APS 85-5004-101

OPERATION AND MAINTENANCE INSTRUCTIONS

FOR

MJ-1-1

TEST STAND AIRCRAFT HYDRAULIC SYSTEM

DIESEL ENGINE DRIVEN

PART NUMBER 10023-10

NSN 4920-01-226-8989

APS SYSTEMS (FSCM 60984)
130 CLARA ST
PORT HUENEME, CALIF. 93041
F41608-86-C-0001

1 SEPTEMBER 1986

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SECTION I

INTRODUCTION AND GENERAL INFORMATION

1-1. INTRODUCTION. This publication is the basic manual of Operation and Maintenance Instructions for the MJ-1 Aircraft Hydraulic System Test Stand, Diesel Engine Driven, manufactured by APS Systems, Port Hueneme, CA 93041 (FSCM 60984). The Aircraft Hydraulic System Test Stand will be referred to as Test Stand throughout this manual.

1-2. SCOPE OF MANUAL. This manual is divided into eight sections as follows:

a. Section I, Introduction and General Information. Contains the information pertaining to the scope of the manual, and a simplified description of the equipment.

b. Section II, Tools and Test Equipment. Contains the list of tools and test equipment required to operate and maintain the Test Stand.

c. Section III, Preparation for Use and Shipment. Contains the instructions for set-up and check-out prior to operation and to prepare the unit for shipment.

d. Section IV, Operation Instructions. Contains the theory of operation and detailed instructions for operating the Test Stand.

e. Section V, Maintenance Instructions. Contains inspection, maintenance, troubleshooting, repair, disassembly, cleaning, assembly and testing instuctions.

f. Section VI, Diagrams. Contains the electrical and hydraulic diagrams required to operate and maintain the Test Stand.

1-3. RELATED PUBLICATIONS.

a. Detroit Diesel series 53 operators manual.

1-4. PURPOSE OF EQUIPMENT. The Test Stand (See Figure 1-1) is a trailer mounted mobile testing unit, for rapidly and accurately determining the performance and operating characteristics of aircraft hydraulic systems. The Test Stand incorporates systems to perform the following test and service operations without the necessity of starting the aircraft engines.

a. Test function and operation of aircraft hydraulic systems components.

b. Test the aircraft systems for internal and external leakages.

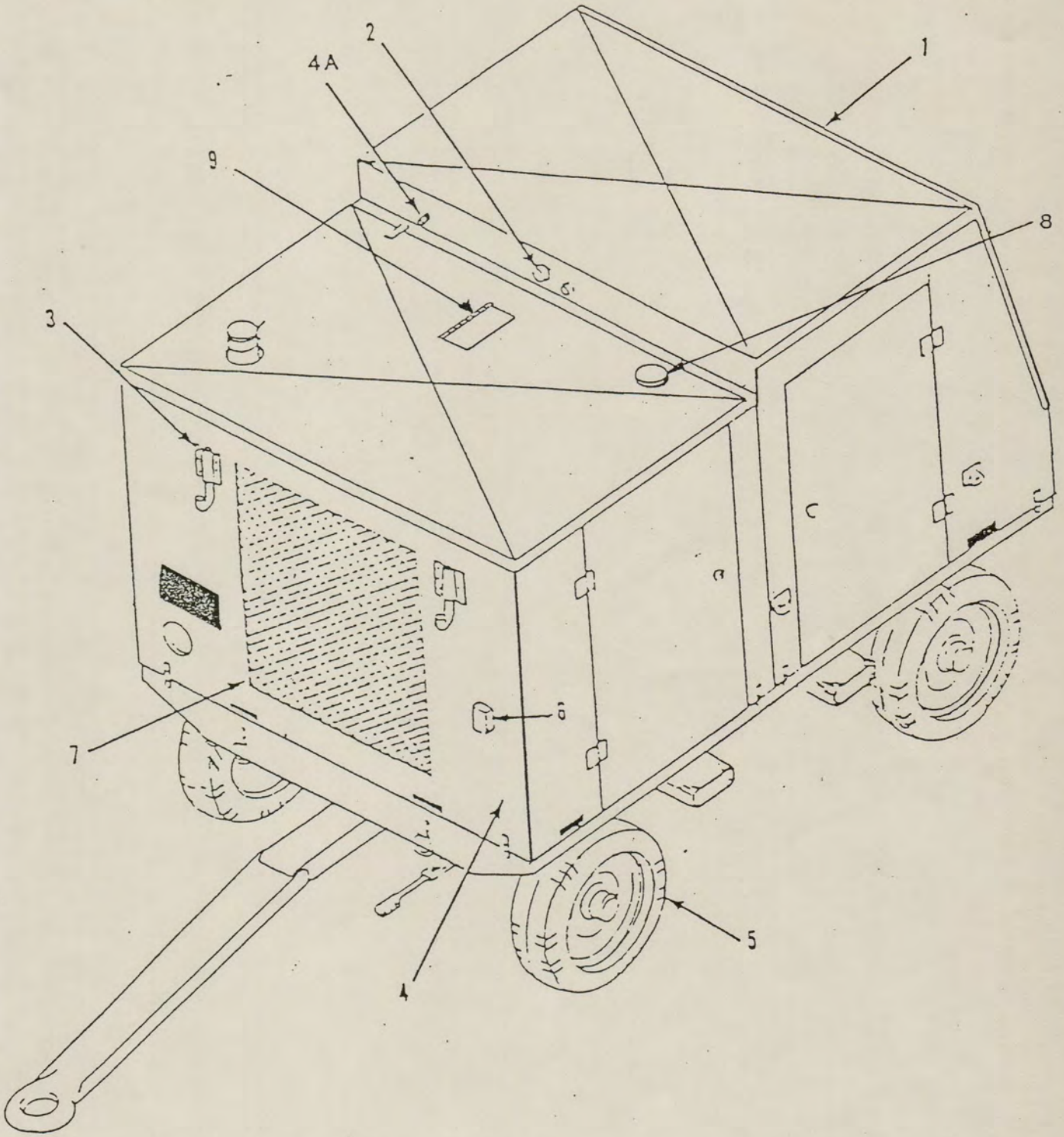
c. Drain, flush, and refill the aircraft hydraulic systems with micronically-filtered hydraulic fluid.

d. Bleed air from aircraft hydraulic systems.

1-5. GENERAL DESCRIPTION.

NOTE

The terms"left side" and "right side" as used below are as viewed from the control panel at the rear of the test stand facing towards the towbar at the front.



1. Controls and Instruments
2. Test Connections
3. Hose Retainer Hooks
4. Housing
4A. Air Outlet
5. Trailer
6. Runaround Block
7. Air Inlet Panel
8. Reservoir Access Door
9. Radiator Access Door

Figure 1-1. Aircraft Hydraulic System Test Stand, Diesel Engine Driven, Type MJ-1

1-6. Operator's controls and instruments (1, Figure 1-1) are located at the rear of the Test Stand. External test connections (2) are located on top of the Test Stand to the rear of the control panel. Hoses are supplied with the Test Stand for connection to the aircraft. Hose retainer hooks (3) are provided on the front of Test Stand to store the hoses. Run around connections (6) are provided at the front of the unit to allow checkout without connecting to an aircraft.

