CHAPTER

73

ENGINE FUEL AND CONTROL

CHAPTER 73 - FUEL AND CONTROL SYSTEM

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CHAPTER 73 - ENGINE

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FUEL AND CONTROL SYSTEM - DESCRIPTION AND OPERATION

1. General. The fuel system is a hydro-mechanical system designed to provide the proper amount of fuel to the engine for optimum performance throughout the operating range. It also provides fuel for operation of the engine variable geometry, to lubricate and operate servos in the fuel control and overspeed governor, and as a coolant for engine lube oil.

2. Description. The major components of the system include the fuel pump, the fuel control, the overspeed governor, the O.S.G. servo filter, the fuel flowmeter (airframe furnished), the oil cooler, the fuel pressurizing valve, two fuel manifolds, twelve fuel nozzles, the manifold drain valve and two variable geometry actuators. (Maintenance of the actuators is covered in Section 75-00.) Figure 1 is a schematic showing the relation of the components in the flow path.

   A. Fuel Pump.

      The fuel pump is mounted on the forward right hand drive pad of the accessory gearbox. It is a dual-element, self-lubricating pump, consisting of a low pressure or boost stage, a high pressure stage, a fuel screen, a relief valve and high and low pressure taps. Its primary purpose is to supply high pressure fuel to the fuel control. Its secondary purpose is to supply high pressure fuel to the overspeed governor servos.

   B. Fuel Control.

      The fuel control is mounted on the fuel pump. The control is a hydro-mechanical unit that selects and regulates the power output of the basic engine, maintaining its operation within an envelope of safe operating limits by performing the following specific functions:

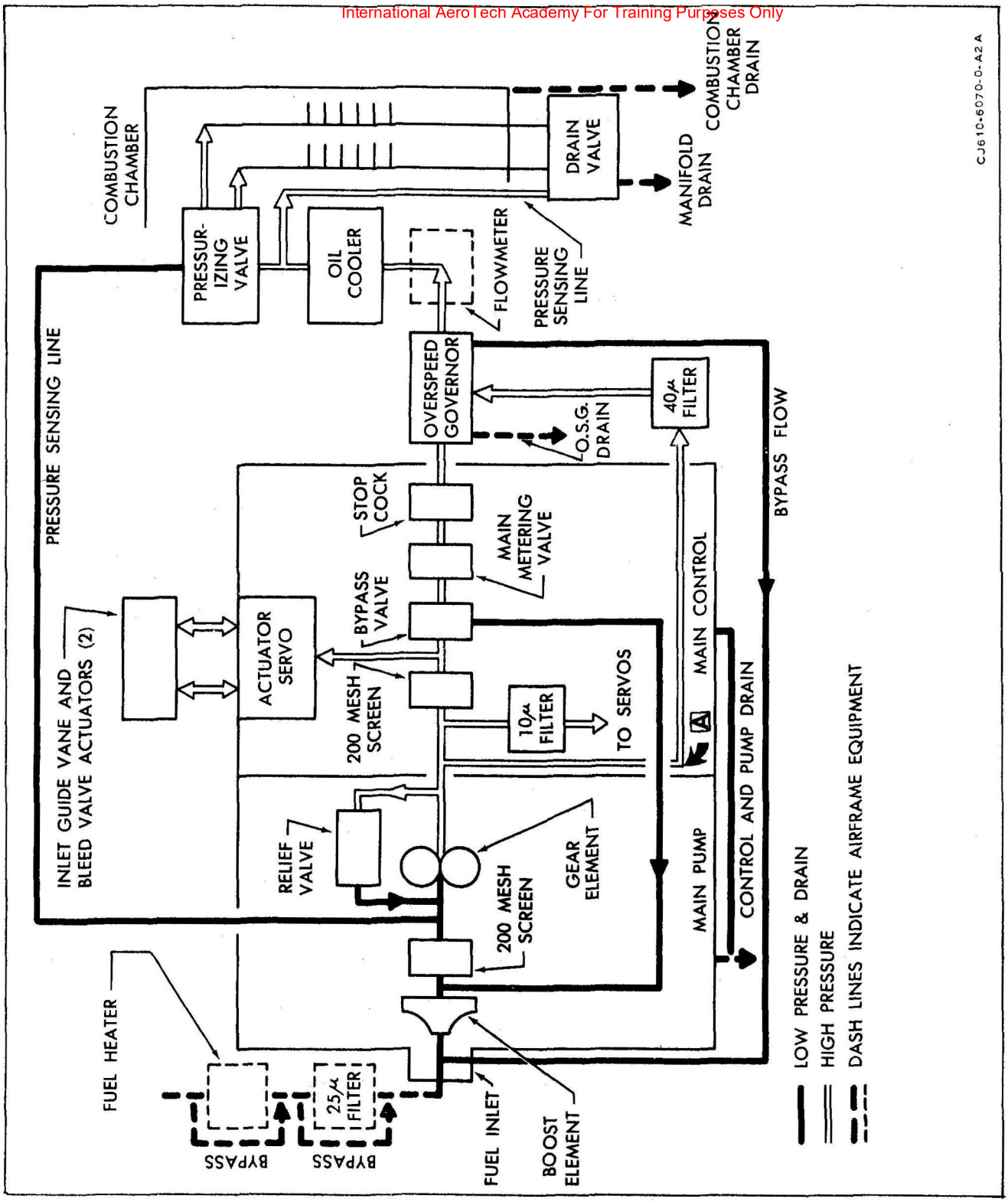
      (1) It establishes maximum, safe, fuel flow limits for all operating conditions, including automatic starting.

      (2) It regulates engine speed by metering fuel to the combustion section.

      (3) It automatically alters the fuel schedules to maintain the desired power setting as operating temperatures and pressures change.

      (4) It regulates fuel flow to simultaneously position the variable vanes and bleed valves to a defined schedule during transient and steady-state operation.

      (5) It provides the proper minimum fuel flow for inflight engine starting, and for prevention of combustor flameouts due to lean fuel-air mixtures during deceleration.



Fuel System Schematic
Figure 1

(6) It provides a positive fuel shut off valve.

C. Overspeed Governor.

The overspeed governor is mounted on the forward center pad of the accessory gearbox. It is an isochronous, hydro-mechanical, self-contained fuel control if the engine overspeeds. Under normal operating conditions all fuel passes through the governor unhindered. But if an overspeed occurs, the governor cuts in and maintains a constant engine speed by metering the flow through it and bypassing the excess fuel to the fuel pump inlet.

D. Fuel Filter - Overspeed Governor Servo.

The O.S.G. servo filter is externally mounted on a bracket attached to the overspeed governor. It is a high pressure filter mounted in the overspeed governor servo fuel supply line to protect the servo mechanism from contamination.

NOTE: There are three additional filters in the fuel system: The low pressure filter (airframe furnished), the fuel pump filter internally installed in the fuel pump, and the fuel control filter internally installed in the fuel control.

E. Fuel Flowmeter. (Airframe furnished)

The fuel flowmeter is installed in the fuel line between the overspeed governor and the oil cooler. It measures engine fuel flow to the fuel manifolds.

F. Oil Cooler.

The oil cooler is recessed in the oil tank which is mounted at the 4 o'clock position on the compressor stator casing. It receives fuel from the flowmeter and discharges fuel to the pressurizing valve. It uses fuel flow to cool lube oil from the oil tank. For further details, refer to the Lubrication System.

G. Fuel Pressurizing Valve.

The fuel pressurizing valve is bolted to the forward side of the oil cooler. It maintains a back pressure on the fuel control to ensure proper fuel pressure on the control servos and the variable geometry servos during low fuel flow conditions.

H. Fuel Drain Valve.

The fuel drain valve is clamped to the accessory gearbox driveshaft cover. It permits draining of the fuel nozzles and fuel manifolds at engine shutdown.

I. Fuel Manifolds.

The 2 fuel manifolds are secured with clamps to the front flange of the mainframe. They receive metered fuel from the pressurizing valve and distribute fuel to the fuel nozzles.

J. Fuel Nozzles.

Twelve fuel nozzles are bolted to equally spaced pads around the mainframe. The fuel nozzles provide the correct spray pattern of metered fuel flow to the combustion chamber for the entire operating range of the engine. The fuel nozzles incorporate a flow divider, a primary and secondary flow passage, and an air shrouded spin chamber orifice. During starting, low-pressure fuel in the primary passage sprays toward the igniter tip for ignition. At higher speeds, the increased fuel pressure opens the flow divider. This allows the fuel to flow into the secondary passage, into the spin chamber where it merges with the primary fuel spray, and then into the mid-annulus of the combustion liner. The air shroud sweeps air across the nozzle orifice to prevent carbon buildup.

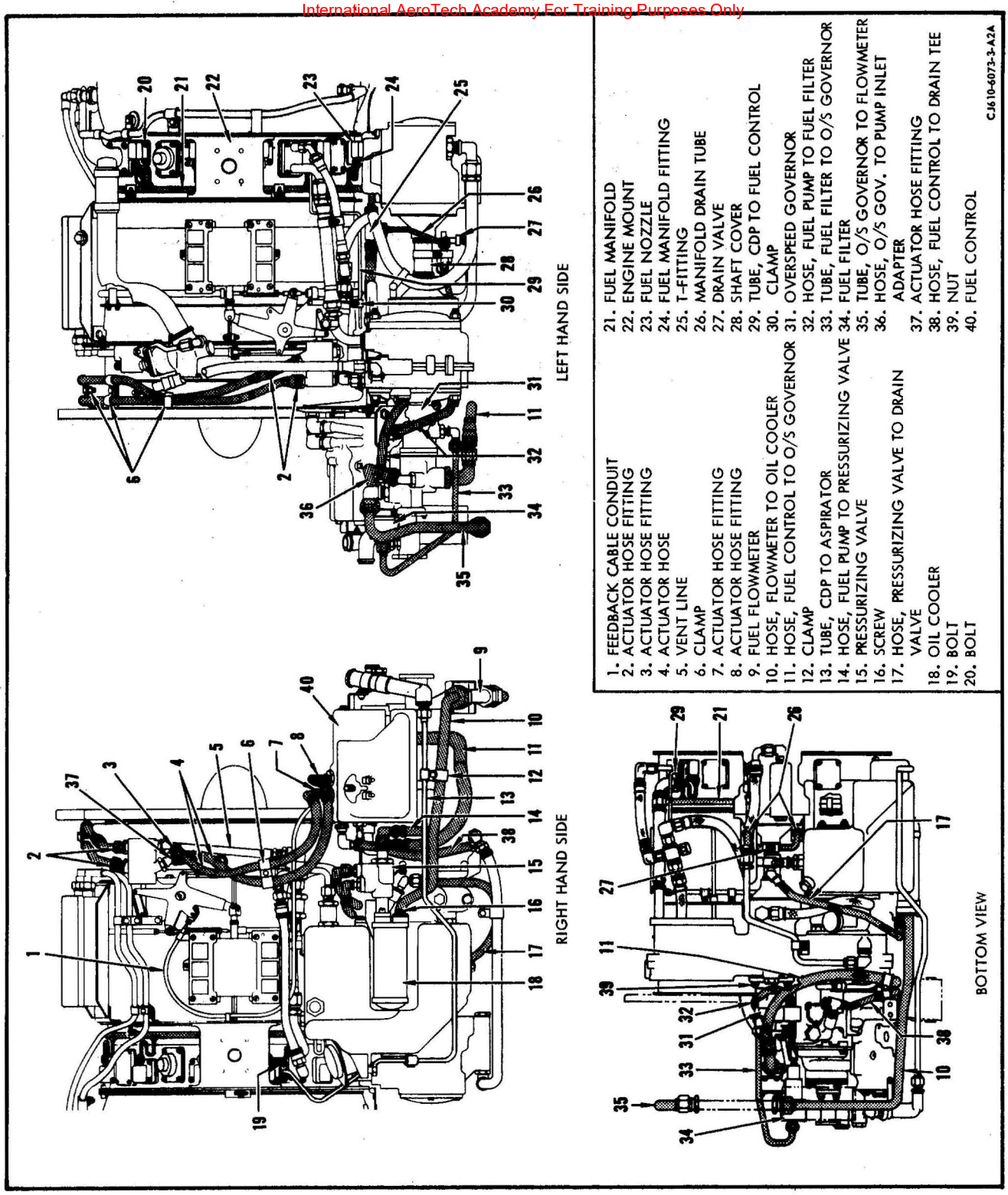
K. The 2 variable geometry actuators are located at 2 and 8 o'clock on the compressor stator casing. The actuators position the variable vanes and the bleed valves as scheduled by the fuel control. Synchronizing cables ensure that the 2 actuators move in unison. (Maintenance of the actuators is covered in Section 75-00.)

3. System Control Signals. To provide proper engine operation, signals representing the pilot's requirements and the engine operating conditions are fed to the fuel control. The following is a list of the signals and their functions.

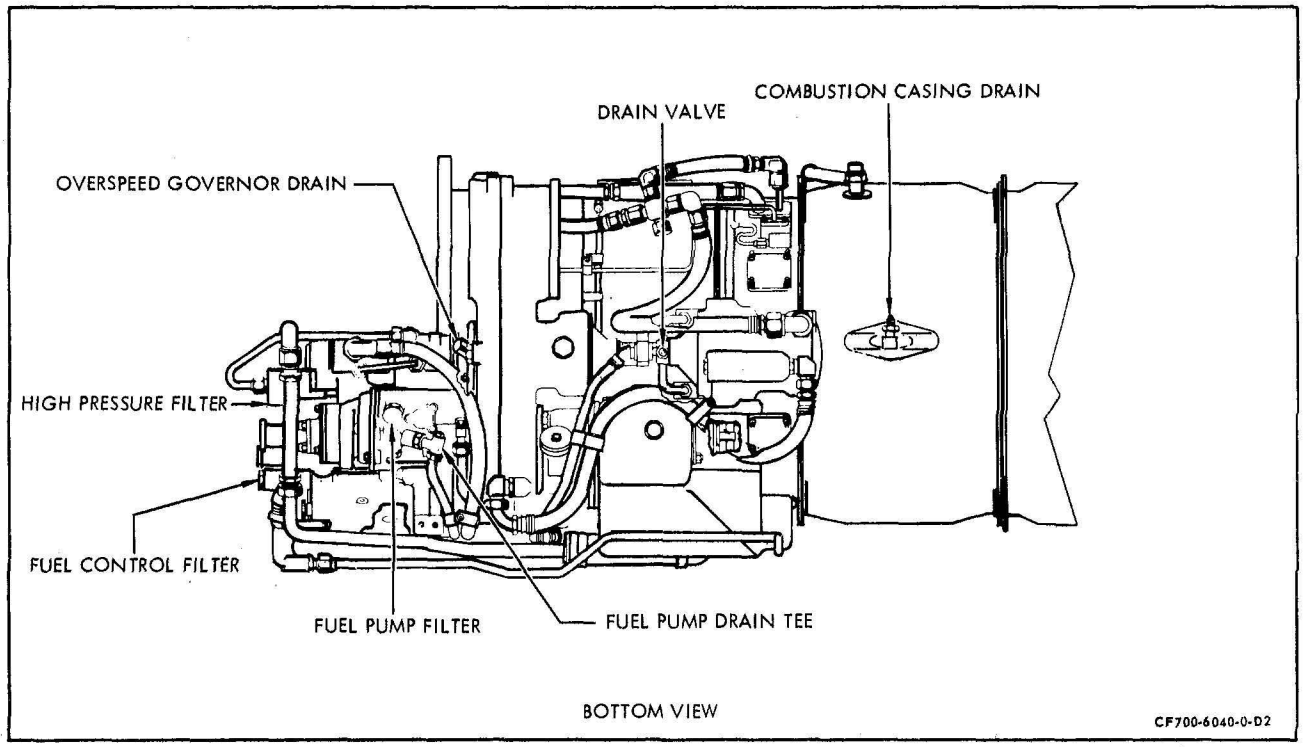
Signal	Function
Throttle Position	Fed to control through aircraft linkage and represents the pilot's demand for a specific rpm.
Engine Speed	Sensed through engine-driven flyweight governor in the fuel control. It is used to determine fuel flow to the engine and variable geometry position.

