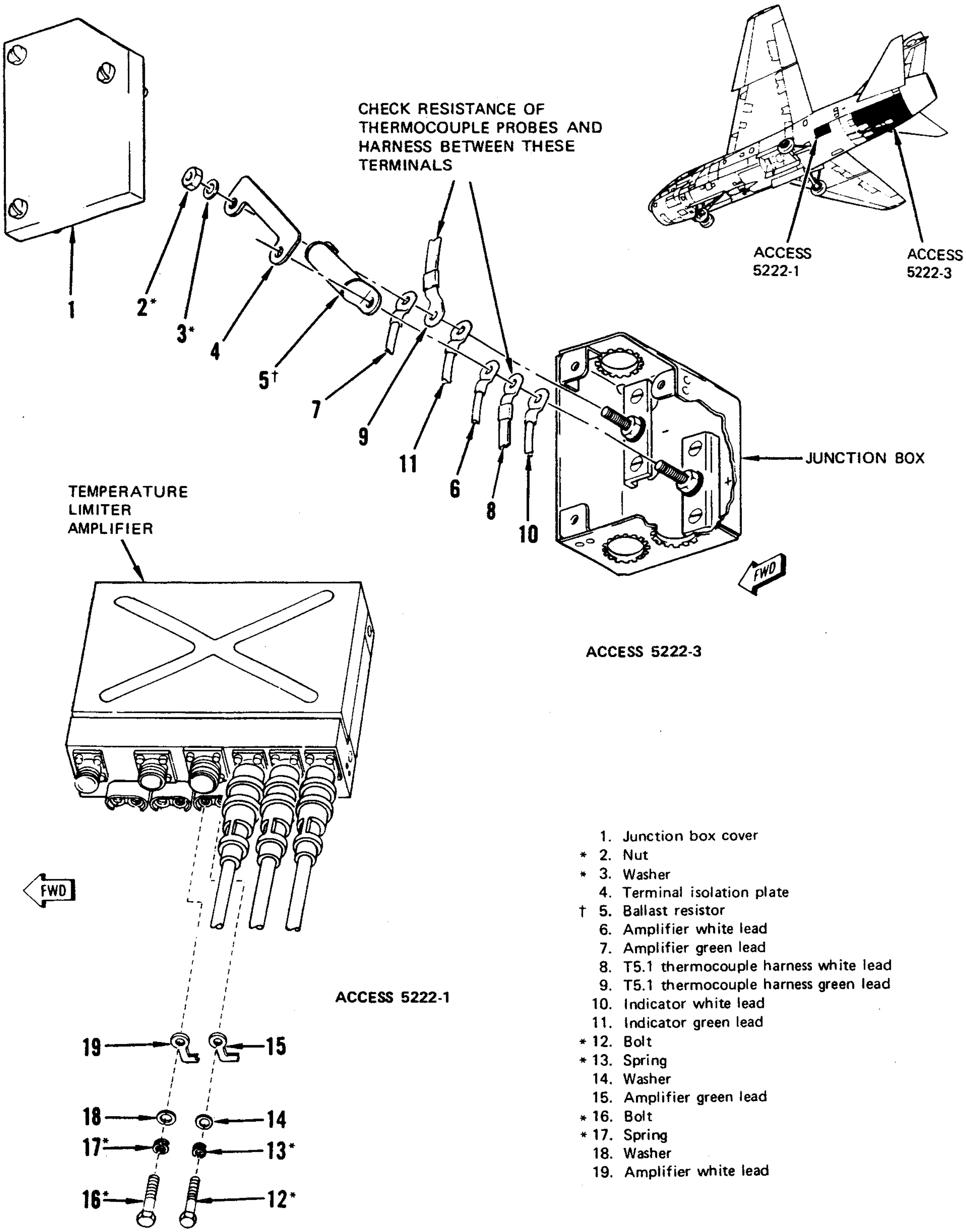
c. Remove nuts (2), washers (3), terminal isolation plate (4), and ballast resistor(s) (5).

d. Disconnect amplifier white lead (6) and amplifier green lead (7).

e. Install terminal isolation plate (4), washers (3), and nuts (2). Tighten nuts to 25 inch-pounds torque.

f. Set switch controls on Jetcal analyzer trim set as follows:

Control	*Position*
INSUL CHECK SWITCH	R X100
RES CHECK SWITCH	NULL BAL A/C AND IND
PRESSURE SWITCH	OFF
TEMP INPUT SWITCH	HEATER CABLE
RPM SWITCH	OFF
A/C IND ADJ	Fully counterclockwise
DECK LIGHT SWITCH	As required
TEMP SWITCH	OPERATE



1. Junction box cover
* 2. Nut
* 3. Washer
4. Terminal isolation plate
† 5. Ballast resistor
6. Amplifier white lead
7. Amplifier green lead
8. T5.1 thermocouple harness white lead
9. T5.1 thermocouple harness green lead
10. Indicator white lead
11. Indicator green lead
* 12. Bolt
* 13. Spring
14. Washer
15. Amplifier green lead
* 16. Bolt
* 17. Spring
18. Washer
19. Amplifier white lead

*Nuts, washers, bolts, and springs are special parts, do not substitute bench stock items.
†If two ballast resistors are used, install back to back.

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Figure 3-14. Static Checks; T5.1 Thermocouple System

PER CENT TEMP CONTROL......................0.0

FUNCTION SELECTOR SWITCH ....OFF

SPREAD SWITCH..ALL

WARNING

To prevent injury to personnel, make sure Jetcal analyzer trim set is grounded with pigtail on power cable.

g. Connect Jetcal analyzer trim set and nine thermocouple heaters as shown in figure 3-15.

h. Connect external electrical power (T.O. 1A-7D-2-1).

i. Place trim set FUNCTION SELECTOR SWITCH in TRIM-T/C. Warm up for 10 minutes.

j. Place TEMP SWITCH in CAL 600°C.

k. Adjust CAL ADJ until TEMP indicator indicates 600.

l. Place TEMP INPUT SWITCH in HEATER CABLE.

m. Place TEMP SWITCH in OPERATE.

NOTE

If the point when engine hot caution light comes on is not within limits, replace turbine outlet temperature indicator (paragraph 3-26).

n. Adjust PER CENT TEMP CONTROL for 650°C (1,202°F) on TEMP readout.

o. Check that engine hot caution light comes on as indicator pointer passes through 620° to 625°C (1,148° to 1,157°F).

p. Allow 10-minute heat soak period.

NOTE

If turbine outlet temperature is not within limits, make following checks to locate faulty component.

q. Check that cockpit turbine outlet temperature indicator indicates 650° (±7°)C (1,202° (±13°)F).

r. Place FUNCTION SELECTOR SWITCH in OFF.

s. Disconnect external electrical power (T.O. 1A-7D-2-1).

t. Disconnect trim set cables.

u. Remove nuts (2), washers (3), and terminal isolation plate (4).

v. Place amplifier green lead (7) on negative terminal and amplifier white lead (6) on positive terminal.

CAUTION

To prevent damage to ballast resistor, use extreme care when installing. Changing the value of the resistor will cause low TOP or undetected overtemperature. Refer to engine logbook for value of ballast resistor.

w. Place ballast resistor(s) (5) and terminal isolation board (4) on junction box terminals. Secure with washers (3) and nuts (2). Tighten nuts to 25 inch-pounds torque.

x. Install junction box cover (1).

y. Install engine removal door (T.O. 1A-7D-2-1).

3-14.2. T5.1 Thermocouple Probe Check.

NOTE

This check is performed to check operation of the individual T5.1 thermocouple probes.

a. Set switch controls on Jetcal analyzer trim set as follows:

Control	*Position*
INSUL CHECK SWITCH	R X100
RES CHECK SWITCH A/C AND IND	NULL BAL

NOTE

1. For performing turbine outlet temperature indicating system test (paragraph 3-14.1) or T5.1 thermocouple probe check (paragraph 3-14.2).

2. For performing T5.1 thermocouple system insulation resistance check (paragraph 3-14.4).

3. For performing turbine outlet temperature indicator check (paragraph 3-14.5). Cable adapter BH10554 is connected between test cable BH485 and aircraft connector P420 (access 5222-1).

4. For performing engine tachometer system test (paragraph 3-15). Test cable adapter BH907-85 is connected to test cable BH485 and aircraft connector P503 (tachometer) and tachometer generator connector (access 5222-1).

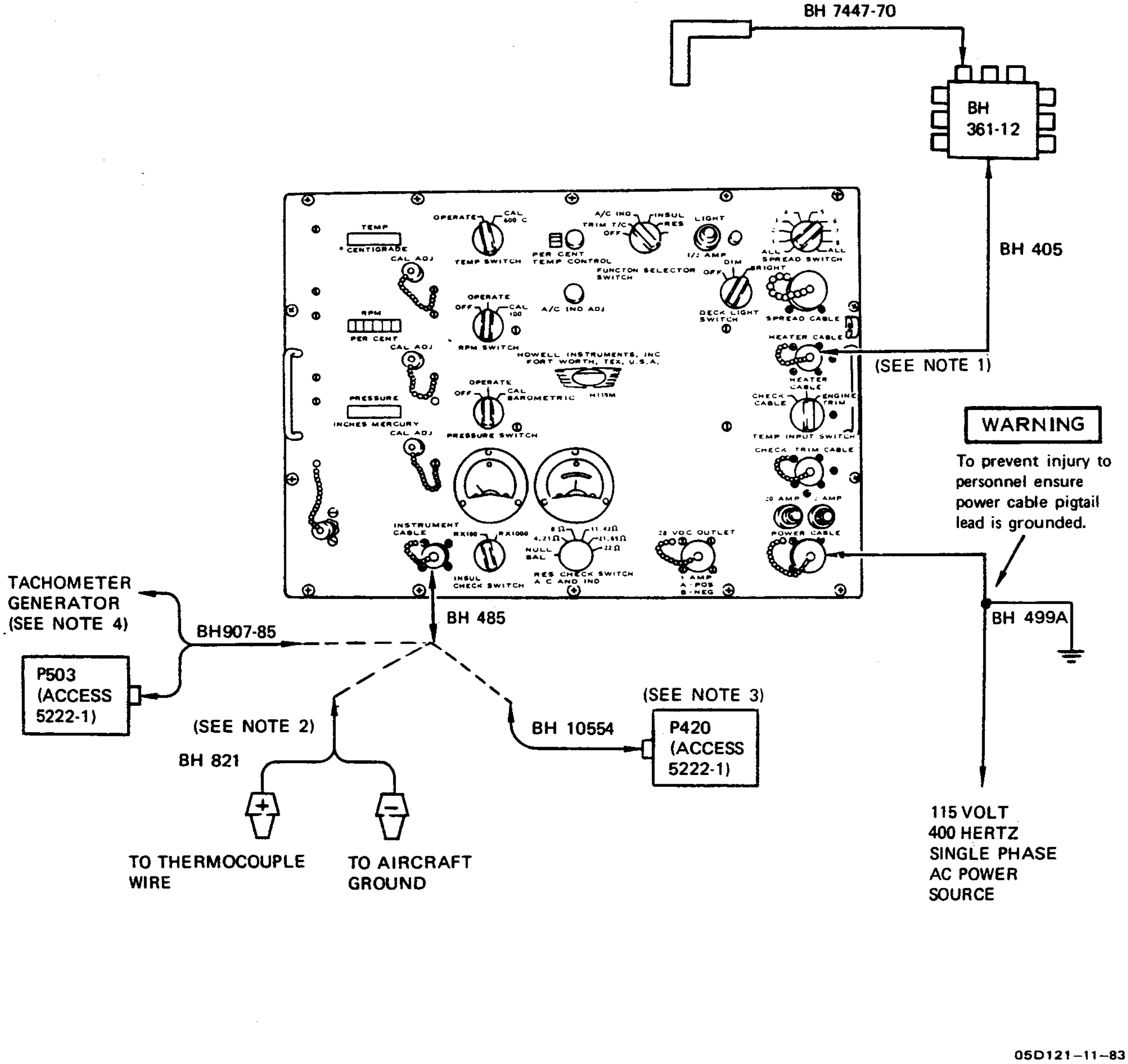


Figure 3-15. Trim Set Connections; Jetcal Analyzer

PRESSURE SWITCH ....OFF

TEMP INPUT SWITCH ...... HEATER CABLE

RPM SWITCH...OFF

A/C IND ADJ.. Fully counterclockwise

DECK LIGHT SWITCH ....As required

TEMP SWITCH ....OPERATE

PER CENT TEMP CONTROL......................0.0

FUNCTION SELECTOR SWITCH ....OFF

SPREAD SWITCH.......................................ALL

WARNING

To prevent injury to personnel, make sure Jetcal analyzer trim set is grounded with pigtail on power cable.

b. Connect trim set and one thermocouple heater as shown in figure 3-15.

c. Connect external electrical power (T.O. 1A-7D-2-1).

d. Place trim set FUNCTION SELECTOR SWITCH in TRIM-T/C. Warm up for 10 minutes.

e. Place TEMP INPUT SWITCH in HEATER CABLE.

f. Place TEMP SWITCH in OPERATE.

g. Adjust PER CENT TEMP CONTROL to 100.0.

h. Check that cockpit turbine outlet temperature indication increases as probe is heated.

i. Adjust PER CENT TEMP CONTROL to 0.0.

j. Remove heater probe and install on next thermocouple probe.

k. Repeat steps g through j until all thermocouple probes have been checked.

l. Place FUNCTION SELECTOR SWITCH in OFF.

m. Disconnect external electrical power (T.O. 1A-7D-2-1).

n. Disconnect trim set cables.

3-14.3. T5.1 Thermocouple System Continuity Check. (Figure 3-14.)

a. Remove engine removal door (T.O. 1A-7D-2-1).

b. Open access 5222-1.

c. Remove junction box cover (1).

CAUTION

To prevent damage to ballast resistor, use extreme care when removing. Changing the value of the resistor will cause low TOP or undetected overtemperature. Refer to engine logbook for value of ballast resistor.

d. Remove nuts (2), washers (3), terminal isolation plate (4), and ballast resistor(s) (5).

e. Disconnect amplifier, T5.1 thermocouple harness, and indicator green and white leads (6 through 11).

f. Remove turbine outlet temperature indicator (paragraph 3-26).

g. Remove bolt (12), spring (13), washer (14), and amplifier green lead (15).

h. Remove bolt (16), spring (17), washer (18), and amplifier white lead (19).

i. Check T5.1 thermocouple harness, indicator leads, and amplifier green and white leads for continuity.

j. Check resistance of ballast resistors.

k. Check resistance of temperature sensing probes and harness between positive and negative terminals. Resistance must be between 0.6 and 0.7 ohms.

l. If resistance is not within limits, proceed as follows:

(1) Loosen captive nuts and disconnect T5.1 thermocouple harness from temperature sensing probes.

NOTE

If resistance is out of limits, replace temperature sensing probe (paragraph 3-27).

(2) Check resistance of each temperature sensing probe. Resistance must be 4.5 (±0.1) ohms.

(3) Connect T5.1 thermocouple harness to temperature sensing probes with captive nuts.

(4) Tighten nuts to 25 inch-pounds torque.

m. Install turbine outlet temperature indicator (paragraph 3-26).

n. Connect engine-to-airframe electrical connector P420. Secure with MS20995C32 lockwire.

o. Secure amplifier white lead (19) to positive terminal with washer (18), spring (17), and bolt (16). Tighten bolts to 3 (±1) inch-pounds torque.

p. Secure amplifier green lead (15) to negative terminal with washer (14), spring (13), and bolt (12). Tighten bolt to 16 (+2, −1) inch-pounds torque.

q. Place indicator white lead (10), T5.1 thermocouple harness white lead (8), and amplifier white lead (6), on positive terminal of junction box.

r. Place indicator green lead (11), T5.1 thermocouple harness green lead (9), and amplifier green lead (7) on negative terminal of junction box.

CAUTION

To prevent damage to ballast resistor, use extreme care when installing. Changing the value of the resistor will cause low TOP or undetected overtemperature. Refer to engine logbook for value of ballast resistor.

s. Place ballast resistor(s) (5) and terminal isolation plate (4) on terminals. Secure with washers (3) and nut (2). Tighten nuts to 25 inch-pounds torque.

t. Install junction box cover (1).

u. Close access 5222-1.

v. Install engine removal door (T.O. 1A-7D-2-1).

3-14.4. T5.1 Thermocouple System Insulation Resistance Check. (Figure 3-14.)

a. Remove engine removal door (T.O. 1A-7D-2-1).

b. Open accesses 5222-1 and 6222-3.

c. Remove junction box cover (1).

CAUTION

To prevent damage to ballast resistor, use extreme care when removing. Changing the value of the resistor will cause low TOP or undetected overtemperature. Refer to engine logbook for value of ballast resistor.

d. Remove nuts (2), washers (3), terminal isolation plate (4), and ballast resistor(s) (5).

e. Disconnect amplifier, T5.1 thermocouple harness, and indicator green and white leads (6 through 11).

f. Remove turbine outlet temperature indicator (paragraph 3-26).

g. Remove bolt (12), spring (13), washer (14), and amplifier green lead (15).

h. Remove bolt (16), spring (17), washer (18), and amplifier white lead (19).

i. Set switch controls on Jetcal analyzer trim set as follows:

Control	*Position*
INSUL CHECK SWITCH	R X100
RES CHECK SWITCH A/C AND IND	NULL BAL
PRESSURE SWITCH	OFF
TEMP INPUT SWITCH	HEATER CABLE
RPM SWITCH	OFF
A/C IND ADJ	Fully counterclockwise
DECK LIGHT SWITCH	As required
TEMP SWITCH	OPERATE
PER CENT TEMP CONTROL	0.0
FUNCTION SELECTOR SWITCH	OFF
SPREAD SWITCH	ALL

WARNING

To prevent injury to personnel, make sure Jetcal analyzer trim set is grounded with pigtail on power cable.

j. Connect trim set as shown in figure 3-15.

k. Place trim set FUNCTION SELECTOR SWITCH in INSUL.

l. Place INSUL CHECK SWITCH in X100.

m. Connect insulation adapter negative lead to airplane ground.

n. Connect positive lead to each T5.1 thermocouple harness lead, amplified lead, and indicator lead in turn. Check that resistance at each test point exceeds 20,000 ohms.

o. If resistance in step n is not within limits, proceed as follows:

(1) Cut lockwire and disconnect electrical connector P420.

(2) Check insulation resistance of indicator lead between junction box and engine-to-airframe jack. Resistance must be more than 20,000 ohms.

(3) Check insulation resistance of airframe indicator lead between P420 and P259. Resistance must be more than 20,000 ohms.

(4) Connect electrical connector P420 and secure with MS20995C32 lockwire.

p. Connect insulation adapter negative lead to forward (negative) terminal of T5.1 junction box.

q. Connect positive lead to aft (positive) terminal. Check that resistance is more than 20,000 ohms.

r. Place FUNCTION SELECTOR SWITCH in OFF.

s. Disconnect trim set cables.

t. Secure amplifier white lead (19) to positive terminal with washer (18), spring (17), and bolt (16). Tighten bolt to 3 (±1) inch-pounds torque.

u. Secure amplifier green lead (15) to negative terminal with washer (14), spring (13), and bolt (12). Tighten bolt to 16 (+2, −1) inch-pounds torque.

v. Place indicator white lead (10), T5.1 thermocouple harness white lead (8), and amplifier white lead (6) on positive terminal of junction box.

w. Place indicator green lead (11), T5.1 thermocouple harness green lead (9), and amplifier green lead (7) on negative terminal of junction box.

CAUTION

To prevent damage to ballast resistor, use extreme care when installing. Changing the value of the resistor will cause low TOP or undetected overtemperature. Refer to engine logbook for value of ballast resistor.

x. Place ballast resistor(s) (5) and terminal isolation plate (4) on terminals. Secure with washers (3) and nuts (2). Tighten nuts to 25 inch-pounds torque.

y. Install junction box cover (1).

z. Install turbine outlet temperature indicator (paragraph 3-26).

aa. Close accesses 6222-3 and 5222-1.

ab. Install engine removal door (T.O. 1A-7D-2-1).

3-14.5. Turbine Outlet Temperature Indicator Check.

a. Open access 5222-1, cut lockwire, and disconnect electrical connector P420.

b. Set switch controls on Jetcal analyzer trim set as follows:

Control	*Position*
INSUL CHECK SWITCH	R X100
RES CHECK SWITCH A/C AND IND	NULL BAL
PRESSURE SWITCH	OFF
TEMP INPUT SWITCH	HEATER CABLE
RPM SWITCH	OFF
A/C IND ADJ	Fully counterclockwise
DECK LIGHT SWITCH	As required
TEMP SWITCH	OPERATE
PER CENT TEMP CONTROL	0.0
FUNCTION SELECTOR SWITCH	OFF
SPREAD SWITCH	ALL

WARNING

To prevent injury to personnel, make sure Jetcal analyzer trim set is grounded with pigtail on power cable.

c. Connect trim set as shown in figure 3-15. Connect BH10554 cable adapter between BH485 test cable and electrical connector P420.

d. Place trim set FUNCTION SELECTOR SWITCH in TRIM T/C. Warm up for 10 minutes.

e. Place TEMP SWITCH in CAL 600°C.

f. Adjust CAL ADJ until TEMP indicator indicates 600°C (1,112°F).

g. Place FUNCTION SELECTOR SWITCH in A/C IND.

h. Place TEMP SWITCH in OPERATE.

i. Adjust A/C IND ADJ control clockwise until 600°C (1,112°F) is indicated on TEMP readout.

NOTE

If indication is out of limits, replace turbine outlet temperature indicator (paragraph 3-26).

j. Check that turbine outlet temperature indicator indicates 600° (±5°)C (1,112° (±9°)F).

k. Slowly adjust A/C IND ADJ control clockwise until engine hot light comes on. TEMP readout shall indicate 622° (+3°, −2°)C (1,152° (+5°, −4°)F). Continue to slowly adjust A/C IND ADJ control clockwise, increasing indicator temperature to 750°C (1,382°F). Check that engine hot light remains on.

l. Slowly adjust A/C IND ADJ control counterclockwise, decreasing indicator temperature indication until engine hot light goes off. TEMP readout shall be between 610° and 625°C (1,130° and 1,157°F).

m. Place FUNCTION SELECTOR SWITCH in OFF.

n. Disconnect trim set cables.

o. Connect and lock-wire electrical connector P420. Close access 5222-1.

3-15. HIGH PRESSURE ROTOR TACHOMETER SYSTEM TEST.

Test Equipment Required

Figure & index No.	Name	AN type designation	Use and application
	Equipment required for engine operation		Operate engine
	Equipment required for connecting external electrical power		Provide electrical power
	Jetcal analyzer trim set	H119M (Howell Instruments, Inc, Fort Worth, Texas)	Measure high pressure rotor speed

a. Open access 5222-1.

b. Cut lockwire and disconnect electrical connector from tachometer generator on forward side of the high speed gearbox.

WARNING

To prevent injury to personnel, make sure Jetcal analyzer trim set is grounded with pigtail on power cable.

c. Connect trim set as shown in figure 3-15. Connect BH907-85 test cable adapter to BH485 test cable, airplane connector P503 (tachometer), and tachometer generator connector (access 5222-1).

d. Place FUNCTION SELECTOR SWITCH in TRIM T/C position. Warm up test set for 10 minutes.

e. Place RPM SWITCH in CAL 100% position.

f. Adjust CAL ADJ potentiometer for 100% indication on trim set RPM indicator.

g. Place RPM SWITCH in OPERATE position.

h. Start engine (T.O. 1A-7D-2-1) and stabilize at IDLE.

NOTE

Tolerances between trim set rpm indicator and airplane tachometer are not critical below 90% rpm. If the airplane tachometer indicator is out of tolerance above 90% rpm, the indicator shall be rejected.

i. With engine at idle, compare trim set rpm with tachometer indication. Tachometer indicator shall not vary from trim set rpm indicator more than ±0.7%.

j. Advance throttle and check rpm indications at two points above 90%. Tachometer indicator shall not vary from trim set rpm indicator more than ±0.7%.

k. Shut down engine (T.O. 1A-7D-2-1).

l. Place FUNCTION SELECTOR SWITCH in OFF.

m. Disconnect trim set cables.

n. Connect electrical connector to tachometer generator. Secure with MS20995C32 lockwire.

o. Close access 5222-1.

3-16. TURBINE OUTLET PRESSURE INDICATOR REMOVAL AND INSTALLATION.

3-16.1. Removal.

a. Turn round head screw counterclockwise until clamp tension on indicator is removed.

b. Slide indicator aft until electrical connector is accessible.

c. Disconnect electrical connector and remove indicator from panel.

3-16.2. Installation.

a. Connect electrical connector to indicator.

b. Install indicator in panel mount. Turn round head screw clockwise until clamp tension secures indicator in place.

c. Perform turbine outlet pressure indicating system operational checkout (paragraph 3-4).

3-17. TURBINE OUTLET PRESSURE TRANSMITTER REMOVAL AND INSTALLATION.

3-17.1. Removal. (Figure 3-16.)

a. Open access 5131-1.

b. Disconnect electrical connector (1).

c. Disconnect Pt5.1 pressure lines (2 and 3).

d. Cut lockwire and remove screws (4), washers (5), and turbine outlet pressure transmitter (6).

e. Remove tee (7), nut (8), and packing (9).

3-17.2. Installation. (Figure 3-16.)

a. Using new packing (9), install nut (8) and tee (7).

b. Secure turbine outlet pressure transmitter (6) to bracket with washers (5) and screws (4).

c. Secure screws with MS20995C32 lockwire.

NOTE

Ensure that vent port (V) is open to atmosphere.

d. Connect Pt5.1 pressure lines (3 and 2).

e. Connect electrical connector (1).

f. Close access 5131-1.

g. Perform turbine outlet pressure indicating system operational checkout (paragraph 3-4).

3-18. P5 AIR PROBE REMOVAL AND INSTALLATION.

3-18.1. Removal. (Figure 3-17.)

a. Remove engine removal door (T.O. 1A-7D-2-1).

b. Remove temperature sensing probes from affected P5 manifold (paragraph 3-27).

c. If removing probe No. 9, 1, 2, 3, or 4, remove air tube (1).

d. If removing probe No. 5, 6, 7, or 8, remove bolt (2) and lockwasher (3).

e. Remove self-locking nuts (4), washers (5), and bolts (6).

f. Remove self-locking nuts (7) and bolts (8).

g. Remove bolts (9) and lockwashers (10).

h. Remove T5.1 thermocouple junction box (paragraph 3-30).

i. Remove bolt (11) and washer (12).

j. Remove lower P5 manifold (13) or upper P5 manifold (14).

k. Remove P5 air probe (15).

3-18.2. Installation. (Figure 3-17.)

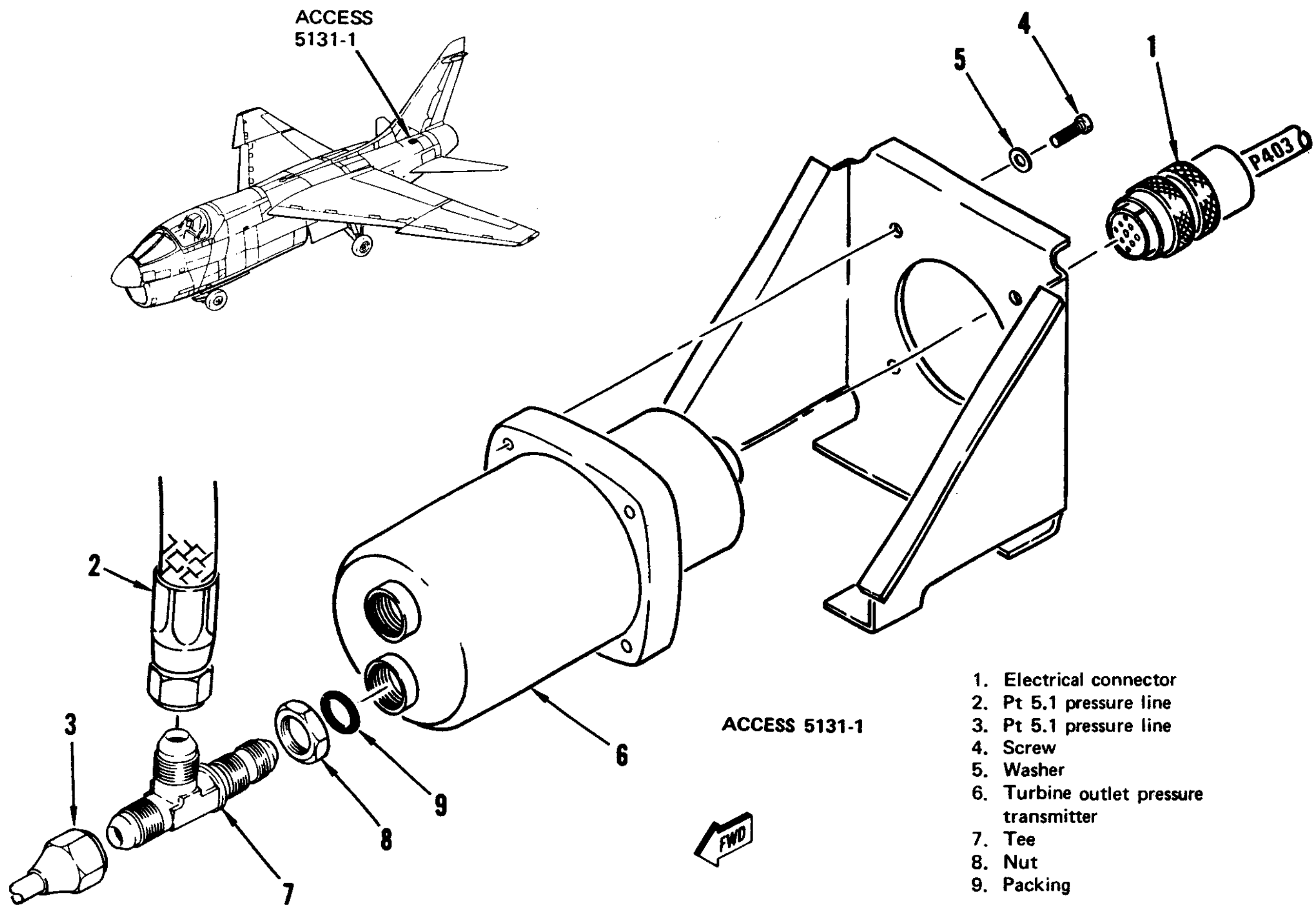
a. Insert P5 air probe (15) in engine.

b. Place upper P5 manifold (14) or lower P5 manifold (13) in position and secure with lockwashers (10) and bolts (9).

c. Install washer (12) and bolt (11).

d. Install T5.1 thermocouple junction box (paragraph 3-30).

e. Connect upper and lower manifolds with bolts (8) and self-locking nuts (7).



1. Electrical connector
2. Pt 5.1 pressure line
3. Pt 5.1 pressure line
4. Screw
5. Washer
6. Turbine outlet pressure transmitter
7. Tee
8. Nut
9. Packing

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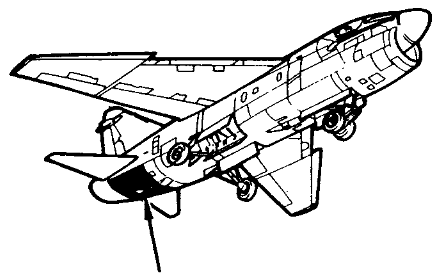
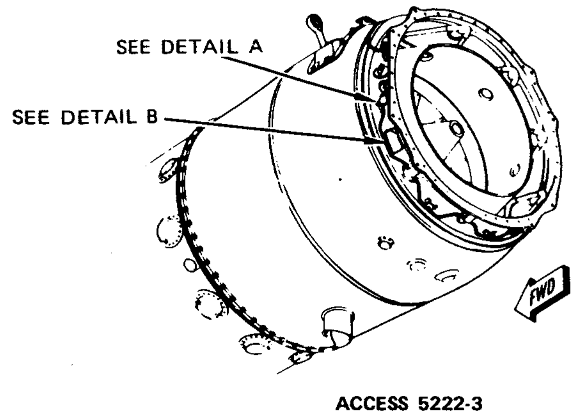
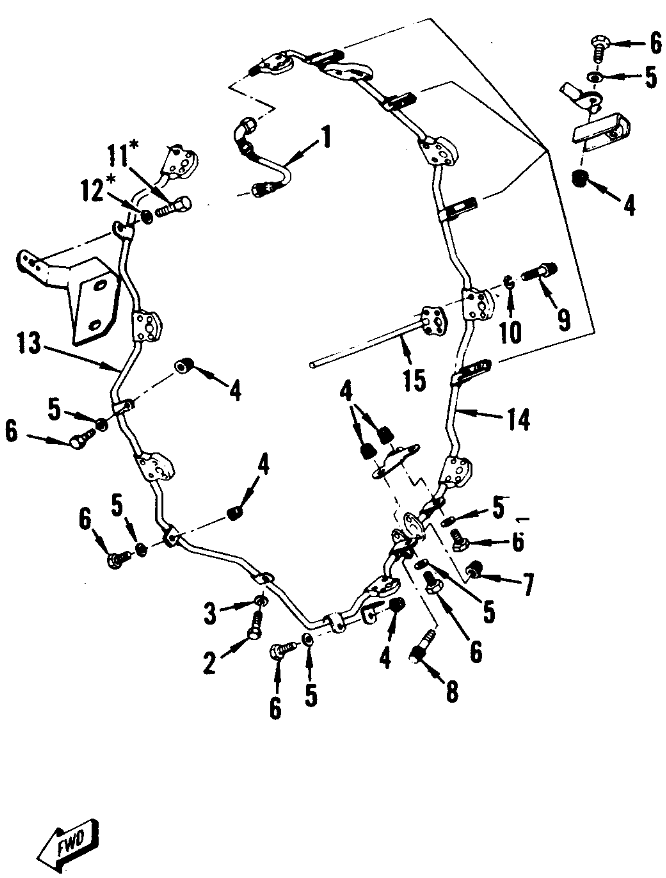
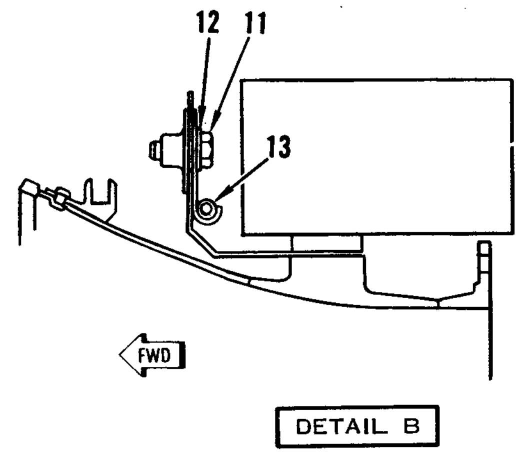
Figure 3-16. Removal and Installation; Turbine Outlet Pressure Transmitter









1. Air tube
2. Bolt
3. Lockwasher
4. Self-locking nut
5. Washer
6. Bolt
7. Self-locking nut
8. Bolt
9. Bolt
10. Lockwasher
11. Bolt
12. Washer
13. Lower P5 manifold
14. Upper P5 manifold
15. P5 air probe

NOTE

Probes are numbered clockwise as viewed from rear. No. 1 probe is located at 12 o'clock position.

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Figure 3-17. Removal and Installation; P5 Air Probe

f. Secure manifold with bolts (6), washers (5), and self-locking nuts (4).

g. If installing lower manifold, install lockwasher (3) and bolt (2).

h. If installing upper manifold, install air tube (1).

i. Install temperature sensing probes (paragraph 3-23).

j. Perform turbine outlet pressure indicating system operational checkout (paragraph 3-4).

k. Install engine removal door (T.O. 1A-7D-2-1).

3-19. OIL PRESSURE INDICATOR REMOVAL AND INSTALLATION.

3-19.1. Removal.

a. Turn round head screw counterclockwise until clamp tension on indicator is removed.

b. Slide indicator aft until electrical connector is accessible.

c. Disconnect electrical connector and remove indicator from panel.

3-19.2. Installation.

a. Connect electrical connector to indicator.

b. Install indicator in panel mount and turn round head screw clockwise until clamp tension secures indicator in place.

c. Perform oil pressure indicating system operational checkout (paragraph 3-4).

3-20. OIL PRESSURE TRANSMITTER REMOVAL AND INSTALLATION. Remove and install oil pressure transmitter through access 5222-3-1 in sequence shown in figure 3-18, observing the following steps.

WARNING

Avoid radiation contamination by adhering to exposure limits. For physical contact with the oil tank source tube, maximum safe exposure time is 15 minutes at one time or a total of 20 minutes per week. At a distance of 12 inches from the source tube, maximum time is 3.3 hours per week. There is no exposure time limit 3 feet from source tube. Deviations to these limits shall be approved by the base medical service. Personnel working with or near this source tube shall become familiar with the procedures in T.O. 00-110N-11.

a. Tubes (2 and 3) must be removed from transmitter and differential pressure switch.

b. Use new packings (7 and 10).

c. Secure nut (4) to engine bracket with MS20995C32 lockwire.

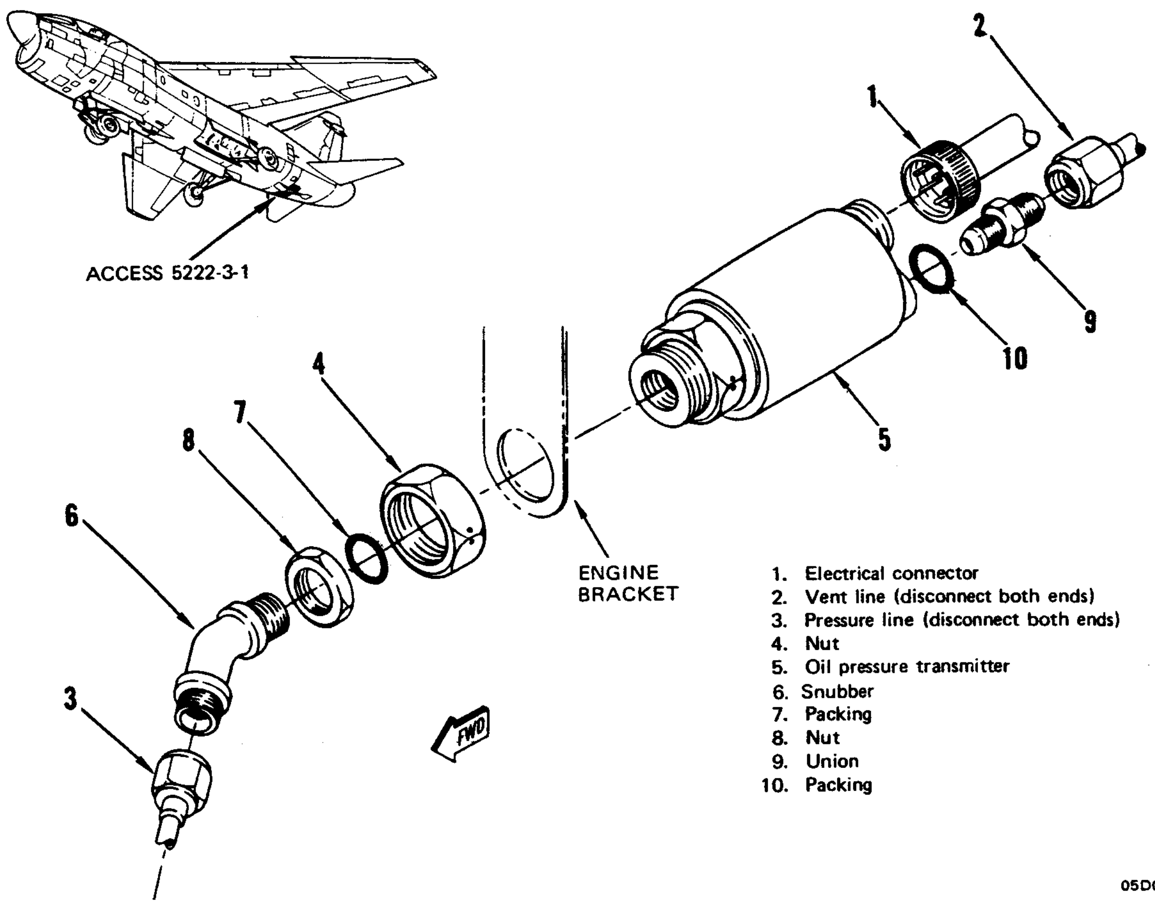
d. Secure electrical connector (1) with MS20995C32 lockwire.

e. Perform oil pressure indicating system operational checkout (paragraph 3-4). Do not shut down engine following operational checkout until steps f and g are accomplished.

f. With engine operating at idle rpm, open pressure line (3) at elbow (6) and bleed air from line.

g. Tighten pressure line (3) and check installation for leaks.

3-21. PRESSURE DIFFERENTIAL SWITCH REMOVAL AND INSTALLATION. Remove and install pressure differential switch through access 5222-3-1 in sequence shown in figure 3-19, observing the following steps.



1. Electrical connector
2. Vent line (disconnect both ends)
3. Pressure line (disconnect both ends)
4. Nut
5. Oil pressure transmitter
6. Snubber
7. Packing
8. Nut
9. Union
10. Packing

Figure 3-18. Removal and Installation; Oil Pressure Transmitter

WARNING

Avoid radiation contamination by adhering to exposure limits. For physical contact with the oil tank source tube, maximum safe exposure time is 15 minutes at one time or a total of 20 minutes per week. At a distance of 12 inches from the source tube, maximum time is 3.3 hours per week. There is no exposure time limit 3 feet from source tube. Deviations from these limits shall be approved by the base medical service. Personnel working with or near this source tube shall become familiar with the procedures in T.O. 00-110N-11.

a. Do not apply tools to or twist electrical connector (1). This is a push-pull type connector.

b. Remove tubes (2 and 3) from airplane to prevent interference during switch removal and installation.

c. Secure nut (7) to engine bracket with MS20995C32 lockwire.

d. Use new packings (5 and 10).

e. Following installation, perform oil pressure indicating system operational checkout (paragraph 3-4). Check installation for leaks.

3-22. OIL FILTER BYPASS SWITCH REMOVAL AND INSTALLATION. Remove and install oil filter bypass switch in sequence shown in figure 3-20 through access 5222-3-1, observing the following steps.

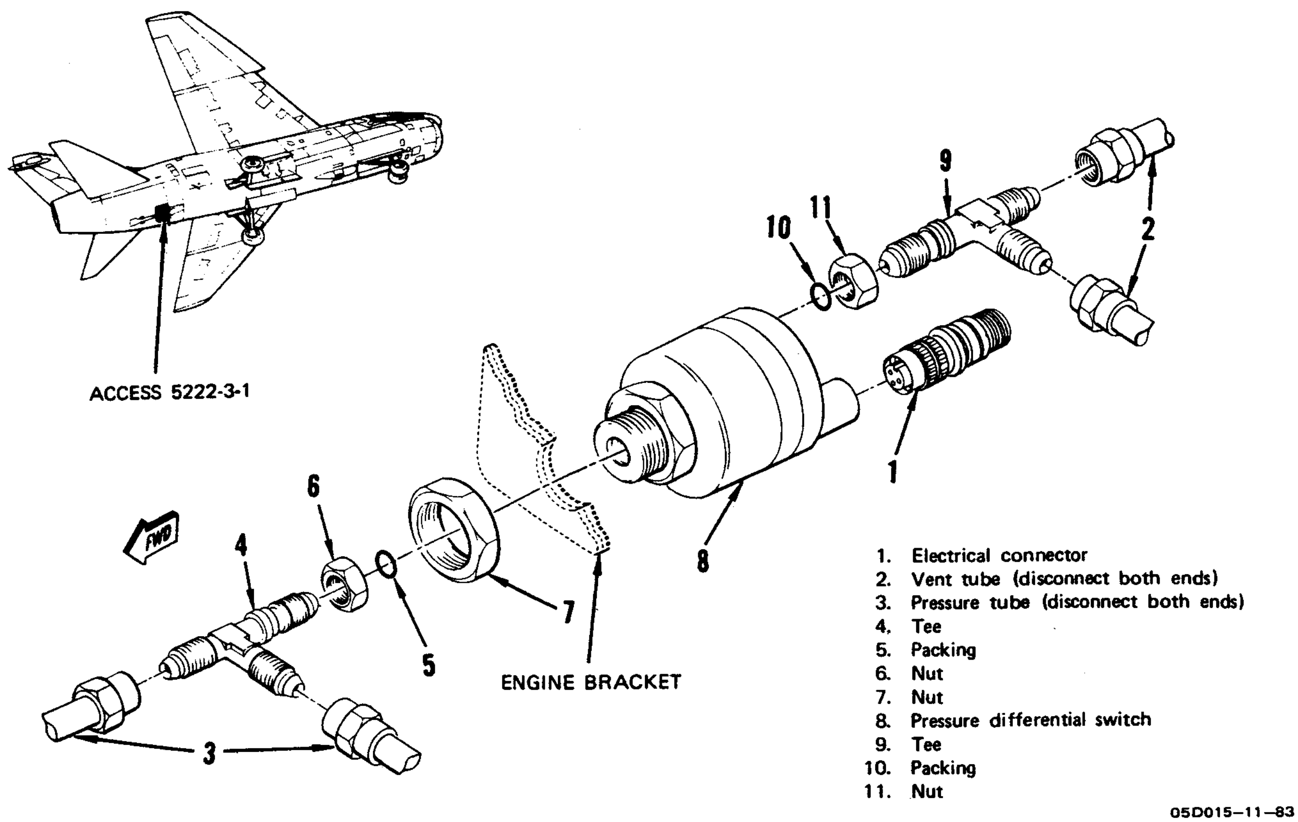


Figure 3-19. Removal and Installation; Pressure Differential Switch

WARNING

Avoid radiation contamination by adhering to exposure limits. For physical contact with the oil tank source tube, maximum safe exposure time is 15 minutes at one time or a total of 20 minutes per week. At a distance of 12 inches from the source tube, maximum time is 3.3 hours per week. There is no exposure time limit 3 feet from source tube. Deviations from these limits shall be approved by the base medical service. Personnel working with or near this source tube shall become familiar with the procedures in T.O. 00-110N-11.

a. Extend arresting gear (T.O. 1A-7D-2-7) to afford access.

b. Do not use tools or twist electrical connector (1). This is a push-pull type connector.

c. Use new packings for installation.

d. After installation, perform oil pressure indicating system operational checkout (paragraph 3-4).

e. Retract arresting gear (T.O. 1A-7D-2-7).

3-23. OIL QUANTITY INDICATOR REMOVAL AND INSTALLATION.

3-23.1. Removal.

a. Turn round head screw counterclockwise until clamp tension on indicator is removed.

b. Slide indicator aft until electrical connector is accessible.

c. Disconnect electrical connectors and remove indicator from panel.

3-23.2. Installation.

a. Check that seal is installed in connector P242.

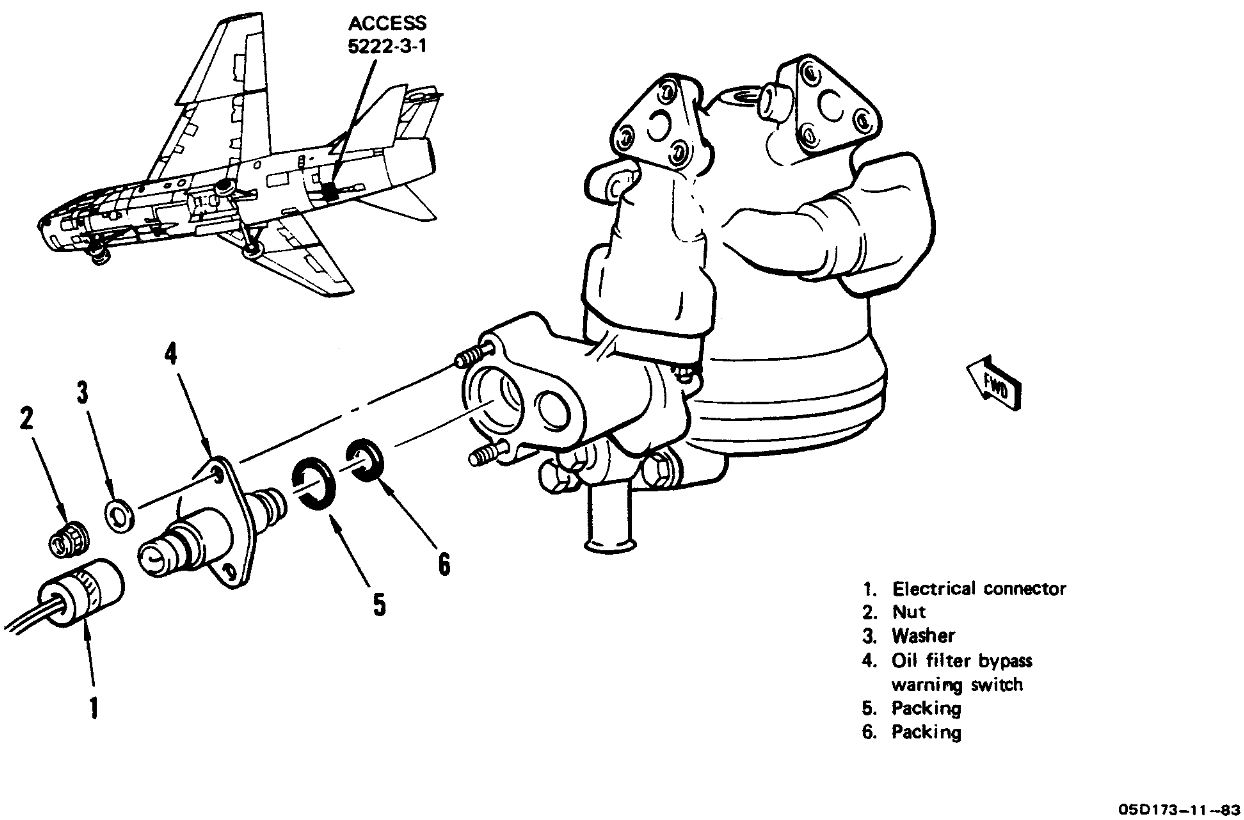


Figure 3-20. Removal and Installation; Oil Filter Bypass Switch

b. Connect electrical connectors to indicator.

c. Install indicator in panel mount and turn round head screw clockwise until clamp tension secures indicator in place.

NOTE

On airplanes after T.O. 1A-7-596, system calibration is not necessary on indicator.

d. Perform oil quantity indicating system calibration (paragraph 3-12).

3-24. SOURCE UNIT REMOVAL AND INSTALLATION.

WARNING

Avoid radiation contamination by adhering to exposure limits. For physical contact with the oil tank source tube, maximum safe exposure time is 15 minutes at one time or a total of 20 minutes per week. At a distance of 12 inches from the source tube, maximum time is 3.3 hours per week. There is no exposure time limit 3 feet from source tube. Deviations from these limits shall be approved by the base medical service. Personnel working with or near this source tube shall become familiar with the procedures in T.O. 00-110N-11.

NOTE

On airplanes after T.O. 1A-7-596, refer to sight glass removal and installation (paragraph 9-12).

3-24.1. Removal. (Figure 3-21.)

a. Extend arresting gear (T.O. 1A-7D-2-7).

b. Open access 5222-3-1.

c. Remove bolt (1) and bracket (2).

d. Remove nuts, bolts, clamps (3, 4, and 5), and source unit (6).

3-24.2. Installation. (Figure 3-21.)

a. Position source unit (6) on oil tank, and secure with clamps (5, 4, and 3), bolts, and nuts.

CAUTION

To prevent damaging or rupturing source tube, use extreme care during installation.

b. Install bracket (2) with bolt (1).

c. Close access 5222-3-1.

d. Retract arresting gear (T.O. 1A-7D-2-7).

e. Perform oil quantity indicating system calibration (paragraph 3-12).

3-25. DETECTOR UNIT REMOVAL AND INSTALLATION.

WARNING

Avoid radiation contamination by adhering to exposure limits. For physical contact with the oil tank source tube, maximum safe exposure time is 15 minutes at one time or a total of 20 minutes per week. At a distance of 12 inches from the source tube, maximum time is 3.3 hours per week. There is no exposure time limit 3 feet from source tube. Deviations from these limits shall be approved by the base medical service. Personnel working with or near this source tube shall become familiar with the procedures in T.O. 00-110N-11.

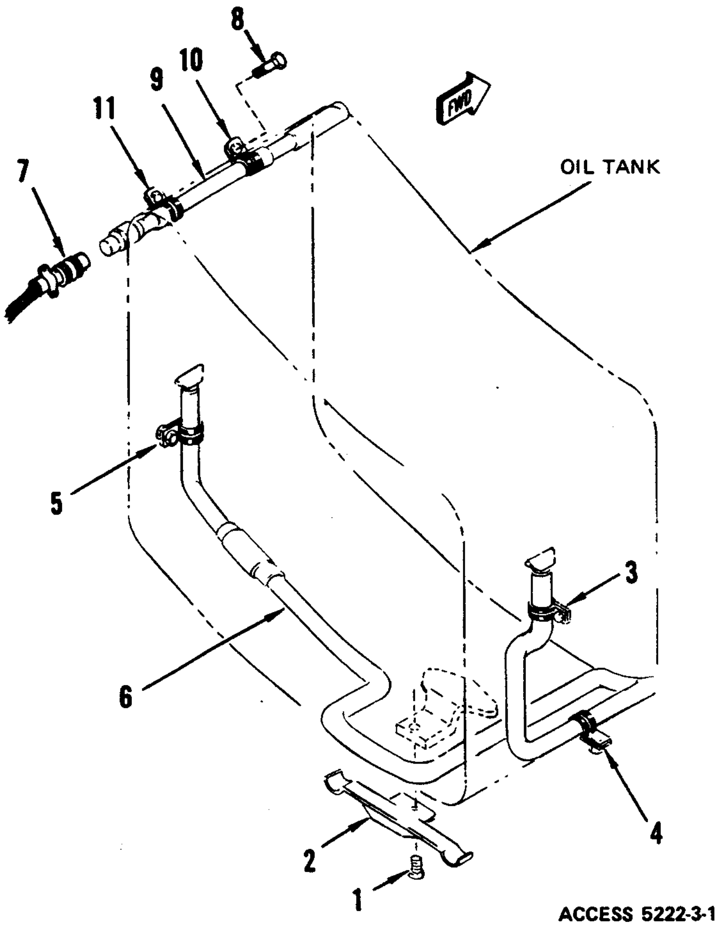
3-25.1. Removal. (Figure 3-21.)

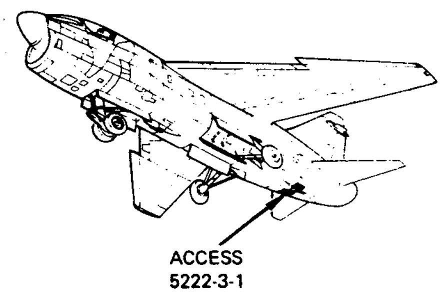
a. Open access 5222-2.

b. Disconnect electrical connector (7).

c. Remove bolts (8) and detector unit (9).

d. Remove clamps (10 and 11).





1. Bolt
2. Bracket
3. Clamp
4. Clamp
5. Clamp
6. Source unit
7. Electrical connector
8. Bolt
9. Detector unit
10. Clamp
11. Clamp

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Figure 3-21. Removal and Installation; Source Unit and Detector Unit

3-25.2. Installation. (Figure 3-21.)

NOTE

Apply adhesive S-1006 (Rayclad Tubes, Inc, Redwood City, California) to inner surface of clamp (10) and corresponding clamping surface of detector.

a. Position clamp (11) on aft end of detector unit (9).

b. Position clamp (10) on detector and attach detector to bracket with bolts (8).

c. Check that seal is installed in electrical connector (7).

d. Connect electrical connector to detector.

e. Perform oil quantity indicating system calibration (paragraph 3-12).

f. Close access 5222-2.

3-26. TURBINE OUTLET TEMPERATURE INDICATOR REMOVAL AND INSTALLATION.

3-26.1. Removal.

a. Turn round head screw counterclockwise until clamp tension on indicator is removed.

b. Slide indicator aft until electrical connector is accessible.

c. Disconnect electrical connector and remove indicator from panel.

3-26.2. Installation.

a. Connect electrical connector to indicator.

b. Install indicator in panel mount and turn round head screw clockwise until clamp tension secures indicator in place.

c. Perform turbine outlet temperature indicating system operational checkout (paragraph 3-4).

3-27. TEMPERATURE SENSING PROBE REMOVAL AND INSTALLATION.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
	GGG-W-686	Torque wrench, 0 to 50 inch-pounds	Measure torque

3-27.1. Removal. (Figure 3-22.)

a. Remove engine removal door (T.O. 1A-7D-2-1).

NOTE

Removable panels on left and right bulkheads give clearance for removing probes at 4 and 8 o'clock positions.

b. Loosen captive nuts and disconnect T5.1 thermocouple harness white positive lead (1) and T5.1 thermocouple harness green negative lead (2).

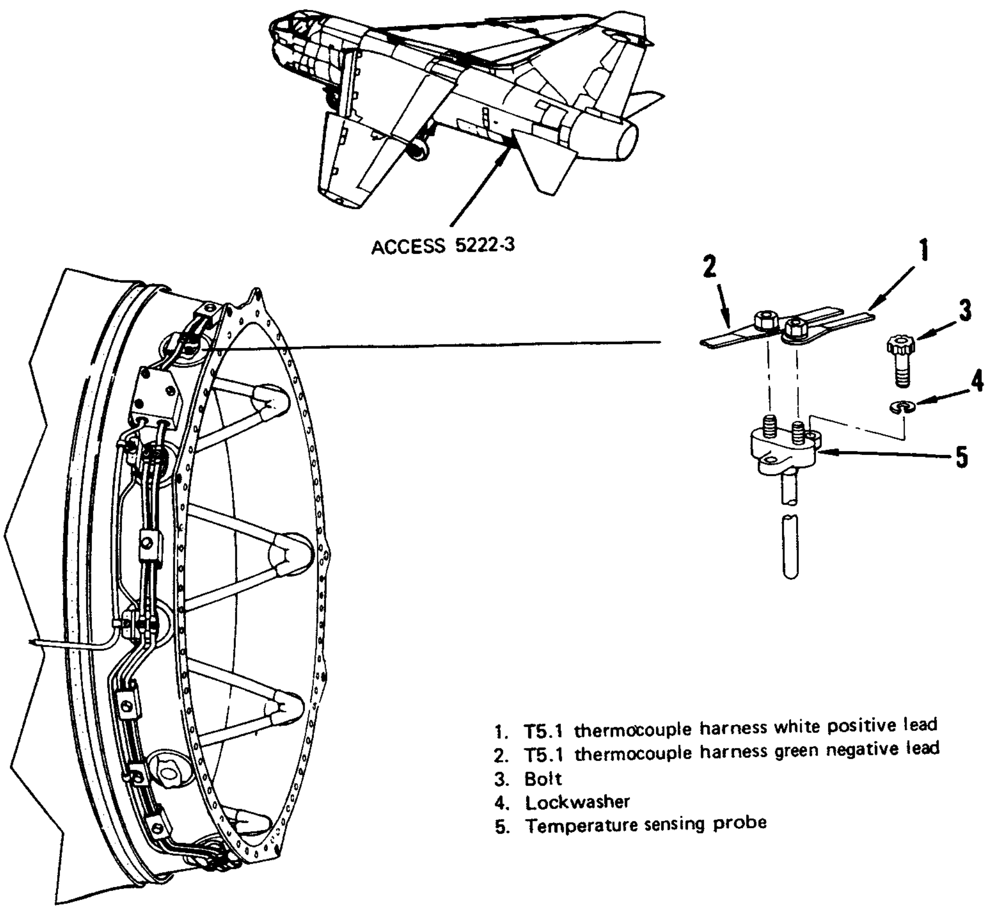
c. Remove bolts (3), lockwashers (4), and temperature sensing probe (5).

3-27.2. Installation. (Figure 3-22.)

NOTE

The probes are made with a small positive (Chromel) terminal stud and a large negative (Alumel) stud to aid in proper installation of the harness. Also, the small studs are on a white background to match the harness color. The temperature sensing probe shall be installed with the negative terminal (large stud — green background) forward.

a. Insert temperature sensing probe (5) through outer mixer fairing and inner mixer fairing with negative terminal stud forward.



1. T5.1 thermocouple harness white positive lead
2. T5.1 thermocouple harness green negative lead
3. Bolt
4. Lockwasher
5. Temperature sensing probe

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Figure 3-22. Removal and Installation; Temperature Sensing Probe

b. Secure temperature sensing probe to outer mixer fairing with two lockwashers (4) and two bolts (3).

c. Install T5.1 thermocouple harness green negative lead (2) on large terminal stud. Secure with captive nut. Tighten nut to 25 inch-pounds torque.

d. Install T5.1 thermocouple harness white positive lead (1) on small terminal stud. Secure with captive nut. Tighten nut to 25 inch-pounds torque.

e. Perform T5.1 thermocouple system continuity check (subparagraph 3-14.3).

f. Install engine removal door (T.O. 1A-7D-2-1).

3-28. T5.1 THERMOCOUPLE HARNESS REMOVAL AND INSTALLATION.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
	AN/URM-90	Bridge	Measure resistance
	H119M	Jetcal analyzer trim set (Howell Instruments, Inc, Fort Worth, Texas)	Measure resistance
	GGG-W-686	Torque wrench, 0 to 50 inch-pounds	Measure torque

3-28.1. Removal. (Figure 3-23.)

a. Remove engine removal door (T.O. 1A-7D-2-1).

b. Open access 5131-1.

c. Loosen captive nuts (1 and 2) and disconnect leads from all temperature sensing probes.

d. If harness covers are used, remove bolts (3), lockwashers (4), and harness covers (5).

e. If harness uses clamps, remove bolts (6), lockwashers (7), and washers (8 and 9).

f. Remove junction box cover (10).

CAUTION

To prevent damage to ballast resistor, use extreme care when removing. Changing the value of the resistor will cause low TOP or undetected overtemperature. Refer to engine logbook for value of ballast resistor.

g. Remove nuts (11), washers (12), terminal isolation plate (13), and ballast resistor(s) (14).

h. Disconnect amplifier white lead (15) from positive terminal, and remove T5.1 thermocouple white harness (16).

i. Disconnect amplifier green lead (17) from negative terminal, and remove T5.1 thermocouple green harness (18).

3-28.2. Installation. (Figure 3-23.)

NOTE

The probes are made with a small positive (Chromel) terminal stud and a large negative (Alumel) stud to aid in proper installation of the harness. Also, the small studs are on a white background to match the harness color.

a. Insert terminal end of T5.1 thermocouple green harness (18) through top hole in junction box.

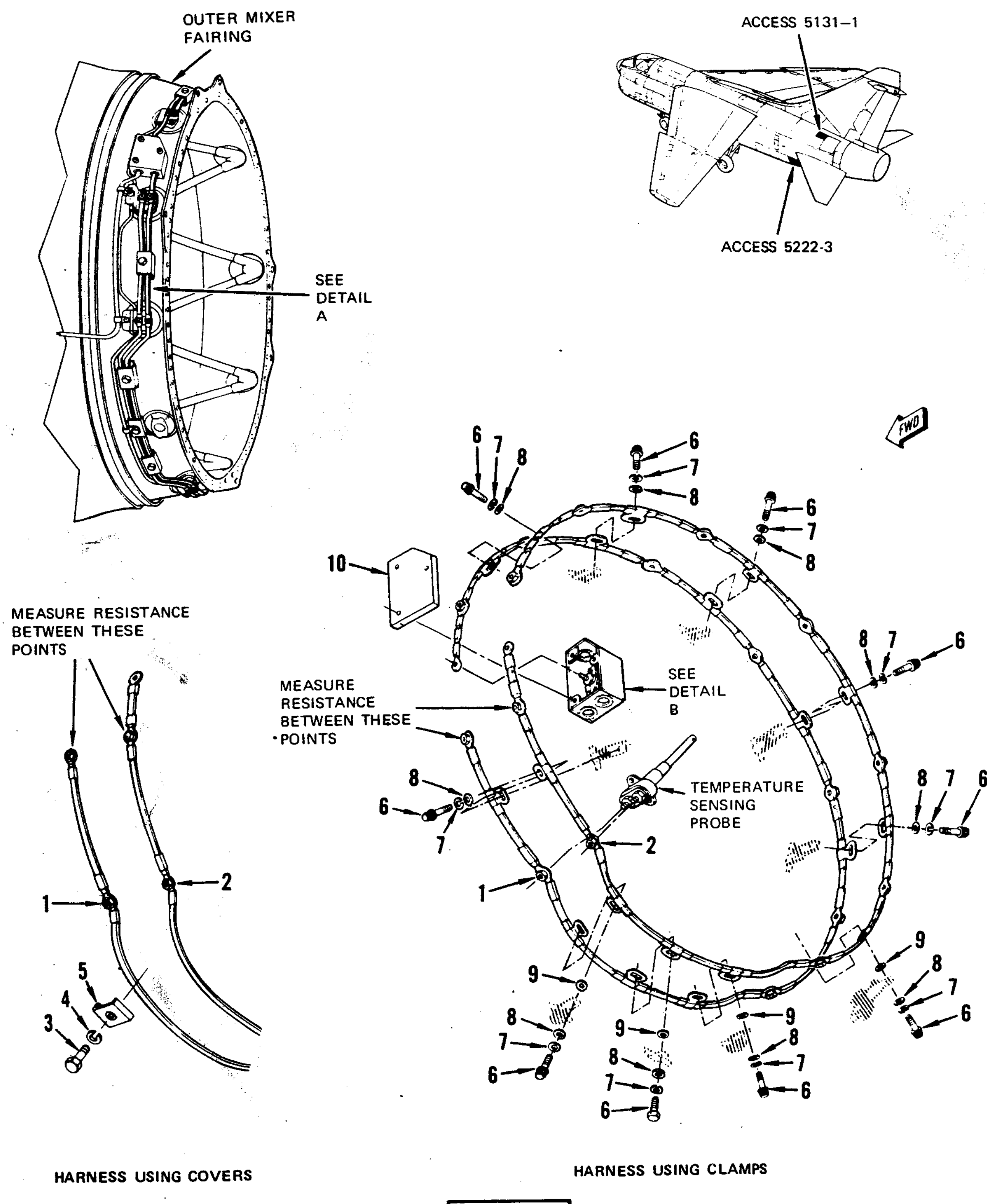
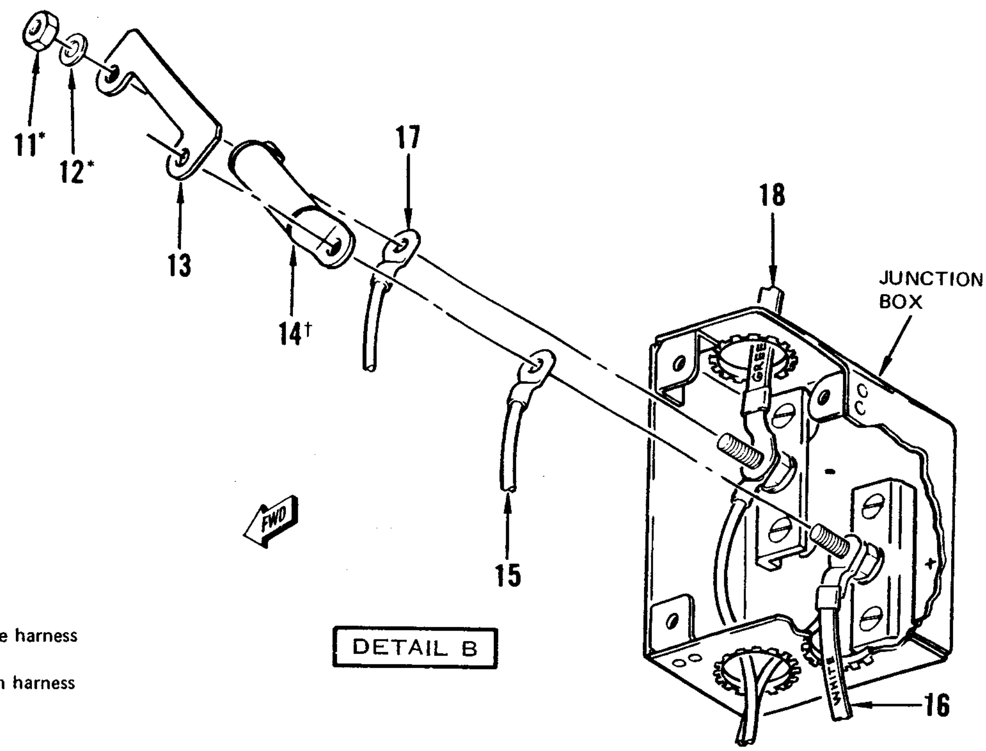


Figure 3-23. Removal and Installation; T5.1 Thermocouple Harness (Sheet 1 of 2)



1. Captive nut
2. Captive nut
3. Bolt
4. Lockwasher
5. Harness cover
6. Bolt
7. Lockwasher
8. Washer
9. Washer
10. Junction box cover
*11. Nut
*12. Washer
13. Isolation plate
†14. Ballast resistor
15. Amplifier white lead
16. T5.1 thermocouple white harness
17. Amplifier green lead
18. T5.1 thermocouple green harness

*Nuts and washers are special parts, do not substitute bench stock items.
†If two ballast resistors are used, install back to back.

Figure 3-23. Removal and Installation; T5.1 Thermocouple Harness (Sheet 2)

b. Secure green harness to temperature sensing probes with captive nuts (1). Tighten nuts to 25 inch-pounds torque.

c. Insert terminal end of T5.1 thermocouple white harness (16) through bottom hole in junction box.

d. Secure white harness to temperature sensing probes with captive nuts (2). Tighten nuts to 25 inch-pounds torque.

e. If harness uses clamps, secure clamps to engine with washers (9 and 8), lockwashers (7), and bolts (6).

CAUTION

To prevent damage to thermocouple harness, ensure harness covers clear harness leads when bolts are tightened.

f. If harness covers (5) are used, secure covers to engine with lockwashers (4) and bolts (3).

g. Check resistance of temperature sensing probes and harness between green and white harness lead terminals. Resistance must be from 0.6 to 0.7 ohm.

h. If resistance is not within limits, proceed as follows:

(1) Loosen captive nuts and disconnect T5.1 thermocouple harness from temperature sensing probes.

NOTE

If resistance is not within limits, replace temperature sensing probe (paragraph 3-27).

(2) Check resistance of each temperature sensing probe between terminals. Resistance must be 4.5 (±0.1) ohms.

(3) Connect T5.1 thermocouple harness to temperature sensing probes with captive nuts.

(4) Tighten nuts to 25 inch-pounds torque.

i. Set switch controls on Jetcal analyzer trim set as follows:

Control	*Position*
INSUL CHECK SWITCH	R X100
RES CHECK SWITCH A/C AND IND	NULL BAL
PRESSURE SWITCH	OFF
TEMP INPUT SWITCH	HEATER CABLE
RPM SWITCH	OFF
A/C IND ADJ	Fully counterclockwise
DECK LIGHT SWITCH	As required
TEMP SWITCH	OPERATE
PER CENT TEMP CONTROL	0.0
FUNCTION SELECTOR SWITCH	OFF
SPREAD SWITCH	ALL

WARNING

To prevent injury to personnel, make sure Jetcal analyzer trim set is grounded with pigtail on power cable.

j. Connect trim set as shown in figure 3-15 for performing insulation resistance check.

k. Connect insulation adapter negative lead to airplane ground and positive lead to white T5.1 thermocouple harness terminal.

l. Place trim set FUNCTION SELECTOR SWITCH in INSUL. Check that resistance exceeds 20,000 ohms.

m. Connect positive lead to green thermocouple harness terminal. Check that resistance exceeds 20,000 ohms.

n. Place FUNCTION SELECTOR SWITCH in OFF.

o. Disconnect trim set cables.

p. Make sure that washer and green indicator lead are installed on negative terminal.

q. Place T5.1 thermocouple green harness (18) lead and amplifier green lead (17) on negative terminal.

r. Ensure that washer and white indicator lead are installed on positive terminal.

s. Place T5.1 thermocouple white harness lead (16) and amplifier white lead (15) on positive terminal.

CAUTION

To prevent damage to ballast resistor, use extreme care when installing. Changing the value of the resistor will cause low TOP or undetected overtemperature. Refer to engine logbook for value of ballast resistor.

t. Place ballast resistor(s) (14) and terminal isolation plate (13) on junction box terminals and secure with washers (12) and nuts (11). Tighten nuts to 25 inch-pounds torque.

u. Install junction box cover (10).

v. Perform T5.1 point dynamic test (subparagraph 7-9.2 or 7-10.2).

w. Perform turbine outlet pressure check (paragraph 4-12).

x. Install engine removal door (T.O. 1A-7D-2-1).

y. Close access 5131-1.

3-29. BALLAST RESISTOR REMOVAL AND INSTALLATION.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
	GGG-W-686	Torque wrench, 0 to 50 inch-pounds	Measure torque

3-29.1. Removal. (Figure 3-24.)

a. Remove engine removal door (T.O. 1A-7D-2-1).

b. Remove junction box cover (1).

c. Remove nuts (2), terminal isolation plate (3), washers (4), and ballast resistor(s) (5)

3-29.2. Installation. (Figure 3-24.)

a. Determine value of ballast resistor from engine logbook.

b. Select resistor part number that gives proper resistance. If two resistors are required, use the following formula to figure value of resistors required:

$$R \text{ (total)} = \frac{R1 \times R2}{R1 + R2}$$

CAUTION

To prevent damage to ballast resistor, use extreme care when installing. Changing the value of the resistor will cause low TOP or undetected overtemperature.

c. Place ballast resistor(s) (5) and terminal isolation plate (4) on junction box terminals and secure with washers (3) and nuts (2). Tighten nuts to 25 inch-pounds torque.

d. Install junction box cover (1).

e. Perform T5 point dynamic test (subparagraph 7-9.2 or 7-10.2).

f. Perform turbine outlet pressure check (paragraph 4-12).

g. Install engine removal door (T.O. 1A-7D-2-1).

3-30. T5.1 THERMOCOUPLE JUNCTION BOX REMOVAL AND INSTALLATION.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
	GGG-W-686	Torque wrench, 0 to 50 inch-pounds	Measure torque

3-30.1. Removal. (Figure 3-25.)

a. Remove engine removal door (T.O. 1A-7D-2-1).

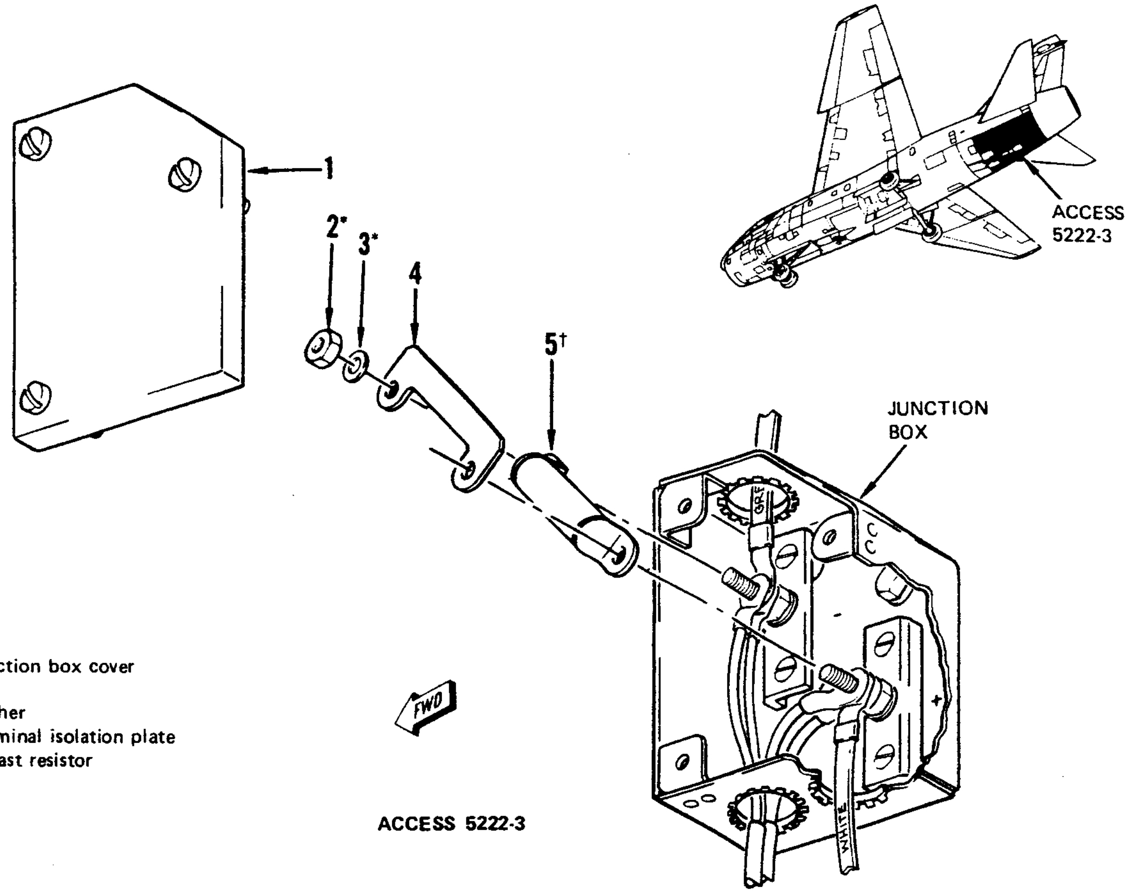
b. Remove junction box cover (1).

CAUTION

To prevent damage to ballast resistor, use extreme care when removing. Changing the value of the resistor will cause low TOP or undetected overtemperature. Refer to engine logbook for value of ballast resistor.

c. Remove nuts (2), washers (3), terminal isolation plate (4), and ballast resistor(s) (5).

d. Disconnect amplifier green lead (6), T5.1 thermocouple harness green lead (7), and indicator green lead (8), and remove washer (9).



1. Junction box cover
*2. Nut
*3. Washer
4. Terminal isolation plate
†5. Ballast resistor

ACCESS 5222-3

*Nuts and washers are special parts, do not substitute bench stock items.
†If two ballast resistors are used, install back to back.

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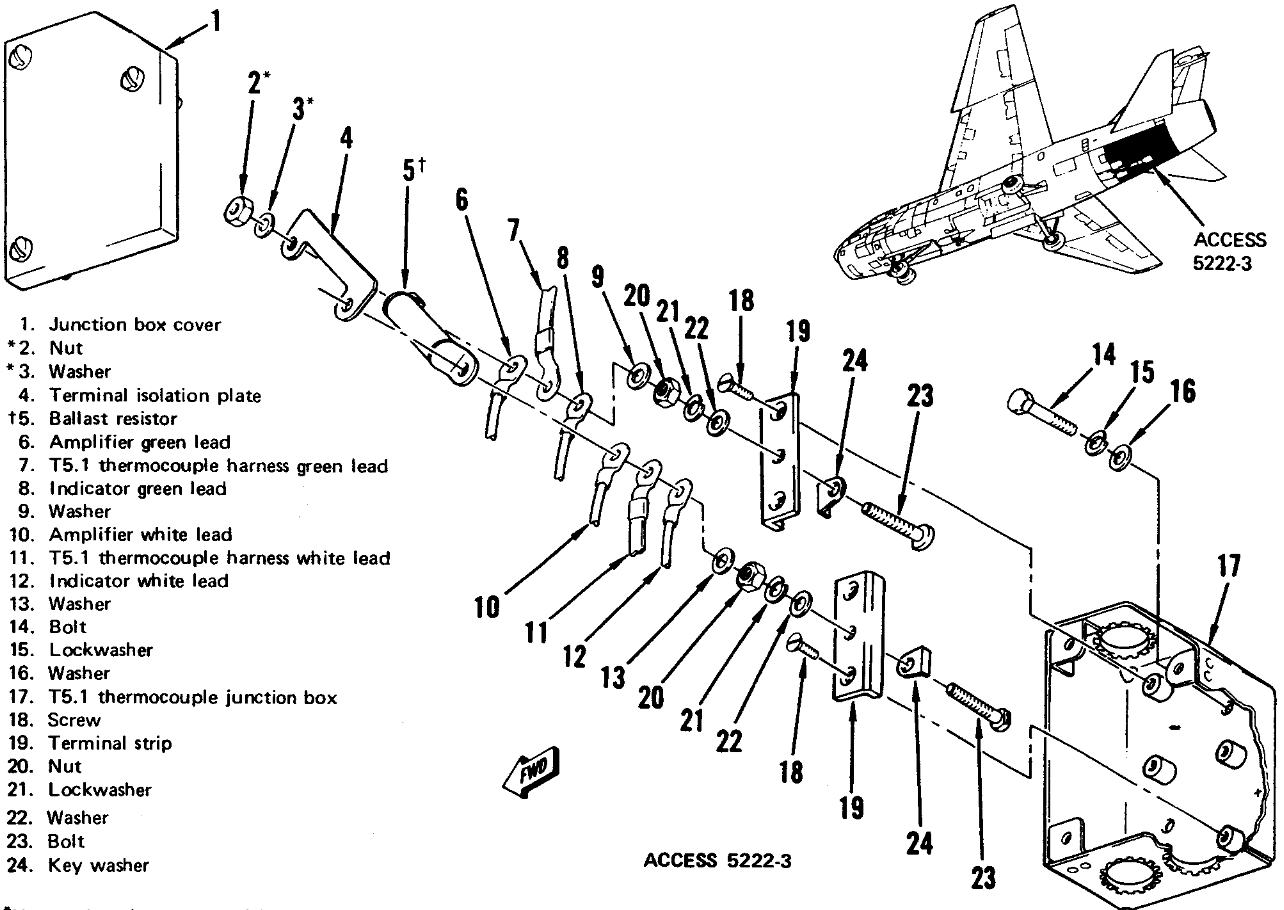
Figure 3-24. Removal and Installation; Ballast Resistor



1. Junction box cover
*2. Nut
*3. Washer
4. Terminal isolation plate
†5. Ballast resistor
6. Amplifier green lead
7. T5.1 thermocouple harness green lead
8. Indicator green lead
9. Washer
10. Amplifier white lead
11. T5.1 thermocouple harness white lead
12. Indicator white lead
13. Washer
14. Bolt
15. Lockwasher
16. Washer
17. T5.1 thermocouple junction box
18. Screw
19. Terminal strip
20. Nut
21. Lockwasher
22. Washer
23. Bolt
24. Key washer

*Nuts and washers are special parts, do not substitute bench stock items.
†If two ballast resistors are used, install back to back.

Figure 3-25. Removal and Installation; T5.1 Thermocouple Junction Box

e. Disconnect amplifier white lead (10), T5.1 thermocouple harness white lead (11), and indicator white lead (12), and remove washer (13).

f. Remove bolts (14), lockwahers (15), washers (16), and T5.1 thermocouple junction box (17).

g. Remove screw (18) and terminal strips (19).

h. Remove nuts (20), lockwashers (21), washers (22), bolts (23), and key washers (24).

3-30.2. Installation. (Figure 3-25.)

a. Place key washers (24) on bolts (23) and install in terminal strips (19). Secure to strip with washers (22), lockwashers (21), and nuts (20). Tighten nuts to 25 inch-pounds torque.

b. Place terminal strips in T5.1 thermocouple junction box (17), and secure with screws (18).

c. Secure junction box to engine with washers (16), lockwashers (15), and bolts (14).

d. Place washer (13), indicator white lead (12), T5.1 thermocouple white lead (11), and amplifier white lead (10) on 10-32 positive terminal.

e. Place washer (9), indicator green lead (8), T5.1 thermocouple green lead (7), and amplifier white lead (6) on 1/4-28 negative terminal.

CAUTION

To prevent damage to ballast resistor, use extreme care when installing. Changing the value of the resistor will cause low TOP or undetected overtemperature. Refer to engine logbook for value of ballast resistor.

f. Place ballast resistor(s) (5) and terminal isolation plate (4) on terminals and secure with washers (3) and nut (2). Tighten nuts to 25 inch-pounds torque.

g. Install junction box cover (1).

h. Perform T5 point dynamic test (subparagraph 7-9.2 or 7-10.2).

i. Install engine removal door (T.O. 1A-7D-2-1).

3-31. FUEL FLOW INDICATOR REMOVAL AND INSTALLATION.

3-31.1. Removal.

a. Turn round head screw counterclockwise until clamp tension on indicator is removed.

b. Slide indicator aft until electrical connector is accessible.

c. Disconnect electrical connector and remove indicator from panel.

3-31.2. Installation.

a. Connect electrical connector to indicator.

b. Install indicator in panel mount. Turn round head screw clockwise until clamp tension secures indicator in place.

c. Perform fuel flow indicating system operational checkout (paragraph 3-4).

3-32. FUEL FLOW TRANSMITTER REMOVAL AND INSTALLATION.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
	GGG-W-686	Torque wrench, 10 to 150 inch-pounds	Measure torque
	413-900-020	Torque wrench, 100 to 750 inch-pounds	Measure torque

CAUTION

To prevent damage to tubes and decrease the possibility of leakage, observe precautions (paragraph 1-18) when removing or installing fuel, oil, or air tubing.

3-32.1. Removal. (Figure 3-26.)

a. Open access 5222-1.

b. Ensure fuel master lever is in OFF.

c. Cut lockwire and disconnect electrical connector (1).

d. Cut lockwire and disconnect inlet tube (2). Remove packings (3).

e. Cut lockwire and disconnect outlet tube (4). Remove packings (5).

f. Remove outlet connectors (6) and packings (7).

g. Remove bolts (8), washers (9), lockwashers (10), and clamps (11).

h. Remove fuel flow transmitter (12).

NOTE

If one of the two tangs on transmitter base is missing, reposition base so that remaining tang is facing aft.

i. If transmitter base requires removal, remove bolts (13), washers (14), and lockwashers (15). Remove transmitter base (16).

3-32.2. Installation. (Figure 3-26.)

a. Place transmitter base (16) in position on low pressure fuel filter with tang facing aft. Secure with lockwashers (15), washers (14), and bolts (13).

b. Position fuel flow transmitter (12) in base assembly as shown and secure with clamps (11), lockwashers (10), washers (9), and bolts (8). Tighten bolts to 80 (±10) inch-pounds torque.

c. Using new packings (7), install outlet connectors (6). Tighten connectors to 300 (±10) inch-pounds torque.

d. Using new packings (5), connect outlet tube (4) to connector. Tighten tube nut to 300 (±10) inch-pounds torque. Secure with MS20995C32 lockwire.

e. Using new packings (3), connect inlet tube (2) to connector. Tighten tube nut to 300 (±10) inch-pounds torque. Secure with MS20995C32 lockwire.

f. Connect electrical connector (1). Secure with MS20995C32 lockwire.

g. Bleed engine fuel system (paragraph 5-19) and check for leaks.

h. Perform fuel flow indicating system operational checkout (paragraph 3-4).

i. Close access 5222-1.

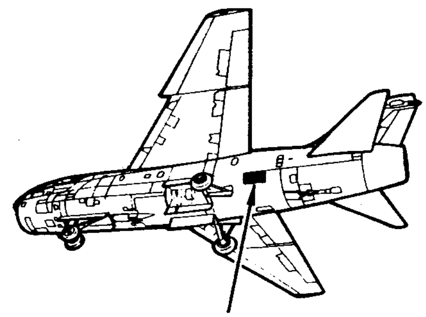
3-33. HIGH PRESSURE ROTOR TACHOMETER INDICATOR REMOVAL AND INSTALLATION.

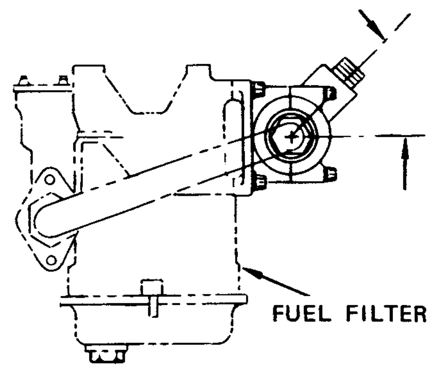
3-33.1. Removal.

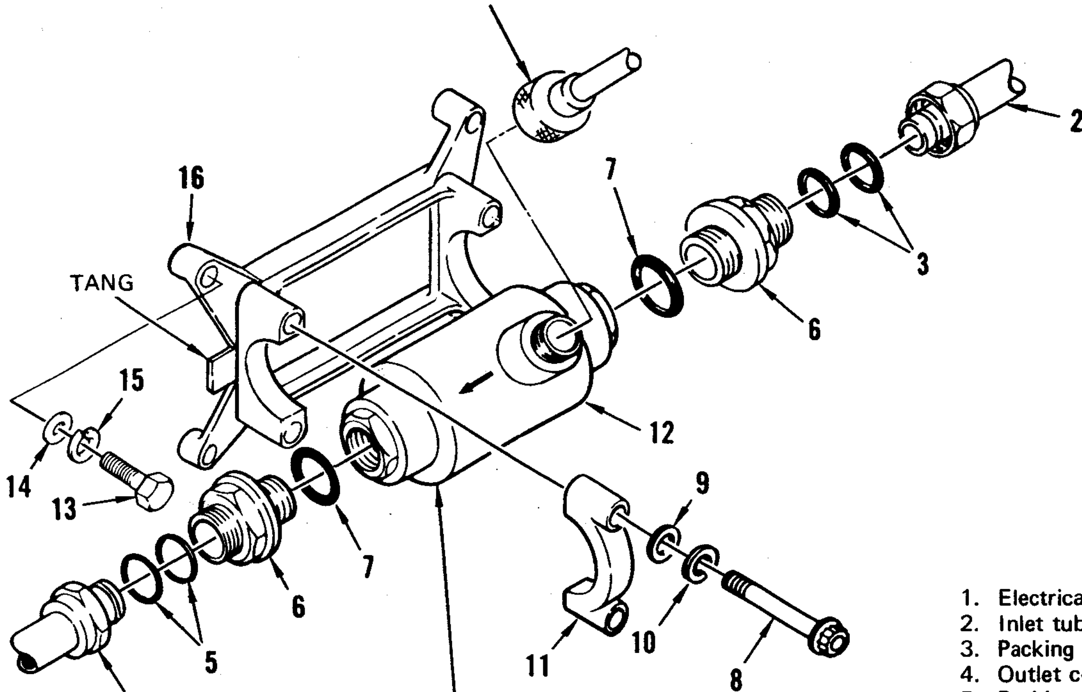
a. Turn round head screw counterclockwise until clamp tension on indicator is removed.

b. Slide indicator aft until electrical connector is accessible.

c. Disconnect electrical connector and remove indicator from panel.







1. Electrical connector
2. Inlet tube
3. Packing
4. Outlet connector
5. Packing
6. Outlet connector
7. Packing
8. Bolt
9. Washer
10. Lockwasher
11. Clamp
12. Fuel flow transmitter
13. Bolt
14. Washer
15. Lockwasher
16. Transmitter base

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Figure 3-26. Removal and Installation; Fuel Flow Transmitter

3-33.2. Installation.

a. Connect electrical connector to indicator.

b. Install indicator in panel mount. Turn round head screw clockwise until clamp tension secures indicator in place.

c. Perform high pressure rotor tachometer indicating system operational checkout (paragraph 3-4).

3-34. HIGH PRESSURE ROTOR TACHOMETER GENERATOR REMOVAL AND INSTALLATION.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
	GGG-W-686	Torque wrench, 0 to 50 inch-pounds	Measure torque

3-34.1. Removal. (Figure 3-27.)

a. Open access 5222-1.

b. Disconnect electrical connector (1).

c. Remove nuts (2), washers (3), high pressure rotor tachometer generator (4), and gasket (5).

3-34.2. Installation. (Figure 3-27.)

WARNING

Solvent P-D-680, Type II, is toxic to skin, eyes, and respiratory tract. Use in a well-ventilated area. Avoid prolonged breathing of vapors. Avoid eye and repeated skin contact. Keep away from sparks and flames.

CAUTION

Gearbox and tachometer generator splines must be thoroughly cleaned and properly greased to prevent excessive gearbox spline wear and subsequent equipment failure.

a. Clean splines of gearbox and high pressure rotor tachometer generator (4) with P-D-680, Type II, drycleaning solvent (T.O. 1-1-1) and clean cloth.

b. Apply generous amount of Molykote 343 or MIL-G-21164 lubricant to generator drive splines and engine mating splines.

c. Using new gasket (5), place generator in position on gearbox as shown. Secure with washers (3) and nuts (2).

d. Tighten nuts in a diagonal manner in increments of 5 inch-pounds torque until 35 (±5) inch-pounds torque is reached.

e. Connect electrical connector (1).

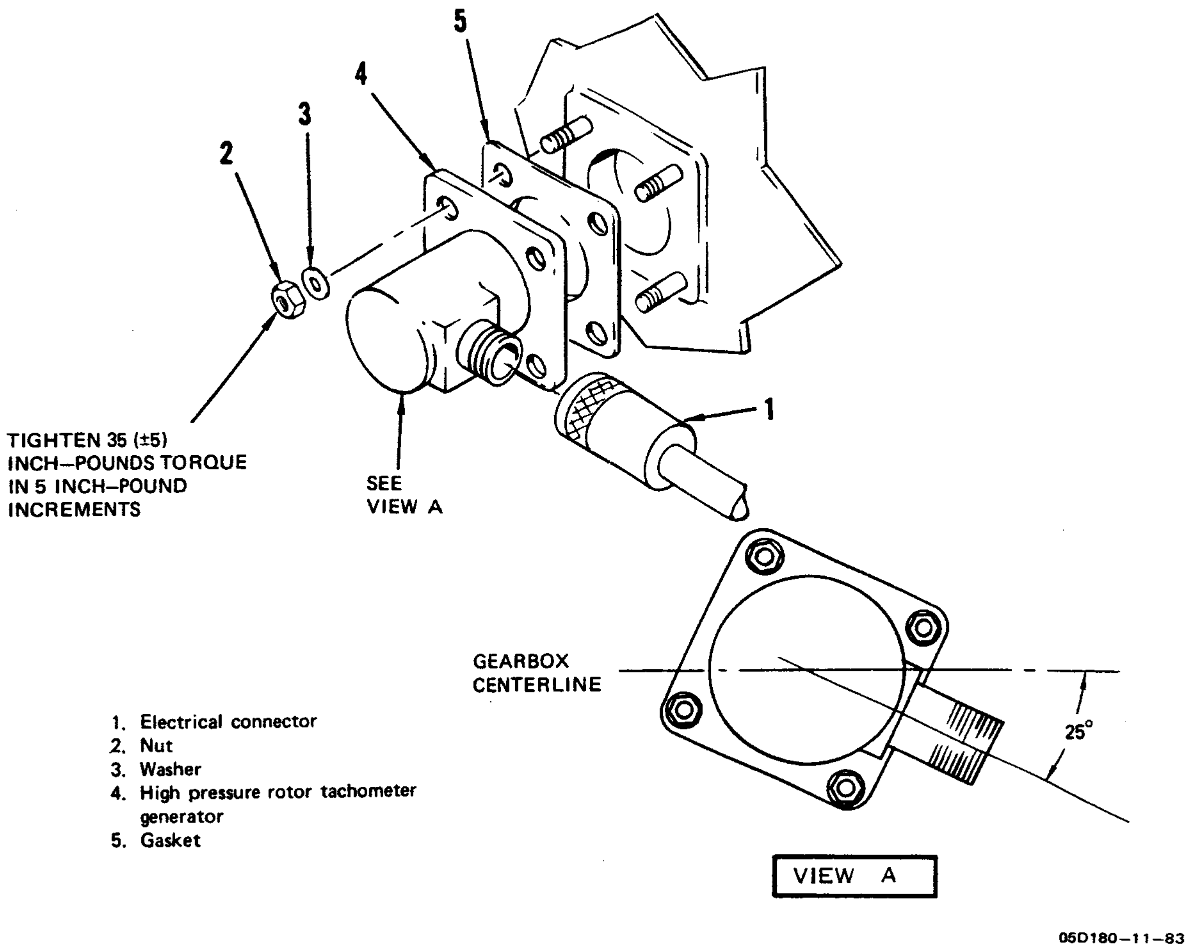
f. Perform high pressure rotor tachometer indicating system operational checkout (paragraph 3-4).

g. Close access 5222-1.

3-35. HIGH PRESSURE ROTOR TACHOMETER DRIVE OIL SEAL REMOVAL AND INSTALLATION.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
	6798284 (Allison Division of General Motors, Indianapolis, Indiana)	Tachometer drive oil seal puller	Remove tachometer drive oil seal
	6798285 (Allison Division of General Motors, Indianapolis, Indiana)	Tachometer drive oil seal drift	Install tachometer drive oil seal



1. Electrical connector
2. Nut
3. Washer
4. High pressure rotor tachometer generator
5. Gasket

Figure 3-27. Removal and Installation; High Pressure Rotor Tachometer Generator

3-35.1. Removal.

a. Open accesses 5222-2 and 5222-1.

b. Remove high pressure tachometer generator (paragraph 3-34).

c. Cut lockwire and disconnect three engine-to-airframe electrical connectors.

d. Remove bolts and lockwashers securing electrical receptacle support bracket to LP fuel pump. Swing bracket aside.

e. Remove tachometer drive oil seal retaining ring.

f. Using puller, remove oil seal.

3-35.2. Installation.

a. Apply light coat of MIL-G-23827 grease to outside diameter of tachometer drive oil seal and gearbox mating area.

b. Using drift, install new oil seal in gearbox.

c. Install oil seal retaining ring.

d. Place electrical receptacle support bracket in position and secure to low pressure fuel pump with lockwashers and bolts.

e. Connect engine-to-airframe electrical connectors.

f. Install high pressure rotor tachometer generator (paragraph 3-34).

g. Close accesses 5222-2 and 5222-1.

3-36. LP FUEL PUMP LOW PRESSURE SWITCH REMOVAL AND INSTALLATION.

Remove and install LP fuel pump low pressure switch through access 5222-1 in sequence shown in figure 3-28, observing the following:

a. Do not use tools or twist electrical connector (1). This is a push-pull type connector.

b. Observe precautions (paragraph 1-18) when removing or installing tubes.

c. Use new packings (5 and 7) during installation.

d. After installation, bleed engine fuel system (paragraph 5-19).

e. After installation, perform fuel system warning system operational checkout (paragraph 3-4).

f. Close access 5222-1.

3-37. HP FUEL PUMP LOW PRESSURE SWITCH REMOVAL AND INSTALLATION.

Remove and install HP fuel pump low pressure switch through access 6222-2 in sequence shown in figure 3-29, observing the following:

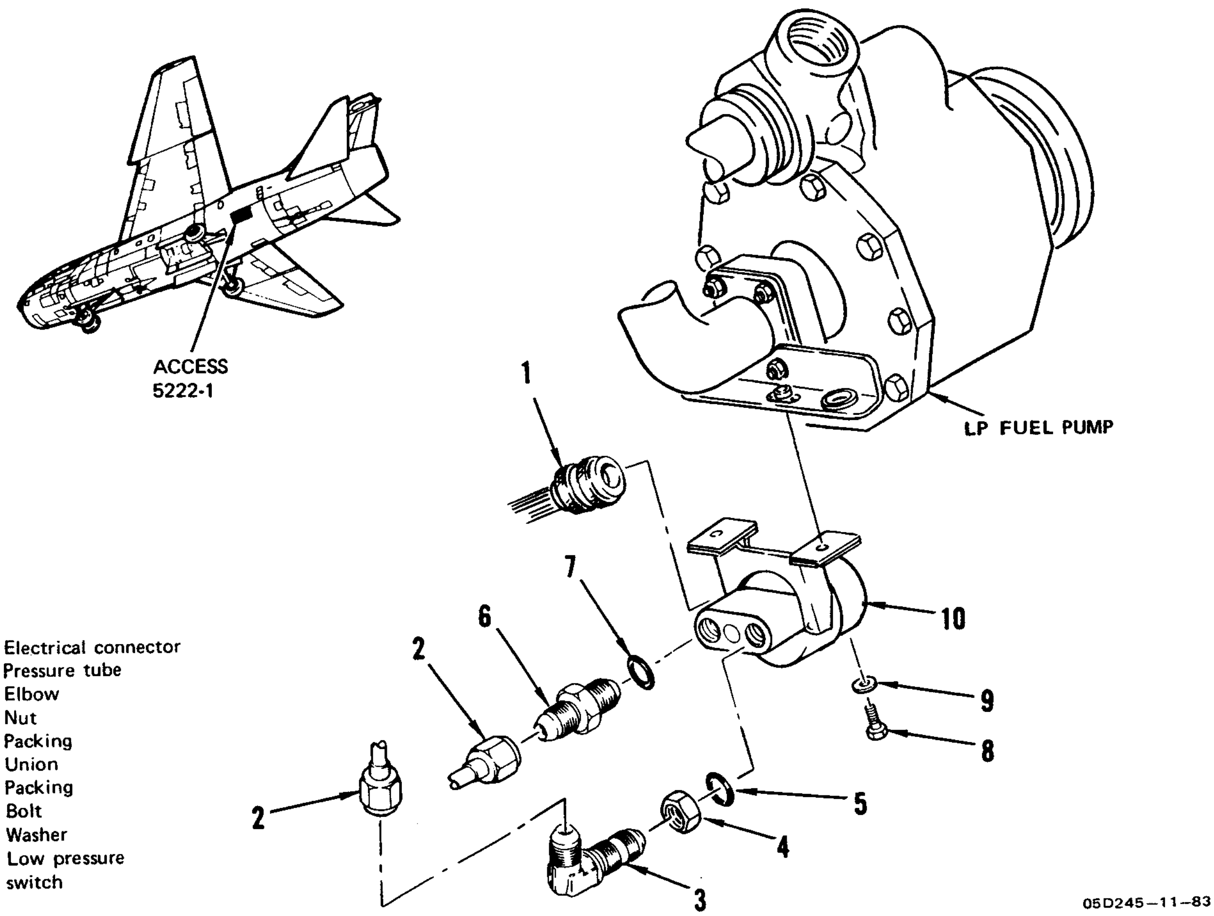
a. Observe precautions (paragraph 1-18) when removing and installing tubes.

b. Secure fuel tube coupling nuts with MS20995C32 lockwire.

c. After installation, bleed engine fuel system (paragraph 5-19).

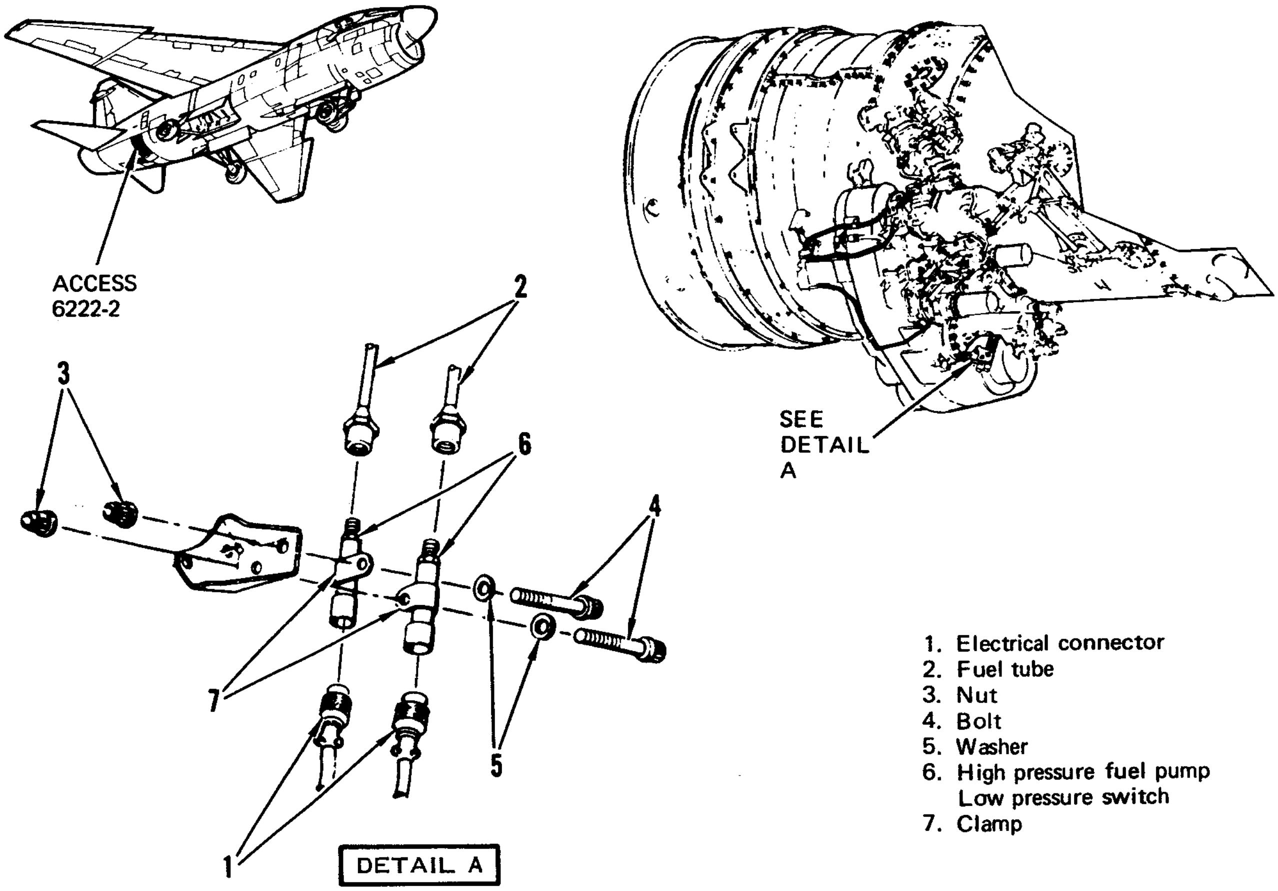
d. After installation, perform fuel pressure warning system operational checkout (paragraph 3-4).

e. Close access 6222-2.



1. Electrical connector
2. Pressure tube
3. Elbow
4. Nut
5. Packing
6. Union
7. Packing
8. Bolt
9. Washer
10. Low pressure switch

Figure 3-28. Removal and Installation; LP Fuel Pump Low Pressure Switch



1. Electrical connector
2. Fuel tube
3. Nut
4. Bolt
5. Washer
6. High pressure fuel pump
   Low pressure switch
7. Clamp

Figure 3-29. Removal and Installation; HP Fuel Pump Low Pressure Switch

SECTION IV

ENGINE SYSTEM

4-1. DESCRIPTION.

4-1.1. General. The A-7D airplane uses a TF41-A-1 engine. This engine is a twin spool, axial flow, full ducted, bypass turbojet. The engine consists of a low, intermediate, and high pressure compressors. It also includes a combustion section, turbine air inlet extension, and fan bypass duct. Leading particulars are in table 4-1; figure 4-1 shows details of the engine.

4-1.2. Engine Sections. The low pressure compressor has three stages and the intermediate pressure compressor two stages. The high pressure compressor consists of 11 stages. Variable geometry inlet guide vanes and bleed valve are a part of the high pressure compressor. This provides a wider range of stall free operation. Refer to Section II for description of guide vanes and bleed valve. The combustion section has 10 combustion liners interconnected with crossover tubes. The turbine consists of four stages. The first and second turbine stages drive the high pressure compressor. The third and fourth turbine stages drive the intermediate and low pressure compressors. The bypass ducts from the outer shell of the engine.

Table 4-1. Engine Leading Particulars

Low pressure compressor stages	3
Bypass ratio	0.76:1
Intermediate pressure compressor stages	2
High pressure compressor stages	11
Overall compressor ratio	20:1 (21:1[1])
Overall length	114.5 inches
Maximum diameter (not including accessories)	40.0 inches
Weight (dry, including power package buildup components)	3,511 pounds
Fuel (normal)	JP-4
Fuel (alternate)[2,3]	JP-5, Jet B, Jet A-1, Jet A
Fuel (emergency)[3,4]	Avgas
Direction of rotor rotation (viewed from rear)	Counterclockwise

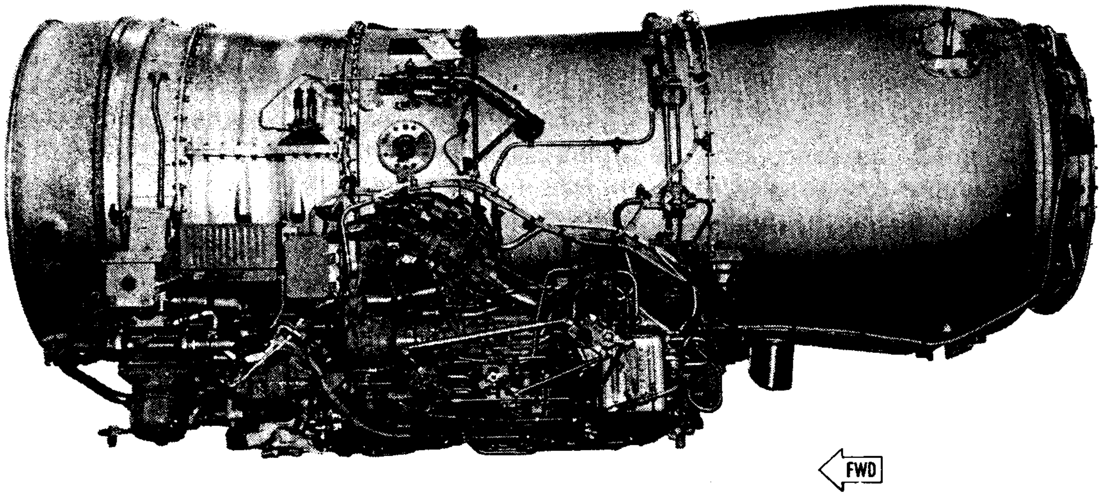
[1]Engines 141159 and subsequent.

[2]Alternate fuels normally do not contain a fuel system icing inhibitor (FSII). Use of alternate fuels is restricted to air temperatures greater than 2°C (35°F). When FSII is added, use is restricted to temperatures greater than the following:

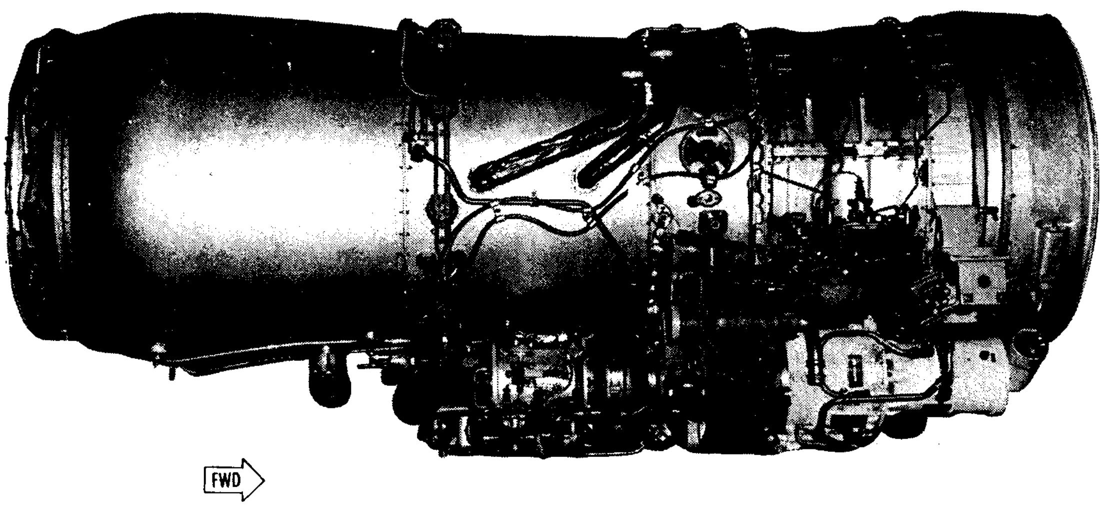
JP-5	-46°C	(-51°F)
Jet B	-49°C	(-56°F)
Jet A-1	-48°C	(-54°F)
Jet A	-38°C	(-36°F)

[3]If alternate or emergency fuel is used, accomplish manual fuel control operational checkout (paragraph 6-4).

[4]If Avgas is used, all tanks must be completely defueled before refueling with any jet fuel.



LEFT SIDE



RIGHT SIDE

05D001-11-83

Figure 4-1. TF41-A-1 Engine

4-2. OPERATION. (Figure 4-2.)

4-2.1. LP Compressor. Air enters the engine through the airplane air inlet duct and is delivered to the three stage, low pressure compressor through the air inlet extension. These three stages make up the fan section of the engine. Each stage of the compressor has a set of rotor blades and a set of stator vanes. As the compressor rotates, a pressure rise develops across each stage of the compressor. After passing the third stage, the air is divided into two flow paths. One path goes around the intermediate and high pressure compressor, combustion, and turbine sections to rejoin the turbine exhaust in the tailpipe. The other flow path goes into the engine core where it is further compressed by the two stage, intermediate compressor.

4-2.2. Intermediate/HP Compressor. Pressurized air from the intermediate pressure compressor is supplied to the 11 stage, high pressure compressor through variable inlet guide vanes. The geometry of these vanes is varied by the airflow control system (Section II). Air is pressurized by the rotating compressor. It flows to the diffuser case by way of a set of outlet guide vanes.

4-2.3. Compressor Efficiency. Total pressure output of the compressors depends on the combined pressurizing ability of each compressor stage. The efficiency of the compressor drops when anything disturbs the smoothness of the airflow across the blades or vanes. This may be caused by dirt on the surfaces or damage to the blade or vane. The mass airflow of the compressor is also decreased by a decrease in air density such as caused by a high temperature or low barometric pressure. The compressor supplies a constant volume of air at a given speed (rpm). As inlet air density drops, the mass of air through the engine will decrease. For the compressor to deliver the same mass airflow under decreased efficiency conditions, the speed of the compressor must increase.

4-2.4. Combustion Chamber. Pressurized air is routed to the combustion chamber and mixed with fuel at the proper combustion ratio. Air that is not used in the combustion process is used to insulate the combustion chamber walls from the heat of combustion. It also dilutes the combustion chamber temperature. The fuel control maintains the right fuel to air ratio. Refer to Section V for description of engine main fuel system.

4-2.5. Turbine. Air is delivered from the combustion section to the turbine through a set of air cooled nozzle guide vanes. High pressure compressor discharge air is used to cool first and second stage turbine. The turbine consists of four stages and each stage consists of a set of nozzle guide vanes and a set of rotor blades. The nozzle guide vanes speed up the gases and point them in a direction to turn the rotors. The rotors receive the high velocity gases and convert this energy into shaft horsepower. The power produced by the turbine depends on the efficiency of the compressor. The efficiency of the turbine is vital to the engine fuel economy.

4-2.6. Atmospheric Effect on Thrust. Atmospheric conditions will affect the thrust output of the engine. Some of these conditions will affect thrust output enough to warrant consideration; others will have a negligible affect. Wind direction and velocity will normally have little affect. If thrust output is below minimum and the engine air inlet is not facing directly into the wind, the inlet should be faced into the wind (±25°) and thrust output rechecked before malfunction analysis is performed. Relative humidity affect on thrust output is minor and need not be considered. Two atmospheric conditions that have great affect on engine thrust output are ambient air temperature and pressure. On a hot day or a day of low pressure, the compressor must turn faster to produce the same mass airflow through the compressor. This in turn increases the temperature rise across the compressor. The turbine outlet temperature will increase with an increase in temperature until its limit is reached. At this point, the fuel control will restrict fuel flow to keep turbine temperature within limits.

4-2.7. Compressor Surge. Compressor surge is an engine malfunction that is caused by compressor pulsation, high TOT, loud banging, or nonreponse of the engine to throttle movement. It is a stoppage or reversal or airflow through the compressor. Also, it may be a sharp reduction of airflow handling ability of the engine. Surge is aggravated by restrictions in the air inlet. Dirty or damaged compressor blades or vanes may also contribute.

4-2.7.1. Acceleration Surge. An acceleration surge occurs when the throttle is rapidly advanced. The fuel control is required to supply extra fuel to provide the necessary rpm. This increase in fuel flow increases combustion pressures, thereby increasing back pressure in the compressor. For the compressor to work against the increased back pressure depends on

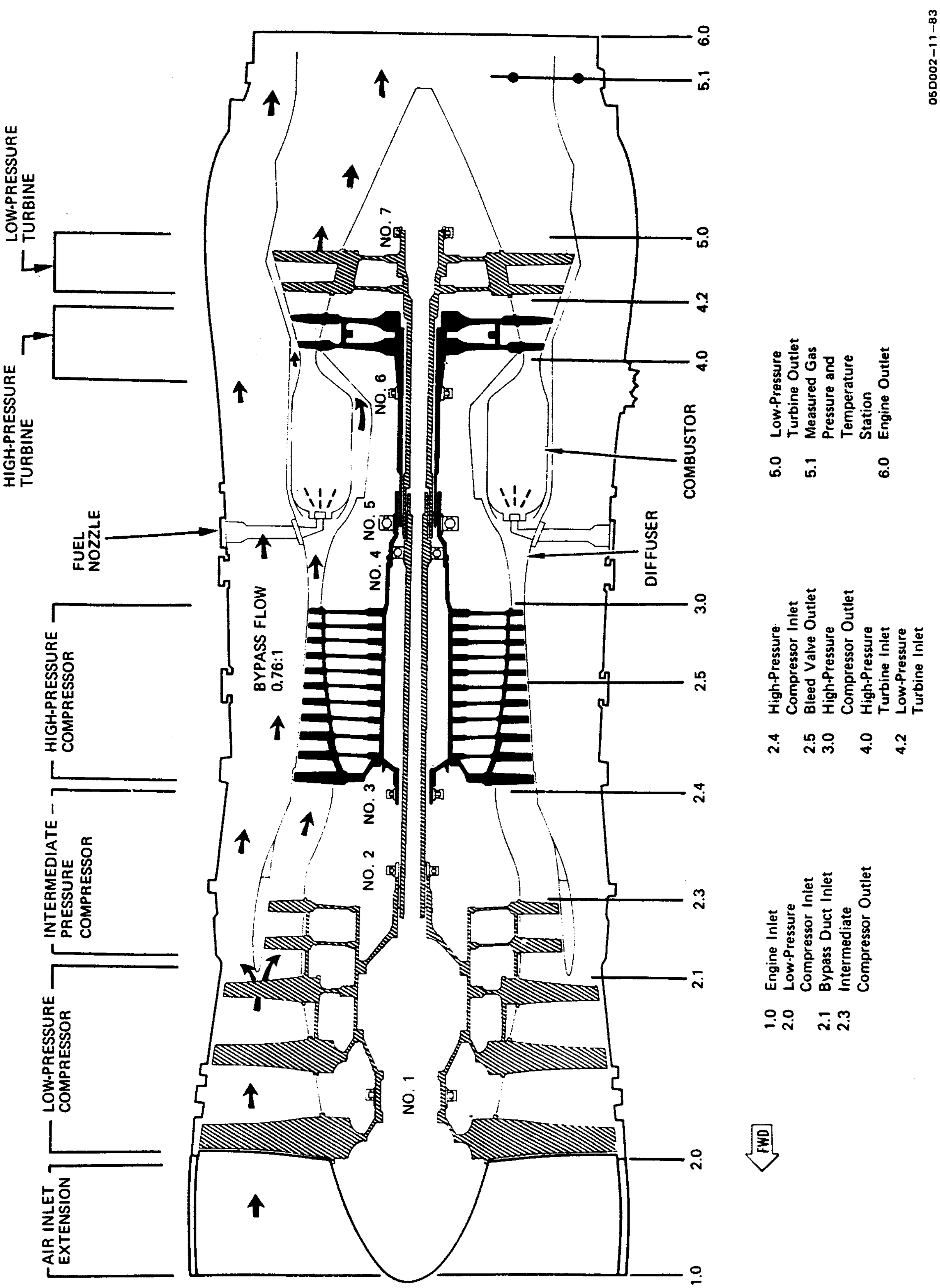


Figure 4-2. Engine Sections, Stations, Bearing Locations, and Airflow Path

several things. An acceleration surge may occur due to compressor blade damage or malfunctioning bleed air system. Also, an acceleration stop improperly adjusted may cause excessive acceleration fuel flow.

4-2.7.2. <u>**Deceleration Surge.**</u> A deceleration surge takes place when the combustion pressures are reduced by reduced fuel flow. This reduces the back pressure on the compressor, causing the airflow to increase. It may increase to a level that the decelerating rotor cannot handle. This type of stall is generally caused by: faulty bleed air system, misadjusted inlet guide vanes, or misadjusted deceleration stop.

4-2.7.3. <u>**Stall Faults.**</u> In most instances, stalls occur due to a combination of factors rather than a single failure or fault. When troubleshooting stalls, it is important to complete all the troubleshooting steps. Do not stop with the first item found out of limits. For example, it may be that a dirty compressor coupled with a fast deceleration time and IGV schedule adjusted to the low side of the limit can collectively cause a compressor stall, even though the engine would operate satisfactorily with any one of these faults.

4-2.8. <u>Engine Rumble/Vibration.</u> Another area of malfunction is engine rumble and vibration. Initial audible evidence of rumble and vibration are about the same, but they do not portray similar symptoms. Vibration is harmful and is a symptom of pending engine or accessory failure. Rumble is a nuisance and not normally cause for engine or accessory rejection.

4-2.8.1. <u>**Rumble.**</u> Rumble is an audible pulsation induced into the gas path by fuel system pressure fluctuations. These fluctuations start in the high pressure fuel pump. They are amplified by the main fuel control. These fluctuations normally occur as a low frequency pulsation in the low power range (slightly above idle to about 85% rpm). Rumble does not affect vibration level or fuel flow.

4-2.8.2. <u>**Vibration.**</u> Vibration is a periodic oscillation of a component having mass (weight). In a jet engine, this oscillation is generally caused by a rotating part that is not in balance. Also, it may be that the clearance between the rotating and stationary parts is excessive. Generally, the frequency of these oscillations will increase when engine speed increases. Vibration is measured by a transducer mounted on the engine. The transducer consists of a magnet that is free to move within a stationary winding. When the engine vibrates, the magnet will tend to remain in place as the winding moves. This action will produce an electrical signal that is proportional to the frequency of the vibration. This voltage is shown on a scale calibrated in mils per second.

4-2.8.3. <u>**Rumble Versus Vibration.**</u> The mechanic must distinguish between vibration and rumble in order to take the proper action. The checks to differentiate vibration from rumble should be made by the pilot when detected. Moving the throttle to a point slightly above or below where pulsations are most pronounced will cause rumble to cease. Vibration will generally increase as the throttle is advanced. If the engine is operated at the same speed in manual fuel control, rumble will cease. Vibration will be affected by fuel control transfer.

4-3. COMPONENTS.

For a list of system components, locations (accesses), and functions, refer to table 4-2.

Table 4-2. Engine System Components

Component	Access	Function
Engine, TF41-A-1	5222-3	Develops thrust for airplane motive power

4-4. PREPARATION FOR OPERATIONAL CHECKOUT.

WARNING

To prevent damage to equipment and injury to personnel, steps a through m must be complied with prior to performing any maintenance on the airplane.

a. Check airplane forms (AFTO Forms 781) for discrepancies that may prevent operation of engine or other systems.

NOTE

Check fuel quantity and service, if required. Keep engine ground runs and engine run time to a minimum. Maintenance checks requiring engine operation should be consolidated.

b. Tow airplane to designated runup area (T.O. 1A-7D-2-1). When using AF32-19 sound suppressor, make sure airplane is secure (T.O. 33D4-6-387-21).

c. Install engine runup tiedown restraint as follows:

   (1) Place catapult tension bar socket assembly retainer in open position by pressing release on side of socket.

   (2) Insert forward end of cable assembly into socket.

   (3) Release socket release mechanism to close socket retainer.

   (4) Secure airplane end of cable assembly to ground anchor within 5° of fuselage centerline.

   (5) Move airplane forward to remove slack from tiedown restraint.

   (6) Install wheel chocks.

d. Check nose gear downlock for proper installation.

e. Check that left main gear up-and-locked switch is open.

f. Check left main gear downlock for proper installation.

g. Check that the left main gear chock is installed.

h. Check that right main gear up-and-locked switch is open.

i. Check right main gear downlock for proper installation.

j. Check that the right main gear chock is installed.

CAUTION

Check that lap belts are in the seat and not hanging over edge of seat, as damage to seat and/or console may result.

k. Check ejection controls safety handle is in down-and-locked position.

l. Check interior canopy jettison and ejection seat prime initiator safety pins for proper installation.

m. Check for presence of fire guard and fire extinguisher before engine start.

n. Using light source of sufficient intensity, check engine air inlet for the following:

   (1) Air inlet duct for structural integrity, with special attention to loose rivets and cracks, and foreign objects.

   (2) Engine-to-airframe seal for distortion or deterioration.

   (3) Engine inlet extension for cracks.

   (4) T1 thermocouple for condition and security.

   (5) Engine inlet for foreign objects, oil leaks, and foreign object damage.

(6) Manually rotate low pressure compressor rotor. Check for freedom of movement, blade tip rub, rotor blade damage, excessive dirt contamination, corrosion, and evidence of oil leakage.

(7) With compressor rotor turning, check compressor vanes for damage, corrosion, and excess dirt contamination.

(8) Spinner for dents, cracks, corrosion, and security.

CAUTION

Care should be taken to avoid damage to radome and lip of air inlet duct.

o. Check that gun gas purge door actuating cylinder is connected to purge door.

p. Check that LOX access door is clear of gun gas purge door.

q. Check and open circuit breakers in left avionic compartment as follows:

(1) M61 gun control circuit breaker CB3111.

(2) LG ACCUM HTR circuit breaker CB3213.

r. Check PC No. 1 hydraulic reservoir for quantity and service, if required (T.O. 1A-7D-2-1).

s. Check PC No. 1 hydraulic filter for bypass popout indicator.

CAUTION

If engine is started with wingfold support strut handle in the latched position, the handle may become jammed. If engine is started with handle in the latched position, make sure landing gear handle is in WHLS DOWN before placing flap handle in ISO to unlatch handle.

t. Make sure left wingfold support strut handle is unlatched.

u. Check PC No. 3 hydraulic filter for bypass popout indicator.

CAUTION

The transfer motive flow quick-disconnect coupling must be connected prior to engine start, or fuel system damage may occur.

v. Check transfer motive flow quick-disconnect coupling for proper installation.

w. Check main low pressure fuel filter for bypass popout indicator.

WARNING

To prevent dumping fuel on ramp and endangering airplane and personnel by fire hazard, check that residual fuel holding tank is empty before starting the engine.

Check that fuel is not underneath airplane prior to applying external electrical power or starting engine.

x. Check engine drain lines, static ports, and engine compartment cooling holes for excessive leakage (table 4-8), obstructions, and foreign material.

y. Check that fuel boost pump manual shutoff valve is open.

z. Check engine oil level, and add oil if oil is not visible on sight gage.

aa. Check that engine oil filter indicator is not popped.

NOTE

On starter serial No. P240 and later, the starter failure indicator is not operative.

ab. Check starter failure indicator for failure indication.

ac. Make sure the following circuit breakers are closed during engine operation:

(1) BAT power circuit breaker CB401.

(2) BAT charger circuit breaker CB402 (airplanes before T.O. 1A-7-551) or CB406 (airplanes after T.O. 1A-7-551).

ad. Check PC No. 3 hydraulic system reservoir for quantity, and service, if required (T.O. 1A-7D-2-1).

ae. Check for proper installation of engine runup tiedown restraint (step c).

af. Using light source of sufficient intensity, check engine exhaust areas for the following:

(1) Engine exhaust for evidence of blade or vane damage and oil leaks; temperature sensing probe for condition and security; and bypass duct for fuel accumulation and oil puddling (table 4-8).

(2) Check tailpipe for cracks, distortion, burns, excessive oil, foreign material, and evidence of foreign object damage.

ag. Using light source of sufficient intensity, check starter for the following:

(1) Oil leakage. If leakage is found, check oil quantity and add oil, if required (T.O. 1A-7D-2-1).

(2) Starter intake and exhaust for damage and overtemperature.

CAUTION

To prevent damage to constant speed drive (CSD), do not operate engine with CSD oil level in upper yellow band (or upper black band).

ah. Check CSD oil quantity and add or drain oil, if required (T.O. 1A-7D-2-1).

ai. If panel is removed, check CSD oil cooler fuel quick-disconnect.

aj. Check PC No. 2 hydraulic filters for bypass popout indicator.

ak. Check PC No. 2 hydraulic system reservoir for quantity, and service, if required (T.O. 1A-7D-2-1).

CAUTION

To prevent possible hydraulic pump damage during low temperature conditions, voids in the systems shall be removed before starting engine. This is done by dumping the accumulators. If PC No. 1 pressure is not within limits during the hydraulic pressure check after engine start, cycle the control stick slowly between neutral and full forward to increase pressure.

Check accumulators for correct precharge pressure and service, if required.

al. Place emergency accumulator shutoff valve in OPEN.

CAUTION

If engine is started with wingfold support strut handle in the latched position, the handle may become jammed. If engine is started with handle in the latched position, make sure landing gear handle is in WHLS DOWN before placing flap handle in ISO to unlatch handle.

am. Make sure right wingfold support strut handle is unlatched.

WARNING

To prevent possible damage to equipment and injury to personnel, if engine removal access 5222-3 is removed, make sure arresting gear actuator circuit breaker CB318 is opened before starting engine.

an. Check and open circuit breakers in right avionic compartment.

(1) HIR-Flap ACCUM circuit breaker CB396.

(2) HTR-EPP ACCUM circuit breaker CB3008.

ao. Check avionic compartment cooling duct screens for structural integrity and foreign material.

CAUTION

To prevent damage to equipment, all ground handling protective covers and air plugs shall be removed before engine runup.

ap. Remove all ground handling protective covers.

aq. Ensure that required structural access panels are installed (table 4-3 and figure 4-3).

ar. Check immediate area around airplane for objects that may enter engine air inlet duct or be blown by engine exhaust during engine operation.

as. Inventory CTK and/or individual tool kits to make sure all tools are in place.

WARNING

To prevent dumping fuel on ramp and endangering airplane and personnel by fire hazard, make sure fuel dump switch is in OFF (cover down).

at. Make sure that switches and controls are in proper position (table 4-4).

Table 4-3. Access Panel Restrictions During Engine Operation

CAUTION

To prevent structural damage to airplane, the following access panels shall be installed before operating engine.

Table 4-3. Access Panel Restrictions During Engine Operation — CONT

1123-1 or 2123-9
1222-5
1222-6
1222-6-1
1222-6-3
1222-11
2212-10
5122-4
5122-6
5132-1
5133-1
6122-4
6122-5
6132-1
6133-1
6222-3

Table 4-4. Switch and Control Positions for Engine Start

Switch or control	Position
Battery switch	OFF
FLIR power switch (Airplanes after T.O. 1A-7-530)	OFF
Double datum switch (Airplanes before T.O. 1A-7-530)	OFF
Double datum/anti-ice switch (Airplanes after T.O. 1A-7-530)	OFF
Auxiliary UHF function selector switch	OFF
UHF radio	Set and on
IFF master switch	OFF
Emergency flap control	Cover down
Flap control	UP
AMF switch	OFF
Yaw stabilization	OFF
APQ-126 radar power switch	OFF

Table 4-4. Switch and Control Positions for Engine Start — CONT

Switch or control	Position
Throttle	OFF
Fuel master control	ON
Alternate fuel feed handle	NORM
Throttle friction level	As desired
Starter switch	NORM
Anti-ice selector switch (airplanes before T.O. 1A-7-530)	OFF
Antiskid switch	BRAKE ACCUM
Fuel dump switch	Cover down
Wing transfer switch	AUTO
Fuel control	NORM
Emergency brakes control	OFF
A/R door release handle	Down
AMF test switch	OFF
Emergency generator switch	OFF
Master generator switch	ON
Landing gear control	WHLS DOWN
Pitch and roll trim switch	OFF
Landing and taxi light switch	OFF
AFCS test switch	OFF
EPP handle	Matched with EPP position
Armament panel switches	OFF or SAFE
Master function switches	Deselected
HUD control switch	OFF
Radar altimeter switch	OFF
Standby reticle switch	OFF

Table 4-4. Switch and Control Positions for Engine Start — CONT

Switch or control	Position
Control display unit switch (airplanes after T.O. 1A-7-562)	OFF
Heading mode switch	MAN
Arresting hook control	Matched with hook position
Doppler radar mode switch	OFF
Oxygen supply lever	OFF
ECM pod switches	OFF
NAV WD COMPUTER switch	OFF
Interior lights	As required
Exterior light switches	As required
LORAN power switch	OFF
TACAN control switch	OFF
ILS power switch	OFF
IMS selector switch	OFF
Air temperature control	AUTO
Cockpit temperature control	As desired
Cabin pressure switch	CABIN DUMP
Rain removal switch	OFF
Defog switch	OFF
CHAFF/FLARE switches	OFF
Radar beacon power switch	OFF
Wingfold control	Matched with position of wing outer panels
Emergency vent air knob	Full open
TISL power switch	OFF

(1) HIR-Flap ACCUM circuit breaker CB396.

(2) HTR-EPP ACCUM circuit breaker CB3008.

ao. Check avionic compartment cooling duct screens for structural integrity and foreign material.

CAUTION

To prevent damage to equipment, all ground handling protective covers and air plugs shall be removed before engine runup.

ap. Remove all ground handling protective covers.

aq. Ensure that required structural access panels are installed (table 4-3 and figure 4-3).

ar. Check immediate area around airplane for objects that may enter engine air inlet duct or be blown by engine exhaust during engine operation.

as. Inventory CTK and/or individual tool kits to make sure all tools are in place.

WARNING

To prevent dumping fuel on ramp and endangering airplane and personnel by fire hazard, make sure fuel dump switch is in OFF (cover down).

at. Make sure that switches and controls are in proper position (table 4-4).

Table 4-3. Access Panel Restrictions During Engine Operation

CAUTION

To prevent structural damage to airplane, the following access panels shall be installed before operating engine.

Table 4-3. Access Panel Restrictions During Engine Operation — CONT

1123-1 or 2123-9
1222-5
1222-6
1222-6-1
1222-6-3
1222-11
2212-10
5122-4
5122-6
5132-1
5133-1
6122-4
6122-5
6132-1
6133-1
6222-3

Table 4-4. Switch and Control Positions for Engine Start

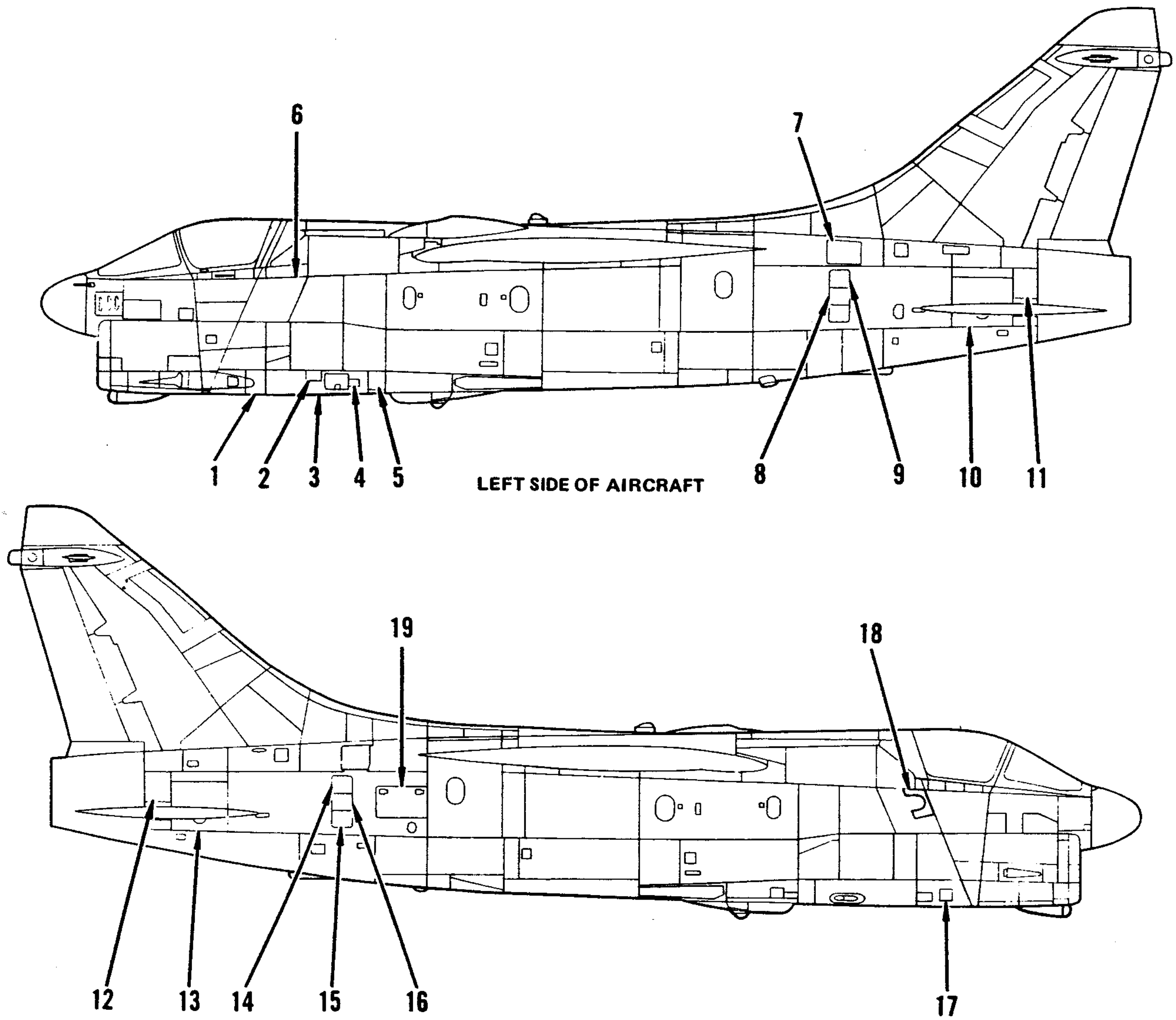
Switch or control	Position
Battery switch	OFF
FLIR power switch (Airplanes after T.O. 1A-7-530)	OFF
Double datum switch (Airplanes before T.O. 1A-7-530)	OFF
Double datum/anti-ice switch (Airplanes after T.O. 1A-7-530)	OFF
Auxiliary UHF function selector switch	OFF
UHF radio	Set and on
IFF master switch	OFF
Emergency flap control	Cover down
Flap control	UP
AMF switch	OFF
Yaw stabilization	OFF
APQ-126 radar power switch	OFF

Table 4-4. Switch and Control Positions for Engine Start — CONT

Switch or control	Position
Throttle	OFF
Fuel master control	ON
Throttle friction level	As desired
Starter switch	NORM
Anti-ice selector switch (Airplanes before T.O. 1A-7-530)	OFF
Antiskid switch	BRAKE ACCUM
Fuel dump switch	Cover down
Wing transfer switch	AUTO
Fuel control	NORM
Emergency brakes control	OFF
A/R door release handle	Down
AMF test switch	OFF
Emergency generator switch	OFF
Master generator switch	ON
Landing gear control	WHLS DOWN
Pitch and roll trim switch	OFF
Landing and taxi light switch	OFF
AFCS test switch	OFF
EPP handle	Matched with EPP position
Armament panel switches	OFF or SAFE
Master function switches	Deselected
HUD control switch	OFF
Radar altimeter switch	OFF
Standby reticle switch	OFF

Table 4-4. Switch and Control Positions for Engine Start — CONT

Switch or control	Position
Heading mode switch	MAN
Arresting hook control	Matched with hook position
Doppler radar mode switch	OFF
Oxygen supply lever	OFF
ECM pod switches	OFF
NAV WD COMPUTER switch	OFF
Interior lights	As required
Exterior light switches	As required
LORAN power switch	OFF
TACAN control switch	OFF
ILS power switch	OFF
IMS selector switch	OFF
Air temperature control	AUTO
Cockpit temperature control	As desired
Cabin pressure switch	CABIN DUMP
Rain removal switch	OFF
Defog switch	OFF
CHAFF/FLARE switches	OFF
Radar beacon power switch	OFF
Wingfold control	Matched with posi-tion of wing outer panels
Emergency vent air knob	Full open
TISL power switch	OFF



1. 1222-5	11. 5132-1
2. 1222-6-1	12. 6132-1
3. 1222-6	13. 6133-1
4. 1222-6-3	14. 6122-5
5. 1222-11	15. 6122-3
6. 1123-1	16. 6122-4
7. 5122-6	17. 2212-10
8. 5122-4	18. 2123-9
9. 5122-5	19. 6222-3
10. 5133-1	

CAUTION

To prevent structural damage to airplane, access panels shown in this figure shall be installed before operating engine.

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Figure 4-3. Access Panel Restrictions; Engine Operation

4-5. OPERATIONAL CHECKOUT.

Test Equipment Required

Figure & index No.	Name	AN type designation	Use and application
	Equipment required for engine operation		Operate engine
	Equipment required for connecting external electrical power		Supply electrical power
	Engine maximum power test set	E2452-3	Indicate turbine outlet pressure

NOTE

A number enclosed in braces at the end of a step in the following test corresponds to a number in troubleshooting table 4-9.

a. Perform preparation for operational checkout (paragraph 4-4).

CAUTION

When ambient temperature is 41°F (5°C) or less and engine operation is required, screen icing conditions may exist and caution must be observed to prevent damage to engine and airplane.

Engine operation without air inlet screen installed must be authorized by the chief of maintenance or a designated representative.

NOTE

If icing conditions exist, 7839425 air inlet screen may be used to remove screen icing.

b. If ambient temperature is 41°F (5°C) or less, perform the following:

(1) Obtain wet bulb temperature or dewpoint and dry bulb temperature from aerology.

(2) Using figure 4-4, determine if engine run can be accomplished with 215-00251-17, 215-00138-27, or 215-00138-42 air inlet screen installed.

(3) Remove any water standing on ramp in area around nose of airplane.

(4) Monitor ambient air during engine operation to make sure that engine is not accidently run in a screen icing environment with 215-00251-17, 215-00138-27, or 215-00138-42 screen installed.

CAUTION

To prevent damage to engine and airframe, make sure inlet duct screen is free of damage. If damaged, refer to T.O. 1A-7D-2-1 for allowable repair criteria.

c. Install engine air inlet duct screen (T.O. 1A-7D-2-1).

CAUTION

Before starting engine with speed brake in extended position, make sure that open access doors 1232-1 and 2232-1 are braced by stay assemblies. Failure to install stay assemblies will cause damage to equipment.

d. Place battery switch in BATT.

NOTE

If fire warning light operation is not satisfactory, refer to T.O. 1A-7D-2-11.

e. Press fire warning test switch. Check that fire warning light comes on. Release switch and check that light goes off.

HOW TO USE CHART:

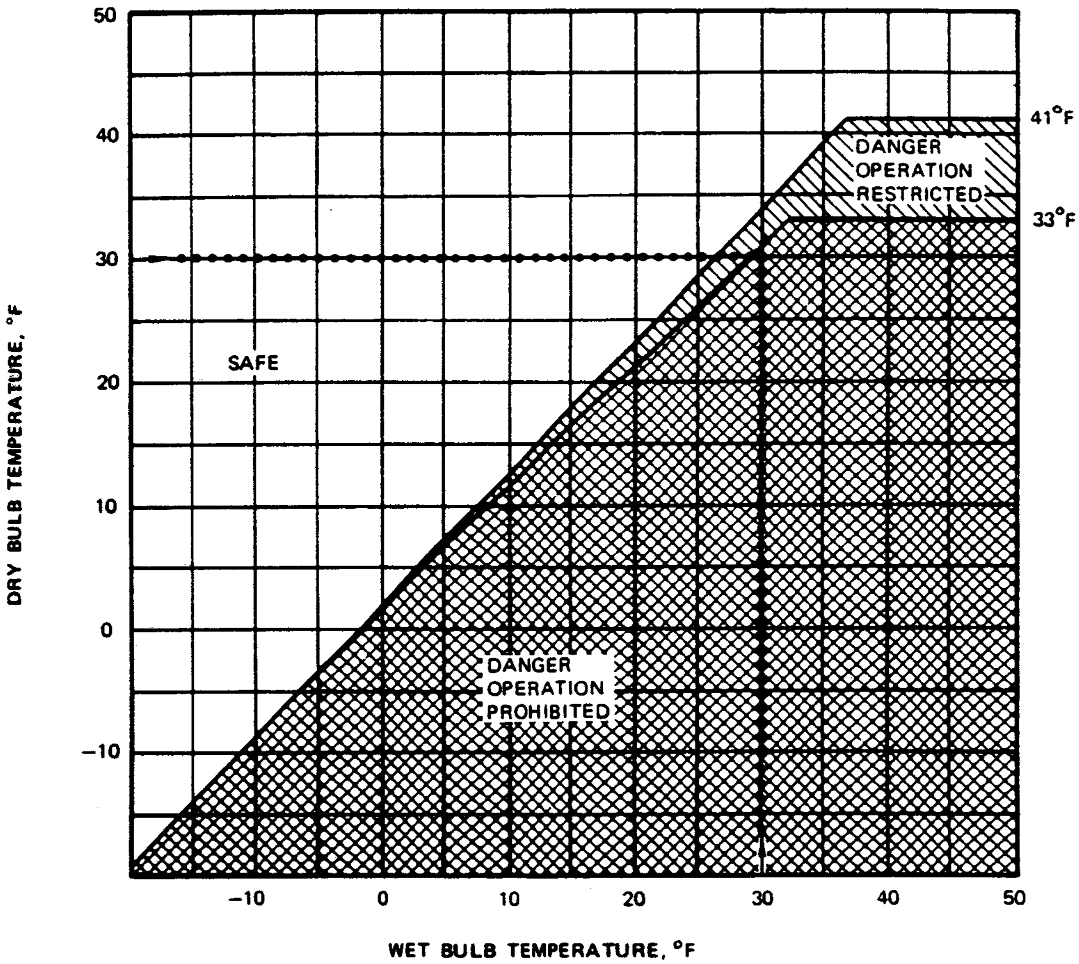
Enter chart with dry and wet bulb temperature and find intersect point.

EXAMPLE

Dry bulb temperature 30°F. Wet bulb temperature 30°F. Intersects in danger area, do not use air inlet screen.

CAUTION

This chart assumes no standing water on ramp in vicinity of air inlet.



Do not operate engine in this region with 215–00251–17, 215–00138–27, or 215–00138–42 air inlet screen installed. Safe for operation with 7839425 air inlet screen installed.

Do not operate engine over 75% rpm in this region with 215–00251–17, 215–00138–27, or 215–00138–42 air inlet screen installed. Safe for operation with 7839425 air inlet screen installed.

Safe for operation with any air inlet screen installed.

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Figure 4-4. Icing Region; Air Inlet Screen (Sheet 1 of 2)

HOW TO USE CHART:
Enter chart with dry bulb and dew point temperature °F; find intersect point.

EXAMPLE:
Dry bulb temperature 30°F. Dew point 30°F. Intersects in danger area, do not use air inlet screen.

CAUTION

This chart assumes no standing water on ramp in vicinity of air inlet.

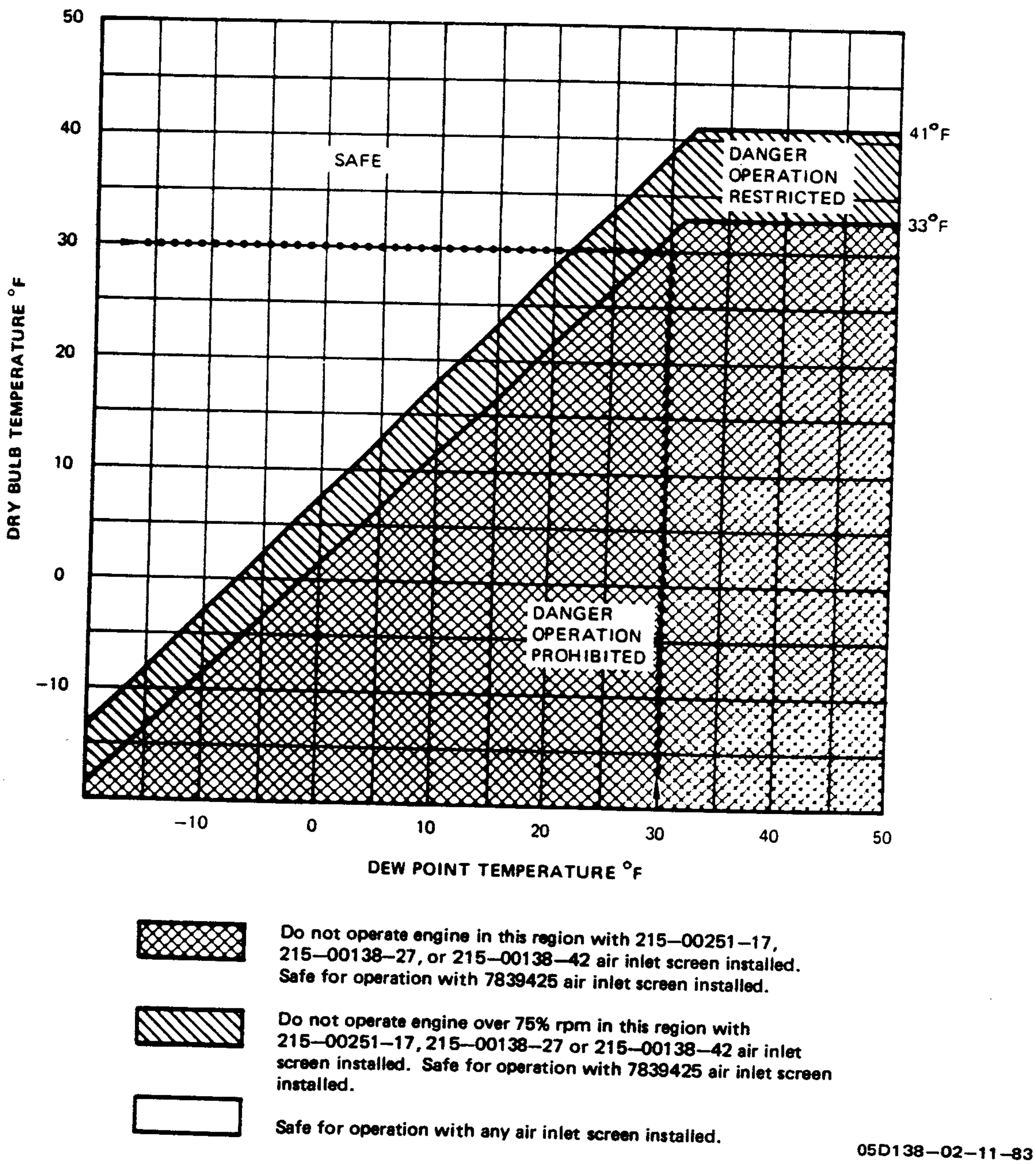

Figure 4-4. Icing Region; Air Inlet Screen (Sheet 2)

NOTE

If a start is attempted with start switch in ABORT, the starter electric motor will rotate, the starter will not light off, and after 7 seconds the starter abort box will shut off the starter motor. The starter abort box circuit breaker must be reset prior to a second start attempt.

f. Place starter switch in NORM.

NOTE

If turbine outlet temperature indicator is not working properly, refer to paragraph 3-5.

g. Check that turbine outlet temperature indicator indicates ± 10°C (± 18°F) of ambient temperature (cold engine). The POWER OFF flag should not be visible.

h. Open access 1222-3.

i. Place and hold TOT switch in ON. Check that ENG HOT caution light comes on at 620° (+5°, −0°)C (1,148° (+9°, −0°)F). Release switch.

j. Close access 1222-3.

k. Open access 5222-4.

l. Cut lockwire and remove cap from turbine outlet pressure (TOP) line. Connect line to engine maximum power test set.

m. Record station barometric pressure (not corrected to sea level).

WARNING

To avoid injury or loss of life during engine run, make sure that personnel are clear of engine air inlet and exhaust ducts, jet fuel starter exhaust, engine low pressure cooling air overboard dump, and air conditioning exhaust.

To prevent a fire, drain residual fuel holding tank after third consecutive start or attempted start. Make sure that accumulation of fuel drained during start is cleaned before next engine start.

CAUTION

Observe all engine starting and operating limits and restrictions in tables 4-5 and 4-6 during engine operational checkout. If tubine outlet temperature time limit is exceeded, refer to table 4-5 for overtemperature inspection limits.

If failure is noted during start, abort start by placing throttle in OFF and starter switch in ABORT.

The jet fuel starter system should abort the start automatically if no engine rotation occurs within 7 (± 1) seconds. If no engine rotation has occurred within 10 seconds, abort the start by placing starter switch in ABORT.

If starter overtemperature light comes on, abort the start by placing starter switch in ABORT. Wait 2 minutes and attempt a second start. If a second overtemperature light is observed, abort the start and replace starter.

NOTE

If battery does not have enough power to start the engine and replacement of battery is not feasible, a booster battery may be connected to external dc power receptable for engine start (T.O. 1A-7D-2-1).

If starter is engaged with fuel master shutoff in the closed position or engine is shut down with fuel master shutoff, record this fact on high pressure fuel pump accessory card.

The automatic starter abort system will abort the start if battery voltage is less than 10 (±0.5) volts or starting period time exceeds 7 (± 1) seconds. If automatic abort occurs, refer to paragraph 8-5 for troubleshooting procedures.

n. Place throttle in CRANK and hold. Check that rpm begins to rise within 7 seconds. {1}

Table 4-5. Starter and Starting Limits and Restrictions

Condition	Limit
Engine rotation noted after engaging crank switch	7 seconds maximum
Light off after throttle placed in outboard IDLE	15 seconds maximum
Idle rpm attained after throttle placed in outboard IDLE	1 minute maximum
Starter duty cycle	Two start cycles within 30 minutes; 30 minutes cooling before another start attempt
Ignition exciter duty cycle	Continuous
Starter cutoff	Primary 42.5% (±1.5%) rpm[1]
	Secondary 46.5% (±1.5%) rpm[2,3]
Drain period between engine shutdown and start	1.5 minutes minimum
Drain period following unsatisfactory engine start	3 minutes minimum[4,5]
Turbine outlet temperature	Refer to table 4-6.
Oil pressure	Refer to table 4-6.
Engine speed	Refer to table 4-6.

Starting restrictions:

a. Ground starts are not permitted using conventional ground power unit.

b. If throttle has been placed in any position other than OFF since previous engine shutdown, crank engine for 30 seconds without fuel or ignition before starting.

[1]If starter does not shut down at primary point, repair before subsequent start.

[2]If starter does not shut down automatically, shut down starter by placing starter switch in ABORT.

[3]If automatic shutdown does not occur, do not advance throttle above IDLE until starter is shut down.

[4]Following an unsuccessful start attempt, check exhaust duct for fuel accumulation prior to attempting another start.

[5]Following a second consecutive unsuccessful start attempt, motor engine for 30 seconds without fuel or ignition and check exhaust duct for fuel accumulation before attempting another start.

CAUTION

Engines after T.O. 2J-TF41-641 are equipped with a temperature limiter amplifier that has a fail-safe circuit which will prevent a severe drop in engine power when the amplifier fails. The amplifier will turn off when output exceeds approximately 390 milliamperes. It will stay off until the condition which caused the high milliampere output is removed. When the amplifier turns off, there will be a sudden increase of T5, rpm, fuel flow, and TOP. The operator should immediately operate the engine as if the manual fuel control was selected due to the engine being operated by the throttle.

Table 4-6. Engine Operating Limits and Restrictions

Operating limits							
	Turbine outlet temperature (TOT)			Engine speed		Oil pressure (psig)	
Condition	Above	Not exceeding	Time limit	% RPM	Time limit	Minimum	Maximum
Starting		620°C (1,148°F)[1,2]		48[3]		15	60 (5 minutes maximum)
Ground operation and takeoff without double datum activated and in-flight		583°C (1,081°F)[1]	30 minutes	101	30 minutes	27[4]	53
	583°C (1,081°F)[1]	640°C (1,184°F)[1]	3 seconds	101 to 104	6 seconds		
				104 to 105	Momentary		
				105	Do not exceed[5]		
Ground operation and takeoff with double datum activated		583°C (1,081°F)[1]	30 minutes	101	30 minutes	27[4]	53

See footnotes at the end of the table.

Operating limits

Table 4-6. Engine Operating Limits and Restrictions — CONT

Condition	Turbine outlet temperature (TOT) Above	Not exceeding	Time limit	Engine speed % RPM	Time limit	Oil pressure (psig) Minimum	Maximum
	583°C (1,081°F)[1]	589°C (1,092°F)[1]	5 minutes	101 to 104	6 seconds		
	589°C (1,092°F)[1]	606°C (1,123)[1]	2 minutes	104 to 105	Momentary		
	606°C (1,123°F)[1]	620°C (1,148°F)[1]	10 seconds	105	Do not exceed[5]		
	620°C (1,148°F)[1]	640°C (1,184°F)[1]	3 seconds				

Instrument fluctuations[6]:

- Turbine out temperature indicator (TOT) .... ±3°C (±5°F)
- Tachometer indicator (PERCENT RPM) .... ±0.2%
- Oil pressure indicator (OIL PRESS) .... ±2 psi differential
- Oil quantity indicator (OIL QTY) .... ±1/32 full scale
- Fuel flow indicator (FUEL FLOW) .... ±25 pph (up to 6,000 pph)
- Turbine outlet pressure indicator (T.O. PRESS) .... ±1/4 inch Hg

See footnotes at the end of the table.

Table 4-6. Engine Operating Limits and Restrictions — CONT

Operating restrictions

a. Do not operate engine at high power without main generator power. If electrical power loss occurs, retard throttle to idle immediately.

b. If engine rpm drops below 48%, shut down engine immediately.

c. When switching fuel control from MAN to NORM, engine rpm must be below 80%.

d. Do not attempt to maintain engine rpm with throttle while in MAN. If rpm decreases below 48%, shut down engine immediately.

e. If emergency fuel (JP-5) is used, accomplish manual fuel control operational checkout (paragraph 6-4).

f. If electrical power loss occurs while operating engine, retard throttle to IDLE immediately.

g. An rpm shift of ± 4% during taxi is acceptable.[8]

[1]If temperature limit is exceeded, refer to table 4-7 for overtemperature inspection requirements.

[2]Abort the start if engine speed stagnates; troubleshoot and correct cause. If three successive starts are aborted for stagnation, refer to table 4-7, and perform action required under symbol B.

[3]After prolonged shutdown, engine speed may be less than normal at idle immediately following engine start. The reduction in rpm varies between engines and will be lowered as temperature decreases. Minimum acceptable cold idle speed is 48% rpm.

[4]Minimum indicated oil pressure is 15 psid below 80% rpm and 27 psid above 80% rpm.

[5]Reject engine if speed exceeds 105% rpm.

[6]Fluctuations are permissible only when minimum or maximum operating limits are not exceeded. Fluctuations are allowable instrument fluctuations and are not intended to cover engine operating parameters.

[7] When operating in Hush House enclosure, reduce target TOP by 0.5 inch Hg on all power check charts.

[8] A ±4% rpm change when taxiing/turning is acceptable provding the following troubleshooting steps have been successfully completed; control cambox rigging check, nonintegral vibration check, and cold start system operational check.

Table 4-7. Engine Overtemperature Inspection Requirements

TOT (T5.1)	During start		
	Less than 3 seconds	3 seconds to 5 seconds	Over 5 seconds
620° to 699°C (1,148 to 1,290°F)	A	B	C
700°C (1,292°F) and above	C	C	C

Ground operation and takeoff, and all engines in flight

TOT (T5.1)	Up to 3 seconds	Over 3 seconds to 2 minutes	Over 2 minutes
583° to 603°C (1,081° to 1,117°F)	X	A	A
604° to 619°C (1,119° to 1,146°F)	X	A	B
620° to 639°C (1,148° to 1,182°F)	X	B	B
640° to 669°C (1,184° to 1,236°F)	B	C	C
670°C (1,238°F) and above	C	C	C

Symbol definition

Symbol	Action required[1]
X	No action required.
A	a. Record peak temperature and time at that temperature and enter data in engine log. b. Investigate and correct cause of overtemperature.
B	a. Record peak temperature and time at that temperature and enter data in engine log. b. Investigate and correct cause of overtemperature. c. Perform combustion liner and HP turbine borescope inspection. d. Perform high pressure turbine second stage borescope inspection. e. Using strong light, visually check turbine through tailpipe. f. Rotate engine and check for unusual noises. g. Check LP and HP rotor coastdown times.
C	a. Record peak temperature and time at that temperature, and enter data in engine log. b. Remove engine for overtemperature inspection at field level.

[1]After 10 A overtemperatures have been recorded, make a B inspection. After 10 B overtemperatures have been recorded, remove engine for overtemperature inspection.

o. At 5% rpm, move throttle outboard to IGNITE and hold.

p. At 15% rpm, keep outboard pressure on throttle and move to outboard of IDLE.

CAUTION

If hung start is encountered, visually check turbine for overtemperature damage through tailpipe using strong light. Pay close attention to low pressure second stage turbine blade tips.

q. Check that TOT begins to rise after throttle has been placed in IDLE. {1}

r. Check that engine rpm continues to rise. {1}

NOTE

Starter cutoff may be detected by an audible starter disengagement and observance of starter exhaust cutoff.

s. Check that starter disengages at 42.5% (±1.5%) rpm. {1}

t. At 48% rpm, move throttle inboard to IDLE.

NOTE

Move throttle as required to maintain approximately 54% rpm until stabilized idle speed is reached.

u. Allow rpm to stabilize.

v. Place starter switch in ABORT.

CAUTION

To prevent overheating of air-conditioning system, make sure that ram air flow starts immediately from ram air exhaust duct after placing cabin pressure switch in CABIN PRESS. If no flow occurs, place switch in CABIN DUMP, shut down engine, and troubleshoot air-conditioning supply system (T.O. 1A-7D-2-3).

NOTE

Leave cabin pressure switch in CABIN PRESS to make sure cooling of avionics equipment during engine operation.

w. Place cabin pressure switch in CABIN PRESS and check that air-conditioning system is operating.

NOTE

If master generator indicator does not indicate V, refer to T.O. 1A-7D-2-11 for troubleshooting procedures.

x. Check that master generator indicator indicates V.

WARNING

Shut down the engine if main fuel pump, fuel boost 1, fuel boost 2, and/or engine oil caution lights stay on. Failure to comply with this warning may cause a fire which could result in injury or loss of life.

y. Check that main fuel pump, fuel boost 1, and fuel boost 2 caution lights go off. {2}

z. Check that oil pressure indicator indicates 15 psid minimum at idle rpm, and oil pressure caution light is not on. {3}

CAUTION

To prevent airplane damage from excessive heat, make sure that gun gas purge air is not present at purge door after engine start. If purge air is present, shut down engine and troubleshoot purge air system (T.O. 1A-7D-2-3).

aa. Check that gun gas purge air is not present at gun gas purge door vent.

ab. Check that engine component drains are within limits in table 4-8.

CAUTION

To prevent airplane movement at high engine rpm, make sure tiedown restraint cable is stretched tight.

ac. Stretch engine run tiedown restraint cable as follows:

(1) Remove wheel chocks and allow airplane to move forward.

(2) Advance throttle to obtain 70% to 75% rpm.

(3) With cable stretched, install wheel chock forward and aft of each main landing gear.

(4) Retard throttle to IDLE.

NOTE

Ensure main fuel system contains minimum 3,000 pounds fuel.

ad. Slowly advance throttle to MIL and stabilize for 3 minutes. Check that all engine parameters are steady and within limits. {4, 5, 6, 7, 8, 9, 10}

ad1. While at MIL power, place alternate fuel feed handle from NORM to ALT FEED.

ad2. Check that engine continues to run with no indication of surge or flameout for 1 minute.

ad3. Return alternate fuel feed handle to NORM.

ad4. If engine surges or flameout was indicated, perform alternate fuel feed system static checkout (T.O. 1A-7D-2-6).

ae. Retard throttle to IDLE and stabilize for 3 minutes. {11}

af. Check that idle speed is 55% (±2%) rpm. {12, 13, 14}

CAUTION

Fast acceleration time can cause engine overtemperature during jam accelerations.

NOTE

It is normal for cold engine acceleration time to be up to 15 seconds. A cold engine is one that has been shut down for 15 minutes or operated at idle for a minimum of 8 minutes.

ag. Perform acceleration/deceleration time checks (paragraph 5-16 or 5-17). {15, 16}

ah. Perform manual fuel control operational checkout (paragraph 6-4).

Table 4-8. Engine Component Drainage Limits

NOTE

If the fuel master lever is left in ON, static fuel leakage may occur from the main fuel control drive seal through the engine accessory seal overboard drain. This condition is considered normal provided leakage is within limits with engine running as indicated. If leakage exceeds allowable limits, refer to table 4-9 for troubleshooting and corrective action.

Components drained	Fluid	Allowable leakage
Oil breather and air blown seal vent	Oil	Oil vapor or drops at the overboard breather are permissible provided oil consumption limit is not exceeded.
CSD-to-engine seal drain	Oil	From engine: None From CSD: 4 cc per hour

See footnotes at the end of the table.

Table 4-8. Engine Component Drainage Limits — CONT

Components drained	Fluid	Allowable leakage
Combustion chamber drain	Fuel	20 cc after shutdown; no leakage during operation.
Gang drain	Oil	None
	Fuel	7 cc per minute[1]
Starter drain	Oil	None
	Fuel	Starter running: None Shutdown: 25 cc
Engine combustor drain	Fuel	Engine running: None Normal shutdown: None Wet shutdown: 675 cc
Low pessure cooling air duct	Oil	Oil wetness is permissible if oil consumption is within limits. After extended operation at idle, oil vapor or drops out of the low pressure cooling air duct are a characteristic of some engines and are not considered cause for engine rejection.
No. 1 bearing area	Oil	Puddling is permitted provided oil consumption limit is not exceeded.
Rear bypass duct	Oil	Puddling is permitted provided oil consumption limit is not exceeded.
HP fuel shutoff valve drain	Fuel	Normal shutdown: 500 cc Wet shutdown: 680 cc
LP fuel pump drain	Fuel	Combined leakage[1]
HP fuel pump drain	Oil Fuel	From engine: None From pump: Combined leakage[1]
Manual fuel control drain	Fuel	Combined leakage[1]
Airflow control drain	Fuel	Combined leakage[1]
Main fuel control drain[2]	Oil Fuel	From engine: None From control: 3 cc per minute
Low-pressure governor drain[2]	Oil Fuel	From engine: None From governor: 3 cc per minute

[1]If limit is exceeded, perform fuel seal leakage isolation procedure (paragraph 5-34).

[2]Components share common manifold and must be isolated individually.

NOTE

To obtain accurate temperature indications, keep thermometer out of direct sunlight or high velocity air and allow to stabilize. Temperature must be taken during checkout.

ai. Obtain ambient temperature in vicinity of fuselage under left wing. Record temperature.

aj. Using ambient pressure recorded in step m, ambient temperature recorded in step ai, and power check chart (figure 4-5); calculate and record Pt5.1 true pressure.

ak. Slowly advance throttle to MIL and stabilize for 5 minutes.

al. Record cockpit turbine outlet pressure (inches Hg gage) and test set indication (inches Hg absolute).

am. Retard throttle to IDLE.

an. Correct test set indication as follows:

$$\begin{bmatrix}\text{Test set} \\ \text{indication} \\ \text{(inches Hg} \\ \text{absolute)}\end{bmatrix} - \begin{bmatrix}\text{Ambient} \\ \text{pressure} \\ \text{(inches Hg} \\ \text{absolute)}\end{bmatrix} = \begin{bmatrix}\text{Corrected Pt5.1} \\ \text{pressure} \\ \text{(inches} \\ \text{Hg gage)}\end{bmatrix}$$

ao. Check that corrected test set indication is equal to or more than Pt5.1 true pressure in step aj. {17}

ap. Check that cockpit turbine outlet pressure is within +0.6, −0.9 inch Hg of corrected test set indication in step an. {18}

aq. Advance throttle to obtain 70% to 75% rpm. Move aft wheel chocks enough to allow tiedown restraint cable to relax after engine shut down.

ar Retard throttle to IDLE.

WARNING

To prevent possible loss of canopy and injury to personnel, the emergency vent air knob should be in full open position to make sure that cockpit is not pressurized when the canopy is opened. Restrain the canopy until it is fully open to prevent excessive opening speed.

as. Place emergency vent air knob in open position. Open canopy if it has been closed during engine run.

as1. Place master generator switch in OFF-RESET.

CAUTION

To prevent engine damage in the event engine will not shut down with throttle in OFF, place fuel master control lever in OFF.

at. When engine TOT has stabilized at idle for 2 minutes, place throttle in OFF. {19}

au. Check that rotors run down freely. High pressure rotor coastdown time shall be 20 seconds minimum; low pressure rotor coastdown time shall be 60 seconds minimum. {20}

av. Place fuel master lever in OFF when engine stops turning.

aw. Check oil lever (T.O. 1A-7D-2-1). Oil consumption must be less than 0.12 gallon per hour. {21}

ax. Disconnect test set from TOP line.

Main Fuel Control Power Check Chart – TF41-A-1

NOTE

Values shown are for engine operating with air inlet screen installed and air conditioning system operating. If engine must be operated with screen removed, add 1.3" Hg to $P_{T5.1}$ true pressure.

Ambient Temperature		Ambient Pressure – Inches Mercury Absolute									
		24.0	24.1	24.2	24.3	24.4	24.5	24.6	24.7	24.8	24.9
°C	°F	$P_{T5.1}$ True Pressure – Inches Mercury Gage									
55.	131.0	18.7	18.8	18.9	18.9	19.0	19.1	19.2	19.3	19.3	19.4
54.	129.2	19.0	19.1	19.2	19.2	19.3	19.4	19.5	19.6	19.6	19.7
53.	127.4	19.3	19.3	19.4	19.5	19.6	19.7	19.7	19.8	19.9	20.0
52.	125.6	19.5	19.6	19.7	19.7	19.8	19.9	20.0	20.1	20.2	20.2
51.	123.8	19.8	19.8	19.9	20.0	20.1	20.2	20.3	20.3	20.4	20.5
50.	122.0	20.1	20.1	20.2	20.3	20.4	20.5	20.6	20.6	20.7	20.8
49.	120.2	20.3	20.4	20.5	20.6	20.7	20.7	20.8	20.9	21.0	21.1
48.	118.4	20.6	20.7	20.8	20.8	20.9	21.0	21.1	21.2	21.3	21.4
47.	116.6	20.8	20.9	21.0	21.1	21.2	21.3	21.4	21.5	21.5	21.6
46.	114.8	21.1	21.2	21.3	21.4	21.5	21.6	21.6	21.7	21.8	21.9
45.	113.0	21.4	21.5	21.6	21.7	21.8	21.8	21.9	22.0	22.1	22.2
44.	111.2	21.7	21.8	21.8	21.9	22.0	22.1	22.2	22.3	22.4	22.5
43.	109.4	21.9	22.0	22.1	22.2	22.3	22.4	22.5	22.6	22.7	22.8
42.	107.6	22.2	22.3	22.4	22.5	22.6	22.7	22.8	22.9	23.0	23.1
41.	105.8	22.5	22.6	22.7	22.8	22.9	23.0	23.1	23.2	23.3	23.4
40.	104.0	22.8	22.9	23.0	23.1	23.1	23.2	23.3	23.4	23.5	23.6
39.	102.2	23.1	23.2	23.3	23.4	23.5	23.6	23.7	23.8	23.9	24.0
38.	100.4	23.4	23.5	23.6	23.7	23.8	23.9	24.0	24.1	24.2	24.3
37.	98.6	23.7	23.8	23.9	24.0	24.1	24.2	24.3	24.4	24.5	24.6
36.	96.8	23.9	24.0	24.1	24.2	24.3	24.4	24.5	24.6	24.7	24.8
35.	95.0	24.2	24.3	24.4	24.5	24.6	24.7	24.8	24.9	25.0	25.1
34.	93.2	24.5	24.6	24.7	24.8	24.9	25.0	25.1	25.2	25.3	25.4
33.	91.4	24.8	24.9	25.0	25.1	25.2	25.3	25.4	25.5	25.6	25.7
32.	89.6	25.1	25.2	25.3	25.4	25.5	25.6	25.8	25.9	26.0	26.1
31.	87.8	25.4	25.5	25.6	25.7	25.9	26.0	26.1	26.2	26.3	26.4
30.	86.0	25.7	25.8	26.0	26.1	26.2	26.3	26.4	26.5	26.6	26.7
29.	84.2	26.1	26.2	26.3	26.4	26.5	26.6	26.7	26.8	26.9	27.0
28.	82.4	26.3	26.5	26.6	26.7	26.8	26.9	27.0	27.1	27.2	27.3
27.	80.6	26.7	26.8	26.9	27.0	27.1	27.2	27.4	27.5	27.6	27.7
26.	78.8	26.9	27.1	27.2	27.3	27.4	27.5	27.6	27.7	27.8	28.0
25.	77.0	27.2	27.3	27.5	27.6	27.7	27.8	27.9	28.0	28.1	28.3
24.	75.2	27.5	27.6	27.7	27.8	28.0	28.1	28.2	28.3	28.4	28.5
23.	73.4	27.7	27.8	28.0	28.1	28.2	28.3	28.4	28.5	28.7	28.8
22.	71.6	28.0	28.1	28.2	28.3	28.5	28.6	28.7	28.8	28.9	29.1
21.	69.8	28.2	28.3	28.4	28.6	28.7	28.8	28.9	29.0	29.2	29.3
20.	68.0	28.3	28.4	28.5	28.7	28.8	28.9	29.0	29.1	29.3	29.4

For temperature below 20°C (68°F) use 20°C (68°F).

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Figure 4-5. Power Check Chart; Main Fuel Control (Sheet 1 of 7)

Main Fuel Control Power Check Chart – TF41-A-1

NOTE

Values shown are for engine operating with air inlet screen installed and air conditioning system operating. If engine must be operated with screen removed, add 1.3" Hg to $P_{T5.1}$ true pressure.

Ambient Temperature		Ambient Pressure – Inches Mercury Absolute									
		25.0	25.1	25.2	25.3	25.4	25.5	25.6	25.7	25.8	25.9
°C	°F	$P_{T5.1}$ True Pressure – Inches Mercury Gage									
55.	131.0	19.5	19.6	19.7	19.7	19.8	19.9	20.0	20.1	20.1	20.2
54.	129.2	19.8	19.9	20.0	20.0	20.1	20.2	20.3	20.4	20.4	20.5
53.	127.4	20.1	20.2	20.2	20.3	20.4	20.5	20.6	20.6	20.7	20.8
52.	125.6	20.3	20.4	20.5	20.6	20.7	20.7	20.8	20.9	21.0	21.1
51.	123.8	20.6	20.7	20.8	20.9	20.9	21.0	21.1	21.2	21.3	21.4
50.	122.0	20.9	21.0	21.1	21.2	21.2	21.3	21.4	21.5	21.6	21.7
49.	120.2	21.2	21.3	21.3	21.4	21.5	21.6	21.7	21.8	21.9	21.9
48.	118.4	21.4	21.5	21.6	21.7	21.8	21.9	22.0	22.1	22.1	22.2
47.	116.6	21.7	21.8	21.9	22.0	22.1	22.2	22.3	22.3	22.4	22.5
46.	114.8	22.0	22.1	22.2	22.3	22.4	22.4	22.5	22.6	22.7	22.8
45.	113.0	22.3	22.4	22.5	22.6	22.7	22.8	22.8	22.9	23.0	23.1
44.	111.2	22.6	22.7	22.8	22.8	22.9	23.0	23.1	23.2	23.3	23.4
43.	109.4	22.9	23.0	23.1	23.2	23.2	23.3	23.4	23.5	23.6	23.7
42.	107.6	23.1	23.2	23.3	23.4	23.5	23.6	23.7	23.8	23.9	24.0
41.	105.8	23.4	23.5	23.6	23.7	23.8	23.9	24.0	24.1	24.2	24.3
40.	104.0	23.7	23.8	23.9	24.0	24.1	24.2	24.3	24.4	24.5	24.6
39.	102.2	24.0	24.1	24.2	24.3	24.4	24.5	24.6	24.7	24.8	24.9
38.	100.4	24.3	24.4	24.5	24.6	24.7	24.8	24.9	25.0	25.1	25.2
37.	98.6	24.6	24.7	24.8	24.9	25.0	25.1	25.2	25.3	25.4	25.5
36.	96.8	24.9	25.1	25.2	25.3	25.4	25.5	25.6	25.7	25.8	25.9
35.	95.0	25.2	25.4	25.5	25.6	25.7	25.8	25.9	26.0	26.1	26.2
34.	93.2	25.5	25.7	25.8	25.9	26.0	26.1	26.2	26.3	26.4	26.5
33.	91.4	25.8	26.0	26.1	26.2	26.3	26.4	26.5	26.6	26.7	26.8
32.	89.6	26.2	26.3	26.4	26.5	26.6	26.7	26.8	26.9	27.0	27.1
31.	87.8	26.5	26.6	26.7	26.8	26.9	27.0	27.1	27.3	27.4	27.5
30.	86.0	26.8	26.9	27.0	27.2	27.3	27.4	27.5	27.6	27.7	27.8
29.	84.2	27.1	27.3	27.4	27.5	27.6	27.7	27.8	27.9	28.0	28.1
28.	82.4	27.4	27.6	27.7	27.8	27.9	28.0	28.1	28.2	28.3	28.4
27.	80.6	27.8	27.9	28.0	28.1	28.2	28.4	28.5	28.6	28.7	28.8
26.	78.8	28.1	28.2	28.3	28.4	28.5	28.6	28.8	28.9	29.0	29.1
25.	77.0	28.4	28.5	28.6	28.7	28.8	28.9	29.1	29.2	29.3	29.4
24.	75.2	28.6	28.8	28.9	29.0	29.1	29.2	29.3	29.5	29.6	29.7
23.	73.4	28.9	29.0	29.1	29.3	29.4	29.5	29.6	29.7	29.8	30.0
22.	71.6	29.2	29.3	29.4	29.5	29.6	29.8	29.9	30.0	30.1	30.2
21.	69.8	29.4	29.5	29.6	29.8	29.9	30.0	30.1	30.2	30.4	30.5
20.	68.0	29.5	29.6	29.7	29.9	30.0	30.1	30.2	30.3	30.5	30.6

For temperature below 20°C (68°F) use 20°C (68°F).

05D156–02–11–83

Figure 4-5. Power Check Chart; Main Fuel Control (Sheet 2)

Main Fuel Control Power Check Chart – TF41-A-1

NOTE

Values shown are for engine operating with air inlet screen installed and air conditioning system operating. If engine must be operated with screen removed, add 1.3" Hg to $P_{T5.1}$ true pressure.

Ambient Temperature		Ambient Pressure – Inches Mercury Absolute									
		26.0	26.1	26.2	26.3	26.4	26.5	26.6	26.7	26.8	26.9
°C	°F	$P_{T5.1}$ True Pressure – Inches Mercury Gage									
55.	131.0	20.3	20.4	20.5	20.5	20.6	20.7	20.8	20.8	20.9	21.0
54.	129.2	20.6	20.7	20.8	20.8	20.9	21.0	21.1	21.2	21 2	21.3
53.	127.4	20.9	21.0	21.1	21.1	21.2	21.3	21.4	21.5	21.5	21.6
52.	125.6	21.1	21.2	21.3	21.4	21.5	21.6	21.6	21.7	21.8	21.9
51.	123.8	21.4	21.5	21.6	21.7	21.8	21.9	21.9	22.0	22.1	22.2
50.	122.0	21.7	21.8	21.9	22.0	22.1	22.2	22.3	22.3	22.4	22.5
49.	120.2	22.0	22.1	22.2	22.3	22.4	22.5	22.5	22.6	22.7	22.8
48.	118.4	22.3	22.4	22.5	22.6	22.7	22.8	22.8	22.9	23.0	23.1
47.	116.6	22.6	22.7	22.8	22.9	23.0	23.0	23.1	23.2	23.3	23.4
46.	114.8	22.9	23.0	23.1	23.2	23.2	23.3	23.4	23.5	23.6	23.7
45.	113.0	23.2	23.3	23.4	23.5	23.6	23.7	23.7	23.8	23.9	24.0
44.	111.2	23.5	23.6	23.7	23.8	23.9	23.9	24.0	24.1	24.2	24.3
43.	109.4	23.8	23.9	24.0	24.1	24.2	24.3	24.4	24.5	24.5	24.6
42.	107.6	24.1	24.2	24.3	24.4	24.5	24.6	24.7	24.7	24.8	24.9
41.	105.8	24.4	24.5	24.6	24.7	24.8	24.9	25.0	25.1	25.2	25.3
40.	104.0	24.7	24.8	24.9	25.0	25.1	25.2	25.3	25.4	25.5	25.6
39.	102.2	25.0	25.1	25.2	25.3	25.4	25.5	25.6	25.7	25.8	25.9
38.	100.4	25.3	25.4	25.5	25.6	25.7	25.8	25.9	26.0	26.1	26.2
37.	98.6	25.6	25.7	25.8	25.9	26.0	26.1	26.2	26.3	26.4	26.5
36.	96.8	26.0	26.1	26.2	26.3	26.4	26.5	26.6	26.7	26.8	26.9
35.	95.0	26.3	26.4	26.5	26.6	26.7	26.8	26 9	27.0	27.1	27.2
34.	93.2	26.6	26.7	26.8	26.9	27.0	27.1	27.2	27.3	27.4	27.5
33.	91.4	26.9	27.0	27.1	27.2	27.3	27.4	27.5	27.6	27.7	27.8
32.	89.6	27.2	27.3	27.4	27.6	27.7	27.8	27.9	28.0	28.1	28.2
31.	87.8	27.6	27.7	27.8	27.9	28.0	28.1	28.2	28.3	28.4	28.5
30.	86.0	27.9	28.0	28.1	28.2	28.3	28.5	28.6	28.7	28.8	28.9
29.	84.2	28.2	28.4	28.5	28.6	28.7	28.8	28.9	29.0	29.1	29.2
28.	82.4	28.6	28.7	28.8	28.9	29.0	29.1	29.2	29.3	29.4	29.6
27.	80.6	28.9	29.0	29.1	29.3	29.4	29.5	29.6	29.7	29.8	29.9
26.	78.8	29.2	29.3	29.4	29.6	29.7	29.8	29.9	30.0	30.1	30.2
25.	77.0	29.5	29.6	29.8	29.9	30.0	30.1	30.2	30.3	30.4	30.6
24.	75.2	29.8	29.9	30.0	30.2	30.3	30.4	30.5	30.6	30.7	30.9
23.	73.4	30.1	30.2	30.3	30.4	30.5	30.7	30.8	30.9	31.0	31.1
22.	71.6	30.4	30.5	30.6	30.7	30.8	30.9	31.1	31.2	31.3	31.4
21.	69.8	30.6	30.7	30.8	30.9	31.1	31.2	31.3	31.4	31.5	31.7
20.	68.0	30.7	30.8	30.9	31.0	31.2	31.3	31.4	31.5	31.6	31.8

For temperature below 20°C (68°F) use 20°C (68°F).

