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T.O. 1F-106A-2-4

TECHNICAL MANUAL

MAINTENANCE

POWER PLANT

USAF SERIES

F-106A AND F-106B

AIRCRAFT

(GENERAL DYNAMICS/CONVAIR)

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INTRODUCTION

POWER PLANT MANUAL

EFFECTIVITY

The information contained in this manual is *applicable to F-106A airplanes 56-453, -454, 56-456 and subsequent, and F-106B airplanes 57-2508 and subsequent.* When the information on a particular system, component, or procedure is peculiar to a certain model or series, applicability to that model and the airplanes affected is specified.

DESCRIPTION

This subsection contains the step-by-step checkout of the system and components to assure that minimum requirements for the proper operation of the system are met.

OPERATIONAL CHECKOUT

This subsection contains the step-by-step checkout of the system and components to assure that minimum requirements for the proper operation of the system are met.

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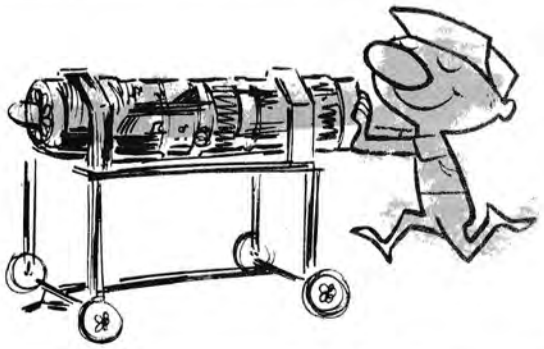
SYSTEM ANALYSIS

Contained under this heading is a list of troubles which could develop within the system or in one of its components. The trouble shooting chart lists the possible cause of the malfunction, indicates the isolation procedure to direct the mechanic as easily as possible to the trouble area, and prescribes the remedial maintenance action.

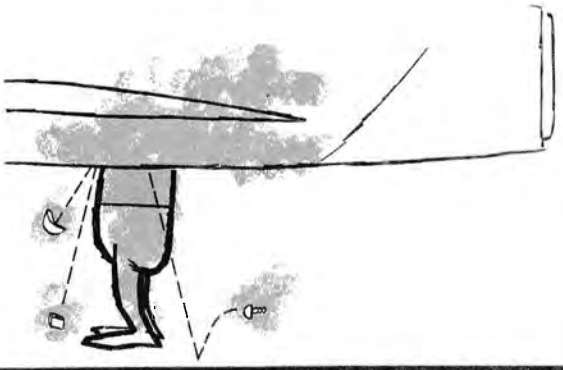
REPLACEMENT

This subsection contains detailed step-by-step procedures for removal and installation of system components.



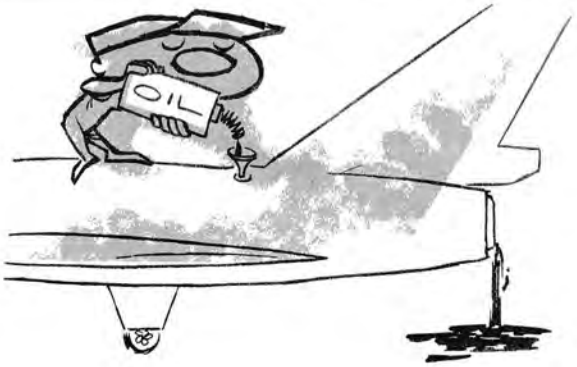
ADJUSTMENT

This subsection includes detailed step-by-step procedures for the adjustment of the complete system and the system components.



SERVICING

This subsection includes instructions for cleaning, draining, replenishing, and lubricating the system and components.



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LIST OF F-106A AND F-106B SYSTEMS MAINTENANCE MANUALS

T.O. 1F-106A-2-1 General Airplane

T.O. 1F-106A-2-2 Ground Handling, Servicing, And Airframe Group Maintenance

T.O. 1F-106A-2-3 Hydraulic and Pneumatic Power Systems

T.O. 1F-106A-2-4 Power Plant

T.O. 1F-106A-2-5 Fuel Supply System

T.O. 1F-106A-2-6 Air Conditioning, Anti-Icing, And Oxygen Systems

T.O. 1F-106A-2-7 Flight Control Systems

T.O. 1F-106A-2-8 Landing Gear

T.O. 1F-106A-2-9 Instrument Systems

T.O. 1F-106A-2-10 Electrical Systems

T.O. 1F-106A-2-12 Armament Systems

T.O. 1F-106A-2-13 Wiring Diagrams, Airframe (F-106A)

T.O. 1F-106B-2-13 Wiring Diagrams, Airframe (F-106B)

T.O. 1F-106A-2-15 Aircraft and Weapon Control Interceptor Systems, Type MA-1 and Type AN/ASQ-25, Dock Instructions

T.O. 1F-106A-2-24 Aircraft and Weapon Control Interceptor System, Type MA-1, Wiring Data (F-106A); *Serial Nos. 57-246, 57-2453 thru 57-2464, 57-2466 thru 57-2506.*

T.O. 1F-106B-2-24 Aircraft and Weapon Control Interceptor System, Type AN/ASQ-25, Wiring Data (F-106B); *Serial Nos. 57-2516 thru 57-2522, 57-2524 thru 57-2531.*

T.O. 1F-106A-2-25 Aircraft and Weapon Control Interceptor System, Type MA-1, Wiring Data (F-106A); *Serial Nos. 56-453, 56-454, 56-456 thru 56-467, 57-230 thru 57-238, 57-240 thru 57-245, 57-2465, 58-759 and subsequent.*

T.O. 1F-106B-2-25 Aircraft and Weapon Control Interceptor System, Type AN/ASQ-25, Wiring Data (F-106B); *Serial Nos. 57-2508 thru 57-2515, 57-2523, 57-2532 and subsequent.*

T.O. 1F-106A-2-27 MA-1 AWCIS Pocketbook

- Vol. I Flight Line Instructions
- Vol. II Dock Instructions for Power, Radar and AAI Subsystems
- Vol. III Dock Instructions for FC&M, Computer, CN&L Subsystems

SUPPLEMENTARY DATA

T.O. 1F-106A-01 List of Applicable Publications

T.O. 1F-106A-1 Flight Manual

T.O. 1F-106B-1 Flight Manual

T.O. 1F-106A-CL-1-1 Pilot's Checklist

T.O. 1F-106B-CL-1-1 Pilots' Checklist

T.O. 1F-106A-3 Structural Repair Manual

T.O. 1F-106A-4 Illustrated Parts Breakdown

T.O. 1F-106B-4 Illustrated Parts Breakdown

T.O. 1F-106A-5 Basic Weight Checklist and Loading Data

T.O. 1F-106B-5 Basic Weight Checklist and Loading Data

T.O. 1F-106A-6 Aircraft Scheduled Inspection and Maintenance Requirements

T.O. 1F-106A-10 Power Package Buildup Instructions

T.O. 1F-106A-16-1 Weapon Loading Procedures

T.O. 1F-106A-16-2 Job-Oriented Weapon Loading Procedures

T.O. 1F-106A-CL-16-1-1 Supervisory Control Sheet

T.O. 1F-106A-CL-16-1-2 Loading Crew Chief's Abbreviated Checklist

T.O. 1F-106A-17 Storage of Aircraft

T.O. 1F-106A-18 Field Maintenance of Airborne Material

T.O. 1F-106A-20 Product Improvement Digest

T.O. 1F-106A-21 Master Guide Aircraft Inventory Record

T.O. 1F-106A-29 Aircrew Weapon Delivery

T.O. 1F-106A-CL-29-1 Aircrew Weapon Delivery Procedures Checklist

Section I

POWER PLANT GENERAL

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DESCRIPTION

1-1. GENERAL

F-106A and F-106B airplanes are powered by Pratt and Whitney J75 continuous flow gas turbine engines. See figures 1-1 and 1-2 for illustrations of the engine installation in relation to the airplane fuselage. The engine consists of the following major sections: the compressor section, the combustion section, the turbine section, the afterburner section, and the accessory section. See figure 1-3 for an illustration of the engine sections. The engine incorporates an axial flow compressor, an eight-unit combustion chamber, a split three-stage turbine, and an afterburner equipped with a two-position iris type exhaust nozzle. The axial flow compressor consists of two sections of eight and seven stages each. The eight-stage or N_1 compressor is a low-pressure unit, connected by a through shaft to the second and third stage turbine wheels. The seven-stage or N_2 compressor section is a high-pressure unit, connected to the first stage turbine wheel by a hollow shaft that encircles the N_1 compressor shaft.

NOTE

Air inlet section and tailcone covers must be used at all times during nonmaintenance periods. Engine must be covered during an inlet section inspection after transit operations. After each maintenance operation personnel must inventory tools and parts used. Inlet guide section of engine must not be used as resting place for tools, parts, nuts, bolts, etc. during maintenance operation.

1-2. DIRECTIONAL REFERENCES.

Right and left, clockwise and counterclockwise, upper and lower, and similar directional references apply to the engine as viewed from the rear or afterburner end. The engine is in the normal horizontal position with the N_2 accessory section at the bottom. Direction of rotation of the compressor and turbine assemblies is clockwise. The combustion chambers are numbered from one through eight in a clockwise direction, with the number one burner being located to the right of the top centerline of the engine.

1-3. ENGINE MOUNTED ACCESSORIES AND SYSTEMS.

Description and operation of engine systems will be found in the applicable sections of this manual. Installation and removal procedures for accessories are incorporated with the system illustration. See figure 1-4 for an illustration of the engine assembly.

1-4. COMPRESSOR SECTION.

The compressor section is made up of the inlet guide vane and shroud, front accessory drive support, compressor front bearing support, N_1 low-pressure compressor assembly, N_1 accessory section, compressor intermediate case, N_2 high-pressure compressor assembly, and the diffuser case. In operation, the compressor section supplies the combustion section of the engine with a high-velocity flow of compressed air. The compressor is divided into two sections. The first is the low-pressure or N_1 compressor, which consists of eight compression stages. The second section is the high-pressure of N_2 compressor section, which is made up of seven compression stages, The N_1 compressor is connected by a shaft to the second and third

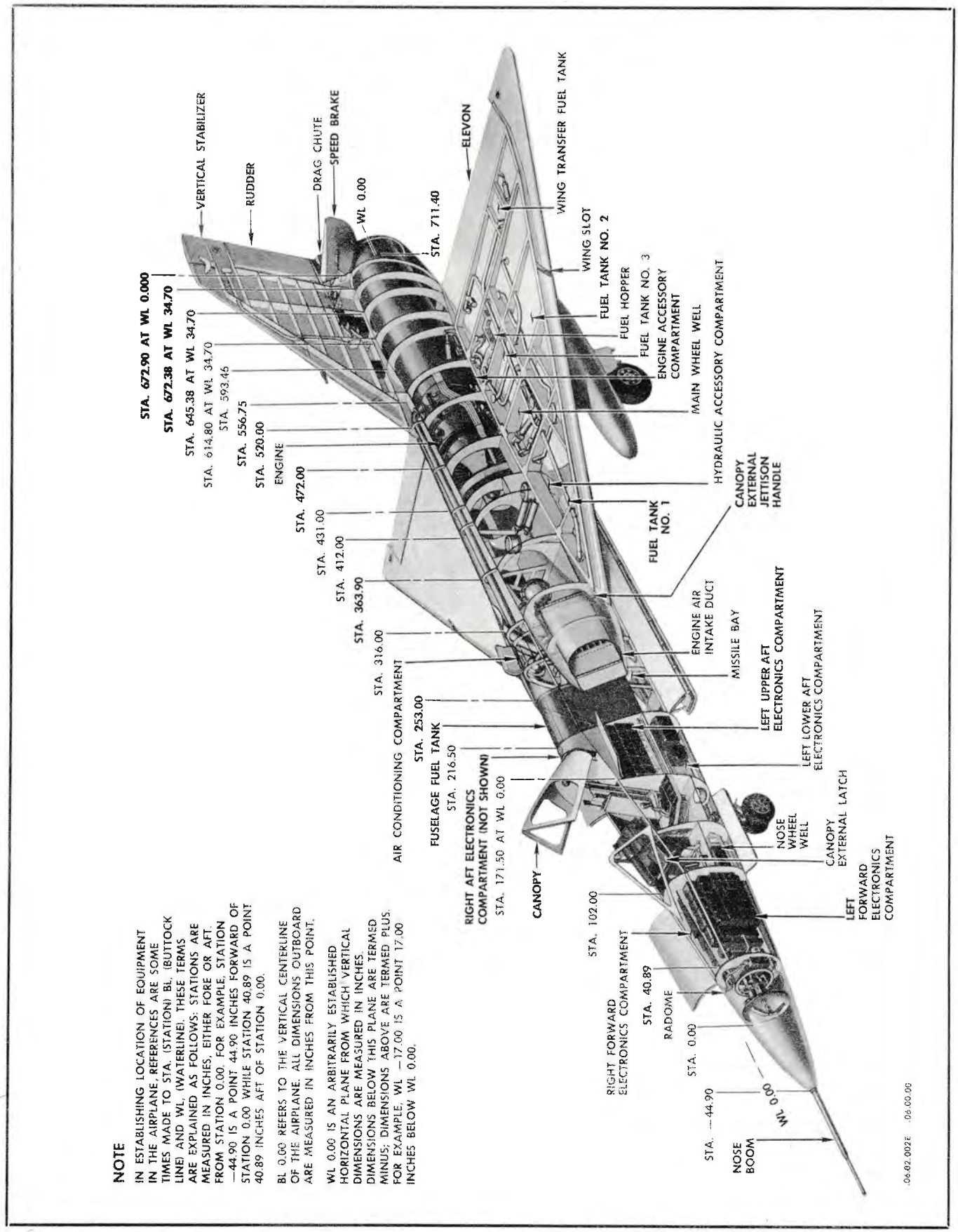


Figure 1-1. Airplane Stations and Compartments, F-106A

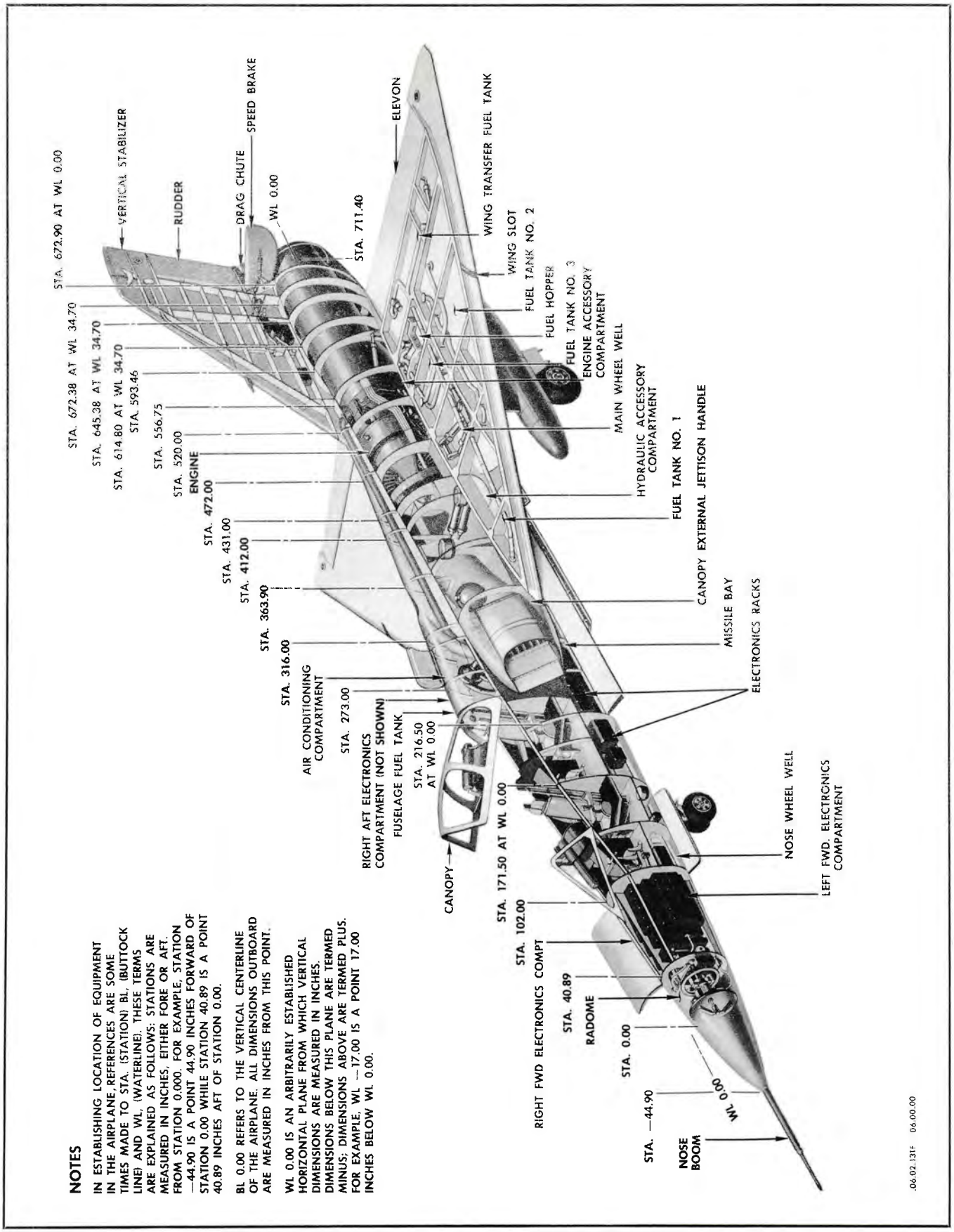


Figure 1-2. Airplane Stations and Compartments, F-106B

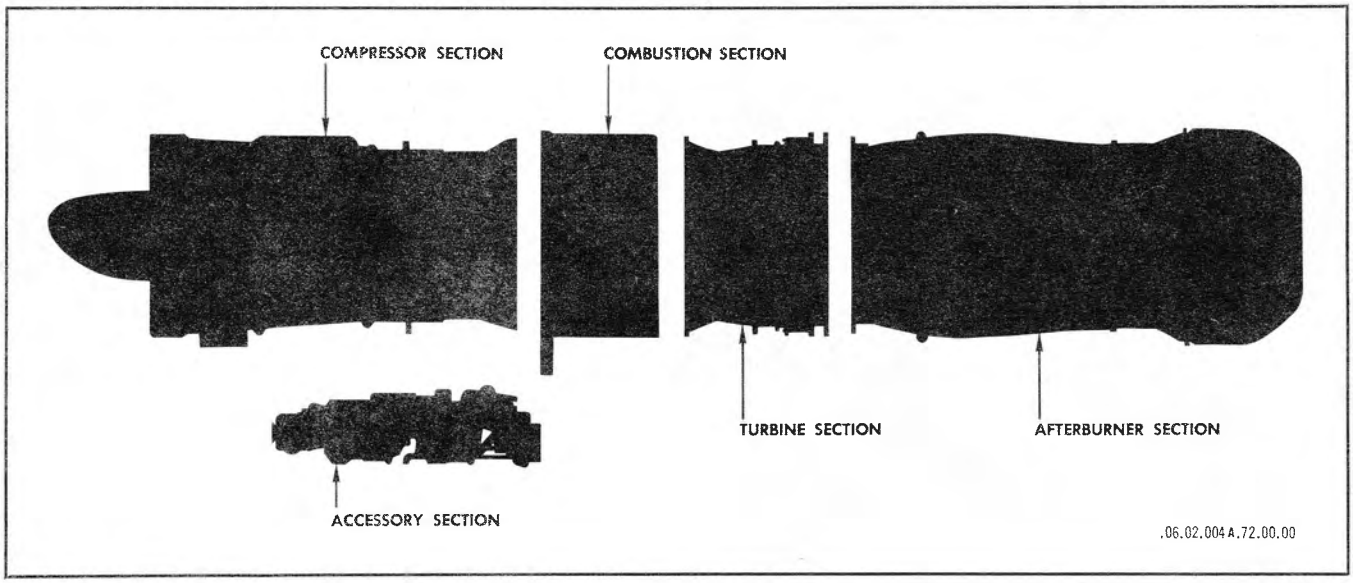


Figure 1-3. Engine Sections

stage turbine wheels. The N_2 compressor is connected to the first stage turbine wheel by a hollow shaft that encircles the inner shaft. Each rotor assembly is free to rotate at its optimum speed. The engine starter is connected only to the N_2 compressor rotor, thereby reducing the required size of the starter system. The forward accessory drive section is mounted on the forward face of the compressor inlet guide vane and shroud center support. This accessory section is not used on F-106 type airplanes. Lubrication lines for the compressor front bearing are routed through the inlet guide vanes.

1-5. COMBUSTION SECTION.

The combustion section is of the can-annular configuration with eight cylindrical combustion chambers (cans). The separate combustion chambers are supported by the nozzle clusters of the fuel manifold at the front and by the exit duct at the rear. Cross-over tubes located on each side of the combustion chambers serve as flame connectors. Ignition sparkigniters are inserted into the forward end of the No. 4 and 5 combustion chambers. A one-piece cylindrical combustion chamber outer case completely encloses this section.

1-6. TURBINE SECTION.

The turbine section consists of the turbine front bearing support, turbine nozzle case, compressor drive turbine assembly, and the turbine exhaust case. The compressor drive turbine assembly consists of three stages. The first stage drives the N_2 compressor; the second and third stages drive the N_1 compressor. In each stage of the turbine, a nozzle ring precedes the turbine wheel. The force of the combustion gases being routed against the turbine rotors causes the rotors to turn and drive the compressors. The gases continue traveling aft into the afterburner diffuser section of the engine.

1-7. AFTERBURNER SECTION.

The afterburner section consists of the afterburner diffuser, afterburner duct, and the variable area two-position exhaust nozzle assembly. The afterburner diffuser section of the engine contains 24 equally spaced spray nozzles located radially around the inner diameter of the diffuser section and three concentric flameholders. Metered fuel from the afterburner fuel control is routed to the spray nozzles during afterburning. Due to temperature limitations, only a relatively small amount of the air entering the engine can be used for combustion ahead of the turbine. There remains a large amount of unused oxygen in the air aft of the turbine section. The injection of metered fuel from the afterburner spray nozzles and the subsequent ignition produces additional thrust. The exhaust nozzle assembly is composed of iris type shutters, which are operated by pneumatic actuating cylinders. The pneumatic cylinders are mounted around the outer diameter of the afterburner duct, and are actuated by compressor bleed air from the exhaust nozzle control valve. During normal engine operation, the cylinders hold the nozzle iris in the closed position. When afterburning occurs, the cylinders open the nozzle to permit the less restricted passage of engine and afterburning gases.

1-8. ACCESSORY SECTION.

The accessory section is located at the bottom of the engine at the "wasp waist" or smallest engine diameter. Components mounted in the N_2 accessory section area are the oil pump and accessory drive housing, fuel pressurizing and dump valve, fuel pump, main fuel control unit, afterburner fuel control unit, and the exhaust nozzle control. The two hydraulic pumps, engine starter, and constant-speed drive system engine mounted gearbox are installed on the forward face of the oil pump and

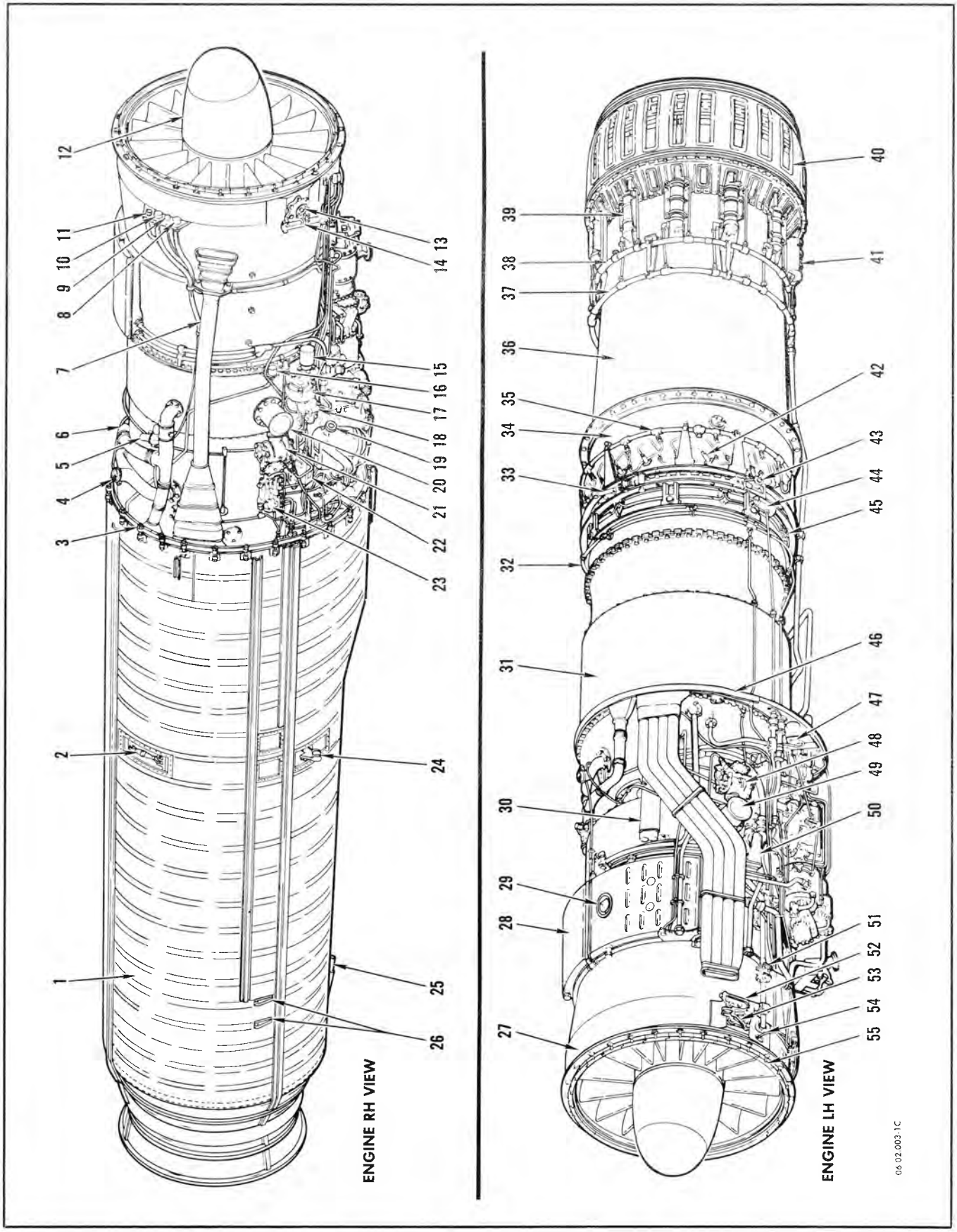
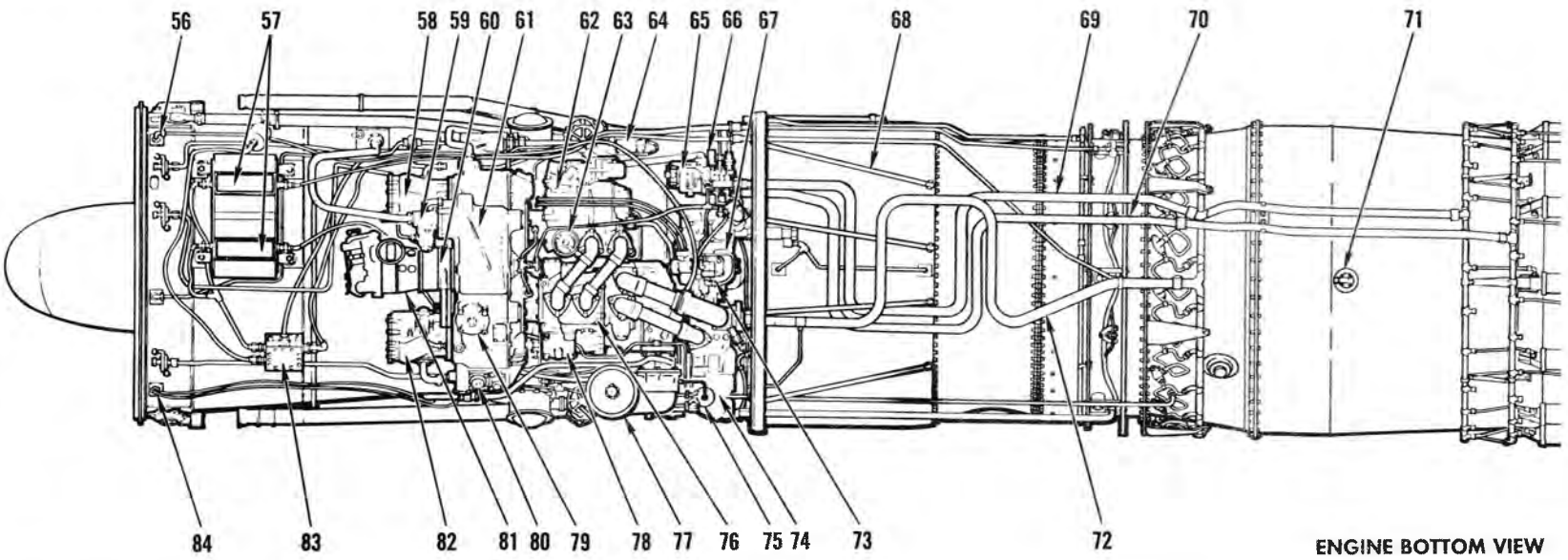


Figure 1-4. Engine Assembly (Sheet 1 of 2)



1. ENGINE SHROUD
2. AFT RIGHT ENGINE MOUNT TURNBUCKLE
3. SHROUD TO FIREWALL ADAPTER RING
4. N_2 COMPRESSOR BLEED AIR MANIFOLD
5. ENGINE GROUND COOLING AIR VALVE
6. ENGINE GROUND COOLING AIR DUCT
7. ENGINE RAM AIR COOLING DUCT
8. P & W ELECTRICAL DISCONNECT
9. EXHAUST TEMPERATURE ELECTRICAL DISCONNECT
10. CONVAIR ELECTRICAL DISCONNECT
11. FUEL TEMPERATURE SENSING ELECTRICAL DISCONNECT
12. NOSE CONE
13. THRUST MOUNT
14. RIGHT FORWARD ENGINE ROLLER BRACKET
15. N_1 COMPRESSOR OVERSPEED WARNING SWITCH
16. SHROUD DIFFERENTIAL PRESSURE SWITCH
17. N_1 ACCESSORY SECTION
18. ANTI-SURGE BLEED GOVERNOR
19. ENGINE FUEL INLET
20. RIGHT ANTI-SURGE BLEED VALVE
21. RIGHT ANTI-SURGE BLEED VALVE ACTUATOR
22. RIGHT IGNITION COMPOSITOR
23. AFTERBURNER IGNITER VALVE
24. AFT RIGHT ENGINE ROLLER BRACKET
25. COOLING SHROUD AFT DRAIN
26. COOLING SHROUD AFT RIGHT SUPPORT BRACKETS
27. COMPRESSOR INLET VANE ASSEMBLY
28. ENGINE OIL TANK
29. ENGINE OIL TANK FILLER
30. FUEL-OIL COOLER
31. ENGINE BURNER SECTION OUTER CASE
32. EXHAUST PRESSURE SENSE MANIFOLD
33. AFT LEFT ENGINE MOUNT TURNBUCKLE
34. AFTERBURNER DIFFUSER SECTION
35. AFTERBURNER FUEL MANIFOLD
36. AFTERBURNER DUCT
37. EXHAUST NOZZLE "CLOSED" PNEUMATIC MANIFOLD
38. EXHAUST NOZZLE "OPEN" PNEUMATIC MANIFOLD
39. EXHAUST NOZZLE ACTUATOR (12)
40. EXHAUST NOZZLE ASSEMBLY
41. EXHAUST NOZZLE ACTUATOR SHIELD (12)
42. AFTERBURNER FUEL NOZZLE (24)
43. AFT LEFT ENGINE ROLLER BRACKET
44. NO. 6 BEARING OIL STRAINER
45. EXHAUST TEMPERATURE SENSING PROBE (6)
46. FIREWALL
47. IGNITION SPARK IGNITER (2)
48. LEFT ANTI-SURGE BLEED VALVE ACTUATOR
49. LEFT ANTI-SURGE BLEED VALVE
50. FUEL FLOWMETER
51. ENGINE ANTI-ICE AIR VALVE
52. FORWARD LEFT ENGINE ROLLER BRACKET
53. FORWARD LEFT ENGINE MOUNT
54. FUEL CONTROL INLET PRESSURE SENSING PROBE
55. INLET SEAL ASSEMBLY
56. FUEL CONTROL TEMPERATURE SENSING BULB
57. IGNITION TRANSFORMERS
58. PRIMARY HYDRAULIC PUMP
59. ENGINE MAIN OIL PUMP
60. CONSTANT SPEED DRIVE ENGINE MOUNTED GEARBOX
61. N_2 ACCESSORY SECTION
62. MAIN FUEL CONTROL UNIT
63. MAIN FUEL CONTROL FILTER
64. LEFT IGNITION COMPOSITOR
65. EXHAUST NOZZLE CONTROL UNIT
66. EXHAUST NOZZLE CONTROL SELECTOR VALVE
67. FUEL PRESSURIZING AND DUMP VALVE
68. FIREWALL LOWER SECTION BRACKET ROD (4)
69. EXHAUST NOZZLE "CLOSED" PNEUMATIC LINE
70. EXHAUST NOZZLE "OPEN" PNEUMATIC LINE
71. FUEL DRAIN
72. AFTERBURNER FUEL LINE
73. EXHAUST NOZZLE CONTROL CONVERTER VALVE
74. AFTERBURNER FUEL CONTROL UNIT
75. FUEL PRESSURE SWITCH
76. FUEL PUMP
77. FUEL STRAINER
78. FUEL PUMP STRAINER
79. ENGINE MAIN OIL STRAINER
80. OIL BREATHER AND PRESSURIZING VALVE
81. STARTER
82. SECONDARY HYDRAULIC PUMP
83. P & W JUNCTION BOX
84. ANTI-SURGE BLEED GOVERNOR TEMPERATURE SENSING BULB

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Figure 1-4. Engine Assembly (Sheet 2 of 2)

accessory drive housing. The engine starter is geared through the oil pump and accessory drive housing to the N_2 compressor rotor by interconnecting shafts. These interconnecting shafts, in turn, transmit power from the N_2 rotor to the oil pump and accessory drive housing for driving the engine accessories during engine operation. The N_2 accessory drive adapter is bolted to the lower right side of the compressor intermediate case. The N_1 accessory section is installed on the lower right-hand side of the engine adjacent to the N_2 accessory section. The compressor bleed valve governor is mounted on this accessory section. Power for driving the N_1 accessory section is taken from the aft end of the N_1 compressor rotor.

1-9. ENGINE INSTRUMENT SYSTEMS AND RELATED EQUIPMENT.

For a description of engine indicating units not found in the following list, refer to system descriptions in the various sections of this manual. Refer to T. O. 1F-106A-2-9 for instrument and indicating systems maintenance information.

ITEM	LOCATION	FUNCTION
Tachometer Indicator.	Pilot's panel.	To provide pilot with an indication of N_2 compressor rpm.
Pressure Ratio Indicator.	Pilot's panel.	To provide pilot with an indication of engine thrust output.
Exhaust Temperature Indicator.	Pilot's panel.	To provide pilot with an indication of engine exhaust gas temperature.
Fuel Flow Indicator.	Pilot's panel.	To provide pilot with an indication of the fuel consumption of the engine.
N_1 Compressor Overspeed Warning Light.	Master warning panel.	To provide pilot with an indication of N_1 compressor overspeed.
Engine Oil Pressure Indicator.	Pilot's panel.	To provide pilot with an indication of engine oil pressure.
Engine Oil Low-Pressure Warning Light.	Master warning panel.	To provide pilot with a warning indication of low engine oil pressure.
Variable Ramp Not Retracted Warning Light.	Pilot's panel.	To provide pilot with an indication that the ramps are not fully retracted.
Fire and Overheat Detection Warning Light and Test Switch.	Pilot's Panel.	To provide pilot with a warning indication of fire or overheat conditions around the engine.

1-10. ENGINE EXHAUST TEMPERATURE INDICATING SYSTEM.

The engine exhaust temperature indicating system consists of six alumel-chromel thermocouples installed in the engine exhaust duct, an indicator on the pilot's main instrument panel on F-106A airplanes, a calibrating resistor, and a connecting electrical circuit. On F-106B airplanes two indicators are incorporated, one on the forward instrument panel, and one on the aft instrument panel. The thermocouples sense exhaust temperature and send electrical signals to the indicator which registers the exhaust temperature in degrees centigrade. A calibrating resistor is used to calibrate the circuit whenever any component is replaced. The resistor is mounted on the structural member forward of the instrument panel, on the right side of the fuselage at sta. 118.0. Whenever an engine is replaced, the circuit must be recalibrated since resistance of the thermocouple loop circuit incorporated in the replacement engine may differ. For the system calibration procedure and additional system information, refer to T.O. 1F-106A-2-9.

1-11. FUEL FLOW INDICATING SYSTEM.

The fuel flow indicating system indicates the rate of fuel flow to the engine in pounds per hour. The system consists of a fuel flow indicator, a fuel flow meter (transmitter), and connecting electrical leads. The indicator is located on the pilot's main instrument panel on

F-106A airplanes, and on the forward and aft main instrument panels on F-106B airplanes. The flowmeter is mounted on the outlet side of the fuel control unit on the engine. All fuel entering the engine except afterburning fuel, passes through the flow meter. The flowmeter incorporates a vane and hub assembly, an ac synchro transmitter, and a magnetic coupling device. The rate of fuel flow is transmitted from the vane and hub assembly to the synchro transmitter by the magnetic coupling. For additional information on this system, refer to T.O. 1F-106A-2-9.

1-12. TACHOMETER SYSTEM.

The tachometer system is provided to indicate the speed of the airplane engine high-pressure (N_2) compressor in percent of rated rpm. The system consists of a tachometer and a tachometer generator. On F-106A airplanes, the tachometer indicator is located on the pilot's main instrument panel. F-106B airplanes incorporate two indicators, one on the forward main instrument panel, and one on the aft main instrument panel. The indicator is remotely positioned by the tachometer generator mounted on the aft left side of the N_2 accessory drive gear train. The output of the generator is directly proportional to the speed of the engine N_2 compressor. The tachometer indicates engine speed from 0 to 110%. The rated rpm varies with each engine and is stamped on the engine data plate. For additional information on this system, refer to T.O. 1F-106A-2-9.

1-13. ENGINE PRESSURE RATIO INDICATING SYSTEM.

The engine pressure ratio indicating system indicates the ratio of exhaust pressure to pitot (ram air) pressure. The pressure ratio indicating system consists of an engine pressure probe, a pressure ratio transmitter in the nose wheel well, a pressure ratio indicator in the cockpit, and connecting tubing. The pressure ratio indicator is mounted on the pilot's main instrument panel on F-106A airplanes, and on the forward and aft main instrument panels on F-106B airplanes. Exhaust pressure is conducted from the engine pressure probe, through tubing, to the transmitter. Pitot pressure from the pitot-static system is also conducted to the transmitter where turbine discharge (engine exhaust) pressure is compared to pitot pressure. The indicator presents the ratio of exhaust-to-pitot pressure (thrust) on the face of the dial. Drains are provided in the system tubing on the aft bulkhead of the nose wheel well compartment. Frequent draining of the system at the drain points is mandatory, especially during cold weather operation. For draining procedures and additional information on this system, refer to T.O. 1F-106A-2-9.

1-14. ENGINE OIL PRESSURE INDICATING SYSTEM.

The engine oil pressure indicating system consists of a single indicator on the main instrument panel of the F-106A airplanes. On F-106B airplanes, separate indicators are installed on the forward and aft instrument panels. The system consists of the indicator in the cockpit, a pressure transmitter installed on the N_2 accessory section oil pressure port, and the connecting circuit. Electrical power is taken from the 26-volt instrument transformer located in the nose wheel well. Oil pressure is indicated by a single pointer on the instrument face, marked in 5 pound increments from 0 psi to 100 psi. For additional information on this system, refer to T.O. 1F-106A-2-9.

1-15. OIL LOW-PRESSURE WARNING SYSTEM.

The oil low-pressure warning system is provided to give the pilot an indication of low engine oil pressure. The system consists of an oil pressure warning light on the warning indication panel and a pressure switch in the engine accessory gear case oil pressure port. On F-106A airplanes, the indicator is installed on the warning indication panel on the right side of the cockpit. F-106B airplanes have two warning indication panels; one below the forward main instrument panel, and one below the aft main instrument panel. The oil low-pressure warning switch is set to extinguish the warning light on an increasing pressure of 40 psi maximum, and to illuminate the light on a decreasing pressure of 37(±2) psi.

1-16. VARIABLE RAMP NOT RETRACTED WARNING SYSTEM.

Applicable to F-106A airplanes 57-246 thru 59-058. Applicable to F-106B airplanes 57-2516 thru 58-904. An amber warning light, placarded "VARIABLE RAMP NOT RETRACTED," is located on the pilot's main instrument panel *on F-106A airplanes*, and on the forward instrument panel only *on F-106B airplanes. On F-106A airplanes 56-453, -454, 56-456 thru 57-245, 59-059 and subsequent, and on F-106B airplanes 57-2508 thru 57-2515, 59-149 and subsequent,* the ramp position warning light is located on the Master Warn Panel. The light illuminates to indicate that the variable ramps have not retracted. Retraction normally occurs when the airplane decelerates to below Mach 1.20. During emergency operation, the light will remain illuminated until the ramps have fully retracted. The warning light receives 28-volt dc power from the essential bus through a 5-ampere circuit fuse in the cockpit left fuse panel. Power is directed to the warning light when the variable ramp control unit deenergizes a ramp position warning light relay. With the ramp position relay deenergized, electrical power is free to pass through the variable ramp retract limit switch to the warning light if the switch is still in the extended position. The ramp position warning light relay is installed on the right side of the nose wheel well compartment. The variable ramp not retracted warning light is a push-to-test type light. The variable ramp not

retracted warning system is an integrated part of the variable ramp control circuit. Refer to T.O. 1F-106A-2-9 for additional information on this system.

1-17. FIRE AND OVERHEAT DETECTION SYSTEM.

The fire and overheat detection system warns the pilot of fire or overheat conditions around the engine. The pilot receives visual indication of this condition when the "FIRE" warning light illuminates. The light is on the pilot's instrument panel *on F-106A airplanes,* and on the forward and aft instrument panels *on F-106B airplanes.* The system operates on electrical power from the 28-volt dc essential bus through the 5-ampere "FIRE & OVERHEAT WARN" fuse in the main wheel well fuse panel. Power for testing the system originates from the 28-volt dc essential bus through the "FIRE & OVERHEAT TEST" fuse in the cockpit right fuse panel *on F-106A airplanes,* and in the cockpit right forward fuse panel *on F-106B airplanes.*

1-18. *Applicable to F-106A airplanes 57-246 thru 57-2465, and F-106B airplanes 57-2516 thru 57-2522.* The fire detection system consists of an overheat detect loop, a fire detect loop, an overheat detector, a fire detector, an overheat detector flasher, an overheat detect relay, a fire detect relay, a test switch, and the "FIRE" warning light. The "FIRE" warning light is connected to the master warning dimming relay for dimming purposes. The fire detect loop is installed around the inner perimeter of the fuselage in the engine section. The overheat loop is installed around the inner perimeter of the fuselage in the afterburner section. When an overheat condition exists, the overheat detect loop completes a circuit through the overheat detector to the overheat detector flasher. The overheat detector flasher, in the right missile bay, itermittently illuminates the "FIRE" warning light. A fire condition is detected in a similar manner. When a fire condition exists the fire detect loop completes a circuit through the fire detector directly to the "FIRE" warning light. Under fire conditions the warning light illumination is steady. The fire and overheat detection system test switch is on the pilot's instrument panel *on F-106A airplanes,* and on the forward instrument panel *on F-106B airplanes.* The test switch is normally positioned in the "OFF" position. When the test switch is placed in the "OVERHEAT" position, the overheat detect relay is energized and the "FIRE" warning light flashes on and off. When the test switch is placed in the "FIRE" position, the fire detect relay is energized and "FIRE" warning light is steadily illuminated.

1-19. *Applicable to F-106A airplanes 56-453, -454, 56-456 thru 57-245, 57-2466 and subsequent, and F-106B airplanes 57-2508 thru 57-2515, 57-2523 and subsequent.* Fire and overheat detection is accomplished by a system incorporating two parallel detector loops (loop 1 and loop 2) installed around the inner perimeter of the fuselage. The detector loops surround the entire length of the engine. Included in the fire and overheat detection system with loop 1 and loop 2 is a detector control box for each loop, a test relay for each loop, and an induction relay for each loop. The system also consists of an overheat flasher, a fire warning relay, a test switch, and the "FIRE" warning light with a dimming switch. The "FIRE" warning light is the push-to-dim type. When an overheat condition exists in any area around the engine, but only severe enough to affect one loop, the "FIRE" warning light in the cockpit flashes on and off. In this condition, the detector loop affected completes a circuit through its detector control box and induction relay to the overheat flasher. The overheat flasher in the right missile bay then supplies intermittent electrical power to the warning light. If the overheat condition is severe enough to affect both loops, the flasher unit is bypassed and the "FIRE" warning light is steadily illuminated. The fire and overheat detection system test switch is on the pilot's instrument panel *on F-106A airplanes,* and on the forward instrument panel on *F-106B airplanes.* When the test switch is placed in either the "LOOP 1" or "LOOP 2" position, test relays are energized and the "FIRE" warning light will flash on and off. Refer to T.O. 1F-106A-2-10 for complete information on the fire and overheat detection system.

1-20. Engine Tools.

The following listed tools are manufactured by Pratt & Whitney Aircraft, East Hartford 8, Conn., and may be used for maintenance on J75 type engines.

NAME	TYPE AND STOCK NUMBER	USE AND APPLICATION
Guide	PWA-3095 (4920-169-8126)	Fuel pump drive shaft gear oil seal guide (large shaft).
Wrench	PWA-3626 (5120-095-3000)	Main oil screen check valve removal.
Sling	PWA-6580 (1730-696-6592)	Compressor rotor chamber outer case lifting.
Drift	PWA-6676 (5120-398-2911)	Starter drive and hydraulic pump drive face oil seal replacement.
Wrench	PWA-7025-2 (5120-303-0904)	Exhaust nozzle actuating cylinder rod end nut adjusting.

1-20. Engine Tools (Cont).

NAME	TYPE AND STOCK NUMBER	USE AND APPLICATION
Puller	PWA-7146 (5120-212-2474)	N_1 gear box oil seal housing, removal.
Truck	PWA-7355 (3920-037-5139)	Afterburner duct and nozzle support stand.
Adapter	HS-7355 (4920-653-8936)	Power assembly remote control adapter.
Sling	PWA-7356 (1730-294-3370)	Afterburner duct and nozzle assembly maintenance.
Burette Valve	PWA-7441 (4920-300-3856)	Fuel manifold pressure check tool.
Test Stand	PWA-8000 (4920-305-0197)	Main Fuel nozzle and afterburner manifold leak test stand.
Bracket — A/B Nozzle Lifting	PWA-8052 (4920-324-9583)	Afterburner nozzle replacement.
Indicator	PWA-8076 (4920-563-1347)	Turbine exhaust temperature test indicator.
Cover	PWA-9045 (4920-510-1234)	Main fuel nozzle cluster cover.
Puller	PWA-10008 (5120-511-1478)	Accessory drive oil seal housing replacement.
Bracket	PWA-10011 (1730-294-3143)	Afterburner duct and nozzle lifting brackets.
Guide	PWA-10012 (4920-693-8153)	Fuel control oil seal (small shaft) replacement.
Puller	PWA-10013 (5120-693-8154)	Afterburner flame holder tie rod replacement.
Wrench	PWA-10014 (5120-596-1196)	Main oil screen and spacer retaining nut replacement.
Wrench	PWA-10015 (5120-693-8155)	Oil pressure relief valve replacement.
Guide	PWA-10016 (4920-693-8156)	N_1 and N_2 tachometer shaft oil seal replacement.
Drift	PWA-10017 (5120-693-8157)	Fuel pump and fuel control oil seal replacement.
Base	PWA-10018 (4920-326-2011)	Fuel pump and fuel control oil seal replacement.
Wrench	PWA-10030 (5120-693-8158)	Fuel nozzle replacement.
Crimper	PWA-10031 (5120-693-8159)	Fuel nozzle tab lock installation.
Base	PWA-10034 (4920-506-3777)	N_2 tachometer drive oil seal replacement.
Drift	PWA-10035 (5120-511-1481)	N_2 tachometer drive oil seal replacement.
Clamp	PWA-10067 (4920-570-9005)	Fuel nozzle sealing replacement.
Seal	PWA-10067-D12 (4920-623-2829)	Neoprene seal for use with PWA No. 10067 (Excello fuel nozzle).
Seal	PWA-10067-D13 (4920-623-2830)	Neoprene seal for use with PWA No. 10067 (Delevan fuel nozzle).
Adapter	PWA-10068 (4920-570-9006)	Fuel manifold pressure check at engine.
Stand	PWA-10069 (4920-570-7384)	Afterburner nozzle actuation test stand.
Spreader	PWA-10077 (5120-570-7416)	Combustion chamber outlet duct clamp removal.
Collar	PWA-10080 (1730-555-4588)	Combustion chamber outer case lifting collar.
Drift	PWA-10226 (5120-534-0724)	Starter oil seal drift.
Drift	PWA-10228 (5120-534-0722)	Starter and hydraulic pump oil seal drift.
Wrench	PWA-10237 (5120-534-0719)	Anti-icing air tube retaining nut wrench.

1-20. Engine Tools (Cont).

NAME	TYPE AND STOCK NUMBER	USE AND APPLICATION
Puller	PWA-10290 (5120-592-6325)	Combustion chamber positioning pin puller.
Wrench	PWA-10318 (5120-541-6836)	Fuel manifold inlet adapter retaining nut wrench.
Support	PWA-10319 (5120-593-3564)	Fuel manifold inlet adapter retaining nut support.
Puller	PWA-10332 (5120-592-9079)	Main oil pump puller.
Fixture	PWA-10347 (4920-593-4099)	Main oil screen assembly fixture.
Puller	PWA-10392 (5120-593-9211)	Afterburner bypass fuel screen weldment puller.
Wrench	PWA-10480 (5120-610-6867)	Tube connecting nut spanner wrench.
Adapter	PWA-10518 (4920-611-2208)	Fuel manifold pressure test in diffuser case.
Adapter	PWA-10572 (4920-650-6272)	Fuel manifold pressure test in diffuser case.
Stand	PWA-10602 (4920-625-6851)	Fuel manifold pressure test in diffuser case.
Cap	PWA-10628 (4920-650-6311)	Fuel manifold pressure test in diffuser case.
Gage	PWA-10809 (5220 NSL)	First stage turbine blade stretch.
Spreader	PWA-10874 (5120-717-4818)	Combustion chamber outlet duct clamp removal.
Power Assembly	PWA-15180 (4920-589-9624)	Fuel control remote trimmer power assembly.
Adapter	PWA-15198 (4920-654-8433)	Power source cart adapter.

OPERATIONAL CHECKOUT

1-21. ENGINE STARTING DESCRIPTION.