1-7. The Test Stand operating components, including the control panels, are enclosed in a steel, weather-resistant housing (4), mounted on a four wheel trailer (5), capable of being towed by a vehicle at speeds up to 20 miles per hour. Hand-operated, mechanical-type parking brakes which act upon the rear wheels, hold the Test Stand in a fixed position while in operation or when parked on a grade. The unit may be fork lifted by inserting fork lift under the frame at market channels. The major components and systems of the Test Stand are as follows: trailer and running gear, housings, diesel engine, gearbox, main hydraulic pump, oil cooler, fill pump, and bleed system, fuel reservoir, hydralic reservoir, hydraulic filters, instruments and controls and the electrical system.

1-8. DETAILED DESCRIPTION.

1-9. TRAILER AND RUNNING GEAR ASSEMBLY. The trailer frame (1, Figure 1-2) is of welded steel construction. The trailer rolls easily on four steel wheels equipped with 6.(0 x 9.00 inch, 6 ply tires. Individual leaf springs for each wheel give the Test Stand good cushioning against road shocks and rough terrain, protecting the components of the Test Stand. A hinged towbar (2) permits ease of positioning of the conventional type with steering knuckles, tie roads, and king pins. A hand lever (3) sets the rear wheel brakes, holding the Test Stand in a fixed position during test operation or in parking on a grade. Two tie-down rings (4) are provided on both the front and rear of the trailer frame to permit tiedown of the Test Stand for storage or shipment.

1-10. HOUSING. (4, Figure 1-1) Hinged doors on the sides of the cabinet permit access to all internal components. A hinged instrument panel cover protects the controls when the Test Stand is not in use. A screened air inlet panel (7) is provided for both radiators. A reservoir access door (8) is installed for servicing the reservoir and radiator access in provided by door (9).

1-11. DIESEL ENGINE. (24, Figure 1-2) A 4 cylinder in-line Detroit Diesel engine, from the Series 53N family provides power for test stand operation. The engine is mounted on a base attached to the test stand frame assembly. Power is transmitted from the engine to the gearbox and from the gearbox to the hydraulic pump.

1-12. MAIN HYDRAULIC PUMP . (25, Figure 1-2). The main hydraulic pump supplies fluid at high pressure for testing of aircraft hydraulic systems. The pump consists of a high pressure pump section and integral boost pump section. The pump contains a manual volume control (13) for varying the output volume and a compensator control (14) to regulate the output volume by changing the stroke length of the pumping pistons. Change in piston stroke length is controlled by system pressure so that when the pump is operating at a pressure less than the maxium setting of the compensator control, the pump delivers full volume. When the system pressure reaches the compensator control setting, the pump output is automatically reduced to the amount of flow required to maintain this pressure throughout the systems. The compensator control provides and adjustable range of 500 to 5000 psig with flow varying to 35 gpm maximum. The volume control permits regulation of maximum volume output by limiting the angle of a cam plate through a hydraulic piston within the pump. The return line for the test system also includes a flowmeter (2) to monitor fluid flow.

The flowmeter (26) is a transparent tube type equipped with a metal float. The flowmeter scale is calibrated for 3 to 35 gpm of hydraulic oil at 100 degrees F. A calibration curve is mounted on the control and instrument panel access door. This calibration curve is used for converting flowmeter indications at fluid temperatures other than 100 degrees F.

KEY TO FIGURE 1-2

1. Trailer and Running Gear Assembly
2. Hinged Towbar
3. Hand Lever
4. Tie Down Rings
5. Oil Cooler Radiator
6. Bleed Valve
7. Radiator (Water)
8. Level Indicator
9. HP Filter
10. LP Filter
11. Fill Pump
12. Filter

13. Reservoir
14. Filler
15. Cover
16. Diesel Engine
17. Main Pump
18. Flowmeter
19. Selector Valve

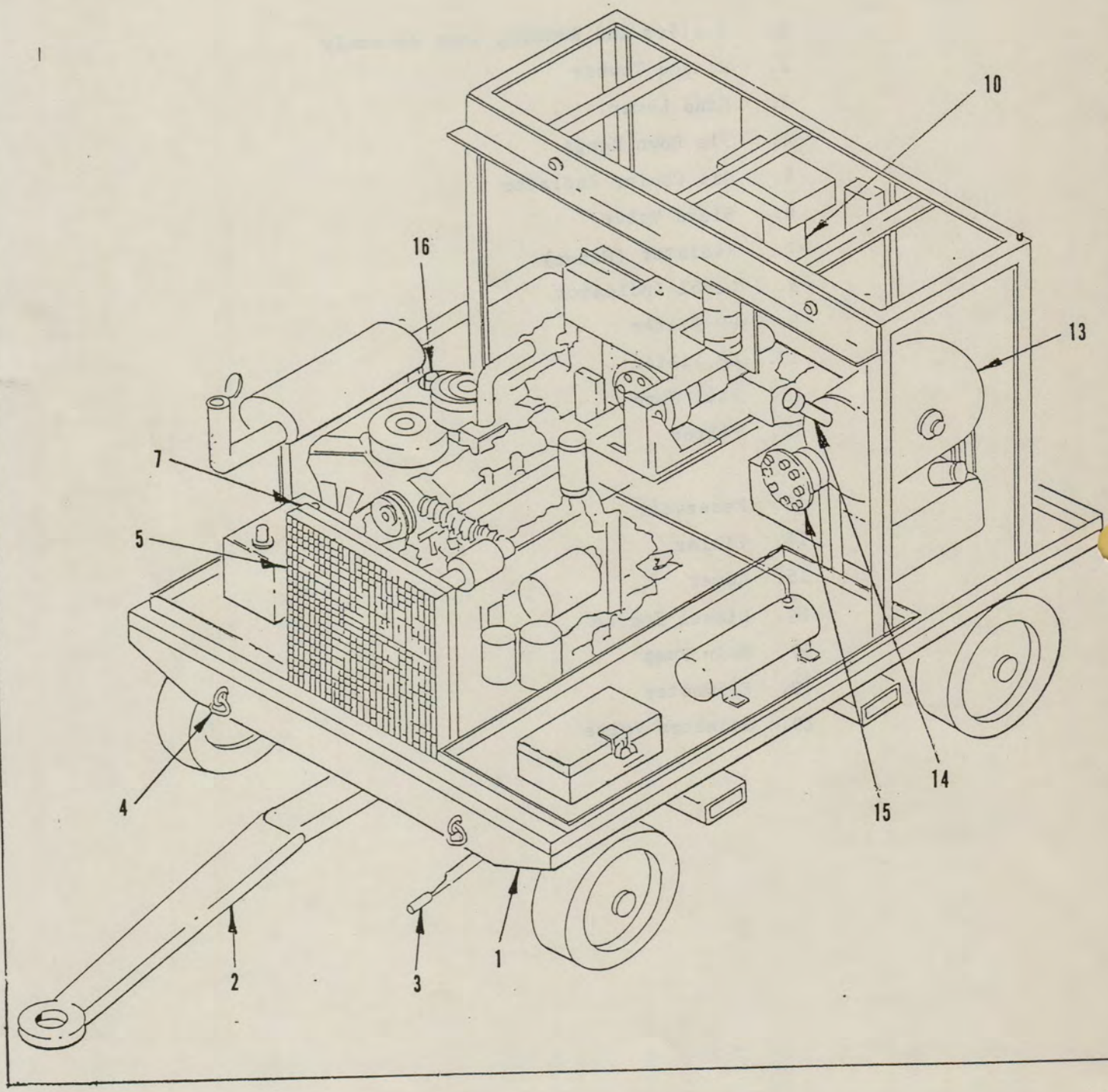


Figure 1-2. Major Components. (Sheet 1 of 2)