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Figure 4-5. Power Check Chart; Main Fuel Control (Sheet 3)

Main Fuel Control Power Check Chart – TF41-A-1

NOTE

Values shown are for engine operating with air inlet screen installed and air conditioning system operating. If engine must be operated with screen removed, add 1.3" Hg to $P_{T5.1}$ true pressure.

Ambient Temperature		Ambient Pressure – Inches Mercury Absolute									
		27.0	27.1	27.2	27.3	27.4	27.5	27.6	27.7	27.8	27.9
°C	°F	$P_{T5.1}$ True Pressure – Inches Mercury Gage									
55.	131.0	21.1	21.2	21.2	21.3	21.4	21.5	21.6	21.6	21.7	21.8
54.	129.2	21.4	21.5	21.6	21.6	21.7	21.8	21.9	22.0	22.1	22.1
53.	127.4	21.7	21.8	21.9	21.9	22.0	22.1	22.2	22.3	22.4	22.4
52.	125.6	22.0	22.1	22.1	22.2	22.3	22.4	22.5	22.6	22.6	22.7
51.	123.8	22.3	22.4	22.4	22.5	22.6	22.7	22.8	22.9	22.9	23.0
50.	122.0	22.6	22.7	22.8	22.9	22.9	23.0	23.1	23.2	23.3	23.4
49.	120.2	22.9	23.0	23.1	23.2	23.2	23.3	23.4	23.5	23.6	23.7
48.	118.4	23.2	23.3	23.4	23.5	23.5	23.6	23.7	23.8	23.9	24.0
47.	116.6	23.5	23.6	23.7	23.8	23.8	23.9	24.0	24.1	24.2	24.3
46.	114.8	23.8	23.9	24.0	24.1	24.1	24.2	24.3	24.4	24.5	24.6
45.	113.0	24.1	24.2	24.3	24.4	24.5	24.6	24.7	24.7	24.8	24.9
44.	111.2	24.4	24.5	24.6	24.7	24.8	24.9	25.0	25.0	25.1	25.2
43.	109.4	24.7	24.8	24.9	25.0	25.1	25.2	25.3	25.4	25.5	25.6
42.	107.6	25.0	25.1	25.2	25.3	25.4	25.5	25.6	25.7	25.8	25.9
41.	105.8	25.3	25.4	25.5	25.6	25.7	25.8	25.9	26.0	26.1	26.2
40.	104.0	25.6	25.7	25.8	25.9	26.0	26.1	26.2	26.3	26.4	26.5
39.	102.2	26.0	26.1	26.2	26.3	26.4	26.5	26.6	26.7	26.8	26.9
38.	100.4	26.3	26.4	26.5	26.6	26.7	26.8	26.9	27.0	27.1	27.2
37.	98.6	26.6	26.7	26.8	26.9	27.0	27.1	27.2	27.3	27.4	27.5
36.	96.8	27.0	27.1	27.2	27.3	27.4	27.5	27.6	27.7	27.8	27.9
35.	95.0	27.3	27.4	27.5	27.6	27.7	27.8	27.9	28.0	28.1	28.2
34.	93.2	27.6	27.7	27.8	27.9	28.0	28.1	28.2	28.3	28.4	28.5
33.	91.4	27.9	28.0	28.2	28.3	28.4	28.5	28.6	28.7	28.8	28.9
32.	89.6	28.3	28.4	28.5	28.6	28.7	28.8	28.9	29.0	29.1	29.2
31.	87.8	28.6	28.8	28.9	29.0	29.1	29.2	29.3	29.4	29.5	29.6
30.	86.0	29.0	29.1	29.2	29.3	29.4	29.5	29.6	29.8	29.9	30.0
29.	84.2	29.3	29.5	29.6	29.7	29.8	29.9	30.0	30.1	30.2	30.3
28.	82.4	29.7	29.8	29.9	30.0	30.1	30.2	30.3	30.4	30.6	30.7
27.	80.6	30.0	30.2	30.3	30.4	30.5	30.6	30.7	30.8	30.9	31.1
26.	78.8	30.3	30.5	30.6	30.7	30.8	30.9	31.0	31.1	31.3	31.4
25.	77.0	30.7	30.8	30.9	31.0	31.1	31.2	31.4	31.5	31.6	31.7
24.	75.2	31.0	31.1	31.2	31.3	31.4	31.5	31.7	31.8	31.9	32.0
23.	73.4	31.2	31.4	31.5	31.6	31.7	31.8	31.9	32.1	32.2	32.3
22.	71.6	31.5	31.7	31.8	31.9	32.0	32.1	32.2	32.4	32.5	32.6
21.	69.8	31.8	31.9	32.0	32.1	32.3	32.4	32.5	32.6	32.7	32.8
20.	68.0	31.9	32.0	32.1	32.2	32.4	32.5	32.6	32.7	32.8	33.0

For temperature below 20°C (68°F) use 20°C (68°F).

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Figure 4-5. Power Check Chart; Main Fuel Control (Sheet 4)

Main Fuel Control Power Check Chart – TF41-A-1

NOTE

Values shown are for engine operating with air inlet screen installed and air conditioning system operating. If engine must be operated with screen removed, add 1.3" Hg to $P_{T5.1}$ true pressure.

Ambient Temperature		Ambient Pressure – Inches Mercury Absolute									
		28.0	28.1	28.2	28.3	28.4	28.5	28.6	28.7	28.8	28.9
°C	°F	$P_{T5.1}$ True Pressure – Inches Mercury Gage									
55.	131.0	21.9	22.0	22.0	22.1	22.2	22.3	22.4	22.4	22.5	22.6
54.	129.2	22.2	22.3	22.4	22.5	22.5	22.6	22.7	22.8	22.9	22.9
53.	127.4	22.5	22.6	22.7	22.8	22.8	22.9	23.0	23.1	23.2	23.3
52.	125.6	22.8	22.9	23.0	23.0	23.1	23.2	23.3	23.4	23.5	23.5
51.	123.8	23.1	23.2	23.3	23.4	23.4	23.5	23.6	23.7	23.8	23.9
50.	122.0	23.4	23.5	23.6	23.7	23.8	23.9	24.0	24.0	24.1	24.2
49.	120.2	23.8	23.8	23.9	24.0	24.1	24.2	24.3	24.4	24.4	24.5
48.	118.4	24.1	24.1	24.2	24.3	24.4	24.5	24.6	24.7	24.8	24.8
47.	116.6	24.4	24.5	24.5	24.6	24.7	24.8	24.9	25.0	25.1	25.2
46.	114.8	24.7	24.8	24.9	24.9	25.0	25.1	25.2	25.3	25.4	25.5
45.	113.0	25.0	25.1	25.2	25.3	25.4	25.5	25.6	25.6	25.7	25.8
44.	111.2	25.3	25.4	25.5	25.6	25.7	25.8	25.9	26.0	26.1	26.1
43.	109.4	25.7	25.7	25.8	25.9	26.0	26.1	26.2	26.3	26.4	26.5
42.	107.6	26.0	26.1	26.2	26.2	26.3	26.4	26.5	26.6	26.7	26.8
41.	105.8	26.3	26.4	26.5	26.6	26.7	26.8	26.9	27.0	27.1	27.2
40.	104.0	26.6	26.7	26.8	26.9	27.0	27.1	27.2	27.3	27.4	27.5
39.	102.2	27.0	27.1	27.2	27.3	27.4	27.5	27.6	27.7	27.8	27.8
38.	100.4	27.3	27.4	27.5	27.6	27.7	27.8	27.9	28.0	28.1	28.2
37.	98.6	27.6	27.7	27.8	27.9	28.0	28.1	28.2	28.3	28.4	28.5
36.	96.8	28.0	28.1	28.2	28.3	28.4	28.5	28.6	28.7	28.8	28.9
35.	95.0	28.3	28.4	28.5	28.6	28.7	28.8	28.9	29.0	29.1	29.2
34.	93.2	28.7	28.8	28.9	29.0	29.1	29.2	29.3	29.4	29.5	29.6
33.	91.4	29.0	29.1	29.2	29.3	29.4	29.5	29.6	29.7	29.8	29.9
32.	89.6	29.4	29.5	29.6	29.7	29.8	29.9	30.0	30.1	30.2	30.3
31.	87.8	29.7	29.8	29.9	30.0	30.1	30.3	30.4	30.5	30.6	30.7
30.	86.0	30.1	30.2	30.3	30.4	30.5	30.6	30.7	30.8	30.9	31.1
29.	84.2	30.4	30.6	30.7	30.8	30.9	31.0	31.1	31.2	31.3	31.4
28.	82.4	30.8	30.9	31.0	31.1	31.2	31.3	31.4	31.6	31.7	31.8
27.	80.6	31.2	31.3	31.4	31.5	31.6	31.7	31.8	32.0	32.1	32.2
26.	78.8	31.5	31.6	31.7	31.8	31.9	32.0	32.2	32.3	32.4	32.5
25.	77.0	31.8	31.9	32.0	32.2	32.3	32.4	32.5	32.6	32.7	32.8
24.	75.2	32.1	32.2	32.4	32.5	32.6	32.7	32.8	32.9	33.1	33.2
23.	73.4	32.4	32.5	32.6	32.8	32.9	33.0	33.1	33.2	33.3	33.5
22.	71.6	32.7	32.8	32.9	33.1	33.2	33.3	33.4	33.5	33.7	33.8
21.	69.8	33.0	33.1	33.2	33.3	33.4	33.6	33.7	33.8	33.9	34.0
20.	68.0	33.1	33.2	33.3	33.4	33.6	33.7	33.8	33.9	34.0	34.1

For temperature below 20°C (68°F) use 20°C (68°F).

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Figure 4-5. Power Check Chart; Main Fuel Control (Sheet 5)

Main Fuel Control Power Check Chart – TF41-A-1

NOTE

Values shown are for engine operating with air inlet screen installed and air conditioning system operating. If engine must be operated with screen removed, add 1.3" Hg to $P_{T5.1}$ true pressure.

Ambient Temperature		Ambient Pressure – Inches Mercury Absolute									
		29.0	29.1	29.2	29.3	29.4	29.5	29.6	29.7	29.8	29.9
°C	°F	$P_{T5.1}$ True Pressure – Inches Mercury Gage									
55.	131.0	22.7	22.7	22.8	22.9	23.0	23.1	23.1	23.2	23.3	23.4
54.	129.2	23.0	23.1	23.2	23.3	23.3	23.4	23.5	23.6	23.7	23.7
53.	127.4	23.3	23.4	23.5	23.6	23.7	23.7	23.8	23.9	24.0	24.1
52.	125.6	23.6	23.7	23.8	23.9	24.0	24.0	24.1	24.2	24.3	24.4
51.	123.8	23.9	24.0	24.1	24.2	24.3	24.4	24.4	24.5	24.6	24.7
50.	122.0	24.3	24.4	24.5	24.5	24.6	24.7	24.8	24.9	25.0	25.1
49.	120.2	24.6	24.7	24.8	24.9	25.0	25.0	25.1	25.2	25.3	25.4
48.	118.4	24.9	25.0	25.1	25.2	25.3	25.4	25.5	25.5	25.6	25.7
47.	116.6	25.2	25.3	25.4	25.5	25.6	25.7	25.8	25.9	26.0	26.0
46.	114.8	25.6	25.7	25.7	25.8	25.9	26.0	26.1	26.2	26.3	26.4
45.	113.0	25.9	26.0	26.1	26.2	26.3	26.4	26.5	26.5	26.6	26.7
44.	111.2	26.2	26.3	26.4	26.5	26.6	26.7	26.8	26.9	27.0	27.1
43.	109.4	26.6	26.7	26.8	26.9	27.0	27.0	27.1	27.2	27.3	27.4
42.	107.6	26.9	27.0	27.1	27.2	27.3	27.4	27.5	27.6	27.7	27.7
41.	105.8	27.2	27.3	27.4	27.5	27.6	27.7	27.8	27.9	28.0	28.1
40.	104.0	27.6	27.7	27.8	27.9	28.0	28.0	28.1	28.2	28.3	28.4
39.	102.2	27.9	28.0	28.1	28.2	28.3	28.4	28.5	28.6	28.7	28.8
38.	100.4	28.3	28.4	28.5	28.6	28.7	28.8	28.9	29.0	29.1	29.2
37.	98.6	28.6	28.7	28.8	28.9	29.0	29.1	29.2	29.3	29.4	29.5
36.	96.8	29.0	29.1	29.2	29.3	29.4	29.5	29.6	29.7	29.8	29.9
35.	95.0	29.3	29.4	29.5	29.6	29.7	29.8	30.0	30.1	30.2	30.3
34.	93.2	29.7	29.8	29.9	30.0	30.1	30.2	30.3	30.4	30.5	30.6
33.	91.4	30.0	30.1	30.2	30.3	30.5	30.6	30.7	30.8	30.9	31.0
32.	89.6	30.4	30.5	30.6	30.7	30.8	30.9	31.0	31.2	31.3	31.4
31.	87.8	30.8	30.9	31.0	31.1	31.2	31.3	31.4	31.5	31.6	31.8
30.	86.0	31.2	31.3	31.4	31.5	31.6	31.7	31.8	31.9	32.0	32.1
29.	84.2	31.5	31.7	31.8	31.9	32.0	32.1	32.2	32.3	32.4	32.5
28.	82.4	31.9	32.0	32.1	32.2	32.3	32.4	32.6	32.7	32.8	32.9
27.	80.6	32.3	32.4	32.5	32.6	32.7	32.9	33.0	33.1	33.2	33.3
26.	78.8	32.6	32.7	32.8	33.0	33.1	33.2	33.3	33.4	33.5	33.6
25.	77.0	33.0	33.1	33.2	33.3	33.4	33.5	33.7	33.8	33.9	34.0
24.	75.2	33.3	33.4	33.5	33.6	33.7	33.9	34.0	34.1	34.2	34.3
23.	73.4	33.6	33.7	33.8	33.9	34.0	34.2	34.3	34.4	34.5	34.6
22.	71.6	33.9	34.0	34.1	34.2	34.4	34.5	34.6	34.7	34.8	35.0
21.	69.8	34.2	34.3	34.4	34.5	34.6	34.7	34.9	35.0	35.1	35.2
20.	68.0	34.3	34.4	34.5	34.6	34.7	34.9	35.0	35.1	35.2	35.3

For temperature below 20°C (68°F) use 20°C (68°F).

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Figure 4-5. Power Check Chart; Main Fuel Control (Sheet 6)

Main Fuel Control Power Check Chart – TF41-A-1

NOTE

Values shown are for engine operating with air inlet screen installed and air conditioning system operating. If engine must be operated with screen removed, add 1.3" Hg to $P_{T5.1}$ true pressure.

Ambient Temperature		Ambient Pressure – Inches Mercury Absolute									
		30.0	30.1	30.2	30.3	30.4	30.5	30.6	30.7	30.8	30.9
°C	°F	$P_{T5.1}$ True Pressure – Inches Mercury Gage									
55.	131.0	23.5	23.5	23.6	23.7	23.8	23.9	23.9	24.0	24.1	24.2
54.	129.2	23.8	23.9	24.0	24.1	24.1	24.2	24.3	24.4	24.5	24.5
53.	127.4	24.1	24.2	24.3	24.4	24.5	24.6	24.6	24.7	24.8	24.9
52.	125.6	24.4	24.5	24.6	24.7	24.8	24.9	24.9	25.0	25.1	25.2
51.	123.8	24.8	24.9	24.9	25.0	25.1	25.2	25.3	25.4	25.4	25.5
50.	122.0	25.1	25.2	25.3	25.4	25.5	25.6	25.6	25.7	25.8	25.9
49.	120.2	25.5	25.6	25.6	25.7	25.8	25.9	26.0	26.1	26.2	26.2
48.	118.4	25.8	25.9	26.0	26.1	26.1	26.2	26.3	26.4	26.5	26.6
47.	116.6	26.1	26.2	26.3	26.4	26.5	26.6	26.7	26.7	26.8	26.9
46.	114.8	26.5	26.5	26.6	26.7	26.8	26.9	27.0	27.1	27.2	27.3
45.	113.0	26.8	26.9	27.0	27.1	27.2	27.3	27.4	27.5	27.5	27.6
44.	111.2	27.1	27.2	27.3	27.4	27.5	27.6	27.7	27.8	27.9	28.0
43.	109.4	27.5	27.6	27.7	27.8	27.9	28.0	28.1	28.2	28.3	28.3
42.	107.6	27.8	27.9	28.0	28.1	28.2	28.3	28.4	28.5	28.6	28.7
41.	105.8	28.2	28.3	28.4	28.5	28.6	28.7	28.8	28.9	29.0	29.1
40.	104.0	28.5	28.6	28.7	28.8	28.9	29.0	29.1	29.2	29.3	29.4
39.	102.2	28.9	29.0	29.1	29.2	29.3	29.4	29.5	29.6	29.7	29.8
38.	100.4	29.3	29.4	29.5	29.6	29.7	29.8	29.9	30.0	30.1	30.2
37.	98.6	29.6	29.7	29.8	29.9	30.0	30.1	30.2	30.3	30.4	30.5
36.	96.8	30.0	30.1	30.2	30.3	30.4	30 5	30.6	30.7	30.8	30.9
35.	95.0	30.4	30.5	30.6	30.7	30.8	30.9	31.0	31.1	31.2	31.3
34.	93.2	30.7	30.8	30.9	31.0	31.1	31.2	31.3	31.4	31.5	31.7
33.	91.4	31.1	31.2	31.3	31.4	31.5	31.6	31.7	31.8	31.9	32.0
32.	89.6	31.5	31.6	31.7	31.8	31.9	32.0	32.1	32.2	32.3	32.4
31.	87.8	31.9	32.0	32.1	32.2	32.3	32.4	32.5	32.6	32.7	32.8
30.	86.0	32.2	32.4	32.5	32.6	32.7	32.8	32.9	33.0	33.1	33.2
29.	84.2	32.6	32.7	32.9	33.0	33.1	33.2	33.3	33.4	33.5	33.6
28.	82.4	33.0	33.1	33.2	33.3	33.4	33.6	33.7	33.8	33.9	34.0
27.	80.6	33.4	33.5	33.6	33.8	33.9	34.0	34.1	34.2	34.3	34.4
26.	78.8	33.7	33.9	34.0	34.1	34.2	34.3	34.4	34.5	34.7	34.8
25.	77.0	34.1	34.2	34.3	34.5	34.6	34.7	34.8	34.9	35.0	35.1
24.	75.2	34.4	34.6	34.7	34.8	34.9	35.0	35.1	35.3	35.4	35.5
23.	73.4	34.7	34.9	35.0	35.1	35.2	35.3	35.4	35.6	35.7	35.8
22.	71.6	35.1	35.2	35.3	35.4	35.5	35.7	35.8	35.9	36.0	36.1
21.	69.8	35.3	35.5	35.6	35.7	35.8	35.9	36.1	36.2	36.3	36.4
20.	68.0	35.5	35.6	35.7	35.8	35.9	36.1	36.2	36.3	36.4	36.5

For temperature below 20° C (68° F) use 20° C (68° F).

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Figure 4-5. Power Check Chart; Main Fuel Control (Sheet 7) ay. Install cap on TOP line. Secure with MS20995C32 lockwire.

az. Place battery switch in OFF.

ba. Close emergency vent air knob.

bb. Ensure alternate fuel feed handle is in NORM.

bc. Remove engine air inlet duct screen.

bd. Remove engine runup tiedown restraint.

be. Tow airplane from runup area (T.O. 1A-7D-2-1).

CAUTION

To prevent damage to engine, do not install tailpipe shield, air duct shield, or engine compartment cooling hole covers until engine has cooled.

bf. Install ground handling protective covers (T.O. 1A-7D-2-1).

bg. Close access 5222-4.

bh. Check exhaust pipe for damage. {22}

bi. Check that oil filter popout indicator is not extended. {23}

4-6. TROUBLESHOOTING.

Test Equipment Required

Figure & index No.	Name	AN type designation	Use and application
	Equipment required for engine operation		Operate engine
	Equipment required for connecting external electrical power		Supply electrical power
	High pressure rotor turning adapter	6798272 (Allison Division of General Motors, Indianapolis, Indiana)	Rotate engine
	Rigging pin	6798854 (Allison Division of General Motors, Indianapolis, Indiana)	Hold linkage in fixed position

4-6.1. Procedures. Refer to table 4-9 for troubleshooting information. Malfunctions are listed by number and are related to a corresponding number following a step in the operational checkout.

4-6.2. Analysis of Malfunction. Powerplant system malfunctions will generally appear as low thrust (TOP), abnormal relationship between engine parameters (TOP, rpm, TOT, and fuel flow), or fluctuating engine parameters. Malfunctions indicated by low thrust or an abnormal relationship between parameters can be placed in two major categories. First, if thrust output is not in proper relationship to fuel/air input (rpm and fuel flow), an engine malfunction is indicated. Second, if thrust output is in proper relationship to fuel/air input but the thrust output is low, a fuel control system malfunction is indicated. Malfunctions indicated by two or more fluctuating parameters generally note a malfunctioning fuel control system. Malfunctions indicated by one fluctuating parameter generally indicates a faulty instrument system.

4-6.3. Ambient Temperature Effect. For powerplant system malfunctions to be properly analyzed, the mechanic must be familiar with engine parameter changes caused by a change in ambient temperature (figure 4-6). An increase in ambient temperature will decrease the density of the air. This decreased density will require the compressor to turn faster to produce the same mass airflow ($NL/\sqrt{T1}$) and thrust. Fuel flow and TOT (T5.1) will increase to produce the required rpm. RPM will increase with rising temperature until TOT attains its limit (approximately 575°C (1,067°F)). At this point, fuel flow is limited by a signal from the temperature limiter amplifier to the main fuel control solenoid. TOT is then held at this level. Restricted fuel flow will limit mass airflow and thrust.

4-6.4. Engine TOT Versus TOP. The first step to be taken for engine analysis is to determine if TOT is normal for the thrust developed (TOP). If it is normal, the engine is making proper use of the fuel it is receiving, if TOT is not normal, then it is not receiving enough fuel to produce the required thrust. This situation points to a fuel system malfunction. If the TOT is high for the thrust developed, the engine is not making proper use of the fuel received. When this condition occurs, it must be resolved if the rpm is normal for the thrust developed. If the rpm is normal and TOT and fuel flow are high, the turbine is requiring greater energy (fuel) to produce the required rpm. This shows a malfunctioning hot section. It may be caused by a combustion section malfunction or a damaged turbine section. If the rpm is high for the thrust developed, the compressors are working harder to pump the required airflow. This notes a malfunctioning compressor section which may be caused by damaged or contaminated compressor blades or vanes, improperly positioned inlet guide vanes, open bleed valve, or air leaks.

4-6.5. Malfunction at Altitude. Troubleshooting the powerplant for discrepancies reported or suspected to exist at altitude is frequently required. It is not feasible to prescribe operational limits for all altitudes under all conditions. The parameters recorded during functional check flight (T.O. 1A-7D-6CF-1) may be used for troubleshooting comparison by first using these parameters to establish a normal for altitude operation, and then comparing this normal with actual. Any wide variation from normal indicates a malfunctioning engine.

Table 4-9. Engine Troubleshooting

Probable cause	Isolation procedure	Remedy
1. Engine will not start properly.		
Defective ignition and starting system	Troubleshoot system (paragraph 8-5).	Replace defective components.
2. Main fuel pump, fuel boost 1, or fuel boost 2 caution lights do not go out with engine operating.		
Defective fuel pressure warning system	Troubleshoot system (paragraph 3-5).	Replace defective components.
3. Engine oil caution light does not go out and/or oil pressure indication is less than 15 psid at idle.		
Defective oil pressure indicating system	Troubleshoot system (paragraph 3-5).	Replace defective components.
Defective oil system	Troubleshoot system (paragraph 9-5).	Replace defective components.
4. Fuel flow, TOT, and tachometer indications fluctuate simultaneously in both main and manual fuel control at part throttle.		
Air trapped in fuel system	None	Bleed engine fuel system (paragraph 5-19).
Defective airflow control	Perform hydromechanical governor pressure test (paragraph 2-17).	Replace airflow control (paragraph 2-9).
Defective HP fuel pump	None	Replace HP fuel pump (paragraph 5-27).
5. Fuel flow, TOT, and tachometer indications fluctuate simultaneously in main fuel control at full throttle.		
Defective T5.1 thermocouple system	Perform T5.1 thermocouple system static checks (paragraph 3-14).	Replace defective components.
Defective temperature limiter amplifier	Perform temperature limiter amplifier static check (paragraph 7-4, 7-5, 7-6, or 7-7).	Troubleshoot amplifier system (paragraph 7-8).
Defective main fuel control	With throttle at idle, open circuit breaker CB308. Slowly advance throttle.	If fluctuations are still present, replace main fuel control (paragraph 5-30).
Defective low pressure governor	None	Replace low pressure governor (paragraph 5-28).
6. Tachometer indication is unstable with TOT and fuel flow indications normal.		
Faulty tachometer indicating system	Troubleshoot tachometer indicating system (paragraph 3-5).	Replace defective components.
7. Fuel flow indication is unstable with TOT and tachometer indications normal.		
Faulty fuel flow indicating system	Troubleshoot fuel flow indicating system (paragraph 3-5).	Replace defective components.

Table 4-9. Engine Troubleshooting — CONT

Probable cause	Isolation procedure	Remedy
8. TOT indication unstable with tachometer and fuel flow indications normal.		
Defective TOT indicating system	Perform TOT indicating system check (subparagraph 3-14.1).	Replace defective component.
9. TOT indication exceeds limit during acceleration to MIL.		
Defective temperature limiter amplifier	Perform temperature limiter amplifier static check (paragraph 7-4, 7-5, 7-6, or 7-7).	Troubleshoot amplifier system (paragraph 7-8).
Defective T5.1 junction-box-to-amplifier circuit	Perform T5.1 thermocouple static checks (paragraph 3-14).	Replace defective components.
Defective main fuel control limiter solenoid	Perform main fuel control limiter solenoid test (subparagraph 7-4.3, 7-5.6, 7-6.2, or 7-7.2).	If solenoid test is not within limits, replace main fuel control (paragraph 5-30).
Defective TOT indicator	Perform TOT indicator test (subparagraph 3-14.5).	If indicator test is not within limits, replace TOT indicator (paragraph 3-22).
Defective ballast resistor	Remove resistor and check resistance.	If resistance is not same as required by engine log, replace ballast resistor (paragraph 3-25).
10. Tachometer indication exceeds limit during acceleration to MIL.		
Defective tachometer indicating system	Troubleshoot tachometer indicating system (paragraph 3-5).	Replace defective components.
High pressure governor not properly adjusted	None	Perform high pressure governor check and adjustment (paragraph 5-11 or 5-12).
11. RPM will not decrease when throttle is retarded.		
Leaking P3 pressure	Check P3 gasket, P3 limiter body, and P3 line for leakage.	If leakage is evident, repair as required.
Deceleration adjusted too slow	None	Adjust acceleration/deceleration time (paragraph 5-16 or 5-17).
Defective main fuel control	None	Replace main fuel control (paragraph 5-30).
12. Idle speed is low.		
Engine throttle control not properly rigged	Place throttle in IDLE. Open access 5222-2. Check that rigging pins can be inserted in control cambox and main fuel control.	If rigging pins cannot be inserted freely, perform cambox rigging (paragraph 5-21) and/or engine control system rigging (T.O. 1A-7D-2-1).
Tachometer indicating system malfunctioning	Perform high pressure rotor tachometer system test (paragraph 3-15).	Replace defective components.
Idle speed not properly adjusted	None	Perform NH idle speed adjustment (paragraph 5-9 or 5-10).

Table 4-9. Engine Troubleshooting — CONT

Probable cause	Isolation procedure	Remedy
Defective main fuel control	None	If unable to adjust idle speed, replace main fuel control (paragraph 5-30).
13. Idle speed is high.		
Defective cold start temperature bulb	Disconnect electrical connector from cold start temperature bulb and check for rpm drop.	If rpm drops, replace cold start temperature bulb (paragraph 5-35).
Cold start fuel valve stuck open	Perform cold start system operational checkout (paragraph 5-4).	Replace cold start valve (paragraph 5-29).
Defective cold start amplifier	Perform relay control box cold start amplifier test (subparagraph 8-7.6).	Replace relay control box (paragraph 8-16).
Engine throttle control not properly rigged	Place throttle in IDLE. Open access 5222-2. Check that rigging pins can be inserted in control cambox and main fuel control.	If rigging pins cannot be inserted freely, perform cambox rigging (paragraph 5-21) and/or engine control system rigging (T.O. 1A-7D-2-1).
Tachometer indicating system malfunctioning	Perform high pressure rotor tachometer system test (paragraph 3-15).	Replace defective components.
Defective manual fuel control (internal leakage)	Check idle speed in manual fuel control.	If idle speed is within limits in manual fuel control, replace manual fuel control (paragraph 6-6).
Defective packing on cold start fuel valve	Check idle speed in manual fuel control. If idle speed is high, check for defective packing on cold start fuel valve.	Replace packing.
Idle speed not properly adjusted	None	Perform NH idle speed adjustment (paragraph 5-9 or 5-10). If unable to adjust idle speed, refer to probable cause 14.
14. Unable to adjust idle speed (rpm high).		
Defective manual fuel control (fuel leaking internally)	Check manual fuel control idle speed.	If manual fuel control idle speed is within limits, replace manual fuel control (paragraph 6-6).
Defective main fuel control	None	Replace main fuel control (paragraph 5-30).
15. Engine acceleration time is slow and/or deceleration time is fast.		
P3 air tube leaking	Check P3 air tube for leakage.	If leakage is indicated, replace or repair defective P3 air tube.
Acceleration/deceleration stops not properly adjusted	None	Perform acceleration/deceleration time checks (paragraph 5-16 or 5-17).
Defective main fuel control	None	Replace main fuel control (paragraph 5-30).
P2.1 air tube leaking	Check P2.1 air tube for leakage.	Replace P2.1 air tube.

Table 4-9. Engine Troubleshooting — CONT

Probable cause	Isolation procedure	Remedy
16. Engine acceleration time is fast and/or deceleration time is slow.		
P2.1 air tube obstructed	Check P2.1 air tube for obstruction.	If obstruction is indicated, replace defective P2.1 air tube.
Acceleration stop out of adjustment	None	Perform acceleration/deceleration time checks (paragraph 5-16 or 5-17).
Defective main control	None	Replace defective main fuel control (paragraph 5-30).
17. PT5.1 is less than true PT5.1. Perform low PT5.1 troubleshooting (figure FO-8).		
18. Cockpit turbine outlet pressure indicator does not indicate within +0.6, −0.9 inch Hg of pressure indicated on trim set.		
Defective turbine outlet pressure indicating system	Troubleshoot turbine outlet pressure indicating system (paragraph 3-5).	Replace defective components.
19. Engine will not shut down.		
HP fuel shutoff valve detent pin dirty	Check HP fuel shutoff valve pointer.	If valve has not closed, clean detent pin with P-D-680 solvent and lubricate pin with MIL-S-8660 silicone compound.
Engine control adapter worn	Perform throttle control system operational checkout (T.O. 1A-7D-2-1).	If throttle will not engage both stops, and control cambox and controlex are properly rigged; replace engine control adapter (paragraph 1-10).
20. Rotor coastdown time is excessively fast.		
Internal failure	Check compressor inlet and turbine outlet for signs of damage.	If damage is indicated, remove engine for inspection. If no damage is indicated, check coastdown time after next flight.
	Rotate low pressure rotor and check for unusual noise and freedom of rotation.	
	Rotate high pressure rotor and check for unusual noise and freedom of rotation.	
	Check magnetic chip detectors for magnetic particle accumulation (paragraph 9-10).	
	Check oil filter element for contamination.	
	Check JOAP results.	
21. Excessive oil consumption.		
Defective engine oil system	Troubleshoot engine oil system (paragraph 9-5).	Replace defective components.

Table 4-9. Engine Troubleshooting — CONT

Probable cause	Isolation procedure	Remedy
22. Visual indications of excessive TOT (indicated TOT normal).		
Defective TOT indicating system	Perform TOT indicating system operational checkout (subparagraph 3-4.4).	Troubleshoot system and replace defective component.
23. Oil filter popout indicator is extended. Refer to figure FO-24, trouble 1.		
24. Power loss (including stalls) or flameout. Refer to figure 4-7 and T.O. 1A-7D-2-5CL-2.		
25. Vibration reported with engine operating.		
Defective engine or engine components	Perform engine vibration check (paragraph 4-11).	Replace engine or components.
26. Audible vibration or rumble in low power range. Perform engine rumble troubleshooting (figure 4-8).		
27. Flight idle speed low.		
Defective main fuel control	None	Replace main fuel control (paragraph 5-30).
28. A sudden unexplainable decrease in thrust during air or ground operation.		
Seventh stage bleed manifold failure	Inspect seventh stage bleed manifold (paragraph 4-26).	If defective, replace engine.
29. Degraded engine performance of high TOT and low TOP.		
Hydraulic fluid, dirt, etc ingested by engine	None	Accomplish engine chemical wash procedures (paragraph 4-27).
30. Sudden increase/decrease in rpm (shift) while engine is operating at idle rpm, without throttle movement, with a noticeable increase in noise.		
	NOTE **Annotate appropriate form(s) to show engine has an rpm shift but is serviceable.**	
Defective engine or components	Perform engine vibration check in accordance with paragraphs 4-11 and 4-12, and engine rumble troubleshooting in accordance with figure 4-8.	If engine does not exceed the vibration limits and the rpm shift does not exceed 2%, continue engine in service. If vibration limit is exceeded or shift exceeds 2%, reject engine to field maintenance.

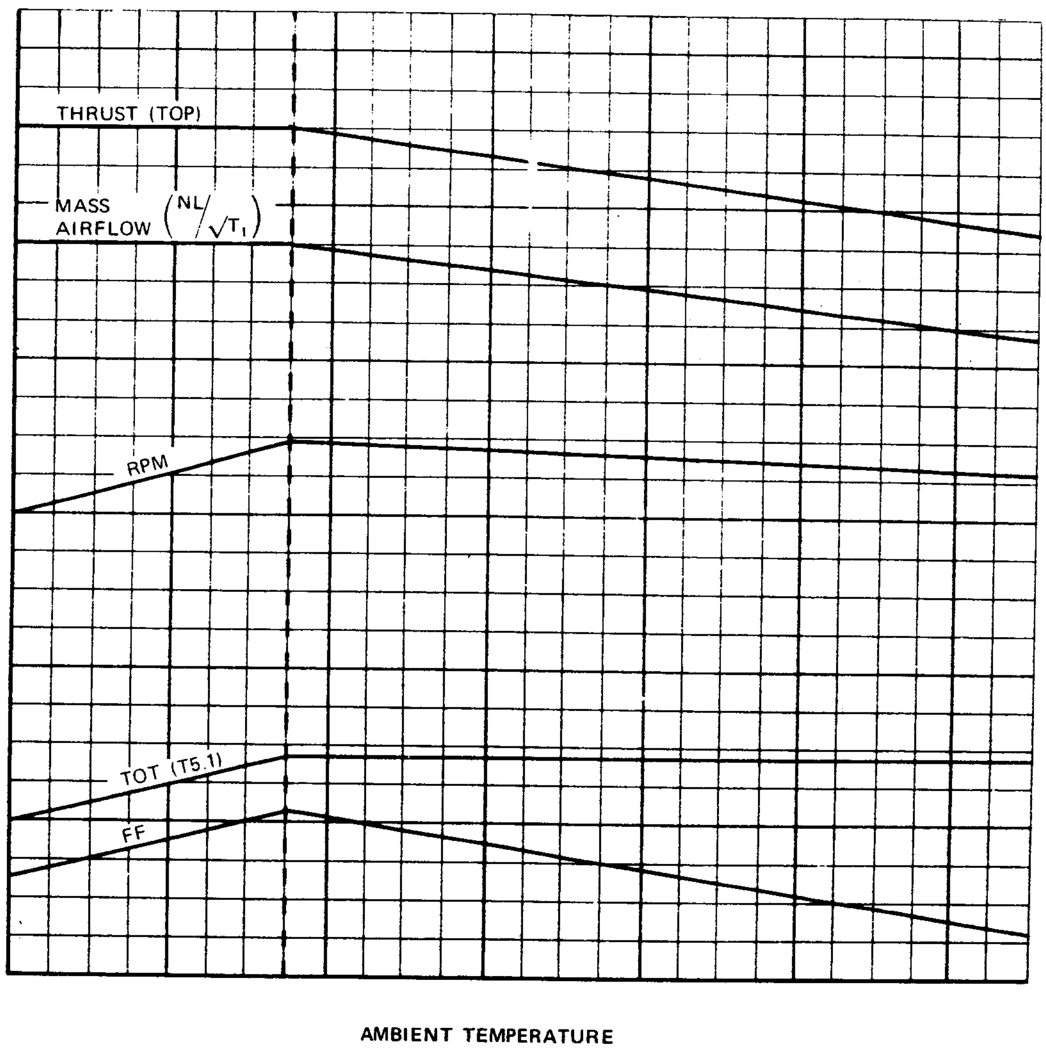

Figure 4-6. Engine Variables Vs Ambient Temperature (Sea Level)

ENGINE ENCOUNTERS COMPRESSOR STALLS

NOTE

When troubleshooting for compressor stall, a possibility exists that more than one malfunction or maladjustment may exist. To ensure that all possible malfunction sources have been eliminated, perform all checks specified before releasing airplane for flight.

1. Remove low pressure fuel filter element (paragraph 5-26) and check for contamination.
2. Check aircraft fuel system for contamination.
3. Check engine inlet area:
   a. Temperature signal probe for cracks.
   b. Duct to engine seal for misalignment.
   c. Engine for damage (paragraph 4-17).
   d. Check LP compressor rotor for freedom of rotation.
4. Check low pressure 2nd stage turbine vanes, blades, and fairings for damage.
5. Check HP compressor rotor for freedom of rotation.

NOTE

If stall is encountered during the following checks, repeat borescope inspection after all checks are completed.

6. Perform borescope inspection of high pressure compressor (paragraph 4-14).
7. Perform IGV linkage force check (paragraph 2-8).
8. Check main and manual fuel control linkages for security.
9. Perform IGV control clearance determination (paragraph 2-15).

Stall occurs when selecting or deselecting manual fuel control

1. Remove fuel outlet tube and check low pressure governor check valve. If valve is stuck open, replace low pressure governor (paragraph 5-28).
2. Perform manual fuel control operational checkout (paragraph 6-4).
3. Perform acceleration/deceleration time check (paragraph 5-16 or 5-17).
4. Perform airflow control system operational checkout (paragraph 2-4 or 2-5).
5. Perform hydromechanical governor (HMG) pressure test (paragraph 2-17).
6. Replace manual fuel control (paragraph 6-6).
7. Replace main fuel control (paragraph 5-30).

Stall occurs during deceleration

1. Perform acceleration/deceleration time check (paragraph 5-16 or 5-17).
2. Perform airflow control system operational checkout (paragraph 2-4 or 2-5).
3. Perform hydromechanical governor (HMG) pressure test (paragraph 2-17).
4. Replace airflow control (paragraph 2-9).
5. Replace main fuel control (paragraph 5-30).

Stall occurs during sea level acceleration or deceleration

1. Perform acceleration/deceleration time check (paragraph 5-16 or 5-17).
2. Perform hydromechanical governor (HMG) pressure test (paragraph 2-17).

NOTE

It is essential that the hydromechanical governor (HMG) pressure test be accomplished prior to bleeding or airflow control system checkout. Failure to do so may result in false indications during the HMG pressure tests.

3. Perform airflow control system operational checkout (paragraph 2-4 or 2-5).

Stall occurs during high altitude acceleration

1. Perform acceleration/deceleration time check (paragraph 5-16 or 5-17).
2. Check altitude idle speed (T.O. 1A-7D-1).

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Figure 4-7. Troubleshooting Diagram; Engine Stall

Audible vibration or rumble in low power range. (See note.)

Perform non-integral vibration (NIV) check (paragraph 4-12 or 4-13).
Is vibration within limits?

YES → Return to service.

NO → Reject engine to field maintenance.

NOTE

Engine rumble is an acoustical (audible) pulsation caused by fuel system pressure fluctuations in the engine combustion system. The TF41 high pressure fuel pump design causes fuel pressure fluctuations. In some engines these fluctuations are amplified by the main fuel control. When the pressure fluctuation amplitude is unusually high, loud rumble may occur. In the combustion chambers, this fluctuating fuel pressure produces an oscillating flame front and combustion pressure changes. The gas path acoustic pressure fluctuations are transmitted outside the engine and may cause airframe vibration in addition to the acoustical noise. Rumble normally occurs in the low power range from slightly above idle (approximately 70% rpm) to approximately 85% rpm on the ground to as high as 88% rpm in flight. Rumble does not produce engine vibration, does not produce any harmful effects to the engine or airframe, and is not a cause for engine or engine component rejection. The only reason that rumble is of any concern is that it may mask or hide engine vibration. Suspected rumble should be reported in the 781. Accurate identification of rumble is possible through ground maintenance procedures.

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Figure 4-8. Troubleshooting Diagram; Engine Rumble

4-7. TEST REQUIREMENTS. Figure 4-9 lists checks, adjustments, and tests required after replacement of components. Table 4-10 list tolerances and references for engine tests. This data is furnished for quick reference only.

Table 4-10. Engine Tests and Adjustments

Kind of check	Check to	Adjust to	Paragraph reference
NH idle speed	55% (±2%) rpm	56% to 57% rpm	5-9 or 5-10
NL maximum speed	87% to 88% rpm	87.2% to 87.8% rpm	5-13 or 5-14
P3 limiter	150 (±8) psig	150 (±5) psig	5-15
Acceleration time	5.5 to 7.5 sec	Same	5-16 or 5-17
Deceleration time	Refer to table 1-12	Same	5-16 or 5-17
Amplifier dynamic			
T5 point pulldown	475° (±4%)C (887° (±7°)F)	475° (±1°)C (887° (±2°)F)	7-9 or 7-10
Mass airflow limiter	DPS − 10.0% (±0.7%) rpm	DPS − 10.0% (±0.5%) rpm	7-9 or 7-10
Manual fuel control			
IDLE	55% to 65% rpm	Same	6-7
MIL	Between min and max TOP	Same	6-7
Power check	Minimum TOP	N/A	4-9

NOTE

Numbers indicate sequence for performing checks and adjustments.

STATIC CHECKS AND ADJUSTMENTS	ENGINE	FUEL SYSTEM: Fuel Boost Pump	LP Fuel Pump	Fuel Filter	Fuel Filter Element	HP Fuel Pump	Manual Fuel Control	Main Fuel Control	Low Pressure Governor	Cold Start Valve	HP Fuel Shutoff Valve
Auto-relight Switch Functional Check											
T_1 Thermocouple System Check											
$T_{5.1}$ Thermocouple System Static Check											
IGV External Linkage Adjustment											
Bleed Valve Cylinder Adjustment											
Control Cambox Rigging								1			1
TLA Amplifier Static Checks											
LP Fuel System Bleeding		1	1	1	1	1	2		1	1	2
DYNAMIC CHECKS AND ADJUSTMENTS											
Engine Start		2	2	2	2	2	3		2	2	3
Check Oil Pressure											
HP Fuel System Bleeding		3	3	3	3	3	4		3	3	4
Leak Check (air, fuel or oil)		4	4	4	4	4	5		4	4	5
N_H Idle Speed Adjustment											
Airflow Control System Operational Check						5					
NL Maximum Speed Adjustment									5		
P_3 Limiter Check											
Accel/Decel Time Checks *											
TLA Amplifier Dynamic Checks											
Manual Fuel Control Check							6				
Turbine Outlet Pressure Check											
Rotor Coastdown Time Check											
Oil Level Check (T.O. 1A-7D-2-1)											
Engine Setup†	1							2			

STATIC CHECKS AND ADJUSTMENTS	AIR SYSTEM: Auto-relight Switch	Airflow Control	Bleed Valve Cylinder	IGV Surge Cylinder
Auto-relight Switch Functional Check	1			
T_1 Thermocouple System Check				
$T_{5.1}$ Thermocouple System Static Check				
IGV External Linkage Adjustment		1		1
Bleed Valve Cylinder Adjustment		2	1	
Control Cambox Rigging				
TLA Amplifier Static Checks				
LP Fuel System Bleeding				
DYNAMIC CHECKS AND ADJUSTMENTS				
Engine Start			2	2
Check Oil Pressure				
HP Fuel System Bleeding				
Leak Check (air, fuel or oil)				
N_H Idle Speed Adjustment				
Airflow Control System Operational Check			3	3
NL Maximum Speed Adjustment				
P_3 Limiter Check				
Accel/Decel Time Checks *				
TLA Amplifier Dynamic Checks				
Manual Fuel Control Check				
Turbine Outlet Pressure Check				
Rotor Coastdown Time Check				
Oil Level Check (T.O. 1A-7D-2-1)				
Engine Setup†		3		

STATIC CHECKS AND ADJUSTMENTS	ELECTRICAL SYSTEM: LP Rotor Tachometer	Relay Control Box	Temperature Limiter Amplifier	Permanent Magnet Generator	Ignition Exciter	Spark Igniter	T_1 Thermocouple	$T_{5.1}$ Turbine Exhaust Harness	$T_{5.1}$ Thermocouple
Auto-relight Switch Functional Check									
T_1 Thermocouple System Check							1		
$T_{5.1}$ Thermocouple System Static Check								1	1
IGV External Linkage Adjustment									
Bleed Valve Cylinder Adjustment									
Control Cambox Rigging									
TLA Amplifier Static Checks									
LP Fuel System Bleeding									
DYNAMIC CHECKS AND ADJUSTMENTS									
Engine Start	1	1		1	1	1			
Check Oil Pressure									
HP Fuel System Bleeding									
Leak Check (air, fuel or oil)									
N_H Idle Speed Adjustment									
Airflow Control System Operational Check									
NL Maximum Speed Adjustment									
P_3 Limiter Check									
Accel/Decel Time Checks *									
TLA Amplifier Dynamic Checks	2						2	2	2
Manual Fuel Control Check									
Turbine Outlet Pressure Check									
Rotor Coastdown Time Check									
Oil Level Check (T.O. 1A-7D-2-1)									
Engine Setup†			1						

STATIC CHECKS AND ADJUSTMENTS	CONTROL SYSTEM: Control Cambox	HP Fuel Shutoff Valve Linkage	Main Fuel Control Linkage	Manual Fuel Control Linkage
Auto-relight Switch Functional Check				
T_1 Thermocouple System Check				
$T_{5.1}$ Thermocouple System Static Check				
IGV External Linkage Adjustment				
Bleed Valve Cylinder Adjustment				
Control Cambox Rigging	1	1	1	1
TLA Amplifier Static Checks				
LP Fuel System Bleeding				
DYNAMIC CHECKS AND ADJUSTMENTS				
Engine Start	2	2	2	2
Check Oil Pressure				
HP Fuel System Bleeding				
Leak Check (air, fuel or oil)				
N_H Idle Speed Adjustment	3		3	3
Airflow Control System Operational Check				
NL Maximum Speed Adjustment				
P_3 Limiter Check				
Accel/Decel Time Checks *				
TLA Amplifier Dynamic Checks				
Manual Fuel Control Check	4		4	4
Turbine Outlet Pressure Check				
Rotor Coastdown Time Check				
Oil Level Check (T.O. 1A-7D-2-1)				
Engine Setup†				

STATIC CHECKS AND ADJUSTMENTS	OIL SYSTEM: Oil Tank	Oil Pump	Oil Pressure Regulating Valve	Oil Pressure Relief Valve	Oil Strainers	Oil Filter	Oil Filter Element	Oil Piping	Fuel Cooled Oil Cooler
Auto-relight Switch Functional Check									
T_1 Thermocouple System Check									
$T_{5.1}$ Thermocouple System Static Check									
IGV External Linkage Adjustment									
Bleed Valve Cylinder Adjustment									
Control Cambox Rigging									
TLA Amplifier Static Checks									
LP Fuel System Bleeding									
DYNAMIC CHECKS AND ADJUSTMENTS									
Engine Start	1	1	1	1	1	1	1	1	1
Check Oil Pressure			2	2					2
HP Fuel System Bleeding									
Leak Check (air, fuel or oil)	2	2	3	3	2	2	2	2	3
N_H Idle Speed Adjustment									
Airflow Control System Operational Check									
NL Maximum Speed Adjustment									
P_3 Limiter Check									
Accel/Decel Time Checks *									
TLA Amplifier Dynamic Checks									
Manual Fuel Control Check									
Turbine Outlet Pressure Check									
Rotor Coastdown Time Check									
Oil Level Check (T.O. 1A-7D-2-1)	3	3	4	4	3	3	3	3	4
Engine Setup†									

*If acceleration adjustment was made, perform T5 datum point dynamic check.

†See T.O. 1A-7D-2-5CL-3

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Figure 4-9. Test Requirements; Component Replacement

4-8. ENGINE SETUP.

Test Equipment Required

Figure & index No.	Name	AN type designation	Use and application
	Equipment required for engine operation		Operate engine
	Engine maximum power test set	E2452-3	Indicate turbine outlet pressure
	Torque wrench, 10 to 150 inch-pounds	MIL-H-4034B	Measure torque
	Hose assembly	MS28741-5	Connect, engine maximum power test set to TOP connector
	Fuel system air bleed	6798863 (Allison Division of General Motors, Indianapolis, Indiana)	Bleed air from engine fuel system
		or	
		6872296 (Allison Division of General Motors, Indianapolis, Indiana)	Bleed air from engine fuel system
		or	
		6872547 (Allison Division of General Motors, Indianapolis, Indiana)	Bleed air from engine fuel system
	Engine limiter test set cable assembly (used with 6872929 test set)	6872339 (Allison Division of General Motors, Indianapolis, Indiana)	Connect test set to engine and external power source
	Engine limiter test set	6872929 (Allison Division of General Motors, Indianapolis, Indiana)	Perform temperature limiter amplifier checks
		or	
		6893706 (Allison Division of General Motors, Indianapolis, Indiana)	Perform temperature limiter amplifier checks
	Power cable adapter (used with 6872929 test set)	6872727 (Allison Division of General Motors, Indianapolis, Indiana)	Connect test set to airplane ARW-77 connector
	Equipment required for 115-volt, 400-hertz, single-phase ac external electrical power (used with 6872929 test set)		Supply electical power to test set
	Thermometer	71275 (United States Gauge Division of Amtek Inc, Sellersville, Pennsylvania)	Measure ambient temperature

4-8.1. Engine Adjustment. This procedure adjusts engine fuel system components and ensures that the engine is running within limits. Because adjustment of one component may affect the setting of another, fuel system components must be adjusted in the prescribed sequence. This procedure is to be performed on all engine installations in the airplane and after main fuel control has been replaced. Checks and adjustments must be made in the exact sequence stated. If discrepancies are noted during setup and adjustment, stop the procedure and refer to troubleshooting paragraph 4-6.

4-8.2. Engine Setup Data Form. Engine setup data form (figure 4-10) will be utilized to enter required instrument indications during engine setup. These data are to be collected and kept with engine records until major overhaul.

4-8.3. Preparation.

NOTE

An engine reinstalled in same airplane following minor maintenance that would not affect engine operation, requires leak checks and power check only.

a. Prepare airplane for engine ground operation (T.O. 1A-7D-2-1).

b. Open accesses 5222-1, 5222-2, 5222-4, 6122-2, 6122-3, 6222-1, and 6222-2.

c. Remove cap from low pressure fuel filter drain valve and connect drain hose. Place free end of hose in suitable container.

d. Place throttle in OFF and fuel master control in ON.

e. Open drain valve on low pressure fuel filter. Let fuel drain until steady air-free flow is obtained.

f. Close valve, remove drain hose, and install cap.

g. Place fuel master control in OFF.

h. Cut lockwire and remove cap nuts from bleed ports on airflow control.

i. Install fuel system air bleeds on airflow control and place free end of hoses in container.

j. Remove cap from TOP line. Connect line to engine maximum power test set.

k. Deleted.

l. Connect engine limiter test set (figure 7-4 or 7-5).

m. Obtain and record station ambient pressure (not corrected to sea level).

NOTE

To obtain accurate temperature indications, keep thermometer out of direct sunlight or high velocity air, and let stabilize. Temperature must be taken during checkout.

n. Place thermometer in vicinity of fuselage under left wing.

CAUTION

Observe engine operating limits and restrictions as outlined in tables 4-4 and 4-5 procedures.

o. Start engine (T.O. 1A-7D-2-1) and stabilize at IDLE.

p. Visually check accessible engine lines and connections for fluid leaks.

q. Using soap and water solution, check TOP line connectors for leaks. No leakage is permitted.

r. Open both bleed valves installed on airflow control and allow fuel to drain until steady air-free flow is obtained.

s. Close bleed valves.

CAUTION

To prevent engine overspeed or overtemperture, advance throttle slowly.

NOTE

Steps t and u are performed to determine that engine limits will not be exceeded during subsequent checks and adjustments.

t. Slowly advance throttle toward MIL. Observe engine rpm and TOP in cockpit. Do not exceed engine limitations.

u. Stabilize at MIL for 3 minutes. Check that engine limits will not be exceeded at MIL.

TF41-A-1 ENGINE SETUP

AIRPLANE S/N	ENGINE S/N	ENGINE TIME	TEST SET S/N	AIRFLOW CONTROL P/N	DATE
NL TRIM SPEED % RPM	DEW POINT	WET BULB TEMP	AMBIENT TEMP	PURPOSE FOR RUN	

AMBIENT PRESS. | IDLE SPEED % RPM | AIRFLOW CONTROL (ACTUAL) +33° % RPM, +7° % RPM | AIRFLOW CONTROL (CHART) T1, +33° MIN, MAX

AIRFLOW CONTROL (CHART) +7° MIN, MAX | T5 PULLDOWN °C, Ma | DOUBLE DATUM TEMP RISE °C | T5 NORMAL

MASS AIRFLOW NORMAL % RPM | PULLDOWN % RPM, Ma | NORMAL | NL MAXIMUM SPEED ENGAGE % RPM | RESET % RPM | ENGAGE % RPM

P3 LIMITER ENGAGE PSI | RESET PSI | ENGAGE PSI | DECEL/ACCEL TIME (SECONDS) NH % RPM | DECEL 1 | ACCEL 1 | DECEL 2 | ACCEL 2

DECEL 3 | ACCEL 3 | AVG DECEL | AVG ACCEL | POWER CHECK TEMP | PRESS | TARGET | MANUAL FUEL CONTROL TARGET (CLIP) MAX, MIN | (NO CLIP) MAX, MIN

PARAMETER	MAIN FUEL CONTROL				MANUAL FUEL CONTROL			
	IDLE		MIL		IDLE		MIL	
	COCKPIT	TEST SET	COCKPIT	TEST SET	COCKPIT	TEST SET	COCKPIT	TEST SET
FUEL FLOW								
TOT								
OIL PRESS.								
% RPM								
TOP								

COAST DOWN TIME (SEC) LP | HP | OIL QUANTITY

ADJUSTMENTS PERFORMED

IDLE SPEED	___ CW ___ CCW		P3 LIMITER	___ CW ___ CCW	
T1 BIAS	___ CW ___ CCW		DECEL	___ CW ___ CCW	
T1 BIAS INITIAL	___*		ACCEL	___ CW ___ CCW	
T1 BIAS FINAL	___*		MAN F/C		
AMPLIFIER T5	___ CW ___ CCW		BOLT	___ CW ___ CCW	
AMPLIFIER NL	___ CW ___ CCW		LEVER	___ CW ___ CCW	
LP GOVERNOR	___ CW ___ CCW		CLIP	___ YES ___ NO	

TEST OPERATOR ______________________

AIRCRAFT OPERATOR ______________________

*Measured from calibration mark

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Figure 4-10. Data Record; TF41-A-1 Engine Setup

WARNING

Use care when checking for air leaks. Severe burns may result from hot air under pressure.

NOTE

No limit is established for air leakage from around service tubes in area of tube entry through bypass duct. Maximum air temperature of leakage is approximately 200°F above ambient.

v. Check low pressure and high pressure air bleed manifolds for leaks.

w. Retard throttle to IDLE.

4-8.4. Setup.

NOTE

Some steps in the following procedure may have previously been performed. It is not necessary to repeat these steps. Do not close accesses until setup procedure is complete.

a. Perform NH idle speed check (paragraph 5-9 or 5-10).

b. Perform airflow control system operational checkout (paragraph 2-4 or 2-5).

c. Perform temperature limiter amplifier dynamic check (paragraph 7-9 or 7-10).

d. Perform acceleration/deceleration time check (paragraph 5-16 or 5-17).

e. Perform power check (paragraph 4-9).

f. Perform manual fuel control operational checkout (paragraph 6-4).

4-8.5. Post Setup.

a. Shut down engine (T.O. 1A-7D-2-1).

b. Place engine limiter test set POWER switch in OFF.

c. Disconnect engine limiter test set from airplane and power source.

d. If using 6872929 test set, disconnect test set from power source.

e. Connect electrical connector to high pressure tachometer generator and amplifier receptacle No. 3.

f. Deleted.

g. Disconnect engine maximum power test set from TOP line and install cap.

h. Remove fuel system air bleeds and install caps.

i. Tighten caps to 120 inch-pounds torque. Secure with MS20995C32 lockwire.

j. Inspect all accessible oil, fuel, and air lines for leakage.

k. Inspect tailpipe and engine aft turbine for damage.

l. Check oil level within 5 to 15 minutes after shutdown (T.O. 1A-7D-2-1).

m. Close accesses 5222-1, 5222-2, 5222-4, 6122-2, 6122-3, 6222-1, and 6222-2.

4-9. POWER CHECK.

Test Equipment Required

Figure & index No.	Name	AN type designation	Use and application
	Equipment required for engine operation		Operate engine
	Engine maximum power test set	E2452-3	Indicate TOP

a. Open access 5222-4.

b. Remove cap from TOP line. Connect line to test set.

c. Record station barometric pressure (not corrected to sea level).

NOTE

To obtain accurate temperature indications, keep thermometer out of direct sunlight or high velocity air and allow to stabilize. Temperature must be taken during checkout.

d. Record ambient temperature in vicinity of fuselage under left wing.

e. Using ambient pressure recorded in step c, ambient temperature recorded in step d, and figure 4-5, calculate and record PT5.1 true pressure.

f. Start engine (T.O. 1A-7D-2-1) and stabilize at IDLE.

g. Slowly advance throttle to MIL and stabilize for 5 minutes.

h. Record cockpit TOP (inches Hg gage) and test set indication (inches Hg absolute).

i. Retard throttle to IDLE.

j. Correct test set indication as follows:

$$\begin{bmatrix}\text{Test set}\\\text{indication}\\\text{(inches Hg}\\\text{absolute)}\end{bmatrix} - \begin{bmatrix}\text{Ambient}\\\text{pressure}\\\text{(inches Hg}\\\text{absolute)}\end{bmatrix} = \begin{bmatrix}\text{Corrected PT5.1}\\\text{pressure}\\\text{(inches}\\\text{Hg gage)}\end{bmatrix}$$

k. Check that the corrected test set indication is equal to or more than PT5.1 true pressure in step e.

l. Check that cockpit TOP indication is within +0.6, −0.9 inch Hg of corrected test set indication obtained in step j.

m. Shut down engine (T.O. 1A-7D-2-1).

n. Disconnect test set pressure hose from TOP line.

o. Install TOP line cap.

p. Close access 5222-4.

4-10. OVERSPEED INSPECTION.

a. Open accesses 5222-1 and 5222-2.

b. Inspect low pressure compressor for obvious damage.

c. Rotate low pressure rotor. Check for freedom of rotation and unusual noises indicating a rub.

d. Inspect turbine outlet for obvious damage.

e. Install the high pressure rotor turning adapter (paragraph 4-19).

f. Rotate high pressure rotor. Check for freedom of rotation and unusual noises.

g. Remove high pressure rotor turning adapter.

h. Remove and inspect magnetic chip detectors (paragraph 9-9).

i. Inspect second stage low pressure turbine for rubbing of blade tips and other obvious damage. If damage is found, reject engine and omit steps j and k.

j. Troubleshoot engine. Correct cause of overspeed (paragraph 4-6).

k. Perform operational checkout (paragraph 4-5).

l. Close accesses 5222-1 and 5222-2.

4-11. ENGINE VIBRATION CHECK.

Test Equipment Required

Figure & index No.	Name	AN type designation	Use and application
	Equipment required for connecting external electrical power		Supply electrical power to vibration analyzer
	Equipment required for engine operation		Operate engine

Test Equipment Required — CONT

Figure & index No.	Name	AN type designation	Use and application
	Multimeter	AN/PSM-6	Measure resistance
4-11	Tach adapter cable	1511427-901 (Sperry Phoenix Co, Phoenix, Arizona)	Connect tachometer generator to airplane wiring harness and tach cable
4-11	Tach cable	1511428 (Sperry Phoenix Co, Phoenix, Arizona)	Connect tach adapter cable to vibration analyzer
4-11	Pickup extension cable	1511429 (Sperry Phoenix Co, Phoenix, Arizona)	Connect pickup cable to vibration analyzer
4-11	Pickup cable	1784341-4 (Sperry Phoenix Co, Phoenix, Arizona)	Connect vibration pickup to pickup extension cable
4-11	Vibration analyzer	1784471-901 (Sperry Phoenix Co, Phoenix, Arizona)	Display vibration amplitude
4-11	Vibration pickup	4-123-0001 or 4-106-0103 or 4-106-0001 or 4-102-0001 (Bell and Howell, CEC Division, Monrovia, California)	Create electrical signal proportional to vibration check for temperature restrictions
	Oil screen puller	6798920 (Allison Division of General Motors, Indianapolis, Indiana)	Remove scavenge oil screens
4-11	Vibration pickup bracket	6798936 (Allison Division of General Motors, Indianapolis, Indiana)	Provide mount for vibration pickup

NOTE

This check is performed to determine the source of a reported inflight vibration.

Pilot should be debriefed by an engine maintenance technician to determine altitude, airspeed, engine speed, and engine oil pressure at time vibration occurred and if vibration was present at all throttle settings.

a. Inspect airplane for loose or damaged access doors, access panels, or control surfaces.

b. Visually check engine air inlet duct for damage.

c. Check first stage compressor blades and vanes for damage (paragraph 4-17).

d. Check low pressure compressor for freedom of rotation.

e. Check tailpipe for security.

f. Check rear turbine rotor blades for damage.

g. Borescope engine (paragraph 4-14 and 4-15).

h. Remove engine removal door (T.O. 1A-7D-2-1).

i. Check magnetic chip detectors for minimum of 20,000-ohm resistance.

j. Remove scavenge oil strainers. Check for metal particles. Install strainers.

k. Remove oil filter element. Check for metal particles. Install element (paragraph 9-14).

l. Perform spectrometric oil analysis of engine oil.

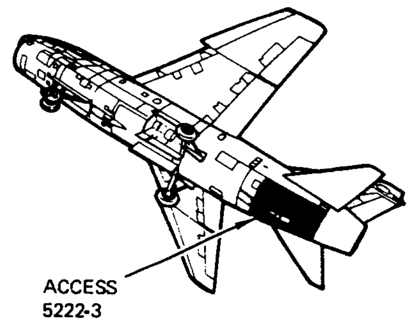
m. Check torque of right trunnion bolt (paragraph 1-8).

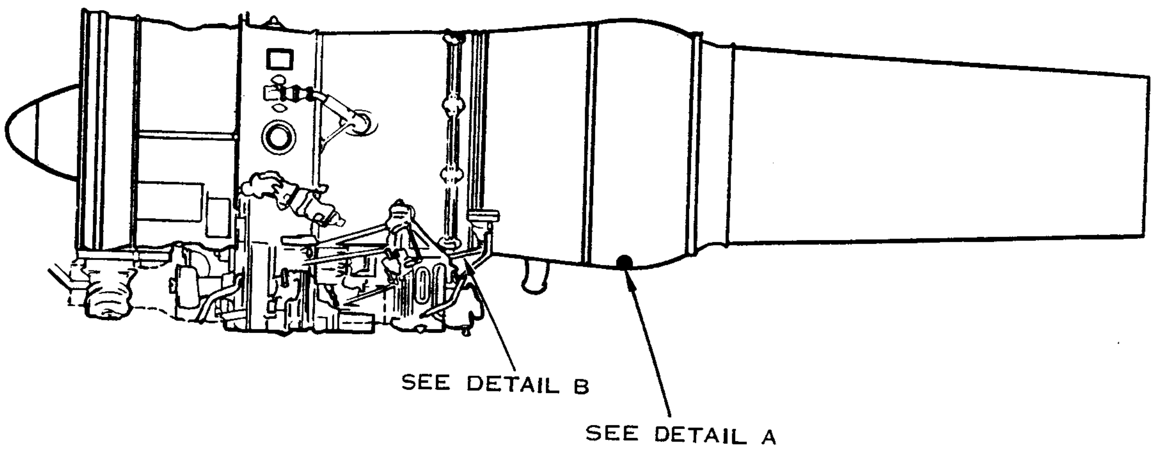
n. Install mounting bracket (1, figure 4-11) on rear bypass duct with bolts (2).

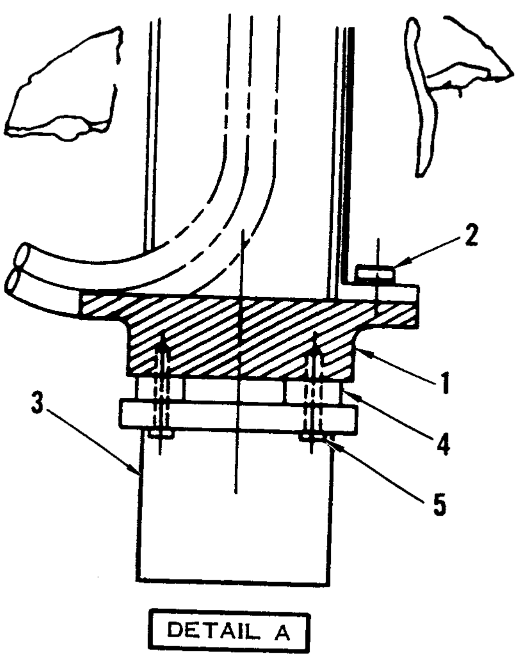
o. Install vibration transducer (3) using phenolic spacers (4) and screws (5).

p. Place vibration analyzer POWER switch in OFF.

1. Mounting bracket, 6798936
2. Bolt
3. Vibration pickup transducer
4. Phenolic spacer
5. Screw
6. Mounting bracket, 6798937







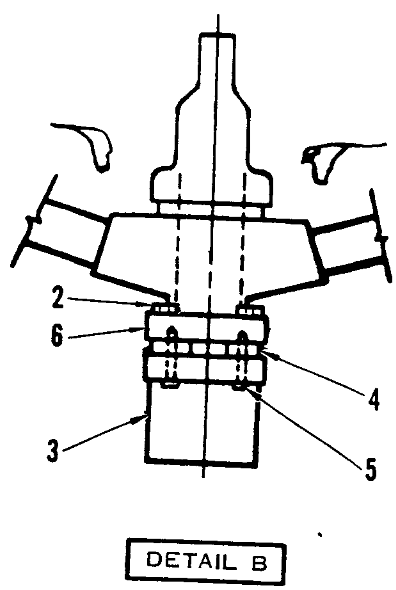


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Figure 4-11. Vibration Check; Engine (Sheet 1 of 2)

NOTE

The following environmental temperature limits must be observed for vibration pickups. If a pickup exceeds this limit it will not be used for further testing.

VIBRATION PICKUP PART NO.	ENVIRONMENT TEMPERATURE LIMIT
4-123-0001	500° F
4-106-0103	262° F
4-106-0001	212° F
4-102-0001	150° F

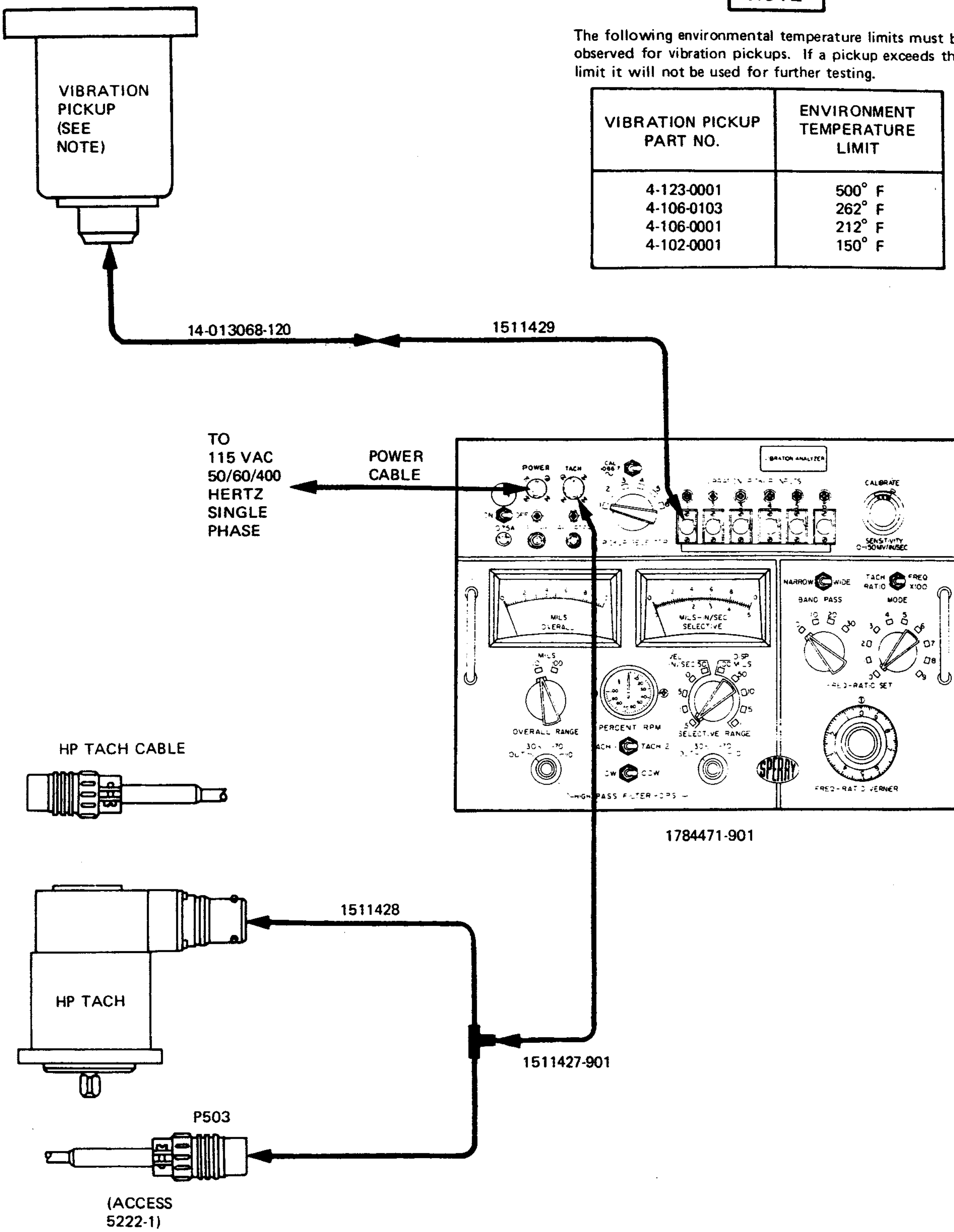

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Figure 4-11. Vibration Check; Engine (Sheet 2)

q. Connect vibration analyzer as shown in figure 4-11, except do not connect vibration pickup to analyzer.

NOTE

If POWER light does not come on, refer to T.O. 33A1-13-94-1 for troubleshooting procedures.

r. Place POWER switch in ON. Check that POWER light comes on.

s. Perform vibration analyzer calibration check as follows:

(1) Set analyzer switches and controls as follows:

Control	*Position*
PICKUP SELECTOR switch	1
OVERALL RANGE switch	10
HIGH PASS FILTER — C.P.S. (OVERALL RANGE) switch	OUT
SELECTIVE RANGE switch	DISP MILS-5
HIGH PASS FILTER — C.P.S. (SELECTIVE RANGE) switch	30
TACH switch	As required
CW-CCW	As required
BAND PASS switch	WIDE
MODE switch	FREQ X 100
FREQ-RATIO switch	10 left, 0 right
FREQ-RATIO VERNIER control	0.665
CALIBRATE control	Sensitivity of pickup

(2) Place and hold CAL switch in CAL. Adjust VIBRATION PICKUP INPUTS 1 control for 2.4 to 2.6 mils on MILS-IN/SEC SELECTIVE meter. Check MILS OVERALL meter for 2.0 to 3.0 mils. Release CAL switch.

(3) Set SELECTIVE RANGE switch to VEL/IN/SEC-10.

(4) Place and hold CAL switch in CAL. Check MILS-IN/SEC SELECTIVE meter for 5.0 to 5.6 inches per second. Release CAL switch.

t. Perform vibration analyzer installation checks as follows:

(1) Connect harness to vibration pickup.

(2) Rap engine structure near vibration pickup in direction of pickup's sensitive axis. Check for MILS OVERALL pointer movement.

(3) Place HIGH PASS FILTER — C.P.S. (OVERALL RANGE) switch in 30.

u. Start engine (T.O. 1A-7D-2-1).

v. Place TACH 1 — TACH 2 and CW-CCW switches to produce an upscale indication on meter.

w. Perform engine operational checkout (paragraph 4-5). Observe MILS OVERALL meter during checkout. If vibration exceeds limit of table 4-11, perform the following steps:

(1) Place MODE switch in FREQ X 100.

NOTE

Traverse FREQ-RATIO VERNIER range no faster than one revolution in 10 seconds.

(2) Using FREQ-RATIO SET switches and FREQ-RATIO VERNIER control, scan for vibration between 40 and 400 hertz.

(3) Record NH speed and vibration frequency (hertz) at which peak vibration occurs.

(4) Plot NH speed versus frequency (figure 4-12) to determine defective engine accessory.

(5) Replace defective accessory and repeat vibration check.

(6) If vibration still exceeds limits, remove engine for test cell checkout.

Table 4-11. Engine Vibration Limits

Type of vibration	Vibration limit (mils)	Conditions
Basic rotating systems (overall reading)[1]		
During fast throttle movement[2]	6	
During slow throttle movement[3]	5	
During 5-minute stabilization period following throttle movement	5	
Idle	3.5	After 5-minute stabilization period
Between idle and 77% rpm	5[4]	After 5-minute stabilization period
Above 77.5% rpm	3.5	After 5-minute stabilization period
Nonrotor related		
NIV	2	60 to 95 hertz and repeats

[1]Limits are applicable only when using 30-hertz high pass filter.

[2]Rate of throttle movement that would result in moving throttle from IDLE to MIL in less than 6 seconds.

[3]Rate of throttle movement that would result in moving throttle from IDLE to MIL in more than 6 seconds.

[4]Providing a throttle movement of ±3% rpm reduces vibration to 3.5 mils or below.

x. Place vibration analyzer POWER switch in OFF.

y. Shut down engine (T.O. 1A-7D-2-1).

z. Disconnect vibration analyzer from engine.

aa. Connect electrical connector P503 to high pressure compressor tachometer generator.

ab. Remove vibration pickup and bracket from engine.

ac. Install engine removal door (T.O. 1A-7D-2-1).

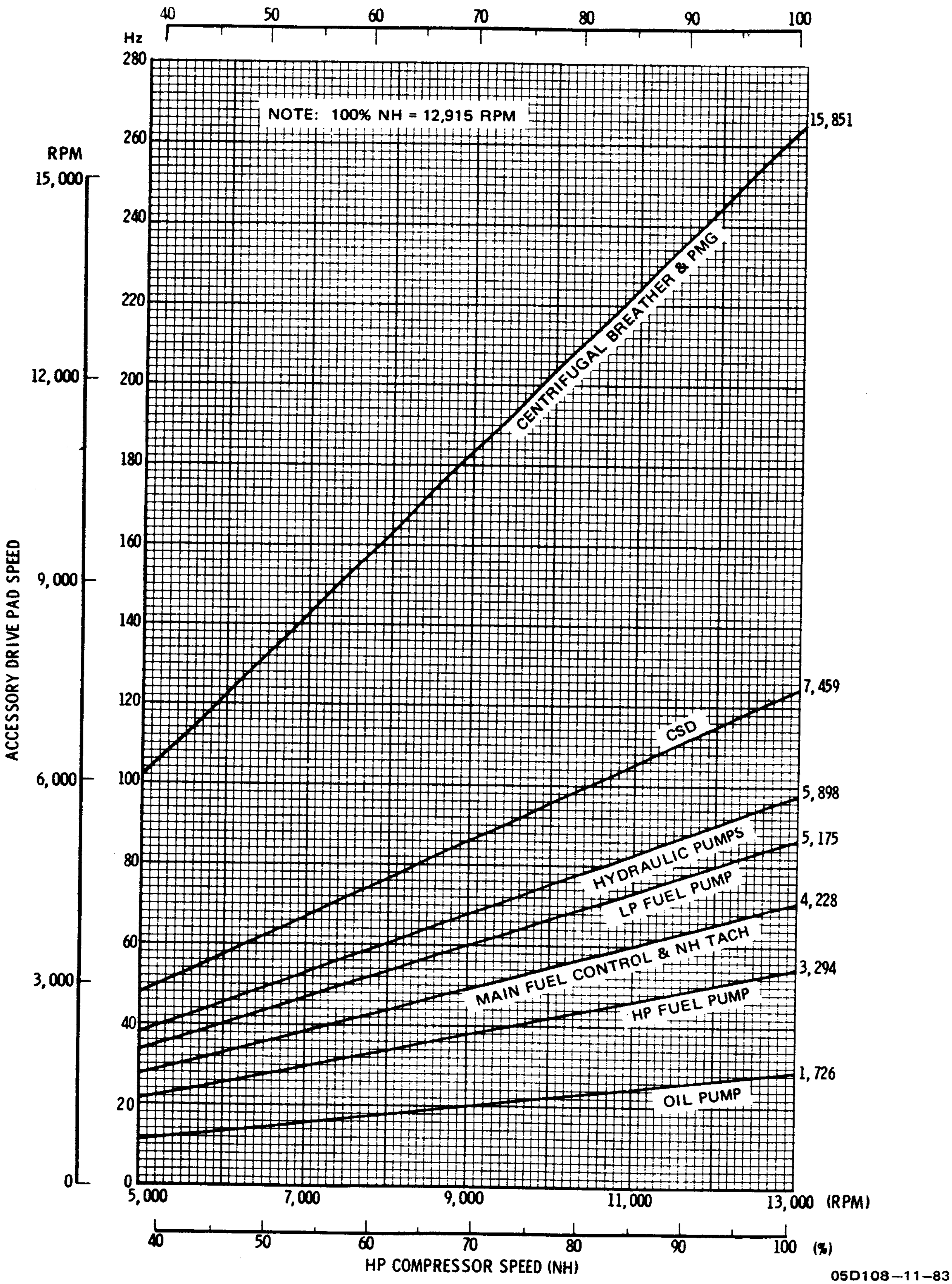


Figure 4-12. Vibration Chart; Engine Accessory

4-12. NONINTEGRAL VIBRATION CHECK (USING 6872929 TEST SET).

Test Equipment Required

Figure & index No.	Name	AN type designation	Use and application
	Equipment required for connecting external electrical power		Supply electrical power to vibration analyzer
	Equipment required for engine operation		Operate engine
	Pickup extension cable	1511429 (Sperry Phoenix Co, Phoenix, Arizona)	Connect pickup cable to vibration analyzer
4-13	Pickup cable	1784341-4 (Sperry Phoenix Co, Phoenix Arizona)	Connect vibration pickup to pickup extension cable
4-13	Vibration analyzer	1784471-901 (Sperry Phoenix Co, Phoenix, Arizona)	Display vibration amplitude
4-13	Vibration pickup	4-123-0001 or 4-106-0103 or 4-106-0001 or 4-102-0001 (Bell and Howell, CEC Division, Monrovia, California)	Create electrical signal proportional to vibration (See figure 4-13 for temperature restrictions)
4-11	Vibration pickup brackets	6798936 and 6798937 (Allison Division of General Motors, Indianapolis, Indiana)	Provide mount for vibration pickups
4-14	Engine limiter test cable assembly	6872490 (Allison Division of General Motors, Indianapolis, Indiana)	Connect test set to engine and external power source
4-14	Engine limiter test set	6872929 (Allison Division of General Motors, Indianapolis, Indiana)	Measure low and high pressure rotor speed
4-14	Power cable adapter	6872727 (Allison Division of General Motors, Indianapolis, Indiana)	Connect test set power cable to airplane ARW-77 connector

NOTE

This procedure is for installed engines that have an audible and/or physical detectable vibration or rumble.

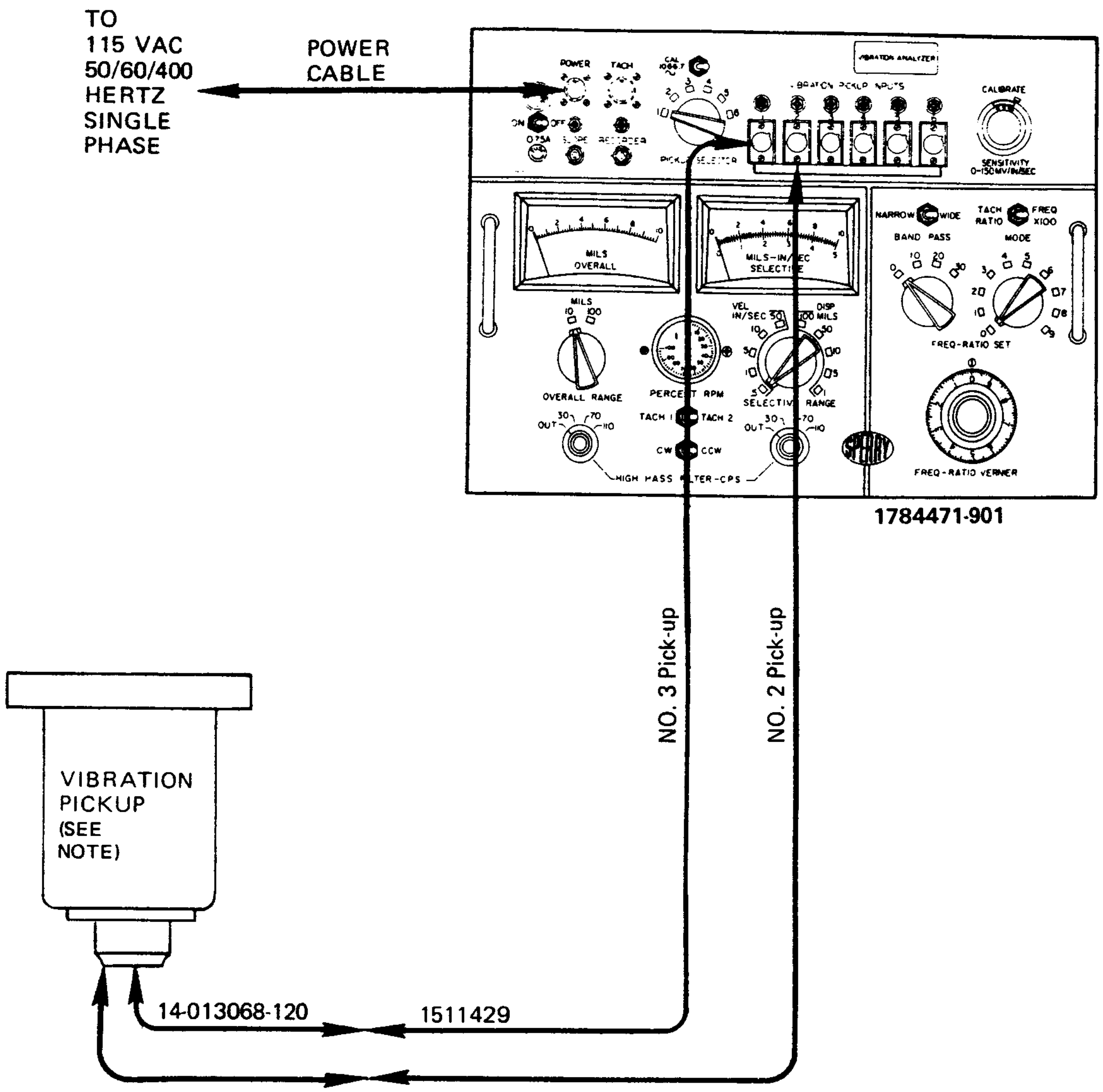
4-12.1. Preparation.

a. Remove engine removal door (T.O. 1A-7D-2-1).

b. Install mounting bracket (1, figure 4-11) on mounting sleeve in rear bypass duct using screws (2) and phenolic spacers (3). Install transducer (4) on bracket using bolts (5).

c. Install mounting bracket (6) on the burner rail at the No. 7 nozzle position using bolts (2) and phenolic spacers (4). Install transducer (3) on bracket using screws (5).

d. Place vibration analyzer power switch in off. Connect vibration analyzer as shown in figure 4-13, except do not connect pickups to analyzer.



NOTE

The following environmental temperature limits must be observed for vibration pickups. If a pickup exceeds this limit it will not be used for further testing.

VIBRATION PICKUP PART NO.	ENVIRONMENTAL TEMPERATURE LIMIT
4-123-0001	500° F
4-106-0103	262° F
4-106-0001	212° F
4-102-0001	150° F

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Figure 4-13. Vibration Analyzer Connections; Nonintegral Vibration Check

NOTE

If POWER light does not come on, refer to T.O. 33A1-13-94-1 for troubleshooting procedures.

e. Place POWER switch in ON. Check that POWER light comes on.

NOTE

Repeat step f substep (1) through step g substep (3) for No. 2 and No. 3 pickups.

f. Perform vibration analyzer calibration check as follows:

(1) Set analyzer switches and controls as follows:

Control	*Position*
PICKUP SELECTOR switch	1
OVERALL RANGE switch	10
HIGH PASS FILTER — C.P.S. (OVERALL RANGE) switch	OUT
SELECTIVE RANGE switch	DISP MILS-5
HIGH PASS FILTER — C.P.S. (SELECTIVE RANGE) switch	30
TACH switch	Not applicable
CW-CCW switch	Not applicable
BAND PASS switch	WIDE
MODE switch	FREQ X 100
FREQ-RATIO switch	10 left, 0 right
FREQ-RATIO VERNIER control	0.665
CALIBRATE control	Sensitivity of pickup

(2) Place and hold CAL switch in CAL. Adjust VIBRATION PICKUP INPUTS 1 control for 2.4 to 2.6 mils on MILS-IN/SEC SELECTIVE meter. Check MILS OVERALL meter for 2.0 to 3.0 mils. Release CAL switch.

(3) Set SELECTIVE RANGE switch to VEL/IN/SEC-10.

(4) Place and hold CAL switch in CAL. Check MILS-IN/SEC SELECTIVE meter for 5.0 to 5.6 mils. Release CAL switch.

g. Perform vibration analyzer installation checks as follows:

(1) Set SELECTIVE RANGE switch to DISP MILS 1.

(2) Connect harness to vibration pickup.

(3) Rap engine structure near vibration pickup in direction of pickup's sensitive axis. Check for MILS OVERALL indicator pointer movement.

(4) Place HIGH PASS FILTER — C.P.S. (OVERALL RANGE) switch in 30.

(5) Place BAND PASS switch in NARROW.

(6) Set FREQ-RATIO SET switch to 0 left and 0 right.

h. Set switches and controls on engine limiter test set as follows:

Control	*Position*
POWER switch	OFF
TACH SIM switch	OFF
SIM SIGNAL control	Full decrease
T1 control	Midrange
T3/T5.1 control	Full decrease
TEMP SELECTOR switch	CAL
T3/T5.1 SIM switch	OFF
T5.1 switch	NORMAL
T3 switch	NORMAL
LP SPEED switch	OFF
SQUAT switch	OFF
METER switch	USE
T1 SIM switch	OFF
TACHOMETER switch	USE
READ/CAL switch	CAL
ZERO ADJ switch	Full decrease

RPM SELECT switch ....NHP

PROBE TRIM control ....Full decrease

MODE switch..RESET

ACCEL START PRESET control ....Centered

i. Remove dust cap from electrical receptacle marked A on temperature limiter amplifier.

CAUTION

To prevent damage to engine components and test set, make sure that test set is connected to 115-volt, 400-hertz, single-phase ac power source. Make a pin-to-pin voltage check of the power source connector before connecting test set.

j. Connect engine limiter test set to airplane and external power source as shown in figure 4-14.

k. Place engine limiter test set POWER switch in ON. Warm up for 10 minutes.

l. Check engine limiter test set as follows:

(1) Place METER switch in CHECK. Check milliammeter for 210 (±20) milliamperes. Place METER switch in USE.

(2) Check TEMP meter for 575° (±1°)C (1,067° (±2°)F).

(3) Place TACHOMETER switch in CHECK and RPM SELECT switch in NLP. Check % RPM meter for 16.7% (±0.3%).

(4) Place RPM SELECT in NHP. Check % RPM meter for 100.0% (±0.3%). Place TACHOMETER switch in USE.

4-12.2. Vibration Check. (Figure 4-15.)

a. Start engine (T.O. 1A-7D-2-1) and stabilize at IDLE.

NOTE

At any stabilized point, the overall vibration level (column 3) should be accountable in columns 4 through 9; it not, reconfirm overall vibration level and repeat scan as required.

Engine limiter test set RPM SELECT switch must be in NHP to read % NH and in NLP to read % NL.

b. Record the following from test sets in vibration data record column indicated.

(1) % NL rotor speed — column 1.

(2) % NH rotor speed — column 2.

(3) Overall vibration meter indication in mils — column 3.

c. If overall vibration indication is less than 2 mils, proceed as follows:

(1) Increase speed about 2% rpm. Check overall vibration meter indication.

(2) Repeat substep (1) for each 2% rpm increment between idle speed and 65% rpm or until overall vibration indication is more than 2 mils.

(3) If overall vibration is more than 2 mils at any point, retard throttle to IDLE and proceed to step d.

(4) If overall vibration is less than 2 mils at any point, retard throttle to IDLE and proceed to subparagraph 4-12.4.

d. Using % rotor speed recorded in step b and figure 4-16, record the following in columns (figure 4-15) shown:

(1) NL rotor frequency — column 1A.

(2) NL X 2 rotor frequency — column 1B.

(3) NH rotor frequency — column 2A.

(4) NH ÷ 2 rotor frequency — column 2B.

e. Using FREQ-RATIO SET switches and FREQ-RATIO VERNIER control, scan slowly (3 to 5 minutes) from 35 to 190 hertz.

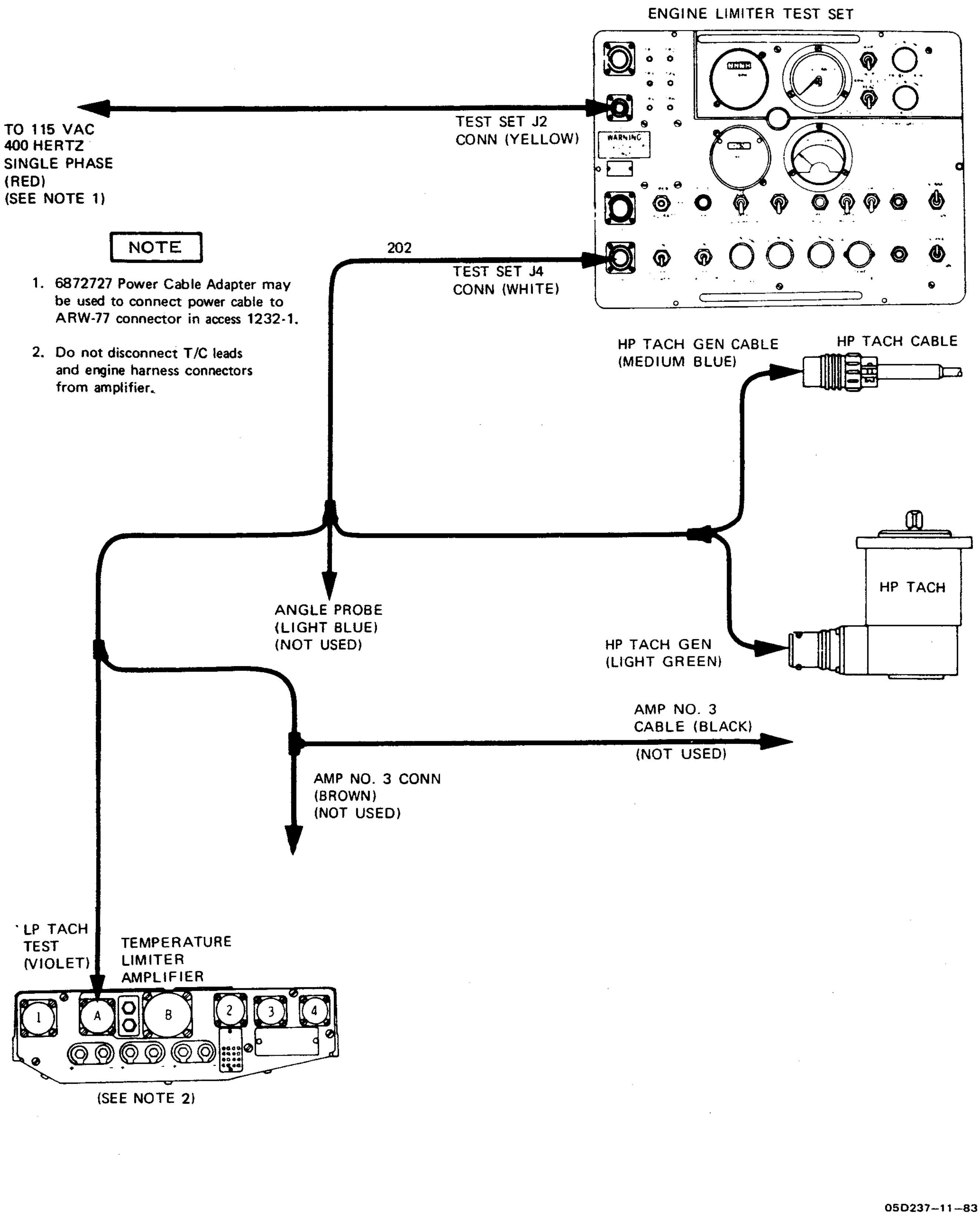

Figure 4-14. Engine Limiter Test Set Connections (Using 6872929 Test Set); Nonintegral Vibration Check

TEST FACILITY __________ ENGINE SERIAL NO. __________ DATE ________ PREPARED BY __________

	ROTOR SPEEDS AND FREQUENCIES				*OVERALL VIBRATION	ANALYZER FREQUENCY AND LEVEL (ROTOR RELATED)				ANALYZER FREQUENCY AND LEVEL GREATER THAN 0.3 MILS: 35 TO 170 Hz NONROTOR RELATED (NIV)			
COLUMN	1		2		3	4	5	6	7	8	9	10	11
	A	B	A	B									
CONDITION	NL RPM		NH RPM		MILS	NL Hz	NH ÷ 2 Hz	NL X 2	NH Hz	Hz	Hz	Hz	Hz
	NL Hz	NLX2 Hz	NH Hz	NH ÷ 2 Hz		MILS	MILS	MILS	MILS	MILS	MILS	MILS	MILS
IDLE					2								
					3								
IDLE + 200 RPM					2								
					3								
IDLE + 400 RPM					2								
					3								
IDLE + 600 RPM					2								
					3								
IDLE + 800 RPM					2								
					3								
IDLE + 1000 RMP					2								
					3								
IDLE + 1200 RPM					2								
					3								
					2								
					3								

*Using 30 Hertz hi-pass filter

2	3

NO. 2 PU LOCATION IS BURNER RAIL
NO. 3 PU LOCATION IS TAIL BRG HSG

Hz = CPS
CPM = RPM
CPM÷60 = CPS

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Figure 4-15. Data Record; Nonintegral Vibration

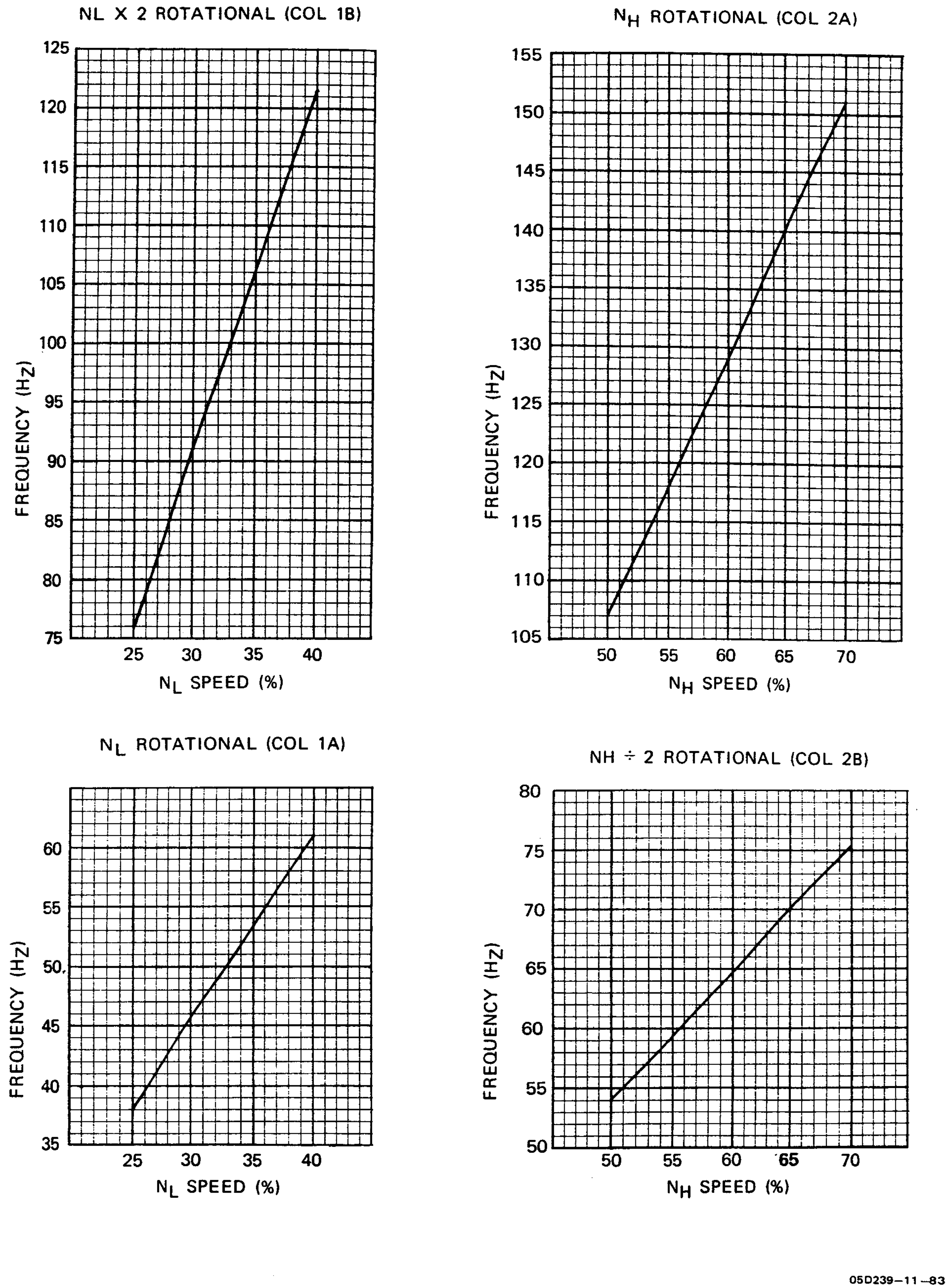


Figure 4-16. Vibration Frequency; Nonintegral

NOTE

While conducting scan, record any vibration level of 0.3 mil or more. Enter dash (—) in columns 4 through 7 if level is below 0.3 mil at these points.

f. Record the frequencies and levels (mils) at the following points in columns indicated:

(1) Frequency in column 1A — log in column 4.

(2) Frequency in column 2B — log in column 5.

(3) Frequency in column 1B — log in column 6.

(4) Frequency in column 2A — log in column 7.

g. While making frequency scan, record the frequencies and levels (mils) whenever vibration level exceeds 0.3 mil or more in the following columns:

(1) Any frequency between column 2B and 1B — log in column 8.

(2) Any frequency between column 2A and 190 — log in column 9.

NOTE

If target speed is exceeded, do not retard throttle. Perform check at speed set.

h. Increase speed about 2% rpm.

i. Repeat steps a through h for each 2% rpm increment between idle speed and 65% rpm.

j. If any frequencies are recorded in the 60- to 95-hertz band in column 8 or 9, repeat steps b through g at that rpm to verify vibration level.

k. Retard throttle to IDLE.

4-12.3. Analysis.

a. Recorded data in columns 4 through 7 are the vibration level of the basic rotating systems (low pressure and high pressure rotors) of the engine.

b. Recorded data in columns 8 and 9 are nonrotor related (NIV).

c. If basic rotating system exceeds limits in table 4-11, reject engine to field maintenance.

d. If NIV exceeds limit in table 4-11, reject engine to field maintenance.

4-12.4. Postcheck.

a. Shut down engine (T.O. 1A-7D-2-1).

b. Place vibration analyzer POWER switch in OFF.

c. Place engine limiter test set POWER switch in OFF.

d. Disconnect test sets from airplane and external electrical power source.

e. Connect electrical connector P503 to high pressure compressor tachometer generator.

f. Install dust cap on temperature limiter amplifier electrical receptacle A.

g. Remove bolts (5, figure 4-11), transducer (4), phenolic spacers (3), screws (2), and mounting plate (1).

h. Install engine removal door (T.O. 1A-7D-2-1).

4-13. NONINTEGRAL VIBRATION CHECK (USING 6893706 TEST SET).

Test Equipment Required

Figure & index No.	Name	AN type designation	Use and application
	Equipment required for connecting external electrical power		Supply electrical power to vibration analyzer
	Equipment required for engine operation		Operate engine
	Pickup extension cable	1511429 (Sperry Phoenix Co, Phoenix, Arizona)	Connect pickup cable to vibration analyzer

Test Equipment Required — CONT

Figure & index No.	Name	AN type designation	Use and application
4-13	Pickup cable	1784341-4 (Sperry Phoenix Co, Phoenix, Arizona)	Connect vibration pickup to pickup extension cable
4-13	Vibration analyzer	1784471-901 (Sperry Phoenix Co, Phoenix, Arizona)	Display vibration amplitude
4-13	Vibration pickup	4-123-0001 (Bell and Howell, CEC Division, Monrovia, California)	Create electrical signal proportional to vibration (See figure FO-9 for temperature restrictions)
4-13	Vibration pickup bracket	6798936 (Allison Division of General Motors, Indianapolis, Indiana)	Provide mount for vibration pickup
4-14	Engine limiter test set	6893706 (Allison Division of General Motors, Indianapolis, Indiana)	Measure low and high pressure rotor speed

NOTE

This procedure is for installed engines that have an audible and/or physical detectable vibration or rumble.

4-13.1. Preparation.

a. Remove engine removal door (T.O. 1A-7D-2-1).

b. Install mounting plate (1, figure 4-11) on mounting sleeve in rear bypass duct using screws (2) and phenolic spacers (3). Install transducer (4) on mounting plate using bolts (5).

c. Place vibration analyzer POWER switch in OFF.

d. Connect vibration analyzer as shown in figure 4-13, except do not connect vibration pickup to analyzer.

NOTE

If POWER light does not come on, refer to T.O. 33A1-13-94-1 for troubleshooting procedures.

e. Place POWER switch in ON. Check that POWER light comes on.

f. Perform vibration analyzer calibration check as follows:

(1) Set analyzer switches and controls as follows:

Control	*Position*
PICKUP SELECTOR switch	1
OVERALL RANGE switch	10
HIGH PASS FILTER — C.P.S. (OVERALL RANGE) switch	OUT
SELECTIVE RANGE switch	DISP MILS-5
HIGH PASS FILTER — C.P.S. (SELECTIVE RANGE) switch	30
TACH switch	Not applicable
CW-CCW switch	Not applicable
BAND PASS switch	WIDE
MODE switch	FREQ X 100
FREQ-RATIO switch	10 left, 0 right
FREQ-RATIO VERNIER control	0.665
CALIBRATE control	Sensitivity of pickup

(2) Place and hold CAL switch in CAL. Adjust VIBRATION PICKUP INPUTS 1 control for 2.4 to 2.6 mils on MILS-IN/SEC SELECTIVE meter. Check MILS OVERALL meter for 2.0 to 3.0 mils. Release CAL switch.

(3) Set SELECTIVE RANGE switch to VEL/IN/SEC-10.

(4) Place and hold CAL switch in CAL. Check MILS-IN/SEC SELECTIVE meter for 5.0 to 5.6 mils. Release CAL switch.

g. Perform vibration analyzer installation check as follows:

(1) Set SELECTIVE RANGE switch to DISP MILS-1.

(2) Connect harness to vibration pickup.

(3) Rap engine structure near vibration pickup in direction of pickup's sensitive axis. Check for MILS OVERALL pointer movement.

(4) Place HIGH PASS FILTER — C.P.S. (OVERALL RANGE) switch in 30.

(5) Place BAND PASS switch in NARROW.

(6) Set FREQ-RATIO SET switch to 0 left and 0 right.

h. Disconnect external electrical power from airplane.

i. Set switches and controls on engine limiter test set as follows:

Control	*Position*
POWER switch	OFF
SQUAT switch	OFF
IGV/CAL switch	IGV
TACH SIMULATED INPUTS control	Fully counter-clockwise
T1 SIMULATED INPUTS control	Fully counter-clockwise
T5 SIMULATED INPUTS control	Fully counter-clockwise
T5 switch	NORMAL
LP SP switch	Center position

j. Open access 5222-1 (figure 4-15).

k. Remove dust cap from electrical receptacle marked A on temperature limiter amplifier.

NOTE

Make sure external electrical power is disconnected from airplane.

l. Connect engine limiter test set to airplane as shown in figure 4-17.

NOTE

When the test set POWER switch is placed in ON, the numerals 00 will appear in the lower portion of the test set display window. This 00 display indicates the SELF TEST has been selected.

When the test set has warmed up (maximum time of 20 minutes), it will begin the self-test function automatically.

After completion of self-test, the numbers 88.88 will be sequenced through the three rows in the display window. This sequencing will continue until a specific test is selected or test set POWER switch is placed in OFF.

m. Place POWER switch in ON. Warm up test set.

4-13.2. <u>Vibration Check.</u> (Figure 4-16.)

a. Start engine (T.O. 1A-7D-2-1) and stabilize at IDLE.

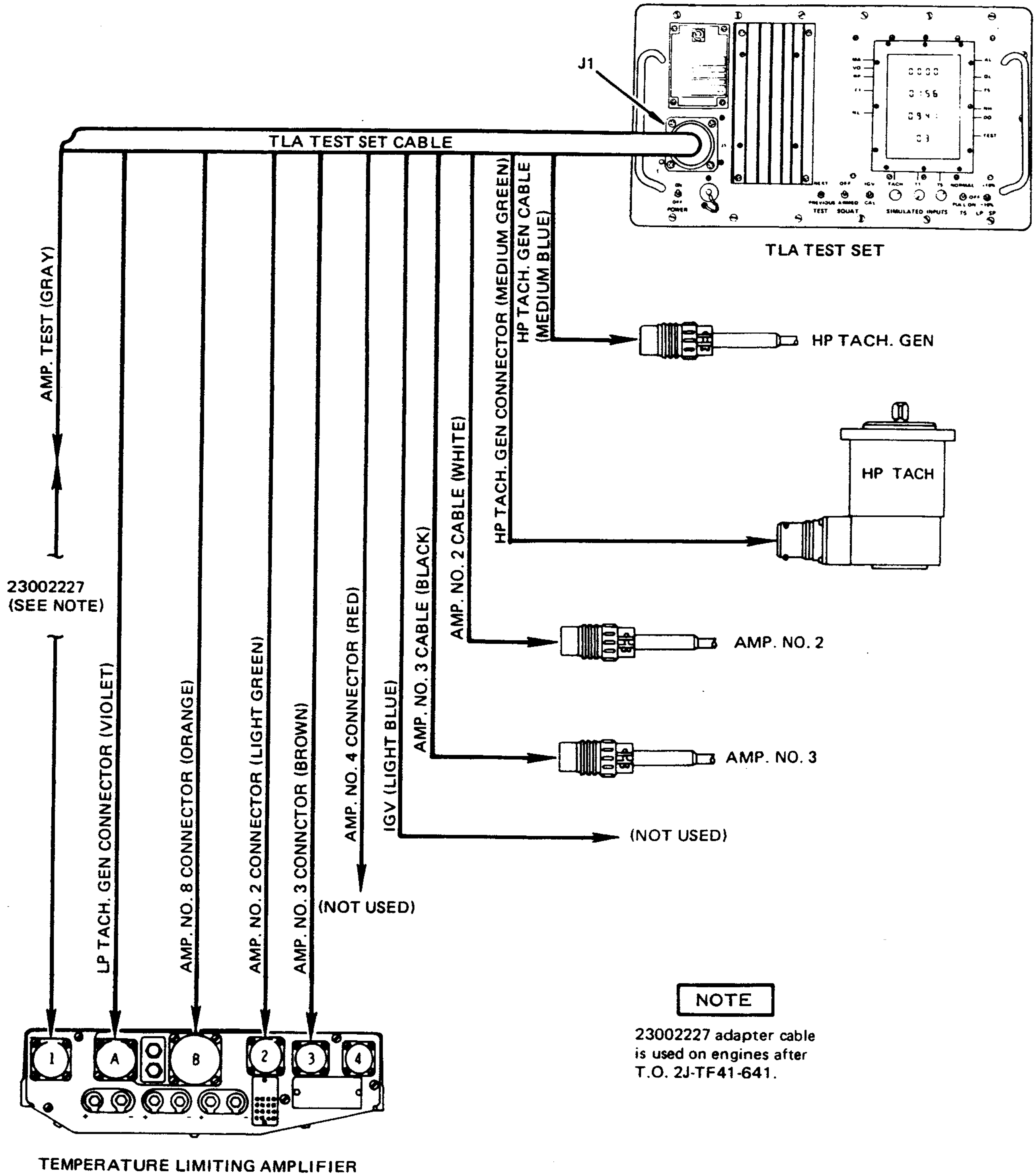
NOTE

At any stabilized point, the overall vibration level (column 3) should be accountable in columns 4 through 9; if not, reconfirm overall vibration level and repeat scan as required.

The 6893706 test set will read only one speed (either NH or NL) at a time. In the checks below, to read NH, place TEST switch in NEXT until 17 is displayed in TEST display window. To read NL, place the TEST switch in PREVIOUS until 10 is displayed in TEST display window.

When TEST 17 is selected, the display window will indicate T5, MA, and NH. When TEST 10 is selected, the display window will indicate T5 and NL.

b. Record the following from test sets in vibration data record column indicated.



NOTE

23002227 adapter cable is used on engines after T.O. 2J-TF41-641.

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Figure 4-17. Engine Limiter Test Set Connections (Using 6893706 Test Set); Nonintegral Vibration Check

(1) % NL rotor speed — column 1.

(2) % NH rotor speed — column 2.

(3) Overall vibration meter indication in mils — column 3.

c. If overall vibration indication is less than 2 mils, proceed as follows:

(1) Increase speed about 2% rpm. Check overall vibration meter indication.

(2) Repeat substep (1) for each 2% rpm increment between idle speed and 65% rpm or until overall vibration indication exceeds 2 mils.

(3) If overall vibration is more than 2 mils at any point, retard throttle to IDLE and proceed to step d.

(4) If overall vibration is less than 2 mils at any point, retard throttle to IDLE and proceed to subparagraph 4-13.4.

d. Using % rotor speed recorded in step b and figure 4-17, record the following in columns (figure 4-16) indicated:

(1) NL rotor frequency — column 1A.

(2) NL X 2 rotor frequency — column 1B.

(3) NH rotor frequency — column 2A.

(4) NL ÷ 2 rotor frequency — column 2B.

e. Using FREQ-RATIO SET switches and FREQ-RATIO VERNIER control, scan slowly (3 to 5 minutes) from 35 to 190 hertz.

NOTE

While conducting scan, record any vibration level of 0.3 mil or more. Enter dash (—) in columns 4 through 7 if level is below 0.3 mil at these points.

f. Record the frequencies and levels (mils) at the following points in columns indicated:

(1) Frequency in column 1A — log in column 4.

(2) Frequency in column 2B — log in column 5.

(3) Frequency in column 1B — log in column 6.

(4) Frequency in column 2A — log in column 7.

g. While making frequency scan, record the frequencies and levels (mils) whenever vibration level exceeds 0.3 mil or more in the following columns:

(1) Any frequency between column 2B and 1B — log in column 8.

(2) Any frequency between column 2A and 190 — log in column 9.

NOTE

If target speed is exceeded, do not retard throttle. Perform check at speed set.

h. Increase speed about 2% rpm.

i. Repeat steps a through h for each 2% rpm increment between idle speed and 65% rpm.

j. If any frequencies are recorded in the 60- to 95-hertz band in column 8 or 9, repeat steps b through g at that rpm to verify vibration level.

k. Retard throttle to IDLE.

4-13.3. Analysis.

a. Recorded data in columns 4 through 7 are the vibration level of the basic rotating systems (low pressure and high pressure rotors) of the engine.

b. Recorded data in columns 8 and 9 are nonrotor related (NIV).

c. If basic rotating system exceeds limits in table 4-11, reject engine to field maintenance.

d. If NIV exceeds limit in table 4-11, reject engine to field maintenance.

4-13.4. Postcheck.

a. Shut down engine (T.O. 1A-7D-2-1).

b. Place vibration analyzer POWER switch in OFF.

c. Place engine limiter test set POWER switch in OFF.

d. Disconnect test sets from airplane.

e. Connect electrical connector P503 to high pressure compressor tachometer generator.

f. Install dust cap on temperature limiter amplifier electrical receptacle A.

g. Remove bolts (5, figure 4-11), transducer (4), phenolic spacers (3), screws (2), and mounting plate (1).

h. Install engine removal door (T.O. 1A-7D-2-1).

i. Close access 5222-1.

4-14. COLD SECTION BORESCOPE INSPECTION.

NOTE

See figure 4-18 for proper borescope application.

Test Equipment Required

Figure & index No.	Name	AN type designation	Use and application
	Equipment required for connecting 115-volt, 60-hertz, single-phase external electrical power		Supply power for borescope
4-19	Engine internal viewing borescope	6798380 (Allison Division of General Motors, Indianapolis, Indiana)	View engine internally
		or	
		6872724 (Allison Division of General Motors, Indianapolis, Indiana)	View engine internally
		or	
		6872797 (Allison Division of General Motors, Indianapolis, Indiana)	View engine internally
		or	
4-20	Fiberscope, Model IF1	6886226 (Allison Division of General Motors, Indianapolis, Indiana)	View engine internally
	Torque wrench, 10 to 150 inch-pounds	GGG-W-686	Measure torque
	Equipment required for engine operation		Operate engine

4-14.1. Preparation (Using Borescope). (Figure 4-19.)

a. Open accesses 5122-5 and 6122-3.

b. Remove No. 5 and 7 fuel nozzles (paragraph 4-20).

c. Install high pressure rotor turning adapter (paragraph 4-19).

d. Remove borescope sealing tubes (1) from engine intermediate compressor case.

e. Remove cotter pin, nut, spacer, and bolt and disconnect inlet guide vane surge cylinder (2) from control arm (3).

f. Place transformer power switch in OFF and rotate light intensity control fully counterclockwise.

GAS PATH AREA	BORESCOPE OR FIBERSCOPE REQUIRED							
	6798380 COLD SECTION	6872724 COLD SECTION	6798380 HOT SECTION	6872724 HOT SECTION	6872797 WITH-600 PROBE	6872797 WITH-400 PROBE	6872797 WITH-500 PROBE	6886226 FIBERSCOPE
LP COMPRESSOR THIRD STAGE	X	X			X			X
IP COMPRESSOR SECOND STAGE	X	X			X			X
HP COMPRESSOR FIRST STAGE	X	X			X			X
HP COMPRESSOR SEVENTH STAGE								X
HP COMPRESSOR ELEVENTH STAGE	X	X			X	X		X
COMBUSTION LINERS			X △1	X △1		X △2		X △3
HP TURBINE FIRST STAGE VANES			X △1	X △1		X △2		X △3
HP TURBINE FIRST STAGE BLADES LEADING EDGE						X △2		X △3
HP TURBINE FIRST STAGE BLADES TRAILING EDGE							X	
HP TURBINE SECOND STAGE BLADES LEADING EDGE							X	

NOTE

△1 Through number 5 and 7 fuel nozzles

△2 Through number 4 and 8 igniter openings

△3 Through number 5 and 7 fuel nozzles and number 4 and 8 igniter openings

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Figure 4-18. Borescope and Fiberscope Application

WARNING

To prevent serious burns and failure to borescope bulb, do not touch bulb with bare fingers. Touching hot bulb will cause serious burns. Touching cold bulb will cause bulb failure.

g. If using 6872797 borescope, connect −600 probe to scope. Tighten until flat surface of knurled collar on scope aligns with objective end of scope.

h. Connect transformer to borescope and power source as shown.

4-14.2. Preparation (Using Fiberscope). (Figure 4-20.)

WARNING

Do not use fiberscope in an explosive or hazardous atmosphere. Although the light emitted from the tip is cool and safe, the light supply does produce considerable heat.

a. Open accesses 5122-5, 6122-3, 6122-5, and 6122-2.

b. Remove No. 5 and 7 fuel nozzles (paragraph 4-20).

c. Install high pressure rotor turning adapter (paragraph 4-19).

d. Remove borescope sealing tubes (1) from engine intermediate compressor case.

e. Remove cotter pin, nut, spacer, and bolt and disconnect inlet guide vane surge cylinder (2) from control arm (3).

f. Cut lockwire and remove bolts (4) and washers (5).

g. Cut lockwire and remove insulation (6).

h. Remove cotter pin (7), bolt (8), washer (9), spring (10), spacers (11 and 12), and washers (13, 14, and 15).

i. Remove V-band coupling (16), low-pressure duct (17), and gaskets (18 and 19).

j. Connect cold light supply to 115-volt, 60-hertz, ac power source.

k. Place intensity switch in LOW and power switch in ON.

l. Insert fiberscope connector into output socket of cold light supply. Make certain it is fully inserted and tighten with clamp.

m. Adjust ocular focus as desired.

4-14.3. High Pressure, Intermediate Pressure, and Low Pressure Compressors.

CAUTION

To prevent damage to throttle push-pull assembly, do not twist, crimp, dent, apply side loads, force, or otherwise mishandle. When inserting borescope through access 5122-5, carefully position throttle push-pull housing to allow borescope insertion.

a. Insert borescope or fiberscope into intermediate compressor case boresight port. Point viewing lens toward front of engine.

b. If using 6798380 or 6872724 borescope, place transformer power switch in ON. Adjust light intensity and focus as required.

CAUTION

If it is necessary to change probes, rotate light intensity control fully counterclockwise and place transformer power switch in OFF before removing probe.

c. If using 6872797 borescope, place transformer power switch in 12V. Adjust light intensity and focus as required.

d. If using fiberscope, adjust distance focus as desired.

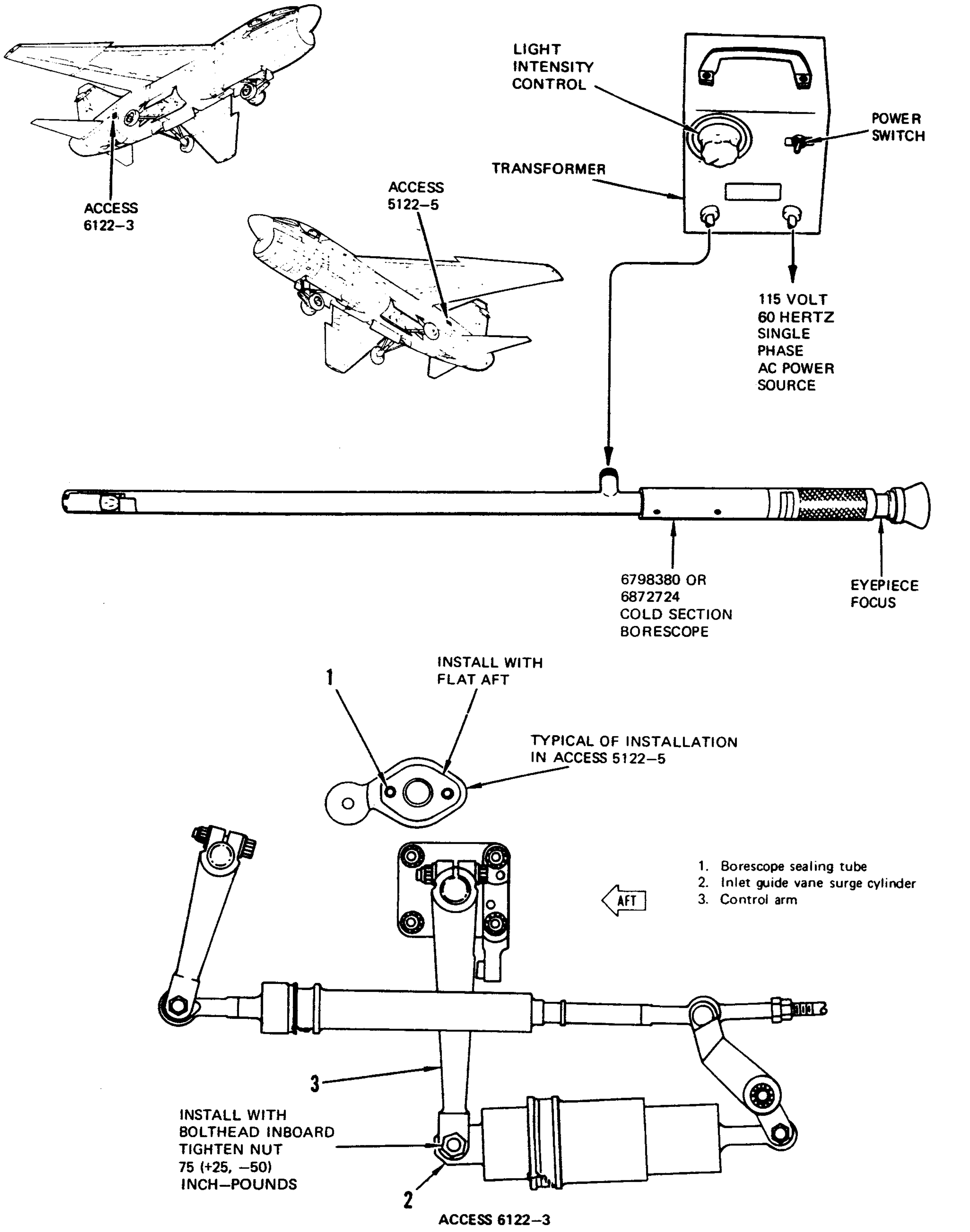

Figure 4-19. Installation and Removal; Cold Section Borescope (Sheet 1 of 2)

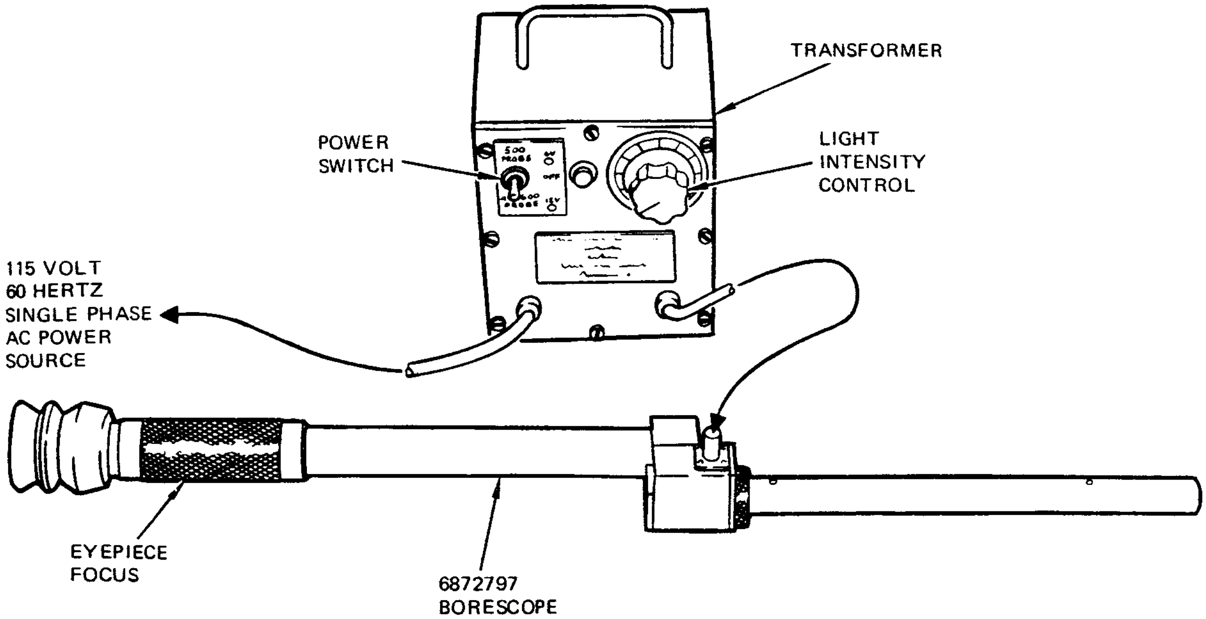

Figure 4-19. Installation and Removal; Cold Section Borescope (Sheet 2)

e. Slowly turn low pressure compressor rotor and inspect intermediate pressure compressor second stage blades and vanes.

f. Reject engine if any of the following conditions are found:

NOTE

All dimensions are to be used as a judgment guideline; they are not meant to be mechanically obtained.

(1) Bent, broken, or missing blades or vanes.

(2) Cracked blades or vanes.

(3) Tears on blades or vanes.

(4) Severe erosion or pitting on blades or vanes.

(5) Abrasion damage depth exceeding 10% of blade or vane thickness.

(6) Nicks or scratches in excess of 0.003 inch; dents in excess of 0.006 inch on inner 1/3 length of blade

(7) Nicks or dents in excess of 0.015 inch on outer 2/3 length of blade.

(8) Nicks or dents in excess of 0.015 inch on vane.

(9) More than three nicks or dents in airfoil of blade or vane.

(10) More than two nicks or dents in leading or trailing edge of blade or vane.

g. If photographs are required, refer to paragraph 4-22 or 4-24 for camera operation.

h. Point viewing lens to view low pressure compressor outlet.

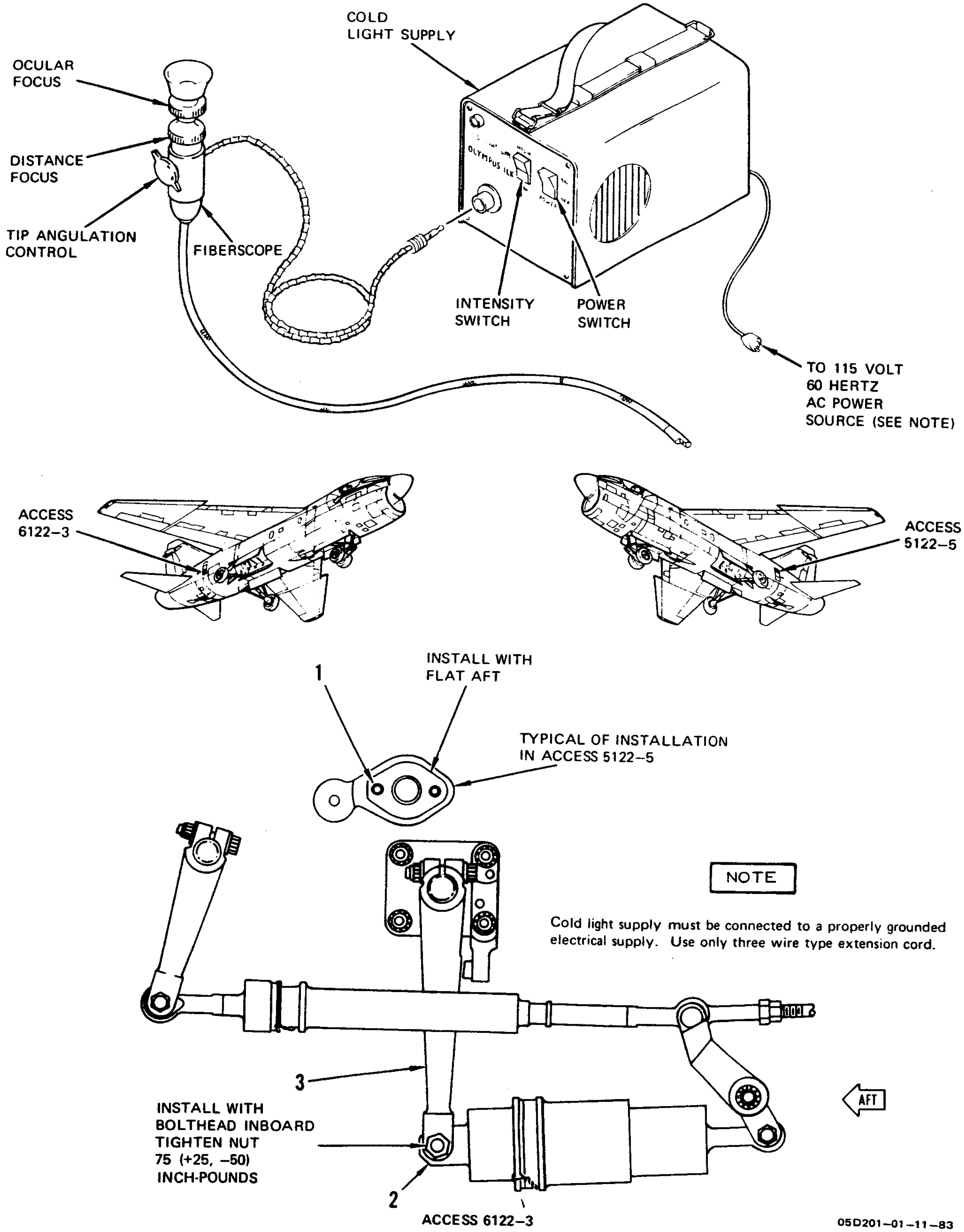

Figure 4-20. Installation and Removal; Cold Section Fiberscope (Sheet 1 of 2)

1. Borescope sealing tube
2. Inlet guide vane surge cylinder
3. Control arm
4. Bolt
5. Washer
6. Insulation
7. Cotter pin
8. Bolt
9. Washer
10. Spring
11. Spacer
12. Spacer
13. Washer
14. Washer
15. Washer
16. V-band coupling
17. Low-pressure duct
18. Gasket
19. Gasket

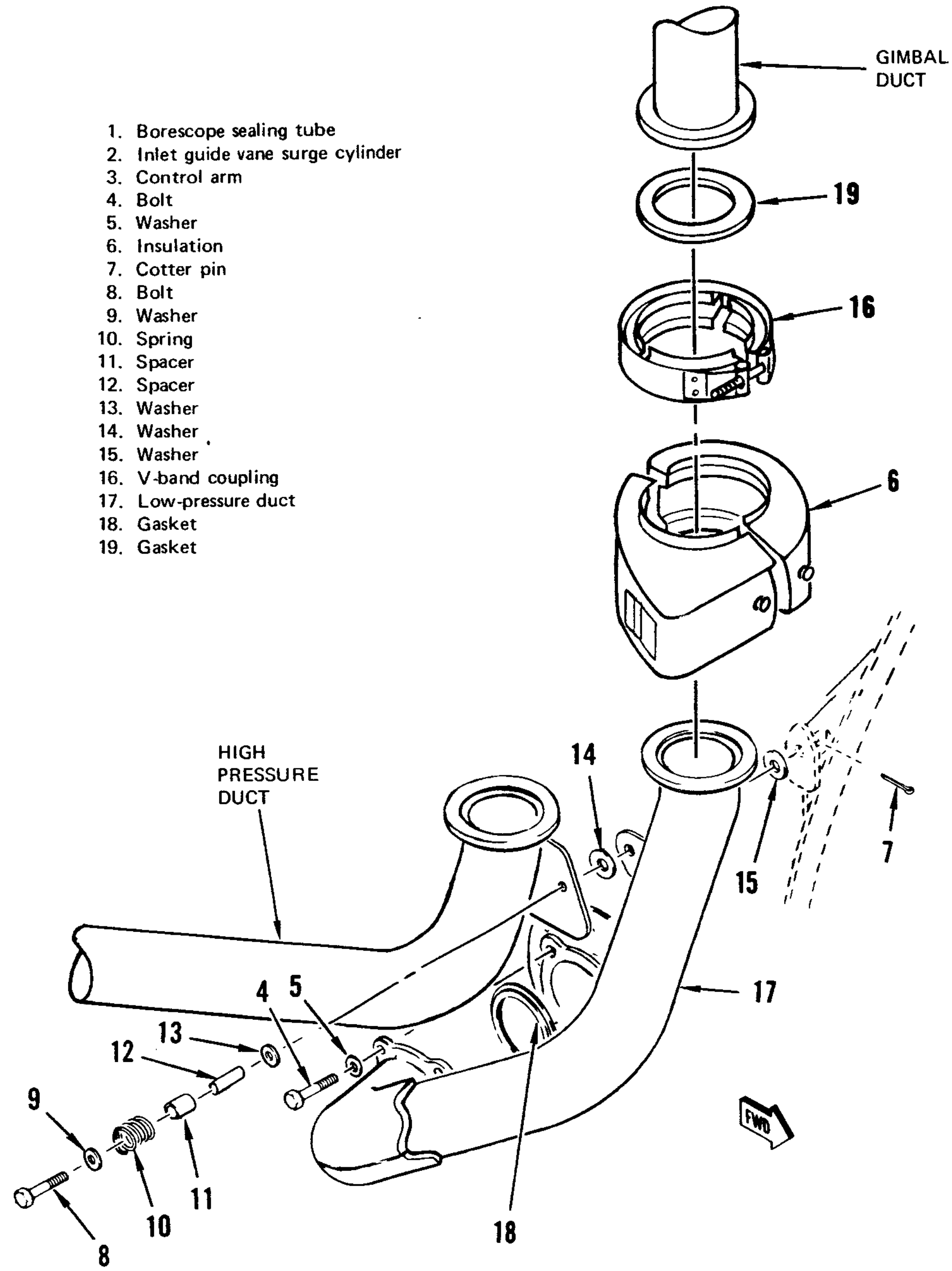

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Figure 4-20. Installation and Removal; Cold Section Fiberscope (Sheet 2)

i. Slowly turn low pressure compressor rotor and inspect low pressure compressor third stage blades and vanes.

j. Reject engine if any of the following conditions are found:

NOTE

All dimensions are to be used as a judgment guideline; they are not meant to be mechanically obtained. Only the outer 1/3 length of blade may be viewed with borescope. Damage limits for remainder of blade are furnished for additional information.

(1) Bent, broken, or missing blades or vanes.

(2) Cracked blades or vanes.

(3) Tears on blades or vanes.

(4) Severe erosion on blades or vanes.

(5) Nicks and scratches in excess of 0.003 inch; dents and abrasions in excess of 0.006 inch on inner 1/3 length of blade.

(6) Nicks and scratches in excess of 0.010 inch; dents and abrasions in excess of 0.020 inch on outer 2/3 length of blade.

(7) Nicks and scratches in excess of 0.010 inch; dents and abrasions in excess of 0.020 inch on vanes.

(8) More than three nicks or dents on each airfoil, leading edge, and trailing edge of blades or vanes.

k. If photographs are required, refer to paragraph 4-22 or 4-24 for camera operation.

l. Direct viewing lens toward rear of engine.

m. Actuate inlet guide vanes to full open position by rotating control arm aft.

n. Slowly turn high pressure compressor and inspect high pressure compressor first and second stage blades and vanes.

o. Reject engine if any of the following conditions are found:

NOTE

All dimensions are to be used as a judgment guideline; they are not meant to be mechanically obtained.

(1) Bent, broken, or missing blades or vanes.

(2) Cracked blades or vanes.

(3) Tears on blades or vanes.

(4) Severe erosion or pitting of blades or vanes.

(5) Nicks and dents on inner 1/3 length of blade.

(6) Nicks and scratches in excess of 0.005 inch; dents and abrasions in excess of 0.010 on outer 2/3 length of blade.

(7) Nicks and scratches in excess of 0.005 inch; dents and abrasions in excess of 0.010 inch on vanes.

p. If photographs are required, refer to paragraph 4-22 or 4-24 for camera operation.

q. If using borescope, place transformer power switch in OFF.

CAUTION

To avoid damage to fiberscope, do not hold tip angulation control and do not force during removal.

r. Remove borescope or fiberscope from intermediate compressor borescope port.

4-14.4. High Pressure Compressor Eleventh Stage.

a. Insert borescope or fiberscope through fuel nozzle opening. Point viewing lens toward front of engine.

b. If using 6798380 or 6872724 borescope, place transformer power switch in ON. Adjust light intensity and focus as required.

CAUTION

If it is necessary to change probes, rotate light intensity control fully counterclockwise and place transformer power switch in OFF before removing probe.

c. If using 6872797 borescope, place transformer power switch in 12V. Adjust light intensity and focus as required.

d. If using fiberscope, adjust distance focus as desired.

e. Slowly turn high pressure compressor rotor and inspect high pressure compressor eleventh stage blades and vanes.

f. Reject engine if any of the following conditions are found:

NOTE

All dimensions are to be used as a judgment guideline; they are not meant to be mechanically obtained.

(1) Bent, broken, or missing blades or vanes.

(2) Cracked blades or vanes.

(3) Tears on blades or vanes.

(4) Severe erosion or pitting of blades or vanes.

(5) Nicks or scratches in excess of 0.003 inch; dents and abrasions in excess of 0.006 inch on inner 1/3 length of blade.

(6) Nicks and scratches in excess of 0.005 inch; dents and abrasions in excess of 0.010 inch on outer 2/3 length of blade.

(7) Nicks and scratches in excess of 0.005 inch; dents and abrasions in excess of 0.010 inch on vanes.

g. If photographs are required, refer to paragraph 4-22 or 4-24 for camera operation.

h. If using borescope, place transformer power switch in OFF.

CAUTION

To avoid damage to fiberscope, do not hold tip angulation control and do not force during removal.

i. Carefully remove borescope or fiberscope from fuel nozzle opening.

4-14.5. <u>High Pressure Compressor Seventh Stage (Fiberscope Only).</u> (Figure 4-21.)

a. Insert fiberscope through bleed port. Adjust tip angulation control to locate nearest opening in high pressure compressor case.

CAUTION

Do not push fiberscope through opening in high pressure compressor case or damage to fiberscope may result.

b. Move fiberscope to edge of opening. Adjust tip angulation control to view seventh stage blades.

c. Slowly turn high pressure compressor and inspect high pressure compressor seventh stage blades. Reject engine if any damaged blades are found.

d. If photographs are required, refer to paragraph 4-22 for camera operation.

CAUTION

To avoid damage to fiberscope, do not hold tip angulation control and do not force during removal.

e. Remove fiberscope from bleed port.

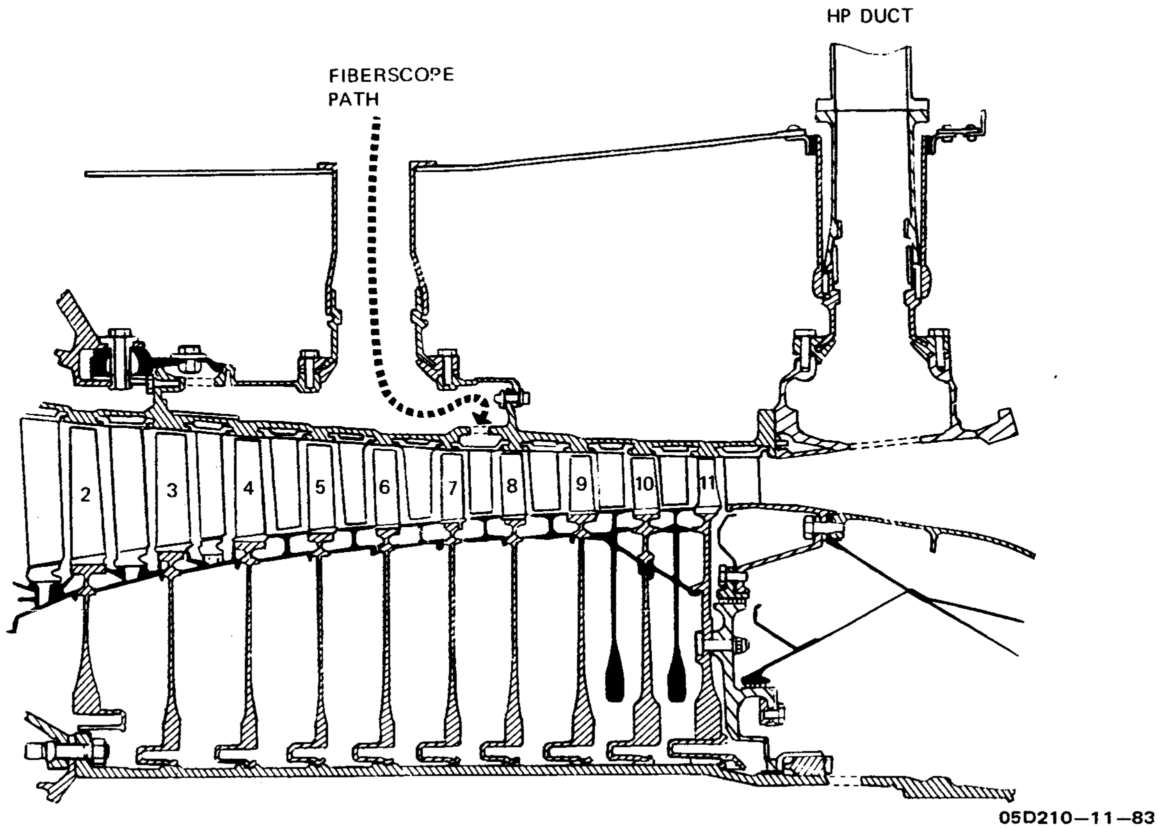


Figure 4-21. Fiberscope Path; High Pressure Compressor Seventh Stage Inspection

4-14.6. Postinspection (Using Borescope). (Figure 4-19.)

a. Rotate light intensity control fully counterclockwise.

b. Disconnect transformer from borescope and power source.

NOTE

Flat of sealing tube mounting flange must be toward rear of engine. Use hand pressure to seat sealing tube.

c. Install borescope sealing tubes (1) in engine intermediate case. Secure with nuts.

d. Connect inlet guide vane surge cylinder (2) to control arm (3) with bolt, spacer, and nut.

e. Tighten nut to 75 (+25, −50) inch-pounds torque. Secure with new cotter pin.

f. Remove high pressure rotor turning adapter (paragraph 4-19).

g. Install No. 5 and 7 fuel nozzles (paragraph 4-20).

h. Close accesses 5122-5 and 6122-3.

4-14.7. Postinspection (Using Fiberscope). (Figure 4-20.)

a. Place power switch in OFF.

b. Disconnect cold light supply from power source.

c. Disconnect fiberscope from cold light supply.

NOTE

Flat of sealing tube mounting flange must be toward rear of engine.

d. Install borescope sealing tubes (1) in engine intermediate case. Secure with nuts.

e. Connect inlet guide vane surge cylinder (2) to control arm (3) with bolt, spacer, and nut.

f. Tighten nut to 75 (+25, −50) inch-pounds torque. Secure with new cotter pin.

g. Remove high pressure compressor rotor turning adapter (paragraph 4-19).

h. Install No. 5 and 7 fuel nozzles (paragraph 4-20).

i. Apply MIL-L-46010 antiseize compound to threads of bolts (4).

NOTE

After tightening duct retaining bolts, a slight gap may exist between duct flange and engine bleed air duct flange.

j. Using new gaskets (18 and 19), place low pressure duct (17) in position and secure with washers (5) and bolts (4). Tighten bolts to 45 (±5) inch-pounds torque. Secure with MS20995C32 lockwire.

NOTE

Refer to T.O. 1-1A-8 for installation precautions of V-band couplings.

k. Place V-band coupling (16) in position and install new self-locking nut on T-bolt.

l. Tighten coupling nut to 90 (±10) inch-pounds torque.

m. Tap coupling lightly with rawhide or plastic mallet at several points around outer band. Retighten nut to 90 (±10) inch-pounds torque. Continue tapping and tightening until torque remains 90 (±10) inch-pounds.

n. Secure duct to engine with washers (15, 14, and 13), spacers (12 and 11), spring (10), washer (9), bolt (8), and new cotter pin (7).

o. Start engine (T.O. 1A-7D-2-1) and operate at IDLE.

WARNING

Use care when checking for leaks. Severe burns may result from hot air under pressure.

p. Check low pressure duct for signs of leakage.

q. Shut down engine (T.O. 1A-7D-2-1).

NOTE

Make sure that insulation is securely laced and that lockwire makes two complete turns around capstan.

r. Install insulation (6) over V-band coupling. Secure with MS20995C32 lockwire.

s. Close accesses 5122-5, 6122-3, 6122-5, and 6122-2.

4-15. HOT SECTION BORESCOPE INSPECTION (USING BORESCOPE).

NOTE

See figure 4-18 for proper borescope application.

Test Equipment Required

Figure & index No.	Name	AN type designation	Use and application
	Equipment required for connecting 115-volt, 60-hertz, single-phase external electrical power		Supply power to borescope
4-22	Engine internal viewing borescope	6798380 (Allison Division of General Motors, Indianapolis, Indiana)	View engine internally
		or	
		6872724 (Allison Division of General Motors, Indianapolis, Indiana)	View engine internally
		or	
4-19		6872797 (Allison Division of General Motors, Indianapolis, Indiana)	View engine internally

4-15.1. Preparation. (Figure 4-22.)

a. If using 6798380 or 6872724 borescope, remove No. 5 and 7 fuel nozzles (paragraph 4-20).

b. If using 6872797 borescope, remove spark igniters (paragraph 8-17).

c. Install high pressure rotor turning adapter (paragraph 4-19).

WARNING

To prevent serious burns and failure of borescope bulb, do not touch bulb with bare fingers. Touching hot bulb will cause serious burns. Touching cold bulb will cause bulb failure.

d. If using 6798380 or 6872724 borescope, proceed as follows:

(1) Loosen thumbscrew (1). Insert light carrier (2) through fuel nozzle opening and into combustion liner. Center clamp (3) on right side (as viewed from rear) of fuel nozzle elbow opening and tighten thumb-bolt (4). With clamp properly positioned, the thumbscrew shall point forward.

(2) Push lamp rod holder (5) toward center of engine as far as it will go and tighten thumbscrew.

(3) Place holder (6) on hot section borescope (7).

CAUTION

The black dots on head and scan controls must be aligned with black dot on grip before installing borescope on engine. This places scanning mirror in a retracted position to prevent damage.

(4) Insert hot section borescope through fuel nozzle opening and into combustion liner along side the light carrier.

(5) Press holder into fuel nozzle opening until borescope is held firmly in place.

(6) Place transformer power switch in OFF. Rotate light intensity control fully counterclockwise.

(7) Connect transformer cable to light carrier and to 115-volt, 60-hertz ac power source as shown.

(8) Place transformer power switch in ON. Adjust light intensity control to desired brightness.

(9) Adjust focus and scan control as desired.

e. If using 6872797 borescope, proceed as follows:

(1) Connect −400 probe to scope. Tighten until flat surface of knurled collar on scope aligns with objective end of scope.

(2) Place transformer power switch in OFF. Rotate light intensity control fully counterclockwise.

(3) Connect transformer to borescope and power source as shown in figure 4-19.

(4) Insert borescope through spark igniter holes into combustion chamber.

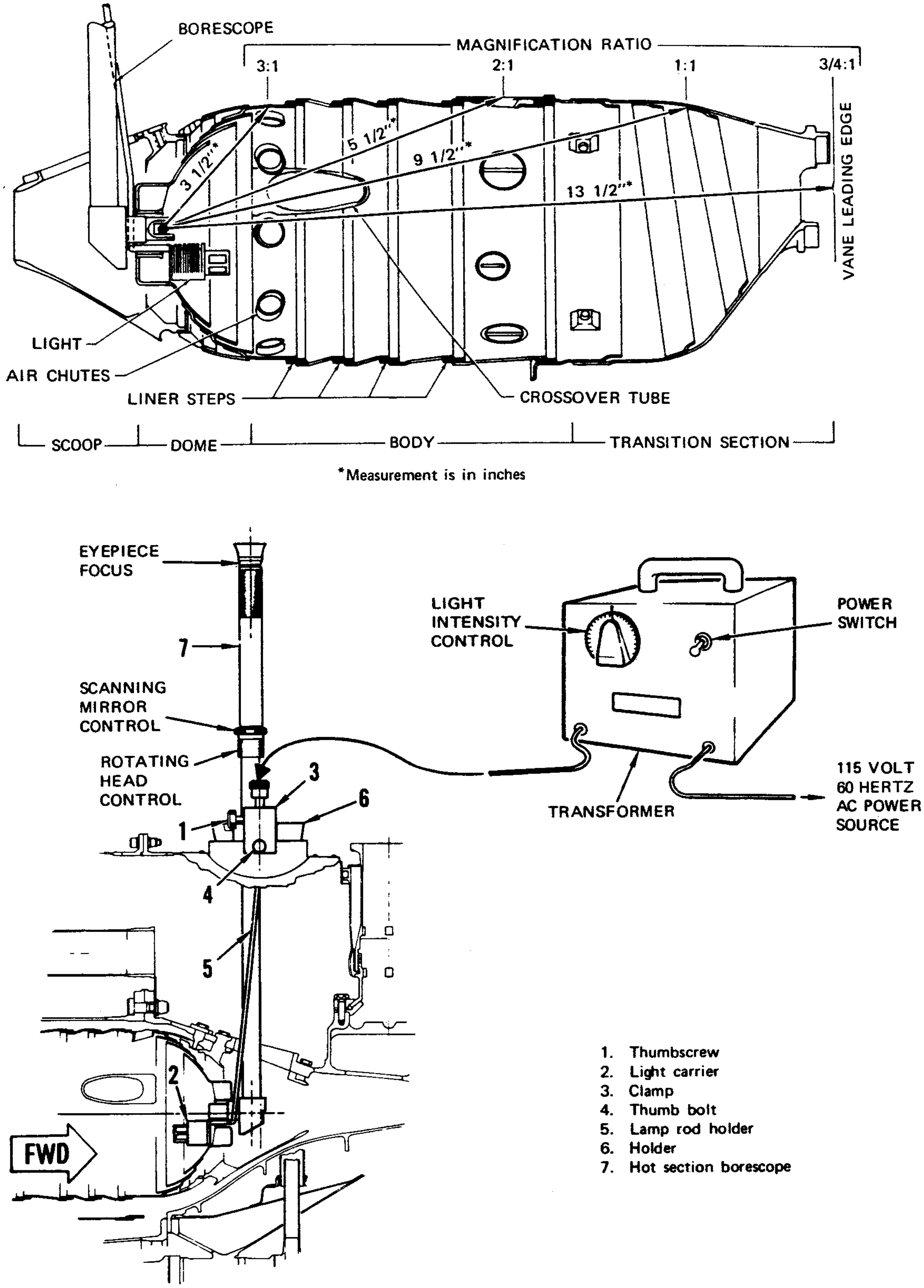
(5) Place transformer power switch in 12V. Adjust light intensity control to desired brightness.

(6) Adjust focus as required.

4-15.2. Inspection.

a. Check high pressure turbine first stage vanes that are visible. Reject engine if serviceable limits (table 4-12 or 4-13) are exceeded.

b. Slowly rotate high pressure compressor rotor and check all high pressure turbine first stage blades. Reject engine if serviceable limits (table 4-14, 4-15, or 4-16) are exceeded.



1. Thumbscrew
2. Light carrier
3. Clamp
4. Thumb bolt
5. Lamp rod holder
6. Holder
7. Hot section borescope

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Figure 4-22. Installation and Removal; Hot Section Borescope

Table 4-12. High Pressure Turbine First Stage Vane Damage Limits

Condition	Area	Serviceable limits

NOTE

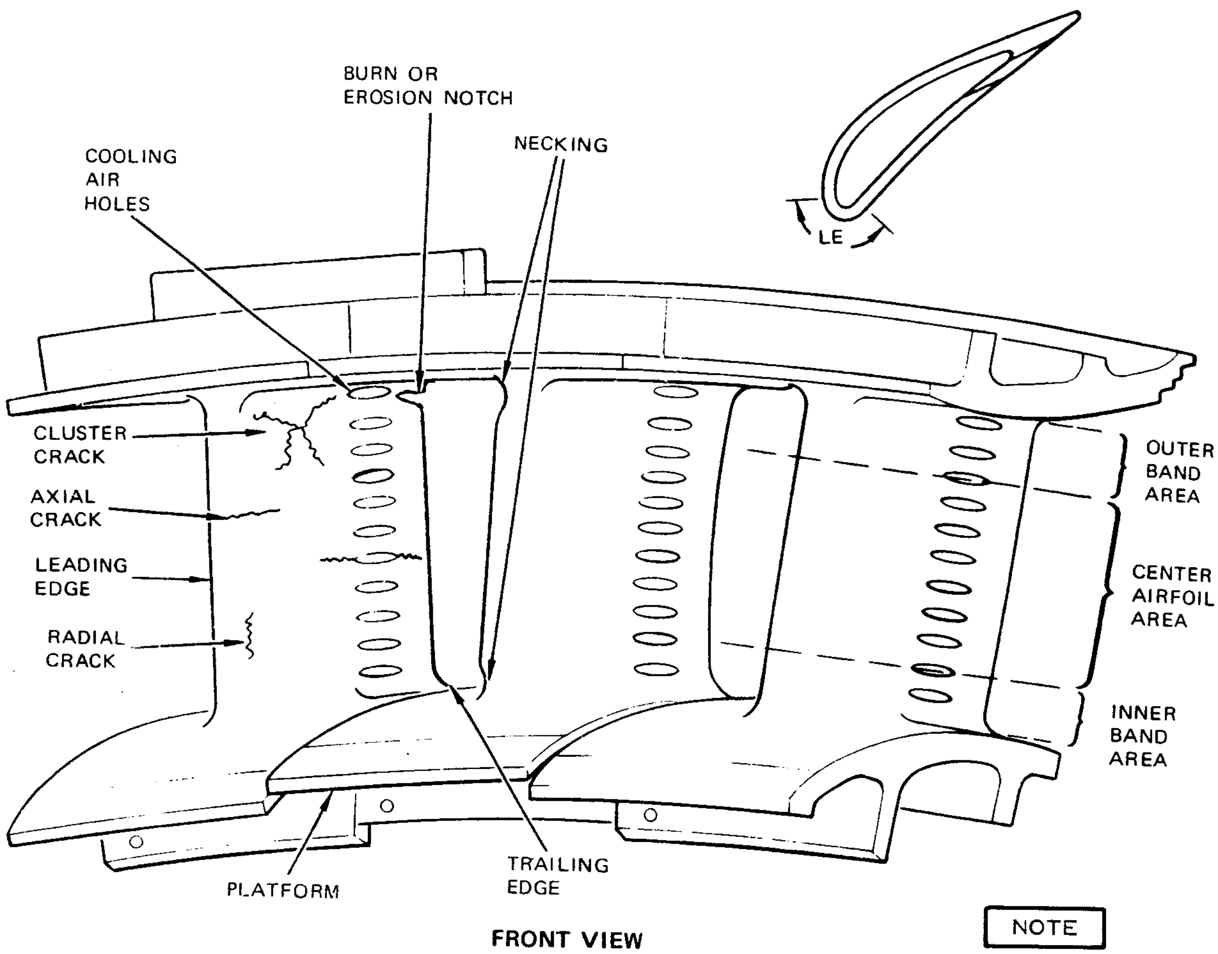
The term radial refers to cracks parallel with the leading edge of vanes. The term axial refers to cracks perpendicular with the leading edge of vanes (figure 4-23).

All dimensions specified in serviceable limits are to be used as judgment factor criteria. These dimensions are not meant to be mechanically obtained and are to be used as guidelines by experienced personnel only.

Condition	Area	Serviceable limits
Cracks	Leading edge axial crack center airfoil area between third trailing edge cooling air hole from outer band to second hole from inner band	Any number of nonintersecting cracks up to 1/8 inch is allowed. Total of three nonintersecting cracks up to 3/8 inch is allowed. Cracks shall not open up to a point where inner passage is visible.
	Leading edge axial crack outer band and inner band area of airfoil	None
	Radial crack	None
	Trailing edge crack	Any number of nonintersecting cracks up to 1/8 inch is allowed. Total of three nonintersecting cracks up to 3/8 inch is allowed.
	Trailing edge hole crack	Cracks from trailing edge air hole adjacent to inner and outer band may extend to within 3/16 inch of leading edge or 1/8 inch of any other crack from the leading edge. Cracks from other trailing edge air holes may extend up to 3/16 inch forward from the hole. Cracks must not intersect and must not be within 1/8 inch of any other crack. Any number of cracks is allowed between trailing edge cooling air holes. Cracks must not be open to a point where inner passage is visible.
	Airfoil cluster crack	One cluster of cracks is allowed. Cracks may extend to the cooling air hole at trailing edge and to within 1/8 inch of leading edge or other crack from leading edge.
	Airfoil crown crack	None

Table 4-12. High Pressure Turbine First Stage Vane Damage Limits — CONT

Condition	Area	Serviceable limits
	Outer band weld crack	Acceptable provided vane segments are not separated and crack has not progressed into airfoil radius.
	Inner and outer band cracks	Cracks are not permitted that extend into airfoil radius. Multiple cracks that could converge and release a piece of band are not permitted.
	Airfoil fillet crack	Cracks are not permitted that extend through the fillet radius into the inner and outer bands.
Bowing	Airfoil	Allowed provided platform has not pulled into gas path far enough to produce a radial gap with adjacent platform at leading edge. Local necking adjacent to bands is not allowed.
Erosion	Leading edge	Allowed if not accompanied by cracks which exceed limits.
	Trailing edge erosion notches	Erosion notches are not to exceed 1/8 inch; up to three notches are allowed.
Nicks and dents	Vane general	Nicks and dents are acceptable provided the metal is not torn, cracked, or punctured.



NOTE

Typical vane distress areas.

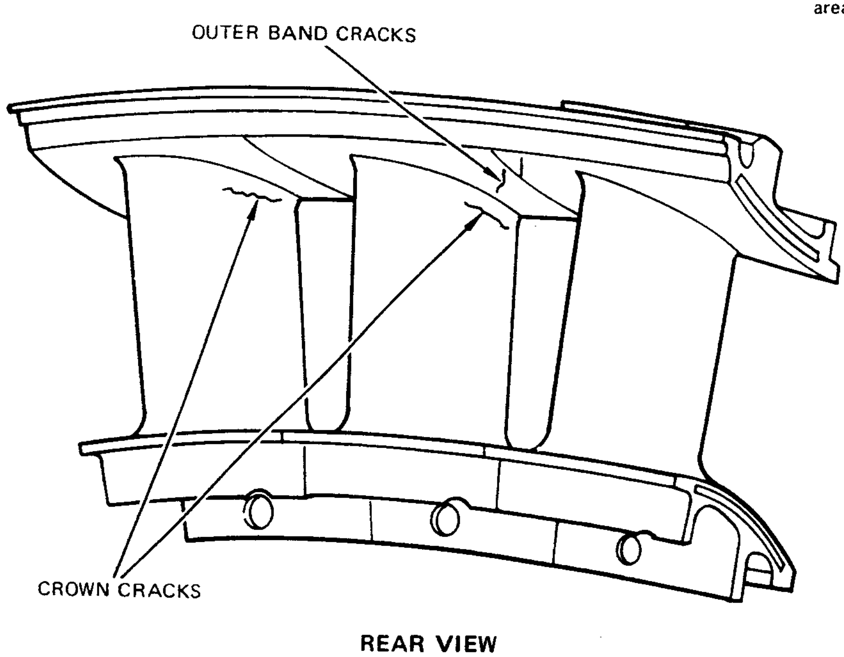


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Figure 4-23. First Stage Vanes; High Pressure Turbine

Table 4-13. High Pressure Turbine First Stage Vane Damage Limits (Reduced Chord Bullnose)

Condition	Serviceable limits	Disposition
	NOTE When inspection is by fiberoptic borescope, all dimensions specified in serviceability criteria are to be used as judgement factor criteria. These dimensions are not meant to be mechanically obtained and are to be used as guidelines for experienced personnel only. The term radial refers to cracks parallel with leading edge of vanes. The term axial refers to cracks perpendicular with the leading edge of vanes. See figure 4-24 for types of damage. Letters/numbers shown on figure 4-24 correspond to conditions listed in this table.	
A. Cracks		
(1) Leading edge axial cracks	Any number of nonintersecting cracks up to 1/8 inch is allowed. Total of three nonintersecting cracks up to 3/8 inch is allowed providing they are separated by a minimum of 1/4 inch. Cracks shall not open up to a point where inner passage is visible. No cracks allowed in the outer band area. Cracks in the fillet around the inner band not to exceed 1/2 inch.	Replace vane segment if serviceable limits are exceeded.
(2) Leading edge radial cracks	None allowed	Replace vane segment if serviceable limits are exceeded.
(3) Trailing edge cracks	Any number of nonintersecting cracks up to 1/4 inch is allowed. Total of three nonintersecting cracks up to 3/8 inch is allowed.	Replace vane segment if serviceable limits are exceeded.
(4) Cooling air hole cracks	Any number of cracks is permitted up to 3/8 inch long. A single crack from trailing edge air hole may extend to the leading edge or within 1/8 inch of any other crack from the leading edge. A maximum of four additional cracks up to 3/8 inch long are permitted provided they are not within 1/8 inch of any other crack. Any number of cracks allowed between trailing edge cooling air holes.	Replace vane segment if serviceable limits are exceeded.

Table 4-13. High Pressure Turbine First Stage Vane Damage Limits (Reduced Chord Bullnose) - CONT

Condition	Serviceable limits	Disposition
	Cracks must not open to a point where inner passage is visible.	
(5) Airfoil cluster crack	One cluster of cracks allowed. Cracks may extend to the cooling air hole at trailing edge and to the leading edge or within 1/8 inch of other cracks from leading edge.	Replace vane segment if serviceable limits are exceeded.
(6) Crown cracks	None allowed	Replace vane segment if serviceable limits are exceeded.
(7) Inner and outer band cracks	Cracks are permitted to extend into airfoil radius.	Replace vane segment if serviceable limits are exceeded.
	Multiple cracks that could converge and release a piece of band are not permitted.	
	Individual vanes are not separated.	Repair by weld T.O.
B. Airfoil bowing	Allowed provided platform has not pulled into gas path for enough to produce a radial gap with adjacent platform at leading edge. Local necking adjacent to bands is not allowed.	Replace vane segment if serviceable limits are exceeded.
C. Erosion		
(1) Leading edge erosion	Allowed if not accompanied by a hole or crack which exceeds limits.	Replace vane segment if serviceable limits are exceeded.
(2) Trailing edge erosion	Erosion notches not to exceed 1/4 inch; up to three notches are allowed.	Replace vane segment if serviceable limits are exceeded.
D. Nicks and dents	Acceptable provided the metal is not torn, cracked, or punctured.	Replace vane segment if serviceable limits are exceeded.

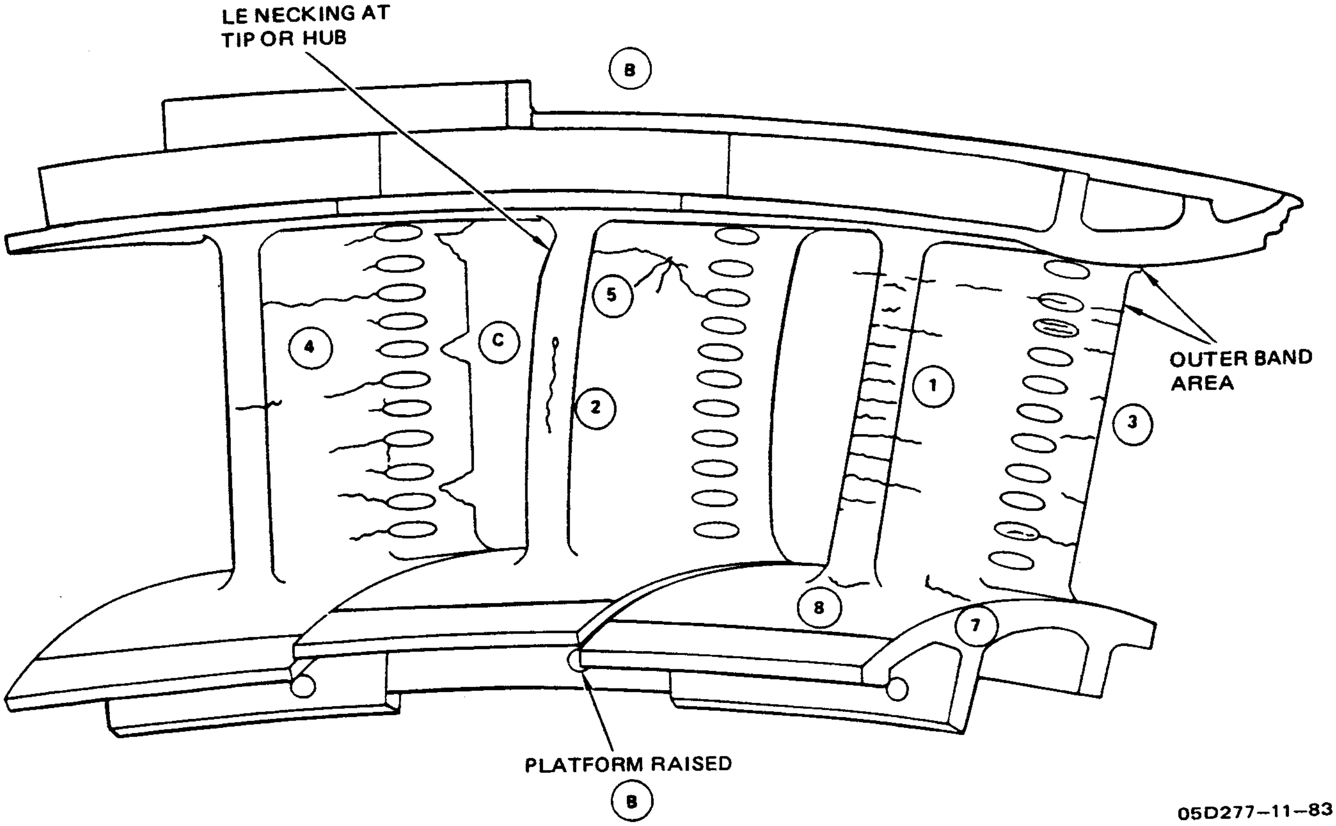


Figure 4-24. First Stage Vanes (Reduced Chord Bullnose); High Pressure Turbine

Table 4-14. High Pressure Turbine First Stage Forged Blades Damage Limits

NOTE

The term radial refers to cracks parallel with the leading edge of blades. The term axial refers to cracks perpendicular with the leading edge of the blades.

Condition	Area	Serviceable limits
Cracks	Shroud tip seal	1/8 inch into leading edge (below shroud fillet radius); no axial cracks leading from a radial crack allowed.
	Leading edge (axial, inner 1/2)	None
	Leading edge (axial, outer 1/2)	Three cracks allowed provided they do not intersect and maximum length does not exceed 1/16 inch on either concave or convex side.
	Trailing edge (axial, inner 1/2)	None
	Trailing edge (axial, outer 1/2)	Maximum of three cracks allowed provided they do not intersect, 1/8-inch maximum. Length not to exceed 1/16 inch on either concave or convex side.
Melting	Any location	None
Pieces missing	Any location	None
Erosion	Any location	No limit (provided not accompanied by cracks exceeding limits)

Table 4-15. High Pressure Turbine First Stage Cast Blades Damage Limits

NOTE

The term radial refers to cracks parallel with the leading edge of vanes. The term axial refers to cracks perpendicular with the leading edge of vanes.

Condition	Area	Serviceable limits
Cracks	Shroud tip seal	Cracks permitted across axial shroud seal as long as crack does not extend into airfoil to shroud fillet radius.
	Leading edge (axial)	None
	Leading edge (radial)	None
	Trailing edge (axial, inner 1/2)	None
	Trailing edge (axial outer 1/2)	Three cracks maximum providing they do not intersect. Maximum crack length must not exceed 1/16 inch on either concave or convex side for a total surface length of 1/8 inch.
Melting	Any location	None
Piece missing	Any location	None
Erosion	Any location	Slight erosion allowed provided no apparent contour change.
Nicks and dents	Leading edge	0.005-inch maximum depth (no sharp edges)
	Airfoil	0.005-inch maximum depth (no sharp edges)
	Trailing edge	0.005-inch maximum depth (no sharp edges)

Table 4-16. High Pressure Turbine First Stage Cast Blades Damage Limits (Improved Cast)

Condition	Serviceable limits	Disposition
	NOTE The term radial refers to cracks parallel with the leading edge of blades and the term axial refers to cracks perpendicular to the leading edge of blades.	
Leading edge cracks (axial)	None allowed	Replace HP turbine rotor or reject engine if serviceable limits are exceeded.
Leading edge cracks (radial)	None allowed	Replace HP turbine rotor or reject engine if serviceable limits are exceeded.
	NOTE Almost all cast blades will show a fine mark down the leading edge which resembles a radial crack. This mark generally extends from the LE tip to hub fillet and is a result of the casting process. The inspector should distinguish between this mark (acceptable) and a LE crack.	
Trailing edge or airfoil cracks	None allowed	Replace HP turbine rotor or reject engine if serviceable limits are exceeded.
Erosion	Slight erosion allowed if no apparent contour change	Replace HP turbine rotor or reject engine if serviceable limits are exceeded.
Shroud tip seal crack	Cracks permitted across axial shroud seal as long as crack does not extend into airfoil to shroud fillet radius	Replace HP turbine rotor or reject engine if serviceable limits are exceeded.
Leading edge, trailing edge, airfoil nicks and dents	.005-inch maximum depth (no sharp edges)	Replace HP turbine rotor or reject engine if serviceable limits are exceeded.
Blade melting or pieces missing	None allowed	Replace HP turbine rotor or reject engine if serviceable limits are exceeded.

c. Check combustion liners. Reject engine if any of the following conditions exist.

(1) Excessive warping or distortion.

(2) 40% or more spotwelds pulled or broken at any one step.

(3) Converging cracks with the possibility of piece breakout.

(4) Pieces missing from the dome, body, or transition sections of the liner assembly.

d. If photographs are required, refer to paragraph 4-24 for camera operation.

4-15.3. Postinspection. (Figure 4-22.)

a. Place transformer power switch in OFF.

b. Rotate light intensity control fully counterclockwise.

c. Disconnect transformer from power source and borescope.

d. If using 6872797 borescope, proceed as follows:

(1) Remove borescope from engine.

(2) Install spark igniters (paragraph 8-17).

CAUTION

Before removing 6798380 or 6872724 borescope from engine, align black dots on head and scan controls with black dot on grip. This places scanning mirror in retracted position to prevent damage.

e. If using 6798380 or 6872724 borescope, proceed as follows:

(1) Remove hot section borescope (7) from engine and remove holder (6).

(2) Loosen thumbscrew (1) and thumb-bolt (4).

WARNING

Use extreme care in handling light carrier as lamp can cause severe burns.

(3) Remove light carrier (2) from fuel nozzle opening.

(4) Install No. 5 and 7 fuel nozzles (paragraph 4-20).

f. Remove high pressure rotor turning adapter (paragraph 4-19).

4-16. HOT SECTION BORESCOPE INSPECTION (USING FIBERSCOPE).

Test Equipment Required

Figure & index No.	Name	AN type designation	Use and application
4-20	Fiberscope, Model IF1	6886226 (Allison Division of General Motors, Indianapolis, Indiana)	View engine internally
	Equipment required for connecting 115-volt, 60-hertz, single-phase ac electrical power		Provide electrical power to fiberscope

4-16.1. Preparation. (Figure 4-25.)

WARNING

Do not use fiberscope in an explosive or hazardous atmosphere. Although the light emitted from the tip is cool and safe, the light supply does produce considerable heat.

a. Remove No. 5 and 7 fuel nozzles (paragraph 4-20).

b. Remove spark igniters (paragraph 8-17).

c. Install high pressure rotor turning adapter (paragraph 4-19).

d. Connect cold light supply to 115-volt, 60-hertz, ac power source.

e. Place intensity switch in LOW and power switch in ON.

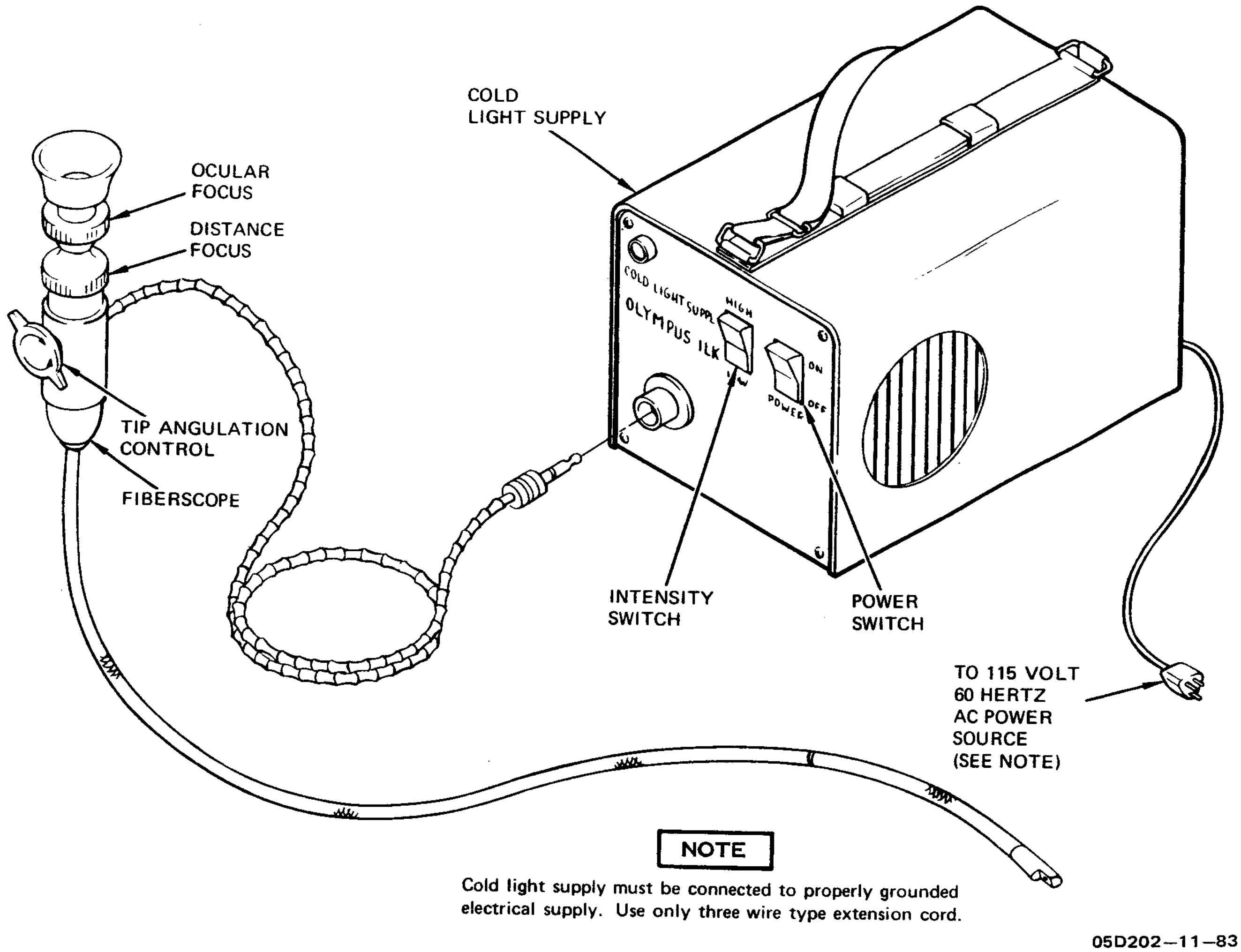


Figure 4-25. Installation and Removal; Hot Section Fiberscope

f. Insert fiberscope connector into output socket of cold light supply, making certain it is fully inserted. Tighten with clamp.

g. Adjust ocular focus as desired.

h. Insert fiberscope through spark igniter and fuel nozzle openings into combustion chamber.

i. Adjust distance focus as desired.

4-16.2. Inspection.

a. Check high pressure turbine first stage vanes that are visible through spark igniter holes and No. 5 and 7 fuel nozzle openings. Reject engine if serviceable limits (table 4-19) are exceeded.

CAUTION

To prevent damage to fiberscope, do not rotate high pressure compressor while scope is inserted aft of high pressure first stage vanes.

b. Slowly rotate high pressure compressor rotor and check all high pressure turbine first stage blades. Reject engine if serviceable limits (table 4-14, 4-15, or 4-16) are exceeded.

c. Check combustion liners. Reject engine if any of the following conditions exist.

(1) Excessive warping or distortion.

(2) 40% or more spotwelds pulled or broken at any one step.

(3) Converging cracks with the possibility of piece breakout.

(4) Pieces missing from the dome, body, or transition sections of the liner assembly (figure 4-22).

d. If photographs are required, refer to paragraph 4-22 for camera operation.

4-16.3. Postinspection. (Figure 4-25.)

a. Place power switch in OFF.

CAUTION

To avoid damage to fiberscope, do not hold tip angulation control and do not force during removal.

b. Remove fiberscope from engine.

c. Disconnect cold light supply from power source.

d. Disconnect fiberscope from cold light supply.

e. Install spark igniters (paragraph 8-17).

f. Install No. 5 and 7 fuel nozzles (paragraph 4-20).

g. Remove high pressure rotor turning adapter (paragraph 4-19).

4-17. FIRST AND SECOND STAGE COMPRESSOR NICK AND DENT LIMITS AND REPAIR.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
		Dial indicator, 0- to 1/2-inch measurement in 0.001 increments	Measure nicks and dents in rotor blades and stator vanes

4-17.1. Inlet Inspection. During routine inlet inspection, cracks and impact damage may be found on low pressure (LP) compressor rotor blades and stator vanes. Damage caused by entry of metal parts will usually extend throughout the LP, intermediate pressure (IP), and high pressure (HP) compressors. Although damage to the LP compressor may be slight, damage to the IP and HP compressors may be extensive. If evidence of foreign object damage is found on any LP rotor blade or stator vane, a borescope inspection (paragraph 4-14) shall be made to determine the extent of damage. Any damage aft of the second stage rotor that exceeds borescope limits shall require engine replacement. If damage limits in subparagraphs 4-17.2 and 4-17.3 are exceeded, an engine change is required.

4-17.2. Damage Limits First and Second Stage Rotor Blades. (Figure 4-26.)

a. Very slight surface damage is acceptable.

b. Damage, other than slight surface damage, on the inner one-third of blades is not acceptable.

c. Cracks at any location are not acceptable.

d. Dents in rotor blade surfaces which have caused a protrusion to form on reverse side are not acceptable.

NOTE

In certain cases where a dial indicator cannot be used to determine nick and dent sizes, an alternate method must be used. A suitable method may be wires of various diameters used as go/no go gages. In some cases, it may be necessary to make an impression of the damage, using modeling clay or other suitable material, to determine size. Other methods may be used locally according to prevailing conditions.

e. Using a dial indicator or other suitable means, measure nicks and dents in leading and trailing edges of blades. Nicks and dents are acceptable, provided damage can be blended smooth and does not exceed limits shown in figure 4-26 after blending.

f. Abrasions caused by grit are acceptable on rotor blades, provided the surface can be blended smooth and depth of damage after blending does not exceed 10% of blade thickness.

4-17.3. Damage Limits First Stage Vanes. (Figure 4-26.)

a. Very slight surface damage is acceptable.

b. Damage, other than slight surface damage, at the inner and outer root of the vane is not acceptable.

c. Cracks at any location are not acceptable.

d. Using a dial indicator or other suitable means, measure nicks and dents in leading and trailing edges of vanes. Nicks and dents are acceptable provided damage can be blended smooth and does not exceed limits shown in figure 4-26 after blending.

4-17.4. Repair. (Figure 4-26.)

CAUTION

Before blending out blade damage, rotate compressor until blade tip is pointing downward. Place a clean cloth under or around blade and/or vane to collect filings and emery dust. All blending and polishing should be done lengthwise along blade.

NOTE

Before attempting to repair repairable damage, perform a borescope inspection of the engine to determine extent of damage (paragraph 4-14). Replace engine if damage exceeds acceptable limits.

a. Blend out slight surface damage or abrasion with fine emery cloth. A fine file may be used on rotor blades. Restore leading edge as nearly as possible to original contour. Do not exceed limits shown in figure 4-26.

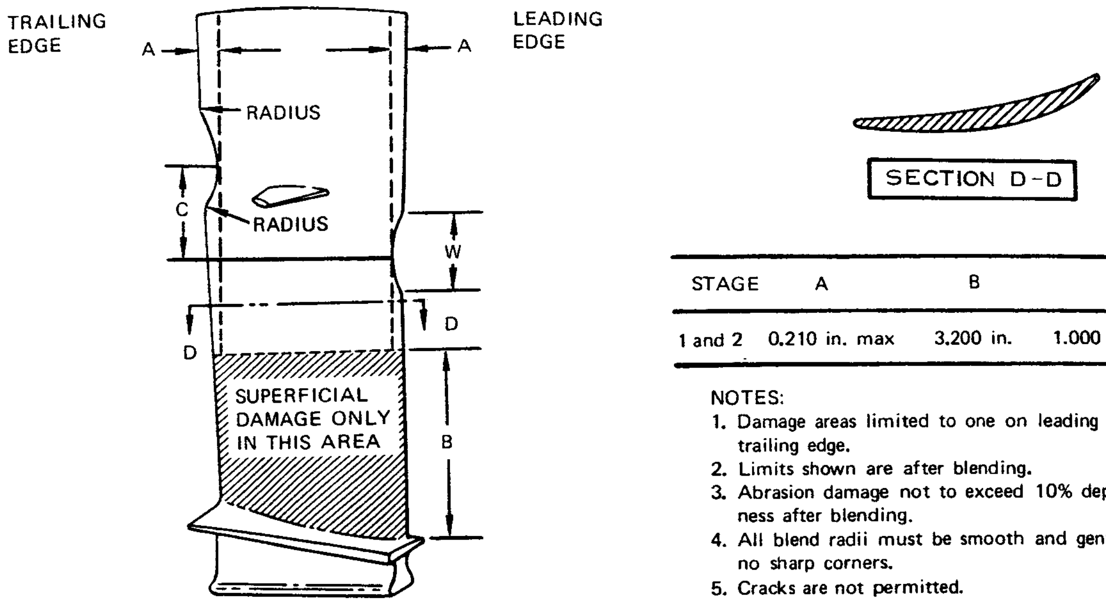
b. Where pitting on blade airfoil runs into blended area, lightly blend with fine emery cloth. Use care to prevent altering contour of airfoil.

c. Lightly blend small indentations on airfoil face with fine emery cloth to remove burrs. Surface should feel smooth to touch; no attempt should be made to blend indentations with surrounding surface.