WARNING

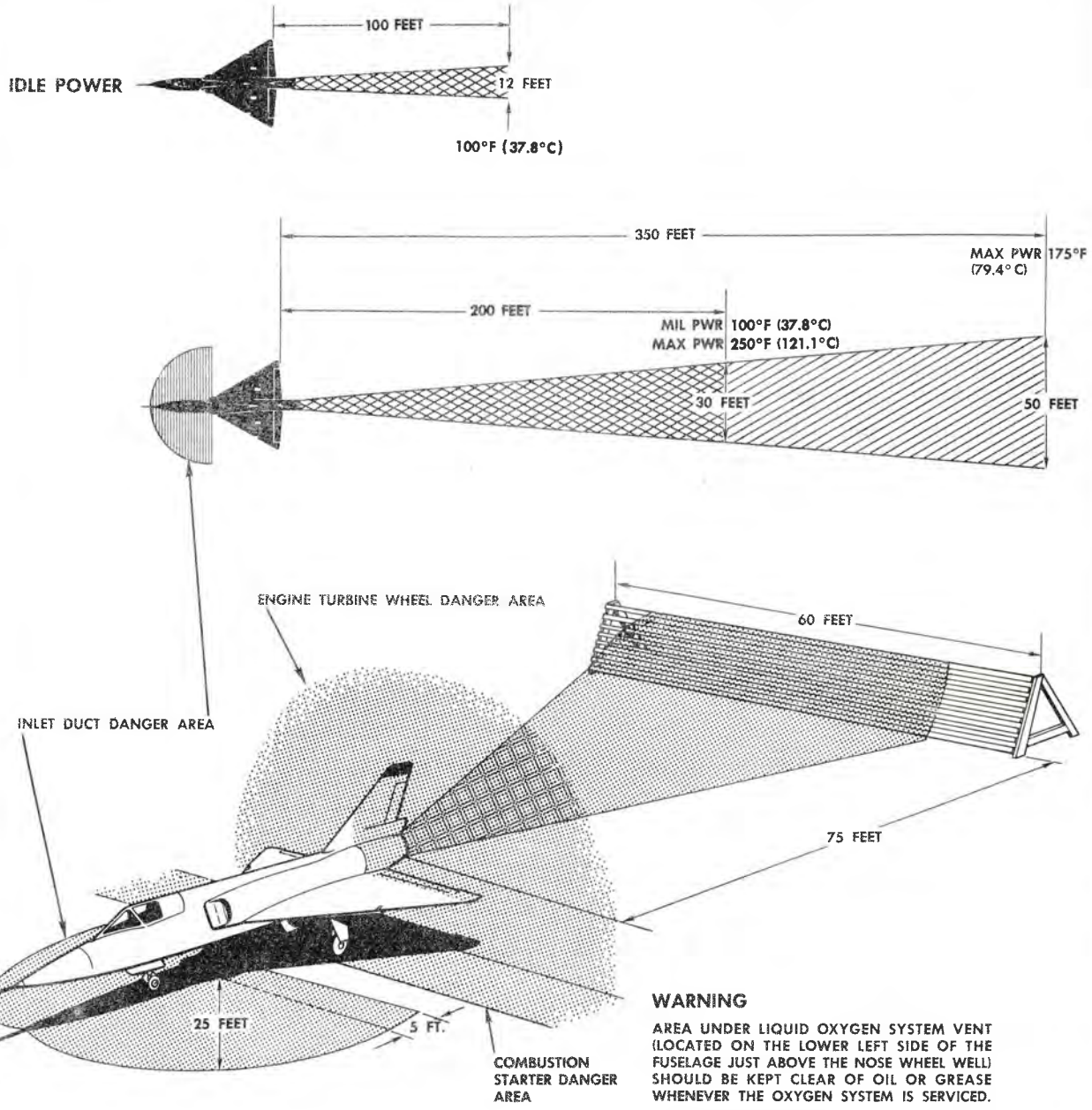
The areas around engine air intake ducts can be dangerous to ground personnel during engine runup due to suction of inrushing air. The area aft of the engine tailpipe is dangerous because of the high temperature and velocity of exhaust gases. These danger areas are illustrated in figure 1-5. The tailpipe area remains dangerous for at least 15 minutes after engine shutdown, and particularly when smoke or vapors are apparent.

During the engine starting procedure, care must be exercised to correctly operate the starter, ignition, and throttle controls to successfully complete the engine start. Actuation of the combustion starter is initiated by first depressing the ignition button and holding. The throttle lever is then moved to the "START" position. This action opens the starter air solenoid valve permitting air rotation of the starter to begin. Engine and starter ignition is also armed at this time. With the ignition button still depressed, the throttle is moved to the "OFF" position, then to "IDLE." The throttle movement during engine start is to be one continuous motion with no hesitation at the "OFF" position. Movement of the throttle from "START" to "IDLE" actuates the starter and engine ignition systems and permits fuel to be injected into the engine combustion chambers. Operation of the starter will continue as long as the ignition button is depressed, or until the starter fuel accumulator fuel supply is depleted, or upon actuation of the starter overspeed switch.

CAUTION

Adequate starter cooling periods must be observed at all times. Refer to paragraph 1-26 for combustion starter duty cycle limitations.

In the event the ignition button is momentarily released, when the throttle is between 'OFF" and "IDLE," and an engine lightoff has not been attained, return the throttle



NOTE

IF BLAST DEFLECTOR IS NOT AVAILABLE, AREA MUST BE CLEAR AT LEAST 350 FEET BEHIND THE AIRPLANE.

WARNING

AREA UNDER LIQUID OXYGEN SYSTEM VENT (LOCATED ON THE LOWER LEFT SIDE OF THE FUSELAGE JUST ABOVE THE NOSE WHEEL WELL) SHOULD BE KEPT CLEAR OF OIL OR GREASE WHENEVER THE OXYGEN SYSTEM IS SERVICED.

ENGINE VARIABLE INLET RAMP EMERGENCY OPERATION WILL EJECT HYDRAULIC FLUID WITH CONSIDERABLE FORCE FROM AN OVERBOARD DRAIN LINE LOCATED UNDER THE LEFT HAND ENGINE INTAKE DUCT.

THE ENGINE BLEED AIR DISCHARGE DUCTS (LOCATED ON THE LEFT AND RIGHT FUSELAGE SIDES ABOVE THE WINGS) DISCHARGE HOT AIR DURING ENGINE OPERATION.

KEEP CLEAR OF AREA 10 FEET FORWARD AND AFT OF MAIN LANDING GEAR UNTIL COMBUSTION START HAS BEEN COMPLETED.

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Figure 1-5. Danger Areas

lever to the "OFF" position. This action will prevent additional fuel from being injected into the engine combustion section. Ignition cannot be reinitiated without performing the complete starting procedure from the beginning. After returning the throttle to the "OFF" position, do not attempt another start until fuel drainage from the engine combustion chamber drain has ceased. If there is no fuel drainage from the engine at this time, check and correct cause of this malfunction.

1-22. J-75 ENGINE GROUND RUN COMPRESSOR STALLS.

Compressor stalls during ground run operation, commonly referred to as "off idle stalls," sometimes occur within the idle to military power range of operation. Rapid movement of the throttle within this operating range should not induce a stall due to the action of an acceleration cam in the fuel control. However, it is possible to induce compressor stall by inadvertent switching of the engine fuel control system from "EMER" to "NORMAL" during engine high rpm operation.

CAUTION

After operational check of the engine emergency fuel system, reduce engine rpm to idle before switching fuel system to "NORMAL."

In the event that a compressor stall is encountered, the engine will usually accelerate through and out of the stall with minor temperature fluctuations. Should engine operation temperature limits be exceeded, it will be necessary to visually check the engine as outlined in paragraph 1-33. Should an over-temperature condition continue to be encountered during stalls, it is recommended that the fuel control be replaced.

1-23. ENGINE OPERATIONAL CHECKOUT AND TESTING.

It will be necessary to conduct an operational check of the engine after completion of engine component replacement and maintenance. The type of operational checkout required for components that have been replaced is shown in the following chart.

ENGINE COMPONENTS REPAIRED OR REPLACED	OPERATIONAL TEST REQUIRED
Exhaust nozzle actuating cylinders. Exhaust nozzle linkage adjustment.	Conduct afterburner operational check. Conduct engine trim check using external gage.
Exhaust nozzle control valve. Exhaust nozzle control selector valve. Exhaust nozzle control converter valve. Afterburner igniter control unit. Afterburner fuel control unit.	Conduct afterburner operational check.
Afterburner or complete engine replacement.	Conduct complete engine ground run check and trim procedures. Use external gage for trim check.
Afterburner fuel spray nozzle. combustion chamber liners. Main fuel system manifold. Main fuel nozzles. Turbine nozzle guide vanes (first stage).	Conduct complete engine ground run check procedure.
Electrical junction boxes. Electrical harnesses.	Conduct afterburner operational check. Check anti-icing controls. Conduct emergency fuel system operation check.
Fuel flowmeter.	Conduct complete engine ground run check procedure.
Main fuel control unit. Fuel pump. Fuel pressurizing and dump valve.	Conduct engine trim procedure using external gage. Conduct emergency fuel system operational check. Conduct afterburner operational check.
Ignition transformers. Indicating systems (harness, transmitters, or probes). Oil strainer.	Conduct engine ground run check procedure.
Oil coolers.	Run engine. Check for leaks.
Engine starter.	Conduct engine start.

1-24. Equipment Requirements.

FIGURE	NAME	TYPE	ALTERNATE	USE AND APPLICATION
1-6.	Airplane Restraining Bridle.	SE 0583-801 (1730-651-0315)		To secure airplane for engine ground run.
	Wheel Chocks.	P/N 42D6594-2 (1730-294-3695)		To chock main landing gear wheels.
	Wheel Chocks.	P/N 50D6602 (1730-268-9822)		To chock main landing gear wheels during ice and snow conditions.
1-6	Engine Inlet Duct Screens.	8-96176-1-2 -1(1730-650-1413)		To prevent foreign material from entering ducts during engine ground run.
		-2(1730-646-8903)		
Refer to T.O. 1F-106A-2-3	High-Pressure Air Compressor.	MC-11 (4310-541-7060)	SE 0704-801 (4310-697-0858)	To provide air for combustion starter operation.
Refer to T.O. 1F-106A-2-10	Generator Set (Gas).	8-96026-801 AF/M32A-13 (6115-583-9365)	8-96026 AF/M32M-2 (6115-617-1417)	To energize electrical systems on aircraft equipped with special quick disconnect receptacle.
	Generator Set (Elec).	8-96025-803 (6125-583-3225)	8-96025-805 A/M24M-2 (6125-623-3566)	
			8-96025 AF/M24M-1 (6125-620-6468)	
	Generator Set.		MC-1 (6125-500-1190)	To energize electrical systems (except AWCIS) on aircraft equipped with standard AN receptacle and on others by using adapter cable 8-96052.
			MD-3 (6115-635-5595)	
	Adapter Cable.	8-96052 (6115-557-8548)		To connect MC-1 and MD-3 units to aircraft equipped with special quick disconnect receptacle.
	Fire-fighting Equipment.			Fire extinguishing agent in case of fire.
	Intercommunication Equipment.			For contact from cockpit to ground observers.

1-25. Preparing and Securing Airplane for Ground Run.

The following procedure is recommended for preparing and securing the airplane for ground run:

a. Park airplane on hard surfaced area with nose of airplane into the wind; airplane must be located so that other parked airplanes are not blasted during run-up; check that area around airplane is free of foreign objects.

WARNING

Danger areas around the engine intake and discharge ducts must be kept clear of all personnel, vehicles, loose gear, stones, hardware, stands, etc. Refer to figure 1-5 of this manual for an illustration of danger areas.

b. Secure airplane to an approved engine runup anchor, using the airplane restraining bridle, SE 0583-801 secured to the attachment rings on the main landing gear. See figure 1-6 for an illustration of engine ground run preparation procedure.

CAUTION

Prior to starting engine, assure that all slack has been removed from restraining bridle and that main landing gear wheel chocks are in place, fore and aft. Engine power must not, under any circumstances, be used to remove the slack from the restraining bridle.

c. Check all logs and records to see that work on previous flight discrepancies has been completed.

d. Check the following ballistic ejection systems for installation of safety pins or deactivation of systems:

1. Cockpit canopy. (Refer to T.O. 1F-106A-2-2)
2. Pilot's seat ejection. (Refer to T.O. 1F-106A-2-2)
3. Armament system. (Refer to T.O. 1F-106A-2-12)
4. External fuel tanks. (Refer to T.O. 1F-106A-2-5)

e. Check that landing gear safety pins are installed.

f. Check that landing gear control handle is in the "DOWN" position.

g. Check that tail hook safety pin is installed.

h. Check that fire-fighting personnel and equipment are on hand and ready for engine start.

i. Remove all plugs and covers from engine air inlet and discharge ducts.

j. Check skin fasteners, etc., in vicinity of engine inlet for security; check that all ducts are free of foreign objects, dirt, oil, etc., and that ducts are not cracked or damaged; check ramps for security and fully retracted position. Perform foreign object damage (FOD) check as follows:

NOTE

A thorough check of engine air inlet ducts for foreign objects is required prior to engine start to minimize the probability of engine sustaining foreign object damage.

1. Upon entering either left or right air inlet duct, first check the forward opening of the vari-ramp panel. This complete area may be visually checked with a flashlight and mirror. Pay special note to the two attached hinge points on the inboard side of the area. The hinge points, upper and lower, form a pocket where hardware may lie undetected. Adjacent to the hinge points several gussets are installed, one above the other, where hardware may accumulate.

2. As you move into the inlet duct, stop at the aft slot in the vari-ramp panel. This is a critical area. At this point, it is almost impossible to visually check forward and aft while entering the duct. Continue down the duct and visually check the horizontal stiffeners.

3. Proceed down the duct to the engine, reverse your position and come out the same duct and visually check aft along the inside of the panel. In this position most areas can be observed.

4. Go back to the scroll duct and visually inspect the area. There are corners of the shelf areas in the scroll duct structure which cannot be seen and must be inspected through the scroll access doors.

5. Using a rawhide or rubber mallet, tap the scroll area directly overhead where the left and right scrolls join together to dislodge any hardware from the flat area. This will cause objects to roll down the scroll where they can be picked up and removed.

6. Tap along the angles, down from the center line of the scrolls. Hardware will lodge along structural rivets and hang until dislodged by some disturbance. This is very critical due to the closeness of the engine. Any piece of hardware dislodged must be located, making sure it did not come through the scroll pores and roll into the engine. Proceed out the opposite intake duct and inspect areas outlined in steps (1) and (2).

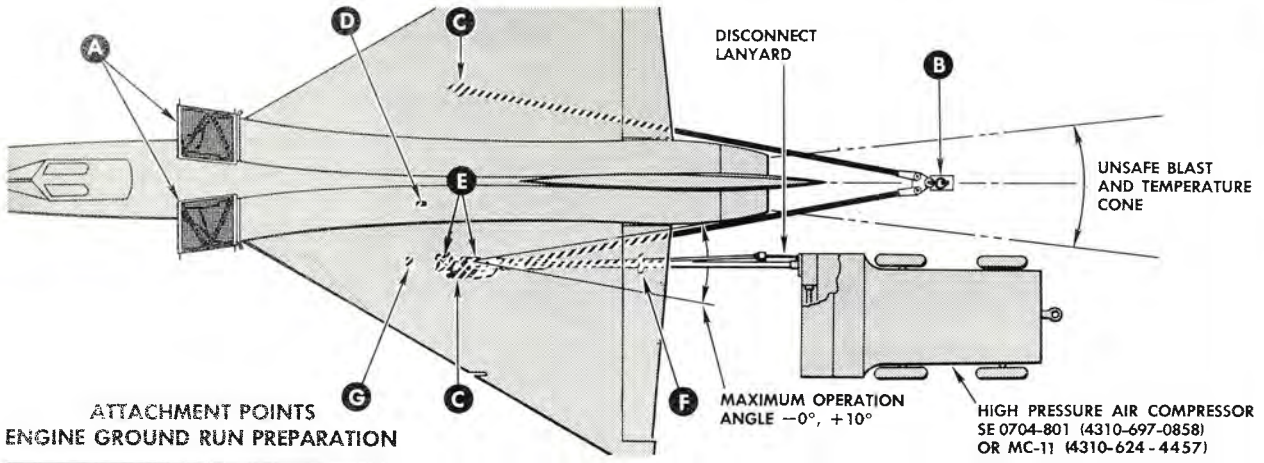
k. *Applicable to F-106A airplanes,* close left and right upper aft electronic compartment doors; secure all stressed panel fasteners.

l. Install engine air inlet duct screens. See figure 1-6 for this procedure.

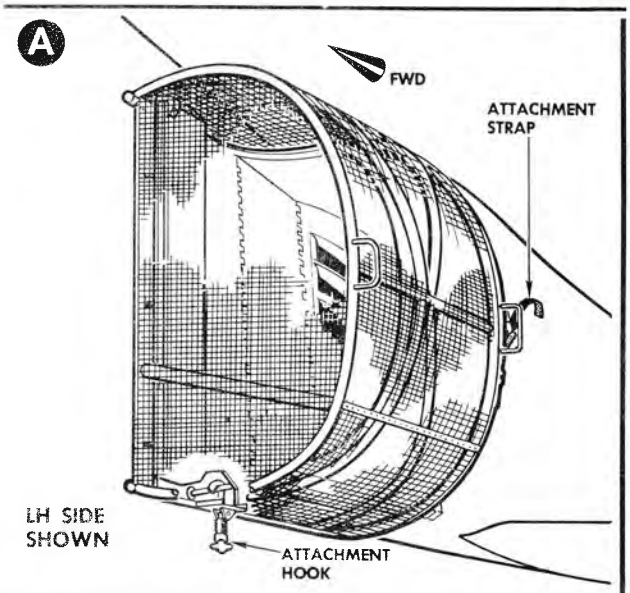
WARNING

Inlet screens must be installed for engine run. Do not install or remove screens with engine running.

m. Check airplane for proper fuel servicing. Refer to T.O. 1F-106A-2-5 for this procedure.



ATTACHMENT POINTS
ENGINE GROUND RUN PREPARATION



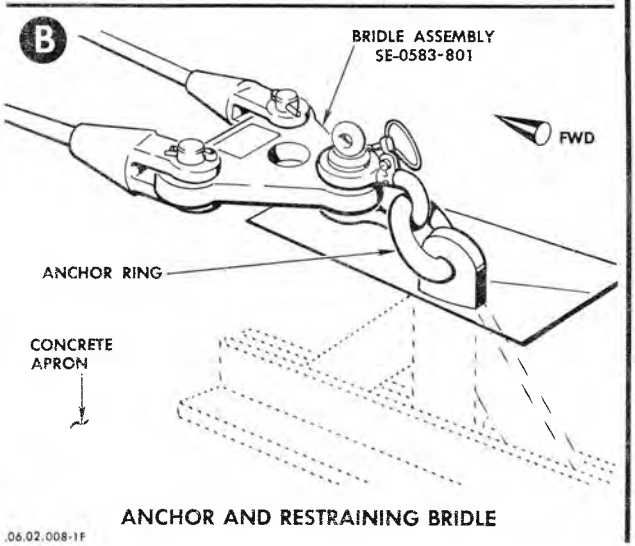
ENGINE AIR INLET DUCT SCREENS 8-96176-1-2

CAUTION

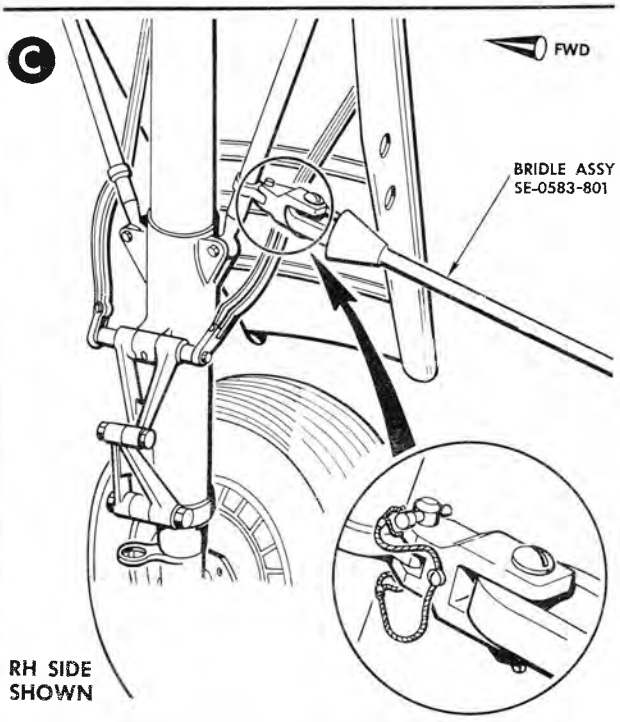
ASSURE THAT THERE IS NO SLACK IN THE RESTRAINING CABLE AND THAT WHEEL CHOCKS ARE IN PLACE, FORE AND AFT, PRIOR TO STARTING ENGINE.

NOTE

BESLER PART 56380-1 IS APPLICABLE TO F-106A AIRPLANES 57-246 THRU 58-086, AND F-106B AIRPLANES 57-2516 THRU 58-904 PRIOR TO INCORPORATION OF TCTO 1F-106-647. BESLER PART 56380-3 IS APPLICABLE TO F-106A AIRPLANES 56-453, -454, 56-456 THRU 57-245, 59-087 AND SUBSEQUENT; AND 57-246 THRU 59-086 AFTER INCORPORATION OF TCTO 1F-106-647. APPLICABLE TO F-106B AIRPLANES 57-2508 THRU 57-2515, 59-149 AND SUBSEQUENT; AND 57-2516 ,THRU 58-904 AFTER INCORPORATION OF TCTO 1F-106-647.



ANCHOR AND RESTRAINING BRIDLE



MAIN GEAR TYPICAL ATTACHMENT

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Figure 1-6. Engine Ground Run Preparation (Sheet 1 of 2)

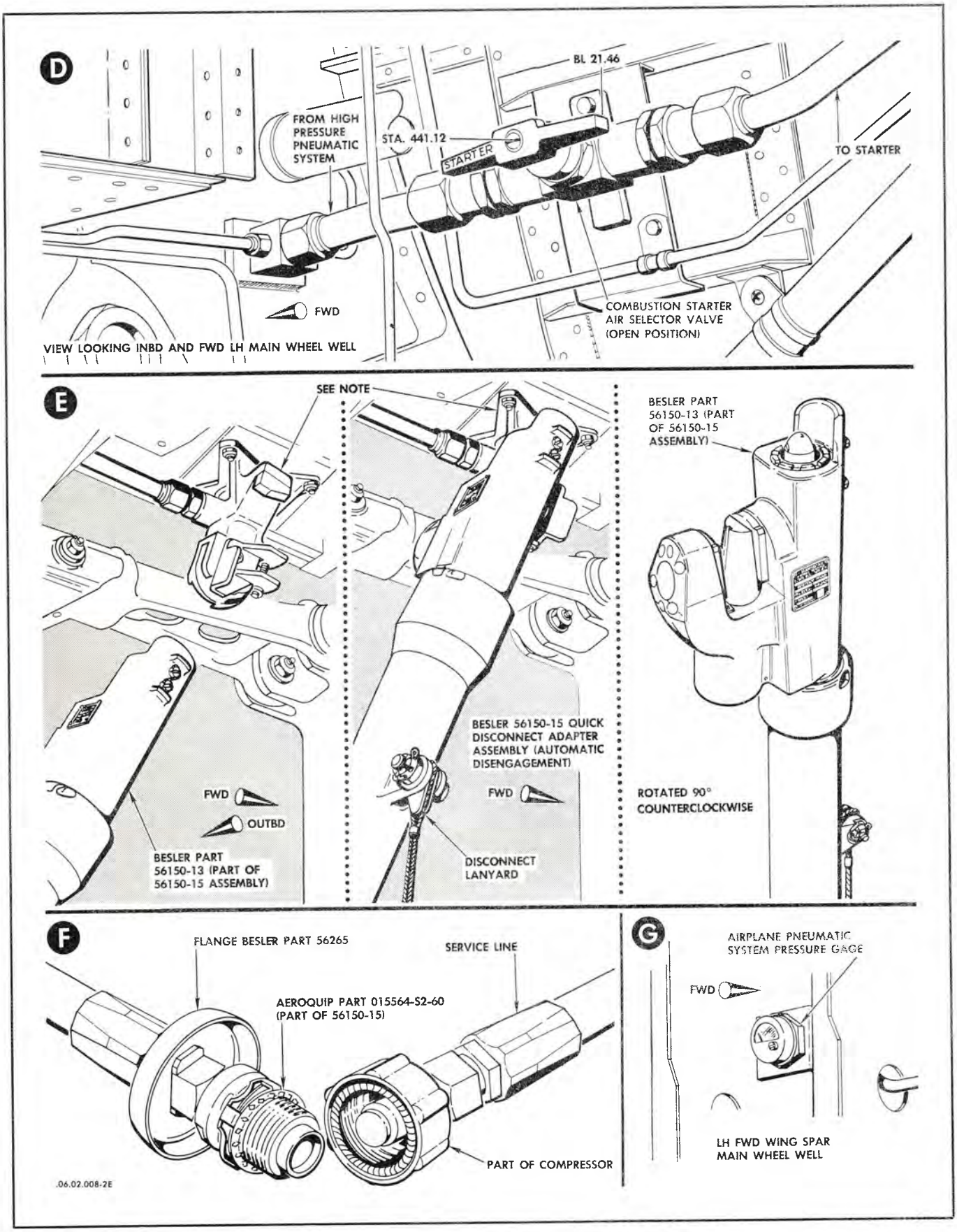


Figure 1-6. Engine Ground Run Preparation (Sheet 2 of 2)

NOTE

It is permissible to use the lowest available grade of aviation gasoline, Military Specification MIL-G-5572 (no oil mix required), JP-5, Military Specification MIL-J-5624, or JP-6, Military Specification MIL-F-25656, as emergency fuels for one-time ferry missions. Where the tactical situation requires the use of these fuels, the engine military trim must be readjusted to meet the pressure ratios shown in figures 1-28 and 1-29 before the airplane can be flown. Since JP-5 freezes at −48.3°C (−55°F) and JP-6 at −40°C (−40°F), missions in which these fuels are used shall be restricted to altitudes where temperatures below these limits are not encountered. When using aviation gasoline, particular attention shall be given to engine tailpipe temperature during starting and throughout the flight.

n. Service engine oil tank. Refer to Section VI for servicing instructions.

NOTE

Refer to servicing portion of this manual for depreserving the engine fuel system, engine lubrication system, and the constant-speed drive system.

o. Check that the hydraulic reservoirs are pressurized and that the reservoirs are serviced to the "FULL" mark. Refer to T.O. 1F-106A-2-3 for these procedures.

CAUTION

Applicable to F-106A airplanes 56-463, -466, 56-467, 57-233 thru -235, -237 and 57-241, and F-106B airplanes 57-2508, -2510, -2512, -2514 and 57-2517; and all other airplanes after incorporation of TCTO 1F-106-631. A reservoir servicing panel is installed directly below the primary hydraulic reservoir. The reservoir pressure shutoff valve, located on the panel, must be locked in the "OPEN" position prior to engine start. Hydraulic reservoir pressure gages located on the servicing panel shall indicate 50 (±5) psi. This precharge pressure is necessary to prevent hydraulic pump cavitation.

NOTE

Prime and bleed the hydraulic system prior to engine run upon completion of hydraulic system maintenance, when the system has been opened, or upon completion of an engine or a hydraulic pump replacement. Refer to T.O. 1F-106A-2-3 for this information.

p. Check air preload of hydraulic accumulators. Refer to T.O. 1F-106A-2-3 for this procedure.

q. Check high-pressure pneumatic system for charge to 3000 psi. Refer to T.O. 1F-106A-2-3 for this procedure. Connect external high-pressure air source to fitting in left main wheel well; starter air selector valve in left wheel to be in the "CLOSED" position. If start is to be made from airplane high-pressure pneumatic system, position starter air selector valve to the "OPEN" position.

r. Check engine starter and constant-speed drive systems for proper oil servicing. Refer to Sections V and IX for these procedures.

NOTE

Prime the oil system upon completion of constant-speed drive system maintenance when the constant-speed oil supply system has been disturbed, or upon completion of a remote or engine mounted gearbox replacement. Refer to Section IX for this information.

s. *Applicable to F-106A airplanes 57-246 thru 57-2465, and F-106B airplanes 57-2516 thru 57-2522.* Check that constant-speed system generator air pressurization (purge air) line is disconnected at T fitting below right hydraulic pump and that warning streamer is attached. The line is to remain disconnected until after engine start to purge possible fuel fumes.

t. Check that external electrical power source is turned off. Connect external ac and dc power source to the airplane external power receptacle.

u. Check that the engine ignition disarming switch in main right wheel well is in "ARMED" position.

v. *Applicable to all F-106A and B airplanes after incorporation of TCTO 1F-106-675.* Check that starter ignition disarm switch is in the "ON" position.

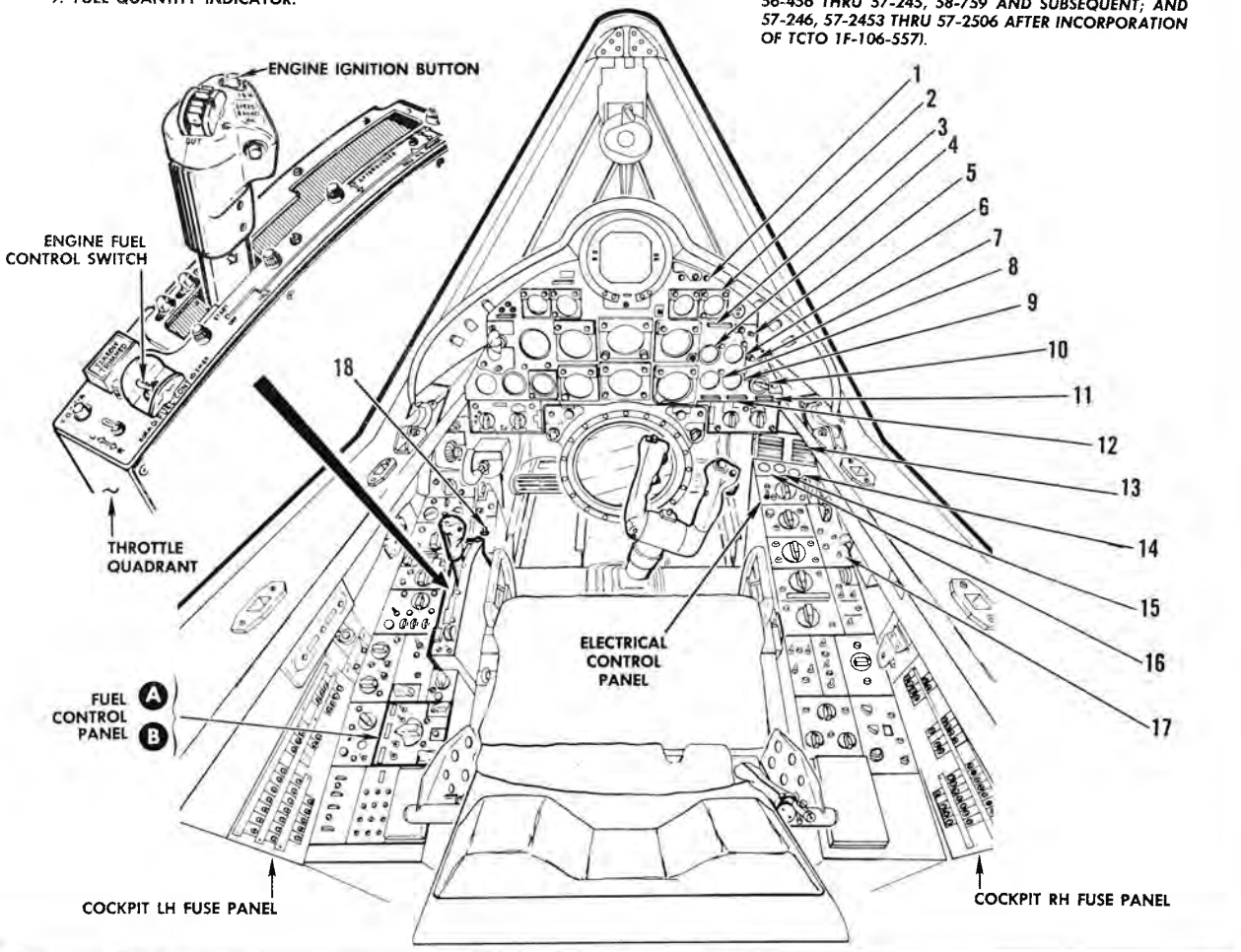
CAUTION

The starter ignition switch is to be used only for an air motor start subsequent to an unsuccessful attempt at starting engine utilizing the combustion capabilities of the starter. During the air motor start procedure, the starter ignition disarm switch must be in the "OFF" position. Refer to paragraph 5-9 for description of starter ignition disarm switch.

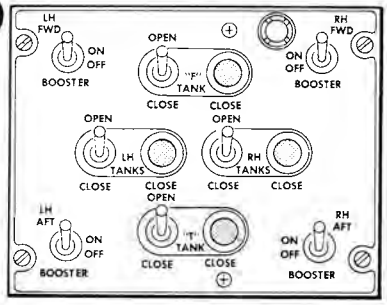
w. Check that fuses are installed in the following panels:

1. Nose wheel well fuse panel.
2. Main wheel well fuse panel.
3. Cockpit RH fuse panel.
4. Cockpit LH fuse panel.

1. VARIABLE RAMP NOT RETRACTED WARNING LIGHT. *(APPLICABLE TO 57-246 THRU 59-059).*
2. ENGINE PRESSURE RATIO INDICATOR.
3. FIRE WARNING LIGHT.
4. ENGINE EXHAUST TEMPERATURE INDICATOR.
5. FIRE AND OVERHEAT TEST SWITCH.
6. TACHOMETER.
7. FUEL QUANTITY TEST SWITCH.
8. FUEL FLOW INDICATOR.
9. FUEL QUANTITY INDICATOR.
10. FUEL QUANTITY SELECTOR SWITCH.
11. HYDRAULIC FAILURE WARNING LIGHT.
12. MASTER WARNING LIGHT.
13. WARNING INDICATION PANEL.
14. ENGINE OIL PRESSURE INDICATOR.
15. HYDRAULIC PRESSURE INDICATOR (SECONDARY SYSTEM).
16. HYDRAULIC PRESSURE INDICATOR (PRIMARY SYSTEM).
17. WARNING LIGHTS TEST SWITCH.
18. IDLE THRUST CONTROL *(APPLICABLE TO 56-453, -454, 56-456 THRU 57-245, 58-759 AND SUBSEQUENT; AND 57-246, 57-2453 THRU 57-2506 AFTER INCORPORATION OF TCTO 1F-106-557).*

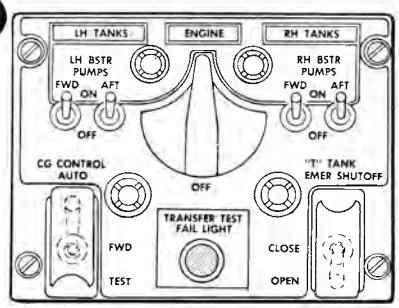


A



APPLICABLE TO 56-453, -454, 56-456 THRU 57-245, -2453, 57-2456 AND SUBSEQUENT; AND 57-246, -2454 AND 57-2455 AFTER INCORPORATION OF TCTO 1F-106-522.

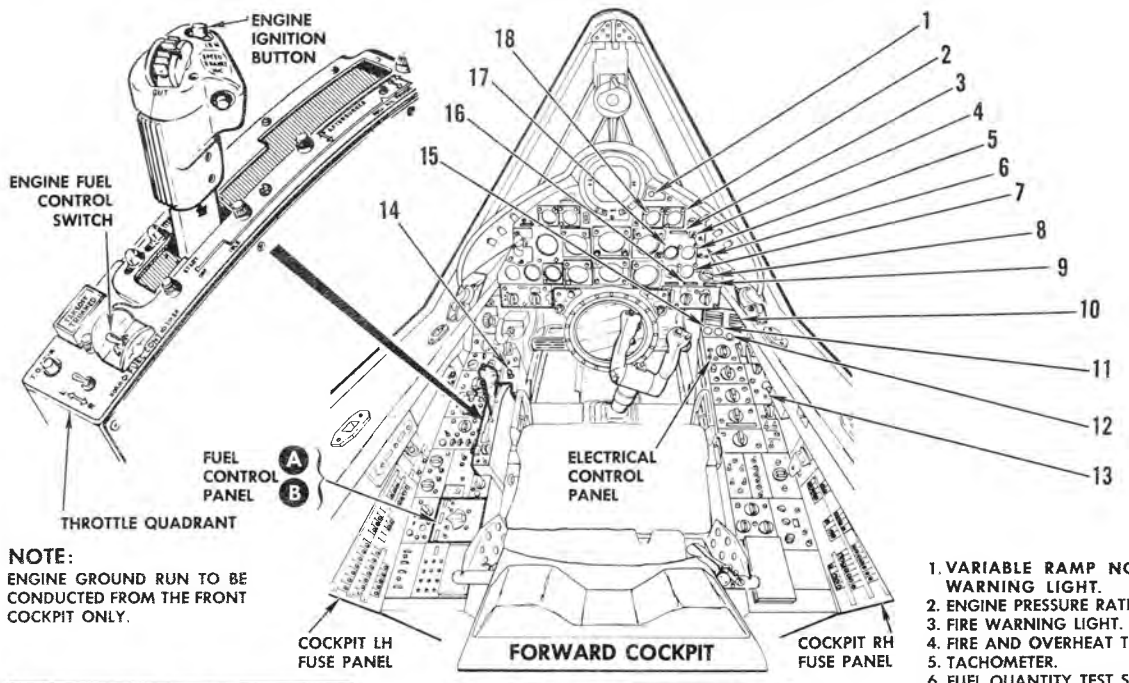
B



APPLICABLE TO 57-246, -2454 AND 57-2455 AFTER INCORPORATION OF TCTO 1F-106-522.

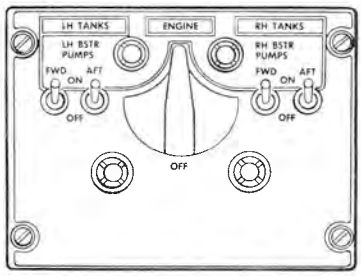
.06.02.761E

Figure 1-7. Engine Controls and Indicators, F-106A

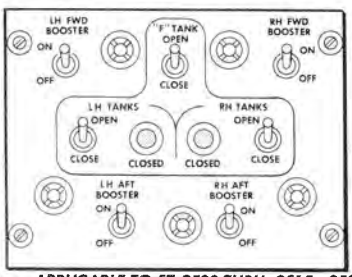


NOTE:
ENGINE GROUND RUN TO BE CONDUCTED FROM THE FRONT COCKPIT ONLY.

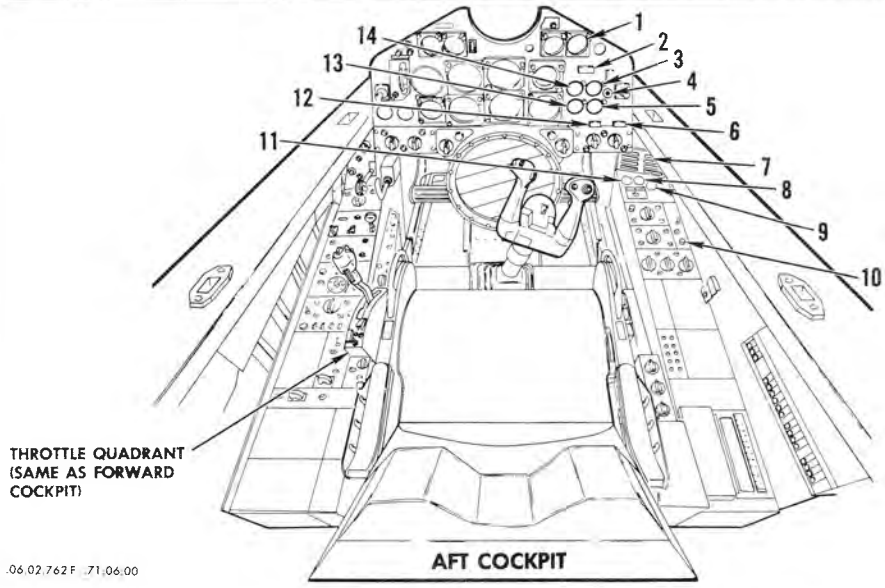
1. VARIABLE RAMP NOT RETRACTED WARNING LIGHT.
2. ENGINE PRESSURE RATIO INDICATOR.
3. FIRE WARNING LIGHT.
4. FIRE AND OVERHEAT TEST SWITCH.
5. TACHOMETER.
6. FUEL QUANTITY TEST SWITCH.
7. FUEL QUANTITY INDICATOR.
8. FUEL QUANTITY SELECTOR SWITCH.
9. HYDRAULIC FAILURE WARNING LIGHT.
10. WARNING INDICATOR PANEL.
11. HYDRAULIC PRESSURE INDICATOR (SECONDARY SYSTEM).
12. ENGINE OIL PRESSURE INDICATOR.
13. WARNING LIGHTS TEST SWITCH.
14. IDLE THRUST CONTROL *(APPLICABLE TO 57-2508 THRU 57-2515, 57-2532 AND SUBSEQUENT; AND 57-2516 THRU 57-2531 AFTER INCORPORATION OF TCTO 1F-106-557).*
15. HYDRAULIC PRESSURE INDICATOR (PRIMARY SYSTEM).
16. MASTER WARNING LIGHT.
17. FUEL FLOW INDCATOR.
18. EXHAUST TEMPERATURE INDICATOR.



A *APPLICABLE TO 57-2516 THRU -2520, -2522, -2524 THRU 57-2526 PRIOR TO INCORPORATION OF TCTO 1F-106-522.*



B *APPLICABLE TO 57-2508 THRU -2515, -2523, 57-2527 AND SUBSEQUENT, AND 57-2516 THRU -2520, -2522, -2524 THRU 57-2526 AFTER INCORPORATION OF TCTO 1F-106-522.*



1. ENGINE PRESSURE RATIO INDICATOR.
2. FIRE WARNING LIGHT.
3. TACHOMETER.
4. FUEL QUANTITY TEST SWITCH.
5. FUEL QUANTITY INDICATOR.
6. HYDRAULIC FAILURE WARNING LIGHT.
7. WARNING INDICATION PANEL (SAME AS FORWARD COCKPIT).
8. HYDRAULIC PRESSURE INDICATOR (SECONDARY SYSTEM).
9. ENGINE OIL PRESSURE INDICATOR.
10. WARNING LIGHT TEST SWITCH.
11. HYDRAULIC PRESSURE INDICATOR (PRIMARY SYSTEM).
12. MASTER WARNING LIGHT.
13. FUEL FLOW INDICATOR.
14. ENGINE EXHAUST TEMPERATURE INDICATOR.

Figure 1-8. Engine Controls and Indicators, F-106B

PROCEDURE

A. PLACE THERMOMETER IN THE SHADE OF THE AIRPLANE PRIOR TO ENGINE RUN. AFTER THERMOMETER HAS STABILIZED, RECORD AMBIENT AIR TEMPERATURE.

B. OBTAIN ACTUAL FIELD BAROMETRIC PRESSURE FROM CONTROL TOWER (NOT BAROMETRIC PRESSURE CORRECTED TO SEA LEVEL) WITHIN 15 MINUTES PRIOR TO ENGINE RUN.

C. ENTER TRIM CHART AT THE Pamb – INCHES Hg (FIELD BAROMETRIC PRESSURE) AND PROCEED VERTICALLY TO DIAGONAL MINIMUM LIMIT TEMPERATURE LINE. PROCEED HORIZONTALLY TO THE LEFT TO OBTAIN MINIMUM ACCEPTABLE EPR.

D. ENTER TRIM CHART AT THE Pamb – INCHES Hg AND PROCEED VERTICALLY TO DIAGONAL MAXIMUM LIMIT TEMPERATURE LINE, PROCEED HORIZONTALLY TO THE LEFT TO OBTAIN MAXIMUM ACCEPTABLE EPR.

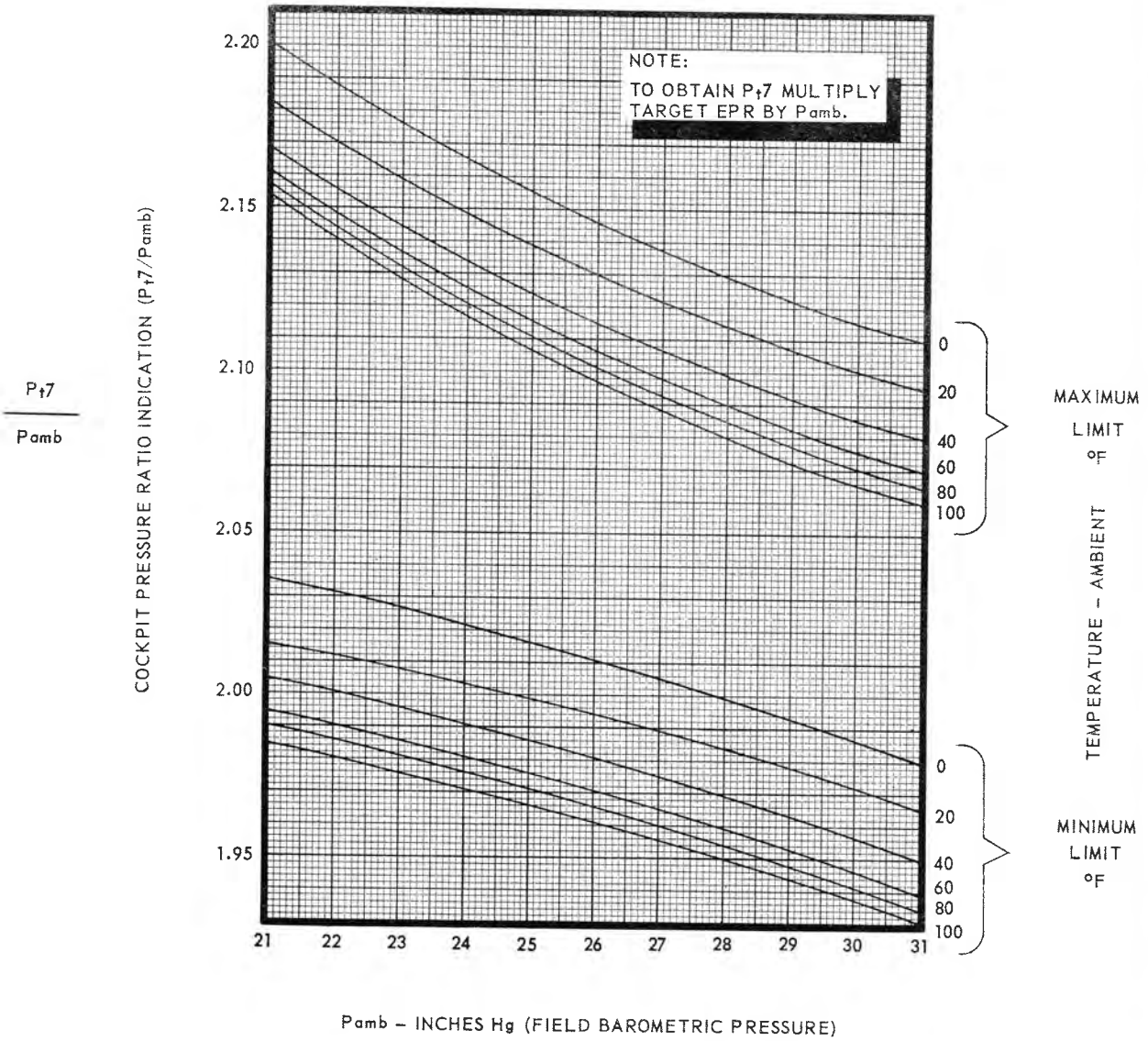


Figure 1–8A. Emergency Fuel Control Limits Chart

x. Check that the constant-speed drive shaft and shaft cover are properly installed. Refer to Section IX for this procedure.

CAUTION

Refer to paragraph 9-4 for engine mounted gearbox conditioning and operational limitations which must be followed if the engine is to be operated with the constant-speed drive shaft removed.

y. Check that there are no fuel puddles in engine tailpipe or in the fuselage areas near drain lines.

NOTE

It will be necessary to trim check the engine using calibrated external instruments, according to paragraphs 1-58 thru 1-68 if any of the following conditions exist:

Engine has been replaced.
Fuel control has been replaced.
Afterburner has been replaced.
Maintenance or adjustment has been performed on the afterburner exhaust nozzle.
Performance decay has been reported from previous flight operation.
Pressure ratio indication out of limits from previous run.
Fuel control "IDLE" or "TRIM" screw paint seal has been broken.
Fuel control "IDLE" adjustment has been made.
Throttle quadrant or throttle teleflex cable has been replaced.

1-26. Engine Start Procedure.

The following procedure is recommended for starting the engine. See figures 1-7 and 1-8 for illustrations of the cockpit equipment used for engine run.

NOTE

On F-106B airplanes, ground starting is accomplished from the front cockpit only.

a. Place the following switches in the indicated positions:

1. Master electrical power switch (F-106B, aft cockpit "ON," forward cockpit "OFF") — "OFF"
2. DC generator switch — "OFF"
3. AC generator switch — "OFF"
4. Fuel control — "NORMAL"
   ("EMER FUEL ON" light) — "OFF"
5. Fuel valve selector switches
   (Applicable to F-106A airplanes 57-246 thru 57-2464) — "ENGINE" and safety wired.
   (Applicable to F-106A airplanes 56-453, -454, 56-456 thru 57-245, 57-2466 thru 57-2477) — "OPEN" and safety wired.
   (Applicable to F-106B airplanes 57-2516 thru 57-2522, 57-2524 thru 57-2526)
   (Fwd. cockpit) — "ENGINE" and safety wired.
   (Aft cockpit) — "NORMAL" and safety wired.

NOTE

If the safety on the fuel selector switches listed in step "a.5," has been broken, it will be necessary to perform a visual inspection of the fuel shutoff valves to ascertain that they are in the open position prior to engine run. Refer to fuel shutoff valve operational checkout in T.O. 1F-106A-2-5. *Applicable after incorporation of TCTO 1F-106-556,* safety wiring of switches is not required.

   (Applicable to F-106A airplanes 56-453, -454, 56-456 thru 57-245, 57-2465, 57-2478 and subsequent) — 'OPEN"
   (Applicable to F-106B airplanes 57-2508 thru 57-2515, 57-2523, 57-2527 and subsequent)
   (Fwd. cockpit) — "OPEN"
   (Aft cockpit) — "NORMAL"
6. Throttle lever — "OFF"
7. Fuel boost pumps — "OFF"
8. Idle thrust control — "OFF"
9. C. G. Control — "AUTO"
10. Variable inlet override switch — "NORMAL"
11. All electronic equipment including MA-1 or AN/ASQ-25 system and communications equipment — "OFF"
12. Refrigeration switch — "OFF"
13. Cabin air switch — "OFF"
14. Cockpit Canopy — "OPEN"
15. Rain clearing — "OFF"
16. All other switches in the nonoperating position.

WARNING

Items 1, and 11 through 13 must be maintained in the condition indicated after engine start to prevent entry of fuel fumes into the cockpit and electronic compartments via the air conditioning system.

b. Turn external ac and dc power on. Power failure warning lights shall illuminate.

c. *Applicable to F-106A airplanes 57-246 thru 57-2465 and F-106B airplanes 57-2516 thru 57-2522.* Check fire detection system by holding fire test switch in "OVERHEAT;" light shall flash on and off. Position switch to "FIRE;" light shall illuminate steadily. *Applicable to F-106A airplanes 56-453, -454, 56-456 thru 57-245, 57-2466 and subsequent, and F-106B airplanes 57-2508 thru 57-2515, 57-2523 and subsequent.* Check fire detection system by placing test switch in "LOOP 1;" then place switch in "LOOP 2." The "FIRE" warning light shall flash on and off when placed in either loop position.

d. Check master warning system by depressing warning lights test switch on right console panel; all warning lights shall illuminate.

e. Set pressure ratio indicator "TAKEOFF" reading for the correct ambient air temperature. This value is determined by computing the ambient temperature at a point half way between the minimum and maximum lines of the takeoff trim check band on the trim charts.

f. Check that all boost pump switches are in "OFF" position and that both "FUEL BOOST PRESS" lights are illuminated. Check operation of fuel boost pumps as follows:

1. Place both forward boost pump switches in "ON" position; both "FUEL BOOST PRESS" lights shall extinguish.
2. Place both forward boost pump switches in "OFF" position; both "FUEL BOOST PRESS" lights shall illuminate.
3. Place both aft boost pump switches in "ON" position; both "FUEL BOOST PRESS" lights shall extinguish.
4. Place both forward boost pump switches in "ON" position; leave aft boost pump switches in "ON" position.

g. *Applicable after incorporation of TCTO 1F-106-688,* bleed the air from the starter fuel accumulator as follows:

1. Place suitable container under push-to-bleed valve on bottom of fuselage at Sta. 507. Ground container to airplane structure.
2. Actuate push-to-bleed valve and bleed at least one gallon of fuel from the accumulator. Continue bleeding until a solid stream of fuel is obtained; release valve.
3. Disconnect drainage container ground from airplane structure and remove container.

h. Initiate engine start as follows:

1. Depress the ignition button and hold; move the throttle outboard to "START" position. Check tachometer for positive rpm indication, then move the throttle inboard to "OFF", then forward to "IDLE". This procedure is accomplished by a continuous movement of the throttle.