Signal	Function
Compressor Discharge Pressure (CDP)	Indicates the amount of air available for combustion. It is used in conjunction with other parameters to determine acceleration schedule and is the controlling parameter in setting the deceleration schedule.
Compressor Inlet Temperature (CIT)	Indicates temperature of inlet air. It is used to determine acceleration and variable geometry positioning schedules.
Variable Geometry Feedback	Indicates position of inlet guide vanes and bleed valves. This is compared with desired vane and valve position to determine fuel pressure to the variable geometry actuators.
Engine Power Reduction Signal	An arrangement of tubes containing CDP air which will reduce fuel flow to less than idle requirements if a blucket failure endangers the structure of the fan.

4. Deleted.



Fuel System
Figure 2



Fuel System Filters and Drains
Figure 3

FUEL AND CONTROL SYSTEM - TROUBLE-SHOOTING

1. General. Visual checks are important when trouble-shooting the fuel and control system, because small defects in mechanical, hydraulic or pneumatic signal lines can affect the fuel flow schedule. A mistaken notion that the fuel control must be changed later becomes a disappointment when the engine is run-up, and the malfunction persists despite the new fuel control. Perform operational checks whenever possible, to identify all available symptoms of the malfunction. The test facilities, spare parts on hand, type of malfunction and the importance of time usually determine how much testing and investigation precedes the decision to replace a component. An obvious symptom, such as a pressurizing and drain valve that does not drain at shutdown, requires little testing or analysis before the "fix" is established. Acceleration problems are in a more difficult category, and special tests are almost a necessity.

Trouble-Shooting information is furnished in Chapter 72-00.

FUEL AND CONTROL SYSTEM - MAINTENANCE PRACTICES

WARNING: ASBESTOS

THIS ENGINE MAY CONTAIN SMALL AMOUNTS OF ASBESTOS. WHEN WORKING WITH THIS ENGINE, THE FOLLOWING PRECAUTIONS MUST BE RIGIDLY ADHERED TO:

BEFORE ANY MAINTENANCE ACTIVITIES ARE UNDERTAKEN, REVIEW THE ILLUSTRATED PARTS BREAKDOWN/CATALOG INDEX TO DETERMINE IF THE HARDWARE TO BE WORKED ON OR USED CONTAINS ASBESTOS.

WHENEVER MECHANICAL REMOVAL OF MATERIAL, SUCH AS MACHINING, GRINDING, BUFFING, DRILLING, SANDING OR ANY TYPE OF MATERIAL BUILD-UP ON PARTS THAT CONTAIN ASBESTOS IS NECESSARY, APPROPRIATE PERSONAL PROTECTIVE EQUIPMENT MUST BE WORN, AND NATIONAL ENVIRONMENTAL CONTROLS REQUIRED FOR THE HANDLING OF ASBESTOS-CONTAINING MATERIAL MUST BE COMPLIED WITH.

BEFORE HANDLING, REPLACING, OR DISPOSING OF ASBESTOS-CONTAINING HARDWARE, APPROPRIATE PERSONAL PROTECTIVE EQUIPMENT AND NATIONAL ENVIRONMENTAL CONTROLS MUST BE STRICTLY ADHERED TO FOR HANDLING ASBESTOS-CONTAINING HARDWARE.

1. General. The information presented under system maintenance applies to the system as a whole. Maintenance information which applies to an individual component is presented as part of the maintenance information for that component.

2. Removal/Installation. Most external lines can be removed and replaced by employing normal maintenance procedures. When replacing lines, install new clamps where necessary.

   CAUTION: 1. WHEN REASSEMBLING ANY UNIT IN THIS SECTION, LUBRICATION COMPOUNDS MUST BE APPLIED IN ACCORDANCE WITH RECOMMENDED PROCEDURES.

   2. ANY SELF-LOCKING NUT IS REUSABLE PROVIDING BOLT OF PROPER SIZE CANNOT BE SCREWED THROUGH BY HAND.

   3. ALL O-RINGS MUST BE DISCARDED AND REPLACED WITH NEW ONES.

   4. ALL COMPONENTS MUST BE LOCKWIRED IN ACCORDANCE WITH 72-01-2.

   5. ALL COMPONENTS MUST BE TORQUED IN ACCORDANCE WITH 72-01-3.

3. Adjustment/Test. The only adjustment that is made on the system is made on the fuel control; therefore, all adjustments are in 73-21-0.

4. Inspection/Check. Inspect the following items during periodic inspections of the engine.

   A. Secureness of all studs, bolts, stand-off brackets or braces to which accessories are fastened.

   B. Accessories for leakage and/or cracking of mounting pads.

   C. Lines and connections for leaks and/or evidence of wear.

   D. Clamping of lines for secureness.

   E. Throttle linkage for binding or excessive resistance.

5. Repairs.

   A. Tighten or replace fittings as necessary to stop leaks.

   B. Tighten bolts, brackets and fasteners which secure accessories to the engine.

   C. Remove and replace accessories with cracks in mounting pads.

   WARNING: ASBESTOS

   THE FOLLOWING PROCEDURE MAY INVOLVE A PART THAT CONTAINS ASBESTOS, WHICH IS HIGHLY TOXIC TO SKIN, EYES, AND RESPIRATORY TRACT. READ GENERAL INFORMATION BEFORE PROCEEDING, AND ADHERE TO ALL SITE SAFETY AND ENVIRONMENTAL CONTROLS CONCERNING ASBESTOS. OTHERWISE, PERSONAL INJURY MAY RESULT.

   CAUTION: DO NOT ATTEMPT TO STOP LEAKS AT THE END FITTINGS OF HOSES BY TIGHTENING THE HEX FITTINGS THAT SECURE THE END FITTING TO THE HOSE.

   D. Remove and replace leaking and/or chafed lines. If fire sleeve covering is worn, remove the line from the engine, loosen the clamp on each end of the line, and remove the covering. Check the line and if no damage is evident, install new covering per 72-02-1 and tighten clamps. Install the line on the engine, torque connector nut and lock-wire.

   E. If leaks result from cross threading or other damage to accessories, replace the accessory. Refer to maintenance instructions on the component to which the damage occurred.

6. Servicing.

A. Approved fuels. Use JP-4, JP-5, or JP-8 fuels conforming to G.E. Specification D50TF2, MIL-T-5624, or MIL-T-83133. The following Table I lists engine fuels conforming to General Electric Specification D50TF2, Class A, are approved for use in General Electric CF700 series engines.

NOTE: Mixing of fuel types is allowed providing the density knob on the fuel control is properly set per 73-21-0.

TABLE I

APPROVED FUEL LIST

Company	Product Name	Density Setting
1. American Oil Company	American Jet Fuel Type A	JP-5
	American Jet Fuel Type A-1	JP-5
2. Atlantic-Richfield	Arcojet A	JP-5
	Arcojet A-1	JP-5
	Arcojet B	JP-4
3. British Petroleum Co., Ltd.	BP A.T.K.	JP-5
	BP A.T.G.	JP-4
	BP AVCAT 48	JP-5

TABLE I

APPROVED FUEL LIST (Cont)

Company	Product Name	Density Setting
4. California Texas	Caltex Jet A-1	JP-5
	Caltex Jet B	JP-4
5. Cities Service Oil Co.	Turbine Type A	JP-5
6. Continental Oil Co.	Conoco Jet-40	
	Conoco Jet-50	JP-5
	Conoco Jet-60	JP-5
	Conoco JP-4	JP-4
7. Empire State	SMC	JP-5
8. Esso International	Esso Turbo Fuel A-1	JP-5
	Esso Turbo Fuel A	JP-5
	Esso Turbo Fuel B	JP-4
9. Gulf Oil Corp.	Gulf Jet A	JP-5
	Gulf Jet A-1	JP-5
10. Humble Oil and Refining Co.	Esso Turbo Fuel A-1	JP-5
	Enco Turbo Fuel A-1	JP-5
	Esso Turbo Fuel A	JP-5
	Enco Turbo Fuel A	JP-5
	Esso Turbo Fuel B	JP-4
	Enco Turbo Fuel B	JP-4
	Esso Turbo Fuel 5	JP-5
	Enco Turbo Fuel 5	JP-5
11. Mobil Oil Co.	Mobil Jet A	JP-5
	Mobil Jet A-1	JP-5
	Mobil Jet B	JP-4
	Mobil Jet 4	JP-4
	Mobil Jet 5	JP-5
11A. Murphy Oil Co.	Murphy Jet A	JP-5
12. Phillips Petroleum Co.	Philjet A-50	JP-5
	Philjet JP-4	JP-4
13. Pure Oil Co.	Purejet Turbine Fuel Type A	JP-5
	Purejet Turbine Fuel Type A-1	JP-5

TABLE I

APPROVED FUEL LIST (Cont)

Company	Product Name	Density Setting
14. Shell Oil Co.	Aeroshell Turbine Fuel JP-4	JP-4
	Aeroshell Turbine Fuel 640	JP-5
	Aeroshell Turbine Fuel 650	JP-5
	Shell Jet A	JP-5
15. Sinclair Refining Co.	Sinclair Superjet Fuel	JP-5
16. Chevron Oil Co.	Chevron Jet Fuel A-1	JP-5
	Chevron Turbine Fuel B	JP-4
17. Standard Oil Co. (Kentucky)	Standard JF A	JP-5
	Standard JF A-1	JP-5
18. Standard Oil Co. (Ohio)	Jet A Kerosene	JP-5
	Jet A-1 Kerosene	JP-5
19. Standard Oil Co. (Texas)	Standard Turbine Fuel A-1	JP-5
	Standard Turbine Fuel B	JP-4
20. Texaco, Incorporated	Texaco Avjet A	JP-5
	Texaco Avjet A-1	JP-5
	Texaco Avjet B	JP-4
21. Union Oil Co. of California	76 Turbine Fuel	JP-5
	Union JP-4	JP-4
Industry/Government Specifications		
22. Air Total Turbine Fuel, 1 and 1A		JP-5
ASTM Jet A Aircraft Turbine Fuel		JP-5
ASTM Jet B Aircraft Turbine Fuel		JP-4
ASTM Jet A-1		JP-5
23. British Fuel D ENG. R.D. 2482, AVTUR 40		JP-5
British Fuel D ENG. R.D. 2486, AVTAG		JP-4
British Fuel D ENG. R.D. 2494, AVTUR 50		JP-5
British Fuel D ENG. R.D. 2498, AVCAT 48		JP-5
British Fuel D ENG. R.D. 2488, AVCAT		JP-5

TABLE I

APPROVED FUEL LIST (Cont)

Company	Product Name	Density Setting
	Industry/Government Specifications	
24.	Canadian Fuel 3-GP-22	JP-4
	Canadian Fuel 3-GP-23	JP-5
	Canadian Fuel 3-GP-24	JP-5
25.	France Air 3404/B	JP-5
	France Air 3405-C	JP-5
	France Air 3407/B	JP-4
26.	Germany TL 9130-006	JP-4
	Germany TL 9130-007	JP-5
27.	MIL-T-5624G JP-4	JP-4
	MIL-T-5624G JP-5	JP-5
	MIL-T-38133 JP-8	JP-5
28.	NATO F-30 (Jet A)	JP-5
	NATO F-34 (Jet A-1)	JP-5
	NATO F-35 (Jet A-1)	JP-5
	NATO F-40 (JP-4)	JP-4
	NATO F-42 (JP-5)	JP-5
	NATO F-44 (JP-5)	JP-5
	NATO F-45 (JP-4)	JP-4
29.	Romania 3754/73 (CS-3)	JP-5
30.	USSR GOST 10227 (TS-1)	JP-5
	USSR GOST 12308 (T-7)	JP-5

B. Use of aviation gasoline.

WARNING: AVIATION GASOLINE, MIL-G-5572

FLAMMABLE - DO NOT USE NEAR WELDING AREAS, NEAR OPEN FLAMES, NEAR ELECTRICAL SPARKS, OR ON HOT SURFACES.

USE ONLY WITH ADEQUATE VENTILATION. BE CAREFUL NOT TO BREATHE VAPORS.

DO NOT SMOKE WHEN USING IT.

DO NOT TAKE INTERNALLY. DO NOT GET IN EYES, ON SKIN, OR ON CLOTHING.

STORE IN APPROVED METAL SAFETY CONTAINERS.

CAUTION: ENGINE OPERATING TIME USING AVIATION GASOLINE IS LIMITED TO 25 HOURS DURING ANY ONE OVERHAUL PERIOD. OPERATING TIME WITH AVIATION GASOLINE MUST BE RECORDED WHEN THE MIXTURE CONTAINS MORE THAN 50 PERCENT OF AVIATION GASOLINE BY VOLUME.

REFER TO AIRCRAFT FAA APPROVED FLIGHT MANUAL FOR ALTITUDE RESTRICTIONS WHEN USING AVIATION GASOLINE FUEL.

(1) Use aviation gasoline as an EMERGENCY fuel only.

(2) When aviation gasoline is used, the following conditions shall apply.

(a) JP-4, JP-5, and JP-8 fuels are not available.

(b) The lowest octane fuel available shall be used.

(c) Adjust the fuel density knob per 73-21-0.

C. Additives.

(1) Anti-icing.

Phillips PFA-55MB (Phillips Petroleum Co., 362 Adams Bldg., Bartlesville, OK 74004) and Methyl Cellosolve (Union Carbide Co., 270 Park Ave., New York, NY 10017) are approved for use in the fuels contained in the Approved Fuel List (table I) at a concentration not in excess of 0.15 percent by volume.

(2) *Fuel Leak Detection.*

WARNING: OIL AND JET FUEL DYES

FLAMMABLE - KEEP IT AWAY FROM HEAT, SPARKS, AND OPEN FLAME.

USE IT IN A WELL-VENTILATED AREA. AVOID PROLONGED OR REPEATED BREATHING OF VAPORS.

WEAR RUBBER GLOVES AND CHEMICAL GOGGLES.

FLUSH SKIN WITH WATER AND SEEK MEDICAL ATTENTION IF SOLUTION CONTACTS SKIN.

STORE IN APPROVED METAL SAFETY CONTAINER.

Automate Yellow 662 (Morton Chemical Co., 335 M'Clean Blvd., Patterson, NJ 07504) is approved for fuel leak detection at a concentration of 1.6 ounces for every 100 US gallons.

FUEL FLOWMETER - MAINTENANCE PRACTICES

WARNING: ASBESTOS

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WHENEVER MECHANICAL REMOVAL OF MATERIAL, SUCH AS MACHINING, GRINDING, BUFFING, DRILLING, SANDING OR ANY TYPE OF MATERIAL BUILD-UP ON PARTS THAT CONTAIN ASBESTOS IS NECESSARY, APPROPRIATE PERSONAL PROTECTIVE EQUIPMENT MUST BE WORN, AND NATIONAL ENVIRONMENTAL CONTROLS REQUIRED FOR THE HANDLING OF ASBESTOS-CONTAINING MATERIAL MUST BE COMPLIED WITH.

BEFORE HANDLING, REPLACING, OR DISPOSING OF ASBESTOS-CONTAINING HARDWARE, APPROPRIATE PERSONAL PROTECTIVE EQUIPMENT AND NATIONAL ENVIRONMENTAL CONTROLS MUST BE STRICTLY ADHERED TO FOR HANDLING ASBESTOS-CONTAINING HARDWARE.

1. General. The fuel flowmeter is an airframe furnished part. The following maintenance procedures cover the General Electric Company flowmeter, P/N 37E501504G001. Refer to the Aircraft Manual if a different flowmeter is installed.