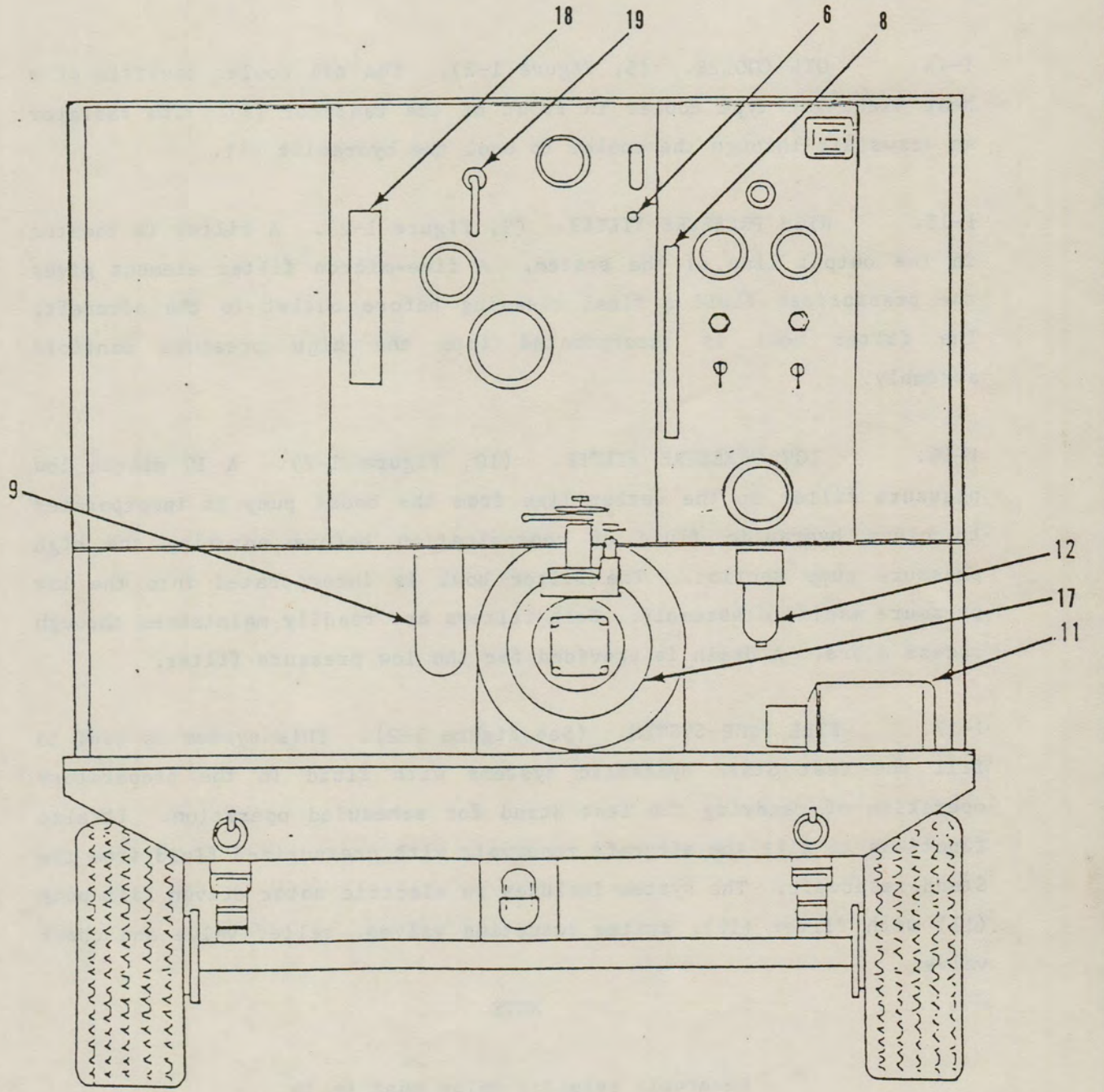


Figure 1-2. Major Components, Rear View. (Sheet 2 of 2)

1-13. HYDRAULIC FLUID RESERVOIR. (13, Figure 1-2). The pressurized reservoir is designed to supply fluid to the systems during operation in "Stand" position of the reservoir selector valve (19) and to supply fluid to the fill systems. A filler neck (14) and cleanout cover (15) is located on the end of the reservoir allowing manual filling. A fluid level indicator (8) of the sight glass type is also provided on the control panel.

1-14. OIL COOLER. (5, Figure 1-2). The oil cooler consists of a heat exchanger type cooler in front of the radiator (7). The radiator an draws air through the cooler to cool the hydraulic oil.

1-15. HIGH PRESSURE FILTER. (9, Figure 1-2). A filter is located in the output line of the system. A five-micron filter element gives the pressurized fluid a final cleaning before outlet to the aircraft. The filter bowl is incorporated into the high pressure manifold assembly.

1-16. LOW PRESSURE FILTER. (10, Figure 1-2). A 10 micron low pressure filter in the outlet line from the boost pump is incorporated to clean hydraulic fluid of contamination before entering the high pressure pump section. The filter bowl is incorporated into the low pressure manifold assembly. Both filters are readily maintained through access doors. A drain is provided for the low pressure filter.

1-17. FILL PUMP SYSTEM. (See Figure 1-2). This system is used to fill the Test Stand hydraulic systems with fluid in the preparatory operation of readying the Test Stand for scheduled operation. It also functions to fill the aircraft reservoir with pressurized fluid from the Stand reservoir. The system includes an electric motor driven fill pump (11) with filter (12), system actuating valves, relief valve and check valve.

NOTE

Reservoir selector valve must be in "Aircraft" reservoir position when performing filling operating

1-18. BLEED SYSTEM. (See Figure 1-2). The Test Stand hydraulic system incorporates a pushbutton bleed valve (6) to bleed air from the system. Air and oil is bled from the low pressure filter (10) in the system and routed to the reservoir (13). The bleed system is incorporated into the low pressure manifold assembly.

1-19. PROTECTIVE DEVICES AND INSTRUMENTATION. Protective devices and instrumentation are provided as follows:

a. Relief valve (10, Figure 6-1) in the low pressure section protects the oil cooler (6) and flowmeter (1) from over pressurization.

b. Thermoswitch (11) in the high pressure pump inlet circuit actuates to sound a warning horn when the fluid temperature reaches 160-170 degrees F.

c. Low pressure switch (17) protects the high pressure pump against cavitation due to low inlet pressure or boost pump failure. If the pressure drops below 40 psig, the horn will sound.

d. Check valve (10) allows fluid to bypass the boost pump in the event of pump failure, preventing fluid starvation of high pressure pump.

e. Differential pressure switch (23) across high pressure filter ports illuminates a red warning light on the control panel to indicate clogged filter element. A duplex gage (15) across the fill system filter (35) monitors inlet and outlet pressures at all times. Low pressure filter is monitored with selector valve (25) positions of boost pump outlet and HP pump inlet.

f. Check valve (14, 34) are located in the hydraulic lines to prevent any back flow between hydraulic circuits.

g. Relief valves (40) protects the air receiver (38) and the aircraft reservoir respectively from overpressurization by the air compressor (37).

h. Circuit breakers (Figure 6-2) are provided for overload protection of various circuits.

i. Low engine oil pressure switch sounds warning horn.

j. High water temperature switch sounds warning horn.

k. Low fuel level switch in fuel tank sounds warning horn.

l. Complete instrumentation and controls are located on the control panels. Refer to Section IV for description of function and location of all controls.