NOTE

Use care to prevent altering the airfoil profile.

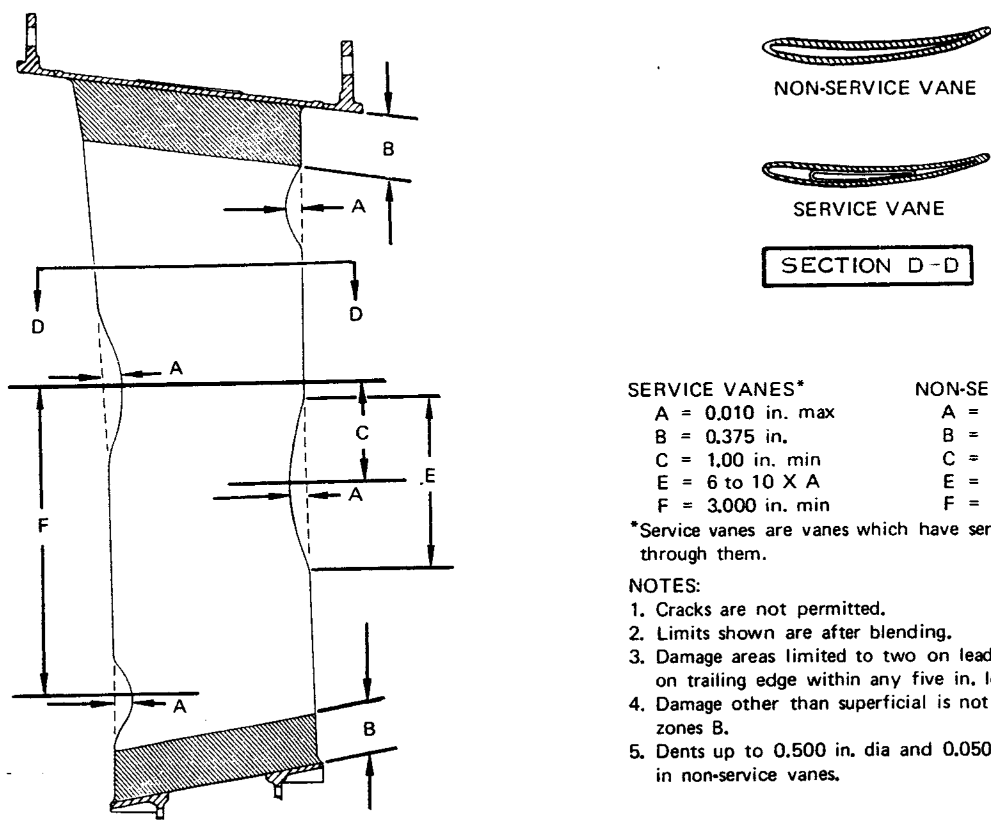
d. Blend out nicks and dents in leading and trailing edges with emery cloth. A fine file may be used on rotor blades if file marks are polished out with emery cloth. Do not exceed limits shown in figure 4-26.



STAGE	A	B	C	W
1 and 2	0.210 in. max	3.200 in.	1.000 in. min	6XA min 10XA max

NOTES:
1. Damage areas limited to one on leading edge and one on trailing edge.
2. Limits shown are after blending.
3. Abrasion damage not to exceed 10% depth of blade thickness after blending.
4. All blend radii must be smooth and gently rounded with no sharp corners.
5. Cracks are not permitted.

Low Pressure Compressor First- and Second-Stage Blade Repair Limits



SERVICE VANES*	NON-SERVICE VANES
A = 0.010 in. max	A = 0.010 in. max
B = 0.375 in.	B = 0.100 in.
C = 1.00 in. min	C = 1.000 in. min
E = 6 to 10 X A	E = 6 to 10 X A
F = 3.000 in. min	F = 3.000 in. min

*Service vanes are vanes which have service tubes passing through them.

NOTES:
1. Cracks are not permitted.
2. Limits shown are after blending.
3. Damage areas limited to two on leading edge and two on trailing edge within any five in. length.
4. Damage other than superficial is not permitted in zones B.
5. Dents up to 0.500 in. dia and 0.050 in. deep permitted in non-service vanes.

Low Pressure Compressor First-Stage Vane Repair Limits

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Figure 4-26. Repair and Damage Limits; Low Pressure Compressor First and Second Stage Blade and First Stage Vane

c. Thoroughly clean engine inlet after repairs are made. Ensure that no tools or other articles are left in engine inlet.

4-18. FIRST STAGE BLADE TIP RUB CHECK.

NOTE

This procedure is to be followed if there is blade tip rub on compressor front case.

a. Place 3-inch straightedge axially across the compressor front case showing the most severe rub. Make sure that straightedge is not resting on inlet extension or compressor front support.

b. Reject the engine if a 0.040-inch wire can be inserted between straightedge and case.

c. If rub depth is within limits, remove pickup and burrs from first stage compressor blade tips by light stoning.

WARNING

Alodine is toxic to skin, eyes, and respiratory tract. Eye and skin protection is required. Good general ventilation is normally adequate.

d. Paint the rubbed area of case (reference T.O. 2J-TF41-6, paragraph 4-108.g.).

4-19. HIGH PRESSURE COMPRESSOR ROTOR TURNING ADAPTER INSTALLATION AND REMOVAL.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
	6798272	High pressure rotor turning adapter	Turn high speed gearbox

4-19.1. Installation. (Figure 4-27.)

a. Open access 6222-1.

b. Remove nuts (1), washers (2), elbow (3), and gasket (4).

c. Install turning adapter and secure with washers and nuts.

4-19.2. Removal. (Figure 4-27.)

a. Remove washers and nuts, and remove turning adapter.

b. If gasket is not available, apply RTV-106 or Permatex No. 1372 sealing compound to mounting flange.

c. Place gasket (4) and elbow (3) on gearbox. Secure with washers (2) and nuts (1).

d. Close access 6222-1.

4-20. NO. 5 AND NO. 7 FUEL NOZZLE REMOVAL AND INSTALLATION.

Test Equipment Required

Figure & index No.	Name	AN type designation	Use and application
	Torque wrench, 10 to 150 inch-pounds	GGG-W-686	Measure torque
	Puller	6872239 (Allison Division of General Motors, Indianapolis, Indiana)	Remove locating adapter

NOTE

This procedure may be used to remove No. 5 and 7 fuel nozzles for borescope inspection.

4-20.1. Removal. (Figure FO-9.)

a. Open accesses 5222-2 and 6222-2. Remove engine removal door (T.O. 1A-7D-2-1).

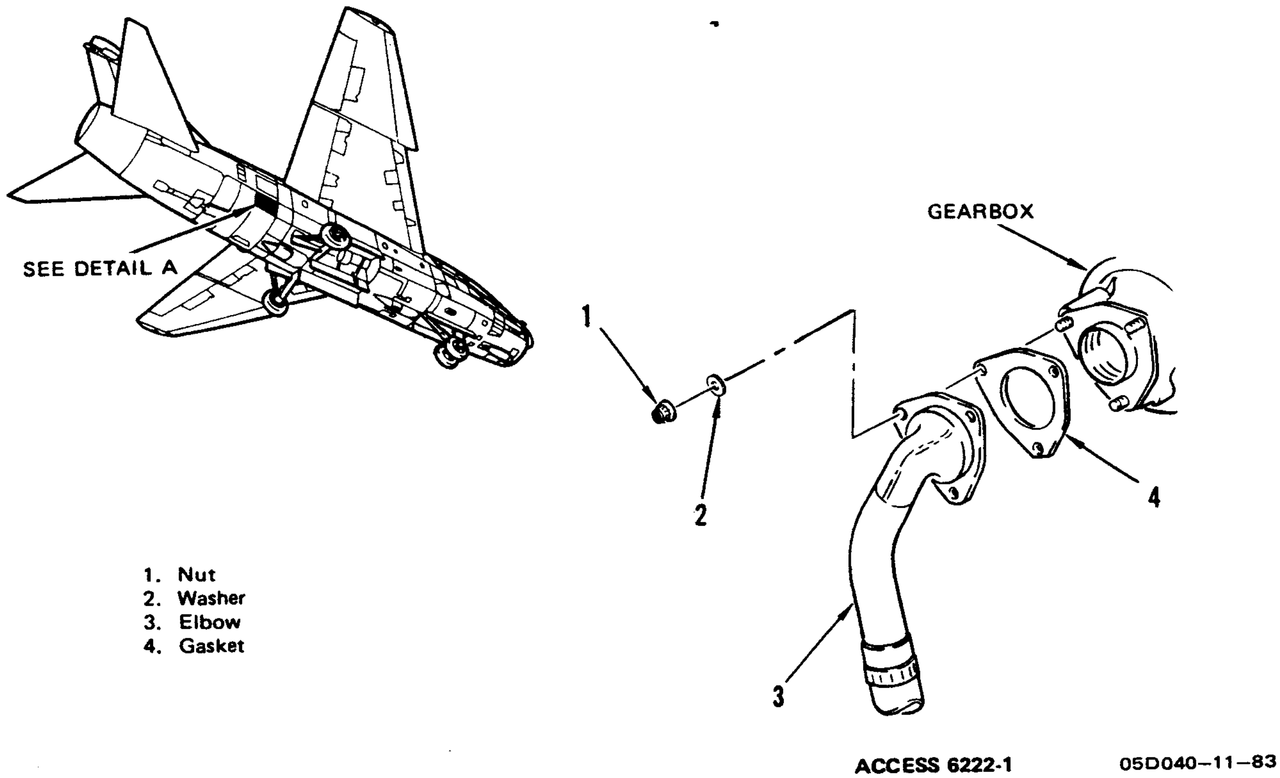


Figure 4-27. Installation and Removal; High Pressure Compressor Rotor Turning Adapter

b. Remove nut (1) and bolt (2), and disconnect retaining clamp.

c. Remove nuts (3) and disconnect bonding leads (4) and lockplates (5).

d. Push manifold tubes (6 and 7) into adjacent elbow connector.

e. Remove nuts (8) and washers (9), and remove No. 7 elbow connector (10).

f. Remove manifold tubes from No. 7 and 8 elbow connectors.

g. Push manifold tubes (11, 12, and 13) into adjacent elbow connectors.

h. Remove nuts (14), washers (15), and No. 4

elbow connector (16).

i. Remove manifold tubes (11 and 12).

j. Remove nuts (17) and washers (18), and remove No. 5 elbow connector (19).

k. Remove manifold tubes (13).

l. Remove packings (20).

m. Remove packings (21) from manifold tubes.

n. Using puller, remove locating adapter (22) from No. 5 and 7 fuel nozzles. Remove packing (23).

o. Remove locating washer (24).

p. Loosen captive bolts and remove No. 5 and 7 fuel nozzles (25). Remove packings (26 and 27).

4-20.2. Inspection. (Figure FO-9.)

a. Visually inspect fuel nozzles. Reject any nozzle with obvious burning, loose, or missing retaining clips or cracks.

b. Fretting up to 0.015 inch on outer air shroud diameter is acceptable.

c. Inspect outer air shroud large chamfered edge and outer air shroud face for damage which would cause blockage or alteration of airflow passages. Replace nozzle if damaged area blocks airflow passage.

d. Erosion up to 0.020 inch on outer air shroud face is acceptable.

e. Replace nozzle if stud or captive bolt is damaged.

4-20.3. Installation. (Figure FO-9.)

a. Apply light coat of EMS27613 antiseize compound (Crawford Fitting Company, Salon, Ohio) or NS165 Never Seez (Never Seez Compound Corporation, Broadview, Illinois) to threads of fuel nozzle captive bolts.

b. Place new packings (27 and 26) on No. 4, 5, and 7 fuel nozzles (25).

c. Place No. 5 and 7 fuel nozzles into diffuser case. Tighten captive bolts to 40 inch-pounds torque.

d. Place new packings (23) in outer groove of No. 5 and 7 locating adapters (22). Aply light coat of MIL-L-25681 lubricant.

e. Apply light coat of MIL-L-25681 lubricant to No. 5 and 7 locating washers (24).

f. Place locating washers and adapters on No. 5 and 7 fuel nozzles and press adapter into bypass duct until tight against nozzle.

g. Place new packings (21) on manifold tubes (6, 7, 11, 12, and 13).

h. Place new packings (20) on No. 4, 5, and 7 locating adapters.

i. Insert unflanged end of manifold tubes (13) into No. 6 elbow connector.

NOTE

Before securing elbow connectors, check that connector is properly seated. A gap between these parts is an indication that packing is not properly seated in groove.

j. Place No. 5 elbow connector (19) in position and secure with washers (18) and nuts (17).

k. Insert unflanged end of manifold tubes (12 and 11) into No. 5 and 4 elbow connectors (19 and 16).

l. Place No. 4 elbow connector in position and secure with washers (15) and nuts (14).

m. Insert unflanged end of manifold tubes (6 and 7) into No. 7 (10) and 8 elbow connectors.

n. Place No. 7 elbow connector in position and secure with washers (9) and nuts (8).

CAUTION

Manifold tubes are push fit into elbow connectors. To prevent damage to connectors and tubes, do not use lockplate to force tubes into position.

o. Push free ends of manifold tubes into adjacent elbow connectors.

p. Secure manifold tubes, lockplates (5), and bonding leads (4) to No. 3, 4, 5, 6, and 7 elbow connectors with nuts (3).

q. Secure retaining clamp with bolt (2) and nut (1).

r. Bleed engine fuel system (paragraph 5-19) and check for leaks.

s. Close accesses 5222-2 and 6222-2 and install engine removal door (T.O. 1A-7D-2-1).

4-21. LOW PRESSURE BEARING SUPPORT FAIRING INSPECTION. Inspect low pressure bearing support fairing through engine tailpipe, observing the following:

a. Use strong light to inspect fairing.

b. Cracks in fairing of less than 1.5 inches are permissible provided the direction of progress will not cause metal breakout.

c. Cracks in fairing of less than 1.5 inches may be stop-drilled to prevent crack growth and allow engine to remain in service until scheduled maintenance.

d. If crack is in excess of 1.5 inches, reject engine to maintenance for repair.

4-22. FIBERSCORE CAMERA OPERATION. Install, operate, and remove camera from fiberscope observing the following:

a. Load and unload film from camera in accordance with paragraph 4-23.

b. Before installing camera on fiberscope, make certain that short rod in eyepiece (figure 4-28) is protruding on left side of groove.

c. Align white dot on adapter with short rod on eyepiece before engaging adapter in eyepiece.

d. Rotate camera 90° clockwise to lock in eyepiece.

e. Use proper diopter lens on viewfinder to focus crosshairs and black dots. These lenses are used to correct operator's vision.

f. Adjust fiberscope distance focus as required.

g. Place cold light supply intensity switch in HIGH before taking photographs.

h. Adjust camera for proper exposure depending on type of film used.

i. Using viewfinder, take photographs as required.

j. Using advance lever, advance film immediately after actuating shutter.

k. Rotate camera 90° counterclockwise to remove.

l. Place cold light supply intensity switch in LOW after making photographs.

4-23. FIBERSCOPE CAMERA FILM LOADING AND UNLOADING. Load and unload camera using 35 millimeter film cartridge with 12, 20, or 36 exposures, observing the following:

a. Do not load film in direct sunlight.

b. Lift film rewind knob (figure 4-29) to open rear cover.

c. Engage perforations on both sides of film with sprocket gear.

d. Make certain film is properly engaged in takeup spool slots.

e. Close rear cover after loading film.

f. Advance film until film counter indicates 1.

g. When film is completely exposed, the advance lever becomes tight during its action and film cannot be advanced.

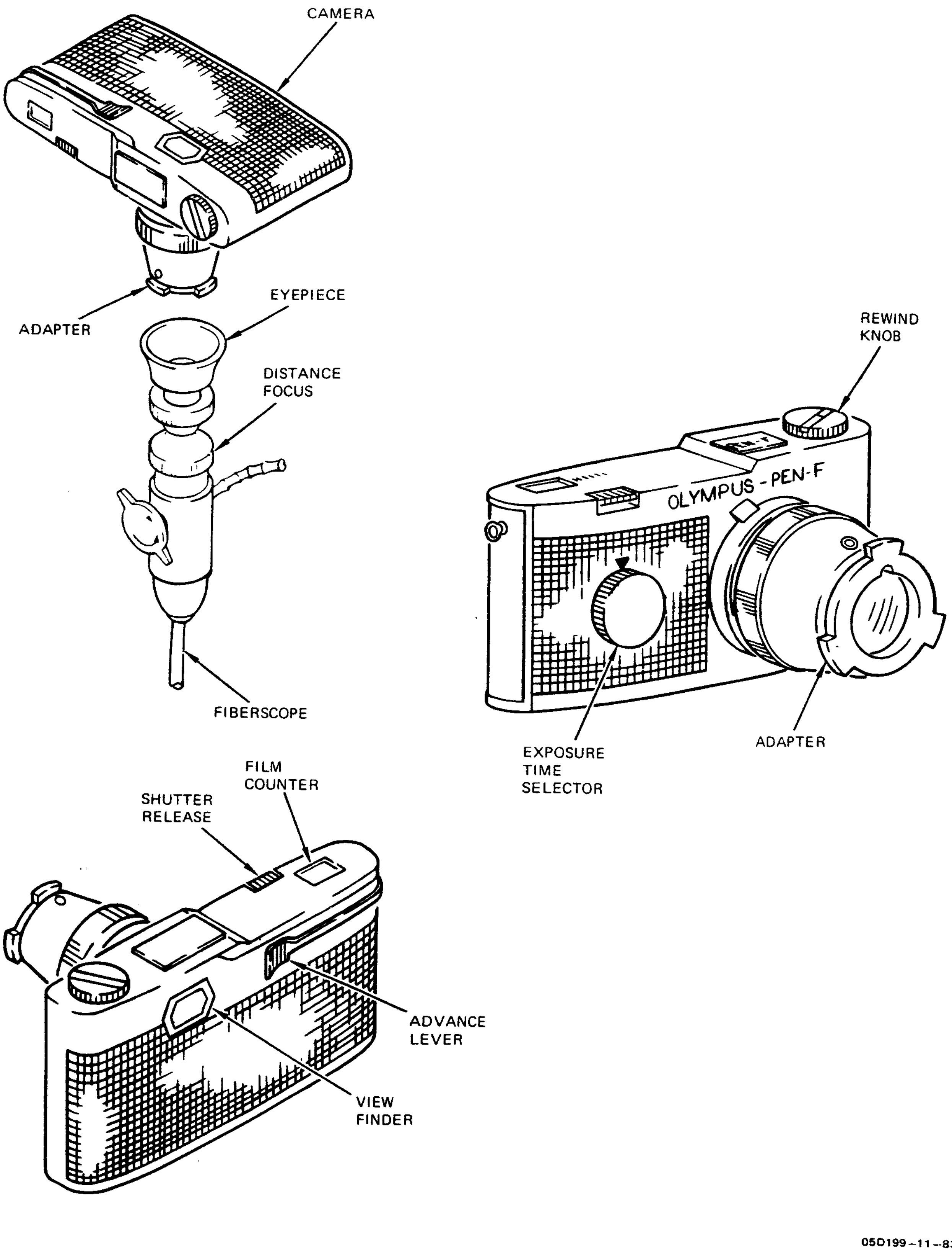


Figure 4-28. Camera Operation; Fiberscope

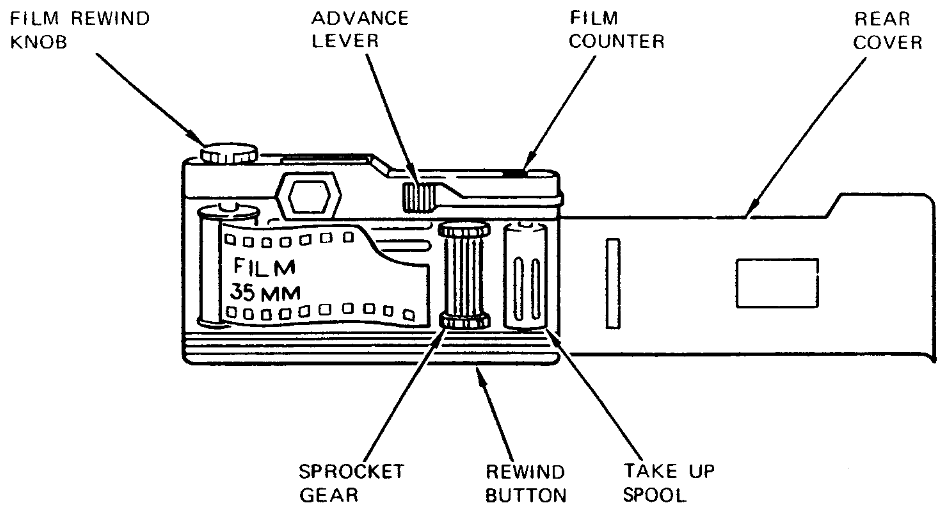


Figure 4-29. Film Loading and Unloading; Fiberscope Camera

h. To rewind film, press rewind button, lift lever on rewind crank, and turn counterclockwise until crank turns freely.

4-24. BORESCOPE CAMERA OPERATION.

Test Equipment Required

Figure & index No.	Name	AN type designation	Use and application
	Equipment required for connecting 115-volt, 60-hertz, single-phase ac external electrical power		Supply power to borescope
4-30	Camera kit	6872798 (Allison Division of General Motors, Indianapolis, Indiana)	Photograph engine internally through borescope

a. Place tripod (1, figure 4-30) at desired height.

b. Attach camera mounting plate (2) to tripod with screw (3).

c. Place borescope (4) in clamp and secure with screw (5).

d. Slide camera forward, connect to borescope, and secure with screw (6).

e. Install film pack (7).

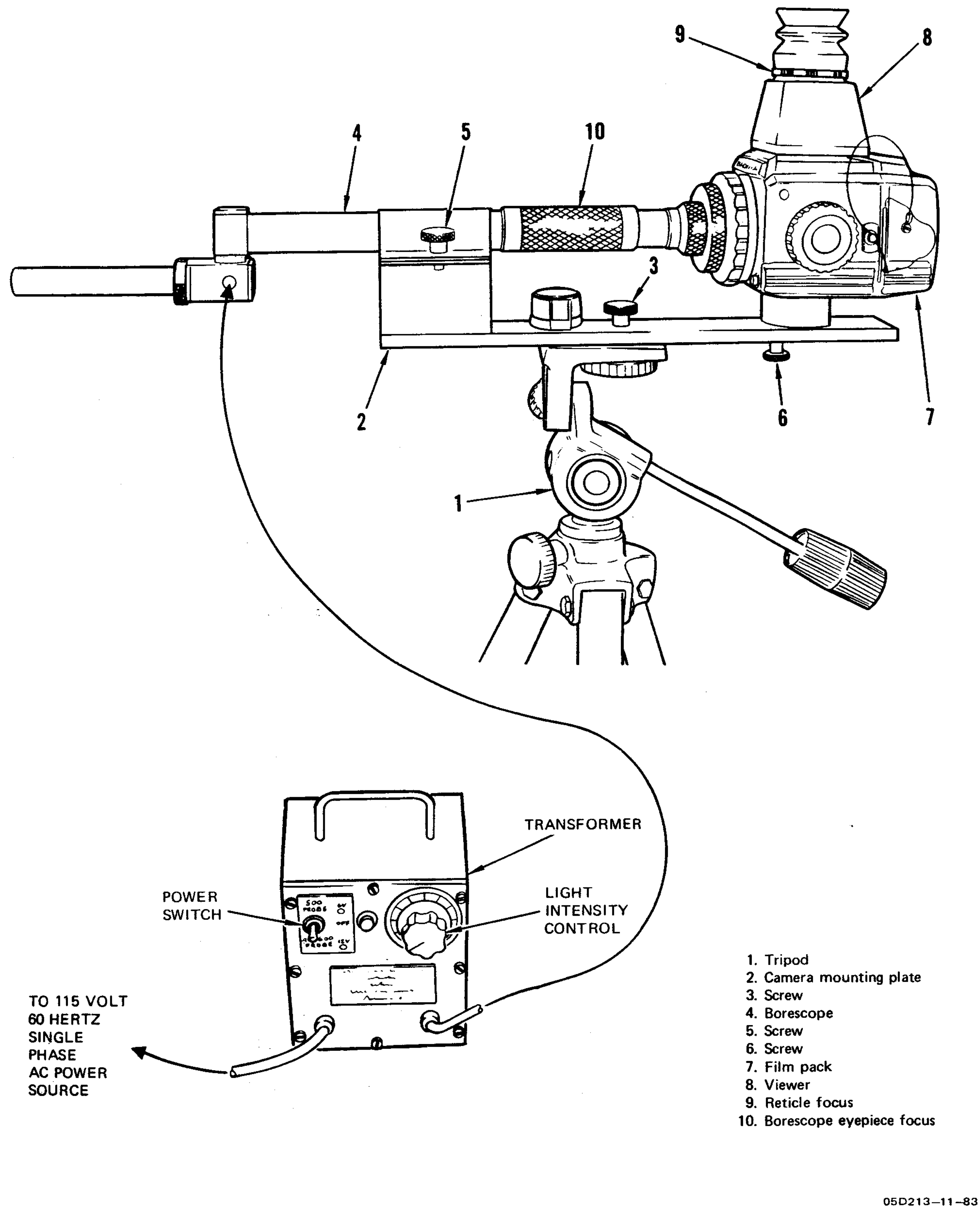
f. Install viewer (8).

g. Place transformer power switch in OFF. Rotate light intensity control fully counterclockwise.

h. Connect transformer to borescope and power source as shown.

i. Adjust tripod and insert borescope into area to be photographed.

j. If using 6872797 borescope, place transformer power switch as follows:



1. Tripod
2. Camera mounting plate
3. Screw
4. Borescope
5. Screw
6. Screw
7. Film pack
8. Viewer
9. Reticle focus
10. Borescope eyepiece focus

Figure 4-30. Camera Operation; Borescope

(1) If using −500 probe, place switch in 6V.

(2) If using −400 or −600 probe, place switch in 12V.

k. If using 6798380 or 6872724 borescope, place transformer power switch in ON.

l. Adjust light intensity.

m. Adjust reticle focus (9) until reticle comes into sharp focus.

n. Adjust borescope eyepiece focus (10) as required.

o. Make photographs as required.

p. Rotate light intensity control fully counterclockwise. Place transformer power switch in OFF.

q. Remove viewer (8).

r. Remove film pack (7).

s. Loosen screw (6) and disconnect camera from borescope. Loosen screw (5) and remove borescope (4).

t. Loosen screw (3) and remove camera mounting plate (2) from tripod (1).

4-25. HIGH PRESSURE TURBINE SECOND STAGE BORESCOPE INSPECTION.

Test Equipment Required

Figure & index No.	Name	AN type designation	Use and application
	Equipment required for connecting 115-volt, 60-hertz, single-phase ac external electrical power		Supply power to borescope

Test Equipment Required — CONT

Figure & index No.	Name	AN type designation	Use and application
4-31	Engine internal viewing borescope	6872797 (Allison Division of General Motors, Indianapolis, Indiana)	View engine internally

a. Remove engine removal door (T.O. 1A-7D-2-1).

b. Remove bolts (1, figure 4-31), cover (2), and gasket (3).

c. Remove self-locking nuts (4) and borescope port plug (5) from turbine case.

d. Connect −500 probe to scope. Tighten until flat surface of knurled collar on scope aligns with objective end of scope.

e. Place transformer power switch in OFF. Rotate light intensity control fully counterclockwise.

f. Connect transformer to borescope and power source as shown.

g. Insert borescope through viewing port.

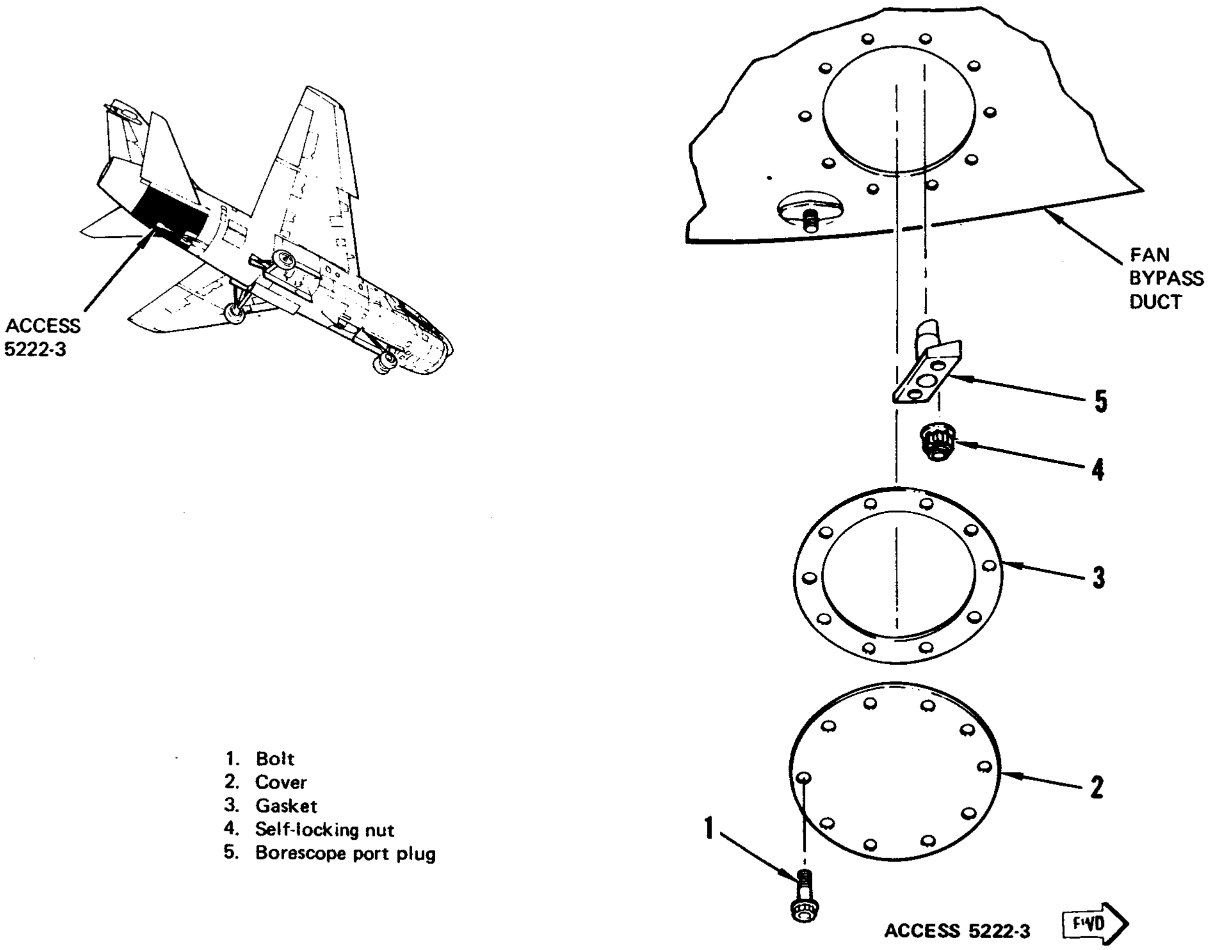
h. Place transformer power switch in 6V. Adjust light intensity control.

i. Adjust focus as required.

j. Check trailing edges of HP turbine first stage blades and leading edges of HP turbine second stage blades. Reject engine if damage exceeds limits in table 4-14 or 4-15 and table 4-17.

k. If photographs are required, refer to paragraph 4-24 for camera operation.

l. Place transformer power switch in OFF.



1. Bolt
2. Cover
3. Gasket
4. Self-locking nut
5. Borescope port plug

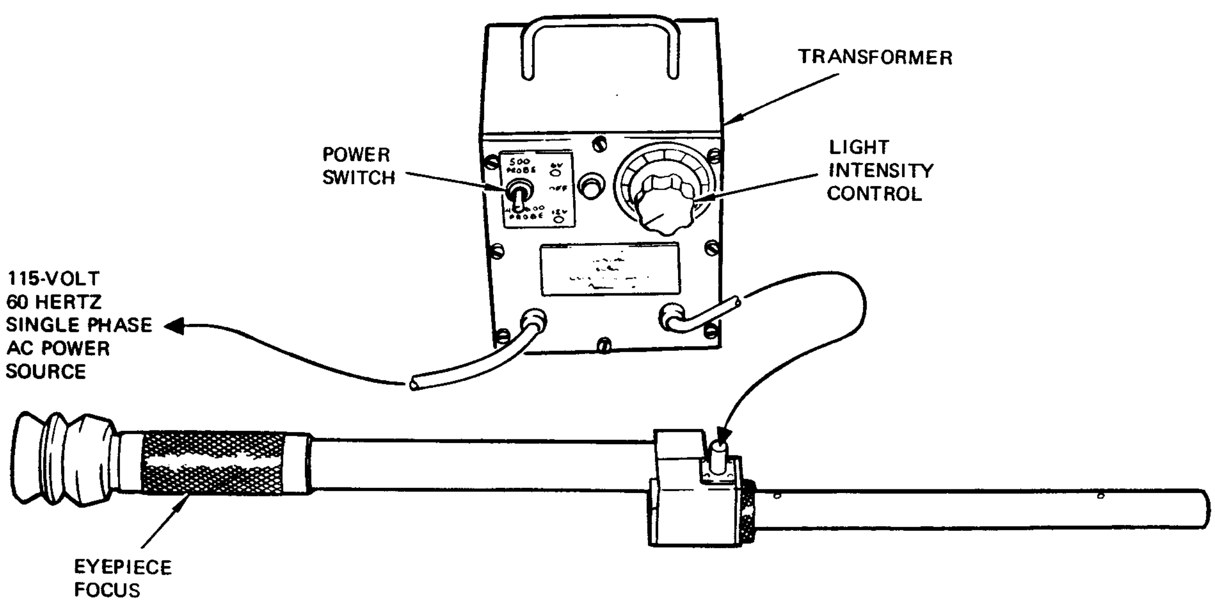


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Figure 4-31. Borescope Inspection; High Pressure Turbine Second Stage

m. Rotate light intensity control fully counterclockwise.

n. Remove borescope from engine.

o. Disconnect transformer from power source and borescope.

CAUTION

To prevent damage to engine, ensure that flange of borescope port plug seats against turbine case prior to and during tightening of self-locking nuts.

p. Install borescope port plug (5) in turbine case. Secure with self-locking nuts (4).

q. Using new gasket (3), secure cover (2) to fan bypass duct with bolts (1).

r. Install engine removal door (T.O. 1A-7D-2-1).

Table 4-17. High Pressure Turbine Second Stage Blade Damage Limits

Condition	Area	Serviceable limits
Nicks and dents	Airfoil (inner 1/3)	0.005-inch maximum depth; no sharp edges allowed.
	Airfoil (outer 2/3)	0.020-inch maximum depth; no sharp edges allowed.
	Leading and trailing edge	0.020-inch maximum depth; no sharp edges allowed.
Erosion	Any location	Slight erosion allowed provided no contour change.
Melting	Any location	None
Pieces missing	Any location	None
Cracks	Any location	None

4-26. SEVENTH STAGE BLEED MANIFOLD INSPECTION.

Test Equipment Required

Figure & index No.	Name	AN type designation	Use and application
4-20	Fiberscope, Model IF1	6886226 (Allison Division of General Motors, Indianapolis, Indiana)	View engine internally
	Equipment required for connecting 115-volt, 60-hertz, single-phase ac electrical power		Provide electrical power to fiberscope

a. Inspect seventh stage bleed manifold, typical part No. 6866550 (T.O. 1J-TF41-4), for failure as follows:

(1) Remove No. 5 and 7 fuel nozzles (paragraph 4-20).

(2) Insert a 3-foot length of semirigid plastic tubing (approximately 1/2 inch ID) into fuel nozzle openings. This tubing is a guide for the fiberoptic borescope.

(3) Slide borescope end through the tube guide. Inspect manifold for cracks or ruptures.

b. If manifold has failed, submit Category I report (T.O. 00-35D-54).

c. If there has been no manifold failure, inspect using current troubleshooting procedures.

4-27. ENGINE CHEMICAL WASH CLEANING.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
	6872509	Nozzle-water wash LP/1P compressors	Use with 6872817
	6872508	Nozzle-water wash HP compressor	Use with 6872817
	6872817	Applicator assembly engine liquid wash	Use with 6872509 or 6872508

4-27.1. Preparation.

NOTE

Chemically wash the engine when any foreign substance (hydraulic fluid, dirt, etc) has been ingested and may degrade its performance.

a. Remove high and low pressure bleed air gimbal ducts (paragraph 1-11).

b. Cap seventh and eleventh stage bleed air ports on engine.

c. Remove T1 thermocouple from engine air inlet extension. Install T1 thermocouple in engine instrumentation protector.

d. Install LP compressor wash probe on T1 thermocouple mounting boss with nozzle pointing rearward.

e. Remove intrascope sealing tube just above left trunnion mount, and install HP compressor wash probe.

f. During engine wash, use one of the following procedures:

(1) Disconnect P3 line at main fuel control and install P3 blanking plate from engine liquid wash applicator kit.

(2) Apply 50- to 100-psi air, free of contaminants, to the P3 pressure tap located mid left side of engine.

g. Disconnect P5.1 line at 90° elbow on P5.1 manifold. Install cap of fitting.

h. Disconnect P3 line at autorelight switch and install cap on fitting.

i. Remove intrascope sealing tube just below right trunnion mount, and install HP compressor wash probe. The flat on probe flange must be toward rear of engine.

CAUTION

Installation of shorting plug is required to prevent damage to the permanent magnet generator (PMG). The dc output must remain connected to relay box and cold start valve. To prevent damage to PMG, do not rotate engine without two ac outputs shorted and dc output connected to a load of about 14 ohms.

j. Disconnect electrical harness at ignition exciter. Install PMG shorting plug in electrical harness connector (T.O. TF2J-41-6).

k. To prevent residue from entering openings during chemical wash cleaning, mask or cover holes on P5.1 probe.

4-27.2. Engine Liquid Wash Applicator Assembly Hookup.

a. Connect manifold of applicator assembly to LP compressor wash probe in engine air inlet extension and to HP compressor wash probes left and right borescope inspection ports.

b. Check that valve on applicator is closed.

c. Connect applicator water hose at a 50 to 100 psi supply of fresh water (minimum of 6 gallons).

d. Place suction hose of applicator in a minimum of 1 gallon of B&B3100 or Turco 5884 cleaner.

4-27.3. Cleaning Procedure.

CAUTION

Allow engine to cool 45 minutes after shutdown before start of engine wash. Do not wash engines when temperature is below 34°F (1°C).

a. Set up controls and switches (table 4-4).

NOTE

Throttle lever must remain in OFF throughout wash and rinse cycles.

b. Place battery switch in ON.

CAUTION

Motor engine for wash procedure will be accomplished using jet fuel starter (JFS) 100-3. Starter operating limits must be observed.

c. Place throttle in CRANK and hold until rpm is indicated. Release throttle to OFF.

d. Open valve on chemical wash applicator.

e. Motor engine for 60 seconds.

f. Place starter switch in ABORT.

g. Place battery switch in OFF.

h. Close valve on applicator.

i. Allow engine to soak/drain for 30 minutes.

j. Repeat steps a through i.

k. Remove suction hose from B&B3100 or Turco 5884 cleaner.

l. Repeat process using clean water to rinse engine. Rinse engine until clear water flows from engine exhaust.

4-27.4. Cleanup After Engine Wash.

a. Disconnect applicator assembly manifold from water supply and engine wash probes.

b. Remove caps from seventh and eleventh stage bleed air parts.

c. Install high and low pressure bleed air gimbal ducts (paragraph 1-11).

d. Remove LP compressor wash probe from air inlet extension and reinstall T1 thermocouple.

e. Secure with two bolts and lockwashers.

f. Remove HP compressor wash probes from LH and RH borescope inspection ports.

g. Reinstall intrascope sealing tubes and secure with nuts. Use hand pressure only to seat tubes. The flat on mounting flanges must be toward rear of engine.

h. Disconnect P3 tube at main fuel control and remove blanking plate.

i. Apply air pressure (100 psi maximum) at P3 pressure port to purge lines to main fuel control and autorelight switch of water.

j. Use a new gasket and reinstall P3 tube to main fuel control.

k. Secure with lockwashers and bolts.

l. Remove cap from autorelight switch fitting.

m. Reconnect P3 tube to switch and secure with lockwire.

n. Remove covering from P5.1 probe.

o. Apply air pressure to P5.1 manifold to purge it of water.

p. Reconnect sensing line at elbow.

q. Remove PMG shorting plug at ignition exciter and reconnect lead.

r. Check oil tank sight glass for indication of water content. If water content is indicated, drain and refill oil tank.

4-27.5. Engine Dryout Run.

CAUTION

Observe all engine operating limits and precautions.

a. Start engine (T.O. 1A-7D-2-1) and stabilize at IDLE for 3 minutes.

b. Advance throttle to 80% rpm. Stabilize for 10 minutes.

c. Retart throttle to IDLE.

d. Perform power check (paragraph 4-9).

e. Shut down engine (T.O. 1A-7D-2-1).

SECTION V

MAIN FUEL SYSTEM

5-1. DESCRIPTION.

5-1.1. Purpose. The main fuel system matches fuel delivery rate automatically to the engine need for all operating conditions. It delivers fuel to the combustion section in an atomized spray for efficient burning. In addition, pressurized fuel operates the airflow control system and fuel system ejector pumps. It is used as a cooling medium for engine and constant speed drive (CSD) transmission lubricating oil.

5-1.2. Fuel Flow. Engine thrust is dependent upon air mass flowing through the engine and the temperature of gases at the entry to the turbine. The fuel system controls the turbine entry temperature by the amount of fuel supplied to the combustion section. The fuel system will vary fuel flow with changes in engine speed, altitude, and airplane speed. Fuel flow is controlled by changing the output of the high pressure (HP) fuel pump. Output of the HP fuel pump is set by a control signal to the servo pistons.

5-1.3. Main Fuel Control. The main fuel control limits maximum high pressure rotor speed and maximum compressor case pressure P3. It also operates with the temperature limiter amplifier (Section VII) to limit maximum turbine outlet temperature and mass airflow. The low pressure governor limits maximum low pressure rotor speed. Refer to Section VII for engine limiting functions and their respective components.

5-1.4. Fuel Filter. The main fuel system uses a 10-micron paper filter element to filter low pressure fuel. The filter is equipped with a popout indicator to warn of possible impending filter bypass. A drain valve on the filter cap may be used to drain fuel from the filter. It is also used to bleed air from low pressure fuel system. The high pressure fuel system is bled at the airflow control.

5-1.5. Components. The main fuel system consists of fuel boost pump, low pressure (LP) fuel pump, fuel filter, HP fuel pump, velocity cleaned fuel filter, cold start valve, low pressure governor, HP fuel shutoff valve, main fuel control, and control cambox.

5-2. OPERATION. (Figure FO-10.)

5-2.1. Boost and LP Pump. Fuel is supplied to the fuel boost pump from the airplane fuel system. The centrifugal type boost pump pressurizes the fuel and routes it to the centrifugal type LP fuel pump for further pressurization. After passing the LP fuel pump, a portion of the fuel is diverted for use as a cooling medium for the CSD transmission lubricating oil. It is also used as motive flow for the airplane fuel system ejector pumps. The fuel boost pump and LP fuel pump are equipped with low pressure warning switches. Refer to Section III for a description of low fuel pressure indicating system.

5-2.2. LP Fuel Filter. Pressurized fuel passes through the fuel flow transmitter to the low pressure fuel filter. (Refer to Section III for fuel flow transmitter description.) Fuel entering the filter passes through and around a cylindrical sleeve which separates a portion of the contaminants and deposits them in the sediment trap. Fuel then passes through a disposable pleated paper 10-micron filter element. If the filter becomes contaminated and the pressure drop across the filter reaches 18 psi, a popout indicator on the bottom of the filter cap will extend between 1/16 and 7/32 inch. The filter cap must be removed to reset this indicator. If the pressure drop continues to increase to 25 psi, a bypass valve in the filter housing will open and permit fuel to go around the filter element.

5-2.3. HP Pump. Filtered and pressurized fuel is delivered to the variable delivery HP fuel pump. As the HP pump rotor turns, an angled camplate causes plungers to rotate and draw fuel from the inlet and deliver it pressurized at the outlet. HP fuel pump output volume is controlled by servo pistons that change the angle of the camplate. Spring force on the servo piston keeps the camplate at maximum stroke until differential pressure between the pump output and main manifold pressure is enough to overcome spring pressure. At this point, the servo will move and decrease the camplate angle. This reduces pump output. If a pump element fails, the failed element is isolated by a check valve. A relief valve limits maximum pump pressure. Each element of the pump is connected to a low pressure switch. (Refer to Section III for description of low fuel pressure indicating system.)

5-2.4. HP Fuel Filter. High pressure fuel flows through the velocity cleaned filter to the fuel cooled oil cooler. The oil cooler dissipates engine heat by exchanging heat between engine lubricating oil and fuel. This flow is not filtered by the velocity cleaned filter. Some of the fuel flows through the velocity cleaned 40-micron filter element. It is then routed to the airflow control low pressure governor and cold start valve. The filter screen is cleaned by the main engine flow washing the contaminants downstream and through the system.

5-2.5. Main Fuel Control. Normally, fuel flows unrestricted through the manual fuel control to the main fuel control. The main fuel control meters the correct amount of fuel by balancing the variable metering orifice (VMO) pressure drop against the pressure drop control governor. This controls HP fuel pump stroke to maintain a VMO pressure drop proportional to the square of engine speed. The pressure drop control governor is driven at a speed proportional to engine speed. The flow area is provided by two rectangular ports passing a fixed metering edge and three triangular ports passing between two parallel metering edges (one fixed and one movable). The movable metering edge is controlled by throttle position and speed signals from the scheduling governor. The position of the VMO plunger is set by capsule length. There are two chambers within the capsule. One is evacuated and the other is subject to P2.1 pressure. The outside of the capsule is acted upon by P3p (potentiometered P3 pressure). Changes in P2.1 or P3p pressure will cause the capsule to expand or contract. This movement is transmitted to the VMO plunger by a rocker lever. As the capsule contracts, the fuel flow will increase. The acceleration control unit (ACU) plunger position is determined by the resultant force between the pressure drop control governor flyweights acting on the plunger and the pressure drop across the plunger. Thus, fuel flow depends on movement of the VMO plunger and movement of scheduling governor sleeve.

5-2.5.1. Flow Manifold Pressure. With the engine operating at a steady state, the pressure drop across the ACU plunger is balanced by the centrifugal force of the pressure drop control governor flyweights. This maintains the ACU plunger in equilibrium. When an out-of-balance condition exists between the pressure drop and governor force, the flow area through the ACU will increase or decrease. This will increase or decrease the main flow manifold pressure. This change in pressure is sensed by the HP fuel pump servo which causes the pump to increase or decrease its stroke to restore balance between the pressure drop and governor force.

5-2.5.2. Engine Acceleration. During acceleration, movement of the throttle increases spring loading which repositions the scheduling governor sleeve. This increases the flow area across the VMO plunger triangular ports. The increase in flow area decreases the pressure drop across the VMO plunger. It is also sensed across the ACU plunger. The pressure drop control governor flyweights moves the ACU plunger to further open the metering ports to the main flow manifold. This increased pressure causes the HP fuel pump to increase supply. As the engine accelerates, the increased P3p pressure acts to decrease the capsule assembly length. This change is mechanically transmitted to the VMO plunger to increase the flow area. When the selected speed is reached, the balance is restored between the ACU plunger and the pressure drop control governor flyweight force.

5-2.5.3. Engine Deceleration. During deceleration, movement of the throttle decreases spring loading which repositions the scheduling governor sleeve. This reduces the flow area across the VMO plunger triangular ports. The decreased flow area increases the pressure drop across the VMO plunger which is sensed across the ACU plunger. The pressure drop moves the ACU plunger to decrease the metering port opening to the main flow manifold. This decreased pressure causes the HP fuel pump to decrease pump delivery. As the engine decelerates, the decreased P3p pressure increases the capsule assembly length. This change is mechanically transmitted to the VMO plunger. When the selected speed is reached, the balance is restored between the ACU plunger and the pressure drop control governor flyweight force.

5-2.5.4. Engine Pressure Changes. A change in engine speed or engine inlet air conditions results in a change in P2.1 and P3p air pressures. See figure 5-1 for graphic display of fuel flow changes versus engine speed, altitude, and airspeed. The change in pressure will cause the capsule assembly length to increase or decrease. The changing length moves the VMO plunger; this changes the VMO triangular port flow area and causes an out-of-balance condition between the VMO pressure drop and the pressure drop control governor. The ACU plunger will move to change the main flow manifold pressure which, in turn, alters the HP fuel pump output until balance is reached.

5-2.5.5. P3 Pressure Limiter. The P3 pressure limiter bellows senses internal P3 pressure and external atmospheric pressure (PO). Normally, the valve is closed; but, if P3/PO pressure exceeds a set value, the bellows will expand and open the valve. This will bleed P3p air to atmosphere, reducing P3p air pressure acting on the capsule. The capsule assembly reduces the VMO triangular port flow area, reducing fuel flow. A reset mechanism is used to check the unit without resorting to maximum P3 pressure. This mechanism is set to make sure that the P3 limiter bellows can control any other governing mechanism in the system.

5-2.6. Main and Pilot Fuel Flow. Metered fuel from the main fuel control is divided into two flows, main flow and pilot flow. Pilot flow is directed through the HP fuel shutoff valve, pilot flow manifold, and fuel strainer tube to the fuel nozzle. Main flow is directed through the low pressure governor, HP fuel shutoff valve, and main flow manifold to the fuel spray control distributor. The spray control distributor provides equal pressure at all fuel nozzles, giving equal distribution at each nozzle. Main flow is then supplied to the fuel nozzle.

5-2.7. Low Pressure Governor. Normally, fuel flows unrestricted through the low pressure governor. As the speed of the low pressure compressor rotor approaches an established maximum speed, the flyweights move the metering piston to decrease the metering ports. The centrifugal force equals the governor spring loading, the metering piston is then in balance and fuel is passed to the main flow manifold through the smaller metering ports remaining uncovered. If there is a further increase in low pressure compressor rotor speed, the added centrifugal force unbalances the metering piston. This causes a reduction in flow area of the small metering ports. Thus, the low pressure governor overrides the main fuel control to prevent further increase in low pressure compressor rotor speed. A cooling flow of fuel is provided to cool the carbon bearing at each end of the unit. This flow comes from the high pressure side of the HP fuel pump. It enters the governor through a restrictor and strainer assembly. The cooling flow passes through the governor and the cold start valve solenoid to the low pressure side of the HP fuel pump. A check valve at the main outlet isolates the normal system when operating on the manual fuel control. A datum reset mechanism reduces the load applied opposite to the centrifugal force of the governor flyweights. This allows the governor to operate at a lower engine speed for test and adjustment.

5-2.8. HP Fuel Shutoff Valve. The HP fuel shutoff valve functions to open and close ports to the main and pilot flow manifolds and to drain the manifolds with the engine shut down. With the valve in the open position, main flow from the low pressure governor is directed to the main flow manifold and HP fuel pump servo. Fuel from the pilot flow is directed to pilot flow manifold. Any leakage past the plunger in the valve is directed to the low pressure return port. When the valve is placed in the closed position, a cam opens the dump valve; pilot and main manifolds are opened to the dump port. Fuel in these manifolds is drained through the dump valve into the residual fuel holding tank. The fuel holding tank is automatically drained during flight through the fuel vent mast. The main and pilot inlet flows are connected to the low pressure return port. Servo pressure is applied to low pressure return port. This reduces servo pressure acting on the servo pistons during engine rundown.

5-2.9. Control Cambox. The control cambox receives throttle lever input from the engine control adapter. It transmits this movement to the HP fuel shutoff valve, main fuel control, and manual fuel control. The cambox is connected to these units by rods and levers. A double datum lockout switch is installed on the cambox. It will close when the throttle is advanced to MIL, and open when the throttle is retarded slightly from MIL. Refer to Section VII for operation of lockout switch. The control cambox input moves through an arc of 68° 30′ from off to INT. This arc is 16° 30′ from off to IDLE and 52° from IDLE to INT. The manual fuel control and main fuel control levers are splined directly to the input shaft and move through the same arc. However, the HP fuel shutoff valve must move through a 70° arc between off and IDLE, and must remain stationary between IDLE and INT. This is accomplished by gearing within the cambox and a lost motion cam. The driving shaft gear will drive the HP shutoff valve lever to open between off and IDLE. The offset roller will then ride on the lost motion cam to hold the valve open and prevent further rotation.

5-2.10. Cold Start System. The cold start system supplies additional fuel to improve cold starts. The cold start temperature bulb senses scavenge oil temperature and routes a signal to the cold start

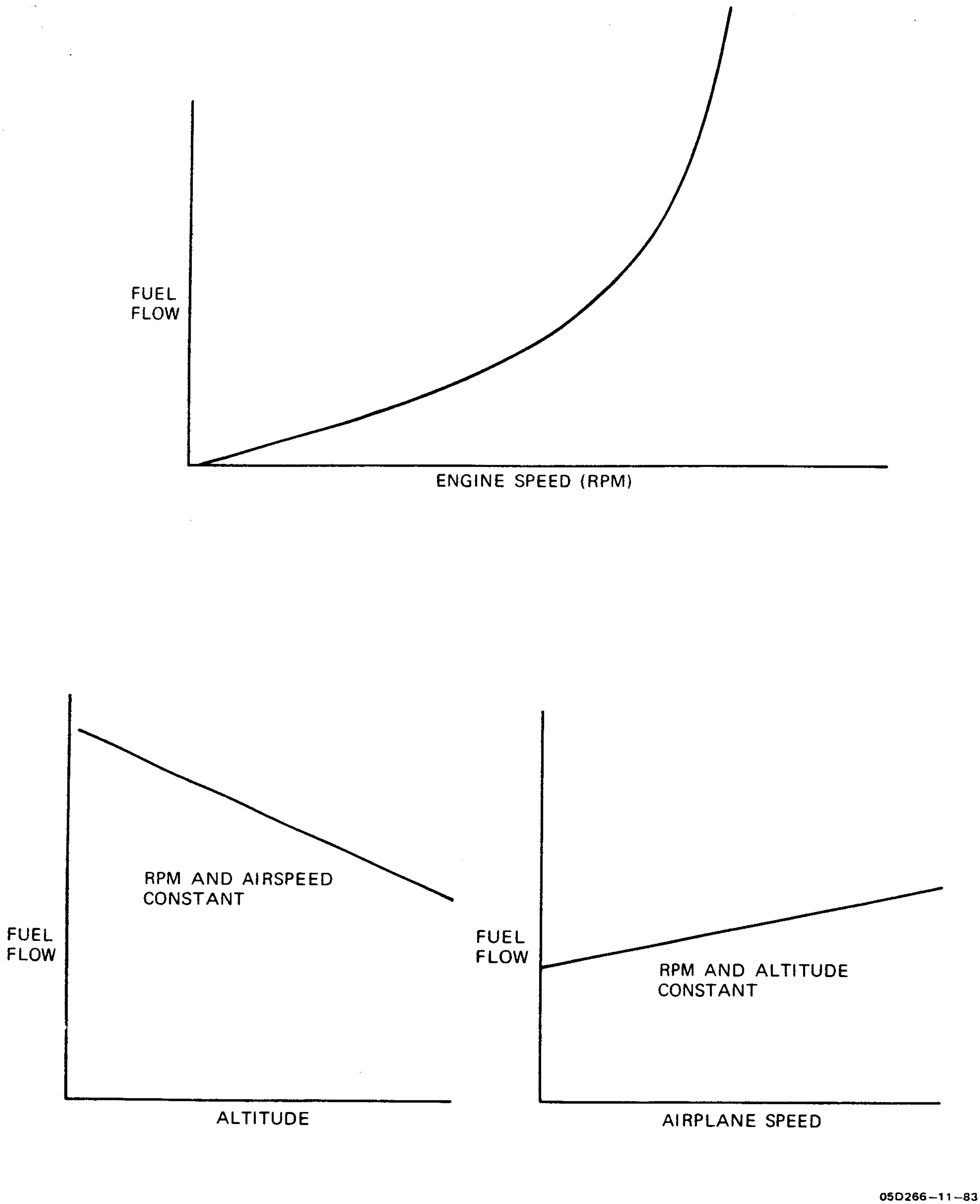


Figure 5-1. Fuel Flow Related Changes; Engine Speed, Altitude, and Airspeed

amplifier. When the oil temperature is about 0°C (32°F), the amplifier actuates a relay. The relay reverses current flow (supplied from permanent magnet generator at engine speeds greater than 10% rpm) to one of the two windings in the cold start valve. This action opens the cold start valve and adds about 170 pounds per hour fuel to the main flow. When oil temperature goes up to about 0°C (32°F), the relay returns to the normal position. This neutralizes the solenoid by having current flowing in each winding in opposition. Spring force will close the cold start valve. These windings are excited at all times to provide a load for the permanent magnet generator dc circuit. If the engine is operated with the cold start valve electrically disconnected, it will be necessary to install a shorting plug on the wiring harness to prevent burning out the permanent magnet generator windings.

5-3. COMPONENTS. For a list of system components, locations (accesses), and functions, refer to table 5-1.

Table 5-1. Main Fuel System Components

Component	Access	Function
Cambox, control	5222-2	Controls HP fuel shutoff valve, main fuel control, and manual fuel control operation
Control, main fuel	5222-2	Meters fuel for engine operation
Filter, fuel	5222-1	Filters low pressure fuel
Governor, low pressures	5222-2	Limits low pressure rotor speed
Pump, fuel boost	5222-1	Provides low pressure fuel to LP fuel pump
Pump, HP fuel	5222-2	Provides high pressure to main fuel control
Pump, LP fuel	5222-1	Provides low pressure fuel to HP fuel pump and airplane fuel system ejector pumps
Tank, residual fuel holding	5223-1	Holds fuel drained from HP fuel shutoff valve
Valve, cold start	5122-3	Adds additional fuel to aid starting cold engine
Valve, HP fuel shutoff	5222-2	Turns on and shuts off fuel to fuel nozzles and drains manifolds when engine is shut down

5-4. COLD START SYSTEM OPERATIONAL CHECKOUT.

Test Equipment Required

Figure & index No.	Name	AN type designation	Use and application
	Equipment required for engine operation		Operate engine
5-2	Cold start system test set	6887840 (Allison Division of General Motors, Indianapolis, Indiana)	Test operation of cold start system

NOTE

A number enclosed in braces at the end of a step in the following test corresponds to a number in troubleshooting figure 5-3.

a. Open access 6222-2.

b. Disconnect electrical connector from cold start temperature bulb and connect test set as shown in figure 5-2.

c. Make sure test set BULB switch is in NORMAL.

d. Start engine (T.O. 1A-7D-2-1) and stabilize at IDLE.

e. Advance throttle to 60% rpm and stabilize.

f. Record engine speed and fuel flow.

g. Place test set BULB switch in COLD. Check that engine speed increases 1% to 5% and fuel flow increases 50 to 150 pph. {1}

h. Place test set BULB switch in NORMAL.

i. Retard throttle to IDLE.

j. Shut down engine (T.O. 1A-7D-2-1).

k. Disconnect test set. Connect electrical connector to cold start temperature bulb.

l. Close access 6222-2.

5-5. COLD START SYSTEM TROUBLESHOOTING.

Test Equipment Required

Figure & index No.	Name	AN type designation	Use and application
	Multimeter	AN/PSM-6	Measure continuity

5-5.1. Procedures. See figure 5-3 for troubleshooting data. Malfunctions are numbered corresponding to numbers following steps in the cold start system operational checkout.

5-5.2. Schematic. For system troubleshooting schematic, see figure FO-10.

5-6. COLD START SYSTEM PRIMARY TROUBLESHOOTING TEST.

Test Equipment Required

Figure & index No.	Name	AN type designation	Use and application
	Equipment required for connecting external electrical power		Provide power source for airplane
5-4	Cold start system test set	6887840 (Allison Division of General Motors, Indianapolis, Indiana)	Troubleshoot cold start system

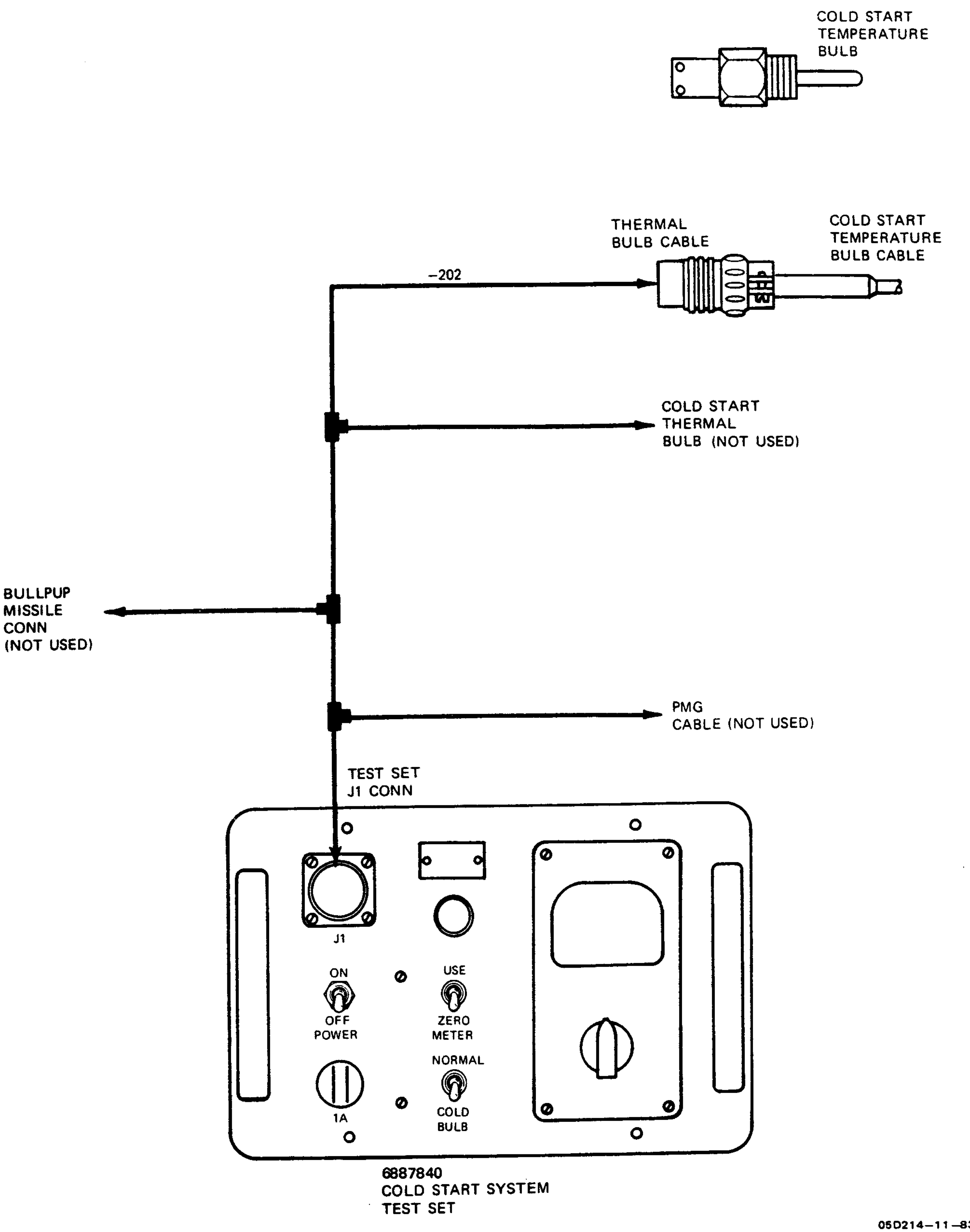


Figure 5-2. Operational Checkout; Cold Start System

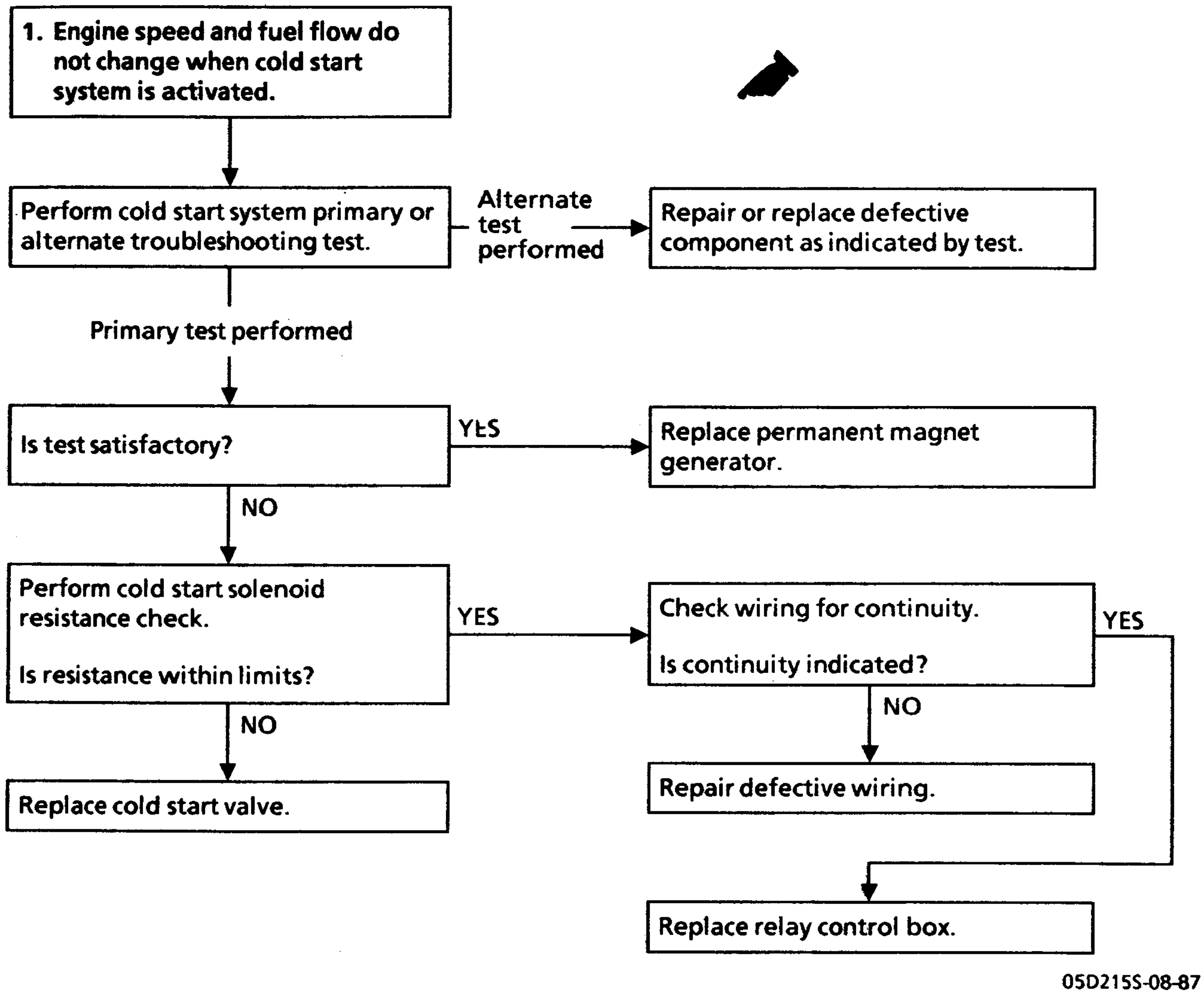


Figure 5-3. Troubleshooting Diagram; Cold Start System

a. Open accesses 1232-1 and 6222-2.

b. Disconnect electrical connectors from cold start temperature bulb and permanent magnet generator.

c. Place test set POWER switch in OFF and BULB switch in COLD.

d. Connect test set as shown in figure 5-4.

e. Connect external electrical power (T.O. 1A-7D-2-1).

NOTE

Operator may determine operation of cold start fuel valve by sound or by feeling valve.

f. Place test set POWER switch in ON. Check that cold start fuel valve solenoid operates.

g. Place BULB switch in NORMAL. Check that cold start fuel valve solenoid operates.

h. Place POWER switch in OFF.

i. Disconnect external electrical power (T.O. 1A-7D-2-1).

j. Disconnect test set. Connect electrical connectors to cold start temperature bulb and permanent magnet generator.

k. Close accesses 1232-1 and 6222-2.

5-6A. COLD START SYSTEM ALTERNATE TROUBLESHOOTING TEST.

Test Equipment Required

Figure & index No.	Name	AN type designation	Use and application
	Multimeter	AN/PSM-6	Measure voltage
5-4.1	Test cable	Local fabrication	Troubleshoot cold start system

Test Equipment Required – CONT

Figure & index No.	Name	AN type designation	Use and application
5-4	Cold atart system test set	6887840 (Allison Division of General Motors, Indianapolis, Ind)	Troubleshoot cold start system

a. Fabricate test cable as shown in figure 5-4.1.

b. Open accesses 5222-2 and 6222-2.

c. Disconnect electrical connectors from cold start valve and cold start temperature bulb.

d. Place test set BULB switch in NORMAL.

e. Connect test set and test cable as shown in figure 5-4.2.

f. Connect multimeter to test jacks 1(–) and 4(+).

g. Start engine (T.O. 1A-7D-2-1) and monitor PMG dc voltage on multimeter. Voltage should be 12 to 16 volts.

(1) If voltage is lower than 12 volts, PMG is defective.

(2) If voltage is 30 to 36 volts, relay control box is defective. Cold start valve will be open.

h. If voltage is 12 to 16 volts dc at IDLE rpm, place test set BULB switch in COLD. Check that engine rpm increases and voltage increases to 30 to 36 volts.

(1) If voltage does not increase, cold start valve will not open and rpm will not increase. Relay control box is defective.

(2) If voltage increases and rpm does not increase, cold start valve is defective.

NOTE

Voltage change on pins 3 and 4 when switching from NORMAL to COLD bulb indicates relay control box is correctly reversing voltage to one solenoid of cold start valve.

i. Voltage on test cable jacks should be as follows:

	NORMAL	*COLD*
1(–) to 2(+)	12 to 16 volts	12 to 16 volts
1(–) to 3(+)	30 to 36 volts	12 to 16 volts
1(–) to 4(+)	12 to 16 volts	30 to 36 volts

j. Place BULB switch in NORMAL.

k. Retard engine to IDLE.

l. Shut down engine (T.O. 1A-7D-2-1).

m. Disconnect test set and test cable. Connect electrical connectors to cold start temperature bulb and cold start valve.

n. Repair or replace defective component and perform operational checkout (paragraph 5-4).

o. Close accesses 5222-2 and 6222-2.

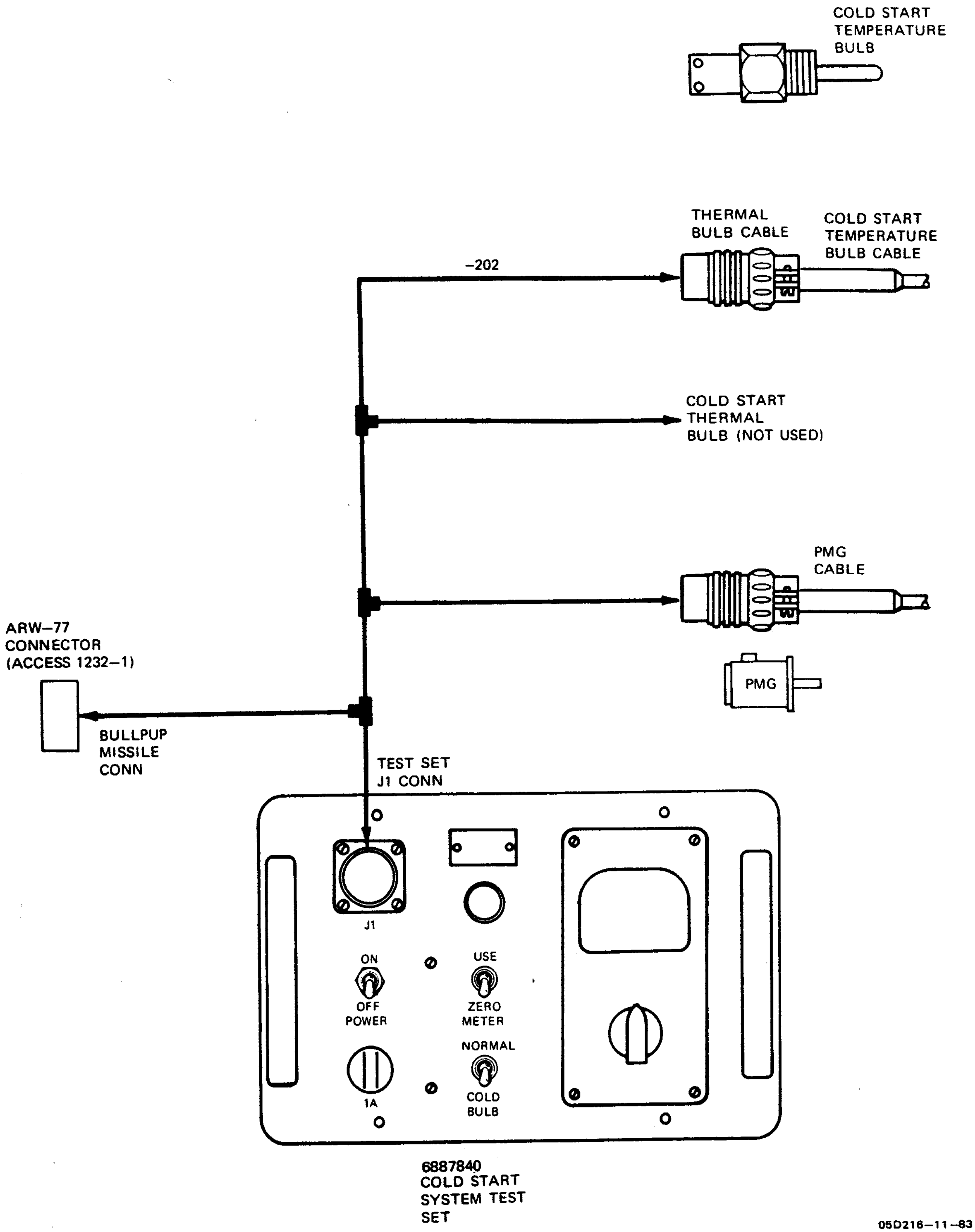


Figure 5-4. Primary Troubleshooting Test; Cold Start System

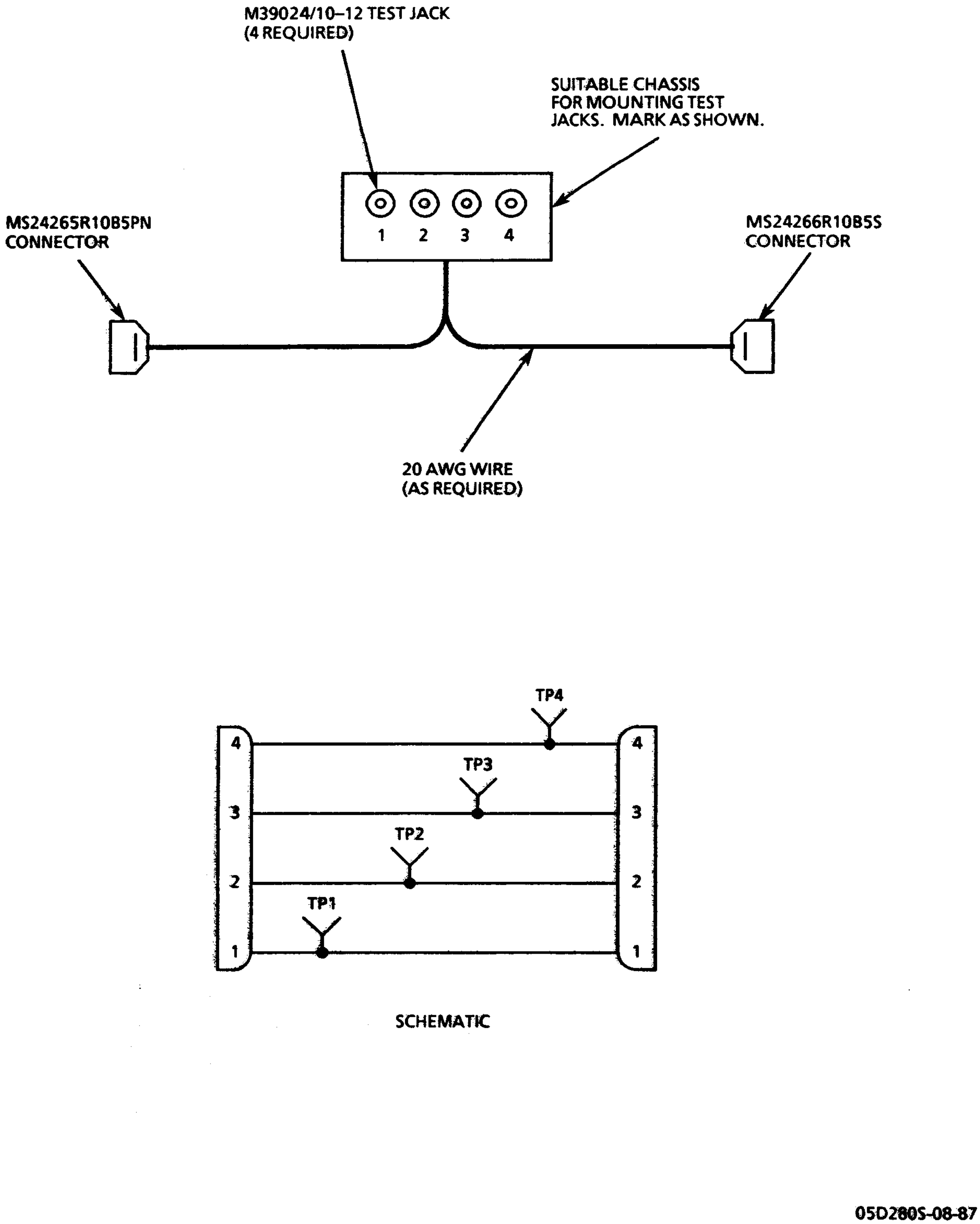


Figure 5-4.1. Test Cable; Locally Fabricated Cold Start System

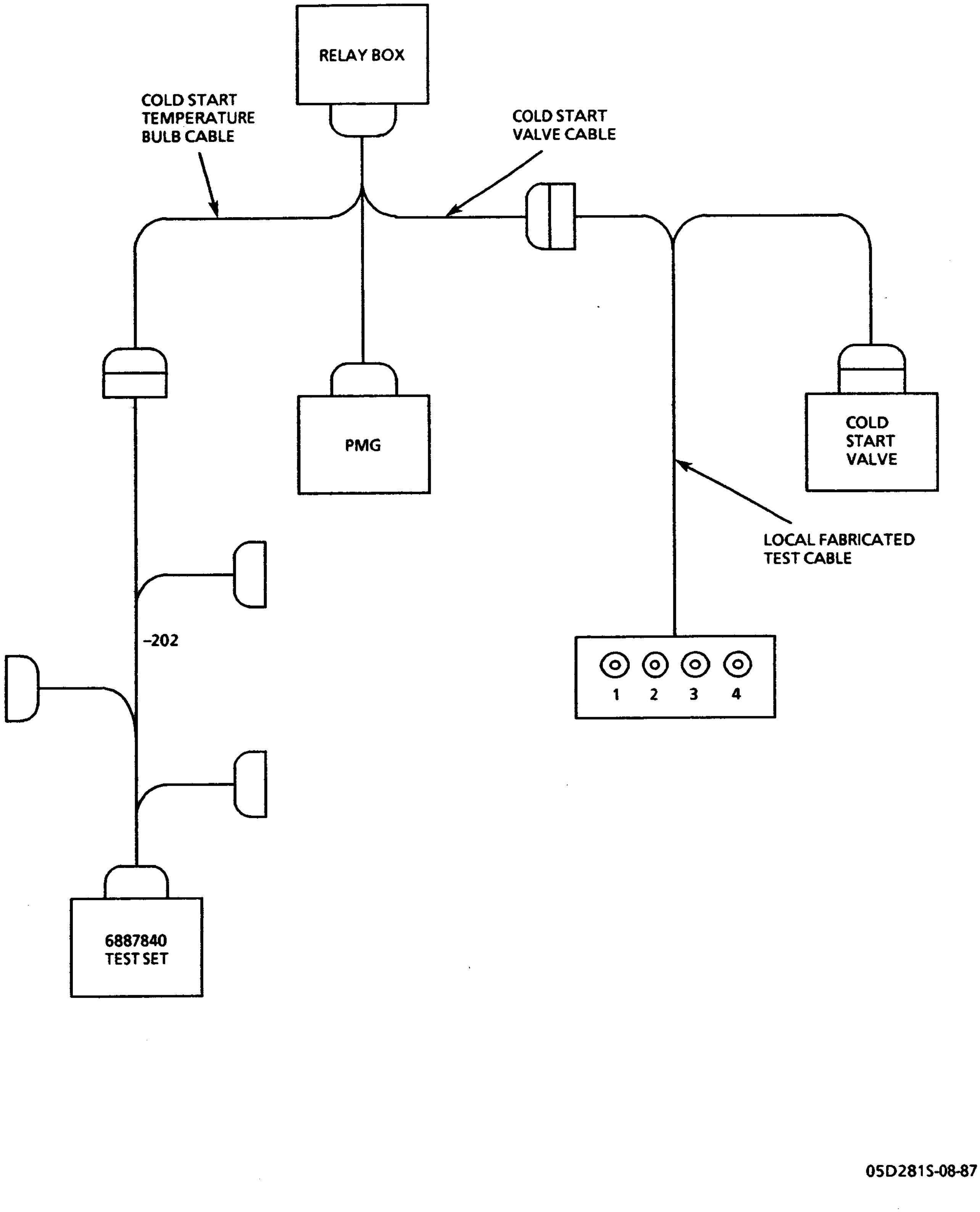


Figure 5-4.2. Alternate Troubleshooting Test; Cold Start System

5-7. COLD START TEMPERATURE BULB TEST.

Test Equipment Required

Figure & index No.	Name	AN type designation	Use and application
5-5	Cold start system test set	6887840 (Allison Division of General Motors, Indianapolis, Indiana)	Measure resistance of cold start temperature bulb

NOTE

Engine must have been shut down for at least 8 hours before performing test.

If resistance is not within limits, replace cold start temperature bulb (paragraph 5-35).

a. Open access 6222-2.

b. Disconnect electrical connector from cold start temperature bulb and connect test set as shown in figure 5-5.

c. Set test set ohmmeter on 3,000-ohm scale, place METER switch in ZERO, and zero meter. Place METER switch in USE.

d. Check temperature bulb resistance as follows:

(1) Oil temperature below 0°C (32°F) — 50 to 85 ohms.

(2) Oil temperature above 0°C (32°F) — 90 to 150 ohms.

e. Disconnect test set. Connect electrical connector to cold start temperature bulb.

f. Close access 6222-2.

5-8. COLD START VALVE SOLENOID RESISTANCE CHECK.

Test Equipment Required

Figure & index No.	Name	AN type designation	Use and application
5-5	Cold start system test set	6887840 (Allison Division of General Motors, Indianapolis, Indiana)	Check cold start solenoid resistance

a. Open access 5222-2.

b. Disconnect electrical connector from cold start valve.

c. Using cold start system test set, check resistance of cold start fuel valve solenoid at valve connector as follows:

(1) Between pins 1 and 2 — approximately 7 ohms.

(2) Between pins 3 and 4 — approximately 7 ohms.

d. Connect electrical connector to cold start valve.

e. Close access 5222-2.

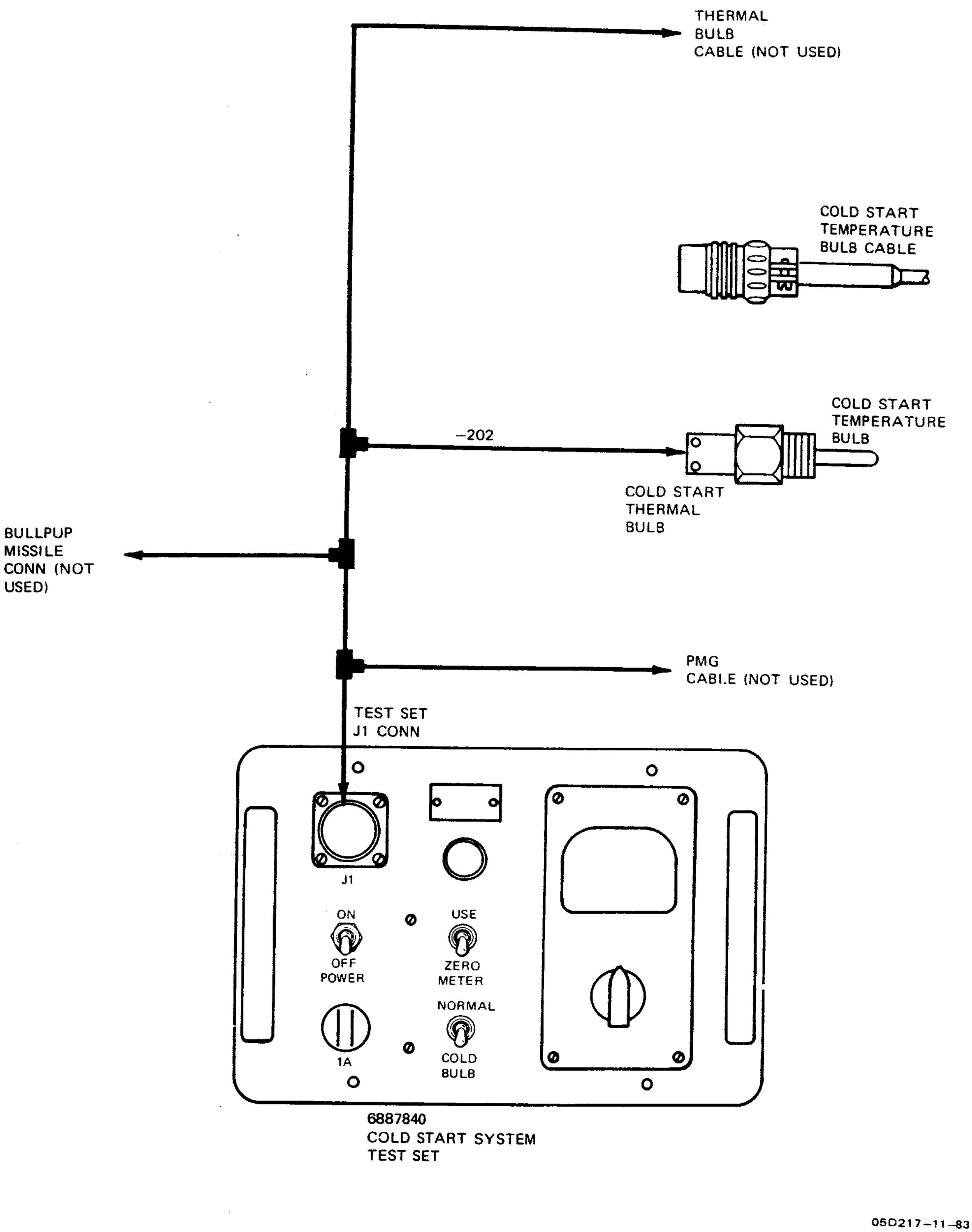


Figure 5-5. Temperature Bulb Test; Cold Start

5-9. NH IDLE SPEED ADJUSTMENT (USING 6872929 TEST SET).

Test Equipment Required

Figure & index No.	Name	AN type designation	Use and application
	Equipment required for engine operation		Operate engine
	Equipment required for 115-volt, 400-hertz, single-phase ac electrical power		Connect external electrical power to test set
	Speed adjusting socket	6798964 (Allison Division of General Motors, Indianapolis, Indiana)	Adjust idle speed
		or	
	Speed adjusting wrench	6872768 (Allison Division of General Motors, Indianapolis, Indiana)	Adjust idle speed
	Engine limiter test set cable assembly	6872490 (Allison Division of General Motors, Indianapolis, Indiana)	Connect test set to engine and external power source
	Engine limiter test set	6872929 (Allison Division of General Motors, Indianapolis, Indiana)	Measure high pressure rotor speed
	Power cable adapter	6872727 (Allison Division of General Motors, Indianapolis, Indiana)	Connect test set power cable to airplane ARW-77 connector

a. Open accesses 5222-1 and 5222-2.

b. Set switches and controls on engine limiter test set as follows:

Control	*Position*
POWER switch	OFF
TACH SIM switch	OFF
SIM SIGNAL control	Full decrease
T1 control	Midrange
T3/T5.1 control	Full decrease
TEMP SELECTOR switch	CAL
T3/T5.1 SIM switch	OFF
T5.1 switch	NORMAL
T3 switch	NORMAL
LP SPEED switch	OFF
SQUAT switch	OFF
METER switch	USE
T1 SIM switch	OFF
TACHOMETER switch	USE
BATT switch	OFF
READ/CAL switch	CAL
ZERO ADJ control	Full decrease
RPM SELECT switch	NHP
PROBE TRIM control	Full decrease
MODE switch	RESET
ACCEL START PRESET control	Centered

c. Disconnect electrical connector from high pressure compressor tachometer generator.

CAUTION

To prevent damage to engine components and test set, make sure that test set is connected to 115-volt, 400-hertz, single-phase ac power source. Make a pin-to-pin voltage check of power source connector before connecting test set.

d. Connect engine limiter test set ro airplane and external power source as shown in figure 5-6.

e. Place test set POWER switch in ON. Warm up for 10 minutes.

f. Check engine limiter test set as follows:

(1) Place METER switch in CHECK. Check milliammeter for 210 (±20) milliamperes. Place METER switch in USE.

(2) Check TEMP meter for 575° (±1°)C (1,067° (±2°)F).

(3) Place TACHOMETER switch in CHECK and RPM SELECT switch in NLP. Check % RPM meter for 16.7% (±0.3%).

(4) Place RPM SELECT switch in NHP. Check % RPM meter for 100.0% (±0.3%). Place TACHOMETER switch in USE.

g. Place TEMP SELECTOR switch in T5.1.

h. Start engine (T.O. 1A-7D-2-1) and stabilize at IDLE.

i. Advance throttle to MIL and stabilize for 3 minutes.

j. Retard throttle to IDLE and stabilize for 3 minutes.

k. Place limiter test set READ/CAL switch in READ.

l. Check that idle speed shown on cockpit tachometer and test set % RPM indicator is 55% (±2%) rpm.

NOTE

Turn idle speed adjustment screw clockwise to increase and counterclockwise to decrease idle speed. One turn is about 6% (800) rpm. If unable to adjust idle speed, refer to paragraph 4-6 for troubleshooting procedures.

m. If not within limits, adjust idle speed (figure 5-6) for 56% to 57% rpm on test set % RPM indicator.

n. Shut down engine (T.O. 1A-7D-2-1).

o. Place test set POWER switch in OFF.

p. Disconnect test set from airplane and external power source.

q. Connect electrical connector to high compressor tachometer generator.

r. Close accesses 5222-1 and 5222-2.

5-10. NH IDLE SPEED ADJUSTMENT (USING 6893706 TEST SET).

Test Equipment Required

Figure & index No.	Name	AN type designation	Use and application
	Equipment required for engine operation		Operate engine
	Speed adjusting wrench	6872768 (Allison Division of General Motors, Indianapolis, Indiana)	Adjust idle speed
	Engine limiter test set	6893706 (Allison Division of General Motors, Indianapolis, Indiana)	Measure high pressure rotor speed

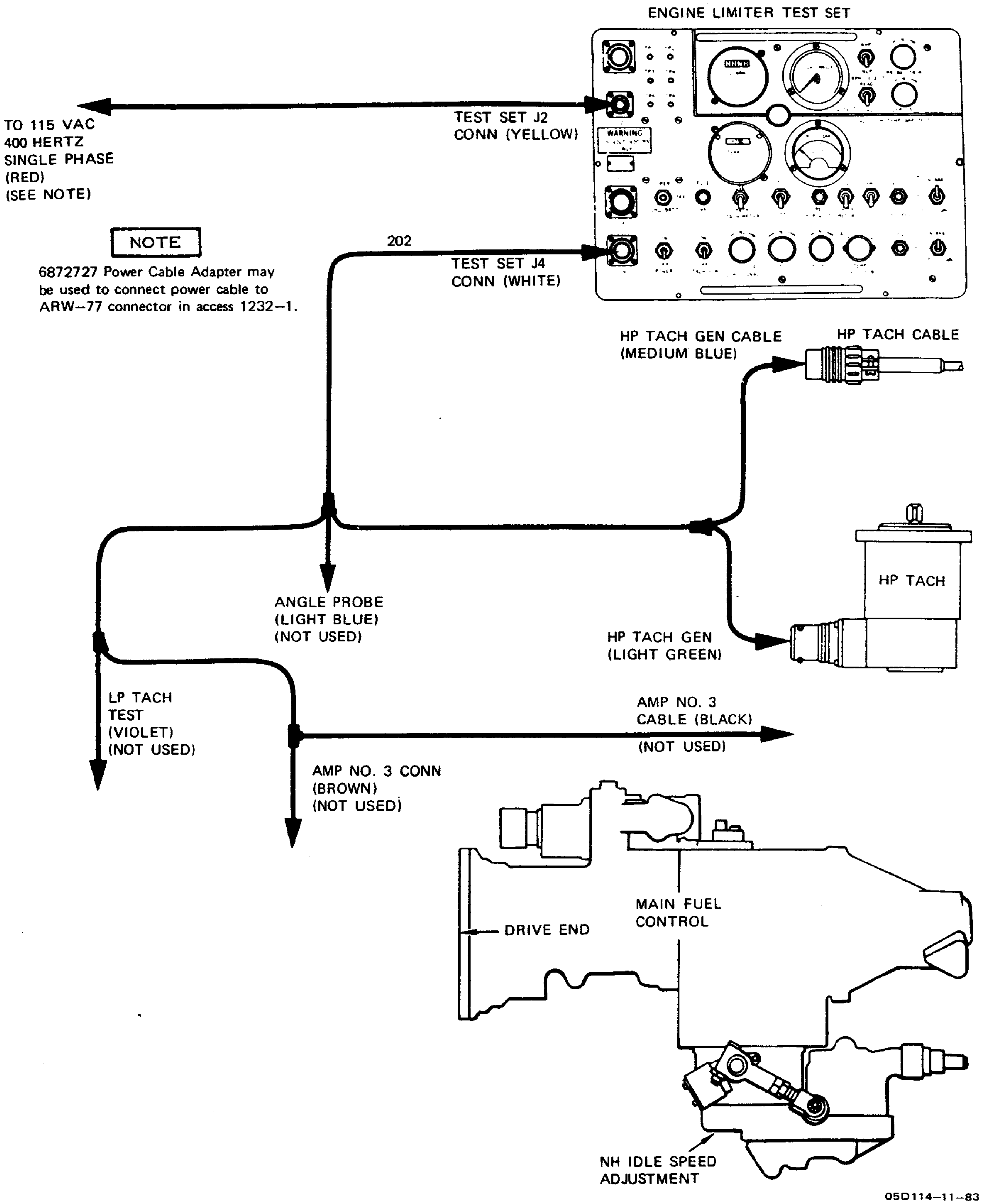


Figure 5-6. Adjustment; NH Idle Speed (Using 6872929 Test Set)

a. Open accesses 5222-1 and 5222-2.

b. Set switches and controls on engine limiter test set as follows:

Control	*Position*
POWER switch	OFF
SQUAT switch	OFF
IGV/CAL switch	IGV
TACH SIMULATED INPUTS control	Fully counter-clockwise
T1 SIMULATED INPUTS control	Fully counter-clockwise
T5 SIMULATED INPUTS control	Fully counter-clockwise
T5 switch	NORMAL
LP SP switch	Center position

NOTE

When the test set POWER switch is placed in ON, the numerals 00 will appear in the lower portion of the test set display window. This 00 display indicates that SELF TEST has been selected.

When the test set has warmed up (maximum time of 20 minutes), it will begin the self-test function automatically.

After completion of self-test, the numbers 88.88 will be sequenced through the three rows in the display window. This sequencing will continue until a specific test is selected or test set POWER switch is placed in OFF.

c. Place POWER switch in ON. Warm up test set.

d. Disconnect electrical connector from high pressure compressor tachometer generator.

e. Connect test set to engine limiter amplifier as shown in figure 5-7.

f. Start engine (T.O. 1A-7D-2-1) and stabilize at IDLE.

g. Place TEST switch in NEXT until 17 appears in TEST display window.

h. Check that T5, NH, and MA indicator lights come on.

i. Advance throttle to MIL and stabilize for 3 minutes.

j. Retard throttle to IDLE and stabilize for 3 minutes.

k. Check idle speed on tachometer and test set NH display window for 55% (±2%) rpm.

NOTE

Turn idle speed adjustment screw clockwise to increase and counterclockwise to decrease idle speed. One turn is about 6% (800) rpm. If unable to adjust idle speed, refer to paragraph 4-6 for troubleshooting procedures.

l. If not within limits, adjust idle speed (figure 5-6) for 56% to 57% rpm on test set NH display window.

m. Shut down engine (T.O. 1A-7D-2-1).

n. Place test set POWER switch in OFF.

o. Disconnect test set from airplane.

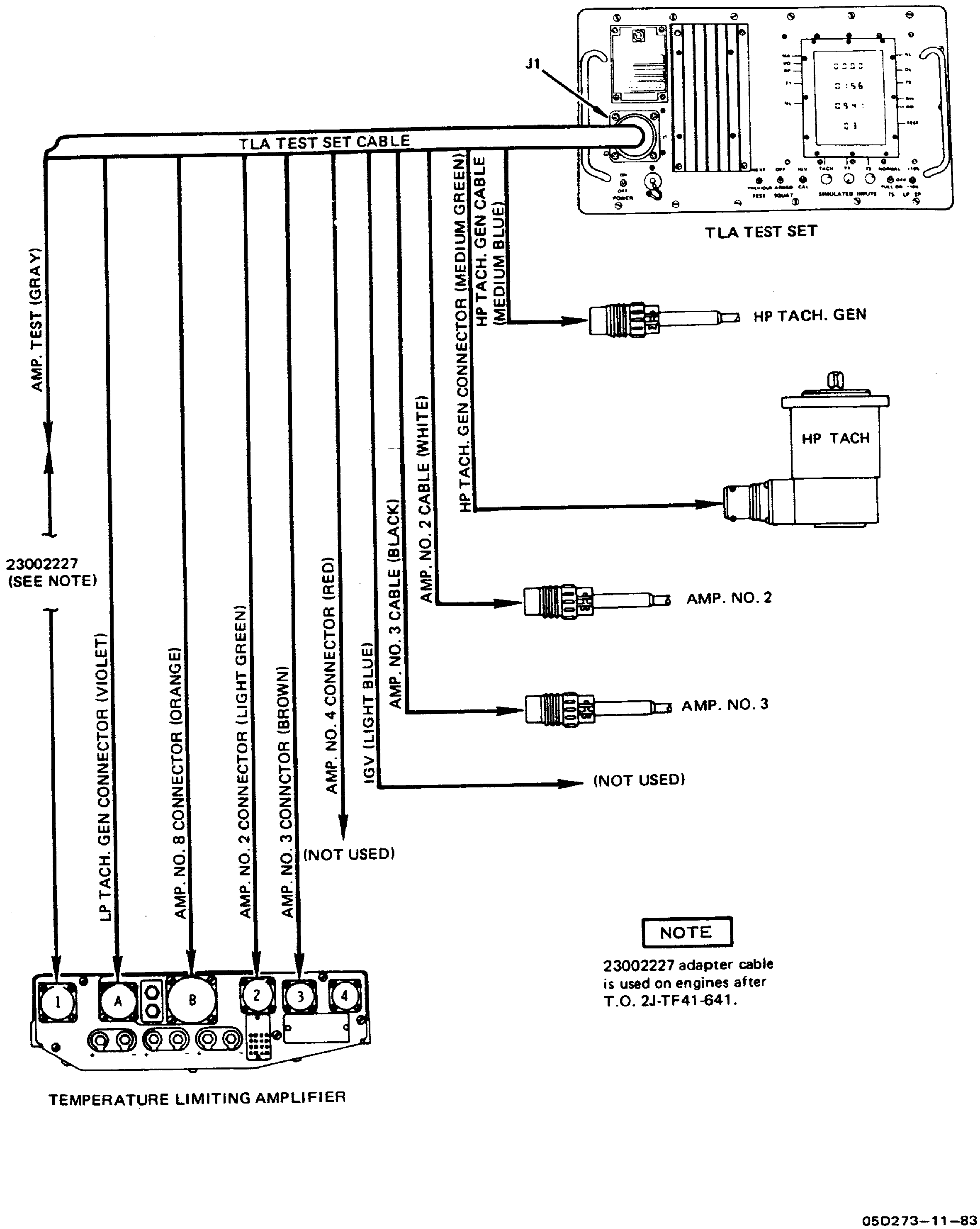


Figure 5-7. Adjustment; NH Idle Speed (Using 6893706 Test Set)

p. Connect electrical connector to high compressor tachometer generator.

q. Close accesses 5222-1 and 5222-2.

5-11. HIGH PRESSURE GOVERNOR CHECK AND ADJUSTMENT (USING 6872929 TEST SET).

Test Equipment Required

Figure & index No.	Name	AN type designation	Use and application
	Equipment required for engine operation		Operate engine
	Equipment required for 115-volt, 400-hertz, single-phase ac external electrical power		Connect external electrical power to test set
7-4	Engine limiter test set cable assembly	6872490 (Allison Division of General Motors, Indianapolis, Indiana)	Connect test set to engine and external power source
7-4	Engine limiter test set	6872929 (Allison Division of General Motors, Indianapolis, Indiana)	Perform temperature limiter amplifier tests
	Power cable adapter	6872727 (Allison Division of General Motors, Indianapolis, Indiana)	Connect test set power cable to airplane ARW-77 connector
	Socket	6798966 (Allison Division of General Motors, Indianapolis, Indiana)	Adjust low pressure governor
	Socket	6798964 (Allison Division of General Motors, Indianapolis, Indiana)	Adjust high pressure governor

NOTE

This procedure is to be used for troubleshooting to ensure proper control adjustment.

This procedure will be effective at ambient temperature above 40°F.

5-11.1. Preparation.

a. Open accesses 5222-1 and 5222-2.

b. Set switches and controls on engine limiter test set as follows:

Control	*Position*
POWER switch	OFF
TACH SIM switch	OFF
SIM SIGNAL control	Full decrease
T1 control	Midrange
T3/T5.1 control	Full decrease
TEMP SELECTOR switch	CAL
T3/T5.1 SIM switch	OFF
T5.1 switch	NORMAL
T3 switch	NORMAL
LP SPEED switch	OFF
SQUAT switch	OFF
METER switch	USE
T1 SIM switch	OFF
TACHOMETER switch	USE
READ/CAL switch	CAL
ZERO ADJ control	Full decrease
RPM SELECT switch	NHP
PROBE TRIM control	Full decrease
MODE switch	RESET
ACCEL START PRESET control	Centered

c. Disconnect electrical connectors from high pressure compressor tachometer generator and amplifier receptacle No. 3.

CAUTION

To prevent damage to engine components and test set, make sure that test set is connected to 115-volt, 400-hertz, single-phase ac power source. Make a pin-to-pin voltage check of the power source connector before connecting test set.

d. Connect engine limiter test set to external electrical power and airplane as shown in figure 7-4.

e. Place engine limiter test set POWER switch in ON. Warm up for 10 minutes.

f. Check engine limiter test set as follows:

(1) . Place METER switch in CHECK. Check milliammeter for 210 (±20) milliamperes. Place METER switch in USE.

(2) Check TEMP meter for 575° (±1°)C (1,067° (± 2°)F).

(3) Place TACHOMETER switch in CHECK and RPM SELECT switch in NLP. Check % RPM meter for 16.7% (±0.3%).

(4) Place RPM SELECT switch in NHP. Check % RPM meter for 100.0% (±0.3%). Place TACHOMETER switch in USE.

g. Start engine (T.O. 1A-7D-2-1) and stabilize at IDLE.

5-11.2. Check.

a. Advance throttle to 80% rpm and stabilize.

NOTE

If tachometer indication is not within limits, troubleshoot high pressure compressor rotor tachometer indicating system (paragraph 3-5) and correct before continuing.

b. Check that cockpit tachometer indication is within ±0.7% of test set indication.

c. Advance throttle to 90% rpm and stabilize.

d. Repeat step b.

e. Advance throttle to MIL and stabilize for 3 minutes.

f. Repeat step b.

g. Retard throttle to IDLE.

h. Place test set LP SPEED switch in +10%.

i. Using adjusting socket, adjust low pressure governor (figure 5-8) one turn clockwise.

CAUTION

Extended operation with cabin dumped may cause damage to avionic equipment. Refer to T.O. 1A-7D-2-1 for cooling requirements of avionic equipment.

j. Place cabin pressure switch in CABIN DUMP.

k. Slowly advance throttle to MIL and stabilize.

l. Record cockpit tachometer indication.

m. Retart throttle to 80% rpm.

n. Jam throttle to MIL.

o. Record peak cockpit tachometer indication.

p. Repeat steps m through o to verify step o.

q. Check that peak rpm was between 100% and 101%.

5-11.3. Adjustment.

a. If rpm was within limits, perform the following:

(1) Place cabin pressure switch in CABIN PRESS.

(2) Place LP SPEED switch in OFF.

(3) Using adjusting socket, adjust low

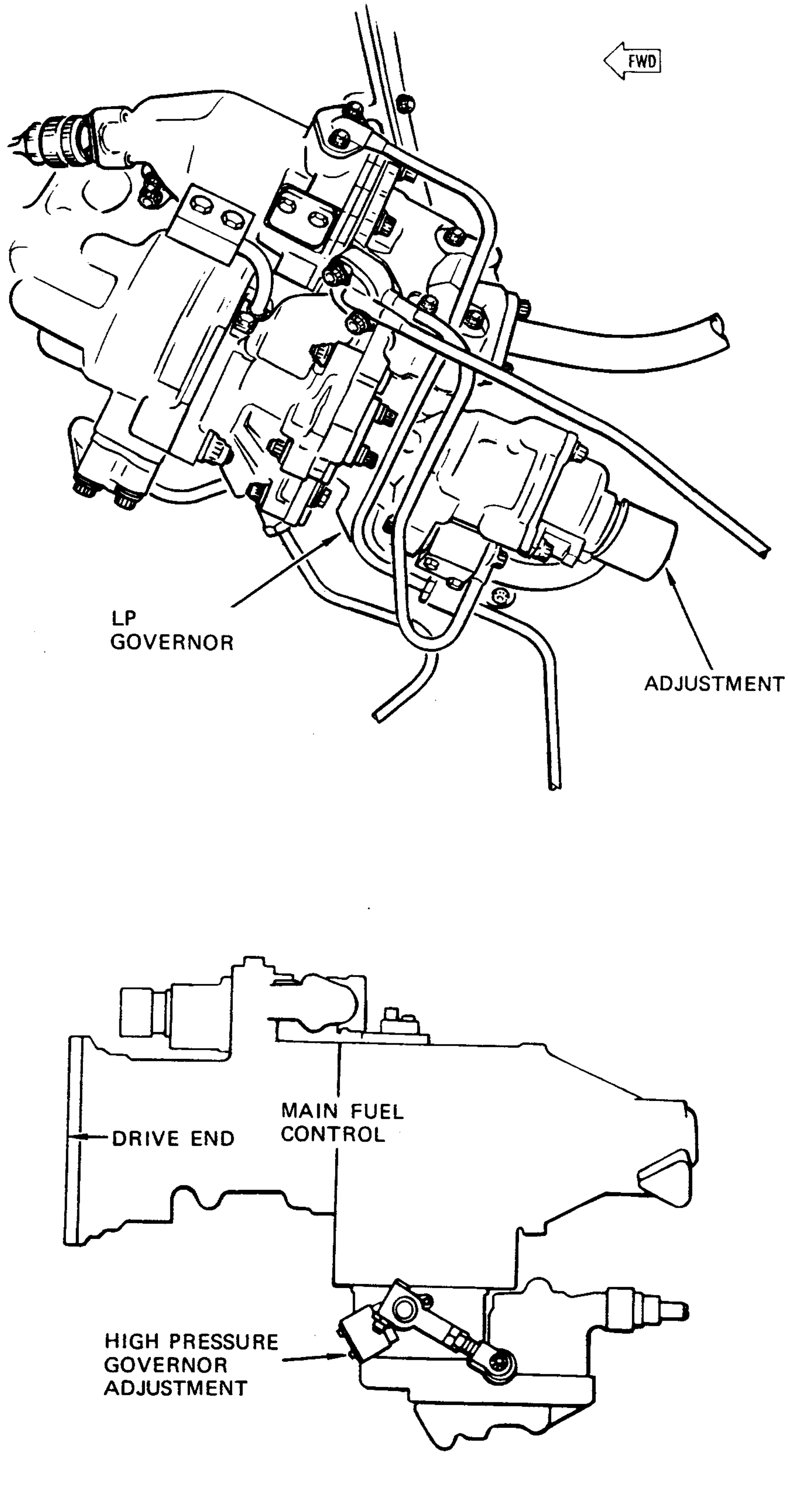


Figure 5-8. Adjustment; High Pressure Governor

pressure governor one turn counterclockwise.

(4) Perform postcheck (subparagraph 5-11.4).

b. If peak rpm was more than 101%, proceed as follows:

(1) Retard throttle to IDLE.

(2) Using adjusting socket, adjust high pressure governor (figure 5-7) 1/8-turn clockwise.

(3) Repeat steps k through q, subparagraph 5-11.2.

(4) Shut down engine (T.O. 1A-7D-2-1).

(5) Perform main fuel control linkage portion of control cambox rigging (paragraph 5-21).

(6) Start engine (T.O. 1A-7D-2-1).

(7) Repeat steps k through q, subparagraph 5-11.2, to verify adjustment.

c. If peak rpm was less than 100%, proceed as follows:

(1) Retard throttle to ILDE.

(2) Shut down engine (T.O. 1A-7D-2-1).

(3) Using adjusting socket, adjust high pressure governor (figure 5-8) 1/4-turn counterclockwise.

(4) Perform main fuel control linkage portion of control cambox rigging (paragraph 5-21).

(5) Start engine (T.O. 1A-7D-2-1).

(6) Repeat steps k through q, subparagraph 5-11.2.

d. Retard throttle to IDLE.

e. Place cabin pressure switch in CABIN PRESS.

f. Place LP SPEED switch in OFF.

g. Using adjusting socket, adjust low pressure governor one turn counterclockwise.

h. Perform NH idle speed check (paragraph 5-9).

i. Perform temperature limiter amplifier dynamic test (paragraph 7-9 or 7-10).

j. Perform NL maximum speed check (paragraph 5-13).

k. Perform acceleration/deceleration time checks (paragraph 5-16 or 5-17).

l. Perform power check (paragraph 4-9).

m. Perform manual fuel control operational checkout (paragraph 6-4).

5-11.4. Postcheck.

a. Shut down engine (T.O. 1A-7D-2-1).

b. Place test set POWER switch in OFF.

c. Disconnect test set from airplane and external power source.

d. Connect electrical connector to high pressure tachometer generator and amplifier receptacle No. 3.

e. Secure high pressure governor adjustment with MS20995C32 lockwire.

f. Close accesses 5222-1 and 5222-2.

g. Record high pressure governor adjustment in engine log.

5-12. HIGH PRESSURE GOVERNOR CHECK AND ADJUSTMENT (USING 6893706 TEST SET).

Test Equipment Required

Figure & index No.	Name	AN type designation	Use and application
	Equipment required for engine operation		Operate engine

Test Equipment Required — CONT

Figure & index No.	Name	AN type designation	Use and application
	Engine limiter test set	6893706 (Allison Division of General Motors, Indianapolis, Indiana)	Perform temperature limiter amplifier tests
	Socket	6798966 (Allison Division of General Motors, Indianapolis, Indiana)	Adjust low pressure governor

NOTE

This procedure is to be used for troubleshooting to ensure proper control adjustment.

This procedure will be effective at ambient temperature above 40°F.

5-12.1. Preparation.

a. Open accesses 5222-1 and 5222-2.

b. Set switches and controls on engine limiter test set as follows:

Control	*Position*
POWER switch	OFF
SQUAT switch	OFF
IGV/CAL	IGV
TACH SIMULATED INPUTS control	Fully counter-clockwise
T1 SIMULATED INPUTS control	Fully counter-clockwise
T5 SIMULATED INPUTS control	Fully counter-clockwise
T5 switch	NORMAL
LP SP switch	Center position

c. Disconnect electrical connectors from high pressure compressor tachometer generator and amplifier receptacle No 3.

d. Connect engine limiter test set as shown in figure 5-7.

NOTE

When the test set POWER switch is placed in ON, the numerals 00 will appear in the lower portion of the test set display window. This 00 display indicates that SELF TEST has been selected.

When the test set has warmed up (maximum time of 20 minutes), it will begin the self-test function automatically.

After completion of self-test, the numbers 88.88 will be sequenced through the three rows in the display window. This sequencing will continue until a specific test is selected or test set POWER switch is placed in OFF.

e. Place POWER switch in ON. Warm up test set.

f. Start engine (T.O. 1A-7D-2-1) and stabilize at IDLE.

5-12.2. Check.

a. Place TEST switch in NEXT until 18 appears in TEST display window.

b. Check that T5 and NH indicator lights come on.

c. Advance throttle to 80% rpm and stabilize.

NOTE

If tachometer indication is not within limits, troubleshoot high pressure compressor rotor tachometer indicating system (paragraph 3-5) and correct before continuing.

d. Check that tachometer is within ±0.7% of test set indication.

e. Advance throttle to 90% rpm and stabilize.

f. Repeat step d.

g. Advance throttle to MIL and stabilize for 3 minutes.

h. Repeat step d.

i. Retard throttle to 80% rpm.

j. Place test set LP SP switch in +10%.

k. Using adjusting socket, adjust low pressure governor (figure 5-8) one turn clockwise.

CAUTION

Extended operation with cabin dumped may cause damage to avionic equipment. Refer to T.O. 1A-7D-2-1 for cooling requirements of avionic equipment.

l. Place cabin pressure switch in CABIN DUMP.

m. Slowly advance throttle to MIL and stabilize.

n. Record tachometer indication in cockpit.

o. Retard throttle to 80% rpm.

p. Jam throttle to MIL.

q. Record peak tachometer indication in cockpit.

r. Repeat steps p and q to verify step q.

s. Check that peak rpm was between 100% and 101%.

5-12.3. Adjustment.

a. If rpm was within limits, perform the following:

(1) Place cabin pressure switch in CABIN PRESS.

(2) Place LP SP switch in center position.

(3) Using adjusting socket, adjust low pressure governor one turn counterclockwise.

(4) Perform postcheck (subparagraph 5-12.4).

b. If peak rpm was more than 101%, proceed as follows:

(1) Retard throttle to IDLE.

(2) Using adjusting socket, adjust high pressure governor (figure 5-8) 1/8-turn clockwise.

(3) Repeat steps n through s, subparagraph 5-12.2.

(4) Shut down engine (T.O. 1A-7D-2-1).

(5) Perform main fuel control linkage portion of control cambox rigging (paragraph 5-21).

(6) Start engine (T.O. 1A-7D-2-1).

(7) Repeat steps n through s, subparagraph 5-12.2 to verify adjustment.

c. If peak rpm was less than 100%, proceed as follows:

(1) Retard throttle to IDLE.

(2) Shut down engine (T.O. 1A-7D-2-1).

(3) Using adjusting socket, adjust high pressure governor (figure 5-8) 1/4-turn counterclockwise.

(4) Perform main fuel control linkage portion of cambox rigging (paragraph 5-21).

(5) Start engine (T.O. 1A-7D-2-1).

(6) Repeat steps n through s, subparagraph 5-12.2.

d. Retard throttle to IDLE.

e. Place cabin pressure switch in CABIN PRESS.

f. Place LP SP switch in center position.

g. Using adjusting socket, adjust low pressure governor one turn counterclockwise.

h. Perform NH idle speed check (paragraph 5-11).

i. Perform temperature limiter amplifier dynamic test (paragraph 7-9 or 7-10).

j. Perform NL maximum speed check (paragraph 5-14).

k. Perform acceleration/deceleration time checks (paragraph 5-17).

l. Perform power check (paragraph 4-12).

m. Perform manual fuel control operational checkout (paragraph 6-4).

5-12.4. Postcheck.

a. Shut down engine (T.O. 1A-7D-2-1).

b. Place test set POWER switch in OFF.

c. Disconnect test set from airplane.

d. Connect electrical connector to high pressure compressor tachometer generator and amplifier receptacle No. 3.

e. Secure high pressure governor adjustment with MS20995C20 lockwire.

f. Close accesses 5222-1 and 5222-2.

g. Record high pressure governor adjustment in engine log.

5-13. NL MAXIMUM SPEED ADJUSTMENT (USING 6872929 TEST SET).

Test Equipment Required

Figure & index No.	Name	AN type designation	Use and application
	Equipment required for engine operation		Operate engine
	Equipment required for 115-volt, 400-hertz, single-phase ac external electrical power		Connect external electrical power to test set
5-9	Reset tool	6798862 (Allison Division of General Motors, Indianapolis, Indiana) or 6872679 (Allison Division of General Motors, Indianapolis, Indiana)	Reset low pressure governor
	Socket	6798966 (Allison Division of General Motors, Indianapolis, Indiana)	Adjust low pressure governor
	Engine limiter test cable assembly	6872490 (Allison Division of General Motors, Indianapolis, Indiana)	Connect test set to engine and external power source
	Engine limiter test set	6872929 (Allison Division of General Motors, Indianapolis, Indiana)	Measure low pressure rotor speed
	Power cable adapter	6872727 (Allison Division of General Motors, Indianapolis, Indiana)	Connect test set power cable to airplane ARW-77 connector

a. Open accesses 5222-1 and 5222-2.

b. Set switches and controls on engine limiter test set as follows:

Control	*Position*
POWER switch	OFF
TACH SIM switch	OFF
SIM SIGNAL control	Full decrease
T1 control	Midrange

T3/T5.1 control	Full decrease
TEMP SELECTOR switch	CAL
T3/T5.1 SIM switch	OFF
T5.1 switch	NORMAL
T3 switch	NORMAL
LP SPEED switch	OFF
SQUAT switch	OFF
METER switch	USE
T1 SIM switch	OFF
TACHOMETER switch	USE
READ/CAL switch	CAL
ZERO ADJ switch	Full decrease
RPM SELECT switch	NHP
PROBE TRIM control	Full decrease
MODE switch	RESET
ACCEL START PRESET control	Centered

c. Remove dust cap from electrical receptacle marked A on temperature limited amplifier.

CAUTION

To prevent damage to engine components and test set, make sure that test set is connected to 115-volt, 400-hertz, single-phase ac power source. Make a pin-to-pin voltage check of the power source connector before connecting test set.

d. Connect engine limiter test set to airplane and external power source as shown in figure 5-9.

e. Place test set POWER switch in ON. Warm up for 10 minutes.

f. Check engine limiter test set as follows:

(1) Place METER switch in CHECK. Check milliammeter for 210 (±20) milliamperes. Place METER switch in USE.

(2) Check that TEMP meter indicates 575° (±1°)C (1,067° (± 2°)F).

(3) Place RPM SELECT switch in NLP. Check % RPM meter for 16.7% (±0.3%). Place TACHOMETER switch in USE.

(4) Place TACHOMETER switch in CHECK and RPM SELECT in NHP. Check % RPM meter for 100.0% (±0.3%).

g. Place RPM SELECT switch in NLP.

h. Place TEMP SELECT switch in T5.1.

i. Start engine (T.O. 1A-7D-2-1) and stabilize at IDLE.

j. Place limiter test set READ/CAL switch in READ.

k. Advance throttle to MIL and stabilize.

l. Record NL rotor speed indication on test set % RPM indicator.

m. Retard throttle to IDLE.

CAUTION

To prevent possible damage to low pressure governor reset holding pillar, do not use side loading forces when placing reset tool in reset or engage position. Make sure that reset tool is installed correctly.

n. Install reset tool on low pressure governor (figure 5-9).

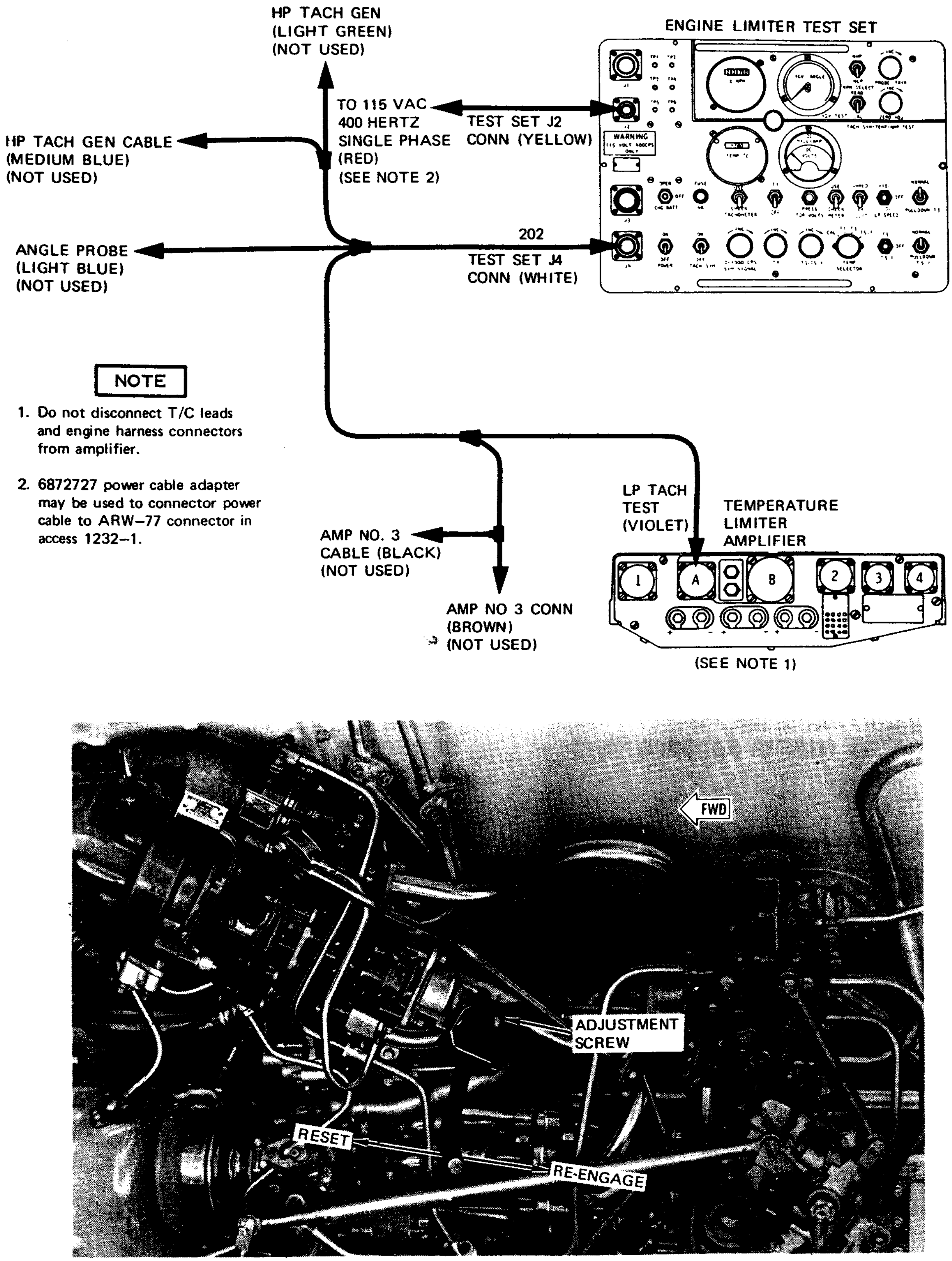
o. Pull lever forward to reset governor.

p. Advance throttle to MIL and stabilize for 3 minutes.

q. Check that NL rotor speed indicated on test set is 87.0% to 88.0% rpm.

NOTE

One turn of adjustment socket is approximately 2.7% rpm. Turn clockwise to increase and counterclockwise to decrease rpm.



NOTE

1. Do not disconnect T/C leads and engine harness connectors from amplifier.
2. 6872727 power cable adapter may be used to connector power cable to ARW–77 connector in access 1232–1.

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Figure 5-9. Adjustment; NL Maximum Speed

r. If not within limits, adjust low pressure governor with adjusting socket until rotor speed is 87.2% to 87.8% as shown on test set % RPM indicator.

s. Retard throttle to IDLE.

t. Pull aft on reset tool lever to engage low pressure governor reset.

u. Remove reset tool.

v. Advance throttle to MIL and check that low pressure governor has reset.

w. Retard throttle to IDLE.

x. Shut down engine (T.O. 1A-7D-2-1).

y. Place test set POWER switch in OFF.

z. Disconnect test set from airplane and external power source.

aa. Install dust cap on temperature limiter amplifier electrical receptacle A.

ab. Close accesses 5222-1 and 5222-2.

5-14. NL MAXIMUM SPEED ADJUSTMENT (USING 6893706 TEST SET).

Test Equipment Required

Figure & index No.	Name	AN type designation	Use and application
	Equipment required for engine operation		Operate engine
5-9	Reset tool	6872679 (Allison Division of General Motors, Indianapolis, Indiana)	Reset low pressure governor
	Socket	6798966 (Allison Division of General Motors, Indianapolis, Indiana)	Adjust low pressure governor
	Engine limiter test set	6893706 (Allison Division of General Motors, Indianapolis, Indiana)	Measure low pressure rotor speed

a. Open accesses 5222-1 and 5222-2.

b. Set switches and controls on engine limiter test set as follows:

Control	*Position*
POWER switch	OFF
SQUAT switch	OFF
IGV/CAL switch	IGV
TACH SIMULATED INPUTS control	Fully counter-clockwise
T1 SIMULATED INPUTS control	Fully counter-clockwise
T5 SIMULATED INPUTS control	Fully counter-clockwise
T5 switch	NORMAL
LP SP switch	Center position

c. Remove dust cap from electrical receptacle marked A on temperature limiter amplifier.

d. Connect engine limiter test set to airplane as shown in figure 5-7.

NOTE

When the test set POWER switch is placed in ON, the numerals 00 will appear in the lower portion of the test set display window. This 00 display indicates that SELF TEST has been selected.

When the test set has warmed up (maximum time of 20 minutes), it will begin the self-test function automatically.

After completion of self-test, the numbers 88.88 will be sequenced through the three rows in the display window. This sequencing will continue until a specific test is selected or test set POWER switch is placed in OFF.

e. Place POWER switch in ON. Warm up test set.

f. Start engine (T.O. 1A-7D-2-1) and stabilize at IDLE.

g. Place test set TEST switch in NEXT until 10 appears in TEST window display.

h. Check that T5 and NL indicator lights come on.

i. Advance throttle to MIL and stabilize.

j. Record NL rotor speed indication on test set NL display window.

k. Retard throttle to IDLE.

CAUTION

To prevent possible damage to low pressure governor reset holding pillar, do not use side loading forces when placing reset tool in reset or engage position. Make sure that reset tool is installed correctly.

l. Install reset tool on low pressure governor (figure 5-9).

m. Pull lever forward to reset governor.

n. Advance throttle to MIL and stabilize for 3 minutes.

o. Check that NL rotor speed indicated on test set NL display window is 87.0% to 88.0% rpm.

NOTE

One turn of adjustment socket is approximately 2.7% rpm. Turn clockwise to increase and counterclockwise to decrease rpm.

p. If not within limits, adjust low pressure governor with adjusting socket until rotor speed is 87.2% to 87.8% as shown on test set NL display window.

q. Retard throttle to IDLE.

r. Pull aft on reset tool lever to engage low pressure governor reset.

s. Remove reset tool.

t. Advance throttle to MIL and check that low pressure governor has reset.

u. Retard throttle to IDLE.

v. Shut down engine (T.O. 1A-7D-2-1).

w. Place test set POWER switch in OFF.

x. Disconnect test set from airplane and external power source.

y. Install dust cap on temperature limiter amplifier electrical receptacle A.

z. Close accesses 5222-1 and 5222-2.

5-15. P3 LIMITER CHECK.

Test Equipment Required

Figure & index No.	Name	AN type designation	Use and application
	Equipment required for engine operation		Operate engine
	Hose assembly	MS28741-5	Connect pressure gage to airplane system

Test Equipment Required — CONT

Figure & index No.	Name	AN type designation	Use and application
	Pressure gage (0 to 300 psig)	1010 (Manning, Maxwell, and Moore, Chicago, Illinois)	Measure P3 pressure
	Reset tool	6798862 (Allison Division of General Motors, Indianapolis, Indiana) or 6872679 (Allison Division of General Motors, Indianapolis, Indiana)	Reset P3 limiter
	Socket	6798965 (Allison Division of General Motors, Indianapolis, Indiana)	Adjust P3 limiter

a. Prepare airplane for engine operation (T.O. 1A-7D-2-1).

b. Open accesses 5222-2 and 5222-4.

c. Cut lockwire and remove cap assembly from P3 pressure tap in diffuser case-to-main fuel control P3 air tube (figure 5-10).

d. Connect hose assembly to P3 pressure tap.

e. Connect pressure gage to hose assembly.

f. Start engine (T.O. 1A-7D-2-1) and stabilize at IDLE.

g. Advance throttle to MIL and stabilize. Record P3 pressure indicated on pressure gage.

h. Retard throttle to IDLE.

CAUTION

To prevent possible damage to P3 limiter reset holding pillar, do not use side loading forces when placing limiter reset tool in reset or engage position. Make sure that reset tool is installed correctly.

i. Install reset tool on P3 limiter (figure 5-10).

j. Pull lever aft to reset P3 limiter.

k. Advance throttle to MIL and stabilize. P3 pressure shown on pressure gage should be 150 (±8) psig.

CAUTION

To prevent damage to engine components, P3 limiter adjustment must not exceed an accumulative total of three complete turns in any one direction.

NOTE

One turn equals approximately 50 psig. Record P3 pressure and the amount and direction of P3 limiter adjustment in the engine log.

l. If not within limits, adjust P3 limiter with adjusting socket, turning clockwise to increase and counterclockwise to decrease P3 pressure until 150 (±5) psig is reached.

m. Retard throttle to IDLE.

n. Pull forward on reset tool lever to engage P3 limiter reset.

o. Remove reset tool.

p. Advance throttle to MIL and check that P3 limiter reset is disengaged. P3 pressure should be about the value recorded in step g.

q. Shut down engine (T.O. 1A-7D-2-1).

r. Remove pressure gage and hose assembly from pressure tap.

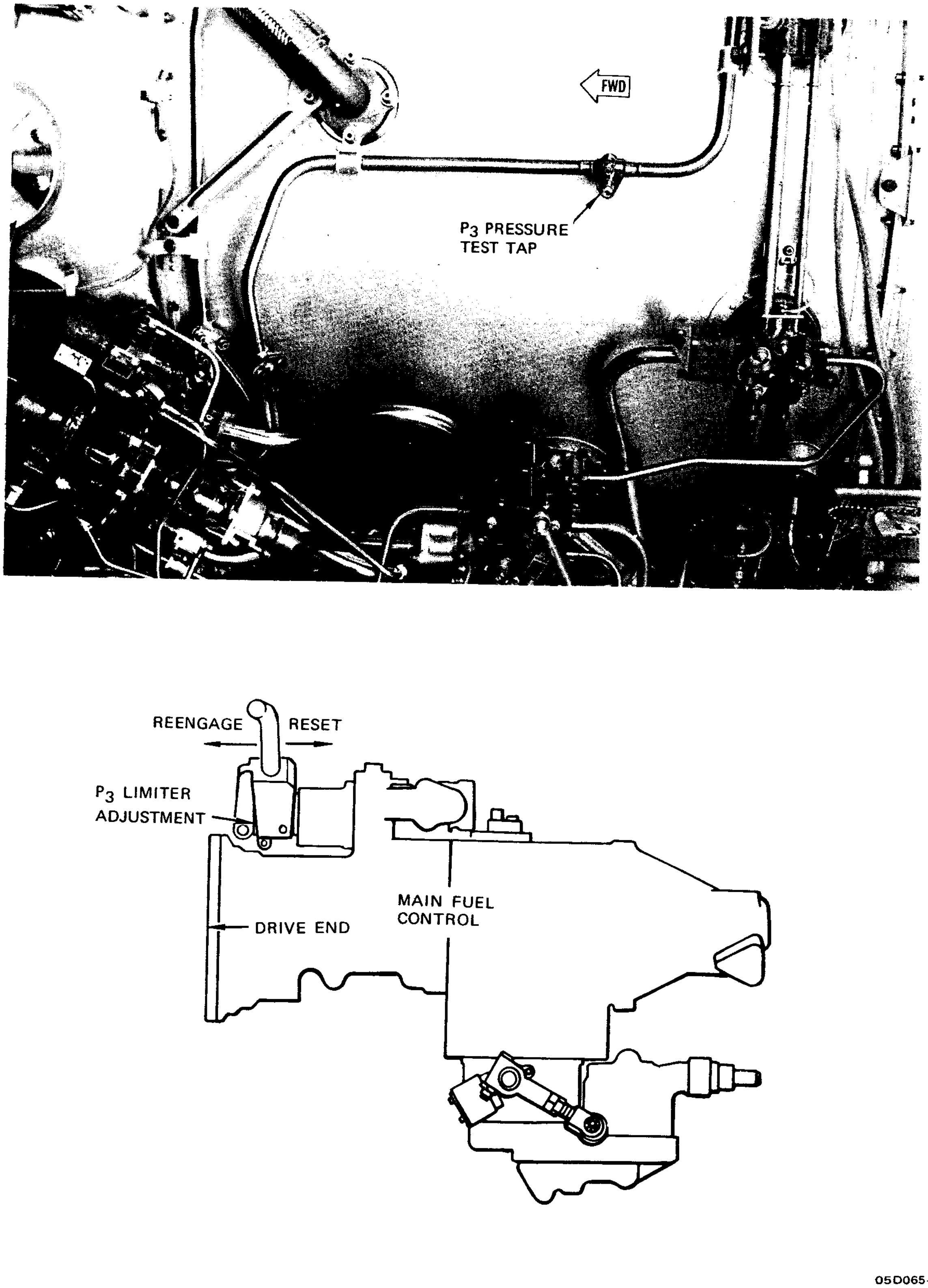

Figure 5-10. P3 Limiter Check

s. Install cap assembly on pressure tap. Secure with MS20995C32 lockwire.

t. Close accesses 5222-2 and 5222-4.

5-16. ACCELERATION/DECELERATION TIME CHECKS (USING 6872929 TEST SET).

Test Equipment Required

Figure & index No.	Name	AN type designation	Use and application
	Equipment required for 115-volt, 400-hertz, single-phase ac external electrical power		Connect external electrical power to test set
	Equipment required for engine operation		Operate engine
	Speed adjusting socket	6798964 (Allison Division of General Motors, Indianapolis, Indiana)	Adjust deceleration or acceleration stops
		or	
	Speed adjusting wrench	6872768 (Allison Division of General Motors, Indianapolis, Indiana)	Adjust deceleration or acceleration stops
	Engine limiter test set cable assembly	6872490 (Allison Division of General Motors, Indianapolis, Indiana)	Connect test set to engine and external power source
	Power cable adapter	6872727 (Allison Division of General Motors, Indianapolis, Indiana)	Connect test set power cable to airplane ARW-77 connector
	Engine limiter test set	6872929 (Allison Division of General Motors, Indianapolis, Indiana)	Measure high pressure rotor speed and acceleration and deceleration times

a. Open accesses 5222-1 and 5222-2.

b. Set switches and controls on engine limiter test set as follows:

Control	*Position*
POWER switch	OFF
TACH SIM switch	OFF
SIM SIGNAL control	Full decrease
T1 control	Midrange
T3/T5.1 control	Full decrease
TEMP SELECTOR switch	CAL
T5.1 switch	NORMAL
T3 switch	NORMAL
LP SPEED switch	OFF
SQUAT switch	OFF
METER switch	USE
T1 SIM switch	OFF
TACHOMETER switch	USE
READ/CAL switch	CAL
ZERO ADJ control	Full decrease
RPM SELECT control	NHP
PROBE TRIM control	Full decrease
T3/T5.1 SIM switch	OFF
ACCEL START control	Centered

c. Disconnect electrical connector from high pressure compressor tachometer generator.

CAUTION

To prevent damage to engine components and test set, ensure that test set is connected to 115-volt, 400-hertz, single-phase ac power source. Make a pin-to-pin voltage check of power source connector before connecting test set.

d. Connect engine limiter test set to airplane and external power source as shown in figure 5-6.

e. Place test set POWER switch in ON. Warm up for 10 minutes.

f. Check engine limiter test set as follows:

(1) Check that TIME display illuminates.

(2) Place METER switch in CHECK. Check milliammeter for 210 (±20) milliamperes. Place METER switch in USE.

(3) Check TEMP meter for 575° (±1°)C (1,067° (±2°)F).

(4) Place TACHOMETER switch in CHECK and RPM SELECT switch in NLP. Check % RPM meter for 16.7% (±0.3%).

(5) Place RPM SELECT switch in NHP. Check % RPM meter for 100% (±0.3%). Place TACHOMETER switch in USE.

g. Place TEMP SELECTOR switch in T5.1.

h. Start engine (T.O. 1A-7D-2-1) and stabilize at IDLE for 3 minutes.

NOTE

It is normal for acceleration time on a cold engine to be up to 15 seconds. A cold engine is one which has been shut down for 15 minutes or stabilized at idle for a minimum of 8 minutes. An acceleration/deceleration stop adjustment must be made in accordance with the following procedures.

Ambient air temperature must be taken in a location where engine or air-conditioning exhaust heat recirculation will not affect temperature.

i. Measure and record ambient air temperature.

j. Place MODE switch in ACCEL.

k. Adjust ACCEL START PRESET control until IDLE light starts to flicker, but before time display starts to count.

l. Place MODE switch in RESET.

m. Advance throttle to MIL and stabilize for 1 minute.

n. Record engine speed indication from test set % RPM indicator.

o. Set ACCEL STOP PRESET control to 1.5 below value recorded in step n.

p. Place MODE switch in DECEL.

q. Jam throttle to IDLE in 1 second or less.

NOTE

An improperly adjusted deceleration stop may result in failure of the engine to decelerate following throttle movement to IDLE.

r. If engine will not decelerate due to an improperly adjusted deceleration screw, perform the following:

(1) Place throttle in a position corresponding to about 90% rpm.

(2) Place manual fuel control switch in MAN.

(3) Slowly retard throttle to IDLE.

(4) Adjust deceleration adjustment screw (figure 5-11) 1/2-turn clockwise.

(5) Place manual fuel control switch in NORM.

(6) Repeat steps m through q.

s. Record time shown in TIME display.

t. Stabilize at IDLE for 1 minute.

u. Place MODE switch in RESET.

v. Place MODE switch in ACCEL.

CAUTION

Fast acceleration time can cause engine overtemperature during jam accelerations. Do not exceed TOT limits.

w. Jam throttle to MIL in 1 second or less.

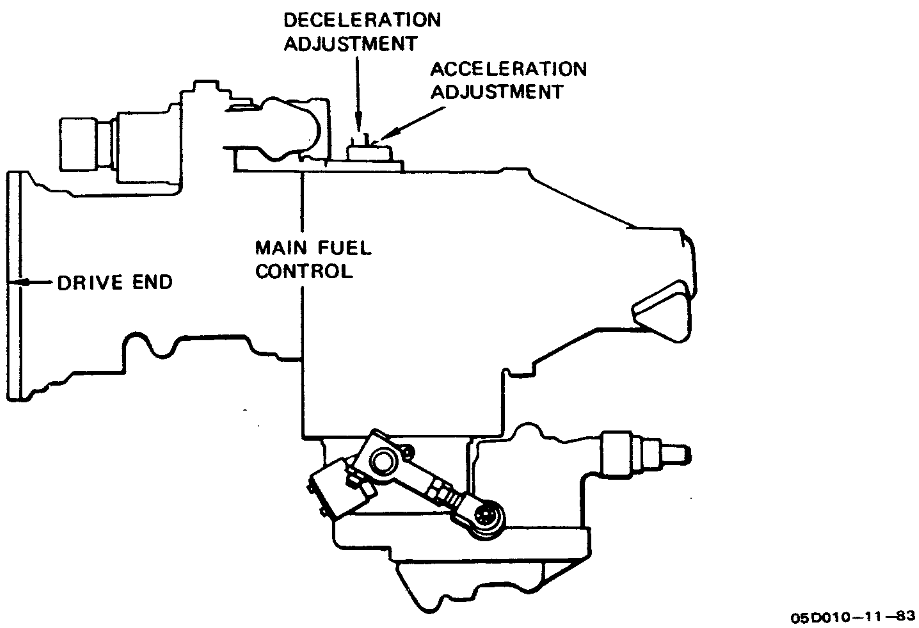

Figure 5-11. Time Check; Acceleration/Deceleration

x. Record time shown in TIME display.

y. Stabilize at MIL for 1 minute.

z. Place MODE switch in RESET.

NOTE

A variation of more than 1 second between any of the times recorded indicates a timing error.

aa. Repeat steps p through z twice and compute average of three accelerations and decelerations.

ab. Retard throttle to IDLE.

ac. Average acceleration time must be within 5.5 to 7.5 seconds. Average deceleration time must be within limits shown in figure 5-12.

NOTE

To increase acceleration or deceleration time, turn screws clockwise.

ad. Adjust acceleration and deceleration screws (figure 5-11) in 1/8-turn increments and repeat time checks (steps j through ac) until both are within limits.

ae. If acceleration screw was adjusted, perform T5 point dynamic test (paragraph 7-9 or 7-10).

af. Shut down engine (T.O. 1A-7D-2-1).

ag. Place test set POWER switch in OFF.

ah. Disconnect test set from airplane and external electrical power.

ai. Connect electrical connector to high pressure compressor tachometer generator.

aj. Close accesses 5222-1 and 5222-2.

Ambient Temperature °F	°C	Time (Seconds) Min	Max
–40	–40	3.5	5.5
–30	–34	3.6	5.6
–20	–29	3.7	5.7
–10	–23	3.8	5.8
0	–18	3.9	5.9
10	–12	4.0	6.0
20	–7	4.1	6.1
30	–1	4.2	6.2
40	4	4.3	6.3
50	10	4.4	6.4
60	16	4.5	6.5
70	21	4.6	6.6
80	27	4.7	6.7
90	32	4.8	6.8
100	38	4.9	6.9
110	43	5.0	7.0
120	49	5.1	7.1
130	54	5.2	7.2
140	60	5.3	7.3

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Figure 5-12. Time Limits; Engine Deceleration

5-17. ACCELERATION/DECELERATION TIME CHECKS (USING 6893706 TEST SET).

Test Equipment Required

Figure & index No.	Name	AN type designation	Use and application
	Equipment required for engine operation		Operate engine
	Speed adjusting socket		General repair
	Speed adjusting wrench	6872768 (Allison Division of General Motors, Indianapolis, Indiana)	Adjust deceleration or acceleration stops
	Engine limiter test set	6893706 (Allison Division of General Motors, Indianapolis, Indiana)	Measure high pressure rotor speed and acceleration and deceleration time

5-17.1. Preparation.

a. Open accesses 5222-1 and 5222-2.

b. Set switches and controls on engine limiter test set as follows:

Control	*Position*
POWER switch	OFF
SQUAT switch	OFF
IGV/CAL switch	IGV
TACH SIMULATED INPUTS control	Fully counter-clockwise
T1 SIMULATED INPUTS control	Fully counter-clockwise
T5 SIMULATED INPUTS control	Fully counter-clockwise
T5 switch	NORMAL
LP SP switch	Center position

c. Disconnect electrical connector from high pressure compressor tachometer generator.

d. Connect engine limiter test set to airplane as shown in figure 5-7.

NOTE

When the test set POWER switch is placed in ON, the numerals 00 will appear in the lower portion test set window display. This 00 display indicates that SELF TEST has been selected.

When the test set has warmed up (maximum of 20 minutes), it will begin the self-test function automatically.

After completion of self-test, the numbers 88.88 will be sequenced through three rows in the window display. This sequencing will continue until a specific test is selected or the test set POWER switch is placed in OFF.

e. Place POWER switch in ON. Warm up test set.

f. Start engine (T.O. 1A-7D-2-1) and stabilize at IDLE for 3 minutes.

NOTE

It is normal for acceleration time on a cold engine to be up to 15 seconds. A cold engine is one which has been shut down for 15 minutes or stabilized at idle for a minimum of 8 minutes. An acceleration/deceleration stop adjustment must be made in accordance with the following procedures.

Ambient air temperature must be taken in a location where engine or air-conditioning exhaust heat recirculation will not affect temperature indications.

g. Measure and record ambient air temperature.

5-17.2. Acceleration/Deceleration Checks (Model 803 or 805 Amplifier).

NOTE

For the acceleration/deceleration checks, the procedures must be followed in the sequence given. Failure to do so will result in the displays blinking or going blank.

a. Make sure switches are set as follows:

(1) SQUAT switch — OFF

(2) IGV/CAL switch — IGV

(3) T5 switch — NORMAL

(4) LP SP switch — Center position

b. Stabilize engine at IDLE.

c. Place TEST switch in NEXT until 15 appears in display window.

d. Check that NH and T5 indicator lights come on.

e. Advance throttle to MIL and stabilize for 3 minutes.

NOTE

The test set will wait 10 seconds for the engine to stabilize after engine reaches or exceeds 90% NH.

f. Deceleration test cannot be conducted until DL display comes on (after 10 seconds above 90%).

g. After DL display comes on, additional acceleration of engine or excessive instability on NH will cause the DL display to go momentarily blank. Deceleration check cannot be made with the DL display blank.

h. After DL display comes on, retard throttle to IDLE (1 second or less throttle movement). The following data will remain in the display window.

NOTE

These data will remain locked in until the next test sequence (acceleration) is selected.

(1) DL — Deceleration time from 1.5% NH below stabilized MIL NH to 75% NH.

(2) NH — Actual NH at which DL is taken.

(3) T5 — T5.1 at time of DC.

NOTE

An improperly adjusted deceleration stop may result in failure of the engine to decelerate after throttle movement to IDLE.

i. If engine will not decelerate due to an improperly adjusted deceleration screw, perform the following:

(1) Place throttle in a position corresponding to about 90% rpm.

(2) Place manual fuel control switch in MAN.

(3) Slowly retard throttle to IDLE.

(4) Adjust deceleration adjustment screw (figure 5-11) 1/2-turn clockwise.

(5) Place manual fuel control switch in NORM.

(6) Repeat steps e through h.

j. Record deceleration time (must be within the limits of figure 5-12).

NOTE

The acceleration test must be run just after the deceleration test. It cannot be performed unless preceded by the deceleration test.

k. Place TEST switch in NEXT until 16 appears in display window. This will release the data stored in display window from the deceleration, and will present actual T5 and NH.

NOTE

The following requirements apply to the acceleration check.

(1) AL display must be present.

(2) Engine speed (NH) must be 50% to 60%.

(3) After the AL display comes on, additional deceleration or excessive instability of the engine will cause the AL display to go momentarily blank. The acceleration check cannot be made with the AL display blank.

l. After AL display comes on, advance throttle to MIL (1 second or less throttle movement). The following data will remain in the display window.

(1) AL — Time to accelerate from stabilized idle to 1.5% NH below the stabilized intermediate power speed established, prior to deceleration check.

(2) NH — Actual NH at which AL is taken.

(3) T5 — T5.1 at time of AL.

m. Record acceleration time (must be within limits of 5.5 to 7.5 seconds).

n. Place TEST switch in NEXT until 17 appears in the display window. This will release the data displayed during the acceleration check and present current engine data.

o. Retard throttle to IDLE.

p. Average acceleration time must be within 5.5 to 7.5 seconds. Average deceleration time must be within limits shown in figure 5-12.

NOTE

To increase acceleration or deceleration time, turn screws clockwise.

q. Adjust acceleration and deceleration screws (figure 5-11) in 1/8-turn increments and repeat time checks (steps e through p) until both are within limits.

r. If acceleration screw was adjusted, perform T5 double datum dynamic test (paragraph 7-9 or 7-10).

s. Shut down engine (T.O. 1A-7D-2-1).

t. Place test set POWER switch in OFF.

u. Disconnect test set from airplane.

v. Connect electrical connnector to high pressure compressor tachometer generator.

w. Close accesses 5222-1 and 5222-2.

5-18. CONTAMINATED FUEL SYSTEM CHECK.

a. Remove fuel filter element (paragraph 5-26).

b. Check fuel filter element for contamination.

NOTE

If filter element is contaminated, perform steps c through x. If element is not contaminated, proceed to step y.

c. Open access 5222-2.

d. Remove bolts (1, figure 5-13) and nuts, and disconnect clamps securing pilot fuel tube.

e. Remove bolts (2) and washers (3).

f. Remove nuts (4) securing bonding lead (5) and lockplate (6).

g. Remove bolts (7) and lockwashers (8).

h. Pull manifold tubes (9 and 10) from elbow connectors by pushing them further into adjacent connector. Remove packings (11).

i. Remove nuts (12) and washers (13).

j. Remove No. 8 elbow connector (14).

k. Remove packings (15, 16, and 17) and retainer ring (18).

l. Remove spray control distributor (19), packings (20), fuel strainer tube (21), and packings (22) from fuel nozzle.

m. Inspect spray control distributor and fuel strainer tube for contamination. If contamination is present, reject engine.

n. Using new packings (22), install fuel strainer tube (21) in fuel nozzle.

o. Using new packings (20), install spray control distributor (19) in fuel nozzle.

p. Place new retainer ring (18) and packing (17) in housing.

q. Place new packing (16) on pilot fuel tube.

r. Place new packing (15) on locating adapter.

s. Place No. 8 elbow connector (14) in position and secure with washers (13) and nuts (12).

t. Install new packings (11) on manifold tubes (9 and 10).

u. Secure housing, main fuel tube, and standoff bracket to No. 8 elbow connector with lockwashers (8) and bolts (7).

NOTE

Manifold tubes must be push fit into elbow connectors. Do not use lockplates to force tubes into position.

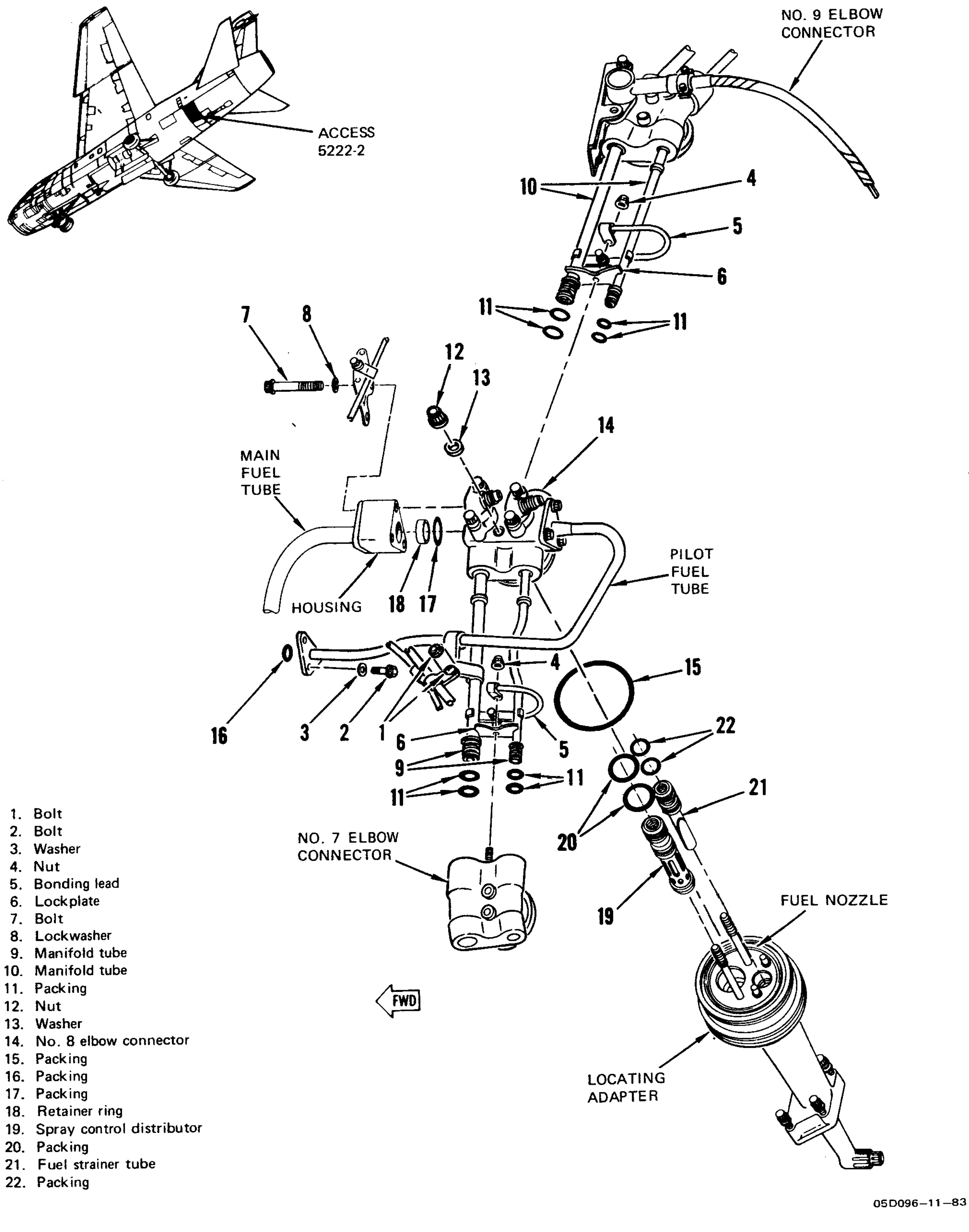
v. Partially withdraw manifold tubes and insert them into adjacent elbow connector. Secure tubes, lockplates (6), and bonding leads (5) with nuts (4).

w. Secure fuel tube with washers (3) and bolts (2).

x. Connect clamps with bolts (1).

y. Install fuel filter element (paragraph 5-26).

z. Close access 5222-2.



1. Bolt
2. Bolt
3. Washer
4. Nut
5. Bonding lead
6. Lockplate
7. Bolt
8. Lockwasher
9. Manifold tube
10. Manifold tube
11. Packing
12. Nut
13. Washer
14. No. 8 elbow connector
15. Packing
16. Packing
17. Packing
18. Retainer ring
19. Spray control distributor
20. Packing
21. Fuel strainer tube
22. Packing

Figure 5-13. Fuel System Check; Contaminated

5-19. ENGINE FUEL SYSTEM BLEEDING.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
	GGG-W-686	Torque wrench, 10 to 150 inch-pounds	Measure torque
	6872296 (Allison Division of General Motors, Indianapolis, Indiana)	Engine fuel system air bleed valve (2)	Bleed entrapped air from engine fuel system
	or		
	6872547	Engine fuel system air bleed valve (2)	Bleed entrapped air from engine fuel system
	or		
	6798863		
	or		
5-15	Local manufacture	Engine fuel system air bleed tool (2)	Bleed entrapped air from engine fuel system

NOTE

This procedure must be performed after engine installation, anytime the fuel system is disturbed or component replaced, or when engine has been starved of fuel.

a. Open accesses 5222-1, 6222-2, and 6122-3.

b. Remove cap (1, figure 5-14) from drain valve. Attach a No. 4 drain hose and run free end to container.

c. Cut lockwire and remove two caps (2) from airflow control.

d. Install engine fuel system air bleed valves on airflow control.

WARNING

Make sure that airplane and container used for draining fuel are grounded. Refer to T.O. 00-25-172 for additional precautions. Fire or explosion may occur, causing injury to personnel or damage to equipment if improper ground is used.

e. Install No. 4 hoses on air bleeds and place free end in container.

f. Place fuel master lever in ON.

g. Open drain valve (3) until a steady, air-free flow of fuel is obtained; then, close valve.

h. Remove drain hose from filter and install cap (1).

i. Start engine (T.O. 1A-7D-2-1) and stabilize at IDLE.

j. Open valves on air bleed tools and bleed fuel system until a steady, air-free flow of fuel is obtained.

CAUTION

Engine automatic limiters are inoperative when manual fuel control is selected. Tachometer and turbine outlet temperature indicators shall be monitored to make sure that limits are not exceeded. If rpm decreases when switching from NORM to MAN, return fuel control switch to NORM immediately. Do not attempt to maintain rpm with the throttle while in MAN. If rpm decreases below 48%, shut down immediately. Advancing throttle in MAN below IDLE rpm may cause overtemperature.

k. Advance throttle for 60% to 65% rpm.

l. Place fuel control switch in MAN and continue bleeding fuel until a steady, air-free flow of fuel is obtained.

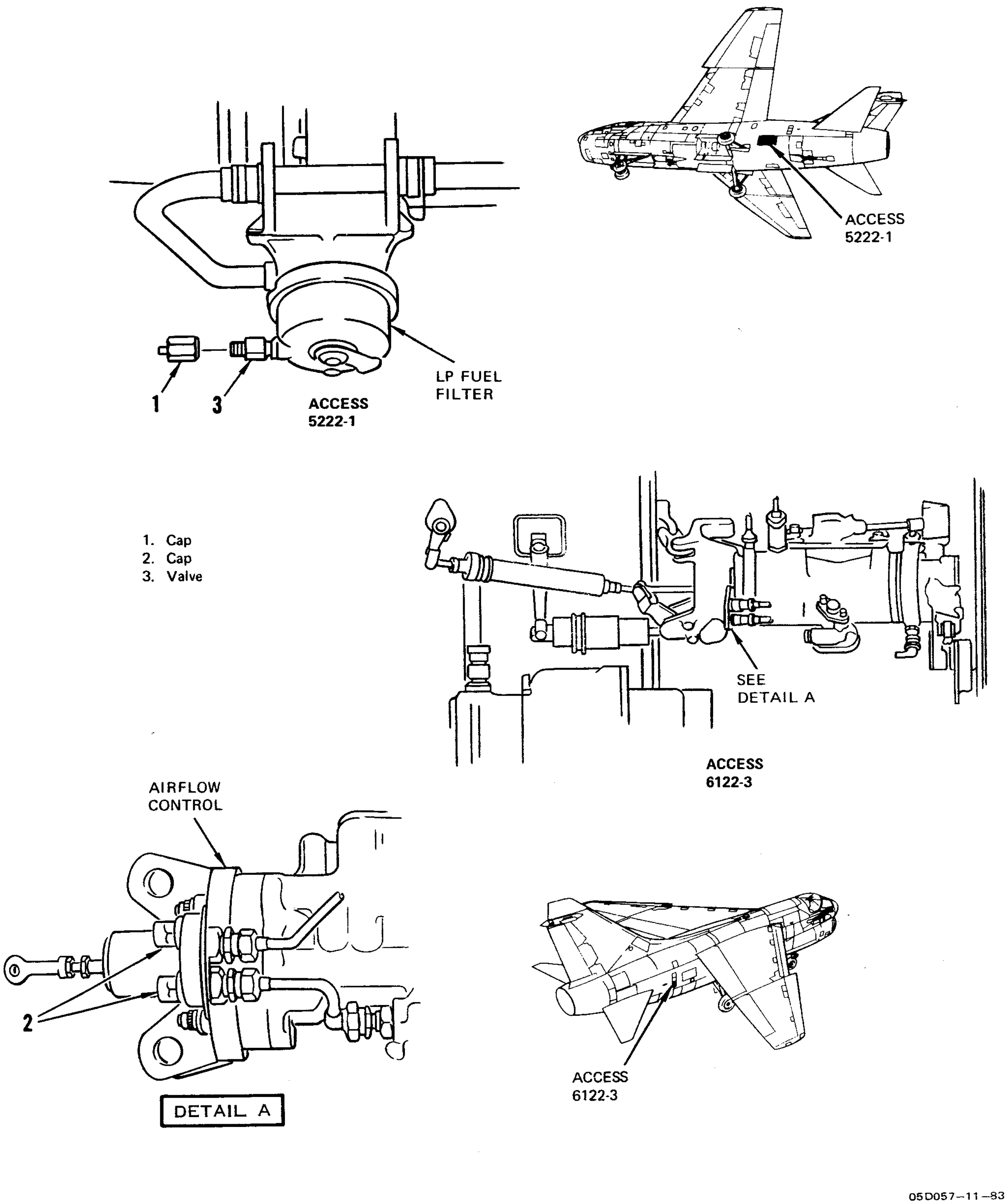


Figure 5-14. Fuel System Bleeding; Engine

m. Place fuel control switch in NORM.

n. Close air bleed tool valves.

o. Retard throttle to IDLE.

p. Shut down engine (T.O. 1A-7D-2-1).

q. Remove hose and fuel system air bleed valves from airflow control.

r. Install caps (2) on airflow control. Tighten caps to 120 inch-pounds torque. Secure with MS20995C32 lockwire.

s. Close accesses 5222-1, 6222-2, and 6122-3.

5-20. ENGINE FUEL SYSTEM AIR BLEED TOOL MANUFACTURE. In the event engine fuel system air bleed valves are not available, a suitable bleed tool may be locally manufactured. See figure 5-15 for details.

5-21. CONTROL CAMBOX RIGGING.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
	GGG-W-686	Torque wrench, 10 to 150 inch-pounds	Indicate torque
	6798854 (Allison Division of General Motors, Indianapolis, Indiana)	Rigging pin (2)	Hold input shafts in a fixed position when engine control linkage is adjusted
	6798964 (Allison Division of General Motors, Indianapolis, Indiana)	Adjusting socket	Adjust square head micromatic bolts
	or		
	6872768 (Allison Division of General Motors, Indianapolis, Indiana)	Speed adjusting wrench	Adjust square head micromatic bolts

WARNING

Avoid radiation contamination by adhering to exposure limits. For physical contact with the oil tank source tube, maximum safe exposure time is 15 minutes at one time or a total of 20 minutes per week. At a distance of 12 inches from the source tube, maximum time is 3.3 hours per week. There is no exposure time limit 3 feet from source tube. Deviations from these limits shall be approved by the base medical service. Personnel working with or near this source tube shall become familiar with the procedures in T.O. 00-110N-11.

CAUTION

To prevent improper adjustment, do not tighten micromatic bolt locking nut with rigging pin installed.

NOTE

The following procedures may be completed individually or sequentially as required.

5-21.1. HP Fuel Shutoff Valve. (Figure 5-16.)

a. Open access 5222-2.

b. Place throttle in MIL and insert rigging pin in control cambox hole 55.

CAUTION

The cambox output lever stop is preset during bench test and shall not be changed. If setting is moved, improper operation will result.

c. Check that cambox output lever engages stop and pointer on HP fuel shutoff valve lever (1) aligns with or is close to mark on valve.

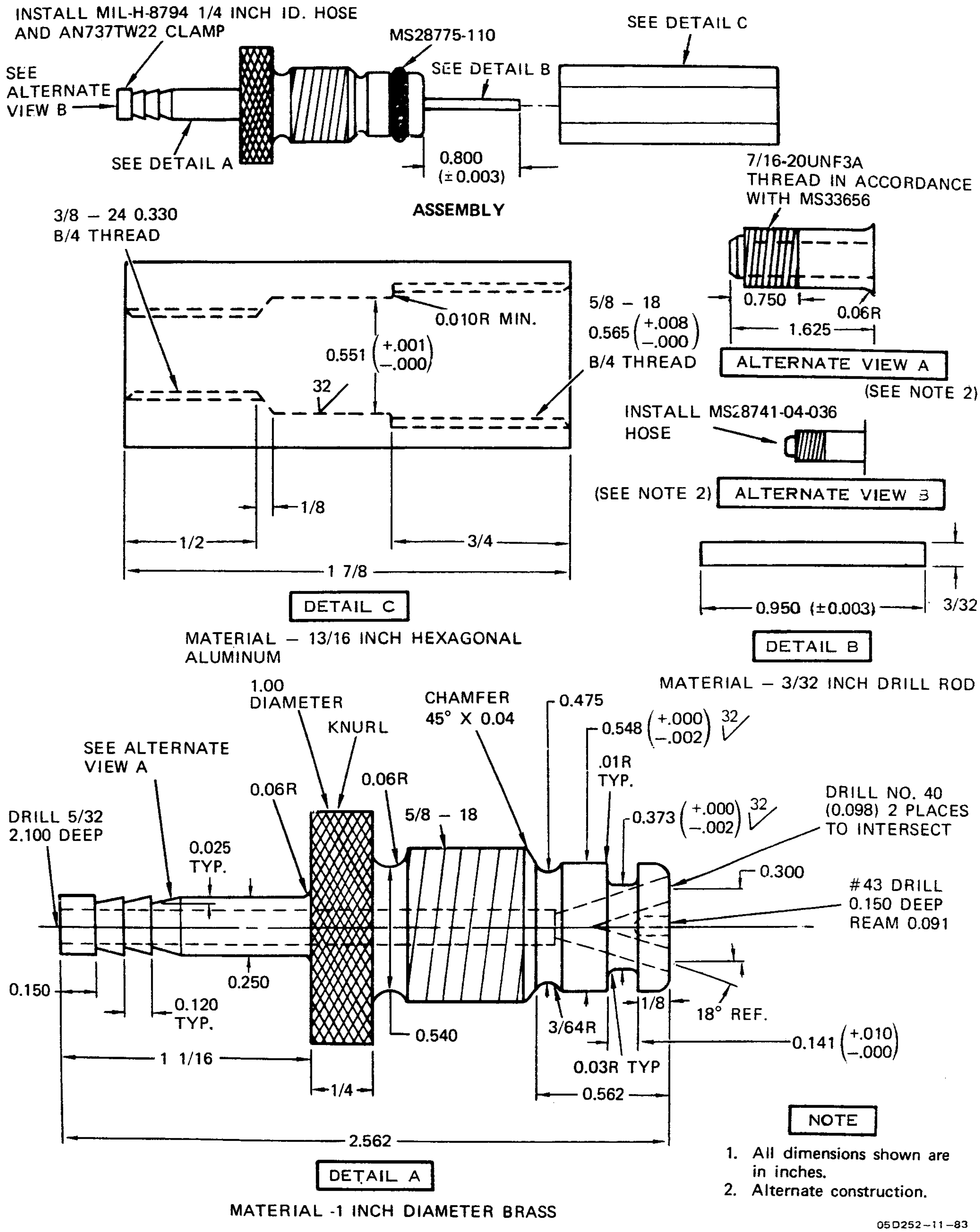
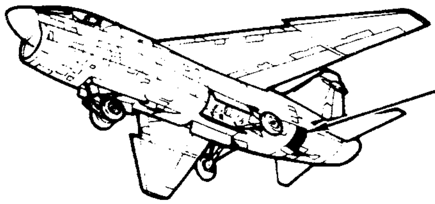
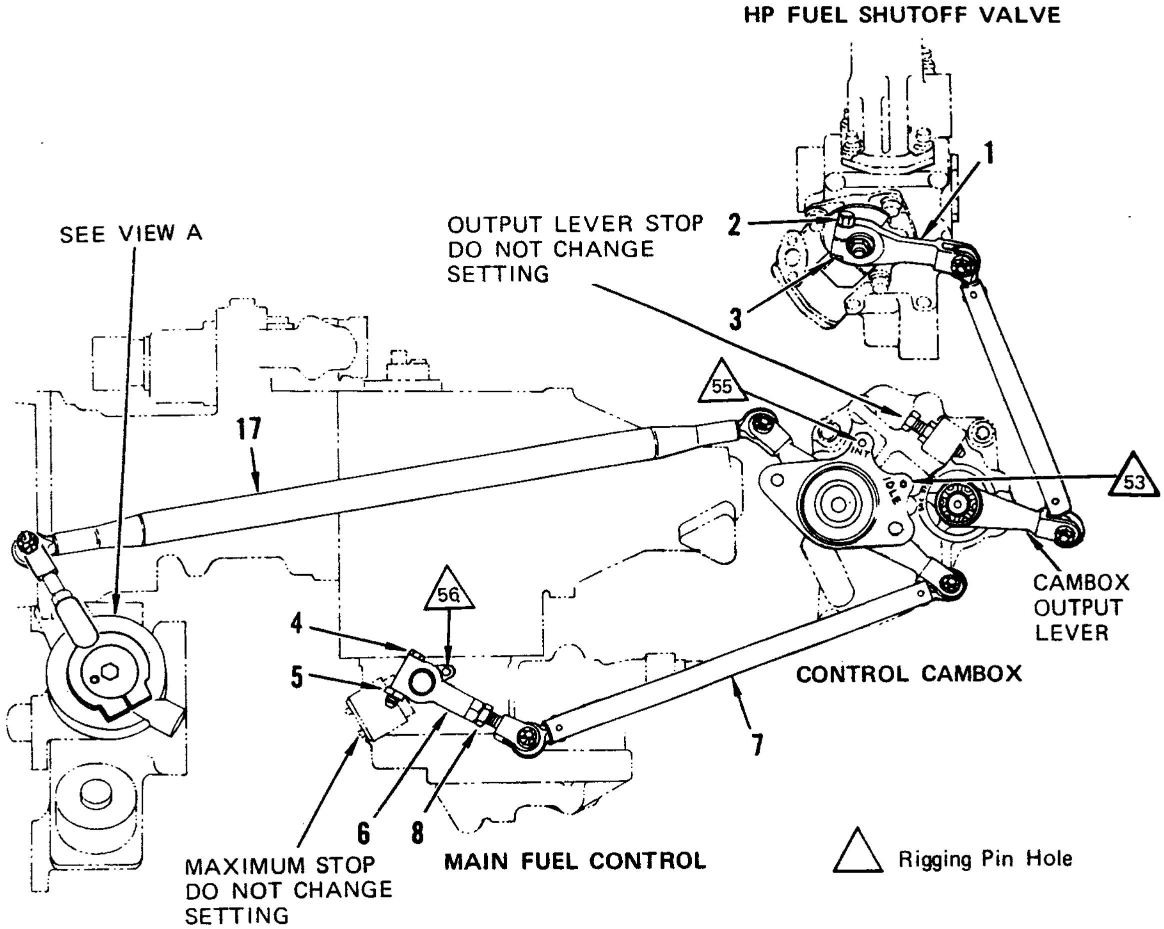


Figure 5-15. Air Bleed Tool; Engine Fuel System





1. HP fuel shutoff valve lever
2. Micromatic adjusting bolt
3. Locking nut
4. Micromatic adjusting bolt
5. Locking nut
6. Main fuel control lever
7. Main fuel control operating rod
8. Locking nut
9. Minimum stop screw
10. Micromatic adjusting bolt
11. Locking nut
12. Stop lever
13. Maximum stop screw
14. Cotter pin
15. Nut
16. Bolt
17. Manual fuel control operating rod
18. Locking nut
19. Clevis

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Figure 5-16. Rigging; Control Cambox (Sheet 1 of 2)

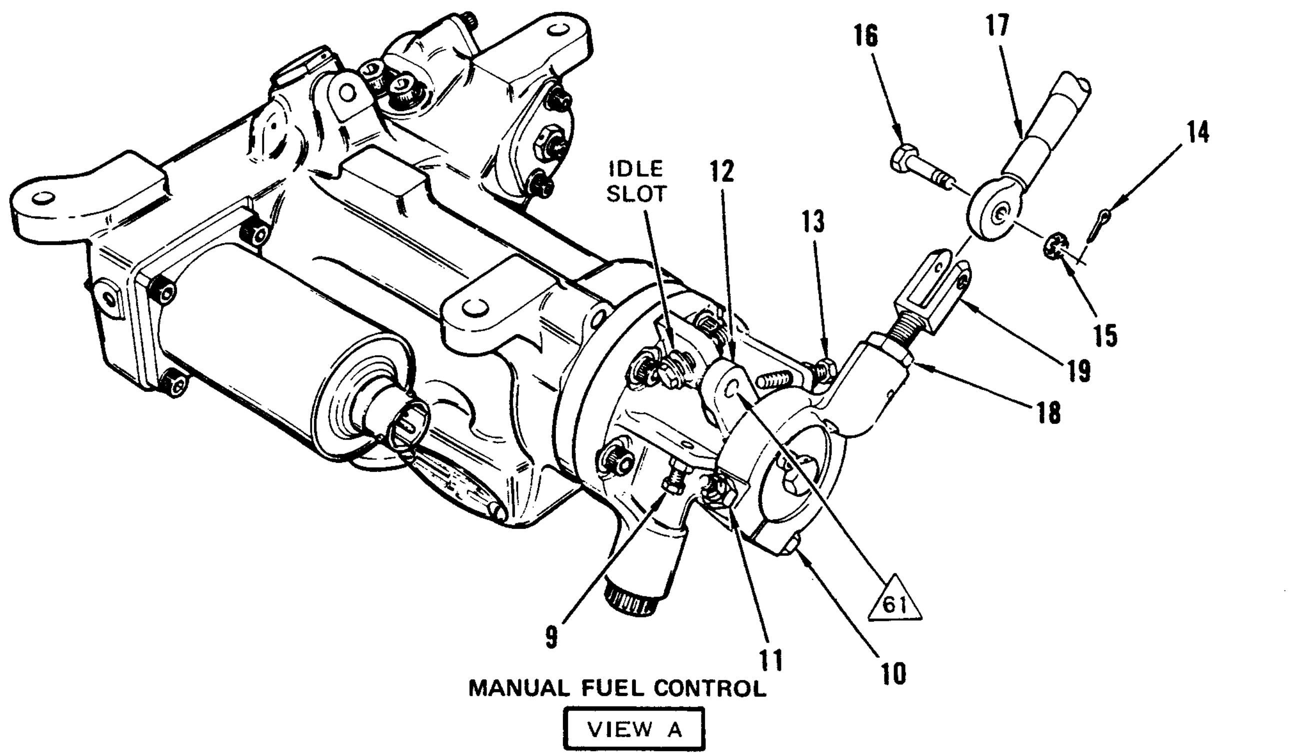


Figure 5-16. Rigging; Control Cambox (Sheet 2)

NOTE

Turn micromatic adjusting bolt clockwise to move pointer counterclockwise.

Use two wrenches, one on micromatic adjusting bolthead and one on locking nut. Turn both in the same direction to adjust micromatic bolt.

d. If adjustment is required, hold micromatic adjusting bolt (2) and loosen locking nut (3) only enough to relieve clamping force. Adjust micromatic bolt until pointer on shutoff valve aligns with or is close to OPEN mark.

e. Remove rigging pin from hole 55.

CAUTION

To prevent damage to fuel shutoff valve shaft, make sure that micromatic bolthead is flush with arm before tightening locking nut.

f. Hold adjusting bolt and tighten locking nut to 40 (+2, −3) inch-pounds torque.

g. Place throttle in OFF. Check that pointer on valve lever aligns with or travels beyond SHUT mark.

h. If no further rigging is required, perform postrigging procedure (subparagraph 5-21.4).

5-21.2. Main Fuel Control Linkage. (Figure 5-16.)

a. Open access 5222-2.

b. Place throttle in IDLE.

c. Insert rigging pin in control cambox hole 53.

d. Check that rigging pin can be inserted freely in main fuel control hole 56.

NOTE

Turn micromatic adjusting bolt clockwise to turn shaft clockwise.

Use two wrenches, one on micromatic adjusting bolthead and one on locking nut, and turn bolt in same direction to adjust micromatic bolt.

e. If adjustment is required, hold micromatic adjust bolt (4) and loosen locking nut (5) only enough to relieve clamping force. Adjust micromatic bolt until rigging pin can be inserted freely in main fuel control hole 56.

f. Remove rigging pin from hole 56.

CAUTION

To prevent damage to main fuel control throttle shaft, make sure that micromatic adjusting bolthead is flush with arm before tightening locking nut.

g. Hold adjusting bolt and tighten locking nut to 40 (+2, −3) inch-pounds torque.

h. Check that rigging pin can be inserted freely in main fuel control hole 56.

i. Remove rigging pins from holes 53 and 56.

j. Advance throttle to MIL and then back off slightly.

NOTE

The purpose of the 0.002-inch shim is to ensure the fuel control lever is against the maximum stop and not against the cambox stop. It is not intended that a 0.002-inch gap be set at this point.

k. Insert 0.002-inch shim between main fuel control lever (6) and maximum stop. Advance throttle (in cockpit) to MIL. Check that shim is gripped by lever and that rigging pin can be inserted in control cambox hole 55. Remove shim.

CAUTION

To prevent damage to engine, never adjust the maximum stopscrew.

l. If adjustment is required, proceed as follows:

(1) Disconnect main fuel control operating rod (7) from main fuel control lever by removing cotter pin, nut, spacer, and bolt.

NOTE

If rigging pin cannot be inserted with the shim trapped, the main fuel control lever is too short; if the shim is not trapped, the lever is too long.

(2) Loosen locking nut (8) and adjust main fuel control lever length to make up for about half the misalignment error at the rigging pin hole.

(3) Temporarily connect operating rod to lever by installing bolt. Repeat steps b through l until requirements are met.

(4) Place throttle in midquadrant.

NOTE

Thread on fork end of main fuel control lever must be visible through inspection hole in lever.

(5) Align fork end of control lever with rod

end and tighten locking nut.

(6) Connect operating rod to lever with bolt, spacer, and nut. Tighten nut to between 5 and 45 inch-pounds. Secure with new cotter pin.

m. Remove shim and rigging pin from hole 55.

n. If no further rigging is required, perform postrigging procedure (subparagraph 5-21.4).

5-21.3. Manual Fuel Control Linkage. (Figure 5-16.)

NOTE

This procedure is a static adjustment to be used only if the manual fuel control is replaced.

a. Open access 5222-2.

b. Back out minimum stopscrew (9) to a position flush with casting.

c. Place throttle in IDLE.

d. Insert rigging pin in hole 53.

e. Check that rigging pin can be easily inserted in hole 61 to engage idle slot.

f. If adjustment is required, proceed as follows:

NOTE

Use two wrenches, one on micromatic bolthead and one on locking nut. Turn both in the same direction to adjust micromatic bolt.

(1) Hold micromatic adjusting bolt (10), and loosen locking nut (11), only enough to relieve clamping force. Adjust micromatic bolt until rigging pin can be easily inserted in hole 61 to engage idle slot.

CAUTION

To prevent improper adjustment, do not tighten locking nut with rigging pin installed.

(2) Remove rigging pin from hole 61.

CAUTION

To prevent damage to manual fuel control throttle shaft, make sure that micromatic bolthead is flush with arm before tightening locking nut.

(3) Hold micromatic adjusting bolt (10) and tighten locking nut (11) to 55 (±5) inch-pounds torque.

g. Remove rigging pins from holes 53 and 61.

NOTE

A new manual fuel control received from manufacturer or overhaul facility will have the maximum stopscrew set at a point equal to military fuel flow. Other controls will have this screw backed out flush with casting.

h. If the maximum stopscrew is set at the military position, proceed as follows:

(1) Place throttle in MIL.

(2) Check that stop lever (12) contacts maximum stopscrew (13). Make sure rigging pin can be easily inserted in hole 55.

(3) Remove rigging pin from hole 55.

(4) Place throttle in OFF.

i. If step h is performed and conditions are not met, proceed as follows:

(1) Remove cotter pin (14), nut (15), and bolt (16). Disconnect manual fuel control operating rod (17).

(2) Loosen locking nut (18) and adjust clevis (19) as required. Align fork of clevis with rod end and tighten locking nut.

(3) Temporarily attach operating rod to clevis with bolt and nut.

(4) Repeat steps c through h until requirements are met.

(5) Check that threads are visible through lever inspection hole.

(6) Tighten locking nut (18) 40 to 45 inch-pounds torque.

(7) Connect operating rod (17) to clevis with bolt (16) and nut (15).

(8) Tighten nut 5 to 45 inch-pounds torque. Secure with new cotter pin (14).

j. Place throttle in OFF.

k. Perform postrigging procedure (subparagraph 5-21.4).

5-21.4. Postrigging.

a. Check that rigging pins are removed.

b. Check throttle for freedom of movement.

c. Perform manual fuel control operational checkout (paragraph 6-4).

d. Close access 5222-2.

5-22. LOW PRESSURE FUEL FILTER DRAINING.

a. Open access 5222-1.

b. Make sure fuel master lever is in OFF.

WARNING

Make sure airplane and container used for draining fuel are grounded. Refer to T.O. 00-25-172 for additional precautions. Fire or explosion may occur causing injury to personnel or damage to equipment if improper ground is used.

c. Remove cap (1, figure 5-14) from low pressure fuel filter drain valve and attach No. 4 drain hose.

d. Place free end of hose in suitable container and open valve.

e. Disconnect quick-disconnect at left motive flow line and hold valve open to allow fuel to drain.

f. Connect quick-disconnect as follows:

(1) Align the halves and push them together until locking fingers rest against locking ring.

(2) Pull sliding collar on female coupling half back to allow locking fingers to expand.

(3) Slide coupling halves together until locking fingers have passed over locking ring.

(4) Release sliding collar and observe that it passes over and compresses locking fingers.

NOTE

Do not grasp or hold sliding collar when checking coupling. Force required to retract sliding collar and unlock coupling is small and disconnect could result.

(5) Check that coupling is properly locked by pulling and pushing on 90° elbow attached to female coupling half.

g. Close valve, disconnect hose, and install cap. (1).

h. Close access 5222-1.

5-23. FUEL BOOST PUMP REMOVAL AND INSTALLATION.

For fuel boost pump removal and installation, refer to T.O. 1A-7D-2-6.

5-24. LP FUEL PUMP REMOVAL AND INSTALLATION.

CAUTION

To prevent damage to tubes and decrease the possibility of leakage, observe precautions (paragraph 1-18) when removing or installing fuel, oil, or air tubing.

5-24.1. Removal. (Figure 5-17.)

a. Open accesses 5222-1 and 5222-2.

b. Make sure fuel master shutoff is in OFF.

c. Drain low pressure fuel filter (paragraph 5-22).

d. Disconnect electrical connector (1).

e. Remove tubes (2 and 3).

f. Disconnect bonding cable (6) from tube.

g. Disconnect two Wiggins couplings (7) (paragraph 1-16), and remove tube (8).

h. Remove nuts (9), washers (10), brackets (11), switch assembly (12), tube (13), and gasket (14).

i. Remove fuel flow transmitter (paragraph 3-28).

j. Remove tube (15) and packings (16).

k. Disconnect tube (17).

l. Remove bolts (18), lockwashers (19), manifold (20), packings (21), and retainer rings (22).

m. Remove housing (23) from connector bracket.

n. Remove bolts (24) and lockwashers (25).

o. Remove bolts (26), lockwashers (27), tube (28), and packings (29).

p. Remove nuts (30) and bracket (31). Disconnect brackets (32 and 33) and remove LP fuel pump (34) and packing (35).