2. Removal/Installation.

WARNING: ASBESTOS

THE FOLLOWING PROCEDURE MAY INVOLVE A PART THAT CONTAINS ASBESTOS, WHICH IS HIGHLY TOXIC TO SKIN, EYES, AND RESPIRATORY TRACT. READ GENERAL INFORMATION BEFORE PROCEEDING, AND ADHERE TO ALL SITE SAFETY AND ENVIRONMENTAL CONTROLS CONCERNING ASBESTOS. OTHERWISE, PERSONAL INJURY MAY RESULT.

A. Removal. (See 73-00, figure 2.)

(1) Disconnect the fuel lines (10, 35) from the flowmeter (9).

(2) Disconnect the electrical connector.

(3) Remove 4 bolts; remove the flowmeter from the bracket.

B. Installation. (See 73-00, figure 2.)

(1) Secure the flowmeter (9) to the brackets with 4 bolts. Torque the bolts to 12-14 lb-in. and lockwire.

NOTE: Position the flowmeter so that, while looking at it from the front of the engine, the electical connector is at the right and behind the fuel inlet connector.

(2) Connect the fuel lines (10, 35) to the flowmeter connectors. Torque the nuts to 650-700 lb-in.

(3) Connect the electrical connector to the flowmeter.

FUEL PUMP - MAINTENANCE PRACTICES

WARNING: ASBESTOS

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BEFORE ANY MAINTENANCE ACTIVITIES ARE UNDERTAKEN, REVIEW THE ILLUSTRATED PARTS BREAKDOWN/CATALOG INDEX TO DETERMINE IF THE HARDWARE TO BE WORKED ON OR USED CONTAINS ASBESTOS.

WHENEVER MECHANICAL REMOVAL OF MATERIAL, SUCH AS MACHINING, GRINDING, BUFFING, DRILLING, SANDING OR ANY TYPE OF MATERIAL BUILD-UP ON PARTS THAT CONTAIN ASBESTOS IS NECESSARY, APPROPRIATE PERSONAL PROTECTIVE EQUIPMENT MUST BE WORN, AND NATIONAL ENVIRONMENTAL CONTROLS REQUIRED FOR THE HANDLING OF ASBESTOS-CONTAINING MATERIAL MUST BE COMPLIED WITH.

BEFORE HANDLING, REPLACING, OR DISPOSING OF ASBESTOS-CONTAINING HARDWARE, APPROPRIATE PERSONAL PROTECTIVE EQUIPMENT AND NATIONAL ENVIRONMENTAL CONTROLS MUST BE STRICTLY ADHERED TO FOR HANDLING ASBESTOS-CONTAINING HARDWARE.

1. General. Maintenance of the fuel pump consists of Removal/Installation, Inspection/Check and cleaning of the fuel pump filter.

2. Removal/Installation. (See 73-00, figure 2.)

WARNING: ASBESTOS

THE FOLLOWING PROCEDURE MAY INVOLVE A PART THAT CONTAINS ASBESTOS, WHICH IS HIGHLY TOXIC TO SKIN, EYES, AND RESPIRATORY TRACT. READ GENERAL INFORMATION BEFORE PROCEEDING, AND ADHERE TO ALL SITE SAFETY AND ENVIRONMENTAL CONTROLS CONCERNING ASBESTOS. OTHERWISE, PERSONAL INJURY MAY RESULT.

A. Removal.

NOTE: It is recommended that the fuel pump and fuel control be removed as an assembly and that further disassembly be accomplished on the bench.

(1) Disconnect the 2 variable geometry actuator hoses (4) from the fittings at the top of the fuel control.

(2) Disconnect at the pressurizing valve, the hose (14) that runs the fuel pump.

(3) Disconnect, at the fuel control, the tube (29) that runs from the 8 o'clock mainframe pad to the fitting on the rear of the fuel control.

(4) Disconnect, at the fuel control aspirator elbow, the tube (13) that runs from the aspirator to the mainframe pad at 4 o'clock.

(5) Free the fuel control feedback cable (1) as follows:

(a) Remove the 2 screws at the fuel control mounting pad that hold the feedback cable conduit bracket.

(b) Disconnect the feedback cable from the fuel control feedback lever by removing the spring clip and pin.

(6) Disconnect the high-pressure fuel filter lines (32, 33) at the fuel pump and overspeed governor (31). (It is not necessary to remove the filter and clamp from the overspeed governor.)

(7) Disconnect, at the fuel pump inlet adapter, the line (36) from the overspeed governor.

CAUTION: DO NOT DISCONNECT (OR APPLY TORQUE TO) THE COUPLING NUT THAT CONNECTS THIS LINE TO THE FLANGED ELBOW FITTING WHEN THE ELBOW IS ATTACHED TO THE FUEL CONTROL. IF IT IS NECESSARY TO DISCONNECT THIS LINE FROM THE ELBOW FITTING, THE ELBOW MUST FIRST BE REMOVED FORM THE FUEL CONTROL.

(8) Disconnect, at the overspeed governor, the line (11) that runs from the aft side of the fuel control to the governor.

(9) Remove the 4 nuts and washers that attach the fuel pump to the accessory gearbox. (Support the assembly while removing the nuts.) Discard the gasket.

CAUTION: CAP ALL OPENINGS WITH SUITABLE PROTECTIVE COVERS.

(10) Slowly move the pump and control assembly forward to remove it from the gearbox.

CAUTION: DO NOT REST THE PUMP ON THE DRIVE SHAFT AT ANY TIMNE. (THIS PREVENTS THE POSSIBILITY OF CARBON SEAL DAMAGE.)

(11) With the pump and control assembly on a bench, disconnect all lines. (It is not necessary to disconnect the lines unless a line, the pump or fuel control require replacement.) If it is necessary to disconnect the fuel discharge hose from the flanged elbow fitting, the elbow must first be removed from the fuel control.

CAUTION: IF THE FUEL PUMP DOES NOT SEPARATE FROM THE FUEL CONTROL BECAUSE OF THE SNUG FIT OF THE MATING SURFACE DOWEL PINS, GENTLY TAP THE STUDS WITH A NONMETALLIC HAMMER. DO NOT PRY APART WITH A SCREW DRIVER OR OTHER SHARP INSTRUMENT BECAUSE OF THE POSSIBILITY OF DAMAGING THE MATING SURFACES.

(12) Remove 4 nuts and washers and separate the fuel pump from the fuel control.

(13) Discard the three O-rings and install protective covers over all openings.

WARNING: ASBESTOS

THE FOLLOWING PROCEDURE MAY INVOLVE A PART THAT CONTAINS ASBESTOS, WHICH IS HIGHLY TOXIC TO SKIN, EYES, AND RESPIRATORY TRACT. READ GENERAL INFORMATION BEFORE PROCEEDING, AND ADHERE TO ALL SITE SAFETY AND ENVIRONMENTAL CONTROLS CONCERNING ASBESTOS. OTHERWISE, PERSONAL INJURY MAY RESULT.

B. Installation.

(1) Install 3 new O-rings, 1 on the fuel pump and 2 on the fuel control mounting pad.

CAUTION: BE SURE THE TEETH OF THE GEAR IN THE FUEL CONTROL MESH PROPERLY WITH THE TEETH OF THE GEAR IN THE FUEL PUMP BEFORE TORQUING THE NUTS.

(2) Align the two holes in the control with the 2 dowel pins on the pump pad. Install the control on the pump and secure it with 4 nuts and washer. (Use caution not to pinch the O-rings.) Torque the nuts to 50-60 lb-in.

(3) Reinstall any hoses that were removed in step A.(11):

(a) Install the fuel control discharge hose (11) by removing the flanged elbow fitting from the fuel control. Connect the hose coupling nut to the elbow. Torque to 710-770 lb-in. Using a new O-ring between the elbow and the fuel control, attach the hose and elbow to the fuel control. Torque the 3 screws to 24-27 lb-in. and lockwire.

(b) Install the small hose (14) on fuel pump elbow fitting. Tighten to standard torque.

(c) Install the small line (38) from fuel pump drain tee to aft side of fuel control. Tighten to standard torque.

WARNING: PLASTILUBE MOLY 3

INHALATION MAY CAUSE IRRITATION OR BURNING OF RESPIRATORY SYSTEM.

CONTACT WITH EYES/FACE/SKIN MAY CAUSE IRRITATION OR BURNING.

INGESTION MAY CAUSE IRRITATION OR BURNING OF DIGESTIVE SYSTEM.

PERSONAL PROTECTIVE EQUIPMENT REQUIRED WHEN HANDLING OR USING THIS MATERIAL.

(4) Lubricate the spline of the fuel pump shaft with Plastilube Moly No. 3 (Thiem Automotive Div., 5151 Demison Ave., Cleveland, OH 44102) or approved equivalent. Install the fuel control and pump assembly with a new gasket on the pad of the accessory gearbox. Secure it with 4 nuts and washers. Torque the nuts to 60-90 lb-in.

(5) Connect, at the overspeed governor (31), the large hose (11) from the rear of the fuel control and tighten to standard torque.

(6) Connect the high pressure fuel filter lines (32, 33) to the fuel pump and overspeed governor and tighten to standard torque.

(7) Connect, at the fuel pump inlet adapter, the line (36) from the overspeed governor. Tighten to standard torque.

(8) Secure the feedback cable conduit bracket to the fuel control pad with 2 screws. Torque the screws to 10-12 lb-in. and lockwire.

(9) Connect the feedback cable to the fuel control feedback lever with the spring clip and pin.

(10) Connect, at the fuel control aspirator elbow, the line (13) that runs from the aspirator to the mainframe pad at 4 o'clock. Tighten to standard torque.

(11) Connect the tube (29) from the 8 o'clock mainframe pad to the fitting on the rear of the fuel control. Tighten to standard torque.

(12) Connect, at the pressurizing valve, the line (14) from the fuel pump. Tighten to standard torque.

(13) Connect the 2 variable geometry actuator lines (4) to the fuel control. Torque the fitting (7) to 70-100 lb-in. Torque the fitting (8) to 100-130 lb-in.

(14) Adjust the feedback cable per section 75-00.

(15) Perform the checks required after a fuel control change per figure 503, section 72-00.

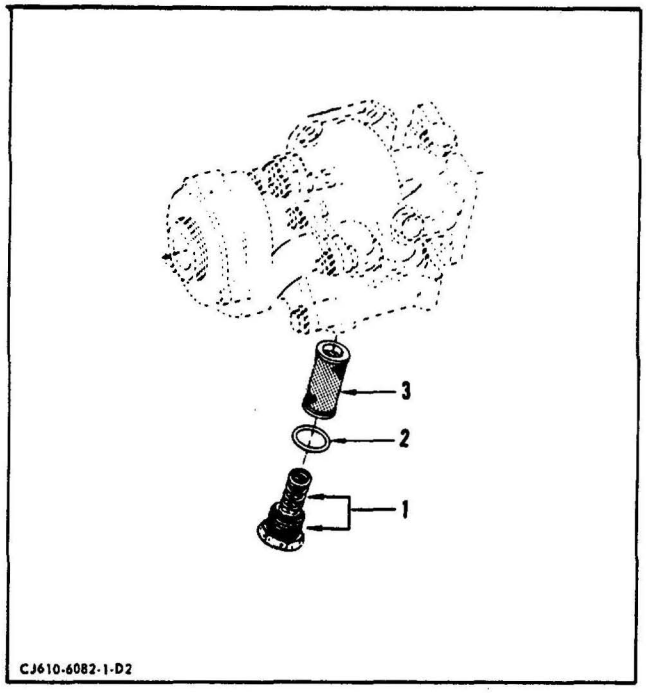
3. Inspection/Check. When serviceable limits are exceeded, the fuel pump may be repaired in accordance with the accessory overhaul manual. Visually inspect the following areas:

Inspect/Check	Maximum Serviceable Limits	Remarks
A. Inlet flange for loose studs.	0.020 inch movement when measured at end of stud.	Replace pump.
B. Any evidence of leakage.	Not serviceable.	Replace pump.
C. External spline wear (if noted visually).	0.4761 inch diameter over 0.080 inch diameter pins.	

4. Cleaning of Fuel Pump Filter. (See figure 201.)

A. Removal.

(1) Remove the plug and spring assembly (1), O-ring (2) and filter (3) from the bottom of the fuel pump housing.



Fuel Pump Filter
Figure 201

B. Cleaning.

(1) Ultrasonic Procedure. This process is the recommended method for cleaning the filter.

WARNING: TRICHLOROETHANE VAPORS ARE HARMFUL - DO NOT USE NEAR OPEN FLAMES OR ON VERY HOT SURFACES.

DO NOT USE NEAR WELDING AREAS, A SOURCE OF CONCENTRATED ULTRAVIOLET RAYS. INTENSE ULTRAVIOLET RAYS CAN CAUSE THE FORMATION OF PHOSGENE GAS, WHICH IS INJURIOUS TO THE LUNGS.

USE ONLY WITH ADEQUATE VENTILATION. AVOID PROLONGED OR REPEATED BREATHING OF VAPORS.

AVOID PROLONGED OR REPEATED CONTACT WOTH SKIN. WEAR APPROVED GLOVE AND GOGGLES (OR FACE SHIELD) WHEN HANDLING AND WASH HANDS THOROUGHLY AFTER HANDLING.

DO NOT TAKE INTERNALLY.

DO NOT SMOKE WHEN USING IT.

STORE IN APPROVED METAL SAFETY CONTAINERS.

(a) Pour trichloroethane, or ewuivalent cleaner, into the cleaning tank of a Blackstone Model SG-2 Ultrasonic Cleaner (Blackstone Ultrasonics Inc,, Sheffield, Pa. 16347), or equivalent, to a depth of approximately 3 inches.

(b) Connect the cleaner to a suitable power source and, with the cleaner switches in the OFF or normal position, allow the cleaner to warm up for approximately 15 seconds.

(c) Place the filter (3, figure 201) in the cleaner tank and turn the cleaner on for the desired length of time (approximately 12 minutes), adjusting the cleaner for maximum surface agitation.

(d) Shut off the cleaner, remove the filter, and cover the tank to prevent the contamination of the cleaning fluid.

(2) Alternate Procedure. When ultrasonic cleaning equipment is not available, the filter should be cleaned as follows:

WARNING: CLEANING OPERATION SHALL BE PERFORMED IN AN APPROVED CLEANING CABINET OR WELL VENTILATED AREA. PRECAUTIONS SHALL BE EXERCISED TO PREVENT INHALATION OF VAPOR EMITTED BY VOLATILE CLEANING MATERIALS, AND TO MINIMIZE DANGER OF EXPLOSION AND FIRE HAZARDS.

(a) Clean the filter by immersing it in carbon tetrachloride, trichloroethane, kerosene, or equivalent. While continually agitating the filter, use a suitably contoured soft bristle brush to dislodge contaminants.

NOTE: Only clean, filtered solvents should be used. Assure that containers used during the cleaning procedure are clean and free from contaminants.

(b) Blow it out with filtered compressed air and be sure no dirt particles have collected in the filter.

(c) Visually inspect the filter using a magnifying glass (10X minimum) and a strong light. If the filter is not completely clean, repeat steps (a) and (b).

C. Replacement.

(1) Install a new O-ring (2) on the plug and spring assembly (1).

(2) Apply petrolatum to the filter (3) to hold it in position until the spring is installed and insert the filter, closed end out, into the fuel pump.

CAUTION: BE SURE THAT THE FILTER IS SEATED. THE END OF THE FILTER SHOULD BE APPROXIMATELY 1/2 INCH INSIDE THE CASTING AND 5 OR MORE THREADS SHOULD BE VISIBLE.

(3) Install the plug and spring assembly (1) and maintain the filter position with the spring.

(4) Torque the plug to 20-30 lb-in. and lockwire.