1-20 ELECTRICAL SYSTEM. (See Figure 6-2). The Electrical system provides the circuits and controls for Test Stand functioning of electrical components. The electrical system's controls are mounted on the inside of the upper front outlet panel at the front of the Test Stand, with a hinged access door to permit facility of maintenance and inspection. Two 24-vdc batteries connected in parallel provide power for test stand engine starting and operation of the fill system motor. The ignition switch turns on the ignition and the start button cranks over the diesel. A Tachometer/Hourmeter is mounted on the instrument panel to record engine speed and Test Stand operating hours. A warning horn (AH1) provides audible warning in the event of high fluid temperatures low boost pressure in either system and in the event of low engine oil pressure, high temperature and low fuel level. A single switch (33) is provided on the auxiliary control panel to turn on panel lights and the lights at the back of the Test Stand (PL3 thru PL5).

1-21. ENGINE. The engine is a four cylinder Detroit Diesel Engine of the 53N Series which generates 125 hp at 2500 rpm. The engine provides power for operating the high-pressure pump. Panel controls include a manual THROTTLE control, engine START switch, and ENGINE SHUTDOWN control. Panel indicators include a Tachometer/hourmeter, Oil pressure gage indicator, Ammeter gage, Oil temperature gage, and Water temperature gage. Pulling the handle of the ENGINE SHUTDOWN control,

mechanically linked to the fuel injector system, fully closes the fuel injectors, starving the engine of fuel at each cylinder.

Accessories to the engine include a governor, an oil-bath type air cleaner, a cooling system, a fuel tank, and a gearbox.

a. Governor. The governor is a constant speed, rotary drive type. It is set for a maximum no-load speed of 2650 rpm and full-load speed of 2500 rpm. Idle is set for 550 rpm.

b. Cooling System. The cooling system has an 11 gallon capacity. The system has a filler port, a temperature gage, and an over temperature switch.

c. Fuel Tank. The fuel tank has a 24 gallon capacity. The tank is fitted with external filler port, a drain plug, a fuel level transmitter, and a low level switch.

d. Gearbox. The gearbox is connected to the engine drive shaft and the hydraulic pump is connected to the gear box.

1-22. TABLE OF LEADING PARTICULARS. Refer to Table 1-1 for the table of leading particulars.

1-23. CONSUMABLE MATERIAL LIST. Refer to table 1-2 for the list of consumable materials required to operate, service and maintain the test stand.

Table 1-1. Leading Particulars

CAPABILITIES	
Temperature Conditions	
Operating	-40 degrees F to +125 degrees F.
Storage	-65 degrees F to +160 degrees F.
Relative Humidity	100 percent
Inclination	8-1/2 degrees maximum in any direction from horizontal operating plane.
HYDRAULIC SYSTEMS	
Fluid Reservoir	
Capacity (at incline of 8-1/2 degrees) .	18 Useable U.S. Gallons
Material	Stainless steel
Hydraulic Fluid	MIL-H-5606
Hydraulic Pump	
Type	High-pressure, axial-position, variable-stroke, pressure compensated with intergral low pressure boost section
Capacity	0-35 gpm up to 3000 psig 0-15 gpm up to 5000 psig

Table 1-1. Leading Particulars - Continued

Discharge pressure	3000 ± 50 psig when delivering 35 gpm with zero flow pressure setting at 3000 psig
Boost pump capacity	40 gpm at 200 psig
Fill Pump	
Type	Motor driven internal gear
Capacity	2 gpm at 150 psig
High Pressure Filter	
Rating	35 gpm at 5000 psig
Size of element	5 micron
Specification	MIL-F-27656
Low Pressure Filter	
Low Pressure Filter Element	10 micron, two element filter AN 6236-3
Fill/Filter Element	10 micron, single element filter AN6235-4A
Oil Cooler	
Type	Air-to-oil, fan cooled
Drive Unit	
Engine	125 hp at 2500 rpm, 4 cylinder in-line, 24 vdc electrical system

Crankcase Capacity	11 quarts
Cooling Capacity	11 gallons
Main Gearbox Capacity	2 quarts lubricant
Lubrication	
Running Gear (Wheel Bearings)	MIL-G-10924
Miscellaneous (Door Hinges, Steering and Braking Mechanism)	MIL-L-15016A
Gearbox	SAE 90 wt. MIL-L-2104 or MIL-10295
Trailer and Cabinet	
Construction	Welded steel
Wheels	Four pneumatic tires, 6.9 x 9 inch
Springs	Leaf type
Brake	Hand operated, mechanical type on rear wheels
Steering	Knuckle type on front wh with towbar and pintle h

Table 1-1. Leading Particulars - Continued

Cabinet	Metal enclosure with access panels; hinged doors; hose storage; weather-resistant properties
Physical Data	
Dimensions (Approximate)	
Length	108 inches
Width	70½ inches
Height	74 inches
Weight (dry)	4900 pounds

Table 1-2. Consumable Materials

Nomenclature	Part Number
Adhesive (stud-lock)	Loctite Corp. Cat. No. 73-31
Agent, degreasing	MIL-D-12491
Compound, corrosion-preventive	MIL-C-6529A
Compound, silicone	MIL-S-8660
Desiccant, activated	MIL-D-3464
Fluid, hydraulic	MIL-H-5606 or MIL-H-83282
Fuel, Diesel	VV-F-800 or MIL-F-5624 (RP-5), MIL-F-5624 (JP4 or JP5)
Glue, Epxoy	Devcon 5 Minute Epoxy Devcon Corp. Danvers, MA 01923
Grease	MIL-G-18790
Grease, automotive	MIL-G-10924
Lubricant	MIL-L-2105 or MIL-L-10324
Oil, Engine	MIL-L-2104 or MIL-L-10295
Paint, external enamel	MIL-STD-808, Code No. DG
Paint, exterior enamel Hydraulic control panel	STD-595, color 31136 (Red)
Paint, interior enamel	MIL-STD-808, Code No. LG
Paint, pre-treat	MIL-C-15328
Paint, primer, epoxy	MIL-P-23377
Paint, primer, zinc chromate	MIL-P-6889
Paper, emery	P-P-105
Powder, lapping	MIL-L-17862
Preservative	MIL-H-6083
Element, engine oil filter	PF911
element, engine fuel filters	TP928 (SEC) & TP936 (PRI)
Element, fill system filter	AN6235-4A

Table 1-2. Consumable Materials - Continued

Nomenclature	Part Number
Element, boost system filter	AN6236-3
Element, high-pressure filter	MIL-F-27656
Sealant	VC-3
Solvent, cleaning	P-D-680, Type II
Solvent, mineral spirits	MIL-C-12491
Tape, water resistant, pressure sensitive	PPD-T-60
Tape, teflon	MIL-T-22730
Solder	QQ-S-571
Lubricant, gearbox	SAE 30 wt., MIL-L-2104 or MIL-10295
Preservative, crankcase & fuel tank	MIL-L-21260

SECTION II

SPECIAL TOOLS AND TEST EQUIPMENT

2-1. SPECIAL TOOLS AND TEST EQUIPMENT. There are no special tools or testing equipment required for the installation, maintenance and testing of the MJ-1 Test Stand.

SECTION III

PREPARATION FOR USE AND SHIPMENT

3-1. INTRODUCTION. The information contained in this section describes the installation functional testing, adjustment, and procedures necessary to prepare the MJ-1 for use. Also, included, are procedure for removal of the test stand if required.

NOTE

Refer to the troubleshooting information given in Section V if an abnormal indication is obtained while testing the system for operation.