5-24.2. Installation. (Figure 5-17.)

a. Install new packing (33) on pump mounting flange.

b. Apply MIL-L-7808 or MIL-L-23699 oil to pump drive splines and mating splines in gearbox.

c. Position LP fuel pump (32) on gearbox.

d. Place brackets (31, 30, and 29) in position and secure brackets and pump to engine with nuts (28).

e. Place packings (27) on tube (26), secure tube to pump and drain block with lockwashers (25) and bolts (24).

f. Secure brackets together with lockwashers (23) and bolts (22).

g. Place housing (21) in connector bracket.

h. Place new retainer rings (20) and new packings (19) in manifold (18).

i. Place manifold in position on LP fuel pump and secure with lockwashers (17) and bolts (16).

j. Connect tube (15).

k. Using new packings (14), install tube (13).

l. Install fuel flow transmitter (paragraph 3-28).

m. Install new gasket (12) on pump flange.

n. Install tube (11), switch assembly (10), and brackets (9) on pump mounting studs and secure with washers (8) and nuts (7).

NOTE

Ensure mounting studs are fully seated before installing tube, switch assembly, and brackets.

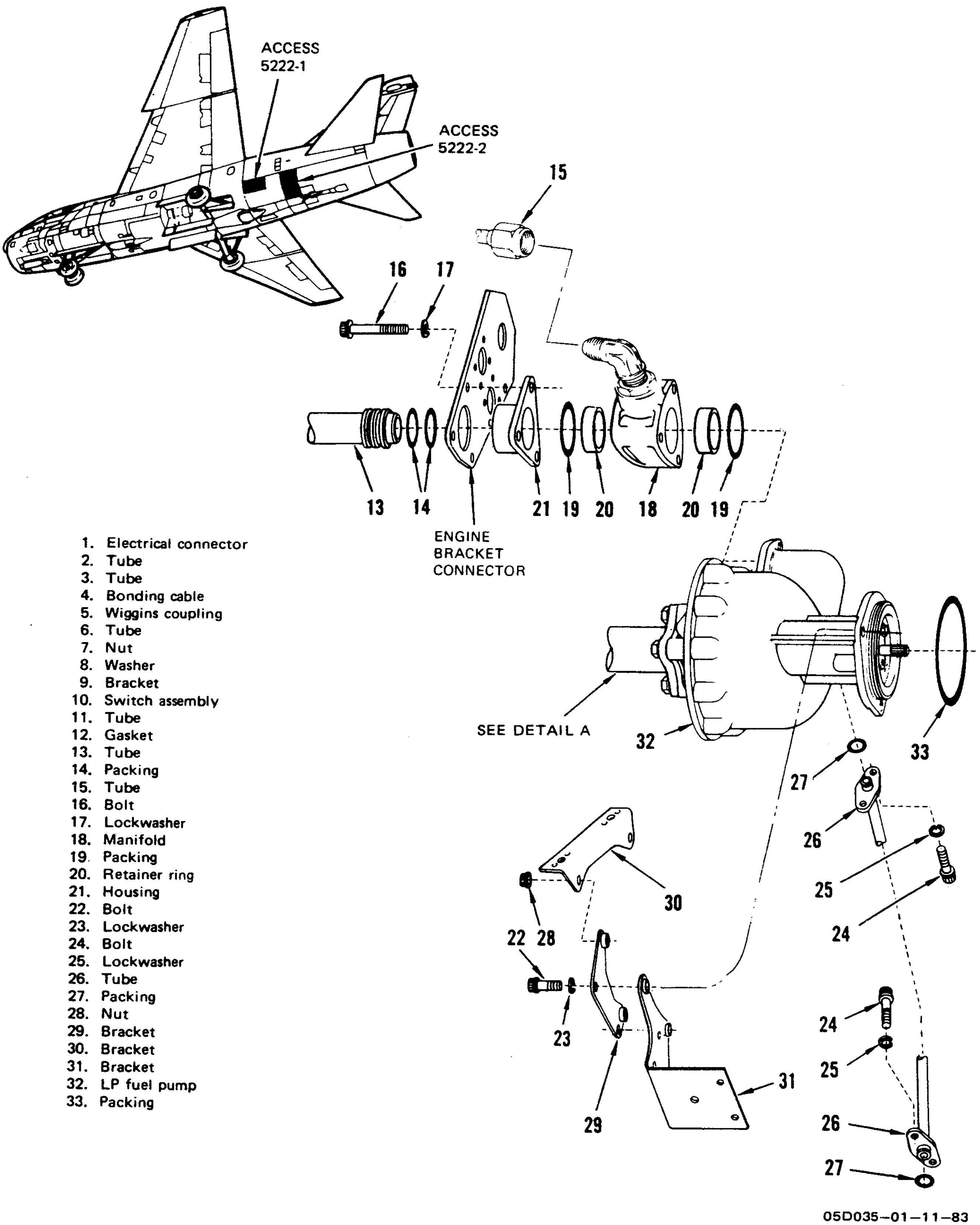
o. Connect tube (6) with two Wiggins couplings (5) (paragraph 1-16).

p. Connect bonding cable (4).

q. Install tubes (2 and 3).

r. Connect electrical connector (1) to pressure switch.

s. Bleed engine fuel system (paragraph 5-19) and check for leaks.



1. Electrical connector
2. Tube
3. Tube
4. Bonding cable
5. Wiggins coupling
6. Tube
7. Nut
8. Washer
9. Bracket
10. Switch assembly
11. Tube
12. Gasket
13. Tube
14. Packing
15. Tube
16. Bolt
17. Lockwasher
18. Manifold
19. Packing
20. Retainer ring
21. Housing
22. Bolt
23. Lockwasher
24. Bolt
25. Lockwasher
26. Tube
27. Packing
28. Nut
29. Bracket
30. Bracket
31. Bracket
32. LP fuel pump
33. Packing

Figure 5-17. Removal and Installation; LP Fuel Pump (Sheet 1 of 2)

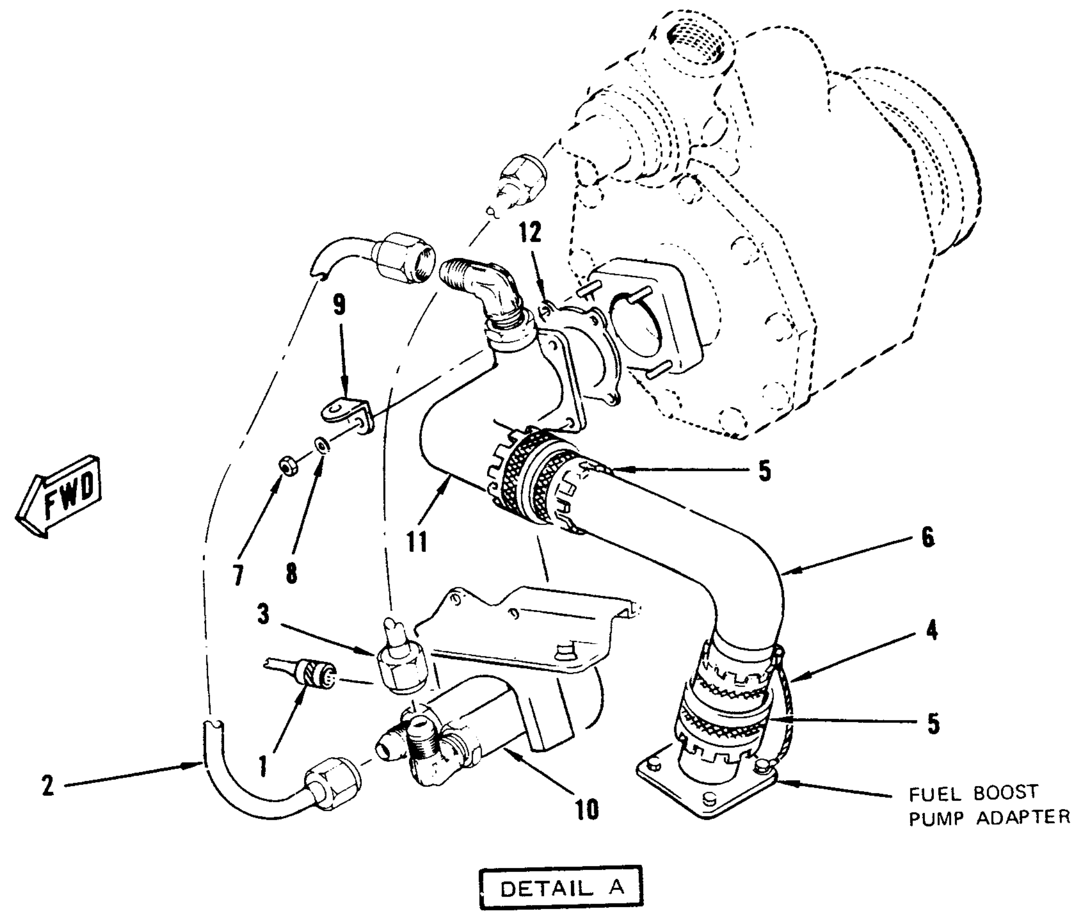


Figure 5-17. Removal and Installation; LP Fuel Pump (Sheet 2)

t. Close accesses 5222-1 and 5222-2.

5-25. FUEL FILTER ASSEMBLY REMOVAL AND INSTALLATION.

CAUTION

To prevent damage to tubes and decrease the possibility of leakage, observe precautions (paragraph 1-18) when removing or installing fuel, oil, or air tubing.

5-25.1. Removal. (Figure 5-18.)

a. Open access 5222-1.

b. Make sure fuel master lever is in OFF.

c. Drain low pressure fuel filter (paragraph 5-22), except leave cap (1) removed.

d. Remove bolts (2), lockwashers (3), and flat washers (4). Remove filter to transmitter tube (5), retaining ring (6), packing (7), sleeve (8), and packings (9).

e. Remove bolts (10) and lockwashers (11). Disconnect airflow control to filter tube (12) and remove packing (13).

f. Remove bolts (14) and lockwashers (15). Disconnect filter to HP fuel pump tube (16) and remove packing (17).

g. Remove bolts (18), flat washers (19), and lockwashers (20) securing fuel flow transmitter bracket (21) to filter.

h. Remove bolts (22) and lockwashers (23) securing filter assembly to mount.

i. Remove bolts (24), lockwashers (25), and flat washers (26) securing filter assembly to engine.

j. Remove fuel filter assembly (27).

5-25.2. Installation. (Figure 5-18.)

a. Ensure LP fuel filter indicator has been reset (indicator not protruding).

b. Position fuel filter assembly (27) on mount and secure to engine with flat washers (26), lockwashers (25), and bolts (24).

c. Secure filter assembly to mount with lockwashers (23) and bolts (22).

d. Secure fuel flow transmitter bracket (21) to filter with lockwashers (20), flat washers (19), and bolts (18).

e. Install new packing (17) on filter to HP fuel pump tube (16) and secure tube to filter assembly with lockwashers (15) and bolts (14).

f. Install new packing (13) on airflow control to filter tube (12) and secure tube to filter assembly with lockwashers (11) and bolts (10).

g. Install new packings (7 and 9) and retaining ring (6) on sleeve (8).

h. Secure sleeve and filter to transmitter tube (5) with flat washers (4), lockwashers (3), and bolts (2).

i. Bleed engine fuel system (paragraph 5-19) and check for leaks.

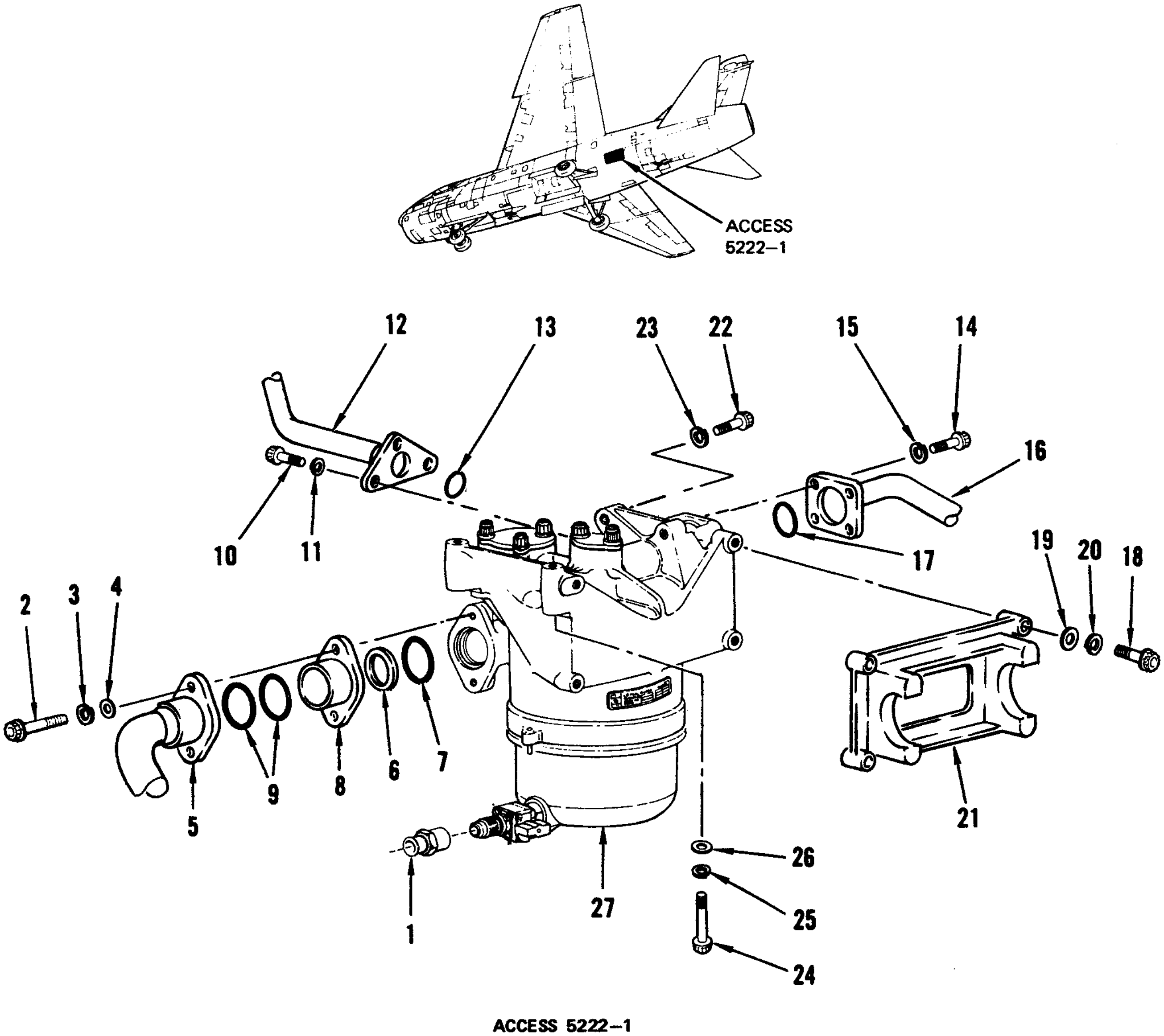
j. Install cap (1) on drain valve.

k. Close access 5222-1.

5-26. FUEL FILTER ELEMENT REMOVAL AND INSTALLATION.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
	GGG-W-686	Torque wrench, 10 to 150 inch-pounds	Measure torque
5-19	T-7260 or T-8133 (Dynamic Filter, Div Michigan Dynamics, Inc)	Indicator reset tool	Reset popout indicator in low pressure fuel filter



1. Cap
2. Bolt
3. Lockwasher
4. Flat washer
5. Filter-to-transmitter tube
6. Retaining ring
7. Packing
8. Sleeve
9. Packing
10. Bolt
11. Lockwasher
12. Airflow control-to-filler tube
13. Packing
14. Bolt
15. Lockwasher
16. Filter-to-HP fuel pump tube
17. Packing
18. Bolt
19. Flat washer
20. Lockwasher
21. Fuel flow transmitter bracket
22. Bolt
23. Lockwasher
24. Bolt
25. Lockwasher
26. Flat washer
27. Fuel filter assembly

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Figure 5-18. Removal and Installation; Fuel Filter Assembly

5-26.1. Removal. (Figure 5-19.)

a. Open access 5222-1.

b. Make sure fuel master lever is in OFF.

c. Drain low pressure fuel filter (paragraph 5-22).

d. Loosen nut (1) and swing lockplate (2) away from cap bolt (3). Do not remove nut from stud.

e. Support cap assembly (4) and turn cap bolt counterclockwise. Cap assembly will be withdrawn from housing as cap bolt is unscrewed.

f. Remove filter element (5) and sediment trap (6) from cap assembly.

g. Remove packings (7) from cap assembly.

WARNING

Solvent P-D-680, Type II, is toxic to skin, eyes, and respiratory tract. Use in a well-ventilated area. Avoid prolonged breathing of vapors. Avoid eye and repeated skin contact. Keep away from sparks and flames.

h. Clean housing sediment trap and cap assembly with P-D-680, Type II, drycleaning solvent.

i. If fuel filter indicator has been tripped, proceed as follows:

(1) Insert indicator reset tool down through cap bolt.

(2) Turn reset tool 1/8-turn clockwise and pull up.

(3) Push indicator button in; then, release reset tool. Indicator button should remain in.

(4) Turn indicator tool 1/8-turn counterclockwise and remove from cap bolt.

5-26.2. Installation. (Figure 5-19.)

a. Lubricate new packings (7) and packing mating surfaces with MIL-L-7808 engine oil. Install packings on cap assembly (4).

b. Lubricate center bolt threads with MIL-L-25681 lubricant.

c. Install sediment trap (6) in cap assembly.

NOTE

Make sure the gaskets on each end of the filter element are in place before installing element.

d. Install filter element (5) in sediment trap.

e. Install cap assembly with grooves in the cap over the locating dowels in housing. Push firmly against the cap and turn cap bolt (3) clockwise to engage the threads. Continue turning the cap bolt until top packing contacts the housing.

f. Using a soft-faced mallet, lightly tap the cap assembly to compress the filter element retainer spring while tightening cap bolt. Continue tapping the cap and turning cap bolt until cap assembly is firmly engaged with housing.

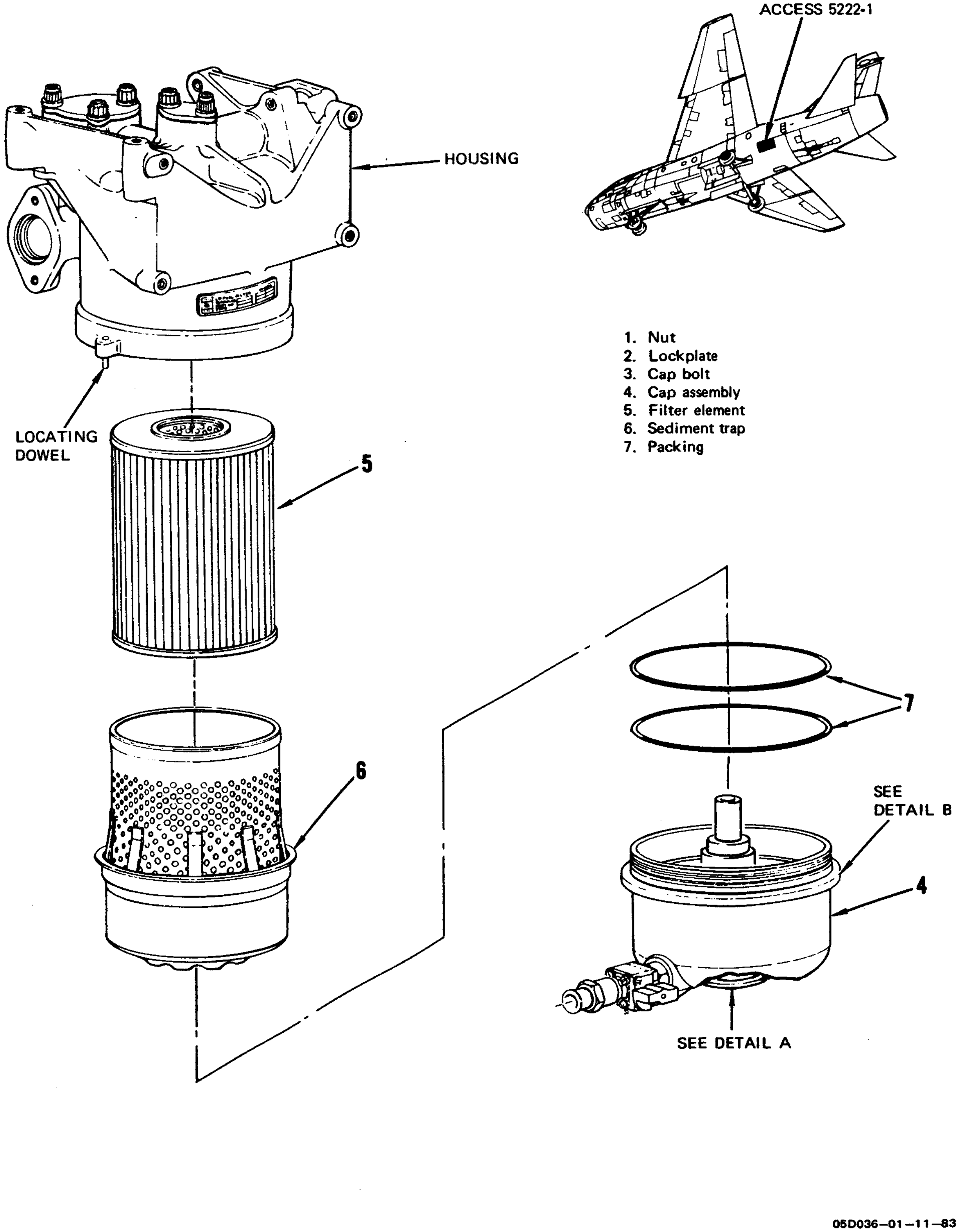
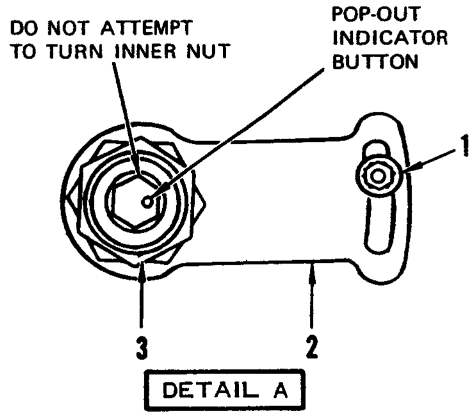
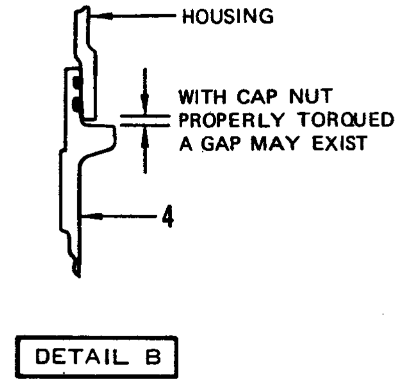


Figure 5-19. Removal and Installation; Fuel Filter Element (Sheet 1)





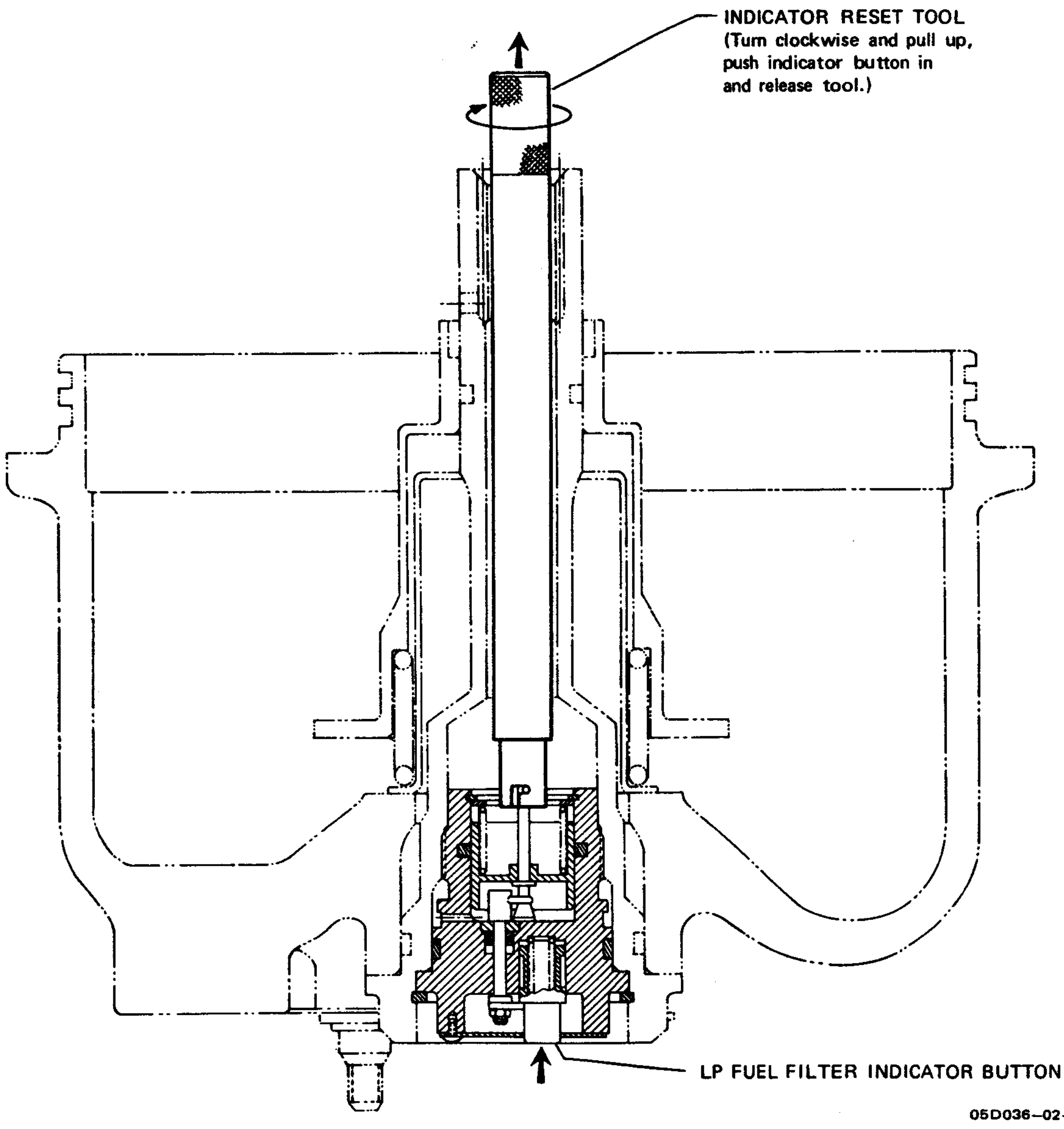


Figure 5-19. Removal and Installation; Fuel Filter Element (Sheet 2)

NOTE

Approximately 1/8-inch gap will exist between the cap assembly and housing when cap is fully engaged.

g. Tighten cap bolt to 130 (±10) inch-pounds torque.

h. Swing lockplate (2) over cap bolt and secure by tightening nut (1).

i. Bleed engine fuel system (paragraph 5-19) and check for leaks.

j. Close access 5222-1.

5-27. HP FUEL PUMP REMOVAL AND INSTALLATION.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
	GGG-W-686	Torque wrench, 10 to 150 inch-pounds	Measure torque
	6798895 (Allison Division of General Motors, Indianapolis, Indiana)	HP fuel pump mounting flange nut box wrench	Remove and install pump flange nuts

WARNING

Avoid radiation contamination by adhering to the following exposure limits. For physical contact with the oil tank source tube, maximum safe exposure time is 15 minutes at one time or a total of 20 minutes per week. At a distance of 12 inches from the source tube, maximum time is 3.3 hours per week. There is no exposure time limit 3 feet from source tube. Deviations from these limits shall be approved by the base medical service. Personnel working with or near this source tube shall become familiar with the procedures in T.O. 00-110N-11.

CAUTION

To prevent damage to tubes and decrease the possibility of leakage, observe precautions (paragraph 1-18) when removing or installing fuel, oil, and air tubing.

5-27.1. <u>Removal.</u> (Figure 5-20.)

a. Remove engine removal door (T.O. 1A-7D-2-1) and open access 5222-2.

NOTE

The following procedure may be used with an installed or uninstalled engine.

b. Drain low pressure fuel filter (paragraph 5-22).

c. Make sure fuel master lever is in OFF.

d. Remove oil tank (paragraph 9-11).

e. Remove jet fuel turbine starter (paragraph 8-13).

WARNING

To prevent fire and possible personnel injury, use suitable containers to catch fuel spillage as fuel lines are disconnected.

f. Remove bolts (1) and lockwashers (2). Disconnect clamps and remove scavenge oil tube (3) and packings (4).

g. Cut lockwire, disconnect servo tube (5) from HP fuel pump, and allow fuel to drain.

h. Remove bolts (6) and lockwashers (7). Disconnect clamp and remove tube and packings (8).

i. Remove bolts (9), lockwashers (10), servo tube (11), and packings (12).

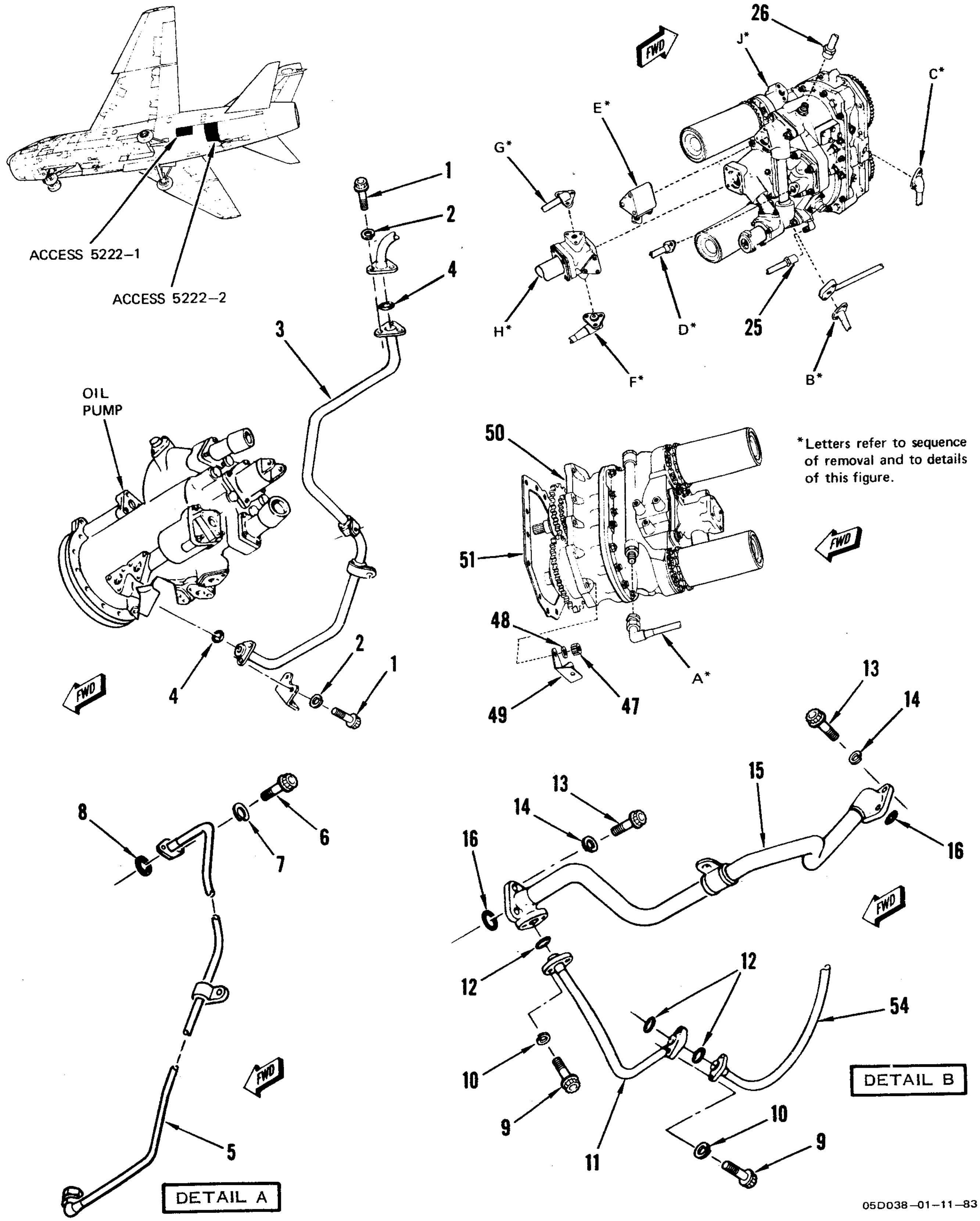


Figure 5-20. Removal and Installation; HP Fuel Pump (Sheet 1 of 3)

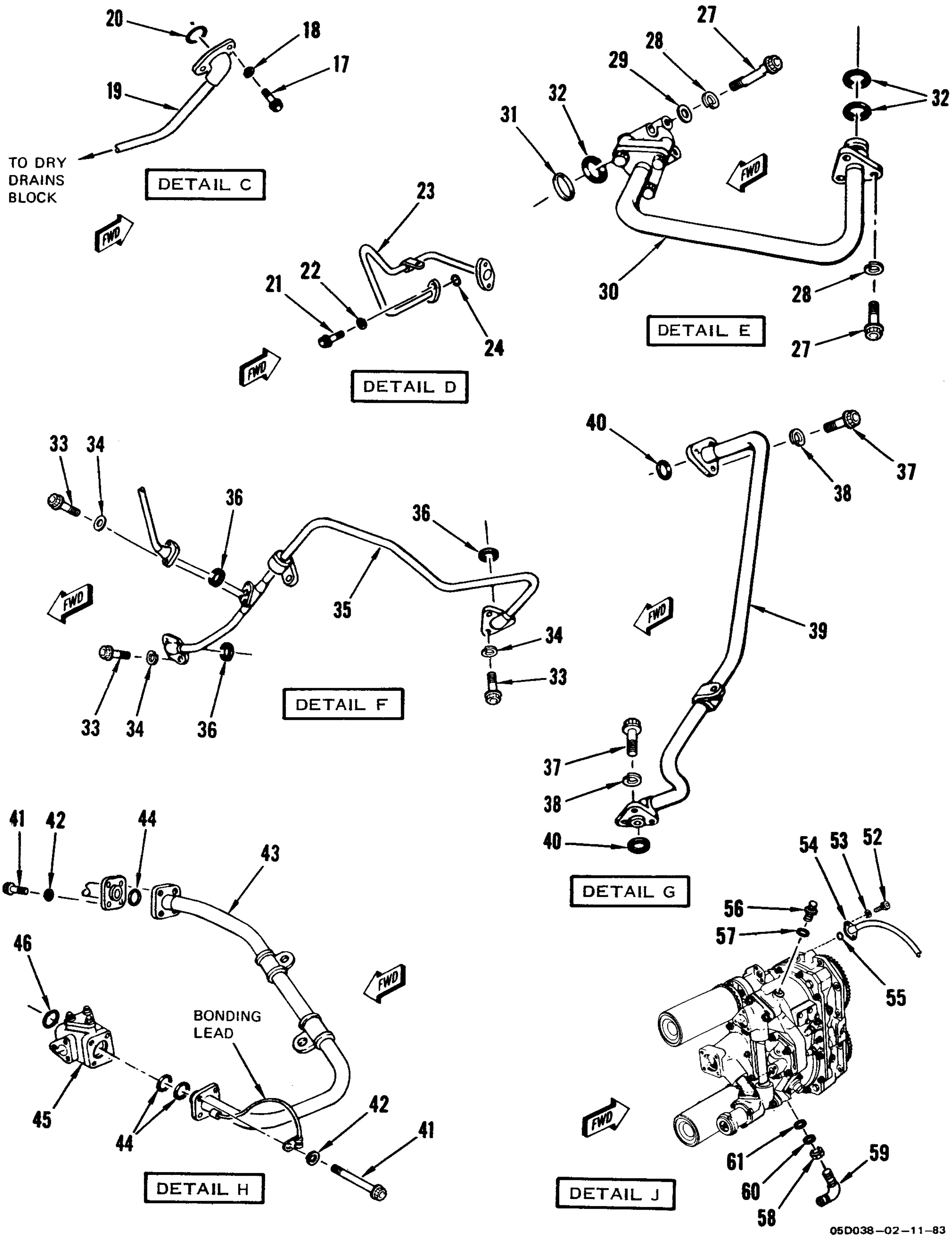


Figure 5-20. Removal and Installation; HP Fuel Pump (Sheet 2)

1. Bolt
2. Lockwasher
3. Scavenge oil tube
4. Packing
5. Servo tube
6. Bolt
7. Lockwasher
8. Packing
9. Bolt
10. Lockwasher
11. Servo tube
12. Packing
13. Bolt
14. Lockwasher
15. Fuel tube
16. Packing
17. Bolt
18. Lockwasher
19. Drain tube
20. Packing
21. Bolt
22. Lockwasher
23. HMG tube
24. Packing
25. Pressure switch tube
26. Pressure switch tube
27. Bolt
28. Lockwasher
29. Washer
30. Fuel tube
31. Retainer ring
32. Packing
33. Bolt
34. Lockwasher
35. Fuel tube
36. Packing
37. Bolt
38. Lockwasher
39. Fuel tube
40. Packing
41. Bolt
42. Lockwasher
43. Fuel tube
44. Packing
45. Block
46. Packing
47. Self-locking nut
48. Washer
49. Bracket
50. HP fuel pump
51. Gasket
52. Bolt
53. Lockwasher
54. Servo tube
55. Packing
56. Snubber
57. Packing
58. Nut
59. Snubber
60. Ring
61. Packing

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Figure 5-20. Removal and Installation; HP Fuel Pump (Sheet 3)

j. Remove bolts (13) and lockwashers (14). Disconnect clamp and remove fuel tube (15) and packings (16).

k. Remove bolts (17) and lockwashers (18). Disengage drain tube (19) from pump and remove packing (20).

l. Remove bolts (21) and lockwashers (22). Disengage HMG tube (23) and remove packing (24). Tie tube back to prevent interference during pump removal.

m. Cut lockwire, disconnect pressure switch tube (25), and tie back to prevent interference during pump removal.

n. Cut lockwire and disconnect pressure switch tube (26).

o. Remove bolts (27), lockwashers (28), washers (29), fuel tube (30), retainer ring (31), and packings (32).

p. Remove bolts (33) and lockwashers (34). Disconnect clamp and remove fuel tube (35) and packings (36).

q. Remove bolts (37) and lockwashers (38). Disconnect clamp and remove fuel tube (39) and packings (40).

r. Remove bolts (41) and lockwashers (42). Disconnect clamps and gently work fuel tube (43) back and forth until tube is free. Remove packings (44), block (45), and packing (46). Tie tube back to prevent interference during pump removal.

s. Remove self-locking nuts (47), washers (48), and bracket (49).

t. Remove HP fuel pump (50) and gasket (51).

u. If pump is to be replaced with a new pump, see detail J and proceed as follows:

(1) Remove bolts (51), lockwashers (53), servo tube (54), and packing (55).

(2) Remove snubber (56) and packing (57).

(3) Loosen nut (58) and remove snubber (59), ring (60), and packing (61).

(4) Drain fuel. Gravity fill all accessible fuel cavities with clean filtered MIL-L-6081, Grade 1010, oil. Plug openings.

5-27.2. Installation. (Figure 5-20.)

a. If new HP fuel pump is being installed, proceed as follows:

(1) Using new packing (61) and ring (60), install nut (58) and snubber (59).

(2) Using new packing (57), install snubber (56).

(3) Using new packing (55), install servo tube (54) and secure to pump with lockwashers (53) and bolts (52).

b. Install high pressure rotor turning adapter (paragraph 4-19).

c. Place new gasket (51) on gearbox.

d. Apply MIL-L-7808 or MIL-L-23699 oil to pump drive splines and mating splines in gearbox.

CAUTION

To prevent damage to pump, make sure pump drive quillshaft is properly installed in the gearbox drive splines.

NOTE

Ensure that tube (39) is in position before installating pump.

e. Install HP fuel pump (50) on gearbox mounting pad. Rotate drive shaft as necessary to permit spline engagement. Place bracket (49) on two bottom studs. Secure pump with 10 washers (48) and 12 self-locking nuts (47). Tighten nuts to 81 (+8, -7) inch-pounds torque.

NOTE

The side of the block without a tube connection must be turned toward the oil pump.

f. Using new packing (46), place block (45) in position.

g. Using new packings (44), install fuel tube (43) and secure tube and bonding lead with lockwashers (42) and bolts (41). Connect clamps.

h. Using new packings (40), install fuel tube (39) and secure with lockwashers (38) and bolts (37). Connect clamp.

i. Using new packings (36), install fuel tube (35) and secure with lockwashers (34) and bolts (33). Connect clamp.

j. Using new packings (32) and retainer ring (31), install fuel tube (30) and secure with washers (29), lockwashers (28), and bolts (27).

k. Connect pressure switch tube (26) to snubber. Secure with MS20995C32 lockwire.

l. Connect pressure switch tube (25) to snubber. Secure with MS20995C32 lockwire. Tighten nut (58).

m. Using new packing (24), connect HMG tube (23) to pump with lockwashers (22) and bolts (21).

n. Using new packing (20), connect drain tube (19) to pump with lockwashers (18) and bolts (17).

o. Using new packings (16), install fuel tube (15) and secure with lockwashers (14) and bolts (13).

p. Using new packings (12), install servo tube (11) and secure with lockwashers (10) and bolts (9).

q. Using new packings (8), install servo tube (5) and secure to HP fuel shutoff valve with lockwashers (7) and bolts (6). Connect clamp.

r. Connect servo tube to pump. Secure with MS20995C32 lockwire.

s. Using new packings (4), install scavenge oil tube (3) with lockwashers (2) and bolts (1).

t. Install jet fuel turbine starter (paragraph 8-13).

u. Remove high pressure rotor turning adapter (paragraph 4-19).

v. Install oil tank (paragraph 9-11).

w. If removed, install engine (paragraph 1-4).

x. Bleed engine fuel system (paragraph 5-19) and check for leaks.

y. Perform NH idle speed adjustment (paragraph 5-9 or 5-10).

z. Perform airflow control system operational checkout (paragraph 2-4 or 2-5).

aa. Install engine removal door (T.O. 1A-7D-2-1).

ab. Close access 5222-2.

5-28. LOW PRESSURE GOVERNOR REMOVAL AND INSTALLATION.

WARNING

Avoid radiation contamination by adhering to the following exposure limits. For physical contact with the oil tank source tube, maximum safe exposure time is 15 minutes at one time or a total of 20 minutes per week. At a distance of 12 inches from the source tube, maximum time is 3.3 hours per week. There is no exposure time limit 3 feet from source tube. Deviations from these limits shall be approved by the base medical service. Personnel working with or near this source tube shall become familiar with the procedures in T.O. 00-110N-11.

CAUTION

To prevent damage to tubes and decrease the possibility of leakage, observe precautions (paragraph 1-18) when removing or installing fuel, oil, or air tubing.

5-28.1. Removal. (Figure 5-21.)

a. Open accesses 5122-3 and 5222-2.

b. Make sure fuel master lever is OFF.

c. Drain low pressure fuel filter (paragraph 5-22).

d. Remove cold start valve (paragraph 5-29).

e. Remove bolts (1) and lockwashers (2). Cut lockwire, disconnect coupling nut, and remove drain tube (3) and packings (4).

f. Remove bolts (5) and lockwashers (6).

g. Disconnect clamp and remove fuel tube (7), housings (8 and 9), packings (10), and retainer ring (11).

h. Remove bolts (12) and lockwashers (13). Disconnect clamp and remove fuel tube (14) and packings (15).

i. Remove bolts (16) and lockwashers (17). Disconnect clamp and remove fuel tube (18) and packings (19).

j. Remove nuts (20), washers (21), low pressure governor (22), and packing (23).

k. Remove union (24) and packing (25).

5-28.2. Installation. (Figure 5-21.)

a. Using new packing (25), install union (24).

b. Place new packing (23) on low pressure governor (22).

c. Apply MIL-L-7808 or MIL-L-23699 oil to governor splines and gearbox mating splines.

d. Place governor in position on low speed gearbox and secure with washers (21) and nuts (20).

e. Using new packings (19), install fuel tube (18) and secure with lockwashers (17) and bolts (16). Connect clamp.

f. Using new packings (15), install fuel tube (14) and secure with lockwashers (13) and bolts

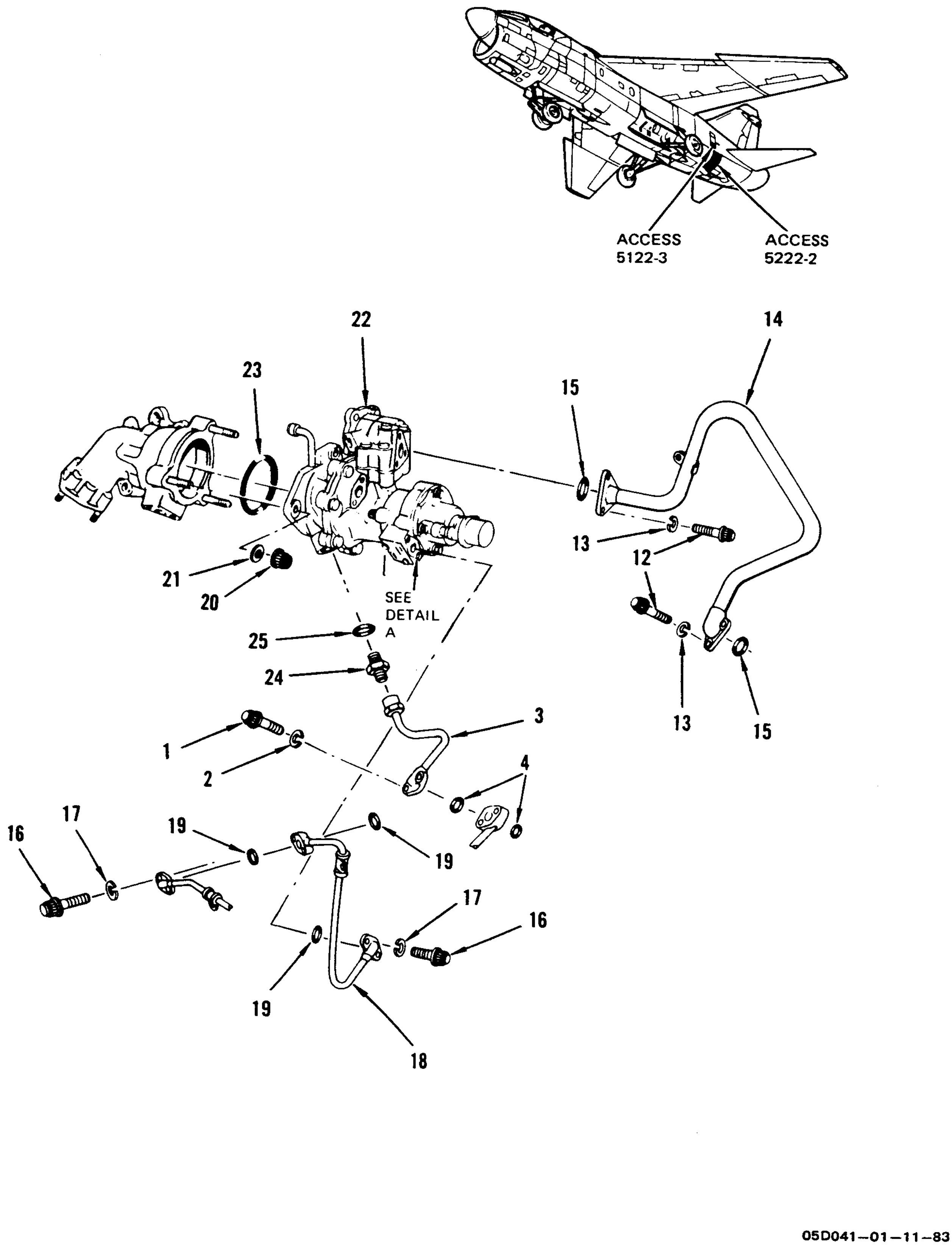
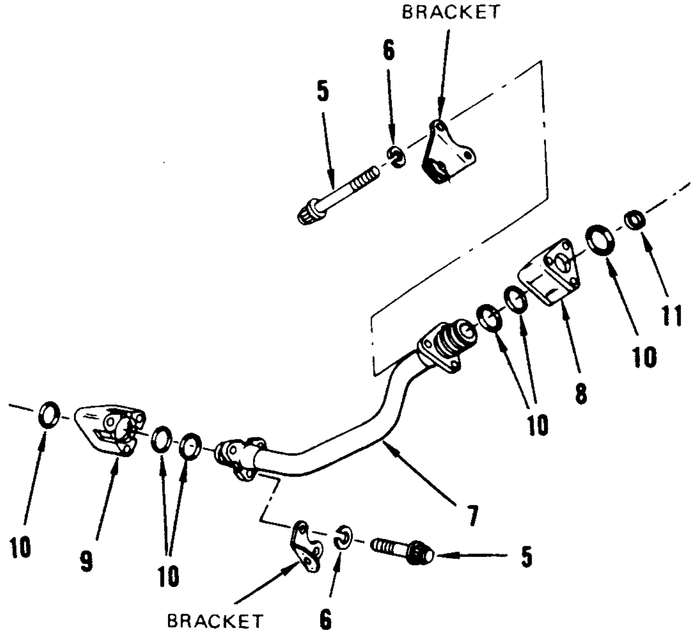


Figure 5-21. Removal and Installation; Low Pressure Governor (Sheet 1 of 2)



DETAIL A

1. Bolt
2. Lockwasher
3. Drain tube
4. Packing
5. Bolt
6. Lockwasher
7. Fuel tube
8. Housing
9. Housing
10. Packing
11. Retainer ring
12. Bolt
13. Lockwasher
14. Fuel tube
15. Packing
16. Bolt
17. Lockwasher
18. Fuel tube
19. Packing
20. Nut
21. Washer
22. Low pressure governor
23. Packing
24. Union
25. Packing

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Figure 5-21. Removal and Installation; Low Pressure Governor (Sheet 2)

(12). Connect clamp.

NOTE

Brackets are held by outboard bolts (5).

g. Using new retainer ring (11) and packings (10), install housings (8 and 9) and fuel tube (7) and secure with lockwashers (6) and bolts (5).

h. Using new packings (4), install drain tube (3) and secure with lockwashers (2) and bolts (1). Connect coupling nut. Secure with MS20995C32 lockwire.

i. Install cold start valve (paragraph 5-29).

j. Bleed engine fuel system (paragraph 5-19) and check for leaks.

k. Perform NL maximum speed adjustment (paragraph 5-13 or 5-14).

l. Close accesses 5122-3 and 5222-2.

5-29. COLD START VALVE REMOVAL AND INSTALLATION.

WARNING

Avoid radiation contamination by adhering to the following exposure limits. For physical contact with the oil tank source tube, maximum safe exposure time is 15 minutes at one time or a total of 20 minutes per week. At a distance of 12 inches from the source tube, maximum time is 3.3 hours per week. There is no exposure time limit 3 feet from source tube. Deviations from these limits shall be approved by the base medical service. Personnel working with or near this source tube shall become familiar with the procedures in T.O. 00-110N-11.

CAUTION

To prevent damage to tubes and decrease the possibility of leakage, observe precautions (paragraph 1-18) when removing or installing fuel, oil, or air tubing.

5-29.1. Removal. (Figure 5-22.)

a. Open accesses 5122-3 and 5222-2.

b. Make sure fuel master lever is in OFF.

c. Disconnect electrical connector (1).

d. Remove bolts (2) and lockwashers (3). Disconnect clamp and remove fuel tube (4) and packings (5).

e. Remove bolt (6) and lockwasher (7).

f. Remove bolts (8) and lockwashers (9).

g. Remove cold start valve (10), packings (11 and 12), and retainer ring (13).

h. If new valve is to be installed, remove bolt (14), lockwasher (15), washers (16), and bracket (17).

5-29.2. Installation. (Figure 5-22.)

a. If new valve is being installed, place bracket (17) and washers (16) in position and secure with lockwasher (15) and bolt (14).

b. Place new retainer ring (13) and packing (12) on transfer tube.

c. Place new packing (11) on cold start valve (10).

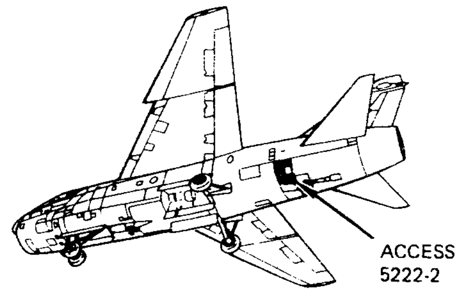
d. Install cold start valve on low pressure governor, make sure that transfer tube properly engages valve. Secure with lockwashers (9) and bolts (8).

e. Measure gap between face of bracket (17) and cold start valve. Install washers (16) to fill the gap to within ±0.005 inch.

f. Secure bracket to low speed gearbox with lockwasher (7) and bolt (6).

g. Using new packings (5), install fuel tube (4) and secure with lockwashers (3) and bolts (2). Connect clamp.

1. Electrical connector
2. Bolt
3. Lockwasher
4. Fuel tube
5. Packing
6. Bolt
7. Lockwasher
8. Bolt
9. Lockwasher
10. Cold start valve
11. Packing
12. Packing
13. Retainer ring
14. Bolt
15. Lockwasher
16. Washer
17. Bracket



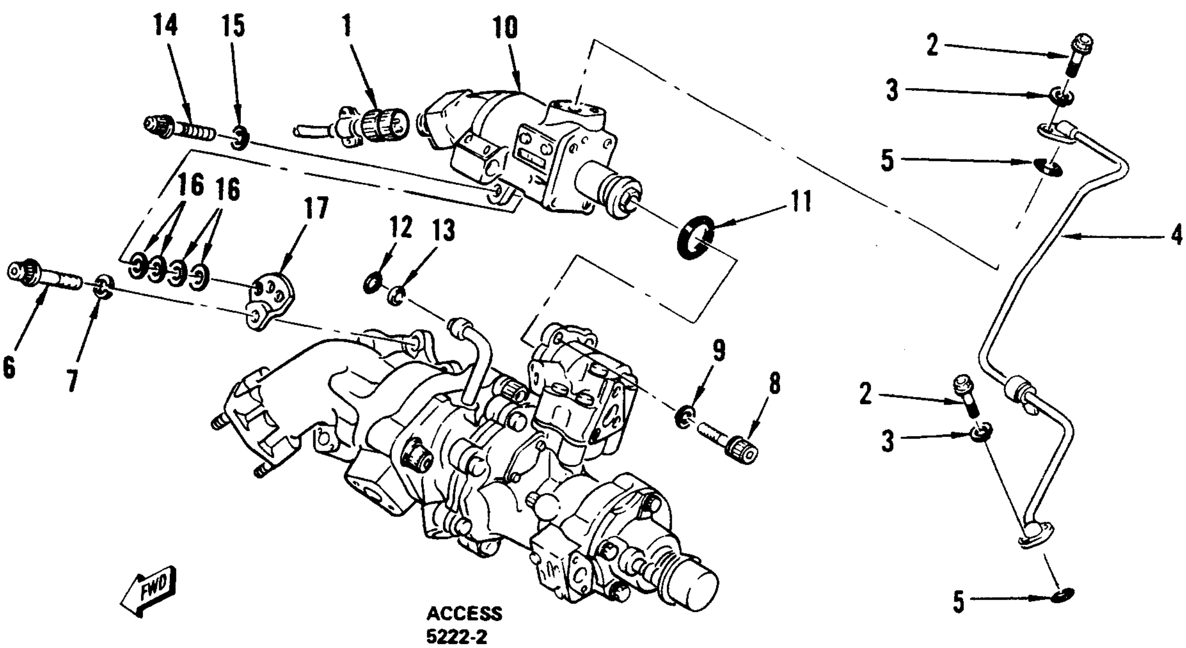


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Figure 5-22. Removal and Installation; Cold Start Valve

h. Connect electrical connector (1).

i. Bleed engine fuel system (paragraph 5-19) and check for leaks.

j. Close accesses 5122-3 and 5222-2.

5-30. MAIN FUEL CONTROL REMOVAL AND INSTALLATION.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
	GGG-W-686	Torque wrench, 10 to 150 inch-pounds	Measure torque

WARNING

Avoid radiation contamination by adhering to the following exposure limits. For physical contact with the oil tank source tube, maximum safe exposure time is 15 minutes at one time or a total of 20 minutes per week. At a distance of 12 inches from the source tube, maximum time is 3.3 hours per week. There is no exposure time limit 3 feet from source tube. Deviations from these limits shall be approved by the base medical service. Personnel working with or near this source tube shall become familiar with the procedures in T.O. 00-110N-11.

CAUTION

To prevent damage to tubes and decrease the possibility of leakage, observe precautions (paragraph 1-18) when removing or installing fuel, oil, or air tubing.

5-30.1. Removal. (Figure 5-23.)

CAUTION

Do not loosen or remove the fuel control P3 limiter, P3 pipe, or Kp2 pipe to faciliate removal.

a. Remove engine removal door (T.O. 1A-7D-2-1) and open access 5222-2.

b. Ensure fuel master lever is in OFF.

c. Remove cotter pins (1), nuts (2), spacers (3), bolts (4), and main fuel control operating rod (5).

d. Remove cotter pins (6), nuts (7), spacer (8), bolts (9), and manual fuel control operating rod (10).

e. Disconnect electrical connector (11).

f. Remove bolts (12) and lockwashers (13). Cut lockwire, disconnect clamp, and remove tubes (14 and 15) and packings (16).

g. Remove bolts (17) and lockwashers (18). Disconnect clamps and remove tubes (19 and 20) and packings (21).

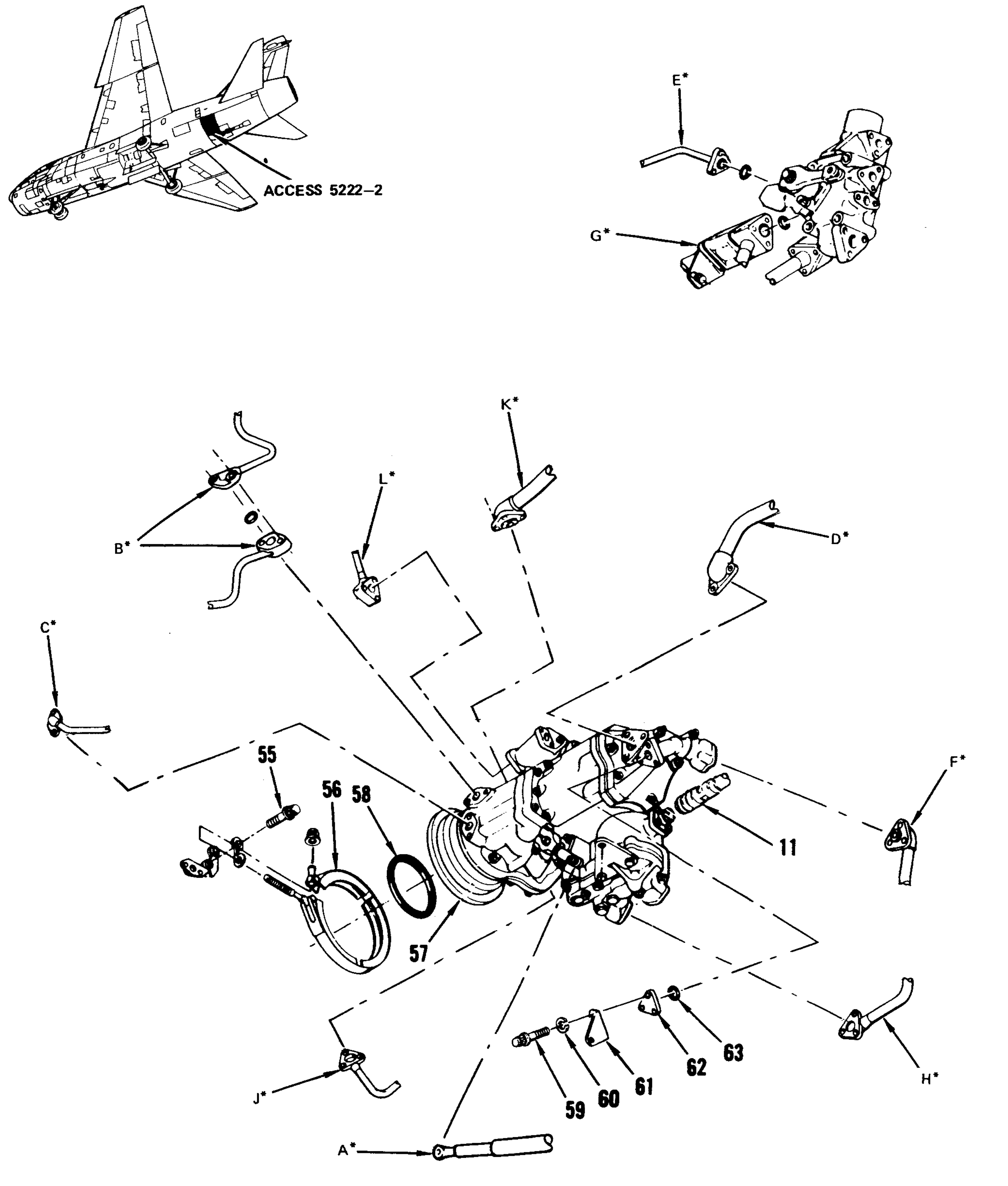
h. Remove bolts (30) and lockwashers (31). Disconnect clamps and remove tubes (32 and 33) and packings (34).

i. Remove bolts (26) and lockwashers (27). Disconnect clamps, cut lockwire, disconnect coupling nut, and remove tube (28) and packing (29).

j. Remove bolts (22) and lockwashers (23). Disconnect clamps and remove tube (24) and packings (25). Tie tube back to provide sufficient clearance for fuel control removal.

k. Remove bolts (35) and lockwashers (36). Loosen, but do not remove, bolts (37). Disconnect clamps and swing tube (38) to one side to provide sufficient clearance for fuel control removal.

l. Remove bolts (39) and lockwashers (40). Disconnect air tube (41) and remove gasket (42).



*Letters refer to sequence of removal
and to details of this figure

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Figure 5-23. Removal and Installation; Main Fuel Control (Sheet 1 of 4)

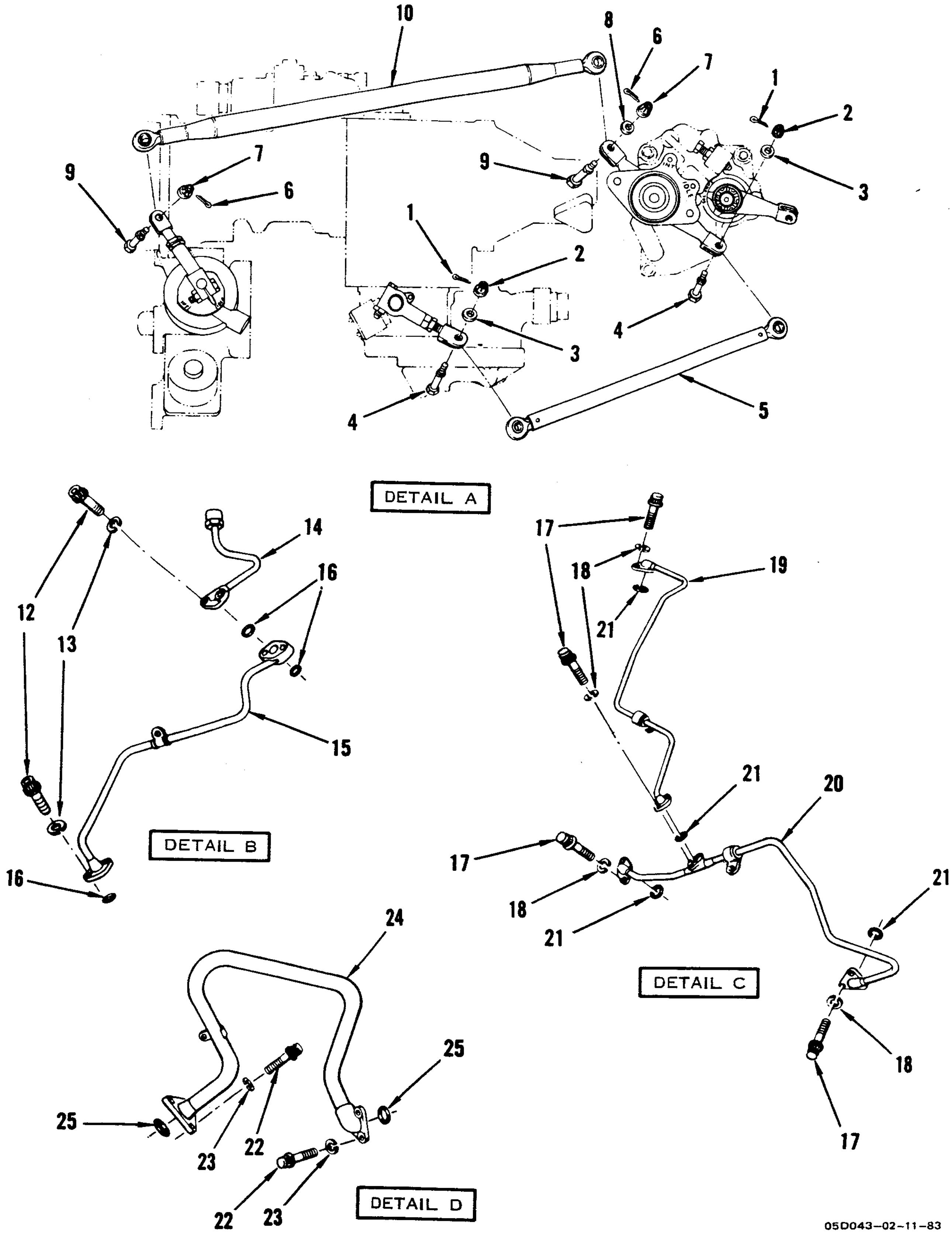


Figure 5-23. Removal and Installation; Main Fuel Control (Sheet 2)

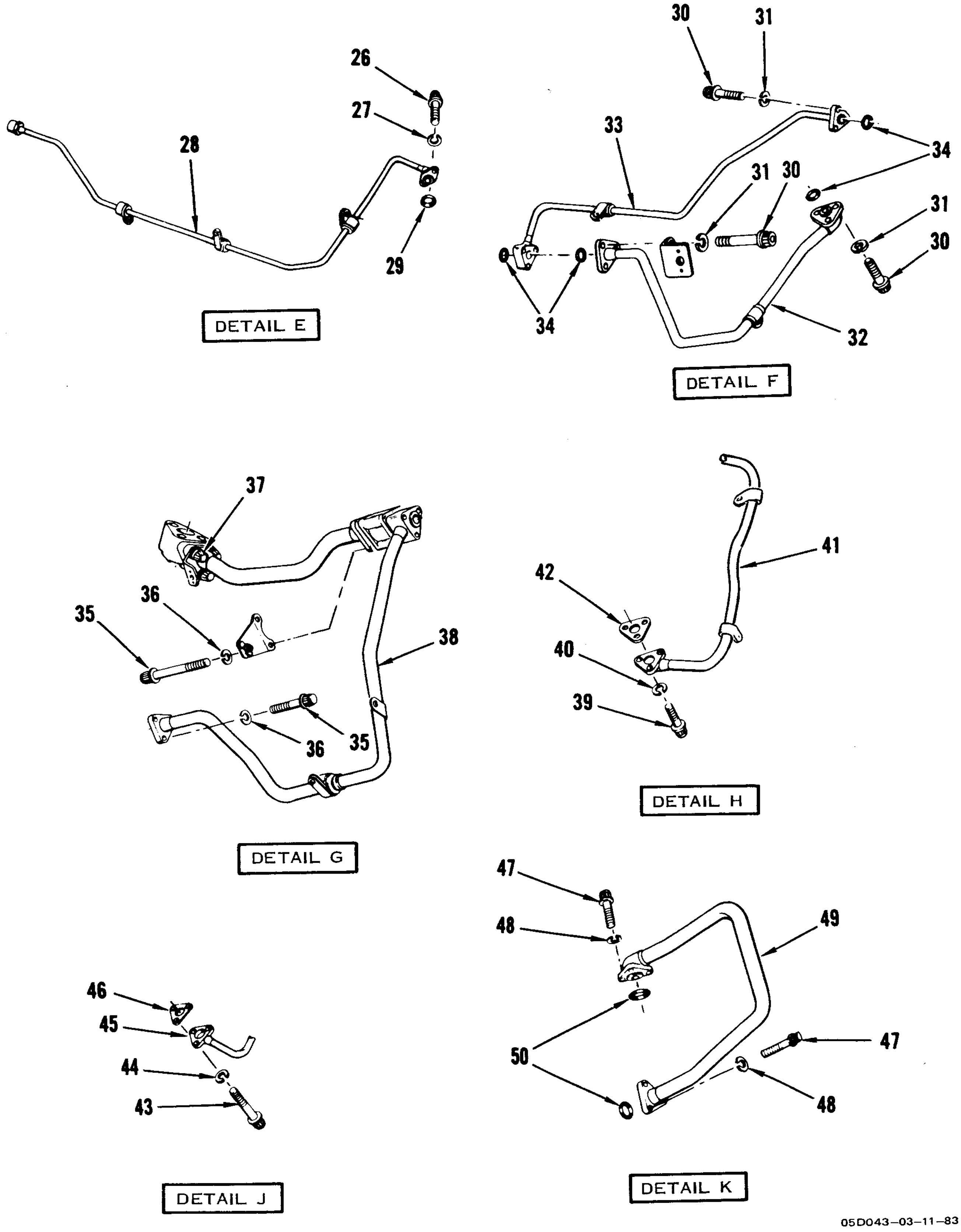
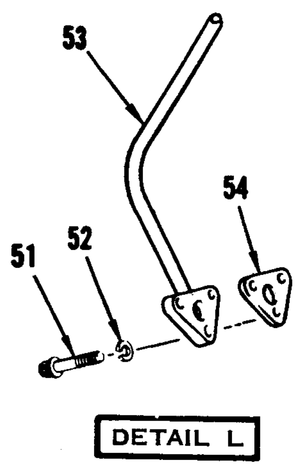


Figure 5-23. Removal and Installation; Main Fuel Control (Sheet 3)



1. Cotter pin	22. Bolt	43. Bolt
2. Nut	23. Lockwasher	44. Lockwasher
3. Spacer	24. Tube	45. Air tube
4. Bolt	25. Packing	46. Gasket
5. Main fuel control operating rod	26. Bolt	47. Bolt
6. Cotter pin	27. Lockwasher	48. Lockwasher
7. Nut	28. Tube	49. Tube
8. Spacer	29. Packing	50. Packing
9. Bolt	30. Bolt	51. Bolt
10. Manual fuel control operating rod	31. Lockwasher	52. Lockwasher
11. Electrical connector	32. Tube	53. Air tube
12. Bolt	33. Tube	54. Gasket
13. Lockwasher	34. Packing	55. Bolt
14. Tube	35. Bolt	56. Clamp
15. Tube	36. Lockwasher	57. Main fuel control
16. Packing	37. Bolt	58. Packing
17. Bolt	38. Tube	59. Bolt
18. Lockwasher	39. Bolt	60. Lockwasher
19. Tube	40. Lockwasher	61. Bracket
20. Tube	41. Air tube	62. Blanking plate
21. Packing	42. Gasket	63. Packing

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Figure 5-23. Removal and Installation; Main Fuel Control (Sheet 4)

m. Remove bolts (43) and lockwashers (44). Disconnect air tube (45) and remove gasket (46).

n. Remove bolts (47), lockwashers (48), tube (49), and packings (50).

o. Remove bolts (51) and lockwashers (52). Disconnect air tube (53) and remove gasket (54).

p. Remove bolt (55) and loosen clamp (56). Remove main fuel control (57) and packing (58).

q. If new main fuel control is to be installed, proceed as follows:

(1) Remove bolts (59), lockwashers (60), bracket (61), blanking plate (62), and packing (63).

(2) Drain fuel. Gravity fill all accessible fuel cavities with clean filtered MIL-L-6081, Grade 1010, oil. Plug openings.

5-30.2. Installation. (Figure 5-23.)

CAUTION

Do not loosen or remove the fuel control P3 limiter, P3 pipe, or Kp2 pipe to facilitate installation.

a. If new fuel control is to be installed, place new packing (63), blanking plate (62), and bracket (61) on main fuel control (57) and secure with lockwashers (60) and bolts (59).

b. Place new packing (58) on main fuel control.

c. Place clamp (56) on gearbox and slide forward out of way.

d. Apply MIL-L-7808 oil to fuel control drive splines and mating splines of gearbox.

e. Install high pressure compressor rotor turning adapter (paragraph 4-19).

f. Carefully install main fuel control, engaging drive splines and locating dowel on mounting pad and secure to engine with clamp (56).

g. Tighten clamp nut to 80 (+5, −10) inch-pounds torque.

h. Secure clamp with bolt (55).

i. Apply Permatex No. 1372 or RTV-106 to new gasket (54) and place in position. Secure air tube (53) with lockwashers (52) and bolts (51).

j. Using new packings (50), install tube (49) with lockwashers (48) and bolts (47).

k. Swing tube (38) in position and secure with lockwashers (36) and bolts (35). Tighten bolts (37). Connect clamps.

l. Apply Permatex No. 1372 or RTV-106 to new gasket (46) and place in position. Secure air tube (45) with lockwashers (44) and bolts (43).

m. Apply Permatex No. 1372 or RTV-106 to new gasket (42) and place in position. Secure air tube (41) with lockwashers (40) and bolts (39). Connect clamps.

n. Using new packings (34), install tubes (33 and 32) with lockwashers (31) and bolts (30). Connect clamps.

o. Using new packing (29), install tube (28) with lockwashers (27) and bolts (26). Connect coupling nut. Secure with MS20995C32 lockwire. Connect clamps.

p. Using new packings (25), install tube (24) with lockwashers (23) and bolts (22). Connect clamps.

q. Using new packings (21), install tubes (20 and 19) with lockwashers (18) and bolts (17). Connect clamps.

r. Using new packings (16), install tubes (15 and 14) with lockwashers (13) and bolts (12). Connect coupling nut. Secure with MS20995C32 lockwire.

s. Connect electrical connector (11).

t. Place manual fuel control operating rod (10) in position and secure with bolts (9), spacer (8), and nuts (7). Tighten nut to between 5 and 45 inch-pounds torque. Secure with new cotter pins (6).

u. Place main fuel control operating rod (5) in position and secure to control cambox with bolts (4) spacers (3), and nuts (2).

v. Perform control cambox rigging (main fuel control linkage) (paragraph 5-21).

w. Tighten nuts to between 5 and 45 inch-pounds torque. Secure with new cotter pins (1).

x. Remove high pressure compressor rotor turning adapter (paragraph 4-19).

y. Perform engine setup (paragraph 4-8).

z. Close access 5222-2.

aa. Install engine removal door (T.O. 1A-7D-2-1).

5-31. HP FUEL SHUTOFF VALVE REMOVAL AND INSTALLATION.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
—	GGG-W-686	Torque wrench, 0 to 50 inch-pounds	Measure torque

WARNING

Avoid radiation contamination by adhering to the following exposure limits. For physical contact with the oil tank source tube, maximum safe exposure time is 15 minutes at one time or a total of 20 minutes per week. At a distance of 12 inches from the source tube, maximum time is 3.3 hours per week. There is no exposure time limit 3 feet from source tube. Deviations from these limits shall be approved by the base medical service. Personnel working with or near this source tube shall become familiar with the procedures in T.O. 00-110N-11.

CAUTION

To prevent damage to tubes and decrease the possibility of leakage, observe precautions (paragraph 1-18) when removing or installing fuel, oil, or air tubing.

5-31.1. Removal. (Figure 5-24.)

a. Open access 5222-2.

b. Make sure fuel master lever is in OFF.

c. Drain low pressure fuel filter (paragraph 5-22).

d. Remove cotter pins (1), nuts (2), spacers (3), bolts (4), and HP fuel shutoff valve operating rod (5).

e. Remove bolts (6) and lockwashers (7). Disconnect clamp. Cut lockwire, disconnect coupling nut, and remove fuel tube (8) and packings (9).

f. Remove bolts (10) and lockwashers (11). Disconnect clamp. Remove fuel tube (12) and packings (13).

g. Remove bolts (14) and lockwashers (15). Disconnect clamp. Remove fuel tube (16) and packings (17).

h. Remove bolts (18), lockwashers (19), fuel tube (20), housing (21), packings (22 and 23), and retainer ring (24).

i. Remove bolts (25) and lockwashers (26), disconnect fuel tube (27), and remove packing (28).

j. Remove bolts (29) and lockwashers (30), disconnect fuel tube (31), and remove packing (32).

k. Remove bolts (33) and lockwashers (34), disengage fuel tubes (35 and 36), and remove packing (37).

l. Remove bolts (38), lockwashers (39), washers (40), and HP fuel shutoff valve (41).

5-31.2. Installation. (Figure 5-24.)

a. Place new packings (37, 32, and 28) in position.

b. Place HP fuel shutoff valve (41) in position and secure with washers (40), lockwashers (39), and bolts (38).

c. Secure fuel tubes (35 and 36) and bracket to valve with lockwashers (34) and bolts (33).

d. Secure fuel tube (31) with lockwashers (30) and bolts (29).

e. Secure fuel tube (27) with lockwashers (26) and bolts (25).

f. Place new retainer ring (24) and packing (23) in housing (21).

g. Place new packings (22) on fuel tube (20).

h. Install fuel tube and housing with lockwashers (19) and bolts (18).

i. Using new packings (17), install fuel tube (16) with lockwashers (15) and bolts (14). Connect clamp.

j. Using new packings (13), install fuel tube (12) with lockwashers (11) and bolts (10). Connect clamp.

k. Using new packing (9), install fuel tube (8)

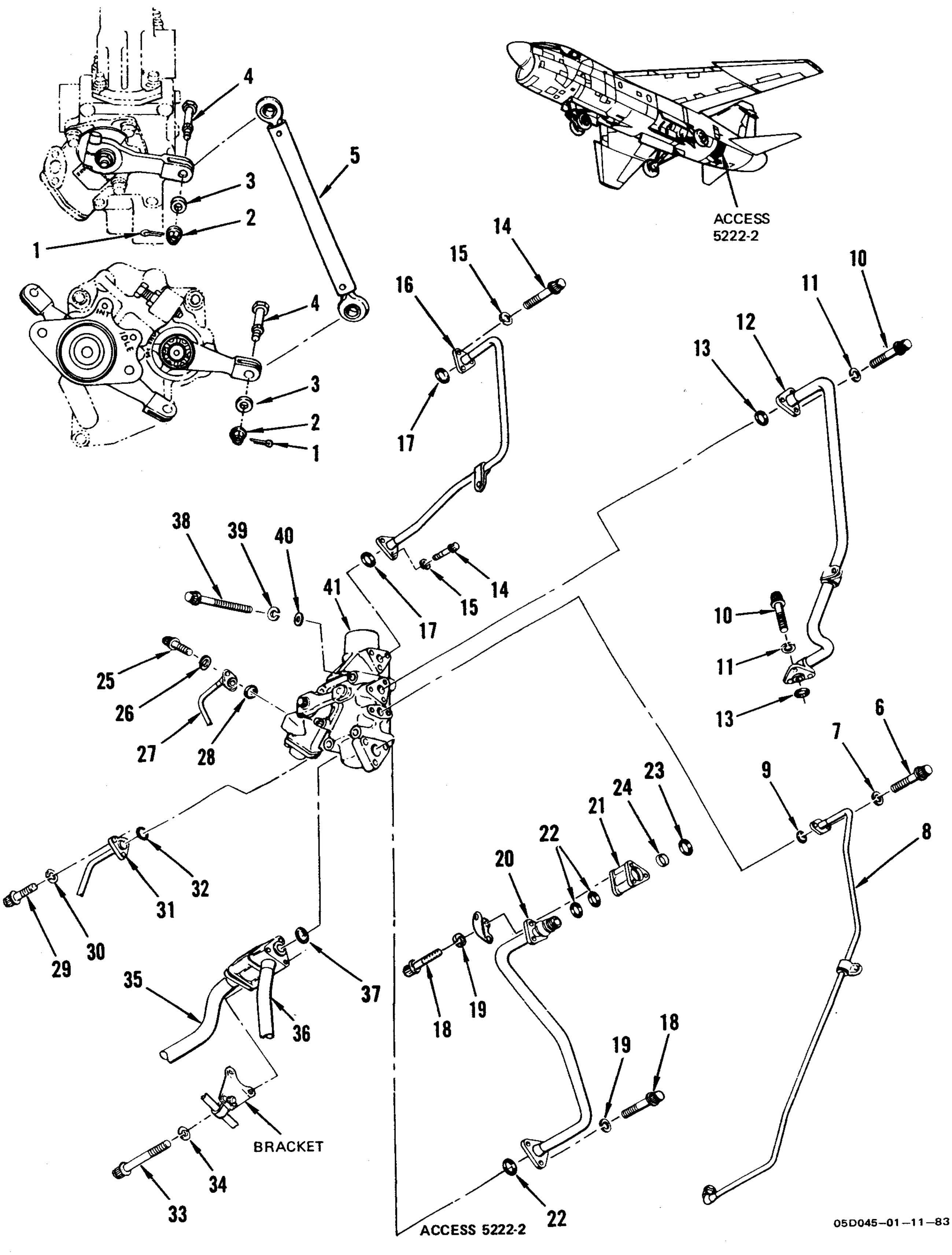

Figure 5-24. Removal and Installation; HP Fuel Shutoff Valve (Sheet 1 of 2)

1. Cotter pin
2. Nut
3. Spacer
4. Bolt
5. HP fuel shutoff valve operating rod
6. Bolt
7. Lockwasher
8. Fuel tube
9. Packing
10. Bolt
11. Lockwasher
12. Fuel tube
13. Packing
14. Bolt
15. Lockwasher
16. Fuel tube
17. Packing
18. Bolt
19. Lockwasher
20. Fuel tube
21. Housing
22. Packing
23. Packing
24. Retainer ring
25. Bolt
26. Lockwasher
27. Fuel tube
28. Packing
29. Bolt
30. Lockwasher
31. Fuel tube
32. Packing
33. Bolt
34. Lockwasher
35. Fuel tube
36. Fuel tube
37. Packing
38. Bolt
39. Lockwasher
40. Washer
41. HP fuel shutoff valve

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Figure 5-24. Removal and Installation; HP Fuel Shutoff Valve (Sheet 2)

with lockwashers (7) and bolts (6). Connect coupling nut. Secure with MS20995C32 lockwire. Connect clamp.

l. Place HP fuel shutoff valve operating rod (5) in position and secure with bolts (4), spacers (3), and nuts (2).

m. Perform control cambox rigging (HP fuel shutoff valve linkage) (paragraph 5-21).

n. Tighten nuts to between 5 and 45 inch-pounds torque. Secure with new cotter pins (1).

o. Bleed engine fuel system (paragraph 5-19) and check for leaks.

p. Close access 5222-2.

5-31.3. LUBRICATION (H.P. FUEL SHUTOFF VALVE).

NOTE

A piece of string and mineral spirits is recommended to clean the visible portion of friction pin.

a. Clean cam plate and friction pin (under control arm) with mineral spirits.

b. Apply a heavy coat of compound around friction pin and on cam plate.

5-32. CONTROL CAMBOX REMOVAL AND INSTALLATION.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
	MIL-H-4034B	Torque wrench, 0 to 50 inch-pounds	Measure torque

WARNING

Avoid radiation contamination by adhering to the following exposure limits. For physical contact with the oil tank source tube, maximum safe exposure time is 15 minutes at one time or a total of 20 minutes per week. At a distance of 12 inches from the source tube, maximum time is 3.3 hours per week. There is no exposure time limit 3 feet from source tube. Deviations from these limits shall be approved by the base medical service. Personnel working with or near this source tube shall become familiar with the procedures in T.O. 00-110N-11.

5-32.1. Removal. (Figure 5-25.)

a. Open access 5222-2.

b. Remove engine control adapter (paragraph 1-10).

c. Disconnect electrical connector from switch.

d. Remove cotter pins (1), nuts (2), spacers (3), and bolts (4), and disconnect operating rods (5, 6, and 7).

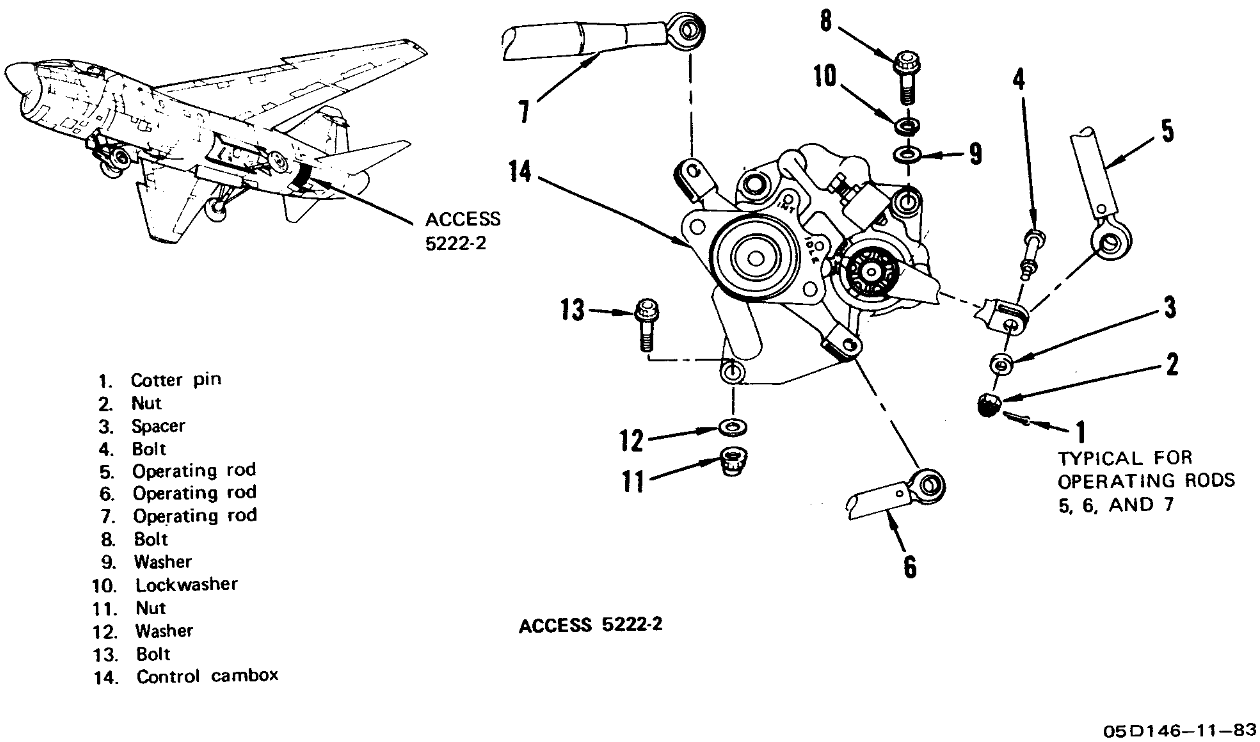


Figure 5-25. Removal and Installation; Control Cambox

e. Remove bolts (8), washers (9), and lockwashers (10).

f. Remove nut (11), washer (12), and bolt (13), and remove control cambox (14) from accessories raft.

5-32.2. Installation. (Figure 5-25.)

a. Secure control cambox (14) to accessories raft with bolt (13), washer (12), nut (11), lockwashers (10), washers (9), and bolts (8).

b. Connect operating rods (5, 6, and 7) to cambox with bolts (4), spacers (3), and nuts (2).

c. Perform control cambox rigging (paragraph 5-21).

d. Tighten nuts to between 5 and 45 inch-pounds torque. Secure with new cotter pins (1).

e. Connect electrical connector to switch.

f. Lubricate and install engine control adapter (paragraph 1-10).

g. Perform NH idle speed adjustment (paragraph 5-9 or 5-10).

h. Perform manual fuel control operational checkout (paragraph 6-4).

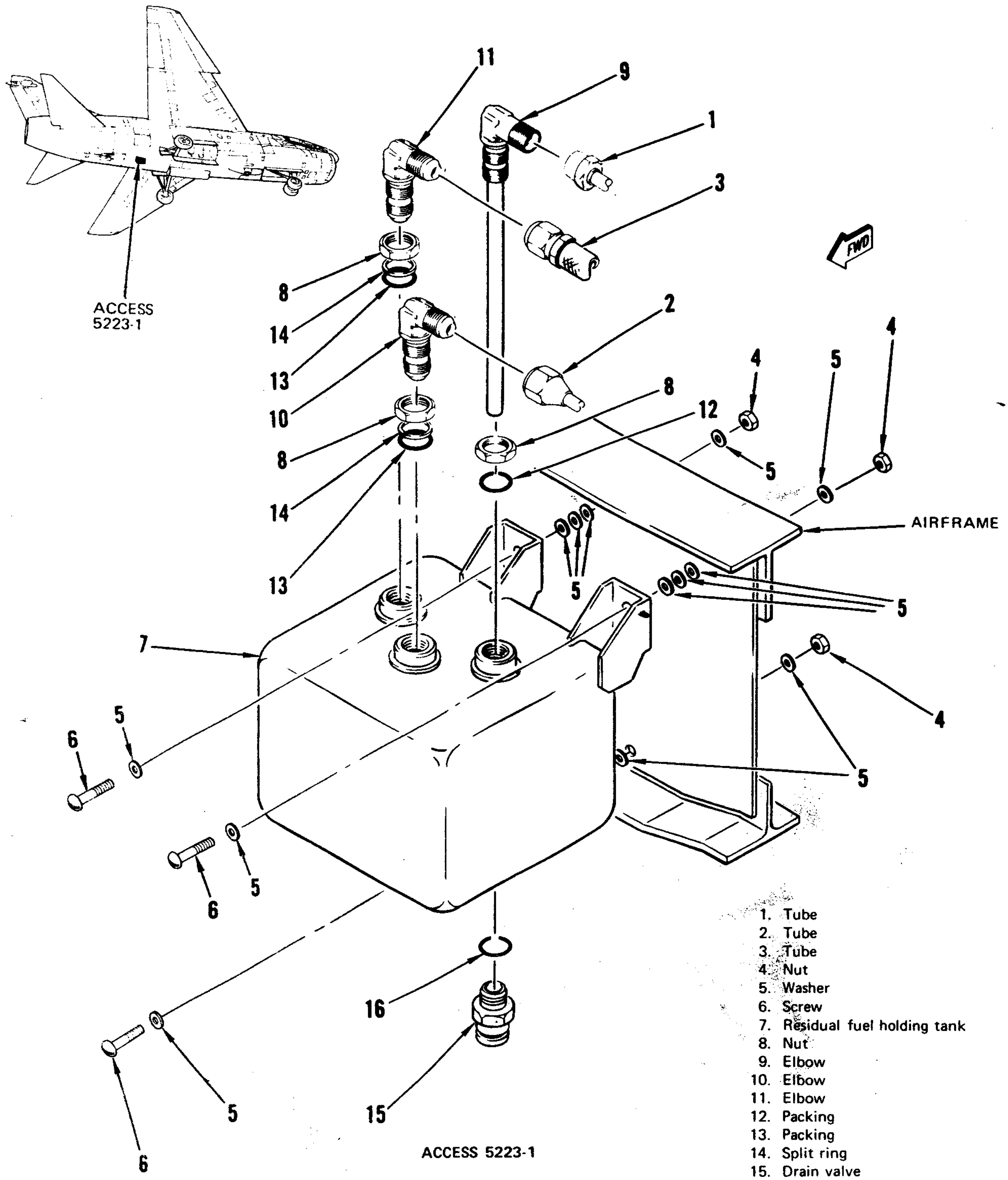
i. Perform manual fuel control adjustment (paragraph 6-7).

j. Close access 5222-2.

5-33. RESIDUAL FUEL HOLDING TANK REMOVAL AND INSTALLATION.

5-33.1. Removal. (Figure 5-26.)

a. Open access 5223-1.



1. Tube
2. Tube
3. Tube
4. Nut
5. Washer
6. Screw
7. Residual fuel holding tank
8. Nut
9. Elbow
10. Elbow
11. Elbow
12. Packing
13. Packing
14. Split ring
15. Drain valve
16. Packing

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Figure 5-26. Removal and Installation; Residual Fuel Holding Tank

WARNING

Make sure airplane and container used for draining residual fuel are grounded. Refer to T.O. 00-25-172 for additional precautions on draining fuel. Fire or explosion may occur causing injury to personnel and damage to equipment if improper ground is used.

b. Position a suitable container under residual fuel holding tank and drain tank.

c. Identify fuel drain lines for installation and disconnect three tubes (1, 2, and 3).

d. Remove engine (paragraph 1-4).

e. Remove lower armorplate from fuselage station (FS) 552 to 570 (T.O. 1A-7D-2-1).

f. Remove 3 nuts (4), 13 washers (5), and 3 screws (6). Remove residual fuel holding tank (7) from airframe.

g. Note position of elbows for reinstallation.

h. Loosen jamnuts (8) and remove elbows (9, 10, and 11), packings (12 and 13), and split rings (14).

i. Remove drain valve (15) and packing (16).

5-33.2. Installation. (Figure 5-26.)

a. Install drain valve (15) with new packing (16) in residual fuel holding tank (7).

b. Install jamnuts (8), new packings (12 and 13), and split rings (14) on elbows (9, 10, and 11).

c. Install elbows in positions noted during removal. Do not tighten jamnuts.

d. Position tank on airframe and secure using 3 screws (6), 13 washers (5), and 3 nuts (4).

e. Connect tubes (1, 2, and 3) to elbows as identified during removal. Tighten jamnuts (8).

f. Install lower armorplate from FS 552 to 570 (T.O. 1A-7D-2-1).

g. Install engine (paragraph 1-4).

h. Start engine (T.O. 1A-7D-2-1) and stabilize at IDLE.

i. Shut down engine (T.O. 1A-7D-2-1).

j. Check residual fuel holding tank connections for leaks.

k. Close access 5223-1.

5-34. FUEL SEAL LEAKAGE ISOLATION PROCEDURE.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
		Equipment required for engine operation	Operate engine

NOTE

These procedures are utilized to determine defective component when fuel drain leakage exceeds limits.

5-34.1. HP Fuel Shutoff Valve Drain.

a. Open access 5222-2.

b. Disconnect HP fuel shutoff valve drain tube from elbow.

c. Use suitable container to catch drained fuel.

d. Start engine (T.O. 1A-7D-2-1).

e. Stabilize at IDLE for 5 minutes.

f. Check fuel leakage rate from valve drain. If leakage is more than 120 drops (6 cc) per minute, replace HP fuel shutoff valve (paragraph 5-31).

g. Shut down engine (T.O. 1A-7D-2-1).

h. Connect drain tube to elbow.

i. Close access 5222-2.

5-34.2. Fuel Drain Block.

a. Open access 5222-2.

b. Disconnect all drain tubes from fuel drain block.

c. Cut lockwire and remove low pressure governor seal drain tube.

d. Disconnect main fuel control seal drain tube at main fuel control.

e. Use suitable container to catch drained fuel.

f. Start engine (T.O. 1A-7D-2-1) and stabilize at IDLE for 5 minutes.

g. Check leakage rate from each of the following components. If leakage rate from any component is more than 60 drops (3 cc) per minute, replace defective component.

(1) LP fuel pump

(2) Airflow control

(3) HP fuel pump

(4) Main fuel control

(5) Manual fuel control

(6) Low pressure governor

h. Shut down engine (T.O. 1A-7D-2-1).

i. Install low pressure governor seal drain tube. Secure with MS20995C32 lockwire.

j. Connect drain tubes to fuel drain block.

k. Remove container and close access 5222-2.

5-35. COLD START TEMPERATURE BULB REMOVAL AND INSTALLATION.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
		Equipment required for engine operation	Operate engine

WARNING

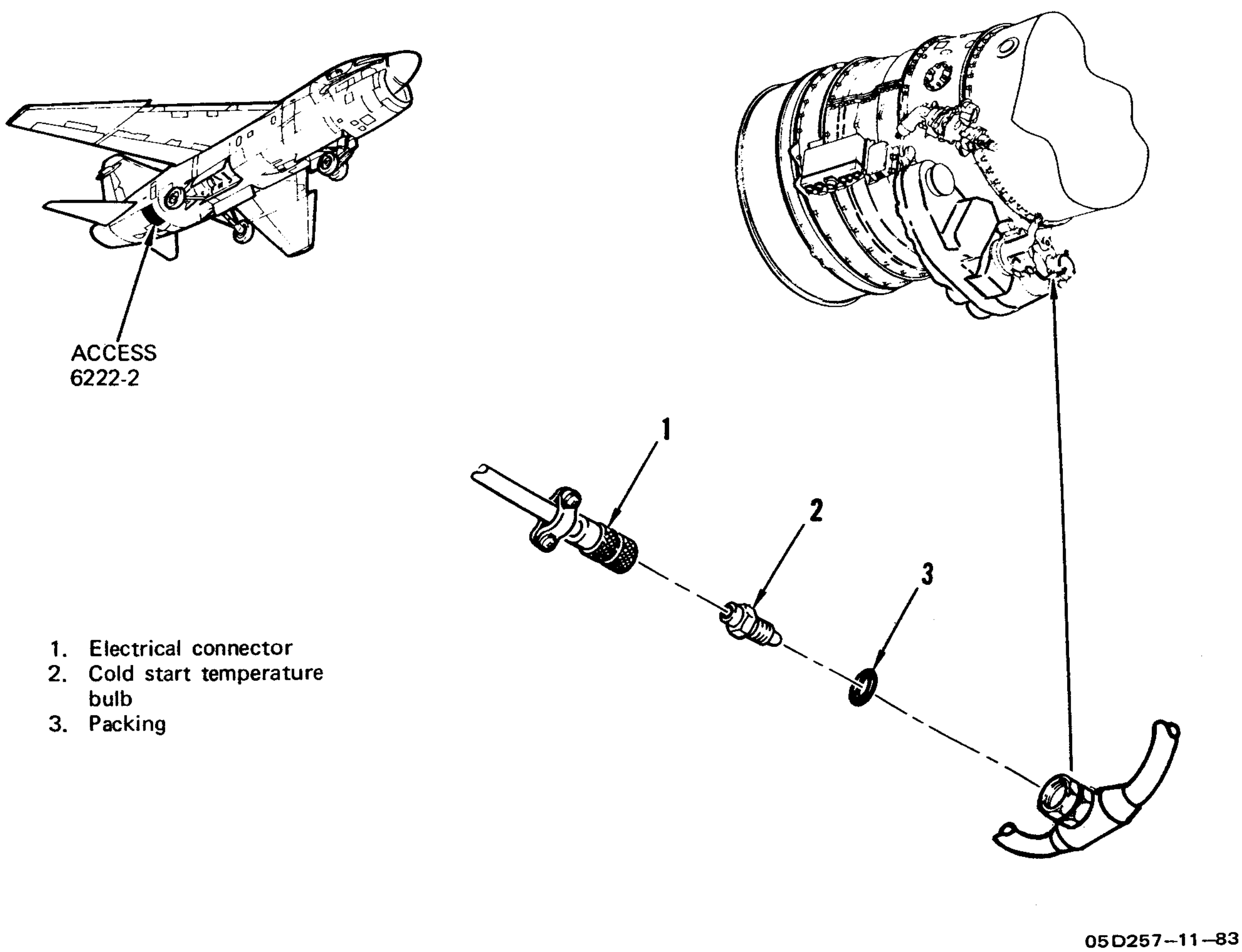
Avoid radiation contamination by adhering to the following exposure limits. For physical contact with the oil tank source tube, maximum safe exposure time is 15 minutes at one time or a total of 20 minutes per week. At a distance of 12 inches from the source tube, maximum time is 3.3 hours per week. There is no exposure time limit 3 feet from source tube. Deviations from these limits shall be approved by the base medical service. Personnel working with or near this source tube shall become familiar with the procedures in T.O. 00-110N-11.

a. Remove and install cold start temperature bulb through access 6222-2 in sequence shown in figure 5-27, observing the following:

(1) Use new packing (3) during installation.

(2) Secure cold start temperature bulb (2) with MS20995C32 lockwire.

b. After installation, start engine (T.O. 1A-7D-2-1) and check bulb installation for leaks.



1. Electrical connector
2. Cold start temperature bulb
3. Packing

Figure 5-27. Removal and Installation; Cold Start Temperature Bulb

5-36. MOTIVE FLOW LINE MANIFOLD REMOVAL AND INSTALLATION.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
		Equipment required for engine operation	Operate engine

5-36.1. Removal. (Figure 5-28.)

a. Open access 5222-1.

b. Disconnect fuel inlet tube (1).

c. Disconnect Wiggins couplings (2 and 3) (paragraph 1-16).

d. Remove nut (4), spacer (5), and screw (6).

e. Remove nuts (7), washers (8), bolts (9), and motive flow line manifold (10).

f. Remove check valve (11), packing (12), clamp (13), union (14), and packing (15).

g. Remove drain valve (16) and packing (17).

5-36.2. Installation. (Figure 5-28.)

a. Fill outlet port of check valve (11) with MIL-O-6018C, Grade 1010, oil. Plug port.

CAUTION

To prevent damage to spherical surface of check valve, do not use screwdriver or any pointed object to actuate valve poppet.

b. Insert a wooden dowel through inlet port and actuate check valve poppet several times to lubricate poppet stem and guide.

c. Remove plug and drain oil from outlet port.

d. Using new packing (17), install drain valve (16).

e. Using new packing (15), install union (14) in inlet port.

f. Place clamp (13) and new packing (12) on check valve (11) and install this assembly on union.

g. Place motive flow line manifold (10) in position and secure to air inlet extension flange with bolts (9), washers (8), and nuts (7).

h. Secure clamp to bracket with screw (6), spacer (5), and nut (4).

i. Connect Wiggins couplings (2 and 3) (paragraph 1-16).

j. Connect fuel inlet tube (1).

k. Start engine (T.O. 1A-7D-2-1) and check installation for leaks.

l. Shut down engine (T.O. 1A-7D-2-1).

m. Close access 5222-1.

5-37. QUICK-DISCONNECT MANIFOLD REMOVAL AND INSTALLATION.

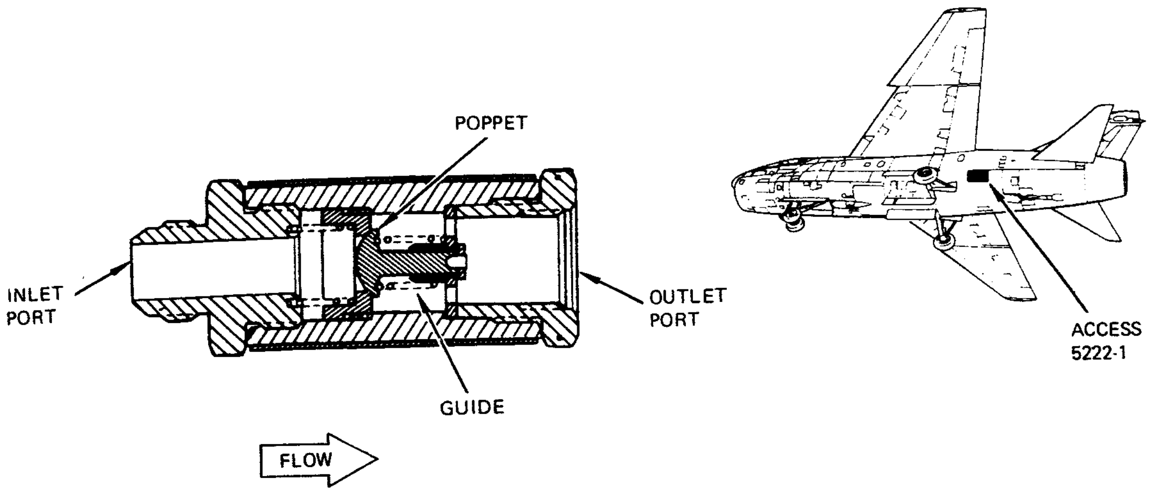
Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
		Equipment required for engine operation	Operate engine

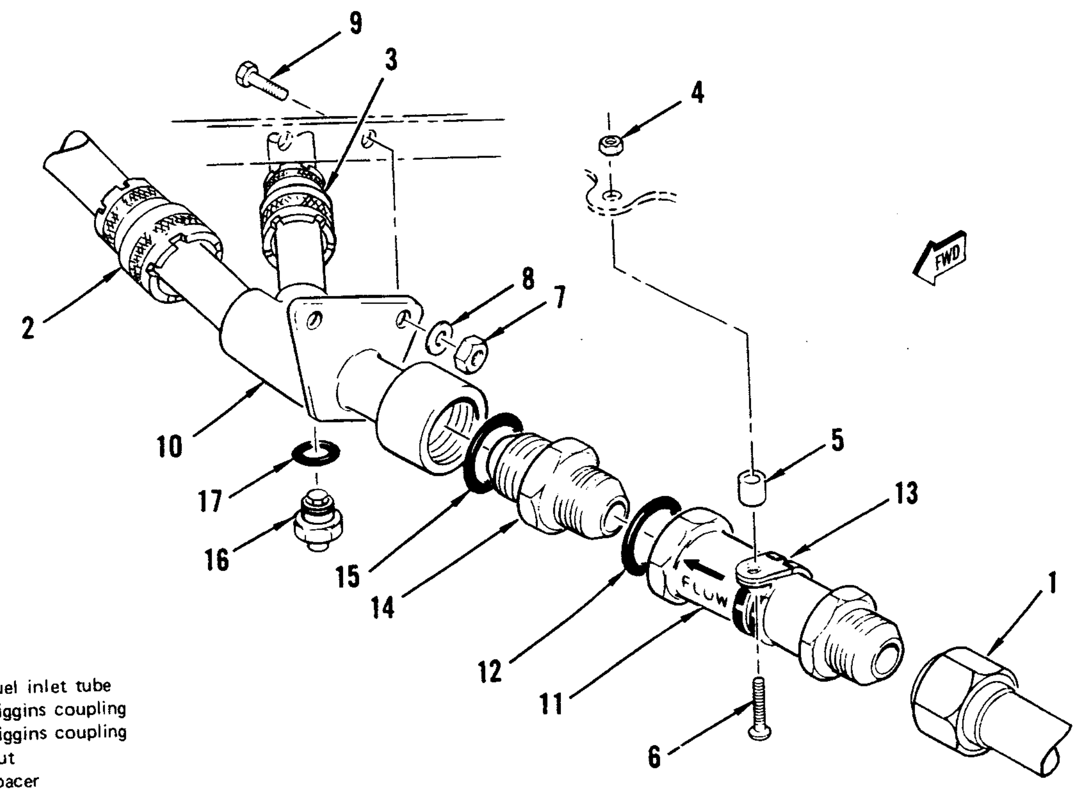
5-37.1. Removal. (Figure 5-29.)

a. Open access 5222-1.

b. Disconnect quick-disconnect (1).



CROSS-SECTION OF CHECK VALVE



ACCESS 5222-1

1. Fuel inlet tube
2. Wiggins coupling
3. Wiggins coupling
4. Nut
5. Spacer
6. Screw
7. Nut
8. Washer
9. Bolt
10. Motive flow line manifold
11. Check valve
12. Packing
13. Clamp
14. Union
15. Packing
16. Drain valve
17. Packing

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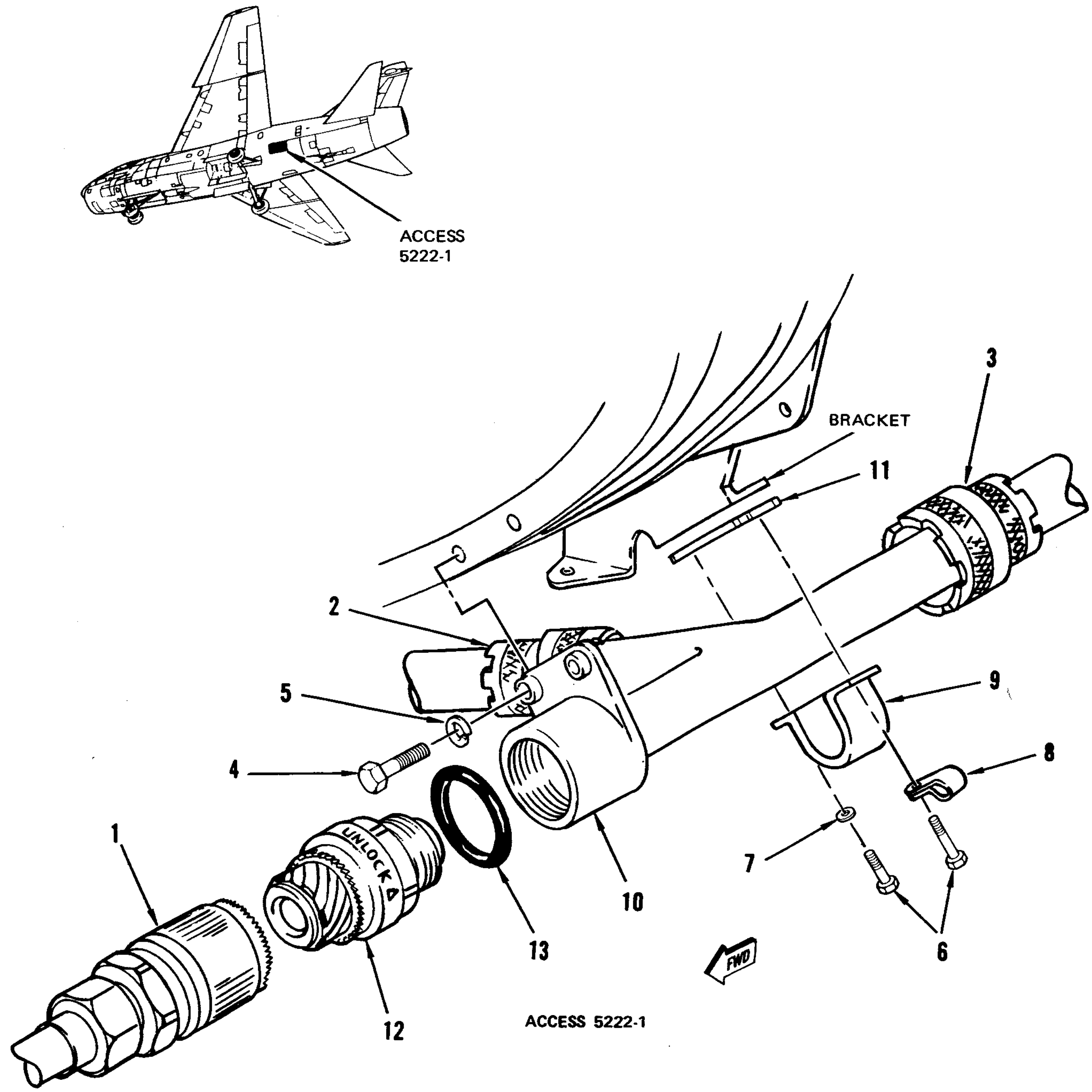
Figure 5-28. Removal and Installation; Motive Flow Line Manifold



1. Quick-disconnect
2. Wiggins coupling
3. Wiggins coupling
4. Bolt
5. Lockwasher
6. Bolt
7. Washer
8. Clamp
9. Support
10. Quick-disconnect manifold
11. Spacer
12. Coupling half
13. Packing

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Figure 5-29. Removal and Installation; Quick-Disconnect Manifold

c. Disconnect Wiggins couplings (2 and 3) (paragraph 1-16).

d. Remove bolts (4), lockwashers (5), bolts (6), washer (7), clamp (8), support (9), quick-disconnect manifold (10), and spacer (11).

e. Cut lockwire and remove coupling half (12) and packing (13).

5-37.2. Installation. (Figure 5-29.)

a. Using new packing (13), install coupling half (12) in quick-disconnect manifold (10). Secure coupling half to manifold with MS20995C32 lockwire.

b. Position manifold on front flange of engine and secure with lockwashers (5) and bolts (4).

c. Position spacer (11) on bracket.

d. Secure support (9) and clamp (8) with washer (7) and bolts (6).

e. Connect Wiggins couplings (2 and 3) (paragraph 1-16).

f. Connect quick-disconnect (1).

g. Start engine (T.O. 1A-7D-2-1) and check installation for leaks.

h. Shut down engine (T.O. 1A-7D-2-1).

i. Close access 5222-1.

5-38. 215-53424-1 AND 215-53424-3 MOTIVE FLOW QUICK-DISCONNECT COUPLINGS INSPECTION.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
		Equipment required for engine operation	Operate engine

a. Open access 6222-1.

b. Disconnect motive flow quick-disconnect couplings.

c. Check for broken and missing aluminum locking fingers.

d. Replace quick-disconnect if damaged beyond the following limits:

(1) Two fingers missing or broken less than 90° apart.

(2) Three fingers missing or broken less than 120° apart.

e. Align halves of quick-disconnect couplings and push them together until locking fingers rest against locking ring.

f. Pull sliding collar on female coupling half back to allow locking fingers to expand.

g. Slide coupling halves together until locking fingers have passed over locking ring.

h. Release sliding collar and observe that it passes over and compresses locking fingers.

NOTE

Do not grasp or hold sliding collar when checking coupling. Force required to unlock coupling is small and disconnect could result.

i. Check that coupling is properly locked by pulling and pushing on 90° elbow attached to female coupling half.

j. Start engine (T.O. 1A-7D-2-1) and check installation for leaks.

k. Shut down engine (T.O. 1A-7D-2-1).

l. Close access 6222-1.

5-39. LOW PRESSURE (LP) GOVERNOR TO HP FUEL SHUTOFF VALVE FUEL TUBE LEAKAGE INSPECTION.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
		Equipment required for engine operation	Operate engine

NOTE

This procedure is to be utilized if fuel seepage or leakage is noted on fuel tube at housing on either end of LP governor to HP fuel shutoff valve fuel tube.

a. Open access 5222-2.

b. Remove nut (1, figure 5-30), washers (2 and 3), and bolt (4).

c. Remove bolts (5), lockwashers (6), bolts (7), lockwashers (8), LP governor to HP fuel shutoff valve fuel tube (9), housing (10), packings (11 and 12), housing (13), packing (14), packing retainer (15), and packings (16).

d. Inspect housings for bore roughness and grooves. If bore is rough, replace housing. If grooves are present, measure combined ID of housing and depth of groove. If this is more than 0.930 inch, replace housing.

e. Install new packings (16), packing retainer (15), new packing (14), housing (13), new packings (12 and 11), and housing (10) on LP governor to HP fuel shutoff valve fuel tube (9).

NOTE

Bracket is retained by bolts (7).

f. Place fuel tube in position and secure to LP governor with lockwashers (8) and bolts (7).

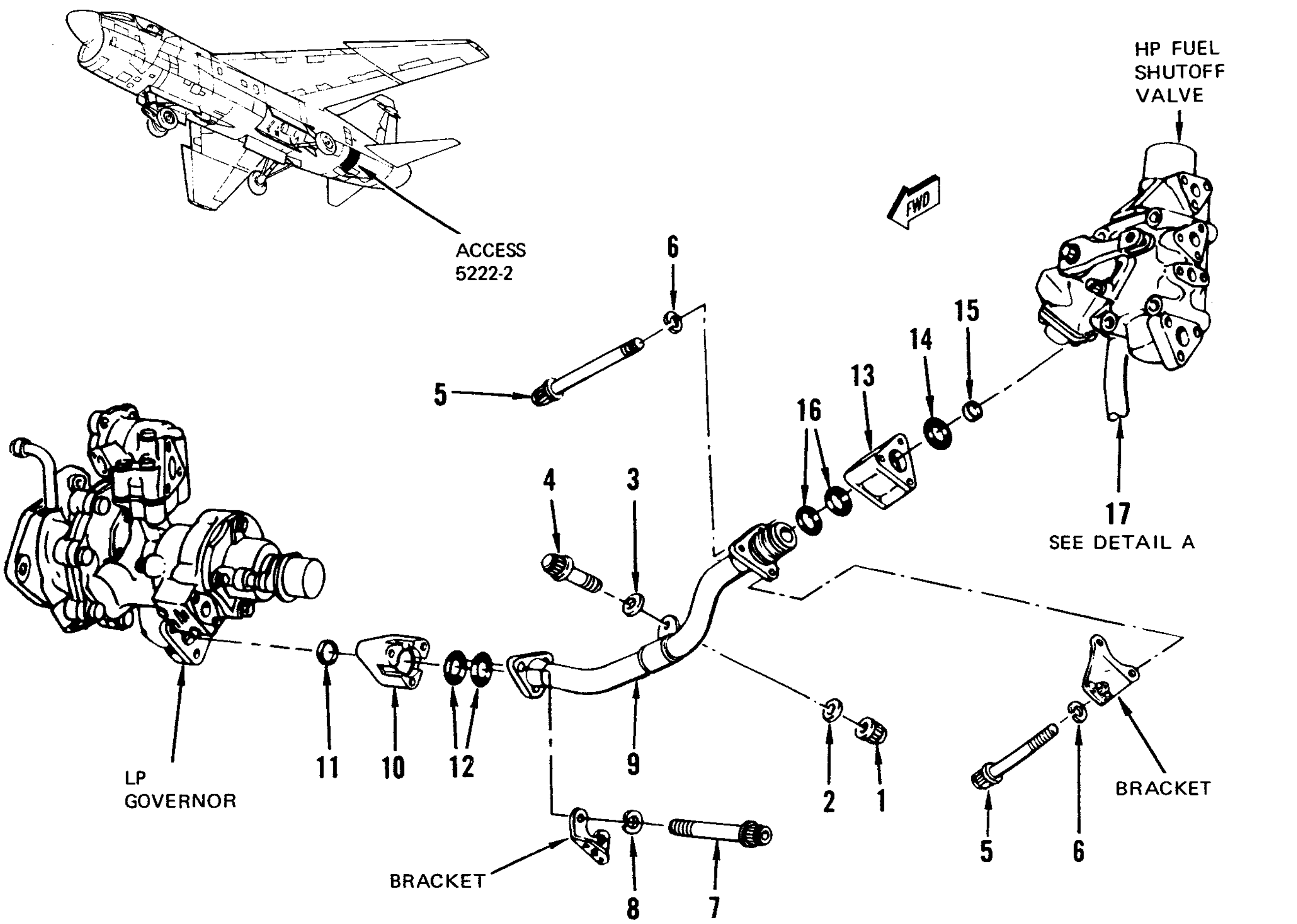
g. Check that housing aligns with face of HP fuel shutoff valve to manual fuel control tube (17) by checking dimension A all the way around housing. If it is less than 0.100 inch at any point, remove tube (steps b and c), and forward to field maintenance for reforming.

h. If dimension A is within limits at all points, install lockwashers (6), bolts (5), bolt (4), washers (2 and 3), and nut (1).

i. Start engine (T.O. 1A-7D-2-1) and check installation for leaks.

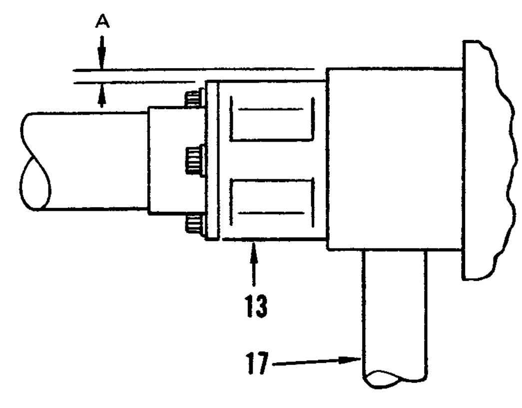
j. Shut down engine (T.O. 1A-7D-2-1).

k. Close access 5222-2.



ACCESS 5222-2

1. Nut
2. Washer
3. Washer
4. Bolt
5. Bolt
6. Lockwasher
7. Bolt
8. Lockwasher
9. LP governor to HP fuel shutoff valve fuel tube
10. Housing
11. Packing
12. Packing
13. Housing
14. Packing
15. Packing retainer
16. Packing
17. HP fuel shutoff valve to manual fuel control tube



DETAIL A

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Figure 5-30. Leakage Inspection; LP Governor to HP Fuel Shutoff Valve Fuel Tube

SECTION VI

MANUAL FUEL SYSTEM

6-1. DESCRIPTION.

6-1.1. Purpose. The manual fuel system is used to meter fuel in the event of a main fuel control malfunction. The manual fuel control is a hydromechanical fuel metering device. It provides acceleration fuel flow as a function of power lever position below idle fuel flow. A ratio of fuel flow to power lever setting regulates flow with power lever between idle and military. Above idle, fuel flow is automatically compensated as a function of fan discharge pressure (P2.1). The control does not give automatic protection for overspeed or overtemperature.

6-1.2. Fuel Control Solenoid. The control uses a magnetic latching type solenoid to select or deselect operation. The solenoid must have power of the proper polarity. A fail-safe feature of the solenoid will be lost for any of the following: reversing plus or minus leads to the solenoid, ohmmeter checks of the winding, or disassembly of the solenoid armature. Although the fail-safe feature is destroyed, it will continue to perform when energized; therefore, the fault may not be apparent.

6-1.3. Fuel Control Lever. The input lever has a variable length clevis and a micromatic bolt adjustment for idle and military power adjustments. The lever also has a maximum power stopscrew and idle slot screw. These screws are for setting the idle and military manual fuel control throttle positions with the engine operating. With these positions set, the engine may be shut down and the linkage adjusted.

6-1.4. Cockpit Indication. A manual fuel control caution light in the cockpit gives visual indication that the fuel control switch is in manual position.

6-2. OPERATION. (Figures 6-1 and FO-11.)

6-2.1. Manual Fuel Control. The manual fuel control is a hydromechanical fuel metering device. It meters fuel whenever a malfunction occurs with the main fuel control. It provides fuel flow as a direct function of throttle lever setting. Fuel flow is compensated automatically as a function of fan discharge pressure (P2.1). The control consists of the following main components: metering valve, throttle lever, P2.1 servo actuator, and magnetically latching type solenoid.

6-2.1.1. Metering Valve. The metering valve consists of a matched steel valve with two lands and a steel sleeve that has entrance, exit, and cutoff ports. When the initiation valve is closed, fuel inlet pressure (P1f) is applied between the lands. The lands are different diameters with a larger area at the head of the valve. P1f pressure is applied to the head of the metering valve through the servo bleed in the hollow stem of the metering valve. When the initiation valve is open, pressure on the head of the metering valve drops to servo operating pressure (Px). This will create an unbalanced force. The metering valve will then shift to the manual mode position. If the throttle lever is above −7°, the control will meter fuel to the fuel nozzles. When the engine is shut down, the nulling spring will move the metering valve to a point midway between the normal and manual positions. This null position allows for minimum axial movement on startup to place the valve in the selected mode, and a known position on shutdown.

6-2.1.2. Throttle Lever. The throttle lever provides rotational movement of the metering valve. If the control is in the manual mode and the throttle is advanced, more flow area is provided in the metering valve. A bleed is in the drain port between the two bearings. This bleed, with any slight leakage past the primary seal, will keep the Px pressure required for manual operation. This provides a fail-safe design for possible primary seal degradation.

6-2.1.3. P2.1 Servo Actuator. The P2.1 servo actuator is in operation when the initiation valve is open. It has a flapper type valve that is moved by a bellows. A torsion shaft transmits bellows action. A reference spring opposes the bellows action. The system is preloaded to the point that the servo valve never completely closes. P2.1 air pressure is applied to the outside of the bellows. A high P2.1 pressure (low altitude) will compress the bellows and open the servo

P_{1f}	Fuel Inlet Pressure
$P_{1f}1$	Normal Fuel Outlet
P_{2f}	Main Burner Flow
P_p	Pilot Burner Flow
P_X	Servo Operating Pressure
$P_{2.1}$	Fan Discharge Pressure

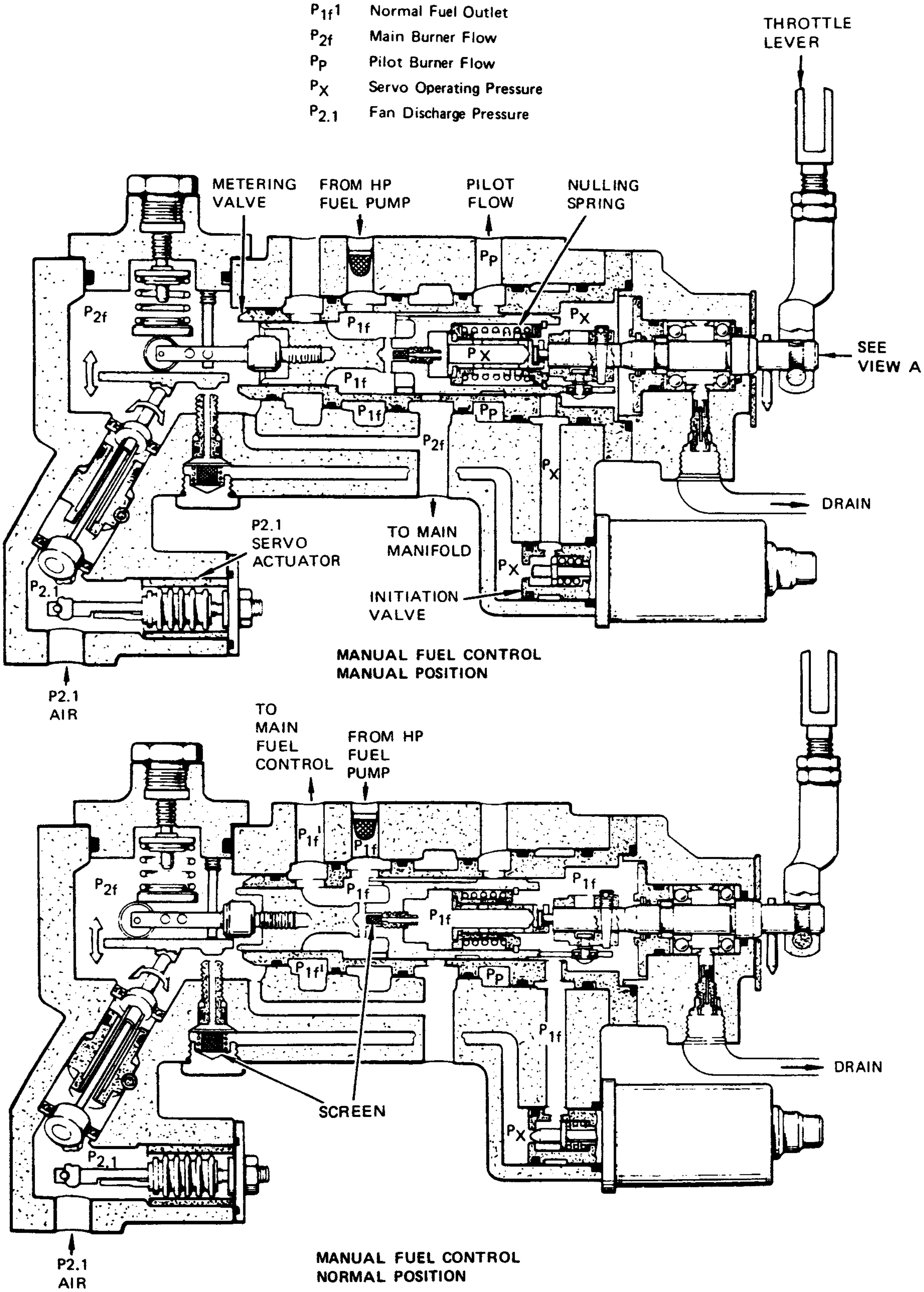

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Figure 6-1. Control System; Manual Fuel (Sheet 1 of 2)

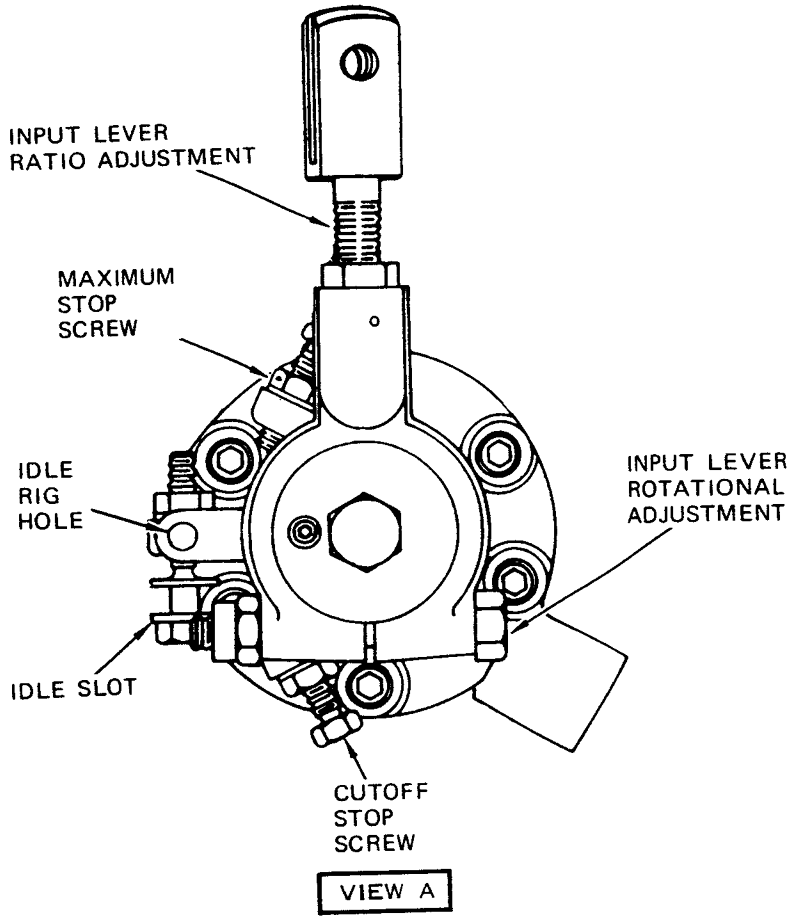

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Figure 6-1. Control System; Manual Fuel (Sheet 2) valve. This will reduce the Px pressure on the head of the metering valve and cause it to move toward the open position. As the metering valve opens, the roller will travel toward center and the spring load will start to close the servo valve. The servo valve will null when there is a balance between the forces tending to open and close it. A low P2.1 pressure (high altitude) will allow the bellows to expand and partially close the servo valve. This will tend to increase servo operating pressure on the head of the metering valve. The metering valve then travels toward the closed position until a null is reached.

6-2.1.4. Solenoid. The solenoid is a magnetic latching type. The armature of the solenid will remain magnetically latched in the direction it was last energized. A permanent magnet in each solenoid core near the armature causes the armature to remain in the last energized position. Power to the solenoid winding is not required once the solenoid is latched in position. The solenoid must have power applied with the proper polarity. Reversing plus or minus leads to the solenoid, making ohmmeter checks of the winding, or disassembling the solenoid armature will void the fail-safe feature of the solenoid. Although the fail-safe feature is cancelled, it will continue to perform when energized; therefore, the fault may not be apparent.

6-2.2. Manual Control Operation. For normal operation, the fuel control switch S1 is in NORM. During engine start, 28 volts dc from the starter circuit excites the normal winding of the manual fuel control solenoid. This is to ensure that the manual fuel control is in a selected position during engine start. After engine start, power is supplied by the emergency dc bus. When in the normal position, fuel flows unrestricted through the manual fuel control to the main fuel control. Manual fuel control operation begins by placing the fuel control switch in MAN. This routes 28 volts dc from the battery bus to the manual fuel control caution light causing the light to come on. The fuel control switch also routes 28 volts dc from the emergency dc bus to excite the manual windings of the magnetic latching solenoid. This opens the initiation valve which reduces P1f pressure to Px pressure. The differential pressure across the metering valve is reversed and the metering valve shifts to the manual mode position. This shuts off fuel flow to the main fuel control. The manual fuel control then meters fuel flow as a function of throttle lever position and P2.1 air pressure. Main manifold pressure is sensed by the high pressure fuel pump. Servo and pump delivery will be varied as required. When operating in manual fuel control mode, the automatic limiters are not operating. The one protection against exceeding limits is throttle lever position.

6-2.3. Main Control Operation. Main fuel control operation may be restored by placing the fuel control switch in NORM. This removes 28 volts dc from the caution light and routes it from the emergency dc bus to the manual fuel control solenoid. The manual fuel control caution light will go out and the solenoid will shift and latch in the normal position. The initiation valve will close and P1f pressure will be applied to the head of the valve. This will create an imbalance and the metering valve will shift to the normal mode position. The metering valve will be wide open on the small diameter end. This allows fuel to flow unrestricted through the control. In the normal mode position, the metering valve will be positioned rotationally by the throttle, but will not affect fuel flow. P2.1 air pressure will be constantly applied to the bellows, preloading the torsion shaft. The P1f pressure is enough to overcome the torsion shaft pressure, and the metering valve remains fully open. However, the control is armed in the event manual mode operation is necessary.

6-2.4. Static Condition. When the engine is shut down and fuel pressure is zero, the metering valve is moved to a null position by spring force. This position is midway between the normal and manual mode positions. This permits the valve to move directly to the selected position without first operating in an unselected position.

6-3. COMPONENTS. For a list of system components, locations (accesses), and functions, refer to table 6-1.

Table 6-1. Manual Fuel System Components

Component	Location	Function
Control, manual fuel	5222-2	Meters fuel in event of main fuel control malfunction
Switch, fuel control	Left console	Selects or deselects manual fuel control operation
Circuit breaker, CB3151	1232-1	Applies 28 volts dc to manual fuel control system
Circuit breaker, CB3181	1232-1	Applies 28 volts dc to manual fuel control caution light
Light, manual fuel control caution	Right console	Indicates position at fuel control switch

6-4. OPERATIONAL CHECKOUT.

Test Equipment Required

Figure & index No.	Name	AN type designation	Use and application
	Equipment required for engine operation		Operate engine
	Adjusting clip	6872249 (Allison Division of General Motors, Indianapolis, Indiana)	Simulate maximum stop adjustment of 800 rpm

NOTE

A number enclosed in braces at the end of a step in the following tests corresponds to a number in the troubleshooting table 6-2.

a. Obtain ambient temperature and station barometric pressure (not corrected to sea level).

b. Using above values and figure FO-12 (figure 6-2 if adjusting clip is installed), record maximum and minimum Pt5.1 values.

Minimum and Maximum Manual Fuel Control Power Check Chart
TF41-A-1 (Adjusting Clip Installed)

NOTE

Values shown are for engine operating with air inlet screen installed and air conditioning system operating. If engine must be operated with screen removed, add 1.3" Hg to $P_{T5.1}$ true pressure.

Ambient Pressure – Inches Mercury Absolute

Ambient Temperature		24.0		24.2		24.4		24.6		24.8	
		$P_{T5.1}$ True Pressure – Inches Mercury Gage									
°C	°F	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
55.	131.0	20.4	16.0	20.5	16.2	20.7	16.3	20.9	16.4	21.0	16.6
54.	129.2	20.4	16.1	20.6	16.2	20.8	16.4	21.0	16.5	21.1	16.6
53.	127.4	20.5	16.2	20.7	16.3	20.9	16.4	21.0	16.6	21.2	16.7
52.	125.6	20.6	16.3	20.8	16.4	20.9	16.5	21.1	16.7	21.3	16.8
51.	123.8	20.7	16.3	20.9	16.5	21.0	16.6	21.2	16.7	21.4	16.9
50.	122.0	20.8	16.4	20.9	16.5	21.1	16.7	21.3	16.8	21.5	16.9
49.	120.2	20.8	16.5	21.0	16.6	21.2	16.7	21.4	16.9	21.5	17.0
48.	118.4	20.9	16.5	21.1	16.7	21.3	16.8	21.4	17.0	21.6	17.1
47.	116.6	21.0	16.6	21.2	16.8	21.4	16.9	21.5	17.0	21.7	17.2
46.	114.8	21.1	16.7	21.3	16.8	21.4	17.0	21.6	17.1	21.8	17.2
45.	113.0	21.2	16.8	21.3	16.9	21.5	17.0	21.7	17.2	21.9	17.3
44.	111.2	21.2	16.8	21.4	17.0	21.6	17.1	21.8	17.3	22.0	17.4
43.	109.4	21.3	16.9	21.5	17.0	21.7	17.2	21.9	17.3	22.0	17.5
42.	107.6	21.4	17.0	21.6	17.1	21.8	17.3	21.9	17.4	22.1	17.5
41.	105.8	21.5	17.1	21.7	17.2	21.8	17.3	22.0	17.5	22.2	17.6
40.	104.0	21.6	17.1	21.8	17.3	21.9	17.4	22.1	17.6	22.3	17.7
39.	102.2	21.7	17.2	21.8	17.3	22.0	17.5	22.2	17.6	22.4	17.8
38.	100.4	21.7	17.3	21.9	17.4	22.1	17.6	22.3	17.7	22.5	17.8
37.	98.6	21.8	17.3	22.0	17.5	22.2	17.6	22.4	17.8	22.5	17.9
36.	96.8	21.9	17.4	22.1	17.6	22.3	17.7	22.4	17.9	22.6	18.0
35.	95.0	22.0	17.5	22.2	17.6	22.3	17.8	22.5	17.9	22.7	18.1
34.	93.2	22.1	17.6	22.2	17.7	22.4	17.9	22.6	18.0	22.8	18.2
33.	91.4	22.1	17.6	22.3	17.8	22.5	17.9	22.7	18.1	22.9	18.2
32.	89.6	22.2	17.7	22.4	17.9	22.6	18.0	22.8	18.2	23.0	18.3
31.	87.8	22.3	17.8	22.5	17.9	22.7	18.1	22.9	18.2	23.0	18.4
30.	86.0	22.4	17.9	22.6	18.0	22.8	18.2	22.9	18.3	23.1	18.5
29.	84.2	22.5	17.9	22.6	18.1	22.8	18.2	23.0	18.4	23.2	18.5
28.	82.4	22.5	18.0	22.7	18.2	22.9	18.3	23.1	18.5	23.3	18.6
27.	80.6	22.6	18.1	22.8	18.2	23.0	18.4	23.2	18.5	23.4	18.7
26.	78.8	22.7	18.1	22.9	18.3	23.1	18.5	23.3	18.6	23.5	18.8
25.	77.0	22.8	18.2	23.0	18.4	23.2	18.5	23.4	18.7	23.5	18.8
24.	75.2	22.9	18.3	23.1	18.4	23.2	18.6	23.4	18.8	23.6	18.9
23.	73.4	22.9	18.4	23.1	18.5	23.3	18.7	23.5	18.8	23.7	19.0
22.	71.6	23.0	18.4	23.2	18.6	23.4	18.7	23.6	18.9	23.8	19.1
21.	69.8	23.1	18.5	23.3	18.7	23.5	18.8	23.7	19.0	23.9	19.1
20.	68.0	23.2	18.6	23.4	18.7	23.6	18.9	23.8	19.0	24.0	19.2
19.	66.2	23.3	18.7	23.5	18.8	23.7	19.0	23.8	19.1	24.0	19.3
18.	64.4	23.3	18.7	23.5	18.9	23.7	19.0	23.9	19.2	24.1	19.4
17.	62.6	23.4	18.8	23.6	19.0	23.8	19.1	24.0	19.3	24.2	19.4
16.	60.8	23.5	18.9	23.7	19.0	23.9	19.2	24.1	19.3	24.3	19.5

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Figure 6-2. Power Check Chart (With Adjusting Clip); Manual Fuel Control (Sheet 1 of 7)

Minimum and Maximum Manual Fuel Control Power Check Chart
TF41-A-1 (Adjusting Clip Installed)

NOTE

Values shown are for engine operating with air inlet screen installed and air conditioning system operating. If engine must be operated with screen removed, add 1.3" Hg to $P_{T5.1}$ true pressure.

Ambient Pressure — Inches Mercury Absolute

Ambient Temperature		25.0		25.2		25.4		25.6		25.8	
		$P_{T5.1}$ True Pressure — Inches Mercury Gage									
°C	°F	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
55.	131.0	21.2	16.7	21.4	16.8	21.5	17.0	21.7	17.1	21.9	17.2
54.	129.2	21.3	16.8	21.5	16.9	21.6	17.0	21.8	17.2	22.0	17.3
53.	127.4	21.4	16.9	21.5	17.0	21.7	17.1	21.9	17.3	22.1	17.4
52.	125.6	21.5	16.9	21.6	17.1	21.8	17.2	22.0	17.3	22.1	17.5
51.	123.8	21.5	17.0	21.7	17.1	21.9	17.3	22.1	17.4	22.2	17.6
50.	122.0	21.6	17.1	21.8	17.2	22.0	17.4	22.1	17.5	22.3	17.6
49.	120.2	21.7	17.2	21.9	17.3	22.1	17.4	22.2	17.6	22.4	17.7
48.	118.4	21.8	17.2	22.0	17.4	22.1	17.5	22.3	17.6	22.5	17.8
47.	116.6	21.9	17.3	22.1	17.4	22.2	17.6	22.4	17.7	22.6	17.9
46.	114.8	22.0	17.4	22.1	17.5	22.3	17.7	22.5	17.8	22.7	17.9
45.	113.0	22.0	17.5	22.2	17.6	22.4	17.7	22.6	17.9	22.8	18.0
44.	111.2	22.1	17.5	22.3	17.7	22.5	17.8	22.7	18.0	22.8	18.1
43.	109.4	22.2	17.6	22.4	17.8	22.6	17.9	22.8	18.0	22.9	18.2
42.	107.6	22.3	17.7	22.5	17.8	22.7	18.0	22.8	18.1	23.0	18.3
41.	105.8	22.4	17.8	22.6	17.9	22.7	18.0	22.9	18.2	23.1	18.3
40.	104.0	22.5	17.8	22.6	18.0	22.8	18.1	23.0	18.3	23.2	18.4
39.	102.2	22.6	17.9	22.7	18.1	22.9	18.2	23.1	18.3	23.3	18.5
38.	100.4	22.6	18.0	22.8	18.1	23.0	18.3	23.2	18.4	23.4	18.6
37.	98.6	22.7	18.1	22.9	18.2	23.1	18.4	23.3	18.5	23.4	18.6
36.	96.8	22.8	18.1	23.0	18.3	23.2	18.4	23.4	18.6	23.5	18.7
35.	95.0	22.9	18.2	23.1	18.4	23.3	18.5	23.4	18.7	23.6	18.8
34.	93.2	23.0	18.3	23.2	18.4	23.3	18.6	23.5	18.7	23.7	18.9
33.	91.4	23.1	18.4	23.2	18.5	23.4	18.7	23.6	18.8	23.8	19.0
32.	89.6	23.1	18.4	23.3	18.6	23.5	18.7	23.7	18.9	23.9	19.0
31.	87.8	23.2	18.5	23.4	18.7	23.6	18.8	23.8	19.0	24.0	19.1
30.	86.0	23.3	18.6	23.5	18.7	23.7	18.9	23.9	19.0	24.1	19.2
29.	84.2	23.4	18.7	23.6	18.8	23.8	19.0	24.0	19.1	24.1	19.3
28.	82.4	23.5	18.8	23.7	18.9	23.9	19.1	24.0	19.2	24.2	19.4
27.	80.6	23.6	18.8	23.8	19.0	23.9	19.1	24.1	19.3	24.3	19.4
26.	78.8	23.6	18.9	23.8	19.1	24.0	19.2	24.2	19.4	24.4	19.5
25.	77.0	23.7	19.0	23.9	19.1	24.1	19.3	24.3	19.4	24.5	19.6
24.	75.2	23.8	19.1	24.0	19.2	24.2	19.4	24.4	19.5	24.6	19.7
23.	73.4	23.9	19.1	24.1	19.3	24.3	19.4	24.5	19.6	24.7	19.7
22.	71.6	24.0	19.2	24.2	19.4	24.4	19.5	24.6	19.7	24.8	19.8
21.	69.8	24.1	19.3	24.3	19.4	24.5	19.6	24.6	19.7	24.8	19.9
20.	68.0	24.2	19.4	24.3	19.5	24.5	19.7	24.7	19.8	24.9	20.0
19.	66.2	24.2	19.4	24.4	19.6	24.6	19.7	24.8	19.9	25.0	20.1
18.	64.4	24.3	19.5	24.5	19.7	24.7	19.8	24.9	20.0	25.1	20.1
17.	62.6	24.4	19.6	24.6	19.7	24.8	19.9	25.0	20.1	25.2	20.2
16.	60.8	24.5	19.7	24.7	19.8	24.9	20.0	25.1	20.1	25.3	20.3

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Figure 6-2. Power Check Chart (With Adjusting Clip); Manual Fuel Control (Sheet 2)

Minimum and Maximum Manual Fuel Control Power Check Chart
TF41-A-1 (Adjusting Clip Installed)

NOTE

Values shown are for engine operating with air inlet screen installed and air conditioning system operating. If engine must be operated with screen removed, add 1.3" Hg to $P_{T5.1}$ true pressure.

Ambient Pressure – Inches Mercury Absolute

Ambient Temperature		26.0		26.2		26.4		26.6		26.8	
		$P_{T5.1}$ True Pressure – Inches Mercury Gage									
°C	°F	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
55.	131.0	22.1	17.4	22.2	17.5	22.4	17.6	22.6	17.8	22.7	17.9
54.	129.2	22.1	17.4	22.3	17.6	22.5	17.7	22.7	17.9	22.8	18.0
53.	127.4	22.2	17.5	22.4	17.7	22.6	17.8	22.7	17.9	22.9	18.1
52.	125.6	22.3	17.6	22.5	17.7	22.7	17.9	22.8	18.0	23.0	18.1
51.	123.8	22.4	17.7	22.6	17.8	22.8	18.0	22.9	18.1	23.1	18.2
50.	122.0	22.5	17.8	22.7	17.9	22.8	18.0	23.0	18.2	23.2	18.3
49.	120.2	22.6	17.8	22.8	18.0	22.9	18.1	23.1	18.3	23.3	18.4
48.	118.4	22.7	17.9	22.8	18.1	23.0	18.2	23.2	18.3	23.4	18.5
47.	116.6	22.8	18.0	22.9	18.1	23.1	18.3	23.3	18.4	23.5	18.6
46.	114.8	22.8	18.1	23.0	18.2	23.2	18.4	23.4	18.5	23.5	18.6
45.	113.0	22.9	18.2	23.1	18.3	23.3	18.4	23.5	18.6	23.6	18.7
44.	111.2	23.0	18.2	23.2	18.4	23.4	18.5	23.5	18.7	23.7	18.8
43.	109.4	23.1	18.3	23.3	18.5	23.5	18.6	23.6	18.7	23.8	18.9
42.	107.6	23.2	18.4	23.4	18.5	23.5	18.7	23.7	18.8	23.9	19.0
41.	105.8	23.3	18.5	23.5	18.6	23.6	18.8	23.8	18.9	24.0	19.0
40.	104.0	23.4	18.6	23.5	18.7	23.7	18.8	23.9	19.0	24.1	19.1
39.	102.2	23.5	18.6	23.6	18.8	23.8	18.9	24.0	19.1	24.2	19.2
38.	100.4	23.5	18.7	23.7	18.9	23.9	19.0	24.1	19.1	24.3	19.3
37.	98.6	23.6	18.8	23.8	18.9	24.0	19.1	24.2	19.2	24.4	19.4
36.	96.8	23.7	18.9	23.9	19.0	24.1	19.2	24.3	19.3	24.4	19.5
35.	95.0	23.8	18.9	24.0	19.1	24.2	19.2	24.4	19.4	24.5	19.5
34.	93.2	23.9	19.0	24.1	19.2	24.3	19.3	24.4	19.5	24.6	19.6
33.	91.4	24.0	19.1	24.2	19.3	24.3	19.4	24.5	19.5	24.7	19.7
32.	89.6	24.1	19.2	24.3	19.3	24.4	19.5	24.6	19.6	24.8	19.8
31.	87.8	24.2	19.3	24.3	19.4	24.5	19.6	24.7	19.7	24.9	19.9
30.	86.0	24.2	19.3	24.4	19.5	24.6	19.6	24.8	19.8	25.0	19.9
29.	84.2	24.3	19.4	24.5	19.6	24.7	19.7	24.9	19.9	25.1	20.0
28.	82.4	24.4	19.5	24.6	19.7	24.8	19.8	25.0	20.0	25.2	20.1
27.	80.6	24.5	19.6	24.7	19.7	24.9	19.9	25.1	20.0	25.3	20.2
26.	78.8	24.6	19.7	24.8	19.8	25.0	20.0	25.2	20.1	25.3	20.3
25.	77.0	24.7	19.7	24.9	19.9	25.1	20.0	25.2	20.2	25.4	20.3
24.	75.2	24.8	19.8	25.0	20.0	25.1	20.1	25.3	20.3	25.5	20.4
23.	73.4	24.9	19.9	25.0	20.0	25.2	20.2	25.4	20.4	25.6	20.5
22.	71.6	24.9	20.0	25.1	20.1	25.3	20.3	25.5	20.4	25.7	20.6
21.	69.8	25.0	20.1	25.2	20.2	25.4	20.4	25.6	20.5	25.8	20.7
20.	68.0	25.1	20.1	25.3	20.3	25.5	20.4	25.7	20.6	25.9	20.8
19.	66.2	25.2	20.2	25.4	20.4	25.6	20.5	25.8	20.7	26.0	20.8
18.	64.4	25.3	20.3	25.5	20.4	25.7	20.6	25.9	20.8	26.1	20.9
17.	62.6	25.4	20.4	25.6	20.5	25.8	20.7	26.0	20.8	26.2	21.0
16.	60.8	25.5	20.4	25.7	20.6	25.9	20.8	26.1	20.9	26.3	21.1

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Figure 6-2. Power Check Chart (With Adjusting Clip); Manual Fuel Control (Sheet 3)

Minimum and Maximum Manual Fuel Control Power Check Chart
TF41-A-1 (Adjusting Clip Installed)

NOTE

Values shown are for engine operating with air inlet screen installed and air conditioning system operating. If engine must be operated with screen removed, add 1.3" Hg to $P_{T5.1}$ true pressure.

Ambient Pressure — Inches Mercury Absolute

Ambient Temperature		27.0		27.2		27.4		27.6		27.8	
		$P_{T5.1}$ True Pressure — Inches Mercury Gage									
°C	°F	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
55.	131.0	22.9	18.0	23.1	18.2	23.2	18.3	23.4	18.4	23.6	18.6
54.	129.2	23.0	18.1	23.2	18.3	23.3	18.4	23.5	18.5	23.7	18.7
53.	127.4	23.1	18.2	23.3	18.3	23.4	18.5	23.6	18.6	23.8	18.7
52.	125.6	23.2	18.3	23.3	18.4	23.5	18.6	23.7	18.7	23.9	18.8
51.	123.8	23.3	18.4	23.4	18.5	23.6	18.6	23.8	18.8	24.0	18.9
50.	122.0	23.4	18.4	23.5	18.6	23.7	18.7	23.9	18.9	24.1	19.0
49.	120.2	23.4	18.5	23.6	18.7	23.8	18.8	24.0	18.9	24.1	19.1
48.	118.4	23.5	18.6	23.7	18.8	23.9	18.9	24.1	19.0	24.2	19.2
47.	116.6	23.5	18.7	23.8	18.8	24.0	19.0	24.2	19.1	24.3	19.2
46.	114.8	23.7	18.8	23.9	18.9	24.1	19.1	24.2	19.2	24.4	19.3
45.	113.0	23.8	18.9	24.0	19.0	24.2	19.1	24.3	19.3	24.5	19.4
44.	111.2	23.9	18.9	24.1	19.1	24.3	19.2	24.4	19.4	24.6	19.5
43.	109.4	24.0	19.0	24.2	19.2	24.3	19.3	24.5	19.4	24.7	19.6
42.	107.6	24.1	19.1	24.3	19.2	24.4	19.4	24.6	19.5	24.8	19.7
41.	105.8	24.2	19.2	24.4	19.3	24.5	19.5	24.7	19.6	24.9	19.8
40.	104.0	24.3	19.3	24.4	19.4	24.6	19.6	24.8	19.7	25.0	19.8
39.	102.2	24.4	19.4	24.5	19.5	24.7	19.6	24.9	19.8	25.1	19.9
38.	100.4	24.4	19.4	24.6	19.6	24.8	19.7	25.0	19.9	25.2	20.0
37.	98.6	24.5	19.5	24.7	19.7	24.9	19.8	25.1	19.9	25.3	20.1
36.	96.8	24.6	19.6	24.8	19.7	25.0	19.9	25.2	20.0	25.4	20.2
35.	95.0	24.7	19.7	24.9	19.8	25.1	20.0	25.3	20.1	25.5	20.3
34.	93.2	24.8	19.8	25.0	19.9	25.2	20.1	25.4	20.2	25.5	20.3
33.	91.4	24.9	19.8	25.1	20.0	25.3	20.1	25.5	20.3	25.6	20.4
32.	89.6	25.0	19.9	25.2	20.1	25.4	20.2	25.5	20.4	25.7	20.5
31.	87.8	25.1	20.0	25.3	20.2	25.5	20.3	25.6	20.5	25.8	20.6
30.	86.0	25.2	20.1	25.4	20.2	25.5	20.4	25.7	20.5	25.9	20.7
29.	84.2	25.3	20.2	25.5	20.3	25.6	20.5	25.8	20.6	26.0	20.8
28.	82.4	25.4	20.3	25.5	20.4	25.7	20.6	25.9	20.7	26.1	20.9
27.	80.6	25.4	20.3	25.6	20.5	25.8	20.6	26.0	20.8	26.2	20.9
26.	78.8	25.5	20.4	25.7	20.6	25.9	20.7	26.1	20.9	26.3	21.0
25.	77.0	25.6	20.5	25.8	20.6	26.0	20.8	26.2	21.0	26.4	21.1
24.	75.2	25.7	20.6	25.9	20.7	26.1	20.9	26.3	21.0	26.5	21.2
23.	73.4	25.8	20.7	26.0	20.8	26.2	21.0	26.4	21.1	26.6	21.3
22.	71.6	25.9	20.7	26.1	20.9	26.3	21.1	26.5	21.2	26.7	21.4
21.	69.8	26.0	20.8	26.2	21.0	26.4	21.1	26.6	21.3	26.8	21.4
20.	68.0	26.1	20.9	26.3	21.1	26.5	21.2	26.7	21.4	26.9	21.5
19.	66.2	26.2	21.0	26.4	21.1	26.6	21.3	26.8	21.5	26.9	21.6
18.	64.4	26.3	21.1	26.5	21.2	26.7	21.4	26.8	21.5	27.0	21.7
17.	62.6	26.4	21.2	26.6	21.3	26.7	21.5	26.9	21.6	27.1	21.8
16.	60.8	26.4	21.2	26.6	21.4	26.8	21.6	27.0	21.7	27.2	21.9

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Figure 6-2. Power Check Chart (With Adjusting Clip); Manual Fuel Control (Sheet 4)

Minimum and Maximum Manual Fuel Control Power Check Chart
TF41-A-1 (Adjusting Clip Installed)

NOTE

Values shown are for engine operating with air inlet screen installed and air conditioning system operating. If engine must be operated with screen removed, add 1.3" Hg to $P_{T5.1}$ true pressure.

Ambient Pressure — Inches Mercury Absolute

Ambient Temperature		28.0		28.2		28.4		28.6		28.8	
		$P_{T5.1}$ True Pressure — Inches Mercury Gage									
°C	°F	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
55.	131.0	23.8	18.7	23.9	18.8	24.1	19.0	24.3	19.1	24.4	19.2
54.	129.2	23.8	18.8	24.0	18.9	24.2	19.1	24.4	19.2	24.5	19.3
53.	127.4	23.9	18.9	24.1	19.0	24.3	19.1	24.5	19.3	24.6	19.4
52.	125.6	24.0	19.0	24.2	19.1	24.4	19.2	24.6	19.4	24.7	19.5
51.	123.8	24.1	19.0	24.3	19.2	24.5	19.3	24.6	19.5	24.8	19.6
50.	122.0	24.2	19.1	24.4	19.3	24.6	19.4	24.7	19.5	24.9	19.7
49.	120.2	24.3	19.2	24.5	19.4	24.7	19.5	24.8	19.6	25.0	19.8
48.	118.4	24.4	19.3	24.6	19.4	24.8	19.6	24.9	19.7	25.1	19.9
47.	116.6	24.5	19.4	24.7	19.5	24.9	19.7	25.0	19.8	25.2	19.9
46.	114.8	24.6	19.5	24.8	19.6	25.0	19.7	25.1	19.9	25.3	20.0
45.	113.0	24.7	19.6	24.9	19.7	25.0	19.8	25.2	20.0	25.4	20.1
44.	111.2	24.8	19.6	25.0	19.8	25.1	19.9	25.3	20.1	25.5	20.2
43.	109.4	24.9	19.7	25.1	19.9	25.2	20.0	25.4	20.1	25.6	20.3
42.	107.6	25.0	19.8	25.2	20.0	25.3	20.1	25.5	20.2	25.7	20.4
41.	105.8	25.1	19.9	25.3	20.0	25.4	20.2	25.6	20.3	25.8	20.5
40.	104.0	25.2	20.0	25.3	20.1	25.5	20.3	25.7	20.4	25.9	20.6
39.	102.2	25.3	20.1	25.4	20.2	25.6	20.4	25.8	20.5	26.0	20.6
38.	100.4	25.4	20.2	25.5	20.3	25.7	20.4	25.9	20.6	26.1	20.7
37.	98.6	25.4	20.2	25.6	20.4	25.8	20.5	26.0	20.7	26.2	20.8
36.	96.8	25.5	20.3	25.7	20.5	25.9	20.6	26.1	20.8	26.3	20.9
35.	95.0	25.6	20.4	25.8	20.6	26.0	20.7	26.2	20.8	26.4	21.0
34.	93.2	25.7	20.5	25.9	20.6	26.1	20.8	26.3	20.9	26.5	21.1
33.	91.4	25.8	20.6	26.0	20.7	26.2	20.9	26.4	21.0	26.6	21.2
32.	89.6	25.9	20.7	26.1	20.8	26.3	21.0	26.5	21.1	26.7	21.3
31.	87.8	26.0	20.7	26.2	20.9	26.4	21.0	26.6	21.2	26.8	21.3
30.	86.0	26.1	20.8	26.3	21.0	26.5	21.1	26.7	21.3	26.9	21.4
29.	84.2	26.2	20.9	26.4	21.1	26.6	21.2	26.8	21.4	27.0	21.5
28.	82.4	26.3	21.0	26.5	21.2	26.7	21.3	26.9	21.5	27.0	21.6
27.	80.6	26.4	21.1	26.6	21.2	26.8	21.4	27.0	21.5	27.1	21.7
26.	78.8	26.5	21.2	26.7	21.3	26.9	21.5	27.1	21.6	27.2	21.8
25.	77.0	26.6	21.3	26.8	21.4	27.0	21.6	27.1	21.7	27.3	21.9
24.	75.2	26.7	21.3	26.9	21.5	27.1	21.6	27.2	21.8	27.4	22.0
23.	73.4	26.8	21.4	27.0	21.6	27.1	21.7	27.3	21.9	27.5	22.0
22.	71.6	26.9	21.5	27.1	21.7	27.2	21.8	27.4	22.0	27.6	22.1
21.	69.8	27.0	21.6	27.1	21.8	27.3	21.9	27.5	22.1	27.7	22.2
20.	68.0	27.0	21.7	27.2	21.8	27.4	22.0	27.6	22.1	27.8	22.3
19.	66.2	27.1	21.8	27.3	21.9	27.5	22.1	27.7	22.2	27.9	22.4
18.	64.4	27.2	21.9	27.4	22.0	27.6	22.2	27.8	22.3	28.0	22.5
17.	62.6	27.3	21.9	27.5	22.1	27.7	22.3	27.9	22.4	28.1	22.6
16.	60.8	27.4	22.0	27.6	22.2	27.8	22.3	28.0	22.5	28.2	22.7

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Figure 6-2. Power Check Chart (With Adjusting Clip); Manual Fuel Control (Sheet 5)

Minimum and Maximum Manual Fuel Control Power Check Chart
TF41-A-1 (Adjusting Clip Installed)

NOTE

Values shown are for engine operating with air inlet screen installed and air conditioning system operating. If engine must be operated with screen removed, add 1.3" Hg to $P_{T5.1}$ true pressure.

Ambient Temperature		Ambient Pressure — Inches Mercury Absolute: 29.0		29.2		29.4		29.6		29.8	
		$P_{T5.1}$ True Pressure — Inches Mercury Gage									
°C	°F	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
55.	131.0	24.6	19.4	24.8	19.5	24.9	19.6	25.1	19.8	25.3	19.9
54.	129.2	24.7	19.5	24.9	19.6	25.0	19.7	25.2	19.9	25.4	20.0
53.	127.4	24.8	19.6	25.0	19.7	25.1	19.8	25.3	20.0	25.5	20.1
52.	125.6	24.9	19.6	25.1	19.8	25.2	19.9	25.4	20.0	25.6	20.2
51.	123.8	25.0	19.7	25.2	19.9	25.3	20.0	25.5	20.1	25.7	20.3
50.	122.0	25.1	19.8	25.3	20.0	25.4	20.1	25.6	20.2	25.8	20.4
49.	120.2	25.2	19.9	25.4	20.0	25.5	20.2	25.7	20.3	25.9	20.5
48.	118.4	25.3	20.0	25.5	20.1	25.6	20.3	25.8	20.4	26.0	20.5
47.	116.6	25.4	20.1	25.6	20.2	25.7	20.4	25.9	20.5	26.1	20.6
46.	114.8	25.5	20.2	25.7	20.3	25.8	20.4	26.0	20.6	26.2	20.7
45.	113.0	25.6	20.3	25.8	20.4	25.9	20.5	26.1	20.7	26.3	20.8
44.	111.2	25.7	20.3	25.9	20.5	26.0	20.6	26.2	20.8	26.4	20.9
43.	109.4	25.8	20.4	25.9	20.6	26.1	20.7	26.3	20.9	26.5	21.0
42.	107.6	25.9	20.5	26.0	20.7	26.2	20.8	26.4	20.9	26.6	21.1
41.	105.8	26.0	20.6	26.1	20.7	26.3	20.9	26.5	21.0	26.7	21.1
40.	104.0	26.1	20.7	26.2	20.8	26.4	21.0	26.6	21.1	26.8	21.3
39.	102.2	26.2	20.8	26.3	20.9	26.5	21.1	26.7	21.2	26.9	21.4
38.	100.4	26.3	20.9	26.4	21.0	26.6	21.2	26.8	21.3	27.0	21.4
37.	98.6	26.4	21.0	26.5	21.1	26.7	21.2	26.9	21.4	27.1	21.5
36.	96.8	26.5	21.0	26.6	21.2	26.8	21.3	27.0	21.5	27.2	21.6
35.	95.0	26.6	21.1	26.7	21.3	26.9	21.4	27.1	21.6	27.3	21.7
34.	93.2	26.6	21.2	26.8	21.4	27.0	21.5	27.2	21.7	27.4	21.8
33.	91.4	26.7	21.3	26.9	21.5	27.1	21.6	27.3	21.8	27.5	21.9
32.	89.6	26.8	21.4	27.0	21.5	27.2	21.7	27.4	21.8	27.6	22.0
31.	87.8	26.9	21.5	27.1	21.6	27.3	21.8	27.5	21.9	27.7	22.1
30.	86.0	27.0	21.6	27.2	21.7	27.4	21.9	27.6	22.0	27.8	22.2
29.	84.2	27.1	21.7	27.3	21.8	27.5	22.0	27.7	22.1	27.9	22.3
28.	82.4	27.2	21.8	27.4	21.9	27.6	22.1	27.8	22.2	28.0	22.4
27.	80.6	27.3	21.8	27.5	22.0	27.7	22.1	27.9	22.3	28.1	22.4
26.	78.8	27.4	21.9	27.6	22.1	27.8	22.2	28.0	22.4	28.2	22.5
25.	77.0	27.5	22.0	27.7	22.2	27.9	22.3	28.1	22.5	28.3	22.6
24.	75.2	27.6	22.1	27.8	22.3	28.0	22.4	28.2	22.6	28.4	22.7
23.	73.4	27.7	22.2	27.9	22.3	28.1	22.5	28.3	22.7	28.5	22.8
22.	71.6	27.8	22.3	28.0	22.4	28.2	22.6	28.4	22.7	28.6	22.9
21.	69.8	27.9	22.4	28.1	22.5	28.3	22.7	28.5	22.8	28.7	23.0
20.	68.0	28.0	22.5	28.2	22.6	28.4	22.8	28.6	22.9	28.8	23.1
19.	66.2	28.1	22.5	28.3	22.7	28.5	22.9	28.7	23.0	28.9	23.2
18.	64.4	28.2	22.6	28.4	22.8	28.6	22.9	28.8	23.1	29.0	23.3
17.	62.6	28.3	22.7	28.5	22.9	28.7	23.0	28.9	23.2	29.1	23.3
16.	60.8	28.4	22.8	28.6	23.0	28.8	23.1	29.0	23.3	29.2	23.4

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Figure 6-2. Power Check Chart (With Adjusting Clip); Manual Fuel Control (Sheet 6)

Minimum and Maximum Manual Fuel Control Power Check Chart
TF41-A-1 (Adjusting Clip Installed)

NOTE

Values shown are for engine operating with air inlet screen installed and air conditioning system operating. If engine must be operated with screen removed, add 1.3" Hg to $P_{T5.1}$ true pressure.

Ambient Pressure — Inches Mercury Absolute

Ambient Temperature		30.0		30.2		30.4		30.6		30.8	
		$P_{T5.1}$ True Pressure — Inches Mercury Gage									
°C	°F	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
55.	131.0	25.4	20.0	25.6	20.2	25.8	20.3	26.0	20.4	26.1	20.6
54.	129.2	25.5	20.1	25.7	20.3	25.9	20.4	26.1	20.5	26.2	20.7
53.	127.4	25.7	20.2	25.8	20.4	26.0	20.5	26.2	20.6	26.3	20.8
52.	125.6	25.8	20.3	25.9	20.5	26.1	20.6	26.3	20.7	26.4	20.9
51.	123.8	25.9	20.4	26.0	20.5	26.2	20.7	26.4	20.8	26.5	21.0
50.	122.0	26.0	20.5	26.1	20.6	26.3	20.8	26.5	20.9	26.6	21.0
49.	120.2	26.1	20.6	26.2	20.7	26.4	20.9	26.6	21.0	26.7	21.1
48.	118.4	26.2	20.7	26.3	20.8	26.5	21.0	26.7	21.1	26.9	21.2
47.	116.6	26.3	20.8	26.4	20.9	26.6	21.0	26.8	21.2	27.0	21.3
46.	114.8	26.4	20.9	26.5	21.0	26.7	21.1	26.9	21.3	27.1	21.4
45.	113.0	26.5	21.0	26.6	21.1	26.8	21.2	27.0	21.4	27.2	21.5
44.	111.2	26.6	21.0	26.7	21.2	26.9	21.3	27.1	21.5	27.3	21.6
43.	109.4	26.7	21.1	26.8	21.3	27.0	21.4	27.2	21.6	27.4	21.7
42.	107.6	26.8	21.2	26.9	21.4	27.1	21.5	27.3	21.7	27.5	21.8
41.	105.8	26.9	21.3	27.0	21.5	27.2	21.6	27.4	21.7	27.6	21.9
40.	104.0	27.0	21.4	27.1	21.6	27.3	21.7	27.5	21.8	27.7	22.0
39.	102.2	27.1	21.5	27.2	21.6	27.4	21.8	27.6	21.9	27.8	22.1
38.	100.4	27.2	21.6	27.3	21.7	27.5	21.9	27.7	22.0	27.9	22.2
37.	98.6	27.3	21.7	27.4	21.8	27.6	22.0	27.8	22.1	28.0	22.3
36.	96.8	27.4	21.8	27.5	21.9	27.7	22.1	27.9	22.2	28.1	22.4
35.	95.0	27.5	21.9	27.7	22.0	27.8	22.2	28.0	22.3	28.2	22.4
34.	93.2	27.6	22.0	27.8	22.1	27.9	22.2	28.1	22.4	28.3	22.5
33.	91.4	27.7	22.0	27.9	22.2	28.0	22.3	28.2	22.5	28.4	22.6
32.	89.6	27.8	22.1	28.0	22.3	28.1	22.4	28.3	22.6	28.5	22.7
31.	87.8	27.9	22.2	28.1	22.4	28.2	22.5	28.4	22.7	28.6	22.8
30.	86.0	28.0	22.3	28.2	22.5	28.3	22.6	28.5	22.8	28.7	22.9
29.	84.2	28.1	22.4	28.3	22.6	28.4	22.7	28.6	22.9	28.8	23.0
28.	82.4	28.2	22.5	28.4	22.7	28.5	22.8	28.7	23.0	28.9	23.1
27.	80.6	28.3	22.6	28.5	22.7	28.7	22.9	28.8	23.0	29.0	23.2
26.	78.8	28.4	22.7	28.6	22.8	28.8	23.0	28.9	23.1	29.1	23.3
25.	77.0	28.5	22.8	28.7	22.9	28.9	23.1	29.0	23.2	29.2	23.4
24.	75.2	28.6	22.9	28.8	23.0	29.0	23.2	29.1	23.3	29.3	23.5
23.	73.4	28.7	23.0	28.9	23.1	29.1	23.3	29.3	23.4	29.4	23.6
22.	71.6	28.8	23.0	29.0	23.2	29.2	23.4	29.4	23.5	29.5	23.7
21.	69.8	28.9	23.1	29.1	23.3	29.3	23.4	29.5	23.6	29.7	23.8
20.	68.0	29.0	23.2	29.2	23.4	29.4	23.5	29.6	23.7	29.8	23.9
19.	66.2	29.1	23.3	29.3	23.5	29.5	23.6	29.7	23.8	29.9	23.9
18.	64.4	29.2	23.4	29.4	23.6	29.6	23.7	29.8	23.9	30.0	24.0
17.	62.6	29.3	23.5	29.5	23.7	29.7	23.8	29.9	24.0	30.1	24.1
16.	60.8	29.4	23.6	29.6	23.8	29.8	23.9	30.0	24.1	30.2	24.2

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Figure 6-2. Power Check Chart (With Adjusting Clip); Manual Fuel Control (Sheet 7)

c. Start engine (T.O. 1A-7D-2-1).

CAUTION

Engine automatic limiters are inoperative when manual fuel control is selected. Do not attempt to maintain rpm with the throttle while switching to MAN. If rpm decreases below 48%, shut down immediately. Advancing throttle in MAN below idle rpm may cause engine overtemperature.

If engine operates erratically in MAN, retard throttle to IDLE before switching to NORM.

d. Place fuel control switch in MAN. Check that manual fuel caution light comes on, an increase occurs in engine speed, and stable operation continues. {1 through 4}

CAUTION

Throttle movements shall be smooth from IDLE to MIL, and shall extend over a period of 10 seconds or more. Failure to comply may result in engine overspeed and overtemperature.

e. If ambient temperature is above 78.8°F (26°C), proceed as follows:

(1) Slowly advance throttle until 575°C (1,067°F) turbine outlet temperature (TOT) or MIL throttle position is attained. {5}

(2) If 575°C (1,067°F) TOT is reached first, retard throttle to 80% rpm and install adjusting clip (figure 6-3). Proceed to step f.

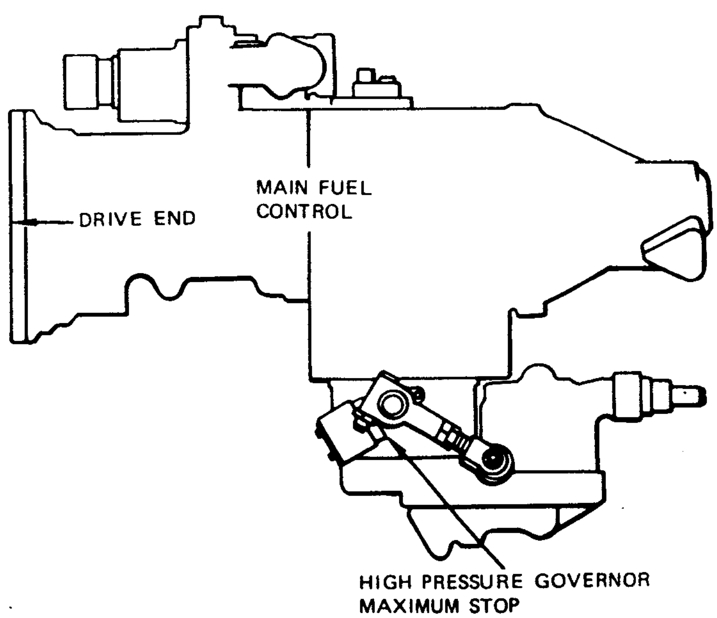

Figure 6-3. Installation; Adjusting Clip

NOTE

If adjusting clip is used, the engine manual fuel control system will require additional rig check (step n).

(3) If MIL throttle position is reached first, proceed to step g.

f. Slowly advance throttle to MIL. {5}

g. Allow engine to stabilize for 5 minutes.

h. Check that TOP is between maximum and minimum Pt5.1 values recorded in step b. {6}

i. Slowly retard throttle to IDLE and stabilize for 3 minutes.

j. Check that engine speed is 55% to 65% rpm. {7 through 10}

CAUTION

When a malfunction causes throttle position and engine speed to be mismatched, the throttle should be placed in IDLE before fuel control is placed in NORM to prevent engine overtemperature.

Transfer from MAN to NORM shall be below 80% rpm to prevent compressor stall.

k. Place fuel control switch in NORM. Check that manual fuel caution light goes off and speed decreases. {11, 12}

l. Shut down engine (T.O. 1A-7D-2-1).

m. Remove adjusting clip (if installed).

NOTE

In step n, recheck of manual fuel control linkage rigging should be accomplished at next available opportunity or next engine trim.

n. If manual fuel control adjustments were done using adjusting clip (6872249), mark aircraft form 781A with red dash and add requirement to recheck manual fuel control rigging when ambient temperature is below 80.6°F (27°C).

6-5. TROUBLESHOOTING.

Test Equipment Required

Figure & index No.	Name	AN type designation	Use and application
	Equipment required for engine operation		Operate engine
	Multimeter	AN/PSM-6	Indicate voltage, continuity, and resistance

6-5.1. Procedures. Refer to table 6-2 for troubleshooting data. Malfunctions are numbered corresponding to numbers following steps in the manual fuel control check.

6-5.2. Schematic. For troubleshooting schematic, see figure FO-11.

Table 6-2. Manual Fuel System Troubleshooting

Probable cause	Isolation procedure	Remedy
1. Manual fuel control advisory light does not come on when fuel control switch is placed in MAN.		
Defective manual fuel control switch	Remove fuel management panel from left console. With switch in MAN, check for continuity between manual fuel control switch terminals 9 and 10.	If continuity is not indicated, replace manual fuel control switch.
Defective wiring	Check wiring for continuity.	If continuity is not indicated, replace defective wiring.
2. Engine speed is not stable with engine operating in manual fuel control mode.		
Defective manual fuel control	None	Replace manual fuel control (paragraph 6-6).
3. No change in engine speed is indicated when manual fuel control switch is placed in MAN.		

CAUTION

Disconnect electrical connectors from manual fuel control before performing continuity checks in manual fuel control system. Reversing current to manual fuel control windings will destroy fail-safe feature.

NOTE

On some rare occasions, it is possible for the manual fuel control to shift without a noticeable change in engine speed.

Probable cause	Isolation procedure	Remedy
Defective manual fuel control solenoid	Open access 5222-2. Disconnect electrical connector from manual fuel control. Check for 28 volts dc between pins 1 and 3 of wiring harness connector.	If voltage is indicated, replace manual fuel control (paragraph 6-6).
Defective manual fuel control switch	Remove fuel management panel fom left console. With switch in MAN, check for continuity between switch terminals 4 and 5.	If continuity is not indicated, replace manual fuel control switch.
Defective wiring	Check wiring for continuity.	If continuity is not indicated, replace defective wiring.
4. Compressor stalls encountered when switching from normal to manual fuel control or from manual to normal fuel control. See figure 4-7.		
5. Engine speed increases rapidly with slight movement of throttle.		
Manual fuel control linkage not properly adjusted	Check manual fuel control adjustment (paragrpah 6-7).	Adjust linkage as required.

Table 6-2. Manual Fuel System Troubleshooting — CONT

Probable cause	Isolation procedure	Remedy
Defective manual fuel control	None	Replace manual fuel control (paragraph 6-6).
6. TOP is not between maximum and minimum Pt5.1 values.		
Manual fuel control not properly adjusted	Check manual fuel control adjustment (paragraph 6-7).	Adjust as required (paragraph 6-7).
Defective manual fuel control	None	Replace manual fuel control (paragraph 6-6).
Leaking or obstructed Ps2.1 tube	None	Clean or replace tube.
7. Manual fuel control idle speed is low.		
Manual fuel control not properly adjusted	Check manual fuel control adjustment (paragraph 6-7).	Adjust as required (paragraph 6-7).
8. Manual fuel control idle speed is high.		
Check valve in LP governor stuck open	Remove check valve and check for misassembly.	Assemble check valve properly.
Manual fuel control not properly adjusted	Check manual fuel control adjustment (paragraph 6-7).	Adjust linkage as required.
9. Unable to adjust manual fuel control idle speed (rpm high).		
Defective main fuel control (check valve stuck open)	None	Replace main fuel control (paragraph 5-30).
Defective manual fuel control	None	Replace manual fuel control (paragraph 6-6).
10. Unable to adjust manual fuel control (rpm low).		
Defective manual fuel control	None	Replace manual fuel control (paragraph 6-6).
11. Manual fuel control advisory light does not go out when manual fuel control switch is placed in NORM but change in engine speed is noted.		

CAUTION

Disconnect electrical connectors from manual fuel control before performing continuity checks in manual fuel control system. Reversing current to manual fuel control windings will destroy fail-safe feature.

Probable cause	Isolation procedure	Remedy
Defective manual fuel control switch	Remove fuel management panel. With fuel control switch in NORM, check for open circuit between switch terminals 9 and 10.	If open circuit is not indicated, replace manual fuel control switch.

Table 6-2. Manual Fuel System Troubleshooting — CONT

Probable cause	Isolation procedure	Remedy
12. No change in engine speed is indicated when manual fuel control switch is placed in NORM.		

CAUTION

Do not check continuity of manual fuel control solenoid or damage to magnetic latches may result.

NOTE

On some rare occasions, it is possible for the manual fuel control to shift without a noticeable change in engine speed.

Probable cause	Isolation procedure	Remedy
Defective manual fuel control solenoid	Open access 5222-2. Disconnect electrical connector from manual fuel control. Check for 28 volts dc between pins 5 and 3 of wiring harness connector.	If voltage is indicated, replace manual fuel control (paragraph 6-6).
Defective manual fuel control switch	Remove fuel management panel from left console. Place fuel control switch in NORM. Check for continuity between switch terminals 1 and 2.	If continuity is not indicated, replace manual fuel control switch.
Defective CR-1 diode	With manual fuel control switch in NORM, check for continuity between pins 5 and 6 of P284 with positive lead at pin 5.	If continuity is not indicated and switch is satisfactory, replace CR-1 diode.
Defective wiring	Check wiring for continuity.	If continuity is not indicated, replace defective wiring.

6-6. MANUAL FUEL CONTROL REMOVAL AND INSTALLATION.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
	GGG-W-686	Torque wrench, 0 to 50 inch-pounds	Measure torque

WARNING

Avoid radiation contamination by adhering to the following exposure limits. For physical contact with the oil tank source tube, maximum safe exposure time is 15 minutes at one time or a total of 20 minutes per week. At a distance of 12 inches from the source tube, maximum time is 3.3 hours per week. There is no exposure time limit 3 feet from the source tube. Deviations from these limits shall be approved by the base medical service. Personnel working with or near this source tube shall become familiar with the procedures in T.O. 00-110N-11.

CAUTION

To prevent damage to tubes and decrease the possibility of leakage, observe precautions (paragraph 1-18) when removing or installing fuel, oil, or air tubing.

6-6.1. Removal. (Figure 6-4.)

a. Open access 5222-2.

b. Make sure fuel master lever is in OFF.

c. Drain low pressure fuel filter (paragraph 5-22).

d. Remove cotter pin (1), nut (2), bolt (3), and operating rod (4).

e. Disconnect electrical connector (5).

f. Cut lockwire and disconnect drain tube (6).

g. Remove bolts (7) and lockwashers (8). Disconnect clamps. Cut lockwire, disconnect coupling nut, and remove drain tube (9) and packing (10).

h. Remove bolts (11) and lockwashers (12). Disconnect clamp. Remove pilot fuel tube (13) and packings (14).

i. Remove bolts (15) and lockwashers (16) securing fuel inlet tube (17).

j. Remove bolts (18) and lockwashers (19) securing servo tube (20).

k. Remove bolts (21) and lockwashers (22) securing manual fuel outlet tube (23).

l. Remove bolts (24), lockwashers (25), bolts (26), and lockwashers (27) securing normal fuel outlet tube (28).

m. Remove bolts (29) and lockwashers (30) securing P2.1 air tube (31).

n. Remove bolts (32), lockwashers (33), washers (34), and manual fuel control (35).

o. Loosen nut (36) and remove elbow (37) and packing (38).

p. Remove packings (39, 40, 41, and 42).

q. If manual fuel control is to be replaced, drain fuel. Gravity fill all accessible fuel cavities with clean filtered MIL-L-6081, Grade 1010, oil. Plug openings.

6-6.2. Installation. (Figure 6-4.)

a. Place new packings (41, 40, and 39) on tubes.

b. Using new packing (38), install elbow (37) and nut (36).