CAUTION: IF IT IS NOT POSSIBLE TO TURN THE PLUG 2 COMPLETE TURNS WITH THE FINGERS, THE FILTER HAS DROPPED OUT OF POSITION AND FURTHUR TIGHTENING WILL COLLAPSE IT. REMOVE THE PLUG AND RESEAT THE FILTER.

FUEL FILTER, O.S.G. SERVO - MAINTENANCE PRACTICES

WARNING: ASBESTOS

THIS ENGINE MAY CONTAIN SMALL AMOUNTS OF ASBESTOS. WHEN WORKING WITH THIS ENGINE, THE FOLLOWING PRECAUTIONS MUST BE RIGIDLY ADHERED TO:

BEFORE ANY MAINTENANCE ACTIVITIES ARE UNDERTAKEN, REVIEW THE ILLUSTRATED PARTS BREAKDOWN/CATALOG INDEX TO DETERMINE IF THE HARDWARE TO BE WORKED ON OR USED CONTAINS ASBESTOS.

WHENEVER MECHANICAL REMOVAL OF MATERIAL, SUCH AS MACHINING, GRINDING, BUFFING, DRILLING, SANDING OR ANY TYPE OF MATERIAL BUILD-UP ON PARTS THAT CONTAIN ASBESTOS IS NECESSARY, APPROPRIATE PERSONAL PROTECTIVE EQUIPMENT MUST BE WORN, AND NATIONAL ENVIRONMENTAL CONTROLS REQUIRED FOR THE HANDLING OF ASBESTOS-CONTAINING MATERIAL MUST BE COMPLIED WITH.

BEFORE HANDLING, REPLACING, OR DISPOSING OF ASBESTOS-CONTAINING HARDWARE, APPROPRIATE PERSONAL PROTECTIVE EQUIPMENT AND NATIONAL ENVIRONMENTAL CONTROLS MUST BE STRICTLY ADHERED TO FOR HANDLING ASBESTOS-CONTAINING HARDWARE.

1. General. Maintenance of the fuel filter consists of Removal/Installation and Cleaning.

2. Removal/Installation. (See figure 201.)

WARNING: ASBESTOS

THE FOLLOWING PROCEDURE MAY INVOLVE A PART THAT CONTAINS ASBESTOS, WHICH IS HIGHLY TOXIC TO SKIN, EYES, AND RESPIRATORY TRACT. READ GENERAL INFORMATION BEFORE PROCEEDING, AND ADHERE TO ALL SITE SAFETY AND ENVIRONMENTAL CONTROLS CONCERNING ASBESTOS. OTHERWISE, PERSONAL INJURY MAY RESULT.

A. Removal.

(1) Disconnect the fuel lines from the high pressure filter housing which is located on a bracket attached tot he overspeed governor.

(2) Remove the filter housing and clamp from the mounting bracket.

(3) Remove the plug (5) and filter (3) from the housing (1).

WARNING: ASBESTOS

THE FOLLOWING PROCEDURE MAY INVOLVE A PART THAT CONTAINS ASBESTOS, WHICH IS HIGHLY TOXIC TO SKIN, EYES, AND RESPIRATORY TRACT. READ GENERAL INFORMATION BEFORE PROCEEDING, AND ADHERE TO ALL SITE SAFETY AND ENVIRONMENTAL CONTROLS CONCERNING ASBESTOS. OTHERWISE, PERSONAL INJURY MAY RESULT.

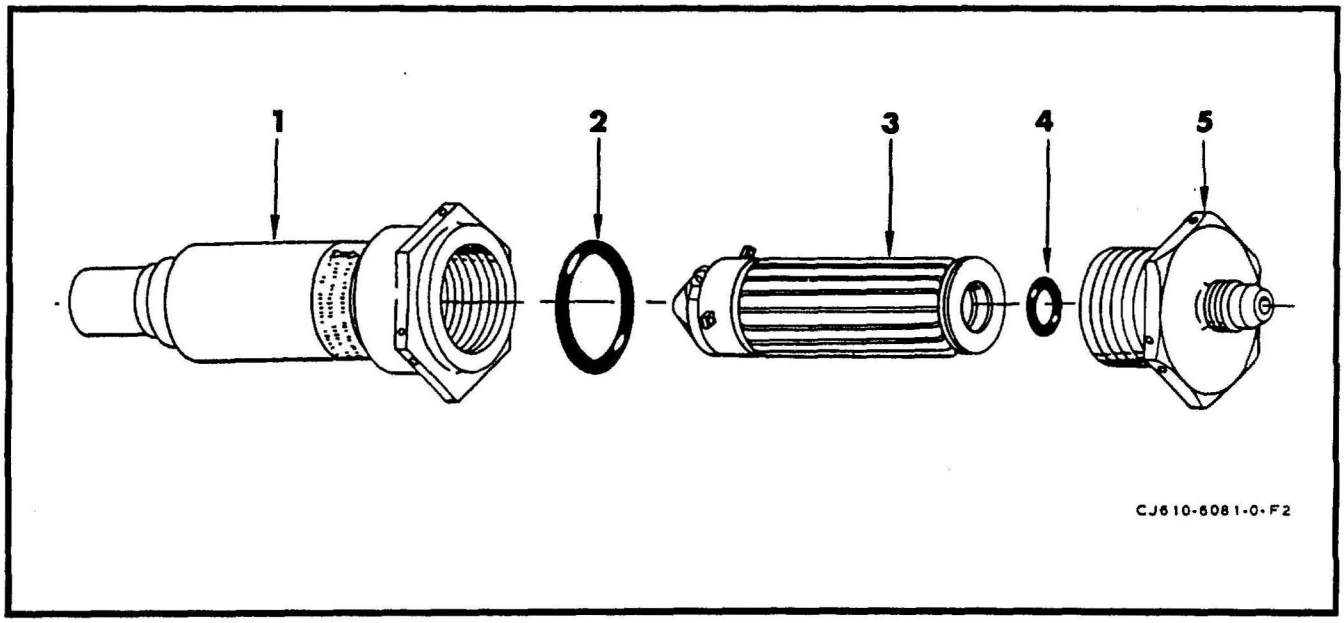
B. Installation.

(1) Install 2 new O-rings (2, 4) on the filter plug and filter element.

(2) Install the filter (3) and plug (5) in the housing (1). Torque the plug to 90-110 lb-in. and lockwire.

(3) Install the filter housing and clamp on the mounting bracket. (The largest OD of the filter housing should be forward of the clamp.)

(4) Connect the fuel lines to the filter housing.



Overspeed Governor Servo Filter
Figure 201

3. Cleaning.

A. Ultrasonic Procedure. (Refer to Accessory Overhaul Manual, SEI-154 for ultrasonic cleaning process.) This process is the recommended method for cleaning the filter.

B. Alternate Procedure. When ultrasonic cleaning equipment is not available, the filter should be cleaned as follows:

WARNING: TRICHLOROETHANE, O-T-620

DO NOT USE NEAR OPEN FLAMES, WELDING AREAS, OR ON VERY HOT SURFACES. DO NOT SMOKE WHEN USING IT. HEAT AND FLAMES CAN CAUSE THE FORMATION OF PHOSGENE GAS WHICH IS INJURIOUS TO THE LUNGS.

REPEATED OR PROLONGED CONTACT WITH LIQUID OR INHALATION OF VAPOR CAN CAUSE SKIN AND EYE IRRITATION, DERMATITIS, NARCOTIC EFFECTS, AND HEART DAMAGE.

AFTER PROLONGED SKIN CONTACT, WASH CONTACTED AREA WITH SOAP AND WATER. REMOVE CONTAMINATED CLOTHING. IF VAPORS CAUSE IRRITATION, GO TO FRESH AIR. GET MEDICAL ATTENTION FOR OVEREXPOSURE OF SKIN AND EYES.

WHEN HANDLING LIQUID IN VAPOR-DEGREASING TANK WITH HINGED COVER AND AIR EXHAUST, OR AT AIR-EXHAUSTED WORKBENCH, WEAR APPROVED GLOVES AND GOGGLES.

WHEN HANDLING LIQUID AT OPEN, UNEXHAUSTED WORKBENCH, WEAR APPROVED RESPIRATOR, GLOVES, AND GOGGLES.

DISPOSE OF LIQUID-SOAKED RAGS IN APPROVED METAL CONTAINER.

(1) Clean the filter element by immersing it in carbon tetrachloride, trichloroethane, kerosene, or equivalent. While continually agitating the filter, use a suitably contoured soft bristle brush to dislodge contaminants from the filter convolutions.

NOTE: Only clean, filtered solvents should be used. Assure that containers used during the cleaning procedure are clean and free from contaminants.

(2) Blow it out with filtered compressed air and be sure no dirt particles have collected in the filter.

CAUTION: DO NOT ATTEMPT TO PROBE THE FILTER CONVOLUTIONS WITH A SHARP TOOL AS THIS MAY DAMAGE THE FILTER AND RENDER THE FILTER NOT SERVICEABLE.

(3) Visually inspect the filter using a magnifying glass (10X minimum) and a strong light. If the filter is not completely clean, repeat steps (1) and (2).

NOTE: If some dark colored stains remain at the bottom of the convolutions, these are not harmful, and the filter is serviceable. If any doubt exists as to the cleanliness of the filter, repeat the cleaning procedure.

FUEL PRESSURIZING VALVE - MAINTENANCE PRACTICES

1. General. Maintenance of the fuel pressurizing valve is limited to Removal/Installation.

2. Removal/Installation. (See 73-00, figure 2.)

   A. Removal.

      (1) Disconnect 4 hoses from the fittings of the pressurizing valve (15).

      (2) Remove 2 screws (16) and washers and remove the pressurizing valve from the oil cooler (18).

   B. Installation.

      (1) Install a new O-ring on the OD of the pressurizing valve (15). Secure the valve to the upper port of the oil cooler (18) with 2 screws and washers. Torque the screws to 7-9 lb-in. and lockwire.

      (2) Connect the 4 hoses to the pressurizing valve and tighten to standard torque values.

FUEL DRAIN VALVE - MAINTENANCE PRACTICES

WARNING: ASBESTOS

THIS ENGINE MAY CONTAIN SMALL AMOUNTS OF ASBESTOS. WHEN WORKING WITH THIS ENGINE, THE FOLLOWING PRECAUTIONS MUST BE RIGIDLY ADHERED TO:

BEFORE ANY MAINTENANCE ACTIVITIES ARE UNDERTAKEN, REVIEW THE ILLUSTRATED PARTS BREAKDOWN/CATALOG INDEX TO DETERMINE IF THE HARDWARE TO BE WORKED ON OR USED CONTAINS ASBESTOS.

WHENEVER MECHANICAL REMOVAL OF MATERIAL, SUCH AS MACHINING, GRINDING, BUFFING, DRILLING, SANDING OR ANY TYPE OF MATERIAL BUILD-UP ON PARTS THAT CONTAIN ASBESTOS IS NECESSARY, APPROPRIATE PERSONAL PROTECTIVE EQUIPMENT MUST BE WORN, AND NATIONAL ENVIRONMENTAL CONTROLS REQUIRED FOR THE HANDLING OF ASBESTOS-CONTAINING MATERIAL MUST BE COMPLIED WITH.

BEFORE HANDLING, REPLACING, OR DISPOSING OF ASBESTOS-CONTAINING HARDWARE, APPROPRIATE PERSONAL PROTECTIVE EQUIPMENT AND NATIONAL ENVIRONMENTAL CONTROLS MUST BE STRICTLY ADHERED TO FOR HANDLING ASBESTOS-CONTAINING HARDWARE.

1. General. Maintenance of the fuel drain valve consists of Removal/Installation.

2. Removal/Installation. (See 73-00, figure 2.)

WARNING: ASBESTOS

THE FOLLOWING PROCEDURE MAY INVOLVE A PART THAT CONTAINS ASBESTOS, WHICH IS HIGHLY TOXIC TO SKIN, EYES, AND RESPIRATORY TRACT. READ GENERAL INFORMATION BEFORE PROCEEDING, AND ADHERE TO ALL SITE SAFETY AND ENVIRONMENTAL CONTROLS CONCERNING ASBESTOS. OTHERWISE, PERSONAL INJURY MAY RESULT.

A. Removal.

(1) Disconnect the left- and right-hand manifold drain tubes (26) from the drain valve (27).

(2) Disconnect, at the drain valve, the hose (17) that connects the fuel pressurizing valve to the drain valve.

(3) Remove the drain valve and clamp.

WARNING: ASBESTOS

THE FOLLOWING PROCEDURE MAY INVOLVE A PART THAT CONTAINS ASBESTOS, WHICH IS HIGHLY TOXIC TO SKIN, EYES, AND RESPIRATORY TRACT. READ GENERAL INFORMATION BEFORE PROCEEDING, AND ADHERE TO ALL SITE SAFETY AND ENVIRONMENTAL CONTROLS CONCERNING ASBESTOS. OTHERWISE, PERSONAL INJURY MAY RESULT.

B. Installation.

(1) Wrap the clamp around the body of the manifold drain valve (27). Secure the clamp and valve loosely to the clamp on the accessory gearbox drive shaft cover (28) with a bolt and nut.

NOTE: The unthreaded projection on the valve should be positioned at the rear of the clamp, and the drain should be in the 6 o'clock position.

(2) Connect the hose (17) leading from the bottom of the pressurizing valve to the threaded fitting on the front of the drain valve.

(3) Connect the left- and right-hand manifold drain tubes (26) to the drain vlave (27). Torque the nuts to 135-150 lb-in.

(4) Tighten the clamps with the nut and bolt. Torque the clamp bolt to 20-25 lb-in.

FUEL NOZZLES - MAINTENANCE PRACTICES

1. General. Maintenance of the fuel nozzles consists of Removal/Installation and Inspection/Check.

2. Removal/Installation. (See 73-00, figure 2.)

NOTE: The fan lube hoses and seal pressurizing air tube must be disconnected to provide access to the fuel nozzles adjacent to the transfer gearbox.

A. Removal.

(1) Disconnect the manifold nut (24) from the fuel nozzle (23).

(2) Use tool, 2C5322, to remove the 4 bolts (20) that secure the nozzle to the mainframe pad. Apply penetrating oil if bolts seize.

(3) Remove the nozzle by pivoting the forward edge of the mounting flange radially outward and to the rear.

B. Installation.

CAUTION: DO NOT HANDLE THE NOZZLE TIP. FINGERPRINTS ALONE MAY BE ENOUGH TO DISTORT THE NOZZLE SPRAY PATTERN.

(1) Insert the fuel nozzle (23) through the mainframe opening with the nozzle orifice facing to the rear, making sure the nozzle tip is extending into the combustion liner nozzle ferrule.

WARNING: EASE OFF 990 ANTISEIZE COMPOUND

OVEREXPOSURE CAN LEAD TO CHRONIC HEALTH HAZARDS SUCH AS SEVERE DAMAGE TO BLOOD FORMING, NERVOUS, URINARY, AND REPRODUCTIVE SYSTEMS.

INHALATION MAY CAUSE IRRITATION OR BURNING OF RESPIRATORY SYSTEM.

CONTACT WITH EYES/FACE/SKIN MAY CAUSE IRRITATION OR BURNING.

INGESTION MAY CAUSE IRRITATION OR BURNING OF DIGESTIVE SYSTEM.

PERSONAL PROTECTIVE EQUIPMENT REQUIRED WHEN HANDLING OR USING THIS MATERIAL.

(2) Lubricate the 4 bolts (20) with Ease-Off 990 (Texacone Co., Box 4236, Dallas, TX) or G-392 Versilube (G.E. Products Co., Waterford, NY) Secure the nozzle to the mainframe with the bolts, torque to 16-19 lb-in. and lockwire.

(3) Connect the manifold nut (24) to the fuel nozzle (23). Torque the nut to 140-160 lb-in.