3-2. PREPARATION FOR USE.

3-3. UNPACKING AND INSTALLATION. The Test Stand is shipped completely assembled on fully inflated tires and requires no major assembly of components prior to preparing the Stand for use other than the following procedures:

a. Strip the waterproof tape from seams, doors and other openings of the cabinet, and strip masking tape from all glass gage faces.

b. Open all cabinet doors and thoroughly inspect interior of the Test Stand to remove all extraneous packing or cushioning material used to protect internal components during shipment. Small areas of normally exposed metal surfaces may be wrapped with protective covering or tape during shipment. Be certain all such coverings are removed.

3-4. INITIAL INSPECTION. It is important to carefully inspect the complete Test Stand for possible damage which may have occured during shipment. The following initial inspection procedures are recommended:

a. Check the data apprearing on the Test Stand nameplates to verify it is the type of unit designated in paragraph 1-1 of this manual. If there is any doubt, do not attmpt to operate the Test Stand in accordance with the instructions contained in this manual.

b. Remove the hose assemblies from the top of the Test Stand. Inspect the hose assemblies carefully for evidence of damage, breaks or loose fittings.

WARNING

The output hose assemblies are subjected to extremely high pressure. Repair any defective hose assembly before using the hose assembly during operation of the Test Stand.

c. Open the control and instrument panel access door. Inspect all gages, indicators, and controls for evidence of shipping damage. Check that all parts are securely mounted. Check that all manually operated switches and controls operate freely.

d. Open access doors. Inspect the plumbing installation for damaged tube assemblies, fittings and hose assemblies. Check that all fittings are securely connected and hoses are not deteriorated.

e. Carefully inspect the electrical wiring for broken wires or frayed insulation. Check that all electrical connections are secure.

f. Inspect engine for evidence of shipping damage. Check that engine mounting bolts are securely tightened.

g. Inspect fuel tank and hydraulic reservoir for evidence of physical damage. Check fuel system carefully for evidence of leakage.

h. Check tires for proper inflated pressure. Normal tire pressure should be 60 pounds with tires cold. Inspect tire treads and casing for cuts or abrasions and remove any inbeded objects from treads.

i. Check the tow and steering assemblies. Make certain that tie rods have not been bent or damaged and that the steering apparatus swings freely.

j. Check hand brake assembly be setting the hand brake and testing rear wheels for braking action.

k. Inspect the Test Stand trailer and cabinet for any damage, making certain that all bolts and screws are secured. Check doors and door latches for proper closing and locking.

3-5 SERVICING ENGINE

a. Servicing Engine After Temporary Storage (30 days or less) To service the engine after temporary storage, proceed as follows:

(1) Visually inspect engine to make certain all accessories are in place and securely mounted. Check electrical connections to engine.

(2) Remove all sealing materials from engine openings.

(3) Open fuel tank drain plug (located under fuel tank and drain until water-free fuel is evident. Close drain cock

(4) Check level of diesel fuel in fuel tank (fuel level gage located on control panel) and, if necessary, add diesel fuel (MIL-L-5624 or equivalent).

(5) Check level of lubricating oil in crankcase. Add lubricating oil (MIL-L-2014) to bring oil level to FULL mark on dipstick. Use grade 30 above 0°C (32°F) or grade 10 below 0°C (+32°F).

b. Servicing Engine After Long-term Storage (30 days or more). To service the engine after long-term storage, proceed as follows:

(1) Visually inspect engine to make certain all accessories are in place and securely mounted. Check electrical connections to engine.

(2) Remove all sealing material from engine openings, fuel tank, electrical equipment, and exhaust outlet.

WARNING

Use cleaning solvents, P-D-680, Type II, in a well ventilated area. Do not inhale solvent vapor or allow solvent to contact skin. Keep solvent away from open flame. Failure to comply may result in injury to personnel.

(3) Remove rust preventative from external surfaces of engine with solvent Federal Specification P-D-680, Type II, or equivalent.

(4) Remove paper strips from between pulleys and belts.

(5) Remove crankcase drain plug and drain preservative oil into suitable container.

(6) Replace crankcase drain plug and torque 25 - 35 ft-lbs. Fill crankcase with 11 quarts (plus 2 quarts if new oil filter is installed) of lubricating oil MIL-L-2104.

(7) Open fuel tank drain plug (located under fuel tank) and drain until water-free fuel is evident. Close drain cock.

(8) Fill the fuel tank with diesel fuel.

(9) Fill engine cooling system with 11 gallons of mixture of 50 percent distilled water and 50 percent coolant O-A-548.

NOTE

If engine will be exposed to freezing temperatures, check cooling system specifications and add coolant O-A-548 in accordance with manufacturer's specifications.

c. Servicing Hydraulic System. Service the hydraulic system, prior to use, as follows:

WARNING

Depressurize hydraulic system prior to servicing. Failure to comply may result in injury to personnel.

(1) Check hydraulic fluid reservoir for preservative fluid. If present, remove outlet cap and open reservoir drain drain valve and drain reservoir. Close drain valve and replace outlet cap.

(2) Remove drain plugs at boost pump system filter and drain preservative fluid (if necessary). Replace plugs.

(3) Remove cap on filler neck and fill test stand reservoir with hydraulic fluid MIL-H-5606, or MIL-H-82382, until reservoir level indicator indicates 3/4 to 7/8 full. Set system power to OFF position.

d. Servicing Batteries. Two 24-vdc storage batteries connected in parallel are furnished with the test stand and in located in battery compartment.

WARNING

When handling batteries, use face shield or goggles, rubber gloves and apron.

(1) Remove battery compartment cover. Disconnect and remove batteries.

(2) Check electrolyte level. Fill battery cells with distilled water to level indicated or approximately 3/8 inch over battery plates.

(3) Charge each battery using a 24-vdc battery charger at a rate of approximately 2-1/4 amperes for at least 18 hours. Check each cell, using a hydrometer, for a specific gravity reading of 1.275 to 1.285.

(4) Install and connect batteries.

e. Servicing Gearbox. Remove drain plug from gearbox to allow corrosion-preventive compound, if present, to drain out. Replace drain plug and fill gearbox with two guarts of lubricant.

3-6. PRELIMINARY LUBRICATION. Carefully inspect the Test Stand lubricating points referred to in Figure 3-1. Be sure the initial lubrication exists at all specified points.

3-7. PREPARATION FOR STORAGE. Prepare the Test Stand for storage as follows:

a. Drain the reservoir (13, Figure 1-2) by opening the reservoir drain valves. Make certain drain valves are closed after reservoir has been completely drained.

b. Drain hydraulic fluid from the hydraulic system at the low pressure filter drain (10, Figure 1-2). When completely drained, replace drain cap.

c. Drain the fluid from the high pressure pump, (9, Figure 1-2) by removing the drain plug located in the bottom of the pump case. When completely drained, replace plug. Refill pump case with MIL-H-6083A.

d. Fill the Test Stand reservoir at the filler neck with preservative fluid specifications MIL-H-6083A, until the reservoir level gage indicates 7/8 full.

e. Operate Test Stand (Section IV) for approximately 10 minutes. Operate system fill valves to fill each hydraulic system with preservative oil.

f. Drain fuel reservoir by opening reservoir drain valve. Make certain drain valve is closed after reservoir has been completely drained.

g. Place serveral bags of activated desiccant MIL-D-3464 inside Test Stand cabinet and near electrical components

h. Fasten doors and latches securely; tape seams and openings with pressure-sensitive, water resistant tape, Specification PPP-T-60.

j. Secure hoses on retainer hooks. Be sure all external hydraulic connections are capped.