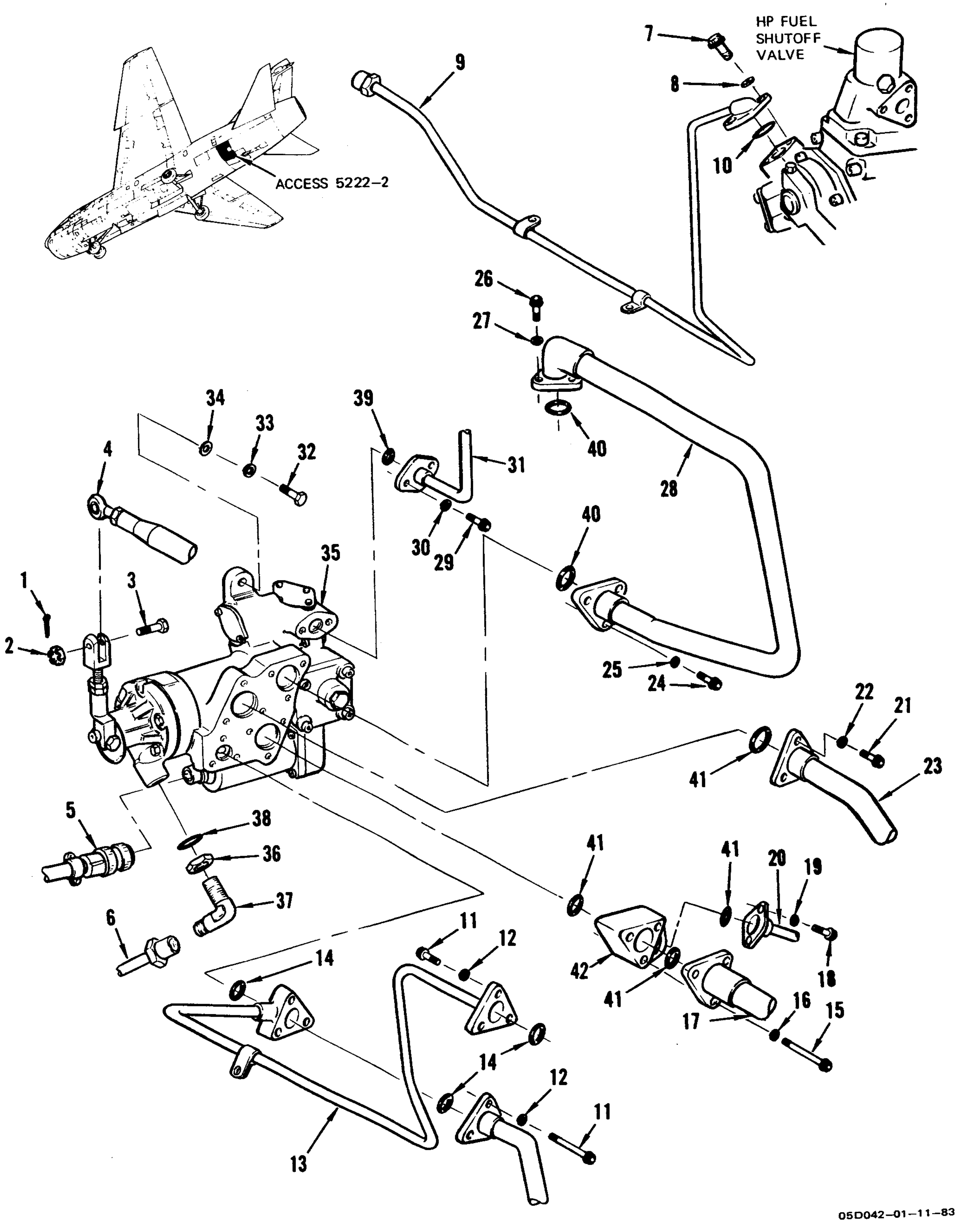

Figure 6-4. Removal and Installation; Manual Fuel Control (Sheet 1 of 2)

1. Cotter pin	15. Bolt	29. Bolt
2. Nut	16. Lockwasher	30. Lockwasher
3. Bolt	17. Fuel inlet tube	31. $P_{2.1}$ air tube
4. Operating rod	18. Bolt	32. Bolt
5. Electrical connector	19. Lockwasher	33. Lockwasher
6. Drain tube	20. Servo tube	34. Washer
7. Bolt	21. Bolt	35. Manual fuel control
8. Lockwasher	22. Lockwasher	36. Nut
9. Drain tube	23. Manual fuel outlet tube	37. Elbow
10. Packing	24. Bolt	38. Packing
11. Bolt	25. Lockwasher	39. Packing
12. Lockwasher	26. Bolt	40. Packing
13. Pilot fuel tube	27. Lockwasher	41. Packing
14. Packing	28. Normal fuel outlet tube	42. Housing

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Figure 6-4. Removal and Installation; Manual Fuel Control (Sheet 2)

NOTE

Wiring harness bracket is held by lower manual fuel control retaining bolt.

c. Place manual fuel control (35) in position and secure with washers (34), lockwashers (33), and bolts (32).

CAUTION

Ensure fuel is not trapped in P2.1 air tube or air blown seal elbow prior to installation of manual fuel control.

d. Connect P2.1 air tube (31) with lockwashers (30) and bolts (29).

e. Connect normal fuel outlet tube (28) with lockwashers (27), bolts (26), lockwashers (25), and bolts (24).

f. Connect manual fuel outlet tube (23) with lockwashers (22) and bolts (21).

g. Connect servo tube (20) to fuel inlet tube (17) with lockwashers (19) and bolts (18).

h. Connect fuel inlet tube (17) and housing (42) with lockwashers (16) and bolts (15).

NOTE

Standoff bracket is held by lower two bolts securing pilot fuel tube.

i. Using new packings (14), place pilot fuel tube (13) in position and secure with lockwashers (12) and bolts (11). Connect clamp.

j. Using new packing (10), place drain tube (9) in position and secure with lockwashers (8) and bolts (7). Connect clamps. Connect coupling nut and secure with MS20995C32 lockwire.

k. Connect drain tube (6) and secure with MS20995C32 lockwire. Tighten nut (35).

l. Connect electrical connector (5).

m. Connect operating rod (4) to lever with bolt (3) and nut (2).

n. Perform control cambox rigging (manual fuel control linkage) (paragraph 5-21).

o. Bleed engine fuel system (paragraph 5-19).

p. Perform manual fuel control operational checkout (paragraph 6-4).

q. Perform manual fuel control adjustment (paragraph 6-7).

r. Tighten nut (2) to between 5 and 45 inch-pounds torque. Secure with new cotter pin (1).

s. Close access 5222-2.

6-7. MANUAL FUEL CONTROL ADJUSTMENT.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
	GGG-W-686	Torque wrench, 10 to 150 inch-pounds	Measure torque
	6798854 (Allison Division of General Motors, Indianapolis, Indiana)	Rigging pin	Hold input shafts in a fixed position when engine control linkage is adjusted

WARNING

Avoid radiation contamination by adhering to the following exposure limits. For physical contact with the oil tank source tube, maximum safe exposure time is 15 minutes at one time or a total of 20 minutes per week. At a distance of 12 inches from the source tube, maximum time is 3.3 hours per week. There is no exposure time limit 3 feet from source tube. Deviations from these limits shall be approved by the base medical service. Personnel working with or near this source tube shall become familiar with the procedures in T.O. 00-110N-11.

NOTE

The requirement for manual fuel control adjustment is based on the manual fuel control operational checkout (paragraph 6-4).

This procedure uses the idle slot screw and maximum stopscrew to set the idle and military positions. This will permit adjustment of linkage with engine shut down.

6-7.1. Preparation. (Figure 6-5.)

a. Open access 5222-2.

b. Obtain ambient temperature and station barometric pressure (not corrected to sea level).

c. Back out minimum stopscrew (1) flush with face of casting.

d. Start engine (T.O. 1A-7D-2-1) and stabilize at IDLE.

e. Using ambient pressure/temperature step b, record maximum and minimum Pt5.1 values from figure FO-12 (adjusting clip not installed) and/or figure 6-2 (clip installed).

f. Advance throttle to 60% to 65% rpm.

CAUTION

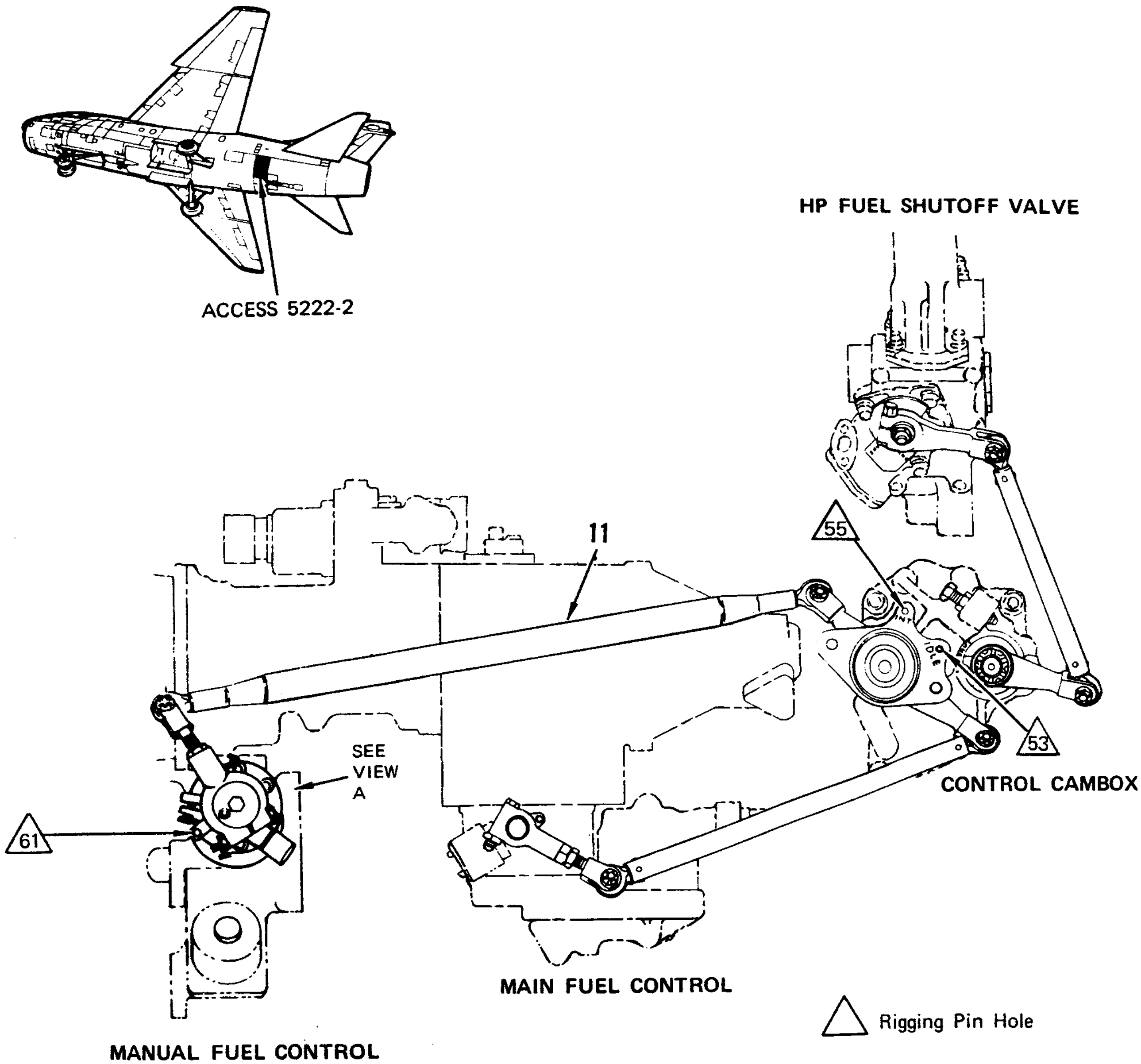
Engine automatic limiters are inoperative when manual fuel control is selected. Do not exceed engine operating limits.

Do not attempt to maintain rpm while switching to MAN.

If rpm decreases below 48%, shut down immediately. Advancing throttle in MAN below idle rpm may cause engine overtemperature.

If engine operates erratically in MAN, retard throttle to IDLE before switching to NORM.

g. Place fuel control switch in MAN. Check that manual fuel control caution light comes on, an increase occurs in engine speed, and stable operation continues.



1. Minimum stop screw
2. Maximum stop screw
3. Stop lever
4. Micromatic adjusting bolt
5. Locking nut
6. Locking nut
7. Idle slot screw
8. Cotter pin
9. Nut
10. Bolt
11. Operating rod
12. Locking nut
13. Clevis

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Figure 6-5. Adjustment; Manual Fuel Control (Sheet 1 of 2)

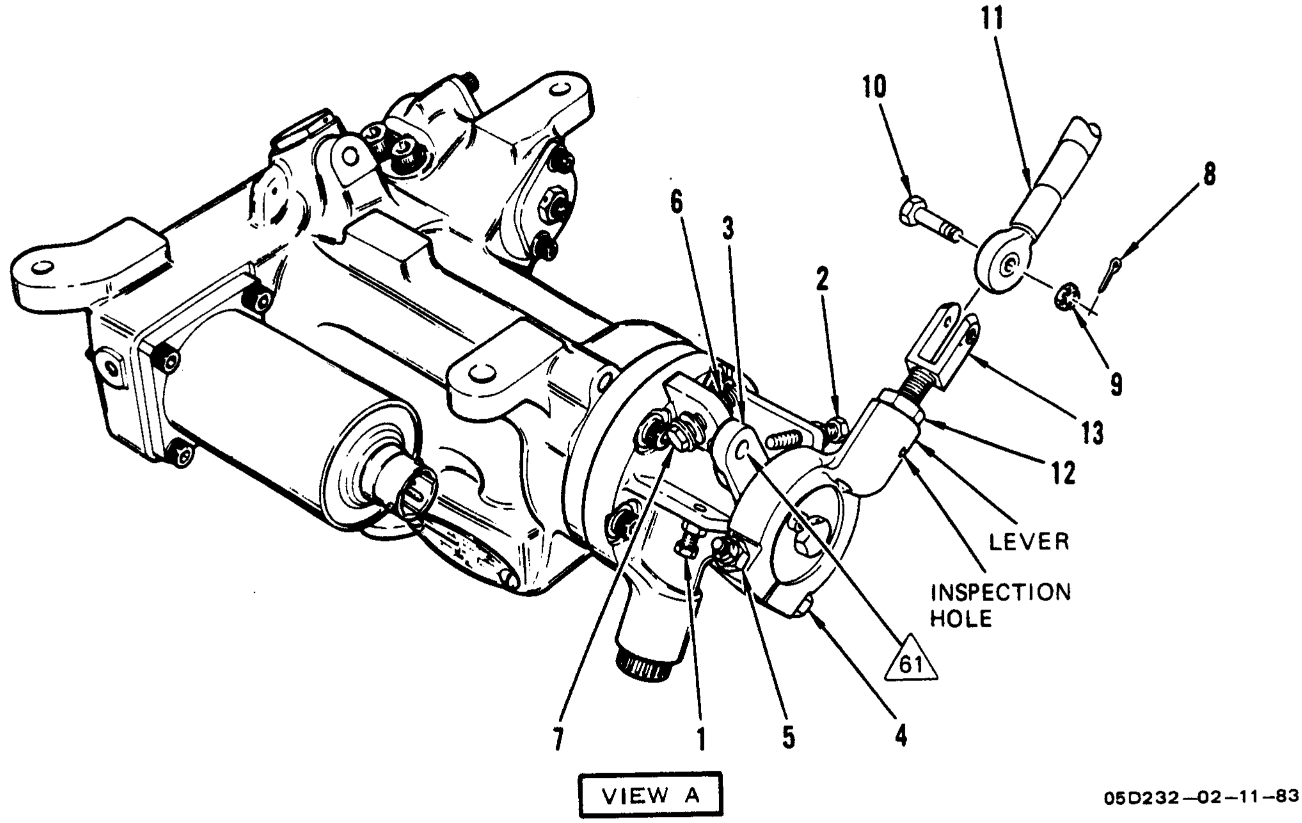


Figure 6-5. Adjustment: Manual Fuel Control (Sheet 2)

6-7.2. Military. (Figure 6-5.)

CAUTION

Throttle movements shall be smooth from IDLE to MIL, and shall extend over a period of 10 seconds or more. Failure to comply may result in engine overspeed and overtemperature.

NOTE

See figure FO-13 for logic tree diagram of procedure sequence.

a. Slowly advance throttle to MIL and stabilize for 5 minutes.

b. If 575°C (1,067°F) is exceeded, proceed as follows:

(1) Using values for target TOP from figure 6-2, see throttle at target TOP.

NOTE

If adjusting clip is used, the engine manual fuel control will require additional rig check (paragraph 6-7.4, step g).

(2) Loosen locking nut and adjust maximum stopscrew (2) so that screw will just touch stop lever (3).

(3) Tighten locking nut 10 to 15 inch-pounds torque.

c. If target TOP from figure FO-12 is exceeded, proceed as follows:

(1) Set throttle at target TOP.

(2) Loosen locking nut and adjust maximum stopscrew (2) so that screw will just touch stop lever (3) with engine operating at target TOP.

(3) Tighten locking nut 10 to 15 inch-pounds torque.

d. If target TOP from figure FO-12 cannot be reached with throttle in MIL, proceed as follows:

NOTE

One flat (1/6 turn) of the micromatic adjusting bolt changes TOP at MIL approximately 4 inches of mercury.

If direction of micromatic bolt adjustment is opposite from the last adjustment, turn bolt an extra one-half flat (1/12 turn) to take up slack in threads.

Turn micromatic bolt clockwise to decrease TOP.

Use two wrenches, one on micromatic bolthead and one on locking nut. Turn both in the same direction to adjust micromatic bolt.

(1) Hold micromatic adjusting bolt (4), and loosen locking nut (5) only enough to relieve clamping force. Adjust micromatic bolt as required to obtain target TOP from figure FO-12.

CAUTION

To prevent damage to manual fuel control shaft, make sure that micromatic bolthead is flush with arm before tightening locking nut.

(2) Hold micromatic adjusting bolt (4) and tighten locking nut (5) to 55 (±5) inch-pounds torque.

(3) Loosen locking nut and adjust maximum stopscrew (2) so that screw will just touch stop lever (3).

(4) Tighten locking nut 10 to 15 inch-pounds torque.

e. If target TOP from figure FO-12 is reached with throttle in the MIL, proceed as follows:

(1) Loosen locking nut and adjust maximum stopscrew (2) so that screw will just touch stop lever (3) with engine operating at target TOP.

(2) Tighten locking nut 10 to 15 inch-pounds torque.

6-7.3. Idle Speed. (Figure 6-5.)

a. Slowly retard throttle to IDLE and stabilize for 3 minutes.

b. Check that manual fuel control idle speed is 55% to 65% rpm.

c. If speed is not within limits, proceed as follows:

(1) Insert rigging pin in hole 53.

NOTE

Use two wrenches, one on micromatic bolthead and one on locking nut. Turn both in same direction to adjust micromatic bolt.

(2) Hold micromatic adjusting bolt (4) and loosen locking nut (5) only enough to relieve clamping force.

(3) Adjust micromatic bolt to obtain 55% to 65% rpm.

CAUTION

To prevent damage to manual fuel control throttle shaft, make sure micromatic bolthead is flush with arm before tightening locking nut.

(4) Hold micromatic adjusting bolt (4) and tighten locking nut (5) to 55 (±5) inch-pounds torque.

d. Loosen locking nut (6) and adjust idle slot screw (7) as required to insert rigging pin in hole 61. Tighten locking nut 20 to 25 inch-pounds torque.

e. Remove rigging pins from holes 53 and 61.

6-7.4. Postcheck.

CAUTION

When a malfunction causes mismatch of throttle setting and engine speed, the throttle should be placed in IDLE before fuel control is placed in NORM to prevent engine overtemperature.

Transfer from MAN to NORM shall be below 80% rpm to prevent compressor stall.

a. Place fuel control switch in NORM. Check that manual fuel control caution light goes off and speed decreases.

b. Shut down engine (T.O. 1A-7D-2-1).

NOTE

The minimum stopscrew, idle slot screw, or maximum stopscrew must not be moved for any reason until the manual fuel control linkage adjustment has been completed. Movement of any of these screws before linkage adjustment has been made will require that the steps in paragraph 6-7 be repeated.

c. Adjust manual fuel control linkage (figure FO-13).

d. Perform manual fuel control operational checkout (paragraph 6-4).

e. Remove 6872249 adjusting clip (if installed).

f. Close access 5222-2.

NOTE

In step g, recheck of manual fuel control linkage rigging should be accomplished at next available opportunity or next engine trim.

g. If manual fuel control adjustments were done using adjusting clip (6872249), mark aircraft form 781A with red dash and add requirement to recheck manual fuel control rigging when ambient temperature is below 80.6°F (27°C).

6-8. MANUAL FUEL CONTROL LINKAGE ADJUSTMENT. (Figures 6-5 and FO-13.)

NOTE

This procedure must be used with figure FO-13.

a. Open access 5222-2.

b. Move throttle to about midquadrant.

NOTE

If both IDLE and MIL positions are either both high or low, a micromatic bolt adjustment (step c) is required.

If MIL position only requires adjustment, a clevis adjustment (step d) is required.

If IDLE position only requires adjustment, a combination micromatic bolt and clevis adjustment (step e) is required.

c. If micromatic bolt adjustment is required, proceed as follows:

NOTE

Use two wrenches, one on micromatic adjusting bolthead and one on locking nut. Turn both in same direction to adjust micromatic bolt.

(1) Hold micromatic adjusting bolt (4) and loosen locking nut (5) only enough to relieve clamping force. Adjust micromatic bolt as required.

CAUTION

To prevent damage to manual fuel control throttle shaft, make sure micromatic bolthead is flush with arm before tightening locking nut.

(2) Hold micromatic adjusting bolt (4) and tighten locking nut (5) to 55 (±5) inch-pounds torque.

d. If clevis adjustment is required, proceed as follows:

(1) Remove cotter pin (8), nut (9), and bolt (10). Disconnect operating rod (11).

(2) Loosen locking nut (12) and adjust clevis (13) as required.

(3) Check that threads are visible through lever inspection hole.

(4) Tighten locking nut (12) 40 to 45 inch-pounds torque.

(5) Connect operating rod (11) to clevis (13) with bolt (10) and nut (9).

(6) Tighten nut 5 to 45 inch-pounds torque. Secure with new cotter pin (8).

e. If combination micromatic bolt and clevis adjustment is required, proceed as follows:

(1) Remove cotter pin (8), nut (9), and bolt (10). Disconnect operating rod (11).

NOTE

Use two wrenches, one on micromatic adjusting bolthead and one on locking nut. Turn both in the same direction to adjust micromatic bolt.

(2) Hold micromatic adjusting bolt (4) and loosen locking nut (5) only enough to relieve clamping force. Adjust micromatic bolt to make up for about half of the adjustment required.

CAUTION

To prevent damage to manual fuel control throttle shaft, make sure micromatic bolthead is flush with arm before tightening locking nut.

(3) Hold micromatic adjusting bolt (4) and tighten locking nut (5) to 55 (±5) inch-pounds torque.

(4) Loosen locking nut (12) and adjust clevis (13) to make up for about half of the adjustment required. Align fork of clevis with rod end and tighten locking nut.

(5) Temporarily attach operating rod to clevis with bolt.

(6) Repeat substeps (2) through (5) until adjustment requirements are met.

(7) Check that threads are visible through lever inspection hole.

(8) Tighten locking nut (12) 40 to 45 inch-pounds torque.

(9) Connect operating rod (11) to clevis (13) with bolt (10) and nut (9).

(10) Tighten nut (9) 5 to 45 inch-pounds torque. Secure with new cotter pin (8).

f. Place throttle in OFF.

g. Close access 5222-2.

SECTION VII

TEMPERATURE LIMITER AMPLIFIER SYSTEM

7-1. DESCRIPTION.

7-1.1. Engine Limiters. The temperature limiter amplifier is one of several engine limiters. Refer to table 7-1 for a list of engine limiting functions and their respective components. The temperature limiter amplifier is a solid state electronic device powered by the primary dc bus. It monitors T1 and T5.1 temperatures and low pressure compressor rotor speed and supplies milliampere signals for the fuel control limiter solenoid. This will cause a limiting function for mass airflow ($NL/\sqrt{T1}$) and turbine outlet temperature (T5.1). Circuits within the amplifier permit the use of a lower datum for testing.

7-1.2. Ballast Resistor. A ballast resistor in the T5.1 thermocouple circuit provides a common T5.1 temperature indication for all engines at the same thrust. The resistor value is selected at the test cell run and recorded in the engine logbook. If it is necessary to replace the resistor, one of equal value must be used. Substitution of another value will give either low thrust or an undetected overtemperature condition. It may be necessary to use two ballast resistors in parallel to get the proper value.

7-1.3. Double Datum System. A second T5.1 datum system (double datum) is provided in the amplifier system. This second datum point lets the engine attain a higher turbine outlet temperature for a limited time period. This action increases the thrust output of the engine during the period of cold engine thrust droop by increasing the T5.1 datum point.

NOTE

The DOUBLE DATUM switch (airplanes before T.O. 1A-7-530) and DOUBLE DATUM/ ANTI-ICE switch (airplanes after T.O. 1A-7-530) perform the same function.

7-1.4. Double Datum Switch. A double datum switch is located on the pilot's left console or a double datum/anti-ice switch is located on fuel management panel on the pilot's left console. With the switch in OFF, the double datum system is disabled. This may be used to prevent initiation of the double datum cycle during ground operation. When the switch is placed in ON, the system is ready for use.

Table 7-1. Engine Limiters

Limiting function	Component	Adjustable
Low pressure compressor rotor speed (NL)	Low pressure governor	Yes
High pressure compressor rotor speed (NH)	Main fuel control	No
Mass airflow ($NL/\sqrt{T1}$)	Temperature limiter amplifier	Yes
Turbine outlet temperature (T5.1)	Temperature limiter amplifier	Yes
Compressor case pressure (Ps3)	Main fuel control	Yes

7-1.5. **Double Datum Lockout Switch.** A double datum lockout switch is installed on the engine control cambox. When the throttle is moved to MIL, the switch is closed and the double datum system is ready for use. At all throttle settings below MIL, the double datum system is disabled.

7-1.6. **Fail-Safe Circuit.** Engines are equipped with a temperature limiter amplifier that has a fail-safe circuit which will prevent a severe reduction in engine power in case of amplifier failure. When the amplifier output exceeds about 390 milliamperes, it is turned off. It will stay off until the condition which caused the high output is corrected.

7-2. OPERATION. (Figure FO-14.)

7-2.1. Deleted.

7-2.2 **Engine Limiting Signals.** Signals are developed by the T1 and T5.1 thermocouples and low pressure compressor rotor tachometer generator (NL). These voltages are fed into fully isolated separate channels of the temperature limiter amplifier. Each signal is processed through a reference and preamplifier circuit. The output from the T1 preamplifier and NL discriminator are mixed and amplified to provide a mass airflow limiting signal ($NL/\sqrt{T1}$). The T5.1 and mass airflow signals are fed through an error signal circuit. This circuit ensures that the channel with the largest error signal is in control by comparing the individual signals and permitting the highest signal to pass through. This error signal is amplified and routed to the fuel control limiter solenoid as a dc milliampere signal. When the T5 or $NL/\sqrt{T1}$ input signals reach their limiting values (eg. 575°C (1,067°F) T5), the amplifier generates an output signal which will be as great as required to hold the input signal at the limiting value. If, for example, T5 is at 574° (1,065°F) (1°C (2°F) below datum), there will be no output signal. If T5 goes to 576°C (1,069°F), the output signal will increase to whatever level is required to reduce the input signal to 575°C (1,067°F) (datum value). During a rapid acceleration, there is an anticipator circuit which reads the rate to temperature (T5) rise and NL speed increase, and causes the milliampere output to rise prior to reaching datum. This is to minimize overshoots. At about 125 milliamperes, the fuel control solenoid begins to move the half-ball valve from its seat. The opening of this valve is proportional to the signal strength; the greater the signal, the larger the opening. With the valve open, P3 air is ported into P2.1 air, increasing the pressure inside the nonevacuated capsule. This causes the capsule to expand, moving the variable metering orifice sleeve and reducing fuel flow. Refer to Section V for operation of the main fuel control.

7-2.3. Thrust Droop. A trait of the TF41 engine is that when a cold engine is accelerated to MIL power and the temperature limiter amplifier limits T5.1 temperature, thrust will decrease (droop) immediately after reaching initial maximum thrust. Droop will be recovered in about 2 minutes of operation at MIL. Droop is a result of reduced engine efficiency due to seal clearances on a cold engine. When the engine warms up, the seal clearances become optimized and droop will be recovered. The second T5.1 datum system (double datum) will permit a higher initial T5.1 temperature to offset part of the droop.

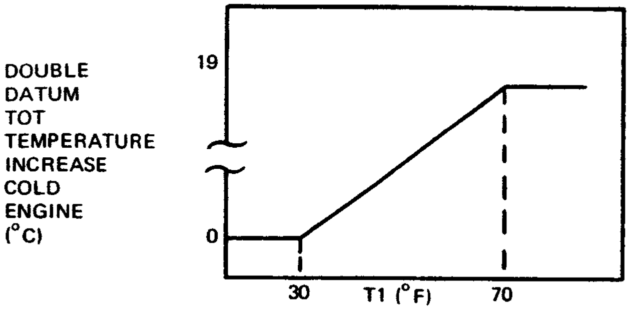
7-2.4. Double Datum. Three basic conditions must exist before the double datum system will operate. First, a ground must be completed to amplifier relay K2. This occurs when the throttle is moved to MIL to close the double datum lockout switch and the double datum switch (airplanes before T.O. 1A-7-530) on the left console is placed in ON or the double datum/anti-ice switch (airplanes after T.O. 1A-7-530) in the fuel management panel on left console is placed in DOUBLE DATUM/ANTI-ICE. With both of these switches closed, relay K2 is grounded through the normally closed contacts of A354K9 relay. Second, the main fuel control limiter solenoid must have a signal of about 150 milliamperes to close amplifier relay K1. Third, the amplifier must be sending a signal to limit turbine outlet temperature (T5.1). The T5.1 temperature at this point will be approximately 575°C (1,067°F). With these three conditions present, the double datum cycle is initiated. T5.1 temperature will increase about 19°C (34°F) from the normal datum of 575°C (1,067°F) in about 8 seconds. The temperature will then decay slowly back to the 575°C (1,057°F) level. The full cycle of double datum, from 575°C (1,067°F) to maximum level and back to 575°C (1,067°F), takes about 2 minutes. Once the double datum cycle is started, it cannot be stopped. When the cycle is completed, it requires approximately 30 seconds to fully recharge for another cycle. If the cycle begins before it is fully recharged, the cycle will be proportional to the amount of recharge.

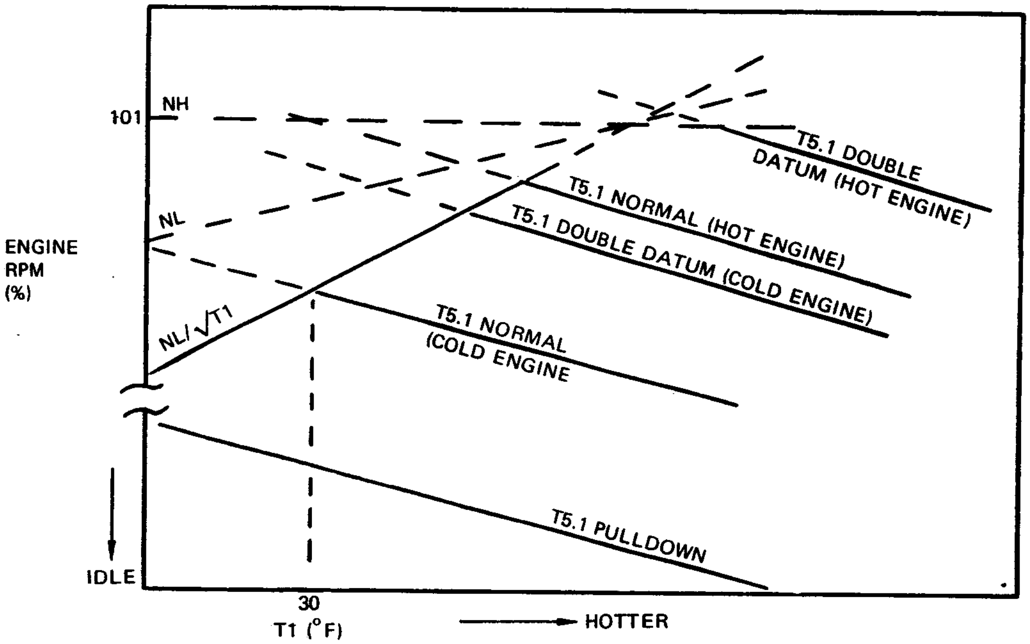
7-2.4.1. Cold Engine. When engine air inlet temperature (T1) is below approximately 30°F, normal double datum temperature (T5.1) increase will not be available. See figure 7-1 for graphic display of engine limiter operation. At these temperatures, the mass airflow limiting signal ($NL/\sqrt{T1}$) will restrict fuel flow. When T1 is between 30°F and 70°F, a partial double datum temperature increase will be present. In the lower temperatures of this range, double datum operation will let T5.1 temperature increase until another limiter takes over to limit fuel flow. The T5.1 increase attained will increase throughout this range until, at about 70°F T1 temperature, the full 19°C (34°F) temperature increase will be reached. This is true only when the engine is cold. A cold engine, for double datum purpose, is one that has been shut down for at least 2 hours and has not been run at high powers since starting.

7-2.4.2. Hot Engine. If double datum is triggered on a hot engine, another limiter (NL or NH) probably will begin limiting fuel flow before the full double datum temperature increase is reached. Therefore, repeated operation of double datum may show inconsistencies in maximum T5.1 temperatures. A pulldown or lower datum condition is available for testing purposes. This places the T5.1 limiter below the other limiters so that an accurate test may be performed.

7-2.4.3. Initial Takeoff. After initial takeoff, the weight-on-gear switch (S302, figure FO-14) moves to the weight-off-gear position and completes a 28-volt dc circuit to energize relay A349K9. This relay closes to provide a ground for relay A354K9, causing it to energize and open the ground circuit for amplifier relay K2, and preventing further cycling of the double datum. When A354K9 is energized, it will remain in this condition until the dc bus is deenergized. Therefore, double datum will be present only for the first takeoff unless dc power is interrupted with weight on gear.

7-2.4.4. Double Datum Reset. Once the double datum cycle is finished and the weight-on-gear switch has been actuated, normal T5.1 temperature operation will continue until: the throttle has been retarded enough to open either K1 or K2 amplifier relay, and the throttle has been kept at or below this point for about 30 seconds.





NH	HIGH PRESSURE GOVERNOR
NL	LOW PRESSURE GOVERNOR
NL/√ T1	MASS AIRFLOW LIMITER
T5.1	TURBINE OUTLET TEMPERATURE LIMITER
T1	ENGINE AIR INLET TEMPERATURE

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Figure 7-1. Limiter Operation; Installed Engine

7-2.5. Limiter Testing. Test set connections are provided on the temperature limiter amplifier. The T5.1 datum point is tested by completing a pulldown circuit. This reduces the datum point 100°C (180°F), placing it at a point lower than the other engine limiters. The mass airflow (NL/$\sqrt{T1}$) is tested by a mass airflow pulldown circuit. This reduces the datum point 10% rpm, placing it at a point lower than the other engine limiters. Mass airflow must be tested at a standard day temperature (15°C (59°F)); therefore, the test set is used to input a signal equivalent to a T1 temperature of 15°C (59°F). An adjustment is provided in the amplifier case for T5.1 and mass airflow datum points. The throttle should be retarded to reduce the engine power to 80% or less prior to selection of either T5 or NL/$\sqrt{T1}$ pulldown. If this is not done, the milliampere output will increase enough to trigger the fail-safe circuit and the amplifier will turn off.

7-3. COMPONENTS. For a list of system components, locations (accesses), and functions, refer to table 7-2.

7-4 and 7-5. Deleted.

7-6. TEMPERATURE LIMITER AMPLIFIER STATIC TEST (USING 6872929 TEST SET).

Test Equipment Required

Figure & index No.	Name	AN type designation	Use and application
	Equipment required for connecting external electrical power		Provide power source for airplane and engine limiter test set

Table 7-2. Temperature Limiter Amplifier System Components

Component	Access	Function
Amplifier, temperature limiter	5222-1	Provides mass airflow or T5.1 temperature limiting signal to main fuel control limiter solenoid
Generator low pressure rotor tachometer	5222-2	Provides signal of low pressure compressor rotor speed to temperature limiter amplifier
Resistor, ballast	5132-1	Acts as a shunt to provide a common T5.1 temperature indication for all engines at the same thrust
Thermocouple, T1	5222-1	Provides signal of engine air inlet temperature to temperature limiter amplifier
Thermocouple, T5.1	5222-3	Provides signal of engine turbine outlet temperature to temperature limiter amplifier and turbine outlet temperature indicator.

Test Equipment Required — CONT

Figure & index No.	Name	AN type designation	Use and application
	Engine limiter test set	6872929 (Allison Division of General Motors, Indianapolis, Indiana)	Perform temperature limiter amplifier tests
	Adapter cable	23002227 (Allison Division of General Motors, Indianapolis, Indiana)	To connect test set cable to connector 1 on amplifier

NOTE

A number enclosed in braces at the end of a step in the following test corresponds to a number in troubleshooting table 7-3.

7-6.1. Preparation.

a. Open access 5222-1.

b. Set switches and controls on engine limiter test set as follows:

Control	*Position*
POWER switch	OFF
TACH SIM switch	OFF
SIM SIGNAL control	Full decrease
T1 control	Midrange
T3/T5.1 control	Full decrease
TEMP SELECTOR switch	CAL
T3/T5.1 SIM switch	OFF
T5.1 switch	NORMAL
T3 switch	NORMAL
LP SPEED switch	OFF
SQUAT switch	OFF
METER switch	USE
T1 SIM switch	OFF
TACHOMETER switch	USE
MODE switch	RESET
ACCEL START PRESET control	Centered
READ/CAL switch	CAL
RPM SELECT switch	NHP
ZERO ADJ control	Full decrease
PROBE TRIM control	Full decrease

CAUTION

To prevent damage to engine components and test set, make sure test set is connected to 115-volt, 400-hertz, single-phase ac power source. Make a pin-to-pin voltage check of power source connector before connecting test set.

c. Connect engine limiter test set to external power source and airplane as shown in figure 7-2.

d. Connect external electrical power to airplane (T.O. 1A-7D-2-1).

7-6.2. Amplifier Fail-Safe Circuit Check.

a. Place POWER switch in ON.

b. Place TEMP SELECTOR switch in T5.1.

c. Place T3/T5.1 SIM switch in T5.1.

d. Turn T3/T5.1 control for a nearly stable reading from 150 to 300 milliamperes. Observe T5 reading for indication of datum setting (about 575°C (1,067°F)). {1, 6}

e. Reduce T3/T5.1 control slightly so milliampere reading starts to drop.

f. Depress and hold PRESS FOR VOLTS switch.

g. Slowly increase T3/T5.1 control. When T5 reaches datum in step d, voltage should start to increase. With T5 setting slightly above datum, voltage should gradually increase, and then suddenly drop to almost zero.

h. Release PRESS FOR VOLTS switch and check for 400 (±50) milliamperes.

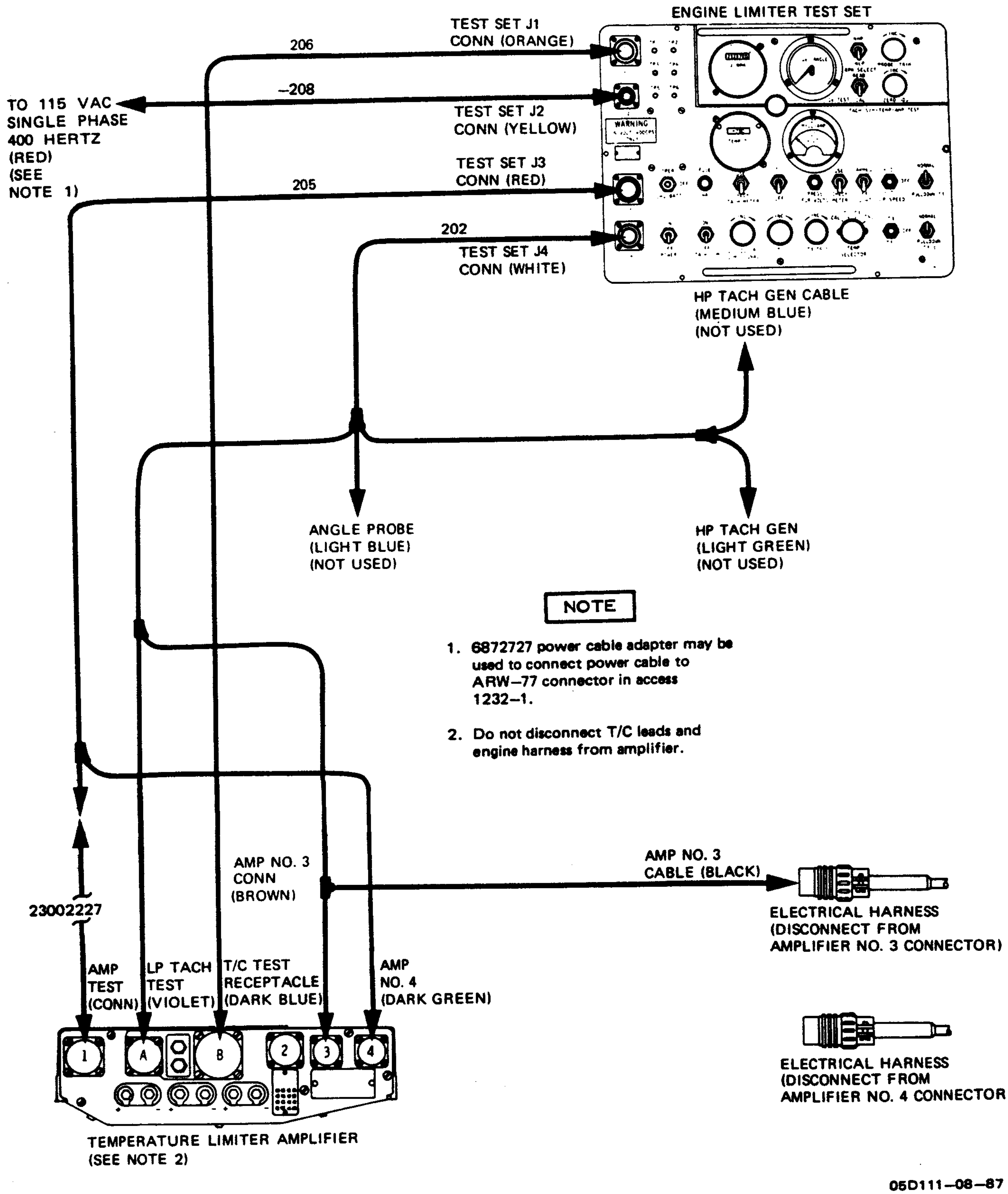


Figure 7-2. Static Test (Using 6872929 Test Set); Temperature Limiter Amplifier

i. If no further tests are required, perform posttest (subparagraph 7-6.4).

7-6.3. Amplifier Phase Advance Check.

a. Place POWER switch in ON.

b. Place TEMP SELECTOR switch in T5.1.

c. Place T3/T5.1 SIM switch in T5.1.

d. Turn T3/T5.1 control for a nearly stable reading of 150 to 300 milliamperes. Observe T5 reading for indication of datum setting (about 575°C (1,067°F)). {1, 6}

e. Reduce T3/T5.1 control to a T5 value of 5° to 10°C (9° to 18°F) below datum setting in step d.

f. Place T3/T5.1 SIM switch in OFF. Allow T5 indication to drop to ambient.

g. Place T3/T5.1 SIM switch in T5.1. Milliampere indication shall promptly show an increase, then start to drift down. If no increase occurs, amplifier is defective and shall be replaced.

h. If no further tests are required, perform posttest (subparagraph 7-6.4).

7-6.4. Posttest.

a. Place POWER switch in OFF.

CAUTION

Check amplifier connectors after test cables are removed to make sure there are no bent pins. Bent pins could cause engine overspeed and overtemperature.

b. Disconnect engine limiter test set from airplane.

c. Connect electrical connectors to amplifier.

d. Close access 5222-1.

7-7. TEMPERATURE LIMITER AMPLIFIER STATIC TEST (USING 6893706 TEST SET).

Test Equipment Required

Figure & index No.	Name	AN type designation	Use and application
	Engine limiter test set	6893706 (Allison Division of General Motors, Indianapolis, Indiana)	Perform temperature limiter amplifier tests
	Adapter cable	23002227 (Allison Division of General Motors, Indianapolis, Indiana)	Connect test cable to connector 1 of amplifier

7-7.1. Preparation.

a. Open access 5222-1.

b. Set switches and controls on test set as follows:

Control	*Position*
POWER switch	OFF
SQUAT switch	OFF
IGV/CAL switch	IGV
TACH SIMULATED INPUTS control	Fully counter-clockwise
T1 SIMULATED INPUTS control	Fully counter-clockwise
T5 SIMULATED INPUTS control	Fully counter-clockwise
T5 switch	NORMAL
LP SP switch	OFF

c. Connect test to amplifier as shown in figure 7-3.

NOTE

Make sure test set is properly connected to amplifier prior to turning power on.

When the test set power switch is placed in ON, the numerals 00 will appear in the lower portion test set display window. This 00 display indicates that SELF TEST has been selected.

When the test set has warmed up (maximum of 20 minutes), it will begin the self-test function automatically.

After completion of self-test, the numbers 88.88 will be sequenced through three rows in the display window. This sequencing will continue until a specific test is selected or the test set POWER switch is placed in OFF.

d. Place POWER switch in ON. Warm up test set.

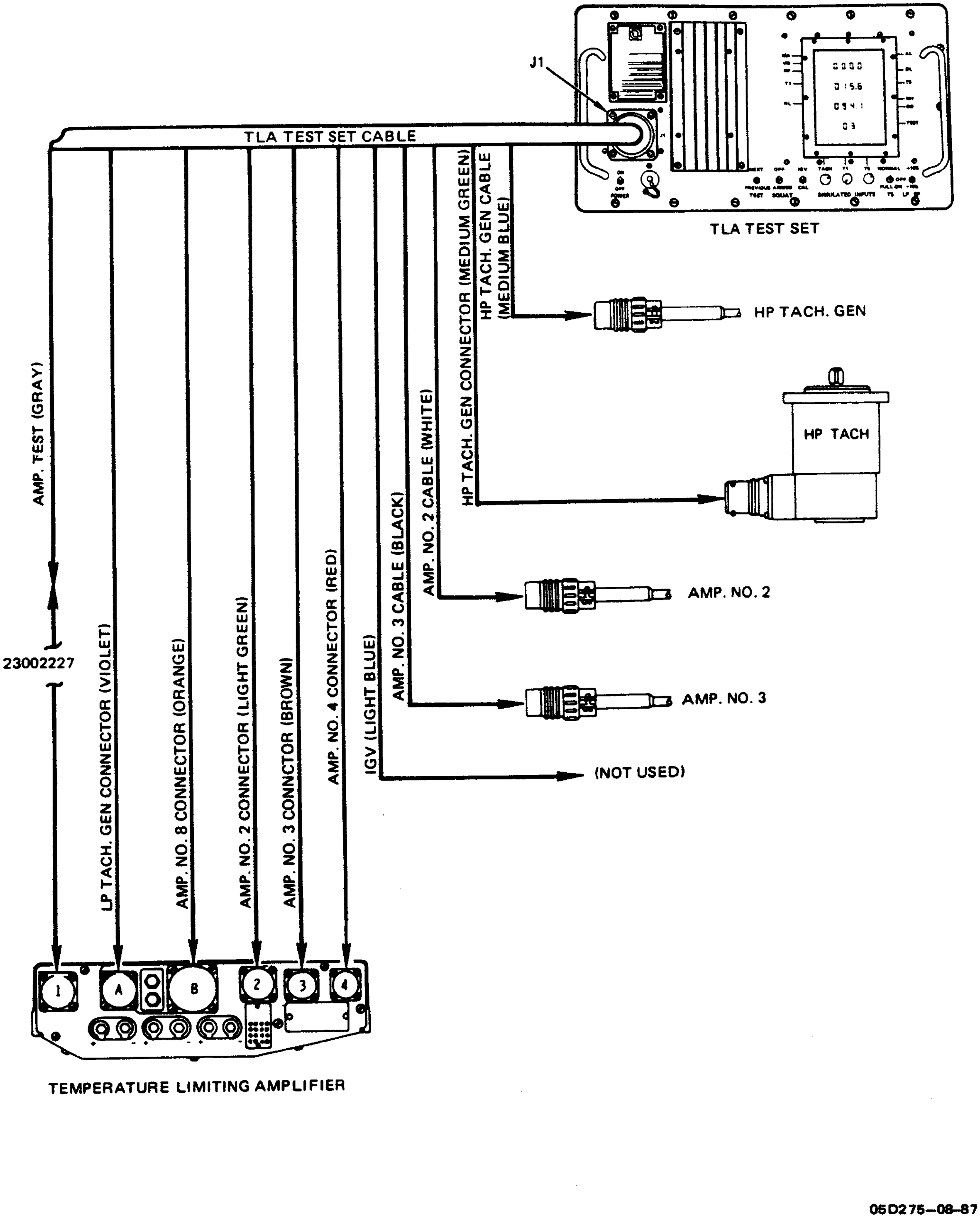


Figure 7-3. Static Test (Using 6893706 Test Set); Temperature Limiter Amplifier

7-7.2. Amplifier Fail-Safe Circuit Check.

a. Place TEST switch in NEXT until 07 appears in TEST display window.

b. Check that T5, T5 SIMULATED INPUTS, and MA indicator lights come on.

NOTE

When conducting check, it will not be possible to get a completely stable MA indication. Adjust T5 SIMULATED INPUTS control for MA drift of 1 to 2 milliamperes per second when test requires a nearly stable MA indication.

c. Turn T5 SIMULATED INPUTS control clockwise for nearly stable MA indication between 150 to 350 milliamperes. {1, 6}

d. Note T5 display window indication; then place TEST switch in NEXT until 08 appears in TEST display window.

e. Check that VO indicator light comes on and MA indicator light goes out.

f. Turn T5 SIMULATED INPUTS control clockwise to increase T5 display 5° to 10°C (9° to 18°F).

g. VO display will gradually increase to a maximum of 12 to 15 volts, then drop to a stable indication of 1 to 3 volts.

h. Place TEST switch in PREVIOUS until 07 appears in TEST display window.

i. Check that MA indicator light comes on and MA display indicates 400 (±50) milliamperes.

j. If no further tests are required, perform posttest (subparagraph 7-7.4).

7-7.3. Amplifier Phase Advance Check.

a. Place TEST switch in NEXT until 07 appears in TEST display window.

b. Check that T5, T5 SIMULATED INPUTS, and MA indicator lights come on.

c. Turn T5 SIMULATED INPUTS control clockwise for T5 display of 565° to 570°C (1,049° to 1,058°F). MA display window should indicate zero. {1, 6}

d. Place TEST switch in PREVIOUS until 06 appears in TEST display window, then advance immediately back to 07.

e. Check that MA display rises to 100 to 200 milliamperes, then drops back to zero.

f. If no further tests are required, perform posttest (subparagraph 7-7.4).

7-7.4. Posttest.

a. Place test set POWER switch in OFF.

b. Disconnect test set from airplane.

c. Connect electrical connectors to amplifier.

d. Close access 5222-1.

7-8. TEMPERATURE LIMITER AMPLIFIER STATIC TEST TROUBLESHOOTING.

Test Equipment Required

Figure & index No.	Name	AN type designation	Use and application
	Multimeter	AN/PSM-6	Measure voltage and check continuity

7-8.1. Procedures. Refer to table 7-3 for troubleshooting information. Malfunctions are listed by number and are related to a corresponding number following a step in the test.

7-8.2 Schematic. See figure FO-14 for schematic diagram.

Table 7-3. Temperature Limiter Amplifier Static Test Troubleshooting

Probable cause	Isolation procedure	Remedy
1. No reaction when adjusting T3/T5.1 control with T3/T5.1 switch in T5.1.		
T5.1 thermocouple leads not properly connected to temperature limiter amplifier	Check that T5.1 thermocouple leads are connected to amplifier as shown in figure 7-8.	Connect leads properly.
Defective T5.1 thermocouple system	Perform T5.1 thermocouple system static checks (paragraph 3-14).	Replace defective components as required.
Defective temperature limiter amplifier	None	Replace temperature limiter amplifier (paragraph 7-14).
2. Test set milliampere indication does not decrease when double datum (SQUAT) switch is placed in ARMED.		
	NOTE Throttle must be placed in military to check double datum circuit.	
Open ground circuit to temperature limiter amplifier	Disconnect electrical connector from amplifier receptacle J3 and P405 connector from receptacle J1. Check for continuity between pin 3-J3 and pin 10-J1.	If continuity is not indicated, check for defective double datum lockout switch.
Defective double datum lockout switch	Place throttle in military. Disconnect electrical connector from double datum lockout switch and check for continuity.	If continuity is not indicated, replace control cambox (paragraph 5-32).
Defective temperature limiter amplifier	None	Replace temperature limiter amplifier (paragraph 7-14).
Defective wiring	Check wiring for continuity.	Replace defective wiring.
3. Test set milliampere indication does not decrease and increase within limits when double datum (SQUAT) switch is placed in ARMED.		
Defective temperature limiter amplifier	None	Replace temperature limiter amplifier (paragraph 7-14).
4. No reaction when adjusting T1 control with temperature selector switch in T1.		
T1 thermocouple leads not properly connected	Check that T1 thermocouple leads are connected to amplifier as shown in figure 7-8.	Connect leads properly.
T1 thermocouple system defective	Perform T1 thermocouple system check (paragraph 7-13).	Replace T1 thermocouple (paragraph 7-15).
Defective temperature limiter amplifier	None	Replace temperature limiter amplifier (paragraph 7-14).

Table 7-3. Temperature Limiter Amplifier Static Test Troubleshooting — CONT

Probable cause	Isolation procedure	Remedy
5. No reaction when adjusting SIM SIGNAL control.		
Defective temperature limiter amplifier	None	Replace temperature limiter amplifier (paragraph 7-14).
6. Temperature limiter amplifier current exceeds 375 milliamperes or turns off.		
Faulty amplifier	Perform fail-safe condition troubleshooting (figure FO-15).	Replace temperature limiter amplifier (paragraph 7-14).
Defective main fuel control	Perform fail-safe condition troubleshooting (figure FO-15).	Replace main fuel control (paragraph 5-30).
Incorrect procedure during trim	Ensure that engine rpm is at 80% NH prior to activating T5 or NL pulldown.	Perform trim procedure again.

7-9. TEMPERATURE LIMITER AMPLIFIER DYNAMIC TEST (USING 6872929 TEST SET).

Test Equipment Required

Figure & index No.	Name	AN type designation	Use and application
	Equipment required for engine operation		Operate engine
	Equipment required for 115-volt, 400-hertz, single-phase ac external electrical power		Connect external electrical power to test set
	Engine limiter test set cable assembly	6872490 (Allison Division of General Motors, Indianapolis, Indiana)	Connect test set to engine and external power source

Test Equipment Required — CONT

Figure & index No.	Name	AN type designation	Use and application
	Engine limiter test set	6872929 (Allison Division of General Motors, Indianapolis, Indiana)	Perform temperature limiter amplifier tests
	Power cable adapter	6872727 (Allison Division of General Motors, Indianapolis, Indiana)	Connect test set power cable to airplane ARW-77 connector
	Adapter cable	23002227 (Allison Division of General Motors, Indianapolis, Indiana)	Connect tests to TLA after T.O. 2J-TF41-641

NOTE

A number enclosed in braces at the end of a step in the following test corresponds to a number in troubleshooting table 7-4.

7-9.1. Preparation.

a. Open access 5222-1.

b. Set switches and controls on engine limiter test set as follows:

Control	*Position*
POWER switch	OFF
TACH SIM switch	OFF
SIM SIGNAL control	Full decrease
T1 control	Midrange
T3/T5.1 control	Full decrease
TEMP SELECTOR switch	CAL
T3/T5.1 SIM switch	OFF
T5.1 switch	NORMAL
T3 switch	NORMAL
LP SPEED switch	OFF
SQUAT switch	OFF
METER switch	USE
T1 SIM switch	OFF
TACHOMETER switch	USE
READ/CAL switch	CAL
ZERO ADJ control	Full decrease
RPM SELECT switch	NHP
PROBE TRIM control	Full decrease
MODE switch	RESET
ACCEL START PRESET control	Centered

c. Disconnect electrical connector from high pressure compressor tachometer generator. Disconnect plug from amplifier jack No. 3.

CAUTION

To prevent damage to engine components and test set, make sure that test set is connected to 115-volt, 400-hertz, single-phase ac power source. Make a pin-to-pin voltage check of the power source connector before connecting test set.

NOTE

Adapter cable 23002227 is required between test set cable and connector 1 of amplifier.

d. Connect engine limiter test set to external electrical power and airplane as shown in figure 7-4.

e. Place engine limiter test set POWER switch in ON. Warm up for 10 minutes.

f. Check engine limiter test set as follows:

(1) Place METER switch in CHECK. Check milliammeter for 210 (±20) milliamperes. Place METER switch in USE.

(2) Check that TEMP meter indicates 575° (±1°)C (1,067° (±2°)F).

(3) Place TACHOMETER switch in CHECK and RPM SELECT switch in NLP. Check % RPM meter for 16.7% (±0.3%).

(4) Place RPM SELECT switch in NHP. Check % RPM meter for 100.0% (±0.3%). Place TACHOMETER switch in USE.

g. Start engine (T.O. 1A-7D-2-1) and stabilize at IDLE.

7-9.2. T5 Point Dynamic Test.

a. Perform preparation procedure, if required.

b. Place test set LP SPEED switch in +10%.

c. Place test set TEMP SELECTOR switch in T5.1.

CAUTION

Before placing T5.1 in PULL DOWN, retard throttle enough to reduce engine RPM to about 80%. After T5.1 switch is in PULL DOWN, advance throttle to intermediate and stabilize. Failure to retard throttle prior to selection of T5.1 PULL DOWN will cause fail-safe circuitry to come on in the amplifier and turn it off. This could cause engine overtemperature.

d. Place test set T5.1 switch in PULL DOWN.

e. Move throttle to MIL and stabilize for 3 minutes.

CAUTION

After the T5.1 limiter has been adjusted using engine limiter test set, no further T5.1 adjustments are permitted to correct for tolerances in the cockpit TOT indicator. Due to indicating system tolerances, readings in the range of 567° to 583°C (1,053° to 1,081°F) may appear on the cockpit TOT indicator (T5.1 switch in NORMAL). In no case should the T5.1 limiter be adjusted using the cockpit indicator as the limiter setting instrument. This may cause severe overtemperature and reduce turbine life.

f. Check T5.1 temperature on test set TEMP °C indicator for 475° (±4°)C (887° (±7°)F). {1 through 5}

NOTE

Clockwise adjustment of T5 datum potentiometer raises temperature. One turn is about 2°C (4°F).

g. If temperature is not within limits, retard throttle to IDLE and adjust T5 datum potentiometer on temperature limiter amplifier.

h. Repeat steps e through g until 475° (±1°)C (887° (+2°)F) is reached on test set TEMP °C indicator.

i. Move throttle to MIL and stabilize.

NOTE

If current is about 400 milliamperes and amplifier has turned off, troubleshoot using probable cause 6 in table 7-3.

j. **Record milliamperes shown on test set. This is main fuel control limiter solenoid current requirement. If current is more than 300 milliamperes, perform acceleration/ deceleration time checks (paragraph 5-16).**

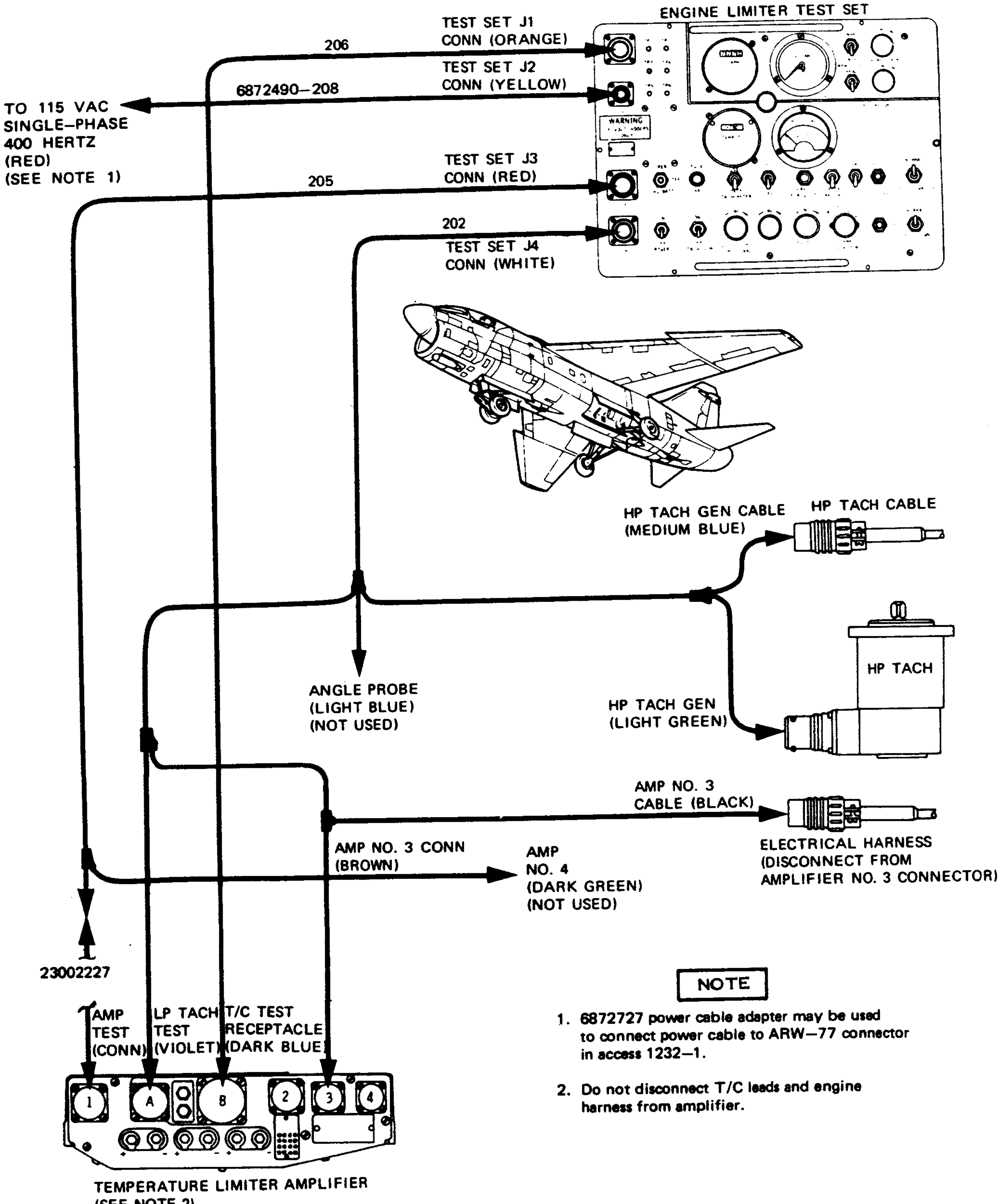
k. **If acceleration time is less than maximum limit, adjust acceleration stop toward the maximum limit to decrease limiter current. If limiter solenoid current still is more than 300 milliamperes, replace main fuel control (paragraph 5-30).**

l. **Retard throttle to IDLE.**

m. **Place cockpit double datum switch (airplanes before T.O. 1A-7-530) in ON or double datum/anti-ice switch (airplanes after T.O. 1A-7-530) in DOUBLE DATUM/ANTI-ICE.**

n. **Move throttle to MIL and check that stabilized T5.1 pulldown temperature is 475° (±4°)C (887° (±7°)F). Record stabilized temperature.**

o. **Momentarily place test set SQUAT switch in ARMED and simultaneously start timing T5.1 temperature.**



NOTE

1. 6872727 power cable adapter may be used to connect power cable to ARW-77 connector in access 1232-1.

2. Do not disconnect T/C leads and engine harness from amplifier.

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Figure 7-4. Dynamic Test (Using 6872929 Test Set); Temperature Limiter Amplifier

p. Check that T5.1 temperature on test set TEMP °C indicator goes up 15°C (27°F) within 15 seconds from time of SQUAT switch closure. It must not exceed 23°C (41°F) above temperature in step n for more than 10 seconds. {6, 7}

q. Check that T5.1 temperature drops to within 6°C (11°F) of temperature in step n within 2 minutes from time of SQUAT switch closure. {7}

r. Retard throttle to IDLE.

s. Place cockpit double datum (airplanes before T.O. 1A-7-530) or double datum/anti-ice (airplanes after T.O. 1A-7-530) switch in OFF.

t. Place test set T5.1 switch in NORMAL and LP SPEED switch in OFF.

u. Wait 3 minutes before going to next step to make sure that double datum cycle has timed out.

NOTE

On cold days, engine may not be operating on T5 limiter and T5.1 temperature limits may not be reached. At about 60°F and above, the T5 limiter will be operating.

v. Move throttle to MIL and make sure amplifier is no longer in T5 pull down. The temperature indicated on test set TEMP °C indicator must not be more than 579°C (1,074°F). {8, 9}

w. Retard throttle to IDLE.

x. If no further tests are required, perform posttest (subparagraph 7-9.5).

7-9.3. Deleted.

7-9.4. <u>Mass Airflow Limiter Dynamic Test.</u>

a. Perform preparation procedure, if required.

b. Check engine data plate and record NL TRIM SPEED value.

c. Place RPM SELECT switch in NLP.

d. Advance throttle to intermediate, stabilize, note NL SPEED, and then reduce throttle until NH RPM is below 80%.

e. If using 6872340 test set, place BATT switch in OPER.

f. Place T1 SIM switch in ON.

g. Place TEMP SELECTOR switch in T1.

h. Adjust T1 control until 15°C is indicated on TEMP °C indicator. {10}

i. Switch test set TEMP SELECTOR switch from T1 to T3 and back to T1. Adjust T1 control as required to maintain 15°C indication on TEMP °C indicator.

j. Repeat step i until 15°C is maintained without a T1 control adjustment.

CAUTION

Prior to placing LP SPEED switch in -10%, retard throttle sufficiently to reduce engine speed to 80%. After LP SPEED switch is set at -10%, advance throttle to intermediate and stabilize. Failure to retard throttle prior to selection of -10% LP SPEED may result in activiation of the fail-safe circuit in the amplifier and turn the amplifier off. This could result in engine overtemperature.

k. Place test set LP SPEED switch in -10%, and then advance throttle to intermediate.

l. Check that indication on test set TEMP °C indicator remains at 15°C. Adjust T1 control, if required, to maintain 15°C.

m. Stabilize engine at MIL for 3 minutes.

n. Check that indication on test set % RPM indicator is 10% (±0.7%) less than value recorded in step b and milliammeter indication is less than 300 milliamperes. {11}

Example:

NL TRIM SPEED 95.0%

95.0% – 10.0 = 85.0%

85.0% – 0.7% = 84.3%

85.0% + 0.7% = 85.7%

Acceptable range = 84.3% to 85.7%

o. If NL speed is not within limits, adjust NL potentiometer on temperature limiter amplifier until test set % RPM indication is 10% (±0.5%) less than value recorded in step b.

p. Indication on test set milliammeter must be less than 300 milliamperes. This is final mass airflow limiter setting and must not be altered during subsequent static checks.

q. Retard throttle to IDLE.

r. If milliammeter indication exceeds 300 milliamperes, perform acceleration/deceleration check (paragraph 5-16).

s. If acceleration time is less than maximum limit, adjust the acceleration stop toward the maximum limit. If milliammeter indication still exceeds 300 milliamperes, replace main fuel control (paragraph 5-30).

t. If using 6872340 test set, place BATT switch in OFF.

u. Place T1 SIM switch in OFF, place LP SPEED switch in OFF, and place TEMP SELECTOR switch in T5.

v. Advance throttle to MIL and observe NL SPEED, which should be same as recorded in step b.

w. Place switches as follows:

Control	*Position*
RPM SELECT switch	NHP
T1 control	Midrange
T1 SIM switch	OFF
LP SPEED switch	OFF

x. Perform postcheck procedures.

7-9.5. Posttest.

a. Shut down engine (T.O. 1A-7D-2-1).

b. Place test set POWER switch in OFF.

c. Disconnect engine limiter test set from airplane and external electrical power.

d. Connect electrical connector to high pressure compressor tachometer generator and amplifier receptacle No. 3.

e. Close access 5222-1.

f. Secure double datum switch guard (airplanes before T.O. 1A-7-530) with MS20995CY20 lockwire (T.O. 1-1A-14).

Control	*Position*
POWER switch	OFF
SQUAT switch	OFF
IGV/CAL switch	IGV
TACH SIMULATED INPUTS control	Fully counter-clockwise
T1 SIMULATED INPUTS control	Fully counter-clockwise
T5 SIMULATED INPUTS control	Fully counter-clockwise
T5 switch	NORMAL
LP SP switch	OFF

c. Disconnect electrical connectors from high pressure compressor tachometer generator and from amplifier receptacle No. 3.

d. Connect engine limiter test set to airplane as shown in figure 7-5.

NOTE

When the test set POWER switch is placed in ON, the numerals 00 will appear in the lower portion TEST window display. This 00 display indicates that SELF TEST has been selected.

When the test set has warmed up (maximum of 20 minutes), the test set will begin the self-test function automatically.

After completion of self-test, the numbers 88.88 will be sequenced through three rows in the window display. This sequencing will continue until a specific test is selected or the test set POWER switch is placed in OFF.

e. Place POWER switch in ON. Warm up test set.

f. Start engine (T.O. 1A-7D-2-1) and stabilize at IDLE.

7-10.2. T5 Datum Point Check.

a. Perform peparation procedure, if required (subparagraph 7-10.1).

b. Place TEST switch in NEXT until 11 appears in TEST display window.

c. Move throttle to 80% and stabilize for 3 minutes.

CAUTION

Make sure throttle is at 80% rpm prior to placing T5 switch in PULL-DN. Failure to have throttle at 80% rpm may cause the fail-safe circuitry to come on in the amplifier and turn it off. This could cause engine overtemperature.

d. Place T5 switch in PULL-DN.

e. Place LP SP switch in +10%.

f. Check that T5 and MA indicator lights come on.

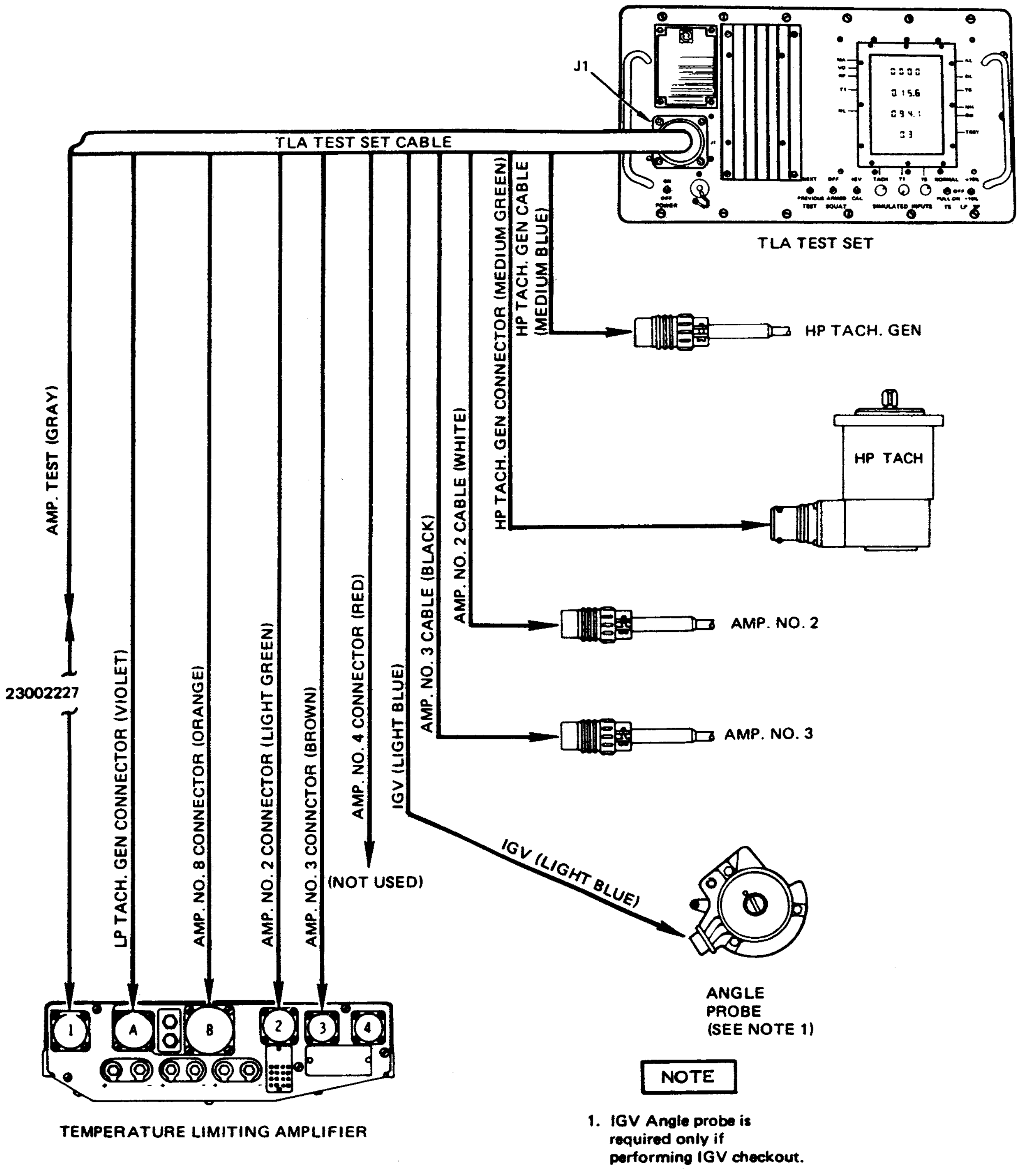
g. Check that T5 display window indicates a temperature.

h. Move throttle to MIL and stabilize for 3 minutes.

CAUTION

After the T5.1 limiter has been adjusted using engine limiter test set, no further T5.1 adjustments are permitted to correct tolerances in the cockpit TOT indicator. Due to indicating system tolerances, readings in the range of 567° to 583° (1,053° to 1,081°F) may be indicated on the cockpit TOT indicator (T5.1 switch in NORMAL). In no case should the T5.1 limiter be adjusted using the cockpit indicator as the limiter setting instrument. This may cause severe overtemperature and reduce turbine life.

i. Check T5.1 temperature on test set T5 display for 475° (±4°)C (887° (±7°)F). {1 through 5}



NOTE

1. IGV Angle probe is required only if performing IGV checkout.

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Figure 7-5. Dynamic Test (Using 6893706 Test Set); Temperature Limiter Amplifier

NOTE

Clockwise adjustment of T5 datum potentiometer raises temperature. One turn is about 2°C (4°F).

j. If temperature is not within limits, retard throttle to IDLE and adjust T5 datum potentiometer on temperature limiter amplifier.

k. Repeat steps f through h for 475° (±1°)C (887° (±2°)F) on test set T5 display.

l. Move throttle to MIL and stabilize.

NOTE

If current is about 400 milliamperes and amplifier has turned off, troubleshoot using probable cause 6 in table 7-3.

m. Record indication on test set MA display. This is main fuel control limiter solenoid current requirement. If current is more than 300 milliamperes, perform acceleration/deceleration time checks (paragraph 5-17).

n. If acceleration time is less than maximum limit, adjust acceleration stop toward maximum limit to decrease limiter current. If limiter solenoid current still exceeds 300 milliamperes, replace main fuel control (paragraph 5-30).

o. Retard throttle to IDLE.

p. Place T5 switch in NORMAL.

q. Place LP SP switch in OFF.

r. If no further tests are required, perform posttest (subparagraph 7-10.6).

7-10.3. T5 Double Datum Point Dynamic Test.

a. Perform T5 datum point check prior to proceeding.

b. Place switches as follows:

Switch	*Position*
SQUAT switch	OFF
IGV/CAL switch	IGV
T5 switch	NORMAL
LP SP switch	OFF

c. Place TEST switch in NEXT until 12 appears in TEST display window.

d. Advance throttle to 80% and stabilize.

CAUTION

Make sure throttle is at 80% before placing T5 switch in PULL-DN. Failure to do so may cause the fail-safe circuit to come on in the amplifier, and turn it off. This could cause engine overtemperature.

e. Place T5 switch in PULL-DN.

f. Place LP SP switch in +10%.

g. Check that T5, MA, and DD indicator lights come on.

h. Move throttle to MIL and stabilize for 3 minutes.

i. Record T5 in display window.

NOTE

Cockpit double datum switch must be turned on prior to activation of the test set SQUAT switch.

j. Place cockpit double datum switch (airplanes before T.O. 1A-7-530) in ON or double datum/anti-ice switch (airplanes after T.O. 1A-7-530) to DOUBLE DATUM/ANTI-ICE.

NOTE

If maximum T5 exceeds 23°C (41°F) over initial temperature for more than 24 seconds, the T5 display will start flashing. If this occurs, promptly retard throttle to IDLE and troubleshoot system.

The DD display window will show elapsed time to reach peak T5, counting from arming of SQUAT switch. The T5 display will indicate the temperature rise to maximum T5. When maximum T5 is reached, T5, MA, and DD time will freeze.

k. Momentarily place SQUAT switch in ARMED; then release. T5 temperature indicated on test set T5 display must rise at least 15°C (27°F) above initial temperature within 15 seconds from time SQUAT switch is first set. It must not exceed 23°C (41°F) above stabilized initial temperature for more than 10 seconds. {6, 7}

l. If all values are within limits, stabilize engine at MIL and proceed to step m.

m. Place TEST switch in NEXT until 13 appears on TEST display.

n. Note MA, T5, and DD displays, which will indicate normal progression of the double datum sequence. When DD display reaches 120 seconds, DD, T5, and MA displays will freeze. If 120 seconds have passed prior to reaching test 13, the displays will record the values which were present at 120 seconds. All values must be within limits of table 4-6.

o. Retard throttle to IDLE.

p. Place cockpit double datum switch (airplanes before T.O. 1A-7-530) or double datum/anti-ice switch (airplanes after T.O. 1A-7-530) in OFF.

q. Place T5 switch in NORMAL and LP SP switch in center position.

r. Move throttle to MIL to make sure amplifier is out of pulldown. {8, 9}

NOTE

Following double datum check, at least 3 minutes must pass before starting other tests. This will ensure that double datum has timed out.

s. If no further tests are required, perform posttest (subparagraph 7-10.6).

7-10.4. Deleted.

7-10.5. Mass Airflow Limiter Dynamic Test. (Engine after T.O. 2J-TF41-641.)

NOTE

Disconnect test set cable from temperature limiter amplifier receptacle No. 4 and connect NL cable to amplifier.

a. Perform preparation procedure, if required (subparagraph 7-10.1).

b. Record engine data plate speed.

c. Place TEST switch in NEXT until 14 appears in TEST display window.

d. Check that T1, NL, MA, and T1 SIMULATED INPUTS lights come on.

NOTE

T1 display will blink until 10° to 20°C (50° to 68°F) is indicated.

e. Rotate T1 SIMULATED INPUTS control clockwise until 15° (±1°)C (59° (±2°)F) is indicated in display window. {10}

CAUTION

On engines after T.O. 2J-TF41-641, advance throttle to 80% prior to placing LPSP switch in -10%. Failure to do so may result in activation of fail-safe circuit in amplifier and turn amplifier off. This could result in engine overtemperature.

f. Advance throttle to approximately 80% (10,300 rpm).

g. Place LP SP switch in – 10%.

NOTE

The T1 display may drift off of the 15°C (59°F) indication. Adjustment of T1 SIMULATED INPUTS control may be required to hold T1 display within 15° (±1°)C (59° (±2°)F). If T1 drifts from 15° (±5°)C (59° (±9°)F), the display will blink.

h. Advance throttle to MIL and stabilize for 3 minutes.

i. With T1 display at 15° (±1°)C (59° (±2°)F), record NL. It must be 10% (±0.7%) less than engine data plate speed in step b. {11}

Example:

DATE PLATE SPEED 95.0%

95.0% – 10.0% - 85.0%

85.0% – 0.7% = 84.3%

85.0% + 0.7% = 85.7%

Acceptable range = 84.3% to 85.7%

j. If NL speed is not within limits, adjust NL potentiometer on amplifier until limits are met.

NOTE

If current is about 400 milliamperes and amplifier has turned off, troubleshoot using probable cause 6 in table 7-3.

k. Record MA indicated in display. If MA exceeds 300 milliamperes, perform acceleration/deceleration check (paragraph 5-17).

l. If acceleration time is less than maximum limit, adjust acceleration stop toward the maximum limit. If MA display still exceeds 300 milliamperes, replace main fuel control (paragraph 5-30).

m. Retard throttle to IDLE.

n. Place LP SP switch in OFF and rotate T1 SIMULATED INPUTS control fully counterclockwise.

o. If no further tests are required, perform posttest (subparagraph 7-10.6).

7-10.6. Posttest.

a. Shut down engine (T.O. 1A-7D-2-1).

b. Place test set POWER switch in OFF.

c. Disconnect test set from airplane.

d. Connect electrical connectors to amplifier.

e. Close access 5222-1.

f. Secure double datum switch guard (airplanes before T.O. 1A-7-530) with MS20995CY20 lockwire (T.O. 1-1A-14).

7-11. TEMPERATURE LIMITER AMPLIFIER DYNAMIC TEST TROUBLESHOOTING.

Test Equipment Required

Figure & index No.	Name	AN type designation	Use and application
	Multimeter	AN/PSM-6	Measure voltage and check continuity

7-11.1. Procedures. Refer to table 7-4 for troubleshooting data. Malfunctions are listed by number and are related to a corresponding number following a step in the test.

7-11.2. Schematic. See figure FO-14 for schematic diagram.

7-12. Deleted.

Table 7-4. Temperature Limiter Amplifier Dynamic Test Troubleshooting

Probable cause	Isolation procedure	Remedy
1. Turbine outlet temperature and rpm fluctuate with engine operating at MIL and T5.1 switch in PULL DOWN.		
Broken temperature limiter amplifier bonding lead	Check condition of bonding lead.	Replace bonding lead.
T5.1 thermocouple leads not properly connected to temperature limiter amplifier	Check that T5.1 thermocouple leads are connected to amplifier as shown in figure 7-8.	Connect T5.1 thermocouple leads properly.
Defective T5.1 thermocouple system	Perform T5.1 thermocouple system static check (paragraph 3-14).	Replace defective components as required.
Defective temperature limiter amplifier	None	Replace temperature limiter amplifier (paragraph 7-14).
Defective main fuel control	None	Replace main fuel control (paragraph 5-30).
2. Test set temperature does not indicate temperature limiter amplifier is in pulldown condition. (Temperature is high and cannot be adjusted into limits.)		
Open power circuit to temperature limiter amplifier	Disconnect electrical connector from amplifier receptacle J2. Check for 28 volts dc between pins 1 and 2 of connector.	If 28 volts dc is not indicated, check for defective wiring.
Defective T5.1 thermocouple system	Perform T5.1 thermocouple system static check (paragraph 3-14).	Replace components as required.

Table 7-4. Temperature Limiter Amplifier Dynamic Test Troubleshooting — CONT

Probable cause	Isolation procedure	Remedy
Defective temperature limiter amplifier	None	Replace temperature limiter amplifier (paragraph 7-14).
Defective wiring	Check wiring for continuity.	If continuity is not indicated, replace or repair defective wiring.
3. RPM exceeds 95% and turbine outlet pressure and fuel flow are low.		
Defective bleed air system	Perform airflow control system operational checkout (paragraph 2-4).	Replace components as required.
4. Turbine outlet temperature overshoots and responds slowly.		
	NOTE On hot days, overshoot of turbine outlet temperature may be normal operation.	
T5.1 thermocouple leads not properly connected to temperature limiter amplifier	Check that T5.1 thermocouple leads are connected to amplifier as shown in figure 7-8.	Connect T5.1 thermocouple leads properly.
Defective T5.1 thermocouple system	Perform T5.1 thermocouple system static checks (paragraph 3-14).	Replace defective components as required.
Defective temperature limiter amplifier	None	Replace temperature limiter amplifier (paragraph 7-14).
Defective main fuel control	None	Replace main fuel control (paragraph 5-30).
5. Step changes occur during T5.1 pulldown.		
	NOTE Step changes are defined as those changes in operating parameters that are rapid and positive, and lacking other than normal fluctuations.	
T1 or T5.1 thermocouple leads not properly connected to temperature limiter amplifier	Check that T1 and T5.1 thermocouple leads are connected to amplifier as shown in figure 7-8.	Connect thermocouple leads properly.
Defective low pressure compressor rotor tachometer generator	Perform mass airflow limiter dynamic test (paragraph 7-9 or 7-10).	If step changes occur, replace low pressure rotor tachometer generator (paragraph 7-16).
Defective T5.1 thermocouple system	Perform T5.1 thermocouple system static check (paragraph 3-14).	Replace components as required.
Defective temperature limiter amplifier	None	Replace temperature limiter amplifier (paragraph 7-14).

Table 7-4. Temperature Limiter Amplifier Dynamic Test Troubleshooting — CONT

Probable cause	Isolation procedure	Remedy
6. Test set temperature does not increase when double datum (SQUAT) switch is placed in ARMED.		
Defective temperature limiter amplifier	**Perform temperature limiter amplifier T5 datum point static test (paragraph 7-6 or 7-7).**	If double datum does not trigger, replace temperature limiter amplifier (paragraph 7-14).
Defective main fuel control	Perform temperature limiter amplifier T5 point dynamic test (subparagraph 7-9.2).	If milliampere indication is less than 160 milliamperes when operating at MIL in T5.1 pulldown, replace main fuel control (paragraph 5-30).
	NOTE Throttle must be placed in military to check double datum circuit.	
Open ground circuit to temperature limiter amplifier	Disconnect electrical connector from amplifier receptacle J3 and P405 connector from receptacle J1. Check for continuity between pin 3-J3 and pin 10-J1.	If continuity is not indicated, check for defective double datum lockout switch.
Defective double datum lockout switch	Place throttle in military. Disconnect electrical connector from double datum lockout switch and check for continuity.	If continuity is not indicated, replace control cambox (paragraph 5-32).
Defective wiring	Check wiring for continuity.	If continuity is not indicated, replace defective wiring.
7. Test set temperature does not increase and decrease within limits when double datum (SQUAT) switch is placed in ARMED.		
Defective temperature limiter amplifier	**Perform temperature limiter amplifier static test (paragraph 7-6 or 7-7).**	If amplifier does not perform within limits, replace temperature limiter amplifier (paragraph 7-14).
8. Temperature limiter amplifier remains in pulldown condition with T5.1 switch in NORMAL.		
Defective temperature limiter amplifier	None	Replace temperature limiter amplifier (paragraph 7-14).
9. Test set temperature indication exceeds limits with engine operating at MIL and T5.1 switch in NORMAL.		
T5.1 thermocouple leads not properly connected to temperature limiter amplifier	Check T5.1 thermocouple leads are connected to amplifier as shown in figure 7-8.	Connect T5.1 thermocouple leads properly.
Defective T5.1 thermocouple system	Perform T5.1 thermocouple system static check (paragraph 3-14).	Replace defective components as required.
Defective temperature limiter amplifier	None	Replace temperature limiter amplifier (paragraph 7-14).
10. No reaction when adjusting T1 control with TEMP SELECTOR switch in T1.		
T1 thermocouple leads not properly connected	Check that T1 thermocouple leads are connected as shown in figure 7-8.	Connect T1 thermocouple leads properly.
T1 thermocouple system defective	Perform T1 thermocouple check (paragraph 7-13).	Replace T1 thermocouple (paragraph 7-15).

Table 7-4. Temperature Limiter Amplifier Dynamic Test Troubleshooting — CONT

Probable cause	Isolation procedure	Remedy
Defective temperature limiter amplifier	None	Replace temperature limiter amplifier (paragraph 7-14).
11. Engine speed does not decrease when LP SPEED switch is placed in −10%.		
	NOTE On very hot days (approximately 120°F and above), speed will not decrease.	
T1 thermocouple leads not properly connected to temperature limiter amplifier.	Check that T1 thermocouples are connected to amplifier as shown in figure 7-8.	Connected thermocouple leads properly.
Defective low pressure compressor rotor tachometer generator	None	Replace low preessure rotor tachometer generator (paragraph 7-16).
Defective wiring from tachometer generator to amplifier	Check wiring for continuity.	Repair or replace defective wiring.
Defective temperature limiter amplifier	None	Replace temperature limiter amplifier (paragraph 7-14).

All data on pages 7-34 thru 7-36, including, Figure 7-6 deleted.

7-13. T1 THERMOCOUPLE SYSTEM CHECK.

Test Equipment Required

Figure & index No.	Name	AN type designation	Use and application
	Bridge	AN/URM-90	Measure resistance
	Multimeter	AN/PSM-6	Measure resistance
	Torque wrench, 0 to 10 inch-pounds	GGG-W-686	Measure torque
	Torque wrench, 5 to 50 inch-pounds	GGG-W-686	Measure torque

a. Open access 5222-1.

CAUTION

Do not attempt to disconnect the leads at the T1 thermocouple. The leads are an integral part of the thermocouple.

b. Disconnect four T1 thermocouple leads from temperature limiter amplifier T1 terminal block by removing bolt, spring, and washer.

c. Check the resistance between each pair of white and green leads. The resistance shall not exceed 1.0 ohm.

d. Check resistance to ground at each lead. The resistance must not be less than 20,000 ohms.

NOTE

When connecting thermocouple leads to temperature limiter amplifier, the stack must be in order of lead, washer, spring, and bolt. Spring, washer, and bolt are special parts. Do not substitute bench stock items.

e. Place T1 thermocouple leads on amplifier terminal block and secure with springs, washers, and bolts.

f. Tighten bolt securing white (Chromel) leads to amplifier to 3 (±1) inch-pounds torque.

g. Tighten bolt securing green (Alumel) leads to amplifier to 16 (+2, −1) inch-pounds torque.

h. Close access 5222-1.

7-14. TEMPERATURE LIMITER AMPLIFIER REMOVAL AND INSTALLATION.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
	GGG-W-686	Torque wrench, 5 to 50 inch-pounds	Measure torque
	GGG-W-686	Torque wrench, 0 to 10 inch-pounds	Measure torque

7-14.1. Removal. (Figure 7-7.)

a. Open access 5222-1.

b. Disconnect three electrical connectors (1, 2, and 3).

NOTE

Tag thermocouple leads before removal to ensure proper installation.

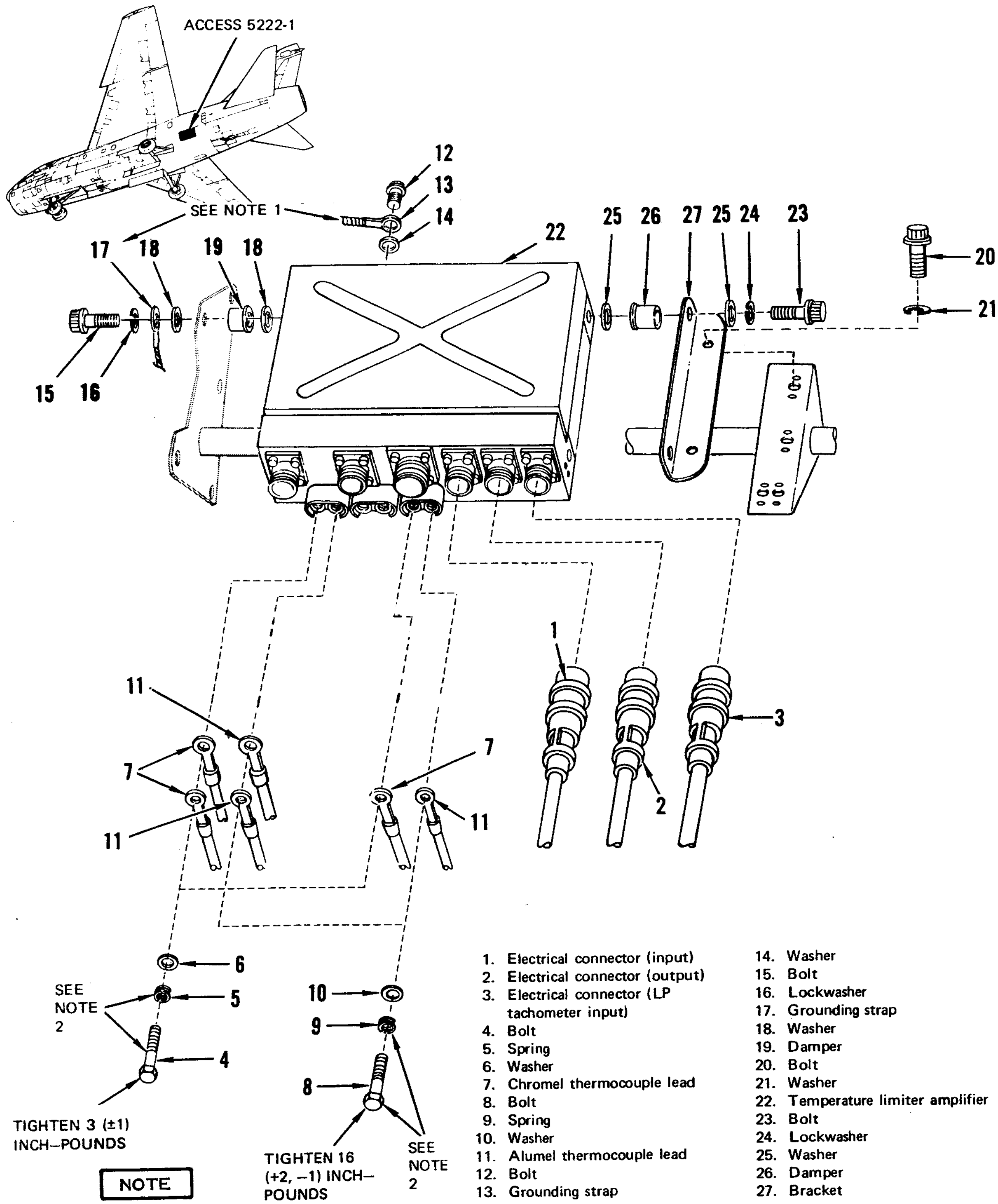
c. Remove bolts (4), springs (5), and washers (6) and disconnect Chromel thermocouple leads (7).

d. Remove bolts (8), springs (9), and washers (10) and disconnect Alumel thermocouple leads (11).

NOTE

Grounding strap mounting location will vary depending on temperature limiter amplifier part number.

e. If grounding strap is installed on upper side, remove bolt (12), grounding strap (13), and washer (14).



1. Electrical connector (input)
2. Electrical connector (output)
3. Electrical connector (LP tachometer input)
4. Bolt
5. Spring
6. Washer
7. Chromel thermocouple lead
8. Bolt
9. Spring
10. Washer
11. Alumel thermocouple lead
12. Bolt
13. Grounding strap
14. Washer
15. Bolt
16. Lockwasher
17. Grounding strap
18. Washer
19. Damper
20. Bolt
21. Washer
22. Temperature limiter amplifier
23. Bolt
24. Lockwasher
25. Washer
26. Damper
27. Bracket

NOTE

1. Grounding strap mounting location will vary depending on amplifier part number.
2. Bolts and springs are special parts. Do not substitute bench stock items.

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Figure 7-7. Removal and Installation; Temperature Limiter Amplifier

f. Remove bolts (15), lockwashers (16), grounding strap (17, if applicable), washers (18), and dampers (19).

g. Remove bolts (20) and lockwashers (21), and remove temperature limiter amplifier (22).

h. Remove bolts (23), lockwashers (24), washers (25), and damper (26), and remove bracket (27).

7-14.2. Installation. (Figure 7-7.)

a. Apply light coat of MIL-S-8660 silicone compound to outside of dampers (26), and install in bracket (27).

b. Secure bracket to temperature limiter amplifier (22) with washers (25), lockwashers (24), and bolts (23). Make sure washers (25) are properly installed as illustrated.

c. Place amplifier and bracket in position and secure bracket with lockwashers (21) and bolts (20).

WARNING

Silicone compound is slightly toxic to eyes and skin. Eye and skin protection is required.

d. Apply light coat of MIL-S-8660 silicone compound to outside diameter of dampers (19), and install in bracket.

e. Secure amplifier and grounding strap (17, if applicable) with washers (18), lockwashers (16), and bolts (15). See figure 7-8 for proper installation of hardware.

NOTE

Failure to properly ground amplifier will result in erratic, unstable engine operation.

f. If grounding strap is available on top side of amplifier, secure grounding strap (13, figure 7-7) with washer (14) and bolt (12).

NOTE

When connecting thermocouple leads to amplifier, the stack must be in order of lead, washer, spring, and bolt. Springs and bolts are special parts. Do not substitute bench stock items.

g. Secure green (Alumel) thermocouple leads (11) to amplifier with washer (10), spring (9), and bolt (8). Tighten bolt to 16 (+2, −1) inch-pounds torque.

h. Secure white (Chromel) thermocouple leads (7) to amplifier with washer (6), spring (5), and bolt (4). Tighten bolt to 3 (±1) inch-pounds torque.

i. Connect three electrical connectors (1, 2, and 3) to amplifier.

NOTE

The following checks must be performed in exact order to ensure proper operation of amplifier.

j. Perform temperature limiter amplifier static test (paragraph 7-4, 7-5, 7-6, or 7-7).

k. Perform temperature limiter amplifier dynamic test (paragraph 7-9 or 7-10).

l. Perform turbine outlet pressure check (paragraph 4-9).

m. Close access 5222-1.

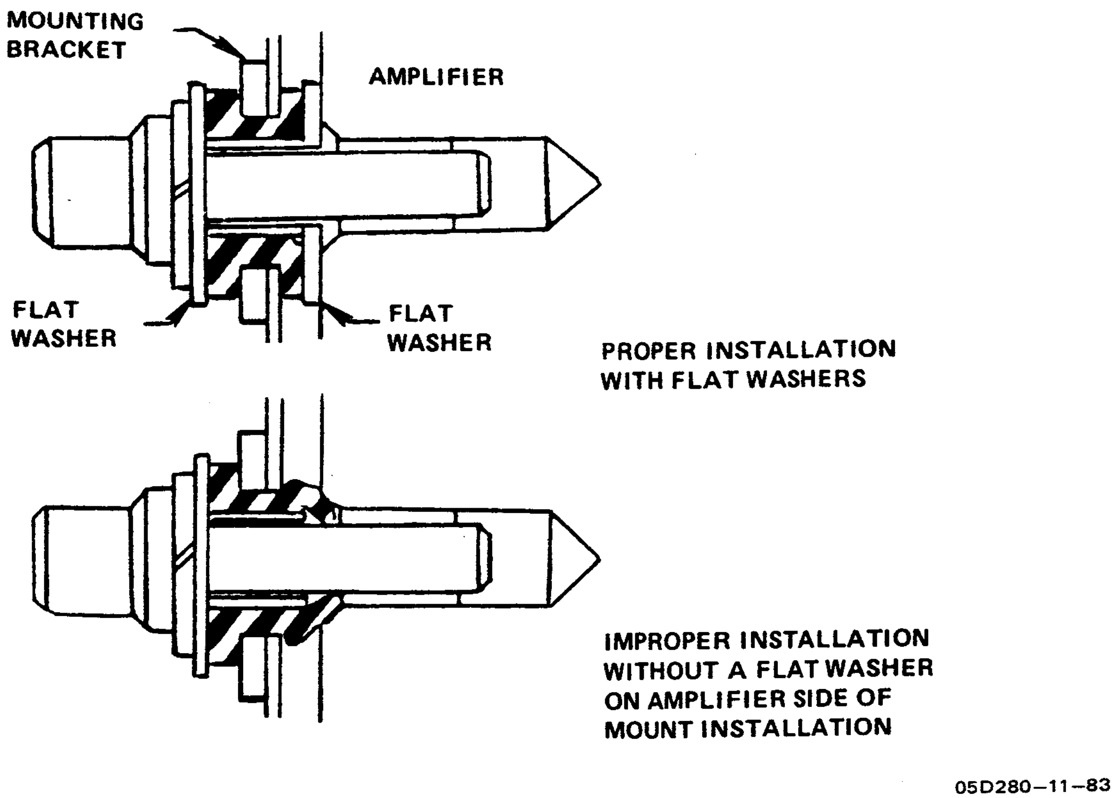


Figure 7-8. Bracket Mounting; Amplifier

7-15. T1 THERMOCOUPLE REMOVAL AND INSTALLATION.

Test Equipment Required

Figure & index No.	Name	AN type designation	Use and application
	GGG-W-686	Torque wrench, 0 to 10 inch-pounds	Measure torque
	GGG-W-686	Torque wrench, 0 to 50 inch-pounds	Measure torque
	6798622 (Allison Division of General Motors, Indianapolis, Indiana)	Engine instrument protector	Provides protection against damage to T1 thermocouple

7-15.1. Removal. (Figure 7-9.)

a. Open access 5222-1.

b. Remove bolt (1), spring (2), and washer (3), and disconnect Alumel (green) thermocouple leads (4) from temperature limiter amplifier.

c. Remove bolt (5), spring (6), and washer (7), and disconnect Chromel (white) thermocouple leads (8) from amplifier.

d. Remove bolts (9) securing cable clamps.

e. Remove bolts (10), lockwashers (11), and T1 thermocouple (12).

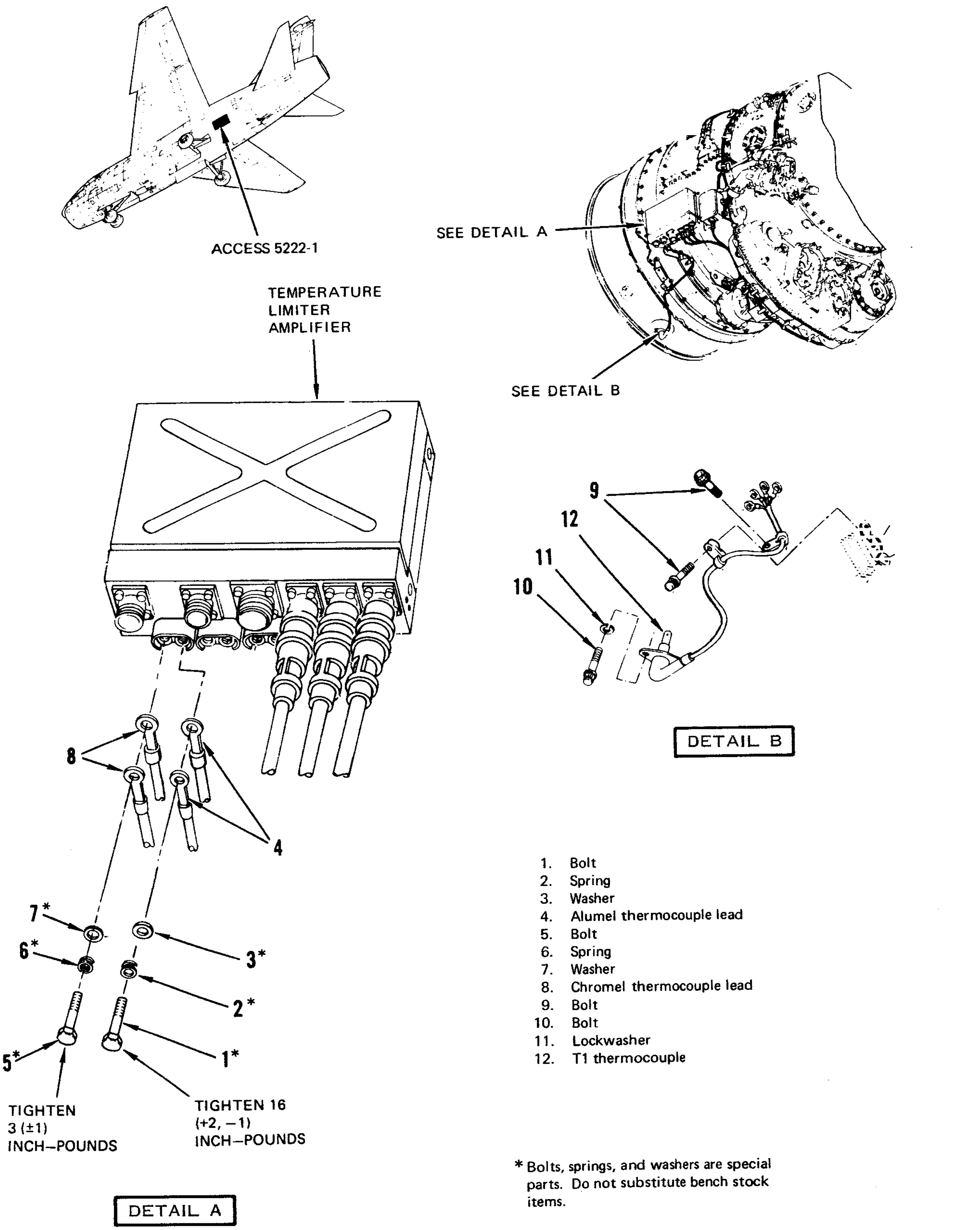
f. Install thermocouple in engine instrument protector, and secure with two bolts.

7-15.2. Installation. (Figure 7-9.)

a. Remove T1 thermocouple from instrument protector.

b. Place T1 thermocouple (12) in position, and secure to air inlet extension with lockwashers (11) and bolts (10).

c. Secure thermocouple cable clamps to engine with bolts (9).



1. Bolt
2. Spring
3. Washer
4. Alumel thermocouple lead
5. Bolt
6. Spring
7. Washer
8. Chromel thermocouple lead
9. Bolt
10. Bolt
11. Lockwasher
12. T1 thermocouple

* Bolts, springs, and washers are special parts. Do not substitute bench stock items.

Figure 7-9. Removal and Installation; T1 Thermocouple

d. Perform T1 thermocouple system check (paragraph 7-13).

NOTE

When connecting thermocouple leads to temperature limiter amplifier, the stack must be in order of lead, washer, spring, and bolt. Spring, washer, and bolt are special parts. Do not substitute with bench stock items.

e. Secure Chromel (white) thermocouple leads (8) to temperature limiter amplifier positive terminal with washer (7), spring (6), and bolt (5). Tighten bolt to 3 (±1) inch-pounds torque.

f. Secure Alumel (green) thermocouple leads (4) to amplifier negative terminal with washer (3), spring (2), and bolt (1). Tighten bolt to 16 (+2, −1) inch-pounds torque.

g. Perform mass airflow dynamic test portion of temperature limiter amplifier dynamic test (paragraph 7-9 or 7-10).

h. Close access 5222-1.

7-16. LOW PRESSURE ROTOR TACHOMETER GENERATOR REMOVAL AND INSTALLATION.

7-16.1. Removal. (Figure 7-10.)

a. Open access 5122-3.

b. Disconnect electrical connector (1).

c. Remove nuts (2), low pressure rotor tachometer generator (3), and gasket (4).

7-16.2. Installation. (Figure 7-10.)

WARNING

0-T-634 trichloroethylene is toxic to skin, eyes, and respiratory tract. Eye and skin protection is required. Good general ventilation is normally adequate.

a. Clean mounting surfaces of low pressure rotor tachometer generator (3) and low speed gearbox with O-T-634 trichloroethylene.

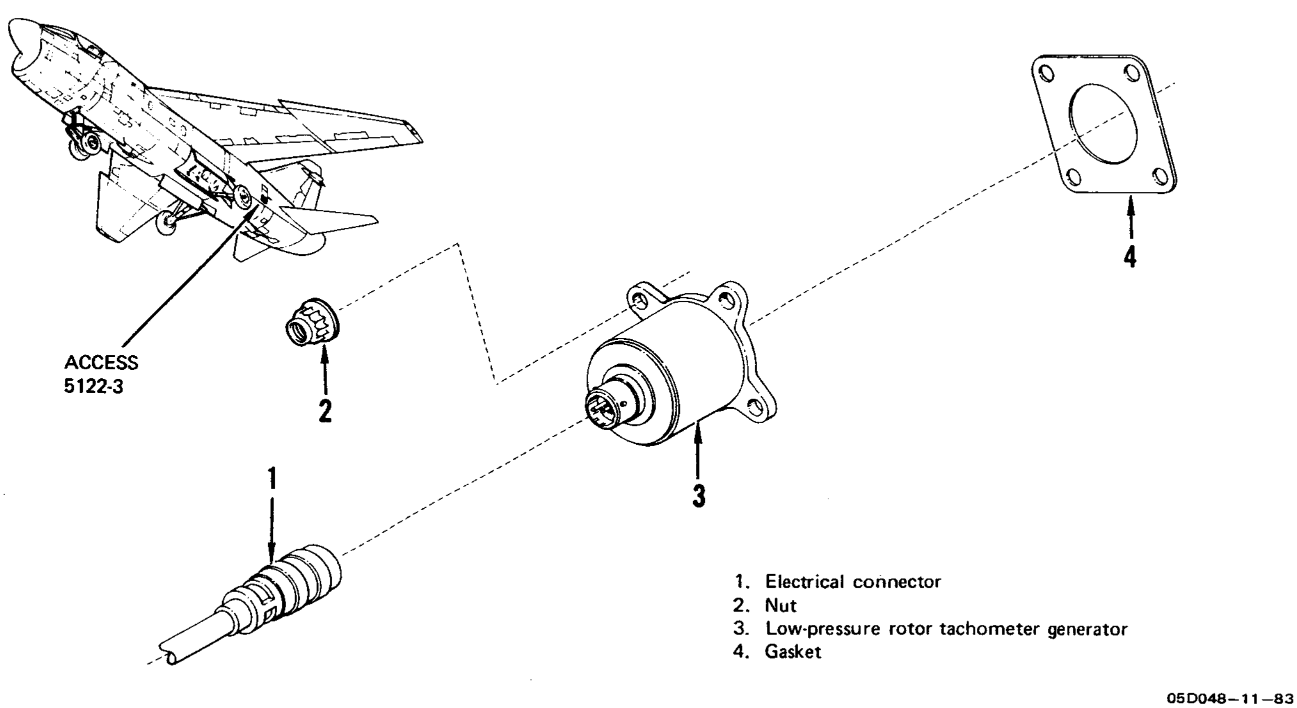


Figure 7-10. Removal and Installation; Low Pressure Tachometer

NOTE

Refer to paragraph 1-18 for instructions on how to apply sealing compound.

b. Apply RTV-106 or Permatex No. 1372 sealing compound to mounting surface of tachometer generator, low speed gearbox, and both sides of gasket (4). Allow 10 minutes for drying.

c. Apply MIL-L-7808 or MIL-L-23699 oil to drive shaft of tachometer generator and mating splines in low speed gearbox.

d. Place gasket and tachometer generator in position and secure with nuts (2).

e. Connect electrical connector (1).

f. Perform temperature limiter amplifier dynamic test (paragraph 7-9 or 7-10).

g. Close access 5122-3.

SECTION VIII

IGNITION AND STARTING SYSTEM

8-1. DESCRIPTION.

8-1.1. Purpose. The ignition and starting system controls engine cranking and ignition for normal ground starts and emergency inflight restarts.

8-1.2. Starting System. The engine starting system uses a jet fuel turbine starter (figure 8-1) to furnish motive power to rotate the engine high speed gearbox. See table 8-1 for starter details. The starter uses power from the airplane battery to provide starting electrical power and fuel from the airplane fuel system for operation. The starter will automatically shut down at completion of the start cycle.

8-1.2.1. Abort Box. An abort box in the starting system shuts down the starter in case of low battery voltage and excessive starter operating time.

8-1.2.2. Purge Switch. A purge switch permits bleeding the starter fuel system without disconnecting or opening fuel lines.

8-1.3. Ignition System. Power for the ignition system comes from an engine driven permanent magnet generator (PMG). The PMG contains three separate circuits. Two of these provide unregulated ac voltage for the ignition system. The third circuit provides 23 (±6) volts dc to operate the autorelight ignition relay and the cold start system. Refer to Section V for description of cold start system. Refer to table 8-2 for ignition system details. The ignition exciter provides current to produce a high energy spark across the spark igniter electrode. An autorelight system automatically provides ignition in the event of a sudden power loss. An air ignite switch on the throttle provides cockpit selection of an ignition cycle. The ignition system is turned on by opening the circuit and turned off by closing the circuit.

8-1.4. Components. The system consists of crank and ignite switches, a jet fuel turbine starter, and a permanent magnet generator. It also has an ignition exciter, igniters, and an autorelight switch.

Table 8-1. Jet Fuel Turbine Starter Leading Particulars

Model	JFS100-13A
Compressor	Single stage centrifugal
Turbine	Single stage axial
Fuel	JP-4
Lubricating oil	MIL-L-7808 or MIL-L-23699 (at temperatures of −40°F and below, use MIL-L-7808)
Turbine oil capacity	13.5 fluid ounces (400 cc)
Accessory drive oil capacity	9.3 fluid ounces (275 cc)
Weight	84 pounds
Primary cutout switch	42.5 (±1.5)% rpm
Secondary cutout switch	46.5 (±1.5)% rpm

1. Fuel inlet
2. Fuel solenoid
3. Start counter
4. Accessory drive oil service port
5. Accessory drive oil drain port (magnetic chip detector)
6. Drain solenoid
7. Fuel drain port
8. Manual reset switch
9. Overtemperature switch
10. Turbine oil drain port (magnetic chip detector)
11. Turbine oil service port
12. Rectifier
13. Ignition coil
14. Primary cutout switch
15. Generator
16. Electric motor

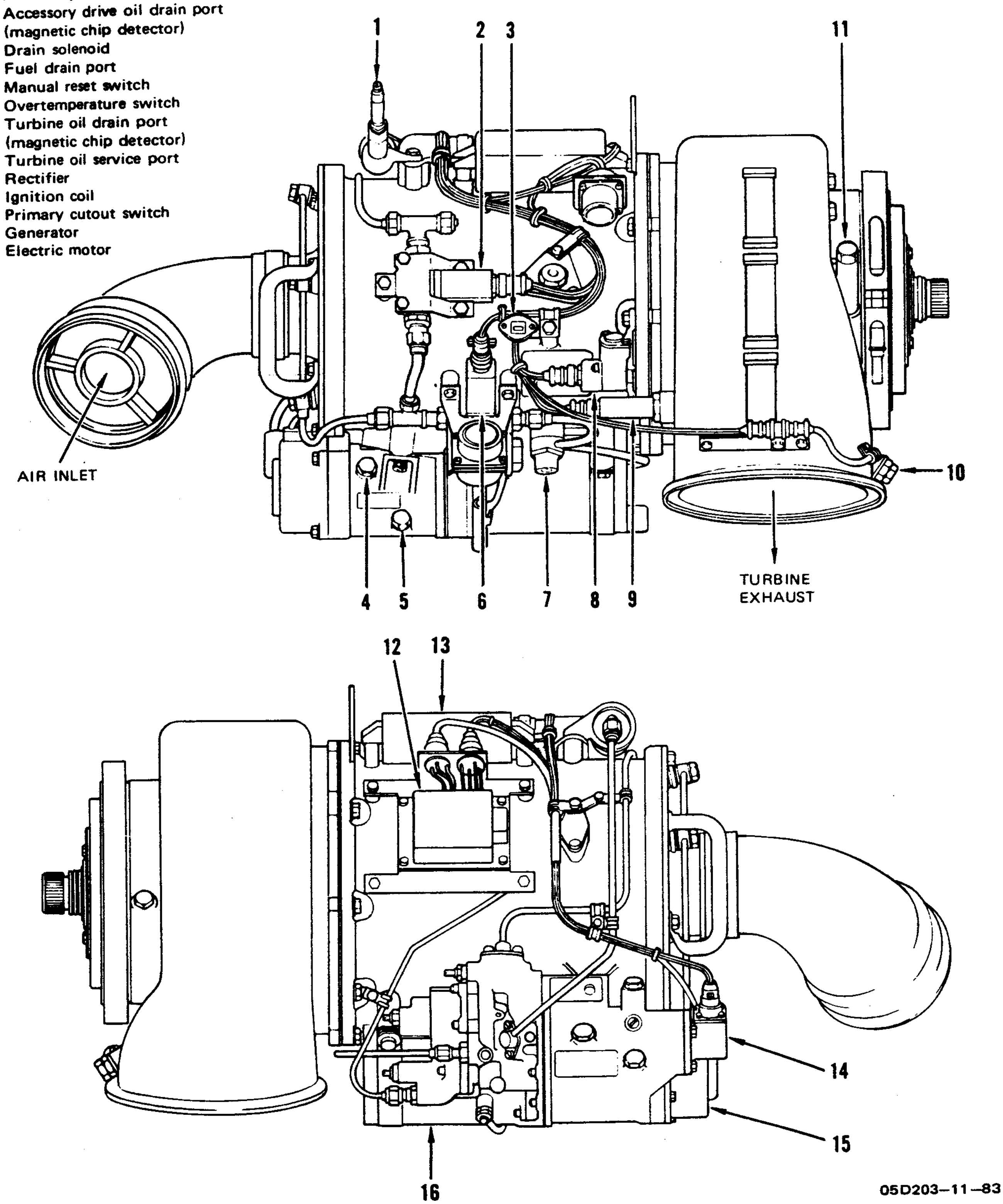


Figure 8-1. Starter Arrangement; Jet Fuel Turbine

Table 8-2. Ignition System Leading Particulars

Permanent Magnet Generator	
AC output voltage, 26 to 42	1,600 rpm
AC output voltage, 260 to 500	16,000 rpm
DC output voltage, 18 minimum	1,600 rpm
DC output voltage, 36 maximum	16,000 rpm
Ignition Exciter	
Operating voltage	15 to 65 volts ac
Spark rate	1.0 to 2.3 sparks per second
Duty cycle	Continuous

8-2. OPERATION. (Figures FO-16 through FO-19.)

8-2.1. Starter Engagement. With manual fuel shutoff valve in ON, battery switch in BATT, and throttle in CRANK; battery power is applied from the battery bus to close starter relay K401 (airplanes before T.O. 1A-7-551) or K402 (airplanes after T.O. 1A-7-551). This connects battery power to the starter motor. The motor rotates the jet fuel turbine starter engine. With the starter switch in NORM and the starter turning 7,000 rpm, the starter permanent magnet generator will supply dc current to hold the starting relay closed, open the fuel supply solenoid, close the fuel drain solenoid, and energize the starter ignition system. After the starter is ignited, it accelerates to a speed of about 4,000 rpm on series 2 starter or 36,000 rpm on series 4 or later. At this speed, the 60% (series 2) or 50% (series 4 or later) switch opens. This terminates power to the ignition system and starter relay, and energizes the start counter. The starter continues to accelerate to governed speed. This will require about 3 seconds from the time the start cycle begins. The starter has enough torque to accelerate the airplane engine to self-sustaining speed. A pawl and ratchet type engaging clutch connects the starter to the engine high speed gearbox.

8-2.2. Starter Shutdown. As the airplane engine accelerates to 42.5% (±1.5%) rpm, the primary cutout switch opens. This will terminate power to the fuel supply solenoid, causing it to close. It also causes the fuel drain solenoid to open. This will shut down the starter, the clutch will disengage, freeing the starter from the engine, and the starter will coast down to a stop. For added safety, a secondary cutout switch acts as backup in case the primary cutout switch fails. This switch will close at 46.5% (±1.5%) engine rpm, energizing a solenoid to open a manually reset switch. On starters before serial No. P240, this secondary switch will light a starter overspeed FAILED indicator. With the secondary cutout switch open, power will be removed from the fuel supply and fuel drain solenoids to shut down the starter engine. The secondary cutout switch is a reset type. Should actuation occur, resetting is required to permit subsequent emergency operation.

8-2.3. Abort Switch. If both the primary and secondary switches fail or if a starter abort is required, a starter abort switch in the cockpit can be used. This switch is placed in ABORT and held for about 5 seconds. It will open the circuit to the fuel solenoid, causing the starter to shut down. In the event of a starter overtemperature, a circuit will be made to the starter caution light, causing it to come on. When the throttle is place in CRANK and the start cycle begins, the cycle will automatically continue to completion. If a failure interrupts the complete cycle or the operator desires to stop the cycle, the starter abort switch must be held in ABORT for at least 5 seconds.

8-2.4. Abort Box. An abort box is part of the starting system. If battery voltage drops below 10.0 (±0.5) volts, the abort box circuit breaker will open and the LV indicator will show red. If the starter motor operates longer than 7 (±1) seconds, the abort box circuit breaker will open and the SPT indicator will show red. If either of these events occur, the starter will automatically abort. The red condition in either indicator will remain until the cause is fixed, circuit breaker is reset, and another start is made.

8-2.5. Ignition. When the throttle is placed in IGNITE, the normally closed ignition circuit is opened. At about 10% engine rpm, enough current is produced in the two ac phases of the PMG to power the ignition exciter. The ignition exciter has two exciter units that are electrically independent. The PMG supplies ac power to the ignition exciter. It is variable in amplitude and frequency, depending on engine speed. The exciter converts input current to high voltage potential for the spark igniters. An input filter prevents feedback into electrical system. Voltage impressed across the power transformer primary is stepped up in the secondary winding. With each change of polarity, a pulse of dc voltage reaches the storage capacitor. When this voltage reaches the level to which the air gap has been calibrated, the gap will ionize. This ionization provides a current path from the storage capacitor through ground to the igniter. From there the path crosses the shunted surface of the igniter back to the storage capacitor. The initial current flow across the igniter ionizes the gap. This gives a low resistance path for discharge of the storage capacitor. When the discharge is complete, the cycle repeats itself. A bleeder resistor gives a discharge path to the storage capacitor when the ignition circuit to the igniter is opened. A safety resistor is a discharge path that prevents exciter damage in case of open circuit operation. The igniter uses a semiconductor material between the center electrode and the shell. When the throttle is held in the outboard position and advanced to IDLE, the ignite switches are held open. When the throttle is moved inboard, the ignite switches are closed. This will short the ignition windings in the PMG, stopping the ignition cycle.

8-2.6. Autorelight. In case of a sudden drop in compressor discharge pressure (P3) (ie, flameout), the autorelight switch will automatically start the ignition cycle. P3 pressure is applied directly to the top side of a snap action diaphragm. It then goes through a check valve to the bottom side. The check valve allows free passage of air from the top side to the bottom side of the diaphragm. A rapid buildup of pressure on the top side is equalized promptly on the bottom side. A sudden drop in P3 pressure causes the check valve to close. This traps pressure against the bottom side of the diaphragm. When the pressure exceeds a preset differential, the snap action diaphragm moves and closes the autorelight switch. This completes a circuit from the dc portion of the permanent magnet generator to the ignition relay in the relay box. The relay is energized and opens the ignition circuit. This causes the ignition cycle to begin. The pressure on the bottom side of the diaphragm is bled through an orifice at a rate which sets the time of switch actuation. When differential pressure on the diaphragm drops to about 4 psid, the diaphragm will shift. This opens the autorelight switch, opens the circuit to the ignition relay, and completes the ignition cycle. Ignition may be provided for emergency air restarts by holding the ignition switch on the throttle depressed. This opens the ignition circuit and starts an ignition cycle.

8-3. COMPONENTS.

For a list of system components, locations (accesses), and functions, refer to table 8-3.

Table 8-3. Ignition and Starting System Components

Component	Access	Function
Exciter, ignition	6122-2	Provides 60 sparks per minute to igniter plugs at 12-joule energy level
Generator, permanent magnet (PMG)	6222-2	Provides electrical power for ignition system
Igniter, spark	5222-3	Ignites fuel in combustion liner No. 4 and 8
Starter, jet fuel turbine	6222-2	Rotates engine for starting
Switch, autorelight	6222-2	Provides automatic engine ignition during sudden compressor pressure drops

8-4. OPERATIONAL CHECKOUT.

Test Equipment Required

Figure & index No.	Name	AN type designation	Use and application
	Equipment required for engine operation		Operate engine
	Spark igniter assembly visual inspection chamber	6872643 (Allison Division of General Motors, Indianapolis, Indiana)	Check ignition system operation
	Autorelight switch test kit	11-8450 (Bendix Corp, South Bend, Indiana)	Switch test

8-4.1. Starting System.

NOTE

A number enclosed in braces at the end of a step in the following test corresponds to a number in troubleshooting figure FO-20.

a. Start engine (T.O. 1A-7D-2-1). {1 through 5}

b. Check that starter shuts down at 42.5% (±1.5%) rpm. {6}

c. Open access 5222-4.

d. Check starter overspeed indicator for NORMAL. {7}

e. Close access 5222-4.

8-4.2. Ignition System (Method 1).

NOTE

A number enclosed in braces at the end of a step in the following test corresponds to a number in troubleshooting figure FO-21.

a. Open access 6122-2.

WARNING

Power must be disconnected from ignition exciter for at least 5 minutes before disconnecting igniter leads. Serious injury can result from energy stored in exciter.

NOTE

If performing operational checkout for starter only, it will not be necessary to disconnect igniter leads.

b. Disconnect left igniter lead from ignition exciter. Cap exciter receptacle.

c. Start engine (T.O. 1A-7D-2-1). {1 through 3}

d. Shut down engine but do not disconnect starting equipment (T.O. 1A-7D-2-1).

WARNING

To prevent personnel injury, wait 5 minutes between operation of engine and removal or installation of spark igniter leads. Serious injury can result from energy stored in exciter.

e. Connect left igniter lead to ignition exciter and disconnect right igniter lead. Cap receptacle.

f. Start engine (T.O. 1A-7D-2-1). {1 through 3}

g. Shut down engine (T.O. 1A-7D-2-1).

WARNING

To prevent personnel injury, wait 5 minutes between operation of engine or installation of spark igniter leads. Serious injury can result from energy stored in exciter.

h. Connect right igniter lead to ignition exciter.

i. Close access 6122-2.

8-4.3. Ignition System (Method 2).

NOTE

A number enclosed in braces at the end of a step in the following test corresponds to a number in troubleshooting figure FO-21.

a. Open accesses 5222-2 and 6222-2.

WARNING

Power must be disconnected from ignition exciter for at least 5 minutes before disconnecting igniter leads. Serious injury can result from energy stored in exciter.

b. Remove left and right spark igniters (paragraph 8-17).

c. Connect leads to igniters and install igniters in viewing chambers.

d. Attach clips on viewing chambers to suitable ground on engine.

e. Remove air inlet duct shield. Check air inlet duct for freedom from foreign objects.

f. Remove tail cone shield.

g. Place battery switch in BATT.

h. Place starter switch in NORM.

WARNING

To avoid personnel injury, make sure all personnel are clear of engine air inlet and exhaust ducts and jet fuel starter exhaust before operating starter.

i. Place throttle in CRANK and hold until rpm starts to rise.

j. At 5% rpm, move throttle outboard to IGNITE and hold.

k. At 15% rpm, visually check igniters for firing. {4, 5}

l. Place throttle in OFF.

m. Place starter switch in ABORT and hold until starter shuts down.

n. Place battery switch in OFF.

o. Disconnect leads and remove igniters from viewing chambers.

p. Install left and right spark igniters (paragraph 8-17).

q. Install air inlet duct shield.

r. Install tail cone shield.

s. Install accesses 5222-2 and 6222-2.

8-4.4. Autorelight System Dynamic Check.

WARNING

To prevent personnel injury, wait 5 minutes between engine operation and removal or installation of spark igniter leads. Serious injury can result from energy stored in exciter.

a. Disconnect both igniter leads from the igniter plugs.

NOTE

The following step can use either igniter plugs removed from engine or slave igniters.

b. Install igniters in viewing chambers, and connect igniter leads.

c. Attach grounding clips to suitable ground on engine.

NOTE

Shorting plug is fabricated using Cannon MS24266R18B315N connector, FSN 5935-00-905-8339. Connect pin No. 13 to pin No. 16, and pin No. 14 to pin No. 15.

d. Remove plug P405 from main engine electrical connector. Install locally fabricated shorting plug.

e. Connect autorelight switch test kit to autorelight switch in accordance with test equipment instructions, except that engine harness connector shall be left attached to autorelight switch.

f. Motor the engine, observing all starter operational limits. Observe igniters in viewing chambers. No sparking should occur.

g. Press and hold TEST button on switch test kit, and observe igniters. Both igniters shall be firing.

h. Release TEST button. Sparking shall cease. Stop motoring engine.

8-5. TROUBLESHOOTING.

Test Equipment Required

Figure & index No.	Name	AN type designation	Use and application
	Multimeter	AN/PSM-6	Check for voltage and continuity

8-5.1. Procedures. Refer to troubleshooting figures FO-20 and FO-21 for troubleshooting data. Malfunctions are numbered corresponding to numbers following steps in the operational checkout.

8-5.2. Schematic. For schematic diagrams to aid in troubleshooting, see figures FO-16 through FO-19.

8-6. AUTORELIGHT SWITCH FUNCTIONAL CHECK.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
	MIL-T-26772	Nitrogen service trailer	Supply source of nitrogen
	11-8450 (Bendix Corp, South Bend, Indiana)	Automatic ignition actuator test set	Test operation of autorelight switch
	11-8514 (Bendix Corp, South Bend, Indiana)	Air hose assembly	Connect test set to switch air pressure port
	11-9127 (Bendix Corp, South Bend, Indiana)	Adapter lead	Provide continuity between autorelight switch and test set

a. Open access 6222-2.

b. Connect nitrogen servicing trailer to test set as shown in figure 8-2.

NOTE

Dry filtered air may be used instead of nitrogen.

Each servicing supplies sufficient pressure for approximately 40 test cycles.

c. Pressurize test set to 150 psi as shown on SUPPLY PRESSURE indicator.

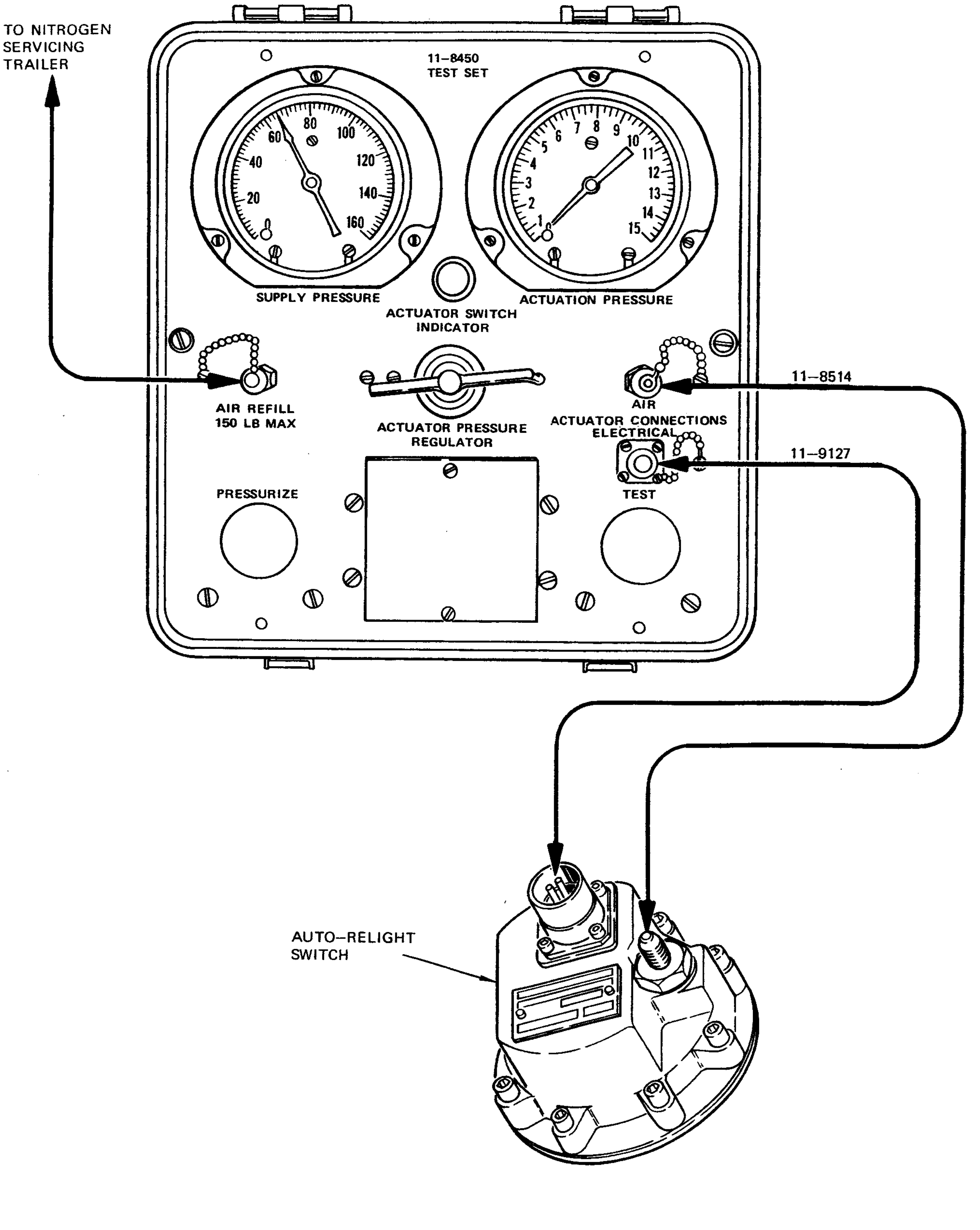


Figure 8-2. Functional Check; Autorelight Switch

d. Disconnect electrical connector from autorelight switch.

e. Cut lockwire and disconnect P3 air tube from autorelight switch.

f. Connect test set to autorelight switch as shown in figure 8-2.

NOTE

If autorelight switch does not operate within limits, replace switch.

g. Test autorelight switch as follows:

(1) Press and hold PRESSURIZE button.

(2) Adjust ACTUATOR PRESSURE REGULATOR control for 13 psi on ACTUATOR PRESSURE gauge.

(3) Release PRESSURIZE button.

(4) Press and hold TEST button.

(5) Check that ACTUATOR SWITCH INDICATOR light comes on.

(6) Release TEST button.

(7) Press and hold PRESSURIZE button.

(8) Adjust ACTUATOR PRESSURE REGULATOR control for 7 psi on ACTUATOR PRESSURE gauge.

(9) Release PRESSURIZE button.

(10) Press and hold TEST button.

(11) Check that ACTUATOR SWITCH INDICATOR light does not come on.

(12) Release TEST button.

h. Disconnect autorelight switch from test set.

i. Reconnect P3 air tube to autorelight switch. Secure with MS20995C32 lockwire.

j. Reconnect electrical connector to autorelight switch.

k. Close access 6222-2.

8-7. IGNITION SYSTEM TEST.

Test Equipment Required

Figure & index No.	Name	AN type designation	Use and application
8-3	Ignition circuits test set	6886199	Test engine ignition circuits
	Power unit	A/M 32A-60	Provide ac power

WARNING

Use extreme caution during test set operation. Dangerously high voltage will be present.

NOTE

These procedures may be performed individually or sequentially. If an individual test is run, the preparation and posttest steps must be performed.

A number enclosed in braces at the end of a step in the following test corresponds to a number in troubleshooting figure FO-22.

8-7.1. Preparation.

a. Set test set switches and controls as follows:

Control	*Position*
S1 PWR switch	Off
TEST PWR S11 switch	OFF

TEST SELECTOR S12 switch .... PMG OUTPUT

MAN/AUTO S10 switch .... AUTO

PWR S2 switch .... Off

CAL S9 switch .... Off

PMG OUTPUT TESTS S17 switch .... OFF

RELAY BOX TESTS S16 switch .... OFF

WIRING TESTS S15 switch .... OFF

EXCITER TESTS S13 switch .... OFF

R21 VOLTS ADJ control .... Fully counterclockwise

b. Connect test set to power source as shown in figure 8-3.

WARNING

If test set OPEN GND light comes on, potential shock hazard exists. Disconnect power source from test set and reject for repair.

c. Place S1 PWR switch in ON. Check that PWR ON light comes on and OPEN GRD light remains off.

8-7.2. Permanent Magnet Generator (PMG) Test.

NOTE

This test checks the output of the permanent magnet generator at engine speeds between 10% and 30% rpm.

a. Perform preparation procedure (subparagraph 8-7.1), if required.

b. Open access 6222-2.

c. Connect test set as shown in figure 8-4.

d. Place TEST SELECTOR S12 switch in PMG OUTPUT.

e. Place TEST PWR S11 switch in ON. Check that blue banded green light adjacent to J2 comes on. {1}

CAUTION

To prevent damage to equipment, do not switch into or out of AC VOLT position of PMG OUTPUT TESTS S17 switch with engine rotating.

f. Place PMG OUTPUT TESTS S17 switch in VOLT AC 5-6.

g. Place airplane battery switch in BATT.

h. Place starter switch in NORM.

NOTE

Do not exceed starter limits in table 4-5.

i. Place throttle in CRANK.

j. With engine rotating between 10% and 30% rpm, check that PMG output is within limits of table 8-4. {2}

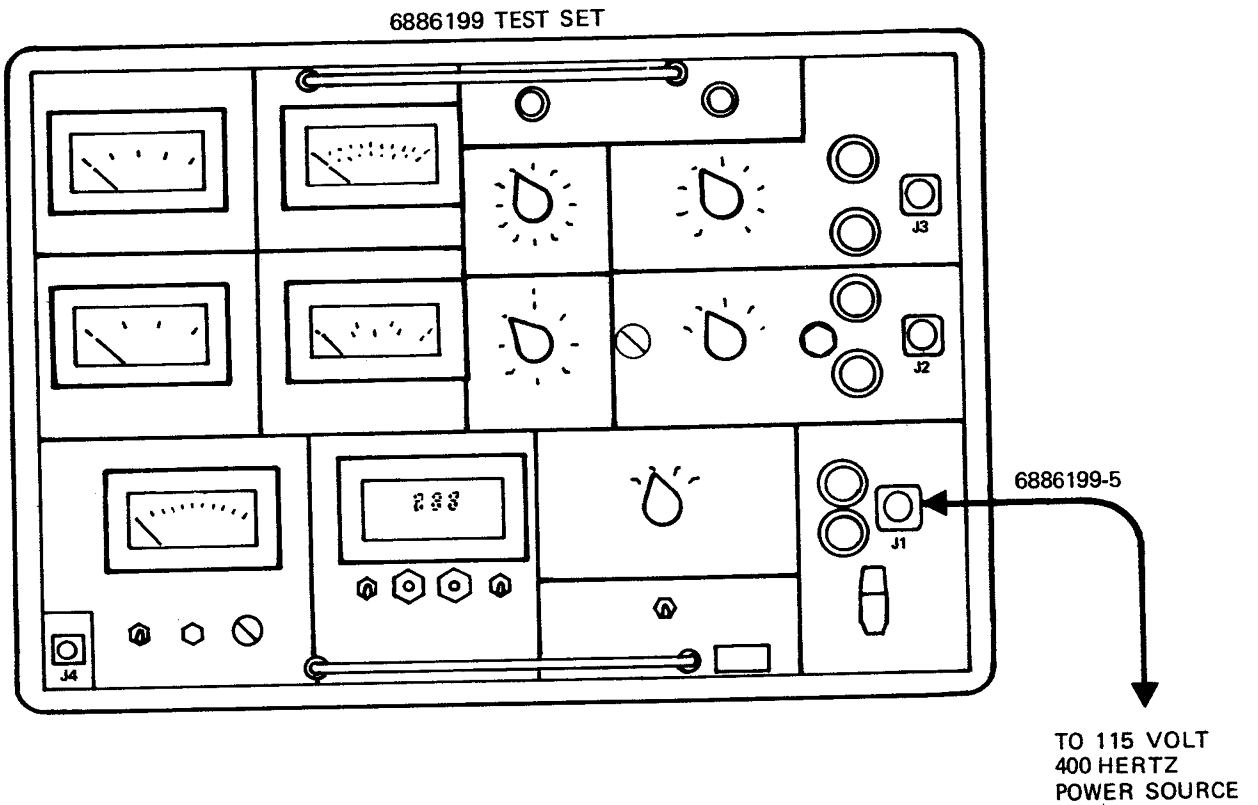


Figure 8-3. System Test; Ignition

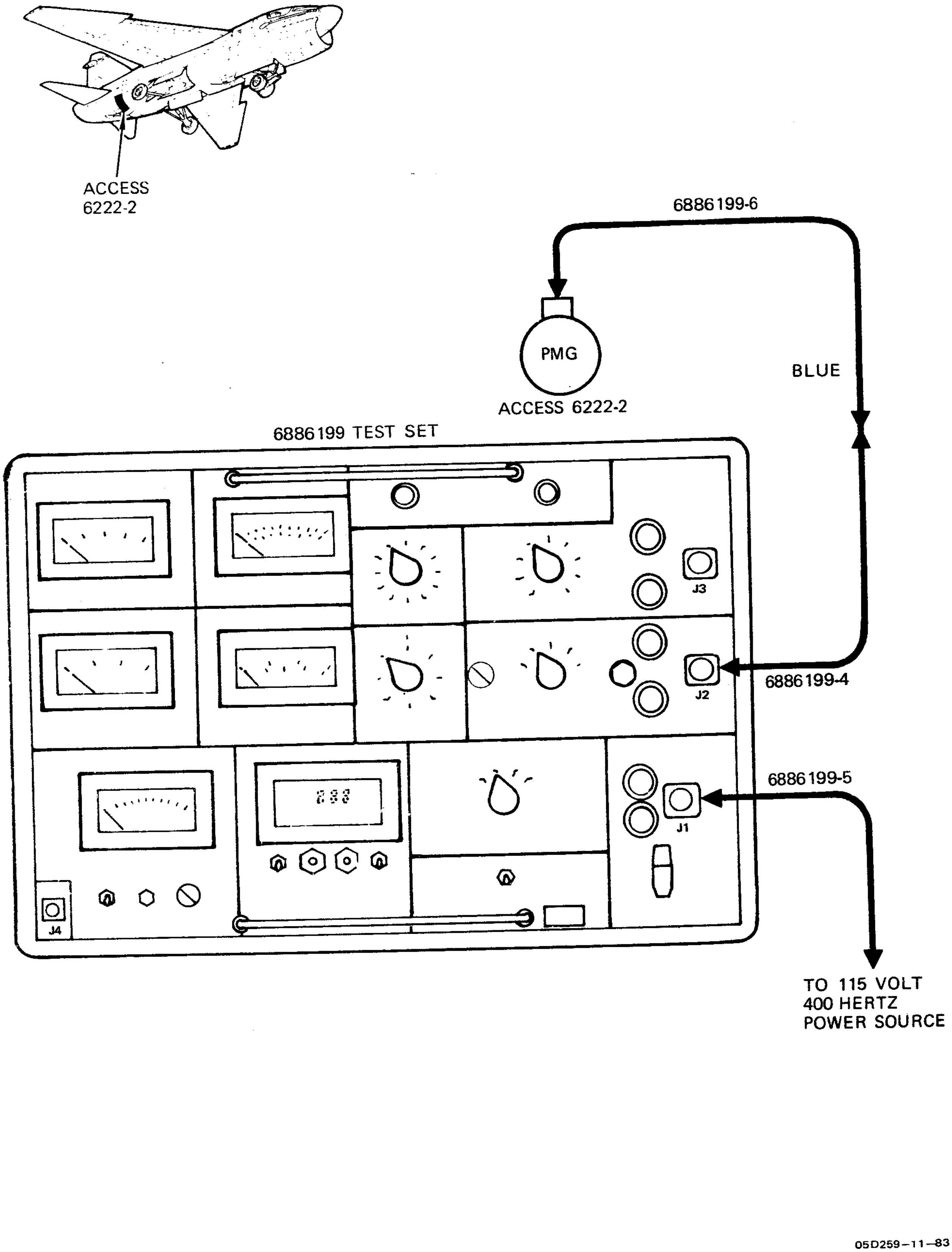


Figure 8-4. Permanent Magnet Generator (PMG) Test

Table 8-4. PMG Output Test Limits

PMG OUTPUT TESTS S17 switch position	M5 AC VOLTMETER (minimum)	M4 AC AMMETER (minimum)	M3 DC VOLTMETER (minimum)	M2 DC AMMETER (minimum)
VOLT AC 5-6	28	2.25	Indication	Indication
VOLT AC 9-10	28	2.25	Indication	Indication
AMP/VOLT DC 1-3			16	1.2

k. Place throttle in OFF.

l. Place starter switch in ABORT.

m. When engine has stopped rotating, place PMG OUTPUT TESTS S17 switch in VOLTS AC 9-10.

n. Repeat steps h through l.

o. When engine has stopped rotating, place PMG OUTPUT TESTS S17 switch in OFF (5 or 7 o'clock position).

p. Place starter switch in NORM.

q. Place throttle in CRANK.

r. Place PMG OUTPUT TESTS S17 switch in the following positions. Check that PMG output is within limits of table 8-4 with engine operating between 10% and 30% rpm. {2}

  (1) AMP AC 9-10.

  (2) AMP/VOLT DC 1-3.

  (3) AMP AC 5-6.

s. Place throttle in OFF.

t. Place starter switch in ABORT.

u. When engine stops rotating, place PMG OUTPUT TESTS S17 switch in OFF (12 o'clock setting).

v. Place TEST PWR S11 switch in OFF.

w. If no further tests are required, perform posttest procedure (subparagraph 8-7.7).

8-7.3. Ignition Exciter Test.

NOTE

This test checks the operation of the ignition exciter.

a. Perform preparation procedure (subparagraph 8-7.1), if required.

b. Open accesses 5222-2 and 6222-2.

WARNING

Power must be disconnected from ignition exciter unit for at least 5 minutes before removing spark igniter leads. Upon removal, leads must be grounded to engine to dissipate energy that may be stored in the exciter. Serious injury can result from stored energy in the exciter.

c. Connect test set to left exciter output and PMG as shown in figure 8-5.

d. Place TEST SELECTOR S12 switch in EXCITER OR WRG.

e. Place TEST PWR S11 switch in ON. Check that yellow banded green light adjacent to J2 comes on. {1}

f. Place EXCITER TESTS S13 switch in INTL TEST.

g. Press INTL TEST S14 switch and adjust R21 VOLTS ADJ for 28 volts ac on M5 AC VOLTMETER.

NOTE

If amperage is out of limits, reject test set.

h. Check that M4 AC AMMETER indicates at least 2.30.

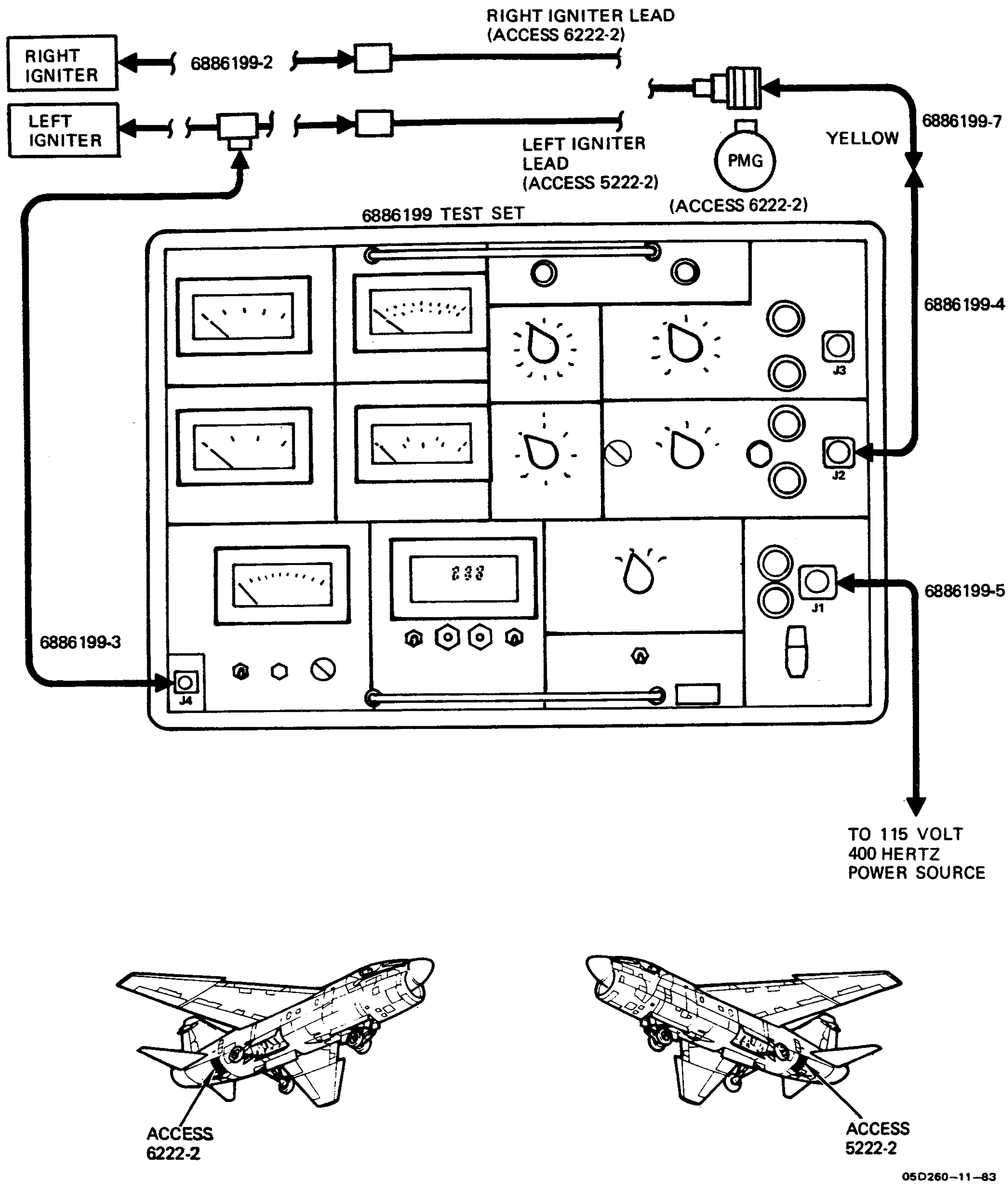


Figure 8-5. Ignition Exciter Test

i. Release switch and rotate R21 VOLTS ADJ fully counterclockwise.

j. Place EXCITER TESTS S13 switch in EXC 1-2.

k. Place PWR S2 switch in ON.

l. Place MAN/AUTO S10 switch in MAN.

m. Adjust R21 VOLTS ADJ control clockwise until M5 AC VOLTMETER indication begins to fluctuate.

n. Momentarily press START S7 switch.

o. Momentarily press RESET S8 switch.

NOTE

The GATE light indicates that a 10-second cycle is in progress.

p. Momentarily press START S7 switch. Check that GATE light is on.

q. Place MAN/AUTO S10 switch in AUTO.

r. Adjust R21 VOLTS ADJ control for 10 on SPARKS/SEC X10 SEC indicator.

s. Check that voltage on M5 AC VOLTMETER is not more than 18 volts at center of swing. Amperage on M4 AC AMMETER will typically be 1.4 amperes at center of swing. {3}

t. Turn R21 VOLTS ADJ control fully counterclockwise.

WARNING

Power must be disconnected from ignition exciter unit for a minimum of 5 minutes before removing spark igniter leads. Upon removal, leads must be grounded to engine to discharge energy that may be stored in the exciter. Serious injury can result from stored energy in the exciter.

u. Disconnect 6886199-2 lead from left exciter output and igniter and connect to right.

v. Place EXCITER TESTS S13 switch in EXC 3-4.

w. Place MAN/AUTO S10 switch in MAN.

x. Adjust R21 VOLTS ADJ control clockwise until M5 AC VOLTMETER indication begins to fluctuate.

y. Repeat steps n through t.

z. Place EXCITER TESTS S13 switch in OFF.

aa. Place PWR S2 switch in off.

ab. Place TEST PWR S11 switch in OFF.

ac. If no further tests are required, perform posttest procedure (subparagraph 8-7.7).

8-7.4. Ignition Wiring Continuity Test.

NOTE

This test checks the continuity of the engine ignition system wiring harness.

a. Perform preparation procedure (subparagraph 8-7.1), if required.

b. Open access 5222-1.

c. Connect test set as shown in figure 8-6.

NOTE

External electrical power is required to operate K2 relay.

d. Connect external electrical power (T.O. 1A-7D-2-1).

e. Place TEST SELECTOR S12 switch in WIRING AT RELAY BOX.

f. Place TEST PWR S11 switch in ON. Check that white banded green light adjacent to J3 comes on. {1}

g. Place WIRING TESTS S15 switch in positions listed in table 8-5 and check for proper indications. {4 through 7}

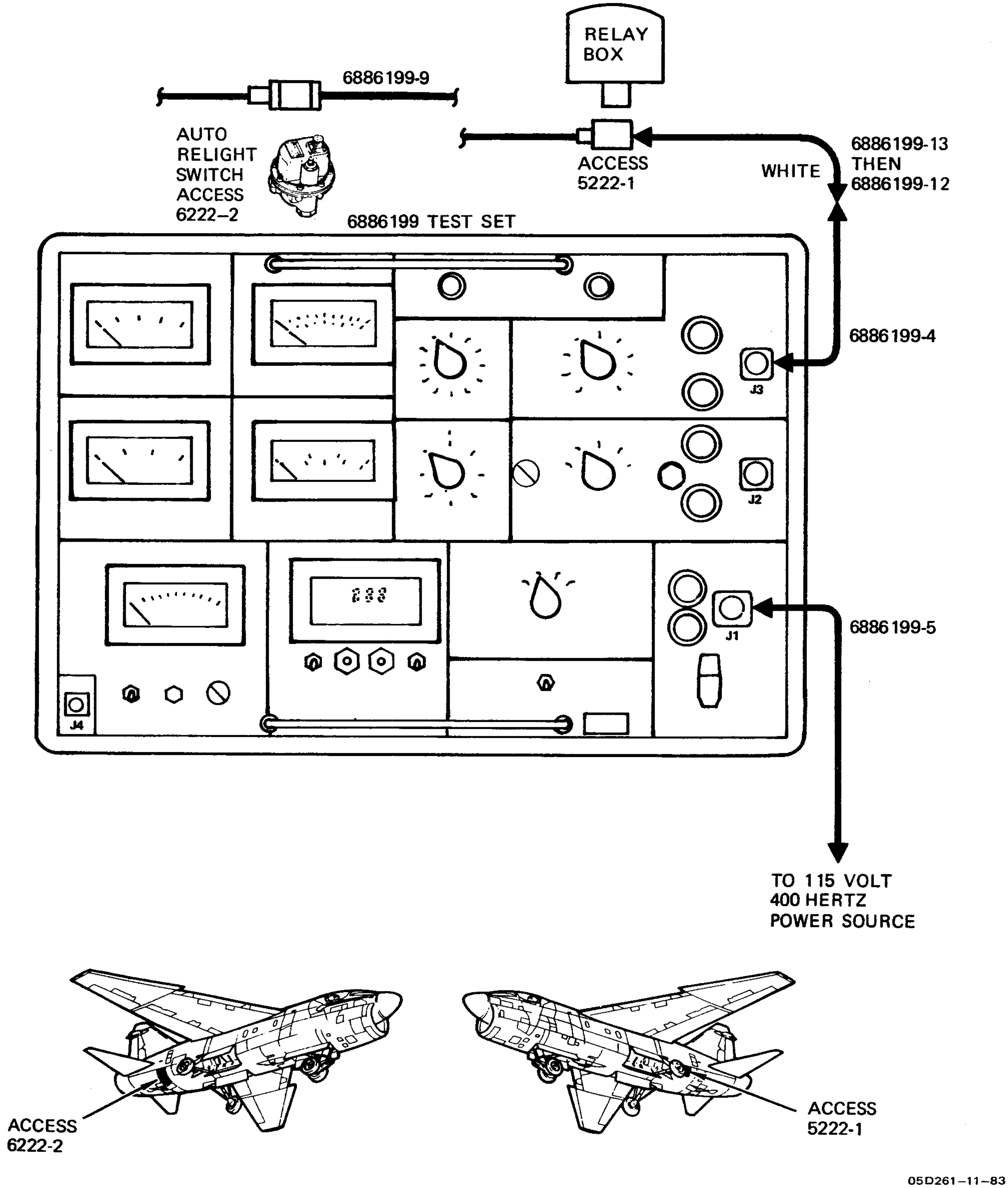


Figure 8-6. Continuity Test; Ignition Wiring

Table 8-5. Ignition Wiring Continuity Tests (6886199-13 Cable)

WIRING TESTS S15 switch position	Throttle position	Throttle air ignite switch position	Go (green) light on	No go (red) light on	Figure FO-22 step
RELITE 2-1			X		4
PMG 1-3			X		5
PMG 7-8	OFF	Extended	X		6
PMG 7-8	IGNITE	Extended		X	7
PMG 7-8	OFF	Depressed		X	7
PMG 11-12	OFF	Extended	X		6
PMG 11-12	IGNITE	Extended		X	7
PMG 11-12	OFF	Depressed		X	7

h. Remove 6886199-13 cable and replace with 6886199-12 cable.

i. Place WIRING TESTS S15 switch in the following positions and check for GO light indication at each position.

(1) THRM BULB 2-1. {8}

(2) CS SOL 2-1. {9}

(3) CS SOL 3-4. {9}

(4) RELITE 2-1. {4}

j. Place WIRING TESTS S15 switch in OFF.

k. Place TEST PWR S11 switch in OFF.

l. Disconnect external electrical power (T.O. 1A-7D-2-1).

m. If no further tests are required, perform posttest procedure (subparagraph 8-7.7).

8-7.5. Relay Control Box Ignition Relay Test.

NOTE

This test checks the ignition relay circuit of the relay box.

a. Perform preparation procedure (subparagraph 8-7.1), if required.

b. Open access 5222-1.

c. Connect test set as shown in figure 8-7.

d. Place TEST SELECTOR S12 switch in RELAY BOX.

e. Place TEST PWR S11 switch in ON. Check that orange banded green light adjacent to connector J3 comes on. {1}

f. Place RELAY BOX TESTS S16 switch in positions listed in table 8-6 and check for proper indications. {10 through 12}

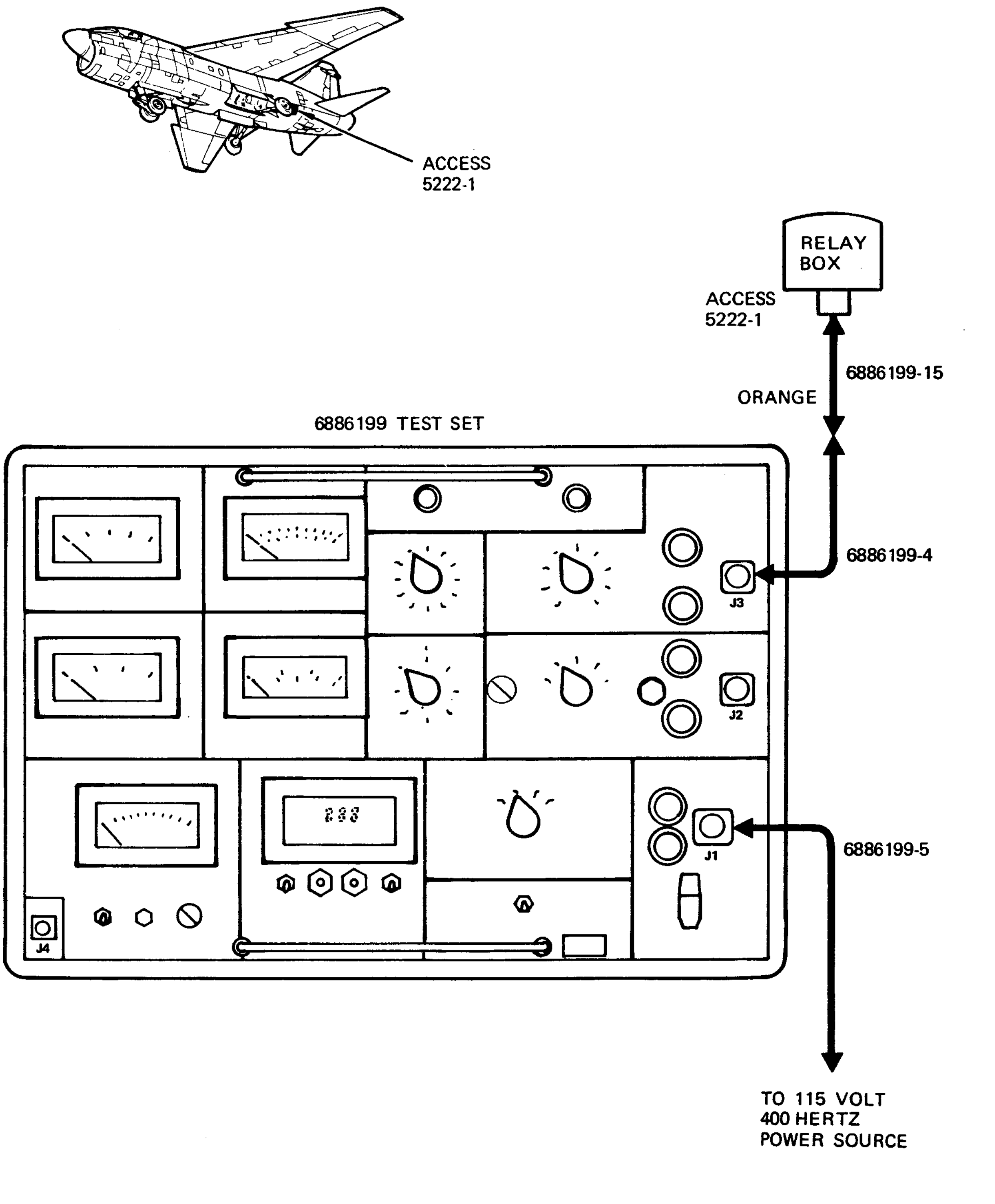


Figure 8-7. Ignition Relay Test; Relay Control Box

Table 8-6. Relay Control Box Ignition Relay Test

RELAY BOX TESTS S16 switch position	M3 DC VOLTMETER	M2 DC AMMETER	GO (green) light	Figure FO-22 step
IGN RELAY OPEN				
15-18	22 (±2)	Indication	X	10
16-17	22 (±2)	Indication	X	10
IGN RELAY CLOSED				
15-18	0	0	X	11
16-17	0	0	X	11
7-20 CONT	0	0	X	12
2-20 CONT	0	0	X	12
OFF				

g. Place TEST PWR S11 switch in OFF.

h. If no further tests are required, perform posttest procedure (subparagraph 8-7.7).

8-7.6. Relay Control Box Cold Start Amplifier Test.

NOTE

This test checks the cold start amplifier circuit of the relay control box.

a. Perform preparation procedure (subparagraph 8-7.1), if required.

b. Open access 5222-1.

c. Connect test set as shown in figure 8-8.

d. Place TEST SELECT S12 switch in RELAY BOX.

e. Place TEST PWR S11 switch in ON. Check that orange banded green light adjacent to connector J3 comes on. {1}

NOTE

During the following tests, a green GO light indicates continuity. A red NO GO light indicates lack of continuity.

f. Place RELAY BOX TESTS S16 switch in positions listed in table 8-7 and check for proper indications. {13 through 15}

g. Place RELAY BOX TESTS S16 switch in OFF.

h. Place TEST PWR S11 switch in OFF.

i. If no further tests are required, perform posttest procedure (subparagraph 8-7.7).

8-7.7. Posttest.

a. Place S1 PWR switch in off.

b. Disconnect test set from airplane and power source.

c. Close accesses 6222-2, 5222-2, and 5222-1.

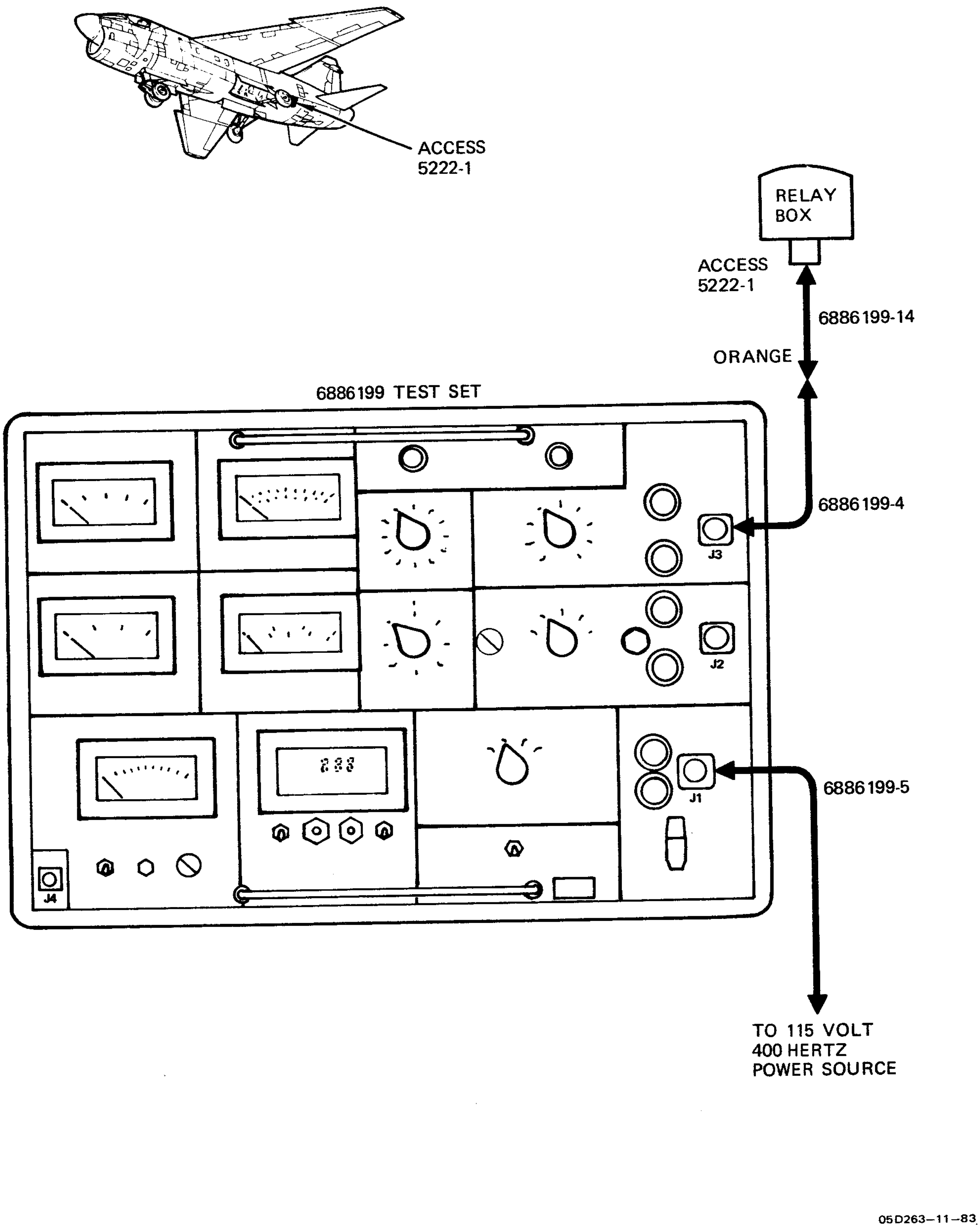


Figure 8-8. Cold Start Amplifier Test; Relay Control Box

Table 8-7. Relay Control Box Cold Start Amplifier Test

RELAY BOX TESTS S16 switch position	M3 DC VOLTMETER	M2 DC AMMETER	Go (green) light	Figure FO-22 step
12-19 CONT	0	0	X	13
4-11 CONT	0	0	X	13
CS AMPL 4-11	22 (±2)	Indication	X	
CS AMPL 3-11	22 (±2)	Indication	X	

8-8. IGNITION SYSTEM TEST TROUBLESHOOTING. Refer to figure FO-22 for troubleshooting data. Malfunctions are numbered corresponding to numbers following steps in the ignition system test. For troubleshooting schematics, see figure FO-16.

8-9. IGNITION EXCITER REMOVAL AND INSTALLATION.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
	GGG-W-686	Torque wrench, 10 to 150 inch-pounds	Measure torque

8-9.1. Removal. (Figure 8-9.)

a. Open accesses 6122-2 and 6122-5.

b. Disconnect electrical connector (1).

WARNING

Power must be disconnected from ignition exciter for at least 5 minutes before disconnecting igniter leads. Serious injury can result from energy stored in exciter.

c. Disconnect igniter leads (2).

d. Remove self-locking nuts (3), washers (4), and ignition exciter (5).

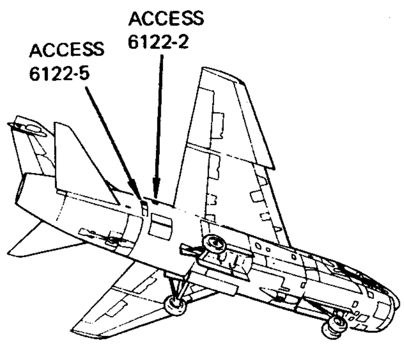
8-9.2. Installation. (Figure 8-9.)

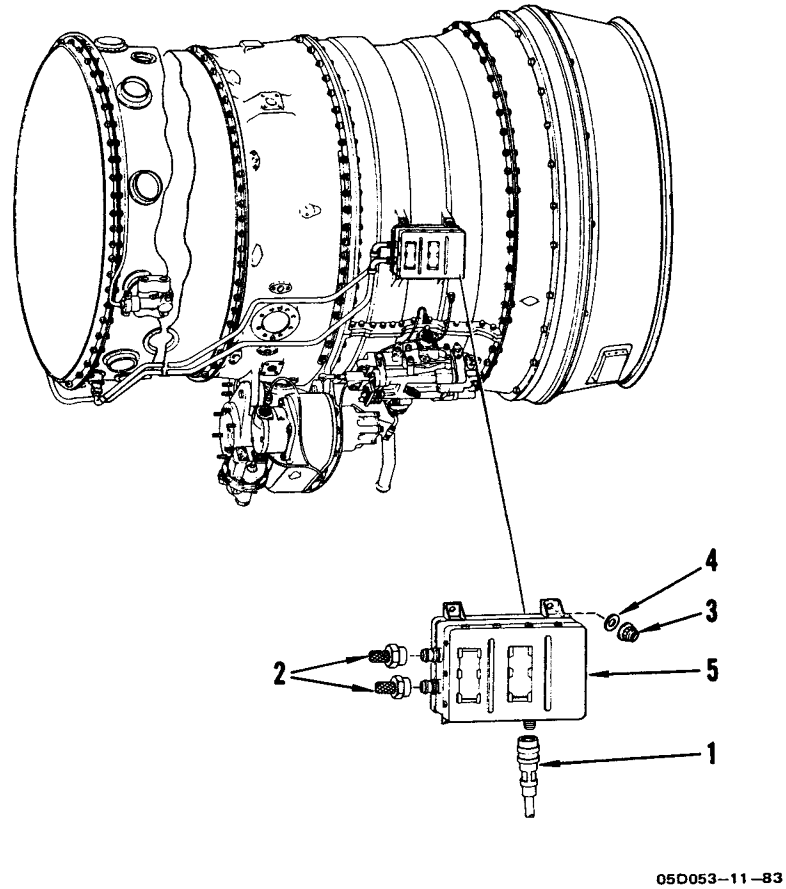
a. Clean ignition exciter wells and lead insulators with clean, dry cloth. Do not use solvents.

b. Inspect output wells for cracks. Reject exciter if cracks are found.

c. Place ignition exciter (5) on mounting bracket and secure with washers (4) and self-locking nuts (3).

d. Connect igniter leads (2) and tighten to 60 (±10) inch-pounds.





1. Electrical connector
2. Igniter lead
3. Self-locking nut
4. Washer
5. Ignition exciter

Figure 8-9. Removal and Installation; Ignition Exciter

e. Connect electrical connector (1).

f. Perform ignition system operational checkout (paragraph 8-4).

g. Close accesses 6122-2 and 6122-5.

8-10. PERMANENT MAGNET GENERATOR REMOVAL AND INSTALLATION.

8-10.1. Removal. (Figure 8-10.)

a. Open access 6222-2.

b. Disconnect electrical connector (1).

c. Remove self-locking nuts (2), washers (3), bracket (4), permanent magnet generator (5), and packing (6).

8-10.2. Installation. (Figure 8-10.)

a. Install new packing (6) on permanent magnet generator (5).

b. Apply MIL-L-7808 or MIL-L-23699 oil to generator drive splines.

c. Place generator and bracket (4) in position and secure with washers (3) and self-locking nuts (2).

d. Connect electrical connector (1).

e. Perform ignition system operational checkout (paragraph 8-4).

f. Close access 6222-2.

8-11. AUTORELIGHT SWITCH REMOVAL AND INSTALLATION.

8-11.1. Removal. (Figure 8-11.)

a. Open access 6222-2.

b. Disconnect electrical connector (1).

c. Cut lockwire and disconnect P3 air tube (2).

d. Remove bolts (3), lockwashers (4), washers (5), and autorelight switch (6).

8-11.2. Installation. (Figure 8-11.)

a. Place autorelight switch (6) on mounting bracket and secure with washers (5), lockwashers (4), and bolts (3).

b. Perform autorelight switch functional check (paragraph 8-6).

c. Connect P3 air tube (2). Secure with MS20995C32 lockwire.

d. Connect electrical connector (1).

e. Close access 6222-2.

8-12. AUTORELIGHT SWITCH SCREEN REMOVAL AND INSTALLATION. Remove and install autorelight switch screen through access 6222-2 in sequence shown in figure 8-12, observing the following steps.

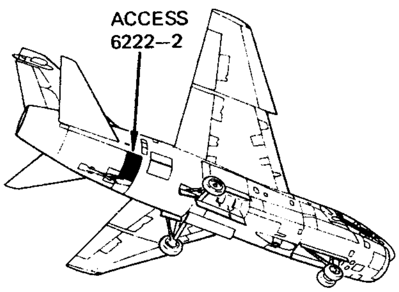
WARNING

Ultrasonic cleaning can be harmful to soft tissue. Protective clothing will be prescribed by the bioenvironmental engineer.

a. If cleaning is required, clean adapter and filter assembly ultrasonically.

b. Use new packing (3) for installation.

c. Secure P3 air tube with MS20995C32 lockwire.



1. Electrical connector
2. Self-locking nut
3. Washer
4. Bracket
5. Permanent magnet generator
6. Packing

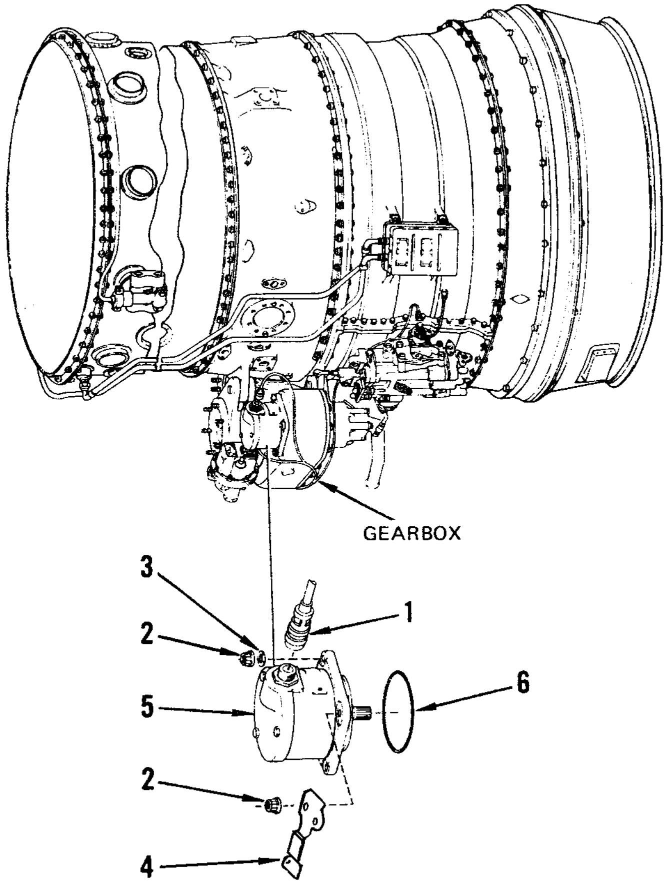
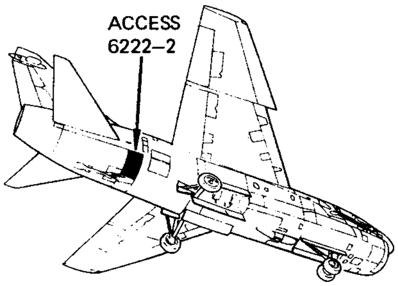
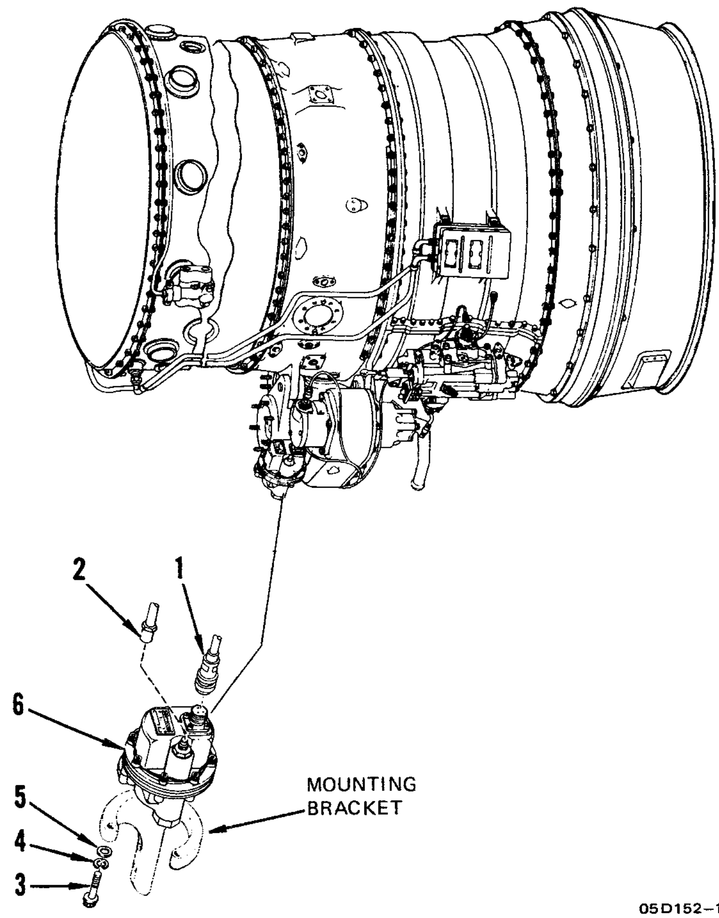


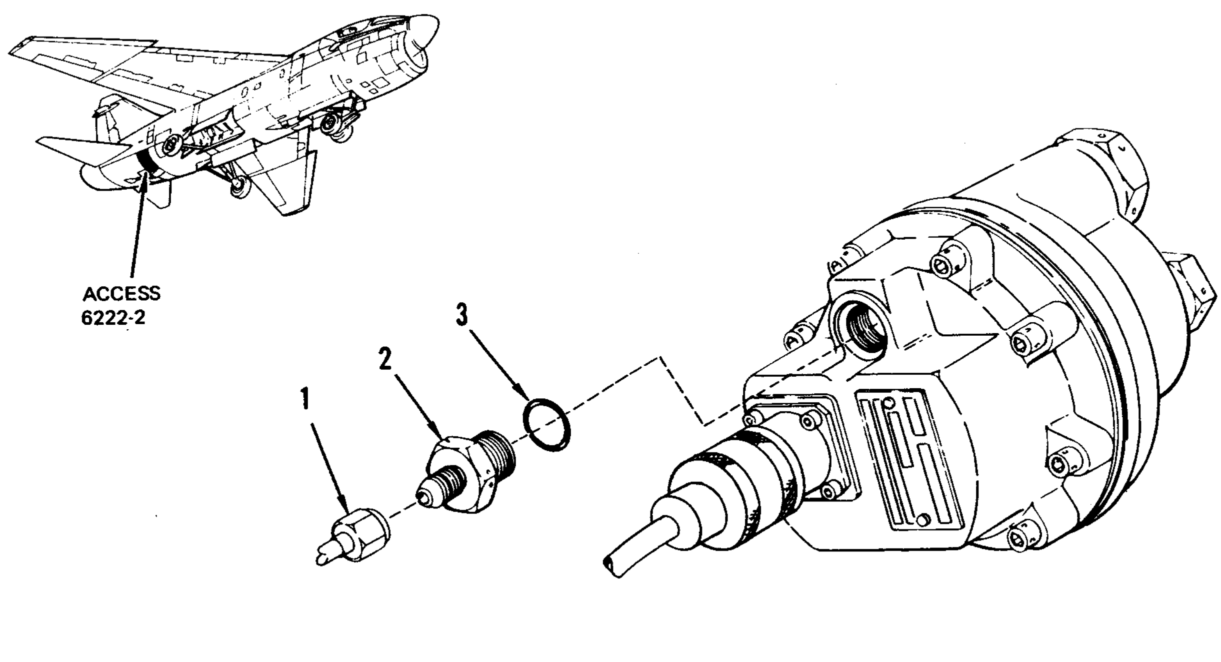
Figure 8-10. Removal and Installation; Permanent Magnet Generator





1. Electrical connector
2. P3 air tube
3. Bolt
4. Lockwasher
5. Washer
6. Auto-relight switch

Figure 8-11. Removal and Installation; Autorelight Switch



1. P_3 air tube
2. Adapter and filter assembly
3. Packing

Figure 8-12. Removal and Installation; Autorelight Switch Screen

8-13. JET FUEL TURBINE STARTER REMOVAL AND INSTALLATION.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
	GGG-W-686	Torque wrench, 10 to 150 inch-pounds	Measure torque

8-13.1. Removal. (Figure 8-13.)

a. Make sure switches and controls in cockpit are positioned as follows:

Control	*Position*
Fuel master lever	OFF
Battery switch	OFF
Starter abort switch	OFF

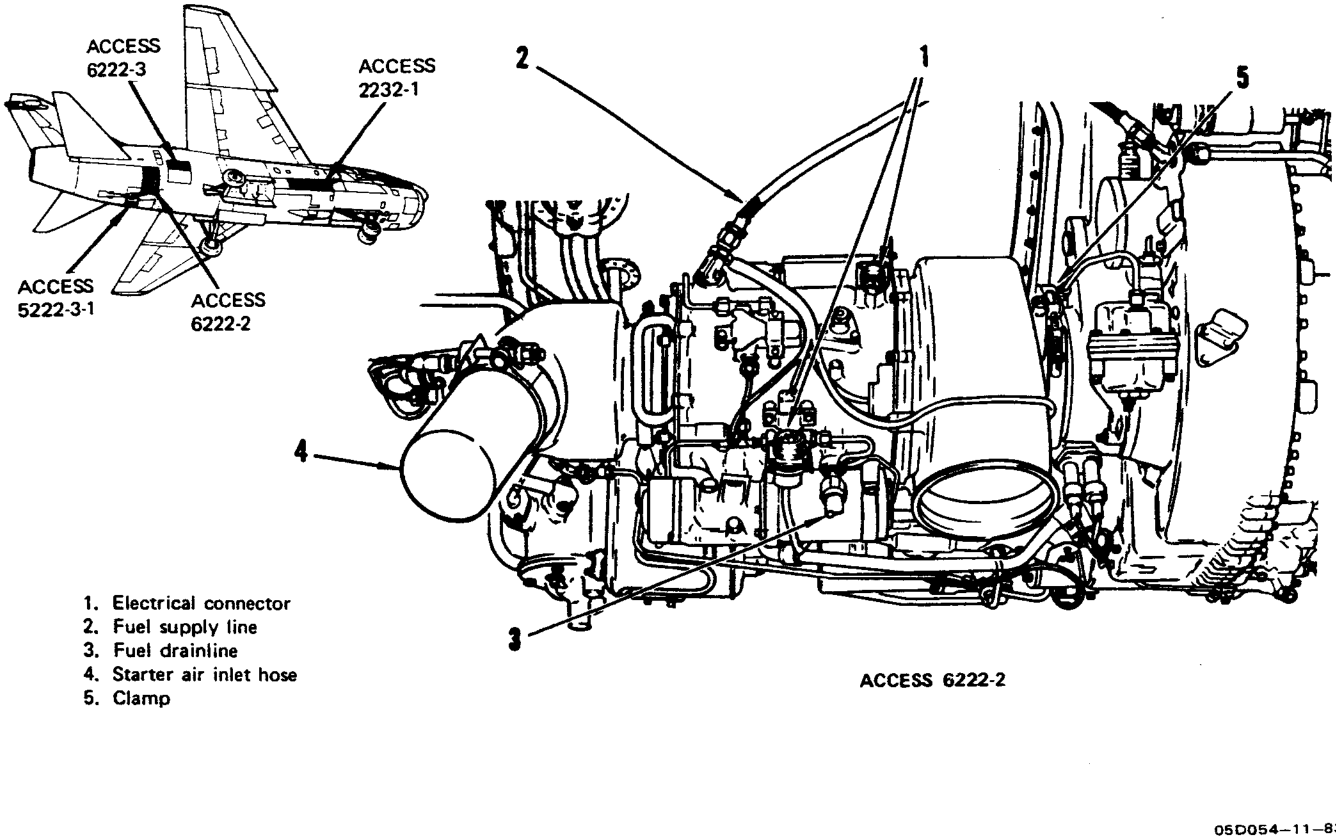


Figure 8-13. Removal and Installation; Jet Fuel Turbine Starter

b. Open accesses 6222-2, and 5222-3-1, 2232-1, and 6222-3.