3. Inspection/Check. When serviceable limits are exceeded, the fuel nozzles may be repaired in accordance with the accessory Overhaul Manual. Visually inspect the following areas.

Inspection/Check	Maximum Serviceable Limits	Remarks
A. Nozzle housing for:		
(1) Evidence of leakage.	Not serviceable.	Replace nozzle.
(2) Cracks.	Not serviceable.	Replace nozzle.
(3) Damaged threads.	Not serviceable.	
B. Nozzle tips and orifice for:		
(1) Carbon buildup.	Any amount if it does not interfere with the spray pattern or close any of the air shroud annulus.	
(2) Nicks, scratches.	Any amount if it does not interfere with spray pattern.	
C. Air shroud for wear.	Any amount, 0.010 inch deep after removal of high metal.	

4. Flow and Spray Test.

A. Equipment and Material.

WARNING: CALIBRATING FLUID MIL-C-7024

COMBUSTIBLE - DO NOT USE NEAR OPEN FLAMES, NEAR WELDING AREAS, OR ON HOT SURFACES.

PROLONGED CONTACT WITH SKIN MAY CAUSE IRRITATION. PROLONGED INHALATION OF VAPOR CAN CAUSE DIZZINESS, HEADACHE, AND INTOXICATION.

IF THERE IS ANY PROLONGED CONTACT WITH SKIN, WASH AFFECTED AREA WITH SOAP AND WATER. IF LIQUID CONTACTS EYES, FLUSH EYES THOROUGHLY WITH WATER. REMOVE SOLVENT-SATURATED CLOTHING. IF VAPORS CAUSE LIGHT-HEADEDNESS, GO TO FRESH AIR. IF LIQUID IS SWALLOWED, DO NOT TRY TO VOMIT. GET MEDICAL ATTENTION.

WHEN HEATED, HOT FLUID MAY CAUSE BURNS. AVOID CONTACT WITH HOT FLUID. IF SKIN CONTACTS HOT FLUID, FLUSH AFFECTED AREA WITH COLD WATER FOR 10 MINUTES. SEEK MEDICAL HELP IMMEDIATELY.

WHEN HANDLING OR WHEN APPLYING LIQUID AT AN AIR-EXHAUSTED WORKBENCH, WEAR APPROVED GLOVES AND GOGGLES (OR FACE SHIELD).

WHEN HANDLING OR WHEN APPLYING LIQUID AT AN UNEXHAUSTED WORKBENCH, WEAR APPROVED GLOVES, GOGGLES (OR FACE SHIELD) AND APPROVED RESPIRATOR.

DISPOSE OF LIQUID-SOAKED RAGS IN APPROVED METAL CONTAINER.

(1) Use calibrating fluid, MIL-C-7024A, Type II. Maintain temperature at nozzle at 78°-82°F (25.56°-27.78°C).

(2) Provide a test stand capable of supplying 600 psig fuel pressure at the fuel nozzle, and a temperature control to provide a fuel temperature at the nozzle within the limitations specified in step (1).

(3) Provide a measuring capability of ±1 psig and ±1 percent of fuel flow rate.

(4) Connect the measuring gage to the side port of the fuel fitting adapter P/N 5232270-F3 (3, figure 201), and the inlet fuel pressure line to the end port of the adapter.

B. Test Procedure.

(1) Refer to table 2 for fuel nozzle performance specifications.

(2) Refer to SEI-154, 73-16-1 (Troubleshooting), paragraph 9 and table 5 in conjunction with the tests specified.

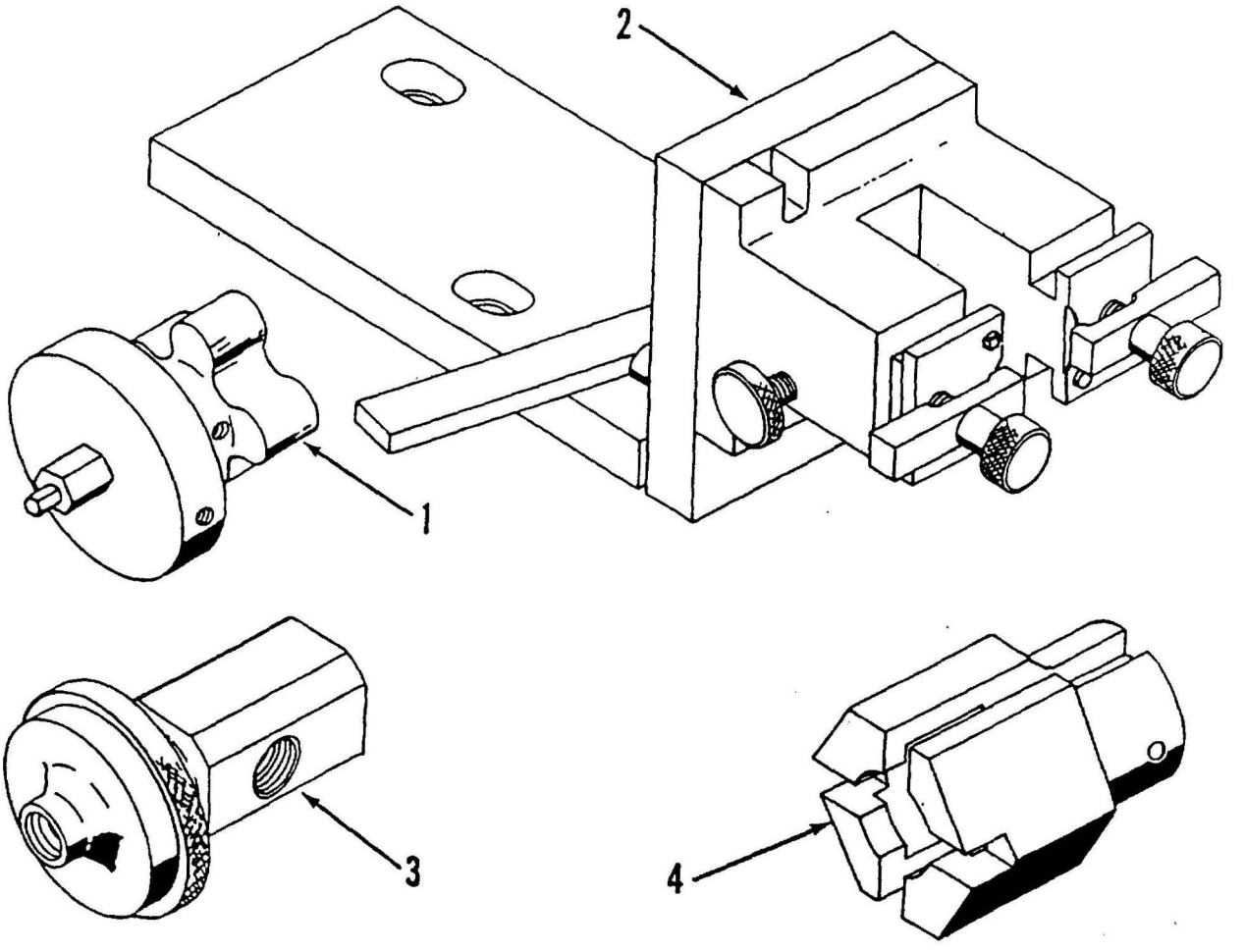
Table 2. Fuel Nozzle Performance Specifications

Pressure Drop (PSIG)	Low Flow Limit (LB/HR)	Average Flow Limit (LB/HR)	High Flow Limit (LB/HR)	Flow Hysteresis	Spray Angle (Degrees)
100	24.26	25.4	26.54	0.5%	72 to 98
135	45.68	48.6	51.52	*	72 to 98
400	259.76	272.0	284.24	1.0 PPH	84 to 98

Flow tests to be conducted by increasing pressures from low pressure to the next higher pressure.

Hysteresis must be checked when increasing and decreasing pressure.

* Flow shall be within 4 lb/hr of the reading at the previous 135 psig increasing test point and must be within flow limits.



1. Adjusting Wrench (5232270-F1)
2. Stand Pipe Adapter (5232270-F2)
3. Fuel Fitting Adapter (5232270-F3)
4. Special Socket (5232270-F4)

NOTE: Tool Vendor is Diesel Equipment Div., GMC.

000CJ6-890700

Special Tools
Figure 201

(3) Flow and spray test nozzles as follows:

(a) With the fuel nozzle assembly installed in the stand pipe adapter, 5232270-F2 (2, figure 201), connect and securely tighten fuel fitting adapter, 5232270-F3 (3) to the threaded inlet of the fuel nozzle assembly.

CAUTION: FLEXIBLE HOSES AND CONNECTORS WITHIN THE TEST SETUP MUST BE CAPABLE OF WITHSTANDING FUEL PRESSURES OF MORE THAN 600 PSIG.

(b) Connect two suitable flexible hoses with connections to fit the side and end ports of the adapter and of sufficient length to connect to the measuring gage and the fuel pressure source. Provide a suitable reservoir to catch fuel spray.

(c) With the line pressure set and maintained at 135 psig by means of the test stand throttling mechanism, adjust the nozzle flow rate to the applicable limits by rotating the adjusting screw (9, figure 202) clockwise to reduce the flow and counterclockwise to increase the flow.

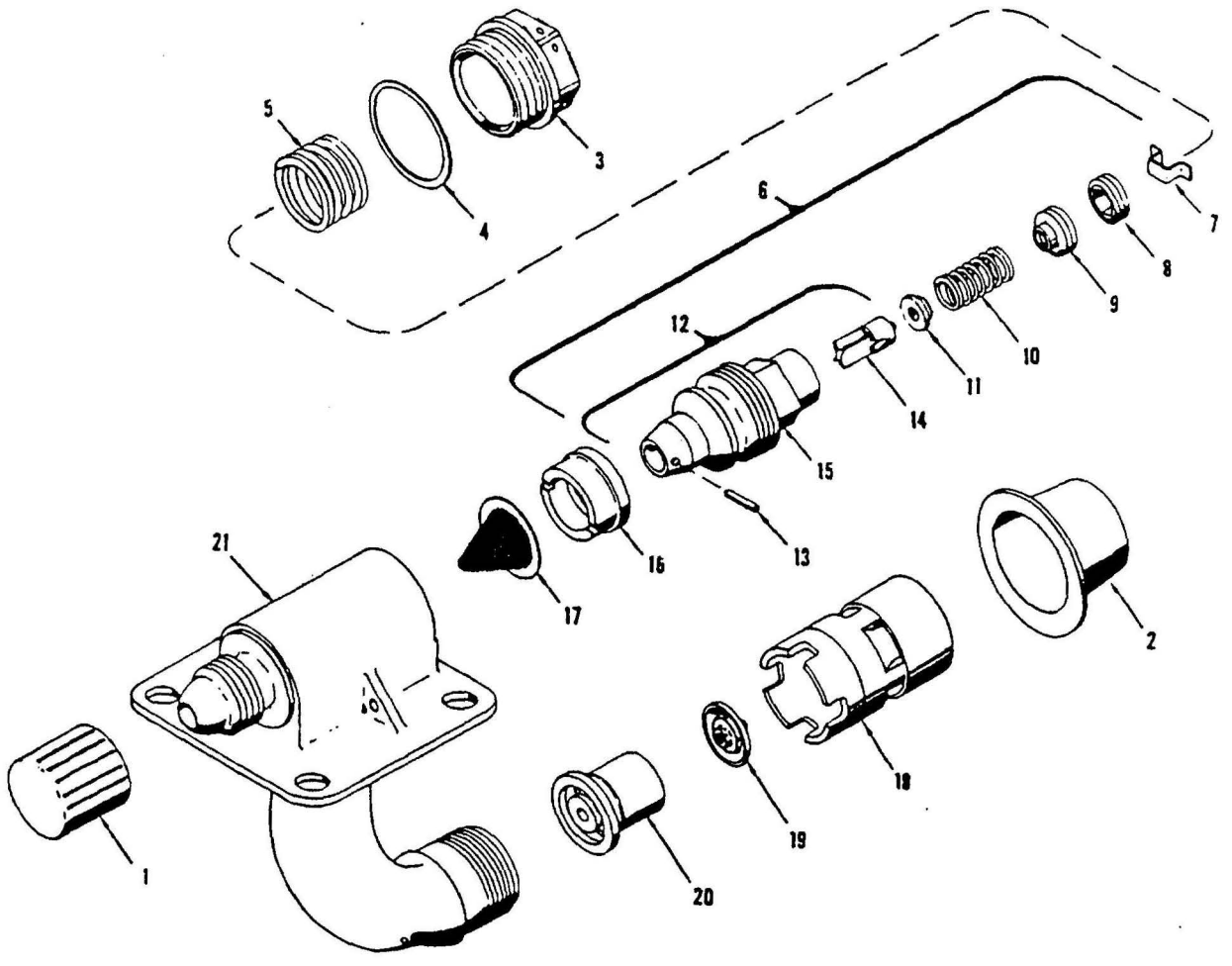
CAUTION: SINCE AT THIS POINT, FUEL FLOW WILL OCCUR THROUGH THE METERING VALVE, IT WILL BE MORE CONVENIENT TO INSERT THE ADJUSTING WRENCH IN POSITION PRIOR TO SETTING THE LINE PRESSURE AND MAINTAIN THE WRENCH IN POSITION UNTIL ADJUSTMENT HAS BEEN COMPLETED.

REMOVAL OF THE WRENCH WHILE THE LINE PRESSURE IS APPLIED WILL ALLOW EXCESSIVE FUEL TO FLOW THROUGH THE 1/16-INCH ALLEN WRENCH SOCKET OF THE ADJUSTING SCREW (9, FIGURE 202). THIS WILL CAUSE AN INCORRECT READING.

BE CAREFUL WHEN INSTALLING THE WRENCH INTO OPERATING POSITION. IF THE WRENCH IS INSERTED TOO FAR INTO THE ADJUSTING SCREW (9), IT MAY CAUSE THE END OF THE 1/16-INCH ALLEN WRENCH TO STRIKE THE VALVE SPRING SHAFT (11) AND INTERFERE WITH NORMAL MOVEMENT OF THE VALVE.

(d) Secure the adjusting screw in position by tightening the lockscrew (8) against the adjusting screw to a torque value of 10-15 lb-in. This is accomplished by using the 5/32-inch allen wrench portion of adjusting wrench, 5232270-F1 (1, figure 201) while maintaining the position of the adjusting screw with the 1/16-inch allen wrench portion of the adjusting wrench.

(e) Install cap (3) and used cap gasket (4). Tighten cap to a torque value of 120-140 lb-in. with a 17/32-inch socket wrench and a torque wrench.



1. Protective Plug Cap
2. Protective Cap
3. Cap
4. Cap Gasket
5. Spring
6. Valve Cage Assembly
7. Lockscrew Retainer
8. Lockscrew
9. Adjusting Screw
10. Valve Spring
11. Valve Spring Shaft
12. Valve and Valve Guide Assembly
13. Valve Retaining Pin
14. Metering Valve *
15. Valve Gage *
16. Valve Cage Seal
17. Filter
18. Spray Tip Nut Assembly
19. Inner Spray Tip Assembly
20. Spacer
21. Body Subassembly

* Matched parts. Must be replaced as a set.

000CJ6-890800

Fuel Nozzle Assembly - Exploded View
Figure 202

(f) Reset line pressure at 135 psig and recheck flow rate. If the flow does not fall within the specified limits, readjust as necessary as instructed in steps (c) and (d).

(g) Decrease line pressure to 0 psig, then increase to 100 psig, then to 135 psig, and finally to 400 psig. Read the flow rate and spray angle at each point. Flow rate and spray angle must fall within the limits specified in table 2. Measure spray angle as shown in figure 203.

(h) Reduce line pressure to 135 psig, taking care not to reduce pressure below 135 psig during operation, and read flow rate. Flow must be within 4 lb/hr of reading previously obtained at 135 psig and must be within flow limits.