WARNING

Release ignition button immediately if no "RPM" reading is evident on the tachometer. Do not move the throttle inboard to the "OFF" position with the ignition button depressed if there is no "RPM" indication. This could result in disintegration of the combustion starter. No "RPM" reading indicates the starter failed to engage the engine. A maximum of two attempts should be made, but if still unsuccessful, the operation should be discontinued until the cause has been established and corrected.

2. Hold ignition button down until the engine instruments indicate a positive, self-sustaining lightoff, or until 30% rpm is reached; release ignition button. During the start procedure, do not jockey the throttle lever.

CAUTION

Do not jockey the throttle as the starting fuel schedule is automatically controlled by the fuel control unit. Jockeying the throttle will interrupt this schedule.

Combustion starter duty cycle, at ambient temperatures up to 32.2°C (90°F), must be limited to two consecutive combustion runs in rapid succession followed by a cooling time of 30 minutes minimum. Succeeding runs must then be spaced a minimum of 25 minutes apart. If combustion starter duty cycle limitations are exceeded, remove the starter for overhaul.

Combustion starter duty cycle, at ambient temperatures above 32.2°C (90°F), must be limited to two consecutive combustion runs in rapid succession followed by a cooling time of 45 minutes minimum. Succeeding runs must then be spaced a minimum of 40 minutes apart. If combustion starter duty cycle limitations are exceeded, remove the starter for overhaul.

i. Engine indicators shall read as follows:

1. The exhaust temperature shall not exceed 400°C during acceleration to idle.
2. Idle rpm shall be 57 to 59%. *Applicable to airplanes equipped with idle thrust control provisions,* idle rpm with exhaust nozzle closed shall be 59 to 61%. Indication shall stabilize in total elapsed time of 35 to 50 seconds.

3. Exhaust temperature shall stabilize at 340°C or below.
4. Fuel flow shall be 1200 to 1500 pounds per hour.
5. Oil low-pressure warning light shall be extinguished; gage shall indicate 45(±5) psi.

NOTE

A 40 to 50 psi oil pressure on the cockpit oil pressure gage is acceptable for continuous engine operation.

j. Momentarily actuate rain clearing switch to "ON" then "OFF" to remove any moisture from system.

k. Actuate "MASTER ELEC POWER" switch to "ON" position.

l. Actuate "AC GEN CONT" and "DC GEN CONT" switches to "ON" position.

m. Turn off external ac and dc power and disconnect the external power plug(s); ac and dc power failure warning lights shall extinguish. If lights fail to extinguish, shutdown engine and investigate cause of malfunction.

n. Reposition starter air selector valve in the left main wheel well to the "CLOSED" position if airplane high pressure air system was used to operate the combustion starter.

o. *Applicable to F-106A airplanes 57-246 thru 57-2465, and F-106B airplanes 57-2516 thru 57-2522.* Connect constant speed system generator air pressurization (purge air) flex line to T fitting located below the right hydraulic pump. Remove warning streamer.

1-27. Unsatisfactory Start.

An unsatisfactory start has occured if one or more of the following conditions occur:

a. Hot Start. The turbine discharge temperature exceeds the starting temperature limit of 400°C. If a greater than normal fuel flow is observed when the power lever is first placed in the idle position, a "hot start" may be anticipated and the operator should be prepared to abort the start before the turbine discharge temperature is exceeded. A hot start may also be caused by a "false or hung start." Refer to paragraph 1-33 for engine over-temperature limitation data.

b. False Start or Hung Start. After lightoff has occurred, the rpm does not increase to idle but remains at some lower rpm. The turbine discharge temperature may continue to rise and the operator should be prepared to abort the start before temperature limits are exceeded.

c. No Start. Combustion starter does not lightoff during full starter operating cycle. If the turbine discharge temperature gage does not indicate a temperature rise, or is there is no increase in rpm, a lightoff has not been obtained.

d. The following procedure should be used in the event any of the requirements of a satisfactory start are not met or if any of the preceding conditions occur:

1. Ignition button — Not Depressed
2. Throttle — "OFF"
3. Fuel boost pump switches — "OFF"
4. Refer to the troubleshooting chart and investigate the reason for the difficulty.
5. Allow a fuel drainage period of at least 30 seconds before attempting another start.

1-28. Procedure, Engine Clearing.

To clear the engine of trapped fuel or vapors, use the same procedure used for excessive EGT or fire in engine tail pipe during ground operation. Refer to paragraph 1-31 for this procedure.

1-29. Engine Ground Run Check Procedure.

The following procedure is recommended for checking engine operation after a normal start has been completed.

a. Run engine at idle until instrument readings have stabilized (approximately 3 minutes). After a new engine installation, or if fuel system has been opened since last engine run, run engine at idle for 5 minutes before advancing throttle.

b. *Applicable to F-106A airplanes 56-453, -454, 56-456 thru 57-245, 58-759 and subsequent; 57-246, 57-2453 thru 57-2506 after incorporation of TCTO 1F-106-557. Applicable to F-106B airplanes 57-2508 thru 57-2515, 57-2532 and subsequent; and 57-2516 thru 57-2531 after incorporation of TCTO 1F-106-557.* Actuate "IDLE THRUST CONT" switch to "ON" then to "OFF." Have ground observer check for opening and closing of the exhaust nozzle.

c. Advance throttle lever to "MIL POWER" and allow instrument reading to stabilize. Engine exhaust temperature shall not exceed 650°C during acceleration. Engine rpm shall not exceed 105.5 per cent. Temperature shall not exceed 635°C after 2 minutes stabilization at military power. Oil pressure shall be 45(±5) psi (oil pressure warning light extinguished). Pressure ratio indicator shall be within the minimum and maximum points on the indicator bug.

CAUTION

Engine operation at "MIL POWER" setting not to exceed 15 minutes. Engine operation at maximum power (throttle full forward and in afterburning) not to exceed 5 minutes.

d. Record engine instrument readings.

e. Advance throttle to the full forward position, then outboard to "AFTERBURNING."

CAUTION

The exhaust nozzle has failed to open if there is a rapid increase of tailpipe temperature and an rpm reduction. Terminate afterburning immediately; investigate malfunction.

Allow engine to stabilize. Record engine instrument readings. Readings shall be within limits outlined in step "c."

f. Simulate afterburner electrical failure by removing "AB PWR" fuse from main wheel well fuse panel. Move throttle lever to nonafterburning, but do not retard; afterburning shall continue.

g. Check operation of afterburner mechanical shutoff valve as follows:

1. Retard throttle lever until afterburning terminates.
2. Advance throttle lever to a position above minimum afterburning range; afterburning shall not occur.
3. Install "AB PWR" fuse. Advance throttle lever to "MIL POWER," then outboard to "AFTERBURNING." Afterburning shall occur.

h. Turn off all boost pumps momentarily; boost pump failure warning and master warning lights shall illuminate. Turn on "FWD L" and "FWD R" boost pumps. Actuate master warning light switch to "RESET" to extinguish light.

i. Retard throttle slowly to minimum afterburning. There shall be no indication of engine roughness as throttle is being retarded. Terminate afterburning immediately if roughness is encountered.

j. Retard throttle to "IDLE." Allow afterburner drainage period of 3 minutes maximum.

k. Check engine emergency fuel system operation by setting throttle at "IDLE". Place fuel control switch to "EMER" position; "EMER FUEL" light shall illuminate.

CAUTION

To prevent possible engine overspeed, do not position fuel control switch to "EMER" when engine is operating at full power. To prevent possible compressor stalls, reduce engine speed to idle before switching from "EMER" to "NORMAL." During operation of the emergency fuel system, the automatic control features of the fuel control are bypassed. Extreme care must be exercised when operating the throttle lever. Carefully check the exhaust temperature and tachometer to prevent engine over-temperature or overspeed. Damage to the turbine section will occur and lead to engine failure if these procedures are not carefully followed.

1. Advance throttle slowly to "MIL POWER" and stabilize for 1 minute. Record rpm, pressure ratio, and exhaust gas temperature.

CAUTION

An adjusted fuel flow of as much as 800 pph less than the above established minimums is acceptable; however, when this condition exists, the afterburner must be checked for proper operation prior to releasing the airplane for flight.

NOTE

The above fuel flow figures have been adjusted for duct loss with inlet screens installed. If inlet screens are removed, add 130 pph to the above values.

For each 1000 feet of field elevation above sea level, subtract 210 pph fuel flow from the above values. The effect of temperature on fuel flow need not be considered in fuel flow calculations.

NOTE

For each degree F (0.55°C) ambient temperature reading above standard day, only 1 pph would be added to the fuel flow limits. For each degree F (0.55°C) ambient temperature reading below standard day, only 1 pph would be subtracted from the fuel flow limits.

m. Pressure ratio curves, Figure 1–8A, will be utilized in lieu of observed fuel flow to determine proper operation of the emergency fuel control system.

NOTE

Fuel flow indicator needle fluctuations shall not exceed distances between any two graduations (400 pph) either in normal or emergency system. Fluctuations resulting in blurring of the needle are not acceptable and shall be cause for investigation. When fluctuations are accompanied by erratic engine RPM or Pressure Ratio, engine malfunction will be suspected and investigated.

n. Move throttle momentarily to "AFTERBURNER" to check afterburner action; afterburner shall light. Return throttle to normal; afterburner shall cease. Retard throttle to "IDLE." Place fuel control switch in "NORMAL" position; "EMER FUEL" light shall extinguish.

1-30. Engine Shutdown Procedure.

a. Idle engine for 5 minutes after power run before shutting down, to prevent possible seizure of the engine rotors.

NOTE

In an emergency, the engine may be shutdown at once. Refer to paragraphs 1-31 and 1-32 for emergency fire procedures.

b. Connect external ac and dc power sources to the external receptacle. Airplane ac and dc generator switches "OFF"; master power switch "OFF."

c. Fuel boost pump switches "OFF."

d. Transfer tank shutoff switch "CLOSED."

e. Connect external high-pressure air source to adapter in left wheel well. Starter air shutoff valve positioned to the "CLOSED" position.

f. Retard throttle lever to "OFF" position.

g. Check primary and secondary hydraulic system warning lights by slight movement of flight controls as engine coasts down. Flashing light indicates one system decreasing below 1000 to 800 psi pressure. Steady light indicates both systems are below 1000 to 800 psi pressure.

h. Return all switches to the nonoperating position, except safety wired fuel selector switches as noted in paragraph 1-26, step "a.5."

i. Check engine and constant-speed drive oil levels.

j. *Applicable to F-106A airplanes 57-246 thru 57-2465, and F-106B airplanes 57-2516 thru 57-2522.* Disconnect constant-speed system generator air pressurization (purge air) flex line at T fitting located below the right hydraulic pump. Install warning streamer at this point.

NOTE

This procedure is necessary to prevent possible entry of engine fuel into the generator pressurization system. The flex line will remain disconnected until the next engine operation. Refer to paragraph 1-25 for the proper method of connecting the flex line.

1-31. EXCESSIVE EGT OR FIRE IN ENGINE TAILPIPE DURING GROUND OPERATION.

In the event of excessive exhaust gas temperature, or if ground observers report fire in the engine tailpipe during ground operation, perform the following:

a. Throttle "OFF."

b. External high-pressure air connected to airplane.

NOTE

If external high-pressure air is not available, open the starter air shutoff valve located in left main wheel well.

c. If external electrical power is connected to the airplane, position the master power switch to "OFF." If external electrical power is not available, the master power switch must be placed in "ON" position.

d. Engine ignition disarming switch in right main wheel well "DISARMED."

CAUTION

Applicable prior to incorporation of TCTO 1F-106-556. When repositioning fuel shutoff valve switches to "ENGINE" or "OPEN" position in preparation for engine operation, it will be necessary to visually check the left and right fuel shutoff valve position indicators to determine that the valves are in the open position. This procedure requires removal of the fire seal doors inboard of the valves. Refer to T.O. 1F-106A-2-5 for an illustration of the fuel shutoff valves. Safety-wire switches in the "ENGINE" or "OFF" position.

e. All fuel shutoff switches—"CLOSED" or "OFF."

f. Boost pump switches—"OFF."

g. Engine ignition button—Depress and hold.

h. Move throttle to "START"; check for positive rpm, then move throttle to "OFF." Permit starter to run full cycle, then release ignition button.

NOTE

Do not advance throttle from the "OFF" position. Advancing the throttle from "OFF" to "IDLE" opens fuel valves in the fuel control unit, allowing fuel to flow into the engine. Under this condition the fuel control unit would require repriming.

1-32. FIRE WITHIN ENGINE COMPARTMENT.

Fire within the engine accessory compartment or in the engine compartment is indicated when the fire detector warning light is illuminated. To extinguish fire proceed as follows:

a. Shutdown engine.

b. All fuel shutoff switches—"CLOSED" or "OFF."

c. Open fire access door with fire extinguisher nozzle and discharge fire extinguisher.

CAUTION

Applicable prior to incorporation of TCTO 1F-106-556. When repositioning fuel shutoff valve switches to "ENGINE" or "OPEN" positions in preparation for engine operation, it will be necessary to visually check the left and right fuel shutoff valve position indicators to determine that the valves are in the open position. This procedure requires removal of the fire seal doors inboard of the valves. Refer to T.O. 1F-106A-2-5 for an illustration of the fuel shutoff valve installation. Safety-wire switches in the "ENGINE" or "OPEN" position.

1-33. INSPECTION OF ENGINES SUBJECTED TO OVER-TEMPERATURE CONDITIONS.

The following table indicates the inspection required for engines subjected to over-temperature operation:

CONDITION	INSPECTION REQUIRED
If T_{t7} exceeds the maximum allowable limit of 650°C for not more than 1 minute, and does not exceed 700°C.	Continue engine in service. No inspection required.
If T_{t7} exceeds the maximum allowable limit of 650°C for more than 1 minute but less than 2 minutes, or exceeds 700°C for less than 5 seconds. If T_t7 exceeds the allowable of 635°C for more than 3 minutes but less than 4 minutes. HOT START – If the engine experiences 5 starts at temperatures exceeding the maximum allowable exhaust gas temperature of 400°C for starting.	Perform visual inspection as follows: (a) Inspect the exhaust duct for foreign particles and inspect the rear of the turbine for apparent damage. (b) Slide back the combustion chamber outer case. Remove the combustion chambers and inspect the burner section, the turbine nozzle guide vanes, and the front of the turbine section for excessive distortion or damage. (c) Measure first stage turbine blades for stretch. Refer to T.O. 2J-J75-6.
Five instances of over-temperature requiring visual inspection of hot section.	Perform hot section teardown inspection as described in T.O. 2J-J75-6.
If T_{t7} exceeds the maximum allowable limit of 650°C for more than 2 minutes or exceeds 700°C for more than 5 seconds.	
If T_{t7} exceeds the allowable limit of 635°C for more than 4 minutes.	
If T_{t7} exceeds 725°C.	
After 25 instances of starts in excess of 400°C.	

1-34. INSPECTION OF ENGINES SUBJECTED TO OVERSPEED CONDITIONS.

The following table indicates the inspection required for engines subjected to overspeed conditions:

CONDITION	INSPECTION REQUIRED
If the observed N_2 rotor speed exceeds 106.5% rpm but does not exceed 108.0% rpm.	(a) Check engine as specified in T.O. 1F-106A-6 prior to continued operation. (b) If any abnormal condition is evident, perform teardown inspection as described in T.O. 2J-J75-6.
If the observed N_2 rotor speed exceeds 108.0% rpm.	Shutdown the engine as soon as practicable and send the engine to overhaul for complete inspection.

1-35. OPERATIONAL CHECKOUT, CONSTANT-SPEED GENERATOR DRIVE SYSTEM.

For operational checkout and testing of the constant-speed generator drive system, refer to T.O. 1F-106A-2-10.

1-36. OPERATIONAL CHECKOUT, TACHOMETER INDICATOR SYSTEM.

For information in regard to the tachometer indicator system check, refer to T.O. 1F-106A-2-9.

1-37. OPERATIONAL CHECKOUT, ENGINE PRESSURE RATIO INDICATING SYSTEM.

For information in regard to the engine pressure ratio indicating system check, refer to T.O. 1F-106A-2-9.

1-38. OPERATIONAL CHECKOUT AND CALIBRATION, ENGINE EXHAUST TEMPERATURE SYSTEM.

For information in regard to the engine exhaust temperature system check and calibration, refer to T.O. 1F-106A-2-9.

1-39. OPERATIONAL CHECKOUT, FUEL FLOW INDICATING SYSTEM.

For information in regard to the fuel flow system check, refer to T.O. 1F-106A-2-9.

1-40. OPERATIONAL CHECKOUT, OIL LOW PRESSURE WARNING AND INDICATING SYSTEMS.

For information in regard to the oil low-pressure warning system check, refer to paragraph 6-14.

SYSTEM ANALYSIS

1-41. SYSTEM ANALYSIS, GENERAL.

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
STARTER DOES NOT ROTATE ENGINE.		
Refer to Section V for starter system analysis.		
THROTTLE STICKING OR BINDING (ON GROUND WITH TEMPERATURE BELOW FREEZING, OR IN FLIGHT)		
Ice formation in the teleflex cable throttle control.	Disconnect cable from linkage at fuel control unit and remove cable from conduit.	Blow moisture out of conduit with nitrogen; clean and degrease teleflex cable; soak teleflex cable in oil, Military Specification MIL-L-7808 and reinstall.
Malfunctioning throttle quadrant.	Disconnect telescopic unit from quadrant bell crank; try to move throttle.	Replace defective component.
ENGINE FAILS TO START.		
Insufficient starter speed.	Check external air source and engine starter. Refer to Section V for starter system analysis.	Replace defective components.
Ignition system inoperative.	Energize the ignition system momentarily with the fuel supply off. Listen for audible sparking with the ear as close as possible to the spark igniters. **CAUTION** Clear engine of fuel before attempting this procedure.	Check for improper or loose connection. Remove spark igniters and inspect condition. Clean or replace if necessary.

1-41. SYSTEM ANALYSIS, GENERAL (CONT).

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
ENGINE FAILS TO START (CONT).		
	Refer to Section V of this manual for additional ignition and starting system troubleshooting. **WARNING** The electrical energy produced by the engine ignition system is sufficient to produce a shock that can be fatal. Be sure that electrical power has been removed from the ignition system before performing system maintenance.	
Lack of fuel to engine.	Check fuel supply in tanks.	
	Fuel pressurizing-and-dump valve draining fuel overboard during engine starting attempt.	Replace valve.
	Check fuel tank boost pump operation.	Repair or replace defective pump.
	Check for obstructed fuel pump inlet line and fuel filter.	Clean lines and the filter.
	Fuel control unit cutoff not opening because of rigging error.	Adjust linkage.
HOT START.		
Insufficient starter speed.	Check external air source and starter. Refer to Section V for starter system analysis.	Repair or replace defective component.
Accumulation of fuel in the engine or afterburner.		Remove excess fuel from afterburner and perform engine clearing procedure.
Starting fuel flow too high.	Observe fuel flow indicator during starting attempt. Confirm accuracy of flowmeter.	Replace the fuel control.

1-41. SYSTEM ANALYSIS, GENERAL (CONT).

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
HUNG START (ENGINE LIGHTS OFF BUT DOES NOT ACCELERATE TO IDLE).		
Starter cutout speed too low.	Check gas turbine compressor and starter. Refer to Section V for starter system analysis.	Repair or replace gas turbine compressor and starter.
Loose or broken burner pressure sensing line.	Check sense line for security or damage.	Tighten or replace burner pressure sense line.
Burner pressure limiter stuck open.	Remove fuel control unit.	Install replacement item. Trim engine.
Fuel control unit acceleration schedule out of limits.		
FLAMEOUT.		
Lack of fuel to engine.	Check fuel supply.	
Broken or obstructed fuel line, valve, or pump.	Check fuel lines, valves, and pumps.	Replace broken line or remove obstruction.
Inadvertent placing of power lever in off position.		
Power lever retarded or advanced too rapidly while operating on emergency fuel system.		Check emergency operation procedure.
Too rich fuel control unit acceleration schedule when in normal operation at high altitude.	Remove fuel control unit.	Install replacement item.
Too lean fuel control unit deceleration schedule when in normal operation.		
FAILURE OF ENGINE TO DECELERATE PROPERLY.		
Fuel control unit rigging error.	Inspect linkage.	Adjust linkage.
Malfunctioning fuel control unit.	Remove fuel control unit.	Install replacement item and trim engine.
FLUCTUATING RPM.		
Water in fuel.	Check for water or other foreign material in fuel.	Check tank drains.
Compressor bleed valve malfunctioning.	Refer to System Analysis, Anti-Surge System in Section VII.	
Air in engine fuel system.		Purge air from system by operating engine.
Clogged fuel filters.	Check filters.	Clean or replace filters.

1-41. SYSTEM ANALYSIS, GENERAL (CONT).

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
ENGINE DOES NOT MAINTAIN MAXIMUM FUEL FLOW.		
Incorrect trim.	Check trim.	Replace fuel control unit if trim cannot be obtained.
Incorrect travel of throttle linkage.	Check linkage for proper travel between the throttle and fuel control unit.	Readjust or replace linkage.
Loose connection in the combustion chamber pressure to fuel control unit (Pt_4) line.	Check line for security of connection.	
Malfunctioning fuel control unit.	Check fuel flow through flowmeter.	Replace the fuel control and trim engine.
Clogged fuel filters.	Remove and inspect the fuel filters.	Replace filters.
HIGH OR LOW OIL PRESSURE INDICATION.		
Oil pressure gage not functioning properly.	Remove gage.	Install replacement item.
Oil pressure transmitter not functioning properly.	Remove transmitter.	Install replacement item.
Oil pressure switch not functioning properly.	Remove switch.	Install replacement item.
Oil pressure relief valve sticking.	Remove oil pressure relief valve and examine for dirt or foreign matter.	Clean thoroughly and, if necessary, clean up the valve with crocus cloth and lap the valve seat.
FLUCTUATING OIL PRESSURE.		
Fuel-oil cooler pressure relief bypass valve malfunctioning.	Remove fuel-oil cooler.	Install replacement item.
HIGH OIL TEMPERATURE.		
Insufficient oil in tank.	Check oil level.	Replenish as necessary.
Clogged oil strainer.	Remove and inspect oil strainer.	Clean and install strainer.
Oil temperature gage not functioning properly.	Check gage and sensing unit for accuracy.	Replace as necessary.
Thermostatic valve in the fuel coolant oil cooler not functioning.	Remove cooler for bench check.	Install replacement item.
Defective oil pump.	Check pump operation with master gage.	Replace pump.
Bearing failure.	Check oil and strainers for metal particles.	Remove engine for overhaul.

1-41. SYSTEM ANALYSIS, GENERAL (CONT).

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
EXCESSIVE OIL CONSUMPTION.		
Oil leakage.	Visually inspect all external tubing and case parting flanges for evidence of oil leaks.	Tighten connectors. Replace seals or gaskets as necessary.
Loose oil tank cap.	Check oil tank cap.	Tighten cap.
Breather pressurization valve not functioning properly.	Remove and check the valve for proper operation.	Replace the breather pressurizing valve.
Main bearing oil seal leakage.	Check for engine smoking, oil in the exhaust duct; oil in the fuel drain collector; oil on the anti-icing air outlet screen.	Replace the engine if required.
HIGH EXHAUST TEMPERATURE.		
Engine over-trimmed.	Check engine trim.	Retrim engine.
Insufficient air.	Check the air intake for obstructions.	Remove obstructions.
Defective thermocouple leads, or temperature gage.	Check thermocouple leads and instruments.	Repair or replace thermocouple leads and instruments. Calibrate system.
Damaged compressor blades. Damaged turbine blades or nozzle guide vanes.	Visually inspect compressor blades, turbine blades, and nozzle guide vanes for damage.	If excessive damage is found, replace engine.
LOW EXHAUST TEMPERATURE.		
Defective thermocouple leads or instruments.	Check thermocouple leads and instruments.	Repair or replace defective leads or instruments. Calibrate system.
Malfunctioning fuel control.	Check for proper trim.	Trim engine. Replace the fuel control unit if proper trim cannot be attained.
ENGINE ROUGHNESS.		
Interference between turbine rotor inner air seals and the inner seal rings.	Check for scraping noise as engine coasts down, after closing of fuel pressurizing-and-dump valve.	Replace the engine if required.
Main bearing failure.	Check the oil strainer for metal particles.	Replace the engine if required.
Malfunctioning accessory.	Check for unusual noises from accessories.	Replace faulty unit.
Erratic fuel flow.	Remove fuel control unit.	Install replacement item. Trim engine.

1-41. SYSTEM ANALYSIS GENERAL (CONT).

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
ENGINE PULSATION.		
Erratic fuel flow to engine.	Remove fuel control unit.	Install replacement item. Trim engine.
Compressor bleed valve not functioning properly.	Visually check valve positioning during engine operation.	Clean lines to bleed valve governor and check bleed valve for freedom of movement.
		Replace bleed valve governor.
FAILURE TO SHIFT TO EMERGENCY FUEL SYSTEM.		
Emergency solenoid not energized.	Check for 28-volt dc at the fuel control connection.	Repair or replace defective electrical equipment.
Malfunctioning of fuel control emergency system.	Remove fuel control unit.	Install replacement item. Trim engine.
FLUCTUATING TAIL PIPE TEMPERATURES.		
Faulty temperature indicating system. **NOTE** Trouble is not in the fuel control unit if tailpipe temperature fluctuates at a constant rpm, fuel flow, airspeed, altitude, and throttle position.	Check thermocouples, leads and instruments.	Repair or replace parts as necessary. Calibrate system.
ENGINE SPEED AND/OR ENGINE TEMPERATURE BECOMES ABNORMAL AS ALTITUDE INCREASES.		
Fuel control unit altitude compensating system malfunctioning.	Remove fuel control unit.	Install replacement item. Trim engine.
INSUFFICIENT THRUST FOR HIGH FLIGHT SPEEDS.		
Variable ramp system malfunctioning.	Refer to variable ramp system analysis procedures in Section IV.	
ENGINE CONTINUES TO RUN WITH THROTTLE IN OFF POSITION.		
Throttle rigging error.	Check linkage for proper rigging.	
Cutoff valve in fuel control unit not functioning properly.	Remove fuel control unit.	Install replacement item. Trim engine.
EXHAUST NOZZLE FAILS TO OPEN OR CLOSE PROPERLY WHEN AFTERBURNING IS INITIATED OR TERMINATED.		
Sticking nozzle segments.	Check the tracks, roller and linkage for freedom of movement.	Lubricate. Refer to afterburner servicing for this procedure.
Loose exhaust nozzle control lines.	Check the security of all the lines.	Tighten the lines.
Exhaust nozzle control unit not functioning properly.	Remove exhaust nozzle control unit.	Install replacement item.

1-41. SYSTEM ANALYSIS, GENERAL (CONT).

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
EXHAUST NOZZLE FAILS TO REMAIN OPEN DURING AFTERBURNING.		
Loose exhaust nozzle control lines.	Check the security of all lines.	Tighten the lines.
Exhaust nozzle control unit not functioning properly.	Remove exhaust nozzle control unit.	Install replacement item.
EXHAUST NOZZLE OPENS DURING NONAFTERBURNING OPERATION.		
Loose exhaust nozzle control lines.	Check the security of all lines.	Tighten the lines.
Internal leaking of exhaust nozzle control unit.	Remove exhaust nozzle control unit.	Install replacement item.
Exhaust nozzle control unit not functioning properly.	Remove exhaust nozzle control unit.	Install replacement item.
EXHAUST NOZZLE OPENS AND FUEL FLOWS BUT AFTERBURNER DOES NOT LIGHT.		
Error in connections to afterburner igniter valve.	Check connections.	Make necessary corrections.
Malfunctioning afterburner fuel igniter valve.	Remove afterburner igniter valve.	Install replacement item.
FULL AFTERBURNER POWER NOT AVAILABLE.		
Afterburner fuel control unit pressure sensing line or fuel screen clogged.	Inspect sensing line and screen for obstruction.	Clean and replace line and/or screen.
Defective fuel pump.	Remove fuel pump.	Install replacement item.
Faulty afterburner fuel control unit.	Remove afterburner fuel control unit.	Install replacement item.
FAILURE TO GET AFTERBURNER FUEL FLOW THROUGH THE AFTERBURNER FUEL CONTROL UNIT. (Afterburner does not light and no evidence of afterburner fuel flow).		
Fuel pump failure.	Remove fuel pump.	Install replacement item.
No electrical signal to afterburner fuel control unit.	Check for 28-volts dc at control connection.	Repair or replace defective electrical equipment.
Actuator section of afterburner fuel control unit failure.	Remove afterburner fuel control unit.	Install replacement item.

REPLACEMENT

1-42. REPLACEMENT, ENGINE.

Refer to paragraph 1-76 for engine preservation information prior to removal of the engine from the airplane. To remove the engine from the airplane, it will first be necessary to remove the fuselage tail cone from the airplane and to install the engine removal rails and brackets.

NOTE

When conducting the airplane leveling procedure for engine removal, the engine removal rails in the fuselage will be leveled longitudinally. The airplane will be leveled laterally.

See figure 1-9 for an illustration of the engine disconnect point access. For lubrication of the engine support attachments to the fuselage, refer to T.O. 1F-106A-2-2. Upon completion of the engine replacement it will be necessary to conduct an operational test of the engine. Refer to paragraph 1-23 for this procedure.

1-43. Equipment Requirements.

FIGURE	NAME	TYPE	ALTERNATE	USE AND APPLICATION
1-13 thru 1-17	Engine Stand.	USAF ETU-8/E (1740-294-3397) with Adapter Kits 8-96398-1 (1730-676-6848) or 8-96165 (1730-632-0059) installed	SE 1012-803 (1740-568-1339)	To aid in removal and installation of engine. To support engine when removed from airplane.
1-11 1-12	Engine Removal Rail and Bracket Set.	8-96017 Basic (1730-570-1387) -801 (1730-632-8435) -803 (1730-654-8392) -805 (1730-676-6856)		To aid in engine removal or installation.
1-19	Engine Forward Roller Assemblies.	8-96041-1 (1730-565-5321) 8-96041-2 (1730-565-5322) 8-96041-803 (1730-710-7308) 8-96041-804 (1730-710-7309)		Removal roller for forward end of engine.
1-10	Tail Cone Adapter Stand.	8-96010 (1730-571-9010)		To support tail cone. *Applicable to airplanes prior to incorporation of the tail hook.*
		8-96010-801 (1730-710-7306)		To support tail cone. *Applicable to airplanes after incorporation of the tail hook.*
1-10	Retractable Truck.	(8220-780800)		To aid in installation and removal of tail cone.
Refer to T.O. 1F-106A-2-2	Jack Pad (3).	SE 0580-7 (1730-640-7155)		Provides bearing surface on wings and fuselage for airplane jacks.
Refer to T.O. 1F-106A-2-2	Airplane Jack (3).	USAF B-6 (5120-246-9178)		To raise and support airplane.
1-19	Shroud Positioning Wedge.	8-96174 (4920-611-9695)		To support and position aft end of shroud. To be used with shroud part No. 8-22654 basic, -3 or -5.

1-43. Equipment Requirements (Cont).

FIGURE	NAME	TYPE	ALTERNATE	USE AND APPLICATION
1-19	Shroud Positioning Wedge.	8-96200 (1560-679-4482)		To support and position aft end of shroud. To be used with shroud part No. 8-22654-801, -803, -805 or -811.
	Shroud Ejector Insert Alignment Tool.	8-96491 (4920-691-4274)		For use with shroud part No. 8-22654-809.
	Sling.	SE 0945-803 (1730-660-0992)		Engine suspension from hoist attachment.
	Engine Compartment Mobile Work Stand.	SE 0867-803 (4920-656-4944)		To support maintenance personnel working inside fuselage after engine removal.
1-19	Engine to Fuselage Locating Gage.	8-96201 (4920-649-5313)		To adjust position of engine in relation to the fuselage prior to installation of the tail cone. This gage is used in conjunction with Shroud Positioning Wedge 8-96200 or ejector alignment tool 8-96491.
	Flight Controls Mixer Assembly Protection Cover.	8-96186 (1730-632-8436)		To cover flight controls mixer assembly when engine is removed from the airplane.

1-44. Procedure, Tail Cone Removal.

See figure 1-10 for the fuselage tail cone removal procedure.

1-45. Procedure, Engine Replacement Rail and Bracket Installation.

See figures 1-11 and 1-12 for engine replacement rail and bracket installation.

1-46. Engine Stand Preparation.

Prior to using engine stand USAF type ETU-8/E for F-106 maintenance, it will be first necessary to install 8-96398 or 8-96165 adapter kit on the stand. See figure 1-13 or 1-14 for this procedure.

1-47. Procedure, Engine Replacement.

See figures 1-15 thru 1-19 for engine removal and installation procedures. If the engine is to be removed from the engine stand following removal from the airplane, use sling SE 0945-803 with the hoisting attachment. Use mobile work stand SE 0867-803 while performing work inside the fuselage following engine removal.

NOTE

When an engine equipped with a constant rise oil pressure system is installed in the airplane, an engine oil pressure reduction orifice plate, part No. 8-27544-27, must be installed at the oil "OUT" line elbow connection of the engine air-oil cooler. J75-P17 engines, S/N 610494 and subsequent (with main oil pump P&WA part No. 384830), have the constant rise oil pressure system. If a J75-P17 engine S/N 610493 and prior is installed in the airplane, the oil pressure reduction orifice plate must be removed from the oil "OUT" elbow connection of the engine air-oil cooler. Refer to Section VI, for orifice plate removal and installation procedures.

Some hose and tube attachment nuts are drilled for safetying. These attachment nuts must be safetied when completing an engine installation.

During engine removal, all engine and airplane tubing that has been disconnected must be capped with suitable plugs and coverings to prevent the entry of dirt, dust, and other foreign material. Before installation, make certain that all plugs and coverings have been removed.

1-48. REPLACEMENT, COMBUSTION CHAMBERS.

1-49. Equipment Requirements.

FIGURE	NAME	TYPE	ALTERNATE	USE AND APPLICATION
1-20 thru 1-22	Engine Stand.	USAF ETU-8/E (1740-294-3397) with Adapter Kits 8-96398-1 (1730-676-6848) and 8-96398-3 (1730-676-6849) or 8-96165 (1630-632-0059) installed.	SE 1012-803 (1740-568-1339)	To support engine when removed from airplane.
1-22	Engine Hoisting Adapter.		8-96068 (1730-540-5034) (for use with engine stand SE 1012-803)	To support engine center section during combustion chamber removal.

1-50. Procedure.

See figures 1-20 through 1-23 for combustion chamber replacement procedure.

1-51. LIMITS OF ACCEPTABILITY FOR COMBUSTION CHAMBERS.

For the limits of acceptability for combustion chambers, refer to T. O. 2J-J75-6.

1-52. REPLACEMENT, CONSTANT-SPEED DRIVE ENGINE MOUNTED GEARBOX.

Removal and installation procedures for the constant-speed drive engine mounted gearbox are shown in figure 9-4.

1-53. REPLACEMENT, HYDRAULIC PUMPS.

For information regarding the replacement of the engine mounted hydraulic pumps, refer to T.O. 1F-106A-2-3.

1-54. ENGINE EXTERNAL TUBE SEALING REQUIREMENTS.

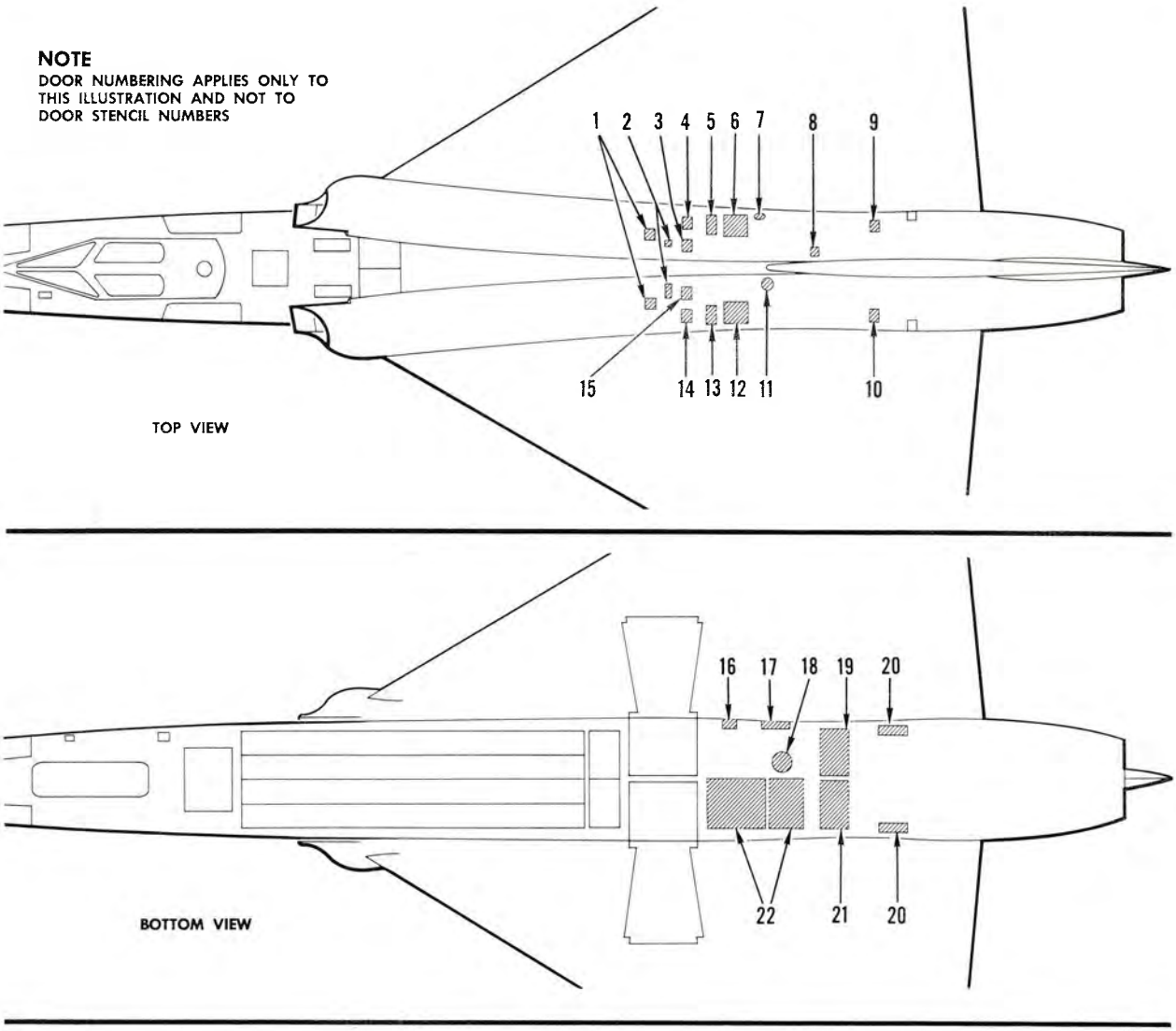
Figure 1-24 illustrates the sealing configurations for external tubes on J-75 engines. When fitting tubes to the engine, visual comparison of the tube with the examples shown will indicate the number and location of seals required. Examples 1 and 2 are two types of external tube connections which require no seals. They are called metal-to-metal type sealing connections and are readily identified by the conical mating seat on the ferrule. Examples 3 and 4 are typical tube connections which pass through the engine fireseal. The packing or seal is placed in the groove as shown and then the tube is inserted through the correct hole location in the fireseal. Examples 5, 6, 7, 8, and 9 are primarily related to oil pressure, scavenge, and breather tube connections. The number of grooves in the tube ferrule dictates the required number of seals. Example 10 shows a tube having no attaching connectors, or fittings, but is slipped into two elbows, then mounted on outlet and inlet ports of engine components. A seal rests against the flat face of each tube ferrule. Examples 11 and 12 show two tubes having different types of fixed flanges which are bolted to the engine cases. Install seal or gasket as indicated. Example 13 shows a tube end adapter that is secured to the engine case with a single bolt. Install a gasket at each end. Examples 14 and 15 show the sealastic type tube connections. Example 14 has a fixed ferrule while example 15 has a loose ferrule. A ferrule (loose or fixed) such as shown in these examples will always indicate a seal requirement. Example 16 shows the sealastic type tube connection at the engine fireseal. This arrangement is used only at the fireseal on oil pressure, scavenge, and breather tubes.

1-55. QUICK DISCONNECT COUPLINGS.

The quick disconnect couplings used on hydraulic, pneumatic, and oil lines are of the self-sealing type and are used when frequent uncoupling of lines is required. The coupling consists of two self-sealing halves, which may be disconnected without draining the system. Figure 1-25 illustrates the types of couplings in both the coupled and uncoupled configurations.

NOTE

Quick disconnect couplings require hand tightening only. Couplings should always be covered when disconnected to prevent entry of foreign material.



DISCONNECT POINTS AND ACCESSIBLE EQUIPMENT

1. INLET DUCT SCROLL INSPECTION ACCESS (SEE NOTE).
2. INLET DUCT SCROLL INSPECTION ACCESS (SEE NOTE).

NOTE

INLET DUCT SCROLL INSPECTION ACCESS DOORS ARE *APPLICABLE TO ALL F-106A AIRPLANES AND F-106B AIRPLANES 57-2508 THRU 57-2515, 56-2521 AND SUBSEQUENT.*

3. CONSTANT SPEED OIL COOLER AIR VALVE.
4. CONSTANT SPEED OIL COOLER AIR VALVE ACTUATOR.
5. CONSTANT SPEED OIL COOLER.
6. RH FORWARD ENGINE MOUNT, ENGINE ELECTRICAL DISCONNECTS (3). RH COOLING AIR DUCT.
7. CONSTANT SPEED UNIT OIL FILLER.
8. N2 COMPRESSOR BLEED AIR DUCT.
9. RH AFT ENGINE MOUNT.
10. LH AFT ENGINE MOUNT.
11. ENGINE OIL FILLER.
12. LH FORWARD ENGINE MOUNT. PRESSURE RATIO LINE (Pt7). OIL COOLING CONTROL AIR LINE. LH COOLING AIR DUCT. ENGINE AIR OIL COOLER "IN" AND "OUT" LINE.
13. ENGINE AIR-OIL COOLER.
14. ENGINE AIR-OIL COOLER AIR VALVE ACTUATOR.
15. ENGINE AIR-OIL COOLER AIR VALVE.
16. ENGINE COMPARTMENT FIRE CONTROL DOOR.
17. LH HYDRAULIC PUMP. LH HYDRAULIC PUMP CASE DRAIN.
18. STARTER DUCT.
19. LH HYDRAULIC PUMP OIL "IN" AND "OUT" LINE. FUEL CONTROL MECHANICAL LINKAGE. OIL TANK SCUPPER DRAIN LINE. FUEL CONTROL DRAIN LINE. AFTERBURNER MANIFOLD DRAIN LINE.
20. ENGINE REMOVAL RAIL BRACKET ACCESS.
21. ENGINE OIL BREATHER. ENGINE FUEL SUPPLY LINE. RH HYDRAULIC PUMP OIL "IN" AND "OUT" LINES. RH HYDRAULIC PUMP DRAIN LINE. SHROUD FORWARD DRAIN LINE. COMBUSTION CHAMBER DRAIN LINE.
22. CONSTANT SPEED DRIVE OIL "IN" AND "OUT" LINES. CONSTANT SPEED DRIVE VENT LINE. CONSTANT SPEED DRIVE UNIT SHAFT. STARTER EXHAUST DUCT. STARTER ACCUMULATOR DRAIN VALVE.

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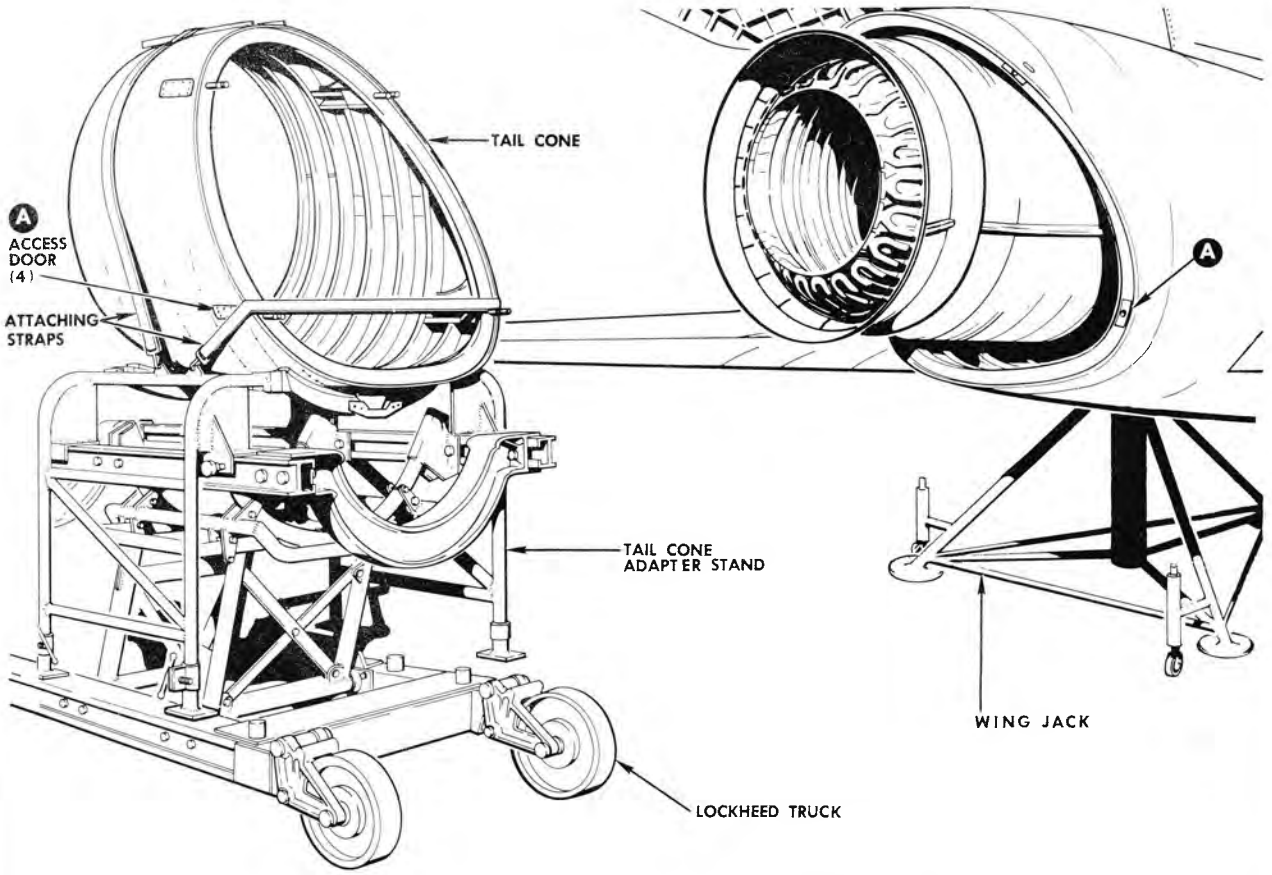
Figure 1-9. Engine Disconnect Point Access



TAIL CONE REMOVAL

a. Open speed brake doors; install door lock.
b. Position Lockheed truck No. 205226, with adapter stand 8-96010 or -801 installed under tail cone. Adapter stand 8-96010-801 is to be used on airplanes having the tail hook installation.

CAUTION

THE AIRPLANE MUST BE STABILIZED BY USE OF WING AND NOSE JACKS WHEN POSITIONING THE TRUCK UNDER THE TAIL CONE.

c. On airplanes with tail hook installed, remove screws (8) attaching hook fairing to fuselage. Release tail cone attachments (4) as shown in details A.
d. Rest tail cone on adapter stand and truck and move aft.
e. Install straps to hold tail cone to support stand.

TAIL CONE INSTALLATION

a. Installation of the fuselage tail cone is essentially the reverse of removal.
b. For bolt type tail cone attachment, torque bolts 100 to 140 inch-pounds; lock-wire bolts using MS20995-NC51 wire.