WARNING

To prevent fire or explosion, both cables must be disconnected from battery prior to plugging or unplugging connector P417.

CAUTION

To prevent damage to battery charger, circuit breakers CB401 and CB402 must be opened prior to connecting or disconnecting battery cables.

c. Open circuit breakers CB401 and CB402.

d. Disconnect both electrical connectors from battery receptacle.

e. Cut lockwire and disconnect two electrical connectors (1).

f. Disconnect fuel supply line (2).

g. Disconnect fuel drain line (3).

h. Remove starter exhaust duct (paragraph 8-14).

i. Remove clamp and starter air inlet hose (4).

j. Support starter through access 5222-3-1 and remove clamp (5).

CAUTION

Maintain clearance between starter, engine, and airframe as starter is removed to prevent damage to engine or airframe.

Do not use wiring harness for handles when removing starter. Damage to electrical components, especially diodes, can result. When removing starter, extra care should be taken to prevent damage to rectify cover.

k. Slide starter aft until disengaged from engine drive splines. Continue moving starter aft to clear bulkhead. Remove starter through access 6222-2.

8-13.2. Installation. (Figure 8-13.)

WARNING

Solvent P-D-680, Type II, is toxic to skin, eyes, and respiratory tract. Use in a well-ventilated area. Avoid prolonged breathing of vapors. Avoid eye and repeated skin contact. Keep away from sparks and flames.

CAUTION

Gearbox and starter mating splines must be thoroughly cleaned and properly lubricated to prevent excessive gearbox spline wear and subsequent equipment failure.

a. Clean splines of gearbox and starter with P-D-680, Type II, drycleaning solvent (T.O. 1-1-1) and clean cloth.

b. Apply a generous amount of MIL-G-81322 grease to starter splines and engine mating splines.

CAUTION

Ensure proper alignment to prevent damage to splines.

Do not use wiring harness assembly for handles when installing starter. Damage to electrical components, especially diodes, can result. When installing starter, use extra care to prevent damage to rectifier cover.

c. Use new packing on starter drive shaft.

d. Insert starter through access 6222-2. Rotate slightly to mate starter splines with engine mating splines.

e. Support starter through access 5222-3-1 and move starter forward until mated with mounting pad. Install clamp (5).

f. Tighten clamp nut to 105 (±5) inch-pounds torque. Using a soft mallet or soft punch hammer and tap clamp opposite nut and then around circumference of ring. Retighten nut to 105 (±5) inch-pounds torque. Continue tapping and tightening operation until tapping does not decrease nut torque value.

NOTE

If starter inlet duct is not aligned, loosen clamp and rotate duct.

g. Lubricate starter air inlet hose (4) very lightly with VV-P-236 petrolatum. Place hose over duct and secure with clamp.

h. Install starter exhaust duct (paragraph 8-14).

i. Connect fuel drain line (3) to starter.

j. Connect fuel supply line (2) to elbow.

k. Connect two electrical connectors (1). Secure with MS20995C32 lockwire.

l. Check starter oil and service (T.O. 1A-7D-2-1).

m. Bleed starter fuel system (paragraph 8-15).

n. Connect both electrical connectors to battery receptacles.

o. Close circuit breakers CB401 and CB402.

p. If starter was replaced for a burned out motor, replace starting relay (paragraph 8-23).

q. Perform ignition and starting system operational checkout (paragraph 8-4).

r. Close accesses 6222-2, 5222-3-1, 6222-3, and 2232-1.

8-14. STARTER EXHAUST DUCT REMOVAL AND INSTALLATION.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
	GGG-W-686	Torque wrench, 10 to 150 inch-pounds	Measure torque

8-14.1. Removal. (Figure 8-14.)

a. Open access 6222-2.

b. Loosen starter exhaust duct clamp (1).

c. Rotate starter exhaust duct (2) 90° counterclockwise (looking up), so indexing pawl (3) is pointing outboard.

d. Remove exhaust duct clamp, exhaust duct, and exhaust duct seal.

e. Inspect exhaust duct (T.O. 1A-7D-3).

8-14.2. Installation. (Figure 8-14.)

a. Install new seal on starter exhaust duct (2).

b. Place starter exhaust duct clamp (1) on exhaust duct. Position exhaust duct on starter with indexing pawl (3) pointing outboard. Turn duct 90° clockwise (looking up) until indexing pawl is point forward and support ears engage support springs.

CAUTION

Indexing pawl will be pointing forward to engage the slot in the duct seal retainer ring on access 6222-2.

c. Tighten nut on clamp to 115 (±5) inch-pounds torque.

d. Close access 6222-2.

8-15. JET FUEL TURBINE STARTER FUEL SYSTEM BLEEDING.

WARNING

Make sure static ground cable is installed during starter bleeding to prevent fire or explosion. Battery power is required for the following procedure.

a. Open access 6222-2.

b. Place suitable container under starter fuel drain (figure 1-2).

c. Place fuel master lever in ON.

d. Place starter purge switch (located on forward side of bulkhead station 590) in PURGE.

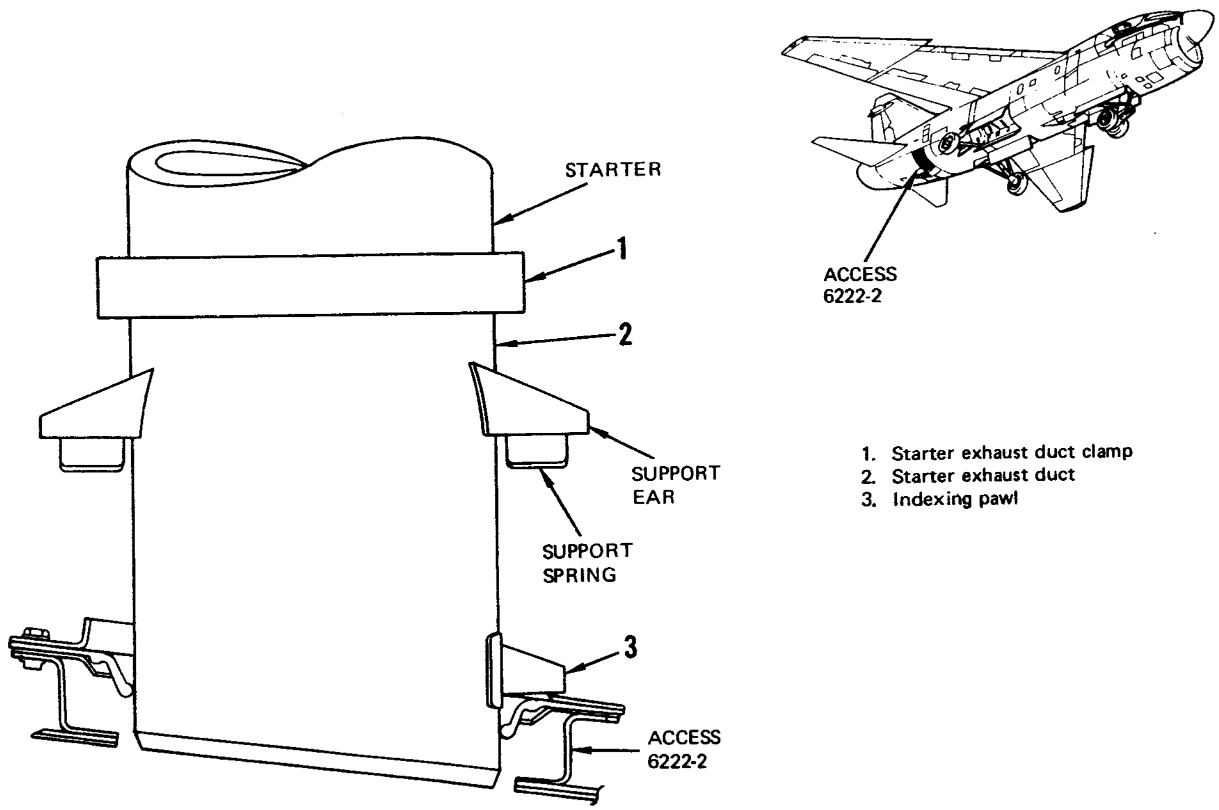
e. Let starter bleed until flow is air-free.

f. Place starter purge switch in NORM and check that fuel flow stops.

g. Check fuel line connections for leaks.

h. Place starter switch in ABORT.

i. Place battery switch in BATT.



1. Starter exhaust duct clamp
2. Starter exhaust duct
3. Indexing pawl

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Figure 8-14. Removal and Installation; Starter Exhaust Duct

j. Place throttle in CRANK and hold to motor engine 2 to 5 seconds.

k. Place throttle in OFF.

l. Place battery switch in OFF.

m. Place fuel master level in OFF.

n. Close access 6222-2.

8-16. RELAY CONTROL BOX REMOVAL AND INSTALLATION.

Remove and install relay control box through access 5222-2 in the sequence shown in figure 8-15, observing the following:

a. After installation, perform ignition system operational checkout (paragraph 8-4).

b. Close access 5222-2.

8-17. SPARK IGNITER REMOVAL AND INSTALLATION.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
	413-900-020	Torque wrench, 100 to 750 inch-pounds	Measure torque value

WARNING

Avoid radiation contamination by adhering to exposure limits. For physical contact with the oil tank source tube, maximum safe exposure time is 15 minutes at one time or a total of 20 minutes per week. At a distance of 12 inches from the source tube, maximum time is 3.3 hours per week. There is no exposure time limit 3 feet from source tube. Deviations from these limits shall be approved by the base medical service. Personnel working with or near this source tube shall become familiar with the procedures in T.O. 00-110N-11.

8-17.1. Removal. (Figure 8-16.)

a. Open access 5222-2 to replace left spark igniter or access 6222-2 to replace right spark igniter.

WARNING

Power must be disconnected from ignition exciter for at least 5 minutes before disconnecting igniter leads. Serious injury can result from energy stored in exciter.

b. Disconnect spark igniter lead (1).

c. Ground igniter lead to engine to discharge energy that may be stored in ignition exciter.

d. Remove locking spring (2).

e. Loosen spark igniter sleeve bolt (3). Remove sleeve bolt and spark igniter (4) as a unit. Separate igniter from sleeve bolt.

f. Remove retaining ring (5), outer seal housing (6), seal (7), and inner seal housing (8).

g. Inspect spark igniter (paragraph 8-18).

8-17.2. Installation. (Figure 8-16.)

a. Install inner seal housing (8), seal (7), outer seal housing (6), and retaining ring (5) on spark igniter sleeve bolt (3).

NOTE

EMS27613 antiseize compound (Crawford Fitting Company, Solon, Ohio) may be used if Never Seez NS165 is not available.

b. Apply Never Seez NS165 (Never Seez Compound Corporation, Broadview, Illinois) to threads of sleeve bolt.

c. Assemble sleeve bolt on spark igniter (4). Insert this assembly into engine, with square section of igniter engaging combustion case.

d. Tighten sleeve bolt to 200 (±10) inch-pounds torque.

e. Back off sleeve bolt until a slot in igniter aligns with slot in sleeve bolt.

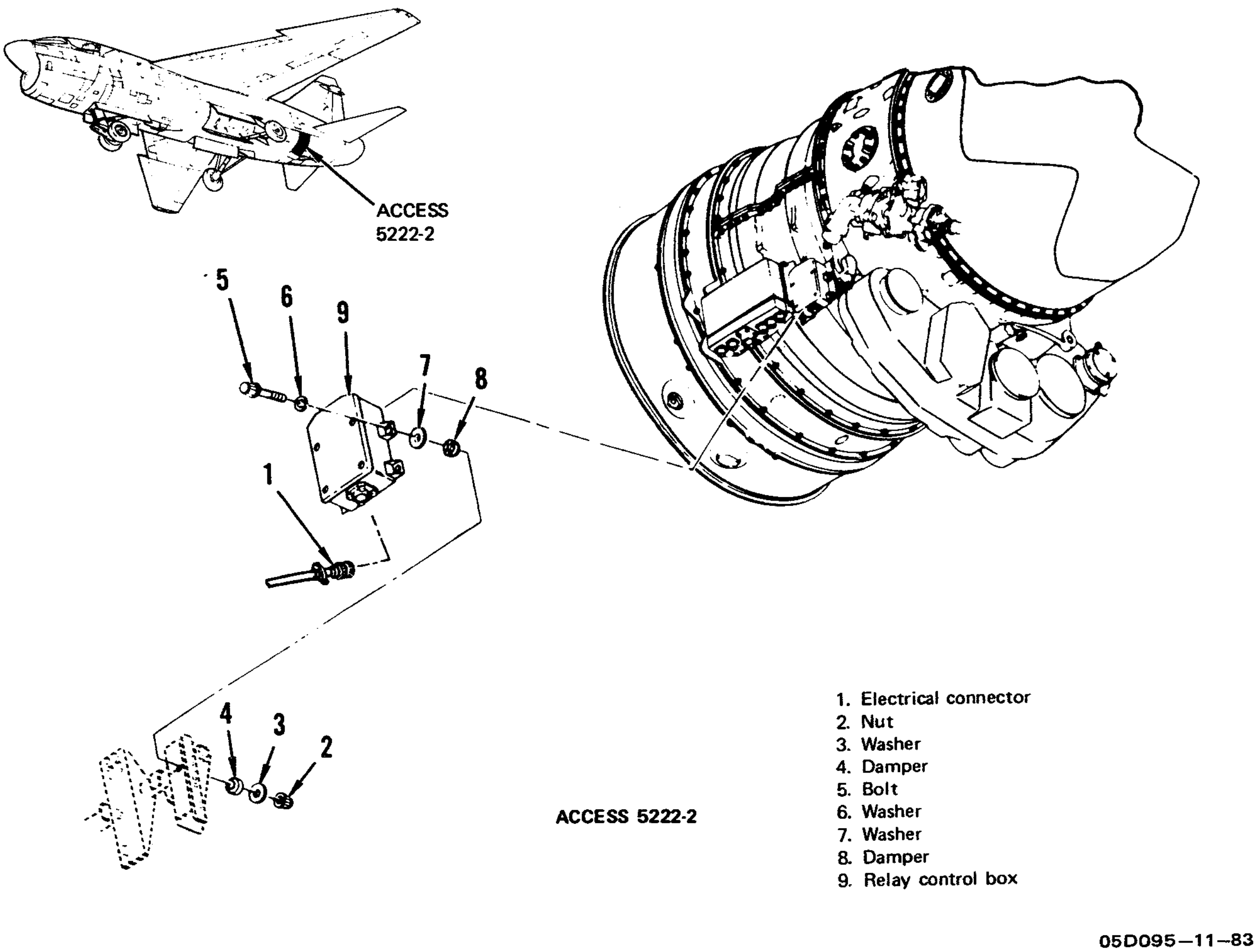


Figure 8-15. Removal and Installation; Relay Control Box

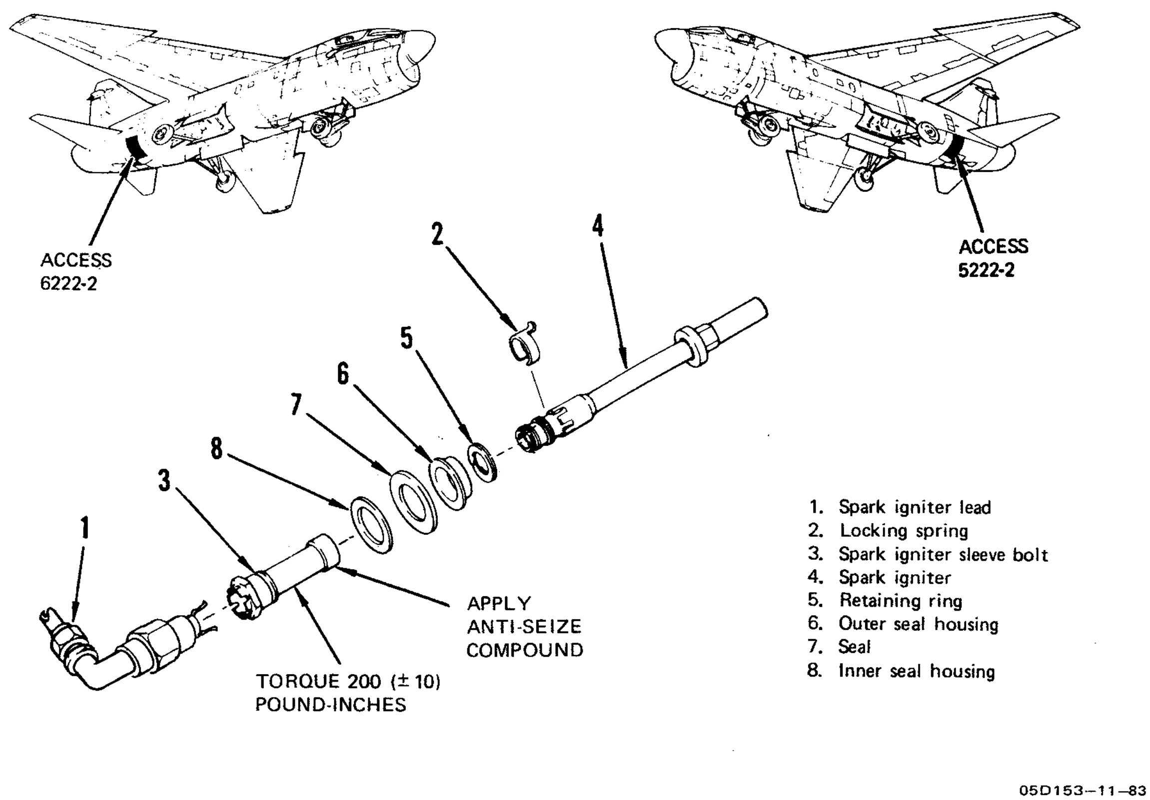


Figure 8-16. Removal and Installation; Spark Igniter

f. Secure sleeve bolt with locking spring (2).

g. Connect spark igniter leads (1) to igniter.

h. Tighten spark igniter lead connector to 60 (± 10) inch-pounds torque.

i. Perform ignition system operational checkout (paragraph 8-4).

j. Close access 5222-2 or 6222-2.

8-18. SPARK IGNITER INSPECTION.

a. Remove spark igniters (paragraph 8-17).

b. Examine inner surface of ceramic tube on threaded end of igniter for cracks. Reject igniter if ceramic is cracked.

c. Inspect igniter inside diameter of outer shell and center electrode depth. Reject igniter if limits shown in figure 8-17 are exceeded.

d. Semiconductor material between electrodes may show an uneven (sawtooth) appearance. This is a normal condition. It is not cause for igniter rejection.

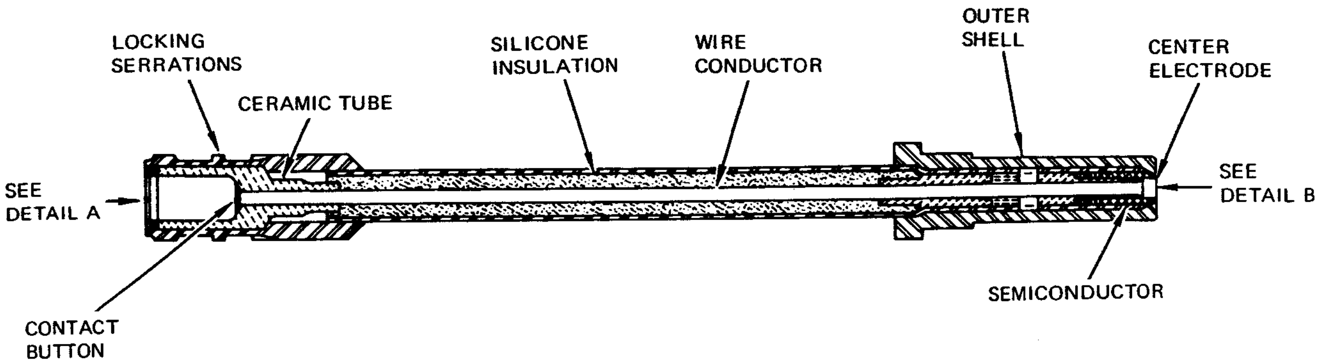
e. Install spark igniters (paragraph 8-17).

8-19. STARTER ABORT BOX REMOVAL AND INSTALLATION. Remove and install starter abort box through access 6222-2 in sequence shown in figure 8-18. Observe the following:

a. After starter abort box installation, start engine (T.O. 1A-7D-2-1) to verify starter operation.

b. Shut down engine (T.O. 1A-7D-2-1).

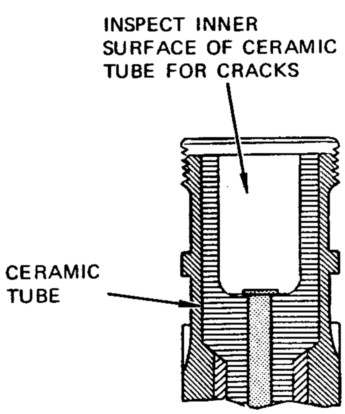
c. Close access 6222-2.



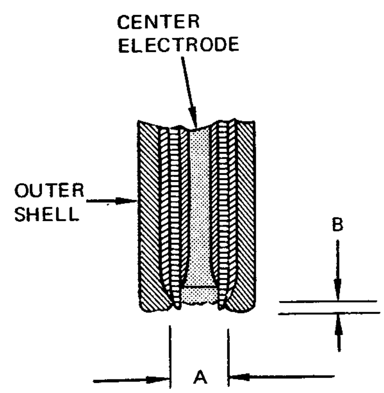
NOTE

Reject igniter when maximum eroded inside diameter of outer shell (A) versus center electrode depth (B) exceeds limits shown.

A = Maximum eroded inside diameter of outer shell	B = Center electrode depth
19/64	0.080
5/16	0.075
21/64	0.065
11/32	0.060
23/64	0.050
3/8	0.045



DETAIL A



DETAIL B

(SEE NOTE)

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Figure 8-17. Inspection; Spark Igniter

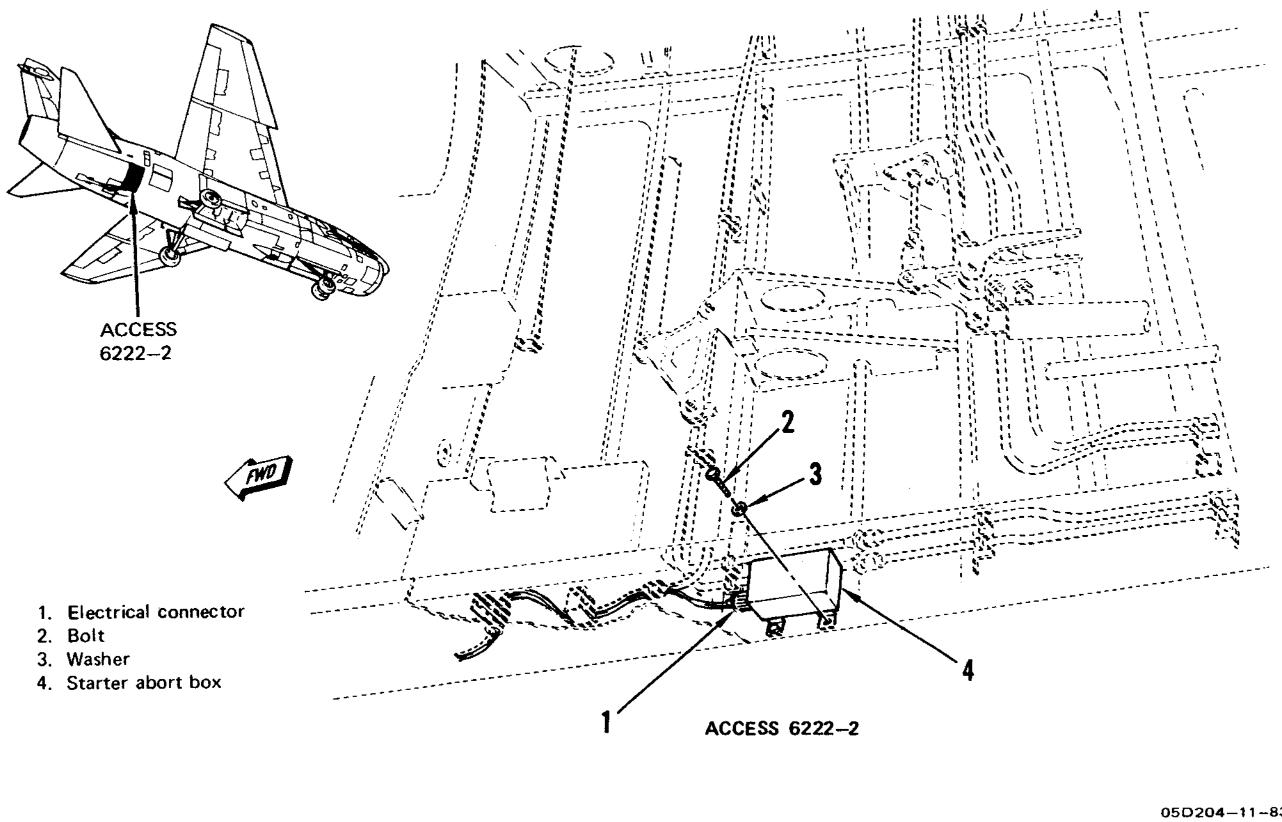


Figure 8-18. Removal and Installation; Starter Abort Box

8-20. STARTER OVERSPEED INDICATOR REMOVAL AND INSTALLATION. Remove and install starter overspeed indicator through accesses 5222-2 and 5222-4 in sequence shown in figure 8-19. Observe the following:

a. Identify wires before cutting.

b. Cut wires at splices.

c. Splice wires of new indicator to wiring harness in accordance with T.O. 1-1A-14.

d. After indicator installation, start engine (T.O. 1A-7D-2-1). Check that indicator shows NORMAL.

e. Shut down engine (T.O. 1A-7D-2-1).

f. Close accesses 5222-2 and 5222-4.

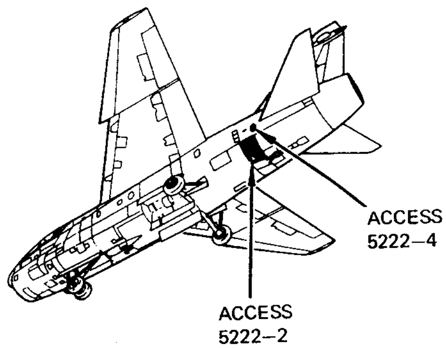
8-21. STARTER FUEL FILTER ELEMENT REMOVAL AND INSTALLATION. Remove and install starter fuel filter element through access 6222-2 or 5222-3 in sequence shown in figure 8-20. Observe the following:

a. Use new packings (4, 8, and 9) during installation.

b. After installation, start engine (T.O. 1A-7D-2-1). Check for leaks.

c. Shut down engine (T.O. 1A-7D-2-1).

d. Close access 6222-2 or 5222-3.



1. Nut
2. Screw
3. Starter overspeed indicator

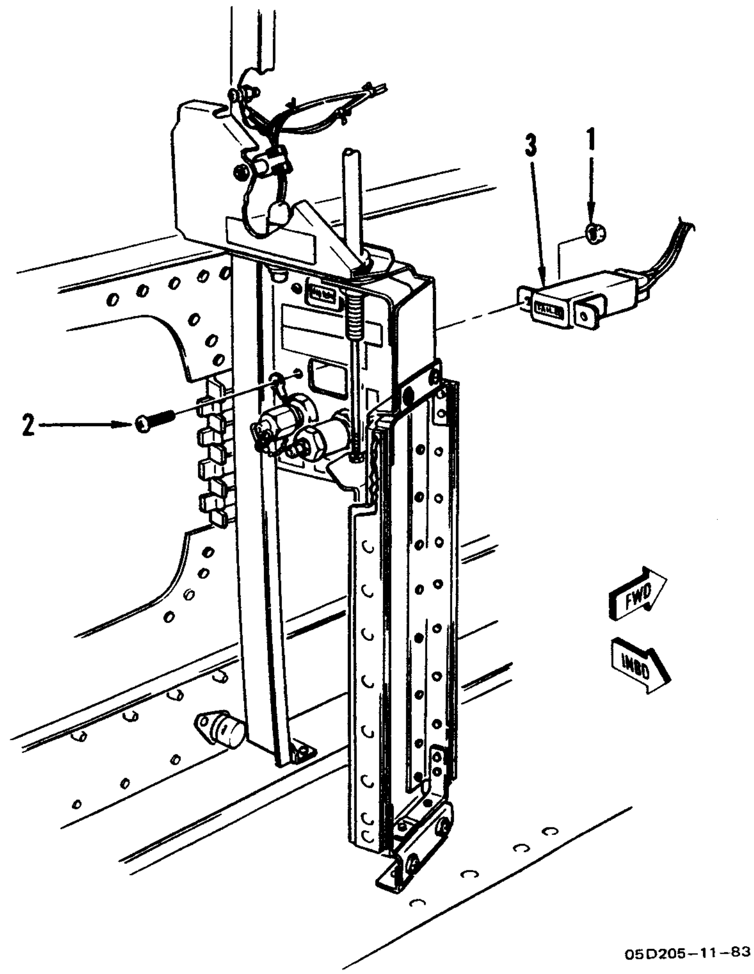
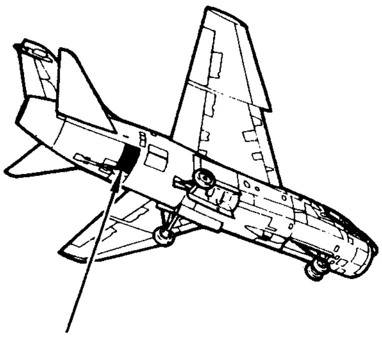
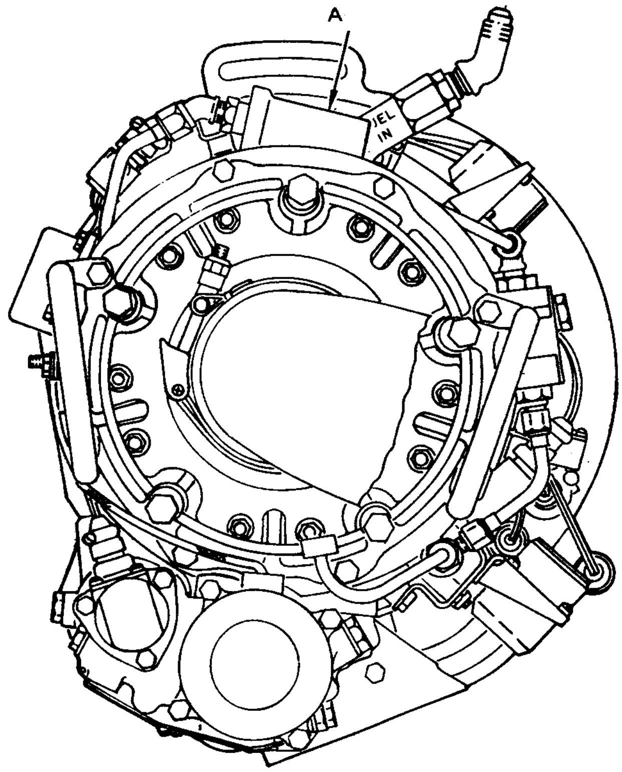


Figure 8-19. Removal and Installation; Starter Overspeed Indicator





1. Fuel tube
2. Elbow
3. Nut
4. Packing
5. Snapring
6. Adapter
7. Fuel filter element
8. Packing
9. Packing

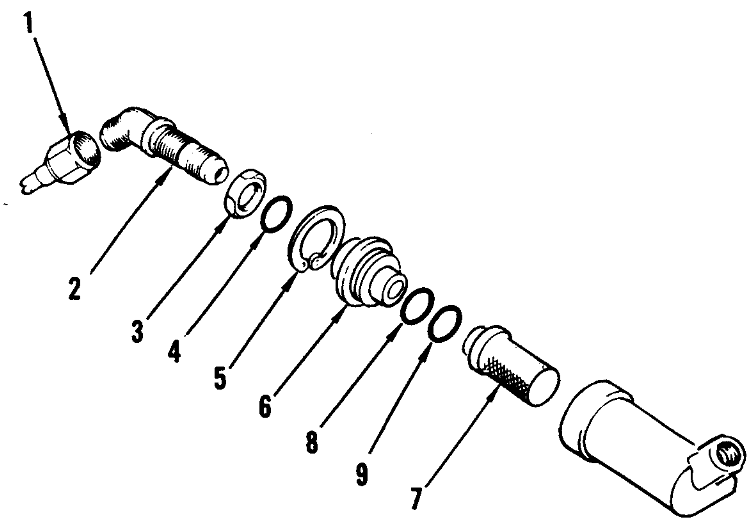


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Figure 8-20. Removal and Installation; Starter Fuel Filter Element

8-22. STARTER OIL STRAINER REMOVAL AND INSTALLATION. Remove, clean, and install starter oil strainer through access 6222-2 in sequence shown in figure 8-21. Observe the following:

a. Use new gasket (2) during installation.

WARNING

Solvent P-D-680, Type II, is toxic to skin, eyes, and respiratory tract. Use in a well-ventilated area. Avoid prolonged breathing of vapors. Avoid eye and repeated skin contact. Keep away from sparks and flames.

b. Clean strainer by agitating in P-D-680, Type II, drycleaning solvent and air-blow dry.

c. Secure strainer with MS20995C20 lockwire.

d. Start engine (T.O. 1A-7D-2-1). Check installation for leaks.

e. Shut down engine (T.O. 1A-7D-2-1).

f. Close access 6222-2.

8-23. STARTING RELAY K401 (AIRPLANES BEFORE T.O. 1A-7-551) OR K402 (AIRPLANES AFTER T.O. 1A-7-551) REMOVAL AND INSTALLATION. Remove and install starting relay through access 6222-2 in sequence shown in figure 8-22. Observe the following:

a. Disconnect battery before disconnecting relay leads.

b. Mark leads before removal to aid in proper installation.

c. Make sure electrical lead boots are placed over terminal ends and studs.

d. After relay installation, perform starting system operational checkout (paragraph 8-4).

e. Close access 6222-2.

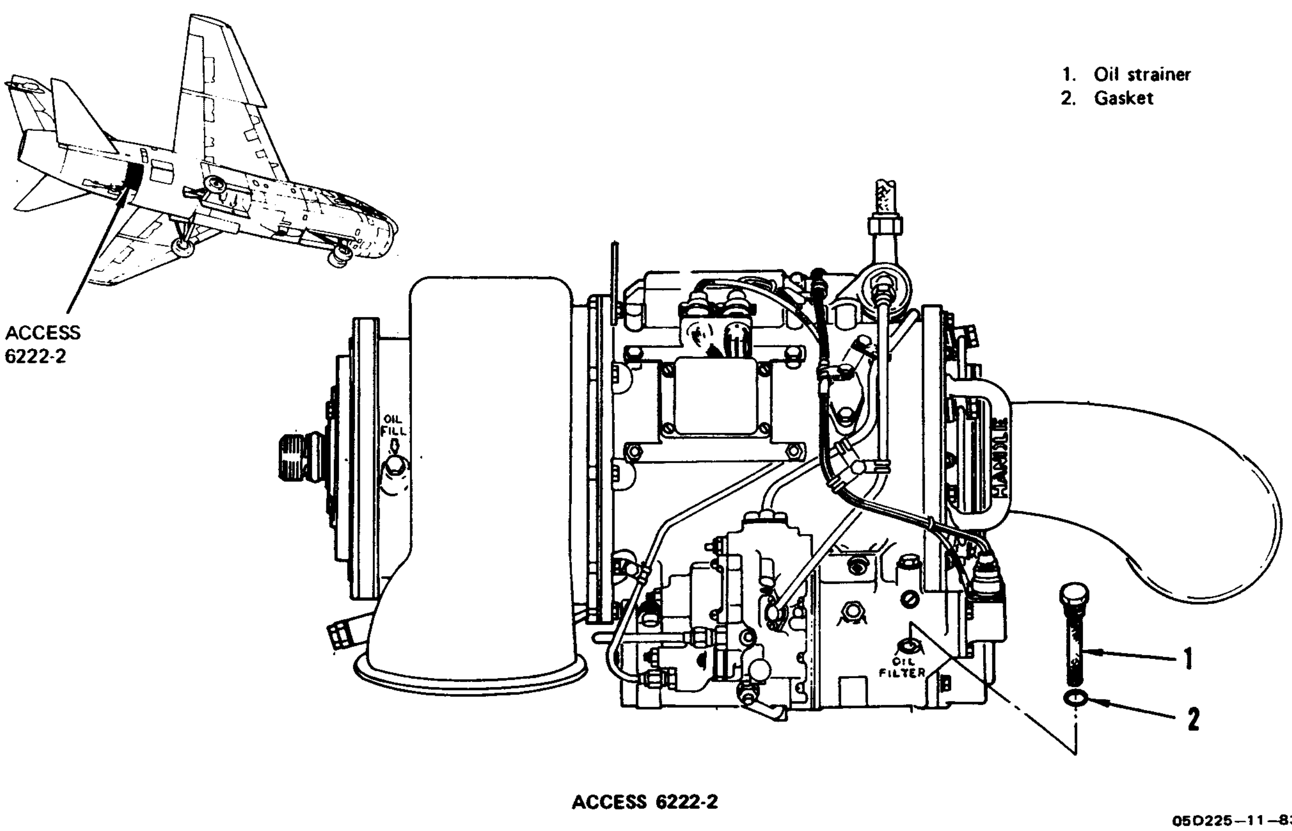
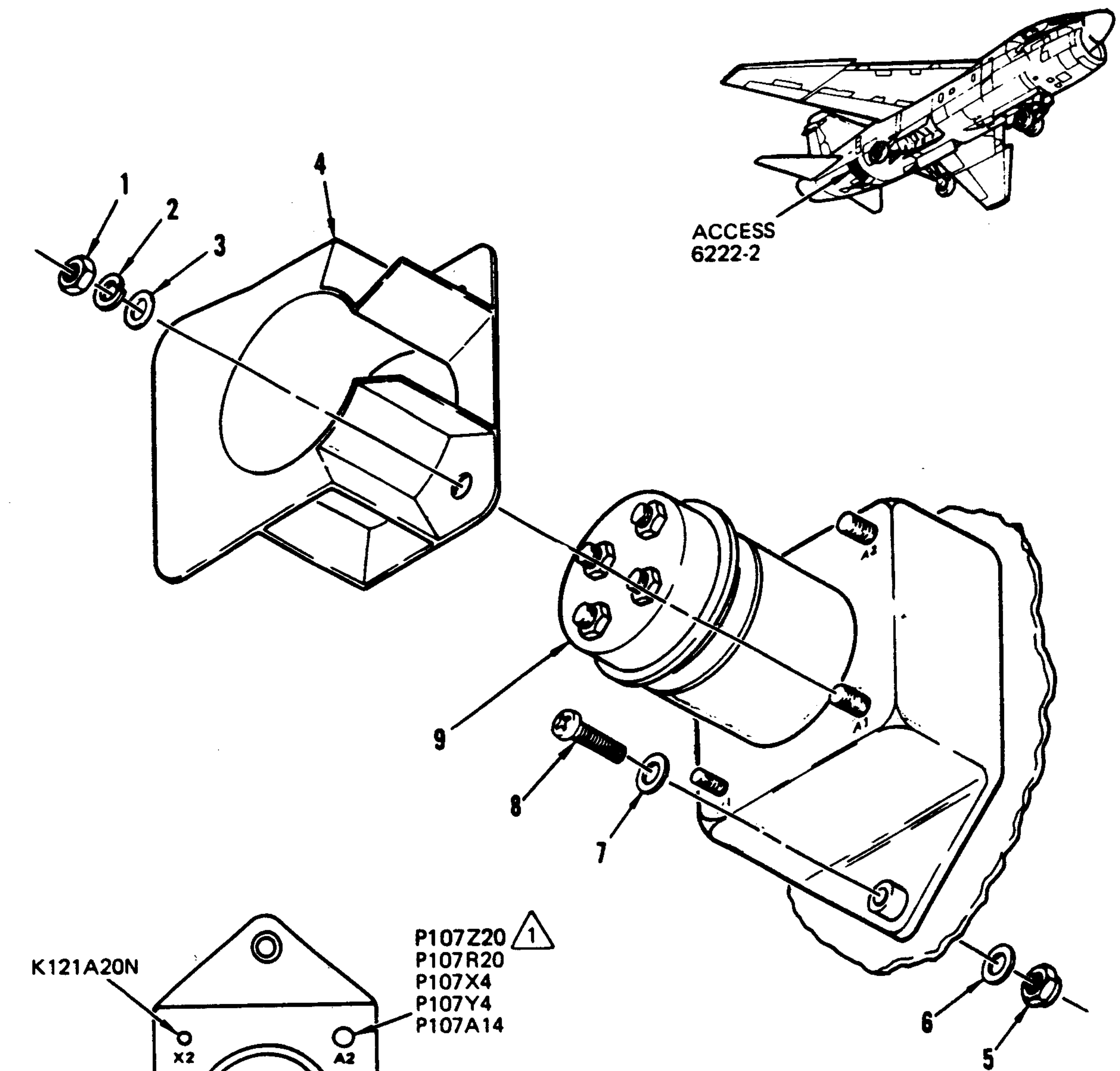
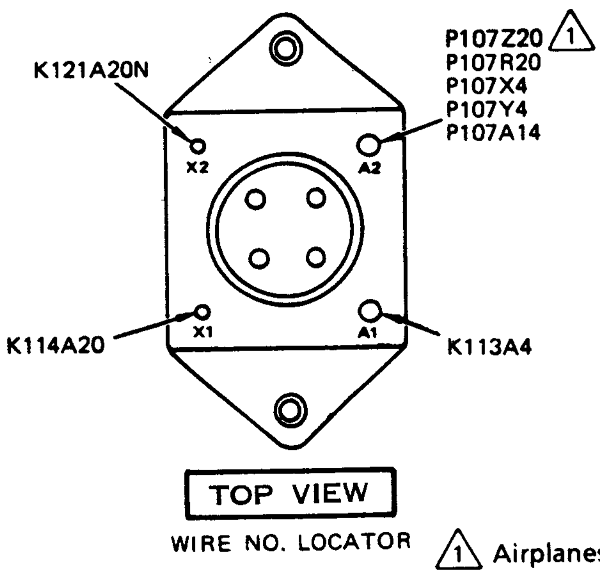


Figure 8-21. Removal and Installation; Starter Oil Strainer





1. Nut
2. Lockwasher
3. Washer
4. Terminal cover
5. Self-locking nut
6. Washer
7. Washer
8. Screw
9. Starting relay (K401 △1 K402 △2)

△1 Airplanes 74-01758 and subsequent

△2 Airplanes before T.O. 1A-7-551

△3 Airplanes after T.O. 1A-7-551

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Figure 8-22. Removal and Installation; Starting Relay

SECTION IX

OIL SYSTEM

9-1. DESCRIPTION.

9-1.1. General. The engine oil system is full flow, dry sump, nonadjustable, pressure regulated system. Refer to table 9-1 for details. The system is vented through the high speed gearbox by a centrifugal breather to an overboard vent. Oil is stored in an engine mounted tank that has a sampling valve. Oil samples may be taken for spectro-graphic analysis. An oil pressure pump and six scavenge pumps are contained within one housing. They are driven by the high speed gearbox. Oil is cooled by a fuel cooled oil cooler on the engine accessory rack. It is distributed by external and internal piping.

9-1.2 Oil Filter. The oil filter assembly has a 30-micron primary filter, 140-micron secondary filter, bypass valve, popout indicator, and filter bypass warning switch. In the event of primary filter restriction, oil may bypass the primary filter. This will continue lubrication of the engine. The popout indicator and switch give visual notice of impending primary filter bypass. As the primary filter element pressure drops with contamination, the popout indicator will actuate first; then with increased pressure drop, the switch will actuate. The oil filter drain valve will drain both sides of the filter.

9-1.3. Chip Detectors. Two magnetic chip detectors are in the scavenge system. One detector is on the aft side of the high speed gearbox. It picks up magnetic particles from the low or high speed gearbox. A second detector on the upper side of the oil pump picks up magnetic particles that originate in oil returning from: No. 7 bearing, No. 1 bearing, internal gearbox, No. 5 bearing, or No. 6 bearing sumps. The chip detectors may be checked for resistance without removal.

9-1.4. Oil Tank. The engine oil tank gravity filling provisions are reached through access 5222-4. An oil filler scupper will drain spilled oil overboard. The oil tank is sealed when the filler cap is installed. The tank sight glass permits visual observation of oil tank quantity.

Table 9-1. Oil System Leading Particulars

Oil Specification	MIL-L-7808 or MIL-L-23699[3]
Oil consumption (maximum)	0.12 gallon per hour
Oil pressure indicated:	
Minimum below 80% rpm	15 psid[1]
Minimum above 80% rpm	27 to 53 psid[2]

[1]Includes instrument error of −3 psid

[2]Includes instrument error of ±3 psid

[3]The TF41 engine may be operated in an emergency situation with a mixture of MIL-L-7808 and MIL-L-23699. The oil mixture must be changed at the earliest opportunity to one type of oil. At temperatures of −40°F and below use MIL-L-7808. MIL-L-23699 is prime and MIL-L-7808 is alternate.

9-1.5. Oil Seals. Ring seals and labyrinth seals retain oil in the five bearing sumps. The ring seal consists of a complete metal ring which remains concentric around a sleeve or shaft having a smooth surface. The labyrinth seal consists of a stationary member and a rotating member. One of the members has fine grooves and the other has a smooth surface. Both types of seals require a continuous airflow for effective sealing.

9-1.6. Accessory Lubrication. Accessories mounted on the high speed gearbox are lubricated by engine oil flow or grease. Refer to table 9-2 for specific spline lubrication method. The jet fuel turbine starter, constant speed drive transmission, hydraulic pumps, fuel boost pump, and centrifugal breather drives have air blown seals. These seals are double labyrinth seals with bypass duct air between them. They prevent oil leakage out of the gearbox and leakage of fluid into the gearbox from the accessory. The high pressure rotor tachometer generator drive is equipped with a spring-loaded, lip-type seal.

9-2. OPERATION. (Figure FO-23.)

9-2.1. Oil Supply. Oil is supplied from near the bottom of the oil tank to the pressure element of the oil pump through a tank mounted supply strainer. On engine start, some 1.2 quarts of oil from the tank circulate within the engine to fill the lubrication line and bearing cavities. The oil drains back into tank when the engine is shut down. The oil pump gear type pressure element pressurizes the oil. This pressure is regulated by a regulating valve. At a pressure differential of 40 (±13) psi above internal gearbox pressure, the regulating valve will open to route filtered oil to the common scavenge oil line and return to the tank. Keeping the oil pressure at a constant differential above internal gearbox pressure will ensure a constant flow across the oil flow nozzles regardless of outside air pressure (altitude). A spill jet in the regulating valve reduces the amount of oil the scavenge pumps must handle at low engine speed. Pressure oil supplied to the spill jet flows through the jet into the common scavenge oil return to the tank. The relief valve will begin to open at about 220 psid and bypass excess pressure to the pump suction.

9-2.2. Oil Cooler. Pressurized oil is routed to the fuel-cooled oil cooler for convective cooling of the oil by transfer of heat to the fuel. The bypass valve limits the maximum differential pressure across the cooler to about 65 psid. If this pressure is exceeded, such as may occur with cold oil, the bypass valve will open and allow oil to bypass the cooler core.

9-2.3. Oil Filter. Pressurized oil enters the oil filter tangentially and is filtered through a 30-micron disposable primary filter element. Filtered oil flows through three outlet ports. Oil pressure on both sides of the filter is sensed by the differential pressure sensing adapter. Before reaching the primary filter element, oil is passed through a 25-micron bypass switch screen, then routed to the popout indicator and bypass switch.

Table 9-2. Accessory Spline Lubrication Method

Accessory	Lubrication method
Constant speed drive (CSD) transmission	Grease[1]
PC No. 1 hydraulic pump	Grease[1]
PC No. 2 hydraulic pump	Grease[1]
PC No. 3 hydraulic pump	Grease[1]
Fuel boost pump	Grease[1]
LP fuel pump	Engine oil
Main fuel control	Engine oil
HP fuel pump	Engine oil
Oil pump	Engine oil
Jet fuel turbine starter	Grease[1]
High pressure rotor tachometer generator	Grease[1]
PMG	Engine oil

[1]Grease is placed on engine and accessory splines during installation

9-2.3.1. Popout Indicator. Oil pressure is applied to both sides of a spring-loaded magnet which holds the popout indicator in the retracted position. When the pressure differential across the filter exceeds about 18 psid, the magnet is forced away from the popout indicator button. The indicator spring forces the button to extend from the housing about 3/16 inch. A spring behind the reset prevention ball forces the ball to a position to prevent resetting of the indicator button. The button cannot be reset until the oil filter element and popout indicator is removed from the oil filter housing. A bimetallic thermal lockout arm prevents actuation of the indicator button below sensed temperature of 105° (±20°)F. When above 105° (±20°)F, the lockout arm will tend to straighten and cause indicator operation.

9-2.3.2. Bypass Switch. Oil pressure is also applied to both sides of a spring-loaded magnet which holds the bypass switch open. When the pressure differential across the filter exceeds about 30 psid, the magnet moves away from the switch. This closes the spring-loaded switch, making a circuit to light the oil caution light on the right console. When the pressure differential drops below about 30 psid, the magnet will attract the switch arm. This overcomes spring pressure on the switch and opens the caution light circuit. A bimetallic thermal lockout arm prevents closing of the switch below sensed temperature of 105° (±20°)F. When above 105° (±20°)F, the lockout arm will straighten and permit switch arm actuation.

9-2.3.3. Filter Bypass. When pressure differential across the filter exceeds about 100 psid, three primary bypass vlaves will open. Oil will bypass the primary filter element and flow through the 140-micron secondary filter element.

9-2.4. Oil Delivery. Pressurized, cooled, filtered oil is routed to the oil pressure transmitter, pressure differential switch, gearboxes, and bearings. It lubricates and cools the low and high pressure compressor and turbine bearings and gears in the internal and low and high speed gearboxes. In addition, oil is supplied to an annulus around the outer race of No. 1 bearing. This squeeze film of oil serves as a hydraulic damper to absorb and minimize vibration. Thread type oil filters throughout the system prevent clogging of small oil feed passages and nozzles.

9-2.5. Oil Scavenge. The scavenge system has seven gear type scavenge pumps. One is in the high speed gearbox and six are in the oil pump to pick up scavenge oil for return to the oil tank. The gearbox scavenge pump works with the first scavenge element in the oil pump to scavenge oil from the high speed gearbox through one scavenge line to the oil tank. The remaining scavenge elements in the oil pump scavenge oil from the No. 7 bearing, No. 1 bearing, internal gearbox, No. 5 bearing, and No. 6 bearing sumps. The five sump scavenge pumps have a screen before the pump. The No. 5 bearing sump scavenge pump transfer tube prevents oil from spilling over the rear seals. After engine shutdown, the bypass valve opens and drainage oil bypasses the scavenge element and drains oil into the scavenge outlet. Oil from the bearing sump scavenge elements goes through one line to the oil tank. Oil entering the tank flows over a deaerator tray. This separates entrapped air from the oil. The oil tank is vented through two ball type valves (figure 9-1) to the high speed gearbox.

9-2.6. System Venting. The oil system is vented to the high speed gearbox either directly or indirectly. Refer to table 9-3 for venting methods and paths. The high speed gearbox is vented to the atmosphere through the centrifugal breather. The breather rotor is driven at 1.2193 times the high pressure compressor rotor speed. Air exiting the gearbox must flow through the vanes of the breather rotor into the interior of the breather shaft. Air will exit from the front of the shaft, through the oil breather hose, and into the atmosphere. The breather vanes separate oil from air by centrifugal action. The oil runs back into the gearbox. This vent system maintains the proper pressure differentials across the seals, preventing oil leakage.

9-2.7. Air Blown Seals. The high speed gearbox air blown seals are pressurized by bypass duct air (P2.1). Fan air is taken from the bottom of the intermediate case. This air passes through a primary restrictor and into a cast passage to the PC No. 1 hydraulic pump seal housing. A screen is used in the primary restrictor. Some of this air pressurizes the PC No. 1 hydraulic pump seal. The air in the seal follows two paths. First, air passes through one side of the labyrinth seal into the gearbox. Second, air passes through the other side of the labyrinth seal and is vented overboard through the air blown seal vent.

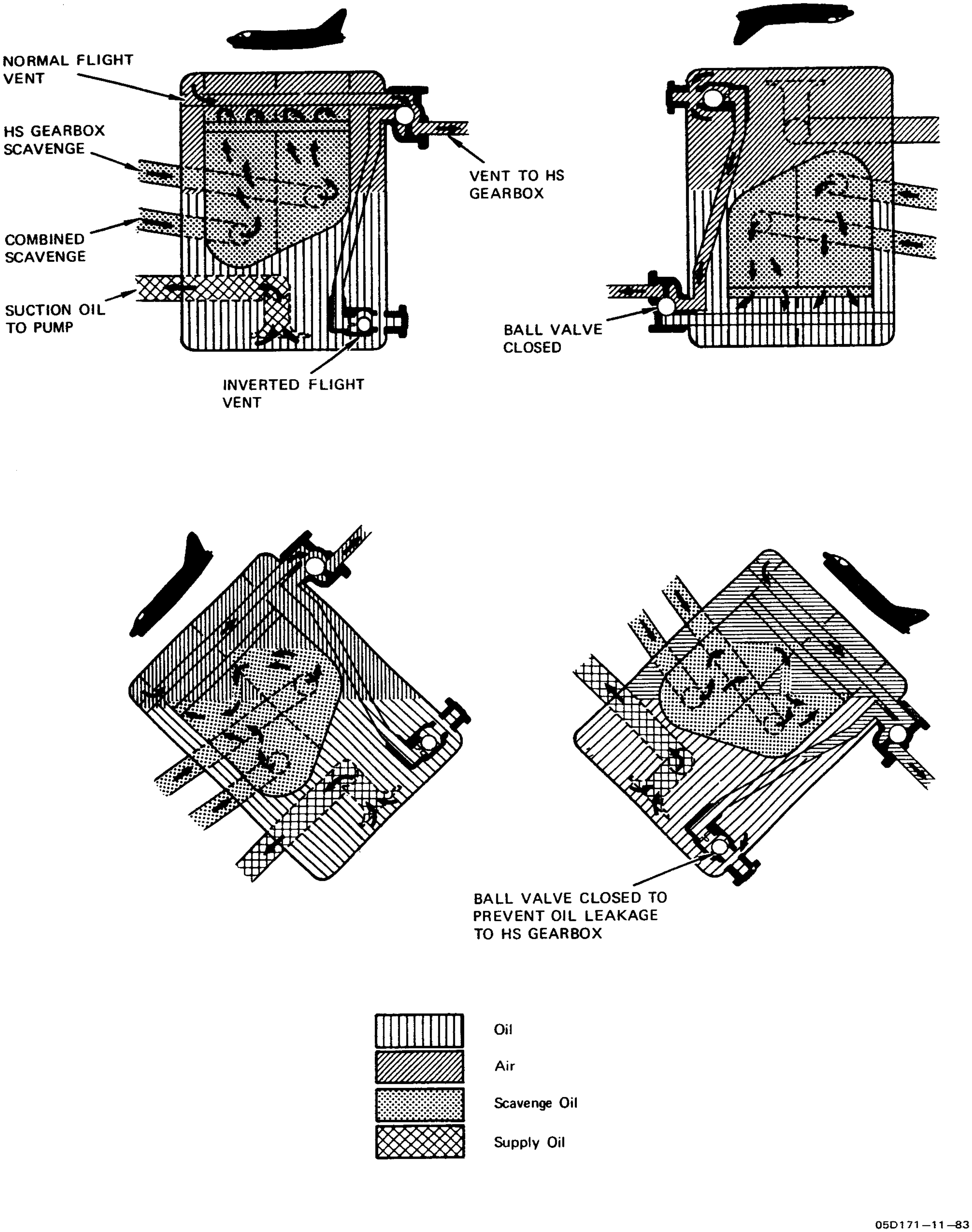


Figure 9-1. Venting Schematic; Oil Tank

After pressurizing PC No. 1 hydraulic pump seal, the remaining air divides into three flows. One flows to the fuel boost pump or PC No. 3 hydraulic pump seal, and another to PC No. 2 hydraulic pump seal. The third flows to the constant speed drive transmission seal housing. Air in the transmission seal housing pressurizes the transmission seals, jet fuel turbine starter seals, and centrifugal breather seals.

9-3. COMPONENTS. For a list of system components, locations (accesses), and functions, refer to table 9-4.

Table 9-3. Oil System Venting (Air Exit Path)

Chamber	Directly to high speed gearbox	Excess capacity of scavenge pump	Path to high speed gearbox
No. 1 bearing	Yes	Yes	LP 1 compressor vane and external tube
Internal gearbox	Yes	Yes	High speed gearbox quill shaft
No. 5 bearing	Yes	Yes	Diffuser case No. 10 strut and external tube
No. 6 bearing	Yes	Yes	Diffuser case No. 1 strut and external tube
No. 7 bearing	No	Yes	
Low speed gearbox	Yes	No	Oil drain line
Oil tank	Yes	No	External tube

Table 9-4. Oil System Components

Component	Access	Function
Cooler, fuel-cooled oil	5222-3	Transfers heat from oil to fuel
Detector, chip	5222-3-1	Traps magnetic particles
Filter, oil	5222-3-1	Filters engine lubricating oil
Pump, oil	5222-3	Pressurizes oil, regulates oil pressure, and scavenges oil
Tank, oil	5222-3	Provides engine oil supply storage

9-4. OPERATIONAL CHECKOUT.

Test Equipment Required

Figure & index No.	Name	AN type designation	Use and application
	Equipment required for engine operation		Operate engine

NOTE

A number enclosed in braces at the end of a step in the following test corresponds to a number in troubleshooting figure FO-24.

a. Check that oil filter popout indicator is retracted. {1}

b. Start engine (T.O. 1A-7D-2-1).

c. Check that oil caution light goes out when pressure exceeds 14 psid. {2, 3}

NOTE

Oil pressure may peg at 60 psi when starting on cold oil, but must be within limits after 5 minutes.

d. Check that oil pressure is steady and is more than 15 psid minimum at idle. {4 through 6}

e. Advance throttle to 80% rpm. Check that oil pressure is 27 to 53 psid. {5}

f. Retard throttle to IDLE.

g. Shut down engine (T.O. 1A-7D-2-1).

h. Check logbook that oil consumption does not exceed 0.12 gallon per hour. {7}

9-5. TROUBLESHOOTING. Refer to figure FO-24 for troubleshooting data. Malfunctions are numbered corresponding to numbers following steps in the operational checkout.

9-6. DIRECT READING OIL PRESSURE CHECK.

Test Equipment Required

Figure & index No.	Name	Part No.	Use and application
	Equipment required for engine operation		Operate engine
	Pressure gage, 0 to 60 psi	3W45737	Indicate oil pressure
	Elbow tube (snubber)	216-55342-1	Reduce pressure variations
	No. 4 pressure plug	AN806D4	Plug scavenge pressure

a. Extend arresting gear (T.O. 1A-7D-2-7).

b. Open access 5222-3-1.

c. Cut lockwire and remove cap (figure 9-2) from tee (2) at oil filter.

d. Connect elbow tube (snubber) to tee with No. 4 hose.

e. Connect pressure gage to elbow tube (snubber) with No. 4 hose.

f. Remove scavenge oil line from rear of oil pressure transmitter and plug with No. 4 pressure plug.

g. Start engine (T.O. 1A-7D-2-1) and operate at idle to warm up oil.

h. Check that oil pressure is 18 psi minimum.

i. Advance throttle to 85%. Check that oil pressure reads 35 psi minimum.

j. Check that oil pressure is steady ± 2 psi at all power settings.

k. Check that cockpit agrees with ± 3 psi at all power settings.

NOTE

If readings are abnormal and both cockpit and direct gages agree, troubleshoot oil system. If cockpit and direct gages disagree troubleshoot oil pressure indicating system.

l. Retard throttle to IDLE.

m. Shut down engine.

n. Disconnect No. 4 hose from tee (2) (figure 9-2).

o. Install cap (1) on tee (2) and secure with MS20995C32 lockwire.

p. Remove No. 4 pressure plug from scavenge oil line and install line on rear of oil pressure transmitter.

q. Close access 5222-3-1.

r. Retrack arresting gear (T.O. 1A-7D-2-7).

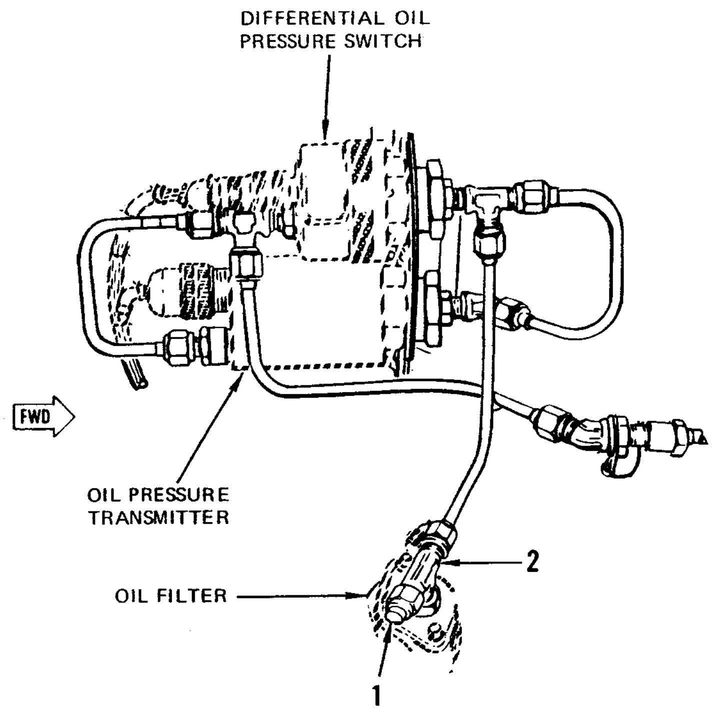


Figure 9-2. Oil Pressure Check; Direct Reading

9-7. OIL TANK DRAINING FROM SAMPLING VALVE.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
	GGG-W-686	Torque wrench, 10 to 150 inch-pounds	Measure torque

a. Open access 5222-2-1.

b. Remove oil sampling drain valve cap.

CAUTION

Use of tools on drain valve handle will cause damage to drain valve, resulting in loss of engine oil. Use of tools is prohibited. Use fingers only.

c. Open drain valve and drain oil as required.

d. Close drain valve.

e. Install oil sampling drain valve cap and tighten to 75 inch-pounds torque.

f. Close access 5222-2-1.

9-8. ENGINE OIL SYSTEM FLUSHING.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
		Equipment required for engine operation	Operate engine

Tools Required — CONT

Figure & index No.	Part number	Nomenclature	Use and application
	6798920 (Allison Division of General Motors, Indianapolis, IN)	Scavenge oil screen puller	Remove scavenge oil screens
	GGG-W-686	Torque wrench, 0 to 15 inch-pounds	Measure torque
	GGG-W-686	Torque wrench, 10 to 150 inch-pounds	Measure torque

WARNING

Avoid radiation contamination by adhering to exposure limits. For physical contact with the oil tank source tube, maximum safe exposure time is 15 minutes at one time or a total of 20 minutes per week. At a distance of 12 inches from the source tube, maximum time is 3.3 hours per week. There is no exposure time limit 3 feet from source tube. Deviations from these limits shall be approved by the base medical service. Personnel working with or near this source tube shall become familiar with the procedures in T.O. 00-110N-11.

a. Extend arresting gear (T.O. 1A-7D-2-1).

b. Open accesses 5222-3-1 and 5222-2.

c. Start engine (T.O. 1A-7D-2-1).

d. Advance throttle to 85% rpm and operate for 10 minutes.

e. Retard throttle to IDLE and shut down engine (T.O. 1A-7D-2-1).

NOTE

Oil must be drained not sooner than 5 minutes nor later than 15 minutes after engine shutdown.

f. Remove bolt (1, figure 9-3), bracket (2), self-locking nuts (3), bracket (4), drain plug (5), and packing (6). Allow tank to drain.

CAUTION

Use extreme care during installation of bracket to prevent damage to source tube.

g. Install packing (6), drain plug (5), bracket (4), and bracket (2) with self-locking nuts (3) and bolt (1). Tighten nuts 37 to 42 inch-pounds torque.

h. On engines before T.O. 2J-TF41-643, remove self-locking nuts (7), washers (8), magnetic chip detector (9), and packing (10). Allow gearbox to drain.

h1. On engines after T.O. 2J-TF41-643, disconnect terminal (8A) by removing self-locking nut (7) and washer (8). Remove sleeve nuts (8B), lockwashers (8C), washers (8D), and remote probe attachment (8E). Remove magnetic chip detector (9) and packing (10). Allow gearbox to drain.

i. On engines before T.O. 2J-TF41-643, install packing (10) and magnetic chip detector (9) with washers (8) and self-locking nuts (7).

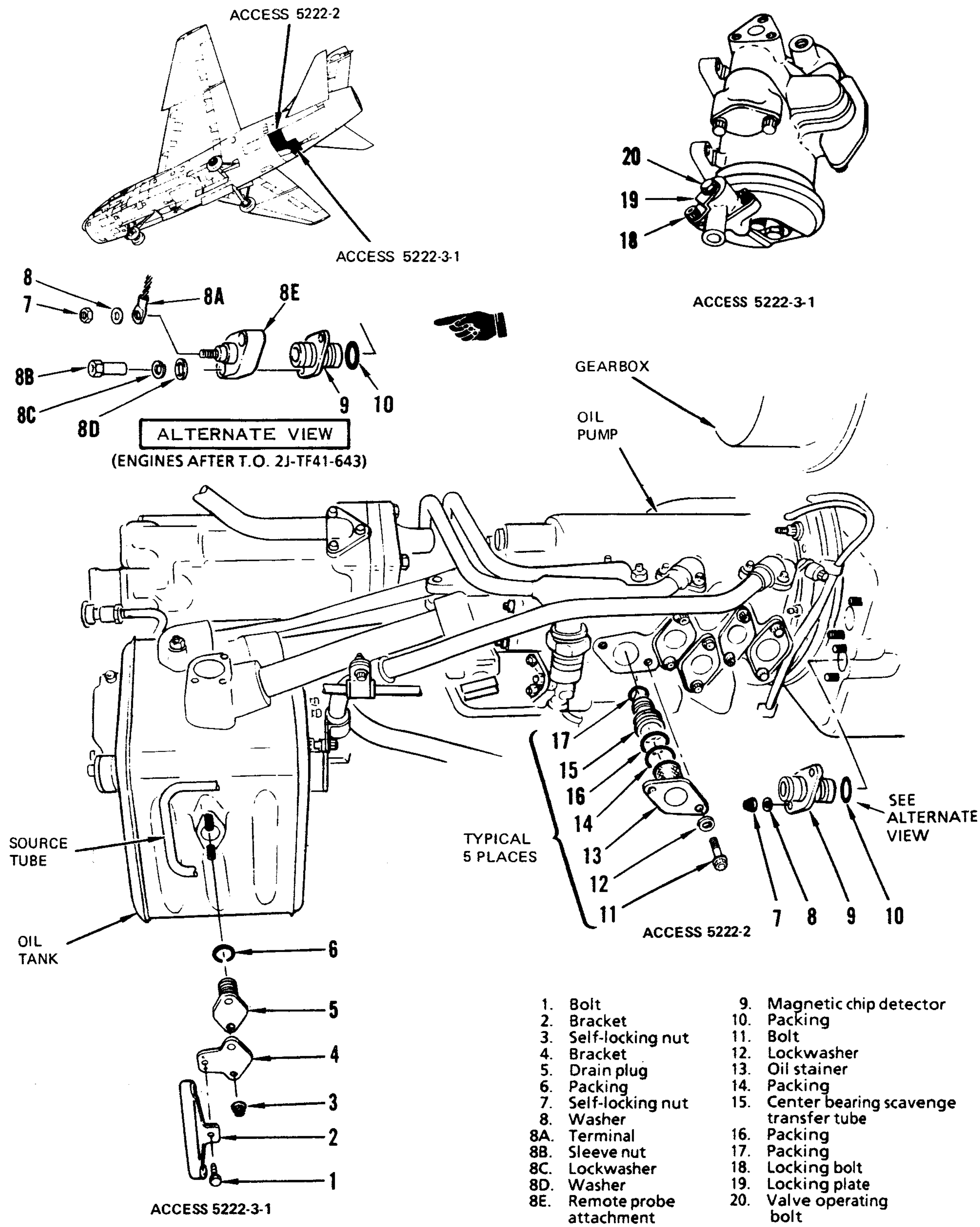
i1. On engines after T.O. 2J-TF41-643, install packing (10) and magnetic chip detector (9) in gearbox. Install remote probe attachment (8E) over chip detector and secure with washers (8D), lockwashers (8C), and sleeve nuts (8B). Connect terminal (8A) to remote probe attachment (8E) with washer (8) and self-locking nut (7).

j. Remove bolts (11), lockwashers (12), oil strainers (13), and packings (14) from all five positions on oil pump.

k. Remove center bearing scavenge transfer tube (15) and packings (16 and 17). Let oil drain from pump.

NOTE

Install center bearing scavenge transfer tube with small end first.



1. Bolt
2. Bracket
3. Self-locking nut
4. Bracket
5. Drain plug
6. Packing
7. Self-locking nut
8. Washer
8A. Terminal
8B. Sleeve nut
8C. Lockwasher
8D. Washer
8E. Remote probe attachment
9. Magnetic chip detector
10. Packing
11. Bolt
12. Lockwasher
13. Oil stainer
14. Packing
15. Center bearing scavenge transfer tube
16. Packing
17. Packing
18. Locking bolt
19. Locking plate
20. Valve operating bolt

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Figure 9-3. System Flushing; Engine Oil

l. Install packings (17 and 16) and center bearing scavenge transfer tube (15) in oil pump.

m. Install packings (14) and oil strainers (13) with lockwashers (12) and bolts (11) in all five positions on oil pump.

n. Loosen locking bolt (18) and disengage locking plate (19).

o. Turn valve operating bolt (20) counterclockwise to open drain valve. Let filter drain.

NOTE

With required torque applied, the head valve operating bolt will not contact drain valve housing.

p. Tighten valve operating bolt (20) 5 to 15 inch-pounds torque.

q. Place locking plate (19) over operating bolt and secure with locking bolt (18).

r. Service oil tank (T.O. 1A-7D-2-1) to 2-quart low mark.

NOTE

Replace all removed packings after last oil flush.

s. Repeat steps c through r twice.

t. Remove oil filter element and replace with clean element (paragraph 9-14).

u. Close accesses 5222-3-1 and 5222-2.

v. Retract arresting gear (T.O. 1A-7D-2-1).

w. Service oil tank (T.O. 1A-7D-2-1).

9-9. MAGNETIC CHIP DETECTOR CONTINUITY CHECK (ENGINES BEFORE T.O. 2J-TF41-643).

Test Equipment Required

Figure & index No.	Name	AN type designation	Use and application
	Multimeter	AN/PSM-6	Check resistance

NOTE

On engines after T.O. 2J-TF41-643, the magnetic chip detectors may be checked from a remote panel near the oil tank filler. Refer to paragraph 9-9A.

a. Open access 5222-2.

b. Check resistance between center contact and flange of detector. Resistance shall be more than 20,000 ohms.

c. If resistance is less than 20,000 ohms, perform magnetic chip detector visual inspection (paragraph 9-10).

d. Close access 5222-2.

9-9A. MAGNETIC CHIP DETECTOR CONTINUITY CHECK (ENGINES AFTER T.O. 2J-TF41-643). (Figure 9-3.1.)

Test Equipment Required

Figure & index No.	Name	AN type designation	Use and application
	Multimeter	AN/PSM-6	Check resistance

a. Open access 5222-4.

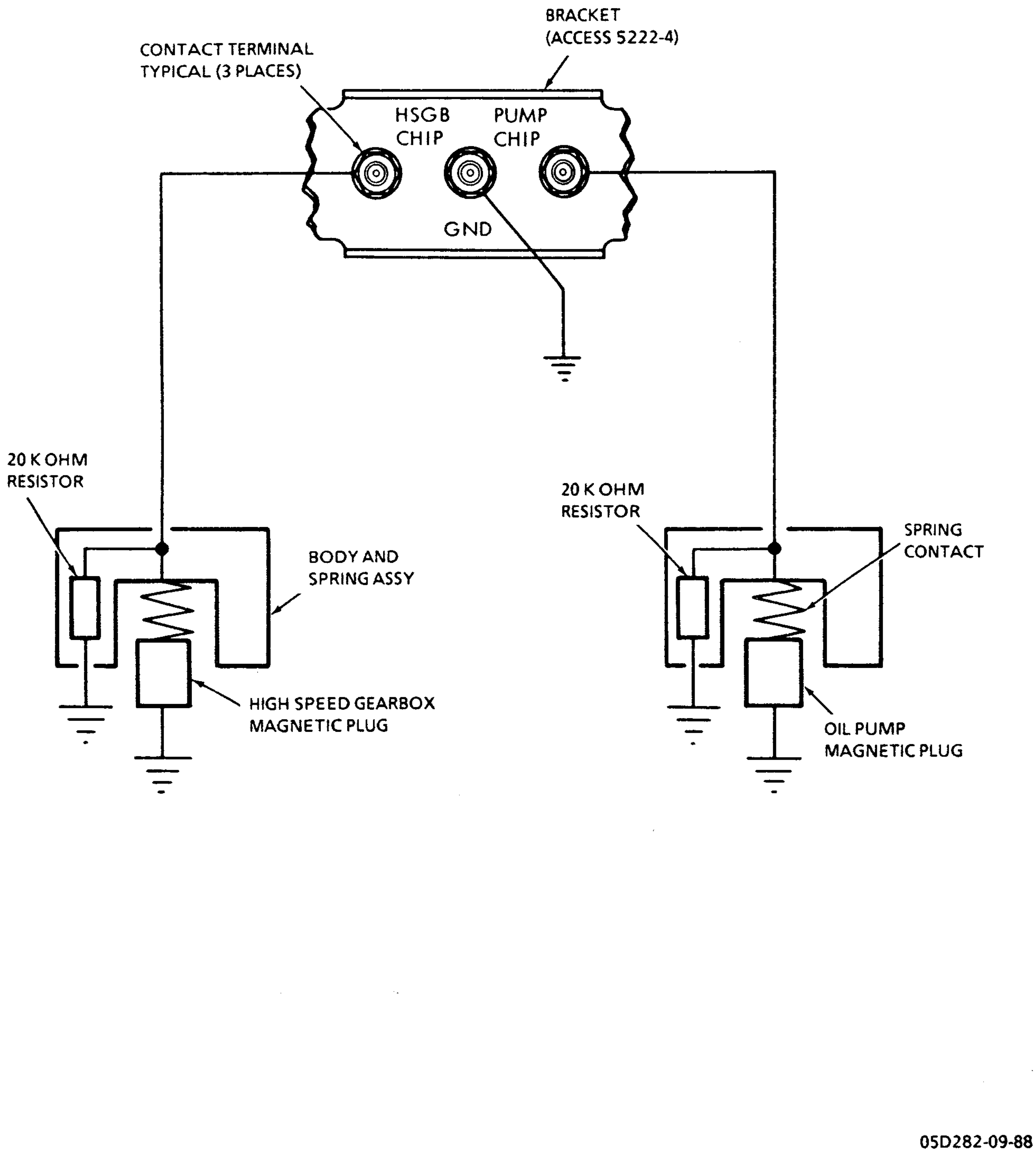


Figure 9-3.1. Detector System; Remote Probe Magnetic Chip (Engines After T.O. 2J-TF41-643)

b. Check resistance between GND and HSGB CHIP terminals, and between GND and PUMP CHIP terminals located on bracket next to oil tank filler. Refer to table 9-5 for inspection limits.

c. Close access 5222-4.

Table 9-5. Magnetic Chip Detector Inspection Limits (Engines After T.O. 2J-TF41-643)

Multimeter indication (ohms)	Remote system	Magnetic chip detector
Between 10 k and 20 k	Okay	Okay
Greater than 20 k	System defective. Check for broken wire, etc.	Okay
Less than 10 k	Okay	Detector is bridged. Perform magnetic chip detector visual inspection (paragraph 9-10).

9-10. MAGNETIC CHIP DETECTOR VISUAL INSPECTION.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
		Equipment required for engine operation	Operate engine

NOTE

As a result of normal engine operation, machining chips, fuzz, and hair-like magnetic particles of varying length may be found on detectors. This is not cause for engine removal.

a. Remove magnetic chip detectors (paragraph 9-21 or 9-21A). Visually inspect for magnetic particle accumulation (figure 9-4).

NOTE

Christmas tree buildup on oil pump chip detector may indicate labyrinth seal wear.

b. If inspection reveals suspicious metal deposits (amount or origin), proceed as follows:

(1) Review engine records for evidence of high oil consumption. If high consumption is revealed, reject engine to IMA.

(2) Perform JOAP analysis (T.O. 33-1-37).

(3) Clean and install detectors (paragraph 9-21 or 9-21A).

(4) Flush oil system (paragraph 9-8).

(5) Start engine (T.O. 1A-7D-2-1) and operate at 75% rpm for 30 minutes.

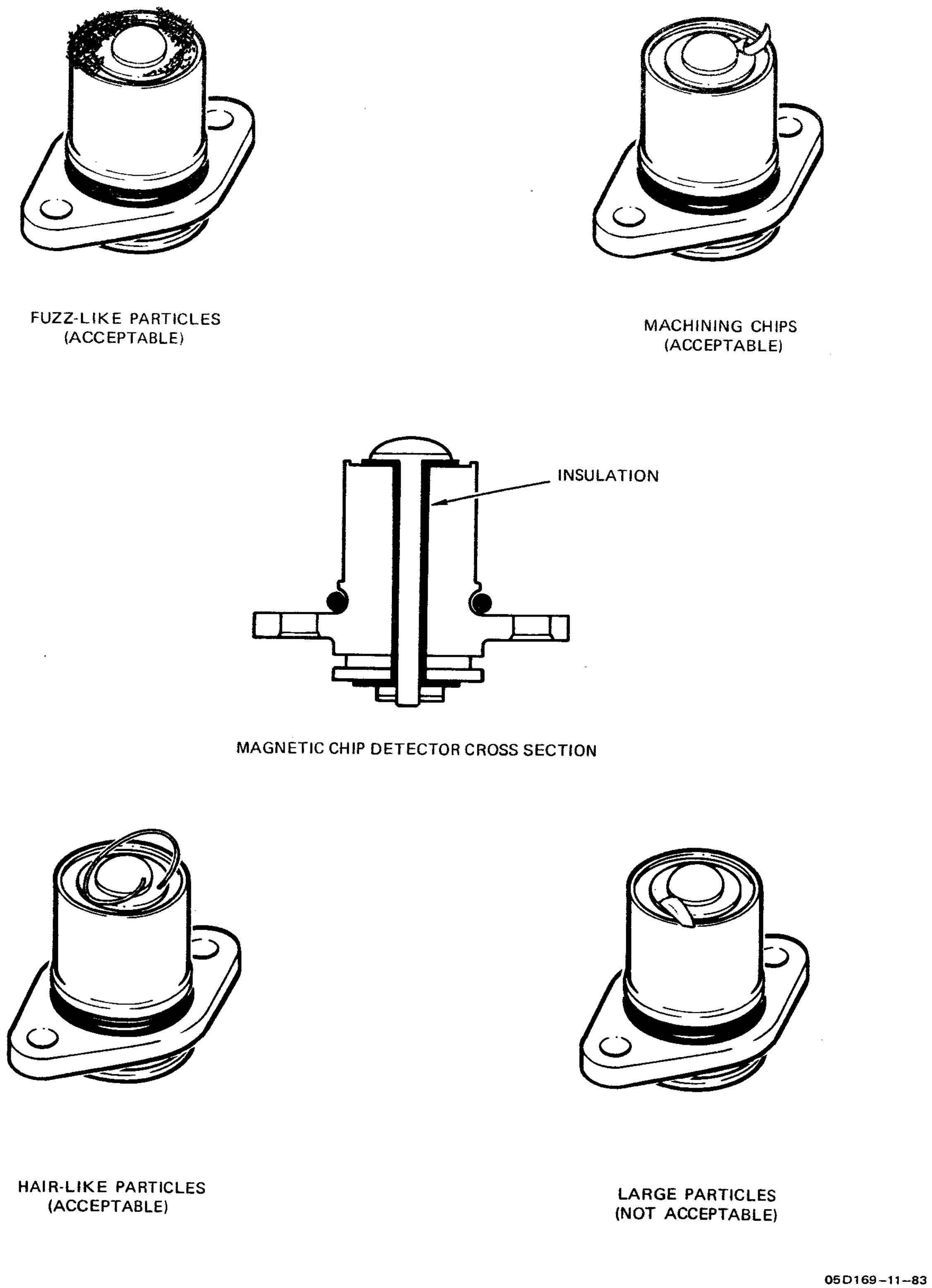


Figure 9-4. Visual Inspection; Magnetic Chip Detector

(6) Shut down engine (T.O. 1A-7D-2-1).

(7) Repeat step a. If further metal deposits of questionable quantity and origin are found, reject engine to field maintenance.

c. If detector inspection does not reveal suspicious metal deposits, clean and install detectors (paragraph 9-21 or 9-21A).

9-11. OIL TANK REMOVAL AND INSTALLATION.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
	GGG-W-686	Torque wrench, 10 to 150 inch-pounds	Measure torque

WARNING

Avoid radiation contamination by adhering to the following exposure limits. For physical contact with the oil tank source tube, maximum safe exposure time is 15 minutes at one time or a total of 20 minutes per week. At a distance of 12 inches from the source tube, maximum time is 3.3 hours per week. There is no exposure time limit 3 feet from source tube. Deviations from these limits shall be approved by the base medical service. Personnel working with or near this source tube shall become familiar with the procedures in T.O. 00-110N-11.

CAUTION

To prevent damage to tubes and reduce possible leakage, observe precautions (paragraph 1-18) when working with fuel, oil, or air tubing.

9-11.1. Removal. (Figure 9-5.)

a. Remove engine removal door (T.O. 1A-7D-2-1) and open access 5222-2.

b. Remove oil filter assembly (paragraph 9-13).

c. Remove source unit (paragraph 3-20).

d. Remove detector unit (paragraph 3-21).

e. Remove self-locking nuts (1), bracket (2), drain plug (3), and packing (4). Let oil drain from tank.

f. Remove bolts (5), lockwashers (6), oil tube (7), and packing (8).

g. Remove bolts (9), lockwashers (10), washers (11), connector (12), packing (13), and retainer (14).

h. Remove bolts (15), lockwashers (16), washers (17), connector (18), packing (19), and retainer (20).

i. Remove bolts (21), lockwashers (22), washers (23), connector (24), packing (25), and retainer (26).

j. Cut lockwire, disconnect oil tube (27), and remove jamnut (28) and union (29).

k. Remove bolts (30), lockwashers (31), tube (32), and packing (33).

l. Remove nut (34), washer (35), bushing (36), sleeve (37), and bolt (38).

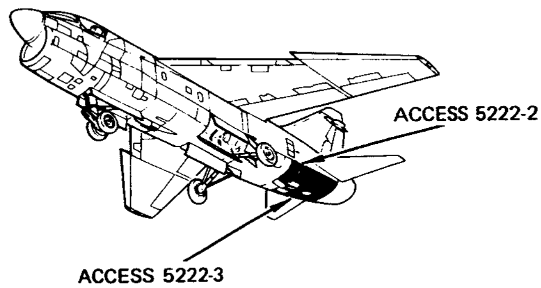
m. Remove bolts (39), washers (40), hollow pins (41), and oil tank (42).

n. Cut lockwire, loosen jamnut (43), and remove valve (44) and packing (45).

9-11.2. Installation. (Figure 9-5.)

a. Install new packing (45) on valve (44). Install valve on oil tank and tighten jamnut (43). Secure nut to housing with MS20995C32 lockwire.

b. Place oil tank (42) on engine and secure to mounting bracket with hollow pins (41),



1. Self-locking nut
2. Bracket
3. Drain plug
4. Packing
5. Bolt
6. Lockwasher
7. Oil tube
8. Packing
9. Bolt
10. Lockwasher
11. Washer
12. Connector
13. Packing
14. Retainer
15. Bolt
16. Lockwasher
17. Washer
18. Connector
19. Packing
20. Retainer
21. Bolt
22. Lockwasher
23. Washer
24. Connector
25. Packing
26. Retainer
27. Oil tube
28. Jamnut
29. Union
30. Bolt
31. Lockwasher
32. Tube
33. Packing
34. Nut
35. Washer
36. Bushing
37. Sleeve
38. Bolt
39. Bolt
40. Washer
41. Hollow pin
42. Oil tank
43. Jamnut
44. Valve
45. Packing

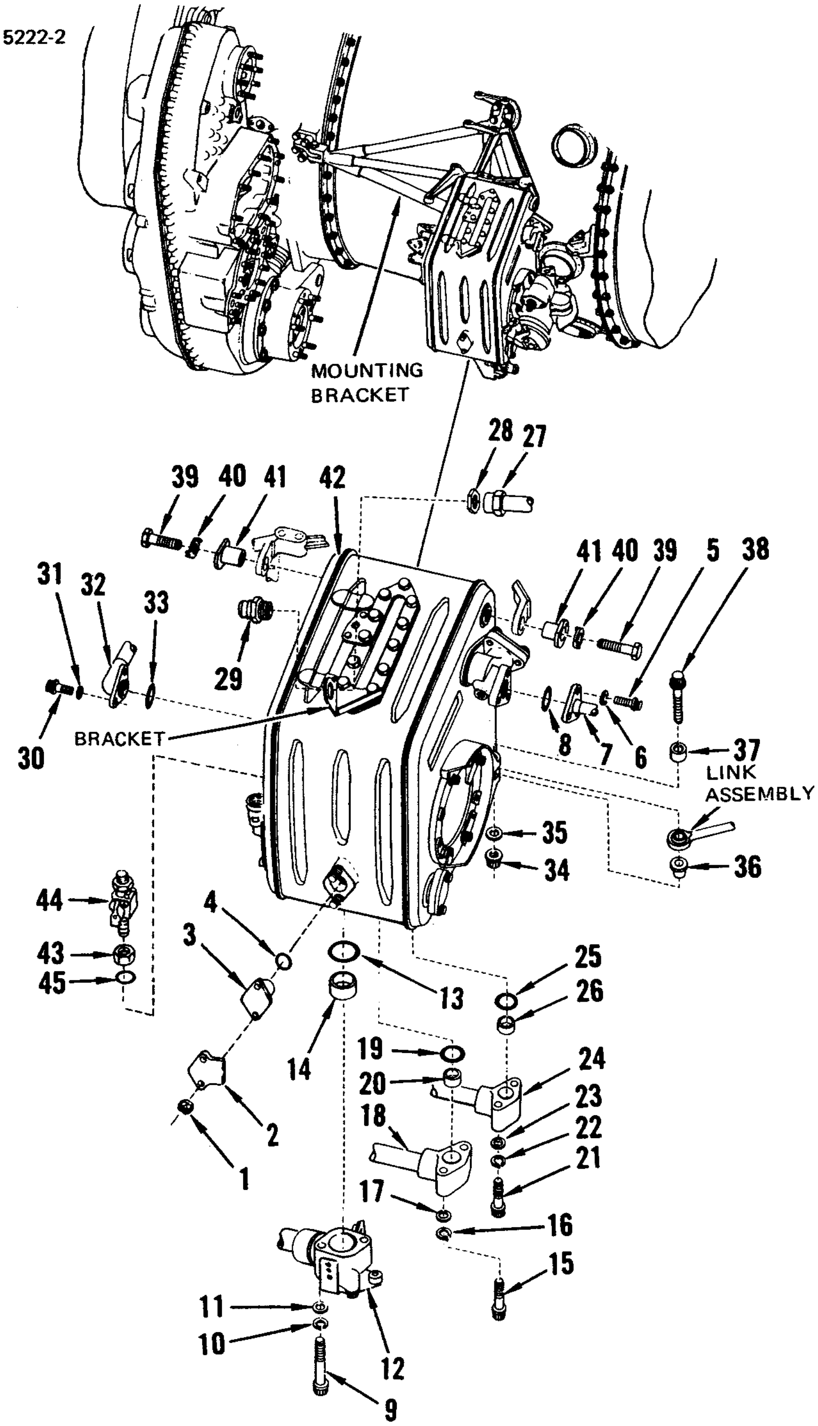


Figure 9-5. Removal and Installation; Oil Tank

washers (40), and bolts (30).

c. Secure oil tank to link assembly with bolt (38), sleeve (37), bushing (36), washer (35), and nut (34).

d. Install new packing (33) on tube (32) and position tube on oil tank. Secure with lockwashers (31) and bolts (30).

e. Secure union (29) to bracket using jamnut (28).

f. Connect oil tube (27) to union. Secure coupling nut to bracket with MS20995C32 lockwire.

g. Install retainer (26) and new packing (25) on connector (24).

h. Secure connector to oil tank with washers (23), lockwashers (22), and bolts (21).

i. Install retainer (20) and new packing (19) on connector (18).

j. Secure connector to oil tank with washers (17), lockwashers (16), and bolts (15).

k. Install retainer (14) and new packing (13) on connector (12).

l. Secure connector to oil tank with washers (11), lockwashers (10), and bolts (9).

m. Install new packing (8) on oil tube (7) and secure to oil tank with lockwashers (6) and bolts (5).

n. Install new packing (4) on drain plug (3). Secure drain plug and bracket (2) to oil tank with self-locking nuts (1). Tighten nuts 37 to 42 inch-pounds torque.

o. Install detector unit (paragraph 3-25).

p. Install source unit (paragraph 3-24).

q. Install oil filter assembly (paragraph 9-13).

r. Service oil tank (T.O. 1A-7D-2-1).

s. Perform oil quantity indicating system calibration (paragraph 3-12).

t. Perform oil system operational checkout (paragraph 9-4) and check installation for leaks.

u. Install engine removal door (T.O. 1A-7D-2-1).

v. Close access 5222-2.

9-12. OIL TANK SIGHT GLASS REMOVAL AND INSTALLATION.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
	GGG-W-686	Torque wrench, 10 to 150 inch-pounds	Measure torque

WARNING

Avoid radiation contamination by adhering to the following exposure limits. For physical contact with the oil tank source tube, maximum safe exposure time is 15 minutes at one time or a total of 20 minutes per week. At a distance of 12 inches from the source tube, maximum time is 3.3 hours per week. There is no exposure time limit 3 feet from the source tube. Deviations from these limits shall be approved by the base medical service. Personnel working with or near this source tube shall become familiar with the procedures in T.O. 00-110N-11.

9-12.1. Removal. (Figure 9-6.)

NOTE

Removal of the oil quantity indicating system (airplanes after T.O. 1A-7-596) is the same format as for oil tank sight glass removal and installation. See figure 9-6 for correct reference numbers for parts to be disconnected (i.e., nuts, screws, etc that secure sight glass housing to tank). The housing assembly is the container for the indicating sending unit.

a. Remove engine removal door (T.O. 1A-7D-2-1).

b. Remove self-locking nuts (1), bracket (2), drain plug (3), and packing (4). Let oil tank drain.

c. Cut lockwire and disconnect oil scupper drain tube (5) from union.

d. Disconnect electrical connector (6).

e. Remove bolt (7) and washers (8).

f. Remove bolts (9), washers (10), and disconnect brackets (11 and 12).

g. Remove sight glass plate (13), sight glass (14), backing plate (15), and retaining grommet (16).

9-12.2. Installation. (Figure 9-6.)

NOTE

Installation of the oil quantity indicating system (airplanes after T.O. 1A-7-596) is the same format as for oil tank sight glass removal and installation. See figure 9-6 for correct reference numbers for parts to be connected (i.e., nuts, screws, etc that secure sight glass housing to tank). The housing assembly is the container for the indicating sending unit.

a. Install retaining grommet (16), backing plate (15), sight glass (14), and sight glass plate (13) in oil tank.

b. Place brackets (12 and 11) in proper position on sight glass plate and secure with washers (10) and bolts (9).

c. Install washers (8) and bolt (7) and secure clamp to sight glass plate.

d. Connect electrical connector (6).

e. Connect oil scupper drain tube (5) to union. Secure with MS20995C32 lockwire.

f. Using new packing (4), install drain plug (3) and bracket (2), and secure with self-locking nuts (1). Tighten nuts 37 to 42 inch-pounds torque.

g. Service oil tank (T.O. 1A-7D-2-1).

h. Check installation for leaks.

i. Install engine removal door (T.O. 1A-7D-2-1).

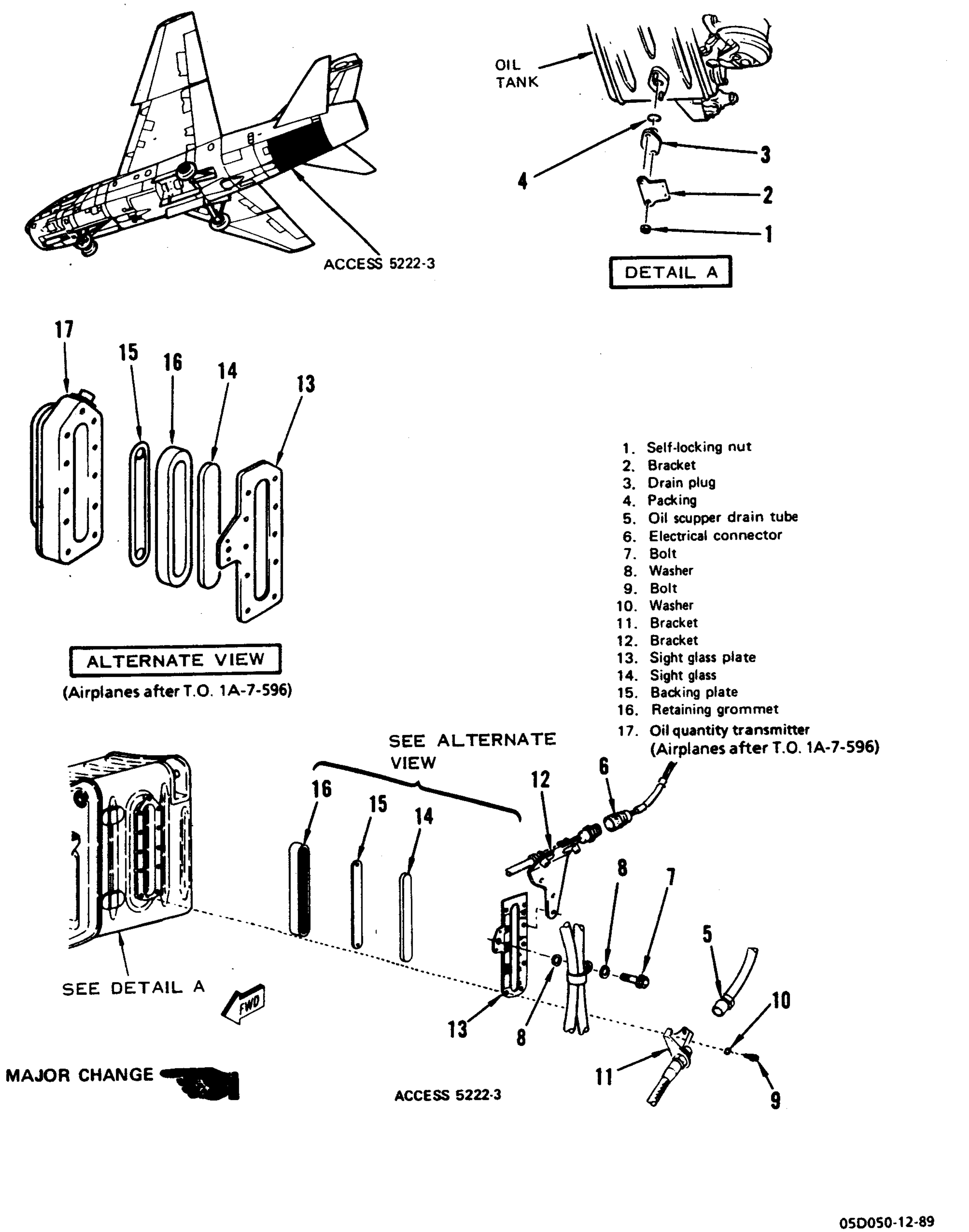


Figure 9-6. Removal and Installation; Oil Tank Sight Glass

9-13. OIL FILTER ASSEMBLY REMOVAL AND INSTALLATION.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
	GGG-W-686	Torque wrench, 0 to 15 inch-pounds	Measure torque

WARNING

Avoid radiation contamination by adhering to the following exposure limits. For physical contact with the oil tank source tube, maximum safe exposure time is 15 minutes at one time or a total of 20 minutes per week. At a distance of 12 inches from the source tube, maximum time is 3.3 hours per week. There is no exposure time limit 3 feet from source tube. Deviations from these limits shall be approved by the base medical service. Personnel working with or near this source tube shall become familiar with the procedures in T.O. 00-110N-11.

CAUTION

To prevent damage to tubes and reduce possible leakage, observe precautions (paragraph 1-18) when working with fuel, oil, or air tubing.

9-13.1. Removal. (Figure 9-7.)

a. Extend arresting gear (T.O. 1A-7D-2-7).

b. Open access 5222-3-1.

CAUTION

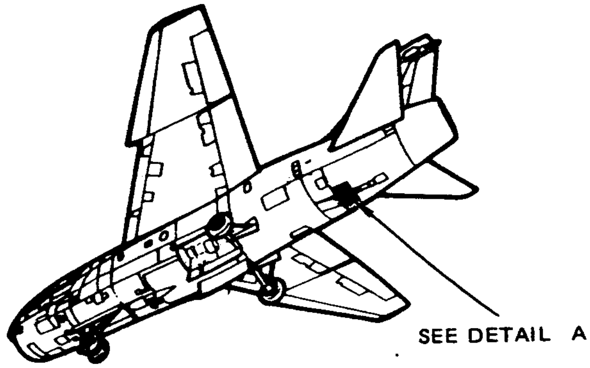
Oil filter bypass switch electrical connector uses push-pull type coupling. To prevent damage to switch and connector, do not use tools, such as pliers, or twist this coupling.

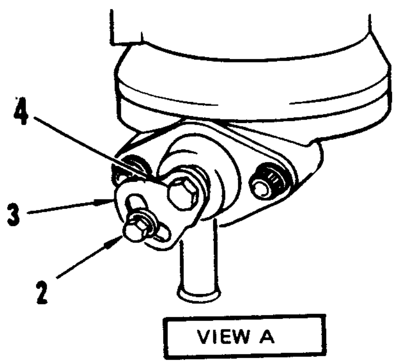
c. Disconnect electrical connector (1).

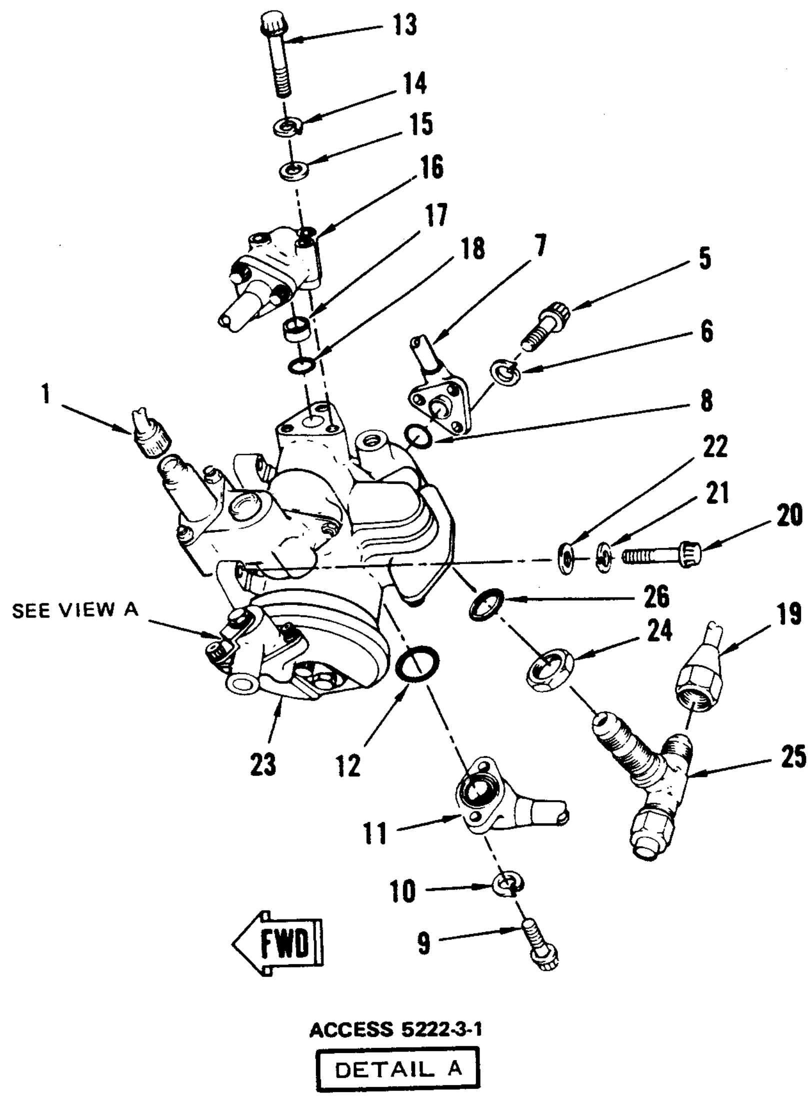
d. Loosen locking bolt (2) and disengage locking plate (3).

e. Turn valve operating bolt (4) counterclockwise to open drain valve. Let filter drain.

f. Remove bolts (5) and lockwashers (6), disconnect oil tube (7), and remove packing (8).







1. Electrical connector
2. Locking bolt
3. Locking plate
4. Valve operating bolt
5. Bolt
6. Lockwasher
7. Oil tube
8. Packing
9. Bolt
10. Lockwasher
11. Oil tube
12. Packing
13. Bolt
14. Lockwasher
15. Washer
16. Housing
17. Retainer ring
18. Packing
19. Oil pressure transmitter tube
20. Bolt
21. Lockwasher
22. Washer
23. Oil filter assembly
24. Nut
25. Tee
26. Packing

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Figure 9-7. Removal and Installation; Oil Filter Assembly

g. Remove bolts (9) and lockwashers (10), disconnect oil tube (11), and remove packing (12).

h. Remove bolts (13), lockwashers (14), and washers (15). Disconnect housing (16) and remove retainer ring (17) and packing (18).

i. Disconnect oil pressure transmitter tube (19).

j. Remove bolts (20), lockwashers (21), washers (22), and oil filter assembly (23).

k. Loosen nut (24), and remove tee (25) and packing (26).

9-13.2. Installation. (Figure 9-7.)

a. Install new packing (26) and nut (24) on tee (25), and install on oil filter assembly (23).

b. Secure oil filter assembly to oil tank using washers (22), lockwashers (21), and bolts (20).

c. Connect oil pressure transmitter tube (19). Tighten nut (24).

d. Using new packing (18) and retainer ring (17), secure housing (16) to oil filter assembly with washers (15), lockwashers (14), and bolts (13).

e. Using new packing (12), secure oil tube (11) to oil filter assembly with lockwashers (10) and bolts (9).

f. Using new packing (8), secure oil tube (7) to oil filter assembly with lockwashers (6) and bolts (5).

NOTE

With required torque applied, the head of valve operating bolt will not contact drain valve housing.

g. Tighten valve operating bolt (4) to 5 to 15 inch-pounds torque.

h. Place locking plate (3) over valve operating bolt, and secure with locking bolt (2).

i. Connect electrical connector (1) to pressure switch.

j. Service oil tank (T.O. 1A-7D-2-1).

k. Perform oil system operational checkout (paragraph 9-4) and check installation for leaks.

l. Close access 5222-3-1.

m. Retract arresting gear (T.O. 1A-7D-2-7).

9-14. OIL FILTER ELEMENT REMOVAL AND INSTALLATION.

Tools Required

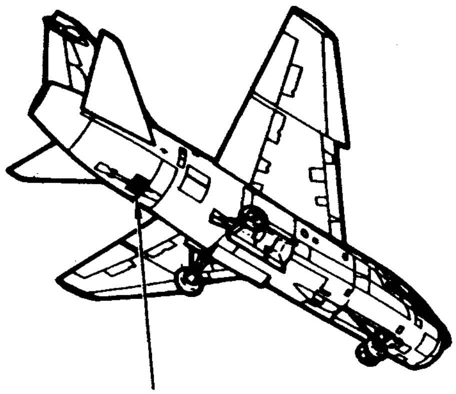
Figure & index No.	Part number	Nomenclature	Use and application
	GGG-W-686	Torque wrench, 10 to 150 inch-pounds	Measure torque
	GGG-W-686	Torque wrench, 0 to 15 inch-pounds	Measure torque

WARNING

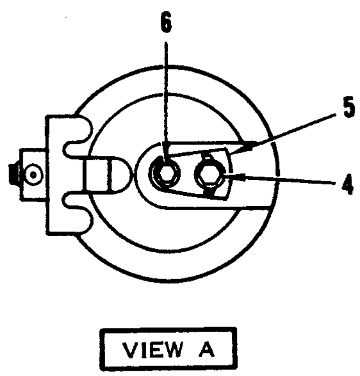
Avoid radiation contamination by adhering to following exposure limits. For physical contact with the oil tank source tube, maximum safe exposure time is 15 minutes at one time or a total of 20 minutes per week. At a distance of 12 inches from the source tube, maximum time is 3.3 hours per week. There is no exposure time limit 3 feet from source tube. Deviations from these limits shall be approved by the base medical service. Personnel working with or near this source tube shall become familiar with the procedures in T.O. 00-110N-11.

9-14.1. Removal. (Figure 9-8.)

a. Extend arresting gear (T.O. 1A-7D-2-7).



1. Locking bolt
2. Locking plate
3. Valve operating bolt
4. Bolt
5. Locking plate
6. Capnut
7. Filter cap
8. Bypass valve
9. Primary filter element
10. Packing
11. Packing
12. Packing
13. Packing
14. Snapring
15. Secondary filter element



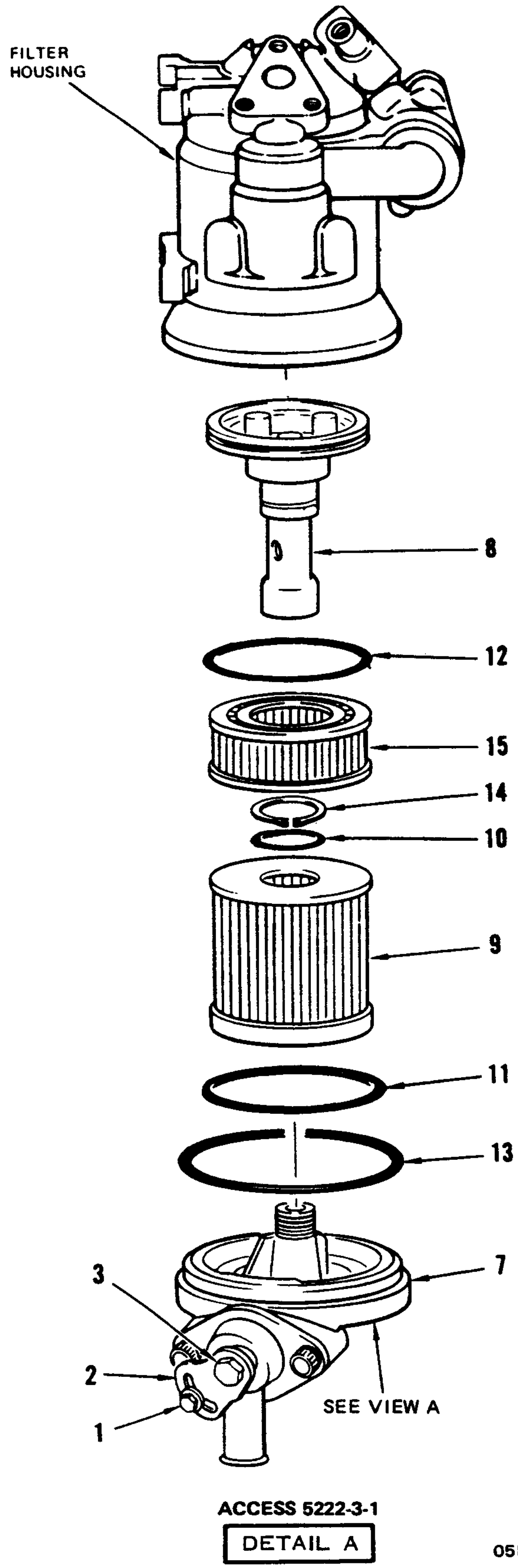


Figure 9-8. Removal and Installation; Oil Filter Element

b. Open access 5222-3-1.

c. Loosen locking bolt (1) and disengage locking plate (2).

d. Turn valve operating bolt (3) counterclockwise to open drain valve. Let filter drain.

e. Loosen bolt (4) and disengage locking plate (5).

f. Loosen capnut (6) and remove filter cap (7).

g. Remove bypass valve (8).

h. Remove primary filter element (9) and packings (10 and 11).

i. Remove packings (12 and 13).

j. If cleaning is required, remove snapring (14) and secondary filter element (15). Send secondary filter element to field maintenance for ultrasonic cleaning.

WARNING

Solvent P-D-680, Type II, is toxic to skin, eyes, and respiratory tract. Use in a well-ventilated area. Avoid prolonged breathing of vapors. Avoid eye and repeated skin contact. Keep away from sparks and flames.

k. Clean filter cap and inside of filter housing with P-D-680, Type II, drycleaning solvent.

9-14.2. Installation. (Figure 9-8.)

a. If secondary filter element (15) has been removed, place clean element on bypass valve (8) and secure with snapring (14).

b. Place new packing (13) on filter cap (7).

c. Place new packing (12) on bypass valve.

d. Place new packings (11 and 10) on primary filter element.

e. Oil packing (11) with MIL-L-7808 or MIL-L-23699 engine oil.

f. Place primary filter element on filter cap. Press down until packing (11) is engaged and element is fully bottomed. Use care to avoid cutting packing.

g. Insert bypass valve (8) through primary filter element and thread onto cap finger-tight.

h. Oil packing (12) with MIL-L-7808 or MIL-L-23699 engine oil.

i. Insert filter element assembly in filter housing, align locating pin in filter cap with slot in housing, and secure with capnut (6).

j. Tighten capnut to 100 inch-pounds torque.

k. Place locking plate (5) over capnut and tighten bolt (4).

NOTE

With required torque applied, the head of valve operating bolt will not contact drain valve housing.

l. Tighten valve operating bolt (3) to 5 to 15 inch-pounds torque.

m. Place locking plate (2) over valve operating bolt and secure with locking bolt (1).

n. Service oil tank (T.O. 1A-7D-2-1).

o. Perform oil system operational checkout (paragraph 9-4) and check installation for leaks.

p. Close access 5222-3-1.

q. Retract arresting gear (T.O. 1A-7D-2-7).

9-15. FUEL-COOLED OIL COOLER REMOVAL AND INSTALLATION.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
	GGG-W-686	Torque wrench, 0 to 15 inch-pounds	Measure torque

WARNING

Avoid radiation contamination by adhering to the following exposure limits. For physical contact with the oil tank source tube, maximum safe exposure time is 15 minutes at one time or a total of 20 minutes per week. At a distance of 12 inches from the source tube, maximum time is 3.3 hours per week. There is no exposure time limit 3 feet from source tube. Deviations from these limits shall be approved by the base medical service. Personnel working with or near this source tube shall become familiar with the procedures in T.O 00-110N-11.

CAUTION

To prevent damage to tubes and reduce possible leakage, observe precautions (paragraph 1-18) when working with fuel, oil, or air tubing.

9-15.1. Removal. (Figure 9-9.)

a. Remove engine removal door (T.O. 1A-7D-2-1).

b. Make sure fuel master lever is in OFF.

c. Loosen locking bolt (1) and disengage locking plate (2).

d. Turn valve operating bolt (3) counterclockwise to open drain valve. Let filter drain.

e. Remove bolts (4) and lockwashers (5), disconnect clamp, and remove tube (6) and packings (7).

f. Cut lockwire and disconnect oil tube (8).

g. Remove tube (9).

h. Remove bolts (10), lockwashers (11), bracket (12), tube assembly (13), retainer (14), and packings (15).

i. Remove bolts (16), lockwashers (17), and washers (18) securing fuel filter (19).

j. Remove bolts (20) and lockwashers (21) securing tube (22).

k. Remove bolts (23), lockwashers (24), washers (25), and fuel-cooled oil cooler (26).

l. Remove packings (27 and 28) and retainer (29).

9-15.2. Installation. (Figure 9-9.)

a. Place new retainer (29) and packing (28) in fuel filter (19).

b. Place new packing (27) on tube (22).

c. Place fuel-cooled oil cooler (26) in position. Secure with washers (25), lockwashers (24), and bolts (23).

d. Secure tube (22) to cooler with lockwashers (21) and bolts (20).

e. Secure fuel filter (19) to cooler with washers (18), lockwashers (17), and bolts (16).

f. Using new packings (15) and retainer (14), install tube assembly (13) and bracket (12) and secure with lockwashers (11) and bolts (10).

g. Install tube (9).

h. Connect oil tube (8). Secure with MS20995C32 lockwire.

i. Using new packings (7), install tube (6) with lockwashers (5) and bolts (4). Connect clamp.

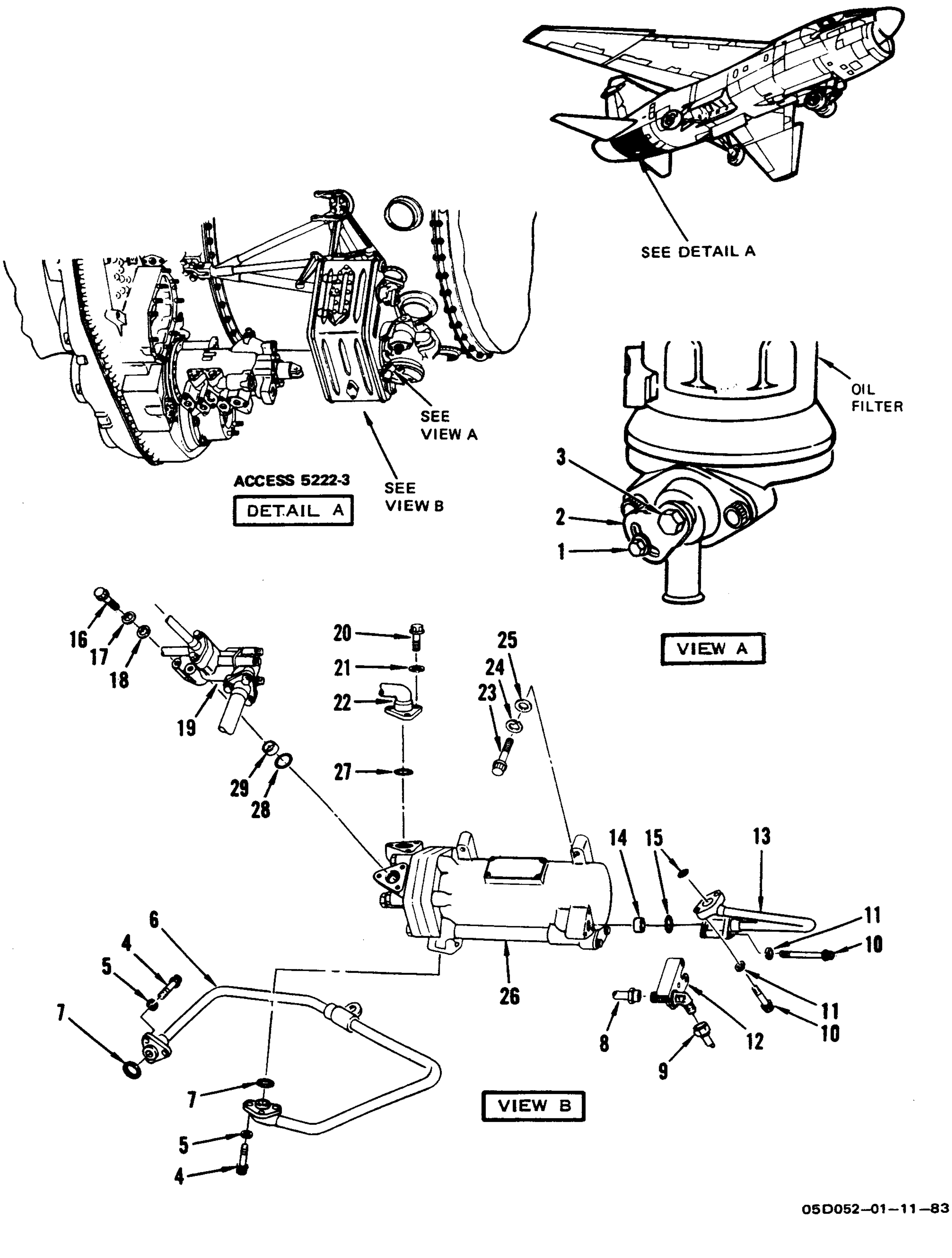


Figure 9-9. Removal and Installation; Fuel-Cooled Oil Cooler (Sheet 1 of 2)

1. Locking bolt	11. Lockwasher	21. Lockwasher
2. Locking plate	12. Bracket	22. Tube
3. Valve operating bolt	13. Tube assembly	23. Bolt
4. Bolt	14. Retainer	24. Lockwasher
5. Lockwasher	15. Packing	25. Washer
6. Tube	16. Bolt	26. Fuel-cooled oil cooler
7. Packing	17. Lockwasher	27. Packing
8. Oil tube	18. Washer	28. Packing
9. Tube	19. Fuel filter	29. Retainer
10. Bolt	20. Bolt	

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Figure 9-9. Removal and Installation; Fuel-Cooled Oil Cooler (Sheet 2)

NOTE

With required torque applied, the head of valve operating bolt will not contact drain valve housing.

j. Tighten valve operating bolt (3) to 5 to 15 inch-pounds torque.

k. Place locking plate (2) over valve operating bolt and secure with locking bolt (1).

l. Service oil tank (T.O. 1A-7D-2-1).

m. Bleed engine fuel system (paragraph 5-19).

n. Perform oil system operational checkout (paragraph 9-4) and check installation for leaks.

o. Install engine removal door (T.O. 1A-7D-2-1).

9-16. OIL PRESSURE REGULATING VALVE REMOVAL AND INSTALLATION.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
	413-900-020	Torque wrench, 100 to 750 inch-pounds	Measure torque

WARNING

Avoid radiation contamination by adhering to the following exposure limits. For physical contact with the oil tank source tube, maximum safe exposure time is 15 minutes at one time or a total of 20 minutes per week. At a distance of 12 inches from the source tube, maximum time is 3.3 hours per week. There is no exposure time limit 3 feet from source tube. Deviations from these limits shall be approved by the base medical service. Personnel working with or near this source tube shall become familiar with the procedures in T.O. 00-110N-11.

CAUTION

To prevent damage to tubes and reduce possible leakage, observe precautions (paragraph 1-18) when working with fuel, oil, or air tubing.

9-16.1. Removal. (Figure 9-10.)

a. Remove engine removal door (T.O. 1A-7D-2-1).

b. Remove bolts (1), lockwashers (2), oil tube (3), and packings (4).

c. Remove bolts (5), lockwashers (6), oil pressure regulating valve (7), packing (8), piston (9), and piston guide (10).

9-16.2. Cleaning. (Figure 9-10.)

WARNING

Solvent P-D-680, Type II, is toxic to skin, eyes, and respiratory tract. Use in a well-ventilated area. Avoid prolonged breathing of vapors. Avoid eye and repeated skin contact. Keep away from sparks and flames. Use approved personal protective equipment (goggles/face shield) when using compressed air. Air pressure is restricted to less than 30 psi. Do not direct air stream towards self or other personnel.

a. Clean regulating valve with P-D-680, Type II, drycleaning solvent. Dry with clean, dry shop air.

b. Check piston (9) and piston guide (10) for nicks. Raised metal or nicks may be honed from piston or piston guide.

9-16.3. Installation. (Figure 9-10.)

a. Apply a light coat of MIL-L-7808 or MIL-L-23699 oil on threads of piston guide (10).

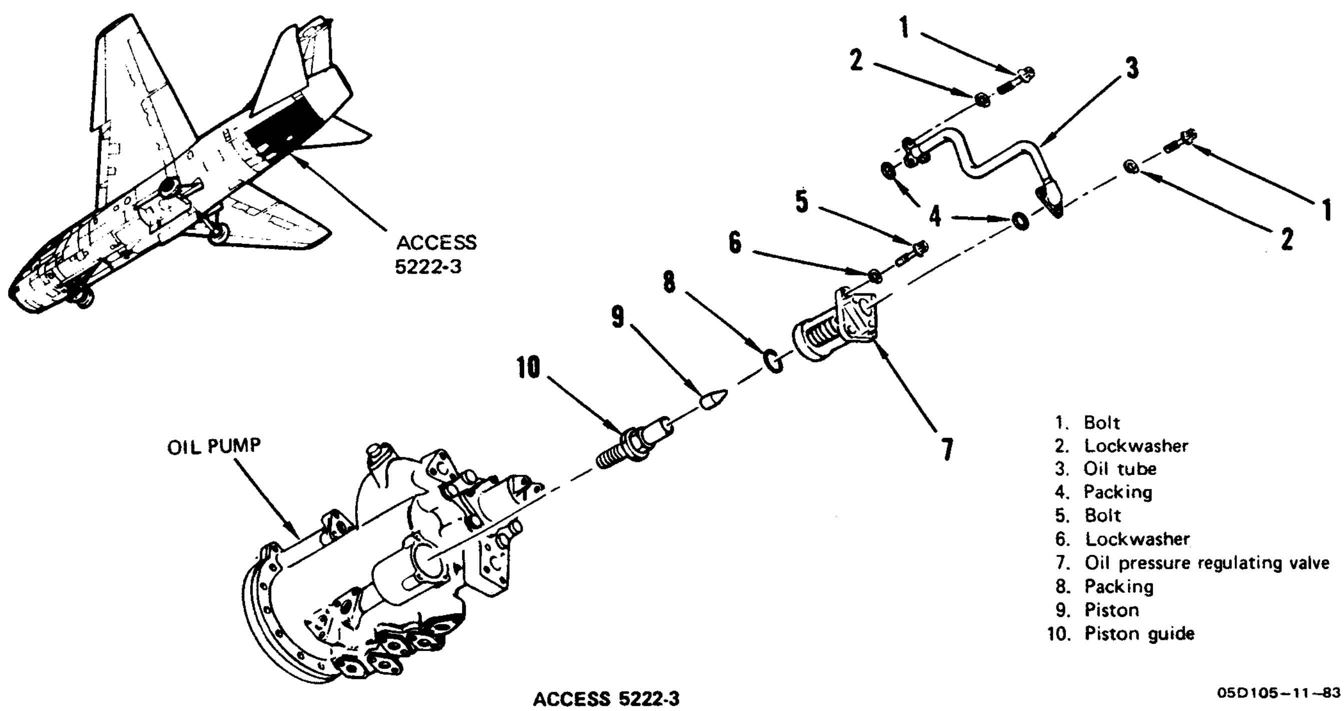


Figure 9-10. Removal and Installation; Oil Pressure Regulating Valve

b. Install piston guide in oil pump and tighten to 200 inch-pounds torque.

c. Install piston (9) in piston guide.

d. Using new packing (8), install oil pressure regulating valve (7) in oil pump and secure with lockwashers (6) and bolts (5).

e. Using new packings (4), install oil tube (3) and secure with lockwashers (2) and bolts (1).

f. Service oil tank (T.O. 1A-7D-2-1).

g. Perform oil system operational checkout (paragraph 9-4) and check installation for leaks.

h. Install engine removal door (T.O. 1A-7D-2-1).

9-17. OIL PRESSURE RELIEF VALVE REMOVAL AND INSTALLATION.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
		Equipment required for engine operation	Operate engine

WARNING

Avoid radiation contamination by adhering to the following exposure limits.

For physical contact with the oil tank source tube, maximum safe exposure time is 15 minutes at one time or a total of 20 minutes per week. At a distance of 12 inches from the source tube, maximum time is 3.3 hours per week. There is no exposure time limit 3 feet from the source tube. Deviations from these limits shall be approved by the base medical service. Personnel working with or near this source tube shall become familiar with the procedures in T.O. 00-110N-11.

9-17.1. Removal. (Figure 9-11.)

a. Remove engine removal door (T.O. 1A-7D-2-1).

b. Remove bolts (1), lockwashers (2), oil pressure relief valve cover (3), and packing (4).

c. Remove bolts (5), lockwashers (6), oil pressure relief valve (7), and packing (8).

9-17.2. Installation. (Figure 9-11.)

a. Using new packing (8), install oil pressure relief valve (7) and secure with lockwashers (6) and bolts (5).

b. Using new packing (4), install oil pressure relief valve cover with flat side of triangular casting toward bottom of pump and secure with lockwashers (2) and bolts (1).

c. Perform oil system operational checkout (paragraph 9-4) and check installation for leaks.

d. Install engine removal door (T.O. 1A-7D-2-1).

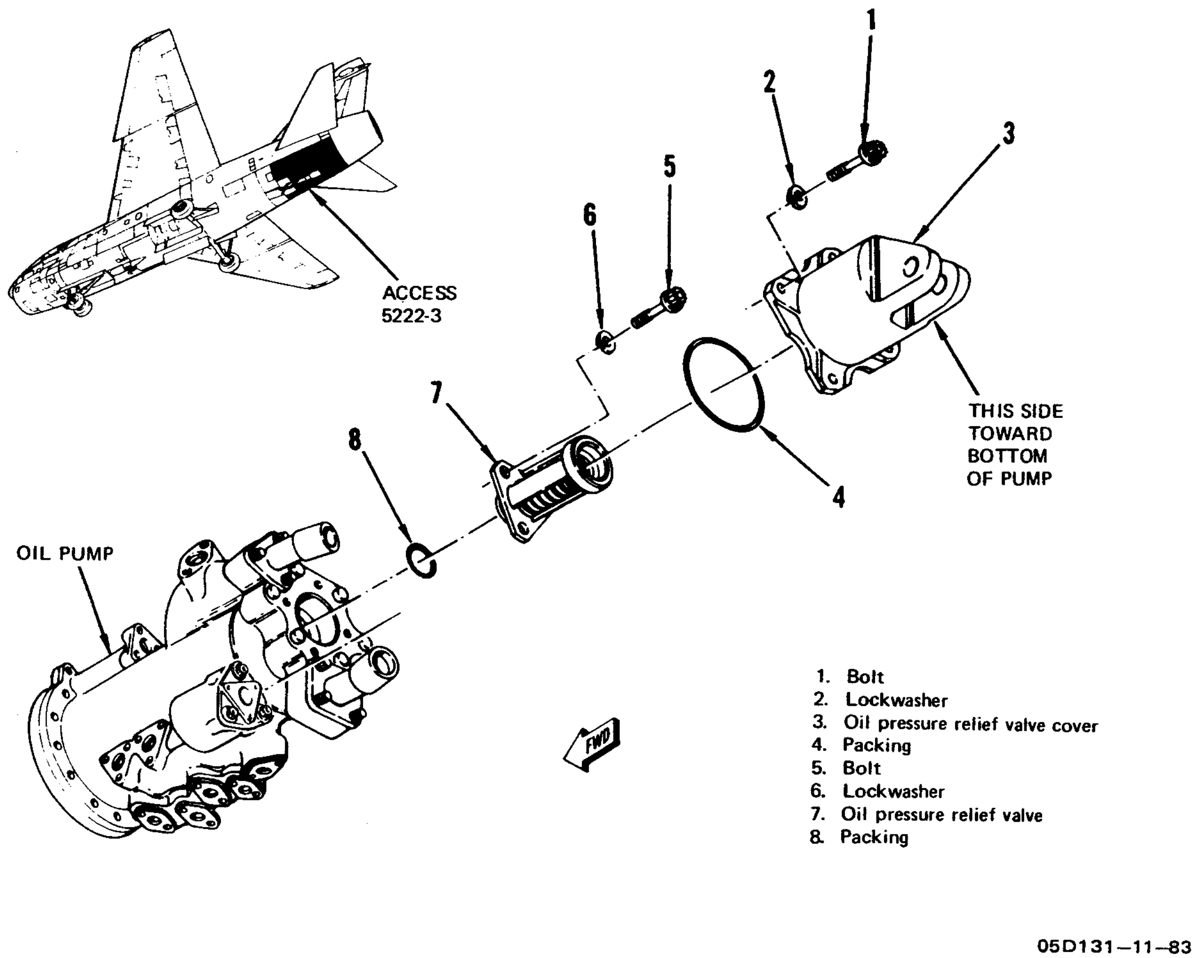


Figure 9-11. Removal and Installation; Oil Pressure Relief Valve

9-18. OIL PUMP REMOVAL AND INSTALLATION.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
		Equipment required for engine operation	Operate engine

WARNING

Avoid radiation contamination by adhering to the following exposure limits. For physical contact with the oil tank source tube, maximum safe exposure time is 15 minutes at one time or a total of 20 minutes per week. At a distance of 12 inches from the source tube, maximum time is 3.3 hours per week. There is no exposure time limit 3 feet from the source tube. Deviations from these limits shall be approved by the base medical service. Personnel working with or near this source tube shall become familiar with the procedures in T.O. 00-110N-11.

CAUTION

To prevent damage to tubes and reduce possible leakage, observe precautions (paragraph 1-18) when working with fuel, oil, or air tubing.

9-18.1. Removal. (Figure 9-12.)

a. Remove engine removal door (T.O. 1A-7D-2-1).

NOTE

The following procedure may be performed with the jet fuel turbine starter installed or removed.

b. If desired, remove jet fuel turbine starter (paragraph 8-13).

c. Remove bolts (1), self-locking nuts (2), bracket (3), drain plug (4), and packing (5). Let oil tank drain.

d. Disconnect electrical connector from cold start thermal bulb.

e. Disconnect electrical connectors from high pressure fuel pump switches.

e1. On engines after T.O. 2J-TF41-643, disconnect terminal from remote probe attachment on magnetic chip detector.

f. Remove scavenge oil tube as follows:

(1) Remove self-locking nut (6), washers (7), and bolt (8) from clamp.

(2) Remove bolt (9), washer (10), and lockwasher (11) from clamp.

(3) Remove bolts (12) and lockwashers (13).

(4) Cut lockwire, loosen coupling nut, and remove scavenge oil tube (14). Remove packing (15).

g. Remove oil-tank-to-oil-pump tubes as follows:

(1) Remove two bolts (16) securing oil quantity detector unit clamps to bracket.

(2) Remove bolts (17), washers (18), and lockwashers (19).

(3) Remove connector (20) and tube (21).

(4) Remove packings (22 and 23) and packing retainer (24).

(5) Remove bolts (25), washer (26), and lockwasher (27).

(6) Remove connector (28) and tube (29).

(7) Remove packings (30 and 31) and packing retainer (32).

(8) Remove bolts (33), washers (34), and lockwashers (35).

(9) Remove bolts (36) and lockwashers (37).

(10) Remove connector (38) and oil tube (39).

(11) Remove packings (40, 41, and 42) and packing retainer (43).

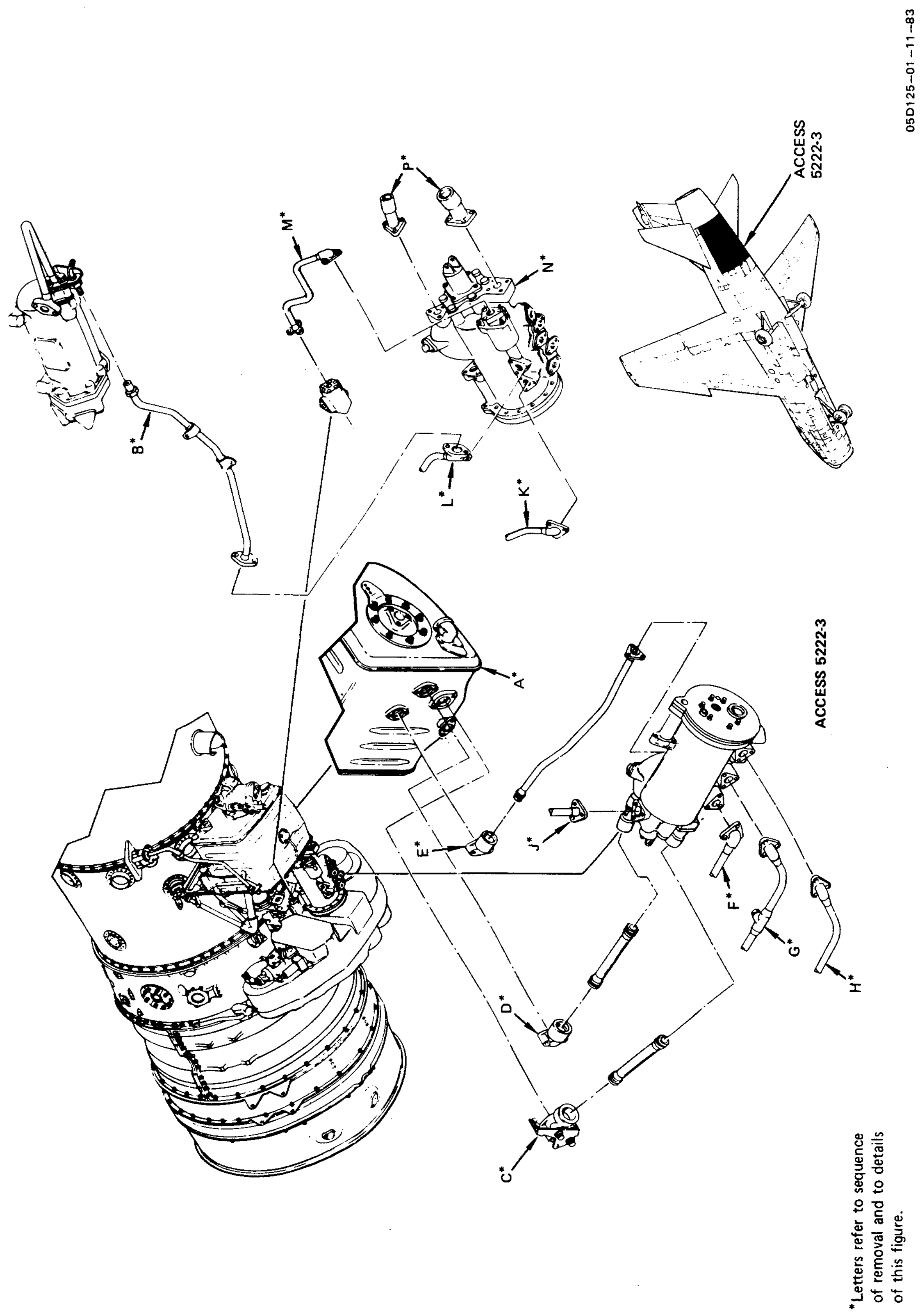


Figure 9-12. Removal and Installation; Oil Pump (Sheet 1 of 4)

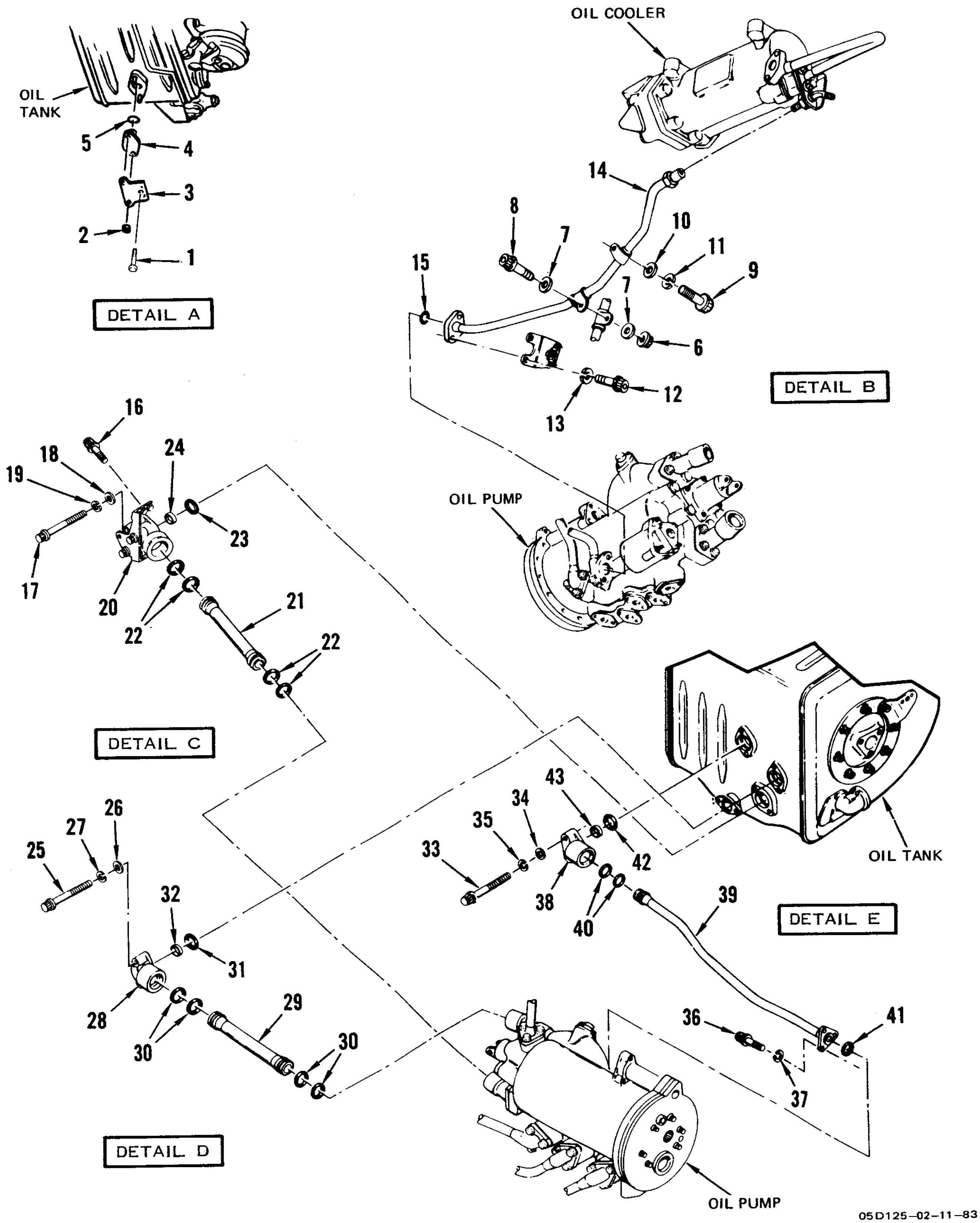


Figure 9-12. Removal and Installation; Oil Pump (Sheet 2)

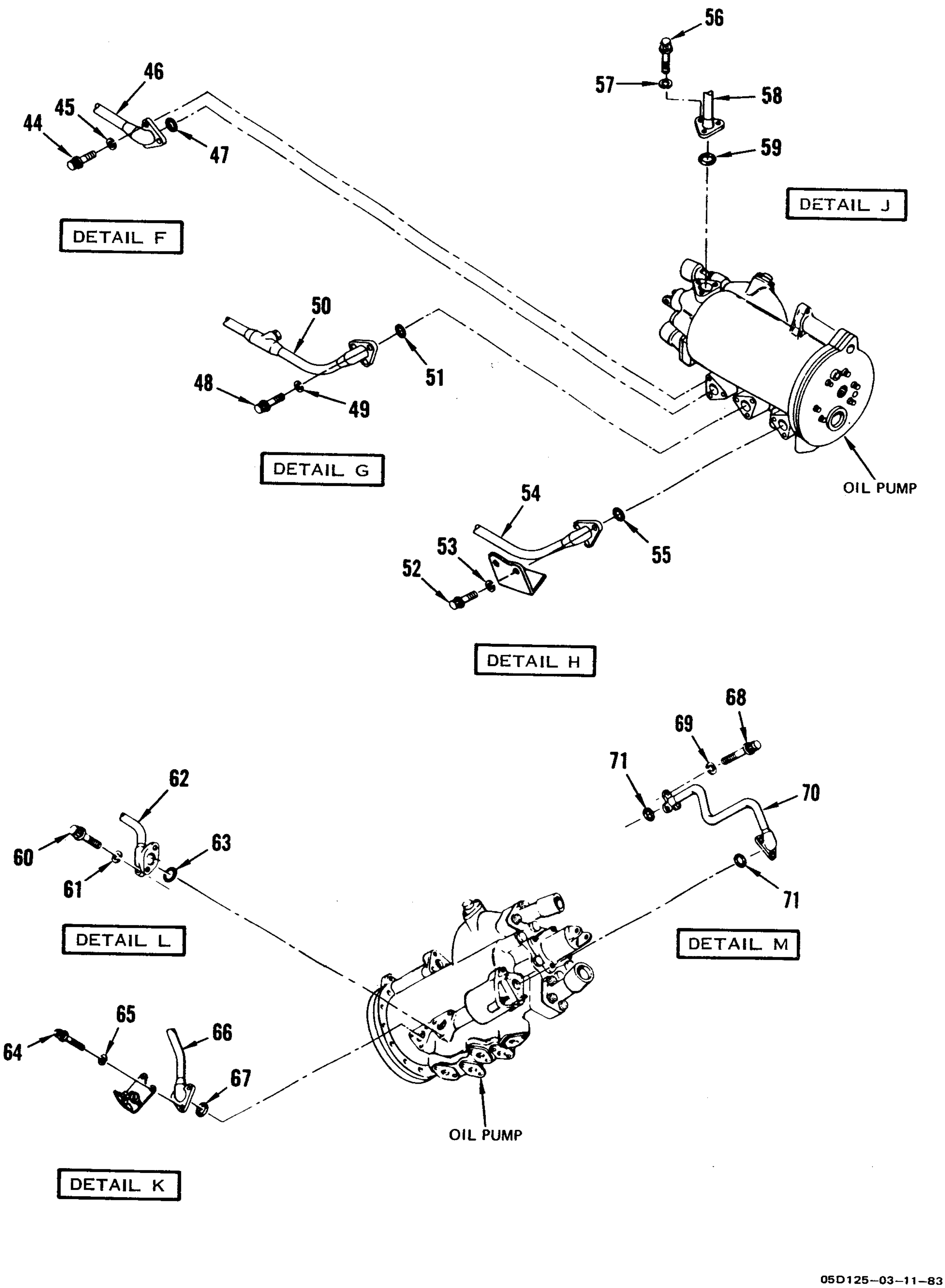
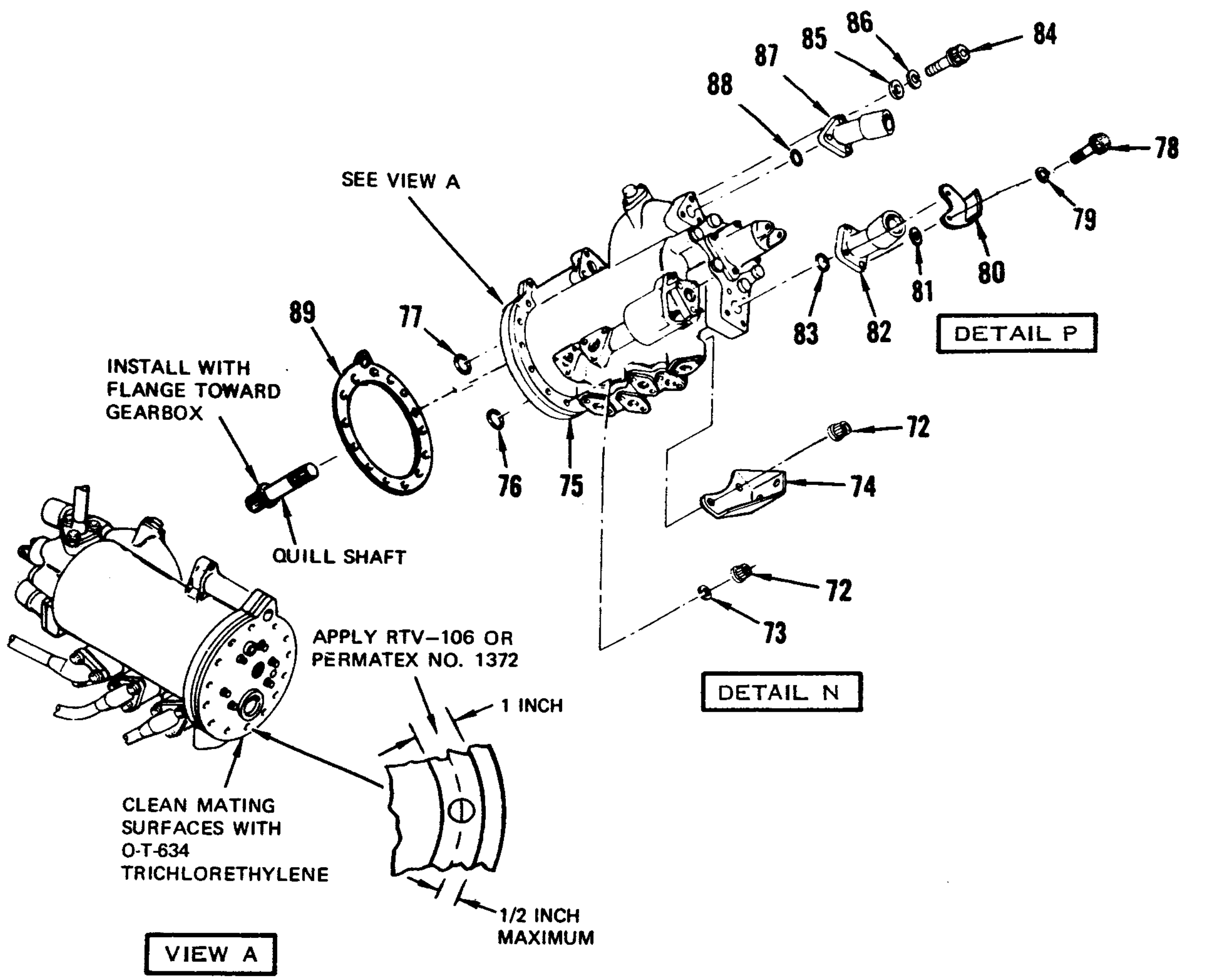


Figure 9-12. Removal and Installation; Oil Pump (Sheet 3)



1. Bolt
2. Self-locking nut
3. Bracket
4. Drain plug
5. Packing
6. Self-locking nut
7. Washer
8. Bolt
9. Bolt
10. Washer
11. Lockwasher
12. Bolt
13. Lockwasher
14. Scavenge oil tube
15. Packing
16. Bolt
17. Bolt
18. Washer
19. Lockwasher
20. Connector
21. Tube
22. Packing
23. Packing
24. Packing retainer
25. Bolt
26. Washer
27. Lockwasher
28. Connector
29. Tube
30. Packing
31. Packing
32. Packing retainer
33. Bolt
34. Washer
35. Lockwasher
36. Bolt
37. Lockwasher
38. Connector
39. Tube
40. Packing
41. Packing
42. Packing
43. Packing retainer
44. Bolt
45. Lockwasher
46. Tube
47. Packing
48. Bolt
49. Lockwasher
50. Tube
51. Packing
52. Bolt
53. Lockwasher
54. Tube
55. Packing
56. Bolt
57. Lockwasher
58. Tube
59. Packing
60. Bolt
61. Lockwasher
62. Tube
63. Packing
64. Bolt
65. Lockwasher
66. Tube
67. Packing
68. Bolt
69. Lockwasher
70. Tube
71. Packing
72. Self-locking nut
73. Countersunk washer
74. Bracket
75. Oil pump
76. Packing
77. Packing
78. Bolt
79. Lockwasher
80. Bracket
81. Washer
82. Inlet connector
83. Packing
84. Bolt
85. Washer
86. Lockwasher
87. Outlet connector
88. Packing
89. Gasket

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Figure 9-12. Removal and Installation; Oil Pump (Sheet 4)

h. Remove engine to oil pump tubes as follows:

(1) Remove bolts (44) and lockwashers (45).

(2) Disengage tube (46) and remove packing (47).

(3) Remove bolts (48) and lockwashers (49).

(4) Disengage clamps, disengage tube (50), and remove packing (51).

(5) Remove bolts (52) and lockwashers (53).

(6) Disengage tube (54) and remove packing (55).

i. Remove bolts (56) and lockwashers (57).

j. Disengage tube (58) and remove packing (59).

k. Remove bolts (60) and lockwashers (61).

l. Remove tube (62) and remove packings (63).

m. Remove bolts (64) and lockwashers (65).

n. Disengage tube (66) and remove packing (67).

o. Remove bolts (68) and lockwashers (69).

p. Remove oil tube (70) and remove packings (71).

q. Remove oil pump as follows:

(1) Remove self-locking nuts (72) and countersunk washers (73). Remove bracket (74) from oil pump studs. Tie bracket back for clearance to remove pump.

(2) Carefully remove oil pump (75) from gearbox. Oil pump quillshaft may come out when pump is removed. If so, reinstall quillshaft with flange toward gearbox.

(3) Remove packings (76 and 77).

NOTE

Perform step r if a replacement pump is to be installed.

r. Remove connectors from oil pump as follows:

(1) Remove bolts (78) and lockwashers (79).

(2) Remove bracket (80) and washers (81).

(3) Remove inlet connector (82) and packing (83).

(4) Remove bolts (84), washers (85), and lockwashers (86).

(5) Remove scavenge connector (87) and packing (88).

s. Remove gasket (89).

9-18.2. Installation. (Figure 9-12.)

a. Install inlet and outlet connectors on oil pump as follows:

(1) Place packing (88) on scavenge connector (87).

(2) Secure scavenge connector to pump with lockwashers (86), washers (85), and bolts (84).

(3) Place new packing (83) on inlet connector (82).

(4) Install enough washers (81) (up to 10) to provide clearance between bracket (80) and inlet connector (82). Secure bracket and connector with lockwashers (79) and bolts (78).

b. Install oil pump as follows:

WARNING

O-T-634 trichloroethylene is toxic to skin, eyes, and respiratory tract. Eye and skin protection is required. Good general ventilation is normally adequate.

(1) Clean mating surfaces of oil pump and high speed gearbox with O-T-634 trichloroethylene.

(2) Place gasket (89) on gearbox.

NOTE

Sealing compound must not extend more than 1/2 inch on either side of mounting stud centerline.

(3) If gasket is not available, apply 1-inch wide band of RTV-106 or Permatex No. 1372 sealing compound around outer edge of oil pump mating surface and gearbox mating surface. Let dry for 10 minutes.

(4) Apply MIL-L-7808 or MIL-L-23699 oil to pump drive splines and quillshaft splines.

(5) Place new packings (77 and 76) on oil pump (75).

(6) Install high pressure rotor turning adapter (paragraph 4-10).

CAUTION

To prevent damage to engine, make sure quillshaft is installed with flange toward gearbox.

(7) Place oil pump on gearbox. Make sure pump mounting flange engages locating dowels on gearbox mounting pad.

(8) Place bracket (74) in position and secure oil pump and bracket with countersunk washers (73) and self-locking nuts (72).

c. Place new packings (71) on tube (70).

d. Secure tube with lockwashers (69) and bolts (68).

e. Place new packing (67) on tube (66).

f. Secure tube and bracket to pump with lockwashers (65) and bolts (64).

g. Place new packings (63) on tube (62).

h. Secure tube to pump with lockwashers (61) and bolts (60).

i. Place new packing (59) on tube (58).

j. Secure tube to pump with lockwashers (57) and bolts (56).

k. Install engine to oil pump tubes as follows:

(1) Place new packing (55) on tube (54).

(2) Secure tube to pump with lockwashers (53) and bolts (52).

(3) Place new packing (51) on tube (50).

(4) Place tube in position and secure to pump with lockwashers (49) and bolts (48).

(5) Place new packing (47) on tube (46).

(6) Secure tube to pump with lockwashers (45) and bolts (44).

l. Install oil tank to oil pump tubes as follows:

(1) Place new packing retainer (43) and packing (42) in connector (38).

(2) Place new packings (41 and 40) on tube (39).

(3) Place tube and connector in position and secure tube to pump with lockwashers (37) and bolts (36).

(4) Secure connector to tank with lockwashers (35), washers (34), and bolts (33).

(5) Place new packing retainer (32) and packing (31) in connector (28).

(6) Place new packings (30) on tube (29).

(7) Place tube and connector in position and secure to tank with lockwashers (27), washers (26), and bolts (25).

(8) Place new packing retainer (24) and packing (23) in connector (20).

(9) Place new packings (22) on tube (21).

(10) Place tube and connector in position and secure to tank with lockwashers (19), washers (18), and bolts (17).

(11) Secure oil quantity detector unit clamps to bracket with two bolts (16).

m. Install scavenge oil tube as follows:

(1) Place new packing (15) on scavenge oil tube (14).

(2) Place tube in position and secure to elbow with coupling nut. Secure coupling nut with MS20995C32 lockwire.

(3) Secure tube and bracket to pump with lockwashers (13) and bolts (12).

(4) Secure retaining clamp with lockwasher (11), washer (10), and bolt (9).

(5) Secure retaining clamp with bolt (8), washers (7), and self-locking nut (6).

n. Place new packing (5) on drain plug (4).

o. Install drain plug and bracket (3), and secure with self-locking nuts (2).

p. Secure oil quantity detector unit clamp with bolt (1).

p1. On engines after T.O. 2J-TF41-643, connect terminal to remote probe attachment on magnetic chip detector.

q. Connect cold start thermal bulb electrical connector.

r. Connect high pressure fuel pump switches electrical connectors.

s. Install jet fuel turbine starter (paragraph 8-13).

t. Remove high pressure rotor turning adapter (paragraph 4-19).

u. Perform oil system operation checkout (paragraph 9-4).

v. Install engine removal door (T.O. 1A-7D-2-1).

9-19. OIL STRAINER REMOVAL AND INSTALLATION.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
	6798920 (Allison Division of General Motors, Indianapolis, Indiana)	Scavenge oil strainer puller	Remove oil strainer from engine
	GGG-W-686	Torque wrench, 10 to 150 inch-pounds	Measure torque

WARNING

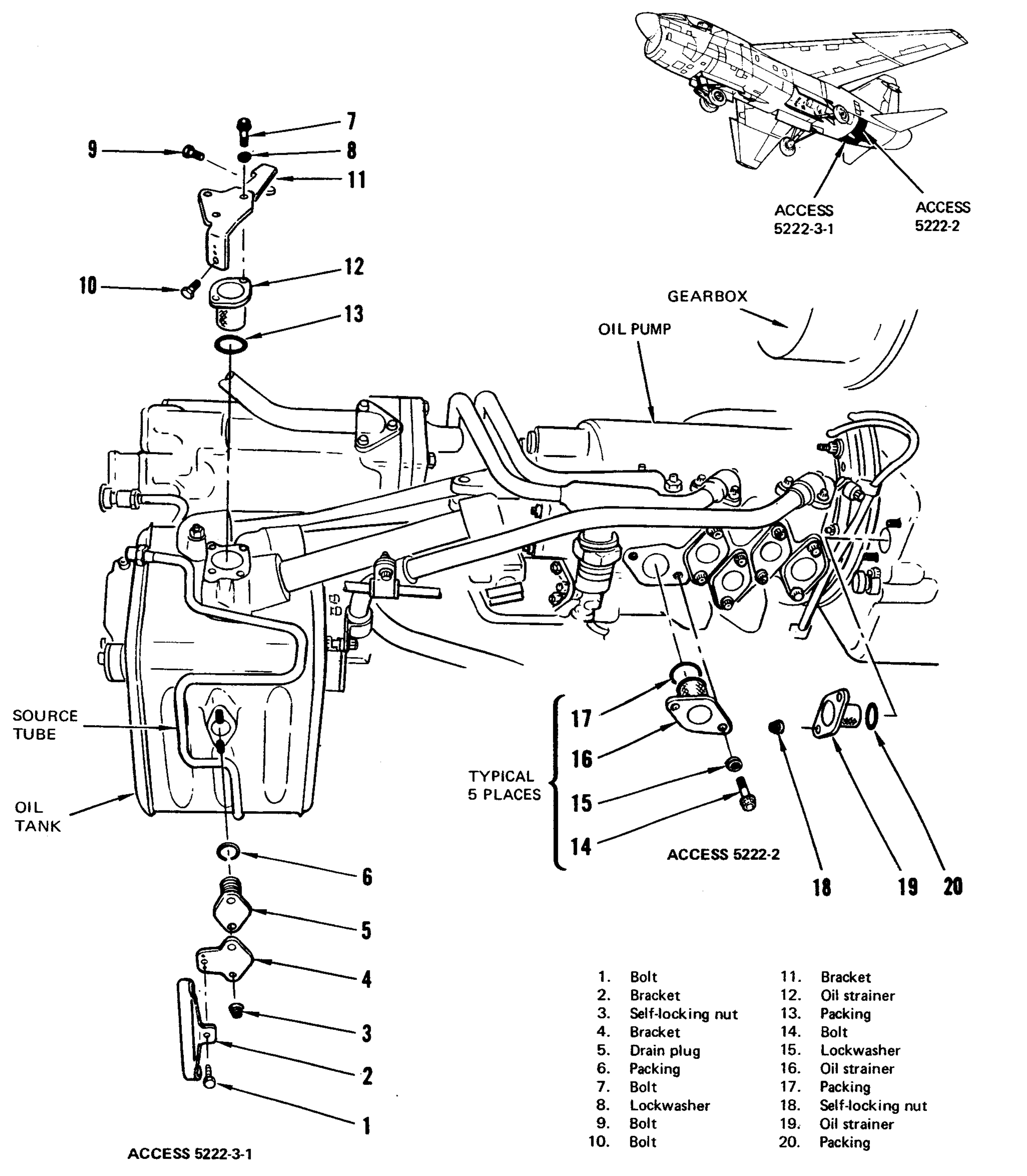
Avoid radiation contamination by adhering to the following exposure limits. For physical contact with the oil tank source tube, maximum safe exposure time is 15 minutes at one time or a total of 20 minutes per week. At a distance of 12 inches from the source tube, maximum time is 3.3 hours per week. There is no exposure time limit 3 feet from the source tube. Deviations from these limits shall be approved by the base medical service. Personnel working with or near this source tube shall become familiar with the procedures in T.O. 00-110N-11.

a. Open accesses 5222-2 and 5222-3-1.

b. Extend arresting gear (T.O. 1A-7D-2-7).

c. Remove and install oil strainers through accesses 5222-2 and 5222-3-1 in sequence shown in figure 9-13, observing the following:

(1) Drain oil tank before removing oil strainer (12) from oil tank.



1. Bolt
2. Bracket
3. Self-locking nut
4. Bracket
5. Drain plug
6. Packing
7. Bolt
8. Lockwasher
9. Bolt
10. Bolt
11. Bracket
12. Oil strainer
13. Packing
14. Bolt
15. Lockwasher
16. Oil strainer
17. Packing
18. Self-locking nut
19. Oil strainer
20. Packing

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Figure 9-13. Removal and Installation; Oil Strainer

WARNING

Solvent P-D-680, Type II, is toxic to skin, eyes, and respiratory tract. Use in a well-ventilated area. Avoid prolonged breathing of vapors. Avoid eye and repeated skin contact. Keep away from sparks and flames.

(2) Clean strainer cavities with lint-free cloth moistened with P-D-680, Type II, drycleaning solvent.

(3) Use new packings (6, 13, 17, and 20) for oil strainer installation.

(4) Use extreme care during installation of bracket (2) to prevent damage to source tube.

(5) Tighten self-locking nuts (3) to 40 (+2, −3) inch-pounds torque.

(6) Following installation, service oil tank (T.O. 1A-7D-2-1).

(7) Following installation, perform oil system operational checkout (paragraph 9-4) and check installation for leaks.

d. Close accesses 5222-3-1 and 5222-2.

e. Retract arresting gear (T.O. 1A-7D-2-7).

9-20. BYPASS DUCT OIL TUBE REMOVAL AND INSTALLATION.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
	413-900-020	Torque wrench, 100 to 750 inch-pounds	Measure torque
	6798382 (Allison Division of General Motors, Indianapolis, Indiana)	Oil and air tube nut wrench	Remove and install oil tube coupling nuts
	or		
	6887853 (Allison Division of General Motors, Indianapolis, Indiana)	Oil and air tube nut wrench	Remove and install oil tube coupling nuts
	6798383 (Allison Division of General Motors, Indianapolis, Indiana)	Oil feed tube nut wrench	Remove and install vibration pickup mount sleeve nut and oil feed tube coupling nut
	or		
	6887852 (Allison Division of General Motors, Indianapolis, Indiana)	Oil feed tube nut wrench	Remove and install vibration pickup mount sleeve nut and oil feed tube coupling nut
	23003633 (Allison Division of General Motors, Indianapolis, Indiana)	Removal tool, cross bypass duct conical seal	Remove used conical seal
	23003632 (Ailison Division of General Motors, Indianapolis, Indiana)	Flare tool, across bypass duct conical seal	Expand tube and seat new conical seals

WARNING

Avoid radiation contamination by adhering to the following exposure limits. For physical contact with the oil tank source tube, maximum safe exposure time is 15 minutes at one time or a total of 20 minutes per week. At a distance of 12 inches from the source tube, maximum time is 3.3 hours per week. There is no exposure time limit 3 feet from source tube. Deviations from these limits shall be approved by the base medical service. Personnel working with or near this source tube shall become familiar with the procedures in T.O. 00-110N-11.

CAUTION

To prevent damage to tubes and reduce possible leakage, observe precautions (paragraph 1-18) when working with fuel, oil, or air tubing.

9-20.1. Removal. Remove bypass duct oil tubes through access 5222-3, observing the following:

a. Remove engine removal door (T.O. 1A-7D-2-1).

b. Remove the LP turbine bearing oil feed and/or scavenge tube (T.O. 2J-TF41-6).

c. Remove conical seal from end of tubes with tool No. 230033683.

9-20.2. Installation. Install bypass duct oil tubes, observing the following:

a. Install new conical seal in end of each tube as follows:

(1) Apply petrolatum to concave portion of conical seal; then insert seal in end of tube.

(2) Grease tapered end of flare tool plunger and conical end of body with petrolatum (tool No. 23003632).

(3) Withdraw plunger by turning screw counterclockwise.

(4) Push seal in place by threading flare tool body into tube coupling nut until snug.

(5) Expand seal by tightening flare tool screw handtight.

NOTE

Do not use wrench to expand seal.

(6) Remove flare tool from tube.

(7) Check that seal is properly seated and secure in end of tube.

b. Install LP turbine bearing oil feed and/or scavenge tube (T.O. 2J-TF41-6).

c. Perform oil system operational checkout (paragraph 9-4) and check installation for leaks.

d. Install engine removal door (T.O. 1A-7D-2-1).

9-21. MAGNETIC CHIP DETECTOR REMOVAL AND INSTALLATION (ENGINES BEFORE T.O. 2J-TF41-643). Remove and install magnetic chip detectors through access 6222-2 in sequence shown in figure 9-14, observing the following:

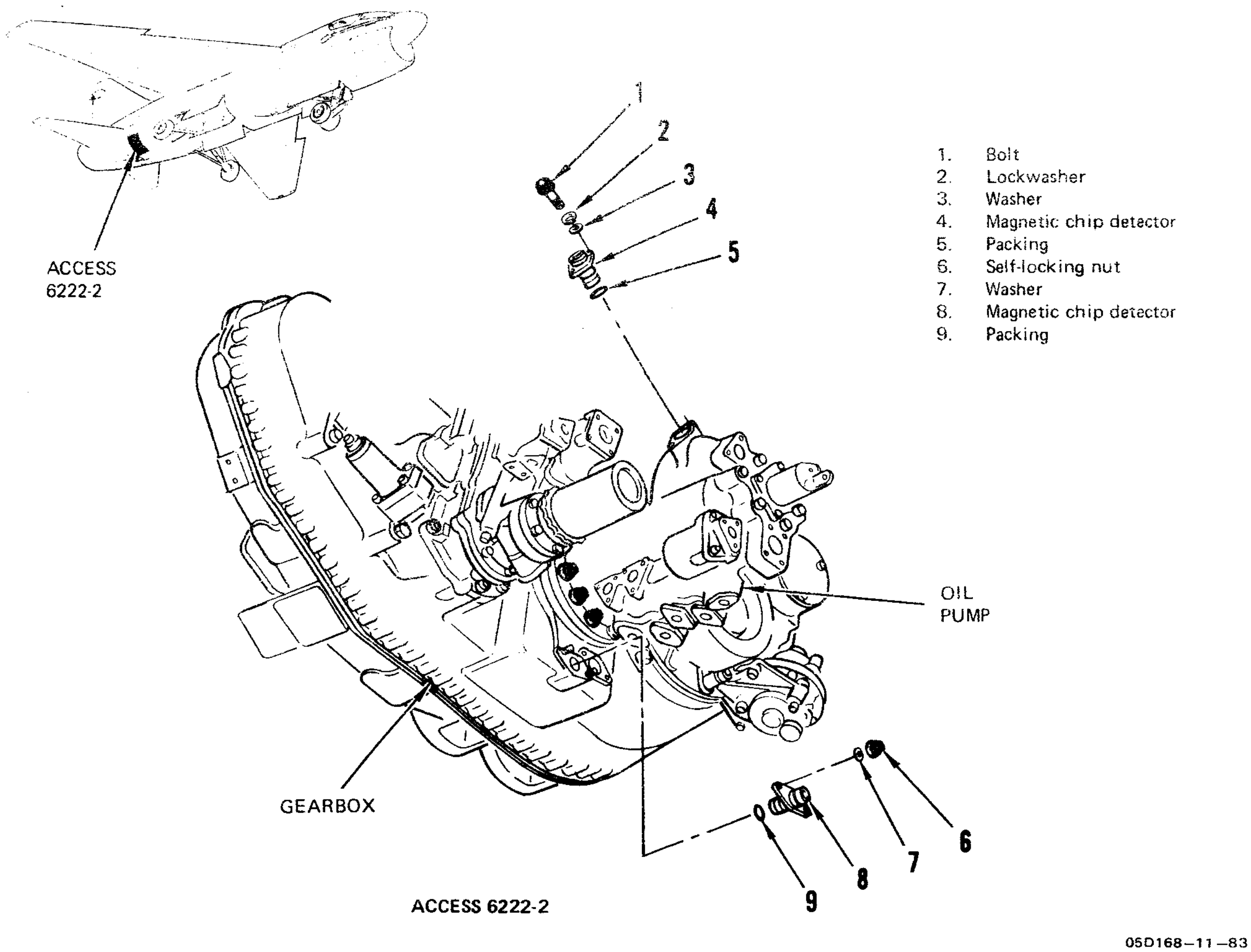
a. Remove washers (2, 3, and 7) before removing chip detectors to prevent washer from adhering to magnet during removal.

b. Use new packings (5 and 9) for installation.

c. Make sure lockwashers (2) are used when installing chip detector in oil pump.

d. Following installation, perform oil system operational checkout (paragraph 9-4) and check installation for leaks.

e. Close access 6222-2.



1. Bolt
2. Lockwasher
3. Washer
4. Magnetic chip detector
5. Packing
6. Self-locking nut
7. Washer
8. Magnetic chip detector
9. Packing

Figure 9-14. Removal and Installation; Magnetic Chip Detector (Engines Before T.O. 2J-TF41-643)

9-21A. MAGNETIC CHIP DETECTOR REMOVAL AND INSTALLATION (ENGINES AFTER T.O. 2J-TF41-643). Remove and install magnetic chip detectors through access 6222-2 in sequence shown in figure 9-14.1, observing the following:

a. Remove washers (5, 6, 14, and 15) before removing chip detectors to prevent washer from adhering to magnet during removal.

b. Inspect and clean probe attachments (7 and 16) as follows:

(1) Thoroughly inspect probe attachment for cracks. Reject attachment if cracks are found.

(2) Check the remote probe spring-loaded center terminal for freedom of movement of the spring guide sleeve in the center stud sleeve guide bore (figure 9-14.2). If sticking of guide sleeve is evident, remove guide sleeve and spring by pulling sleeve out of guide bore to unsnap top spring coil. Thoroughly clean guide sleeve and guide bore. If required, carefully deburr corner edges of guide sleeve and bore. Push guide sleeve and spring into guide bore until top spring coil snaps into groove at top of bore. Recheck for freedom of movement.

(3) Clean remote probe attachments with a dry, lint-free cloth.

c. Use new packings (9 and 18) for installation.

d. Make sure lockwashers (5 and 14) are used when installing chip detectors.

e. Following installation, perform magnetic chip detector continuity check (paragraph 9-9A).

f. Following installation, perform oil system operational checkout (paragraph 9-4) and check installation for leaks.

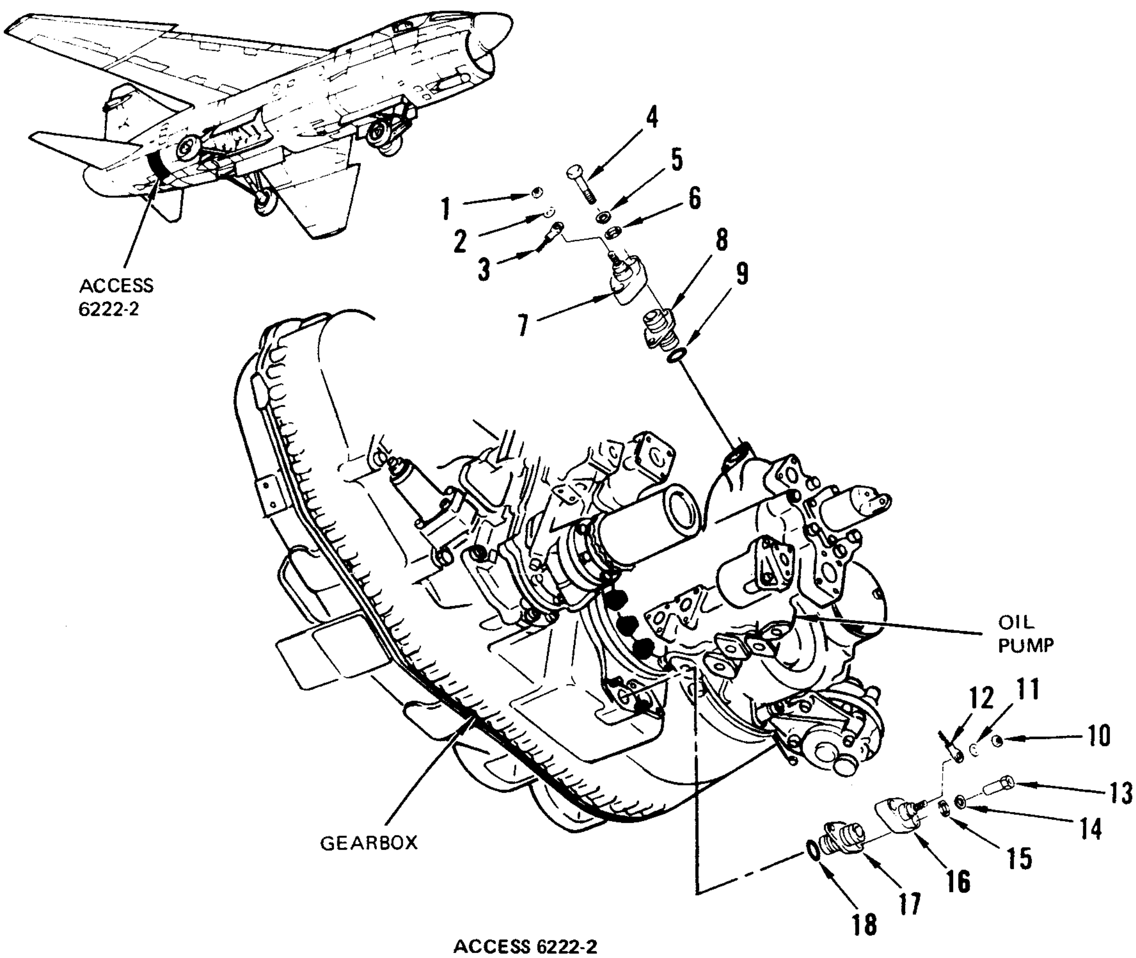
g. Close access 6222-2.

9-22. OIL FILTER POPOUT INDICATOR REMOVAL AND INSTALLATION.

9-22.1. Removal. (Figure 9-15.)

a. Extend arresting gear (T.O. 1A-7D-2-7).

b. Open access 5222-3-1.



1. Self-locking nut
2. Washer
3. Terminal
4. Bolt
5. Lockwasher
6. Washer
7. Remote probe attachment
8. Magnetic chip detector
9. Packing
10. Self-locking nut
11. Washer
12. Terminal
13. Sleeve nut
14. Lockwasher
15. Washer
16. Remote probe attachment
17. Magnetic chip detector
18. Packing

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Figure 9-14.1. Removal and Installation; Magnetic Chip Detector (Engines After T.O. 2J-TF41-643)

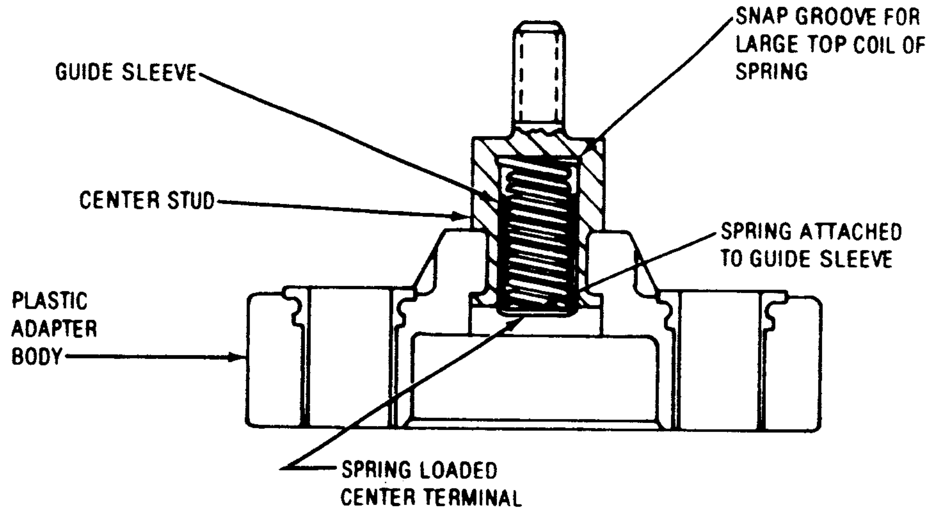

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Figure 9-14.2. Inspection; Remote Probe Attachment (Engines After T.O. 2J-TF41-643)

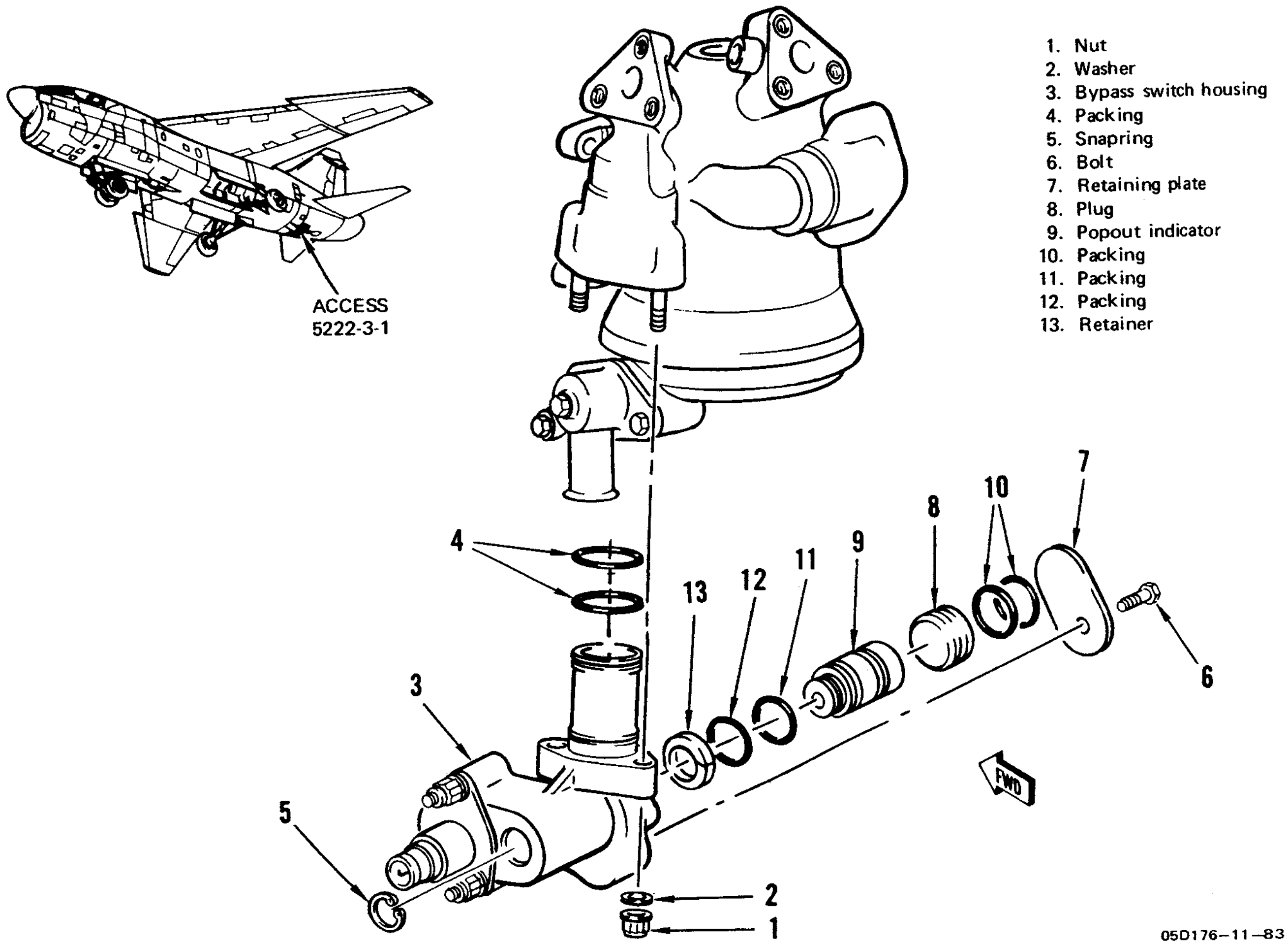


Figure 9-15. Removal and Installation; Oil Filter Popout Indicator

c. Remove oil filter element (paragraph 9-14).

d. Remove nuts (1), washers (2), bypass switch housing (3), and packings (4).

e. Place popout indicator in inverted position (button pointing upward). Push in button to reset.

f. If button remains set, proceed to subparagraph 9-22.2.

g. If button does not remain set, perform the following:

(1) Remove snapring (5), bolt (6), retaining plate (7), plug (8), and popout indicator (9).

(2) Remove packings (10, 11, and 12) and retainer (13).

9-22.2. Installation. (Figure 9-15.)

a. If indicator requires replacement, proceed as follows:

(1) Place retainer (13) and new packings (12 and 11) on popout indicator (9).

(2) Place new packings (10) on plug (8).

(3) Insert popout indicator and plug in bypass switch housing (3) and secure with retaining plate (7), bolt (6), and snapring (5).

b. Place new packings (4) on bypass switch housing (3).

c. Place bypass switch housing in position and secure with washers (2) and nuts (1).

d. Perform oil system operational checkout (paragraph 9-4) and check installation for leaks.

e. Close access 5222-3-1.

f. Retract arresting gear (T.O. 1A-7D-2-7).

9-23. OIL FILTER BYPASS SWITCH SCREEN REMOVAL AND INSTALLATION.

Remove and install oil filter bypass switch screen through access 5222-3-1 in sequence shown in figure 9-16, observing the following:

a. Extend arresting gear (T.O. 1A-7D-2-7).

b. Forward bypass switch screen (5) to field maintenance for ultrasonic cleaning.

WARNING

Solvent P-D-680, Type II, is toxic to skin, eyes, and respiratory tract. Use in a well-ventilated area. Avoid prolonged breathing of vapors. Avoid eye and repeated skin contact. Keep away from sparks and flames.

c. Clean bypass switch housing (3) with P-D-680, Type II, drycleaning solvent.