(i) Starting at 0 psig, slowly increase line pressure to 400 psig, while viewing the spray under a strong light and slowly rotating the nozzle tip. There shall be no high contrast streaks. Minor, random, streaking is allowable but streaks must flare into a uniform spray (see figure 204, sheets 1 and 2). The spray should not exhibit pulsation or abrupt changes in spray angle during transient operation. Spray cone skewness shall be within 2 degrees of the nozzle axis.

(j) Increase line pressure to 600 psig and check for leakage at split line between spray tip nut assembly (18, figure 202) and body subassembly (21), and at cap gasket (4) seal.

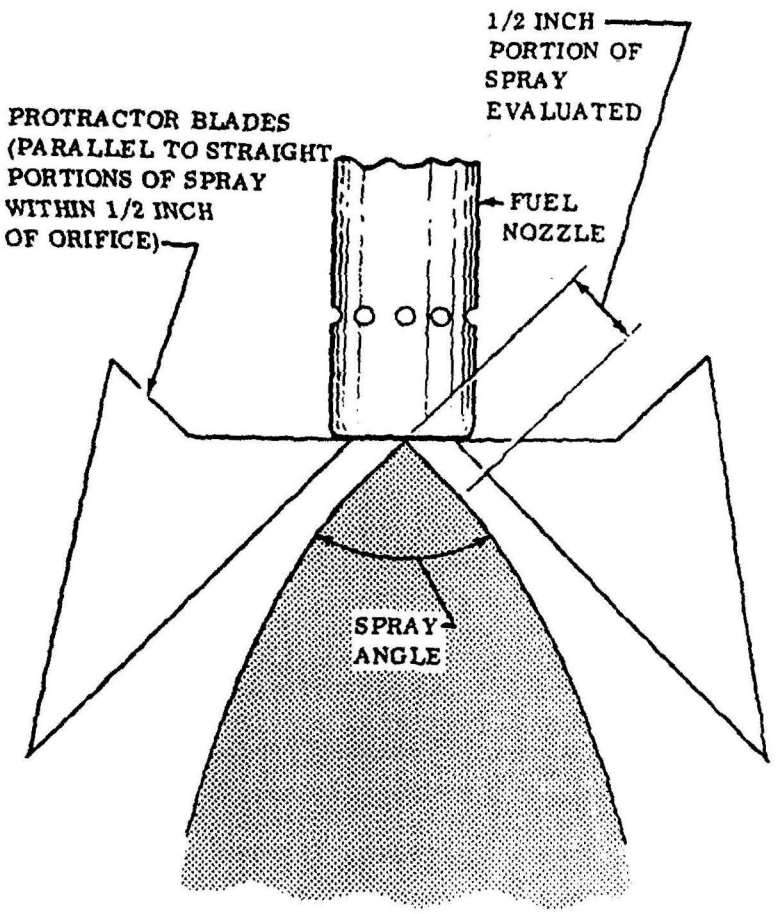
C. Remove fuel nozzle from stand pipe adapter (2, figure 201) and install protective cap (2, figure 202) on spray tip nut assembly (18) and protective cap (1) on threaded inlet fitting of body subassembly (21).

D. Weld the spray tip nut assembly (18) to the body subassembly (21) as follows:

NOTE: Only Class A welders qualified per Specification MIL-T-5021C are authorized to accomplish this procedure.

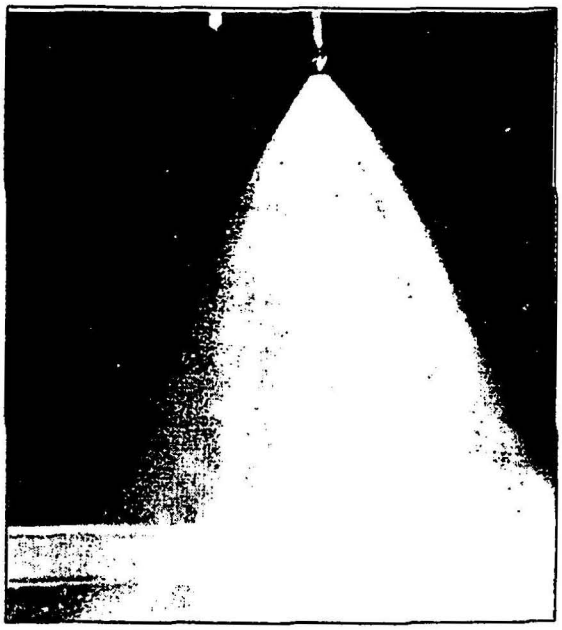
(1) Mark the body subassembly (21) as shown in figure 205. Do not mark on machined surface. Marking of the body subassembly aids in location of spray tip nut weld.

(2) Locally clean the area where spray tip nut assembly (18) is to be welded to body subassembly.

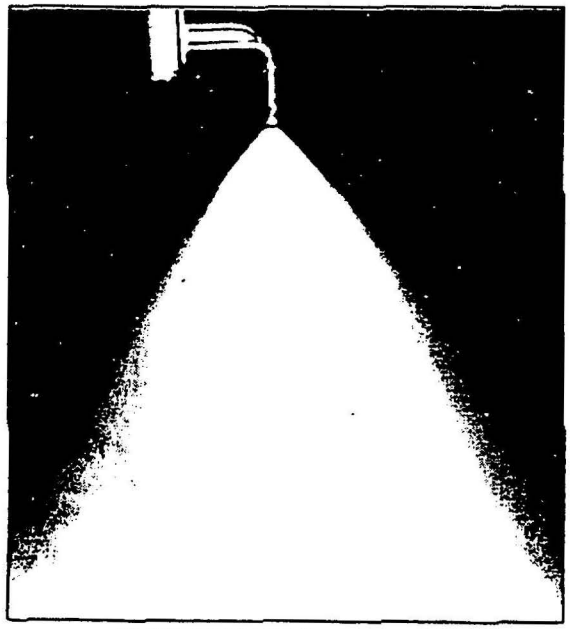


Spray Angle Measurement
Figure 203

135 PSIG FLOW CHECK
MAXIMUM SPRAY QUALITY DEVIATIONS
AS SHOWN ARE ACCEPTABLE



400 PSIG FLOW CHECK
MAXIMUM SPRAY QUALITY DEVIATIONS
AS SHOWN ARE ACCEPTABLE



400 PSIG FLOW CHECK
MAXIMUM SPRAY QUALITY DEVIATIONS
AS SHOWN ARE ACCEPTABLE

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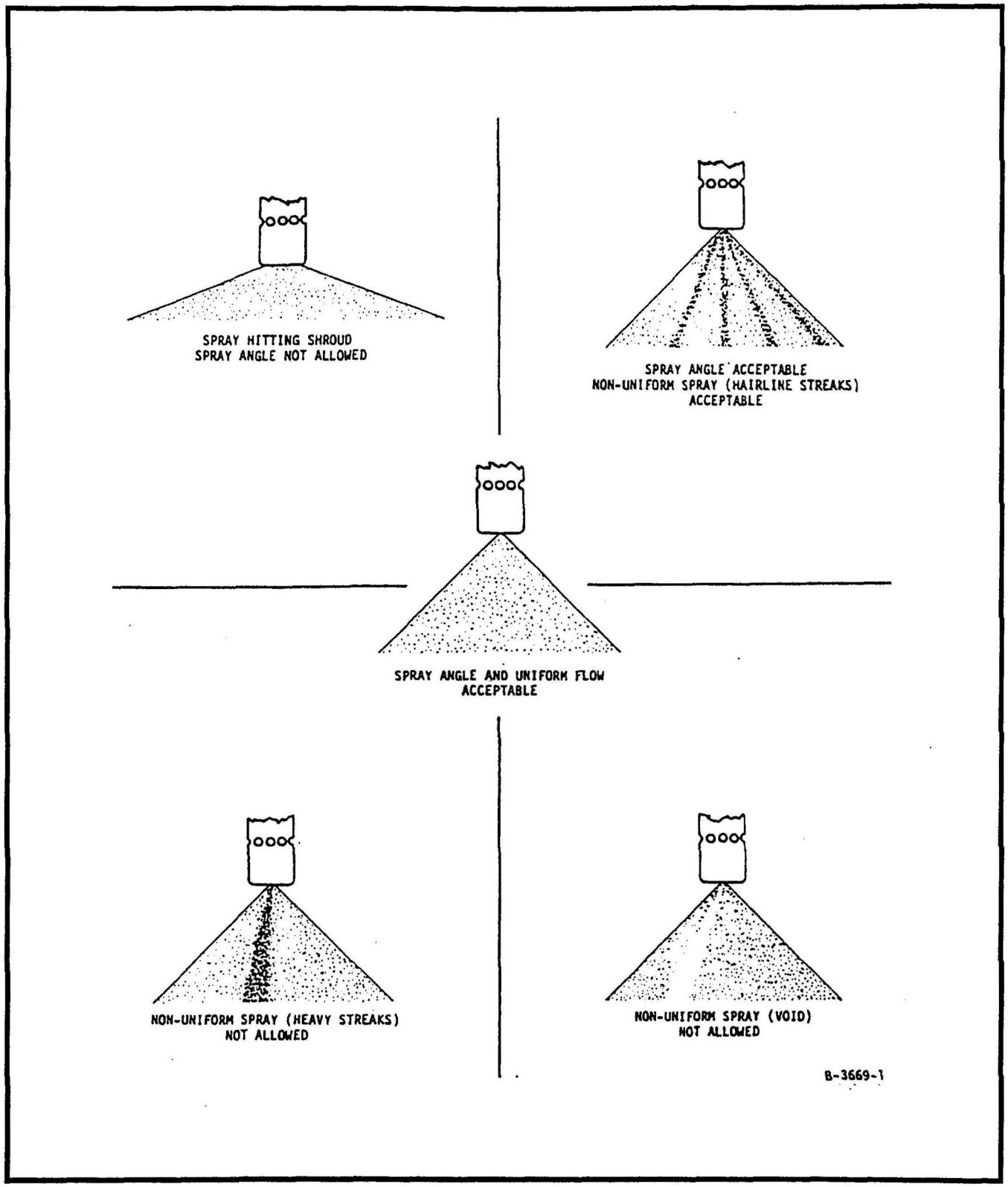
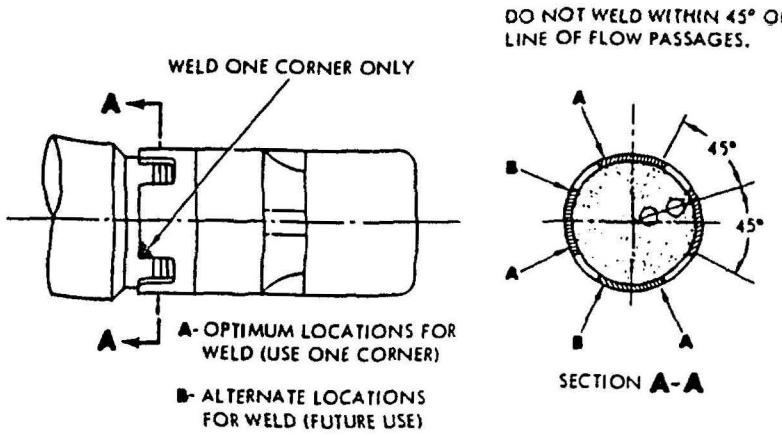
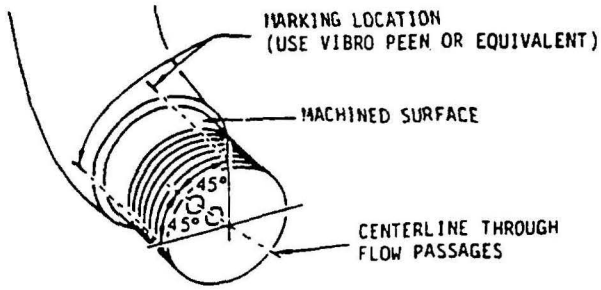
BB-0243

Fuel Nozzle Spray Cone Limits (Sheet 1 of 2)
Figure 204



Fuel Nozzle Spray Cone Limits (Sheet 2 of 2)
Figure 204





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Spray Tip Nut Weld Locations
Figure 205

WARNING: GENERAL WELDING

DO NOT LET FLAMMABLE SOLVENTS SUCH AS ACETONE AND METHYL ETHYL KETONE CONTACT HEATED WELDED PARTS.

CONTACT WITH FUMES MAY CAUSE SKIN IRRITATION, DERMATITIS, AND EYE IRRITATION. REPEATED INHALATION OF FUMES CAN CAUSE COUGHING, WHEEZING, AND PERMANENT LUNG DAMAGE.

IF FUMES CAUSE IRRITATION, GO TO FRESH AIR. IF COUGHING OR WHEEZING PERSISTS, GET MEDICAL ATTENTION.

WELDING SHOULD ONLY BE DONE IN AN AIR-EXHAUSTED ENCLOSED OR SHIELDED WORK AREA.

CONTACT WITH ULTRAVIOLET RAYS MAY CAUSE FATIGUE, NAUSEA, AND FEVER. REPEATED CONTACT MAY CAUSE PERMANENT SKIN AND TISSUE DAMAGE.

COVER ALL EXPOSED SKIN TO AVOID REDDENING OF SKIN. IF REDDENING OF SKIN OCCURS AFTER REPEATED USE OF WELDING MACHINE, GET MEDICAL ATTENTION.

ONLY EXPERIENCED TRAINED PERSONNEL SHOULD USE WELDING MACHINES. WHEN USING EQUIPMENT, FOLLOW APPROVED SAFETY PROCEDURES FOR SHIELDING AND PERSONAL PROTECTIVE EQUIPMENT.

NOTE: This is a fusion type weld. Do not use filler material.

(3) Using a gas shielded tungsten arc adjusted to approximately 60 amps DC straight polarity, weld one tab of the spray tip nut to the body subassembly. (See figure 205 for optimum and alternate weld locations.)

(4) Test the integrity of the weld by inspecting the weld joint using a 10X glass. The joint must be free of cracks and must appear fused (melted and flowed together) and the length of perimeter of the joint must not be less than 0.40 inch.

FUEL MANIFOLDS - MAINTENANCE PRACTICES

WARNING: ASBESTOS

THIS ENGINE MAY CONTAIN SMALL AMOUNTS OF ASBESTOS. WHEN WORKING WITH THIS ENGINE, THE FOLLOWING PRECAUTIONS MUST BE RIGIDLY ADHERED TO:

BEFORE ANY MAINTENANCE ACTIVITIES ARE UNDERTAKEN, REVIEW THE ILLUSTRATED PARTS BREAKDOWN/CATALOG INDEX TO DETERMINE IF THE HARDWARE TO BE WORKED ON OR USED CONTAINS ASBESTOS.

WHENEVER MECHANICAL REMOVAL OF MATERIAL, SUCH AS MACHINING, GRINDING, BUFFING, DRILLING, SANDING OR ANY TYPE OF MATERIAL BUILD-UP ON PARTS THAT CONTAIN ASBESTOS IS NECESSARY, APPROPRIATE PERSONAL PROTECTIVE EQUIPMENT MUST BE WORN, AND NATIONAL ENVIRONMENTAL CONTROLS REQUIRED FOR THE HANDLING OF ASBESTOS-CONTAINING MATERIAL MUST BE COMPLIED WITH.

BEFORE HANDLING, REPLACING, OR DISPOSING OF ASBESTOS-CONTAINING HARDWARE, APPROPRIATE PERSONAL PROTECTIVE EQUIPMENT AND NATIONAL ENVIRONMENTAL CONTROLS MUST BE STRICTLY ADHERED TO FOR HANDLING ASBESTOS-CONTAINING HARDWARE.