3-8. PREPARATION FOR SHIPMENT. The Test Stand does not require an external packing container. For shipment, prepare the Test Stand in the same way as for storage, paragraph 3-7, steps at through j.

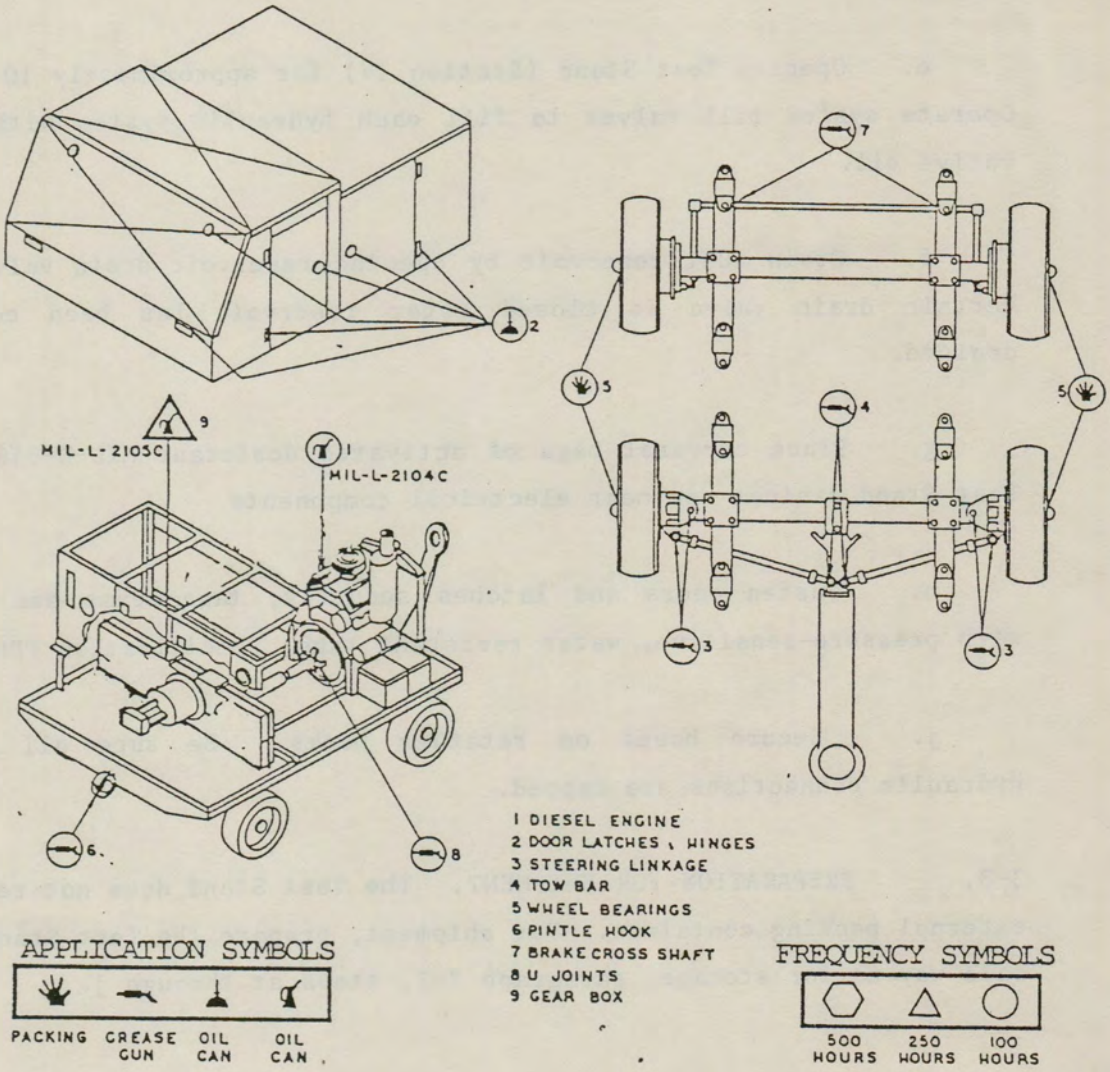


Figure 3-1. Lubrication Chart

Part Number	Figure and Index	Part Number	Figure and Index	Part Number	Figure and Index
	22	916-166	29-36		
8223746-1	24-48	916-484Z	29-35		
8223747-1	40-21	923-10A	18-6		
8223748-1	40-17	973157	23-2		
8223749-1	40-16	974152	6-7		
8223750-1	10-10	674253	23-11		
8223751-1	10-21	984079	32-5		
8223752-1	10-16				
8223753-1	10-1				
8223754-1	10-6				
8223755-1	10-25				
8223756-1	10-23				
8223758-1	10-9				
8223759-1	3-29				
	9				
8223760-1	4-7				
8223762-1	24-30				
8223769-1	15-70				
8223770-1	31-8				
	33				
8223771-1	31-12				
	38				
8223773-1	3-19				
	8				
8223774-1	3-41				
	10				
8223777-1	2-4				
8223780-1	15-67				
8223782-1	27-3				
8223782-2	27-4				
8223783-1	27-25				
	29				
8223784-1	27-17				
	28				
8223785-1	27-10				
8223787-1	27-7				
8223788-1	27-13				
8223789-1	27-14				
8223790-1	30-3				
8223793-1	27-28				
8223795-1	24-5				
8225	41-25				
85916-1A	38-24				
85920-52A	38-15				
85920-54A	38-6				
874-N5	24-17				
890144	6-8				
	23-10				
89405-49A	38-1				
9-1887-1	28-28				
9-1891-1	29-27				

SECTION IV

OPERATION INSTRUCTIONS

4-1. GENERAL. This section provides theory of operation and operational procedures for the MJ-1 Test Stand. Operational procedures outlined in this section shall not contradict established technical orders of the aircraft and aircraft components being tested.

4-2. THEORY OF OPERATION.

4-3. WITH RESERVOIR SELECTOR VALVE IN "AIRCRAFT RESERVOIR" POSITION. The boost pump (2, Figure 6-1) draws fluid from the aircraft through the suction return port and flowmeter (1) into the boost pump. The output of the boost pump is passed through the cooler (6) and low pressure filter (7) to the suction side of the high pressure pump (13). The boost pump pressure is controlled by the boost relief valve (10). The output of the high pressure pump is passed through the high pressure check valve (34), the high pressure filter (22), the flow control valve (24), and the pressure out to the aircraft. The output pressure is controlled by the high pressure relief valve (31) and the compensator control on the high pressure pump. The output volume is regulated by the flow control valve (24) and the volume control on the high pressure pump.

4-4. WITH RESERVOIR SELECTOR VALVE IN "STAND RESERVOIR" POSITION. Boost pump (2) draws fluid from the Test Stand reservoir (27) and follows the same route as in paragraph 4-3. Fluid returing to the suction return port passes through the reservoir selector valve (32) into the Test Stand reservoir.

4-5. FILL AND BLEED SYSTEM. The fill and bleed system can be operated in either the fill or bleed mode. In the fill mode of operation, the fill pump motor (29) and pump (28) are engized by the fill

pump pushbutton (20). When the fill valve (30) is opened, the fill pump then draws fluid from the oil reservoir (27) and passes fluid through the fill pump filter (35) low pressure check valve (14) and the fill valve (30) to the hydraulic system.