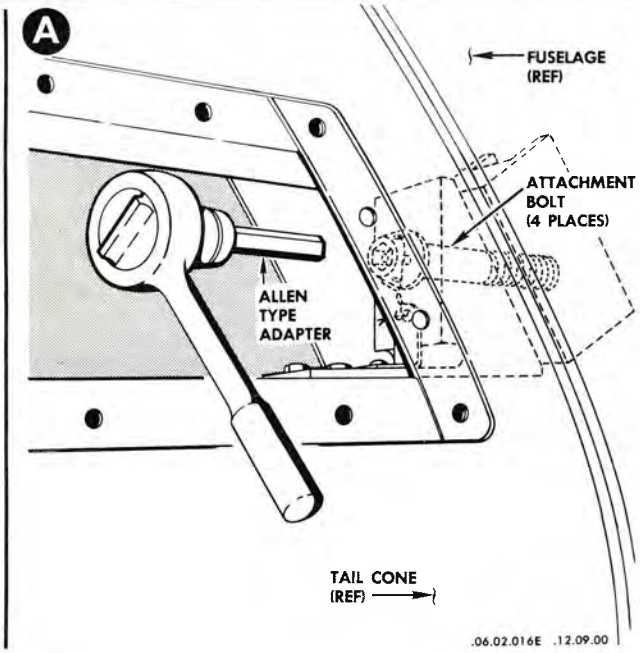


Figure 1-10. Replacement, Tailcone

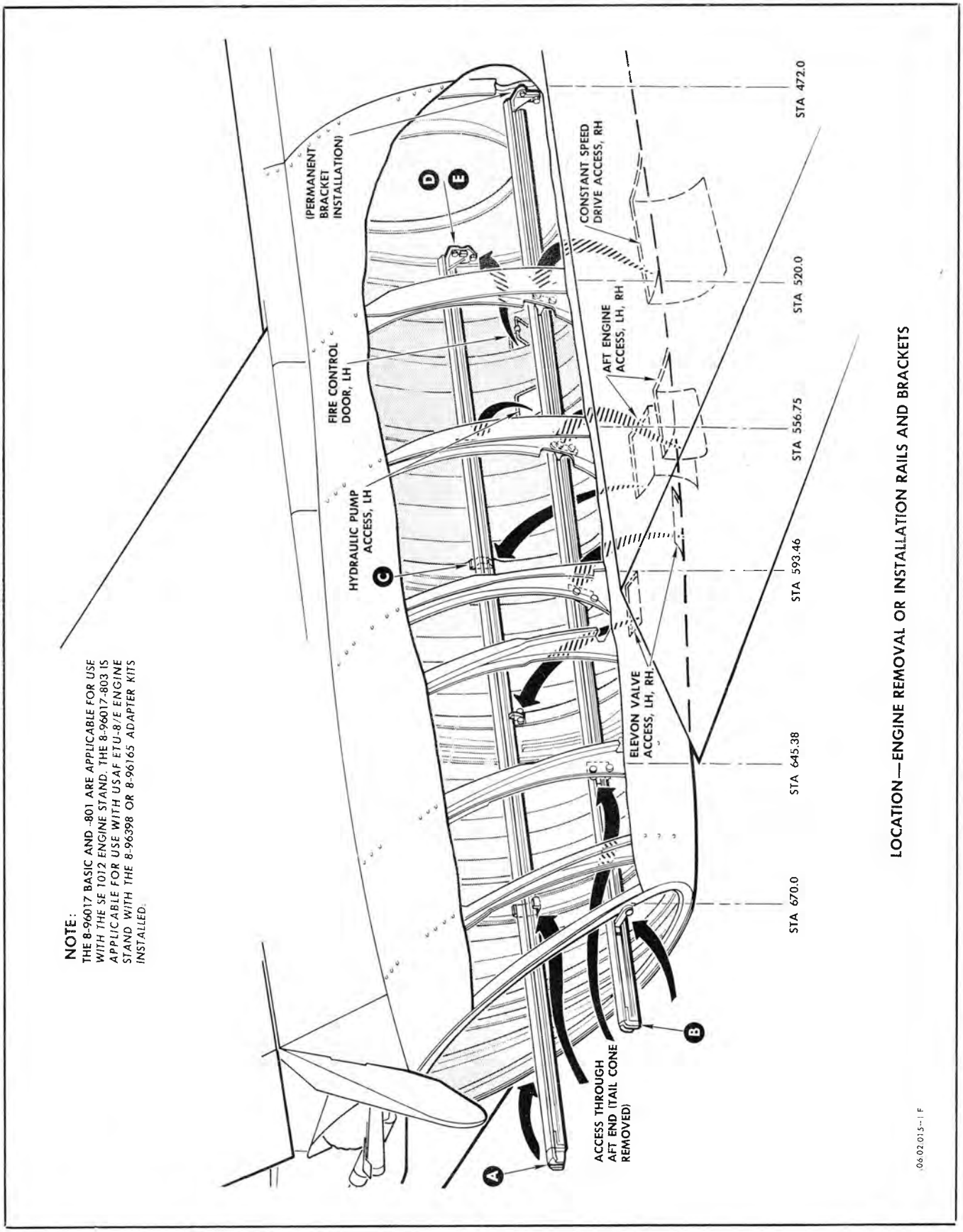


Figure 1-11. Engine Replacement, Rail and Bracket Installation, 8-96017 Basic, -801, -803 (Sheet 1 of 2)
Applicable to F-106A airplanes 57-246 thru 58-798, and F-106B airplanes 57-2516 thru 57-2541

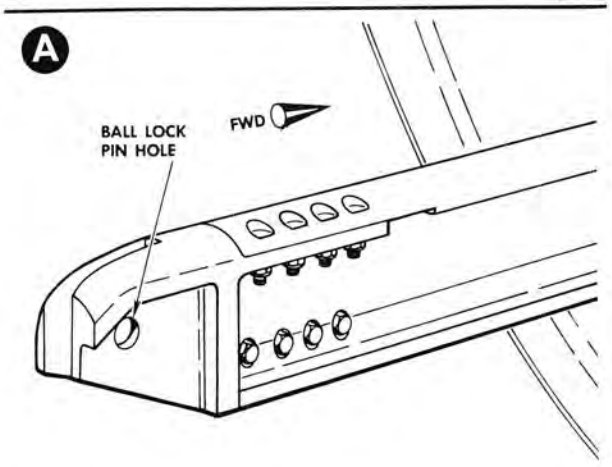
INSTALLATION,
ENGINE REMOVAL RAILS AND BRACKETS

a. Open engine compartment access doors.
b. Remove fuselage tail cone.
c. Install rail brackets and rails as follows:

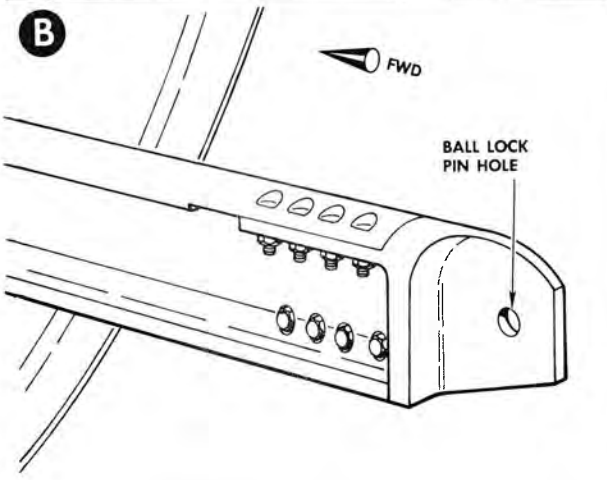
QTY	PART NUMBER	STATION LOCATION	POSITION
1	8-96017—21 BRACKET	472.0	LEFT
2	—9 BRACKET	520.0	LEFT AND RIGHT
2	—11 BRACKET	556.75	LEFT AND RIGHT
2	—13 BRACKET	593.46	LEFT AND RIGHT
2	—15 BRACKET	645.38	LEFT AND RIGHT
1	—17 BRACKET	670.0	LEFT
1	—18 BRACKET	670.0	RIGHT
1	—27, -59 OR -67 RAIL	FUSELAGE	LEFT
1	—28, -63 OR -69 RAIL	FUSELAGE	RIGHT

NOTE

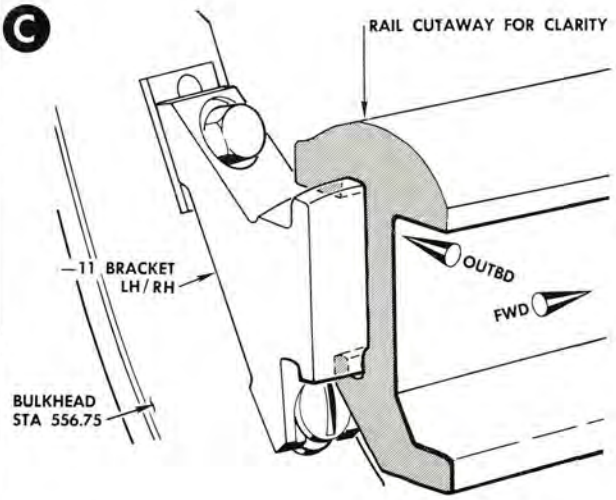
CHECK THAT THE ABOVE LISTED BRACKETS HAVE BEEN REMOVED UPON COMPLETION OF ENGINE REPLACEMENT.



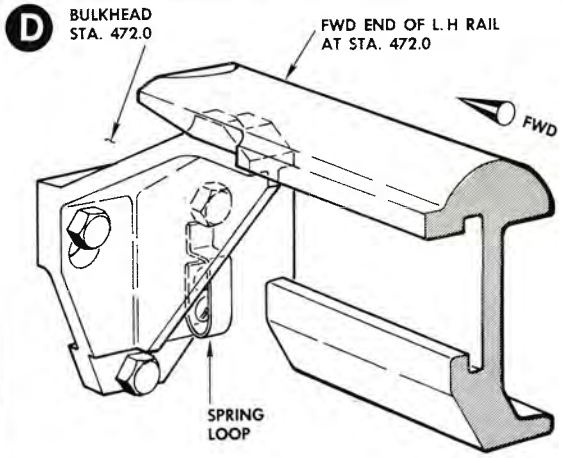
AFT END OF LEFT RAIL FOR -803



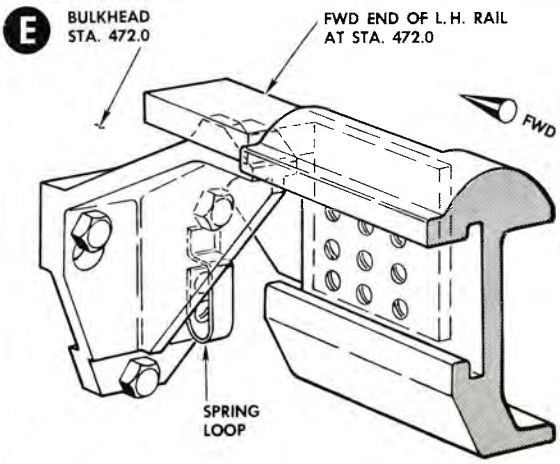
AFT END OF RIGHT RAIL FOR -803



TYPICAL BRACKET AND RAIL ATTACHMENT



FORWARD MOUNT BRACKET FOR BASIC



FORWARD MOUNT BRACKET FOR -801 AND -803

.06.02.015-2

Figure 1-11. Engine Replacement, Rail and Bracket Installation, 8-96017 Basic, -801, -803 (Sheet 2 of 2)
Applicable to F-106A airplanes 57-246 thru 58-798, and F-106B airplanes 57-2516 thru 57-2541

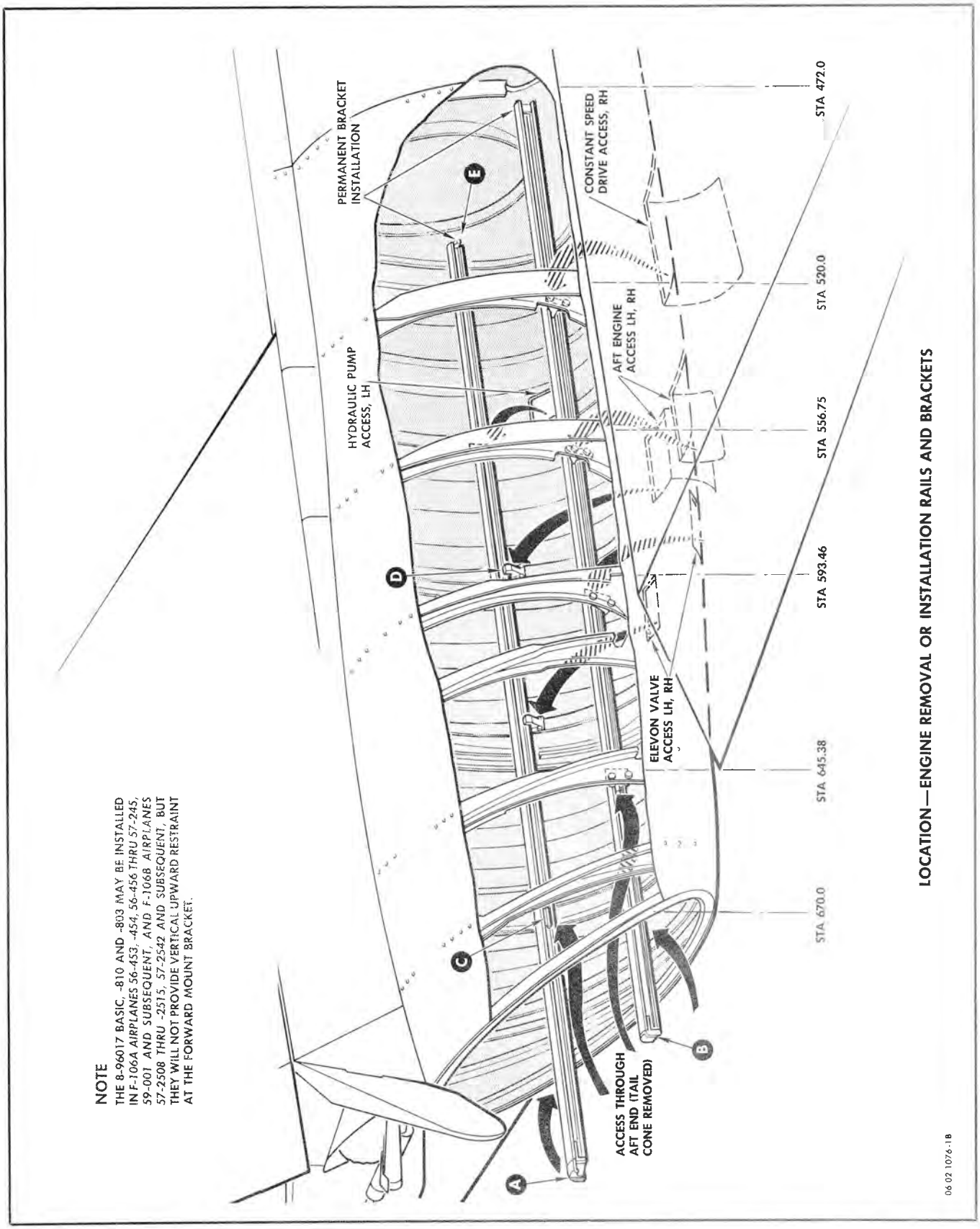


Figure 1-12. Engine Replacement, Rail and Bracket Installations, 8-96017-805 (Sheet 1 of 2)
Applicable to F-106A airplanes 56-453, 56-454, 56-456 thru 57-245, 59-001 and subsequent, and F-106B airplanes 57-2508 thru 57-2515, 57-2542 and subsequent

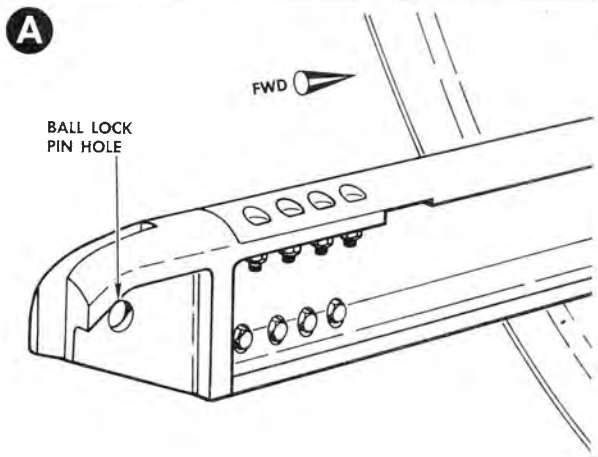
INSTALLATION, ENGINE REMOVAL RAILS AND BRACKETS

a. Open engine compartment access doors.
b. Remove fuselage tail cone.
c. Install rail brackets and rails as follows:

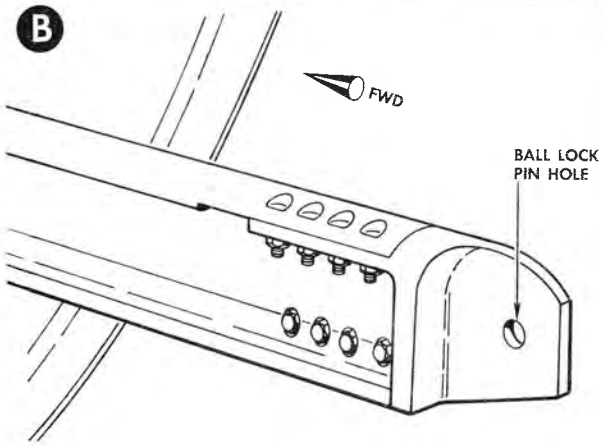
QTY	PART NUMBER	STATION LOCATION	POSITION
2	8-96017-91 BRACKET	520.0	LEFT AND RIGHT
2	8-96017-93 BRACKET	556.75	LEFT AND RIGHT
2	8-96017-95 BRACKET	593.46	LEFT AND RIGHT
2	8-96017-97 BRACKET	645.38	LEFT AND RIGHT
1	8-96017-85 RAIL	FUSELAGE	LEFT
1	8-96017-87 RAIL	FUSELAGE	RIGHT

NOTE

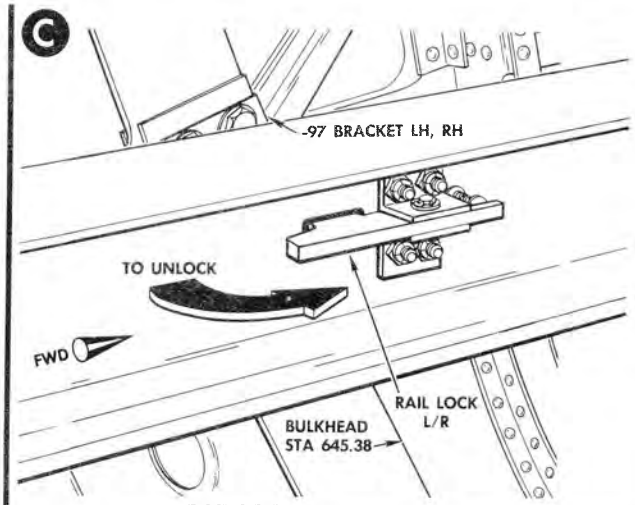
CHECK THAT THE ABOVE LISTED BRACKETS HAVE BEEN REMOVED UPON COMPLETION OF ENGINE REPLACEMENT.



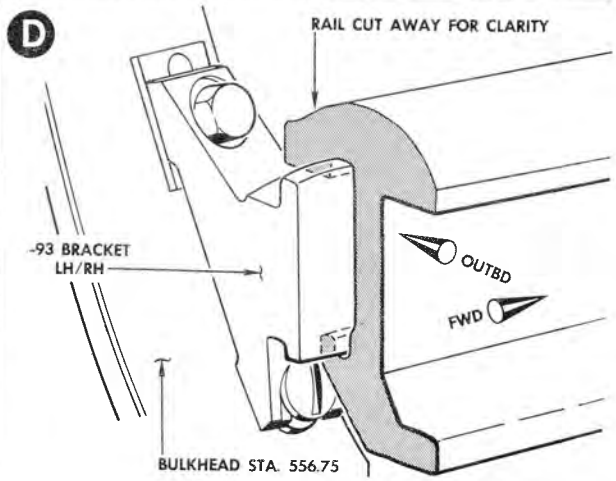
AFT END OF LEFT RAIL



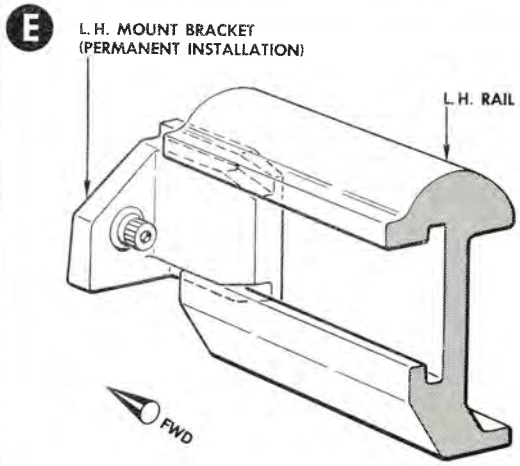
AFT END OF RIGHT RAIL



RAIL LOCK ATTACHMENT



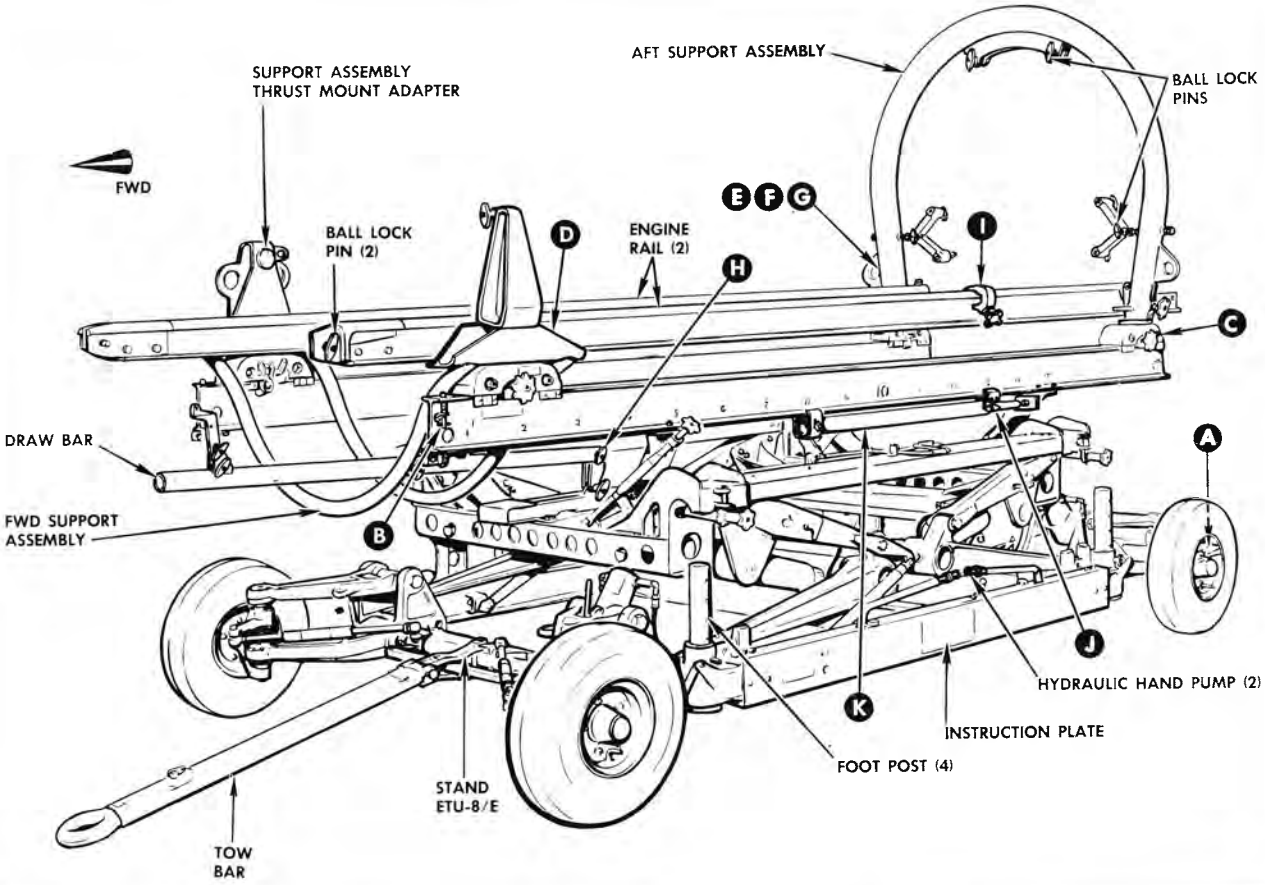
TYPICAL BRACKET AND RAIL ATTACHMENT

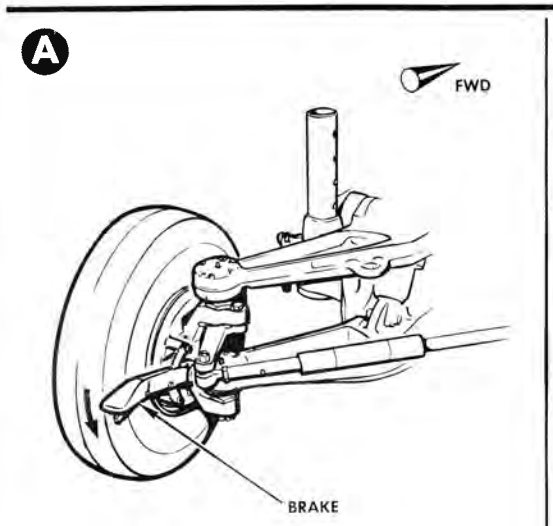


FORWARD MOUNT BRACKET

.06.02.1076 -2

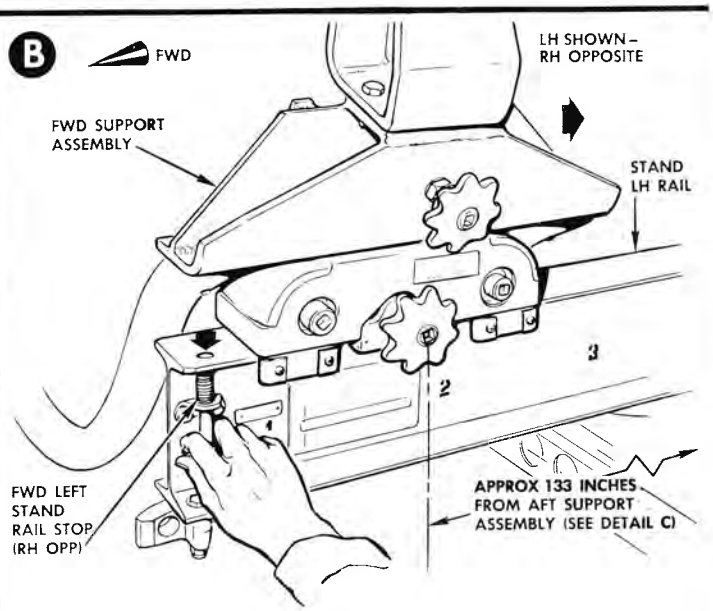
Figure 1-12. Engine Replacement, Rail and Bracket Installations, 8-96017-805 (Sheet 2 of 2)
Applicable to F-106A airplanes 56-453, 56-454, 56-456 thru 57-245, 59-001 and subsequent, and F-106B airplanes 57-2508 thru 57-2515, 57-2542 and subsequent





PROCEDURE

a. Position stand on level surface. Engage stand brakes (2 places).



b. Depress stand forward left and right rail stops. Roll forward support assembly on to stand rails; release stops. Support assembly thrust mount adapter to be on right side of stand.

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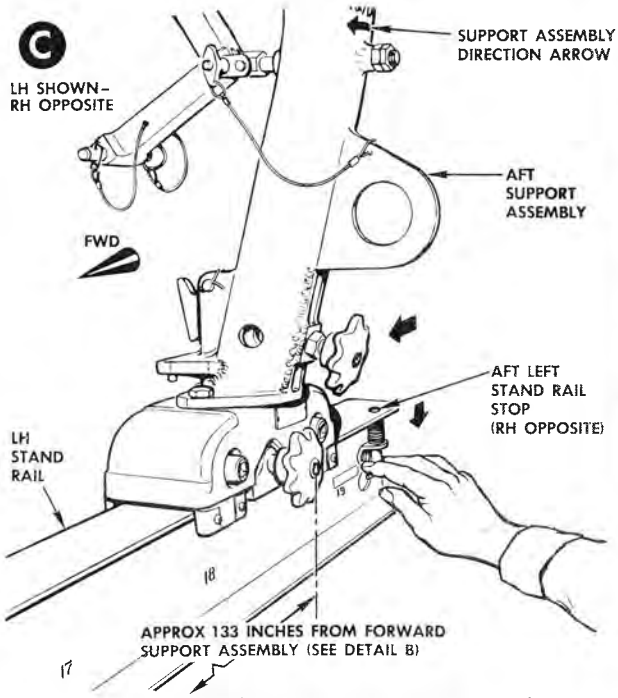
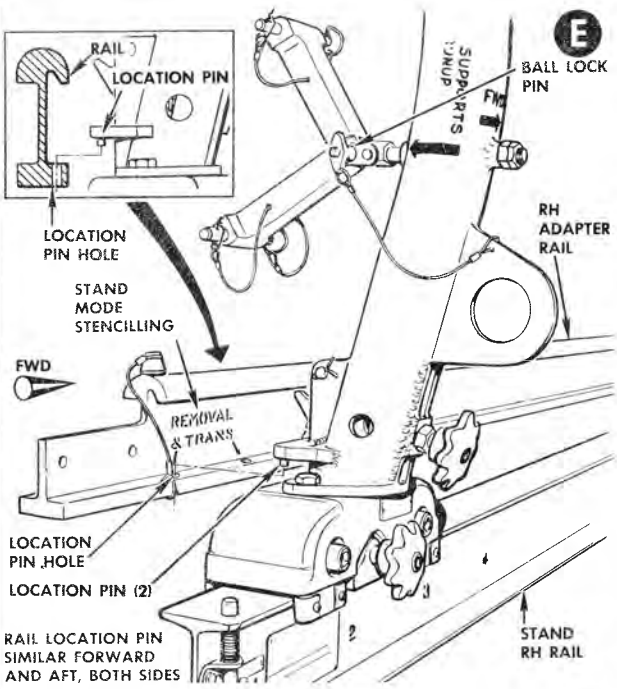
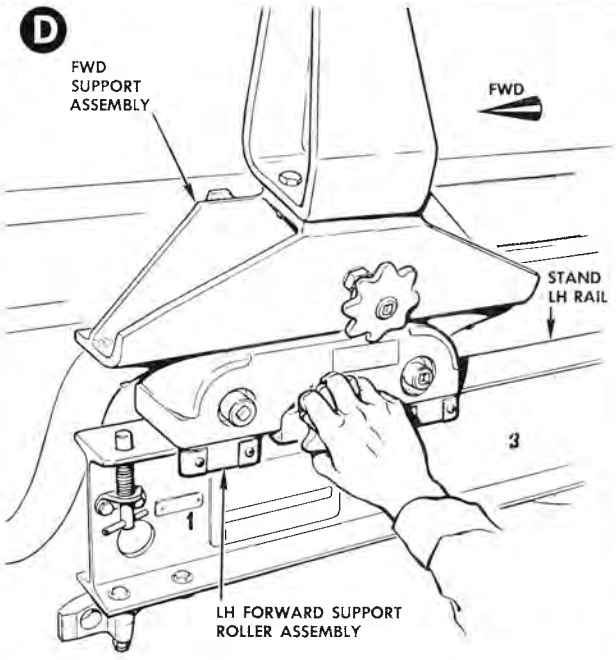
Figure 1-13. Engine Stand Preparation, Type USAF ETU-8/E Using Adapter Kit 8-96398 (Sheet 1 of 3)



c. Depress stand aft left and right rail stops. Roll aft stand support assembly on to stand rails; release stops. Support direction arrow to be pointed forward.

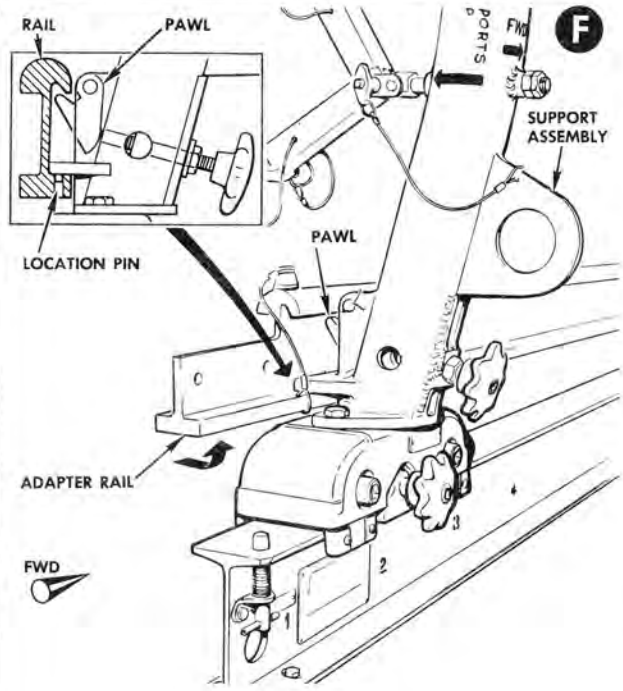


f. Position adapter rails on support assembly locating pins (forward and aft) for mode of stand operation desired. Note stencilling on rails.



d. Position forward and aft support assemblies approximately 133 inches apart as shown on details "B" and "C."

e. Lightly tighten support roller assemblies to stand rails as shown (4 places).



g. Position adapter rails on forward and aft support assembly locating pins.

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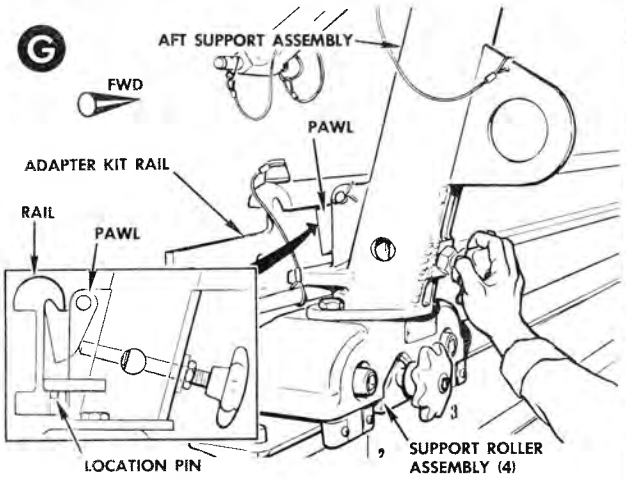
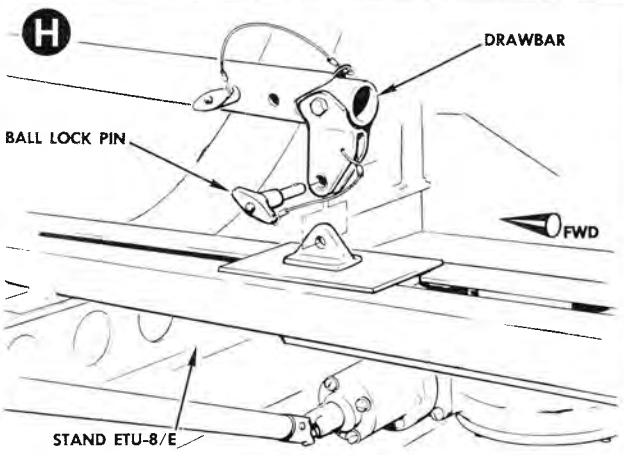
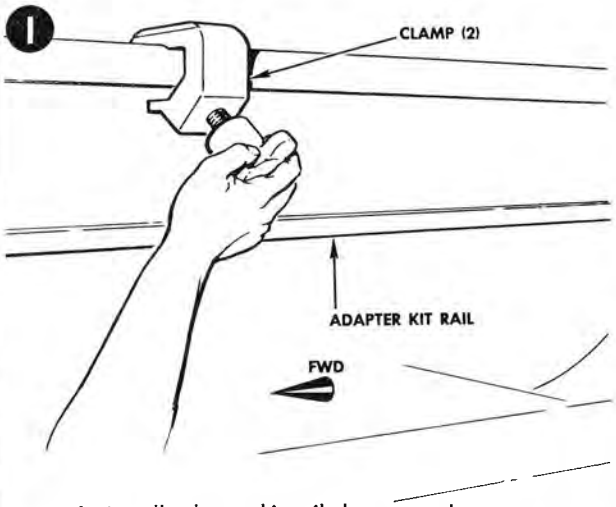
Figure 1-13. Engine Stand Preparation, Type USAF ETU-8/E Using Adapter Kit 8-96398 (Sheet 2 of 3)



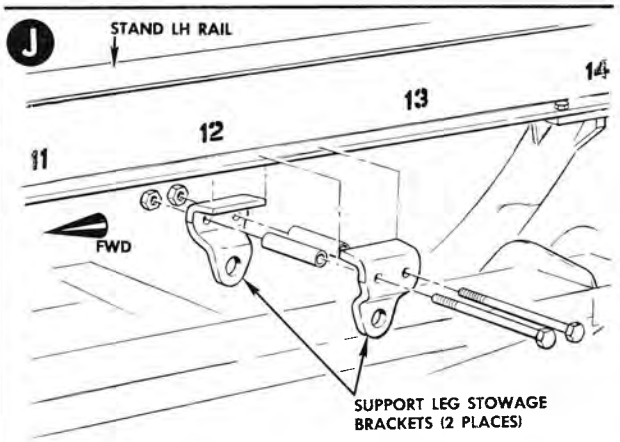
h. Tighten adapter rail attachments (4 places) as shown. Tighten support roller assemblies to stand rails.



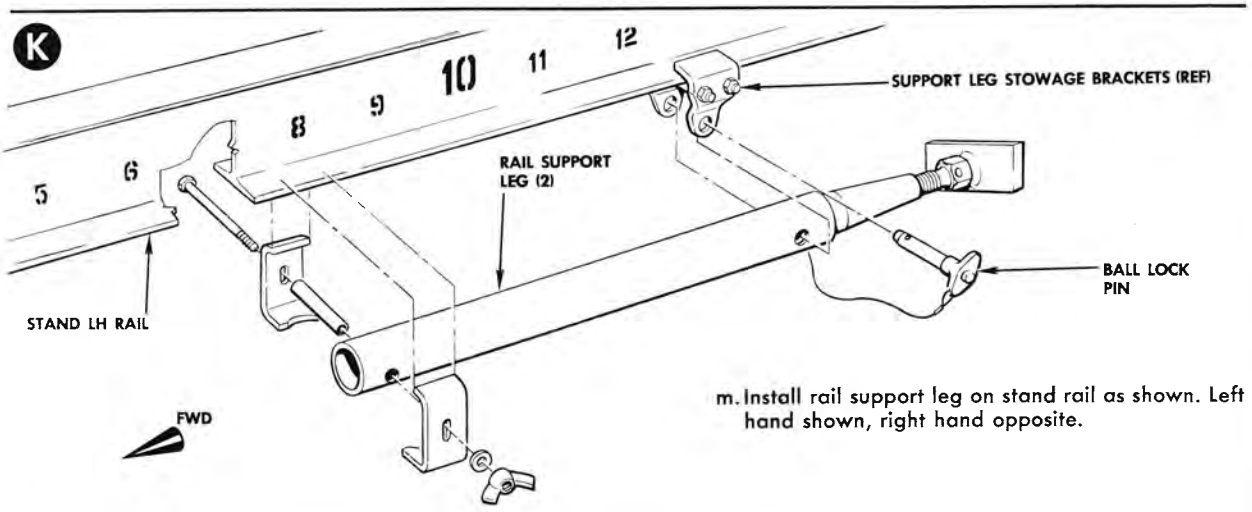
i. Remove basic ETU-8/E stand drawbar if installed.
j. Install adapter kit drawbar as shown.



k. Install adapter kit rail clamps as shown.



l. Install support leg stowage brackets on engine stand left and right rails. Left hand shown, right hand opposite.



m. Install rail support leg on stand rail as shown. Left hand shown, right hand opposite.

06.02.783-3

Figure 1-13. Engine Stand Preparation, Type USAF ETU-8/E Using Adapter Kit 8-96398 (Sheet 3 of 3)

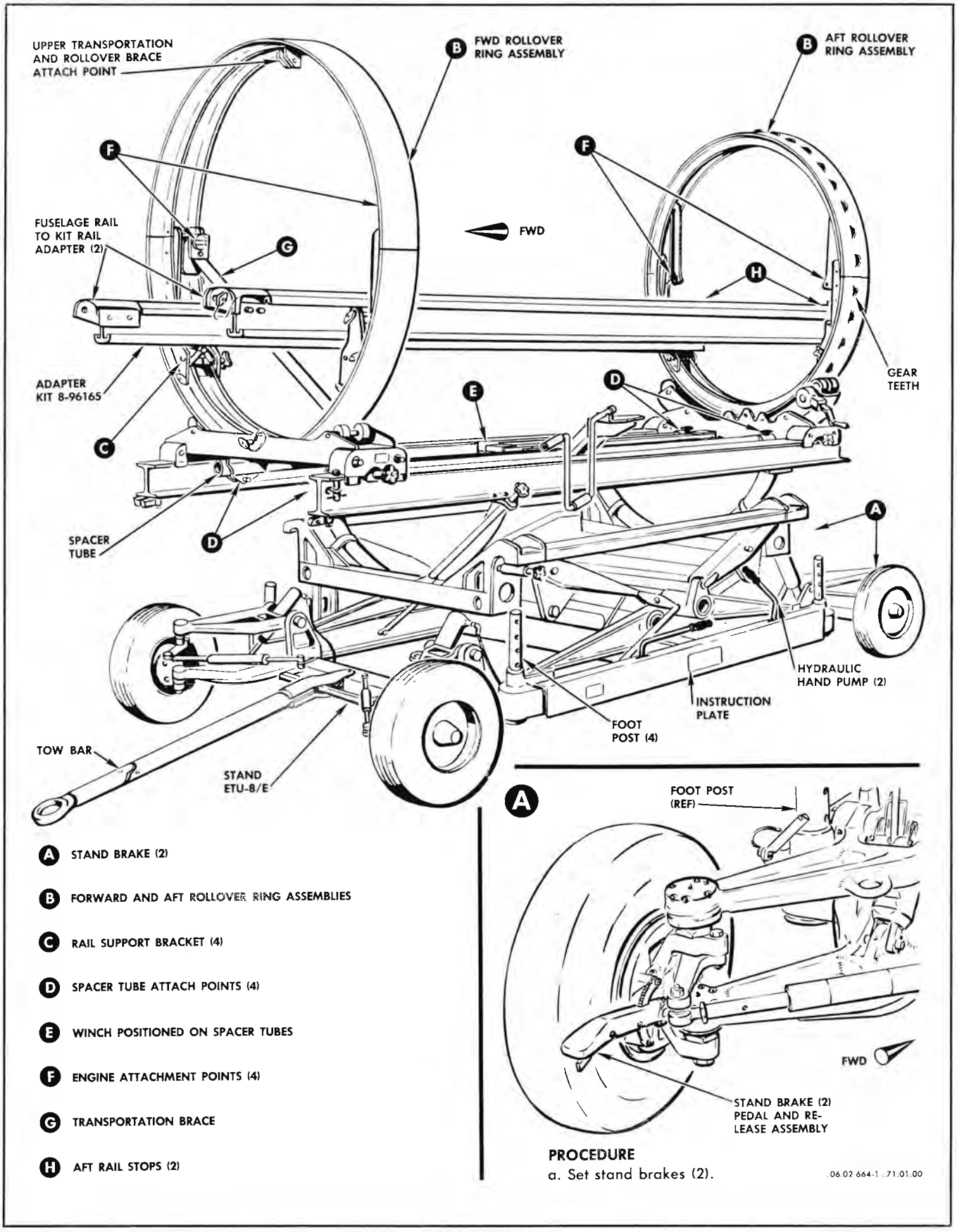
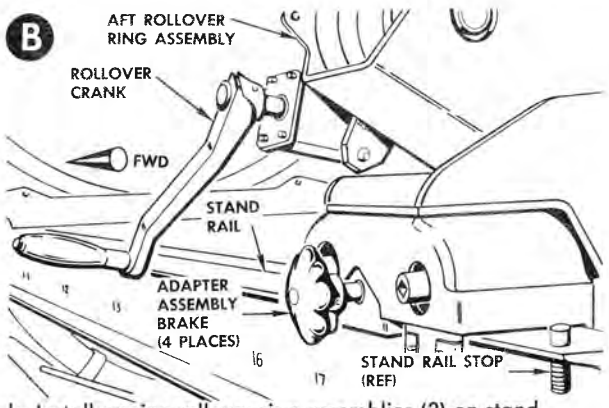
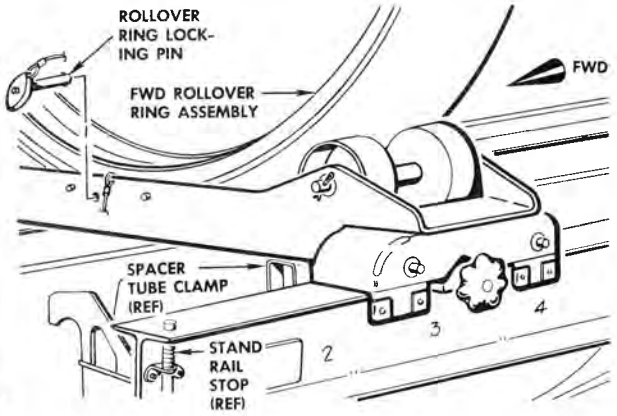
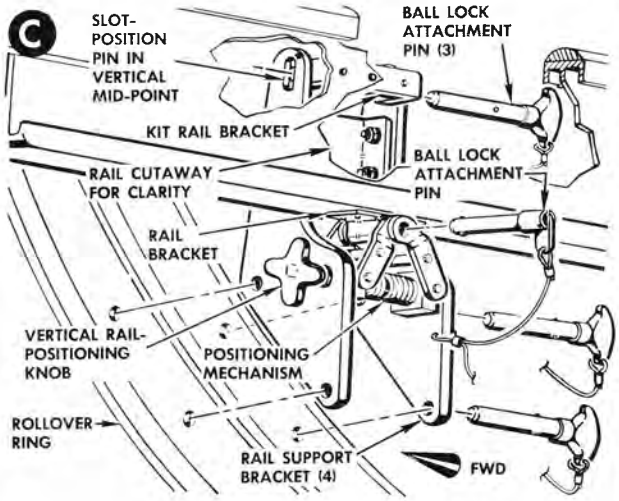


Figure 1-14. Engine Stand Preparation, Type USAF ETU-8/E Using Adapter Kit 8-96165 (Sheet 1 of 3)

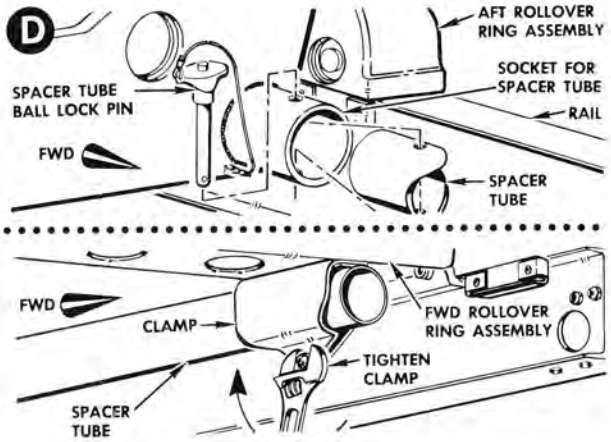


b. Install engine rollover ring assemblies (2) on stand rails. Ring with gear teeth to be at end of stand opposite stand towbar with rollover crank on same side of stand as hydraulic hand pumps. Ring assemblies to be approximately 133 inches apart.



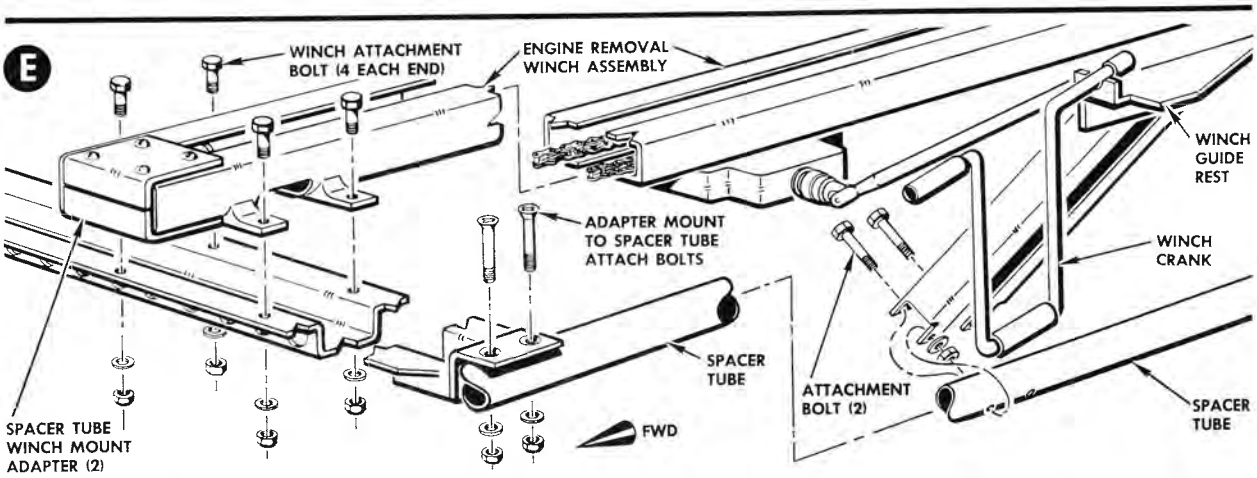


c. Install rail supports and rail assemblies. Rail ends with rail couplings to go toward stand towbar. Adjust rails to middle vertical position.



d. Install rollover ring spacer tubes and pins in aft sockets; install spacer tubes in forward clamps.

e. Check rollover rings for being parallel and that they are perpendicular to stand horizontal centerline. Tighten spacer tube clamps.



f. Remove engine removal winch assembly from stand. Reinstall winch assembly at spacer tubes.

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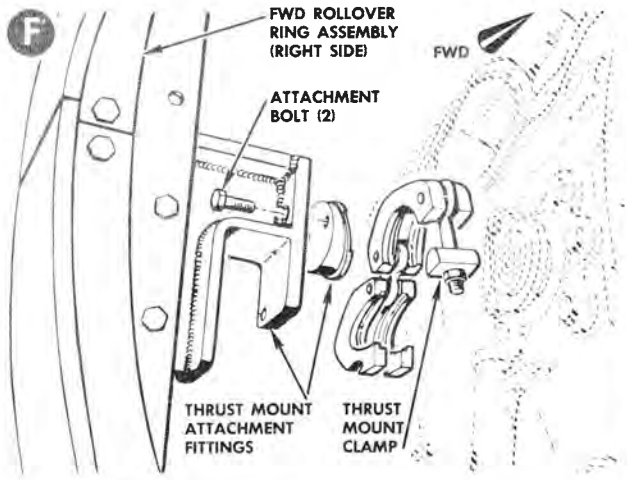
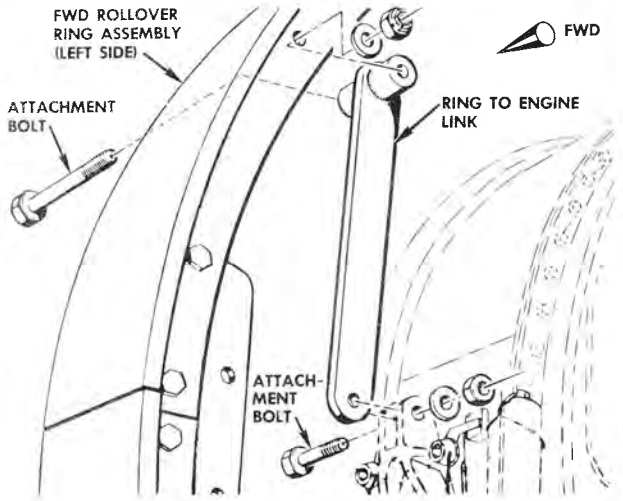
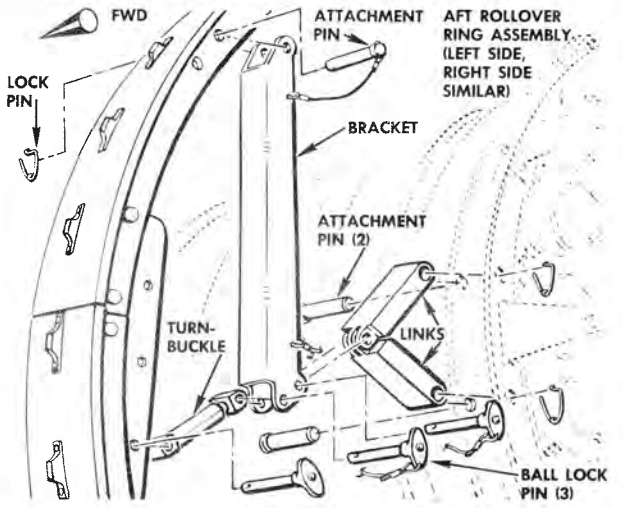
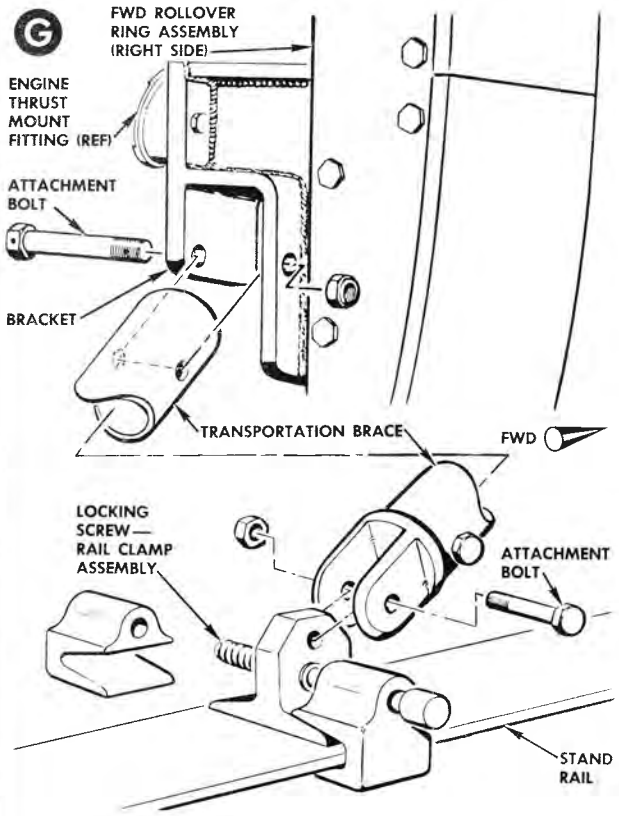
Figure 1-14. Engine Stand Preparation, Type USAF ETU-8/E Using Adapter Kit 8-96165 (Sheet 2 of 3)





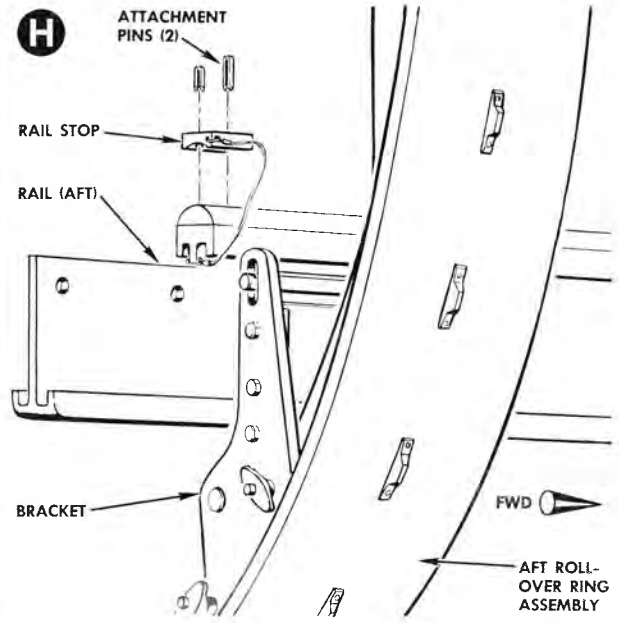


g. Install engine mount attachment fittings on forward and aft rollover ring assemblies.



h. Center the entire adapter kit assembly on the stand. Engage adapter assembly brakes (4 places).

i. Install brace on right side of stand at forward rollover ring.



j. Install rail stop at aft end of each rail.