1. General. Maintenance of the fuel manifolds consists of Removal/Installation and Inspection/Check.

2. Removal/Installation. (See 73-00, figure 2.)

WARNING: ASBESTOS

THE FOLLOWING PROCEDURE MAY INVOLVE A PART THAT CONTAINS ASBESTOS, WHICH IS HIGHLY TOXIC TO SKIN, EYES, AND RESPIRATORY TRACT. READ GENERAL INFORMATION BEFORE PROCEEDING, AND ADHERE TO ALL SITE SAFETY AND ENVIRONMENTAL CONTROLS CONCERNING ASBESTOS. OTHERWISE, PERSONAL INJURY MAY RESULT.

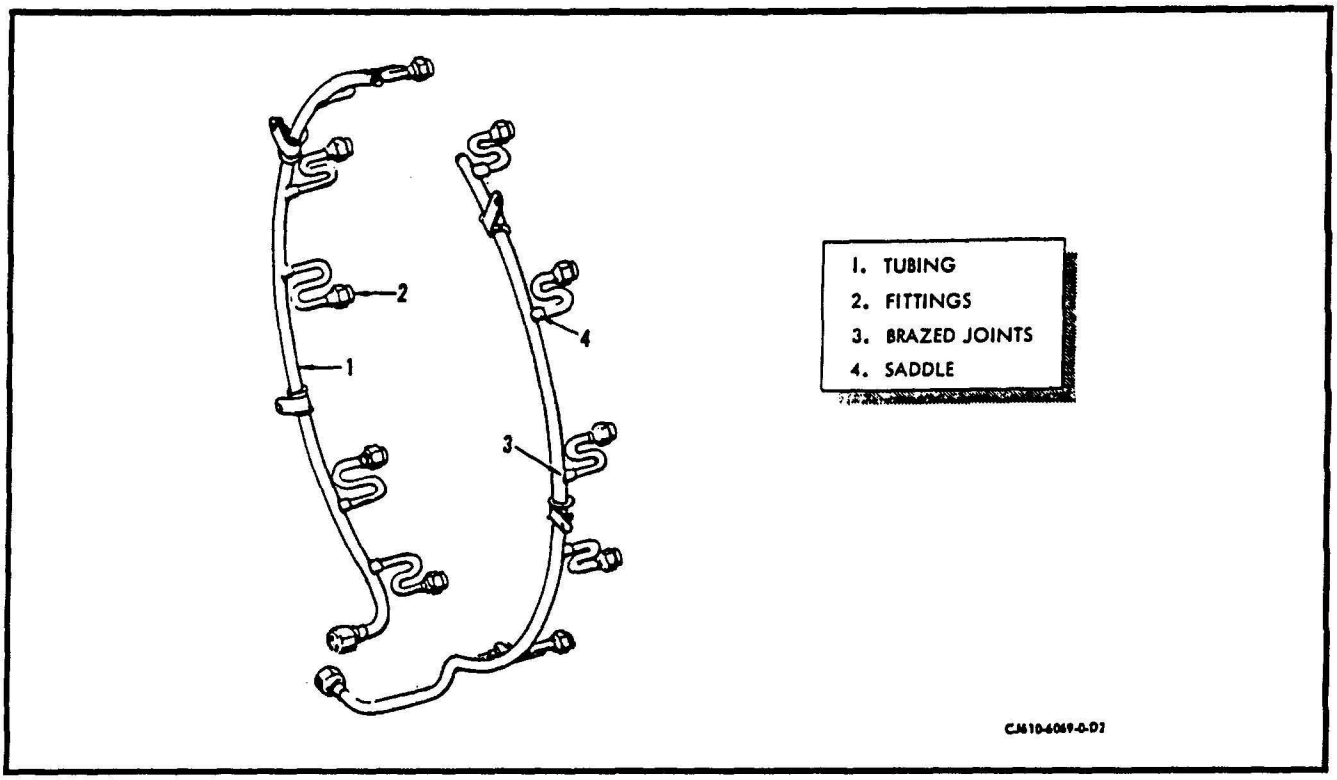
A. Removal.

(1) Remove the main engine mount (22) from the mainframe flanges.

(2) Disconnect the fuel manifold fittings (24) from the fuel nozzles (23).

(3) Disconnect the fuel manifold (21) from the T-fitting (25).

(4) Remove the manifold and manifold clamps.



Fuel Manifold
Figure 201

WARNING: ASBESTOS

THE FOLLOWING PROCEDURE MAY INVOLVE A PART THAT CONTAINS ASBESTOS, WHICH IS HIGHLY TOXIC TO SKIN, EYES, AND RESPIRATORY TRACT. READ GENERAL INFORMATION BEFORE PROCEEDING, AND ADHERE TO ALL SITE SAFETY AND ENVIRONMENTAL CONTROLS CONCERNING ASBESTOS. OTHERWISE, PERSONAL INJURY MAY RESULT.

B. Installation.

(1) Connect the manifold fittings (24) to the fuel nozzles (23). Torque to 140-160 lb-in. and lockwire.

CAUTION: INCORRECT LOCK-WIRING OF THE FUEL MANIFOLD TO THE DRAIN T-FITTING MAY CAUSE DAMAGE TO THE OIL TANK.

(2) Connect the manifold (21) to the T-fitting (25). Torque to 270-300 lb-in. and lockwire.

(3) Secure the manifold clamps to the brackets. Torque the clamp bolts to 20-25 lb-in.

(4) Secure the main engine mount (22) to the mainframe flanges. Torque the bolts to 44-48 lb-in. and lockwire.

3. Inspection/Check. When serviceable limits are exceeded, the manifold may be repaired in accordance with the Overhaul Manual. Visually inspect the following areas. (See figure 201.)

Inspect/Check	Maximum Serviceable Limits	Remarks
A. Tubes for:		
(1) Cracks.	Not serviceable	Replace fuel manifold.
(2) Nicks or scratches.	Not serviceable if of measurable depth.	Blend. Do not decrease tube diameter more than 0.005 inch. Blend along axis of tube.
(3) Dents.	Twelve large-tube dents, 0.020 inch in depth. One small-tube dent, 0.010 inch in depth. No sharp edges.	
(4) Distortion.	Any amount if fittings line up with nozzles, the tubes are not collapsed and there is no interference with other parts of the engine.	
(5) Chafing.	Any amount, 0.003 inch below adjacent non-defective surface.	
B. The fittings for:		
(1) Burrs.	Not serviceable.	Remove by working threads with lapping compound. Flush with cleaning solvent.
(2) Stripped threads.	Not serviceable.	
C. Brazed joints for cracks.	Not serviceable.	
D. Contact or interference between tubing assembly and adjacent parts.	Not serviceable.	

CAUTION: BE SURE THAT ALL FOREIGN MATERIAL IS REMOVED FROM MANIFOLD.

FUEL CONTROL - MAINTENANCE PRACTICES

1. General. Maintenance of the fuel control consists of Removal/Installation, Adjustment/Test and cleaning of the control filter.

2. Removal/Installation.

   A. Removal. Remove the fuel control per 73-13-0.

   B. Installation. Install the fuel control per 73-13-0.

3. Adjustment/Test.

   Three field adjustments are allowed on the fuel control:

   - Idle Speed Adjustment

   - Maximum Speed Adjustment

   - Fuel Density Adjustment

   These adjustments can be made from outside the fuel control with the control installed on the engine.

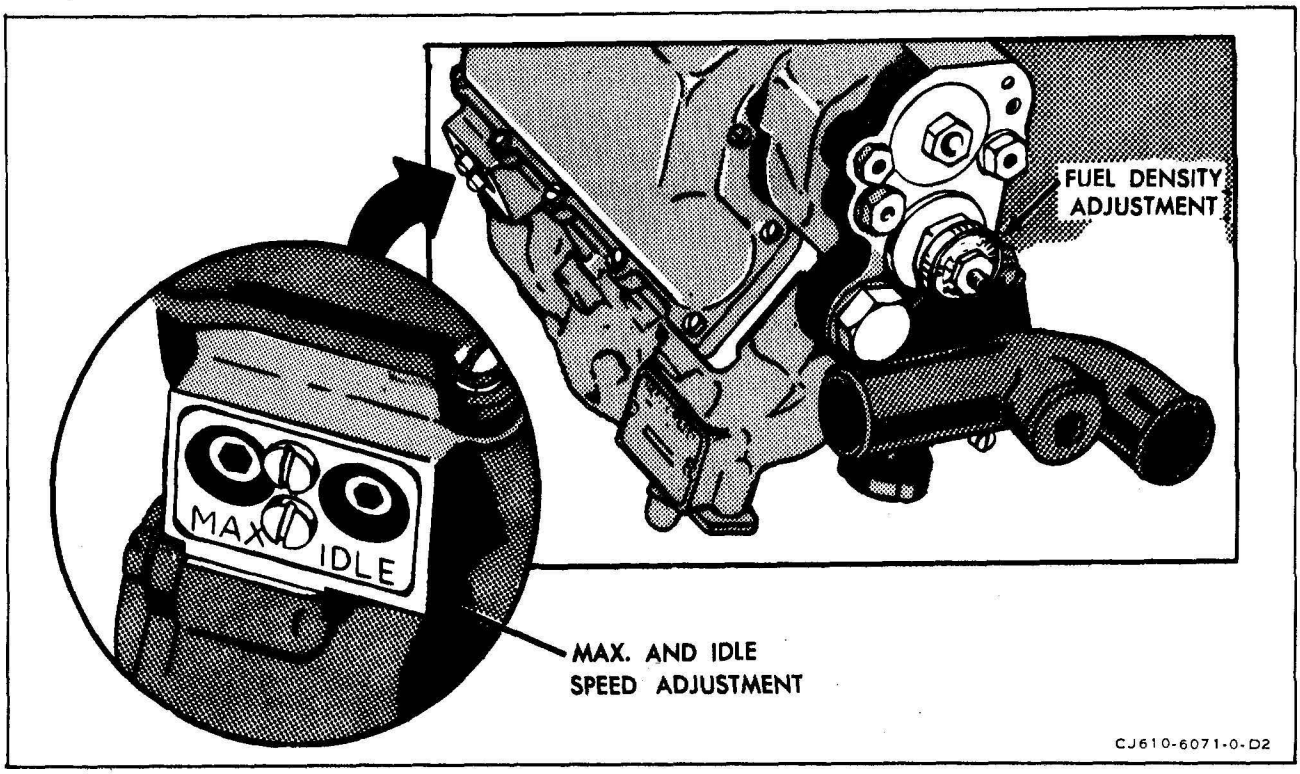
   A. Idle Speed Adjustment. (See figure 201.)

      WARNING: DO NOT ADJUST IDLE SPEED WHEN THE ENGINE IS OPERATING ABOVE IDLE.

      (1) The adjusting screw is located at the bottom right-hand side of the fuel control. To increase speed turn the IDLE adjusting screw clockwise; to decrease speed turn it counterclockwise. One click of the adjusting screw will change engine speed approximately 55 rpm.

         NOTE: Adjustment clicks are sensed by touch and can easily be detected after limited experience.

         NOTE: To eliminate the effect of backlash, preload the internal linkage of the fuel control by completing all adjustments of idle speed in a counterclockwise direction with 5 clicks. For example: (1) to increase engine speed 1 click, turn the adjusting screw 6 clicks clockwise, then 5 clicks counterclockwise. (2) To decrease engine speed 1 click, turn the adjusting screw 4 clicks clockwise, then 5 clicks counterclockwise.



Fuel Control Adjustments
Figure 201

(2) Adjust idle speed after the engine has operated at maximum speed for at least 3 minutes. Set speed per 72-00, Adjustment/Test. Recheck maximum speed whenever idle speed has been adjusted.

B. Maximum Speed Adjustment. (See figure 201.)

WARNING: DO NOT ADJUST MAXIMUM SPEED WITH THE ENGINE OPERATING ABOVE IDLE. REDUCE ENGINE SPEED TO IDLE OR SHUT THE ENGINE DOWN, MAKE THE ADJUSTMENT, THEN RUN THE ENGINE UP TO CHECK THE ADJUSTMENT.

(1) The adjusting screw is located at the bottom right-hand side of the fuel control. To increase speed, turn the MAX adjusting screw clockwise; to decrease speed turn it counterclockwise. One click of the adjusting screw will change engine speed approximately 30 rpm.

NOTE: Adjustment clicks are sensed by touch and can easily be detected after limited experience.

NOTE: To eliminate the effect of backlash, preload the internal link-age of the fuel control by completing all adjustments of maximum speed in a counterclockwise direction with 5 clicks. For example: (1) To increase engine speed 1 click, turn the adjusting screw 6 clicks clockwise, then 5 clicks counterclockwise. (2) To decrease engine speed 1 click, turn the adjusting screw 4 clicks clockwise, then 5 clicks counterclockwise.

(2) Adjustment of maximum speed affects idle speed. Recheck idle speed after every maximum speed adjustment.

C. Fuel Density Adjustment. (See figure 201.)

CAUTION: THE ADJUSTMENT KNOB MUST BE SEATED IN ITS POSITIONING DETENT SATISFACTORY OPERATION.

(1) A fuel density adjustment on the front of the fuel control allows the fuel control to compensate for fuels of varying densities. It meters more or less fuel to the combustion area depending on the density of the fuel. The engine will operate satisfactorily with a mixture of approved fuels provided that the density adjustment on the fuel control is set to correspond to the fuel that is the larger part of the mixture. To make an adjustment, push the knob in, rotate it to the desired setting, and release pressure. If necessary, jiggle the knob until it locks.

CAUTION: ENGINE OPERATING TIME USING AVIATION GASOLINE IS LIMITED TO 25 HOURS DURING ANY ONE OVERHAUL PERIOD. OPERATING TIME WITH AVIATION GASOLINE MUST BE RECORDED WHEN THE MIXTURE CONTAINS MORE THAN 50 PERCENT OF AVIATION GASOLINE BY VOLUME.

(2) The fuel control density knob is to be set according to the following table depending upon the mixture of aviation gasoline and JP-4, JP-5, or JP-8.

Percent by Volume of Aviation Gasoline		Density Setting
Below	20%	JP-4, JP-5, or JP-8
	20-35%	.75
	35-50%	.72
Above	50%	.69

NOTE: Density knob adjustment must be restricted to plus or minus 1 click from setting specified for type of fuel being used.

4. Cleaning of Fuel Control Filter. (See figure 202.)

A. Removal.

(1) Remove the plug (4), O-ring (3), spring (2), and filter (1) from the front of the fuel control housing.

NOTE: Do not remove the second filter located behind the retaining ring.

B. Cleaning.

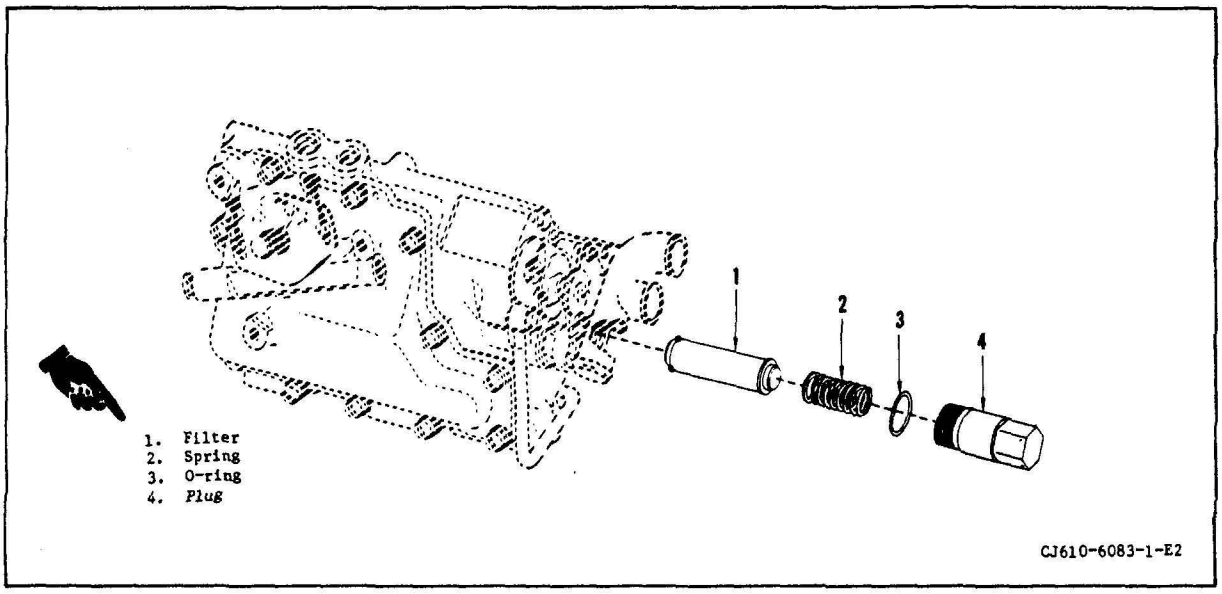
(1) Ultrasonic Procedure. (Refer to Accessory Overhaul Manual, SEI-154, for ultrasonic cleaning procedure.) This is the recommended method for cleaning the filter.