In the bleed mode of operation, when the bleed valve (4) pushbutton is depressed, fluid flows from the low pressure filter (7) through the bleed valve (4) to the oil reservoir (27). The sight tube is a transparent tube that provides a means of checking the air bleed operation.

4-6. OPERATING CONTROLS AND INSTRUMENTS. All controls and instruments are indentified and described in Figures 4-1 thru 4-3 and Tables 4-1 thru 4-3.

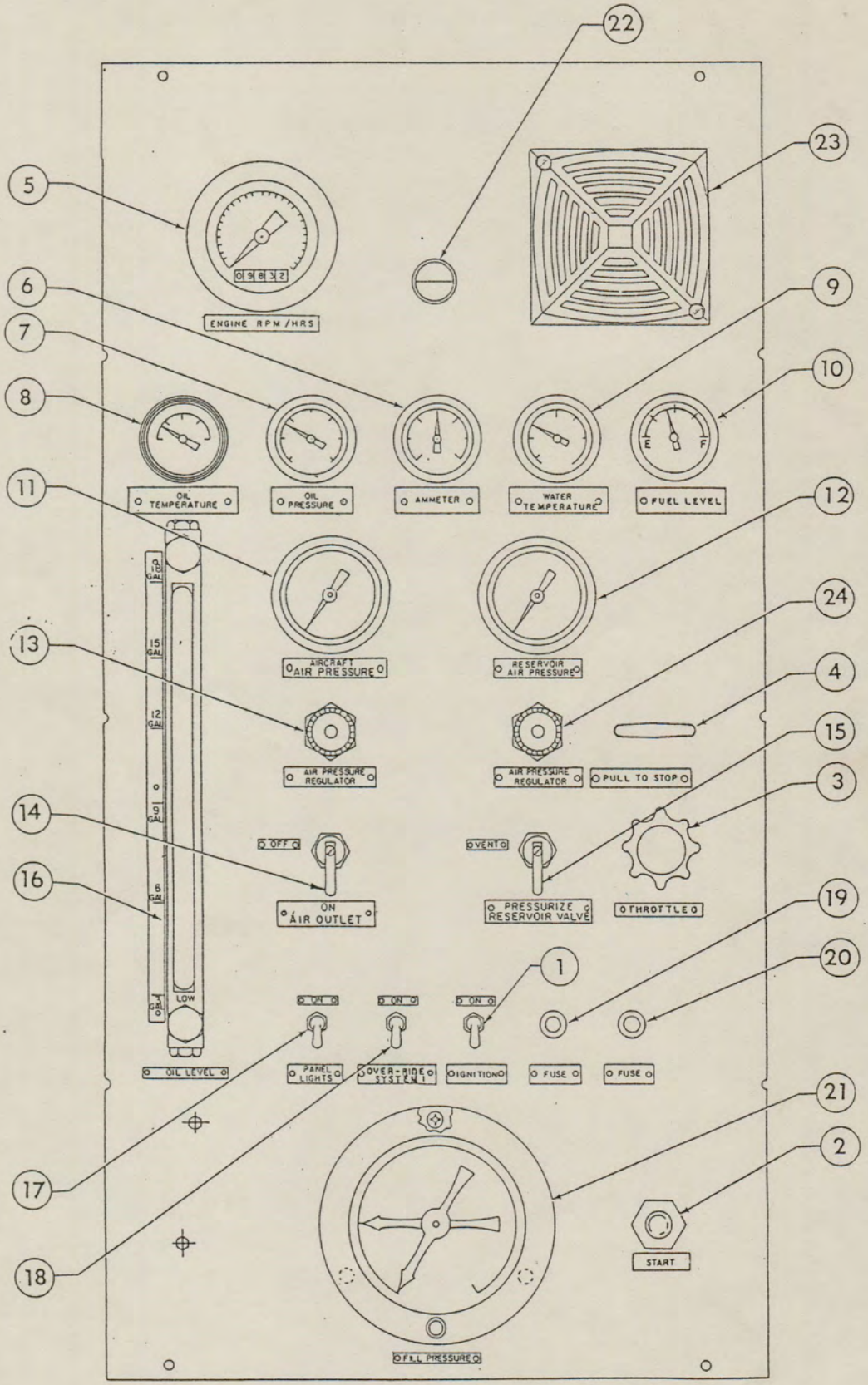


Figure 4-1. Auxiliary Panel

Table 4-1. Auxilary Panel Controls and Instruments

Index No Figure 4-1	Control or Instrument	Description & Location	Function or Operation
1	Ignition Switch	Off-On toggle type switch on panel	Energizes battery electrical system
2	Engine START Button	Push button on panel	Starts engine
3	THROTTLE Control	Pull handle on panel	Sets output speed of engine (Push throttle to decrease; pull to increase)
4	ENGINE SHUTDOWN Control	Pull handle on panel	Stops engine by cutting off fuel supply
5	TACHOMETER/HOUR METER	3-3,500 and 0-9,999 on panel	Indicates speed of engine in rpm and indicates total hours of engine operation
6	AMMETER Gage	60-0-60 gage on panel	Indicates charge and discharge of test stand batteries
7	OIL PRESSURE Gage	0-80 gage on panel	Indicates engine oil pressure
8	OIL TEMPERATURE Gage	0-320 gage on panel	Indicates engine oil temperature

Table 4-1. Auxilary Panel Controls and Instruments (Continued)

Index No Figure 4-1	Control or Instrument	Description & Location	Function or Operation
9	WATER TEMPERATURE Gage	0-265 gage on panel	Indicates temperature of water in engine coolant system
10	FUEL gage	0, 1/2, 4/4, full on panel	Indicates amount of fuel in fuel tank
11	AIRCRAFT AIR PRESSURE gage	0-160 psig gage on panel	Indicates air pressure at aircraft reservoir
12	RESERVOIR AIR PRESSURE gage	0-160 psig gage on panel	Indicates air pressure in Test Stand reservoir
13	AIR PRESSURE REGULATOR	Knob adjustment on panel	Adjusts air pressure output to aircraft reservoir
14	AIR OUTLET Selector Valve	Handle on panel	Air ON or OFF to aircraft reservoir
15	PRESSURE RESERVOIR VALVE (Vent)	Handle on panel	Selects air pressure to pressurize stand reservoir or vents air to atmosphere
16	RESERVOIR LEVEL Indicator	0 to gal on panel	Indicates level (amount) of fluid in Test Stand Reservoir.
17	PANEL LIGHTS ON Switch	Off-On toggle type switch	Turns panel illuminating lights on and off

Table 4-1. Auxilary Panel Controls and Instruments (Continued)

Index No Figure 4-1	Control or Instrument	Description & Location	Function or Operation
18	Overide	Switch on panel	Horn disable
19	CIRCUIT BREAKER	10 amps	Protects aux panel circuits
20	CB, FILL PUMP	35 amps	Protects fill pump motor
21	FILL SYSTEM gage	Duplex 0-200 psig on panel	Indicates pressure on both sides of fill system filter simultaneously. Difference indicates pressure drop across filter.
22	Panel Light	One clear incandescent	Illuminate control panel
23	WARNING HORN	On panel	Audio warning of malfunction
24	AIR PRESSURE REGULATOR	Knob adjustment on panel	Adjusts air pressure to reservoir