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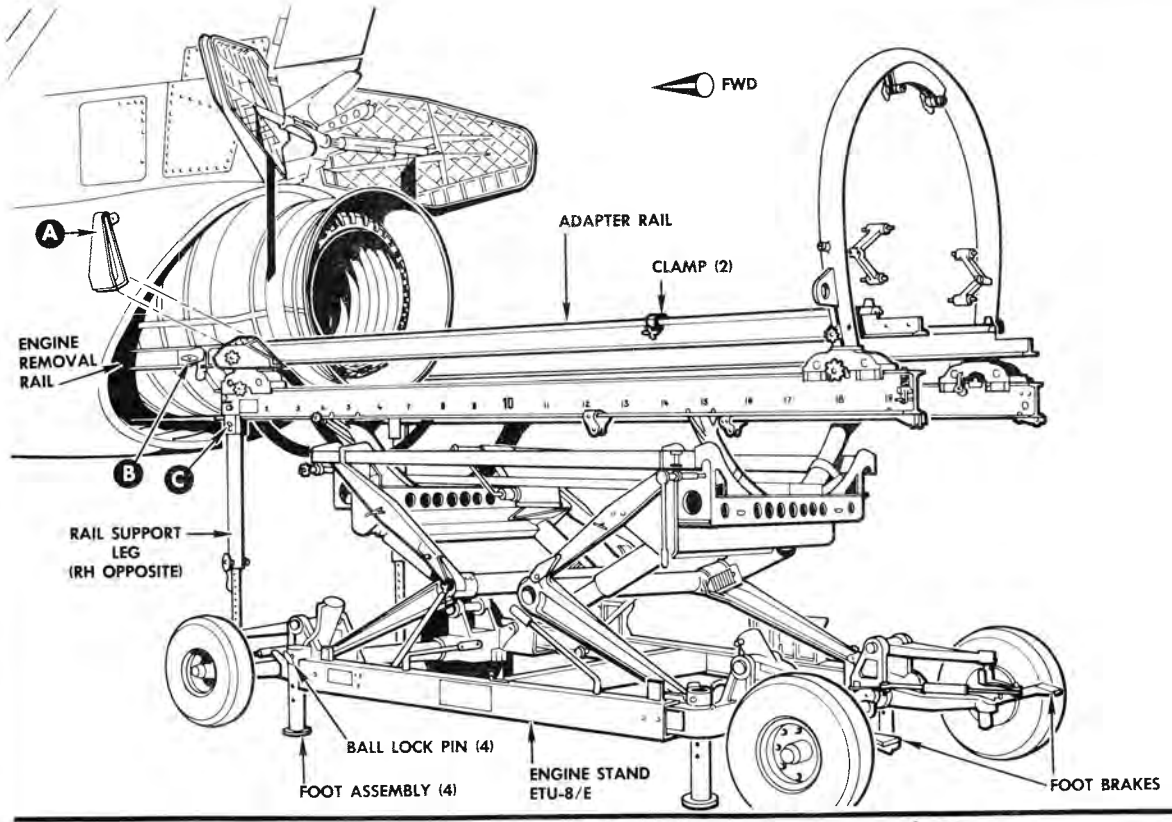
Figure 1-14. Engine Stand Preparation, Type USAF ETU-8/E Using Adapter Kit 8-96165 (Sheet 3 of 3)



PROCEDURE

a. Remove tail cone from airplane.
b. Open engine access doors in fuselage.
c. Install engine removal rails and brackets in fuselage.

CAUTION

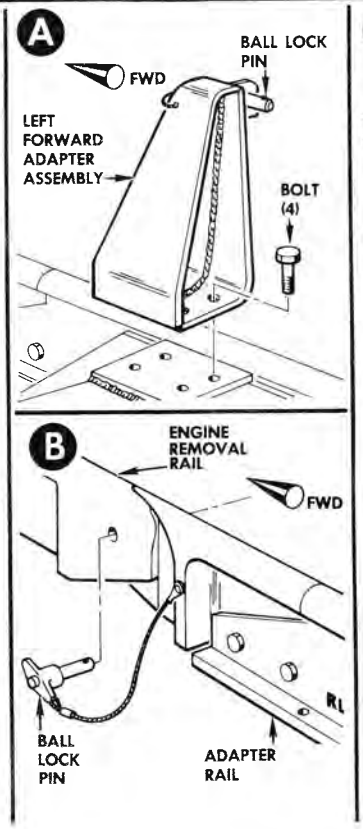
WHEN INSTALLING THE ENGINE RAILS, DO NOT ALLOW ANY WEIGHT TO BE PLACED ON THE ELEVON FEEDBACK POTENTIOMETER SHAFT. ANY WEIGHT THAT MIGHT BE EXERTED TENDS TO BEND THE FLEXIBLE CABLE SECTION OF THE SHAFT OUT OF ALIGNMENT.

d. Stabilize airplane in level position by jacking aircraft. Refer to T.O. 1F-106A-2-2 for jacking procedure. For engine replacement procedure, lateral level will be checked at the airplane leveling lugs. Longitudinal level will be checked at the engine removal rails in the fuselage with the removal rails level, the airplane will have a slight nose up attitude.
e. Remove left forward adapter assembly as shown in detail A.
f. Position engine stand aft of airplane. Adjust height of engine stand until stand and fuselage rails are in alignment. Install ball lock pins as shown in detail B.

CAUTION

ALIGNMENT OF FUSELAGE AND STAND RAILS IS NECESSARY TO PREVENT INTERFERENCE OF ENGINE COMPONENTS AND FUSELAGE STRUCTURE DURING ENGINE REPLACEMENT.

g. Engage stand brakes (2) and foot assemblies (4).
h. Install rail support legs (2) at forward end of stand as shown in detail C.



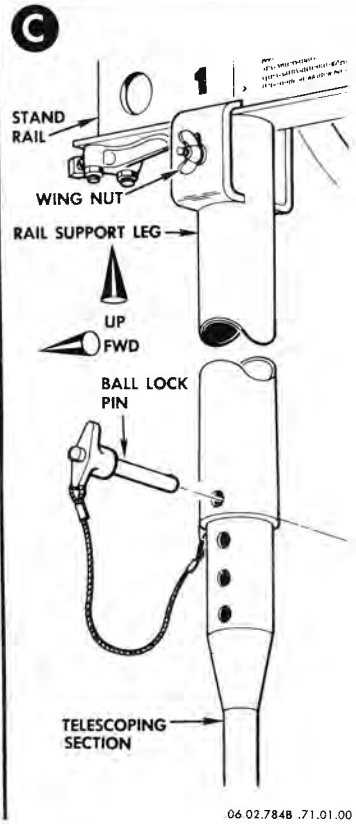
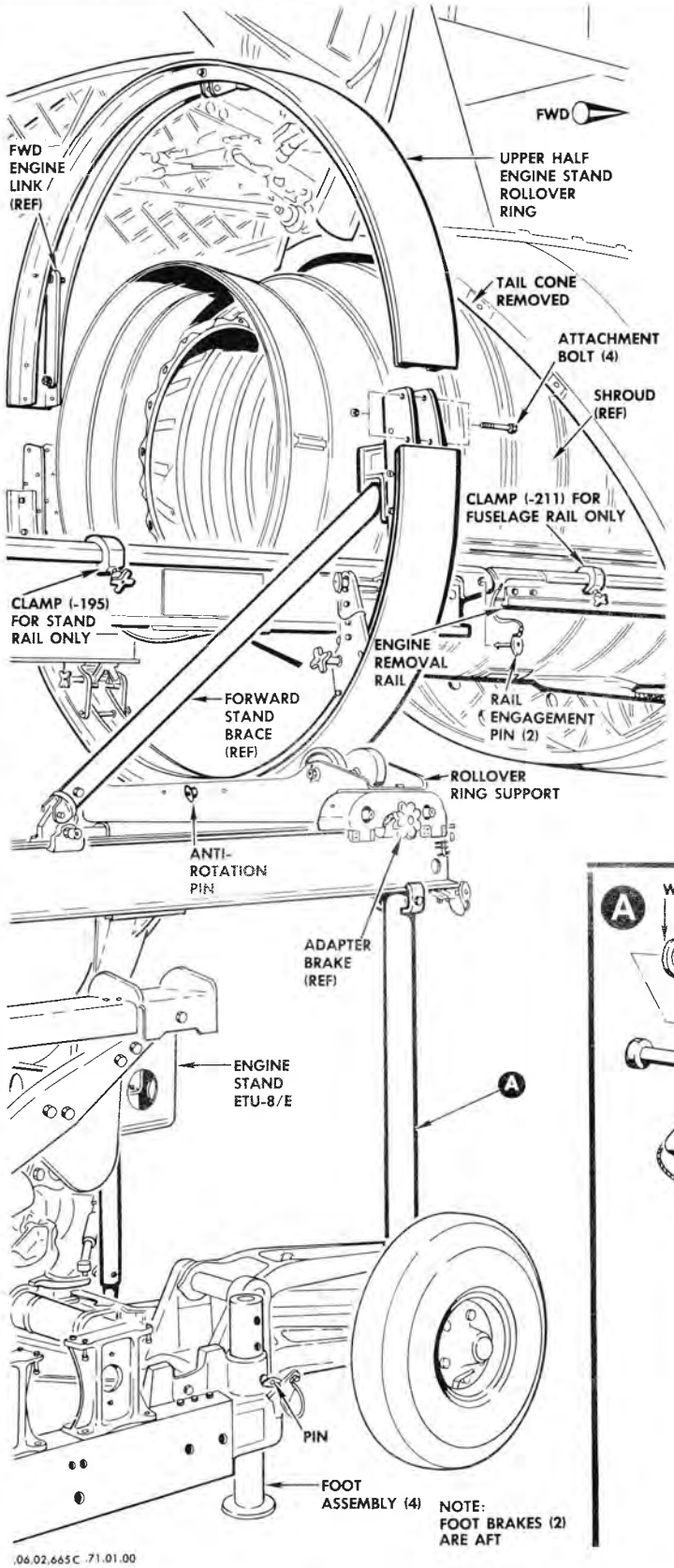


Figure 1-15. Engine Replacement Preparation Using Stand Type USAF ETU-8/E and Adapter Kit 8-96398



PROCEDURE

a. Remove tail cone from airplane.
b. Open engine access doors in fuselage.
c. Install engine removal rails and brackets in fuselage.

CAUTION

WHEN INSTALLING THE ENGINE RAILS DO NOT ALLOW ANY WEIGHT TO BE PLACED ON THE ELEVON FEEDBACK POTENTIOMETER SHAFT. ANY WEIGHT THAT MIGHT BE EXERTED TENDS TO BEND THE FLEXIBLE CABLE SECTION OF THE SHAFT OUT OF ALIGNMENT.

d. Stabilize airplane in level position by jacking aircraft. Refer to T.O. 1F-106A-2-2 for jacking procedure. For engine replacement procedure, lateral level will be checked at the airplane leveling lugs. Longitudinal level will be checked at the engine removal rails in the fuselage with the removal rails level, the airplane will have a slight nose up attitude.
e. Remove upper half of engine stand forward rollover ring.
f. Position engine stand aft of airplane. Adjust height of engine stand until stand and fuselage rails are in alignment. Install engagement pins.

CAUTION

ALIGNMENT OF FUSELAGE AND STAND RAILS IS NECESSARY TO PREVENT INTERFERENCE OF ENGINE COMPONENTS AND FUSELAGE STRUCTURE DURING ENGINE REPLACEMENT.

g. Engage stand brakes (2) and foot assemblies (4).
h. Install removal rail support legs (2) at forward end of stand.
i. Check that the anti-rotation pins are installed between the engine stand rollover rings and the ring support.

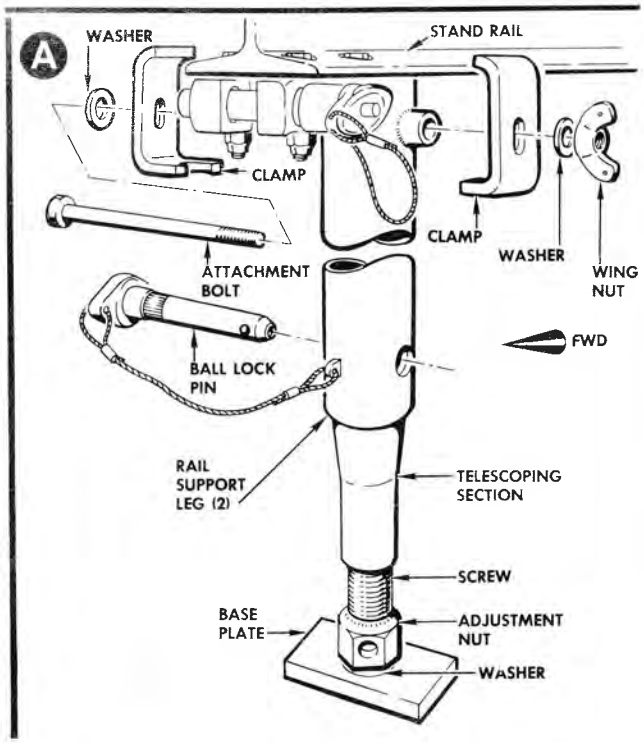
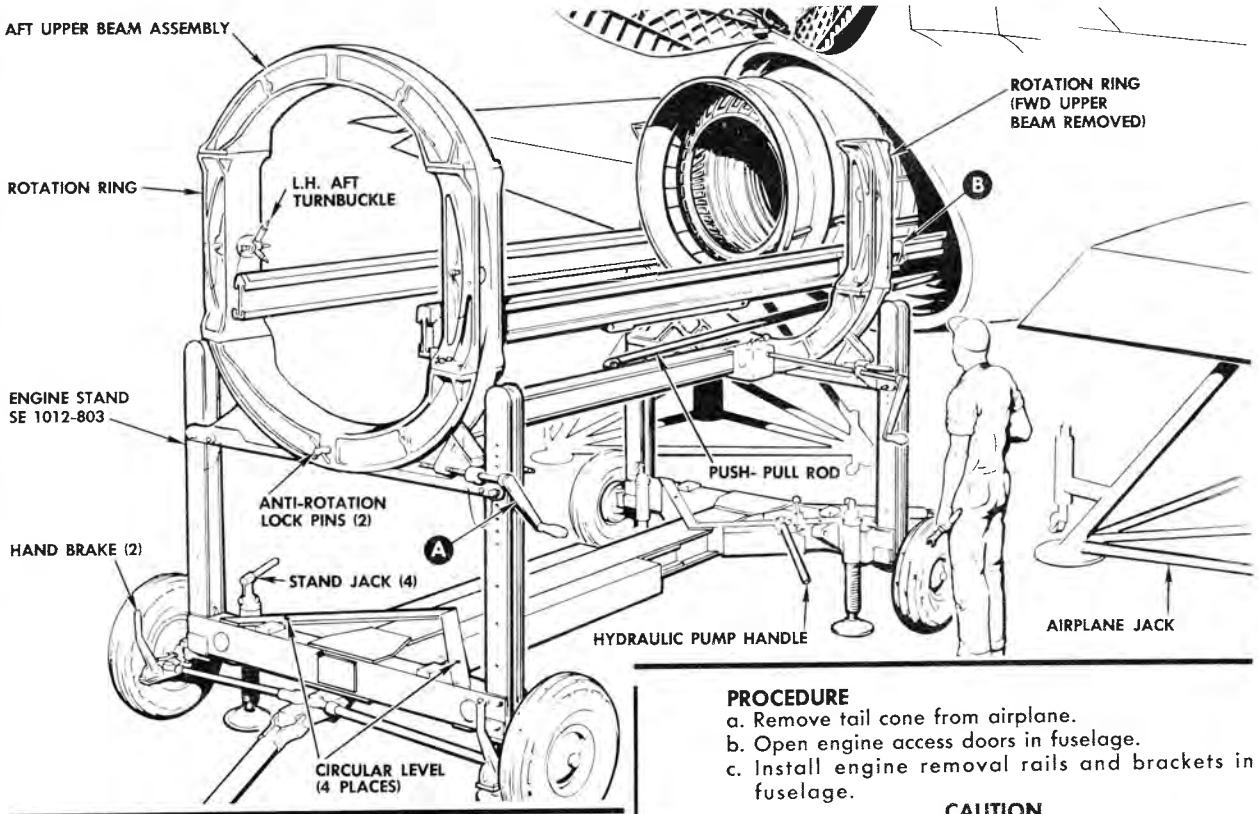
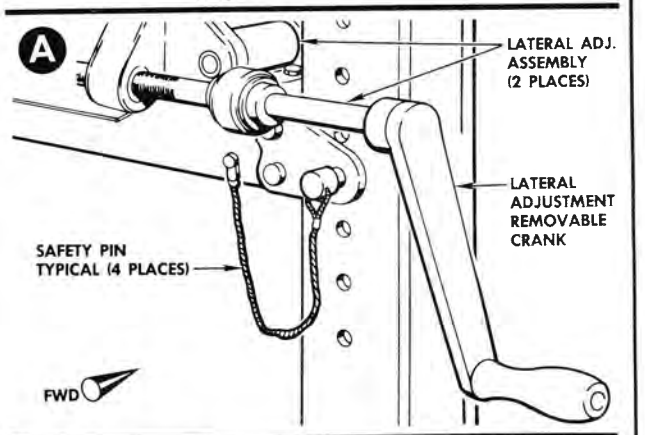
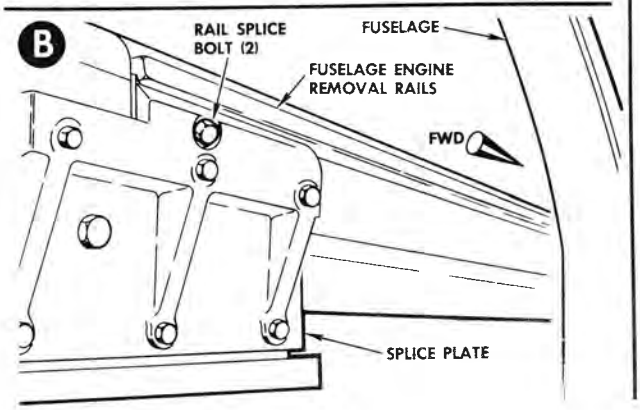


Figure 1-16. Engine Replacement Preparation Using Stand Type USAF ETU-8/E and Adapter Kit 8-96165







PROCEDURE

a. Remove tail cone from airplane.

b. Open engine access doors in fuselage.

c. Install engine removal rails and brackets in fuselage.

CAUTION

WHEN INSTALLING THE ENGINE RAILS, DO NOT ALLOW ANY WEIGHT TO BE PLACED ON THE ELEVON FEEDBACK POTENTIOMETER SHAFT. ANY WEIGHT THAT MIGHT BE EXERTED TENDS TO BEND THE FLEXIBLE CABLE SECTION OF THE SHAFT OUT OF ALIGNMENT.

d. Stabilize airplane in level position by jacking aircraft. Refer to T.O. 1F-106A-2-2 for jacking procedure. For engine replacement procedure, lateral level will be checked at the airplane leveling lugs. Longitudinal level will be checked at the engine removal rails in the fuselage with the removal rails level, the airplane will have a slight nose up attitude.

e. Remove forward upper beam assembly from the SE 1012-803 engine stand.

f. Check that anti-rotation lock pins (2) are installed in rotation rings.

g. Position engine stand aft of airplane. Set stand brakes (2). Jack stand until weight is off wheels; level stand using levels (4) installed on stand carriage. Raise stand until stand and fuselage rails are approximately level; install inner cradle safety pins (4) as shown in detail A. Make final vertical adjustment for rail alignment using stand jacks.

CAUTION

ALIGNMENT OF FUSELAGE AND STAND RAILS IS NECESSARY TO PREVENT INTERFERENCE OF ENGINE COMPONENTS AND FUSELAGE STRUCTURE DURING ENGINE REPLACEMENT.

h. Install rail splice bolts (2) as shown in detail B.

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Figure 1-17. Engine Replacement Preparation Using Stand Type SE 1012-803

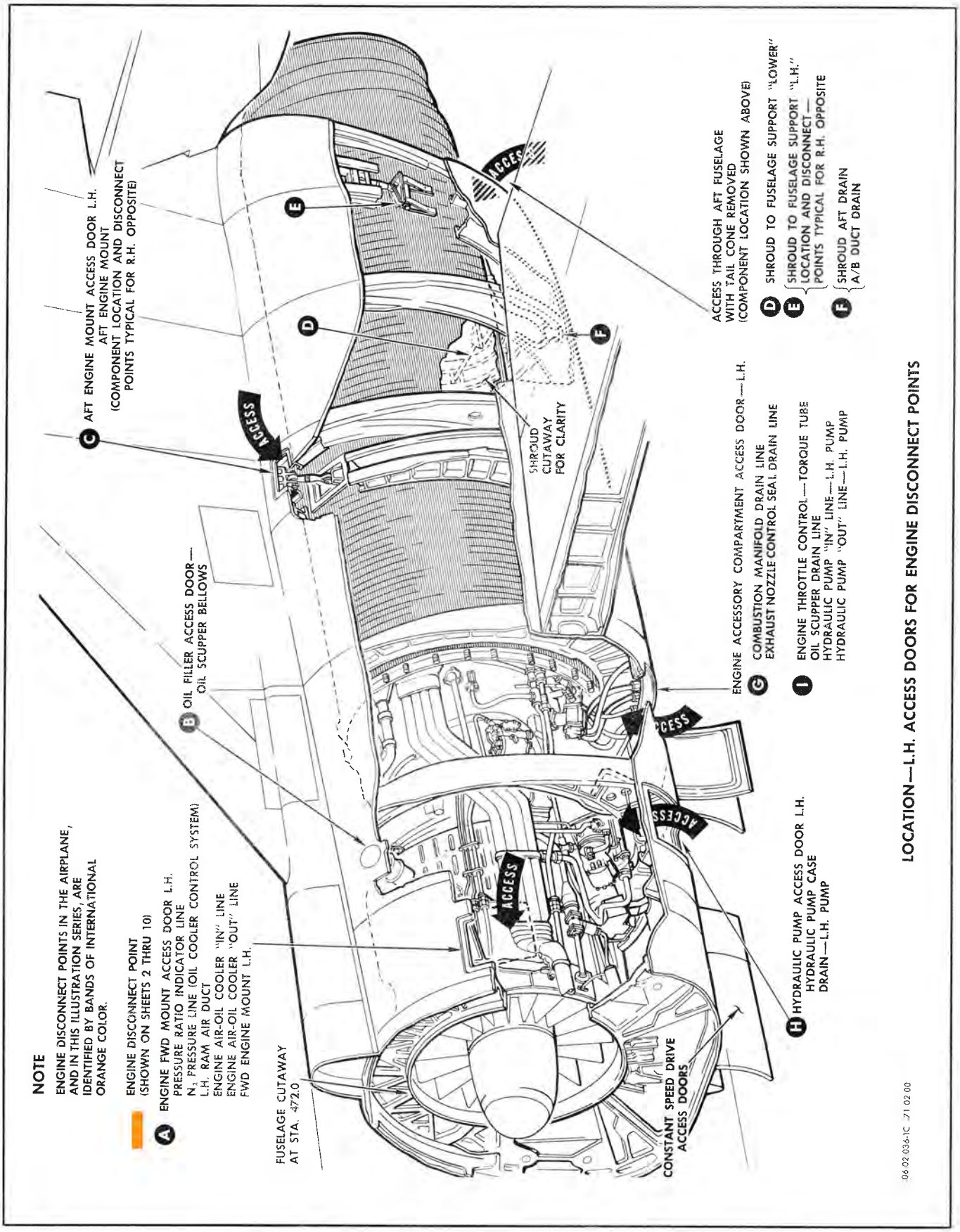


Figure 1-18. Engine Replacement, Disconnect Points (Sheet 1 of 10)

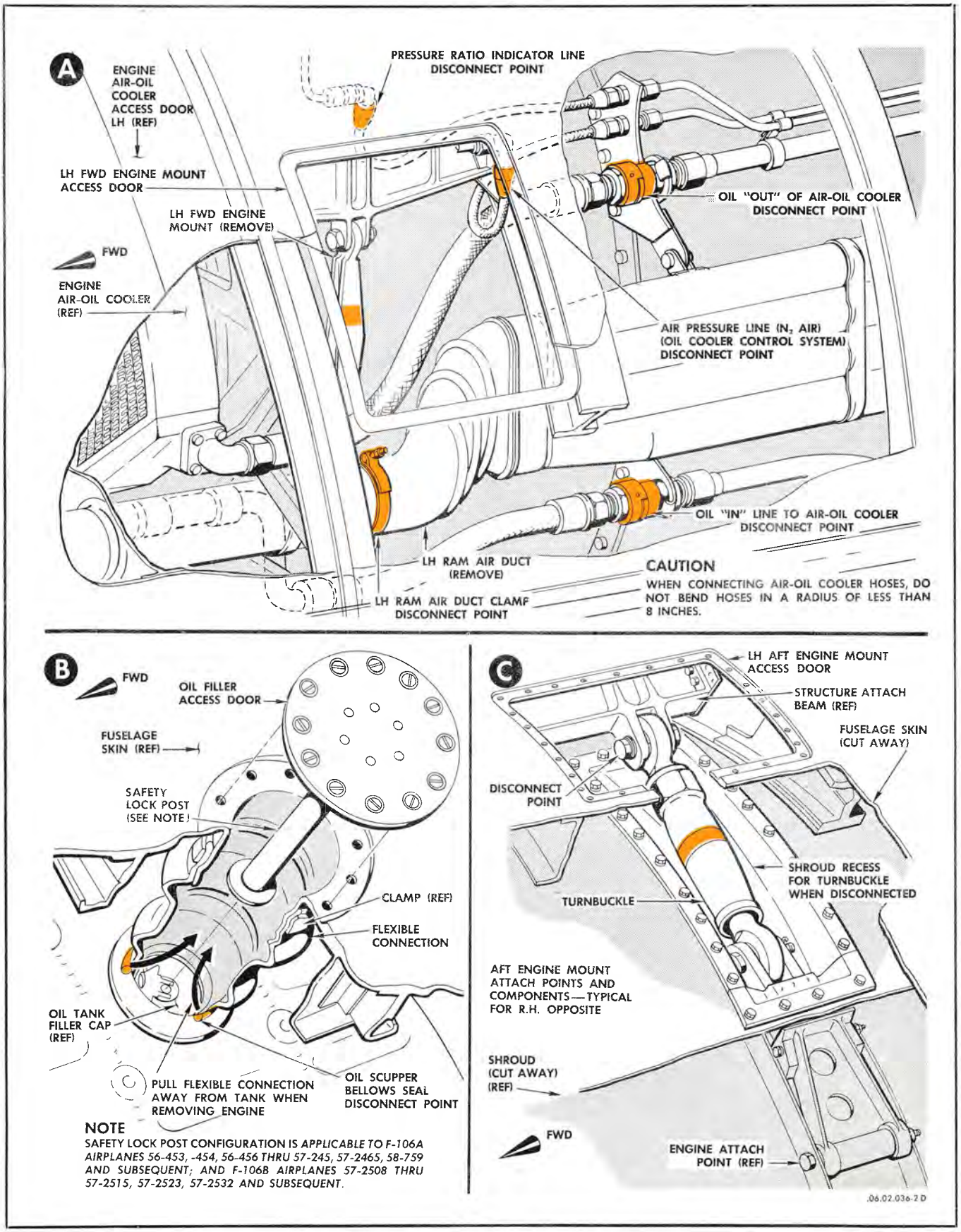


Figure 1-18. Engine Replacement, Disconnect Points (Sheet 2 of 10)

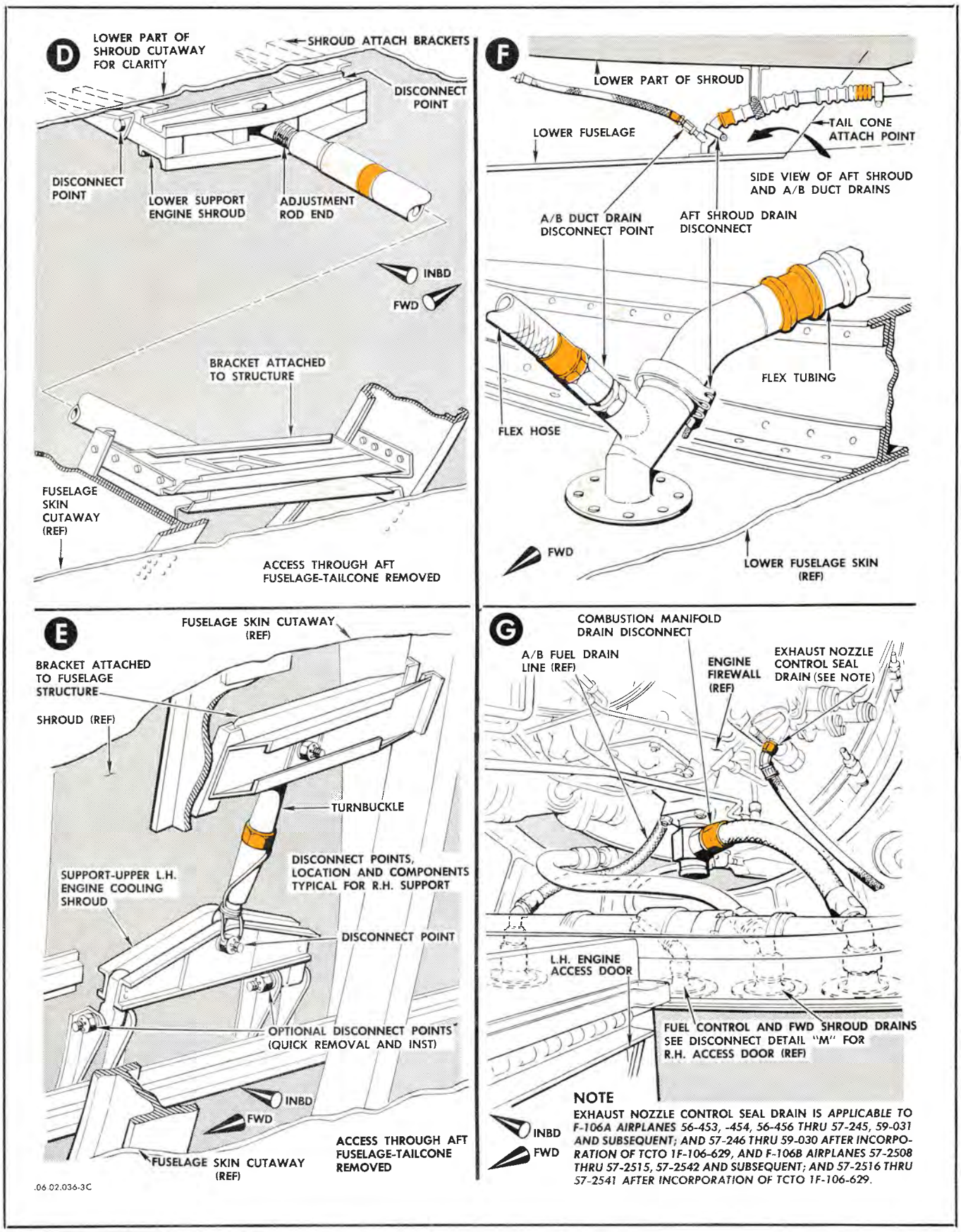


Figure 1-18. Engine Replacement, Disconnect Points (Sheet 3 of 10)

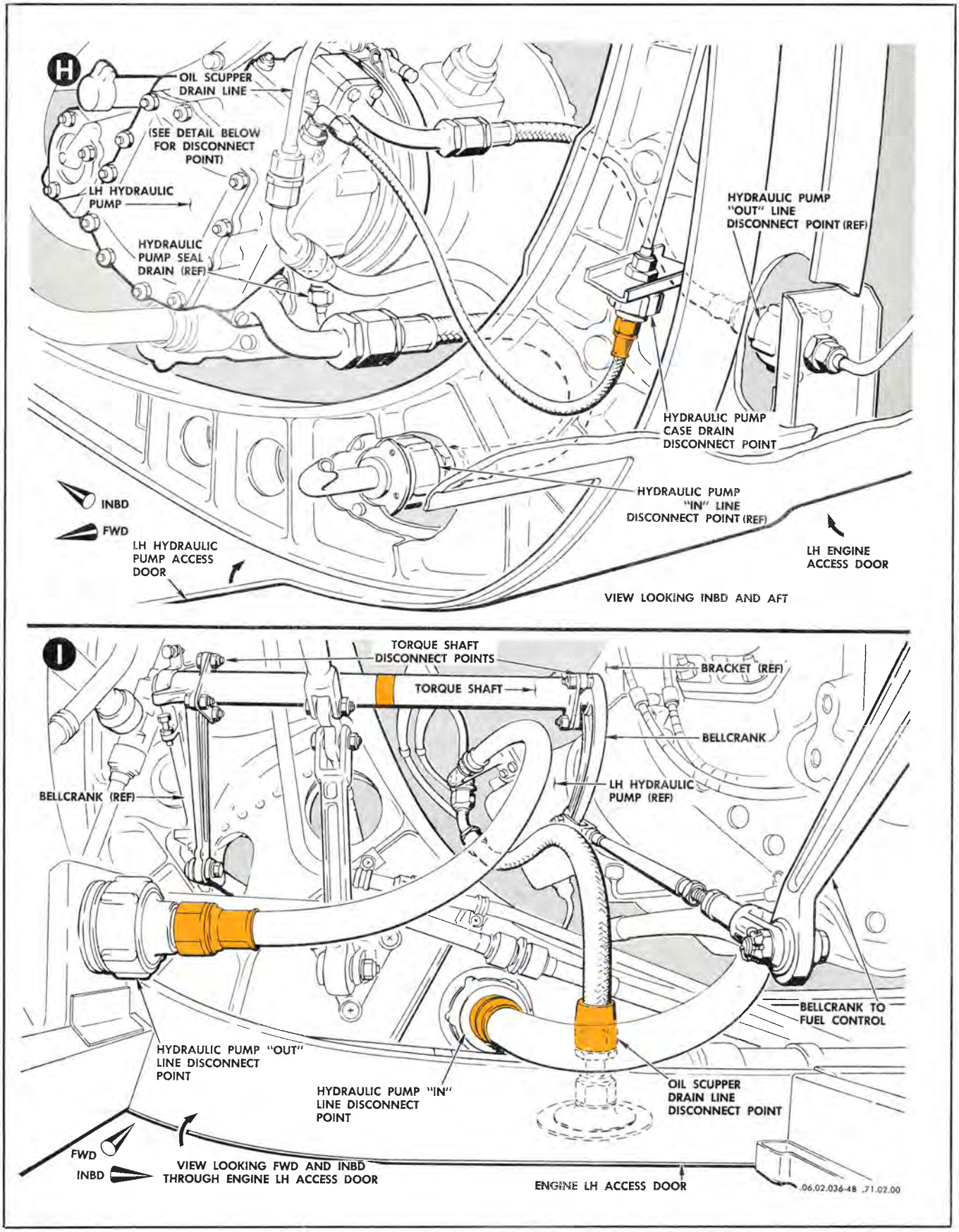


Figure 1-18. Engine Replacement, Disconnect Points (Sheet 4 of 10)

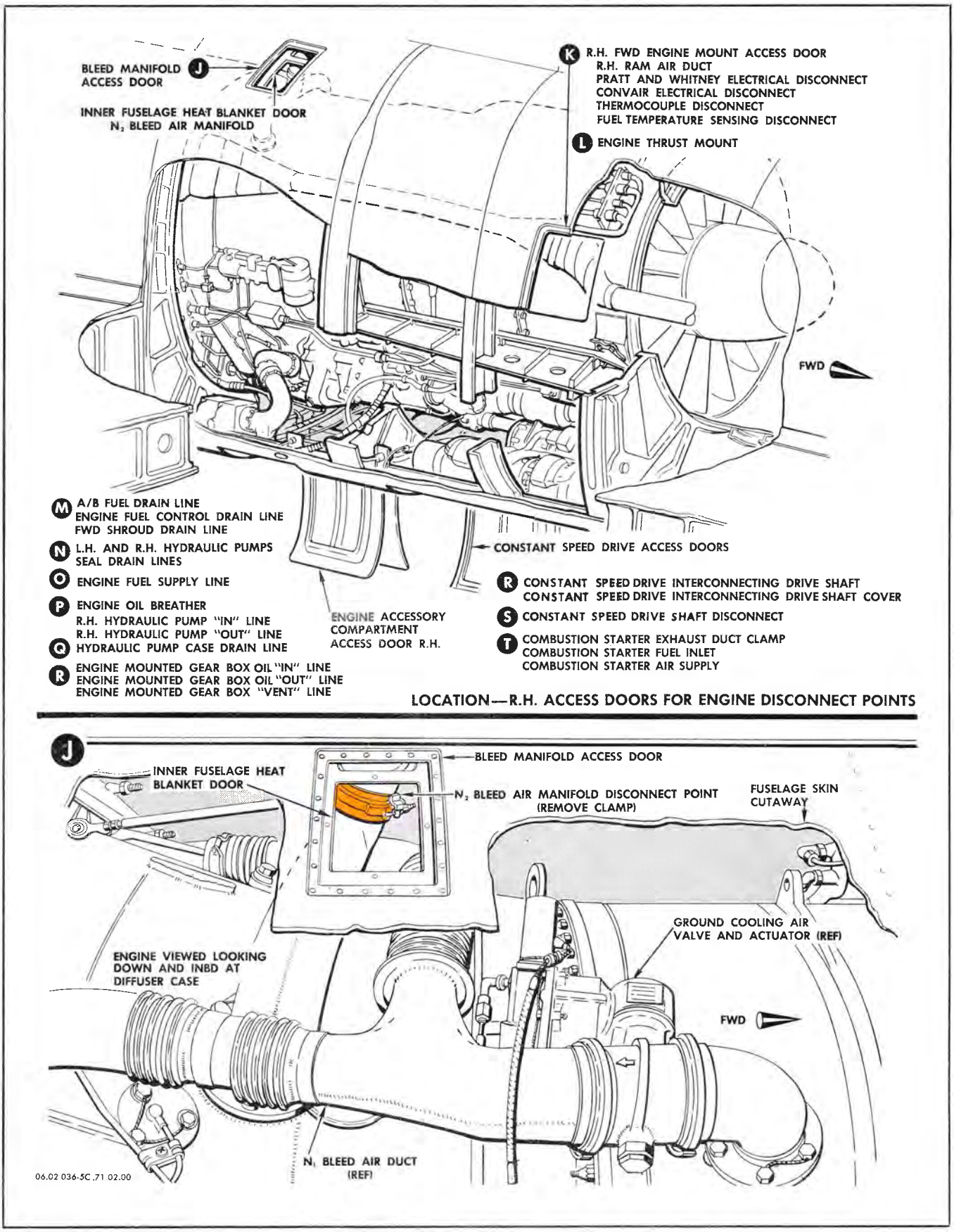


Figure 1-18. Engine Replacement, Disconnect Points (Sheet 5 of 10)

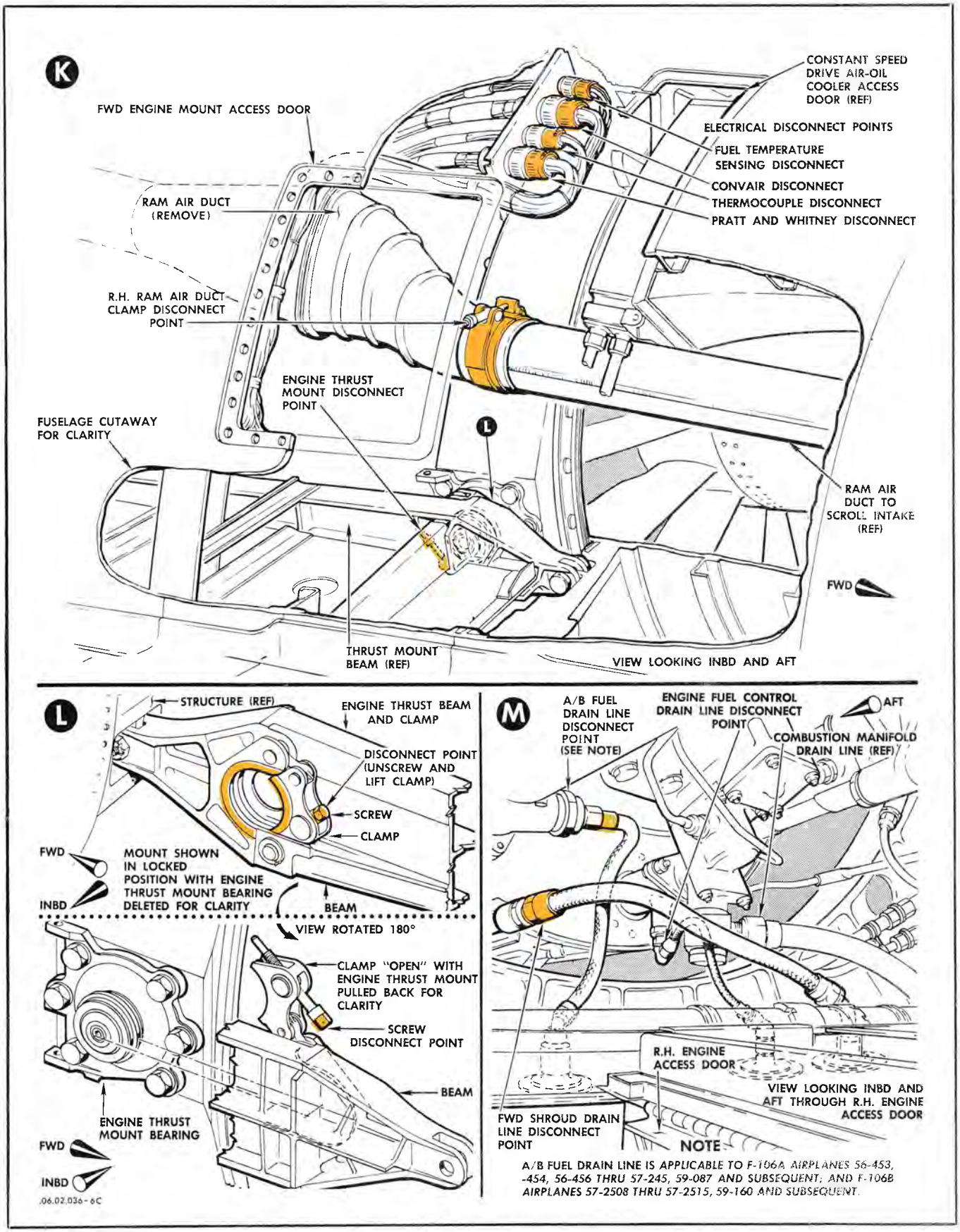


Figure 1-18. Engine Replacement, Disconnect Points (Sheet 6 of 10)

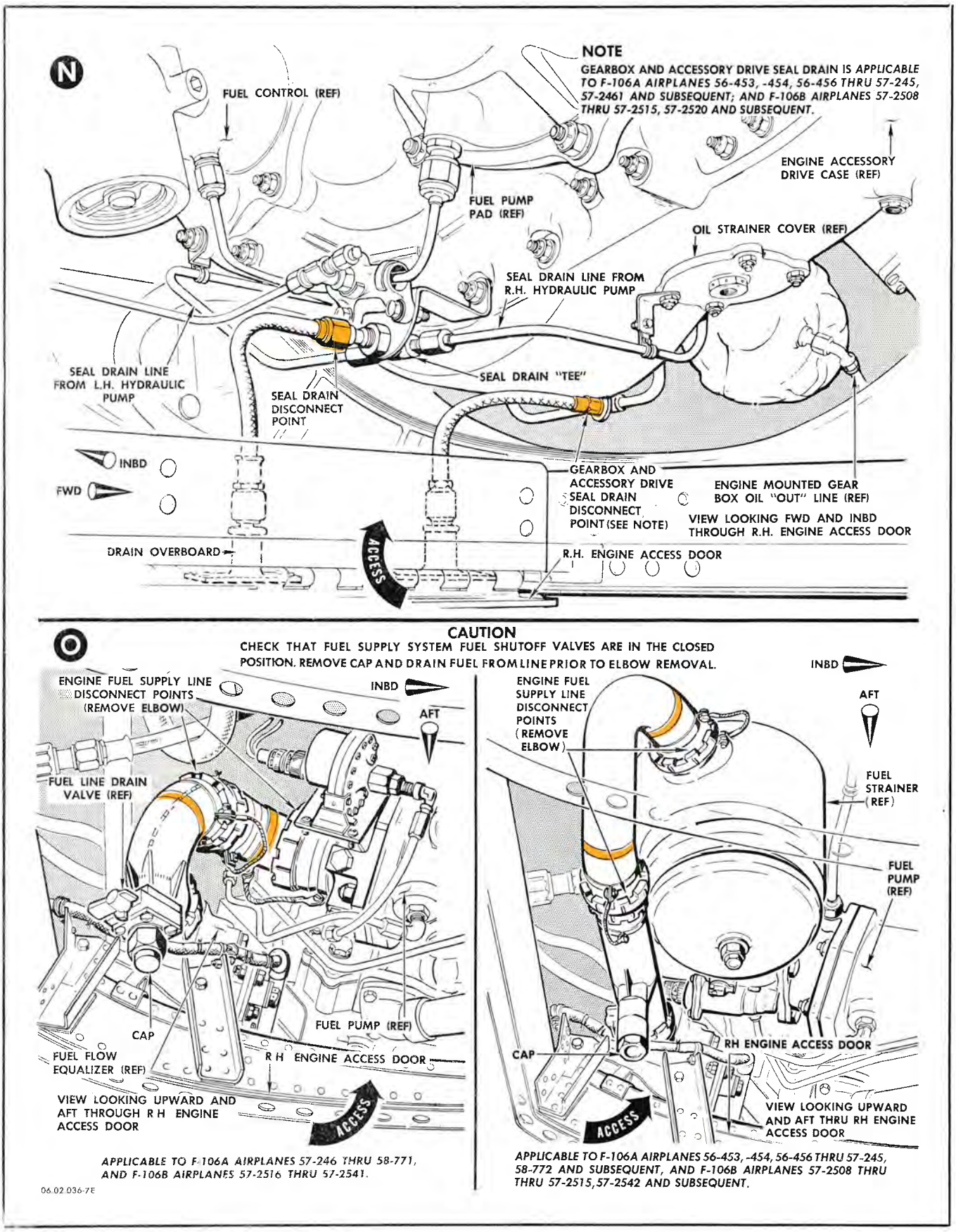


Figure 1-18. Engine Replacement, Disconnect Points (Sheet 7 of 10)

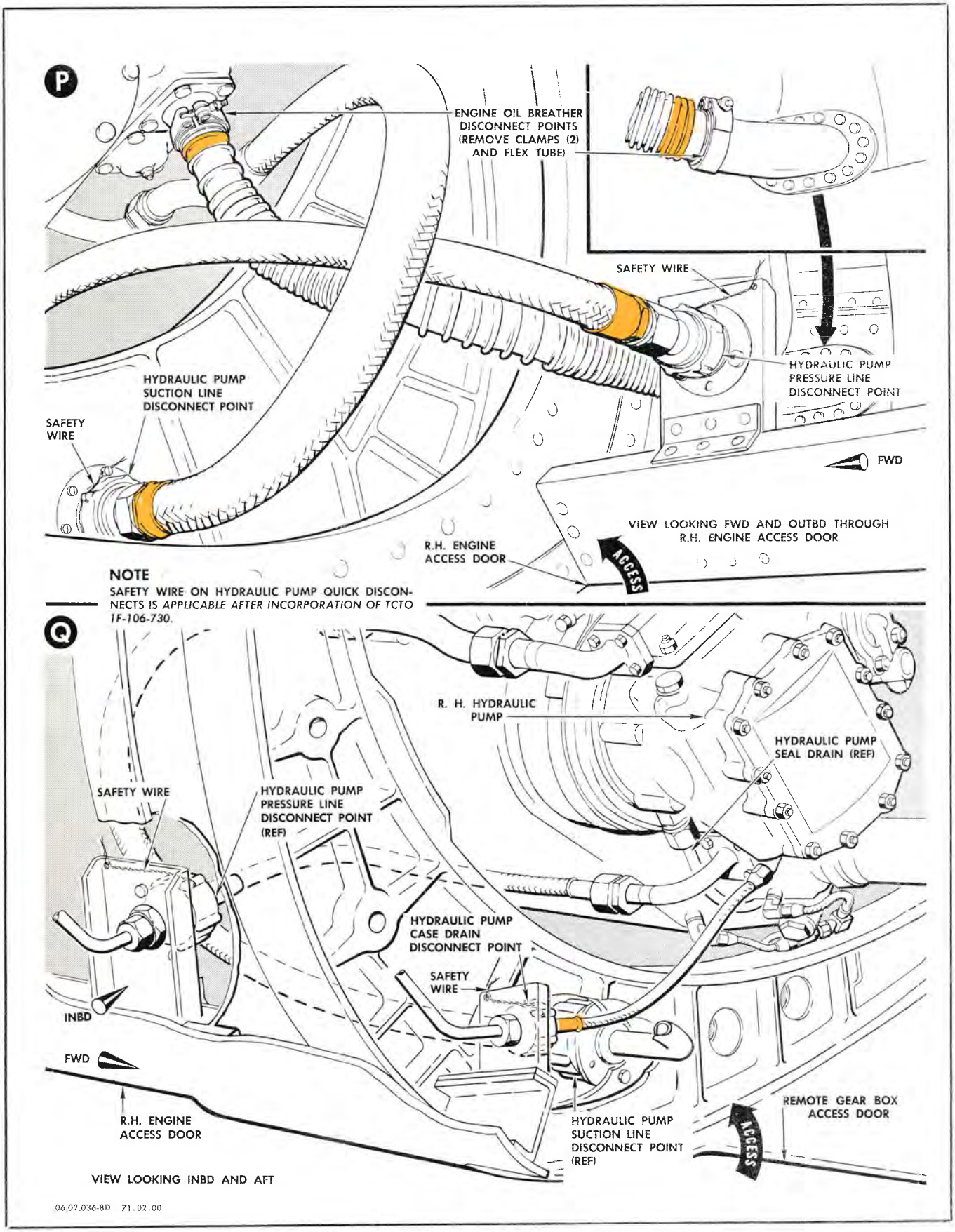


Figure 1-18. Engine Replacement, Disconnect Points (Sheet 8 of 10)