(2) Alternate Procedure. When ultrasonic cleaning equipment is not available, the filter should be cleaned as follows:

WARNING: CLEANING OPERATION SHALL BE PERFORMED IN AN APPROVED CLEANING CABINET OR WELL VENTILATED AREA. PRECAUTIONS SHALL BE EXERCISED TO PREVENT INHALATION OF VAPOR EMITTED BY VOLATILE CLEANING MATERIALS, AND TO MINIMIZE DANGER OF EXPLOSION AND FIRE HAZARDS.

(a) Clean the filter element by immersing it in carbon tetrachloride, trichloroethane, kerosene, or equivalent. While continually agitating the filter, use a suitably contoured soft bristle brush to dislodge contaminants.

NOTE: Only clean, filtered solvents should be used. Assure that containers used during the cleaning procedure are clean and free from contaminants.



Fuel Control Filter
Figure 202

(b) Blow it out with filtered compressed air and be sure no dirt particles have collected in the filter.

(c) Visually inspect the filter using a magnifying glass (10X minimum) and a strong light. If the filter is not completely clean, repeat steps (a) and (b).

C. Installation.

(1) Install a new O-ring (3) on the plug (4).

(2) Install the filter (1), spring (2), and plug (4) in the fuel control housing. Torque the plug to 60-80 lb in. and lock-wire it.

OVERSPEED GOVERNOR - MAINTENANCE PRACTICES

WARNING: ASBESTOS

THIS ENGINE MAY CONTAIN SMALL AMOUNTS OF ASBESTOS. WHEN WORKING WITH THIS ENGINE, THE FOLLOWING PRECAUTIONS MUST BE RIGIDLY ADHERED TO:

BEFORE ANY MAINTENANCE ACTIVITIES ARE UNDERTAKEN, REVIEW THE ILLUSTRATED PARTS BREAKDOWN/CATALOG INDEX TO DETERMINE IF THE HARDWARE TO BE WORKED ON OR USED CONTAINS ASBESTOS.

WHENEVER MECHANICAL REMOVAL OF MATERIAL, SUCH AS MACHINING, GRINDING, BUFFING, DRILLING, SANDING OR ANY TYPE OF MATERIAL BUILD-UP ON PARTS THAT CONTAIN ASBESTOS IS NECESSARY, APPROPRIATE PERSONAL PROTECTIVE EQUIPMENT MUST BE WORN, AND NATIONAL ENVIRONMENTAL CONTROLS REQUIRED FOR THE HANDLING OF ASBESTOS-CONTAINING MATERIAL MUST BE COMPLIED WITH.

BEFORE HANDLING, REPLACING, OR DISPOSING OF ASBESTOS-CONTAINING HARDWARE, APPROPRIATE PERSONAL PROTECTIVE EQUIPMENT AND NATIONAL ENVIRONMENTAL CONTROLS MUST BE STRICTLY ADHERED TO FOR HANDLING ASBESTOS-CONTAINING HARDWARE.

1. General. Maintenance of the overspeed governor consists of Removal/Installation and Inspection/Check.

2. Removal/Installation. (See 73-00, figure 2.)

WARNING: ASBESTOS

THE FOLLOWING PROCEDURE MAY INVOLVE A PART THAT CONTAINS ASBESTOS, WHICH IS HIGHLY TOXIC TO SKIN, EYES, AND RESPIRATORY TRACT. READ GENERAL INFORMATION BEFORE PROCEEDING, AND ADHERE TO ALL SITE SAFETY AND ENVIRONMENTAL CONTROLS CONCERNING ASBESTOS. OTHERWISE, PERSONAL INJURY MAY RESULT.

A. Removal.

(1) Remove the line (36) that connects the overspeed governor (31) to the fuel pump adapter.

(2) Remove the tube (35) that connects the overspeed governor to the fuel flowmeter (9).

(3) Disconnect, at the overspeed governor, the hose (11) that leads to the fitting at the rear of the fuel control.

(4) Remove the 2 tubes (32, 33) that connect the high-pressure filter to the fuel pump and to the overspeed governor.

(5) Disconnect the drai line (if attached).

(6) Remove the high-pressure filter (34) per 73-14-0. Remove the clamp from the bracket on the overspeed governor.

(7) Remove the 6 nuts and wshers (39) that attach the overspeed governor (31) to the front middle pad of the accessory gearbox and carefully remove the governor and gasket. Discard the gasket.

WARNING: ASBESTOS

THE FOLLOWING PROCEDURE MAY INVOLVE A PART THAT CONTAINS ASBESTOS, WHICH IS HIGHLY TOXIC TO SKIN, EYES, AND RESPIRATORY TRACT. READ GENERAL INFORMATION BEFORE PROCEEDING, AND ADHERE TO ALL SITE SAFETY AND ENVIRONMENTAL CONTROLS CONCERNING ASBESTOS. OTHERWISE, PERSONAL INJURY MAY RESULT.

B. Installation.

(1) Lubricate the spline of the overspeed governor shaft with Plastilube Moly No. 3 (Warren Refining Co., Cleveland, Ohio) or equivalent. Secure the overspeed governor (31) and a new gasket to the front middle pad of the accessory gearbox with 6 nuts and washers (39). Torque the nuts to 25-35 lb-in.

NOTE: Viewed facing the gearbox, the drain fitting should be in approximately the 5 o'clock position.

(2) Secure the high-pressure filter (34) and clamp to the bracket on the overspeed governor (31). (The largest OD of the filter housing should be forward of the clamp.)

(3) Connect the high-pressure filter to the overspeed governor and to the fuel pump with 2 tubes (32, 33).

(4) Connect to the overspeed governor (31) the large hose (11) that is attached to the rear of the fuel control. Tighten to standard torque.

(5) Install the tube (35) that connects the overspeed governor the the fuel flowmeter. Tighten to standard torque.

(6) Install the hose (36) that connects the overspeed governor to the fuel pump inlet adapter. Tighten to standard torque.

NOTE: Position the overspeed governor lever arm up for normal operation; position it down for test.

3. Inspection/Check.

A. Visually inspect the overspeed governor for evidence of external leakage and replace governor if evidence of leakage exists.

B. Check the overspeed governor for excessive internal leakage, if suspected, as follows:

(1) Disconnect the overspeed governor bypass line at the fuel inlet manifold and run the line into a bucket or other container. Cap the fuel inlet manifold connection.

CAUTION: MAKE SURE THE IGNITION SWITCH IS OFF DURING MOTORING.

(2) Engage the starter and bring engine speed up to the maximum speed starter is capable of producing. Advance the throttle to IDLE (without ignition) and measure the quantity of fuel discharged from the overspeed governor bypass line in 30 seconds. (Do not exceed maximum starter operating time per duty cycle.)

(3) The maximum allowable bypass flow is 80 pph or about 370 cc (or 0.8 pt.) per 30 seconds. If the bypass flow is more than 370 cc per 30 seconds, replace the overspeed governor.

(4) STOPCOCK the throttle and disengage starter motor. After compressor rotor has stopped rotating, allow starter to cool for 3 minutes. Then motor the engine for 30 seconds to clear the engine of fuel.

(5) Reconnect the overspeed governor bypass line to the fuel inlet manifold.

CDP (P_3) TUBE ASSEMBLY - MAINTENANCE PRACTICES

1. General. The flange end of the CDP (P_3) tube is secured with the CDP (P_3) restrictor to the mainframe at the 8 o'clock position. The CDP line to fuel control runs forward and around the bottom of the engine toa fitting on the aft side of the fuel control. The CDP line to fan rear frame is connected to the fuel control line through a tee fitting at the mainframe.

2. Removal/Installation.

   A. Removal.

      (1) Remove the 2 bolts that seeure the flanged end of the tube (29) and the CDP restrictor to the mainframe. Remove the restrictor and discard the two gaskets.

      (2) Disconnect the CDP to aft fan tube at the tee fitting.

      (3) Remove the clamp (30) that secures the tube to the synchronizing cable conduit and remove the CDP to fuel control tube.

      (4) Disconnect the tube at the fitting at the 7 o'clock position on the fan rear frame.

      (5) Remove the clamps securing the P_3 tube to the engine and fan frame.

      (6) Remove the tubing seal retainer at the firewall and remove the tube.

   B. Installation.

      (1) Assemble the CDP tube (29) to the aft fitting on the fuel control.

      (2) Lubricate the 2 tube flange bolts with Ease-Off 990 (Texacone Co., Box 4236, Dallas, Texas) or G-392 Versilube (G.E. Products Co., Waterford, N.Y.) Position the restrictor with 2 new gaskets (one on each side of the restrictor) and secure the tube flange and restrictor to the mainframe using the two bolts. Torque to 24-27 lb-in. and lockwire.

      (3) Torque the coupling nut at the fuel control to 90-100 lb-in.

      (4) Install the clamp (30) and torque the clamp nut to 24-27 lb-in.

(5) Secure the CDP to fan rear frame tube at the tee fitting. Torque to 90-100 lb-in.

(6) Secure the tube to the fitting at the 7 o'clock position on the fan rear frame. Torque to 90-100 lb-in.

(7) Install the remaining tube clamps. Torque the clamp nuts to 24-27 lb-in.

(8) Install the tubing seal retainer at the firewall on the turbine casing front flange.

3. Inspection/Check. Inspect the tube assembly per 72-02-1.

CDP LINE TO ASPIRATOR - MAINTENANCE PRACTICES

1. General. Maintenance of the CDP line to T_2 aspirator is limited to Removal/Installation and Inspection?Check. This information is given in the following paragraphs.

2. Removal/Installation. (See 73-00, figure 2.)

   A. Removal.

      (1) Remove the 2 screws (19) that secure the aspirator tube flange to the mainframe at the 4 o'clock position. Discard the gasket.

      (2) Loosen the tube coupling nut at the sensor eductor on the front of the fuel control.

      (3) Remove the clamp (12) that secures the tube to the flowmeter-oil cooler fuel line and remove the air tube (13).

   B. Installation.

      (1) Assemble the air tube (13) to the fitting on the sensor eductor.

      (2) Lubricate the 2 tube flange bolts (19) with Ease-Off 990 (Texacone Co., Box 4236, Dallas, Texas) or G-392 Versilube (G.E. Products Co.,Waterford, N.Y.) Use a new gasket and secure the flanged end of the tube to the mainframe with the bolts. Torque to 24-27 lb-in. and lockwire.

         NOTE: To eliminate unnecessary stresses in the P3 line, make sure that the bolt holes in the P3 line flange are properly aligned with the holes in the mainframe. If the holes are not aligned, re-form the line for proper alignment before installing the bolts.

      (3) Torque the connecting nut at the eductor to 75-125 lb-in.

      (4) Install the clamp (12) and torque the clamp bolt to 24-27 lb-in.

3. Inspection/Check. Inspect the CDP to aspirator air tube per 72-02-1.

VARIABLE GEOMETRY ACTUATOR LINES - MAINTENANCE PRACTICES

WARNING: ASBESTOS

THIS ENGINE MAY CONTAIN SMALL AMOUNTS OF ASBESTOS. WHEN WORKING WITH THIS ENGINE, THE FOLLOWING PRECAUTIONS MUST BE RIGIDLY ADHERED TO:

BEFORE ANY MAINTENANCE ACTIVITIES ARE UNDERTAKEN, REVIEW THE ILLUSTRATED PARTS BREAKDOWN/CATALOG INDEX TO DETERMINE IF THE HARDWARE TO BE WORKED ON OR USED CONTAINS ASBESTOS.

WHENEVER MECHANICAL REMOVAL OF MATERIAL, SUCH AS MACHINING, GRINDING, BUFFING, DRILLING, SANDING OR ANY TYPE OF MATERIAL BUILD-UP ON PARTS THAT CONTAIN ASBESTOS IS NECESSARY, APPROPRIATE PERSONAL PROTECTIVE EQUIPMENT MUST BE WORN, AND NATIONAL ENVIRONMENTAL CONTROLS REQUIRED FOR THE HANDLING OF ASBESTOS-CONTAINING MATERIAL MUST BE COMPLIED WITH.

BEFORE HANDLING, REPLACING, OR DISPOSING OF ASBESTOS-CONTAINING HARDWARE, APPROPRIATE PERSONAL PROTECTIVE EQUIPMENT AND NATIONAL ENVIRONMENTAL CONTROLS MUST BE STRICTLY ADHERED TO FOR HANDLING ASBESTOS-CONTAINING HARDWARE.

1. General. Maintenance of the actuator lines consists of Removal/Installation. When performing maintenance on the actuator lines use the following procedures.

2. Removal/Installation. (See 73-00, figure 2.)

WARNING: ASBESTOS

THE FOLLOWING PROCEDURE MAY INVOLVE A PART THAT CONTAINS ASBESTOS, WHICH IS HIGHLY TOXIC TO SKIN, EYES, AND RESPIRATORY TRACT. READ GENERAL INFORMATION BEFORE PROCEEDING, AND ADHERE TO ALL SITE SAFETY AND ENVIRONMENTAL CONTROLS CONCERNING ASBESTOS. OTHERWISE, PERSONAL INJURY MAY RESULT.

A. Removal.

(1) Disconnect the attaching hose clamps (6) at the 3, 9, 11 and 12 o'clock positions.

(2) Loosen the coupling nuts (7, 8) at the control and the coupling nuts (2, 3, 37) at the actuators and remove the actuator lines (4).

NOTE: On acutator systems equipped with drain lines, remove the drain lines.

WARNING: ASBESTOS

THE FOLLOWING PROCEDURE MAY INVOLVE A PART THAT CONTAINS ASBESTOS, WHICH IS HIGHLY TOXIC TO SKIN, EYES, AND RESPIRATORY TRACT. READ GENERAL INFORMATION BEFORE PROCEEDING, AND ADHERE TO ALL SITE SAFETY AND ENVIRONMENTAL CONTROLS CONCERNING ASBESTOS. OTHERWISE, PERSONAL INJURY MAY RESULT.

B. Installation.

(1) Install the fuel hose between the forward port (3) on the actuator and the fitting (7) on the fuel control. Torque the coupling nuts to 70-100 lb-in.

(2) Install the fuel hose between the aft port (37) on the actuator and the fitting (8) on the fuel control. Torque the coupling nuts to 100-130 lb-in.

(3) Install the fuel hose between the 2 forward ports of the actuators. Torque the coupling nuts to 70-100 lb-in.

(4) Install the fuel hose between the 2 aft ports of the actuators. Torque the coupling nuts to 100-130 lb-in.

NOTE: On actuator systems equipped with drain lines, install the drain lines and tighten the coupling nuts to standrad torque.

(5) Connect the hose clamps (6) at the 3, 9, 11 and 12 o'clock positions. Torque the clamp bolts to 24-27 lb-in.

3. Inspection/Check. Inspect the actuator lines per 72-02-1.