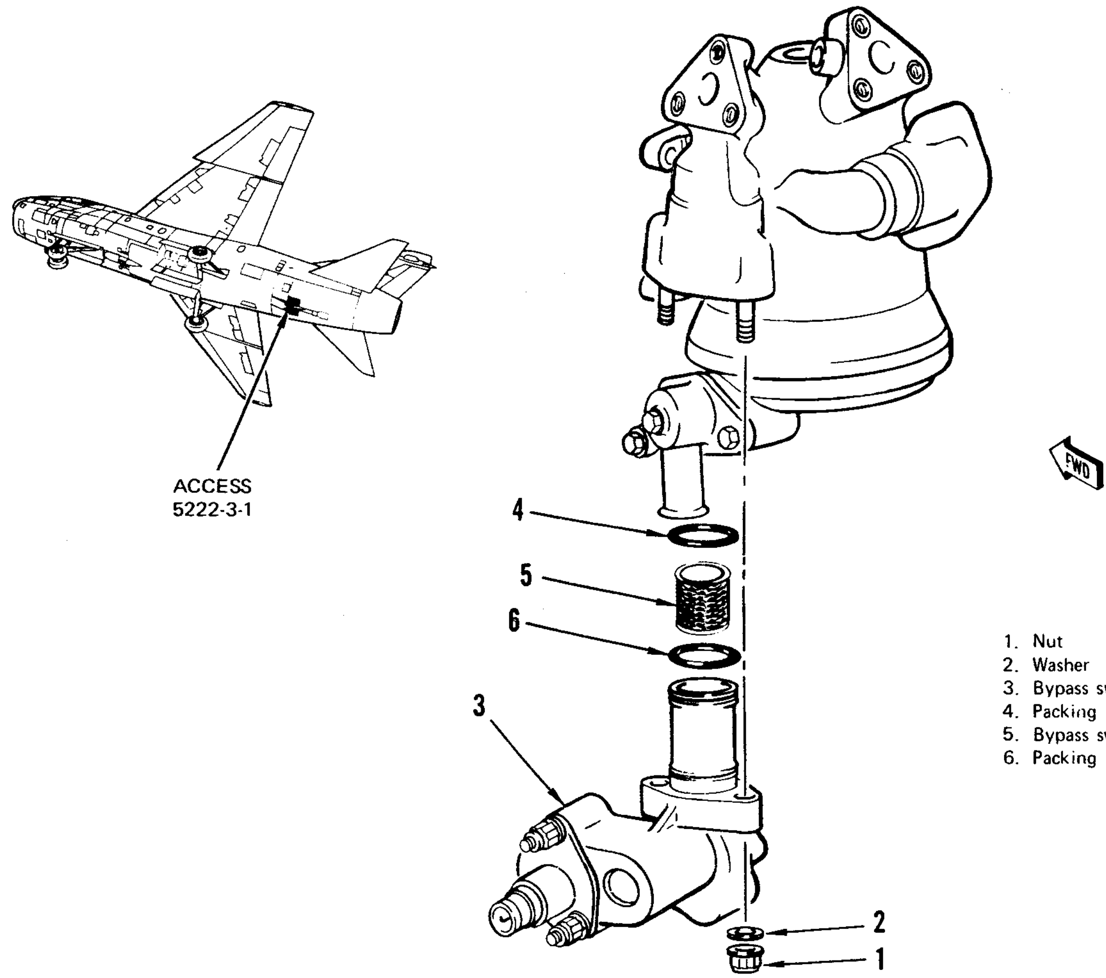
d. Use a strip of thin shim stock to guide bypass switch screen over end of bypass switch housing.

e. Use new packings (4 and 6) for installation.

f. Following screen installation, perform oil system operational checkout (paragraph 9-4) and check installation for leaks.

g. Close access 5222-3-1.

h. Retract arresting gear (T.O. 1A-7D-2-7).



1. Nut
2. Washer
3. Bypass switch housing
4. Packing
5. Bypass switch screen
6. Packing

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Figure 9-16. Removal and Installation; Oil Filter Bypass Switch Screen

9-24. CENTER BEARING SCAVENGE OIL TUBE REMOVAL AND INSTALLATION.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
	6798382 (Allison Division of General Motors, Indianapolis, Indiana)	Oil and air tube nut wrench	Remove and install oil tube coupling nut
	or		
	6887853 (Allison Division of General Motors, Indianapolis, Indiana)	Oil and air tube nut wrench	Remove and install oil tube coupling nut
	413-900-020	Torque wrench, 100 to 750 inch-pounds	Measure torque
	23003633 (Allison Division of General Motors, Indianapolis, Indiana)	Removal tool, conical seal	Remove used conical seal
	23003632 (Allison Division of General Motors, Indianapolis, Indiana)	Flare tool, conical seal	Expand tube and seat new conical seal

WARNING

Avoid radiation contamination by adhering to the following exposure limits. For physical contact with the oil tank source tube, maximum safe exposure time is 15 minutes at one time or a total of 20 minutes per week. At a distance of 12 inches from the source tube, maximum time is 3.3 hours per week. There is no exposure time limit 3 feet from source tube. Deviations from these limits shall be approved by the base medical service. Personnel working with or near this source tube shall become familiar with the procedures in T.O. 00-110N-11.

CAUTION

To prevent damage to tube and reduce possible leakage, observe precautions (paragraph 1-18) when working with fuel, oil, or air tubing.

9-24.1. Removal. Remove center bearing scavenge oil tube through accesses 6222-2 and 5222-3-1 in sequence shown in figure 9-17, observing the following:

a. Extend arresting gear (T.O. 1A-7D-2-7).

b. Remove accesses 5222-3-1 and 6222-2.

c. Remove jet fuel turbine starter (paragraph 8-13).

d. Remove center bearing scavenge oil tube.

e. Remove conical seal from end of tube using tool No. 23003633.

9-24.2. Installation. Install center bearing oil tube, observing the following:

a. Install new conical seal in with end of each tube tool No. 23003632 as follows:

(1) Apply petrolatum to concave portion of conical seal, then insert seal in end of tube.

(2) Grease tapered end of flare tool plunger and conical end of body with petrolatum.

(3) Withdraw plunger by turning screw countercloskwise.

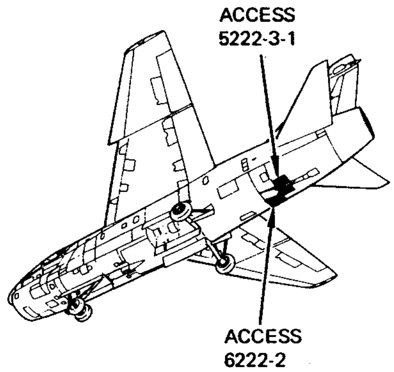
(4) Push seal in place by threading flare tool body into tube coupling nuts until snug.

(5) Expand seal by tightening flare tool screw handtight.

NOTE

Do not use wrench to expand seal.

(6) Remove flare tool from tube.



1. Electrical connector
2. Cold start temperature bulb.
3. Packing
4. Bolt
5. Self-locking nut
6. Washer
7. Washer
8. Bolt
9. Bolt
10. Lockwasher
11. Center bearing scavenge oil tube
12. Packing

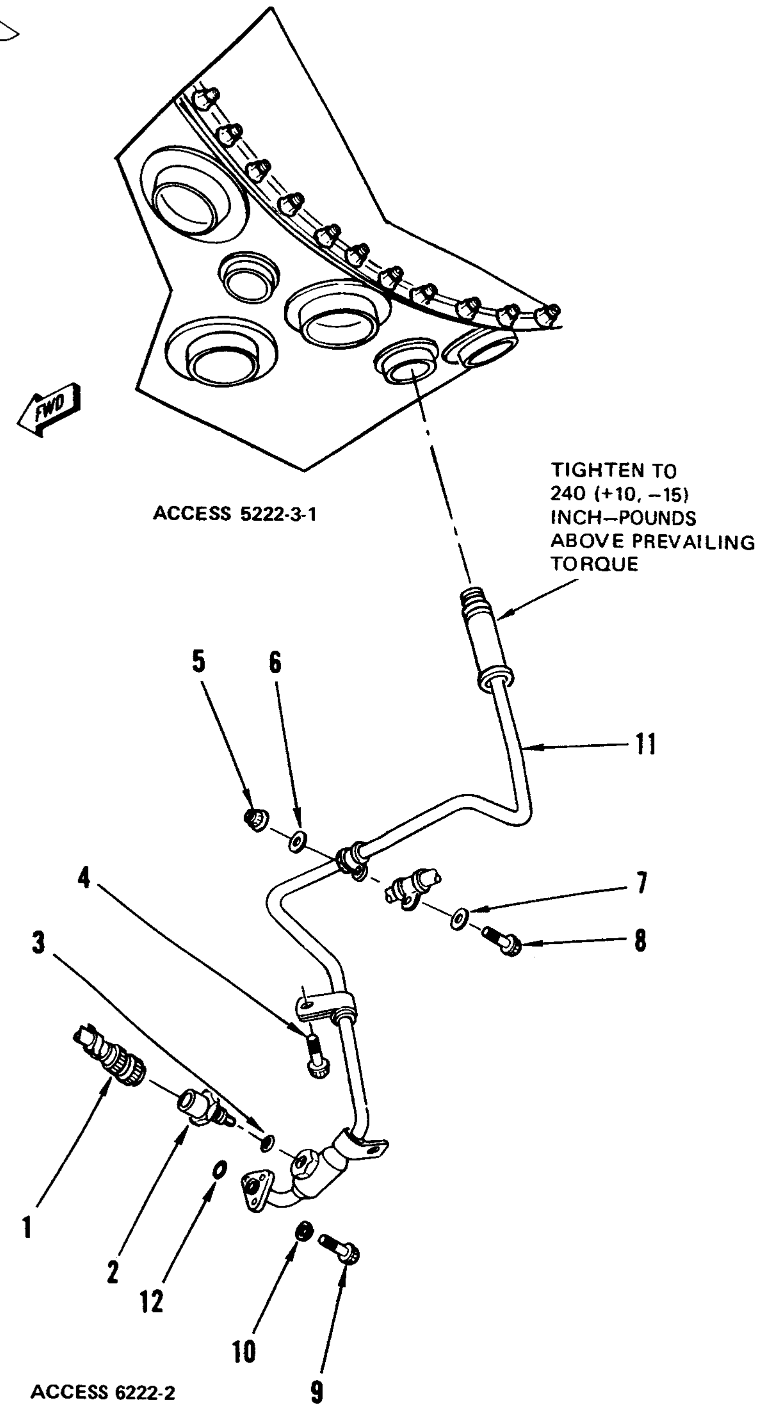


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Figure 9-17. Removal and Installation; Center Bearing Scavenge Oil Tube

(7) Check that seal is properly seated and secure in end of tube.

b. Grease coupling nut with MIL-L-25681 lubricant.

c. Use new packings (3 and 12) for installation.

d. Install tube on engine in reverse order of removal (figure 9-17).

e. Tighten coupling nut to 100 (+10, −15) inch-pounds above prevailing torque.

f. Install jet fuel turbine starter (paragraph 8-13).

g. Perform oil system operational checkout (paragraph 9-4) and check installation for leaks.

h. Close accesses 6222-2 and 5222-3-1.

i. Retract arresting gear (T.O. 1A-7D-2-7).

9-25. ENGINE OIL CONSUMPTION CHECK.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
	GGG-W-686	Torque wrench, 10 to 150 inch-pounds	Indicate torque

NOTE

The following check shall be used to check an engine for excessive oil consumption. Perform check only after external oil leaks have been corrected and if internal leakage of the engine is suspected.

This check must be performed without interruption.

a. Make sure oil tank is serviced to 2-quart low mark or above.

b. Start engine (T.O. 1A-7D-2-1) and operate as follows:

(1) Idle — 3 minutes

(2) 75% rpm — 20 minutes

(3) Idle — 2 minutes

c. Shut down engine (T.O. 1A-7D-2-1) and wait 5 minutes.

CAUTION

Use of tools on sampling drain valve handle will cause damage to drain valve, causing loss of engine oil. Use of tools is prohibited. Use fingers only.

d. Check sight glass and using oil sampling drain valve, drain oil or add oil until level is at about 2-quart low mark.

e. Install oil cap on oil sampling drain valve. Tighten to 75 inch-pounds torque.

f. Measure distance (in millimeters) from 1-pint low mark to bottom of oil meniscus (ie, highest level of convex/concave oil surface), and record.

g. Start engine (T.O. 1A-7D-2-1) and operate as follows:

(1) Idle — 3 minutes

(2) 75% rpm — 20 minutes

(3) Idle — 2 minutes

h. Shut down engine (T.O. 1A-7D-2-1) and wait 5 minutes.

i. Record distance in millimeters from 1-pint low mark to bottom of oil meniscus.

j. If oil level in step i is higher than in step f, repeat steps b through i until oil level in step i is equal to or lower than step f.

k. If oil level in step i is equal to or lower than in step f, continue with the following within 5 to 15 minutes.

l. Start engine (T.O. 1A-7D-2-1) and operate as follows:

   (1) Idle — 3 minutes

   (2) 75% rpm — 20 minutes

   (3) Idle — 2 minutes

m. Shut down engine (T.O. 1A-7D-2-1) and wait 5 minutes.

n. Record distance in millimeters from 1-pint low mark to bottom of oil meniscus.

o. Determine oil level change by substracting oil level recorded in step n from base line limit in step i.

p. Maximum oil consumption limit is 4.5 millimeters. If oil consumption in step o exceeds limit, reject engine for excessive oil use.

q. If oil consumption in step n is within limits, proceed with the following within 5 to 15 minutes.

r. Start engine (T.O. 1A-7D-2-1) and operate as follows:

   (1) Idle — 3 minutes

   (2) 94% rpm — 20 minutes

   (3) Idle — 2 minutes

s. Shut down engine (T.O. 1A-7D-2-1) and wait 5 minutes.

t. Record distance in millimeters from 1-pint low mark to bottom of oil meniscus.

u. Start engine (T.O. 1A-7D-2-1) and operate as follows:

   (1) Idle — 3 minutes

   (2) 94% rpm — 20 minutes

   (3) Idle — 2 minutes

v. Shut down engine (T.O. 1A-7D-2-1) and wait 5 minutes.

w. Record distance in millimeters from 1-pint low mark to bottom of oil meniscus.

x. If oil level in step w is higher than in step t, repeat steps e through w until oil level in step w is equal to or lower than step t.

y. If oil level in step w is equal to or lower than step t, subtract oil level in step w from step t.

z. Maximum oil consumption limit is 4.5 millimeters. If oil consumption in step y exceeds limit, reject engine for excessive oil use.

aa. If oil consumption in step y is within limits, service oil tank and return engine to service.

SECTION X

CONSTANT SPEED DRIVE SYSTEM

10-1. DESCRIPTION. The constant speed drive (CSD) system converts variable high speed gearbox input speeds to a constant output speed of 8,000 (±80) rpm. This constant output speed is used to drive the master ac generator and control generator output frequency to 400 (±4) hertz. A self-contained reservoir within the transmission stores a supply of deaerated oil for system operation and lubrication. A vent valve in the transmission keeps pressure within the transmission to ambient or greater. The system consists of a transmission and transmission oil cooler. For system arrangement, see figure 10-1. For transmission details, refer to table 10-1.

10-2. OPERATION. (Figure FO-25.)

10-2.1. CSD Transmission. The transmission is driven by the engine high speed gearbox. The transmission consists of a differential, variable hydraulic unit, fixed hydraulic unit, and governor. It also has a charge pump, charge relief valve, scavenge pump, and reservoir. The differential is a summing device which adds to or substracts from the input speed to achieve the desired output speed. The variable hydraulic unit functions as a pump to drive the fixed hydraulic unit. The direction of fluid flow will determine the fixed unit direction of rotation.

10-2.1.1. Charge Pump. The charge pump draws oil from the reservoir and supplies it pressurized through a filter to the hydraulic units, governor, and lubrication points. The charge pressure is controlled by the charge relief valve. In the event the filter should become blocked, a differential bypass valve in the filter will open to permit fluid passage. The scavenge pump picks up oil from the sump and pumps it through the oil cooler to the reservoir.

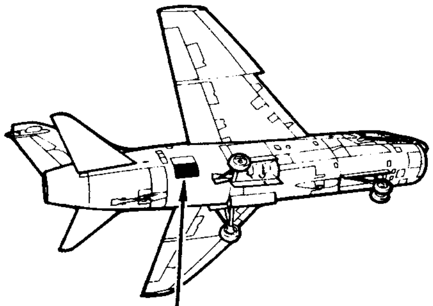
10-2.1.2. Governor. The spring-biased, flyweight-operated governor controls a pilot valve to direct charge oil pressure to the control cylinder. Flyweights are driven by the output gear and operate against bias spring force.

10-2.1.2.1. Overdrive Phase. When the input speed is too low (overdrive phase) to provide the desired output speed, the governor routes charge pressure to the control cylinder. The control cylinder piston actuates to change the angular setting of the variable unit wobbler. The variable unit, acting as a pump, supplies fluid flow to the fixed unit. This will cause the fixed unit to rotate in a direction opposite that of the variable unit. The input ring gear being meshed with the fixed unit will rotate in a direction opposite that of the carrier shaft, thereby adding to the output speed.

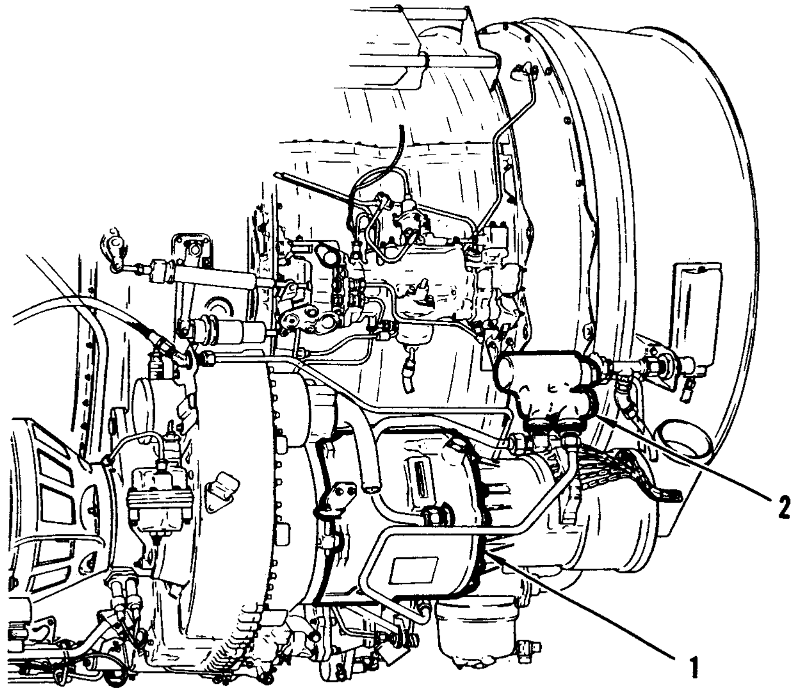
10-2.1.2.2. Straight-Through Phase. When the input speed is enough (straight-through phase) to hold a desired output, the governor will route charge pressure to move the variable wobbler so that the variable unit output is zero. This will cause the fixed unit and input ring gear to stop rotating. The input rotation is then transferred directly through the differential.

10-2.1.2.3. Underdrive Phase. When the input speed is too high (underdrive phase) to give a desired output speed, the governor restricts charge pressure to the control cylinder. This will permit the spring to position the piston, positioning the variable wobbler so that its face is parallel to the face of the fixed wobbler plate. The variable unit, acting as a pump, supplies fluid flow to the fixed unit. This causes the fixed unit to rotate in the same direction as the variable unit. The input ring gear, being in mesh with the fixed hydraulic unit, will rotate in the same direction as the carrier shaft, reducing output speed.

10-2.1.3. Transmission Overtemp. In the event of transmission failure causing oil overtemperature, a disconnect assembly will decouple the transmission. An internal solder ring melts when transmission oil temperature reaches a temperature of 171° to 182°C (340° to 360°F). This allows a spring-loaded piston with a protruding pin to move away from a shaft containing a spring-loaded pawl. When the pin moves away, it releases the pawl against the input shaft, causing the shaft to move away from the input spline shaft. It then disconnects the input spline shaft from the differential.



1. Transmission
2. Transmission oil cooler
3. Transmission oil filter
4. Transmission chip detector



ACCESS 6222-1

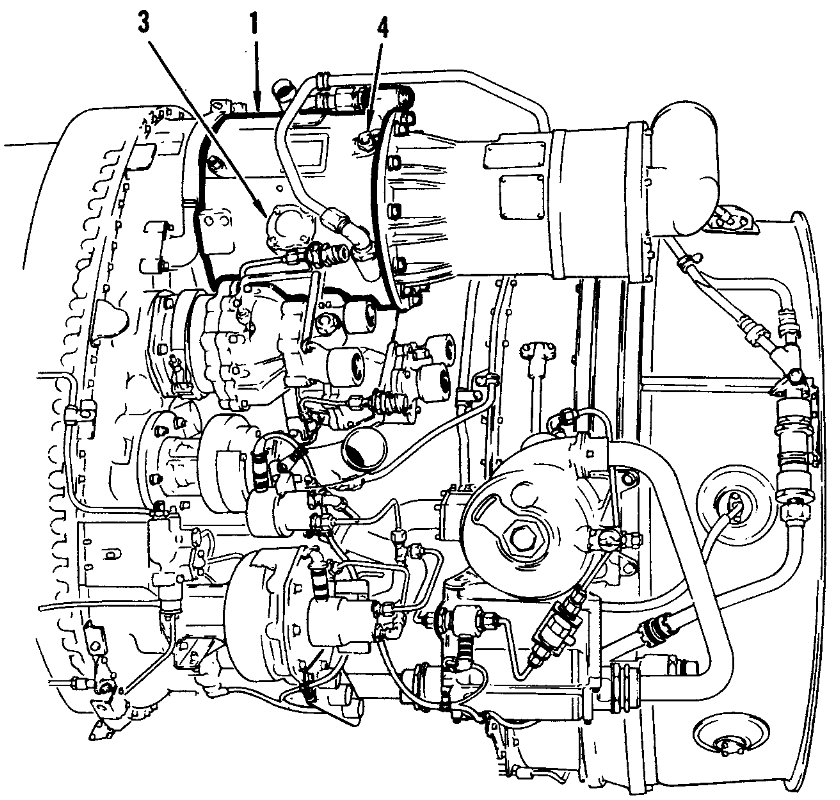


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Figure 10-1. System Arrangement; Constant Speed Drive

10-2.2. Transmission Oil Cooler. The transmission oil cooler receives scavenge oil from the transmission and fuel from the low pressure fuel pump. The scavenge oil is cooled through a heat exchanging action and is returned to the transmission reservoir. If the cooler becomes blocked, a bypass valve opens at a 50 (±10) psi pressure differential so that oil can bypass the cooler and return to the reservoir.

10-3. COMPONENTS. For a list of system components, locations (accesses), and functions, refer to table 10-2.

Table 10-1. Transmission Leading Particulars

Output speed	8,000 (±80) rpm
Input rotation (viewing drive input)	Clockwise
Output rotation (viewing drive output)	Counterclockwise
Output power, continuous rated load	42 horsepower
Oil specification	MIL-L-7808 or MIL-L-23699 (at temperature of −40°F and below use MIL-L-7808)
Input shaft shear section	4,500 to 5,000 inch-pounds
Disconnect actuating temperature	171° to 182°C (340° to 360°F)

Table 10-2. Constant Speed Drive System Components

Component	Access	Function
Cooler, transmission	6222-1	Cools transmission scavenge oil
Transmission	6222-1	Converts variable input speed to constant output speed

10-4. OPERATIONAL CHECKOUT.

Operational checkout of the constant speed drive system is an integral part of the checkout of the ac power supply system. Refer to ac power supply system operational checkout (T.O. 1A-7D-2-11).

10-5. TROUBLESHOOTING.

Troubleshooting of the constant speed drive system is an integral part of the troubleshooting of the ac power supply system. Refer to ac power supply system troubleshooting (T.O. 1A-7D-2-11).

10-6. TRANSMISSION REMOVAL AND INSTALLATION.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
	413-900-020	Torque wrench, 100 to 750 inch-pounds	Measure torque
	215-00303-41	Component handling dolly	Support transmission during removal and installation and provide ground transporta-tion of the transmission
	215-00304-1	Transmission adapter	Adapt and secure transmission to dolly

10-6.1. Removal. (Figure 10-2.)

a. Open access 6222-1.

b. Remove master ac generator (T.O. 1A-7D-2-11).

c. Disconnect drain line (1) and oil cooler lines (2 and 3).

d. Place transmission adapter on component handling dolly and insert pin to lock adapter.

e. Adjust and position dolly and adapter to place adapter plate at forward end of transmission. Secure to transmission with four washers and nuts.

NOTE

If lockbolt does not loosen readily, tap circumference of lug ring with a soft-faced mallet or soft punch and hammer. Self-aligning washer and flat washer should be retained on lockbolt by packing, and need not be removed.

f. Cut lockwire and loosen lockbolt (4).

g. Rotate lug ring counterclockwise by tapping firmly on locking boss until lugs disengage (about 30°).

CAUTION

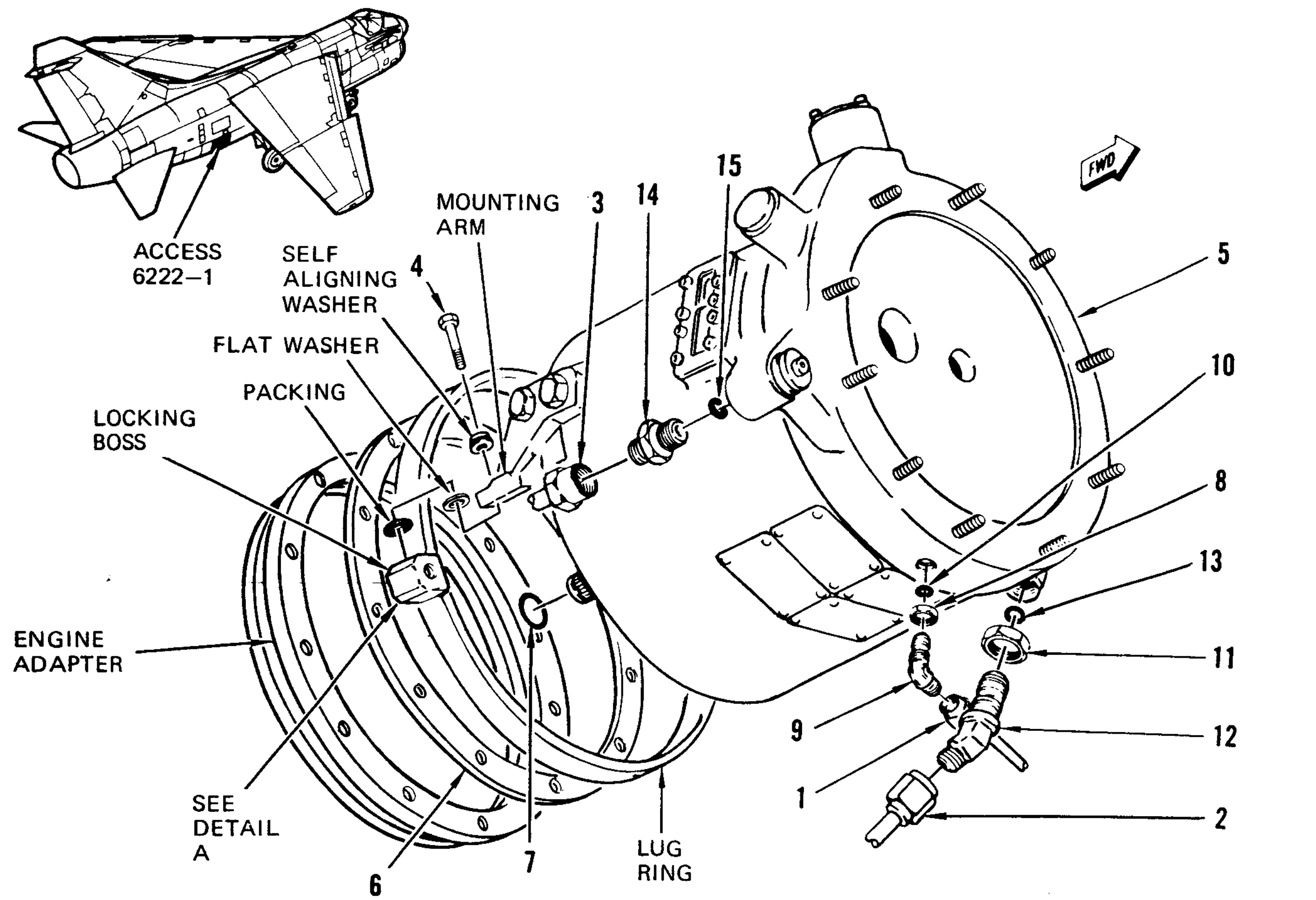
Carbon seals are easily damaged. To prevent damage to seals, do not lift transmission by shaft, do not bump shaft, and do not let weight of transmission rest on shaft.

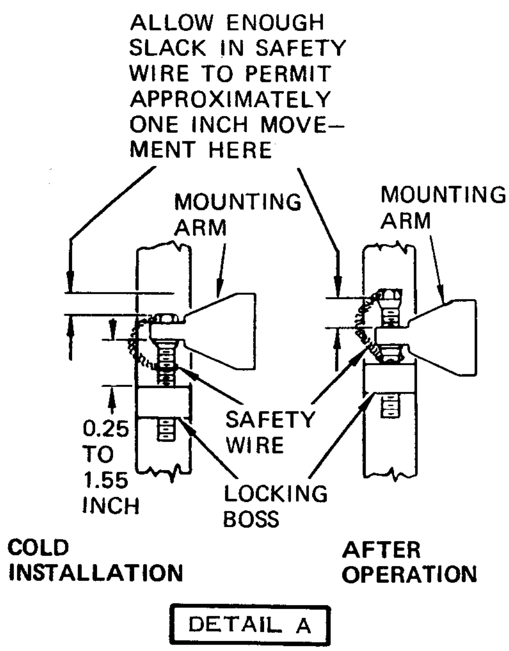
h. Move transmission (5) forward to disengage drive shaft, and remove from engine.

i. Remove gasket (6) and packing (7).

j. If transmission is to be replaced, proceed as follows:

(1) Remove nut (8), elbow (9), and packing (10).





1. Drain line
2. Oil cooler line
3. Oil cooler line
4. Lockbolt
5. Transmission
6. Gasket
7. Packing
8. Nut
9. Elbow
10. Packing
11. Nut
12. Elbow
13. Packing
14. Union
15. Packing

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Figure 10-2. Removal and Installation; Transmission (Sheet 1 of 2)

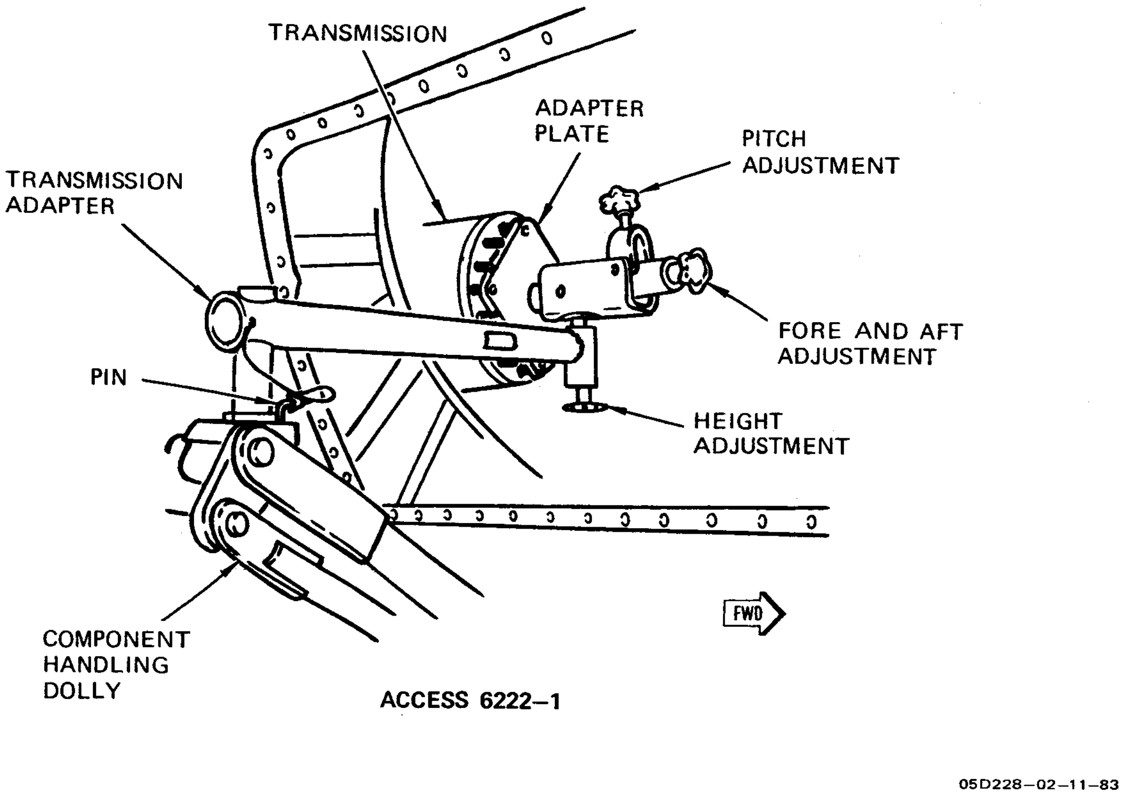


Figure 10-2. Removal and Installation; Transmission (Sheet 2)

(2) Remove nut (11), elbow (12), and packing (13).

(3) Remove union (14) and packing (15).

10-6.2. Installation. (Figure 10-2.)

CAUTION

To prevent contamination of transmission, all lines must be cleaned and oil cooler must be replaced if contamination is found in constant speed drive system.

a. If transmission is being replaced, proceed as follows:

(1) Using new packing (15), install union (14).

(2) Using new packing (13), install elbow (12) and nut (11).

(3) Using new packing (10), install elbow (9) and nut (8).

WARNING

Solvent P-D-680, Type II, is toxic to skin, eyes, and respiratory tract. Use in a well-ventilated area. Avoid prolonged breathing of vapors. Avoid eye and repeated skin contact. Keep away from sparks and flames.

CAUTION

Gearbox and transmission mating splines must be thoroughly cleaned and greased to prevent undue gearbox spline wear and equipment failure.

b. Clean splines of gearbox and trasmission (5) with P-D-680, Type II, drycleaning solvent and clean cloth.

c. Lubricate new packing (7) with MIL-L-7808 oil. Install in recess of transmission spline.

d. Apply generous amount of MIL-G-81322 grease to transmission splines and gearbox mating splines.

e. Coat mating splines of lug ring lightly with MIL-G-81322 grease.

NOTE

Locating pinhole is 20° counterclockwise from bottom of adapter.

f. If lug ring has been removed from engine adapter, place ring on thread of adapter so that locking boss is about 60° counterclockwise from locating pinhole in adapter. Engage threads and rotate ring about 120° clockwise.

g. If lug ring has not been removed from engine adapter, move ring so that locking boss is at about 7 o'clock position.

h. Install gasket (6) on engine adapter.

CAUTION

Carbon seals are easily damage. To prevent damage to seals, do not lift transmission by shaft, do not bump shaft, and do not let weight of transmission rest on shaft.

i. Secure transmission to adapter plate with four washers and nuts.

CAUTION

Locating pinhole in adapter must be aligned with locating pin at 5 o'clock position on transmission flange.

j. Move component handling dolly until transmission is aligned with mounting pad. Adjust adapter for final alignment.

k. Carefully move transmission aft until seated on high speed gearbox.

l. Fit grooves of lug ring over lugs on transmission flange; then rotate ring clockwise until lugs on ring engage lugs on transmission flange.

m. Check that packing is retaining a flat washer and self-aligning washer on lockbolt.

n. Insert lockbolt (4) to engage threads in lug ring captive nut and tighten as follows:

(1) Tighten lockbolt to 132 (±12) inch-pounds torque.

(2) Using soft-faced mallet or hammer and soft punch, tap ring at several places around circumference.

(3) Retighten lockbolt to 132 (±12) inch-pounds torque.

(4) Continue tapping and tightening until tapping no longer decreases torque.

NOTE

If gap between lugs is not within limits, remove transmission and replace lug ring.

(5) Check that gap between locking boss and mounting arm is from 0.25 to 1.55 inches.

NOTE

The mounting ring may tend to tighten during use. Leave a loop of safety wire for about 1 inch of axial movement of lockbolt in the bracket.

(6) Secure lockbolt with MS20995C32 lockwire.

o. Remove handling dolly and adapter from transmission.

p. Connect oil cooler lines (2 and 3) and drain line (1).

q. Service transmission (T.O. 1A-7D-2-1).

r. Install master ac generator (T.O. 1A-7D-2-11).

s. When performing operational checkout for ac generator installation, make a leak check of transmission.

t. After engine has been operated, cut lockwire and repeat step n.

u. Close access 6222-1.

10-7. TRANSMISSION OIL FILTER REMOVAL AND INSTALLATION.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
	GGG-W-686	Torque wrench, 10 to 150 inch-pounds	Measure torque

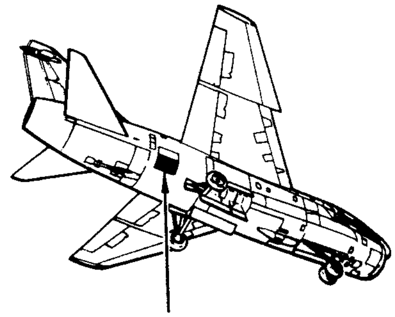
10-7.1. Removal. (Figure 10-3.)

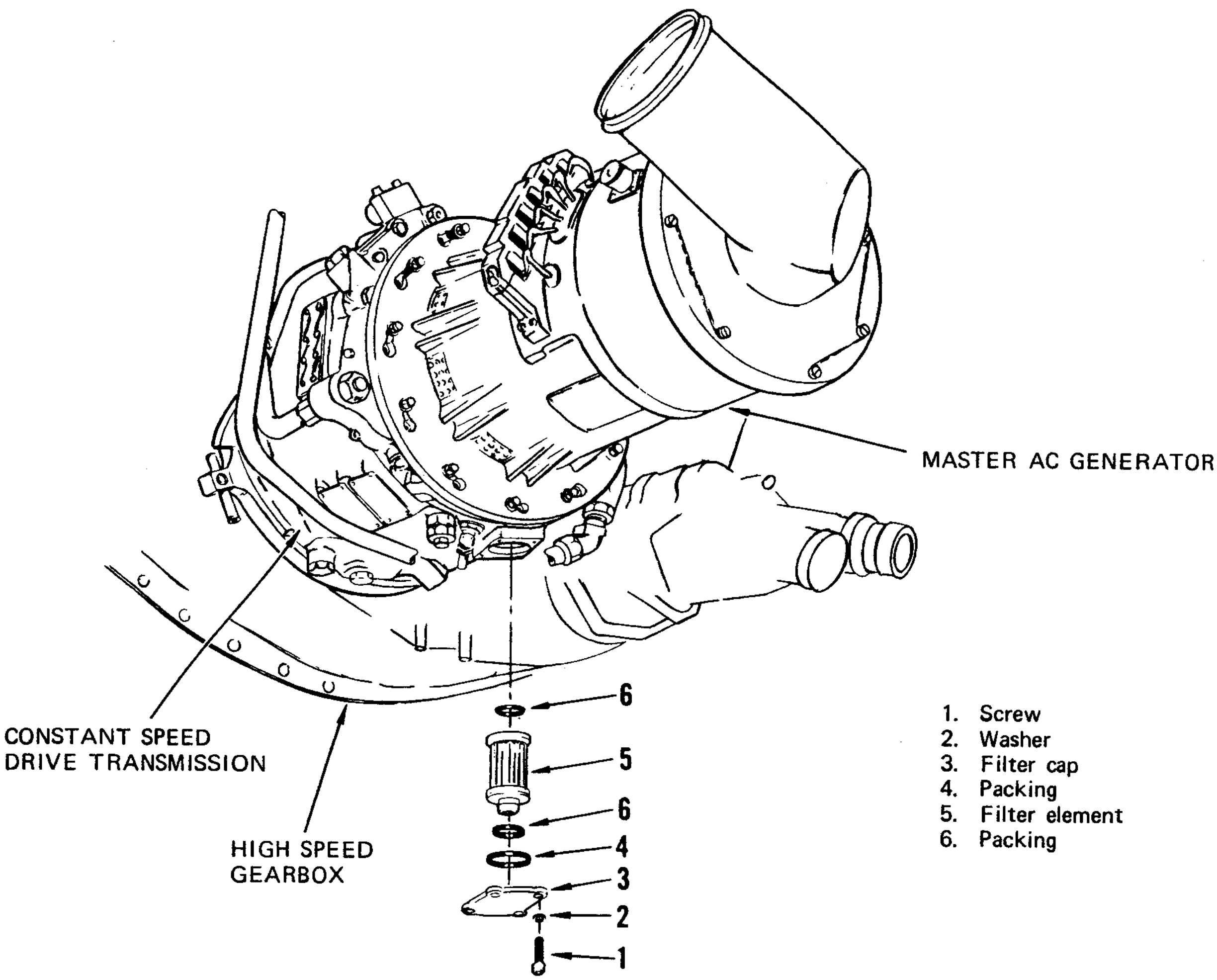
a. Open access 6222-1.

CAUTION

Filter element is easily damaged by scraping against filter cavity, dropping, or similar treatment. Handle with care.

b. Remove screws (1), washers (2), filter cap (3), packing (4), filter element (5), and packings (6).





1. Screw
2. Washer
3. Filter cap
4. Packing
5. Filter element
6. Packing

ACCESS 6222–1

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Figure 10-3. Removal and Installation; Transmission Oil Filter

10-7.2. Installation. (Figure 10-3.)

CAUTION

Filter element will be damaged if screws are used to force element into cavity.

a. Using new packings (6), insert filter element (5) into filter cavity.

b. Using new packing (4), install filter cap (3) and secure with washers (2) and screws (1). Tighten screws to 50.5 ($\pm$2.5) inch-pounds torque.

c. Service transmission (T.O. 1A-7D-2-1).

d. Start engine (T.O. 1A-7D-2-1) and check filter installation for leaks.

e. Shut down engine (T.O. 1A-7D-2-1).

f. Close access 6222-1.

10-8. TRANSMISSION CHIP DETECTOR PLUG REMOVAL AND INSTALLATION.

Tools Required

Figure & index No.	Part number	Nomenclature	Use and application
	GGG-W-686	Torque wrench, 10 to 150 inch-pounds	Measure torque

a. Open access 6222-1.

b. Remove and install transmission chip detector plug through access 6222-1 in sequence shown in figure 10-4, observing the following:

(1) Use new packing (2) for installation.

(2) Tighten chip detector plug (1) to 30 ($\pm$5) inch-pounds torque. Secure with MS20995C32 lockwire.

c. Close access 6222-1.

10-9. TRANSMISSION OIL COOLER REMOVAL AND INSTALLATION.

Remove and install transmission oil cooler through access 6222-1 in sequence shown in figure 10-5, observing the following steps.

WARNING

Fuel spillage is possible with fuel in wing tank. To prevent spillage, disconnect the quick-disconnect coupling (4) on line from the motive flow to the emergency wing transfer selector valve prior to removing the fuel line from the transmission oil cooler.

CAUTION

Prior to removal of transmission fuel oil cooler, make sure left and right motive flow fuel lines (figure 1-6) are disconnected.

a. Use new packings (11, 14, 16, and 19) for installation.

b. Mount oil cooler with lugs on aft side of mounting bracket.

c. Following installation, service transmission (T.O. 1A-7D-2-1).

d. Following installation, bleed engine fuel system (paragraph 5-19).

e. Check oil cooler installation for leaks during bleeding procedure.

f. Close access 6222-1.

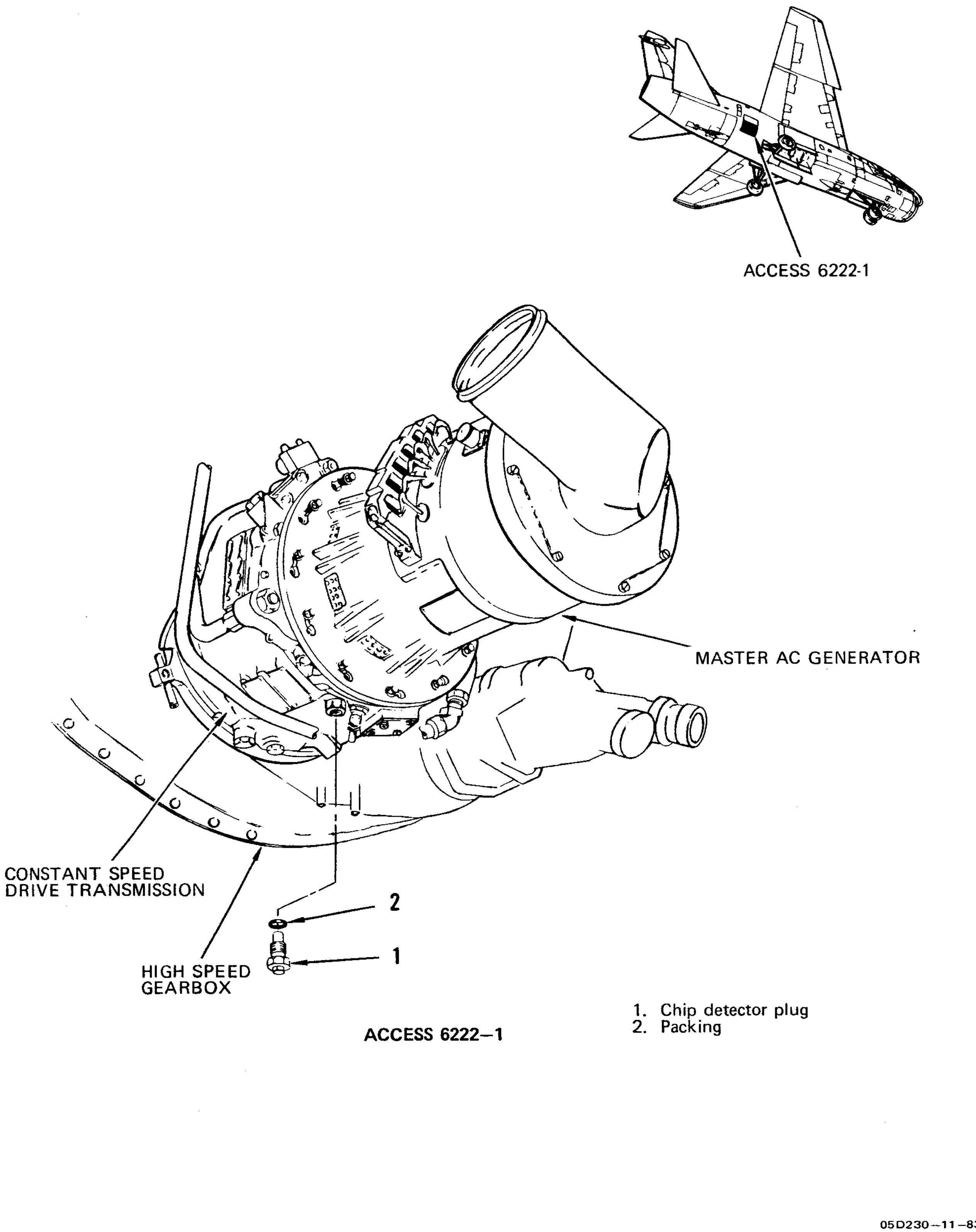
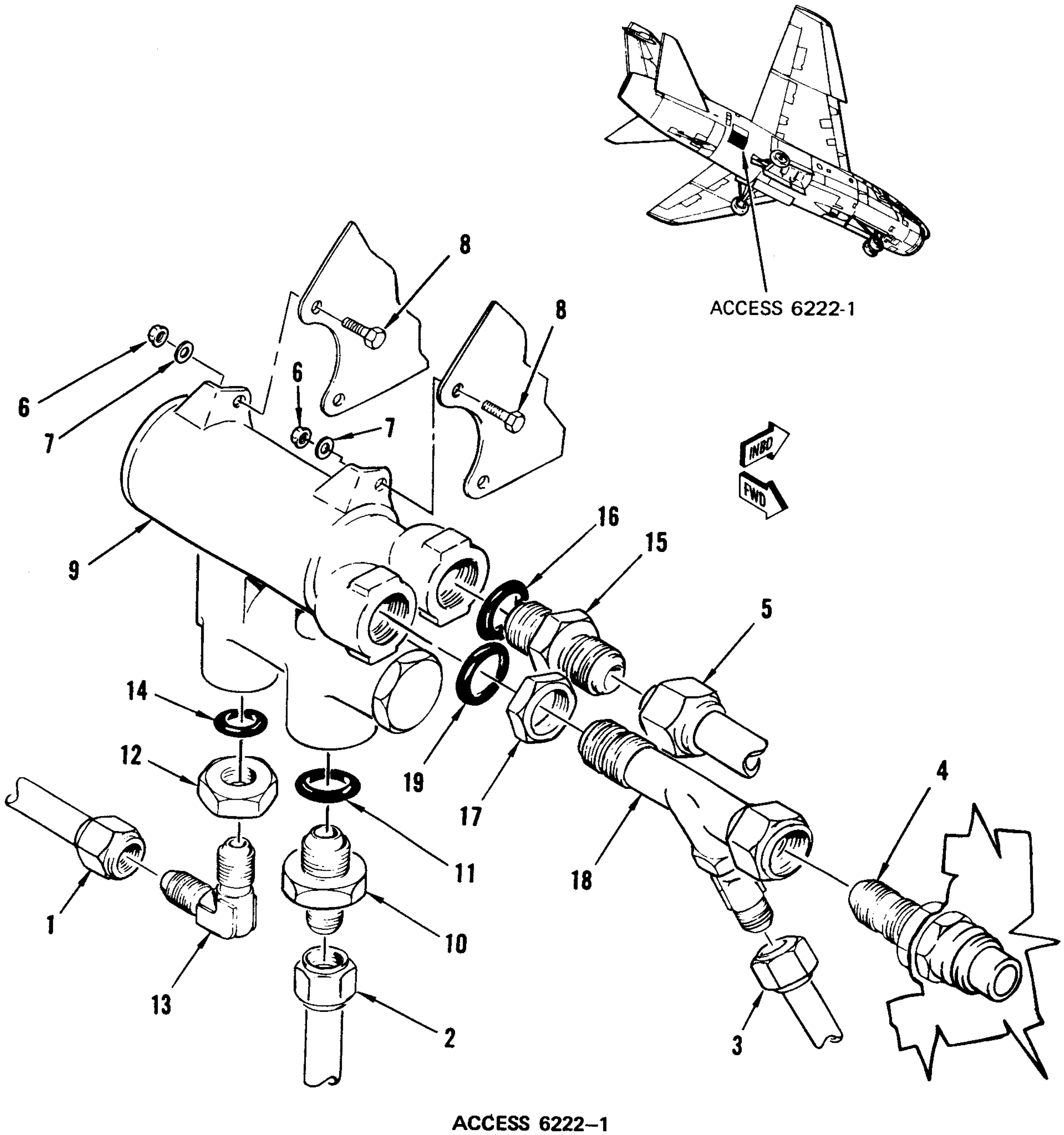


Figure 10-4. Removal and Installation; Transmission Chip Detector Plug



1. Oil tube
2. Oil tube
3. Fuel tube
4. Quick-disconnect
5. Fuel tube
6. Nut
7. Washer
8. Bolt
9. Transmission oil cooler
10. Union
11. Packing
12. Nut
13. Elbow
14. Packing
15. Union
16. Packing
17. Nut
18. Tee
19. Packing

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Figure 10-5. Removal and Installation; Transmission Oil Cooler

SECTION XI

EXTRA POWER CHECK CHARTS

11-1. EXTRA MAIN FUEL CONTROL POWER CHECK CHARTS. Detachable main fuel control power check charts are provided in figure FO-26. These charts may be removed from this manual for use with Engine Setup Procedures Checklist (T.O. 1A-7D-2-5CL-3).

11-2. EXTRA MANUAL FUEL CONTROL POWER CHECK CHARTS. Detachable manual fuel control power check charts are provided in figures FO-27 and FO-28. These charts may be removed from this manual for use with Engine Setup Procedures Checklist (T.O. 1A-7D-2-5CL-3).

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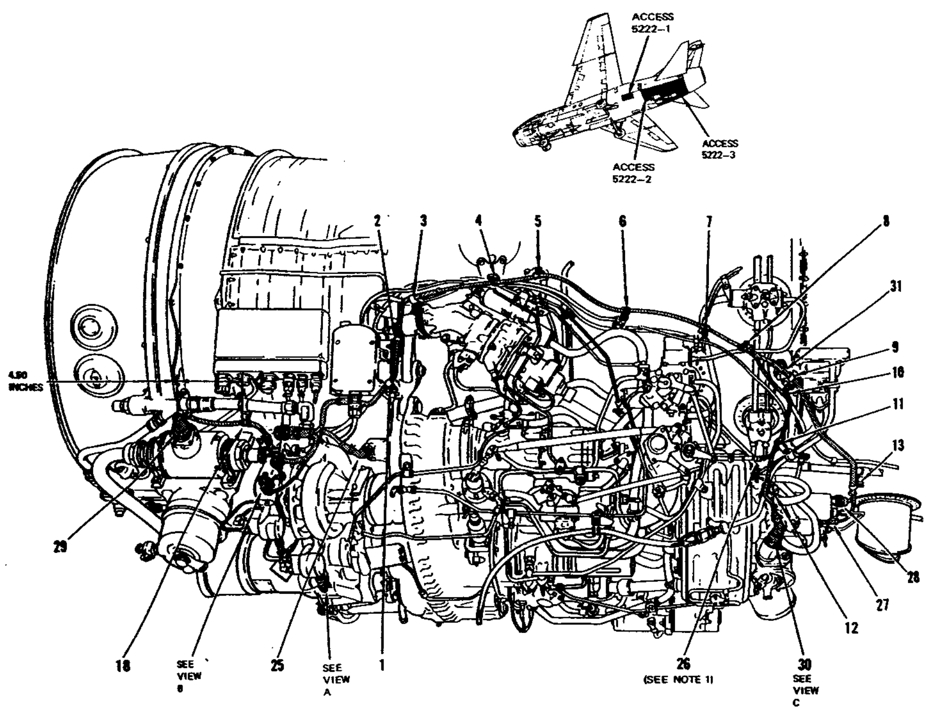

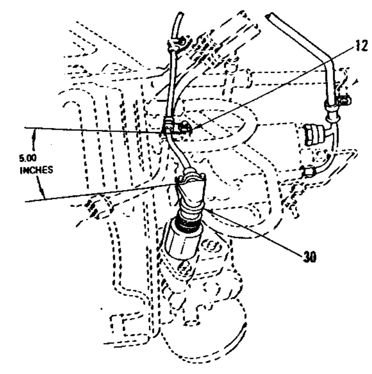

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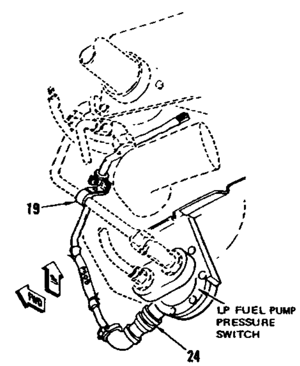

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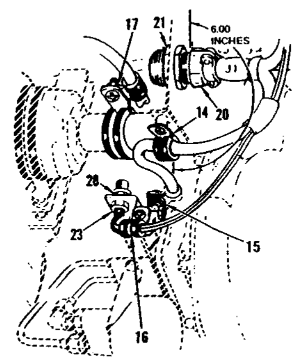

VIEW B

NOTE

1. Check that seal is installed in electrical connector P501 prior to connecting to detector unit.
2. Tighten clamps securely but not to the degree that will cause cold flow of wire insulation.
3. Clamping shall be such that the movement permitted will not stress the wire connections.
4. Clamp size may be adjusted ±1 size to fit variations.
5. Spacers may be adjusted ±1/8 inch in size to fit variations.

1. Clamp
2. Clamp
3. Clamp
4. Clamp
5. Clamp
6. Clamp
7. Clamp
8. Clamp
9. Clamp
10. Clamp
11. Clamp
12. Clamp
13. Clamp
14. Clamp
15. Clamp
16. Clamp
17. Clamp
18. Clamp
19. Clamp
20. Connector, interface (J1)
21. Jamnut
22. Jamnut
23. Connector interface (J2)
††24. Connector, LP fuel pump pressure switch (P508)
25. Connector, tachometer generator (P503)
26. Connector, oil quantity detector unit (P501)
††27. Connector, oil pressure switch (P502)
28. Connector, oil pressure transmitter (P504)
29. Connector, fuel flow transmitter (P505)
††30. Connector, oil filter bypass switch (P511)
31. Electrical harness

††Push-pull type coupling

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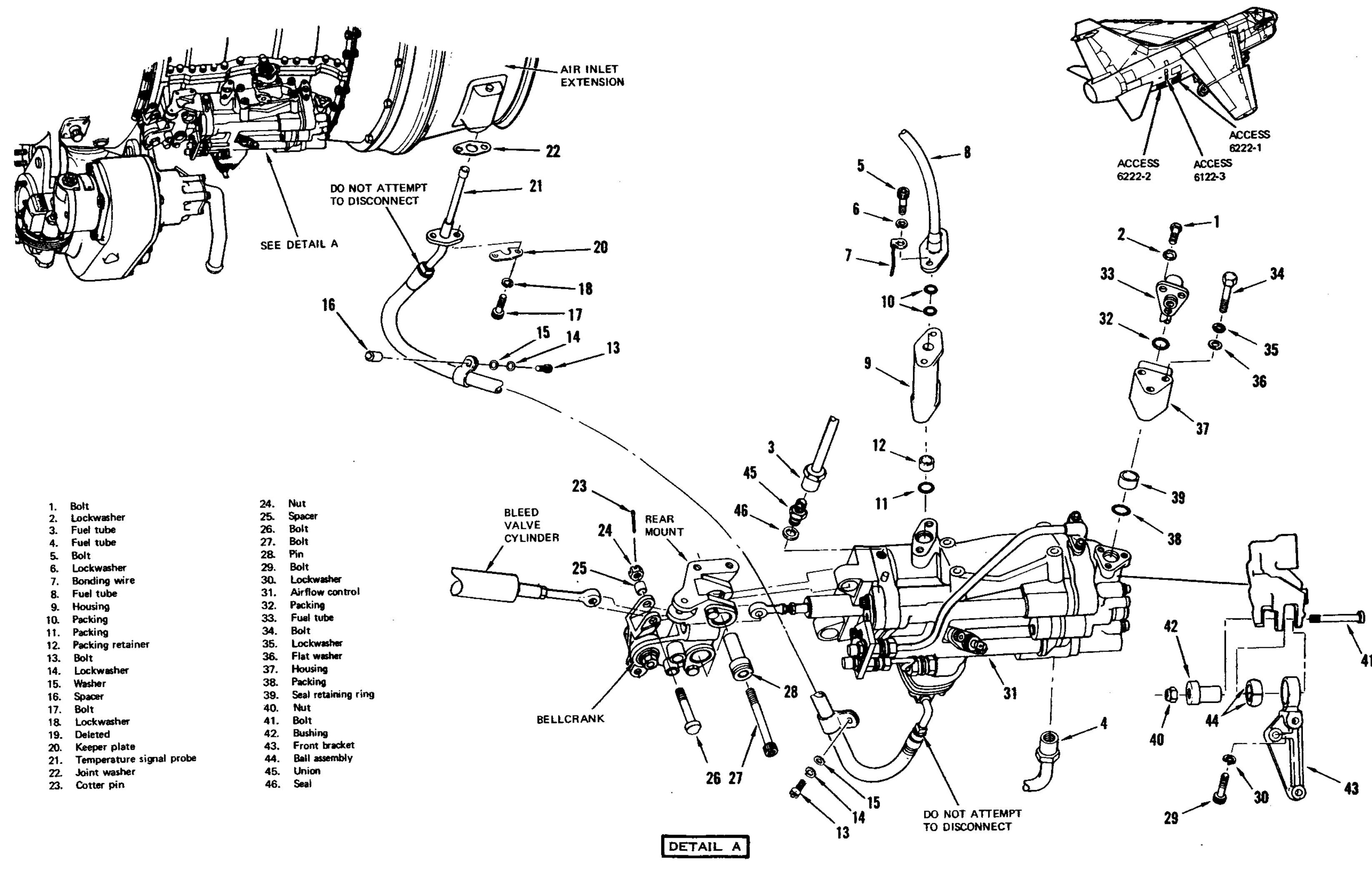
Figure FO-1. Removal and Installation; TF41-A-1 Engine Buildup Wiring Harness



1. Bolt
2. Lockwasher
3. Fuel tube
4. Fuel tube
5. Bolt
6. Lockwasher
7. Bonding wire
8. Fuel tube
9. Housing
10. Packing
11. Packing
12. Packing retainer
13. Bolt
14. Lockwasher
15. Washer
16. Spacer
17. Bolt
18. Lockwasher
19. Deleted
20. Keeper plate
21. Temperature signal probe
22. Joint washer
23. Cotter pin
24. Nut
25. Spacer
26. Bolt
27. Bolt
28. Pin
29. Bolt
30. Lockwasher
31. Airflow control
32. Packing
33. Fuel tube
34. Bolt
35. Lockwasher
36. Flat washer
37. Housing
38. Packing
39. Seal retaining ring
40. Nut
41. Bolt
42. Bushing
43. Front bracket
44. Ball assembly
45. Union
46. Seal

Figure FO-2. Removal and Installation; Airflow Control

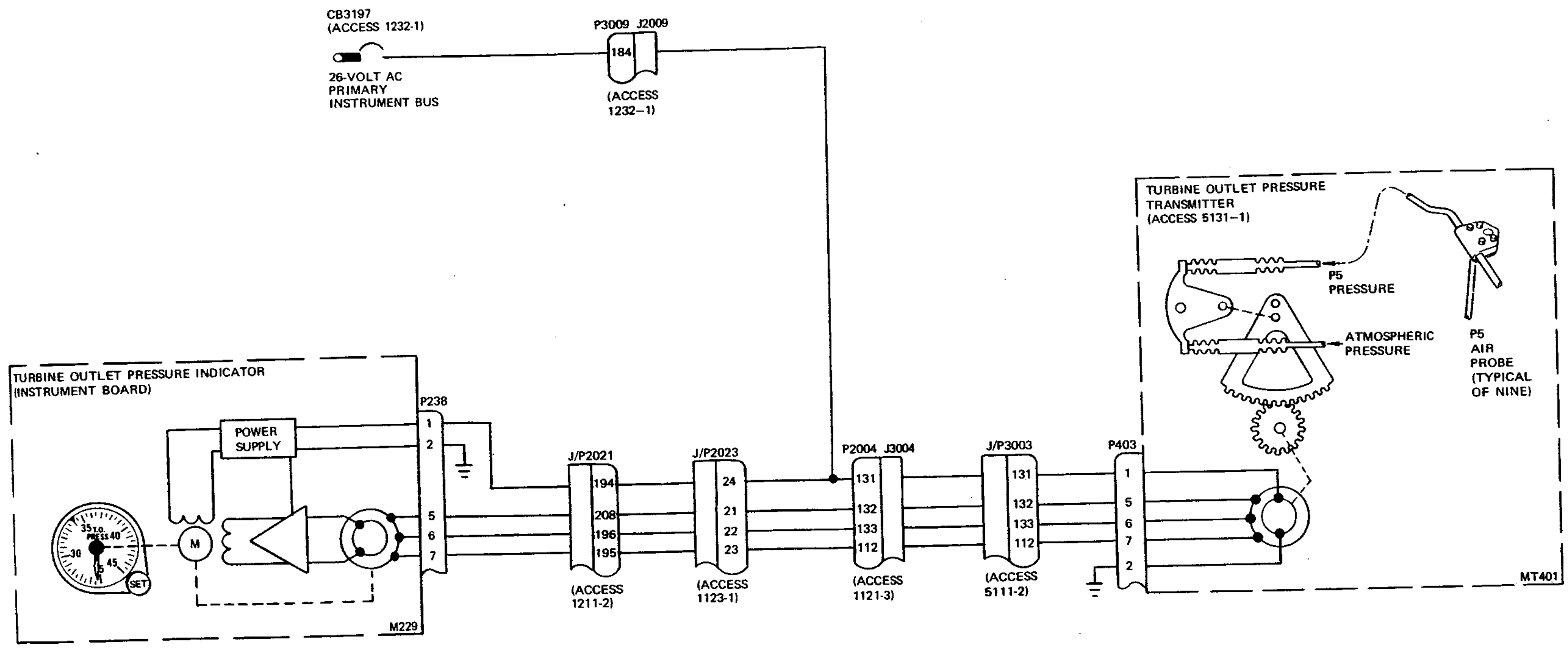


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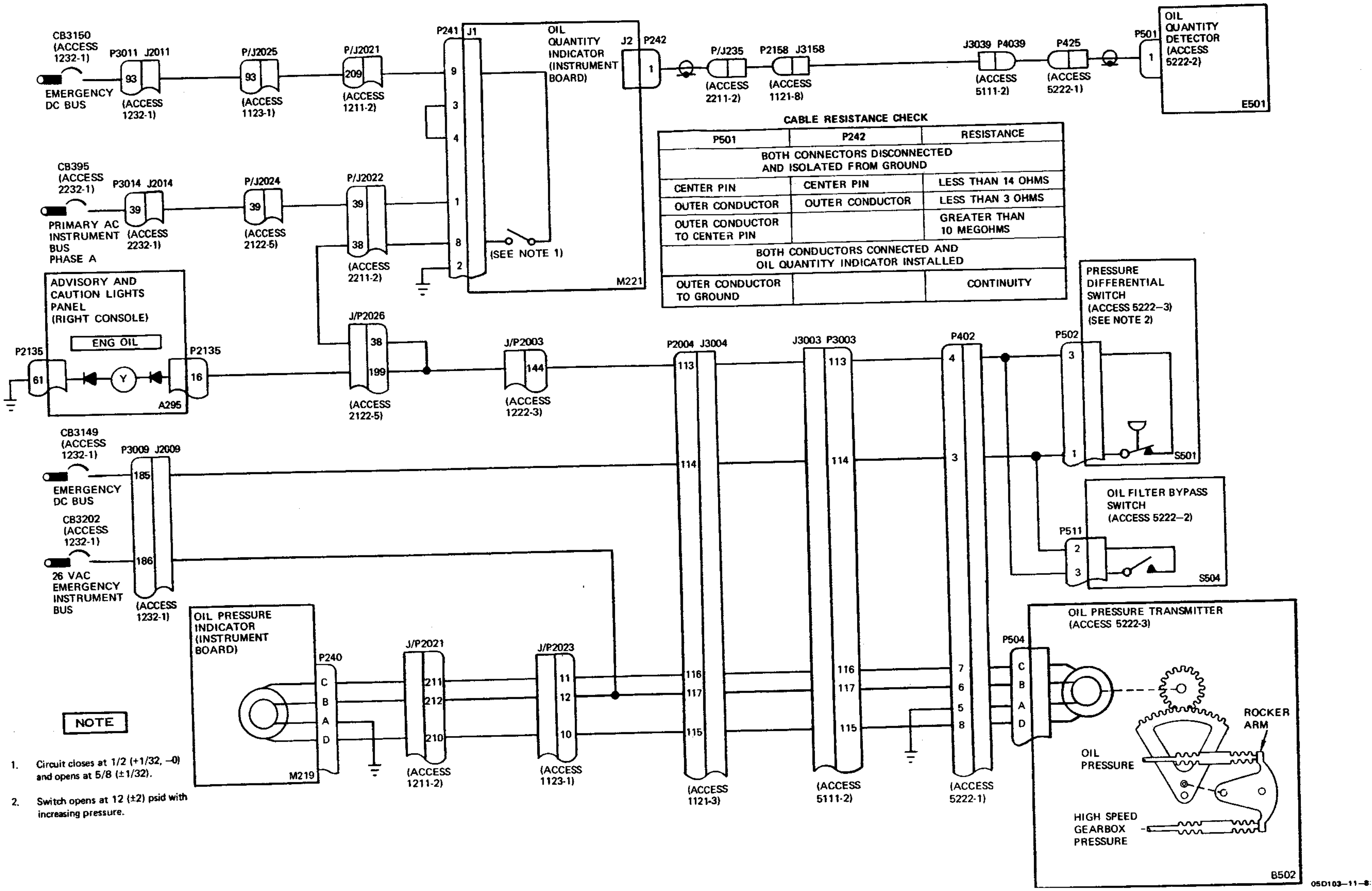
Figure FO-3. Schematic Diagram; Turbine Outlet Pressure Indicating System



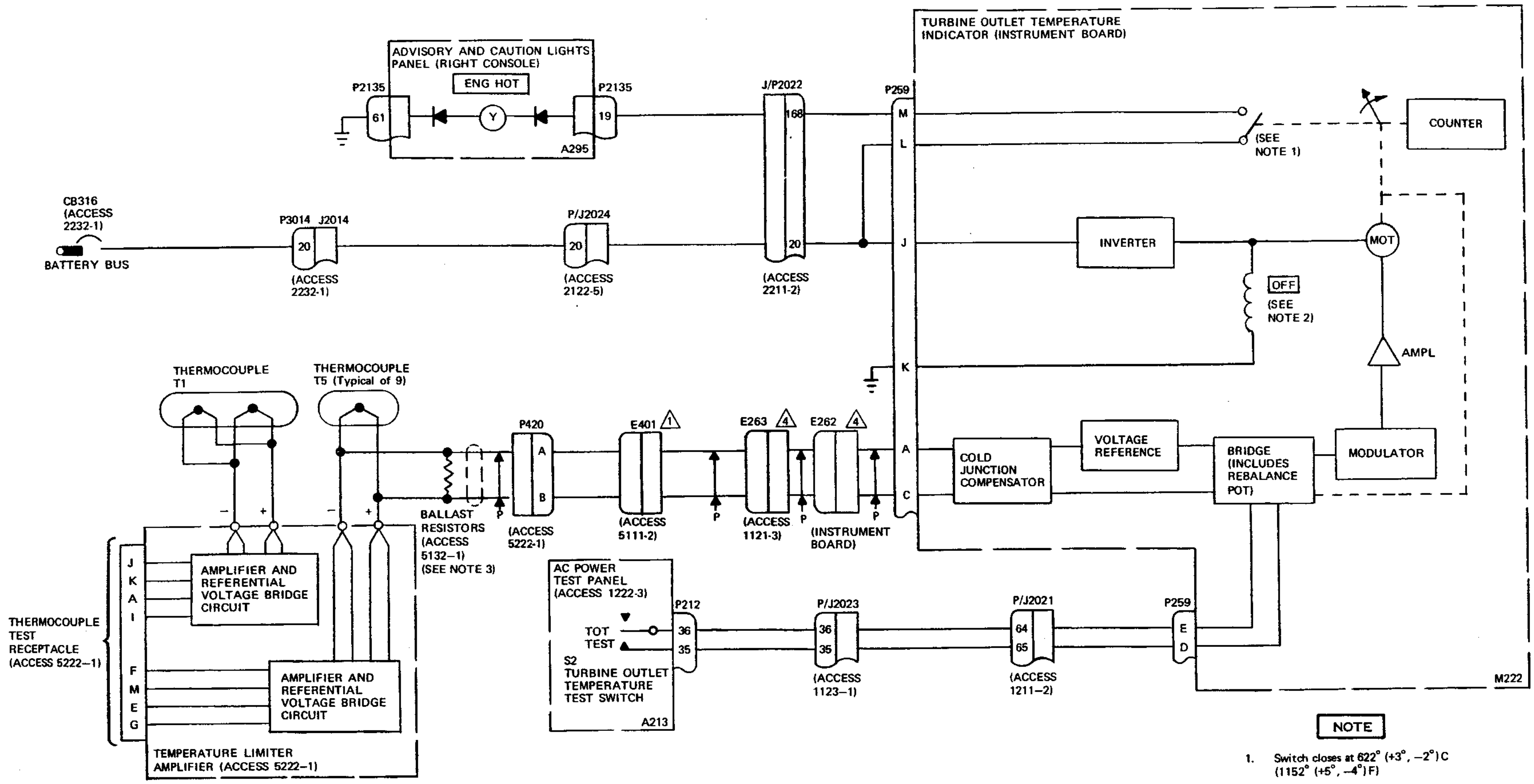
CABLE RESISTANCE CHECK

P501	P242	RESISTANCE
BOTH CONNECTORS DISCONNECTED AND ISOLATED FROM GROUND		
CENTER PIN	CENTER PIN	LESS THAN 14 OHMS
OUTER CONDUCTOR	OUTER CONDUCTOR	LESS THAN 3 OHMS
OUTER CONDUCTOR TO CENTER PIN		GREATER THAN 10 MEGOHMS
BOTH CONDUCTORS CONNECTED AND OIL QUANTITY INDICATOR INSTALLED		
OUTER CONDUCTOR TO GROUND		CONTINUITY

NOTE

1. Circuit closes at 1/2 (+1/32, –0) and opens at 5/8 (±1/32).
2. Switch opens at 12 (±2) psid with increasing pressure.

Figure FO-4. Schematic Diagram; Oil Quantity and Pressure Indicating System



NOTE

1. Switch closes at 622° (+3°, −2°) C (1152° (+5°, −4°) F)
2. OFF flag retracts when 28-volt dc power is applied.
3. Value of ballast resistor selected at manufacture or overhaul. See engine log for value.
4. Small pin for Alumel (A) Large pin for Chromel (C)

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Figure FO-5. Schematic Diagram; Turbine Outlet Temperature Indicating System

NOTE

1. Switch opens at approximately 185 psig
2. Switch opens at 7.0 (±0.5) psid
3. Switch opens at 12.5 (±2.5) psid

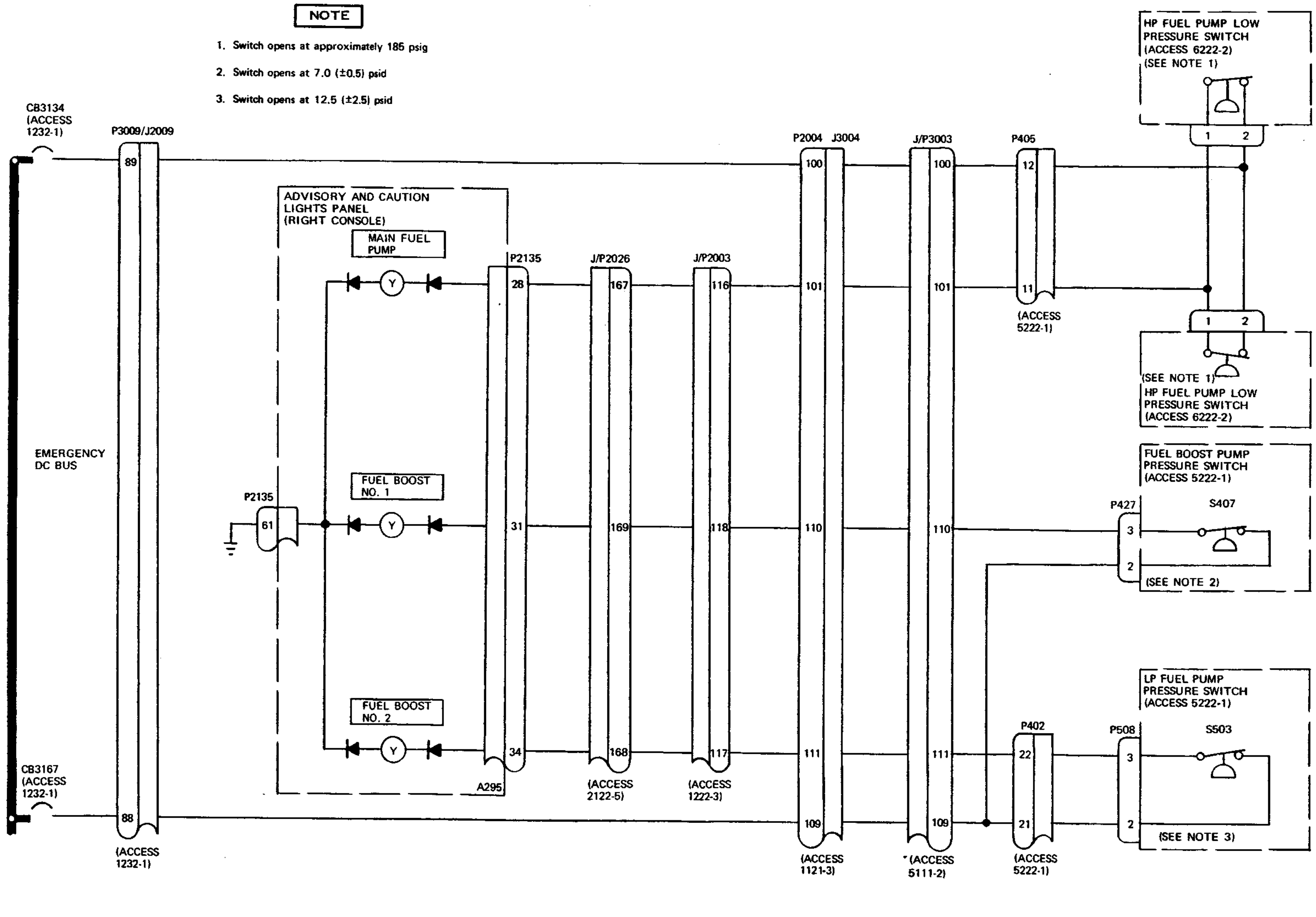


Figure FO-6. Schematic Diagram; Low Fuel Pressure Warning System

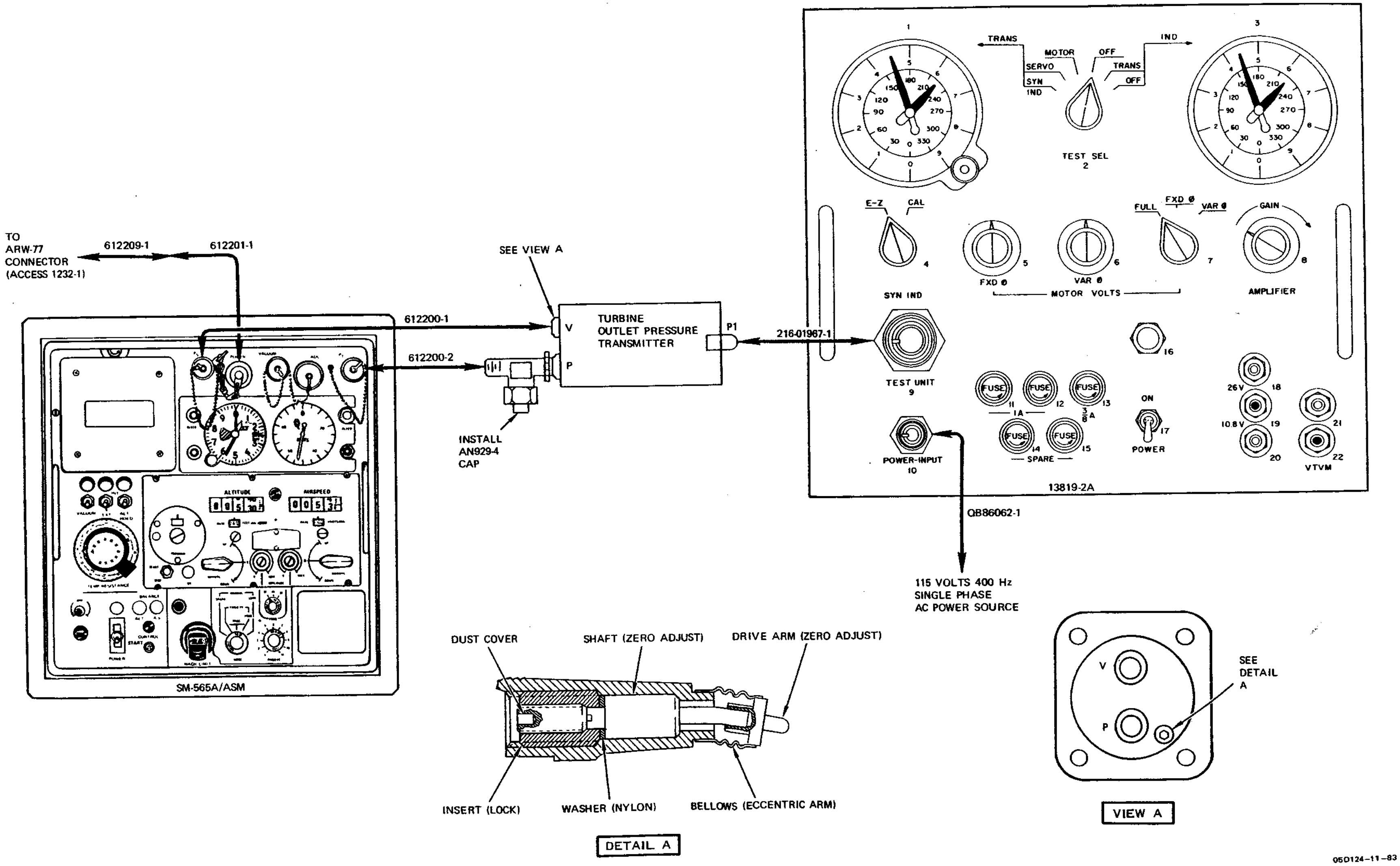
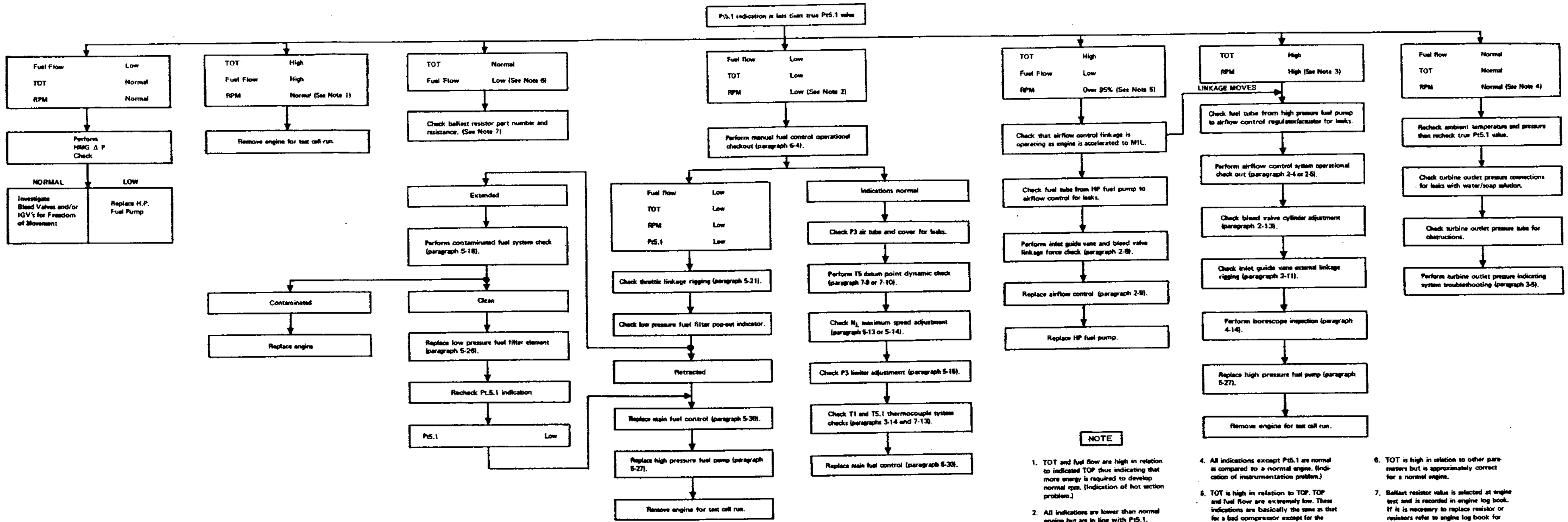


Figure FO-7. Test and Calibration; Turbine Outlet Pressure Transmitter



NOTE

1. TOT and fuel flow are high in relation to indicated TOP thus indicating that more energy is required to develop normal rpm. (Indication of hot section problem.)
2. All indications are lower than normal engine but are in line with Pt5.1. (Indication of fuel system problem.)
3. TOT and RPM are high in relation to indicated TOP thus indicating that a greater RPM is required to provide sufficient pressure by the compressors. (Indication of compressor section problem.)
4. All indications except Pt5.1 are normal as compared to a normal engine. (Indication of instrumentation problem.)
5. TOT is high in relation to TOP. TOP and fuel flow are extremely low. These indications are basically the same as that for a bad compressor except for the extremeties of TOP and fuel flow. (Indication of bleed valve stuck open and IGV's stuck at 35°.)
6. TOT is high in relation to other parameters but is approximately correct for a normal engine.
7. Ballast resistor value is selected at engine test and is recorded in engine log book. If it is necessary to replace resistor or resistors refer to engine log book for proper value.

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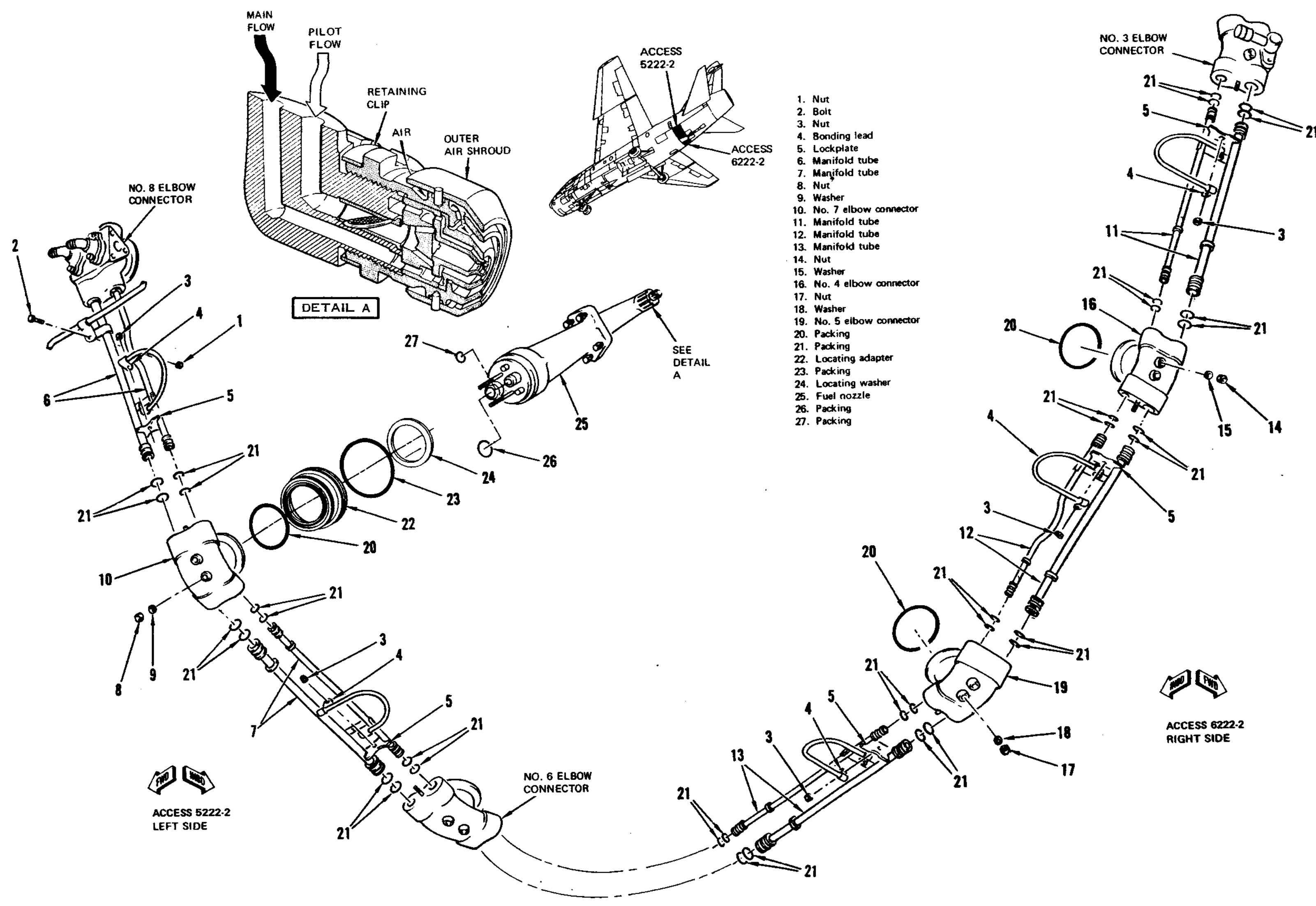
Figure FO-8. Troubleshooting Diagram; Low Pt5.1



1. Nut
2. Bolt
3. Nut
4. Bonding lead
5. Lockplate
6. Manifold tube
7. Manifold tube
8. Nut
9. Washer
10. No. 7 elbow connector
11. Manifold tube
12. Manifold tube
13. Manifold tube
14. Nut
15. Washer
16. No. 4 elbow connector
17. Nut
18. Washer
19. No. 5 elbow connector
20. Packing
21. Packing
22. Locating adapter
23. Packing
24. Locating washer
25. Fuel nozzle
26. Packing
27. Packing

Figure FO-9. Removal and Installation; No. 5 and No. 7 Fuel Nozzle

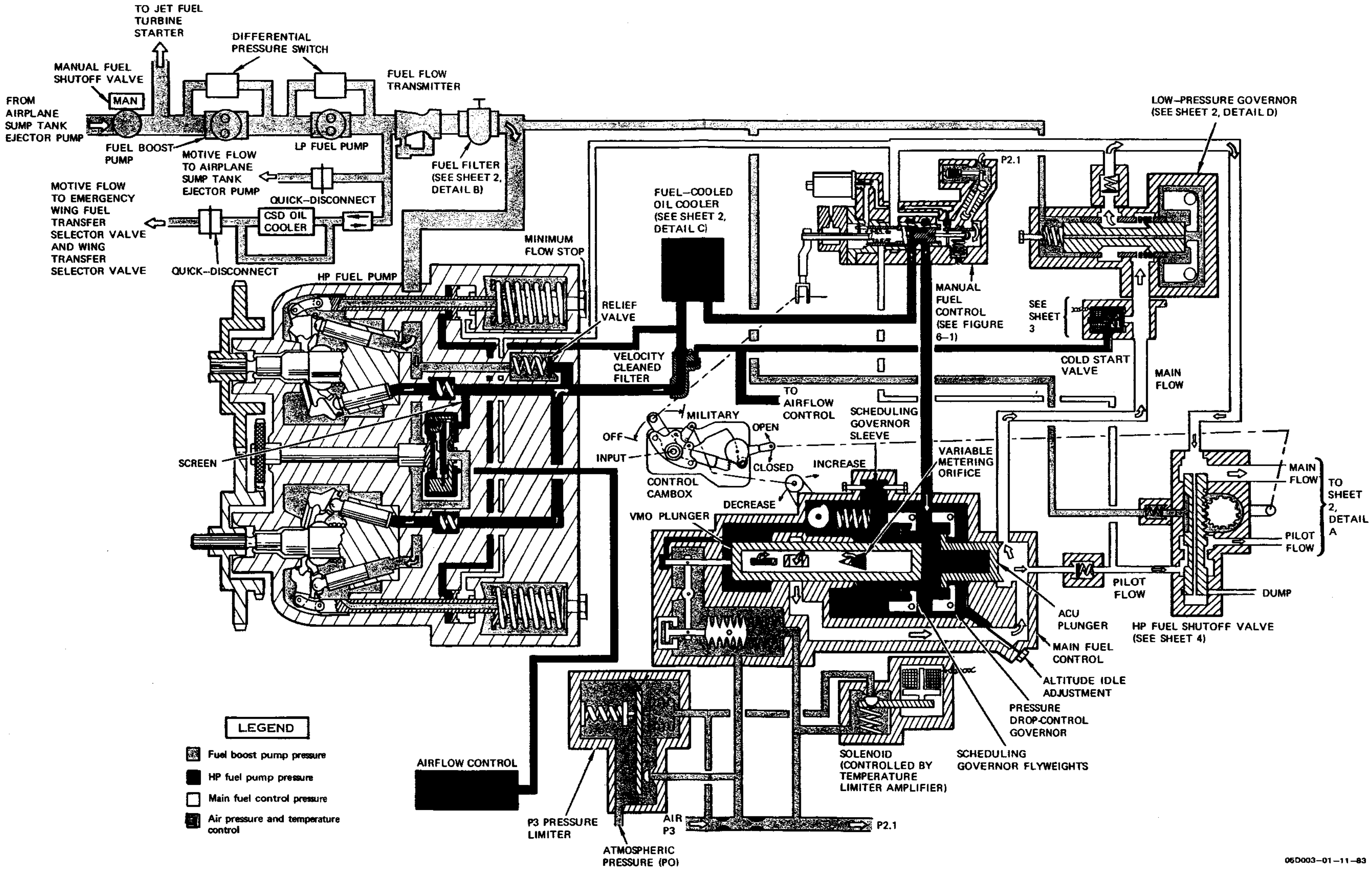


Figure FO-10. System Schematic; Main Fuel (Sheet 1 of 4)

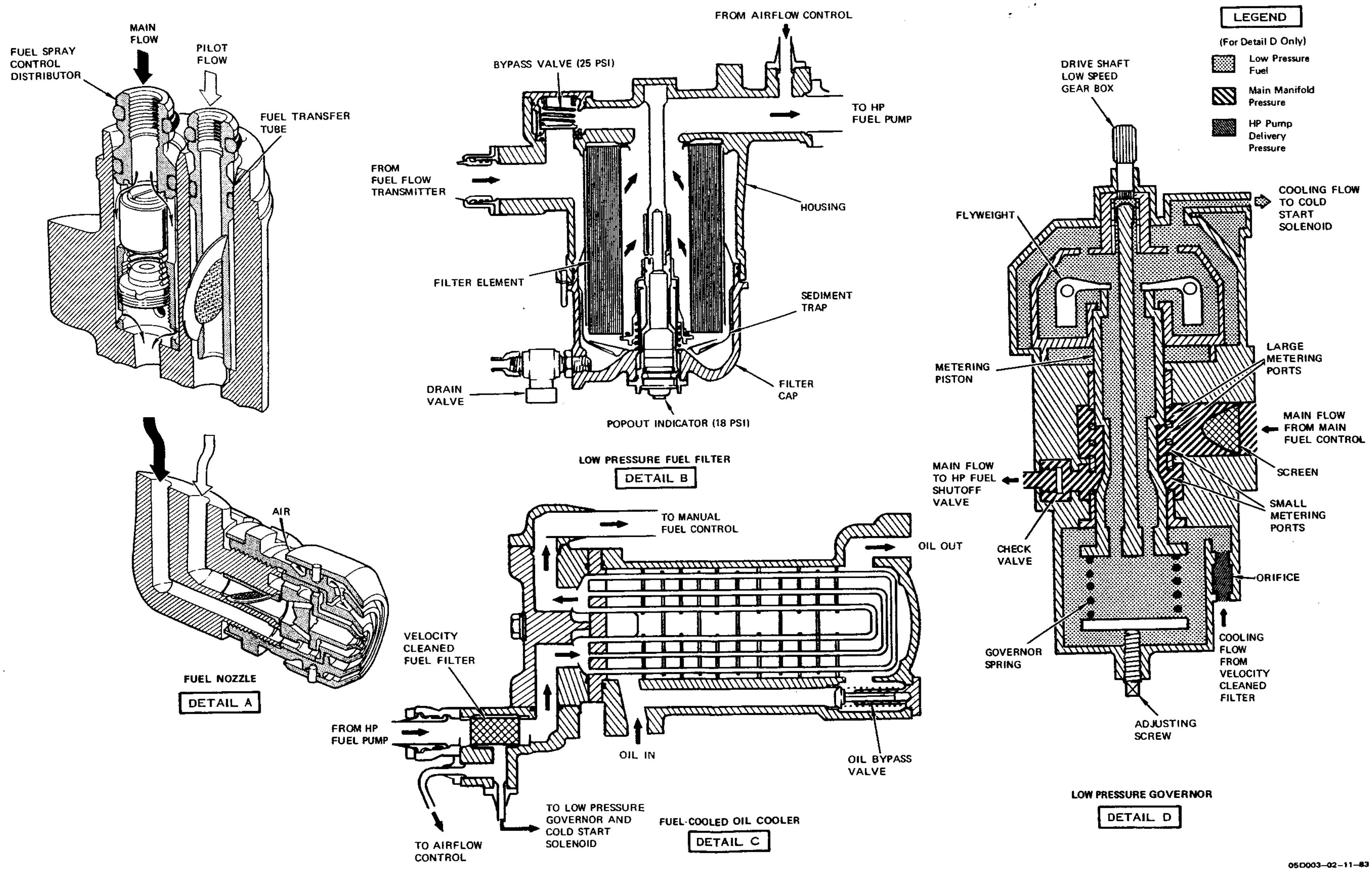
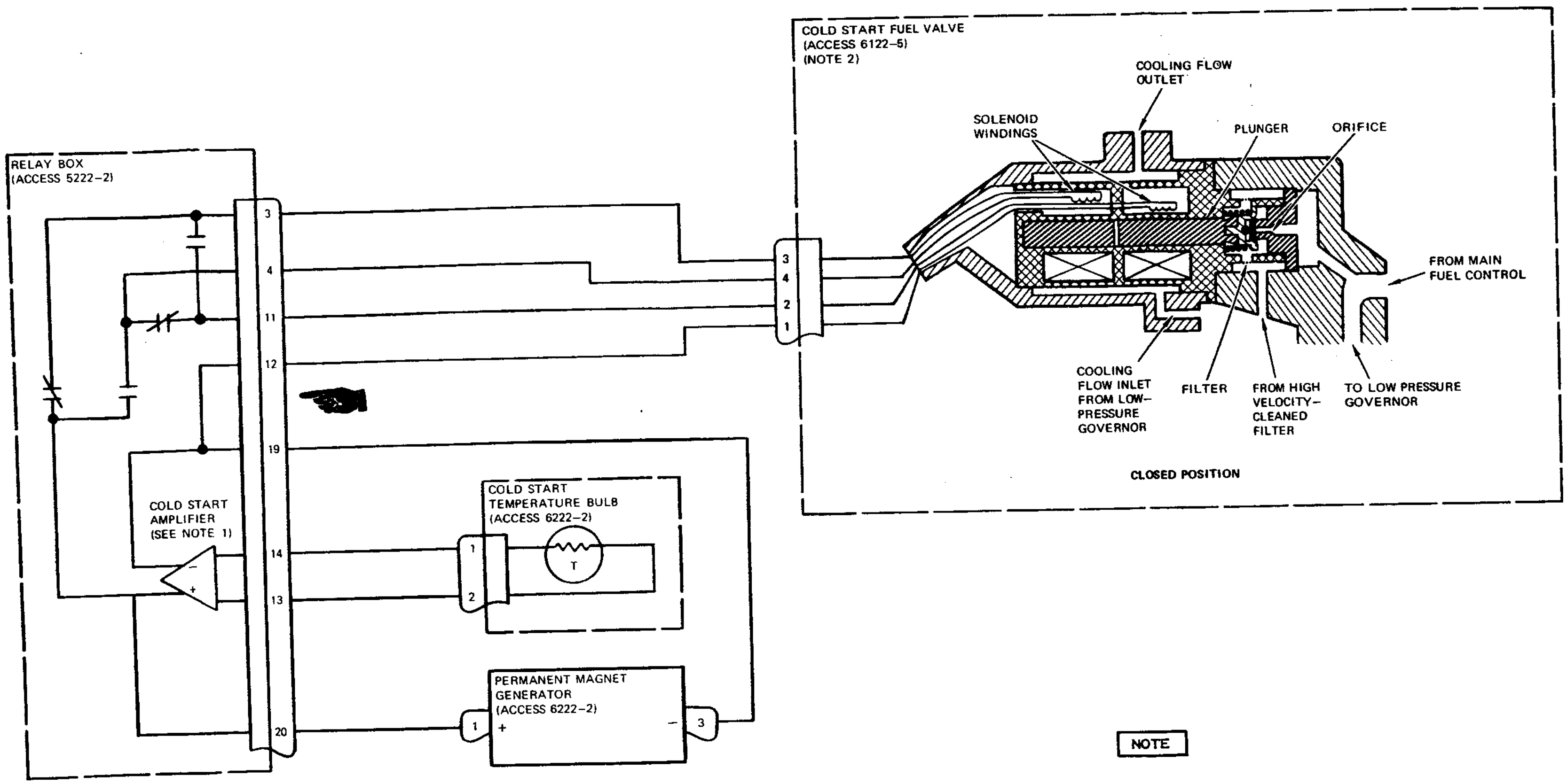


Figure FO-10. System Schematic; Main Fuel (Sheet 2)



NOTE

1. COLD START RELAYS ARE ENERGIZED BY THE COLD START AMPLIFIER WHEN OIL TEMPERATURE IS BELOW 0°C (32° F).
2. COLD START FUEL VALVE PROVIDES CONSTANT LOAD FOR PERMANENT MAGNET GENERATOR DC CIRCUIT.

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Figure FO-10. System Schematic; Main Fuel (Sheet 3)

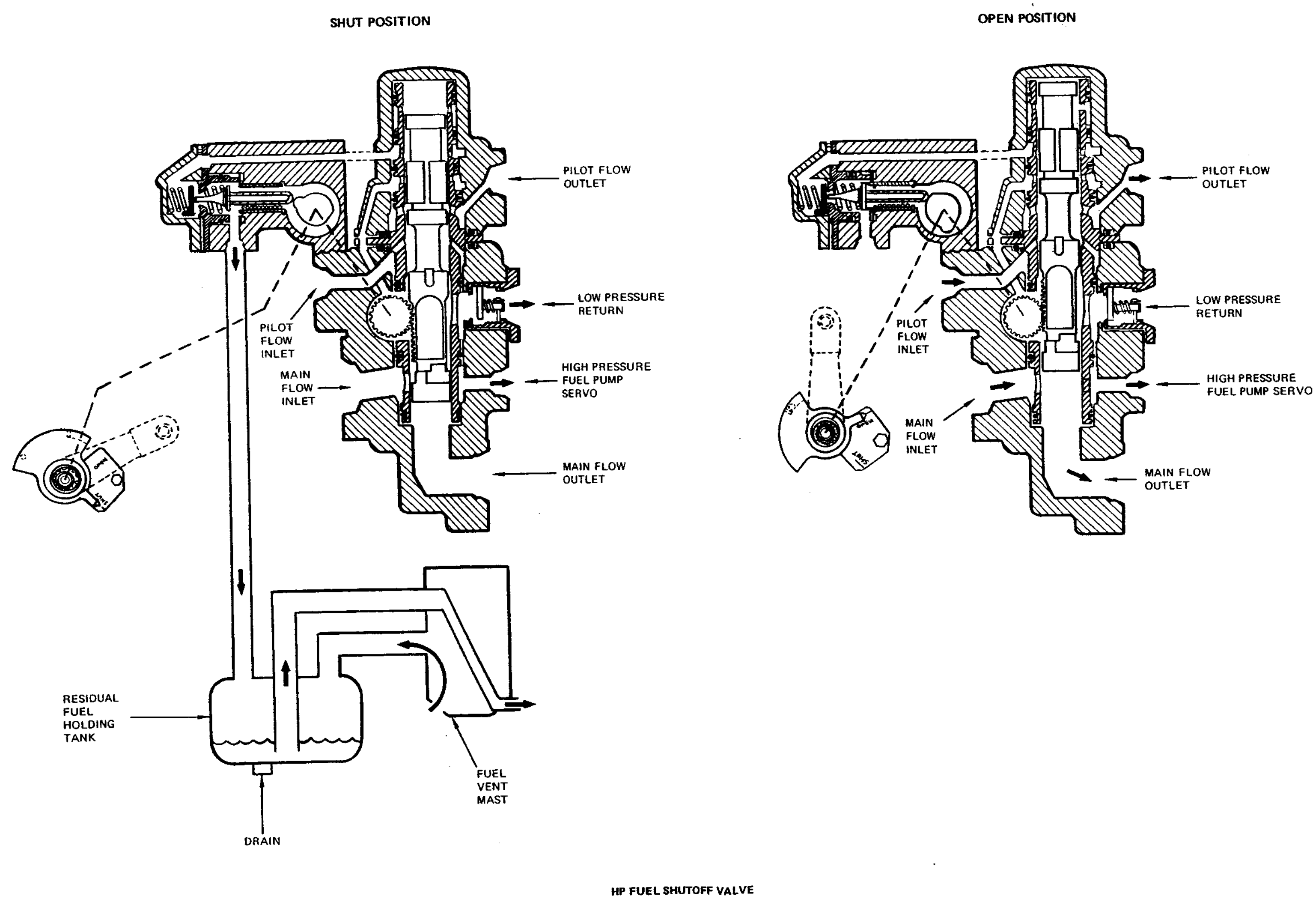

Figure FO-10. System Schematic; Main Fuel (Sheet 4)

NOTE

1. DISCONNECT ELECTRICAL CONNECTOR FROM MANUAL FUEL CONTROL BEFORE PERFORMING CONTINUITY CHECKS IN MANUAL FUEL CONTROL SYSTEM. REVERSING CURRENT TO MANUAL FUEL CONTROL WINDINGS WILL DESTROY FAIL SAFE FEATURE.

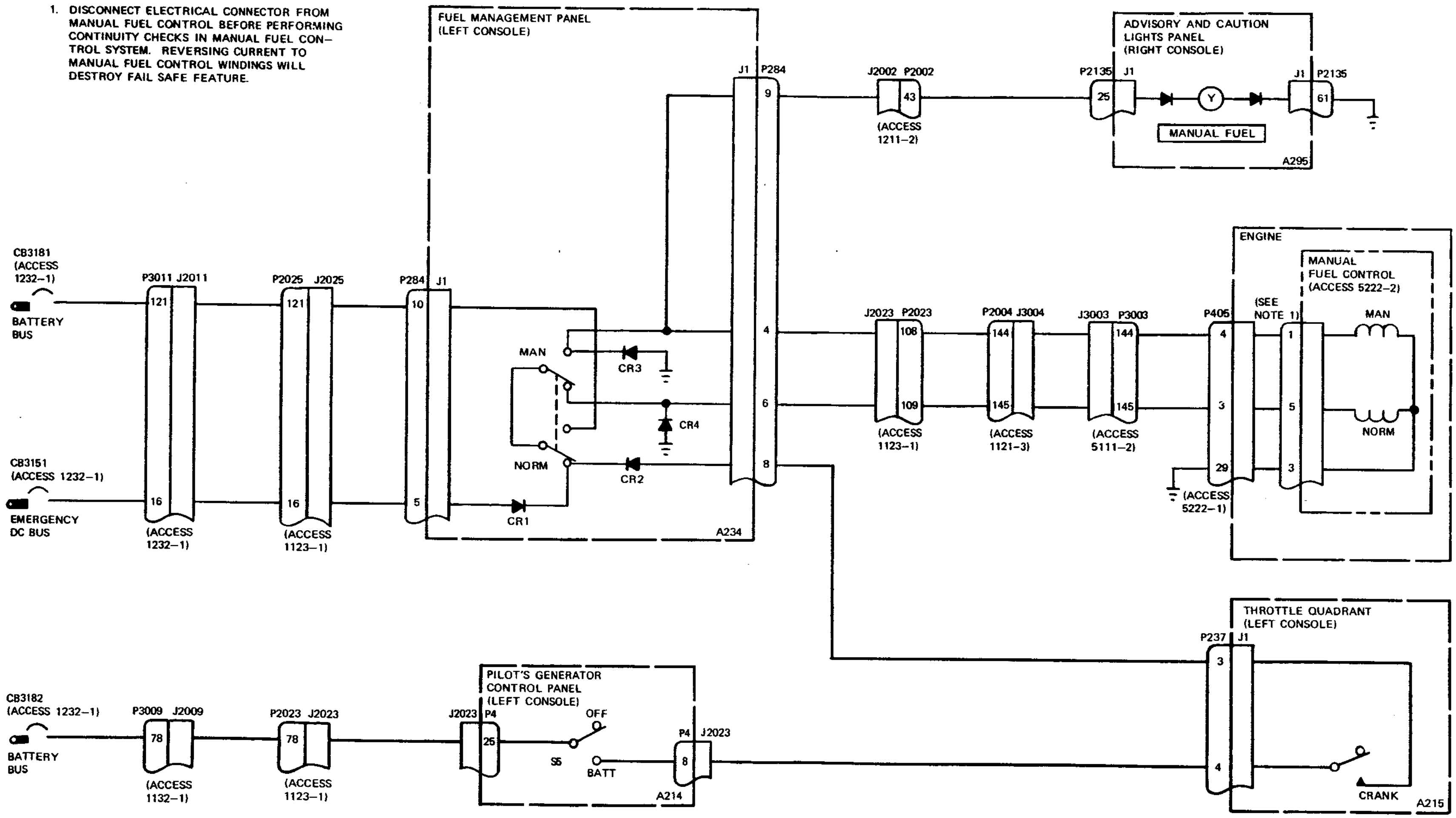

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Figure FO-11. Schematic Diagram; Manual Fuel Control Wiring

Minimum and Maximum Manual Fuel Control Power Check Chart
TF41-A-1

NOTE

Values shown are for engine operating with air inlet screen installed and air conditioning system operating. If engine must be operated with screen removed, add 1.3" Hg to $P_{T5.1}$ true pressure.

Ambient Temperature		Ambient Pressure – Inches Mercury Absolute									
		24.0		24.2		24.4		24.6		24.8	
		$P_{T5.1}$ True Pressure – Inches Mercury Gage									
°C	°F	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
27.	80.6	29.5	26.3	29.8	26.6	30.0	26.8	30.2	27.0	30.5	27.2
26.	78.8	29.6	26.4	29.8	26.6	30.1	26.9	30.3	27.1	30.6	27.3
25.	77.0	29.7	26.5	29.9	26.7	30.2	26.9	30.4	27.2	30.7	27.4
24.	75.2	29.7	26.6	30.0	26.8	30.2	27.0	30.5	27.2	30.7	27.5
23.	73.4	29.8	26.6	30.1	26.9	30.3	27.1	30.6	27.3	30.8	27.5
22.	71.6	29.9	26.7	30.2	26.9	30.4	27.2	30.7	27.4	30.9	27.6
21.	69.8	30.0	26.8	30.2	27.0	30.5	27.2	30.7	27.5	31.0	27.7
20.	68.0	30.1	26.9	30.3	27.1	30.6	27.3	30.8	27.5	31.1	27.8
19.	66.2	30.2	27.0	30.4	27.2	30.7	27.4	30.9	27.6	31.2	27.8
18.	64.4	30.2	27.0	30.5	27.3	30.7	27.5	31.0	27.7	31.2	27.9
17.	62.6	30.3	27.1	30.6	27.3	30.8	27.6	31.1	27.8	31.3	28.0
16.	60.8	30.4	27.2	30.6	27.4	30.9	27.6	31.2	27.9	31.4	28.1
15.	59.0	30.5	27.3	30.7	27.5	31.0	27.7	31.2	27.9	31.5	28.2
14.	57.2	30.6	27.3	30.8	27.6	31.1	27.8	31.3	28.0	31.6	28.2
13.	55.4	30.6	27.4	30.9	27.6	31.1	27.9	31.4	28.1	31.7	28.3
12.	53.6	30.7	27.5	31.0	27.7	31.2	27.9	31.5	28.2	31.7	28.4
11.	51.8	30.8	27.6	31.1	27.8	31.3	28.0	31.6	28.2	31.8	28.5
10.	50.0	30.9	27.6	31.1	27.9	31.4	28.1	31.6	28.3	31.9	28.6
9.	48.2	31.0	27.7	31.2	27.9	31.5	28.2	31.7	28.4	32.0	28.6
8.	46.4	31.0	27.8	31.3	28.0	31.6	28.2	31.8	28.5	32.1	28.7
7.	44.6	31.1	27.9	31.4	28.1	31.6	28.3	31.9	28.6	32.2	28.8
6.	42.8	31.2	27.9	31.5	28.2	31.7	28.4	32.0	28.6	32.2	28.9
5.	41.0	31.3	28.0	31.5	28.2	31.8	28.5	32.1	28.7	32.3	28.9
4.	39.2	31.4	28.1	31.6	28.3	31.9	28.6	32.1	28.8	32.4	29.0
3.	37.4	31.4	28.2	31.7	28.4	32.0	28.6	32.2	28.9	32.5	29.1
2.	35.6	31.5	28.2	31.8	28.5	32.0	28.7	32.3	28.9	32.6	29.2
1.	33.8	31.6	28.3	31.9	28.6	32.1	28.8	32.4	29.0	32.7	29.3
-0.	32.0	31.7	28.4	31.9	28.6	32.2	28.9	32.5	29.1	32.7	29.3
-1.	30.2	31.8	28.5	32.0	28.7	32.3	28.9	32.6	29.2	32.8	29.4
-2.	28.4	31.8	28.5	32.1	28.8	32.4	29.0	32.6	29.3	32.9	29.5
-3.	26.6	31.9	28.6	32.2	28.9	32.5	29.1	32.7	29.3	33.0	29.6
-4.	24.8	32.0	28.7	32.3	28.9	32.5	29.2	32.8	29.4	33.1	29.7
-5.	23.0	32.1	28.8	32.4	29.0	32.6	29.3	32.9	29.5	33.2	29.7
-6.	21.2	32.2	28.8	32.4	29.1	32.7	29.3	33.0	29.6	33.2	29.8
-7.	19.4	32.2	28.9	32.5	29.2	32.8	29.4	33.1	29.6	33.3	29.9
-8.	17.6	32.3	29.0	32.6	29.2	32.9	29.5	33.1	29.7	33.4	30.0
-9.	15.8	32.4	29.1	32.7	29.3	32.9	29.6	33.2	29.8	33.5	30.0
-10.	14.0	32.5	29.2	32.8	29.4	33.0	29.6	33.3	29.9	33.6	30.1
-11.	12.2	32.6	29.2	32.8	29.5	33.1	29.7	33.4	30.0	33.7	30.2
-12.	10.4	32.7	29.3	32.9	29.5	33.2	29.8	33.5	30.0	33.7	30.3
-13.	8.6	32.7	29.4	33.0	29.6	33.3	29.9	33.5	30.1	33.8	30.4
-14.	6.8	32.8	29.5	33.1	29.7	33.4	29.9	33.6	30.2	33.9	30.4
-15.	5.0	32.9	29.5	33.2	29.8	33.4	30.0	33.7	30.3	34.0	30.5
-16.	3.2	33.0	29.6	33.2	29.9	33.5	30.1	33.8	30.3	34.1	30.6
-17.	1.4	33.1	29.7	33.3	29.9	33.6	30.2	33.9	30.4	34.2	30.7
-18.	-0.4	33.1	29.8	33.4	30.0	33.7	30.3	34.0	30.5	34.2	30.7
-19.	-2.2	33.2	29.8	33.5	30.1	33.8	30.3	34.0	30.6	34.3	30.8
-20.	-4.0	33.3	29.9	33.6	30.2	33.9	30.4	34.1	30.7	34.4	30.9
-21.	-5.8	33.4	30.0	33.7	30.2	33.9	30.5	34.2	30.7	34.5	31.0
-22.	-7.6	33.5	30.1	33.7	30.3	34.0	30.6	34.3	30.8	34.6	31.1
-23.	-9.4	33.5	30.1	33.8	30.4	34.1	30.6	34.4	30.9	34.7	31.1
-24.	-11.2	33.6	30.2	33.9	30.5	34.2	30.7	34.5	31.0	34.7	31.2
-25.	-13.0	33.7	30.3	34.0	30.5	34.3	30.8	34.5	31.0	34.8	31.3
-26.	-14.8	33.8	30.4	34.1	30.6	34.3	30.9	34.6	31.1	34.9	31.4
-27.	-16.6	33.9	30.4	34.1	30.7	34.4	30.9	34.7	31.2	35.0	31.5
-28.	-18.4	33.9	30.5	34.2	30.8	34.5	31.0	34.8	31.3	35.1	31.5
-29.	-20.2	34.0	30.6	34.3	30.8	34.6	31.1	34.9	31.4	35.2	31.6
-30.	-22.0	34.1	30.7	34.4	30.9	34.7	31.2	35.0	31.4	35.2	31.7
-31.	-23.8	34.2	30.7	34.5	31.0	34.8	31.3	35.0	31.5	35.3	31.8
-32.	-25.6	34.3	30.8	34.5	31.1	34.8	31.3	35.1	31.6	35.4	31.8
-33.	-27.4	34.3	30.9	34.6	31.2	34.9	31.4	35.2	31.7	35.5	31.9
-34.	-29.2	34.4	31.0	34.7	31.2	35.0	31.5	35.3	31.7	35.6	32.0
-35.	-31.0	34.5	31.0	34.8	31.3	35.1	31.6	35.4	31.8	35.7	32.1
-36.	-32.8	34.6	31.1	34.9	31.4	35.2	31.6	35.4	31.9	35.7	32.2
-37.	-34.6	34.7	31.2	35.0	31.5	35.2	31.7	35.5	32.0	35.8	32.2
-38.	-36.4	34.7	31.3	35.0	31.5	35.3	31.8	35.6	32.1	35.9	32.3
-39.	-38.2	34.8	31.4	35.1	31.6	35.4	31.9	35.7	32.1	36.0	32.4
-40.	-40.0	34.9	31.4	35.2	31.7	35.5	31.9	35.8	32.2	36.1	32.5

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Figure FO-12. Power Check Chart; Manual Fuel Control (Sheet 1 of 7)

Minimum and Maximum Manual Fuel Control Power Check Chart
TF41-A-1

NOTE

Values shown are for engine operating with air inlet screen installed and air conditioning system operating. If engine must be operated with screen removed, add 1.3" Hg to $P_{T5.1}$ true pressure.

Ambient Temperature		Ambient Pressure – Inches Mercury Absolute									
		25.0		25.2		25.4		25.6		25.8	
		$P_{T5.1}$ True Pressure – Inches Mercury Gage									
°C	°F	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
27.	80.6	30.7	27.4	31.0	27.7	31.2	27.9	31.5	28.1	31.7	28.3
26.	78.8	30.8	27.5	31.1	27.7	31.3	28.0	31.6	28.2	31.8	28.4
25.	77.0	30.9	27.6	31.2	27.8	31.4	28.0	31.6	28.3	31.9	28.5
24.	75.2	31.0	27.7	31.2	27.9	31.5	28.1	31.7	28.3	32.0	28.6
23.	73.4	31.1	27.8	31.3	28.0	31.6	28.2	31.8	28.4	32.1	28.6
22.	71.6	31.2	27.8	31.4	28.1	31.7	28.3	31.9	28.5	32.2	28.7
21.	69.8	31.2	27.9	31.5	28.1	31.7	28.4	32.0	28.6	32.2	28.8
20.	68.0	31.3	28.0	31.6	28.2	31.8	28.4	32.1	28.7	32.3	28.9
19.	66.2	31.4	28.1	31.7	28.3	31.9	28.5	32.2	28.7	32.4	29.0
18.	64.4	31.5	28.2	31.7	28.4	32.0	28.6	32.2	28.8	32.5	29.1
17.	62.6	31.6	28.2	31.8	28.5	32.1	28.7	32.3	28.9	32.6	29.1
16.	60.8	31.7	28.3	31.9	28.5	32.2	28.8	32.4	29.0	32.7	29.2
15.	59.0	31.7	28.4	32.0	28.6	32.3	28.8	32.5	29.1	32.8	29.3
14.	57.2	31.8	28.5	32.1	28.7	32.3	28.9	32.6	29.2	32.8	29.4
13.	55.4	31.9	28.5	32.2	28.8	32.4	29.0	32.7	29.2	32.9	29.5
12.	53.6	32.0	28.6	32.3	28.9	32.5	29.1	32.8	29.3	33.0	29.5
11.	51.8	32.1	28.7	32.3	28.9	32.6	29.2	32.8	29.4	33.1	29.6
10.	50.0	32.2	28.8	32.4	29.0	32.7	29.2	32.9	29.5	33.2	29.7
9.	48.2	32.2	28.9	32.5	29.1	32.8	29.3	33.0	29.6	33.3	29.8
8.	46.4	32.3	28.9	32.6	29.2	32.8	29.4	33.1	29.6	33.4	29.9
7.	44.6	32.4	29.0	32.7	29.3	32.9	29.5	33.2	29.7	33.5	30.0
6.	42.8	32.5	29.1	32.8	29.3	33.0	29.6	33.3	29.8	33.5	30.0
5.	41.0	32.6	29.2	32.8	29.4	33.1	29.6	33.4	29.9	33.6	30.1
4.	39.2	32.7	29.3	32.9	29.5	33.2	29.7	33.5	30.0	33.7	30.2
3.	37.4	32.8	29.3	33.0	29.6	33.3	29.8	33.5	30.0	33.8	30.3
2.	35.6	32.8	29.4	33.1	29.7	33.4	29.9	33.6	30.1	33.9	30.4
1.	33.8	32.9	29.5	33.2	29.7	33.4	30.0	33.7	30.2	34.0	30.4
-0.	32.0	33.0	29.6	33.3	29.8	33.5	30.0	33.8	30.3	34.1	30.5
-1.	30.2	33.1	29.7	33.4	29.9	33.6	30.1	33.9	30.4	34.1	30.6
-2.	28.4	33.2	29.7	33.4	30.0	33.7	30.2	34.0	30.4	34.2	30.7
-3.	26.6	33.3	29.8	33.5	30.1	33.8	30.3	34.1	30.5	34.3	30.8
-4.	24.8	33.3	29.9	33.6	30.1	33.9	30.4	34.1	30.6	34.4	30.8
-5.	23.0	33.4	30.0	33.7	30.2	34.0	30.4	34.2	30.7	34.5	30.9
-6.	21.2	33.5	30.0	33.8	30.3	34.0	30.5	34.3	30.8	34.6	31.0
-7.	19.4	33.6	30.1	33.9	30.4	34.1	30.6	34.4	30.9	34.7	31.1
-8.	17.6	33.7	30.2	33.9	30.4	34.2	30.7	34.5	30.9	34.8	31.2
-9.	15.8	33.8	30.3	34.0	30.5	34.3	30.8	34.6	31.0	34.8	31.3
-10.	14.0	33.8	30.4	34.1	30.6	34.4	30.9	34.7	31.1	34.9	31.3
-11.	12.2	33.9	30.4	34.2	30.7	34.5	30.9	34.7	31.2	35.0	31.4
-12.	10.4	34.0	30.5	34.3	30.8	34.6	31.0	34.8	31.3	35.1	31.5
-13.	8.6	34.1	30.6	34.4	30.8	34.6	31.1	34.9	31.3	35.2	31.6
-14.	6.8	34.2	30.7	34.5	30.9	34.7	31.2	35.0	31.4	35.3	31.7
-15.	5.0	34.3	30.8	34.5	31.0	34.8	31.3	35.1	31.5	35.4	31.7
-16.	3.2	34.3	30.8	34.6	31.1	34.9	31.3	35.2	31.6	35.4	31.8
-17.	1.4	34.4	30.9	34.7	31.2	35.0	31.4	35.3	31.7	35.5	31.9
-18.	-0.4	34.5	31.0	34.8	31.2	35.1	31.5	35.3	31.7	35.6	32.0
-19.	-2.2	34.6	31.1	34.9	31.3	35.2	31.6	35.4	31.8	35.7	32.1
-20.	-4.0	34.7	31.2	35.0	31.4	35.2	31.7	35.5	31.9	35.8	32.2
-21.	-5.8	34.8	31.2	35.0	31.5	35.3	31.7	35.6	32.0	35.9	32.2
-22.	-7.6	34.9	31.3	35.1	31.6	35.4	31.8	35.7	32.1	36.0	32.3
-23.	-9.4	34.9	31.4	35.2	31.6	35.5	31.9	35.8	32.1	36.1	32.4
-24.	-11.2	35.0	31.5	35.3	31.7	35.6	32.0	35.9	32.2	36.1	32.5
-25.	-13.0	35.1	31.6	35.4	31.8	35.7	32.1	35.9	32.3	36.2	32.6
-26.	-14.8	35.2	31.6	35.5	31.9	35.7	32.1	36.0	32.4	36.3	32.6
-27.	-16.6	35.3	31.7	35.6	32.0	35.8	32.2	36.1	32.5	36.4	32.7
-28.	-18.4	35.4	31.8	35.6	32.0	35.9	32.3	36.2	32.6	36.5	32.8
-29.	-20.2	35.4	31.9	35.7	32.1	36.0	32.4	36.3	32.6	36.6	32.9
-30.	-22.0	35.5	31.9	35.8	32.2	36.1	32.5	36.4	32.7	36.7	33.0
-31.	-23.8	35.6	32.0	35.9	32.3	36.2	32.5	36.5	32.8	36.7	33.0
-32.	-25.6	35.7	32.1	36.0	32.4	36.3	32.6	36.5	32.9	36.8	33.1
-33.	-27.4	35.8	32.2	36.1	32.4	36.3	32.7	36.6	33.0	36.9	33.2
-34.	-29.2	35.9	32.3	36.1	32.5	36.4	32.8	36.7	33.0	37.0	33.3
-35.	-31.0	35.9	32.3	36.2	32.6	36.5	32.9	36.8	33.1	37.1	33.4
-36.	-32.8	36.0	32.4	36.3	32.7	36.6	32.9	36.9	33.2	37.2	33.5
-37.	-34.6	36.1	32.5	36.4	32.8	36.7	33.0	37.0	33.3	37.3	33.5
-38.	-36.4	36.2	32.6	36.5	32.8	36.8	33.1	37.1	33.4	37.4	33.6
-39.	-38.2	36.3	32.7	36.6	32.9	36.9	33.2	37.1	33.4	37.4	33.7
-40.	-40.0	36.4	32.7	36.7	33.0	36.9	33.3	37.2	33.5	37.5	33.8

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Figure FO-12. Power Check Chart; Manual Fuel Control (Sheet 2)

Minimum and Maximum Manual Fuel Control Power Check Chart
TF41-A-1

NOTE

Values shown are for engine operating with air inlet screen installed and air conditioning system operating. If engine must be operated with screen removed, add 1.3" Hg to $P_{T5.1}$ true pressure.

Ambient Temperature		Ambient Pressure – Inches Mercury Absolute: 26.0 ($P_{T5.1}$ True Pressure – Inches Mercury Gage)		26.2		26.4		26.6		26.8	
°C	°F	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
27.	80.6	32.0	28.5	32.2	28.8	32.5	29.0	32.7	29.2	32.9	29.4
26.	78.8	32.1	28.6	32.3	28.8	32.5	29.1	32.8	29.3	33.0	29.5
25.	77.0	32.1	28.7	32.4	28.9	32.6	29.1	32.9	29.4	33.1	29.6
24.	75.2	32.2	28.8	32.5	29.0	32.7	29.2	33.0	29.5	33.2	29.7
23.	73.4	32.3	28.9	32.6	29.1	32.8	29.3	33.1	29.5	33.3	29.8
22.	71.6	32.4	29.0	32.7	29.2	32.9	29.4	33.1	29.6	33.4	29.8
21.	69.8	32.5	29.0	32.7	29.3	33.0	29.5	33.2	29.7	33.5	29.9
20.	68.0	32.6	29.1	32.8	29.3	33.1	29.6	33.3	29.8	33.6	30.0
19.	66.2	32.7	29.2	32.9	29.4	33.2	29.6	33.4	29.9	33.7	30.1
18.	64.4	32.8	29.3	33.0	29.5	33.3	29.7	33.5	30.0	33.8	30.2
17.	62.6	32.8	29.4	33.1	29.6	33.3	29.8	33.6	30.0	33.8	30.3
16.	60.8	32.9	29.4	33.2	29.7	33.4	29.9	33.7	30.1	33.9	30.3
15.	59.0	33.0	29.5	33.3	29.8	33.5	30.0	33.8	30.2	34.0	30.4
14.	57.2	33.1	29.6	33.4	29.8	33.6	30.1	33.9	30.3	34.1	30.5
13.	55.4	33.2	29.7	33.4	29.9	33.7	30.1	34.0	30.4	34.2	30.6
12.	53.6	33.3	29.8	33.5	30.0	33.8	30.2	34.0	30.5	34.3	30.7
11.	51.8	33.4	29.9	33.6	30.1	33.9	30.3	34.1	30.5	34.4	30.8
10.	50.0	33.5	29.9	33.7	30.2	34.0	30.4	34.2	30.6	34.5	30.9
9.	48.2	33.5	30.0	33.8	30.2	34.1	30.5	34.3	30.7	34.6	30.9
8.	46.4	33.6	30.1	33.9	30.3	34.1	30.6	34.4	30.8	34.7	31.0
7.	44.6	33.7	30.2	34.0	30.4	34.2	30.6	34.5	30.9	34.7	31.1
6.	42.8	33.8	30.3	34.1	30.5	34.3	30.7	34.6	31.0	34.8	31.2
5.	41.0	33.9	30.3	34.1	30.6	34.4	30.8	34.7	31.0	34.9	31.3
4.	39.2	34.0	30.4	34.2	30.7	34.5	30.9	34.8	31.1	35.0	31.4
3.	37.4	34.1	30.5	34.3	30.7	34.6	31.0	34.8	31.2	35.1	31.5
2.	35.6	34.1	30.6	34.4	30.8	34.7	31.1	34.9	31.3	35.2	31.5
1.	33.8	34.2	30.7	34.5	30.9	34.8	31.1	35.0	31.4	35.3	31.6
-0.	32.0	34.3	30.8	34.6	31.0	34.9	31.2	35.1	31.5	35.4	31.7
-1.	30.2	34.4	30.8	34.7	31.1	34.9	31.3	35.2	31.6	35.5	31.8
-2.	28.4	34.5	30.9	34.8	31.2	35.0	31.4	35.3	31.6	35.6	31.9
-3.	26.6	34.6	31.0	34.9	31.2	35.1	31.5	35.4	31.7	35.6	32.0
-4.	24.8	34.7	31.1	34.9	31.3	35.2	31.6	35.5	31.8	35.7	32.0
-5.	23.0	34.8	31.2	35.0	31.4	35.3	31.6	35.6	31.9	35.8	32.1
-6.	21.2	34.8	31.3	35.1	31.5	35.4	31.7	35.7	32.0	35.9	32.2
-7.	19.4	34.9	31.3	35.2	31.6	35.5	31.8	35.7	32.1	36.0	32.3
-8.	17.6	35.0	31.4	35.3	31.7	35.6	31.9	35.8	32.1	36.1	32.4
-9.	15.8	35.1	31.5	35.4	31.7	35.6	32.0	35.9	32.2	36.2	32.5
-10.	14.0	35.2	31.6	35.5	31.8	35.7	32.1	36.0	32.3	36.3	32.6
-11.	12.2	35.3	31.7	35.6	31.9	35.8	32.1	36.1	32.4	36.4	32.6
-12.	10.4	35.4	31.7	35.6	32.0	35.9	32.2	36.2	32.5	36.5	32.7
-13.	8.6	35.5	31.8	35.7	32.1	36.0	32.3	36.3	32.6	36.5	32.8
-14.	6.8	35.5	31.9	35.8	32.2	36.1	32.4	36.4	32.6	36.6	32.9
-15.	5.0	35.6	32.0	35.9	32.2	36.2	32.5	36.5	32.7	36.7	33.0
-16.	3.2	35.7	32.1	36.0	32.3	36.3	32.6	36.5	32.8	36.8	33.1
-17.	1.4	35.8	32.2	36.1	32.4	36.4	32.6	36.6	32.9	36.9	33.1
-18.	-0.4	35.9	32.2	36.2	32.5	36.4	32.7	36.7	33.0	37.0	33.2
-19.	-2.2	36.0	32.3	36.3	32.6	36.5	32.8	36.8	33.1	37.1	33.3
-20.	-4.0	36.1	32.4	36.3	32.7	36.6	32.9	36.9	33.1	37.2	33.4
-21.	-5.8	36.2	32.5	36.4	32.7	36.7	33.0	37.0	33.2	37.3	33.5
-22.	-7.6	36.2	32.6	36.5	32.8	36.8	33.1	37.1	33.3	37.4	33.6
-23.	-9.4	36.3	32.6	36.6	32.9	36.9	33.2	37.2	33.4	37.4	33.7
-24.	-11.2	36.4	32.7	36.7	33.0	37.0	33.2	37.3	33.5	37.5	33.7
-25.	-13.0	36.5	32.8	36.8	33.1	37.1	33.3	37.3	33.6	37.6	33.8
-26.	-14.8	36.6	32.9	36.9	33.1	37.2	33.4	37.4	33.7	37.7	33.9
-27.	-16.6	36.7	33.0	37.0	33.2	37.2	33.5	37.5	33.7	37.8	34.0
-28.	-18.4	36.8	33.1	37.1	33.3	37.3	33.6	37.6	33.8	37.9	34.1
-29.	-20.2	36.9	33.1	37.1	33.4	37.4	33.7	37.7	33.9	38.0	34.2
-30.	-22.0	36.9	33.2	37.2	33.5	37.5	33.7	37.8	34.0	38.1	34.2
-31.	-23.8	37.0	33.3	37.3	33.6	37.6	33.8	37.9	34.1	38.2	34.3
-32.	-25.6	37.1	33.4	37.4	33.6	37.7	33.9	38.0	34.2	38.3	34.4
-33.	-27.4	37.2	33.5	37.5	33.7	37.8	34.0	38.1	34.2	38.4	34.5
-34.	-29.2	37.3	33.6	37.6	33.8	37.9	34.1	38.2	34.3	38.4	34.6
-35.	-31.0	37.4	33.6	37.7	33.9	38.0	34.2	38.2	34.4	38.5	34.7
-36.	-32.8	37.5	33.7	37.8	34.0	38.0	34.2	38.3	34.5	38.6	34.8
-37.	-34.6	37.6	33.8	37.8	34.1	38.1	34.3	38.4	34.6	38.7	34.8
-38.	-36.4	37.6	33.9	37.9	34.1	38.2	34.4	38.5	34.7	38.8	34.9
-39.	-38.2	37.7	34.0	38.0	34.2	38.3	34.5	38.6	34.7	38.9	35.0
-40.	-40.0	37.8	34.0	38.1	34.3	38.4	34.6	38.7	34.8	39.0	35.1

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Figure FO-12. Power Check Chart; Manual Fuel Control (Sheet 3)

Minimum and Maximum Manual Fuel Control Power Check Chart
TF41-A-1

NOTE

Values shown are for engine operating with air inlet screen installed and air conditioning system operating. If engine must be operated with screen removed, add 1.3" Hg to $P_{T5.1}$ true pressure.

Ambient Temperature		Ambient Pressure – Inches Mercury Absolute: 27.0		27.2		27.4		27.6		27.8	
		$P_{T5.1}$ True Pressure – Inches Mercury Gage									
°C	°F	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
27.	80.6	33.2	29.6	33.4	29.9	33.7	30.1	33.9	30.3	34.2	30.5
26.	78.8	33.3	29.7	33.5	29.9	33.8	30.2	34.0	30.4	34.3	30.6
25.	77.0	33.4	29.8	33.6	30.0	33.9	30.2	34.1	30.5	34.4	30.7
24.	75.2	33.5	29.9	33.7	30.1	34.0	30.3	34.2	30.6	34.5	30.8
23.	73.4	33.6	30.0	33.8	30.2	34.1	30.4	34.3	30.6	34.6	30.9
22.	71.6	33.6	30.1	33.9	30.3	34.1	30.5	34.4	30.7	34.6	31.0
21.	69.8	33.7	30.1	34.0	30.4	34.2	30.6	34.5	30.8	34.7	31.0
20.	68.0	33.8	30.2	34.1	30.5	34.3	30.7	34.6	30.9	34.8	31.1
19.	66.2	33.9	30.3	34.2	30.5	34.4	30.8	34.7	31.0	34.9	31.2
18.	64.4	34.0	30.4	34.3	30.6	34.5	30.9	34.8	31.1	35.0	31.3
17.	62.6	34.1	30.5	34.4	30.7	34.6	30.9	34.9	31.2	35.1	31.4
16.	60.8	34.2	30.6	34.4	30.8	34.7	31.0	35.0	31.3	35.2	31.5
15.	59.0	34.3	30.7	34.5	30.9	34.8	31.1	35.0	31.3	35.3	31.6
14.	57.2	34.4	30.7	34.6	31.0	34.9	31.2	35.1	31.4	35.4	31.7
13.	55.4	34.5	30.8	34.7	31.1	35.0	31.3	35.2	31.5	35.5	31.7
12.	53.6	34.6	30.9	34.8	31.1	35.1	31.4	35.3	31.6	35.6	31.8
11.	51.8	34.6	31.0	34.9	31.2	35.2	31.5	35.4	31.7	35.7	31.9
10.	50.0	34.7	31.1	35.0	31.3	35.3	31.5	35.5	31.8	35.8	32.0
9.	48.2	34.8	31.2	35.1	31.4	35.3	31.6	35.6	31.9	35.9	32.1
8.	46.4	34.9	31.3	35.2	31.5	35.4	31.7	35.7	32.0	36.0	32.2
7.	44.6	35.0	31.3	35.3	31.6	35.5	31.8	35.8	32.0	36.0	32.3
6.	42.8	35.1	31.4	35.4	31.7	35.6	31.9	35.9	32.1	36.1	32.4
5.	41.0	35.2	31.5	35.5	31.7	35.7	32.0	36.0	32.2	36.2	32.4
4.	39.2	35.3	31.6	35.5	31.8	35.8	32.1	36.1	32.3	36.3	32.5
3.	37.4	35.4	31.7	35.6	31.9	35.9	32.2	36.2	32.4	36.4	32.6
2.	35.6	35.5	31.8	35.7	32.0	36.0	32.2	36.3	32.5	36.5	32.7
1.	33.8	35.6	31.9	35.8	32.1	36.1	32.3	36.3	32.6	36.6	32.8
-0.	32.0	35.6	31.9	35.9	32.2	36.2	32.4	36.4	32.7	36.7	32.9
-1.	30.2	35.7	32.0	36.0	32.3	36.3	32.5	36.5	32.7	36.8	33.0
-2.	28.4	35.8	32.1	36.1	32.3	36.4	32.6	36.6	32.8	36.9	33.1
-3.	26.6	35.9	32.2	36.2	32.4	36.4	32.7	36.7	32.9	37.0	33.2
-4.	24.8	36.0	32.3	36.3	32.5	36.5	32.8	36.8	33.0	37.1	33.2
-5.	23.0	36.1	32.4	36.4	32.6	36.6	32.8	36.9	33.1	37.2	33.3
-6.	21.2	36.2	32.5	36.5	32.7	36.7	32.9	37.0	33.2	37.3	33.4
-7.	19.4	36.3	32.5	36.5	32.8	36.8	33.0	37.1	33.3	37.4	33.5
-8.	17.6	36.4	32.6	36.6	32.9	36.9	33.1	37.2	33.3	37.4	33.6
-9.	15.8	36.5	32.7	36.7	33.0	37.0	33.2	37.3	33.4	37.5	33.7
-10.	14.0	36.6	32.8	36.8	33.0	37.1	33.3	37.4	33.5	37.6	33.8
-11.	12.2	36.6	32.9	36.9	33.1	37.2	33.4	37.5	33.6	37.7	33.9
-12.	10.4	36.7	33.0	37.0	33.2	37.3	33.5	37.5	33.7	37.8	33.9
-13.	8.6	36.8	33.1	37.1	33.3	37.4	33.5	37.6	33.8	37.9	34.0
-14.	6.8	36.9	33.1	37.2	33.4	37.5	33.6	37.7	33.9	38.0	34.1
-15.	5.0	37.0	33.2	37.3	33.5	37.6	33.7	37.8	34.0	38.1	34.2
-16.	3.2	37.1	33.3	37.4	33.6	37.6	33.8	37.9	34.0	38.2	34.3
-17.	1.4	37.2	33.4	37.5	33.6	37.7	33.9	38.0	34.1	38.3	34.4
-18.	-0.4	37.3	33.5	37.6	33.7	37.8	34.0	38.1	34.2	38.4	34.5
-19.	-2.2	37.4	33.6	37.6	33.8	37.9	34.1	38.2	34.3	38.5	34.6
-20.	-4.0	37.5	33.6	37.7	33.9	38.0	34.1	38.3	34.4	38.6	34.6
-21.	-5.8	37.5	33.7	37.8	34.0	38.1	34.2	38.4	34.5	38.7	34.7
-22.	-7.6	37.6	33.8	37.9	34.1	38.2	34.3	38.5	34.6	38.8	34.8
-23.	-9.4	37.7	33.9	38.0	34.2	38.3	34.4	38.6	34.7	38.8	34.9
-24.	-11.2	37.8	34.0	38.1	34.2	38.4	34.5	38.7	34.7	38.9	35.0
-25.	-13.0	37.9	34.1	38.2	34.3	38.5	34.6	38.8	34.8	39.0	35.1
-26.	-14.8	38.0	34.2	38.3	34.4	38.6	34.7	38.8	34.9	39.1	35.2
-27.	-16.6	38.1	34.2	38.4	34.5	38.7	34.8	38.9	35.0	39.2	35.3
-28.	-18.4	38.2	34.3	38.5	34.6	38.7	34.8	39.0	35.1	39.3	35.3
-29.	-20.2	38.3	34.4	38.6	34.7	38.8	34.9	39.1	35.2	39.4	35.4
-30.	-22.0	38.4	34.5	38.6	34.8	38.9	35.0	39.2	35.3	39.5	35.5
-31.	-23.8	38.5	34.6	38.7	34.8	39.0	35.1	39.3	35.4	39.6	35.6
-32.	-25.6	38.5	34.7	38.8	34.9	39.1	35.2	39.4	35.4	39.7	35.7
-33.	-27.4	38.6	34.8	38.9	35.0	39.2	35.3	39.5	35.5	39.8	35.8
-34.	-29.2	38.7	34.8	39.0	35.1	39.3	35.4	39.6	35.6	39.9	35.9
-35.	-31.0	38.8	34.9	39.1	35.2	39.4	35.4	39.7	35.7	40.0	36.0
-36.	-32.8	38.9	35.0	39.2	35.3	39.5	35.5	39.8	35.8	40.1	36.1
-37.	-34.6	39.0	35.1	39.3	35.4	39.6	35.6	39.9	35.9	40.2	36.1
-38.	-36.4	39.1	35.2	39.4	35.4	39.7	35.7	40.0	36.0	40.2	36.2
-39.	-38.2	39.2	35.3	39.5	35.5	39.8	35.8	40.1	36.1	40.3	36.3
-40.	-40.0	39.3	35.4	39.6	35.6	39.9	35.9	40.1	36.1	40.4	36.4

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Figure FO-12. Power Check Chart; Manual Fuel Control (Sheet 4)

Minimum and Maximum Manual Fuel Control Power Check Chart
TF41-A-1

NOTE

Values shown are for engine operating with air inlet screen installed and air conditioning system operating. If engine must be operated with screen removed, add 1.3" Hg to $P_{T5.1}$ true pressure.

Ambient Temperature		Ambient Pressure – Inches Mercury Absolute: 28.0		28.2		28.4		28.6		28.8	
		$P_{T5.1}$ True Pressure – Inches Mercury Gage									
°C	°F	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
27.	80.6	34.4	30.7	34.7	31.0	34.9	31.2	35.2	31.4	35.4	31.6
26.	78.8	34.5	30.8	34.8	31.0	35.0	31.3	35.3	31.5	35.5	31.7
25.	77.0	34.6	30.9	34.9	31.1	35.1	31.4	35.4	31.6	35.6	31.8
24.	75.2	34.7	31.0	35.0	31.2	35.2	31.4	35.5	31.7	35.7	31.9
23.	73.4	34.8	31.1	35.0	31.3	35.3	31.5	35.5	31.8	35.8	32.0
22.	71.6	34.9	31.2	35.1	31.4	35.4	31.6	35.6	31.8	35.9	32.1
21.	69.8	35.0	31.3	35.2	31.5	35.5	31.7	35.7	31.9	36.0	32.2
20.	68.0	35.1	31.4	35.3	31.6	35.6	31.8	35.8	32.0	36.1	32.2
19.	66.2	35.2	31.4	35.4	31.7	35.7	31.9	35.9	32.1	36.2	32.3
18.	64.4	35.3	31.5	35.5	31.8	35.8	32.0	36.0	32.2	36.3	32.4
17.	62.6	35.4	31.6	35.6	31.8	35.9	32.1	36.1	32.3	36.4	32.5
16.	60.8	35.5	31.7	35.7	31.9	36.0	32.2	36.2	32.4	36.5	32.6
15.	59.0	35.6	31.8	35.8	32.0	36.1	32.3	36.3	32.5	36.6	32.7
14.	57.2	35.6	31.9	35.9	32.1	36.2	32.3	36.4	32.6	36.7	32.8
13.	55.4	35.7	32.0	36.0	32.2	36.3	32.4	36.5	32.7	36.8	32.9
12.	53.6	35.8	32.1	36.1	32.3	36.3	32.5	36.6	32.7	36.9	33.0
11.	51.8	35.9	32.2	36.2	32.4	36.4	32.6	36.7	32.8	37.0	33.1
10.	50.0	36.0	32.2	36.3	32.5	36.5	32.7	36.8	32.9	37.1	33.2
9.	48.2	36.1	32.3	36.4	32.6	36.6	32.8	36.9	33.0	37.1	33.3
8.	46.4	36.2	32.4	36.5	32.6	36.7	32.9	37.0	33.1	37.2	33.3
7.	44.6	36.3	32.5	36.6	32.7	36.8	33.0	37.1	33.2	37.3	33.4
6.	42.8	36.4	32.6	36.7	32.8	36.9	33.1	37.2	33.3	37.4	33.5
5.	41.0	36.5	32.7	36.8	32.9	37.0	33.1	37.3	33.4	37.5	33.6
4.	39.2	36.6	32.8	36.8	33.0	37.1	33.2	37.4	33.5	37.6	33.7
3.	37.4	36.7	32.9	36.9	33.1	37.2	33.3	37.5	33.6	37.7	33.8
2.	35.6	36.8	32.9	37.0	33.2	37.3	33.4	37.6	33.7	37.8	33.9
1.	33.8	36.9	33.0	37.1	33.3	37.4	33.5	37.7	33.7	37.9	34.0
-0.	32.0	37.0	33.1	37.2	33.4	37.5	33.6	37.8	33.8	38.0	34.1
-1.	30.2	37.1	33.2	37.3	33.5	37.6	33.7	37.9	33.9	38.1	34.2
-2.	28.4	37.2	33.3	37.4	33.5	37.7	33.8	37.9	34.0	38.2	34.3
-3.	26.6	37.2	33.4	37.5	33.6	37.8	33.9	38.0	34.1	38.3	34.3
-4.	24.8	37.3	33.5	37.6	33.7	37.9	34.0	38.1	34.2	38.4	34.4
-5.	23.0	37.4	33.6	37.7	33.8	38.0	34.0	38.2	34.3	38.5	34.5
-6.	21.2	37.5	33.7	37.8	33.9	38.1	34.1	38.3	34.4	38.6	34.6
-7.	19.4	37.6	33.7	37.9	34.0	38.2	34.2	38.4	34.5	38.7	34.7
-8.	17.6	37.7	33.8	38.0	34.1	38.3	34.3	38.5	34.6	38.8	34.8
-9.	15.8	37.8	33.9	38.1	34.2	38.4	34.4	38.6	34.6	38.9	34.9
-10.	14.0	37.9	34.0	38.2	34.3	38.4	34.5	38.7	34.7	39.0	35.0
-11.	12.2	38.0	34.1	38.3	34.3	38.5	34.6	38.8	34.8	39.1	35.1
-12.	10.4	38.1	34.2	38.4	34.4	38.6	34.7	38.9	34.9	39.2	35.2
-13.	8.6	38.2	34.3	38.5	34.5	38.7	34.8	39.0	35.0	39.3	35.3
-14.	6.8	38.3	34.4	38.6	34.6	38.8	34.9	39.1	35.1	39.4	35.3
-15.	5.0	38.4	34.5	38.6	34.7	38.9	34.9	39.2	35.2	39.5	35.4
-16.	3.2	38.5	34.5	38.7	34.8	39.0	35.0	39.3	35.3	39.6	35.5
-17.	1.4	38.6	34.6	38.8	34.9	39.1	35.1	39.4	35.4	39.7	35.6
-18.	-0.4	38.7	34.7	38.9	35.0	39.2	35.2	39.5	35.5	39.8	35.7
-19.	-2.2	38.8	34.8	39.0	35.1	39.3	36.3	39.6	35.6	39.9	35.8
-20.	-4.0	38.8	34.9	39.1	35.1	39.4	35.4	39.7	35.6	40.0	35.9
-21.	-5.8	38.9	35.0	39.2	35.2	39.5	35.5	39.8	35.7	40.1	36.0
-22.	-7.6	39.0	35.1	39.3	35.3	39.6	35.6	39.9	35.8	40.1	36.1
-23.	-9.4	39.1	35.2	39.4	35.4	39.7	35.7	40.0	35.9	40.2	36.2
-24.	-11.2	39.2	35.2	39.5	35.5	39.8	35.8	40.1	36.0	40.3	36.3
-25.	-13.0	39.3	35.3	39.6	35.6	39.9	35.8	40.2	36.1	40.4	36.3
-26.	-14.8	39.4	35.4	39.7	35.7	40.0	35.9	40.3	36.2	40.5	36.4
-27.	-16.6	39.5	35.5	39.8	35.8	40.1	36.0	40.3	36.3	40.6	36.5
-28.	-18.4	39.6	35.6	39.9	35.9	40.2	36.1	40.4	36.4	40.7	36.6
-29.	-20.2	39.7	35.7	40.0	35.9	40.3	36.2	40.5	36.5	40.8	36.7
-30.	-22.0	39.8	35.8	40.1	36.0	40.4	36.3	40.6	36.5	40.9	36.8
-31.	-23.8	39.9	35.9	40.2	36.1	40.4	36.4	40.7	36.6	41.0	36.9
-32.	-25.6	40.0	36.0	40.3	36.2	40.5	36.5	40.8	36.7	41.1	37.0
-33.	-27.4	40.1	36.0	40.4	36.3	40.6	36.6	40.9	36.8	41.2	37.1
-34.	-29.2	40.2	36.1	40.4	36.4	40.7	36.6	41.0	36.9	41.3	37.2
-35.	-31.0	40.3	36.2	40.5	36.5	40.8	36.7	41.1	37.0	41.4	37.3
-36.	-32.8	40.3	36.3	40.6	36.6	40.9	36.8	41.2	37.1	41.5	37.3
-37.	-34.6	40.4	36.4	40.7	36.7	41.0	36.9	41.3	37.2	41.6	37.4
-38.	-36.4	40.5	36.5	40.8	36.7	41.1	37.0	41.4	37.3	41.7	37.5
-39.	-38.2	40.6	36.6	40.9	36.8	41.2	37.1	41.5	37.4	41.8	37.6
-40.	-40.0	40.7	36.7	41.0	36.9	41.3	37.2	41.6	37.4	41.9	37.7

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Figure FO-12. Power Check Chart; Manual Fuel Control (Sheet 5)

Minimum and Maximum Manual Fuel Control Power Check Chart
TF41-A-1

NOTE

Values shown are for engine operating with air inlet screen installed and air conditioning system operating. If engine must be operated with screen removed, add 1.3" Hg to $P_{T5.1}$ true pressure.

Ambient Temperature		Ambient Pressure – Inches Mercury Absolute: 29.0		29.2		29.4		29.6		29.8	
		$P_{T5.1}$ True Pressure – Inches Mercury Gage									
°C	°F	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
27.	80.6	35.7	31.8	35.9	32.1	36.1	32.3	36.4	32.5	36.6	32.7
26.	78.8	35.8	31.9	36.0	32.1	36.2	32.4	36.5	32.6	36.7	32.8
25.	77.0	35.8	32.0	36.1	32.2	36.3	32.5	36.6	32.7	36.8	32.9
24.	75.2	35.9	32.1	36.2	32.3	36.4	32.6	36.7	32.8	36.9	33.0
23.	73.4	36.0	32.2	36.3	32.4	36.5	32.6	36.8	32.9	37.0	33.1
22.	71.6	36.1	32.3	36.4	32.5	36.6	32.7	36.9	33.0	37.1	33.2
21.	69.8	36.2	32.4	36.5	32.6	36.7	32.8	37.0	33.1	37.2	33.3
20.	68.0	36.3	32.5	36.6	32.7	36.8	32.9	37.1	33.1	37.3	33.4
19.	66.2	36.4	32.6	36.7	32.8	36.9	33.0	37.2	33.2	37.4	33.5
18.	64.4	36.5	32.7	36.8	32.9	37.0	33.1	37.3	33.3	37.5	33.6
17.	62.6	36.6	32.7	36.9	33.0	37.1	33.2	37.4	33.4	37.6	33.7
16.	60.8	36.7	32.8	37.0	33.1	37.2	33.3	37.5	33.5	37.7	33.7
15.	59.0	36.8	32.9	37.1	33.2	37.3	33.4	37.6	33.6	37.8	33.8
14.	57.2	36.9	33.0	37.2	33.3	37.4	33.5	37.7	33.7	37.9	33.9
13.	55.4	37.0	33.1	37.3	33.3	37.5	33.6	37.8	33.8	38.0	34.0
12.	53.6	37.1	33.2	37.4	33.4	37.6	33.7	37.9	33.9	38.1	34.1
11.	51.8	37.2	33.3	37.5	33.5	37.7	33.8	38.0	34.0	38.2	34.2
10.	50.0	37.3	33.4	37.6	33.6	37.8	33.9	38.1	34.1	38.3	34.3
9.	48.2	37.4	33.5	37.7	33.7	37.9	33.9	38.2	34.2	38.4	34.4
8.	46.4	37.5	33.6	37.8	33.8	38.0	34.0	38.3	34.3	38.5	34.5
7.	44.6	37.6	33.7	37.9	33.9	38.1	34.1	38.4	34.4	38.6	34.6
6.	42.8	37.7	33.8	38.0	34.0	38.2	34.2	38.5	34.5	38.7	34.7
5.	41.0	37.8	33.8	38.1	34.1	38.3	34.3	38.6	34.5	38.8	34.8
4.	39.2	37.9	33.9	38.2	34.2	38.4	34.4	38.7	34.6	38.9	34.9
3.	37.4	38.0	34.0	38.3	34.3	38.5	34.5	38.8	34.7	39.0	35.0
2.	35.6	38.1	34.1	38.4	34.4	38.6	34.6	38.9	34.8	39.1	35.1
1.	33.8	38.2	34.2	38.4	34.5	38.7	34.7	39.0	34.9	39.2	35.2
-0.	32.0	38.3	34.3	38.5	34.5	38.8	34.8	39.1	35.0	39.3	35.3
-1.	30.2	38.4	34.4	38.6	34.6	38.9	34.9	39.2	35.1	39.4	35.3
-2.	28.4	38.5	34.5	38.7	34.7	39.0	35.0	39.3	35.2	39.5	35.4
-3.	26.6	38.6	34.6	38.8	34.8	39.1	35.1	39.4	35.3	39.6	35.5
-4.	24.8	38.7	34.7	38.9	34.9	39.2	35.2	39.5	35.4	39.7	35.6
-5.	23.0	38.8	34.8	39.0	35.0	39.3	35.2	39.6	35.5	39.8	35.7
-6.	21.2	38.9	34.9	39.1	35.1	39.4	35.3	39.7	35.6	39.9	35.8
-7.	19.4	39.0	34.9	39.2	35.2	39.5	35.4	39.8	35.7	40.0	35.9
-8.	17.6	39.1	35.0	39.3	35.3	39.6	35.5	39.9	35.8	40.1	36.0
-9.	15.8	39.2	35.1	39.4	35.4	39.7	35.6	40.0	35.9	40.2	36.1
-10.	14.0	39.3	35.2	39.5	35.5	39.8	35.7	40.1	36.0	40.3	36.2
-11.	12.2	39.4	35.3	39.6	35.6	39.9	35.8	40.2	36.0	40.4	36.3
-12.	10.4	39.5	35.4	39.7	35.7	40.0	35.9	40.3	36.1	40.5	36.4
-13.	8.6	39.6	35.5	39.8	35.7	40.1	36.0	40.4	36.2	40.6	36.5
-14.	6.8	39.6	35.6	39.9	35.8	40.2	36.1	40.5	36.3	40.7	36.6
-15.	5.0	39.7	35.7	40.0	35.9	40.3	36.2	40.6	36.4	40.8	36.7
-16.	3.2	39.8	35.8	40.1	36.0	40.4	36.3	40.7	36.5	40.9	36.8
-17.	1.4	39.9	35.9	40.2	36.1	40.5	36.4	40.8	36.6	41.0	36.9
-18.	-0.4	40.0	36.0	40.3	36.2	40.6	36.5	40.9	36.7	41.1	36.9
-19.	-2.2	40.1	36.0	40.4	36.3	40.7	36.5	41.0	36.8	41.2	37.0
-20.	-4.0	40.2	36.1	40.5	36.4	40.8	36.6	41.1	36.9	41.3	37.1
-21.	-5.8	40.3	36.2	40.6	36.5	40.9	36.7	41.2	37.0	41.4	37.2
-22.	-7.6	40.4	36.3	40.7	36.6	41.0	36.8	41.3	37.1	41.5	37.3
-23.	-9.4	40.5	36.4	40.8	36.7	41.1	36.9	41.4	37.2	41.6	37.4
-24.	-11.2	40.6	36.5	40.9	36.8	41.2	37.0	41.5	37.3	41.7	37.5
-25.	-13.0	40.7	36.6	41.0	36.9	41.3	37.1	41.6	37.4	41.8	37.6
-26.	-14.8	40.8	36.7	41.1	36.9	41.4	37.2	41.7	37.4	41.9	37.7
-27.	-16.6	40.9	36.8	41.2	37.0	41.5	37.3	41.8	37.5	42.0	37.8
-28.	-18.4	41.0	36.9	41.3	37.1	41.6	37.4	41.9	37.6	42.1	37.9
-29.	-20.2	41.1	37.0	41.4	37.2	41.7	37.5	42.0	37.7	42.2	38.0
-30.	-22.0	41.2	37.1	41.5	37.3	41.8	37.6	42.1	37.8	42.3	38.1
-31.	-23.8	41.3	37.1	41.6	37.4	41.9	37.7	42.2	37.9	42.4	38.2
-32.	-25.6	41.4	37.2	41.7	37.5	42.0	37.8	42.3	38.0	42.5	38.3
-33.	-27.4	41.5	37.3	41.8	37.6	42.1	37.8	42.4	38.1	42.6	38.4
-34.	-29.2	41.6	37.4	41.9	37.7	42.2	37.9	42.5	38.2	42.7	38.5
-35.	-31.0	41.7	37.5	42.0	37.8	42.3	38.0	42.6	38.3	42.8	38.5
-36.	-32.8	41.8	37.6	42.1	37.9	42.4	38.1	42.7	38.4	42.9	38.6
-37.	-34.6	41.9	37.7	42.2	38.0	42.5	38.2	42.8	38.5	43.0	38.7
-38.	-36.4	42.0	37.8	42.3	38.1	42.6	38.3	42.9	38.6	43.1	38.8
-39.	-38.2	42.1	37.9	42.4	38.1	42.7	38.4	43.0	38.7	43.2	38.9
-40.	-40.0	42.2	38.0	42.5	38.2	42.8	38.5	43.1	38.8	43.3	39.0

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Figure FO-12. Power Check Chart; Manual Fuel Control (Sheet 6)

Minimum and Maximum Manual Fuel Control Power Check Chart
TF41-A-1

NOTE

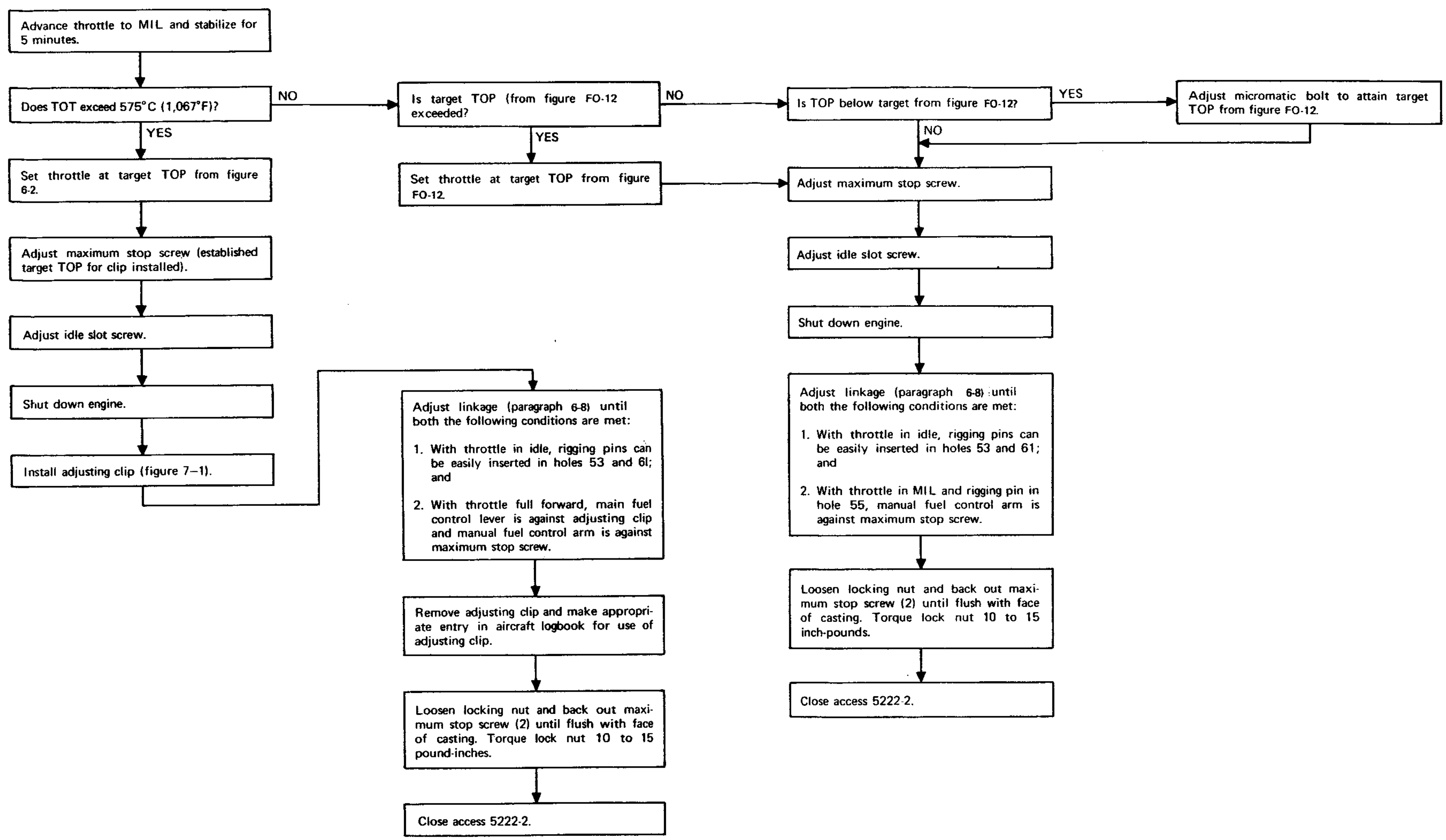
Values shown are for engine operating with air inlet screen installed and air conditioning system operating. If engine must be operated with screen removed, add 1.3" Hg to $P_{T5.1}$ true pressure.

Ambient Pressure – Inches Mercury Absolute

Ambient Temperature		30.0		30.2		30.4		30.6		30.8	
		$P_{T5.1}$ True Pressure – Inches Mercury Gage									
°C	°F	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
27.	80.6	36.9	32.9	37.1	33.2	37.4	33.4	37.6	33.6	37.9	33.8
26.	78.8	37.0	33.0	37.2	33.2	37.5	33.5	37.7	33.7	38.0	33.9
25.	77.0	37.1	33.1	37.3	33.3	37.6	33.6	37.8	33.8	38.1	34.0
24.	75.2	37.2	33.2	37.4	33.4	37.7	33.7	37.9	33.9	38.2	34.1
23.	73.4	37.3	33.3	37.5	33.5	37.8	33.8	38.0	34.0	38.3	34.2
22.	71.6	37.4	33.4	37.6	33.6	37.9	33.8	38.1	34.1	38.4	34.3
21.	69.8	37.5	33.5	37.7	33.7	38.0	33.9	38.2	34.2	38.5	34.4
20.	68.0	37.6	33.6	37.8	33.8	38.1	34.0	38.3	34.3	38.6	34.5
19.	66.2	37.7	33.7	37.9	33.9	38.2	34.1	38.4	34.4	38.7	34.6
18.	64.4	37.8	33.8	38.0	34.0	38.3	34.2	38.5	34.5	38.8	34.7
17.	62.6	37.9	33.9	38.1	34.1	38.4	34.3	38.6	34.6	38.9	34.8
16.	60.8	38.0	34.0	38.2	34.2	38.5	34.4	38.8	34.7	39.0	34.9
15.	59.0	38.1	34.1	38.3	34.3	38.6	34.5	38.9	34.7	39.1	35.0
14.	57.2	38.2	34.2	38.4	34.4	38.7	34.6	39.0	34.8	39.2	35.1
13.	55.4	38.3	34.3	38.5	34.5	38.8	34.7	39.1	34.9	39.3	35.2
12.	53.6	38.4	34.4	38.7	34.6	38.9	34.8	39.2	35.0	39.4	35.3
11.	51.8	38.5	34.4	38.8	34.7	39.0	34.9	39.3	35.1	39.5	35.4
10.	50.0	38.6	34.5	38.9	34.8	39.1	35.0	39.4	35.2	39.6	35.5
9.	48.2	38.7	34.6	39.0	34.9	39.2	35.1	39.5	35.3	39.7	35.6
8.	46.4	38.8	34.7	39.1	35.0	39.3	35.2	39.6	35.4	39.8	35.7
7.	44.6	38.9	34.8	39.2	35.1	39.4	35.3	39.7	35.5	39.9	35.8
6.	42.8	39.0	34.9	39.3	35.2	39.5	35.4	39.8	35.6	40.0	35.9
5.	41.0	39.1	35.0	39.4	35.2	39.6	35.5	39.9	35.7	40.1	36.0
4.	39.2	39.2	35.1	39.5	35.3	39.7	35.6	40.0	35.8	40.2	36.0
3.	37.4	39.3	35.2	39.6	35.4	39.8	35.7	40.1	35.9	40.3	36.1
2.	35.6	39.4	35.3	39.7	35.5	39.9	35.8	40.2	36.0	40.5	36.2
1.	33.8	39.5	35.4	39.8	35.6	40.0	35.9	40.3	36.1	40.6	36.3
-0.	32.0	39.6	35.5	39.9	35.7	40.1	36.0	40.4	36.2	40.7	36.4
-1.	30.2	39.7	35.6	40.0	35.8	40.2	36.1	40.5	36.3	40.8	36.5
-2.	28.4	39.8	35.7	40.1	35.9	40.3	36.2	40.6	36.4	40.9	36.6
-3.	26.6	39.9	35.8	40.2	36.0	40.4	36.3	40.7	36.5	41.0	36.7
-4.	24.8	40.0	35.9	40.3	36.1	40.5	36.3	40.8	36.6	41.1	36.8
-5.	23.0	40.1	36.0	40.4	36.2	40.6	36.4	40.9	36.7	41.2	36.9
-6.	21.2	40.2	36.1	40.5	36.3	40.7	36.5	41.0	36.8	41.3	37.0
-7.	19.4	40.3	36.2	40.6	36.4	40.8	36.6	41.1	36.9	41.4	37.1
-8.	17.6	40.4	36.2	40.7	36.5	40.9	36.7	41.2	37.0	41.5	37.2
-9.	15.8	40.5	36.3	40.8	36.6	41.1	36.8	41.3	37.1	41.6	37.3
-10.	14.0	40.6	36.4	40.9	36.7	41.2	36.9	41.4	37.2	41.7	37.4
-11.	12.2	40.7	36.5	41.0	36.8	41.3	37.0	41.5	37.3	41.8	37.5
-12.	10.4	40.8	36.6	41.1	36.9	41.4	37.1	41.6	37.4	41.9	37.6
-13.	8.6	40.9	36.7	41.2	37.0	41.5	37.2	41.7	37.5	42.0	37.7
-14.	6.8	41.0	36.8	41.3	37.1	41.6	37.3	41.8	37.6	42.1	37.8
-15.	5.0	41.1	36.9	41.4	37.2	41.7	37.4	41.9	37.7	42.2	37.9
-16.	3.2	41.2	37.0	41.5	37.3	41.8	37.5	42.0	37.7	42.3	38.0
-17.	1.4	41.3	37.1	41.6	37.3	41.9	37.6	42.1	37.8	42.4	38.1
-18.	-0.4	41.4	37.2	41.7	37.4	42.0	37.7	42.2	37.9	42.5	38.2
-19.	-2.2	41.5	37.3	41.8	37.5	42.1	37.8	42.3	38.0	42.6	38.3
-20.	-4.0	41.6	37.4	41.9	37.6	42.2	37.9	42.5	38.1	42.7	38.4
-21.	-5.8	41.7	37.5	42.0	37.7	42.3	38.0	42.6	38.2	42.8	38.5
-22.	-7.6	41.8	37.6	42.1	37.8	42.4	38.1	42.7	38.3	42.9	38.6
-23.	-9.4	41.9	37.7	42.2	37.9	42.5	38.2	42.8	38.4	43.0	38.7
-24.	-11.2	42.0	37.8	42.3	38.0	42.6	38.3	42.9	38.5	43.1	38.8
-25.	-13.0	42.1	37.9	42.4	38.1	42.7	38.4	43.0	38.6	43.2	38.9
-26.	-14.8	42.2	38.0	42.5	38.2	42.8	38.5	43.1	38.7	43.3	39.0
-27.	-16.6	42.3	38.1	42.6	38.3	42.9	38.6	43.2	38.8	43.5	39.1
-28.	-18.4	42.4	38.1	42.7	38.4	43.0	38.7	43.3	38.9	43.6	39.2
-29.	-20.2	42.5	38.2	42.8	38.5	43.1	38.7	43.4	39.0	43.7	39.3
-30.	-22.0	42.6	38.3	42.9	38.6	43.2	38.8	43.5	39.1	43.8	39.4
-31.	-23.8	42.7	38.4	43.0	38.7	43.3	38.9	43.6	39.2	43.9	39.5
-32.	-25.6	42.8	38.5	43.1	38.8	43.4	39.0	43.7	39.3	44.0	39.6
-33.	-27.4	42.9	38.6	43.2	38.9	43.5	39.1	43.8	39.4	44.1	39.6
-34.	-29.2	43.0	38.7	43.3	39.0	43.6	39.2	43.9	39.5	44.2	39.7
-35.	-31.0	43.1	38.8	43.4	39.1	43.7	39.3	44.0	39.6	44.3	39.8
-36.	-32.8	43.2	38.9	43.5	39.2	43.8	39.4	44.1	39.7	44.4	39.9
-37.	-34.6	43.3	39.0	43.6	39.3	43.9	39.5	44.2	39.8	44.5	40.0
-38.	-36.4	43.4	39.1	43.7	39.4	44.0	39.6	44.3	39.9	44.6	40.1
-39.	-38.2	43.5	39.2	43.8	39.4	44.1	39.7	44.4	40.0	44.7	40.2
-40.	-40.0	43.6	39.3	43.9	39.5	44.2	39.8	44.5	40.1	44.8	40.3

05D157-07-11-83

Figure FO-12. Power Check Chart; Manual Fuel Control (Sheet 7)



05D251-11-83

Figure FO-13. Adjustment Sequence; Manual Fuel Control

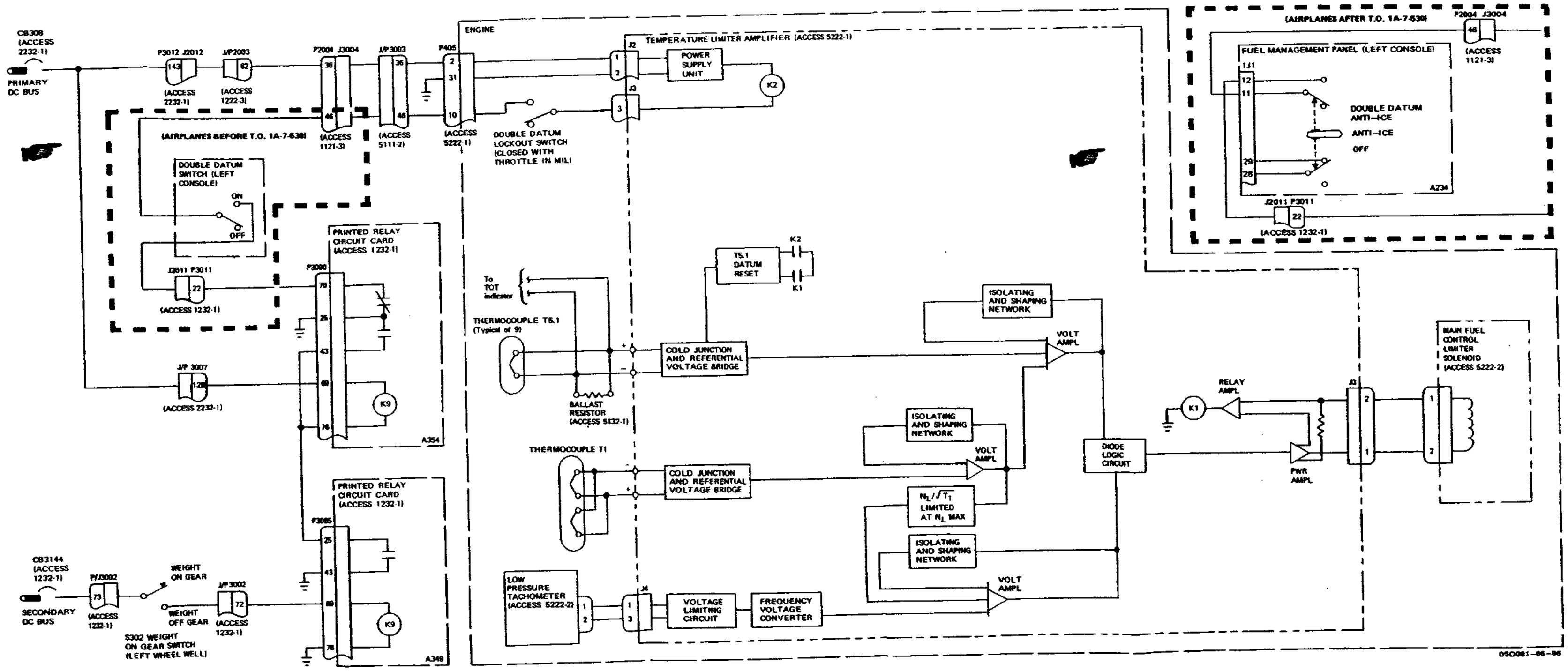
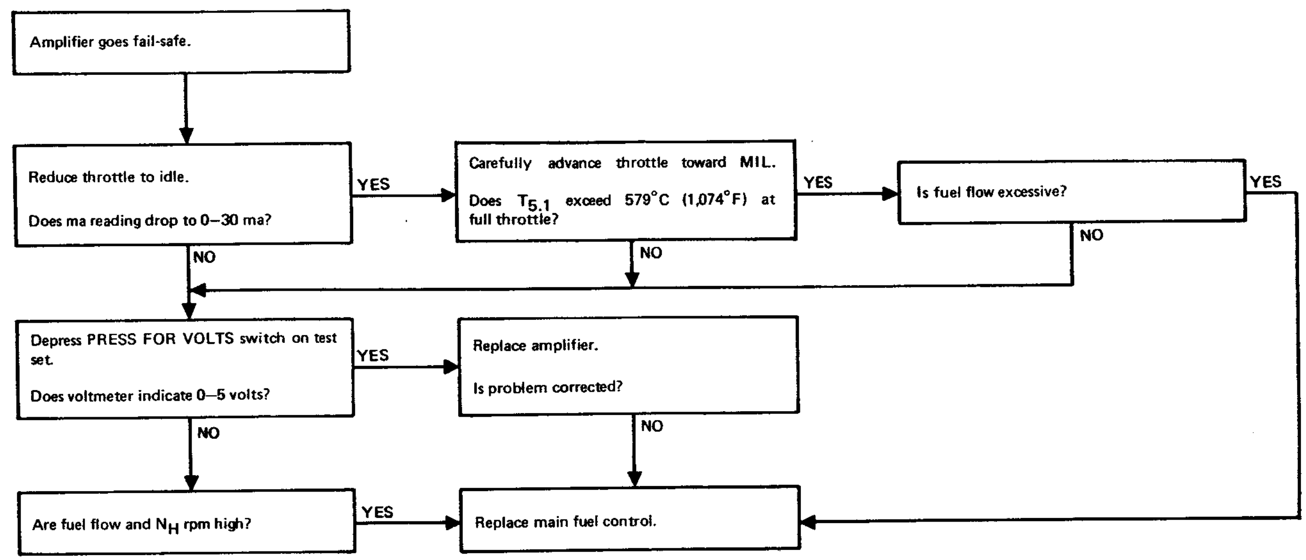


Figure FO-14. Schematic Diagram; Temperature Limiter Amplifier System



05D278–11–83

Figure FO-15. Troubleshooting Diagram; Model 805 Amplifier Fail-Safe Condition

NOTE

THE AUTO—RELIGHT SWITCH IS ACTUATED BY A RAPID DROP IN PRESSURE FROM THE HIGH PRESSURE COMPRESSOR.