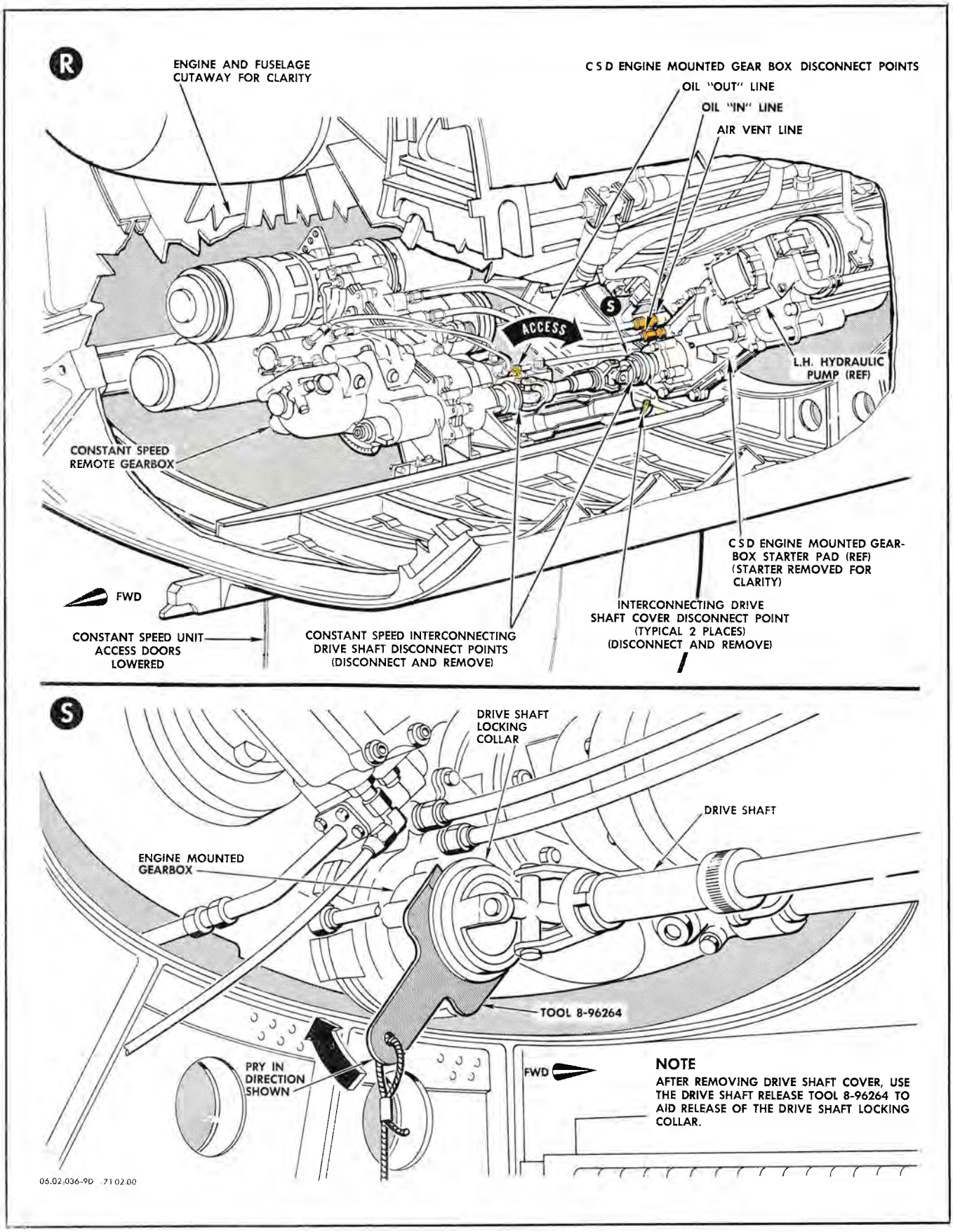


Figure 1-18. Engine Replacement, Disconnect Points (Sheet 9 of 10)

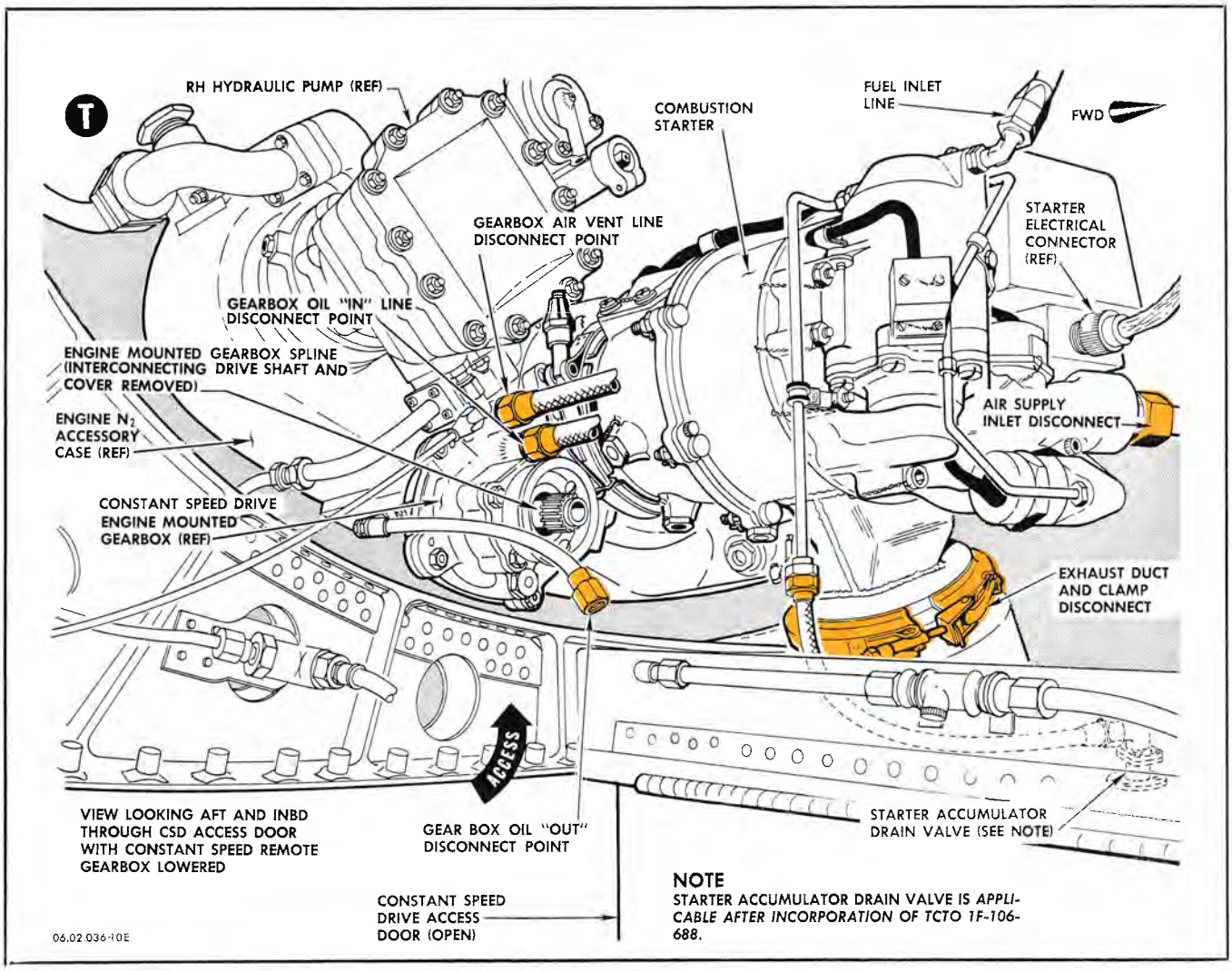


Figure 1-18. Engine Replacement, Disconnect Points (Sheet 10 of 10)

1-56. ENGINE JAM NUT TYPE FITTINGS.

Jam nut type fittings used on engine components are comprised of an assembly consisting of a fitting, jam nut, seal ring, and an O-ring seal. When installing this type of fitting, the following procedure is to be used.

a. Thread the jam nut on the fitting until the counterbored face of the nut is beyond the seal groove in the fitting.

b. Install the seal ring on the fitting. It will be necessary to work, or roll, the ring over the lead thread and then to thread it to the seal groove in the fitting. Inspect the ring after completing this operation and if it has been damaged, replace the ring.

c. Lubricate a new O-ring seal with engine oil and install it in the groove on the fitting.

d. Work the seal ring and the O-ring seal toward the inner end of the seal groove.

e. Thread the fitting into the related part until the seal contacts the mating face. This contact can be determined by the pronounced increase in resistance to the tightening torque. Thread the fitting in an additional half turn. Any further adjustment to align the fitting should be accomplished by threading in further, up to a maximum of one additional turn.

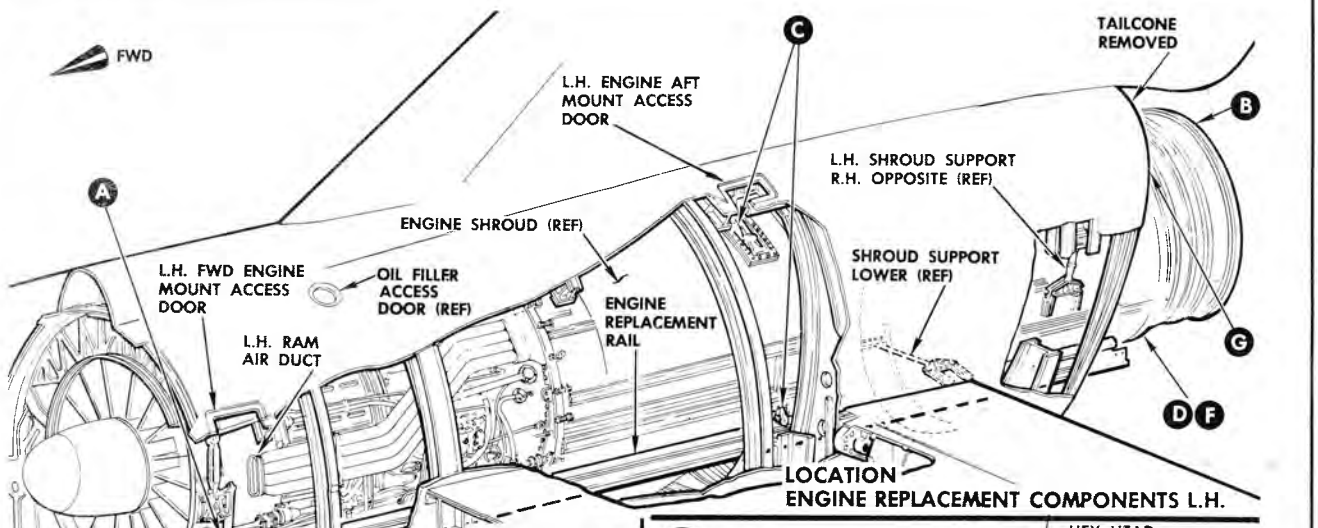
f. When the fitting has been properly aligned, hold the fitting in the proper position with a wrench and tighten the jam nut until it bottoms firmly against the face of the related part.

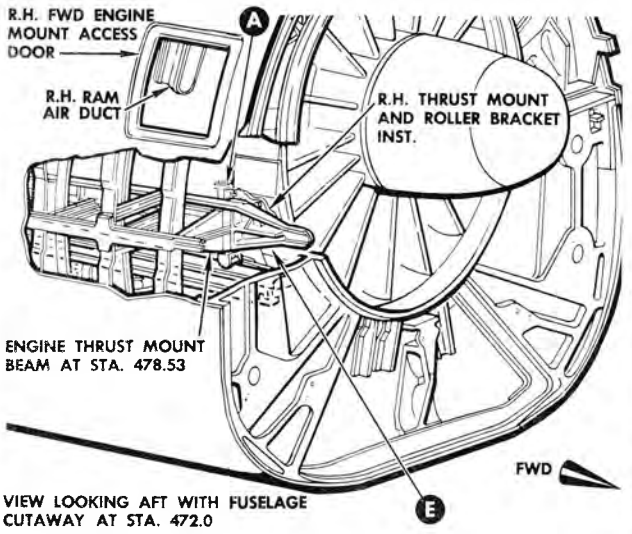
NOTE

A slight extrusion of the O-ring seal between the mating face and the nut is acceptable if it does not prevent a metal-to-metal bottoming of the nut by more than a few thousandths of an inch. If the ring extrudes badly from under the edge of the nut, begin again with new sealing parts.

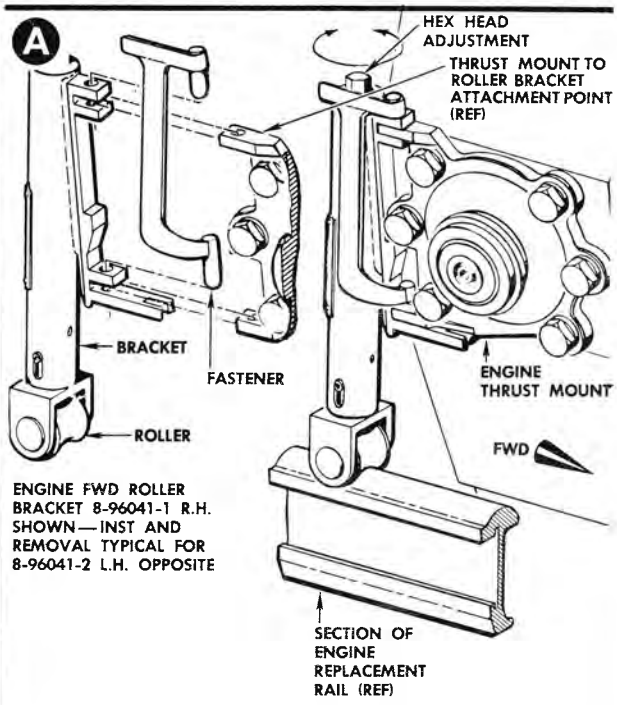
1-57. TUBING AND BOLT TORQUE VALUES.

See figures 1-26 and 1-27 for illustrations showing tubing and bolt standard torque values.





LOCATION — ENGINE REPLACEMENT COMPONENTS R.H.



REMOVAL

a. Remove fuselage tail cone.
b. Install engine replacement rails.
c. Perform applicable engine stand preparation procedure.

d. Install 8-96041-1-2 engine forward roller brackets (-1RH, -2LH) as follows:
   1. Open forward mount access doors.
   2. Fully retract rollers of each bracket assembly by turning hex head adjustment at top of each assembly.
   3. Install bracket assemblies at forward engine mounts.
   4. Adjust rollers down until engine replacement rails are contacted.

CAUTION

CONTINUED DOWNWARD ADJUSTMENT OF ROLLERS AFTER RAILS HAVE BEEN CONTACTED WILL RESULT IN DAMAGE TO STRUCTURE.

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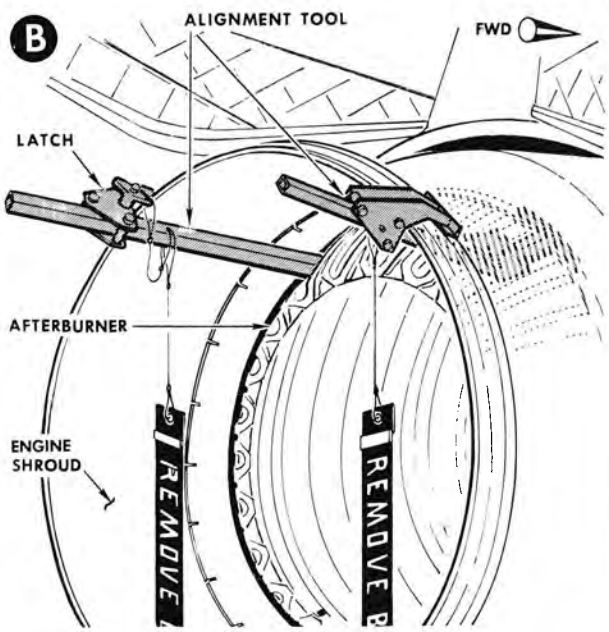
Figure 1-19. Engine Replacement (Sheet 1 of 4)



e. Place shroud ejector alignment tool, or shroud positioning wedges, between aft end of shroud and engine prior to disconnecting shroud supports. Adjust shroud supports as required to aid installation of positioning wedges; lock wedge handles. For installation of shroud ejector alignment tool, use following procedure:
   1. Remove latch retaining pin and slide latch aft against stop.
   2. Insert tool between shroud and engine, and align angle on forward end of bar with second roller track down from engine verticle centerline (approximately 30 degrees).
   3. Guide tool forward until angle stops against aft edge of flap roller support ring.

CAUTION

INSTALL TOOL WITH CARE TO PREVENT DAMAGE TO ENGINE AND SHROUD.

   4. Raise aft end of tool and slide latch over aft section of shroud ejector. Adjust shroud support turnbuckles until latch can be positioned.
   5. Insert pin through the hole in latch and bar.

f. Disconnect engine and shroud at all disconnect points except at the four engine mounts.

WARNING

CHECK THAT THE FUEL SUPPLY SYSTEM SHUTOFF VALVES ARE CLOSED. REMOVE DRAIN CAP FROM ENGINE FUEL INLET LINE; DRAIN LINE PRIOR TO LINE REMOVAL.

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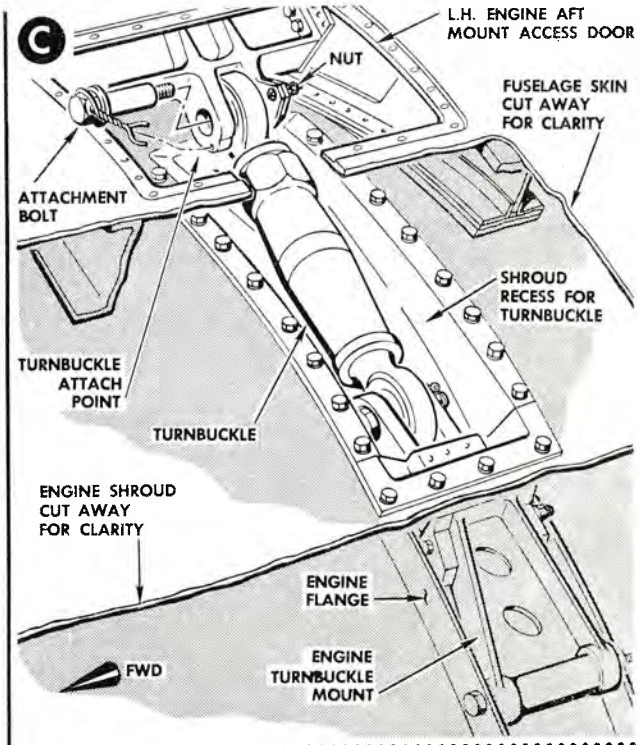
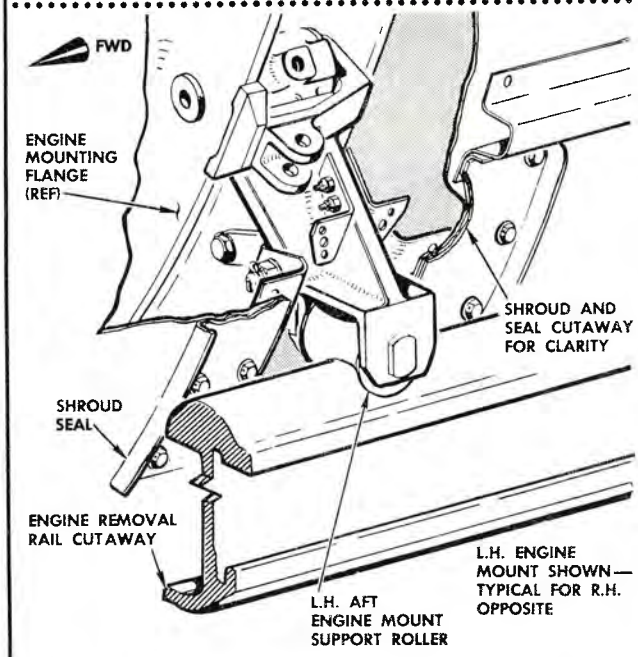


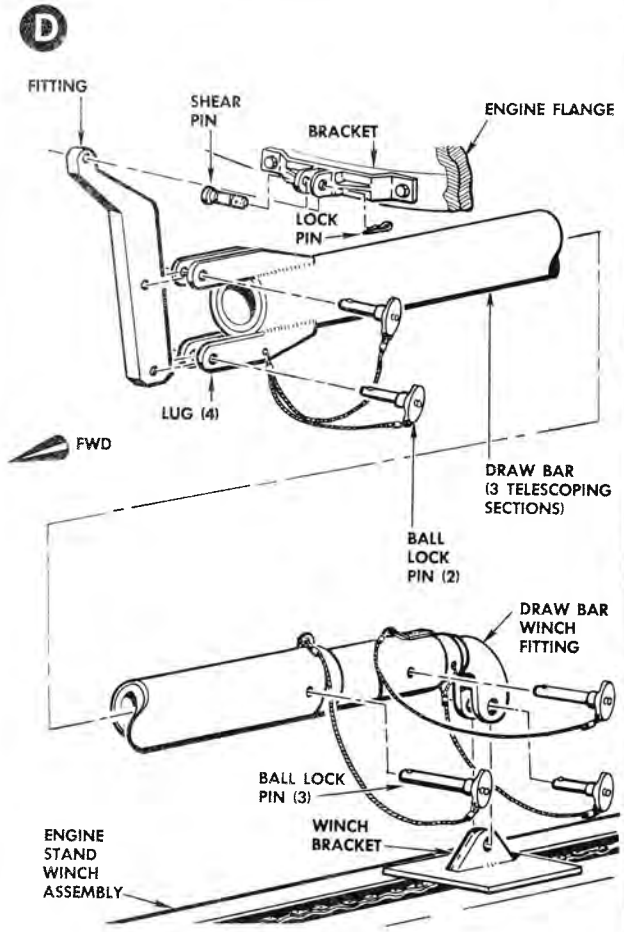


g. Lower aft end of engine by loosening two aft engine mount turnbuckles until aft support rollers rest on removal rails; remove turnbuckles.

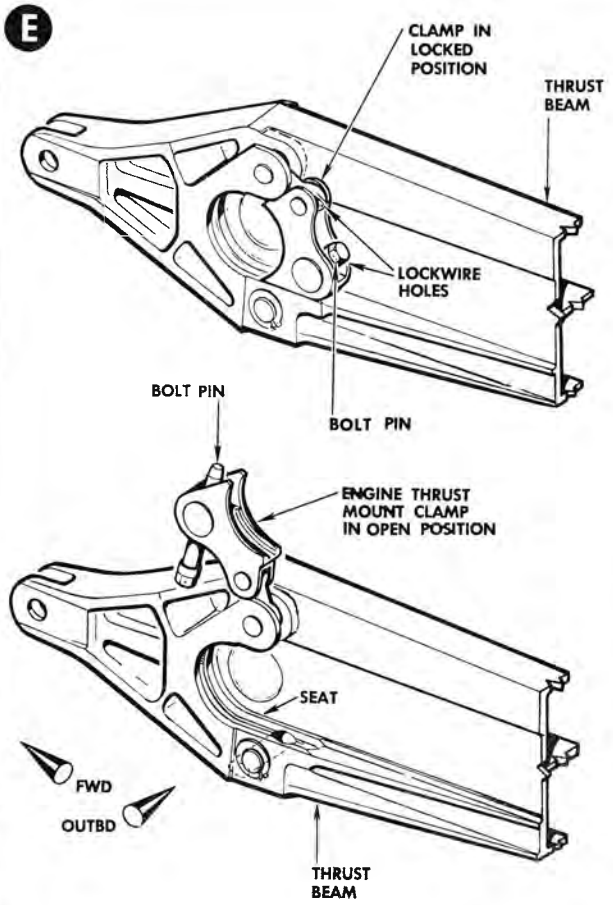
CAUTION

CONTINUED TURNING OF TURNBUCKLES AFTER SUPPORT ROLLERS CONTACT RAILS WILL RESULT IN DAMAGE TO FUSELAGE STRUCTURE.

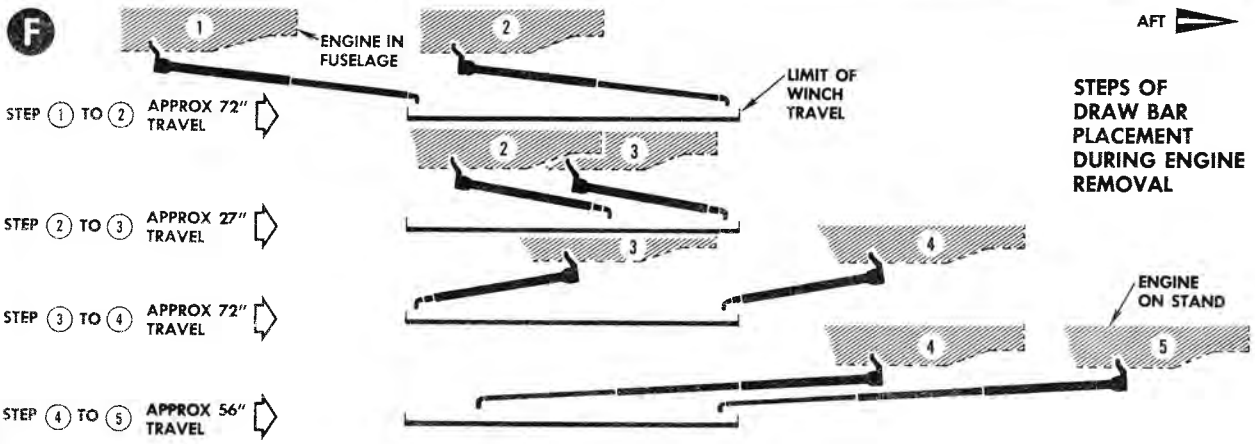
Figure 1-19. Engine Replacement (Sheet 2 of 4)



h. Install engine removal stand draw bar between engine and engine removal stand winch.



i. Tighten hex head adjustment at top of forward roller brackets enough to permit removal of LH mount link bolt and to open RH thrust mount clamp.



j. Using removal stand hand crank, carefully roll engine out of fuselage; position engine on stand.

k. Install engine to stand attachment points.

l. Install 8-96186 cover over flight control mixer assembly.

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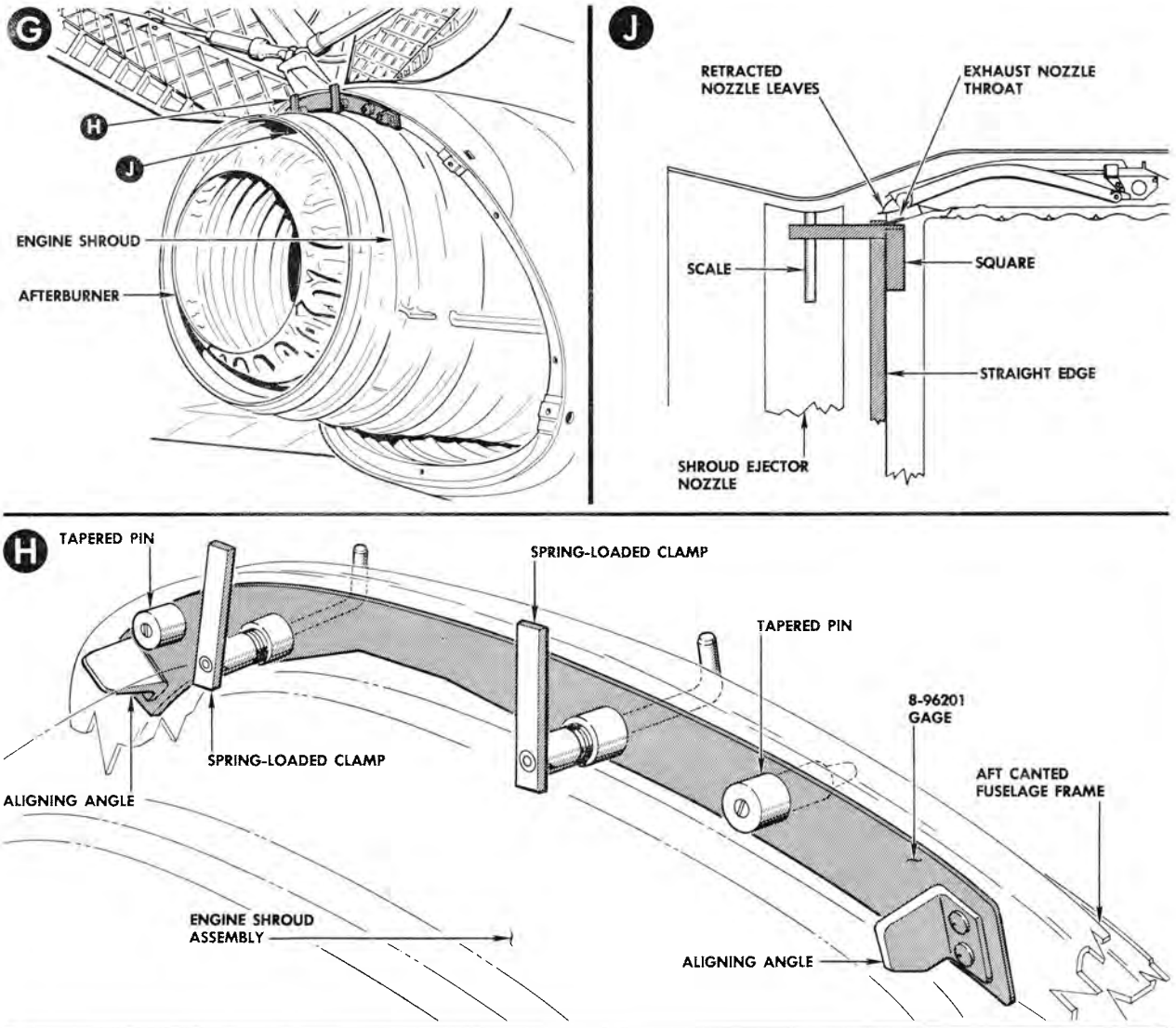
Figure 1-19. Engine Replacement (Sheet 3 of 4)



INSTALLATION

a. Installation is essentially the reverse of removal.
b. Engine thrust mount clamp must be held open when engine is being installed.
c. Check that ball and seat of thrust mount clamp is clean of foreign material. Adjust height of engine forward end using adjustments on forward roller brackets, until thrust mount clamp and left forward support link can be installed. Install link and thrust mount clamp. Torque clamp 740 to 840 inch-pounds; back off to zero torque. Retorque clamp 450 to 500 inch-pounds. Check that ball of clamp is properly seated. Safety-wire clamp bolt.
d. Adjust position of engine afterburner in relation to fuselage and shroud using gage 8-96201. Position gage on the aft canted fuselage frame by inserting the tapered pins (2) on the gage into the top locating holes (2) on the frame. Depress the spring loaded clamps (2) and rotate lever 90 degrees to bring the clamps to bear on flange of the canted frame.
e. Adjust the engine rear support turnbuckles (2) until the engine shroud clears both the aligning angles by 0.005 to 0.015 inch.
f. Connect and adjust shroud support turnbuckles.
g. Remove shroud support wedges or ejector alignment tool and the 8-96201 alignment gage.
h. Check concentricity of the engine exhaust nozzle to the ejector of the shroud as follows:
   1. Push exhaust nozzle leaves into the retracted (open) position and check the concentricity as shown in detail J.
   2. Adjust engine rear support turnbuckles until exhaust nozzle is within 0.060 inch of being centered in the shroud ejector nozzle.

CAUTION

The exhaust nozzle-to-shroud requires very close alignment to assure even distribution of cooling airflow around the nozzle. Shroud misalignment may result in overheat damage to the exhaust nozzle support assembly.

i. Remove engine stand upon completion of engine installation.
j. Remove engine removal rails and brackets.
k. Install fuselage tail cone.
l. Safety-wire engine and shroud aft attachments.

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Figure 1-19. Engine Replacement (Sheet 4 of 4)

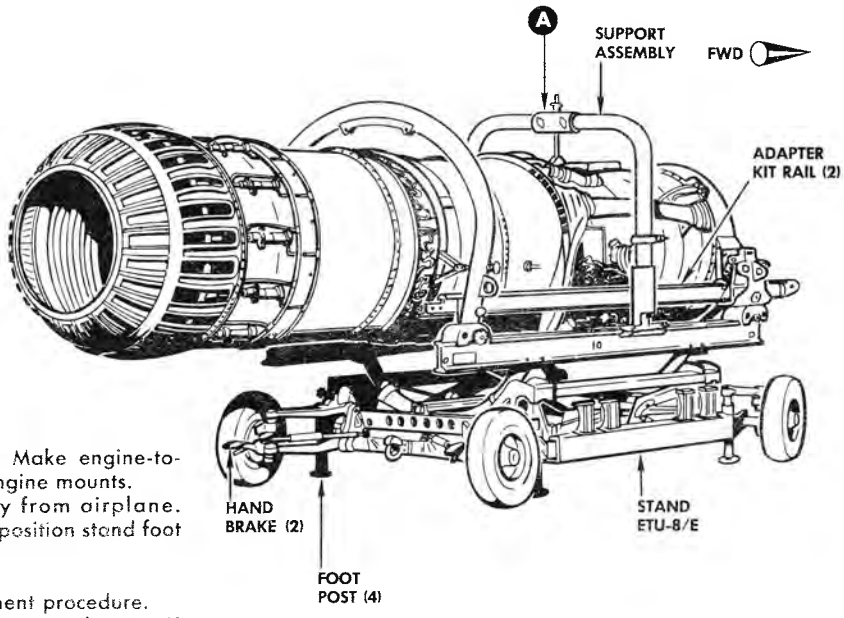
ADJUSTMENT

1-58. ENGINE TRIMMING.

As service time is accumulated on an engine, it will be noted that the engine pressure ratio will tend to diminish. This is due primarily to contamination of the engine air passage. It is permissible to increase (trim) the N_2 compressor speed up to 1.7% rpm (150 rpm) above the engine adjusted data plate speed. When it becomes necessary to increase the engine speed more than the specified values, the engine air passages should be cleaned prior to continued engine operation. Refer to paragraph 1-69 for procedure. See figures 1-28 and 1-29 for the engine trim check charts.

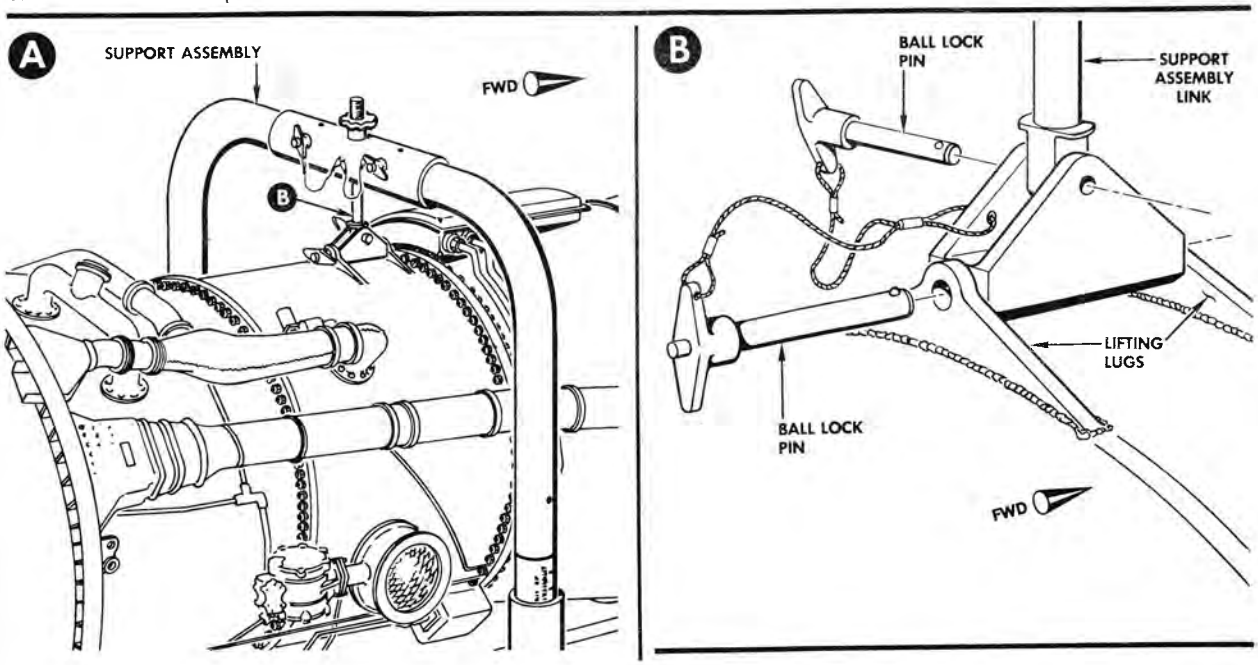
NOTE

It is permissible to use the lowest available grade of aviation gasoline, Military Specification MIL-G-5572 (no oil mix required); JP-5, Military Specification MIL-J-5624; or JP-6, Military Specification MIL-F-25656, as emergency fuels for one-time ferry missions. Where the tactical situation requires the use of these fuels, the engine military trim must be readjusted to meet the pressure ratios shown in figure 1-28 before the airplane can be flown. Since JP-5 freezes at −48.3°C (−55°F) and JP-6 at −40°C (−40°F), missions in which these fuels are used shall be restricted to altitudes where temperatures below these limits are not encountered. When using aviation gasoline, particular attention shall be given to engine tailpipe temperature during starting and throughout the flight.



PROCEDURE

a. Remove engine from airplane. Make engine-to-stand attachments at forward engine mounts.
b. Move engine and stand away from airplane. Engage stand hand brakes and position stand foot posts to contact ground.
c. Remove shroud from engine. Refer to Section IV for replacement procedure.
d. Install engine aft stand-to-engine attachments (2 places).
e. Remove stand adapter kit rails (2).



f. Position engine support assembly over engine forward lifting lug; secure support assembly to stand rails.
g. Connect support assembly link to engine lifting lug.
h. Tighten support link nut until nut is finger tight.

CAUTION

DO NOT LIFT ENGINE WITH SUPPORT ADAPTER ASSEMBLY. CONTINUED TIGHTENING OF ADJUSTMENTS WILL RESULT IN DAMAGE TO ENGINE.

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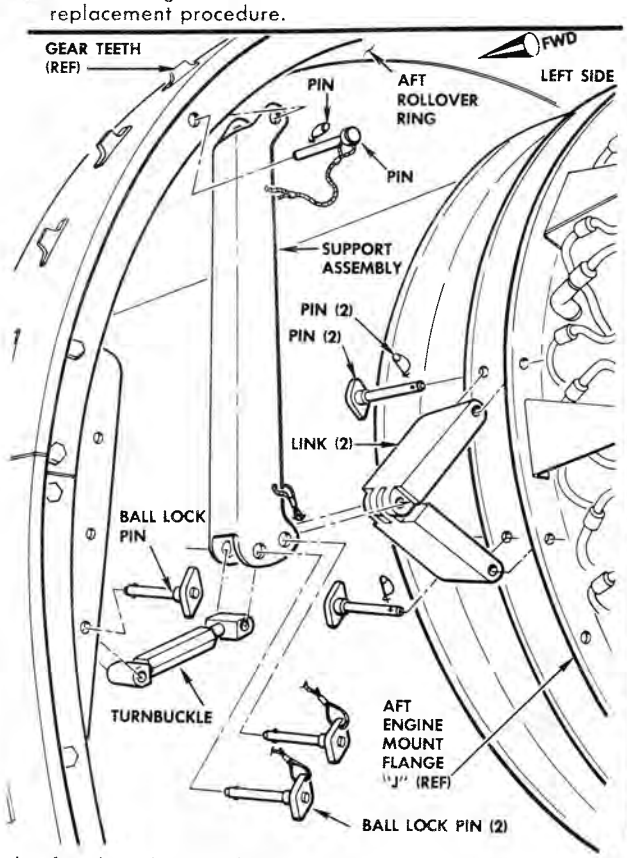
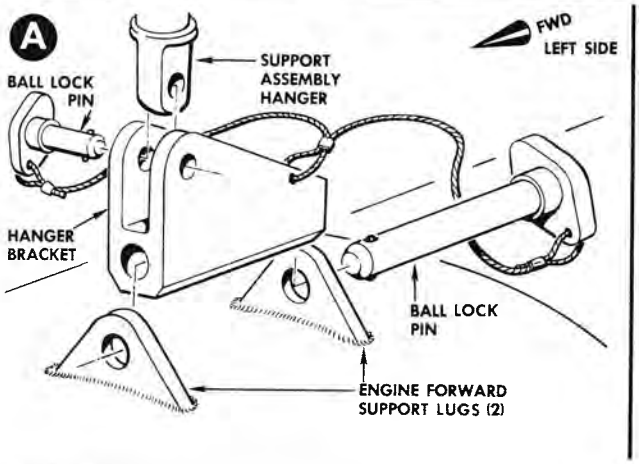
Figure 1-20. Combustion Chamber Replacement Preparation Using Stand ETU-8/E and Adapter Kit 8-96398

PROCEDURE

a. Remove engine from airplane.
b. Move engine and stand away from airplane. Install stand forward rollover ring upper half.
c. Remove engine shroud. Refer to Section IV for replacement procedure.



d. After shroud removal, lower engine at engine intermediate support until engine-to-aft-rollover ring attachments can be made. Install attachments.
e. Disconnect engine intermediate support at engine support brackets and move support assembly forward.



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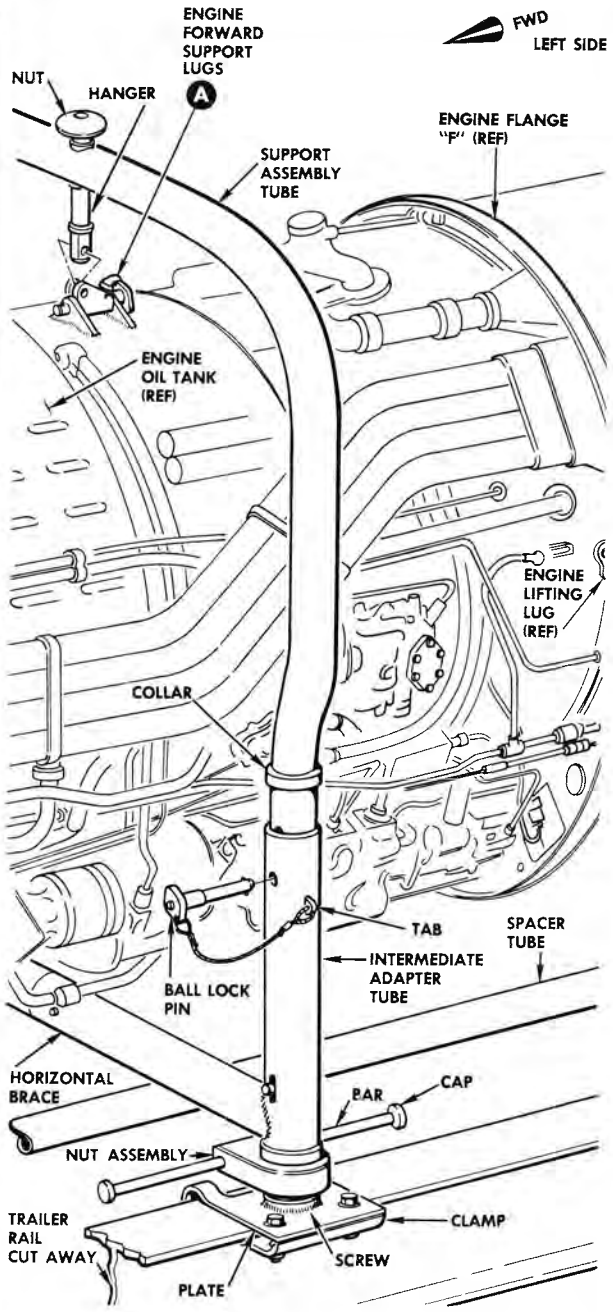
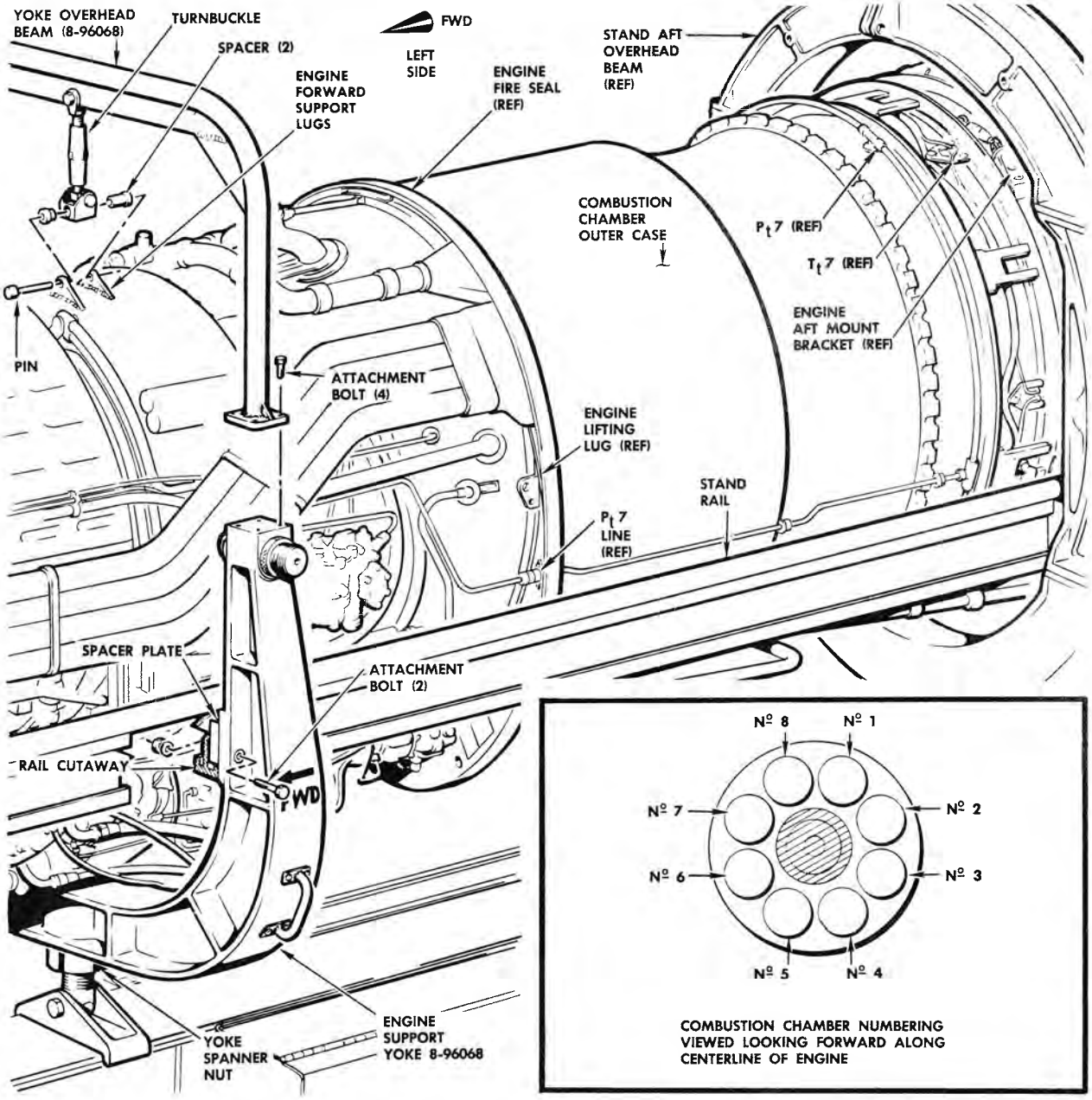


f. Make overhead attachment at engine forward support lugs using support assembly. Support assembly legs to be perpendicular to engine stand rails.
g. Tighten support assembly adjustment screws by hand until light tension is noticed.

CAUTION

DO NOT LIFT ENGINE WITH SUPPORT ADAPTER ASSEMBLY. CONTINUED TIGHTENING OF ADJUSTMENTS WILL RESULT IN DAMAGE TO ENGINE.

Figure 1-21. Combustion Chamber Replacement Preparation Using Stand ETU-8/E and Adapter Kit 8-96165



PROCEDURE

a. Remove engine from airplane.
b. Remove shroud from engine. Refer to Section IV for replacement procedure.
c. Reinstall engine aft roller brackets after shroud has been removed. Lower engine until rollers contact engine stand rails.
d. Disconnect engine support yoke 8-96068; move yoke forward for connection to engine at support lugs.
e. Position yoke assembly until yoke overhead beam is directly over engine support lugs; install connecting turnbuckle.
f. Align yoke-to-stand rail bolt holes. Position spacer plates and install interconnecting bolts.
g. Tighten yoke spanner nut by hand until firm contact with stand beam assembly is made. Tighten overhead turnbuckle by hand until all slack is removed.

CAUTION

DO NOT USE WRENCHES OR OTHER MECHANICAL AIDS TO ADJUST YOKE SPANNER NUT OR TURNBUCKLE IN THIS APPLICATION. YOKE SUPPORT ASSEMBLY IS PROVIDED ONLY TO PREVENT ENGINE DEFLECTION WHEN COMBUSTION CHAMBER OUTER CASE ATTACHMENT BOLTS ARE REMOVED.

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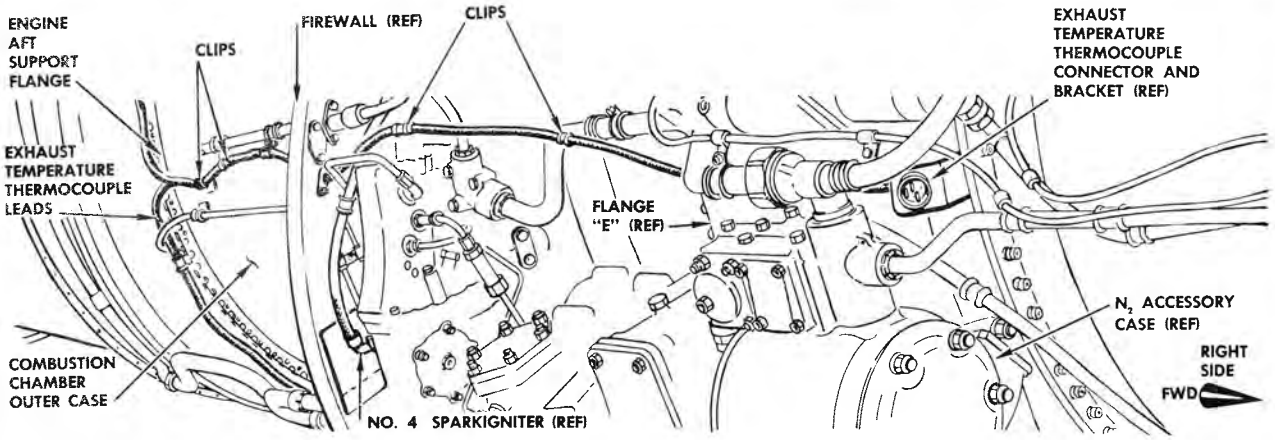
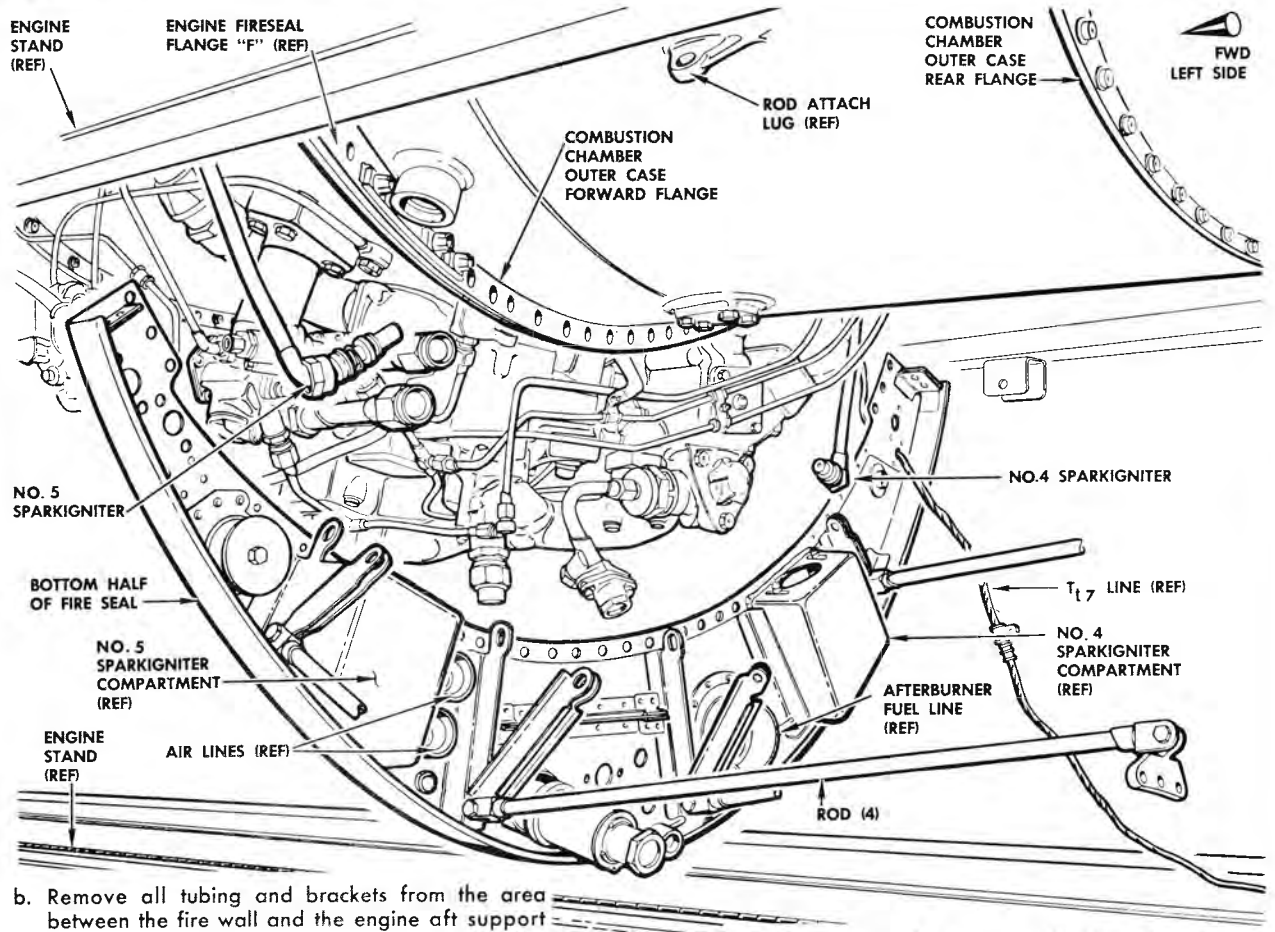
Figure 1-22. Combustion Chamber Replacement Preparation Using Stand SE 1012-803



PROCEDURE

a. Disconnect exhaust temperature thermocouple (T_{t7}) at forward flange of the combustion chamber outer case; remove thermocouple clipping aft to engine aft support flange.



b. Remove all tubing and brackets from the area between the fire wall and the engine aft support ring. Cap all tube and port openings.

NOTE

BEFORE REMOVING BRACKETS FROM ENGINE ATTACHMENT, NOTE BRACKET LOCATION FOR REINSTALLATION.

c. Disconnect and remove sparkigniters from Nos. 4 and 5 combustion chambers.

d. Disconnect tubing attached to bottom half of firewall. Remove firewall attachment to flange "F"; lower bottom half of firewall to permit passage of combustion chamber outer case forward flange.

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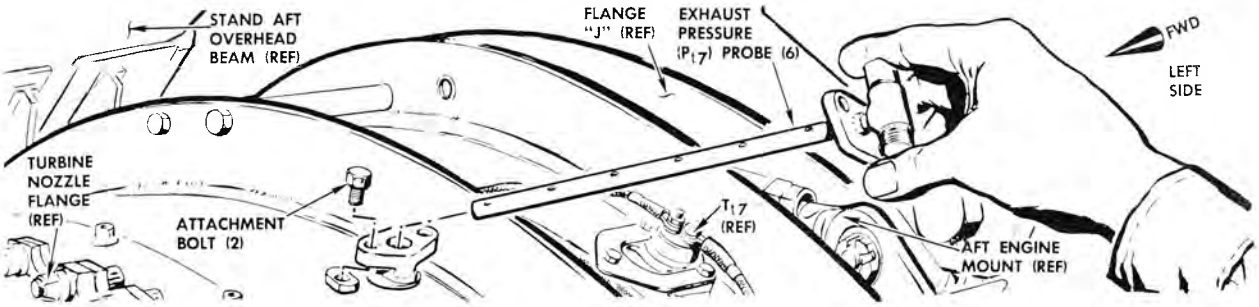
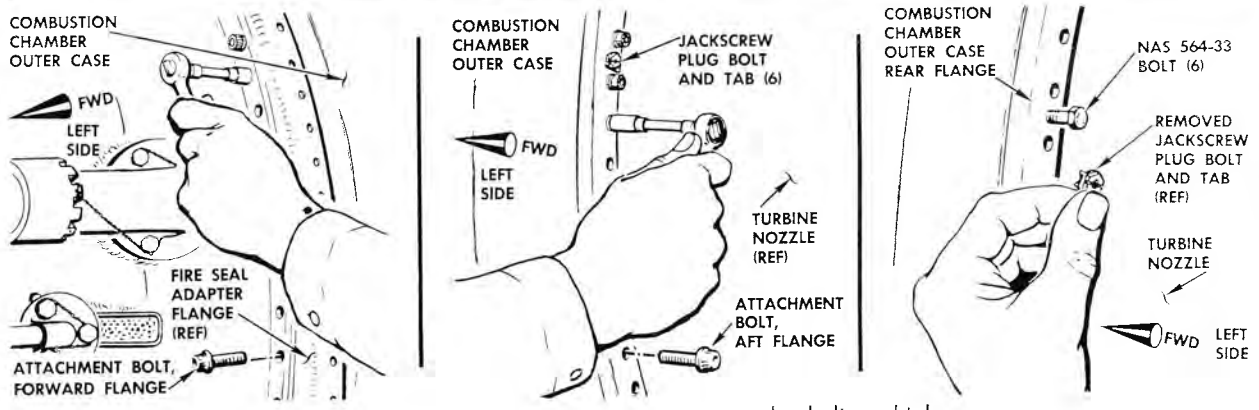
Figure 1-23. Replacement, Combustion Chambers (Sheet 1 of 3)



e. Remove exhaust pressure (P_{t7}) probe (6). Note installed position of each probe removed from installation in same position. Cover probe openings in engine case.



f. Remove combustion chamber outer case forward and aft flange bolts.

g. Remove the six jackscrew plug bolts and tabs from the case rear flange. Install NAS564-33 bolts or equivalent in jackscrew holes and jack case free of turbine nozzle case. Remove jack bolts; reinstall plug bolts and tabs.

NOTE

PROVIDE SUPPORT FOR THE OUTER CASE DURING THIS PROCEDURE TO PREVENT CASE FROM DROPPING ON COMBUSTION CHAMBERS.

h. Move burner case aft to fully expose combustion chambers. Exercise care that case does not drag on chambers.

i. Secure burner case forward flange seal to diffuser case flange to prevent damage to seal.

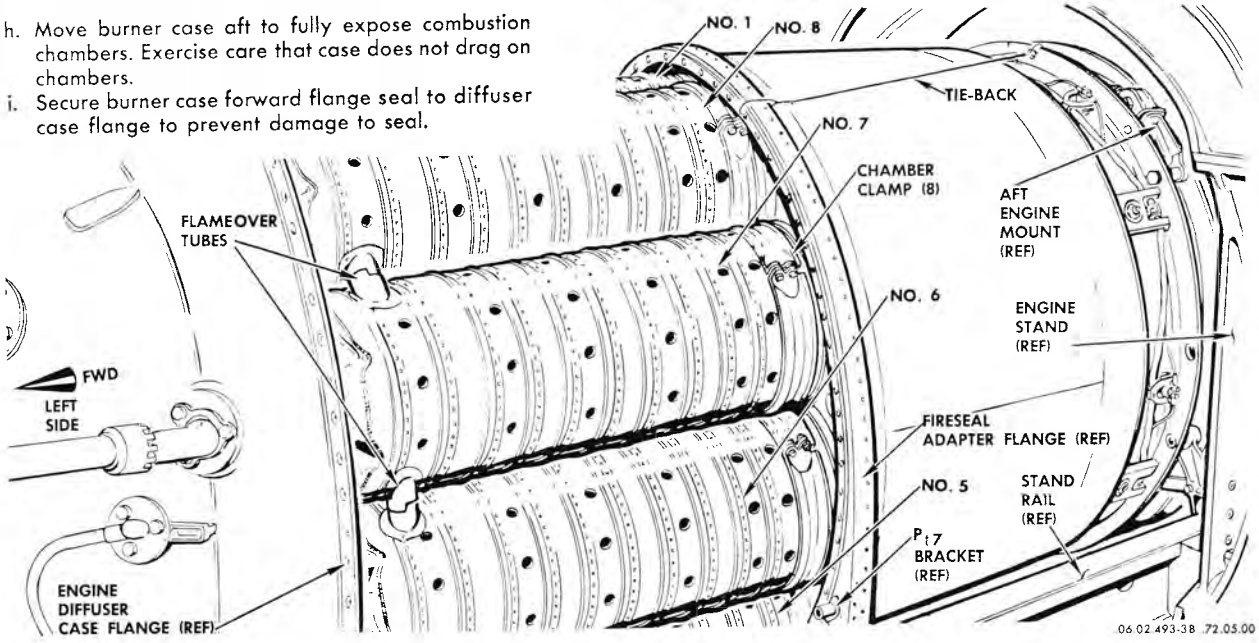
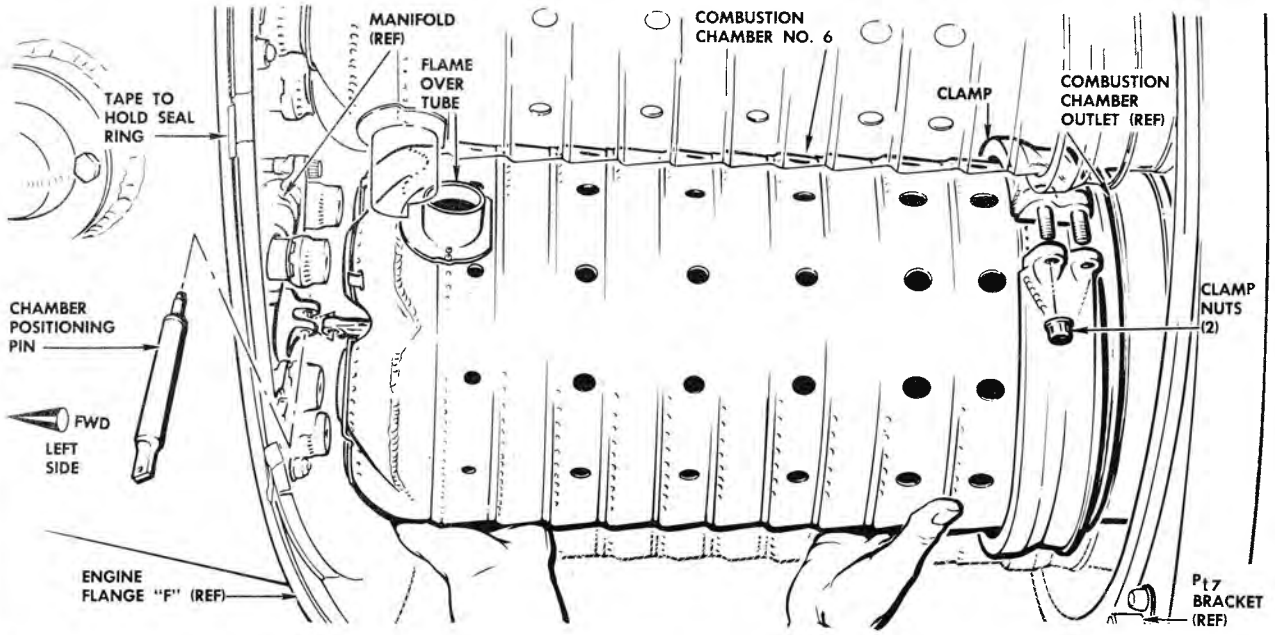


Figure 1-23. Replacement, Combustion Chambers (Sheet 2 of 3)



j. Remove bolts (2) from clamp at aft end of each combustion chamber. Spread clamp and slide clamp forward on to combustion chamber.

k. While supporting combustion chamber, remove chamber positioning pin from forward end of chamber.

NOTE

THE FLAMEOVER TUBES CONNECTING THE COMBUSTION CHAMBERS ARE ALTERNATELY MALE AND FEMALE. IN ORDER TO REMOVE A CHAMBER HAVING FEMALE FLAMEOVER TUBES, IT WILL BE NECESSARY TO FIRST REMOVE THE CHAMBERS ON EITHER SIDE OF IT.

l. Move combustion chamber aft, then move chamber away from engine.

NOTE

NOTE POSITION OF EACH COMBUSTION CHAMBER FOR REINSTALLATION IN THE SAME POSITION.

INSTALLATION, COMBUSTION CHAMBER.

a. Install combustion chambers in the following sequence: 5, 7, 1, 3, 6, 8, 2, and 4.

b. Installation is essentially the reverse of removal.

NOTE

WHEN INSTALLING NO. 5 CHAMBER, GUIDE THE BURNER PRESSURE SENSING TUBE INTO THE CHAMBER TRANSFER TUBE. CHAMBERS NO. 4 AND 5 INCORPORATE THE SPARK IGNITER GUIDES.

c. Check that combustion chamber outer case forward flange seal is undamaged and is positioned on diffuser case flange before installing chamber outer case.

d. Torque combustion chamber outer case forward and aft flange bolts 125 to 170 inch-pounds.

e. Install sparkigniters with anti-seize compound, Specification MIL-T-5544, sparingly used, on the sparkigniter shell threads. Use new gaskets and torque 300 to 350 inch-pounds.

NOTE

DO NOT APPLY COMPOUND TO THE FIRST THREAD AS THE COMPOUND MAY RUN DOWN ONTO THE ELECTRODE WHEN HOT.

f. Torque afterburner fuel-manifold-to-fuel-line attachment 2200 to 2400 inch-pounds.

NOTE

FOLLOWING INSTALLATION OF COMPONENTS REMOVED, EXCEPTING ENGINE SHROUD, PERFORM A TEST STAND ENGINE OPERATIONAL LEAK CHECK OF THE AFTERBURNER FUEL LINES.

g. Install shroud on engine. Refer to Section IV for replacement procedure.

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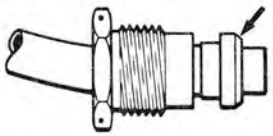
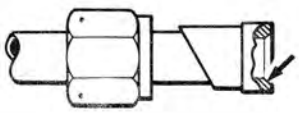
Figure 1-23. Replacement, Combustion Chambers (Sheet 3 of 3)

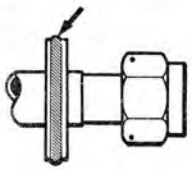
EXAMPLE 1



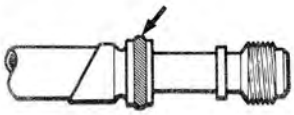
EXAMPLE 2



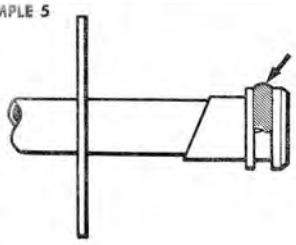
EXAMPLE 3



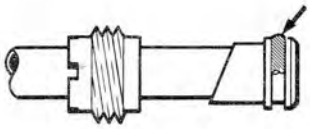
EXAMPLE 4



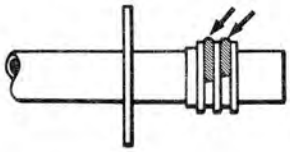
EXAMPLE 5



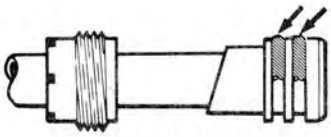
EXAMPLE 6



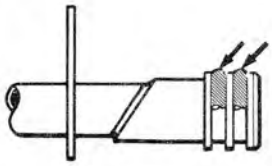
EXAMPLE 7



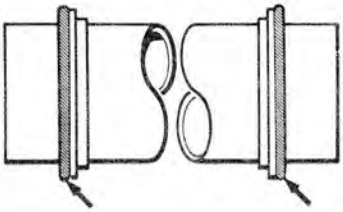
EXAMPLE 8



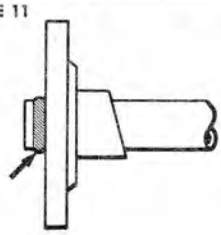
EXAMPLE 9



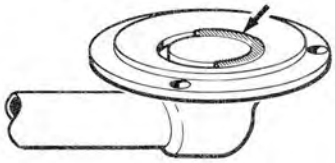
EXAMPLE 10



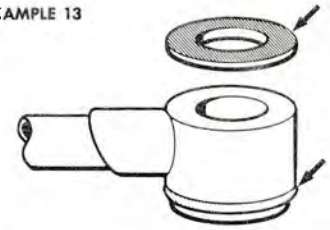
EXAMPLE 11



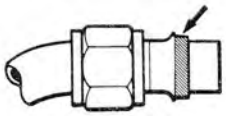
EXAMPLE 12



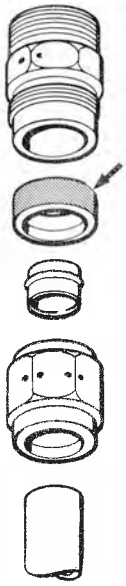
EXAMPLE 13



EXAMPLE 14



EXAMPLE 15



EXAMPLE 16

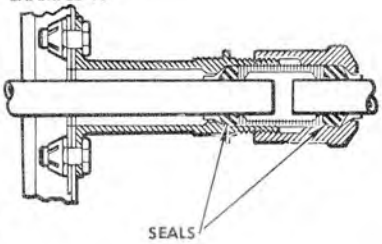


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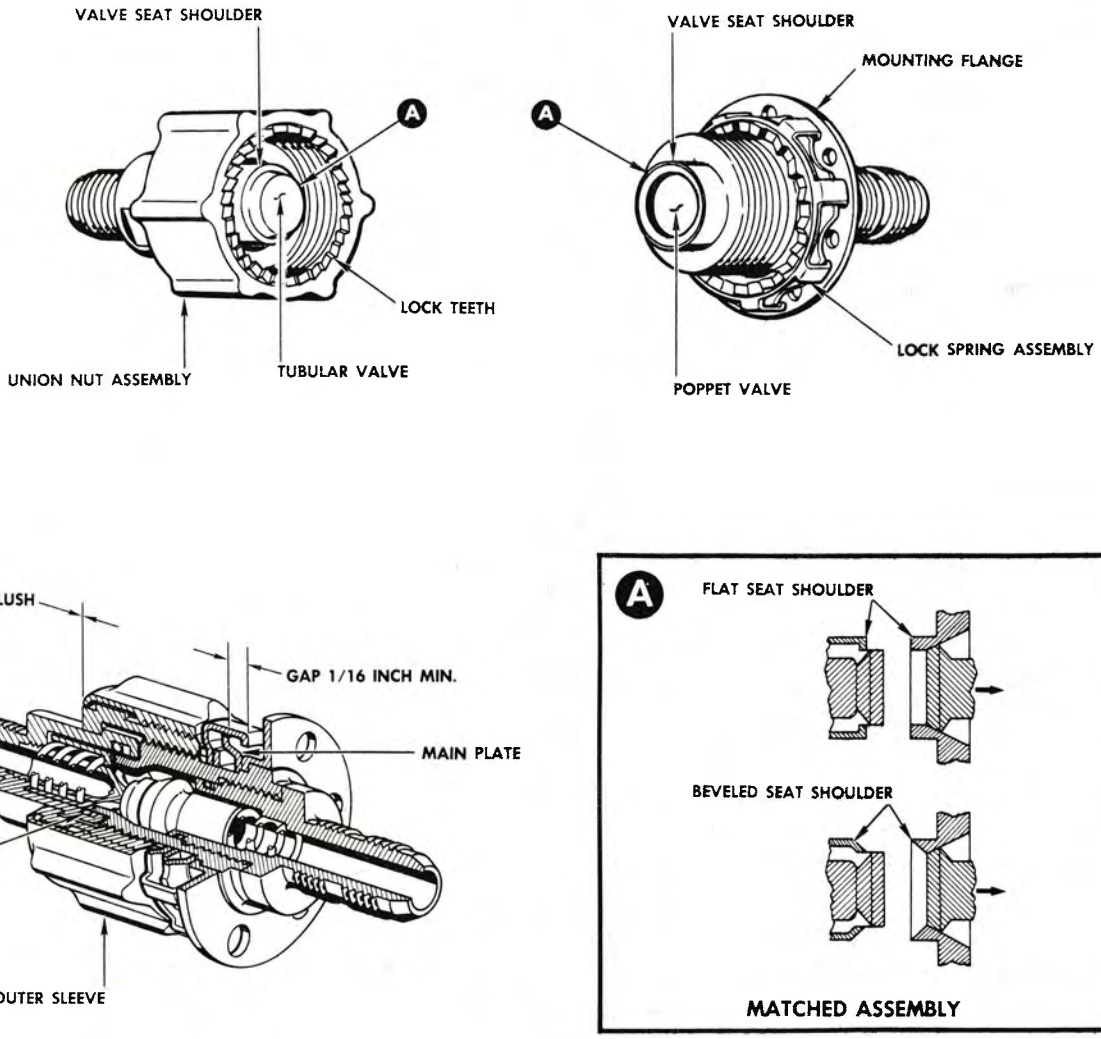
Figure 1-24. Engine External Tube Seals



AEROQUIP COUPLING PROPERLY TIGHTENED

CONNECTING COUPLING HALVES

Connect the coupling halves by rotating the union nut clockwise. The union may be hand tightened. When coupling location prevents hand tightening a crowfoot wrench similar to AN8508 is recommended. Do not use a striking block, pipe wrench, or pliers. Tighten until teeth of union nut fully engage teeth of the lock spring; listen for audible click. Proper tightening extends the lock spring leg ends beyond the mainplate forming a gap.

CAUTION

THE COUPLING LOCK SPRING IS PROVIDED FOR SAFETY. IN NO CASE SHALL THE COUPLING BE CONNECTED WITHOUT THE LOCK SPRING BEING INSTALLED.

The inner ring and outer sleeve are flush as shown; the outer sleeve remains loose. The outer sleeve is provided to release the teeth of the union nut from the lock spring when disconnecting the coupling.

COUPLING SIZE	TORQUE VALUE
4 & 5	10 foot-pounds
6 & 8	15 foot-pounds
10 & 12	20 foot-pounds
16, 20, 24	30 foot-pounds

CAUTION

EXCESSIVE TORQUING OF COUPLINGS WILL RESULT IN DAMAGE TO THE UNION NUT AND CAUSE MALFUNCTIONING OF THE LOCK SPRING RELEASING MECHANISM.

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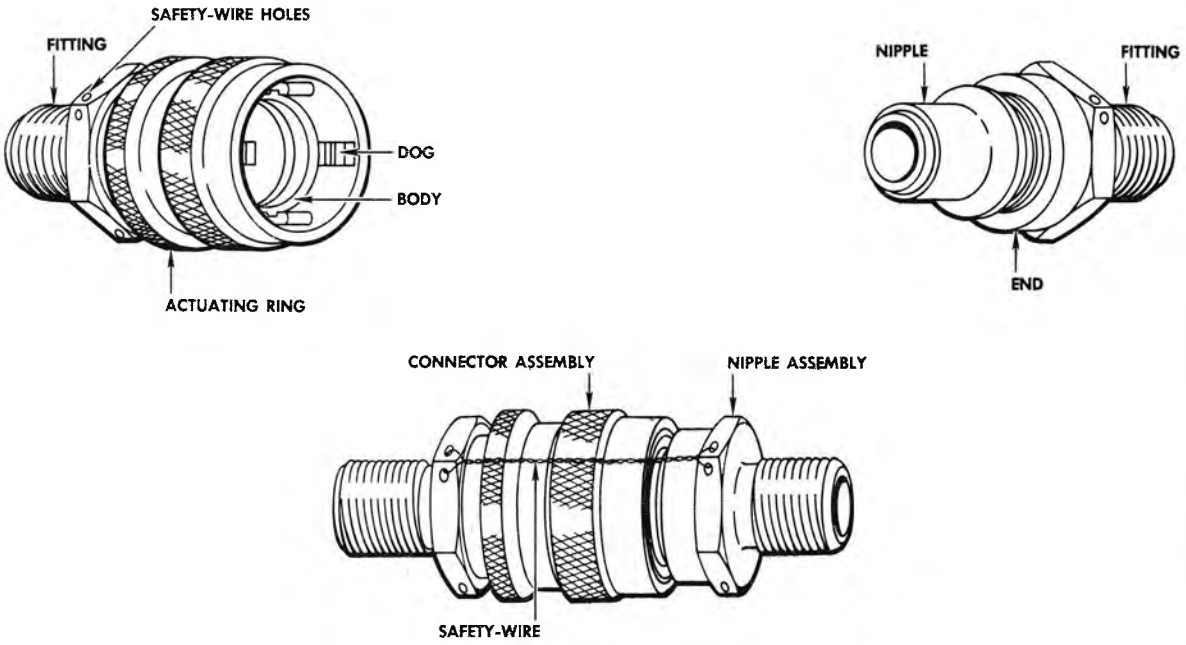
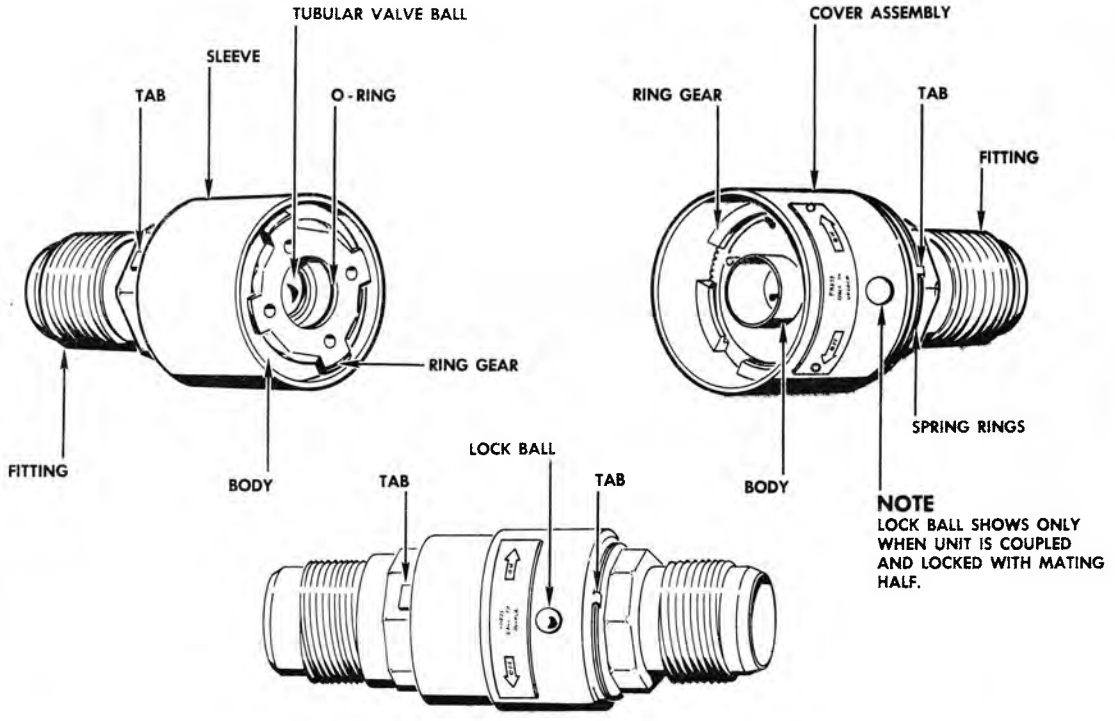
Figure 1-25. Quick Disconnect Couplings (Sheet 1 of 2)



WIGGINS COUPLING PROPERLY CONNECTED



EASTERN AIRCRAFT PRODUCTS COUPLING PROPERLY CONNECTED

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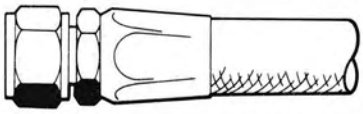
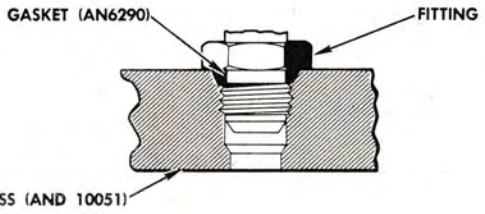
Figure 1-25. Quick Disconnect Couplings (Sheet 2 of 2)



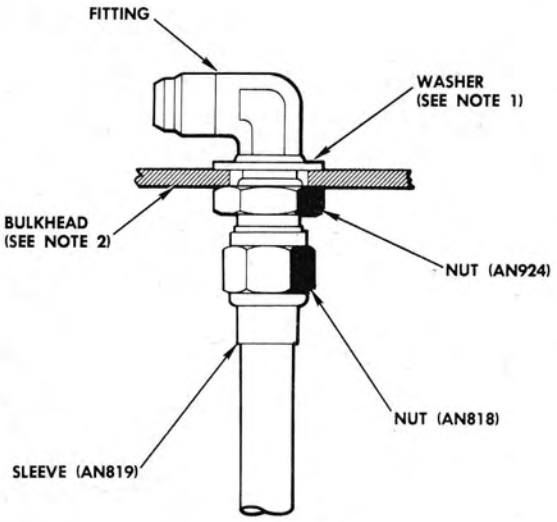
INSTALLATION OF HOSE ASSEMBLIES

a. Lubricate threads on hydraulic hose fittings with the system hydraulic fluid.
b. Lubricate threads on pneumatic hose fittings with grease, Specification MIL-L-4343.
c. Lubricate threads on oxygen hose fittings with MIL-T-5542; see warning.
d. Torque hose assembly fittings to values shown in right-hand column of table below.



INSTALLATION OF FLARED NON-POSITIONING TYPE FITTINGS

a. Lubricate gasket with applicable lubricant; see sheet 2 and warning.
b. Install gasket in groove on fitting.
c. Screw fitting assembly into boss until it bottoms tightly against boss.



INSTALLATION OF FLARED-TUBE, STRAIGHT-THREADED CONNECTORS

NOTES

1. USE AN AN690 WASHER, 1/16 INCH THICK FOR FITTINGS SIZE —6 OR SMALLER, AND A WASHER 3/32 INCH THICK FOR FITTINGS LARGER THAN SIZE —6. A WASHER IS NOT REQUIRED WHERE FITTING END HAS HEX INSTEAD OF FLANGE SHOWN.
2. FITTING WITH BULKHEAD END CONFORMING TO AND 10057 IN SIZE —6 AND SMALLER MAY BE USED THROUGH BULKHEADS UP TO 3/16 INCH MAXIMUM THICKNESS. FITTING WITH BULKHEAD END CONFORMING IN SIZE —8 AND LARGER, AND ALL SIZES OF AN832 FITTINGS MAY BE USED THROUGH BULKHEADS UP TO 3/8 INCH MAXIMUM THICKNESS.

WRENCH TORQUE VALUES FOR FLARED TUBING NUTS (INCH-POUNDS)

TUBING OD INCHES (HOSES ID)	5052-0 ALUMINUM ALLOY TUBING FLARE AND 10061 OR AND 10078		6061-T6 ALUMINUM ALLOY TUBING FLARE AND 10061 OR AND 10078		STEEL AND TITANIUM TUBING FLARE AND 10061		HOSE ASSEMBLY FITTINGS MS28740 AN6292 AN6270	
	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
3/16	35	60	35	70	90	100	70	100
1/4	40	65	70	120	135	150	70	120
*5/16	60	80	80	130	180	200	85	180
*3/8	75	125	130	180	270	300	100	250
*1/2	150	250	300	400	450	500	210	420
5/8	200	350	430	550	650	700	300	480
3/4	300	500	650	800	900	1000	500	850
1	500	700	900	1100	1200	1400	700	1150
1-1/4	600	900	—	—	—	—	—	—
1-1/2	600	900	—	—	—	—	—	—

* SEE NOTE 3

NOTES

1. WHERE ALUMINUM ALLOY TUBING IS USED IN STEEL FITTINGS, TORQUE VALUES FOR ALUMINUM ALLOY TUBING WILL APPLY.
2. WHERE ALUMINUM ALLOY THREADED PARTS ARE MATED WITH STEEL THREADED PARTS, TORQUE VALUES FOR ALUMINUM ALLOY TUBING WILL APPLY.
3. *APPLICABLE TO 5052-0 ALUMINUM ALLOY TUBING USED IN LIQUID OXYGEN SYSTEM ONLY,* SUBSTITUTE THE FOLLOWING VALUES:
   5/16—100 MIN, 125 MAX
   3/8 —200 MIN, 250 MAX
   1/2 —300 MIN, 400 MAX

WARNING

DO NOT USE PETROLEUM LUBRICANTS WITH OXYGEN FITTINGS.

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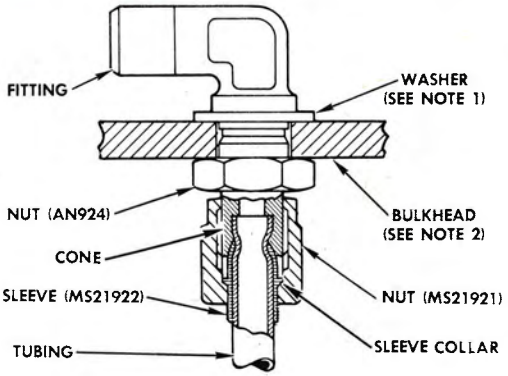
Figure 1-26. Tubing Torque Values (Sheet 1 of 2)



NOTES:

1. USE WASHER AN960, 0.062 THICK FOR FITTINGS SIZE -6 OR SMALLER, AND 0.031 THICK FOR FITTINGS SIZE -8 OR LARGER WHEN BULKHEAD IS 0.187 THICK OR LESS. WHEN BULKHEAD IS THICKER THAN 0.187, WASHER IS NOT REQUIRED PROVIDED HOLE IN BULKHEAD IS EQUAL TO THE HOLE IN APPLICABLE AN960 WASHER. SIZES -8 AND LARGER MAY BE USED THROUGH BULKHEADS UP TO 0.281 MAXIMUM THICKNESS. ENDS IN ACCORDANCE WITH MS33515, STYLE E, MAY BE USED THROUGH BULKHEADS UP TO 0.187 MAXIMUM. WASHER IS NOT REQUIRED WHERE FITTING END HAS HEX INSTEAD OF FLANGE SHOWN, PROVIDED HOLE IN BULKHEAD IS EQUAL TO HOLE SIZE IN APPLICABLE AN960 WASHER.
2. FITTING WITH BULKHEAD END CONFORMING TO MS33515, STYLE S, IN SIZES -6 AND SMALLER MAY BE USED THROUGH BULKHEADS UP TO 0.250 MAXIMUM THICKNESS. SIZES -8 AND LARGER AND ALL SIZES OF MS21903 MAY BE USED THROUGH BULKHEADS UP TO 0.375 MAXIMUM THICKNESS.

INSTALLATION AND TORQUE PROCEDURES FOR FLARELESS TUBE FITTINGS

a. Check that all parts are free from dirt, burrs and foreign particles.
b. Lubricate fittings and tube sleeve. See gasket selection table.
c. Install tube in fitting. Check that sleeve is in full contact with cone seat and that nut makes full contact with sleeve collar.
d. Tighten tube nut with wrench until sleeve is in full contact with tube. This will be indicated by a sharp rise in torque. Nut must tighten smoothly until this contact is made.

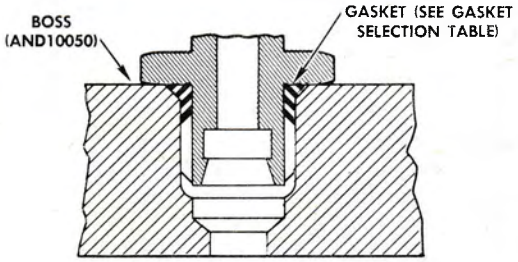
CAUTION

NEVER OVERTIGHTEN A LEAKING MS FITTING. THIS WILL DEFORM THE SLEEVE OR TUBE AND CAUSE ADDITIONAL LEAKS.

e. Tighten nut an additional ⅓ turn more (two hex flats of nut), no more or less. Fittings must be firmly held during this procedure to prevent rotation.
f. If leak occurs after installation, disconnect fitting and check for foreign material that may prevent tight seal. Check inside diameter of the affected tube at the sleeve area using ball gage test. If tube collapse is too great, replace tube. If tube passes test, reinstall and repeat tightening procedures.

TUBE BALL GAGE TEST CHART

TUBE O.D.	WALL THICKNESS					
	0.022	0.028	0.035	0.042	0.049	0.058
	BALL SIZE					
3/16	1/8	7/64	3/32	5/64	1/16	–
1/4	3/16	11/64	5/32	9/64	1/8	7/64
3/8	5/16	19/64	9/32	17/64	1/4	15/64
1/2	7/16	27/64	13/32	25/64	3/8	23/64
5/8	9/16	35/64	17/32	33/64	1/2	31/64
3/4	11/16	43/64	21/32	41/64	5/8	39/64
1	15/16	59/64	29/32	57/64	7/8	55/64
1-1/4	1-3/16	1-11/64	1-5/32	1-9/64	1-1/8	1-7/64
1-1/2	1-7/16	1-27/64	1-13/32	1-25/64	1-3/8	1-23/64



INSTALLATION OF FLARELESS NON-POSITIONING TYPE FITTINGS

a. Lubricate the gasket in appropriate liquid (see table).
b. Install gasket on the fitting as shown in detail.
c. Screw the fitting assembly into the boss until it bottoms tightly on the boss as shown.

GASKET SELECTION TABLE

APPLICATION	GASKET AN OR MS NO.	APPROPRIATE LUBRICANT FOR GASKETS AND TUBE FITTINGS
HYDRAULIC	AN6290	MIL-H-5606
PNEUMATIC	AN6290	MIL-L-4343
ENGINE OIL	AN6290	MIL-L-7808
FUEL	MS29512	MIL-H-5606
OXYGEN	AN6290	MIL-T-5542
OTHER USES	AN6290	FLUID USED IN SYSTEM

WARNING

DO NOT USE PETROLEUM LUBRICANTS WITH OXYGEN FITTINGS.

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Figure 1-26. Tubing Torque Values (Sheet 2 of 2)

BOLT SIZE	STEEL BOLTS				ALUMINUM ALLOY BOLTS (AN365D NUTS)		
	NUT TYPES AN365 AND AN310		NUT TYPES AN364 AND AN320				
	INCH LBS	FOOT LBS	INCH LBS	FOOT LBS	BOLT SIZE	INCH LBS	FOOT LBS
10-32	20-25	—	12-15	—	3/16	10-14	—
1/4-28	50-70	—	30-40	—	1/4	20-35	—
5/16-24	100-140	9-12	60-85	5-7	5/16	50-75	4-6
3/8-24	160-190	13-16	95-110	8-9	3/8	80-110	7-9
7/16-20	450-500	38-42	270-300	23-25	7/16	100-140	8-12
1/2-20	480-690	40-57	290-410	24-34	1/2	170-220	14-18
9/16-18	800-1000	67-83	480-600	40-50	5/8	400-460	34-38
5/8-18	1100-1300	92-108	660-780	55-65			
3/4-16	2300-2500	192-208	1300-1500	109-125			
7/8-14	2500-3000	209-250	1500-1800	125-150			
1-14	3700-5500	308-458	2200-3300	184-275			
1-1/8-12	5000-7000	417-583	3000-4200	250-350			
1-1/4-12	9000-11000	750-916	5400-6600	450-550			

When using torque wrench adapters, if the desired torque is known, the torque wrench dial reading may be found as follows:

T_w = Wrench dial reading.
T_a = Desired torque at end of adapter.
L = Lever length of torque wrench.
A = Length of adapter (center distance).

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

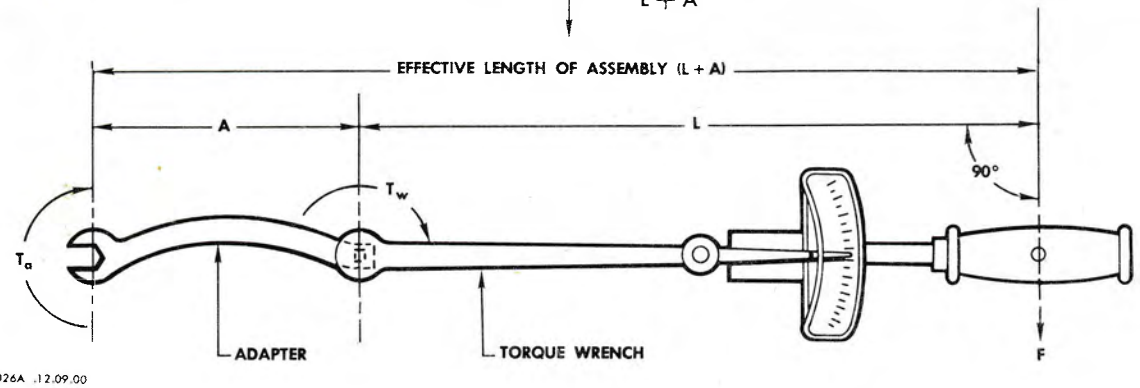

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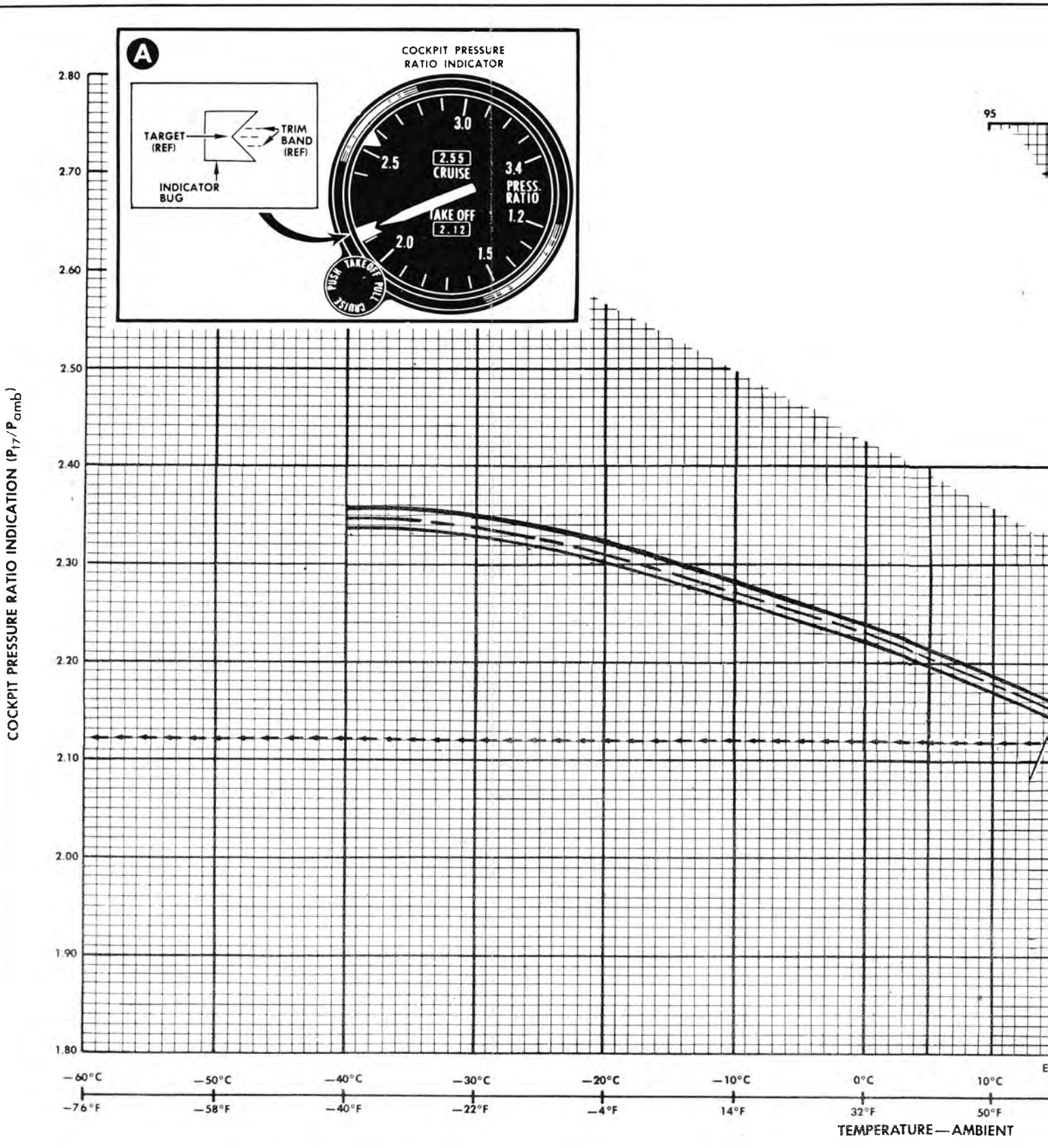
Figure 1-27. Bolt Torque Values

1-59. TEMPERATURE CONVERSION TABLE.

The following table is provided for use during engine trim check and adjustment.

READING IN °F ← °C OR °F → °C TO BE CONVERTED			READING IN °F ← °C OR °F → °C TO BE CONVERTED			READING IN °F ← °C OR °F → °C TO BE CONVERTED			READING IN °F ← °C OR °F → °C TO BE CONVERTED		
− 18.4	− 28	−33.33	+ 66.2	+ 19	− 7.22	+132.8	+ 56	+13.33	+199.4	+ 93	+33.89
− 14.8	− 26	−32.22	+ 68.0	+ 20	− 6.67	+134.6	+ 57	+13.89	+201.2	+ 94	+34.44
− 11.2	− 24	−31.11	+ 69.8	+ 21	− 6.11	+136.4	+ 58	+14.44	+203.0	+ 95	+35.00
− 7.6	− 22	−30.00	+ 71.6	+ 22	− 5.56	+138.2	+ 59	+15.00	+204.8	+ 96	+35.56
− 4.0	− 20	−28.89	+ 73.4	+ 23	− 5.00	+140.0	+ 60	+15.56	+206.6	+ 97	+36.11
− 0.4	− 18	−27.78	+ 75.2	+ 24	− 4.44	+141.8	+ 61	+16.11	+208.4	+ 98	+36.67
+ 3.2	− 16	−26.67	+ 77.0	+ 25	− 3.89	+143.6	+ 62	+16.67	+210.2	+ 99	+37.22
+ 6.8	− 14	−25.56	+ 78.8	+ 26	− 3.33	+145.4	+ 63	+17.22	+212.0	+100	+37.78
+ 10.4	− 12	−24.44	+ 80.6	+ 27	− 2.78	+147.2	+ 64	+17.78	+213.8	+101	+38.33
+ 14.0	− 10	−23.33	+ 82.4	+ 28	− 2.22	+149.0	+ 65	+18.33	+215.6	+102	+38.89
+ 17.6	− 8	−22.22	+ 84.2	+ 29	− 1.67	+150.8	+ 66	+18.89	+217.4	+103	+39.44
+ 19.4	− 7	−21.67	+ 86.0	+ 30	− 1.11	+152.6	+ 67	+19.44	+219.2	+104	+40.00
+ 21.2	− 6	−21.11	+ 87.8	+ 31	− 0.56	+154.4	+ 68	+20.00	+221.0	+105	+40.56
+ 23.0	− 5	−20.56	+ 89.6	+ 32	± 0.00	+156.2	+ 69	+20.56	+222.8	+106	+41.11
+ 24.8	− 4	−20.00	+ 91.4	+ 33	+ 0.56	+158.0	+ 70	+21.11	+224.6	+107	+41.67
+ 26.6	− 3	−19.44	+ 93.2	+ 34	+ 1.11	+159.8	+ 71	+21.67	+226.4	+108	+42.22
+ 28.4	− 2	−18.89	+ 95.0	+ 35	+ 1.67	+161.6	+ 72	+22.22	+228.2	+109	+42.78
+ 30.2	− 1	−18.33	+ 96.8	+ 36	+ 2.22	+163.4	+ 73	+22.78	+230.0	+110	+43.33
+ 32.0	± 0	−17.78	+ 98.6	+ 37	+ 2.78	+165.2	+ 74	+23.33	+231.8	+111	+43.89
+ 33.8	+ 1	−17.22	+100.4	+ 38	+ 3.33	+167.0	+ 75	+23.89	+233.6	+112	+44.44
+ 35.6	+ 2	−16.67	+102.2	+ 39	+ 3.89	+168.8	+ 76	+24.44	+235.4	+113	+45.00
+ 37.4	+ 3	−16.11	+104.0	+ 40	+ 4.44	+170.6	+ 77	+25.00	+237.2	+114	+45.56
+ 39.2	+ 4	−15.56	+105.8	+ 41	+ 5.00	+172.4	+ 78	+25.56	+239.0	+115	+46.11
+ 41.0	+ 5	−15.00	+107.6	+ 42	+ 5.56	+174.2	+ 79	+26.11	+240.8	+116	+46.67
+ 42.8	+ 6	−14.44	+109.4	+ 43	+ 6.11	+176.0	+ 80	+26.67	+242.6	+117	+47.22
+ 44.6	+ 7	−13.89	+111.2	+ 44	+ 6.67	+177.8	+ 81	+27.22	+244.4	+118	+47.78
+ 46.4	+ 8	−13.33	+113.0	+ 45	+ 7.22	+179.6	+ 82	+27.78	+246.2	+119	+48.33
+ 48.2	+ 9	−12.78	+114.8	+ 46	+ 7.78	+181.4	+ 83	+28.33	+248.0	+120	+48.89
+ 50.0	+ 10	−12.22	+116.6	+ 47	+ 8.33	+183.2	+ 84	+28.89	+249.8	+121	+49.44
+ 51.8	+ 11	−11.67	+118.4	+ 48	+ 8.89	+185.0	+ 85	+29.44	+251.6	+122	+50.00
+ 53.6	+ 12	−11.11	+120.2	+ 49	+ 9.44	+186.8	+ 86	+30.00	+253.4	+123	+50.56
+ 55.4	+ 13	−10.56	+122.0	+ 50	+10.00	+188.6	+ 87	+30.56	+255.2	+124	+51.11
+ 57.2	+ 14	−10.00	+123.8	+ 51	+10.56	+190.4	+ 88	+31.11	+257.0	+125	+51.67
+ 59.0	+ 15	− 9.44	+125.6	+ 52	+11.11	+192.2	+ 89	+31.67	+258.8	+126	+52.22
+ 60.8	+ 16	− 8.89	+127.4	+ 53	+11.67	+194.0	+ 90	+32.22			
+ 62.6	+ 17	− 8.33	+129.2	+ 54	+12.22	+195.8	+ 91	+32.78			
+ 64.4	+ 18	− 7.78	+131.0	+ 55	+12.78	+197.6	+ 92	+33.33			


A
COCKPIT PRESSURE
RATIO INDICATOR
TARGET
(REF)
TRIM
BAND
(REF)
INDICATOR
BUG
3.0
2.5
2.55
CRUISE
3.4
PRESS.
RATIO
TAKE OFF
2.12
1.2
2.0
1.5
PUSH TAKE OFF PULL CRUISE
95
COCKPIT PRESSURE RATIO INDICATION (P_{t7}/P_{amb})
2.80
2.70
2.60
2.50
2.40
2.30
2.20
2.10
2.00
1.90
1.80
−60°C
−50°C
−40°C
−30°C
−20°C
−10°C
0°C
10°C
−76°F
−58°F
−40°F
−22°F
−4°F
14°F
32°F
50°F
TEMPERATURE — AMBIENT

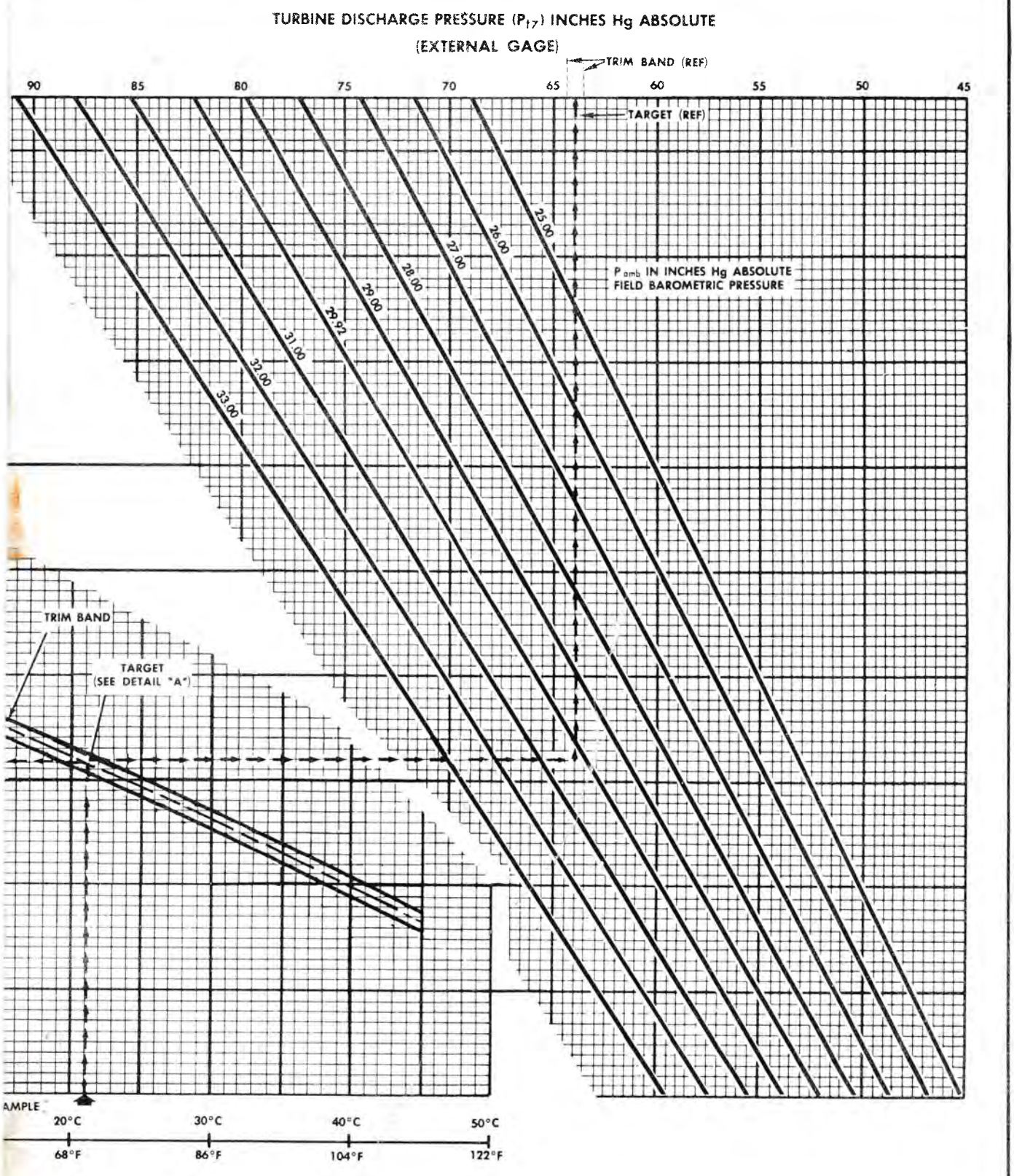


Figure 1-28. Engine Trim Chart, J75-P-17 Engine with Ham. Std. Fuel Control 546850, 547300, 552555, 553080, 557200, 557557, 568222, 576408, 576410, 576411, or 576412

1-60. ADJUSTED DATA PLATE SPEED DETERMINATION.