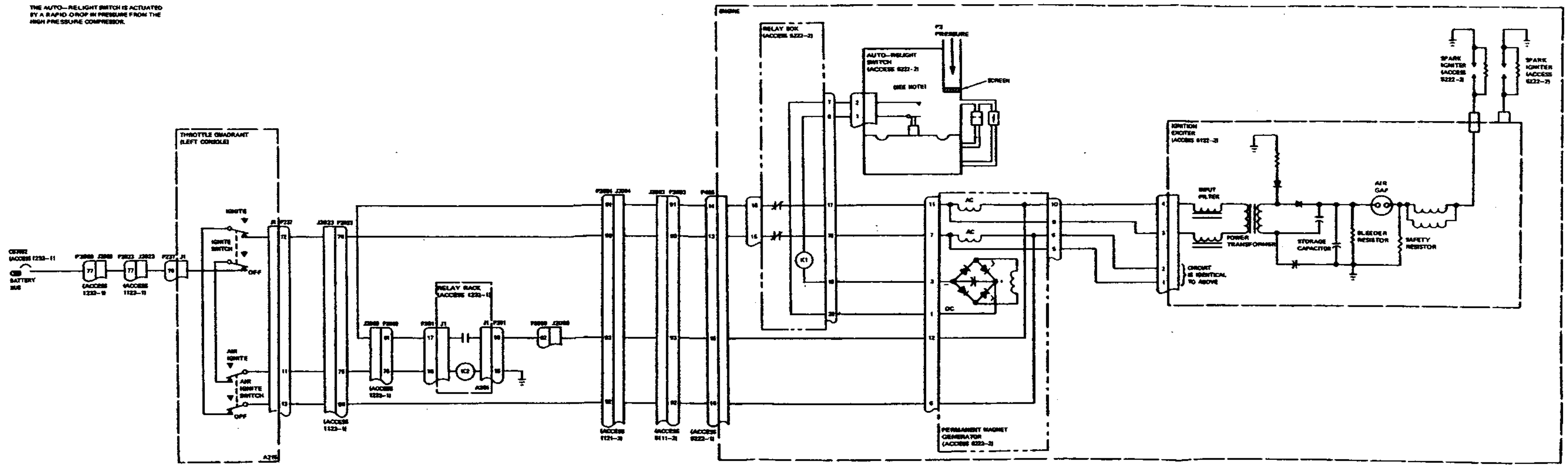
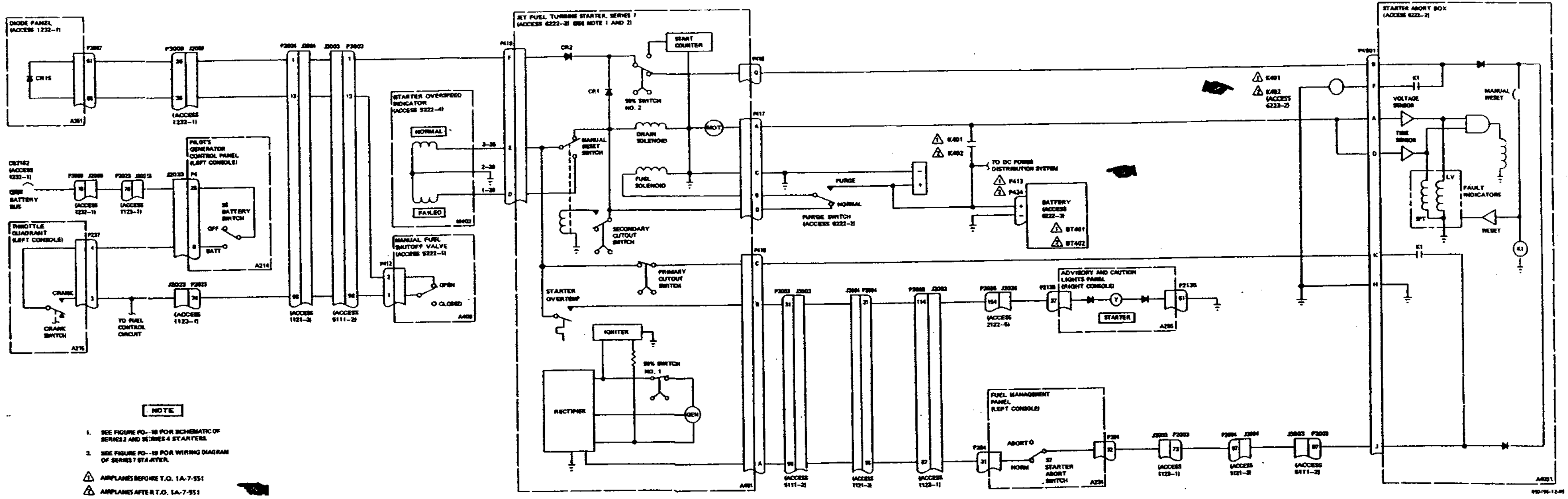


Figure FO-16. Schematic Diagram; Ignition System



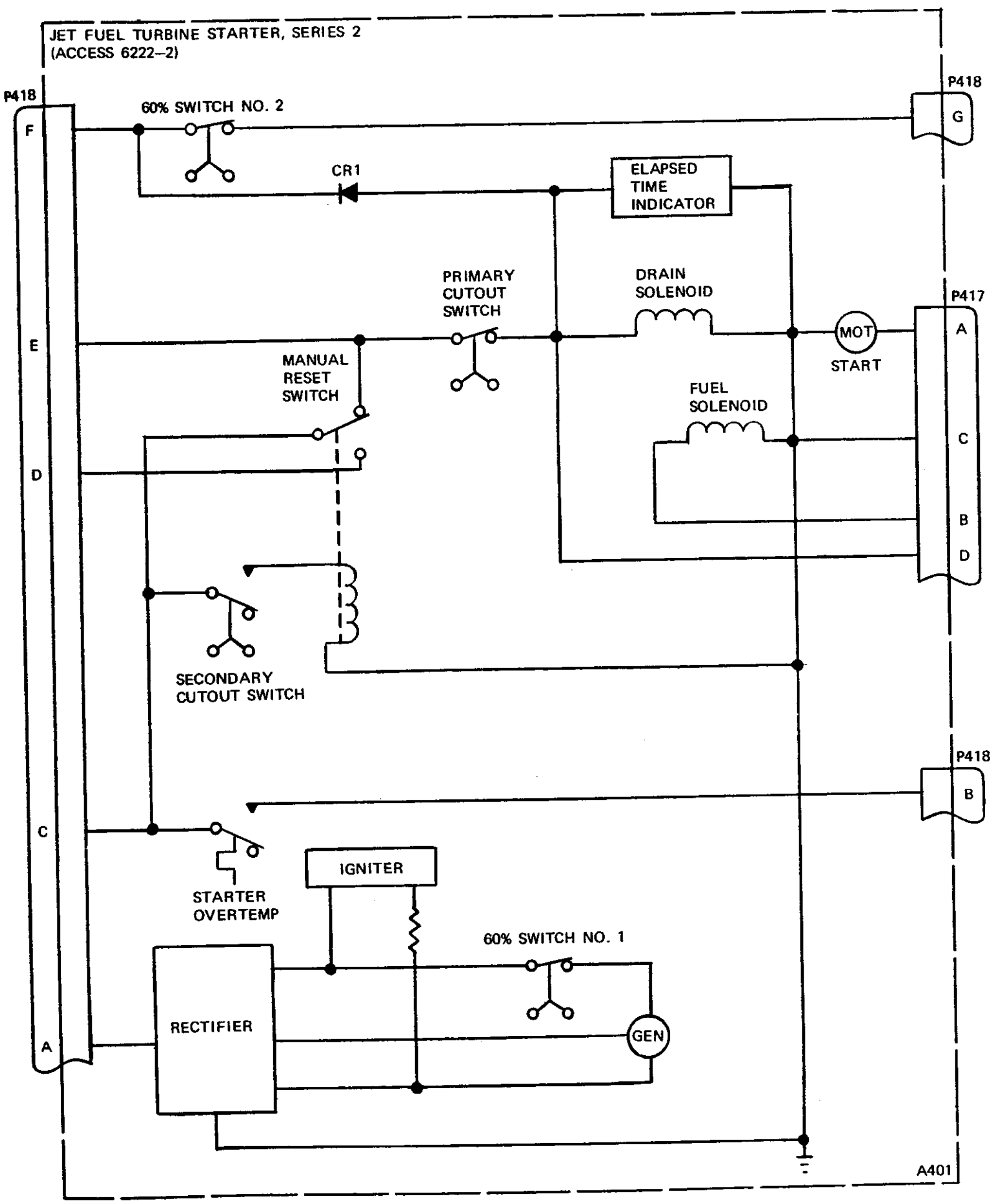
NOTE

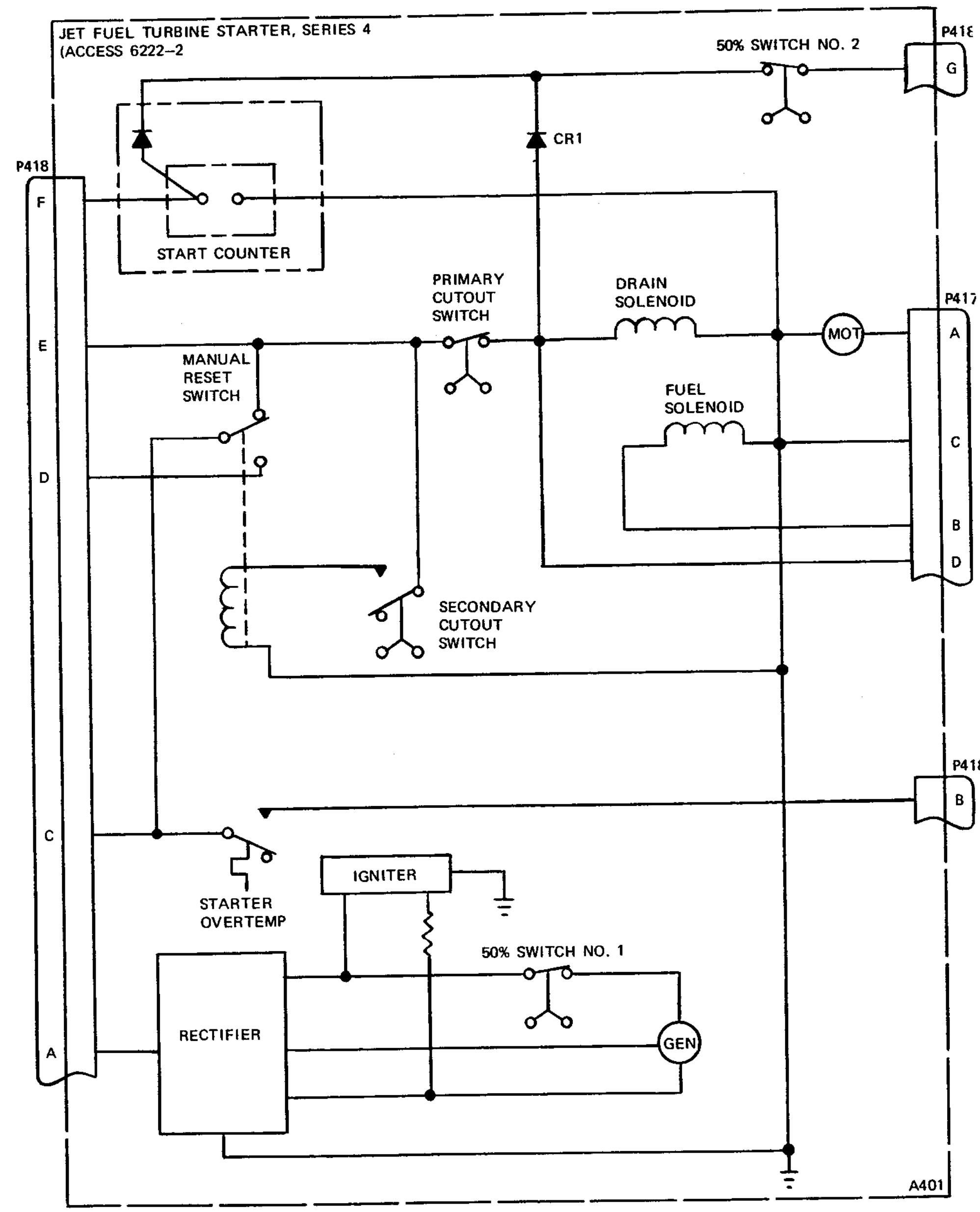
1. SEE FIGURE FO--18 FOR SCHEMATIC OF SERIES 2 AND SERIES 4 STARTERS.
2. SEE FIGURE FO--19 FOR WIRING DIAGRAM OF SERIES 7 STARTER.

△1 AIRPLANES BEFORE T.O. 1A-7-551

△2 AIRPLANES AFTER T.O. 1A-7-551

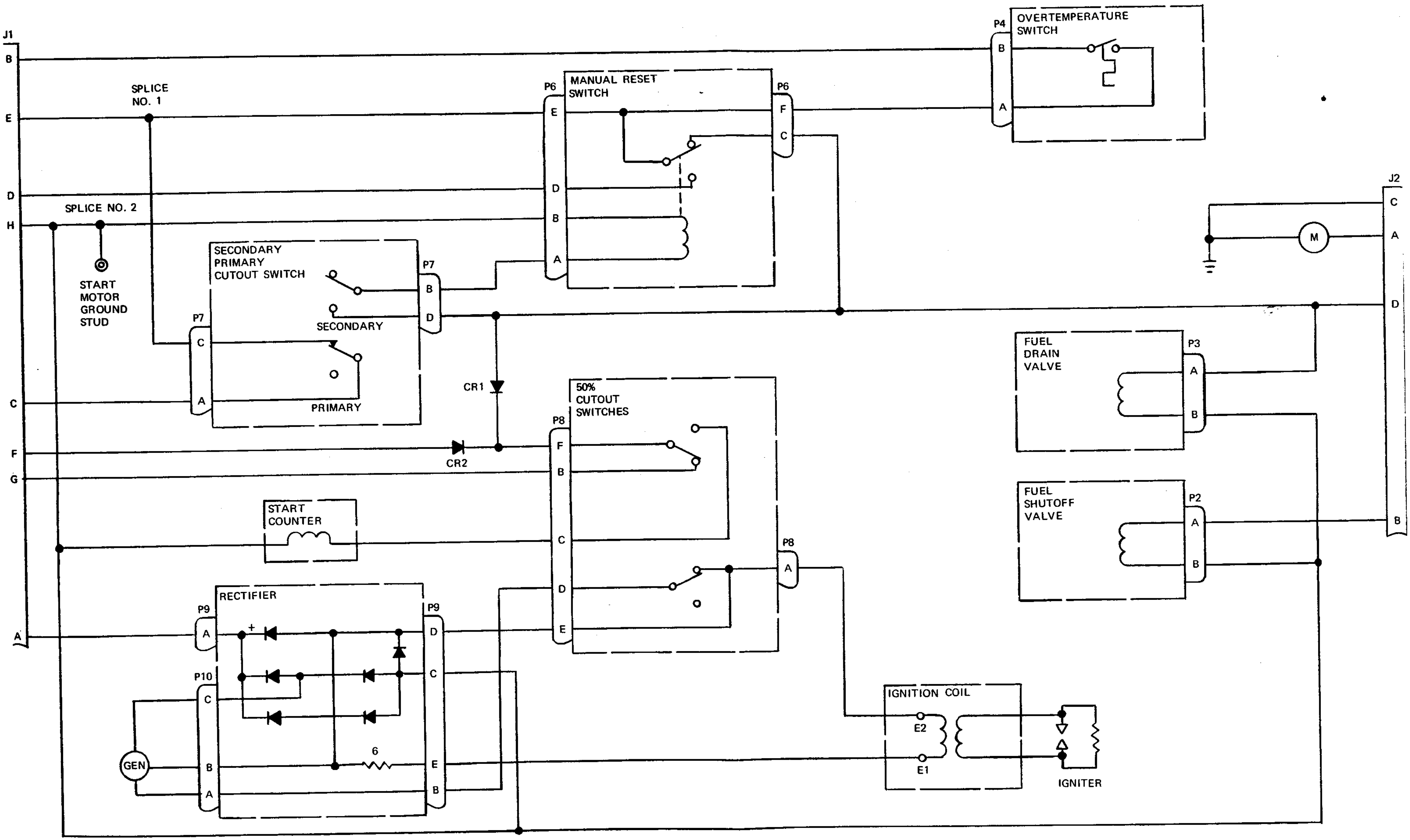
Figure FO-17. Schematic Diagram; Jet Fuel Turbine Starter System





05D195–11–

Figure FO-18. Schematic Diagram; Jet Fuel Turbine Starter Series 2 and 4



NOTE

UNLESS OTHERWISE SPECIFIED, ALL RESISTANCE VALUES ARE IN OHMS.

05D209-11-

Figure FO-19. Schematic Diagram; Jet Fuel Turbine Starter Series 7

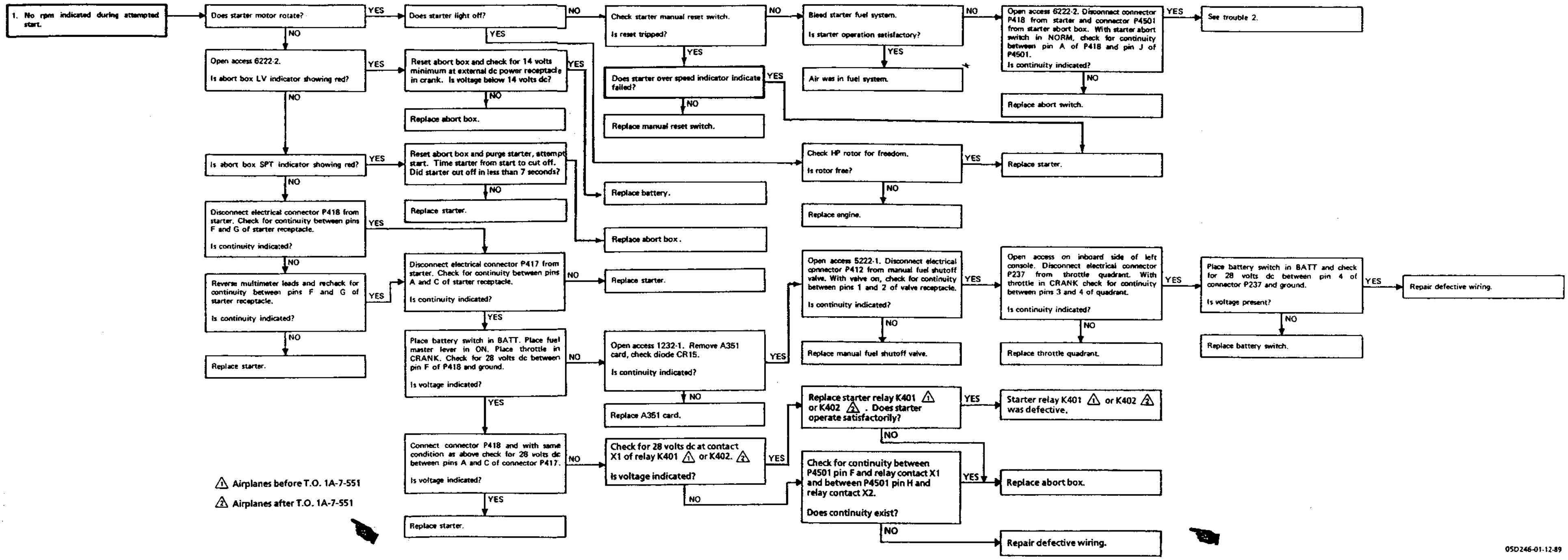
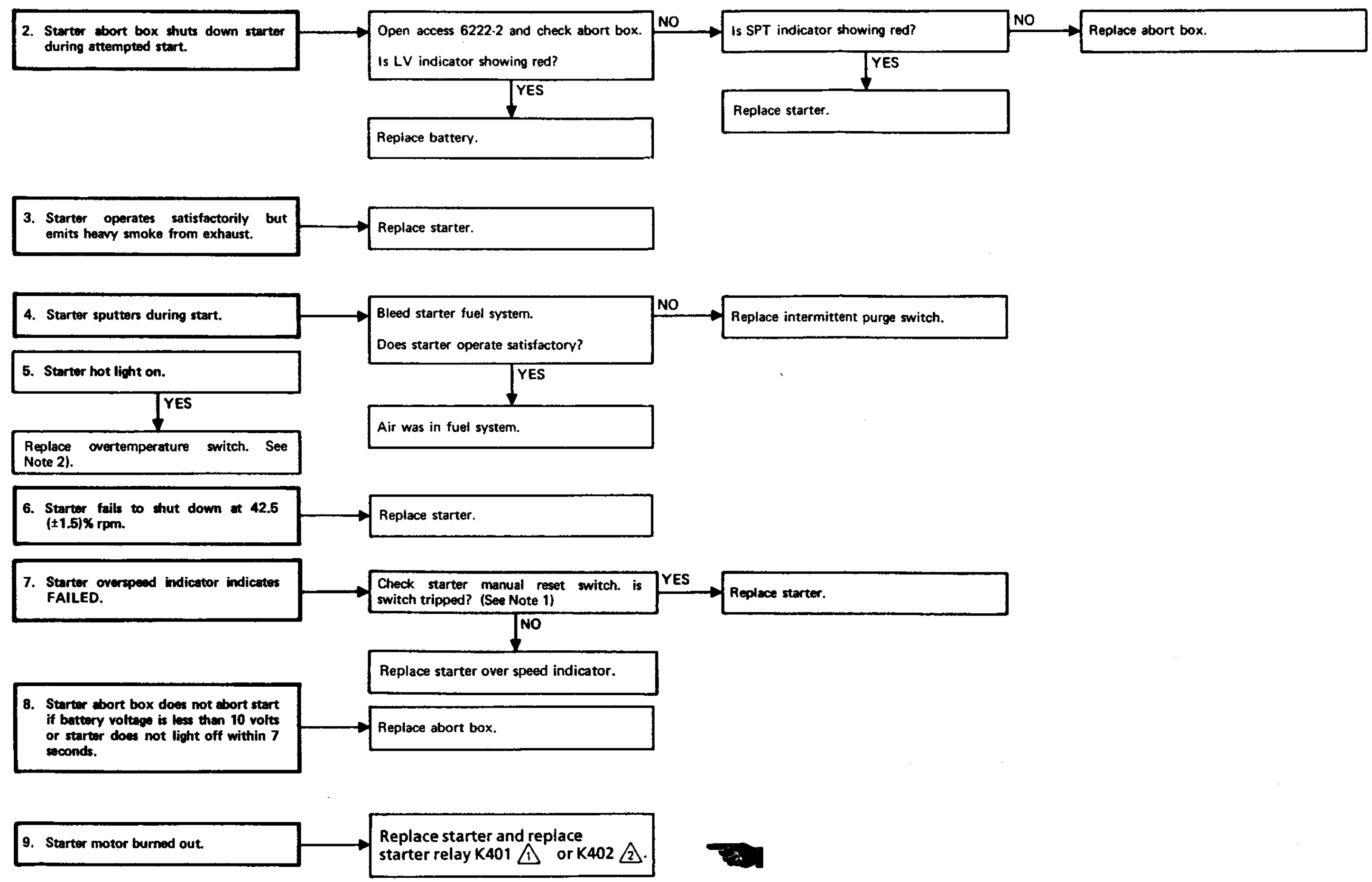


Figure FO-20. Troubleshooting Diagram; Starting System (Sheet 1 of 2)

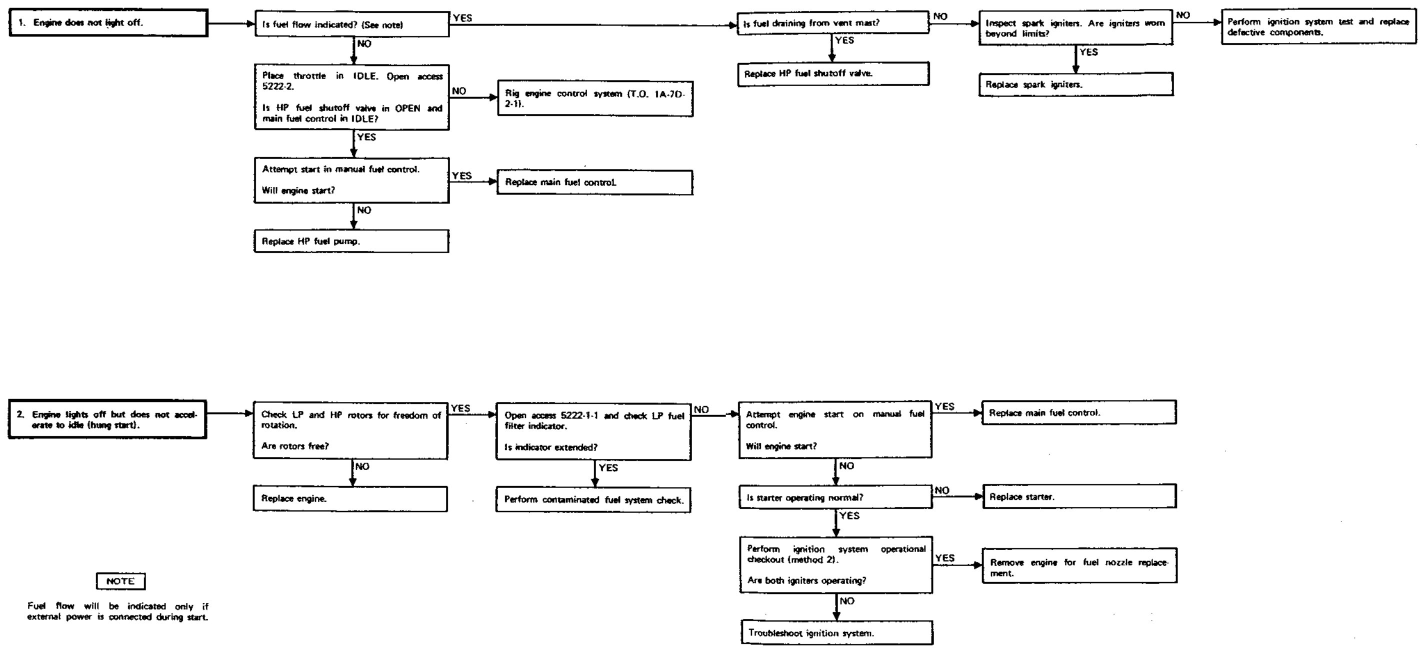


NOTE

1. If operational necessity dictates, manual reset switch may be used once.
2. If starter hot light is on after replacement of temperature switch, replace starter.

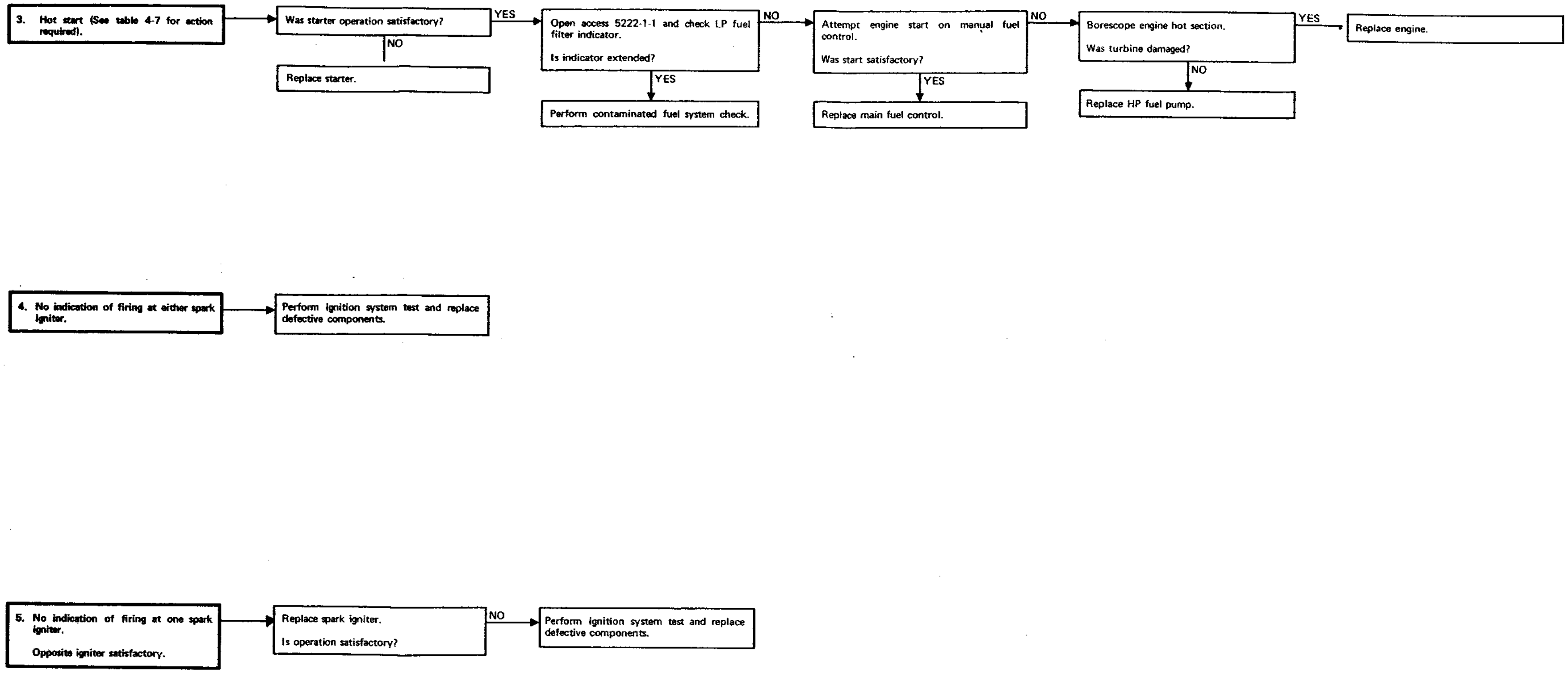
05D246-02-12-89

Figure FO-20. Troubleshooting Diagram; Starting System (Sheet 2)



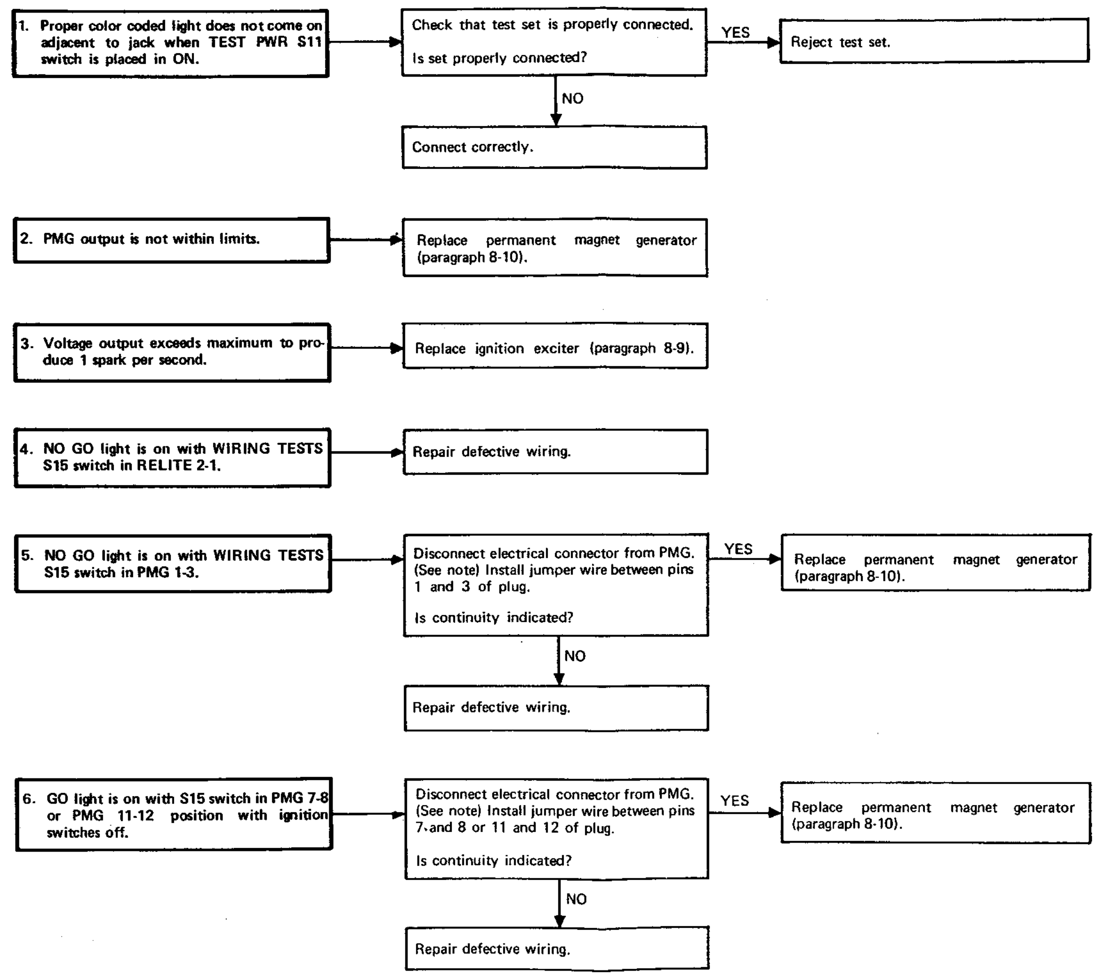
060247-01-11-

Figure FO-21. Troubleshooting Diagram; Ignition System (Sheet 1 of 2)



05D247-02-11-83

Figure FO-21. Troubleshooting Diagram; Ignition System (Sheet 2)

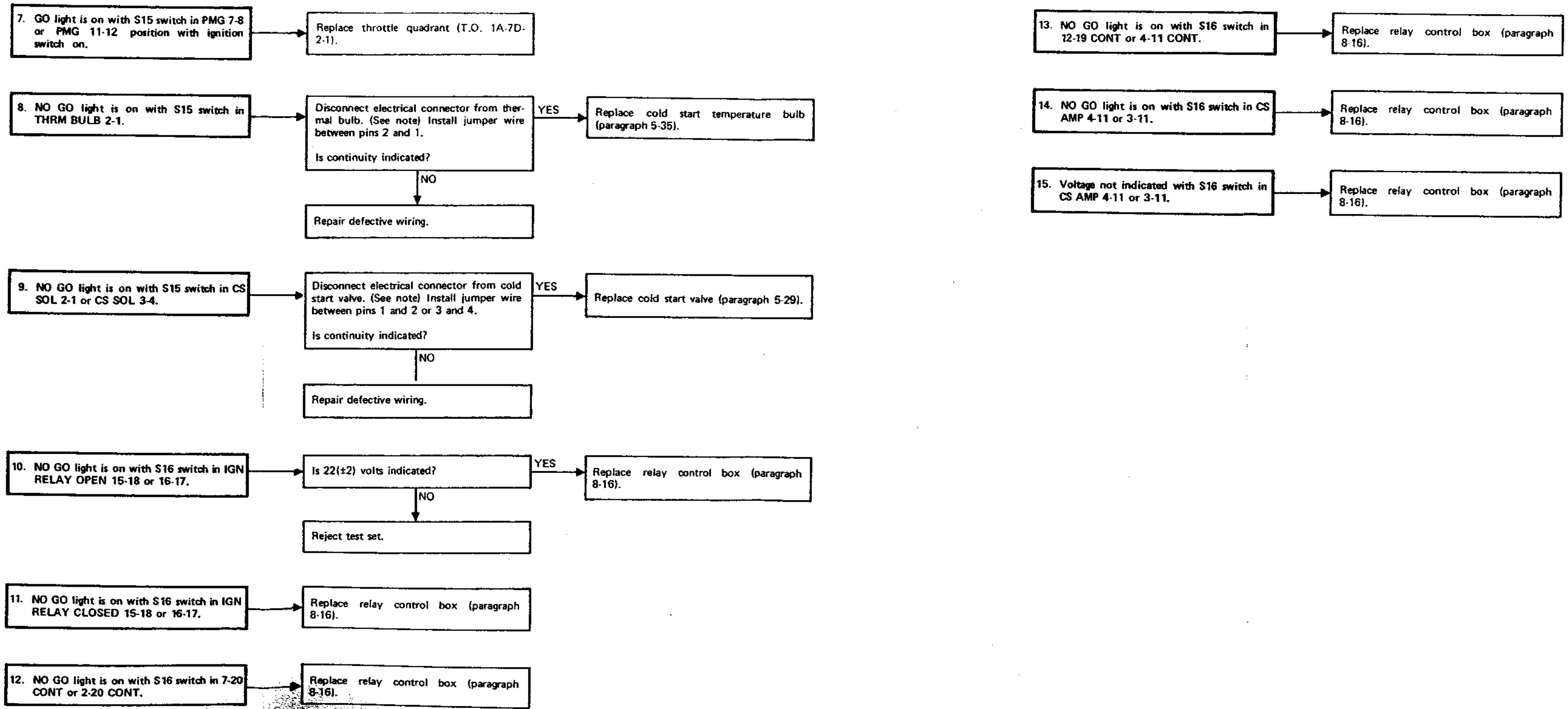


NOTE

Before removing plugs or installing jumper wire place TEST PWR S11 switch in OFF.

05D253-01-11-83

Figure FO-22. Test Troubleshooting Diagram; Ignition System (Sheet 1 of 2)



050253-02-11-83

Figure FO-22. Test Troubleshooting Diagram; Ignition System (Sheet 2 of 2)

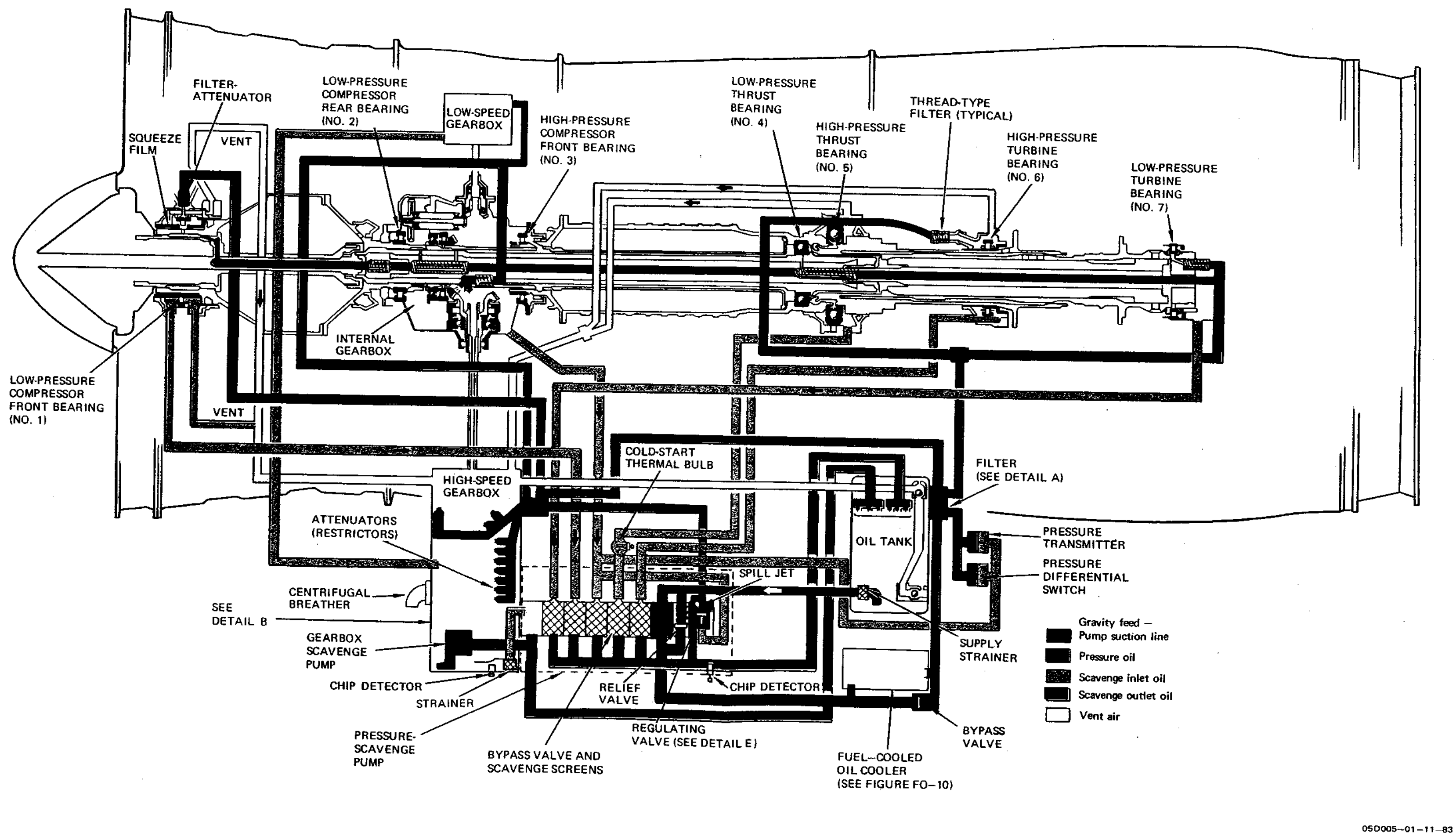
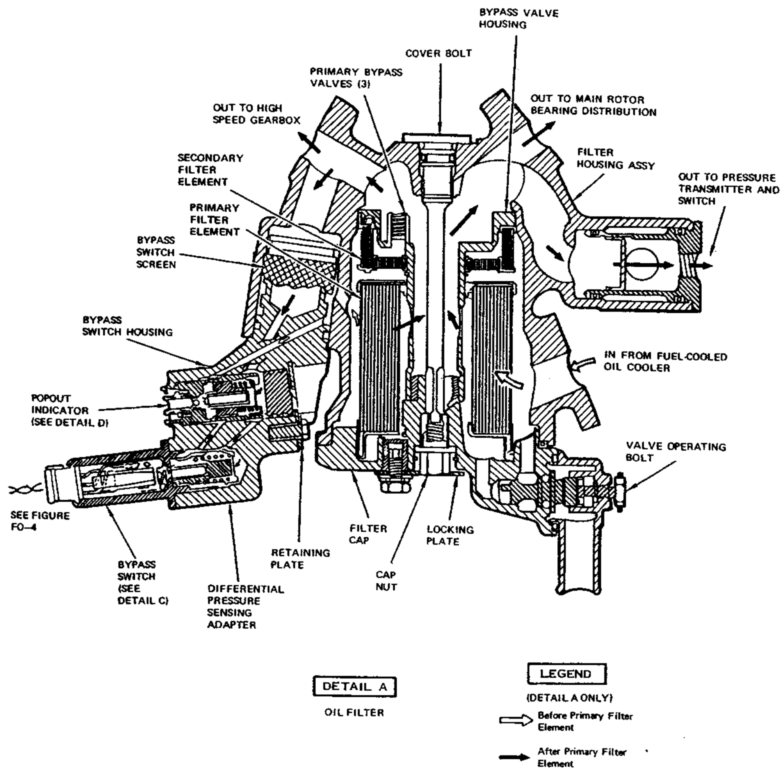
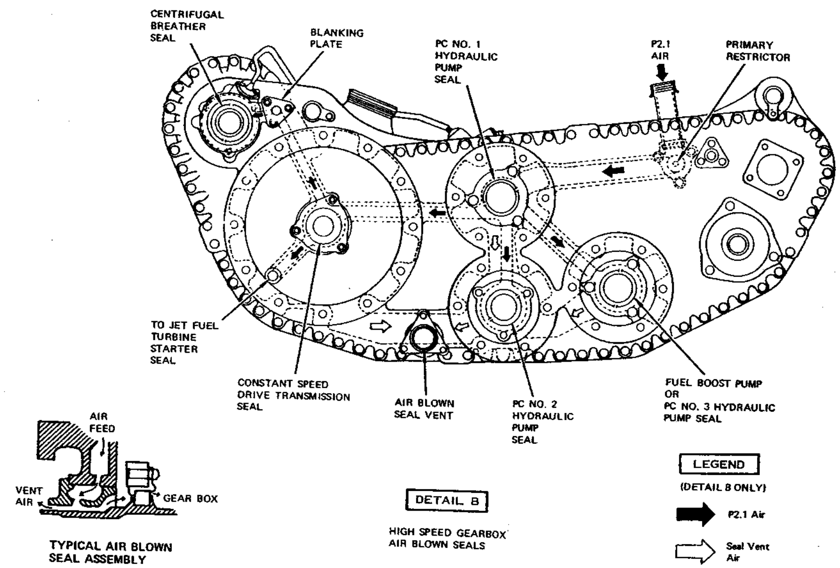


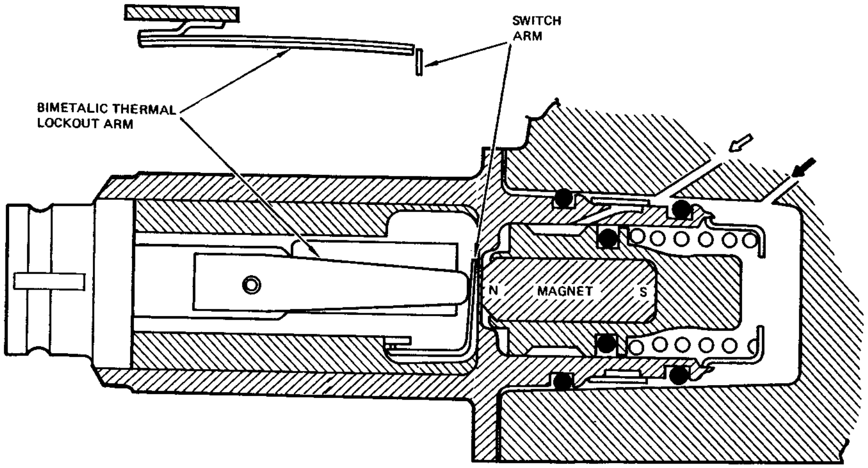
Figure FO-23. System Schematic; Oil (Sheet 1 of 3)





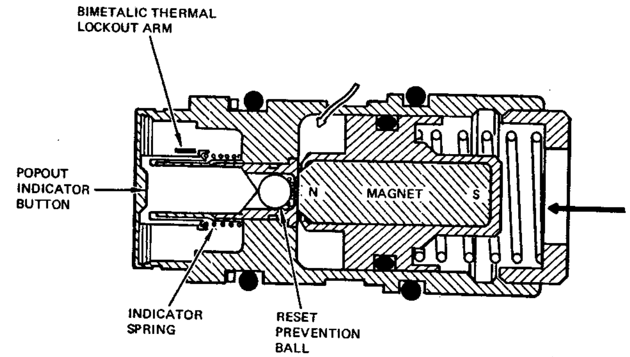
050006-02-11-83

Figure FO-23. System Schematic; Oil (Sheet 2)



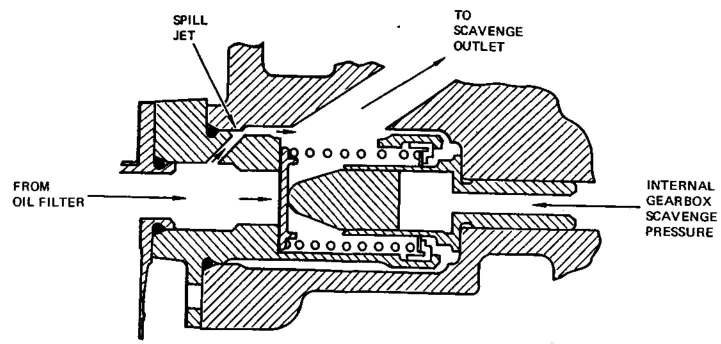
BYPASS SWITCH

DETAIL C



POPOUT INDICATOR

DETAIL D

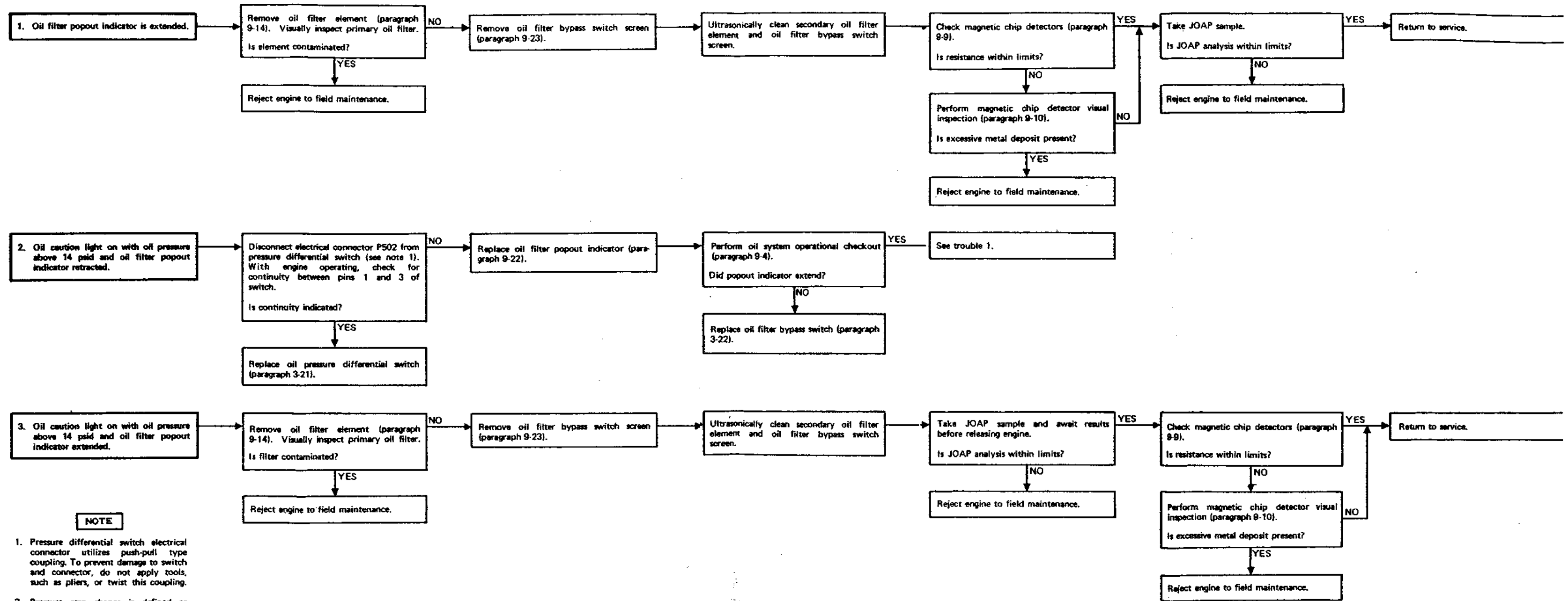


OIL PRESSURE REGULATING VALVE

DETAIL E

05D005-03-11-83

Figure FO-23. System Schematic; Oil (Sheet 3)



NOTE

1. Pressure differential switch electrical connector utilizes push-pull type coupling. To prevent damage to switch and connector, do not apply tools, such as pliers, or twist this coupling.
2. Pressure step change is defined as occurring when oil pressure has decreased to a new level and has held relatively constant at that level of pressure.

06D248-01-11-

Figure FO-24. Troubleshooting Diagram; Oil System (Sheet 1 of 3)

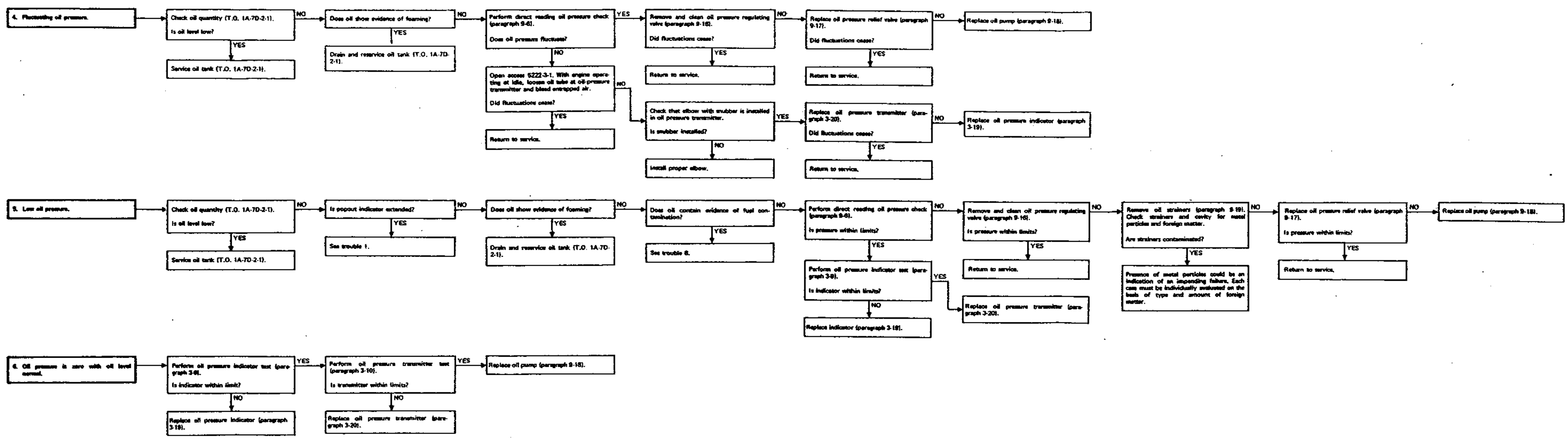


Figure FO-24. Troubleshooting Diagram; Oil System (Sheet 2)

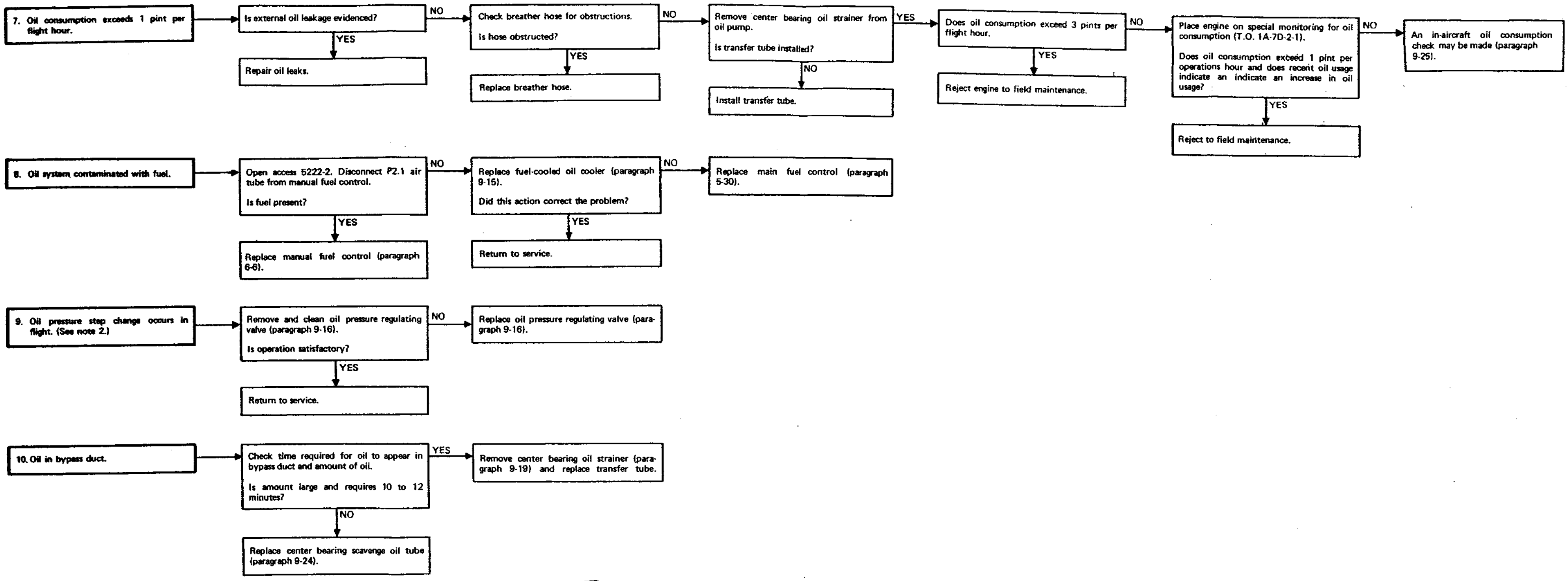


Figure FO-24. Troubleshooting Diagram; Oil System (Sheet 3)

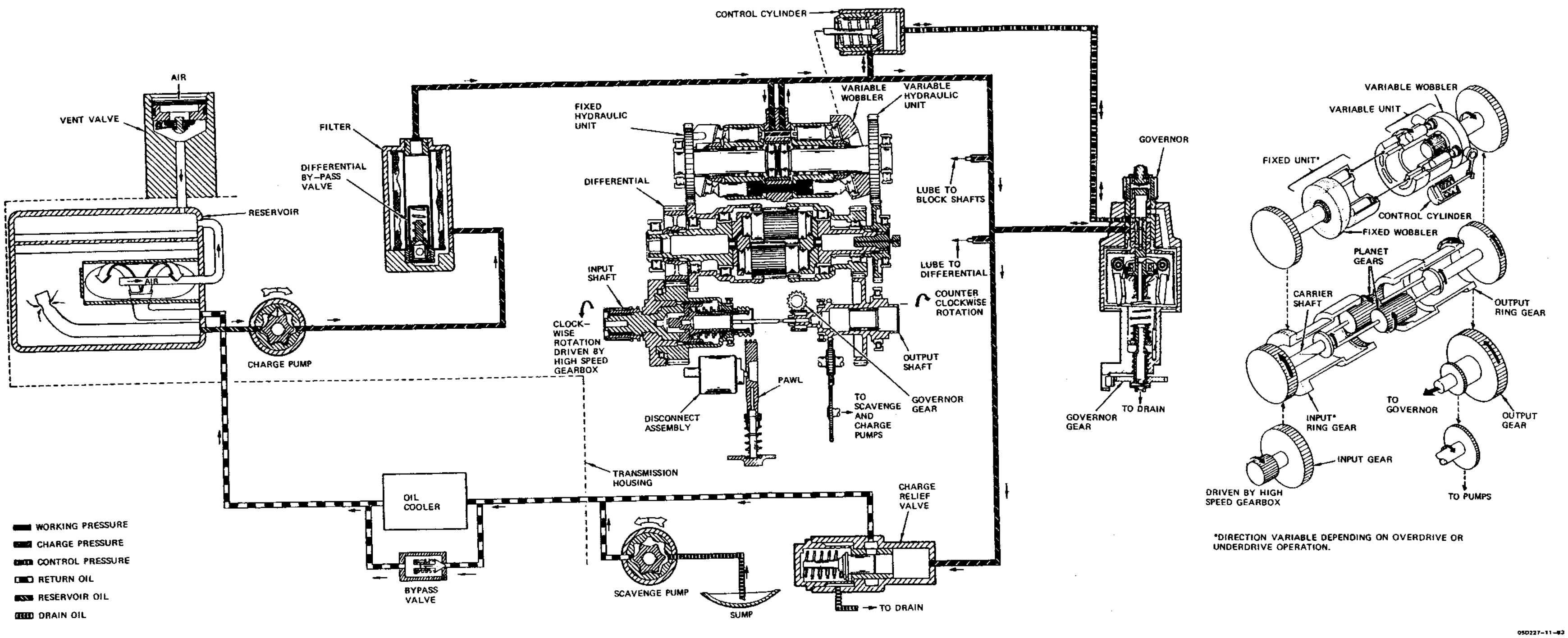


Figure FO-25. Schematic Diagram; Constant Speed Drive System

NOTE

This chart may be removed from manual for use with checklist.

CUT ALONG THIS LINE

Main Fuel Control Power Check Chart – TF41-A-1

NOTE

Values shown are for engine operating in A-7D airplane with air inlet screen installed and air conditioning system operating. If engine must be operated with screen removed, add 1.3" Hg to $P_{T5.1}$ true pressure.

Ambient Temperature		Ambient Pressure – Inches Mercury Absolute									
		24.0	24.1	24.2	24.3	24.4	24.5	24.6	24.7	24.8	24.9
°C	°F	$P_{T5.1}$ True Pressure – Inches Mercury Gage									
55.	131.0	18.7	18.8	18.9	18.9	19.0	19.1	19.2	19.3	19.3	19.4
54.	129.2	19.0	19.1	19.2	19.2	19.3	19.4	19.5	19.6	19.6	19.7
53.	127.4	19.3	19.3	19.4	19.5	19.6	19.7	19.7	19.8	19.9	20.0
52.	125.6	19.5	19.6	19.7	19.7	19.8	19.9	20.0	20.1	20.2	20.2
51.	123.8	19.8	19.8	19.9	20.0	20.1	20.2	20.3	20.3	20.4	20.5
50.	122.0	20.1	20.1	20.2	20.3	20.4	20.5	20.6	20.6	20.7	20.8
49.	120.2	20.3	20.4	20.5	20.6	20.7	20.7	20.8	20.9	21.0	21.1
48.	118.4	20.6	20.7	20.8	20.8	20.9	21.0	21.1	21.2	21.3	21.4
47.	116.6	20.8	20.9	21.0	21.1	21.2	21.3	21.4	21.5	21.5	21.6
46.	114.8	21.1	21.2	21.3	21.4	21.5	21.6	21.6	21.7	21.8	21.9
45.	113.0	21.4	21.5	21.6	21.7	21.8	21.8	21.9	22.0	22.1	22.2
44.	111.2	21.7	21.8	21.8	21.9	22.0	22.1	22.2	22.3	22.4	22.5
43.	109.4	21.9	22.0	22.1	22.2	22.3	22.4	22.5	22.6	22.7	22.8
42.	107.6	22.2	22.3	22.4	22.5	22.6	22.7	22.8	22.9	23.0	23.1
41.	105.8	22.5	22.6	22.7	22.8	22.9	23.0	23.1	23.2	23.3	23.4
40.	104.0	22.8	22.9	23.0	23.1	23.1	23.2	23.3	23.4	23.5	23.6
39.	102.2	23.1	23.2	23.3	23.4	23.5	23.6	23.7	23.8	23.9	24.0
38.	100.4	23.4	23.5	23.6	23.7	23.8	23.9	24.0	24.1	24.2	24.3
37.	98.6	23.7	23.8	23.9	24.0	24.1	24.2	24.3	24.4	24.5	24.6
36.	96.8	23.9	24.0	24.1	24.2	24.3	24.4	24.5	24.6	24.7	24.8
35.	95.0	24.2	24.3	24.4	24.5	24.6	24.7	24.8	24.9	25.0	25.1
34.	93.2	24.5	24.6	24.7	24.8	24.9	25.0	25.1	25.2	25.3	25.4
33.	91.4	24.8	24.9	25.0	25.1	25.2	25.3	25.4	25.5	25.6	25.7
32.	89.6	25.1	25.2	25.3	25.4	25.5	25.6	25.8	25.9	26.0	26.1
31.	87.8	25.4	25.5	25.6	25.7	25.9	26.0	26.1	26.2	26.3	26.4
30.	86.0	25.7	25.8	26.0	26.1	26.2	26.3	26.4	26.5	26.6	26.7
29.	84.2	26.1	26.2	26.3	26.4	26.5	26.6	26.7	26.8	26.9	27.0
28.	82.4	26.3	26.5	26.6	26.7	26.8	26.9	27.0	27.1	27.2	27.3
27.	80.6	26.7	26.8	26.9	27.0	27.1	27.2	27.4	27.5	27.6	27.7
26.	78.8	26.9	27.1	27.2	27.3	27.4	27.5	27.6	27.7	27.8	28.0
25.	77.0	27.2	27.3	27.5	27.6	27.7	27.8	27.9	28.0	28.1	28.3
24.	75.2	27.5	27.6	27.7	27.8	28.0	28.1	28.2	28.3	28.4	28.5
23.	73.4	27.7	27.8	28.0	28.1	28.2	28.3	28.4	28.5	28.7	28.8
22.	71.6	28.0	28.1	28.2	28.3	28.5	28.6	28.7	28.8	28.9	29.1
21.	69.8	28.2	28.3	28.4	28.6	28.7	28.8	28.9	29.0	29.2	29.3
20.	68.0	28.3	28.4	28.5	28.7	28.8	28.9	29.0	29.1	29.3	29.4

For temperatures below 20°C use 20°C.

05D241-01-11-83

Figure FO-26. Power Check Chart; Main Fuel Control (Sheet 1 of 7)

NOTE

This chart may be removed from manual for use with checklist.

CUT ALONG THIS LINE

Main Fuel Control Power Check Chart – TF41-A-1

NOTE

Values shown are for engine operating in A-7D airplane with air inlet screen installed and air conditioning system operating. If engine must be operated with screen removed, add 1.3" Hg to $P_{T5.1}$ true pressure.

Ambient Temperature		Ambient Pressure – Inches Mercury Absolute									
		25.0	25.1	25.2	25.3	25.4	25.5	25.6	25.7	25.8	25.9
°C	°F	$P_{T5.1}$ True Pressure – Inches Mercury Gage									
55.	131.0	19.5	19.6	19.7	19.7	19.8	19.9	20.0	20.1	20.1	20.2
54.	129.2	19.8	19.9	20.0	20.0	20.1	20.2	20.3	20.4	20.4	20.5
53.	127.4	20.1	20.2	20.2	20.3	20.4	20.5	20.6	20.6	20.7	20.8
52.	125.6	20.3	20.4	20.5	20.6	20.7	20.7	20.8	20.9	21.0	21.1
51.	123.8	20.6	20.7	20.8	20.9	20.9	21.0	21.1	21.2	21.3	21.4
50.	122.0	20.9	21.0	21.1	21.2	21.2	21.3	21.4	21.5	21.6	21.7
49.	120.2	21.2	21.3	21.3	21.4	21.5	21.6	21.7	21.8	21.9	21.9
48.	118.4	21.4	21.5	21.6	21.7	21.8	21.9	22.0	22.1	22.1	22.2
47.	116.6	21.7	21.8	21.9	22.0	22.1	22.2	22.3	22.3	22.4	22.5
46.	114.8	22.0	22.1	22.2	22.3	22.4	22.4	22.5	22.6	22.7	22.8
45.	113.0	22.3	22.4	22.5	22.6	22.7	22.8	22.8	22.9	23.0	23.1
44.	111.2	22.6	22.7	22.8	22.8	22.9	23.0	23.1	23.2	23.3	23.4
43.	109.4	22.9	23.0	23.1	23.2	23.2	23.3	23.4	23.5	23.6	23.7
42.	107.6	23.1	23.2	23.3	23.4	23.5	23.6	23.7	23.8	23.9	24.0
41.	105.8	23.4	23.5	23.6	23.7	23.8	23.9	24.0	24.1	24.2	24.3
40.	104.0	23.7	23.8	23.9	24.0	24.1	24.2	24.3	24.4	24.5	24.6
39.	102.2	24.0	24.1	24.2	24.3	24.4	24.5	24.6	24.7	24.8	24.9
38.	100.4	24.3	24.4	24.5	24.6	24.7	24.8	24.9	25.0	25.1	25.2
37.	98.6	24.6	24.7	24.8	24.9	25.0	25.1	25.2	25.3	25.4	25.5
36.	96.8	24.9	25.1	25.2	25.3	25.4	25.5	25.6	25.7	25.8	25.9
35.	95.0	25.2	25.4	25.5	25.6	25.7	25.8	25.9	26.0	26.1	26.2
34.	93.2	25.5	25.7	25.8	25.9	26.0	26.1	26.2	26.3	26.4	26.5
33.	91.4	25.8	26.0	26.1	26.2	26.3	26.4	26.5	26.6	26.7	26.8
32.	89.6	26.2	26.3	26.4	26.5	26.6	26.7	26.8	26.9	27.0	27.1
31.	87.8	26.5	26.6	26.7	26.8	26.9	27.0	27.1	27.3	27.4	27.5
30.	86.0	26.8	26.9	27.0	27.2	27.3	27.4	27.5	27.6	27.7	27.8
29.	84.2	27.1	27.3	27.4	27.5	27.6	27.7	27.8	27.9	28.0	28.1
28.	82.4	27.4	27.6	27.7	27.8	27.9	28.0	28.1	28.2	28.3	28.4
27.	80.6	27.8	27.9	28.0	28.1	28.2	28.4	28.5	28.6	28.7	28.8
26.	78.8	28.1	28.2	28.3	28.4	28.5	28.6	28.8	28.9	29.0	29.1
25.	77.0	28.4	28.5	28.6	28.7	28.8	28.9	29.1	29.2	29.3	29.4
24.	75.2	28.6	28.8	28.9	29.0	29.1	29.2	29.3	29.5	29.6	29.7
23.	73.4	28.9	29.0	29.1	29.3	29.4	29.5	29.6	29.7	29.8	30.0
22.	71.6	29.2	29.3	29.4	29.5	29.6	29.8	29.9	30.0	30.1	30.2
21.	69.8	29.4	29.5	29.6	29.8	29.9	30.0	30.1	30.2	30.4	30.5
20.	68.0	29.5	29.6	29.7	29.9	30.0	30.1	30.2	30.3	30.5	30.6

For temperatures below 20°C use 20°C.

05D241–02–11–83

Figure FO-26. Power Check Chart; Main Fuel Control (Sheet 2)

NOTE

This chart may be removed from manual for use with checklist.

CUT ALONG THIS LINE

Main Fuel Control Power Check Chart – TF41-A-1

NOTE

Values shown are for engine operating in A-7D airplane with air inlet screen installed and air conditioning system operating. If engine must be operated with screen removed, add 1.3" Hg to $P_{T5.1}$ true pressure.

Ambient Temperature		Ambient Pressure – Inches Mercury Absolute									
		26.0	26.1	26.2	26.3	26.4	26.5	26.6	26.7	26.8	26.9
°C	°F	$P_{T5.1}$ True Pressure – Inches Mercury Gage									
55.	131.0	20.3	20.4	20.5	20.5	20.6	20.7	20.8	20.8	20.9	21.0
54.	129.2	20.6	20.7	20.8	20.8	20.9	21.0	21.1	21.2	21.2	21.3
53.	127.4	20.9	21.0	21.1	21.1	21.2	21.3	21.4	21.5	21.5	21.6
52.	125.6	21.1	21.2	21.3	21.4	21.5	21.6	21.6	21.7	21.8	21.9
51.	123.8	21.4	21.5	21.6	21.7	21.8	21.9	21.9	22.0	22.1	22.2
50.	122.0	21.7	21.8	21.9	22.0	22.1	22.2	22.3	22.3	22.4	22.5
49.	120.2	22.0	22.1	22.2	22.3	22.4	22.5	22.5	22.6	22.7	22.8
48.	118.4	22.3	22.4	22.5	22.6	22.7	22.8	22.8	22.9	23.0	23.1
47.	116.6	22.6	22.7	22.8	22.9	23.0	23.0	23.1	23.2	23.3	23.4
46.	114.8	22.9	23.0	23.1	23.2	23.2	23.3	23.4	23.5	23.6	23.7
45.	113.0	23.2	23.3	23.4	23.5	23.6	23.7	23.7	23.8	23.9	24.0
44.	111.2	23.5	23.6	23.7	23.8	23.9	23.9	24.0	24.1	24.2	24.3
43.	109.4	23.8	23.9	24.0	24.1	24.2	24.3	24.4	24.5	24.5	24.6
42.	107.6	24.1	24.2	24.3	24.4	24.5	24.6	24.7	24.7	24.8	24.9
41.	105.8	24.4	24.5	24.6	24.7	24.8	24.9	25.0	25.1	25.2	25.3
40.	104.0	24.7	24.8	24.9	25.0	25.1	25.2	25.3	25.4	25.5	25.6
39.	102.2	25.0	25.1	25.2	25.3	25.4	25.5	25.6	25.7	25.8	25.9
38.	100.4	25.3	25.4	25.5	25.6	25.7	25.8	25.9	26.0	26.1	26.2
37.	98.6	25.6	25.7	25.8	25.9	26.0	26.1	26.2	26.3	26.4	26.5
36.	96.8	26.0	26.1	26.2	26.3	26.4	26.5	26.6	26.7	26.8	26.9
35.	95.0	26.3	26.4	26.5	26.6	26.7	26.8	26.9	27.0	27.1	27.2
34.	93.2	26.6	26.7	26.8	26.9	27.0	27.1	27.2	27.3	27.4	27.5
33.	91.4	26.9	27.0	27.1	27.2	27.3	27.4	27.5	27.6	27.7	27.8
32.	89.6	27.2	27.3	27.4	27.6	27.7	27.8	27.9	28.0	28.1	28.2
31.	87.8	27.6	27.7	27.8	27.9	28.0	28.1	28.2	28.3	28.4	28.5
30.	86.0	27.9	28.0	28.1	28.2	28.3	28.5	28.6	28.7	28.8	28.9
29.	84.2	28.2	28.4	28.5	28.6	28.7	28.8	28.9	29.0	29.1	29.2
28.	82.4	28.6	28.7	28.8	28.9	29.0	29.1	29.2	29.3	29.4	29.6
27.	80.6	28.9	29.0	29.1	29.3	29.4	29.5	29.6	29.7	29.8	29.9
26.	78.8	29.2	29.3	29.4	29.6	29.7	29.8	29.9	30.0	30.1	30.2
25.	77.0	29.5	29.6	29.8	29.9	30.0	30.1	30.2	30.3	30.4	30.6
24.	75.2	29.8	29.9	30.0	30.2	30.3	30.4	30.5	30.6	30.7	30.9
23.	73.4	30.1	30.2	30.3	30.4	30.5	30.7	30.8	30.9	31.0	31.1
22.	71.6	30.4	30.5	30.6	30.7	30.8	30.9	31.1	31.2	31.3	31.4
21.	69.8	30.6	30.7	30.8	30.9	31.1	31.2	31.3	31.4	31.5	31.7
20.	68.0	30.7	30.8	30.9	31.0	31.2	31.3	31.4	31.5	31.6	31.8

For temperatures below 20°C use 20°C.

05D241-03-11-83

Figure FO-26. Power Check Chart; Main Fuel Control (Sheet 3)

NOTE

This chart may be removed from manual for use with checklist.

CUT ALONG THIS LINE

Main Fuel Control Power Check Chart – TF41-A-1

NOTE

Values shown are for engine operating in A-7D airplane with air inlet screen installed and air conditioning system operating. If engine must be operated with screen removed, add 1.3" Hg to $P_{T5.1}$ true pressure.

Ambient Temperature		Ambient Pressure – Inches Mercury Absolute									
		27.0	27.1	27.2	27.3	27.4	27.5	27.6	27.7	27.8	27.9
°C	°F	$P_{T5.1}$ True Pressure – Inches Mercury Gage									
55.	131.0	21.1	21.2	21.2	21.3	21.4	21.5	21.6	21.6	21.7	21.8
54.	129.2	21.4	21.5	21.6	21.6	21.7	21.8	21.9	22.0	22.1	22.1
53.	127.4	21.7	21.8	21.9	21.9	22.0	22.1	22.2	22.3	22.4	22.4
52.	125.6	22.0	22.1	22.1	22.2	22.3	22.4	22.5	22.6	22.6	22.7
51.	123.8	22.3	22.4	22.4	22.5	22.6	22.7	22.8	22.9	22.9	23.0
50.	122.0	.22.6	22.7	22.8	22.9	22.9	23.0	23.1	23.2	23.3	23.4
49.	120.2	22.9	23.0	23.1	23.2	23.2	23.3	23.4	23.5	23.6	23.7
48.	118.4	23.2	23.3	23.4	23.5	23.5	23.6	23.7	23.8	23.9	24.0
47.	116.6	23.5	23.6	23.7	23.8	23.8	23.9	24.0	24.1	24.2	24.3
46.	114.8	23.8	23.9	24.0	24.1	24.1	24.2	24.3	24.4	24.5	24.6
45.	113.0	24.1	24.2	24.3	24.4	24.5	24.6	24.7	24.7	24.8	24.9
44.	111.2	24.4	24.5	24.6	24.7	24.8	24.9	25.0	25.0	25.1	25.2
43.	109.4	24.7	24.8	24.9	25.0	25.1	25.2	25.3	25.4	25.5	25.6
42.	107.6	25.0	25.1	25.2	25.3	25.4	25.5	25.6	25.7	25.8	25.9
41.	105.8	25.3	25.4	25.5	25.6	25.7	25.8	25.9	26.0	26.1	26.2
40.	104.0	25.6	25.7	25.8	25.9	26.0	26.1	26.2	26.3	26.4	26.5
39.	102.2	26.0	26.1	26.2	26.3	26.4	26.5	26.6	26.7	26.8	26.9
38.	100.4	26.3	26.4	26.5	26.6	26.7	26.8	26.9	27.0	27.1	27.2
37.	98.6	26.6	26.7	26.8	26.9	27.0	27.1	27.2	27.3	27.4	27.5
36.	96.8	27.0	27.1	27.2	27.3	27.4	27.5	27.6	27.7	27.8	27.9
35.	95.0	27.3	27.4	27.5	27.6	27.7	27.8	27.9	28.0	28.1	28.2
34.	93.2	27.6	27.7	27.8	27.9	28.0	28.1	28.2	28.3	28.4	28.5
33.	91.4	27.9	28.0	28.2	28.3	28.4	28.5	28.6	28.7	28.8	28.9
32.	89.6	28.3	28.4	28.5	28.6	28.7	28.8	28.9	29.0	29.1	29.2
31.	87.8	28.6	28.8	28.9	29.0	29.1	29.2	29.3	29.4	29.5	29.6
30.	86.0	29.0	29.1	29.2	29.3	29.4	29.5	29.6	29.8	29.9	30.0
29.	84.2	29.3	29.5	29.6	29.7	29.8	29.9	30.0	30.1	30.2	30.3
28.	82.4	29.7	29.8	29.9	30.0	30.1	30.2	30.3	30.4	30.6	30.7
27.	80.6	30.0	30.2	30.3	30.4	30.5	30.6	30.7	30.8	30.9	31.1
26.	78.8	30.3	30.5	30.6	30.7	30.8	30.9	31.0	31.1	31.3	31.4
25.	77.0	30.7	30.8	30.9	31.0	31.1	31.2	31.4	31.5	31.6	31.7
24.	75.2	31.0	31.1	31.2	31.3	31.4	31.5	31.7	31.8	31.9	32.0
23.	73.4	31.2	31.4	31.5	31.6	31.7	31.8	31.9	32.1	32.2	32.3
22.	71.6	31.5	31.7	31.8	31.9	32.0	32.1	32.2	32.4	32.5	32.6
21.	69.8	31.8	31.9	32.0	32.1	32.3	32.4	32.5	32.6	32.7	32.8
20.	68.0	31.9	32.0	32.1	32.2	32.4	32.5	32.6	32.7	32.8	33.0

For temperatures below 20°C use 20°C

05D241–04–11–83

Figure FO-26. Power Check Chart; Main Fuel Control (Sheet 4)

NOTE

This chart may be removed from manual for use with checklist.

CUT ALONG THIS LINE

Main Fuel Control Power Check Chart – TF41-A-1

NOTE

Values shown are for engine operating in A-7D airplane with air inlet screen installed and air conditioning system operating. If engine must be operated with screen removed, add 1.3" Hg to $P_{T5.1}$ true pressure.

Ambient Temperature		Ambient Pressure – Inches Mercury Absolute									
		28.0	28.1	28.2	28.3	28.4	28.5	28.6	28.7	28.8	28.9
°C	°F	$P_{T5.1}$ True Pressure – Inches Mercury Gage									
55.	131.0	21.9	22.0	22.0	22.1	22.2	22.3	22.4	22.4	22.5	22.6
54.	129.2	22.2	22.3	22.4	22.5	22.5	22.6	22.7	22.8	22.9	22.9
53.	127.4	22.5	22.6	22.7	22.8	22.8	22.9	23.0	23.1	23.2	23.3
52.	125.6	22.8	22.9	23.0	23.0	23.1	23.2	23.3	23.4	23.5	23.5
51.	123.8	23.1	23.2	23.3	23.4	23.4	23.5	23.6	23.7	23.8	23.9
50.	122.0	23.4	23.5	23.6	23.7	23.8	23.9	24.0	24.0	24.1	24.2
49.	120.2	23.8	23.8	23.9	24.0	24.1	24.2	24.3	24.4	24.4	24.5
48.	118.4	24.1	24.1	24.2	24.3	24.4	24.5	24.6	24.7	24.8	24.8
47.	116.6	24.4	24.5	24.5	24.6	24.7	24.8	24.9	25.0	25.1	25.2
46.	114.8	24.7	24.8	24.9	24.9	25.0	25.1	25.2	25.3	25.4	25.5
45.	113.0	25.0	25.1	25.2	25.3	25.4	25.5	25.6	25.6	25.7	25.8
44.	111.2	25.3	25.4	25.5	25.6	25.7	25.8	25.9	26.0	26.1	26.1
43.	109.4	25.7	25.7	25.8	25.9	26.0	26.1	26.2	26.3	26.4	26.5
42.	107.6	26.0	26.1	26.2	26.2	26.3	26.4	26.5	26.6	26.7	26.8
41.	105.8	26.3	26.4	26.5	26.6	26.7	26.8	26.9	27.0	27.1	27.2
40.	104.0	26.6	26.7	26.8	26.9	27.0	27.1	27.2	27.3	27.4	27.5
39.	102.2	27.0	27.1	27.2	27.3	27.4	27.5	27.6	27.7	27.8	27.8
38.	100.4	27.3	27.4	27.5	27.6	27.7	27.8	27.9	28.0	28.1	28.2
37.	98.6	27.6	27.7	27.8	27.9	28.0	28.1	28.2	28.3	28.4	28.5
36.	96.8	28.0	28.1	28.2	28.3	28.4	28.5	28.6	28.7	28.8	28.9
35.	95.0	28.3	28.4	28.5	28.6	28.7	28.8	28.9	29.0	29.1	29.2
34.	93.2	28.7	28.8	28.9	29.0	29.1	29.2	29.3	29.4	29.5	29.6
33.	91.4	29.0	29.1	29.2	29.3	29.4	29.5	29.6	29.7	29.8	29.9
32.	89.6	29.4	29.5	29.6	29.7	29.8	29.9	30.0	30.1	30.2	30.3
31.	87.8	29.7	29.8	29.9	30.0	30.1	30.3	30.4	30.5	30.6	30.7
30.	86.0	30.1	30.2	30.3	30.4	30.5	30.6	30.7	30.8	30.9	31.1
29.	84.2	30.4	30.6	30.7	30.8	30.9	31.0	31.1	31.2	31.3	31.4
28.	82.4	30.8	30.9	31.0	31.1	31.2	31.3	31.4	31.6	31.7	31.8
27.	80.6	31.2	31.3	31.4	31.5	31.6	31.7	31.8	32.0	32.1	32.2
26.	78.8	31.5	31.6	31.7	31.8	31.9	32.0	32.2	32.3	32.4	32.5
25.	77.0	31.8	31.9	32.0	32.2	32.3	32.4	32.5	32.6	32.7	32.8
24.	75.2	32.1	32.2	32.4	32.5	32.6	32.7	32.8	32.9	33.1	33.2
23.	73.4	32.4	32.5	32.6	32.8	32.9	33.0	33.1	33.2	33.3	33.5
22.	71.6	32.7	32.8	32.9	33.1	33.2	33.3	33.4	33.5	33.7	33.8
21.	69.8	33.0	33.1	33.2	33.3	33.4	33.6	33.7	33.8	33.9	34.0
20.	68.0	33.1	33.2	33.3	33.4	33.6	33.7	33.8	33.9	34.0	34.1

For temperatures below 20°C use 20°C.

05D241–05–11–83

Figure FO-26. Power Check Chart; Main Fuel Control (Sheet 5)

NOTE

This chart may be removed from manual for use with checklist.

CUT ALONG THIS LINE

Main Fuel Control Power Check Chart – TF41-A-1

NOTE

Values shown are for engine operating in A-7D airplane with air inlet screen installed and air conditioning system operating. If engine must be operated with screen removed, add 1.3" Hg to $P_{T5.1}$ true pressure.

Ambient Temperature		Ambient Pressure – Inches Mercury Absolute									
		29.0	29.1	29.2	29.3	29.4	29.5	29.6	29.7	29.8	29.9
°C	°F	$P_{T5.1}$ True Pressure – Inches Mercury Gage									
55.	131.0	22.7	22.7	22.8	22.9	23.0	23.1	23.1	23.2	23.3	23.4
54.	129.2	23.0	23.1	23.2	23.3	23.3	23.4	23.5	23.6	23.7	23.7
53.	127.4	23.3	23.4	23.5	23.6	23.7	23.7	23.8	23.9	24.0	24.1
52.	125.6	23.6	23.7	23.8	23.9	24.0	24.0	24.1	24.2	24.3	24.4
51.	123.8	23.9	24.0	24.1	24.2	24.3	24.4	24.4	24.5	24.6	24.7
50.	122.0	24.3	24.4	24.5	24.5	24.6	24.7	24.8	24.9	25.0	25.1
49.	120.2	24.6	24.7	24.8	24.9	25.0	25.0	25.1	25.2	25.3	25.4
48.	118.4	24.9	25.0	25.1	25.2	25.3	25.4	25.5	25.5	25.6	25.7
47.	116.6	25.2	25.3	25.4	25.5	25.6	25.7	25.8	25.9	26.0	26.0
46.	114.8	25.6	25.7	25.7	25.8	25.9	26.0	26.1	26.2	26.3	26.4
45.	113.0	25.9	26.0	26.1	26.2	26.3	26.4	26.5	26.5	26.6	26.7
44.	111.2	26.2	26.3	26.4	26.5	26.6	26.7	26.8	26.9	27.0	27.1
43.	109.4	26.6	26.7	26.8	26.9	27.0	27.0	27.1	27.2	27.3	27.4
42.	107.6	26.9	27.0	27.1	27.2	27.3	27.4	27.5	27.6	27.7	27.7
41.	105.8	27.2	27.3	27.4	27.5	27.6	27.7	27.8	27.9	28.0	28.1
40.	104.0	27.6	27.7	27.8	27.9	28.0	28.0	28.1	28.2	28.3	28.4
39.	102.2	27.9	28.0	28.1	28.2	28.3	28.4	28.5	28.6	28.7	28.8
38.	100.4	28.3	28.4	28.5	28.6	28.7	28.8	28.9	29.0	29.1	29.2
37.	98.6	28.6	28.7	28.8	28.9	29.0	29.1	29.2	29.3	29.4	29.5
36.	96.8	29.0	29.1	29.2	29.3	29.4	29.5	29.6	29.7	29.8	29.9
35.	95.0	29.3	29.4	29.5	29.6	29.7	29.8	30.0	30.1	30.2	30.3
34.	93.2	29.7	29.8	29.9	30.0	30.1	30.2	30.3	30.4	30.5	30.6
33.	91.4	30.0	30.1	30.2	30.3	30.5	30.6	30.7	30.8	30.9	31.0
32.	89.6	30.4	30.5	30.6	30.7	30.8	30.9	31.0	31.2	31.3	31.4
31.	87.8	30.8	30.9	31.0	31.1	31.2	31.3	31.4	31.5	31.6	31.8
30.	86.0	31.2	31.3	31.4	31.5	31.6	31.7	31.8	31.9	32.0	32.1
29.	84.2	31.5	31.7	31.8	31.9	32.0	32.1	32.2	32.3	32.4	32.5
28.	82.4	31.9	32.0	32.1	32.2	32.3	32.4	32.6	32.7	32.8	32.9
27.	80.6	32.3	32.4	32.5	32.6	32.7	32.9	33.0	33.1	33.2	33.3
26.	78.8	32.6	32.7	32.8	33.0	33.1	33.2	33.3	33.4	33.5	33.6
25.	77.0	33.0	33.1	33.2	33.3	33.4	33.5	33.7	33.8	33.9	34.0
24.	75.2	33.3	33.4	33.5	33.6	33.7	33.9	34.0	34.1	34.2	34.3
23.	73.4	33.6	33.7	33.8	33.9	34.0	34.2	34.3	34.4	34.5	34.6
22.	71.6	33.9	34.0	34.1	34.2	34.4	34.5	34.6	34.7	34.8	35.0
21.	69.8	34.2	34.3	34.4	34.5	34.6	34.7	34.9	35.0	35.1	35.2
20.	68.0	34.3	34.4	34.5	34.6	34.7	34.9	35.0	35.1	35.2	35.3

For temperatures below 20°C use 20°C.

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Figure FO-26. Power Check Chart; Main Fuel Control (Sheet 6)

NOTE

This chart may be removed from manual for use with checklist.

CUT ALONG THIS LINE

Main Fuel Control Power Check Chart – TF41-A-1

NOTE

Values shown are for engine operating in A-7D airplane with air inlet screen installed and air conditioning system operating. If engine must be operated with screen removed, add 1.3" Hg to $P_{T5.1}$ true pressure.

Ambient Temperature		Ambient Pressure – Inches Mercury Absolute									
		30.0	30.1	30.2	30.3	30.4	30.5	30.6	30.7	30.8	30.9
°C	°F	$P_{T5.1}$ True Pressure – Inches Mercury Gage									
55.	131.0	23.5	23.5	23.6	23.7	23.8	23.9	23.9	24.0	24.1	24.2
54.	129.2	23.8	23.9	24.0	24.1	24.1	24.2	24.3	24.4	24.5	24.5
53.	127.4	24.1	24.2	24.3	24.4	24.5	24.6	24.6	24.7	24.8	24.9
52.	125.6	24.4	24.5	24.6	24.7	24.8	24.9	24.9	25.0	25.1	25.2
51.	123.8	24.8	24.9	24.9	25.0	25.1	25.2	25.3	25.4	25.4	25.5
50.	122.0	25.1	25.2	25.3	25.4	25.5	25.6	25.6	25.7	25.8	25.9
49.	120.2	25.5	25.6	25.6	25.7	25.8	25.9	26.0	26.1	26.2	26.2
48.	118.4	25.8	25.9	26.0	26.1	26.1	26.2	26.3	26.4	26.5	26.6
47.	116.6	26.1	26.2	26.3	26.4	26.5	26.6	26.7	26.7	26.8	26.9
46.	114.8	26.5	26.5	26.6	26.7	26.8	26.9	27.0	27.1	27.2	27.3
45.	113.0	26.8	26.9	27.0	27.1	27.2	27.3	27.4	27.5	27.5	27.6
44.	111.2	27.1	27.2	27.3	27.4	27.5	27.6	27.7	27.8	27.9	28.0
43.	109.4	27.5	27.6	27.7	27.8	27.9	28.0	28.1	28.2	28.3	28.3
42.	107.6	27.8	27.9	28.0	28.1	28.2	28.3	28.4	28.5	28.6	28.7
41.	105.8	28.2	28.3	28.4	28.5	28.6	28.7	28.8	28.9	29.0	29.1
40.	104.0	28.5	28.6	28.7	28.8	28.9	29.0	29.1	29.2	29.3	29.4
39.	102.2	28.9	29.0	29.1	29.2	29.3	29.4	29.5	29.6	29.7	29.8
38.	100.4	29.3	29.4	29.5	29.6	29.7	29.8	29.9	30.0	30.1	30.2
37.	98.6	29.6	29.7	29.8	29.9	30.0	30.1	30.2	30.3	30.4	30.5
36.	96.8	30.0	30.1	30.2	30.3	30.4	30.5	30.6	30.7	30.8	30.9
35.	95.0	30.4	30.5	30.6	30.7	30.8	30.9	31.0	31.1	31.2	31.3
34.	93.2	30.7	30.8	30.9	31.0	31.1	31.2	31.3	31.4	31.5	31.7
33.	91.4	31.1	31.2	31.3	31.4	31.5	31.6	31.7	31.8	31.9	32.0
32.	89.6	31.5	31.6	31.7	31.8	31.9	32.0	32.1	32.2	32.3	32.4
31.	87.8	31.9	32.0	32.1	32.2	32.3	32.4	32.5	32.6	32.7	32.8
30.	86.0	32.2	32.4	32.5	32.6	32.7	32.8	32.9	33.0	33.1	33.2
29.	84.2	32.6	32.7	32.9	33.0	33.1	33.2	33.3	33.4	33.5	33.6
28.	82.4	33.0	33.1	33.2	33.3	33.4	33.6	33.7	33.8	33.9	34.0
27.	80.6	33.4	33.5	33.6	33.8	33.9	34.0	34.1	34.2	34.3	34.4
26.	78.8	33.7	33.9	34.0	34.1	34.2	34.3	34.4	34.5	34.7	34.8
25.	77.0	34.1	34.2	34.3	34.5	34.6	34.7	34.8	34.9	35.0	35.1
24.	75.2	34.4	34.6	34.7	34.8	34.9	35.0	35.1	35.3	35.4	35.5
23.	73.4	34.7	34.9	35.0	35.1	35.2	35.3	35.4	35.6	35.7	35.8
22.	71.6	35.1	35.2	35.3	35.4	35.5	35.7	35.8	35.9	36.0	36.1
21.	69.8	35.3	35.5	35.6	35.7	35.8	35.9	36.1	36.2	36.3	36.4
20.	68.0	35.5	35.6	35.7	35.8	35.9	36.1	36.2	36.3	36.4	36.5

For temperatures below 20°C use 20°C.

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Figure FO-26. Power Check Chart; Main Fuel Control (Sheet 7)

eckList.

CUT ALONG THIS LINE

Minimum and Maximum Manual Fuel Control Power Check Chart
TF41-A-1

NOTE

Values shown are for engine operating in A-7D airplane with air inlet screen installed and air conditioning system operating. If engine must be operated with screen removed, add 1.3" Hg to $P_{T5.1}$ true pressure.

Ambient Temperature		Ambient Pressure — Inches Mercury Absolute: 24.0		24.2		24.4		24.6		24.8	
		$P_{T6.1}$ True Pressure — Inches Mercury Gage									
°C	°F	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
27.	80.6	29.5	26.3	29.8	26.6	30.0	26.8	30.2	27.0	30.5	27.2
26.	78.8	29.6	26.4	29.8	26.6	30.1	26.9	30.3	27.1	30.6	27.3
25.	77.0	29.7	26.5	29.9	26.7	30.2	26.9	30.4	27.2	30.7	27.4
24.	75.2	29.7	26.6	30.0	26.8	30.2	27.0	30.5	27.2	30.7	27.5
23.	73.4	29.8	26.6	30.1	26.9	30.3	27.1	30.6	27.3	30.8	27.5
22.	71.6	29.9	26.7	30.2	26.9	30.4	27.2	30.7	27.4	30.9	27.6
21.	69.8	30.0	26.8	30.2	27.0	30.5	27.2	30.7	27.5	31.0	27.7
20.	68.0	30.1	26.9	30.3	27.1	30.6	27.3	30.8	27.5	31.1	27.8
19.	66.2	30.2	27.0	30.4	27.2	30.7	27.4	30.9	27.6	31.2	27.8
18.	64.4	30.2	27.0	30.5	27.3	30.7	27.5	31.0	27.7	31.2	27.9
17.	62.6	30.3	27.1	30.6	27.3	30.8	27.6	31.1	27.8	31.3	28.0
16.	60.8	30.4	27.2	30.6	27.4	30.9	27.6	31.2	27.9	31.4	28.1
15.	59.0	30.5	27.3	30.7	27.5	31.0	27.7	31.2	27.9	31.5	28.2
14.	57.2	30.6	27.3	30.8	27.6	31.1	27.8	31.3	28.0	31.6	28.2
13.	55.4	30.6	27.4	30.9	27.6	31.1	27.9	31.4	28.1	31.7	28.3
12.	53.6	30.7	27.5	31.0	27.7	31.2	27.9	31.5	28.2	31.7	28.4
11.	51.8	30.8	27.6	31.1	27.8	31.3	28.0	31.6	28.2	31.8	28.5
10.	50.0	30.9	27.6	31.1	27.9	31.4	28.1	31.6	28.3	31.9	28.6
9.	48.2	31.0	27.7	31.2	27.9	31.5	28.2	31.7	28.4	32.0	28.6
8.	46.4	31.0	27.8	31.3	28.0	31.6	28.2	31.8	28.5	32.1	28.7
7.	44.6	31.1	27.9	31.4	28.1	31.6	28.3	31.9	28.6	32.2	28.8
6.	42.8	31.2	27.9	31.5	28.2	31.7	28.4	32.0	28.6	32.2	28.9
5.	41.0	31.3	28.0	31.5	28.2	31.8	28.5	32.1	28.7	32.3	28.9
4.	39.2	31.4	28.1	31.6	28.3	31.9	28.6	32.1	28.8	32.4	29.0
3.	37.4	31.4	28.2	31.7	28.4	32.0	28.6	32.2	28.9	32.5	29.1
2.	35.6	31.5	28.2	31.8	28.5	32.0	28.7	32.3	28.9	32.6	29.2
1.	33.8	31.6	28.3	31.9	28.6	32.1	28.8	32.4	29.0	32.7	29.3
-0.	32.0	31.7	28.4	31.9	28.6	32.2	28.9	32.5	29.1	32.7	29.3
-1.	30.2	31.8	28.5	32.0	28.7	32.3	28.9	32.6	29.2	32.8	29.4
-2.	28.4	31.8	28.5	32.1	28.8	32.4	29.0	32.6	29.3	32.9	29.5
-3.	26.6	31.9	28.6	32.2	28.9	32.5	29.1	32.7	29.3	33.0	29.6
-4.	24.8	32.0	28.7	32.3	28.9	32.5	29.2	32.8	29.4	33.1	29.7
-5.	23.0	32.1	28.8	32.4	29.0	32.6	29.3	32.9	29.5	33.2	29.7
-6.	21.2	32.2	28.8	32.4	29.1	32.7	29.3	33.0	29.6	33.2	29.8
-7.	19.4	32.2	28.9	32.5	29.2	32.8	29.4	33.1	29.6	33.3	29.9
-8.	17.6	32.3	29.0	32.6	29.2	32.9	29.5	33.1	29.7	33.4	30.0
-9.	15.8	32.4	29.1	32.7	29.3	32.9	29.6	33.2	29.8	33.5	30.0
-10.	14.0	32.5	29.2	32.8	29.4	33.0	29.6	33.3	29.9	33.6	30.1
-11.	12.2	32.6	29.2	32.8	29.5	33.1	29.7	33.4	30.0	33.7	30.2
-12.	10.4	32.7	29.3	32.9	29.5	33.2	29.8	33.5	30.0	33.7	30.3
-13.	8.6	32.7	29.4	33.0	29.6	33.3	29.9	33.5	30.1	33.8	30.4
-14.	6.8	32.8	29.5	33.1	29.7	33.4	29.9	33.6	30.2	33.9	30.4
-15.	5.0	32.9	29.5	33.2	29.8	33.4	30.0	33.7	30.3	34.0	30.5
-16.	3.2	33.0	29.6	33.2	29.9	33.5	30.1	33.8	30.3	34.1	30.6
-17.	1.4	33.1	29.7	33.3	29.9	33.6	30.2	33.9	30.4	34.2	30.7
-18.	-0.4	33.1	29.8	33.4	30.0	33.7	30.3	34.0	30.5	34.2	30.7
-19.	-2.2	33.2	29.8	33.5	30.1	33.8	30.3	34.0	30.6	34.3	30.8
-20.	-4.0	33.3	29.9	33.6	30.2	33.9	30.4	34.1	30.7	34.4	30.9
-21.	-5.8	33.4	30.0	33.7	30.2	33.9	30.5	34.2	30.7	34.5	31.0
-22.	-7.6	33.5	30.1	33.7	30.3	34.0	30.6	34.3	30.8	34.6	31.1
-23.	-9.4	33.5	30.1	33.8	30.4	34.1	30.6	34.4	30.9	34.7	31.1
-24.	-11.2	33.6	30.2	33.9	30.5	34.2	30.7	34.5	31.0	34.7	31.2
-25.	-13.0	33.7	30.3	34.0	30.5	34.3	30.8	34.5	31.0	34.8	31.3
-26.	-14.8	33.8	30.4	34.1	30.6	34.3	30.9	34.6	31.1	34.9	31.4
-27.	-16.6	33.9	30.4	34.1	30.7	34.4	30.9	34.7	31.2	35.0	31.5
-28.	-18.4	33.9	30.5	34.2	30.8	34.5	31.0	34.8	31.3	35.1	31.5
-29.	-20.2	34.0	30.6	34.3	30.8	34.6	31.1	34.9	31.4	35.2	31.6
-30.	-22.0	34.1	30.7	34.4	30.9	34.7	31.2	35.0	31.4	35.2	31.7
-31.	-23.8	34.2	30.7	34.5	31.0	34.8	31.3	35.0	31.5	35.3	31.8
-32.	-25.6	34.3	30.8	34.5	31.1	34.8	31.3	35.1	31.6	35.4	31.8
-33.	-27.4	34.3	30.9	34.6	31.2	34.9	31.4	35.2	31.7	35.5	31.9
-34.	-29.2	34.4	31.0	34.7	31.2	35.0	31.5	35.3	31.7	35.6	32.0
-35.	-31.0	34.5	31.0	34.8	31.3	35.1	31.6	35.4	31.8	35.7	32.1
-36.	-32.8	34.6	31.1	34.9	31.4	35.2	31.6	35.4	31.9	35.7	32.2
-37.	-34.6	34.7	31.2	35.0	31.5	35.2	31.7	35.5	32.0	35.8	32.2
-38.	-36.4	34.7	31.3	35.0	31.5	35.3	31.8	35.6	32.1	35.9	32.3
-39.	-38.2	34.8	31.4	35.1	31.6	35.4	31.9	35.7	32.1	36.0	32.4
-40.	-40.0	34.9	31.4	35.2	31.7	35.5	31.9	35.8	32.2	36.1	32.5

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Figure FO-27. Power Check Chart; Manual Fuel Control (Sheet 1 of 7)

CUT ALONG THIS LINE

Minimum and Maximum Manual Fuel Control Power Check Chart
TF41-A-1

NOTE

Values shown are for engine operating in A-7D airplane with air inlet screen installed and air conditioning system operating. If engine must be operated with screen removed, add 1.3" Hg to $P_{T5.1}$ true pressure.

Ambient Temperature		Ambient Pressure — Inches Mercury Absolute: 25.0		25.2		25.4		25.6		25.8	
		$P_{T5.1}$ True Pressure — Inches Mercury Gage									
°C	°F	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
27.	80.6	30.7	27.4	31.0	27.7	31.2	27.9	31.5	28.1	31.7	28.3
26.	78.8	30.8	27.5	31.1	27.7	31.3	28.0	31.6	28.2	31.8	28.4
25.	77.0	30.9	27.6	31.2	27.8	31.4	28.0	31.6	28.3	31.9	28.5
24.	75.2	31.0	27.7	31.2	27.9	31.5	28.1	31.7	28.3	32.0	28.6
23.	73.4	31.1	27.8	31.3	28.0	31.6	28.2	31.8	28.4	32.1	28.6
22.	71.6	31.2	27.8	31.4	28.1	31.7	28.3	31.9	28.5	32.2	28.7
21.	69.8	31.2	27.9	31.5	28.1	31.7	28.4	32.0	28.6	32.2	28.8
20.	68.0	31.3	28.0	31.6	28.2	31.8	28.4	32.1	28.7	32.3	28.9
19.	66.2	31.4	28.1	31.7	28.3	31.9	28.5	32.2	28.7	32.4	29.0
18.	64.4	31.5	28.2	31.7	28.4	32.0	28.6	32.2	28.8	32.5	29.1
17.	62.6	31.6	28.2	31.8	28.5	32.1	28.7	32.3	28.9	32.6	29.1
16.	60.8	31.7	28.3	31.9	28.5	32.2	28.8	32.4	29.0	32.7	29.2
15.	59.0	31.7	28.4	32.0	28.6	32.3	28.8	32.5	29.1	32.8	29.3
14.	57.2	31.8	28.5	32.1	28.7	32.3	28.9	32.6	29.2	32.8	29.4
13.	55.4	31.9	28.5	32.2	28.8	32.4	29.0	32.7	29.2	32.9	29.5
12.	53.6	32.0	28.6	32.3	28.9	32.5	29.1	32.8	29.3	33.0	29.5
11.	51.8	32.1	28.7	32.3	28.9	32.6	29.2	32.8	29.4	33.1	29.6
10.	50.0	32.2	28.8	32.4	29.0	32.7	29.2	32.9	29.5	33.2	29.7
9.	48.2	32.2	28.9	32.5	29.1	32.8	29.3	33.0	29.6	33.3	29.8
8.	46.4	32.3	28.9	32.6	29.2	32.8	29.4	33.1	29.6	33.4	29.9
7.	44.6	32.4	29.0	32.7	29.3	32.9	29.5	33.2	29.7	33.5	30.0
6.	42.8	32.5	29.1	32.8	29.3	33.0	29.6	33.3	29.8	33.5	30.0
5.	41.0	32.6	29.2	32.8	29.4	33.1	29.6	33.4	29.9	33.6	30.1
4.	39.2	32.7	29.3	32.9	29.5	33.2	29.7	33.5	30.0	33.7	30.2
3.	37.4	32.8	29.3	33.0	29.6	33.3	29.8	33.5	30.0	33.8	30.3
2.	35.6	32.8	29.4	33.1	29.7	33.4	29.9	33.6	30.1	33.9	30.4
1.	33.8	32.9	29.5	33.2	29.7	33.4	30.0	33.7	30.2	34.0	30.4
-0.	32.0	33.0	29.6	33.3	29.8	33.5	30.0	33.8	30.3	34.1	30.5
-1.	30.2	33.1	29.7	33.4	29.9	33.6	30.1	33.9	30.4	34.1	30.6
-2.	28.4	33.2	29.7	33.4	30.0	33.7	30.2	34.0	30.4	34.2	30.7
-3.	26.6	33.3	29.8	33.5	30.1	33.8	30.3	34.1	30.5	34.3	30.8
-4.	24.8	33.3	29.9	33.6	30.1	33.9	30.4	34.1	30.6	34.4	30.8
-5.	23.0	33.4	30.0	33.7	30.2	34.0	30.4	34.2	30.7	34.5	30.9
-6.	21.2	33.5	30.0	33.8	30.3	34.0	30.5	34.3	30.8	34.6	31.0
-7.	19.4	33.6	30.1	33.9	30.4	34.1	30.6	34.4	30.9	34.7	31.1
-8.	17.6	33.7	30.2	33.9	30.4	34.2	30.7	34.5	30.9	34.8	31.2
-9.	15.8	33.8	30.3	34.0	30.5	34.3	30.8	34.6	31.0	34.8	31.3
-10.	14.0	33.8	30.4	34.1	30.6	34.4	30.9	34.7	31.1	34.9	31.3
-11.	12.2	33.9	30.4	34.2	30.7	34.5	30.9	34.7	31.2	35.0	31.4
-12.	10.4	34.0	30.5	34.3	30.8	34.6	31.0	34.8	31.3	35.1	31.5
-13.	8.6	34.1	30.6	34.4	30.8	34.6	31.1	34.9	31.3	35.2	31.6
-14.	6.8	34.2	30.7	34.5	30.9	34.7	31.2	35.0	31.4	35.3	31.7
-15.	5.0	34.3	30.8	34.5	31.0	34.8	31.3	35.1	31.5	35.4	31.7
-16.	3.2	34.3	30.8	34.6	31.1	34.9	31.3	35.2	31.6	35.4	31.8
-17.	1.4	34.4	30.9	34.7	31.2	35.0	31.4	35.3	31.7	35.5	31.9
-18.	-0.4	34.5	31.0	34.8	31.2	35.1	31.5	35.3	31.7	35.6	32.0
-19.	-2.2	34.6	31.1	34.9	31.3	35.2	31.6	35.4	31.8	35.7	32.1
-20.	-4.0	34.7	31.2	35.0	31.4	35.2	31.7	35.5	31.9	35.8	32.2
-21.	-5.8	34.8	31.2	35.0	31.5	35.3	31.7	35.6	32.0	35.9	32.2
-22.	-7.6	34.9	31.3	35.1	31.6	35.4	31.8	35.7	32.1	36.0	32.3
-23.	-9.4	34.9	31.4	35.2	31.6	35.5	31.9	35.8	32.1	36.1	32.4
-24.	-11.2	35.0	31.5	35.3	31.7	35.6	32.0	35.9	32.2	36.1	32.5
-25.	-13.0	35.1	31.6	35.4	31.8	35.7	32.1	35.9	32.3	36.2	32.6
-26.	-14.8	35.2	31.6	35.5	31.9	35.7	32.1	36.0	32.4	36.3	32.6
-27.	-16.6	35.3	31.7	35.6	32.0	35.8	32.2	36.1	32.5	36.4	32.7
-28.	-18.4	35.4	31.8	35.6	32.0	35.9	32.3	36.2	32.6	36.5	32.8
-29.	-20.2	35.4	31.9	35.7	32.1	36.0	32.4	36.3	32.6	36.6	32.9
-30.	-22.0	35.5	31.9	35.8	32.2	36.1	32.5	36.4	32.7	36.7	33.0
-31.	-23.8	35.6	32.0	35.9	32.3	36.2	32.5	36.5	32.8	36.7	33.0
-32.	-25.6	35.7	32.1	36.0	32.4	36.3	32.6	36.5	32.9	36.8	33.1
-33.	-27.4	35.8	32.2	36.1	32.4	36.3	32.7	36.6	33.0	36.9	33.2
-34.	-29.2	35.9	32.3	36.1	32.5	36.4	32.8	36.7	33.0	37.0	33.3
-35.	-31.0	35.9	32.3	36.2	32.6	36.5	32.9	36.8	33.1	37.1	33.4
-36.	-32.8	36.0	32.4	36.3	32.7	36.6	32.9	36.9	33.2	37.2	33.5
-37.	-34.6	36.1	32.5	36.4	32.8	36.7	33.0	37.0	33.3	37.3	33.5
-38.	-36.4	36.2	32.6	36.5	32.8	36.8	33.1	37.1	33.4	37.4	33.6
-39.	-38.2	36.3	32.7	36.6	32.9	36.9	33.2	37.1	33.4	37.4	33.7
-40.	-40.0	36.4	32.7	36.7	33.0	36.9	33.3	37.2	33.5	37.5	33.8

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Figure FO-27. Power Check Chart; Manual Fuel Control (Sheet 2)

checklist.

CUT ALONG THIS LINE

Minimum and Maximum Manual Fuel Control Power Check Chart
TF41-A-1

NOTE

Values shown are for engine operating in A-7D airplane with air inlet screen installed and air conditioning system operating. If engine must be operated with screen removed, add 1.3" Hg to $P_{T5.1}$ true pressure.

Ambient Temperature		Ambient Pressure – Inches Mercury Absolute: 26.0		26.2		26.4		26.6		26.8	
		$P_{T5.1}$ True Pressure – Inches Mercury Gage									
°C	°F	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
27.	80.6	32.0	28.5	32.2	28.8	32.5	29.0	32.7	29.2	32.9	29.4
26.	78.8	32.1	28.6	32.3	28.8	32.5	29.1	32.8	29.3	33.0	29.5
25.	77.0	32.1	28.7	32.4	28.9	32.6	29.1	32.9	29.4	33.1	29.6
24.	75.2	32.2	28.8	32.5	29.0	32.7	29.2	33.0	29.5	33.2	29.7
23.	73.4	32.3	28.9	32.6	29.1	32.8	29.3	33.1	29.5	33.3	29.8
22.	71.6	32.4	29.0	32.7	29.2	32.9	29.4	33.1	29.6	33.4	29.8
21.	69.8	32.5	29.0	32.7	29.3	33.0	29.5	33.2	29.7	33.5	29.9
20.	68.0	32.6	29.1	32.8	29.3	33.1	29.6	33.3	29.8	33.6	30.0
19.	66.2	32.7	29.2	32.9	29.4	33.2	29.6	33.4	29.9	33.7	30.1
18.	64.4	32.8	29.3	33.0	29.5	33.3	29.7	33.5	30.0	33.8	30.2
17.	62.6	32.8	29.4	33.1	29.6	33.3	29.8	33.6	30.0	33.8	30.3
16.	60.8	32.9	29.4	33.2	29.7	33.4	29.9	33.7	30.1	33.9	30.3
15.	59.0	33.0	29.5	33.3	29.8	33.5	30.0	33.8	30.2	34.0	30.4
14.	57.2	33.1	29.6	33.4	29.8	33.6	30.1	33.9	30.3	34.1	30.5
13.	55.4	33.2	29.7	33.4	29.9	33.7	30.1	34.0	30.4	34.2	30.6
12.	53.6	33.3	29.8	33.5	30.0	33.8	30.2	34.0	30.5	34.3	30.7
11.	51.8	33.4	29.9	33.6	30.1	33.9	30.3	34.1	30.5	34.4	30.8
10.	50.0	33.5	29.9	33.7	30.2	34.0	30.4	34.2	30.6	34.5	30.9
9.	48.2	33.5	30.0	33.8	30.2	34.1	30.5	34.3	30.7	34.6	30.9
8.	46.4	33.6	30.1	33.9	30.3	34.1	30.6	34.4	30.8	34.7	31.0
7.	44.6	33.7	30.2	34.0	30.4	34.2	30.6	34.5	30.9	34.7	31.1
6.	42.8	33.8	30.3	34.1	30.5	34.3	30.7	34.6	31.0	34.8	31.2
5.	41.0	33.9	30.3	34.1	30.6	34.4	30.8	34.7	31.0	34.9	31.3
4.	39.2	34.0	30.4	34.2	30.7	34.5	30.9	34.8	31.1	35.0	31.4
3.	37.4	34.1	30.5	34.3	30.7	34.6	31.0	34.8	31.2	35.1	31.5
2.	35.6	34.1	30.6	34.4	30.8	34.7	31.1	34.9	31.3	35.2	31.5
1.	33.8	34.2	30.7	34.5	30.9	34.8	31.1	35.0	31.4	35.3	31.6
-0.	32.0	34.3	30.8	34.6	31.0	34.9	31.2	35.1	31.5	35.4	31.7
-1.	30.2	34.4	30.8	34.7	31.1	34.9	31.3	35.2	31.6	35.5	31.8
-2.	28.4	34.5	30.9	34.8	31.2	35.0	31.4	35.3	31.6	35.6	31.9
-3.	26.6	34.6	31.0	34.9	31.2	35.1	31.5	35.4	31.7	35.6	32.0
-4.	24.8	34.7	31.1	34.9	31.3	35.2	31.6	35.5	31.8	35.7	32.0
-5.	23.0	34.8	31.2	35.0	31.4	35.3	31.6	35.6	31.9	35.8	32.1
-6.	21.2	34.8	31.3	35.1	31.5	35.4	31.7	35.7	32.0	35.9	32.2
-7.	19.4	34.9	31.3	35.2	31.6	35.5	31.8	35.7	32.1	36.0	32.3
-8.	17.6	35.0	31.4	35.3	31.7	35.6	31.9	35.8	32.1	36.1	32.4
-9.	15.8	35.1	31.5	35.4	31.7	35.6	32.0	35.9	32.2	36.2	32.5
-10.	14.0	35.2	31.6	35.5	31.8	35.7	32.1	36.0	32.3	36.3	32.6
-11.	12.2	35.3	31.7	35.6	31.9	35.8	32.1	36.1	32.4	36.4	32.6
-12.	10.4	35.4	31.7	35.6	32.0	35.9	32.2	36.2	32.5	36.5	32.7
-13.	8.6	35.5	31.8	35.7	32.1	36.0	32.3	36.3	32.6	36.5	32.8
-14.	6.8	35.5	31.9	35.8	32.2	36.1	32.4	36.4	32.6	36.6	32.9
-15.	5.0	35.6	32.0	35.9	32.2	36.2	32.5	36.5	32.7	36.7	33.0
-16.	3.2	35.7	32.1	36.0	32.3	36.3	32.6	36.5	32.8	36.8	33.1
-17.	1.4	35.8	32.2	36.1	32.4	36.4	32.6	36.6	32.9	36.9	33.1
-18.	-0.4	35.9	32.2	36.2	32.5	36.4	32.7	36.7	33.0	37.0	33.2
-19.	-2.2	36.0	32.3	36.3	32.6	36.5	32.8	36.8	33.1	37.1	33.3
-20.	-4.0	36.1	32.4	36.3	32.7	36.6	32.9	36.9	33.1	37.2	33.4
-21.	-5.8	36.2	32.5	36.4	32.7	36.7	33.0	37.0	33.2	37.3	33.5
-22.	-7.6	36.2	32.6	36.5	32.8	36.8	33.1	37.1	33.3	37.4	33.6
-23.	-9.4	36.3	32.6	36.6	32.9	36.9	33.2	37.2	33.4	37.4	33.7
-24.	-11.2	36.4	32.7	36.7	33.0	37.0	33.2	37.3	33.5	37.5	33.7
-25.	-13.0	36.5	32.8	36.8	33.1	37.1	33.3	37.3	33.6	37.6	33.8
-26.	-14.8	36.6	32.9	36.9	33.1	37.2	33.4	37.4	33.7	37.7	33.9
-27.	-16.6	36.7	33.0	37.0	33.2	37.2	33.5	37.5	33.7	37.8	34.0
-28.	-18.4	36.8	33.1	37.1	33.3	37.3	33.6	37.6	33.8	37.9	34.1
-29.	-20.2	36.9	33.1	37.1	33.4	37.4	33.7	37.7	33.9	38.0	34.2
-30.	-22.0	36.9	33.2	37.2	33.5	37.5	33.7	37.8	34.0	38.1	34.2
-31.	-23.8	37.0	33.3	37.3	33.6	37.6	33.8	37.9	34.1	38.2	34.3
-32.	-25.6	37.1	33.4	37.4	33.6	37.7	33.9	38.0	34.2	38.3	34.4
-33.	-27.4	37.2	33.5	37.5	33.7	37.8	34.0	38.1	34.2	38.4	34.5
-34.	-29.2	37.3	33.6	37.6	33.8	37.9	34.1	38.2	34.3	38.4	34.6
-35.	-31.0	37.4	33.6	37.7	33.9	38.0	34.2	38.2	34.4	38.5	34.7
-36.	-32.8	37.5	33.7	37.8	34.0	38.0	34.2	38.3	34.5	38.6	34.8
-37.	-34.6	37.6	33.8	37.8	34.1	38.1	34.3	38.4	34.6	38.7	34.8
-38.	-36.4	37.6	33.9	37.9	34.1	38.2	34.4	38.5	34.7	38.8	34.9
-39.	-38.2	37.7	34.0	38.0	34.2	38.3	34.5	38.6	34.7	38.9	35.0
-40.	-40.0	37.8	34.0	38.1	34.3	38.4	34.6	38.7	34.8	39.0	35.1

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Figure FO-27. Power Check Chart; Manual Fuel Control (Sheet 3)

ecklist.

CUT ALONG THIS LINE

Minimum and Maximum Manual Fuel Control Power Check Chart
TF41-A-1

NOTE

Values shown are for engine operating in A-7D airplane with air inlet screen installed and air conditioning system operating. If engine must be operated with screen removed, add 1.3" Hg to $P_{T5.1}$ true pressure.

Ambient Temperature		Ambient Pressure — Inches Mercury Absolute: 27.0		27.2		27.4		27.6		27.8	
		$P_{T5.1}$ True Pressure — Inches Mercury Gage									
°C	°F	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
27.	80.6	33.2	29.6	33.4	29.9	33.7	30.1	33.9	30.3	34.2	30.5
26.	78.8	33.3	29.7	33.5	29.9	33.8	30.2	34.0	30.4	34.3	30.6
25.	77.0	33.4	29.8	33.6	30.0	33.9	30.2	34.1	30.5	34.4	30.7
24.	75.2	33.5	29.9	33.7	30.1	34.0	30.3	34.2	30.6	34.5	30.8
23.	73.4	33.6	30.0	33.8	30.2	34.1	30.4	34.3	30.6	34.6	30.9
22.	71.6	33.6	30.1	33.9	30.3	34.1	30.5	34.4	30.7	34.6	31.0
21.	69.8	33.7	30.1	34.0	30.4	34.2	30.6	34.5	30.8	34.7	31.0
20.	68.0	33.8	30.2	34.1	30.5	34.3	30.7	34.6	30.9	34.8	31.1
19.	66.2	33.9	30.3	34.2	30.5	34.4	30.8	34.7	31.0	34.9	31.2
18.	64.4	34.0	30.4	34.3	30.6	34.5	30.9	34.8	31.1	35.0	31.3
17.	62.6	34.1	30.5	34.4	30.7	34.6	30.9	34.9	31.2	35.1	31.4
16.	60.8	34.2	30.6	34.4	30.8	34.7	31.0	35.0	31.3	35.2	31.5
15.	59.0	34.3	30.7	34.5	30.9	34.8	31.1	35.0	31.3	35.3	31.6
14.	57.2	34.4	30.7	34.6	31.0	34.9	31.2	35.1	31.4	35.4	31.7
13.	55.4	34.5	30.8	34.7	31.1	35.0	31.3	35.2	31.5	35.5	31.7
12.	53.6	34.6	30.9	34.8	31.1	35.1	31.4	35.3	31.6	35.6	31.8
11.	51.8	34.6	31.0	34.9	31.2	35.2	31.5	35.4	31.7	35.7	31.9
10.	50.0	34.7	31.1	35.0	31.3	35.3	31.5	35.5	31.8	35.8	32.0
9.	48.2	34.8	31.2	35.1	31.4	35.3	31.6	35.6	31.9	35.9	32.1
8.	46.4	34.9	31.3	35.2	31.5	35.4	31.7	35.7	32.0	36.0	32.2
7.	44.6	35.0	31.3	35.3	31.6	35.5	31.8	35.8	32.0	36.0	32.3
6.	42.8	35.1	31.4	35.4	31.7	35.6	31.9	35.9	32.1	36.1	32.4
5.	41.0	35.2	31.5	35.5	31.7	35.7	32.0	36.0	32.2	36.2	32.4
4.	39.2	35.3	31.6	35.5	31.8	35.8	32.1	36.1	32.3	36.3	32.5
3.	37.4	35.4	31.7	35.6	31.9	35.9	32.2	36.2	32.4	36.4	32.6
2.	35.6	35.5	31.8	35.7	32.0	36.0	32.2	36.3	32.5	36.5	32.7
1.	33.8	35.6	31.9	35.8	32.1	36.1	32.3	36.3	32.6	36.6	32.8
-0.	32.0	35.6	31.9	35.9	32.2	36.2	32.4	36.4	32.7	36.7	32.9
-1.	30.2	35.7	32.0	36.0	32.3	36.3	32.5	36.5	32.7	36.8	33.0
-2.	28.4	35.8	32.1	36.1	32.3	36.4	32.6	36.6	32.8	36.9	33.1
-3.	26.6	35.9	32.2	36.2	32.4	36.4	32.7	36.7	32.9	37.0	33.2
-4.	24.8	36.0	32.3	36.3	32.5	36.5	32.8	36.8	33.0	37.1	33.2
-5.	23.0	36.1	32.4	36.4	32.6	36.6	32.8	36.9	33.1	37.2	33.3
-6.	21.2	36.2	32.5	36.5	32.7	36.7	32.9	37.0	33.2	37.3	33.4
-7.	19.4	36.3	32.5	36.5	32.8	36.8	33.0	37.1	33.3	37.4	33.5
-8.	17.6	36.4	32.6	36.6	32.9	36.9	33.1	37.2	33.3	37.4	33.6
-9.	15.8	36.5	32.7	36.7	33.0	37.0	33.2	37.3	33.4	37.5	33.7
-10.	14.0	36.6	32.8	36.8	33.0	37.1	33.3	37.4	33.5	37.6	33.8
-11.	12.2	36.6	32.9	36.9	33.1	37.2	33.4	37.5	33.6	37.7	33.9
-12.	10.4	36.7	33.0	37.0	33.2	37.3	33.5	37.5	33.7	37.8	33.9
-13.	8.6	36.8	33.1	37.1	33.3	37.4	33.5	37.6	33.8	37.9	34.0
-14.	6.8	36.9	33.1	37.2	33.4	37.5	33.6	37.7	33.9	38.0	34.1
-15.	5.0	37.0	33.2	37.3	33.5	37.6	33.7	37.8	34.0	38.1	34.2
-16.	3.2	37.1	33.3	37.4	33.6	37.6	33.8	37.9	34.0	38.2	34.3
-17.	1.4	37.2	33.4	37.5	33.6	37.7	33.9	38.0	34.1	38.3	34.4
-18.	-0.4	37.3	33.5	37.6	33.7	37.8	34.0	38.1	34.2	38.4	34.5
-19.	-2.2	37.4	33.6	37.6	33.8	37.9	34.1	38.2	34.3	38.5	34.6
-20.	-4.0	37.5	33.6	37.7	33.9	38.0	34.1	38.3	34.4	38.6	34.6
-21.	-5.8	37.5	33.7	37.8	34.0	38.1	34.2	38.4	34.5	38.7	34.7
-22.	-7.6	37.6	33.8	37.9	34.1	38.2	34.3	38.5	34.6	38.8	34.8
-23.	-9.4	37.7	33.9	38.0	34.2	38.3	34.4	38.6	34.7	38.8	34.9
-24.	-11.2	37.8	34.0	38.1	34.2	38.4	34.5	38.7	34.7	38.9	35.0
-25.	-13.0	37.9	34.1	38.2	34.3	38.5	34.6	38.8	34.8	39.0	35.1
-26.	-14.8	38.0	34.2	38.3	34.4	38.6	34.7	38.8	34.9	39.1	35.2
-27.	-16.6	38.1	34.2	38.4	34.5	38.7	34.8	38.9	35.0	39.2	35.3
-28.	-18.4	38.2	34.3	38.5	34.6	38.7	34.8	39.0	35.1	39.3	35.3
-29.	-20.2	38.3	34.4	38.6	34.7	38.8	34.9	39.1	35.2	39.4	35.4
-30.	-22.0	38.4	34.5	38.6	34.8	38.9	35.0	39.2	35.3	39.5	35.5
-31.	-23.8	38.5	34.6	38.7	34.8	39.0	35.1	39.3	35.4	39.6	35.6
-32.	-25.6	38.5	34.7	38.8	34.9	39.1	35.2	39.4	35.4	39.7	35.7
-33.	-27.4	38.6	34.8	38.9	35.0	39.2	35.3	39.5	35.5	39.8	35.8
-34.	-29.2	38.7	34.8	39.0	35.1	39.3	35.4	39.6	35.6	39.9	35.9
-35.	-31.0	38.8	34.9	39.1	35.2	39.4	35.4	39.7	35.7	40.0	36.0
-36.	-32.8	38.9	35.0	39.2	35.3	39.5	35.5	39.8	35.8	40.1	36.1
-37.	-34.6	39.0	35.1	39.3	35.4	39.6	35.6	39.9	35.9	40.2	36.1
-38.	-36.4	39.1	35.2	39.4	35.4	39.7	35.7	40.0	36.0	40.2	36.2
-39.	-38.2	39.2	35.3	39.5	35.5	39.8	35.8	40.1	36.1	40.3	36.3
-40.	-40.0	39.3	35.4	39.6	35.6	39.9	35.9	40.1	36.1	40.4	36.4

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Figure FO-27. Power Check Chart; Manual Fuel Control (Sheet 4)

ecklist.

CUT ALONG THIS LINE

Minimum and Maximum Manual Fuel Control Power Check Chart
TF41-A-1

NOTE

Values shown are for engine operating in A-7D airplane with air inlet screen installed and air conditioning system operating. If engine must be operated with screen removed, add 1.3" Hg to $P_{T5.1}$ true pressure.

Ambient Temperature		Ambient Pressure — Inches Mercury Absolute: 28.0		28.2		28.4		28.6		28.8	
		$P_{T5.1}$ True Pressure — Inches Mercury Gage									
°C	°F	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
27.	80.6	34.4	30.7	34.7	31.0	34.9	31.2	35.2	31.4	35.4	31.6
26.	78.8	34.5	30.8	34.8	31.0	35.0	31.3	35.3	31.5	35.5	31.7
25.	77.0	34.6	30.9	34.9	31.1	35.1	31.4	35.4	31.6	35.6	31.8
24.	75.2	34.7	31.0	35.0	31.2	35.2	31.4	35.5	31.7	35.7	31.9
23.	73.4	34.8	31.1	35.0	31.3	35.3	31.5	35.5	31.8	35.8	32.0
22.	71.6	34.9	31.2	35.1	31.4	35.4	31.6	35.6	31.8	35.9	32.1
21.	69.8	35.0	31.3	35.2	31.5	35.5	31.7	35.7	31.9	36.0	32.2
20.	68.0	35.1	31.4	35.3	31.6	35.6	31.8	35.8	32.0	36.1	32.2
19.	66.2	35.2	31.4	35.4	31.7	35.7	31.9	35.9	32.1	36.2	32.3
18.	64.4	35.3	31.5	35.5	31.8	35.8	32.0	36.0	32.2	36.3	32.4
17.	62.6	35.4	31.6	35.6	31.8	35.9	32.1	36.1	32.3	36.4	32.5
16.	60.8	35.5	31.7	35.7	31.9	36.0	32.2	36.2	32.4	36.5	32.6
15.	59.0	35.6	31.8	35.8	32.0	36.1	32.3	36.3	32.5	36.6	32.7
14.	57.2	35.6	31.9	35.9	32.1	36.2	32.3	36.4	32.6	36.7	32.8
13.	55.4	35.7	32.0	36.0	32.2	36.3	32.4	36.5	32.7	36.8	32.9
12.	53.6	35.8	32.1	36.1	32.3	36.3	32.5	36.6	32.7	36.9	33.0
11.	51.8	35.9	32.2	36.2	32.4	36.4	32.6	36.7	32.8	37.0	33.1
10.	50.0	36.0	32.2	36.3	32.5	36.5	32.7	36.8	32.9	37.1	33.2
9.	48.2	36.1	32.3	36.4	32.6	36.6	32.8	36.9	33.0	37.1	33.3
8.	46.4	36.2	32.4	36.5	32.6	36.7	32.9	37.0	33.1	37.2	33.3
7.	44.6	36.3	32.5	36.6	32.7	36.8	33.0	37.1	33.2	37.3	33.4
6.	42.8	36.4	32.6	36.7	32.8	36.9	33.1	37.2	33.3	37.4	33.5
5.	41.0	36.5	32.7	36.8	32.9	37.0	33.1	37.3	33.4	37.5	33.6
4.	39.2	36.6	32.8	36.8	33.0	37.1	33.2	37.4	33.5	37.6	33.7
3.	37.4	36.7	32.9	36.9	33.1	37.2	33.3	37.5	33.6	37.7	33.8
2.	35.6	36.8	32.9	37.0	33.2	37.3	33.4	37.6	33.7	37.8	33.9
1.	33.8	36.9	33.0	37.1	33.3	37.4	33.5	37.7	33.7	37.9	34.0
-0.	32.0	37.0	33.1	37.2	33.4	37.5	33.6	37.8	33.8	38.0	34.1
-1.	30.2	37.1	33.2	37.3	33.5	37.6	33.7	37.9	33.9	38.1	34.2
-2.	28.4	37.2	33.3	37.4	33.5	37.7	33.8	37.9	34.0	38.2	34.3
-3.	26.6	37.2	33.4	37.5	33.6	37.8	33.9	38.0	34.1	38.3	34.3
-4.	24.8	37.3	33.5	37.6	33.7	37.9	34.0	38.1	34.2	38.4	34.4
-5.	23.0	37.4	33.6	37.7	33.8	38.0	34.0	38.2	34.3	38.5	34.5
-6.	21.2	37.5	33.7	37.8	33.9	38.1	34.1	38.3	34.4	38.6	34.6
-7.	19.4	37.6	33.7	37.9	34.0	38.2	34.2	38.4	34.5	38.7	34.7
-8.	17.6	37.7	33.8	38.0	34.1	38.3	34.3	38.5	34.6	38.8	34.8
-9.	15.8	37.8	33.9	38.1	34.2	38.4	34.4	38.6	34.6	38.9	34.9
-10.	14.0	37.9	34.0	38.2	34.3	38.4	34.5	38.7	34.7	39.0	35.0
-11.	12.2	38.0	34.1	38.3	34.3	38.5	34.6	38.8	34.8	39.1	35.1
-12.	10.4	38.1	34.2	38.4	34.4	38.6	34.7	38.9	34.9	39.2	35.2
-13.	8.6	38.2	34.3	38.5	34.5	38.7	34.8	39.0	35.0	39.3	35.3
-14.	6.8	38.3	34.4	38.6	34.6	38.8	34.9	39.1	35.1	39.4	35.3
-15.	5.0	38.4	34.5	38.6	34.7	38.9	34.9	39.2	35.2	39.5	35.4
-16.	3.2	38.5	34.5	38.7	34.8	39.0	35.0	39.3	35.3	39.6	35.5
-17.	1.4	38.6	34.6	38.8	34.9	39.1	35.1	39.4	35.4	39.7	35.6
-18.	-0.4	38.7	34.7	38.9	35.0	39.2	35.2	39.5	35.5	39.8	35.7
-19.	-2.2	38.8	34.8	39.0	35.1	39.3	35.3	39.6	35.6	39.9	35.8
-20.	-4.0	38.8	34.9	39.1	35.1	39.4	35.4	39.7	35.6	40.0	35.9
-21.	-5.8	38.9	35.0	39.2	35.2	39.5	35.5	39.8	35.7	40.1	36.0
-22.	-7.6	39.0	35.1	39.3	35.3	39.6	35.6	39.9	35.8	40.1	36.1
-23.	-9.4	39.1	35.2	39.4	35.4	39.7	35.7	40.0	35.9	40.2	36.2
-24.	-11.2	39.2	35.2	39.5	35.5	39.8	35.8	40.1	36.0	40.3	36.3
-25.	-13.0	39.3	35.3	39.6	35.6	39.9	35.8	40.2	36.1	40.4	36.3
-26.	-14.8	39.4	35.4	39.7	35.7	40.0	35.9	40.3	36.2	40.5	36.4
-27.	-16.6	39.5	35.5	39.8	35.8	40.1	36.0	40.3	36.3	40.6	36.5
-28.	-18.4	39.6	35.6	39.9	35.9	40.2	36.1	40.4	36.4	40.7	36.6
-29.	-20.2	39.7	35.7	40.0	35.9	40.3	36.2	40.5	36.5	40.8	36.7
-30.	-22.0	39.8	35.8	40.1	36.0	40.4	36.3	40.6	36.5	40.9	36.8
-31.	-23.8	39.9	35.9	40.2	36.1	40.4	36.4	40.7	36.6	41.0	36.9
-32.	-25.6	40.0	36.0	40.3	36.2	40.5	36.5	40.8	36.7	41.1	37.0
-33.	-27.4	40.1	36.0	40.4	36.3	40.6	36.6	40.9	36.8	41.2	37.1
-34.	-29.2	40.2	36.1	40.4	36.4	40.7	36.6	41.0	36.9	41.3	37.2
-35.	-31.0	40.3	36.2	40.5	36.5	40.8	36.7	41.1	37.0	41.4	37.3
-36.	-32.8	40.3	36.3	40.6	36.6	40.9	36.8	41.2	37.1	41.5	37.3
-37.	-34.6	40.4	36.4	40.7	36.7	41.0	36.9	41.3	37.2	41.6	37.4
-38.	-36.4	40.5	36.5	40.8	36.7	41.1	37.0	41.4	37.3	41.7	37.5
-39.	-38.2	40.6	36.6	40.9	36.8	41.2	37.1	41.5	37.4	41.8	37.6
-40.	-40.0	40.7	36.7	41.0	36.9	41.3	37.2	41.6	37.4	41.9	37.7

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Figure FO-27. Power Check Chart; Manual Fuel Control (Sheet 5)

checklist.

CUT ALONG THIS LINE

Minimum and Maximum Manual Fuel Control Power Check Chart
TF41-A-1

NOTE

Values shown are for engine operating in A-7D airplane with air inlet screen installed and air conditioning system operating. If engine must be operated with screen removed, add 1.3" Hg to $P_{T5.1}$ true pressure.

Ambient Pressure – Inches Mercury Absolute

Ambient Temperature		29.0		29.2		29.4		29.6		29.8	
		$P_{T5.1}$ True Pressure – Inches Mercury Gage									
°C	°F	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
27.	80.6	35.7	31.8	35.9	32.1	36.1	32.3	36.4	32.5	36.6	32.7
26.	78.8	35.8	31.9	36.0	32.1	36.2	32.4	36.5	32.6	36.7	32.8
25.	77.0	35.8	32.0	36.1	32.2	36.3	32.5	36.6	32.7	36.8	32.9
24.	75.2	35.9	32.1	36.2	32.3	36.4	32.6	36.7	32.8	36.9	33.0
23.	73.4	36.0	32.2	36.3	32.4	36.5	32.6	36.8	32.9	37.0	33.1
22.	71.6	36.1	32.3	36.4	32.5	36.6	32.7	36.9	33.0	37.1	33.2
21.	69.8	36.2	32.4	36.5	32.6	36.7	32.8	37.0	33.1	37.2	33.3
20.	68.0	36.3	32.5	36.6	32.7	36.8	32.9	37.1	33.1	37.3	33.4
19.	66.2	36.4	32.6	36.7	32.8	36.9	33.0	37.2	33.2	37.4	33.5
18.	64.4	36.5	32.7	36.8	32.9	37.0	33.1	37.3	33.3	37.5	33.6
17.	62.6	36.6	32.7	36.9	33.0	37.1	33.2	37.4	33.4	37.6	33.7
16.	60.8	36.7	32.8	37.0	33.1	37.2	33.3	37.5	33.5	37.7	33.7
15.	59.0	36.8	32.9	37.1	33.2	37.3	33.4	37.6	33.6	37.8	33.8
14.	57.2	36.9	33.0	37.2	33.3	37.4	33.5	37.7	33.7	37.9	33.9
13.	55.4	37.0	33.1	37.3	33.3	37.5	33.6	37.8	33.8	38.0	34.0
12.	53.6	37.1	33.2	37.4	33.4	37.6	33.7	37.9	33.9	38.1	34.1
11.	51.8	37.2	33.3	37.5	33.5	37.7	33.8	38.0	34.0	38.2	34.2
10.	50.0	37.3	33.4	37.6	33.6	37.8	33.9	38.1	34.1	38.3	34.3
9.	48.2	37.4	33.5	37.7	33.7	37.9	33.9	38.2	34.2	38.4	34.4
8.	46.4	37.5	33.6	37.8	33.8	38.0	34.0	38.3	34.3	38.5	34.5
7.	44.6	37.6	33.7	37.9	33.9	38.1	34.1	38.4	34.4	38.6	34.6
6.	42.8	37.7	33.8	38.0	34.0	38.2	34.2	38.5	34.5	38.7	34.7
5.	41.0	37.8	33.8	38.1	34.1	38.3	34.3	38.6	34.5	38.8	34.8
4.	39.2	37.9	33.9	38.2	34.2	38.4	34.4	38.7	34.6	38.9	34.9
3.	37.4	38.0	34.0	38.3	34.3	38.5	34.5	38.8	34.7	39.0	35.0
2.	35.6	38.1	34.1	38.4	34.4	38.6	34.6	38.9	34.8	39.1	35.1
1.	33.8	38.2	34.2	38.4	34.5	38.7	34.7	39.0	34.9	39.2	35.2
-0.	32.0	38.3	34.3	38.5	34.5	38.8	34.8	39.1	35.0	39.3	35.3
-1.	30.2	38.4	34.4	38.6	34.6	38.9	34.9	39.2	35.1	39.4	35.3
-2.	28.4	38.5	34.5	38.7	34.7	39.0	35.0	39.3	35.2	39.5	35.4
-3.	26.6	38.6	34.6	38.8	34.8	39.1	35.1	39.4	35.3	39.6	35.5
-4.	24.8	38.7	34.7	38.9	34.9	39.2	35.2	39.5	35.4	39.7	35.6
-5.	23.0	38.8	34.8	39.0	35.0	39.3	35.2	39.6	35.5	39.8	35.7
-6.	21.2	38.9	34.9	39.1	35.1	39.4	35.3	39.7	35.6	39.9	35.8
-7.	19.4	39.0	34.9	39.2	35.2	39.5	35.4	39.8	35.7	40.0	35.9
-8.	17.6	39.1	35.0	39.3	35.3	39.6	35.5	39.9	35.8	40.1	36.0
-9.	15.8	39.2	35.1	39.4	35.4	39.7	35.6	40.0	35.9	40.2	36.1
-10.	14.0	39.3	35.2	39.5	35.5	39.8	35.7	40.1	36.0	40.3	36.2
-11.	12.2	39.4	35.3	39.6	35.6	39.9	35.8	40.2	36.0	40.4	36.3
-12.	10.4	39.5	35.4	39.7	35.7	40.0	35.9	40.3	36.1	40.5	36.4
-13.	8.6	39.6	35.5	39.8	35.7	40.1	36.0	40.4	36.2	40.6	36.5
-14.	6.8	39.6	35.6	39.9	35.8	40.2	36.1	40.5	36.3	40.7	36.6
-15.	5.0	39.7	35.7	40.0	35.9	40.3	36.2	40.6	36.4	40.8	36.7
-16.	3.2	39.8	35.8	40.1	36.0	40.4	36.3	40.7	36.5	40.9	36.8
-17.	1.4	39.9	35.9	40.2	36.1	40.5	36.4	40.8	36.6	41.0	36.9
-18.	-0.4	40.0	36.0	40.3	36.2	40.6	36.5	40.9	36.7	41.1	36.9
-19.	-2.2	40.1	36.0	40.4	36.3	40.7	36.5	41.0	36.8	41.2	37.0
-20.	-4.0	40.2	36.1	40.5	36.4	40.8	36.6	41.1	36.9	41.3	37.1
-21.	-5.8	40.3	36.2	40.6	36.5	40.9	36.7	41.2	37.0	41.4	37.2
-22.	-7.6	40.4	36.3	40.7	36.6	41.0	36.8	41.3	37.1	41.5	37.3
-23.	-9.4	40.5	36.4	40.8	36.7	41.1	36.9	41.4	37.2	41.6	37.4
-24.	-11.2	40.6	36.5	40.9	36.8	41.2	37.0	41.5	37.3	41.7	37.5
-25.	-13.0	40.7	36.6	41.0	36.9	41.3	37.1	41.6	37.4	41.8	37.6
-26.	-14.8	40.8	36.7	41.1	36.9	41.4	37.2	41.7	37.4	41.9	37.7
-27.	-16.6	40.9	36.8	41.2	37.0	41.5	37.3	41.8	37.5	42.0	37.8
-28.	-18.4	41.0	36.9	41.3	37.1	41.6	37.4	41.9	37.6	42.1	37.9
-29.	-20.2	41.1	37.0	41.4	37.2	41.7	37.5	42.0	37.7	42.2	38.0
-30.	-22.0	41.2	37.1	41.5	37.3	41.8	37.6	42.1	37.8	42.3	38.1
-31.	-23.8	41.3	37.1	41.6	37.4	41.9	37.7	42.2	37.9	42.4	38.2
-32.	-25.6	41.4	37.2	41.7	37.5	42.0	37.8	42.3	38.0	42.5	38.3
-33.	-27.4	41.5	37.3	41.8	37.6	42.1	37.8	42.4	38.1	42.6	38.4
-34.	-29.2	41.6	37.4	41.9	37.7	42.2	37.9	42.5	38.2	42.7	38.5
-35.	-31.0	41.7	37.5	42.0	37.8	42.3	38.0	42.6	38.3	42.8	38.5
-36.	-32.8	41.8	37.6	42.1	37.9	42.4	38.1	42.7	38.4	42.9	38.6
-37.	-34.6	41.9	37.7	42.2	38.0	42.5	38.2	42.8	38.5	43.0	38.7
-38.	-36.4	42.0	37.8	42.3	38.1	42.6	38.3	42.9	38.6	43.1	38.8
-39.	-38.2	42.1	37.9	42.4	38.1	42.7	38.4	43.0	38.7	43.2	38.9
-40.	-40.0	42.2	38.0	42.5	38.2	42.8	38.5	43.1	38.8	43.3	39.0

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Figure FO-27. Power Check Chart; Manual Fuel Control (Sheet 6)

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CUT ALONG THIS LINE

Minimum and Maximum Manual Fuel Control Power Check Chart
TF41-A-1

NOTE

Values shown are for engine operating in A-7D airplane with air inlet screen installed and air conditioning system operating. If engine must be operated with screen removed, add 1.3" Hg to $P_{T5.1}$ true pressure.

Ambient Temperature		Ambient Pressure – Inches Mercury Absolute: 30.0		30.2		30.4		30.6		30.8	
		$P_{T5.1}$ True Pressure – Inches Mercury Gage									
°C	°F	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
27.	80.6	36.9	32.9	37.1	33.2	37.4	33.4	37.6	33.6	37.9	33.8
26.	78.8	37.0	33.0	37.2	33.2	37.5	33.5	37.7	33.7	38.0	33.9
25.	77.0	37.1	33.1	37.3	33.3	37.6	33.6	37.8	33.8	38.1	34.0
24.	75.2	37.2	33.2	37.4	33.4	37.7	33.7	37.9	33.9	38.2	34.1
23.	73.4	37.3	33.3	37.5	33.5	37.8	33.8	38.0	34.0	38.3	34.2
22.	71.6	37.4	33.4	37.6	33.6	37.9	33.8	38.1	34.1	38.4	34.3
21.	69.8	37.5	33.5	37.7	33.7	38.0	33.9	38.2	34.2	38.5	34.4
20.	68.0	37.6	33.6	37.8	33.8	38.1	34.0	38.3	34.3	38.6	34.5
19.	66.2	37.7	33.7	37.9	33.9	38.2	34.1	38.4	34.4	38.7	34.6
18.	64.4	37.8	33.8	38.0	34.0	38.3	34.2	38.5	34.5	38.8	34.7
17.	62.6	37.9	33.9	38.1	34.1	38.4	34.3	38.6	34.6	38.9	34.8
16.	60.8	38.0	34.0	38.2	34.2	38.5	34.4	38.8	34.7	39.0	34.9
15.	59.0	38.1	34.1	38.3	34.3	38.6	34.5	38.9	34.7	39.1	35.0
14.	57.2	38.2	34.2	38.4	34.4	38.7	34.6	39.0	34.8	39.2	35.1
13.	55.4	38.3	34.3	38.5	34.5	38.8	34.7	39.1	34.9	39.3	35.2
12.	53.6	38.4	34.4	38.7	34.6	38.9	34.8	39.2	35.0	39.4	35.3
11.	51.8	38.5	34.4	38.8	34.7	39.0	34.9	39.3	35.1	39.5	35.4
10.	50.0	38.6	34.5	38.9	34.8	39.1	35.0	39.4	35.2	39.6	35.5
9.	48.2	38.7	34.6	39.0	34.9	39.2	35.1	39.5	35.3	39.7	35.6
8.	46.4	38.8	34.7	39.1	35.0	39.3	35.2	39.6	35.4	39.8	35.7
7.	44.6	38.9	34.8	39.2	35.1	39.4	35.3	39.7	35.5	39.9	35.8
6.	42.8	39.0	34.9	39.3	35.2	39.5	35.4	39.8	35.6	40.0	35.9
5.	41.0	39.1	35.0	39.4	35.2	39.6	35.5	39.9	35.7	40.1	36.0
4.	39.2	39.2	35.1	39.5	35.3	39.7	35.6	40.0	36.8	40.2	36.0
3.	37.4	39.3	35.2	39.6	35.4	39.8	35.7	40.1	35.9	40.3	36.1
2.	35.6	39.4	35.3	39.7	35.5	39.9	35.8	40.2	36.0	40.5	36.2
1.	33.8	39.5	35.4	39.8	35.6	40.0	35.9	40.3	36.1	40.6	36.3
-0.	32.0	39.6	35.5	39.9	35.7	40.1	36.0	40.4	36.2	40.7	36.4
-1.	30.2	39.7	35.6	40.0	35.8	40.2	36.1	40.5	36.3	40.8	36.5
-2.	28.4	39.8	35.7	40.1	35.9	40.3	36.2	40.6	36.4	40.9	36.6
-3.	26.6	39.9	35.8	40.2	36.0	40.4	36.3	40.7	36.5	41.0	36.7
-4.	24.8	40.0	35.9	40.3	36.1	40.5	36.3	40.8	36.6	41.1	36.8
-5.	23.0	40.1	36.0	40.4	36.2	40.6	36.4	40.9	36.7	41.2	36.9
-6.	21.2	40.2	36.1	40.5	36.3	40.7	36.5	41.0	36.8	41.3	37.0
-7.	19.4	40.3	36.2	40.6	36.4	40.8	36.6	41.1	36.9	41.4	37.1
-8.	17.6	40.4	36.2	40.7	36.5	40.9	36.7	41.2	37.0	41.5	37.2
-9.	15.8	40.5	36.3	40.8	36.6	41.1	36.8	41.3	37.1	41.6	37.3
-10.	14.0	40.6	36.4	40.9	36.7	41.2	36.9	41.4	37.2	41.7	37.4
-11.	12.2	40.7	36.5	41.0	38.8	41.3	37.0	41.5	37.3	41.8	37.5
-12.	10.4	40.8	36.6	41.1	36.9	41.4	37.1	41.6	37.4	41.9	37.6
-13.	8.6	40.9	36.7	41.2	37.0	41.5	37.2	41.7	37.5	42.0	37.7
-14.	6.8	41.0	36.8	41.3	37.1	41.6	37.3	41.8	37.6	42.1	37.8
-15.	5.0	41.1	36.9	41.4	37.2	41.7	37.4	41.9	37.7	42.2	37.9
-16.	3.2	41.2	37.0	41.5	37.3	41.8	37.5	42.0	37.7	42.3	38.0
-17.	1.4	41.3	37.1	41.6	37.3	41.9	37.6	42.1	37.8	42.4	38.1
-18.	-0.4	41.4	37.2	41.7	37.4	42.0	37.7	42.2	37.9	42.5	38.2
-19.	-2.2	41.5	37.3	41.8	37.5	42.1	37.8	42.3	38.0	42.6	38.3
-20.	-4.0	41.6	37.4	41.9	37.6	42.2	37.9	42.5	38.1	42.7	38.4
-21.	-5.8	41.7	37.5	42.0	37.7	42.3	38.0	42.6	38.2	42.8	38.5
-22.	-7.6	41.8	37.6	42.1	37.8	42.4	38.1	42.7	38.3	42.9	38.6
-23.	-9.4	41.9	37.7	42.2	37.9	42.5	38.2	42.8	38.4	43.0	38.7
-24.	-11.2	42.0	37.8	42.3	38.0	42.6	38.3	42.9	38.5	43.1	38.8
-25.	-13.0	42.1	37.9	42.4	38.1	42.7	38.4	43.0	38.6	43.2	38.9
-26.	-14.8	42.2	38.0	42.5	38.2	42.8	38.5	43.1	38.7	43.3	39.0
-27.	-16.6	42.3	38.1	42.6	38.3	42.9	38.6	43.2	38.8	43.5	39.1
-28.	-18.4	42.4	38.1	42.7	38.4	43.0	38.7	43.3	38.9	43.6	39.2
-29.	-20.2	42.5	38.2	42.8	38.5	43.1	38.7	43.4	39.0	43.7	39.3
-30.	-22.0	42.6	38.3	42.9	38.6	43.2	38.8	43.5	39.1	43.8	39.4
-31.	-23.8	42.7	38.4	43.0	38.7	43.3	38.9	43.6	39.2	43.9	39.5
-32.	-25.6	42.8	38.5	43.1	38.8	43.4	39.0	43.7	39.3	44.0	39.6
-33.	-27.4	42.9	38.6	43.2	38.9	43.5	39.1	43.8	39.4	44.1	39.6
-34.	-29.2	43.0	38.7	43.3	39.0	43.6	39.2	43.9	39.5	44.2	39.7
-35.	-31.0	43.1	38.8	43.4	39.1	43.7	39.3	44.0	39.6	44.3	39.8
-36.	-32.8	43.2	38.9	43.5	39.2	43.8	39.4	44.1	39.7	44.4	39.9
-37.	-34.6	43.3	39.0	43.6	39.3	43.9	39.5	44.2	39.8	44.5	40.0
-38.	-36.4	43.4	39.1	43.7	39.4	44.0	39.6	44.3	39.9	44.6	40.1
-39.	-38.2	43.5	39.2	43.8	39.4	44.1	39.7	44.4	40.0	44.7	40.2
-40.	-40.0	43.6	39.3	43.9	39.5	44.2	39.8	44.5	40.1	44.8	40.3

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Figure FO-27. Power Check Chart; Manual Fuel Control (Sheet 7)

NOTE

This chart may be removed from manual for use with checklist.

CUT ALONG THIS LINE

Minimum and Maximum Manual Fuel Control Power Check Chart
TF41-A-1 (Adjusting Clip Installed)

NOTE

Values shown are for engine operating in A-7D airplane with air inlet screen installed and air conditioning system operating. If engine must be operated with screen removed, add 1.3" Hg to $P_{T5.1}$ true pressure

Ambient Pressure — Inches Mercury Absolute

Ambient Temperature		24.0		24.2		24.4		24.6		24.8	
		$P_{T5.1}$ True Pressure — Inches Mercury Gage									
°C	°F	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
55.	131.0	20.4	16.0	20.5	16.2	20.7	16.3	20.9	16.4	21.0	16.6
54.	129.2	20.4	16.1	20.6	16.2	20.8	16.4	21.0	16.5	21.1	16.6
53.	127.4	20.5	16.2	20.7	16.3	20.9	16.4	21.0	16.6	21.2	16.7
52.	125.6	20.6	16.3	20.8	16.4	20.9	16.5	21.1	16.7	21.3	16.8
51.	123.8	20.7	16.3	20.9	16.5	21.0	16.6	21.2	16.7	21.4	16.9
50.	122.0	20.8	16.4	20.9	16.5	21.1	16.7	21.3	16.8	21.5	16.9
49.	120.2	20.8	16.5	21.0	16.6	21.2	16.7	21.4	16.9	21.5	17.0
48.	118.4	20.9	16.5	21.1	16.7	21.3	16.8	21.4	17.0	21.6	17.1
47.	116.6	21.0	16.6	21.2	16.8	21.4	16.9	21.5	17.0	21.7	17.2
46.	114.8	21.1	16.7	21.3	16.8	21.4	17.0	21.6	17.1	21.8	17.2
45.	113.0	21.2	16.8	21.3	16.9	21.5	17.0	21.7	17.2	21.9	17.3
44.	111.2	21.2	16.8	21.4	17.0	21.6	17.1	21.8	17.3	22.0	17.4
43.	109.4	21.3	16.9	21.5	17.0	21.7	17.2	21.9	17.3	22.0	17.5
42.	107.6	21.4	17.0	21.6	17.1	21.8	17.3	21.9	17.4	22.1	17.5
41.	105.8	21.5	17.1	21.7	17.2	21.8	17.3	22.0	17.5	22.2	17.6
40.	104.0	21.6	17.1	21.8	17.3	21.9	17.4	22.1	17.6	22.3	17.7
39.	102.2	21.7	17.2	21.8	17.3	22.0	17.5	22.2	17.6	22.4	17.8
38.	100.4	21.7	17.3	21.9	17.4	22.1	17.6	22.3	17.7	22.5	17.8
37.	98.6	21.8	17.3	22.0	17.5	22.2	17.6	22.4	17.8	22.5	17.9
36.	96.8	21.9	17.4	22.1	17.6	22.3	17.7	22.4	17.9	22.6	18.0
35.	95.0	22.0	17.5	22.2	17.6	22.3	17.8	22.5	17.9	22.7	18.1
34.	93.2	22.1	17.6	22.2	17.7	22.4	17.9	22.6	18.0	22.8	18.2
33.	91.4	22.1	17.6	22.3	17.8	22.5	17.9	22.7	18.1	22.9	18.2
32.	89.6	22.2	17.7	22.4	17.9	22.6	18.0	22.8	18.2	23.0	18.3
31.	87.8	22.3	17.8	22.5	17.9	22.7	18.1	22.9	18.2	23.0	18.4
30.	86.0	22.4	17.9	22.6	18.0	22.8	18.2	22.9	18.3	23.1	18.5
29.	84.2	22.5	17.9	22.6	18.1	22.8	18.2	23.0	18.4	23.2	18.5
28.	82.4	22.5	18.0	22.7	18.2	22.9	18.3	23.1	18.5	23.3	18.6
27.	80.6	22.6	18.1	22.8	18.2	23.0	18.4	23.2	18.5	23.4	18.7
26.	78.8	22.7	18.1	22.9	18.3	23.1	18.5	23.3	18.6	23.5	18.8
25.	77.0	22.8	18.2	23.0	18.4	23.2	18.5	23.4	18.7	23.5	18.8
24.	75.2	22.9	18.3	23.1	18.4	23.2	18.6	23.4	18.8	23.6	18.9
23.	73.4	22.9	18.4	23.1	18.5	23.3	18.7	23.5	18.8	23.7	19.0
22.	71.6	23.0	18.4	23.2	18.6	23.4	18.7	23.6	18.9	23.8	19.1
21.	69.8	23.1	18.5	23.3	18.7	23.5	18.8	23.7	19.0	23.9	19.1
20.	68.0	23.2	18.6	23.4	18.7	23.6	18.9	23.8	19.0	24.0	19.2
19.	66.2	23.3	18.7	23.5	18.8	23.7	19.0	23.8	19.1	24.0	19.3
18.	64.4	23.3	18.7	23.5	18.9	23.7	19.0	23.9	19.2	24.1	19.4
17.	62.6	23.4	18.8	23.6	19.0	23.8	19.1	24.0	19.3	24.2	19.4
16.	60.8	23.5	18.9	23.7	19.0	23.9	19.2	24.1	19.3	24.3	19.5

05D243-01-11-83

Figure FO-28. Power Check Chart (With Adjusting Clip); Manual Fuel Control (Sheet 1 of 7)

NOTE

This chart may be removed from manual for use with checklist.

CUT ALONG THIS LINE

Minimum and Maximum Manual Fuel Control Power Check Chart
TF41-A-1 (Adjusting Clip Installed)

NOTE

Values shown are for engine operating in A-7D airplane with air inlet screen installed and air conditioning system operating. If engine must be operated with screen removed, add 1.3″ Hg to $P_{T5.1}$ true pressure

Ambient Temperature		Ambient Pressure – Inches Mercury Absolute									
		25.0		25.2		25.4		25.6		25.8	
		$P_{T5.1}$ True Pressure – Inches Mercury Gage									
°C	°F	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
55.	131.0	21.2	16.7	21.4	16.8	21.5	17.0	21.7	17.1	21.9	17.2
54.	129.2	21.3	16.8	21.5	16.9	21.6	17.0	21.8	17.2	22.0	17.3
53.	127.4	21.4	16.9	21.5	17.0	21.7	17.1	21.9	17.3	22.1	17.4
52.	125.6	21.5	16.9	21.6	17.1	21.8	17.2	22.0	17.3	22.1	17.5
51.	123.8	21.5	17.0	21.7	17.1	21.9	17.3	22.1	17.4	22.2	17.6
50.	122.0	21.6	17.1	21.8	17.2	22.0	17.4	22.1	17.5	22.3	17.6
49.	120.2	21.7	17.2	21.9	17.3	22.1	17.4	22.2	17.6	22.4	17.7
48.	118.4	21.8	17.2	22.0	17.4	22.1	17.5	22.3	17.6	22.5	17.8
47.	116.6	21.9	17.3	22.1	17.4	22.2	17.6	22.4	17.7	22.6	17.9
46.	114.8	22.0	17.4	22.1	17.5	22.3	17.7	22.5	17.8	22.7	17.9
45.	113.0	22.0	17.5	22.2	17.6	22.4	17.7	22.6	17.9	22.8	18.0
44.	111.2	22.1	17.5	22.3	17.7	22.5	17.8	22.7	18.0	22.8	18.1
43.	109.4	22.2	17.6	22.4	17.8	22.6	17.9	22.8	18.0	22.9	18.2
42.	107.6	22.3	17.7	22.5	17.8	22.7	18.0	22.8	18.1	23.0	18.3
41.	105.8	22.4	17.8	22.6	17.9	22.7	18.0	22.9	18.2	23.1	18.3
40.	104.0	22.5	17.8	22.6	18.0	22.8	18.1	23.0	18.3	23.2	18.4
39.	102.2	22.6	17.9	22.7	18.1	22.9	18.2	23.1	18.3	23.3	18.5
38.	100.4	22.6	18.0	22.8	18.1	23.0	18.3	23.2	18.4	23.4	18.6
37.	98.6	22.7	18.1	22.9	18.2	23.1	18.4	23.3	18.5	23.4	18.6
36.	96.8	22.8	18.1	23.0	18.3	23.2	18.4	23.4	18.6	23.5	18.7
35.	95.0	22.9	18.2	23.1	18.4	23.3	18.5	23.4	18.7	23.6	18.8
34.	93.2	23.0	18.3	23.2	18.4	23.3	18.6	23.5	18.7	23.7	18.9
33.	91.4	23.1	18.4	23.2	18.5	23.4	18.7	23.6	18.8	23.8	19.0
32.	89.6	23.1	18.4	23.3	18.6	23.5	18.7	23.7	18.9	23.9	19.0
31.	87.8	23.2	18.5	23.4	18.7	23.6	18.8	23.8	19.0	24.0	19.1
30.	86.0	23.3	18.6	23.5	18.7	23.7	18.9	23.9	19.0	24.1	19.2
29.	84.2	23.4	18.7	23.6	18.8	23.8	19.0	24.0	19.1	24.1	19.3
28.	82.4	23.5	18.8	23.7	18.9	23.9	19.1	24.0	19.2	24.2	19.4
27.	80.6	23.6	18.8	23.8	19.0	23.9	19.1	24.1	19.3	24.3	19.4
26.	78.8	23.6	18.9	23.8	19.1	24.0	19.2	24.2	19.4	24.4	19.5
25.	77.0	23.7	19.0	23.9	19.1	24.1	19.3	24.3	19.4	24.5	19.6
24.	75.2	23.8	19.1	24.0	19.2	24.2	19.4	24.4	19.5	24.6	19.7
23.	73.4	23.9	19.1	24.1	19.3	24.3	19.4	24.5	19.6	24.7	19.7
22.	71.6	24.0	19.2	24.2	19.4	24.4	19.5	24.6	19.7	24.8	19.8
21.	69.8	24.1	19.3	24.3	19.4	24.5	19.6	24.6	19.7	24.8	19.9
20.	68.0	24.2	19.4	24.3	19.5	24.5	19.7	24.7	19.8	24.9	20.0
19.	66.2	24.2	19.4	24.4	19.6	24.6	19.7	24.8	19.9	25.0	20.1
18.	64.4	24.3	19.5	24.5	19.7	24.7	19.8	24.9	20.0	25.1	20.1
17.	62.6	24.4	19.6	24.6	19.7	24.8	19.9	25.0	20.1	25.2	20.2
16.	60.8	24.5	19.7	24.7	19.8	24.9	20.0	25.1	20.1	25.3	20.3

05D243-02-11-83

Figure FO-28. Power Check Chart (With Adjusting Clip); Manual Fuel Control (Sheet 2)

NOTE

This chart may be removed from manual for use with checklist.

CUT ALONG THIS LINE

Minimum and Maximum Manual Fuel Control Power Check Chart
TF41-A-1 (Adjusting Clip Installed)

NOTE

Values shown are for engine operating in A-7D airplane with air inlet screen installed and air conditioning system operating. If engine must be operated with screen removed, add 1.3" Hg to $P_{T5.1}$ true pressure.

Ambient Pressure – Inches Mercury Absolute

Ambient Temperature		26.0		26.2		26.4		26.6		26.8	
		$P_{T5.1}$ True Pressure – Inches Mercury Gage									
°C	°F	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
55.	131.0	22.1	17.4	22.2	17.5	22.4	17.6	22.6	17.8	22.7	17.9
54.	129.2	22.1	17.4	22.3	17.6	22.5	17.7	22.7	17.9	22.8	18.0
53.	127.4	22.2	17.5	22.4	17.7	22.6	17.8	22.7	17.9	22.9	18.1
52.	125.6	22.3	17.6	22.5	17.7	22.7	17.9	22.8	18.0	23.0	18.1
51.	123.8	22.4	17.7	22.6	17.8	22.8	18.0	22.9	18.1	23.1	18.2
50.	122.0	22.5	17.8	22.7	17.9	22.8	18.0	23.0	18.2	23.2	18.3
49.	120.2	22.6	17.8	22.8	18.0	22.9	18.1	23.1	18.3	23.3	18.4
48.	118.4	22.7	17.9	22.8	18.1	23.0	18.2	23.2	18.3	23.4	18.5
47.	116.6	22.8	18.0	22.9	18.1	23.1	18.3	23.3	18.4	23.5	18.6
46.	114.8	22.8	18.1	23.0	18.2	23.2	18.4	23.4	18.5	23.5	18.6
45.	113.0	22.9	18.2	23.1	18.3	23.3	18.4	23.5	18.6	23.6	18.7
44.	111.2	23.0	18.2	23.2	18.4	23.4	18.5	23.5	18.7	23.7	18.8
43.	109.4	23.1	18.3	23.3	18.5	23.5	18.6	23.6	18.7	23.8	18.9
42.	107.6	23.2	18.4	23.4	18.5	23.5	18.7	23.7	18.8	23.9	19.0
41.	105.8	23.3	18.5	23.5	18.6	23.6	18.8	23.8	18.9	24.0	19.0
40.	104.0	23.4	18.6	23.5	18.7	23.7	18.8	23.9	19.0	24.1	19.1
39.	102.2	23.5	18.6	23.6	18.8	23.8	18.9	24.0	19.1	24.2	19.2
38.	100.4	23.5	18.7	23.7	18.9	23.9	19.0	24.1	19.1	24.3	19.3
37.	98.6	23.6	18.8	23.8	18.9	24.0	19.1	24.2	19.2	24.4	19.4
36.	96.8	23.7	18.9	23.9	19.0	24.1	19.2	24.3	19.3	24.4	19.5
35.	95.0	23.8	18.9	24.0	19.1	24.2	19.2	24.4	19.4	24.5	19.5
34.	93.2	23.9	19.0	24.1	19.2	24.3	19.3	24.4	19.5	24.6	19.6
33.	91.4	24.0	19.1	24.2	19.3	24.3	19.4	24.5	19.5	24.7	19.7
32.	89.6	24.1	19.2	24.3	19.3	24.4	19.5	24.6	19.6	24.8	19.8
31.	87.8	24.2	19.3	24.3	19.4	24.5	19.6	24.7	19.7	24.9	19.9
30.	86.0	24.2	19.3	24.4	19.5	24.6	19.6	24.8	19.8	25.0	19.9
29.	84.2	24.3	19.4	24.5	19.6	24.7	19.7	24.9	19.9	25.1	20.0
28.	82.4	24.4	19.5	24.6	19.7	24.8	19.8	25.0	20.0	25.2	20.1
27.	80.6	24.5	19.6	24.7	19.7	24.9	19.9	25.1	20.0	25.3	20.2
26.	78.8	24.6	19.7	24.8	19.8	25.0	20.0	25.2	20.1	25.3	20.3
25.	77.0	24.7	19.7	24.9	19.9	25.1	20.0	25.2	20.2	25.4	20.3
24.	75.2	24.8	19.8	25.0	20.0	25.1	20.1	25.3	20.3	25.5	20.4
23.	73.4	24.9	19.9	25.0	20.0	25.2	20.2	25.4	20.4	25.6	20.5
22.	71.6	24.9	20.0	25.1	20.1	25.3	20.3	25.5	20.4	25.7	20.6
21.	69.8	25.0	20.1	25.2	20.2	25.4	20.4	25.6	20.5	25.8	20.7
20.	68.0	25.1	20.1	25.3	20.3	25.5	20.4	25.7	20.6	25.9	20.8
19.	66.2	25.2	20.2	25.4	20.4	25.6	20.5	25.8	20.7	26.0	20.8
18.	64.4	25.3	20.3	25.5	20.4	25.7	20.6	25.9	20.8	26.1	20.9
17.	62.6	25.4	20.4	25.6	20.5	25.8	20.7	26.0	20.8	26.2	21.0
16.	60.8	25.5	20.4	25.7	20.6	25.9	20.8	26.1	20.9	26.3	21.1

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Figure FO-28. Power Check Chart (With Adjusting Clip); Manual Fuel Control (Sheet 3)

NOTE

This chart may be removed from manual for use with checklist.

CUT ALONG THIS LINE

Minimum and Maximum Manual Fuel Control Power Check Chart
TF41-A-1 (Adjusting Clip Installed)

NOTE

Values shown are for engine operating in A-7D airplane with air inlet screen installed and air conditioning system operating. If engine must be operated with screen removed, add 1.3" Hg to $P_{T5.1}$ true pressure.

Ambient Temperature		Ambient Pressure – Inches Mercury Absolute									
		27.0		27.2		27.4		27.6		27.8	
		$P_{T5.1}$ True Pressure – Inches Mercury Gage									
°C	°F	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
55.	131.0	22.9	18.0	23.1	18.2	23.2	18.3	23.4	18.4	23.6	18.6
54.	129.2	23.0	18.1	23.2	18.3	23.3	18.4	23.5	18.5	23.7	18.7
53.	127.4	23.1	18.2	23.3	18.3	23.4	18.5	23.6	18.6	23.8	18.7
52.	125.6	23.2	18.3	23.3	18.4	23.5	18.6	23.7	18.7	23.9	18.8
51.	123.8	23.3	18.4	23.4	18.5	23.6	18.6	23.8	18.8	24.0	18.9
50.	122.0	23.4	18.4	23.5	18.6	23.7	18.7	23.9	18.9	24.1	19.0
49.	120.2	23.4	18.5	23.6	18.7	23.8	18.8	24.0	18.9	24.1	19.1
48.	118.4	23.5	18.6	23.7	18.8	23.9	18.9	24.1	19.0	24.2	19.2
47.	116.6	23.6	18.7	23.8	18.8	24.0	19.0	24.2	19.1	24.3	19.2
46.	114.8	23.7	18.8	23.9	18.9	24.1	19.1	24.2	19.2	24.4	19.3
45.	113.0	23.8	18.9	24.0	19.0	24.2	19.1	24.3	19.3	24.5	19.4
44.	111.2	23.9	18.9	24.1	19.1	24.3	19.2	24.4	19.4	24.6	19.5
43.	109.4	24.0	19.0	24.2	19.2	24.3	19.3	24.5	19.4	24.7	19.6
42.	107.6	24.1	19.1	24.3	19.2	24.4	19.4	24.6	19.5	24.8	19.7
41.	105.8	24.2	19.2	24.4	19.3	24.5	19.5	24.7	19.6	24.9	19.8
40.	104.0	24.3	19.3	24.4	19.4	24.6	19.6	24.8	19.7	25.0	19.8
39.	102.2	24.4	19.4	24.5	19.5	24.7	19.6	24.9	19.8	25.1	19.9
38.	100.4	24.4	19.4	24.6	19.6	24.8	19.7	25.0	19.9	25.2	20.0
37.	98.6	24.5	19.5	24.7	19.7	24.9	19.8	25.1	19.9	25.3	20.1
36.	96.8	24.6	19.6	24.8	19.7	25.0	19.9	25.2	20.0	25.4	20.2
35.	95.0	24.7	19.7	24.9	19.8	25.1	20.0	25.3	20.1	25.5	20.3
34.	93.2	24.8	19.8	25.0	19.9	25.2	20.1	25.4	20.2	25.5	20.3
33.	91.4	24.9	19.8	25.1	20.0	25.3	20.1	25.5	20.3	25.6	20.4
32.	89.6	25.0	19.9	25.2	20.1	25.4	20.2	25.5	20.4	25.7	20.5
31.	87.8	25.1	20.0	25.3	20.2	25.5	20.3	25.6	20.5	25.8	20.6
30.	86.0	25.2	20.1	25.4	20.2	25.5	20.4	25.7	20.5	25.9	20.7
29.	84.2	25.3	20.2	25.5	20.3	25.6	20.5	25.8	20.6	26.0	20.8
28.	82.4	25.4	20.3	25.5	20.4	25.7	20.6	25.9	20.7	26.1	20.9
27.	80.6	25.4	20.3	25.6	20.5	25.8	20.6	26.0	20.8	26.2	20.9
26.	78.8	25.5	20.4	25.7	20.6	25.9	20.7	26.1	20.9	26.3	21.0
25.	77.0	25.6	20.5	25.8	20.6	26.0	20.8	26.2	21.0	26.4	21.1
24.	75.2	25.7	20.6	25.9	20.7	26.1	20.9	26.3	21.0	26.5	21.2
23.	73.4	25.8	20.7	26.0	20.8	26.2	21.0	26.4	21.1	26.6	21.3
22.	71.6	25.9	20.7	26.1	20.9	26.3	21.1	26.5	21.2	26.7	21.4
21.	69.8	26.0	20.8	26.2	21.0	26.4	21.1	26.6	21.3	26.8	21.4
20.	68.0	26.1	20.9	26.3	21.1	26.5	21.2	26.7	21.4	26.9	21.5
19.	66.2	26.2	21.0	26.4	21.1	26.6	21.3	26.8	21.5	26.9	21.6
18.	64.4	26.3	21.1	26.5	21.2	26.7	21.4	26.8	21.5	27.0	21.7
17.	62.6	26.4	21.2	26.6	21.3	26.7	21.5	26.9	21.6	27.1	21.8
16.	60.8	26.4	21.2	26.6	21.4	26.8	21.6	27.0	21.7	27.2	21.9

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Figure FO-28. Power Check Chart (With Adjusting Clip); Manual Fuel Control (Sheet 4)

NOTE

This chart may be removed from manual for use with checklist.

CUT ALONG THIS LINE

Minimum and Maximum Manual Fuel Control Power Check Chart
TF41-A-1 (Adjusting Clip Installed)

NOTE

Values are shown for engine operating in A-7D airplane with air inlet screen installed and air conditioning system operating. If engine must be operated with screen removed, add 1.3" Hg to $P_{T5.1}$ true pressure.

Ambient Temperature		Ambient Pressure – Inches Mercury Absolute									
		28.0		28.2		28.4		28.6		28.8	
		$P_{T5.1}$ True Pressure – Inches Mercury Gage									
°C	°F	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
55.	131.0	23.8	18.7	23.9	18.8	24.1	19.0	24.3	19.1	24.4	19.2
54.	129.2	23.8	18.8	24.0	18.9	24.2	19.1	24.4	19.2	24.5	19.3
53.	127.4	23.9	18.9	24.1	19.0	24.3	19.1	24.5	19.3	24.6	19.4
52.	125.6	24.0	19.0	24.2	19.1	24.4	19.2	24.6	19.4	24.7	19.5
51.	123.8	24.1	19.0	24.3	19.2	24.5	19.3	24.6	19.5	24.8	19.6
50.	122.0	24.2	19.1	24.4	19.3	24.6	19.4	24.7	19.5	24.9	19.7
49.	120.2	24.3	19.2	24.5	19.4	24.7	19.5	24.8	19.6	25.0	19.8
48.	118.4	24.4	19.3	24.6	19.4	24.8	19.6	24.9	19.7	25.1	19.9
47.	116.6	24.5	19.4	24.7	19.5	24.9	19.7	25.0	19.8	25.2	19.9
46.	114.8	24.6	19.5	24.8	19.6	25.0	19.7	25.1	19.9	25.3	20.0
45.	113.0	24.7	19.6	24.9	19.7	25.0	19.8	25.2	20.0	25.4	20.1
44.	111.2	24.8	19.6	25.0	19.8	25.1	19.9	25.3	20.1	25.5	20.2
43.	109.4	24.9	19.7	25.1	19.9	25.2	20.0	25.4	20.1	25.6	20.3
42.	107.6	25.0	19.8	25.2	20.0	25.3	20.1	25.5	20.2	25.7	20.4
41.	105.8	25.1	19.9	25.3	20.0	25.4	20.2	25.6	20.3	25.8	20.5
40.	104.0	25.2	20.0	25.3	20.1	25.5	20.3	25.7	20.4	25.9	20.6
39.	102.2	25.3	20.1	25.4	20.2	25.6	20.4	25.8	20.5	26.0	20.6
38.	100.4	25.4	20.2	25.5	20.3	25.7	20.4	25.9	20.6	26.1	20.7
37.	98.6	25.4	20.2	25.6	20.4	25.8	20.5	26.0	20.7	26.2	20.8
36.	96.8	25.5	20.3	25.7	20.5	25.9	20.6	26.1	20.8	26.3	20.9
35.	95.0	25.6	20.4	25.8	20.6	26.0	20.7	26.2	20.8	26.4	21.0
34.	93.2	25.7	20.5	25.9	20.6	26.1	20.8	26.3	20.9	26.5	21.1
33.	91.4	25.8	20.6	26.0	20.7	26.2	20.9	26.4	21.0	26.6	21.2
32.	89.6	25.9	20.7	26.1	20.8	26.3	21.0	26.5	21.1	26.7	21.3
31.	87.8	26.0	20.7	26.2	20.9	26.4	21.0	26.6	21.2	26.8	21.3
30.	86.0	26.1	20.8	26.3	21.0	26.5	21.1	26.7	21.3	26.9	21.4
29.	84.2	26.2	20.9	26.4	21.1	26.6	21.2	26.8	21.4	27.0	21.5
28.	82.4	26.3	21.0	26.5	21.2	26.7	21.3	26.9	21.5	27.0	21.6
27.	80.6	26.4	21.1	26.6	21.2	26.8	21.4	27.0	21.5	27.1	21.7
26.	78.8	26.5	21.2	26.7	21.3	26.9	21.5	27.1	21.6	27.2	21.8
25.	77.0	26.6	21.3	26.8	21.4	27.0	21.6	27.1	21.7	27.3	21.9
24.	75.2	26.7	21.3	26.9	21.5	27.1	21.6	27.2	21.8	27.4	22.0
23.	73.4	26.8	21.4	27.0	21.6	27.1	21.7	27.3	21.9	27.5	22.0
22.	71.6	26.9	21.5	27.1	21.7	27.2	21.8	27.4	22.0	27.6	22.1
21.	69.8	27.0	21.6	27.1	21.8	27.3	21.9	27.5	22.1	27.7	22.2
20.	68.0	27.0	21.7	27.2	21.8	27.4	22.0	27.6	22.1	27.8	22.3
19.	66.2	27.1	21.8	27.3	21.9	27.5	22.1	27.7	22.2	27.9	22.4
18.	64.4	27.2	21.9	27.4	22.0	27.6	22.2	27.8	22.3	28.0	22.5
17.	62.6	27.3	21.9	27.5	22.1	27.7	22.3	27.9	22.4	28.1	22.6
16.	60.8	27.4	22.0	27.6	22.2	27.8	22.3	28.0	22.5	28.2	22.7

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Figure FO-28. Power Check Chart (With Adjusting Clip); Manual Fuel Control (Sheet 5)

NOTE

This chart may be removed from manual for use with checklist.

CUT ALONG THIS LINE

Minimum and Maximum Manual Fuel Control Power Check Chart
TF41-A-1 (Adjusting Clip Installed)

NOTE

Values shown are for engine operating in A-7D airplane with air inlet screen installed and air conditioning system operating. If engine must be operated with screen removed, add 1.3" Hg to $P_{T5.1}$ true pressure.

Ambient Temperature		Ambient Pressure – Inches Mercury Absolute: 29.0		29.2		29.4		29.6		29.8	
		$P_{T5.1}$ True Pressure – Inches Mercury Gage									
°C	°F	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
55.	131.0	24.6	19.4	24.8	19.5	24.9	19.6	25.1	19.8	25.3	19.9
54.	129.2	24.7	19.5	24.9	19.6	25.0	19.7	25.2	19.9	25.4	20.0
53.	127.4	24.8	19.6	25.0	19.7	25.1	19.8	25.3	20.0	25.5	20.1
52.	125.6	24.9	19.6	25.1	19.8	25.2	19.9	25.4	20.0	25.6	20.2
51.	123.8	25.0	19.7	25.2	19.9	25.3	20.0	25.5	20.1	25.7	20.3
50.	122.0	25.1	19.8	25.3	20.0	25.4	20.1	25.6	20.2	25.8	20.4
49.	120.2	25.2	19.9	25.4	20.0	25.5	20.2	25.7	20.3	25.9	20.5
48.	118.4	25.3	20.0	25.5	20.1	25.6	20.3	25.8	20.4	26.0	20.5
47.	116.6	25.4	20.1	25.6	20.2	25.7	20.4	25.9	20.5	26.1	20.6
46.	114.8	25.5	20.2	25.7	20.3	25.8	20.4	26.0	20.6	26.2	20.7
45.	113.0	25.6	20.3	25.8	20.4	25.9	20.5	26.1	20.7	26.3	20.8
44.	111.2	25.7	20.3	25.9	20.5	26.0	20.6	26.2	20.8	26.4	20.9
43.	109.4	25.8	20.4	25.9	20.6	26.1	20.7	26.3	20.9	26.5	21.0
42.	107.6	25.9	20.5	26.0	20.7	26.2	20.8	26.4	20.9	26.6	21.1
41.	105.8	26.0	20.6	26.1	20.7	26.3	20.9	26.5	21.0	26.7	21.1
40.	104.0	26.1	20.7	26.2	20.8	26.4	21.0	26.6	21.1	26.8	21.3
39.	102.2	26.2	20.8	26.3	20.9	26.5	21.1	26.7	21.2	26.9	21.4
38.	100.4	26.3	20.9	26.4	21.0	26.6	21.2	26.8	21.3	27.0	21.4
37.	98.6	26.4	21.0	26.5	21.1	26.7	21.2	26.9	21.4	27.1	21.5
36.	96.8	26.5	21.0	26.6	21.2	26.8	21.3	27.0	21.5	27.2	21.6
35.	95.0	26.6	21.1	26.7	21.3	26.9	21.4	27.1	21.6	27.3	21.7
34.	93.2	26.6	21.2	26.8	21.4	27.0	21.5	27.2	21.7	27.4	21.8
33.	91.4	26.7	21.3	26.9	21.5	27.1	21.6	27.3	21.8	27.5	21.9
32.	89.6	26.8	21.4	27.0	21.5	27.2	21.7	27.4	21.8	27.6	22.0
31.	87.8	26.9	21.5	27.1	21.6	27.3	21.8	27.5	21.9	27.7	22.1
30.	86.0	27.0	21.6	27.2	21.7	27.4	21.9	27.6	22.0	27.8	22.2
29.	84.2	27.1	21.7	27.3	21.8	27.5	22.0	27.7	22.1	27.9	22.3
28.	82.4	27.2	21.8	27.4	21.9	27.6	22.1	27.8	22.2	28.0	22.4
27.	80.6	27.3	21.8	27.5	22.0	27.7	22.1	27.9	22.3	28.1	22.4
26.	78.8	27.4	21.9	27.6	22.1	27.8	22.2	28.0	22.4	28.2	22.5
25.	77.0	27.5	22.0	27.7	22.2	27.9	22.3	28.1	22.5	28.3	22.6
24.	75.2	27.6	22.1	27.8	22.3	28.0	22.4	28.2	22.6	28.4	22.7
23.	73.4	27.7	22.2	27.9	22.3	28.1	22.5	28.3	22.7	28.5	22.8
22.	71.6	27.8	22.3	28.0	22.4	28.2	22.6	28.4	22.7	28.6	22.9
21.	69.8	27.9	22.4	28.1	22.5	28.3	22.7	28.5	22.8	28.7	23.0
20.	68.0	28.0	22.5	28.2	22.6	28.4	22.8	28.6	22.9	28.8	23.1
19.	66.2	28.1	22.5	28.3	22.7	28.5	22.9	28.7	23.0	28.9	23.2
18.	64.4	28.2	22.6	28.4	22.8	28.6	22.9	28.8	23.1	29.0	23.3
17.	62.6	28.3	22.7	28.5	22.9	28.7	23.0	28.9	23.2	29.1	23.3
16.	60.8	28.4	22.8	28.6	23.0	28.8	23.1	29.0	23.3	29.2	23.4

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Figure FO-28. Power Check Chart (With Adjusting Clip); Manual Fuel Control (Sheet 6)

NOTE

This chart may be removed from manual for use with checklist.

CUT ALONG THIS LINE

Minimum and Maximum Manual Fuel Control Power Check Chart TF41-A-1 (Adjusting Clip Installed)

NOTE

Values are shown for engine operating in A-7D airplane with air inlet screen installed and air conditioning system operating. If engine must be operated with screen removed, add 1.3″ Hg to $P_{T5.1}$ true pressure.

Ambient Temperature		Ambient Pressure – Inches Mercury Absolute: 30.0		30.2		30.4		30.6		30.8	
		$P_{T5.1}$ True Pressure – Inches Mercury Gage									
°C	°F	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
55.	131.0	25.4	20.0	25.6	20.2	25.8	20.3	26.0	20.4	26.1	20.6
54.	129.2	25.5	20.1	25.7	20.3	25.9	20.4	26.1	20.5	26.2	20.7
53.	127.4	25.7	20.2	25.8	20.4	26.0	20.5	26.2	20.6	26.3	20.8
52.	125.6	25.8	20.3	25.9	20.5	26.1	20.6	26.3	20.7	26.4	20.9
51.	123.8	25.9	20.4	26.0	20.5	26.2	20.7	26.4	20.8	26.5	21.0
50.	122.0	26.0	20.5	26.1	20.6	26.3	20.8	26.5	20.9	26.6	21.0
49.	120.2	26.1	20.6	26.2	20.7	26.4	20.9	26.6	21.0	26.7	21.1
48.	118.4	26.2	20.7	26.3	20.8	26.5	21.0	26.7	21.1	26.9	21.2
47.	116.6	26.3	20.8	26.4	20.9	26.6	21.0	26.8	21.2	27.0	21.3
46.	114.8	26.4	20.9	26.5	21.0	26.7	21.1	26.9	21.3	27.1	21.4
45.	113.0	26.5	21.0	26.6	21.1	26.8	21.2	27.0	21.4	27.2	21.5
44.	111.2	26.6	21.0	26.7	21.2	26.9	21.3	27.1	21.5	27.3	21.6
43.	109.4	26.7	21.1	26.8	21.3	27.0	21.4	27.2	21.6	27.4	21.7
42.	107.6	26.8	21.2	26.9	21.4	27.1	21.5	27.3	21.7	27.5	21.8
41.	105.8	26.9	21.3	27.0	21.5	27.2	21.6	27.4	21.7	27.6	21.9
40.	104.0	27.0	21.4	27.1	21.6	27.3	21.7	27.5	21.8	27.7	22.0
39.	102.2	27.1	21.5	27.2	21.6	27.4	21.8	27.6	21.9	27.8	22.1
38.	100.4	27.2	21.6	27.3	21.7	27.5	21.9	27.7	22.0	27.9	22.2
37.	98.6	27.3	21.7	27.4	21.8	27.6	22.0	27.8	22.1	28.0	22.3
36.	96.8	27.4	21.8	27.5	21.9	27.7	22.1	27.9	22.2	28.1	22.4
35.	95.0	27.5	21.9	27.7	22.0	27.8	22.2	28.0	22.3	28.2	22.4
34.	93.2	27.6	22.0	27.8	22.1	27.9	22.2	28.1	22.4	28.3	22.5
33.	91.4	27.7	22.0	27.9	22.2	28.0	22.3	28.2	22.5	28.4	22.6
32.	89.6	27.8	22.1	28.0	22.3	28.1	22.4	28.3	22.6	28.5	22.7
31.	87.8	27.9	22.2	28.1	22.4	28.2	22.5	28.4	22.7	28.6	22.8
30.	86.0	28.0	22.3	28.2	22.5	28.3	22.6	28.5	22.8	28.7	22.9
29.	84.2	28.1	22.4	28.3	22.6	28.4	22.7	28.6	22.9	28.8	23.0
28.	82.4	28.2	22.5	28.4	22.7	28.5	22.8	28.7	23.0	28.9	23.1
27.	80.6	28.3	22.6	28.5	22.7	28.7	22.9	28.8	23.0	29.0	23.2
26.	78.8	28.4	22.7	28.6	22.8	28.8	23.0	28.9	23.1	29.1	23.3
25.	77.0	28.5	22.8	28.7	22.9	28.9	23.1	29.0	23.2	29.2	23.4
24.	75.2	28.6	22.9	28.8	23.0	29.0	23.2	29.1	23.3	29.3	23.5
23.	73.4	28.7	23.0	28.9	23.1	29.1	23.3	29.3	23.4	29.4	23.6
22.	71.6	28.8	23.0	29.0	23.2	29.2	23.4	29.4	23.5	29.5	23.7
21.	69.8	28.9	23.1	29.1	23.3	29.3	23.4	29.5	23.6	29.7	23.8
20.	68.0	29.0	23.2	29.2	23.4	29.4	23.5	29.6	23.7	29.8	23.9
19.	66.2	29.1	23.3	29.3	23.5	29.5	23.6	29.7	23.8	29.9	23.9
18.	64.4	29.2	23.4	29.4	23.6	29.6	23.7	29.8	23.9	30.0	24.0
17.	62.6	29.3	23.5	29.5	23.7	29.7	23.8	29.9	24.0	30.1	24.1
16.	60.8	29.4	23.6	29.6	23.8	29.8	23.9	30.0	24.1	30.2	24.2

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Figure FO-28. Power Check Chart (With Adjusting Clip); Manual Fuel Control (Sheet 7)