The speed at which a new engine originally produced military rated thrust is stamped on the engine data plate. This speed is for "standard day," 15°C (59°F) at 29.92 inches Hg. The engine fuel control unit is designed to automatically vary the engine speed with changes in compressor inlet temperature (T_{t2}) as shown in figures 1-29 and 1-30. To determine adjusted data plate speed for the ambient field conditions, proceed as follows:

a. Obtain the ambient air temperature using an accurate mercury thermometer in the shade of the airplane. Do not use cockpit ambient or Control Tower temperatures. Position thermometer so engine temperature will not affect reading.

b. Enter the temperature-rpm chart (figures 1-29 and 1-30) at the temperature obtained in step "a." Proceed vertically to the military rated thrust line. Move horizontally to the left from this point to the percentage of data plate speed to be expected at this temperature. This is known as speed bias.

c. Multiply data plate speed by the percentage value (speed bias) determined in step "b." This is known as adjusted data plate speed.

1-61. ENGINE TRIM AND IDLE SPEED ADJUSTMENT.

1-62. Equipment Requirements.

FIGURE	NAME	TYPE	ALTERNATE	USE AND APPLICATION
Refer to T.O. 1F-106A-2-9.	Pitot Static System Field Tester.	MB-1 (6635-334-7433)	Engine Trim Kit U.S. Accessory Prod. P/N 817D-1200 (1560-690-8092)	To measure turbine discharge pressure (P_{t7}).
	Mercury Thermometer. (10 inches minimum length.)	Local Procurement	Equivalent	To determine ambient temperature.
	T Fitting.	AN829-4D (4730-278-8167)	Equivalent	To provide attachment point to measure turbine discharge pressure.
	Flex Hose.	MS28741-4-0200 (4720-595-2770)	Equivalent	To aid connecting T fitting to engine firewall fitting.

1-63. Preparation of Airplane and Engine for Trim and Idle Speed Adjustment.

a. Check throttle control linkage for correct adjustment and security. See figure 2-7 for this procedure.

b. Prepare airplane for engine ground run. Refer to paragraph 1-25 for this procedure.

c. Park airplane in a thoroughly cleaned area and pointed into the wind. It is permissible to vary airplane heading as much as ±15 degrees of indicated wind direction. The wind velocity shall not exceed 8 knots. Cross winds or tail winds will affect engine trim.

NOTE

The engine may be trimmed in wind velocities up to 15 knots. The airplane is acceptable for flight following this trim if pilot's takeoff trim check parameters are met. If it is necessary to trim the engine at velocities exceeding 8 knots, the trim must be rechecked as soon as 8 knot conditions prevail.

d. Check that the exhaust nozzle is in the closed position.

e. Inlet duct screens removed.

f. Inlet duct variable ramps retracted.

g. Ground cooling air on (engine ground cooling valve open).

h. Cabin air (N_2 bleed) on.

i. Constant-speed generating system electrical load on or off.

j. Anti-icing air off (valve closed).

NOTE

Position anti-icing switch to cockpit to "MAN ON" for 5 seconds, then to "OFF." Visually check valve position indicator on body of valve for valve being closed.

k. Check that the constant-speed drive air-oil cooler air valve is open and that the engine air-oil cooler valve is closed.

l. Check that all upper fuselage access doors are installed.

CAUTION

Engine trimming should be avoided, if possible, under either of the following conditions:

1. When temperature is between −10°C (14°F) and 5°C (41°F) and fog is present.
2. When the dew point is within 4°C (7°F) of ambient temperature.

NOTE

When operational necessity makes it mandatory to trim engine under conditions cited in above CAUTION, Anti-ice will be turned on manually for duration of high power setting run and engine will be trimmed ½ inch Hg. below P_{t7} target. Engine is acceptable for flight following such trim if pilots take-off trim parameter is met. Trim should be rechecked at earliest opportunity when temperature and dew point are within acceptable range.

Figure 1-29. Deleted.

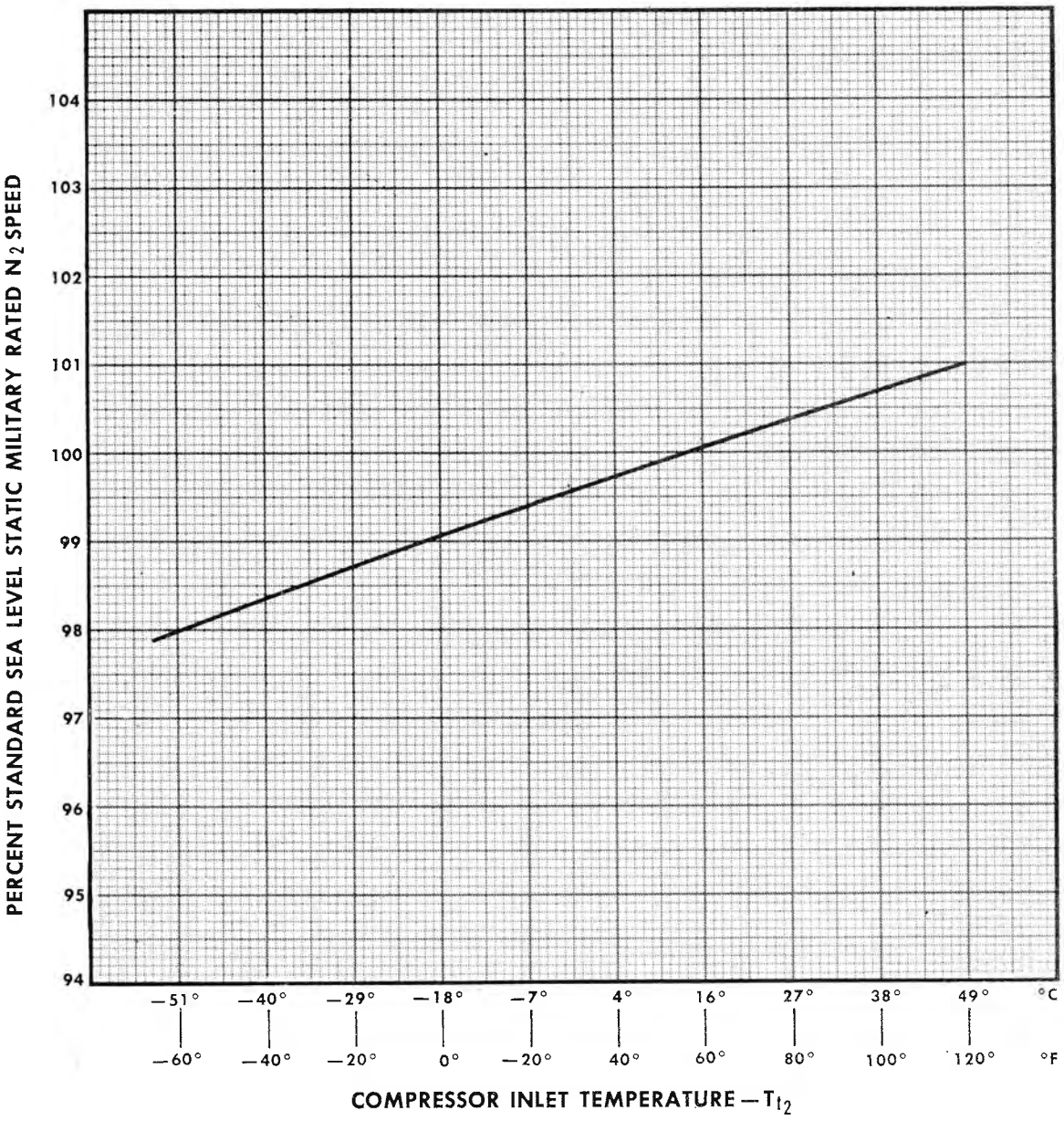


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Figure 1-30. Temperature-RPM Curve, for Hamilton Standard Fuel Controls 544750, 546850, 546920, 547300, 552555, 553080, 557200, 557557, 568222, 576408, 576410, 576411, and 576412

m. Gain access to trimming and idle speed adjustment points on bottom side of fuel control unit through the engine accessory compartment left access door.

n. Connect pressure gage portion of MB-1 Tester to pressure ratio line tee fitting located just forward of engine firewall on left side of engine.

o. On engines not equipped with the tee fitting, disconnect the pressure ratio line from fitting at forward left side of the engine firewall. Install T fitting on line disconnected. Install flex hose between T fitting and firewall fitting. Connect pressure gage portion of MB-1 Tester to T fitting.

1-64. Procedure.

NOTE

Engine trim data will be recorded on AFTO Form 111 each time the engine is trimmed. This form will be filed and maintained with the engine historical records.

a. Place thermometer in the shade of the airplane. Thermometer to be accurate within 0.3°C (0.5°F) with sufficient range to measure the highest ambient air temperature. After thermometer has stabilized, record ambient air temperature.

b. Obtain actual field barometric pressure from Control Tower (not barometric pressure corrected to sea level) within 15 minutes prior to engine trim run operation.

c. Enter trim chart (figure 1-28) at the ambient air temperature and proceed vertically to the trim band target line half way between the minimum and maximum limits of the trim band.

d. Proceed horizontally to the left to obtain pressure ratio indicator "TAKEOFF" setting; set indicator at this value.

e. Enter trim chart at the ambient air temperature and proceed vertically to the target line. Proceed horizontally to the right from this point to the field barometric pressure obtained in step "b." Proceed vertically from this point of intersection to determine the turbine discharge pressure (P_{t7}) test gage target value.

NOTE

P_{t7} tolerance is found by projecting the trim band minimum and maximum lines to the P_{t7} line.

f. Start and run engine at military power for 5 minutes to stabilize operation and temperatures. Refer to paragraph 1-26 for this procedure.

CAUTION

Engine over-temperature and overspeed limits must be closely watched during this operation to prevent exceeding the specified limits.

g. Record the following readings at the end of 5 minutes of military power operation.

1. Turbine discharge pressure from test manifold pressure gage.
2. Tachometer percentage rpm.
3. Pressure ratio.

h. Reduce power to idle.

i. Determine that the cockpit pressure ratio gage pointer has not exceeded the minimum or maximum limits of the trim band, and that the turbine discharge pressure external gage has not exceeded the limits determined in step "e."

j. If jet engine trim band has been exceeded, adjust the engine fuel control military trim adjustment screw and repeat steps "f" through "i." Turning the trim screw clockwise will increase engine power. Turning the trim screw counterclockwise will decrease engine power.

NOTE

Before making trim adjustment, loosen the set screw on the side of the fuel control in line with the trim screw. After trim adjustment, tighten the set screw to prevent change in trim adjustment.

k. Check idle rpm; indication shall be 57 to 59% On airplanes equipped with idle thrust control provisions, idle rpm with exhaust nozzle closed shall indicate 59 to 61%. Idle adjustment screw is located adjacent to military trim adjustment screw. Idle adjustment shall be made with the exhaust nozzle closed.

NOTE

If idle adjustment is made, it is mandatory that the military trim adjustment be rechecked.

l. Check that engine maximum allowable speed increase or adjusted data plate speed has not been exceeded. Refer to paragraphs 1-58 and 1-60 for these limits.

m. Shutdown engine. Refer to paragraph 1-30 for this procedure.

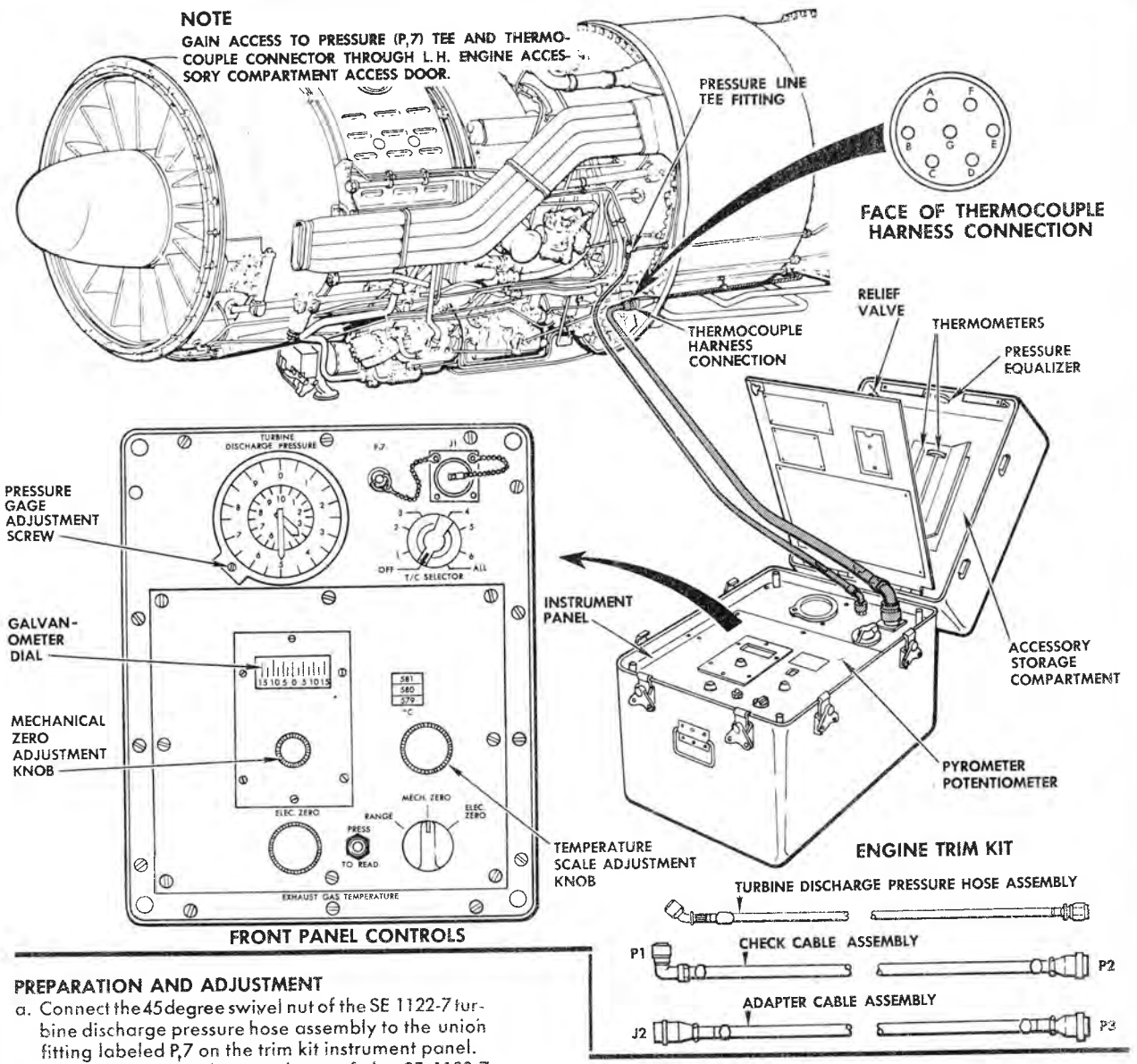
n. Paint "IDLE" and "TRIM" adjustment screws with a narrow band of brightly colored lacquer to "seal" the adjustment.

o. Remove test equipment.

1-65. ENGINE TRIM AND IDLE SPEED ADJUSTMENT USING SE 1122 ENGINE TRIM KIT.

NOTE

The following trim procedure is applicable to airplanes having Pratt and Whitney engine equipped with a dual thermocouple type harness. The individual thermocouple temperature lead connector, located on lower left side of fireseal, denotes engine having this type of harness (see figure 1-31).



PREPARATION AND ADJUSTMENT

a. Connect the 45 degree swivel nut of the SE 1122-7 turbine discharge pressure hose assembly to the union fitting labeled P_t7 on the trim kit instrument panel.

b. Connect the straight swivel nut of the SE 1122-7 turbine discharge pressure hose assembly to the pressure line tee fitting.

c. Connect plug P1 of the SE 1122-35 check cable assembly to the electrical receptacle J1 on the trim kit instrument panel.

d. On J75-P-17 engines, connect plug P2 of the SE 1122-35 check cable assembly to the thermocouple harness connection.

NOTE

ON J75-P-9 ENGINES CONNECT PLUG P2 OF THE SE 1122-35 CHECK CABLE ASSEMBLY TO RECEPTACLE J2 OF THE SE 1122-33 ADAPTER CABLE ASSEMBLY AND PLUG P3 OF THE SE 1122-33 ADAPTER TO THE THERMOCOUPLE HARNESS CONNECTION.

e. Set the T/C SELECTOR switch to OFF.

f. Set the RANGE-MECH. ZERO-ELEC. ZERO switch to MECH. ZERO.

g. Depress the PRESS TO READ button and rotate the mechanical zero adjustment knob as necessary to center the lighted pointer to zero on the galvanometer dial.

h. Set and hold the RANGE-MECH. ZERO-ELEC. ZERO switch to ELEC. ZERO.

i. Depress the PRESS TO READ button and rotate the ELEC. ZERO knob as necessary to center the pointer to zero on the galvanometer dial.

j. Set the RANGE-MECH. ZERO-ELEC. ZERO switch to RANGE.

k. Set the TURBINE DISCHARGE PRESSURE GAGE to the ambient barometric pressure by means of the pressure gage adjustment screw. (This should be done with the P_t7 port open.)

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Figure 1-31. Connecting SE 1122 Engine Trim Kit

1-66. Equipment Requirements.

FIGURE	NAME	TYPE	ALTERNATE	USE AND APPLICATION
1-31	Engine Trim Kit	817D1200 (4920-601-8092)	SE1122 (4920-626-6385)	To trim engine

1-67. Preparation.

a. Check throttle control linkage for correct adjustment and security. See figure 2-7 for this procedure.

b. Prepare airplane for engine ground run. Refer to paragraph 1-25 for this procedure.

c. Park airplane in a thoroughly cleaned area and pointed into the wind. It is permissible to vary airplane heading as much as ±15 degrees of indicated wind direction. The wind velocity shall not exceed 8 knots. Cross winds or tail winds will affect engine trim.

NOTE

The engine may be trimmed in wind velocities up to 15 knots. The airplane is acceptable for flight following trimming in 15 knot wind velocity if pilot's takeoff trim check parameters are met. If it is necessary to trim the engine at velocities exceeding 8 knots, the trim must be rechecked as soon as 8 knot conditions prevail.

d. Check that the exhaust nozzle is in the closed position.

e. Inlet duct screens removed.

f. Inlet duct variable ramps retracted.

g. Ground cooling air on (engine ground cooling valve open).

h. Cabin air (N_2 bleed) on.

i. Constant-speed generating system electrical load on or off.

j. Anti-icing air off (valve closed).

NOTE

Position anti-icing switch in cockpit to "MAN ON" for 5 seconds, then to "OFF." Visually check valve position indicator on body of valve for valve being closed.

k. Check that the constant-speed drive air-oil cooler air valve is open and that the engine air-oil cooler valve is closed.

l. Check that all fuselage upper access doors are installed.

m. Connect and adjust the engine trim kit as shown in figure 1-31.

1-68. Procedure.

Note

Engine trim data will be recorded on AFTO Form 111 each time the engine is trimmed. This form will be filed and maintained with the engine historical records.

a. Place trim kit thermometer in the shade of the airplane. After thermometer has stabilized, record ambient air temperature.

b. Obtain actual field barometric pressure from Control Tower (not barometric pressure corrected to sea level) within 15 minutes prior to engine trim run operation.

c. Enter trim chart (figure 1-28) at the ambient air temperature and proceed vertically to the trim band target line half way between the minimum and maximum limits of the trim band.

d. Proceed horizontally to the left to obtain pressure ratio indicator "TAKEOFF" setting; set cockpit indicator at this value.

e. Enter trim chart at the ambient air temperature and proceed vertically to the target line. Proceed horizontally to the right from this to the field barometric pressure obtained in step "b." Proceed vertically from this point of intersection to determine the turbine discharge pressure (P_{t7}) test gage target value.

NOTE

P_{t7} tolerance is found by projecting the trim band minimum and maximum lines to the P_{t7} line.

f. Start and run engine at military power for 5 minutes to stabilize operation and temperatures. Refer to paragraph 1-26 for this procedure.

CAUTION

Engine over-temperature and overspeed limits must be closely watched during this operation to prevent exceeding the specified limits.

g. Record the following readings at end of 5 minutes of military power operation.

1. Turbine discharge pressure directly from the "TURBINE DISCHARGE PRESSURE" test gage.

2. Tachometer percentage rpm.
3. Pressure ratio from cockpit indicator.
4. Measure individual thermocouple and average engine exhaust gas temperature (EGT) by setting the "T/C SELECTOR" switch to the desired position, depressing the "PRESS TO READ" button, and rotating the temperature scale adjustment knob as necessary to center the lighted pointer to zero on the galvanometer dial. The measured EGT will appear between the hairlines in the "°C" window.

CAUTION

If the temperature of any one thermocouple exceeds 649°C, or if a temperature spread between any of the thermocouples exceeds 139°C, a condition of fuel nozzle flow restriction should be suspected. Shutdown the engine.

h. Reduce power to idle.

i. Determine that the cockpit pressure ratio gage pointer has not exceeded the minimum or maximum limits of the trim band, and that the "TURBINE DISCHARGE PRESSURE" test gage reading is within the maximum and minimum limits determined in step "e."

j. If engine trim band has been exceeded, adjust the engine fuel control military trim adjustment screw and repeat steps "f" through "i." Turning the trim screw clockwise will increase engine power. Turning the trim screw counterclockwise will decrease engine power.

Note

Before making trim adjustment, loosen the set screw on the side of the fuel control in line with the trim screw. After trim adjustment, tighten the set screw to prevent change in trim adjustment.

k. Check idle rpm; indication shall be 57 to 59%. On airplanes equipped with idle thrust control provisions, idle rpm with exhaust nozzle closed shall indicate 59 to 61%. Idle adjustment screw is located adjacent to military trim adjustment screw. Idle adjustment shall be made with the exhaust nozzle closed.

NOTE

If idle adjustment is made, it is mandatory that the military trim adjustment be rechecked.

l. Check that engine maximum allowable speed increase or adjusted data plate speed has not been exceeded. Refer to paragraphs 1-58 and 1-60 for these limits.

m. Shutdown engine. Refer to paragraph 1-30 for this procedure.

n. Paint "IDLE" and "TRIM" adjustment screws with a narrow band of brightly colored lacquer to "seal" the adjustment.

o. Remove test equipment.

SERVICING

1-69. CLEANING, ENGINE AIR PASSAGES.

Cleaning of the air passages is intended for use on engines displaying definite evidence of performance deterioration due to accumulation of foreign material on compressor blades and in air passages. Deterioration due to this cause may be detected by repeated necessity to increase military trim high-pressure rotor speed (N_2) to maintain constant corrected engine thrust. It is recommended that the engine passages be cleaned if the rpm required to obtain military rated thrust exceeds 1.7% rpm above the engine adjusted data plate speed, or 102.75% N_2 rpm (J75-P-17 engines). Refer to paragraph 1-60 to determine adjusted data plate speed. The cleaning procedure should not be used except in cases where thrust loss is definitely indicated. It will be necessary to remove the engine from the airplane and install the engine in a ground run test stand. Refer to T.O. 1F-106A-10 for engine running in a test stand.

CAUTION

If the test stand concept differs from T.O. 1F-106A-10 equipment, it will be necessary to remove the hydraulic pumps and the CSD engine mounted gearbox. The service life of these components can be shortened due to possibility of incorrect inlet and case pressures, insufficient fluid in the cases, high fluid temperature, or contaminated fluid. For hydraulic pump removal information, refer to T.O. 1F-106A-2-3.

For engine removal information, refer to paragraph 1-42. For constant-speed drive engine mounted gearbox removal information, refer to paragraph 9-10. For starter removal information, refer to paragraph 5-21. For the cleaning of engine air passages procedure, refer to T. O. 2J-J75-6.

1-70. IDENTIFICATION OF METAL PARTICLES.

When particles of metal are found in the fuel filter, fuel screens, or oil screens, they may be either steel, tin, aluminum, magnesium, silver, bronze, or cadmium. When particles cannot be positively identified by visual inspection, use the following chart to determine the kind of metal present:

WARNING

Exercise extreme care when working with acids. Wear protective clothing and work in a well ventilated area. If acid should come in contact with the skin, wash immediately with water and obtain medical attention at once.

METAL TO BE IDENTIFIED	EQUIPMENT AND CHEMICALS REQUIRED	IDENTIFYING REACTION
Steel	Permanent magnet.	Steel or iron will be attracted by the magnet.
Cadmium	Solution of ammonium nitrate (NH_4NO_3), Military Specification JAN-A-175. Solution to consist of two ounces aqueous (water) containing 10% ammonium nitrate.	Place particles in ammonium nitrate solution. If all or any of the particles dissolve in the solution, they are cadmium. Rinse and dry any remaining particles before continuing with next test.
Tin	Clean soldering iron, heated to 260°C (500°F) and tinned with 50-50 solder (50% tin, 50% lead).	Drop particles on heated soldering iron. If particles melt and fuse with the solder they are tin.
Aluminum	Two ounces each of 50% by volume hydrochloric acid (HCL), Federal Specification O-A-86.	When a particle of aluminum is placed in hydrochloric acid, it will fizz with a rapid emission of gas bubbles and gradually disintegrate and form a black residue (aluminum chloride $ALCL_3$). **NOTE** Silver and bronze are not noticeably attacked by hydrochloric acid (HCL).
Silver	Concentrated nitric acid (HNO_3), Federal Specification O-A-88.	When a silver particle is placed in nitric acid (HNO_3) it reacts rather slowly, producing a whitish fog in the acid.
Bronze or Copper	Concentrated nitric acid (HNO_3), Federal Specification O-A-88.	When a bronze or copper particle is placed in nitric acid (HNO_3) a bright green cloud is produced.
Magnesium	A source of open flame.	When exposed to an open flame magnesium will burn with a bright white flash. **WARNING** Never attempt to burn more than a few particles of metal suspected to be magnesium. Magnesium powder or dust is explosive.

1-70. IDENTIFICATION OF METAL PARTICLES (CONT).

METAL TO BE IDENTIFIED	EQUIPMENT AND CHEMICALS REQUIRED	IDENTIFYING REACTION
Aluminum Silicone Paint **NOTE** Aluminum silicone paint may be found on the main oil screen in the form of silver colored flakes. These flakes are magnetic and may be mistaken for aluminum or silver. Use this test to identify silver colored flakes on the main oil screen.	A solution of sodium hydroxide consisting of one pellet sodium hydroxide to three cc's of water. Add the solution to a watch glass.	When aluminum silicone paint is placed in sodium hydroxide there will be a mild reaction in the form of gas bubbles and some visible gas as the particles change to sodium aluminate. When aluminum chips are placed in sodium hydroxide the reaction will be much more active with more gas bubbles forming and more gas visible. When silver particles are placed in sodium hydroxide there will be no reaction.

1-71. SERVICING ENGINE LUBRICATION SYSTEMS.

For engine lubrication system servicing instructions, refer to Section VI.

1-72. SERVICING CONSTANT-SPEED DRIVE LUBRICATION SYSTEM.

For the constant-speed drive lubrication system information and servicing, refer to Section IX.

1-73. LUBRICATION, ENGINE COMPONENTS.

For engine component service lubrication, refer to T.O. 1F-106A-2-2.

1-74. BLEEDING, HYDRAULIC SYSTEM.

Bleed the airplane hydraulic system following the installation of the engine in the airplane. Refer to T.O. 1F-106A-2-3 for this procedure.

1-75. REPLACEMENT, HYDRAULIC SYSTEM LOW PRESSURE FILTER ELEMENT.

Clean or replace the hydraulic system low-pressure filter element after first engine ground run following installation of the engine in the airplane. Refer to T.O. 1F-106A-2-3 for this procedure.

1-76. PRESERVATION, GENERAL.

For extended periods of airplane inactivity, it is necessary that the engine fuel and oil systems, and the constant-speed drive oil system be preserved. The period of inactivity can fall in one of three categories as determined by maintenance control personnel prior to beginning of the inactivity period. These periods of airplane inactivity can be 1 to 28 days, 28 to 119 days, or beyond 119 days. For the inactivity period of 1 to 28 days, no preservation is required. However all inlet, exhaust, vent, drain and service openings should be covered to prevent entry of moisture and foreign materials. For the inactivity period of 28 to 119 days, preservation of the systems will be required as outlined in following paragraphs. For preservation beyond 119 days, the procedure for the 28 to 119 days period will be conducted, then the engine will be removed from the airplane.

NOTE

During preserving procedures, it is necessary to air motor the engine. Refer to paragraph 5-13 for the air motoring procedure.

The engine will be prepared for storage and installed in a shipping container in accordance with T.O. 2J-1-18.

1-77. PRESERVATION, ENGINE OIL SYSTEM (28 TO 119 DAYS).

a. Prepare engine for ground run operation. Refer to paragraph 1-25 for this procedure. Remove constant-speed system drive shaft to prevent generator oil flooding. Refer to paragraph 9-4 for engine mounted gearbox conditioning and operational limitations which must be followed during this operation. Check engine starter oil level; service as required.

b. Place drainage receptacles under engine oil tank drain, N_2 accessory section case drain, and the engine air-oil cooler and engine fuel-oil cooler drains.

c. Motor engine with starter until oil pressure and engine rpm is indicated; disengage starter. Open drains and allow oil to drain to a slow drip.

d. Open drains. Motor engine with starter, permitting scavenge pumps to clear engine. Disengage starter when steady flow from drains ceases.

CAUTION

Do not exceed starter operation limitation of 90 seconds in a 20 minute period.

e. Clean and reinstall main oil strainer. Refer to paragraph 6-41 for this procedure.

f. Close and secure all oil drain points.

CAUTION

When installing the engine oil drain plug in the N_2 accessory case drain, a maximum of 75 to 100 inch-pounds torque shall be used. Do not over torque and strip accessory case threads.

g. Fill engine oil tank to "FULL" mark on dip stick with oil, Military Specification MIL-L-7808.

h. Motor engine with starter until oil pressure is indicated; disengage starter. Reinstall constant-speed system drive shaft. Disconnect coupled engine mounted gear box oil "in" and "out" lines at quick disconnect fittings. Reconnect lines to the constant-speed remote gear box.

NOTE

Preservation of the constant-speed drive system should be conducted at this time. Refer to paragraph 1-81 for this procedure.

i. Start engine and operate at idle. Refer to paragraph 1-26 for this procedure.

j. With engine pressures and temperatures stabilized, advance throttle to 75% rpm. Operate at this setting for 5 minutes; shutdown engine. Refer to paragraph 1-30 for engine shutdown procedure.

1-78. PRESERVATION, ENGINE FUEL SYSTEM (28 to 119 days).

1-79. Equiment Requirements.

FIGURE	NAME	TYPE	ALTERNATE	USE AND APPLICATION
1-6	External High-Pressure Air Compressor.	SE 0704-801 (4310-697-0858)	Equivalent.	To provide sufficient air supply for combustion starter air motoring operation.
Refer to T.O. 1F-106A-2-3	High-Pressure Air Compressor.	MC-11 (4310-541-7060)	SE 0704-801 (4310-697-0858)	To provide air supply for combustion starter air motoring operation.
Refer to T.O. 1F-106A-2-10	Generator Set (Gas).	8-96026-801 AF/M32A-13 (6115-583-9365)	8-96026 AF/M32M-2 (6115-617-1417)	To energize electrical systems on aircraft equipped with special quick disconnect receptacle.
	Generator Set (Elec).	8-96025-803 AF/ECU-10/M (6125-583-3225)	8-96025-805 A/M24M-2 (6125-628-3566)	
			8-96025 AF/M24M-1 (6125-620-6468)	
	Generator Set.		MC-1 (6125-500-1190)	To energize electrical systems (except AWCIS) on aircraft equipped with standard AN receptacle and on others by using adapter cable 8-96052.
			MD-3 (6115-635-5595)	
	Adapter Cable.	8-96052 (6115-557-8548)		To connect MC-1 and MD-3 units to aircraft equipped with special quick disconnect receptacle.

1-79. Equipment Requirements (Cont).

FIGURE	NAME	TYPE	ALTERNATE	USE AND APPLICATION
	Engine Inlet Duct Screens.	8-96176-1-2 -1(1730-650-1413) -2(1730-646-8903)		To prevent foreign material from entering ducts during engine ground run.
	Wheel Chocks.	P/N42D-65942 (1730-294-3695) Class 19A or equivalent.		To chock landing gear wheels.
		P/N50D-6602 (1730-268-9822) Class 10A		To chock landing gear wheels during ice and snow conditions.
	Variable controlled pressure flushing oil source of 5 to 25 psi (Flushing oil Military Specification MIL-O-6081, grade 1010).			To flush and preserve engine fuel system.
	Variable controlled dry air pressure source of 0 to 60 psi (2).			To aid in preservation of afterburner igniter valve.
	Variable controlled preserving source of 0 to 10 psi (2) (Preserving oil Military Specification MIL-C-6529A).			To preserve afterburner igniter valve.
	Dehydrating Agent. (52, one pound bags.)	Military Specification MIL-D-3464, type 5, grade A	Equivalent	To preserve engine area.
	Humidity Indicators.	AN7511-1	Equivalent	To provide visual indication of fuselage area preservation condition.
	Stop Watch.	A-8 (6645-557-0322)	Equivalent	To time depreserving operation.
	Drain Receptacles.			To catch drainage fluids during preserving procedure.
	Intercommunication Equipment.			For contact from cockpit to ground observers.
	Fire-fighting Equipment.			To extinguish flames in case of fire.

1-80. Procedure.

a. Place 5 gallon drain receptacle under fuel pressurizing and dump valve overboard drain.

b. Disconnect signal line from main fuel control unit where it attaches to pressurizing and dump valve; leave dump valve connection open to atmosphere. Cap signal line from main fuel control unit.

c. Remove upper aft plug from right side of afterburner fuel control; install drain hose. Place 5 gallon drain receptacle under drain hose.

NOTE

Some fuel will spray out tailpipe during engine air motoring.

d. Disconnect and cover engine fuel inlet line at engine fuel pump inlet port. Remove constant-speed system drive shaft.

NOTE

Refer to paragraph 9-4 for engine mounted gearbox conditioning and operational limitations which must be followed during this operation.

e. Connect 5 to 25 psi pressure source of flushing oil, Military Specification MIL-O-6081, grade 1010, to the engine fuel pump inlet port.

f. Remove engine ignition power fuse from main wheel well fuse panel.

g. Check that fuel control and afterburner control fuses on nose wheel well fuse panel are installed.

h. Place controls in following position:

1. Fuel valve selector	"OFF"
2. Fuel boost pump switches	"OFF"
3. Fuel control switch	"NORMAL"
4. Throttle	"OFF"

i. With engine starter applicable air source connected to the airplane, depress ignition button and move throttle to "START" position; start stop watch. Starter shall motor engine. Ignition button to be depressed during entire procedure.

j. Move throttle to "OFF;" ignition shall not occur. Advance throttle to "MIL POWER."

1. After 15 seconds move throttle to afterburning.
2. After 25 seconds move throttle to "MIL POWER."
3. After 30 seconds place fuel control switch in emergency.
4. After 40 seconds place fuel control switch in normal.
5. Move throttle to "OFF," then to full forward position at a slow steady rate; 5 seconds for full quadrant travel.
6. When stop watch reads 60 seconds, move throttle to "OFF" and release ignition button. Starter operation shall cease. Shut off gas turbine compressor; remove electrical power from airplane.

NOTE

During this procedure a minimum of 3 gallons of fluid should drain from the dump valve and 2 gallons from the afterburner manifold.

k. Remove flushing equipment from engine, reconnect lines.

l. Drain engine oil tank and engine N_2 accessory section of oil; close tank drain and reinstall accessory section drain plug.

CAUTION

When installing the N_2 accessory section drain plug, use only a maximum of 75 to 100 inch-pounds torque to prevent stripping of accessory case threads.

m. Remove and clean fuel system filters and screens. Refer to Sections II and III for these procedures.

n. Remove the following lines from the afterburner igniter valve:

1. Fuel supply line.
2. Tailpipe drain line.
3. Fuel discharge line.
4. Air supply line from diffuser case.
5. Air line from exhaust nozzle control open line.

NOTE

Refer to T.O. 2J-J75-6 for line identification.

o. Connect controlled variable air pressure source of 0 to 60 psi where air supply line from diffiuser case normally attaches to igniter valve. Apply 60 psi air pressure.

p. Using a 0 to 10 psi controlled pressure source of preserving oil, Military Specification MIL-C-6529A, type III, connect preserving oil source to fuel inlet port of igniter valve. Apply 8 to 10 psi oil pressure. When oil flows freely from igniter valve drain fitting, reduce air pressure to 5 to 10 psi.

q. Oil flow will decrease from drain fitting and oil will start to drip from igniter valve fuel discharge port.

When oil flow decreases at fuel discharge port, repeat steps "o" and "p."

r. Adjust air and oil pressure to 10 psi.

s. Connect second 0 to 10 psi controlled pressure source of preserving oil, Military Specification MIL-C-6529A, type III, to exhaust nozzle air line port on igniter valve. Raise oil pressure to 8 to 10 psi; reduce oil pressure to zero.

t. Repeat step "s." Remove oil source connected in step "s." Allow oil to drain from igniter valve. Reduce first oil source pressure and air pressure to zero; remove air and oil line. Allow oil to drain from igniter valve into a receptacle. Reconnect engine lines to igniter valve.

u. If engine is to remain in the airplane, perform the following:

1. Install dehydrating agent, Military Specification MIL-D-3464, Type 5, Grade A in one pound bags in engine and duct areas. Distribute 26 pounds throughout engine compartment. Distribute 13 pounds in engine air inlet ducts, and 13 pounds in engine exhaust duct. Record amount of dehydrating agent placed in each area.

2. Seal engine intake, exhaust, vent, and drain openings, and boundary layer bleeds. Humidity indicators and inspection windows to be provided at intake and exhaust ducts.

3. Checking of preserved unit to be made at 2 week intervals if airplane is stored outside, or every 30 days if stored inside.

1-81. PRESERVATION, CONSTANT-SPEED DRIVE OIL SYSTEM (28 TO 119 DAYS).

At the time of engine preservation, it will be necessary to also preserve the constant-speed oil system. Just prior to the engine preserving run, perform the the following procedure:

a. Drain the constant-speed system oil tank only. Refer to Section IX for this procedure.

b. Fill the constant-speed system oil tank with oil, Military Specification MIL-L-7808.

1-82. DEPRESERVATION, GENERAL.

For an airplane inactivity period of 1 to 28 days, depreservation of the engine fuel and oil systems, and the constant speed drive system is not required. However all covers should be removed from the inlet, exhaust, vent, drain and service openings and the areas checked for normal operating condition. For an inactivity period of 28 to 119 days, the previously listed systems are preserved and will require depreserving action. The following paragraphs outline the steps necessary to depreserve these systems. These procedures also apply to a new engine, engine preserved for a period beyond 119 days, a new fuel control, or a new constant-speed drive unit after being installed in the airplane.

1-83. DEPRESERVATION, ENGINE OIL SYSTEM.

a. Place drain receptacles under the oil tank drain, N_2 accessory section oil drain, fuel-oil cooler oil drain, and air-oil cooler drain.

b. With drains open, allow preserving oil to drain to slow drip.

c. Remove engine oil strainer and clean. Refer to paragraph 6-41 for this procedure.

d. Reinstall oil strainer and all plugs removed for the draining procedure.

CAUTION

When installing oil drain plug in the N_2 accessory case, torque plug to maximum of not more than 75 to 100 inch-pounds to prevent stripping of accessory case threads.

e. Service engine oil tank.

1-84. DEPRESERVATION, ENGINE FUEL SYSTEM.

When depreserving an installed engine, or when installing a new control unit, or installing a preserved engine in the airplane, it is necessary that the preservative oil be flushed from the engine fuel system with engine fuel, prior to engine operation. An 8 hour soaking period after the flushing process is not required; however, if malfunction, erratic operation, or leakage by the shaft seals is encountered during initial operation, assure that the system is filled with fuel and allow the system to soak for 8 hours, and then recheck the operation prior to rejecting a component of the system.

1-85. Equipment Requirements.

FIGURE	NAME	TYPE	ALTERNATE	USE AND APPLICATION
Refer to T.O. 1F-106A-2-3	High-Pressure Air Compressor.	MC-11 (4310-541-7060)	SE 0704-801 (4310-697-0858)	To provide air supply for combustion starter air motoring operation.
Refer to T.O. 1F-106A-2-10	Generator Set (Gas).	8-96026-801 AF/M32A-13 (6115-583-9365)	8-96026 AF/M32M-2 (6115-617-1417)	To energize electrical systems on aircraft equipped with special quick disconnect receptacle.

1-85. Equipment Requirements (Cont).

FIGURE	NAME	TYPE	ALTERNATE	USE AND APPLICATION
	Generator Set (Elec).	8-96025-803 AF/ECU-10/M (6125-583-3225)	8-96025-805 A/M24M-2 (6125-628-3566)	
			8-96025 AF/M24M-1 (6125-620-6468)	
	Generator Set.		MC-1 (6125-500-1190)	To energize electrical systems (except AWCIS) on aircraft equipped with standard AN receptacles and on others by using adapter cable 8-96052.
			MD-3 (6115-635-5595)	
	Adapter Cable.	8-96052 (6115-557-8548)		To connect MC-1 and MD-3 units to aircraft equipped with special quick disconnect receptacle.
	Engine Inlet Duct Screens.	8-96176-1-2 -1(1730-650-1413) -2(1730-646-8903)		To prevent foreign material from entering ducts during engine ground run.
	Wheel Chocks.	P/N42D-65942 (1730-294-3695) Class 19A or equivalent		To chock landing gear wheels.
		P/N 50D6602 (1730-268-9822) Class 10A		To chock landing gear wheels during ice and snow conditions.
	Stop Watch.	A-8 (6645-557-0322)	Equivalent	To time depreserving operation.
	Drain Receptacles.			To catch drainage fluids during depreserving procedure.
	Intercommunication Equipment.			For contact from cockpit to ground observers.
	Fire-fighting Equipment.			To extinguish flames in case of fire.

1-86. Procedure

The following procedure is used to depreserve the engine fuel system while the engine is installed in the airplane:

a. Disconnect fuel pressurizing and dump valve sensing line at the fuel control. Cap fitting on fuel control and leave sensing line open to atmosphere.

b. Place drain receptacle under fuel pressurizing and dump valve drain, and the afterburner duct drain.

c. Connect external ac and dc power to airplane receptacles. Refer to T.O. 1F-106A-2-10 for this procedure.

d. Prepare combustion starter for air motoring. Refer to paragraph 5-13 for this procedure. Check starter oil level; service as required.

e. Remove constant-speed system drive shaft to prevent generator oil flooding. Refer to paragraph 9-4 for engine mounted gearbox conditioning and operational limitations which must be followed during this operation.

NOTE

Check that requirements for engine oil system depreserving have been accomplished.

f. Check that the following fuses are installed:

1.	"EXT PWR"	Main wheel well fuse panel.
2.	"FUEL CONT"	Nose wheel well fuse panel.
3.	"AB CONT"	Nose wheel well fuse panel.
4.	"LH FUEL VALVE SHUTOFF"	Cockpit LH fuse panel.
5.	"RH FUEL VALVE SHUTOFF"	Cockpit LH fuse panel.
6.	"FWD FUEL VALVE SHUTOFF"	Cockpit LH fuse panel.

CAUTION

Check that engine ignition fuse has been removed.

g. Place the following switches in the position indicated:

1.	Fuel Control	"NORMAL"
2.	Fuel selector valve	"ENGINE"
3.	Fuel Boost pumps (2) one left, one right	"ON"

h. Move throttle lever to "START." Depress ignition button and hold in the depressed position during the period of starter operation.

i. With ignition button depressed, move throttle to "OFF" then to "MIL POWER" position. Use stop watch to check operation.

CAUTION

If engine oil low pressure warning light does not extinguish, release ignition button and move throttle lever to "OFF" position. Investigate and correct cause of malfunction.

j. After cranking engine with throttle at "MIL POWER" for approximately 30 seconds, place fuel control switch in "EMERGENCY" position.

k. After total elapsed time of 40 seconds, move fuel control switch back to "NORMAL" position.

l. Move throttle to "OFF" position then to full power position (take 5 seconds for full quadrant travel). At 60 seconds, release "IGNITION" button and return throttle to "OFF."

NOTE

During the depreservation operation, a minimum of 3 gallons of oil-fuel mixture should drain from the dump valve. If minimum amount of liquid does not drain, repeat depreserving procedure.

m. Remove drain hoses, reconnect fuel lines, and shut down gas turbine compressor.

n. Install engine ignition fuse in main wheel well fuse panel.

o. Allow fuel to remain in fuel control unit a minimum of 8 hours.

p. Remove and clean the following engine filters.

1. Fuel pump strainer. See figure 2-7.
2. Fuel control filter. See figure 2-7.
3. Fuel pressurizing and dump valve screen. See figure 2-8.

q. Reinstall constant-speed system drive shaft. Refer to Section IX for this procedure. Disconnect coupled engine mounted gearbox oil "in" and "out" at quick disconnect fittings. Reconnect lines to the constant-speed remote gearbox.

r. Perform engine run and operational check. Refer to paragraph 1-25 for this procedure.

NOTE

Check that requirements for depreserving of the engine oil system and the constant-speed drive system have been accomplished before running the engine.

1-87. DEPRESERVATION, CONSTANT-SPEED DRIVE SYSTEM.

a. Drain and prime the constant-speed oil system. Refer to Section IX for this procedure.

b. After the first engine run, check the constant-speed oil tank for oil level to the "FULL" mark on the dip stick. Refer to Section IX for this procedure.

EXTREME WEATHER CONDITIONS

1-88. GENERAL.

Airplanes stationed in arctic or desert regions are subject to extreme temperature and weather conditions and will require special precautionary measures during maintenance.

1-89. HOT WEATHER OPERATION.

During hot weather operations, normal starting procedures will be used. Temperatures will possibly be on the high side of operating ranges. This will require that engine ground run operations be accomplished as rapidly as possible.

1-90. COLD WEATHER OPERATION.

1-91. Engine Fuel System.

As atmospheric temperatures are reduced, the solubility of water in fuel is also reduced. This results in water separating from fuel and settling in low points of fuel system accessories and equipment. With the occurance of freezing temperatures, this water will freeze, causing malfunction of the fuel system. Water in fuel will also freeze, forming needle-shaped crystals that may be found in fuel strainer. This will restrict fuel flow and in severe cases will completely clog the strainer. To remedy this condition, heated air must be applied to the engine and fuel system components. Use ground heating unit 8-96106 or 8-96107.

CAUTION

Continue heat application for sufficient time to insure positive removal of all ice. Fuel flow at engine start may cause any remaining lumps of ice to slip and block fuel passages. All fuel filters, screens, and fuel supply system low points must be inspected and drained after application of heat.

1-92. Engine Oil System.

Icing conditions may exist in the oil system at the same time as in the fuel system. During cold weather, an airplane left outside after engine run will have greater possibility of water in the fuel and oil systems due to condensation. In the event that ice conditions are suspected, the airplane should be placed in a heated area for a period of time sufficient to warm the affected areas.

1-93. Engine Cold Weather Operating Procedures.

Starting of the engine during cold weather will be conducted in the normal manner. Operate the engine at idle for 2 minutes before advancing the throttle. Upon completion of operations, the engine will be shutdown in the normal manner.

NOTE

Because of low ambient temperatures, thrust developed by the engine will be noticeably greater than normal. Refer to engine trim procedure to compute thrust limits for the ambient temperature.