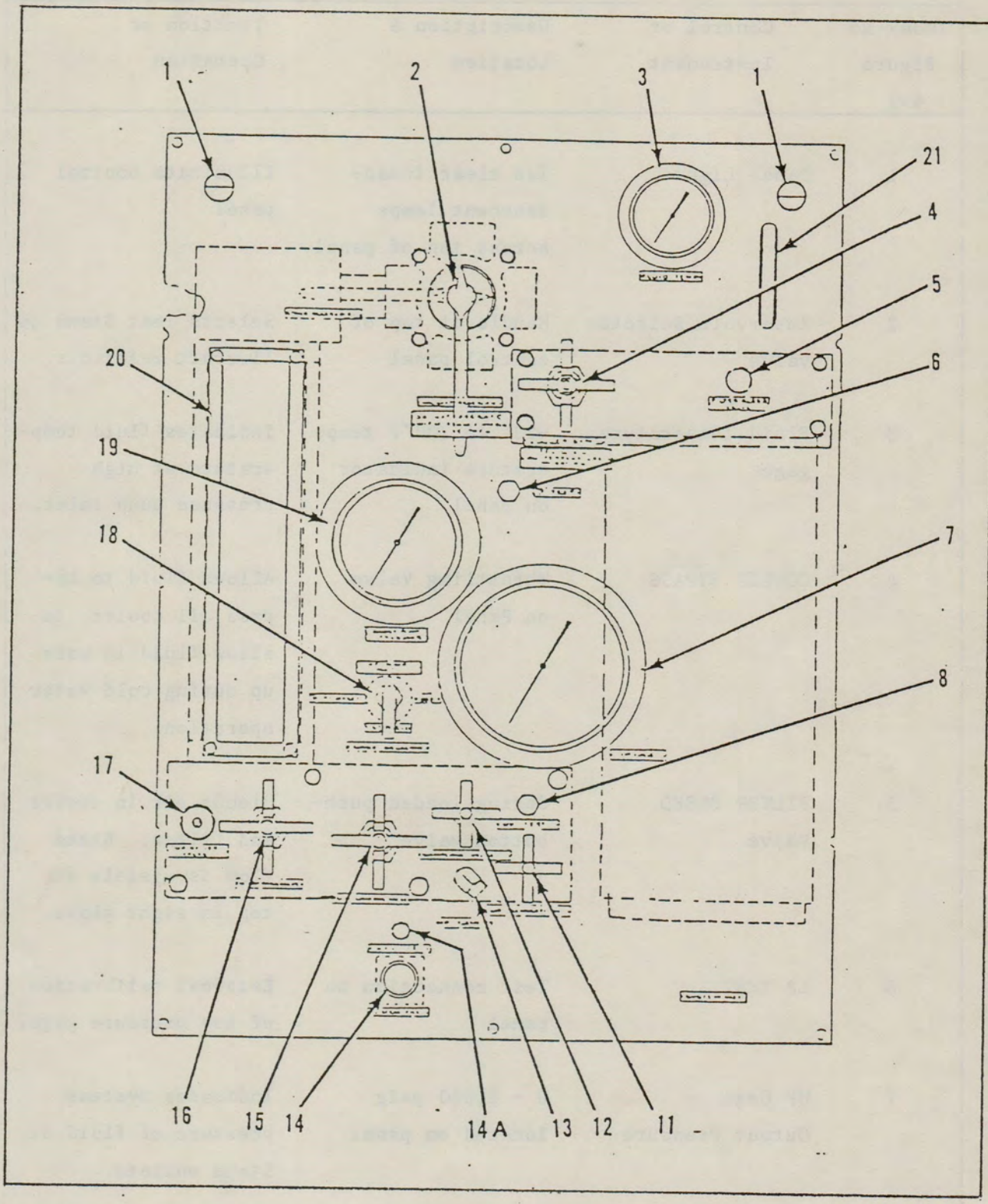


Figure 4-2. Hydraulic Panel Controls

Table 4-2. Hydraulic Control Panel and Instruments

Index No Figure 4-2	Control or Instrument	Description & Location	Function or Operation
1	Panel Lights	Two clear incandenscent lamps across top of panel	Illuminate control panel
2	Reservoir Selector valve	Handle at top of control panel	Selects Test Stand or Aircraft reservoir
3	Fluid Temperature gage	-20° to 200°F temperature indicator on panel	Indicates fluid temperature at high pressure pump inlet.
4	COOLER BYPASS	Throttling Valve on Panel	Allows fluid to bypass oil cooler, to allow fluid to warm up during cold water operation.
5	FILTER BLEED Valve	Spring loaded push-button valve	Bleeds air in cooler and filter. Bleed flow is visible at top in sight glass.
6	LP TEST	Test connection on panel	External calibration of low pressure gage.
7	HP Gage Output Pressure	0 - 6,000 psig located on panel	Indicates systems pressure of fluid at Stand outlets.
8	HP TEST	Test connection on panel	External calibration of high pressure gage

Table 4-2. Hydraulic Control Panel and Instruments - Continued

Index No Figure 4-2	Control or Instrument	Description & Location	Function or Operation
9	NOT USED		
10	NOT USED		
11	HP GAGE SHUTOFF valve	Needle type on panel	Isolates fluid pressure gage (7) from system outlets for positive reading and external calibration.
12	Fluid SAMPLING VALVE	Needle valve on panel	Permit taking sample of pressurized fluid at output if desired.
13	HP SAMPLE	Port on Panel	Allows taking of fluid samples.
14	SYSTEM FILL Valve	Valve on panel	Permits filling of system from reservoir.
14A	HP Filter Lamp	Red lamp on panel	Lights in event of high differential pressure accross high pressure filter.
15	FLOW CONTROL Valve	Plug type throttling valve on main control	Control flow of fluid to Test Stand outlets.
16	HP BY PASS Valve	Plug type throttling valve on main control panel	Bypasses fluid from pressure outlet to suction return line

Table 4-2. Hydraulic Control Panel and Instruments - Continued

Index No Figure 4-2	Control or Instrument	Description & Location	Function or Operation
17	HP RELIEF VALVE	Adjustable pilot-operated type with lock nut on panel	Selects pressure at which high pressure fluid is bypassed to suction return line.
18	GAGE SELECTOR Valve	4 way selector valve on panel	Selects pressure reading at boost pump outlet, HP pump inlet, suction return line (boost pump inlet) and OFF (used for calibration).
19	BOOST PUMP PRESSURE Gage	Compound gage; 0-30 in hg vacum 0-300 psig on panel	Indicates pressure at point selected by pressure selector valve (18).
20	Flowmeter	Tubular type; 0-35 gpm capacity; panel	Indicates the volume of fluid returning to the system(s) circuit.
21	Filter Bleed Sight Tube	Tubular type; on Panel	Indicates bleed oil flow past filter bleed valve

Table 4-3. Miscellaneous Controls

Index No Figure 4-3	Control or Instrument	Description & Location	Function or Operation
1	VOLUME CONTROL	Manual control on high pressure pump on lower sub-panel	Regulates maximum pressure fluid from 0-35 gpm.
2	PRESSURE CONTROL (Compensator)	Screw shaft adjustment on high pressure pump on low sub-panel.	Maintains contant pressure in hydraulic system as delivered by pump
3	HAND BRAKE	Hand lever operated brake system, at front lower right hand corner.	Operates brake on rear wheels, when stand in no in use
4	Air Connection	To aircraft, behind auxiliary panel	Provides air to pressuring aircraft reservoir
5	Hydraulic Connector	To aircraft, behind main control panels	To provide return port from aircraft hydraulic system under test-System No. 1.
6	Hydraulic Connector	To aircraft, behind control panel	To provide pressure port to aircraft hydraulic system under test-System No. 1.

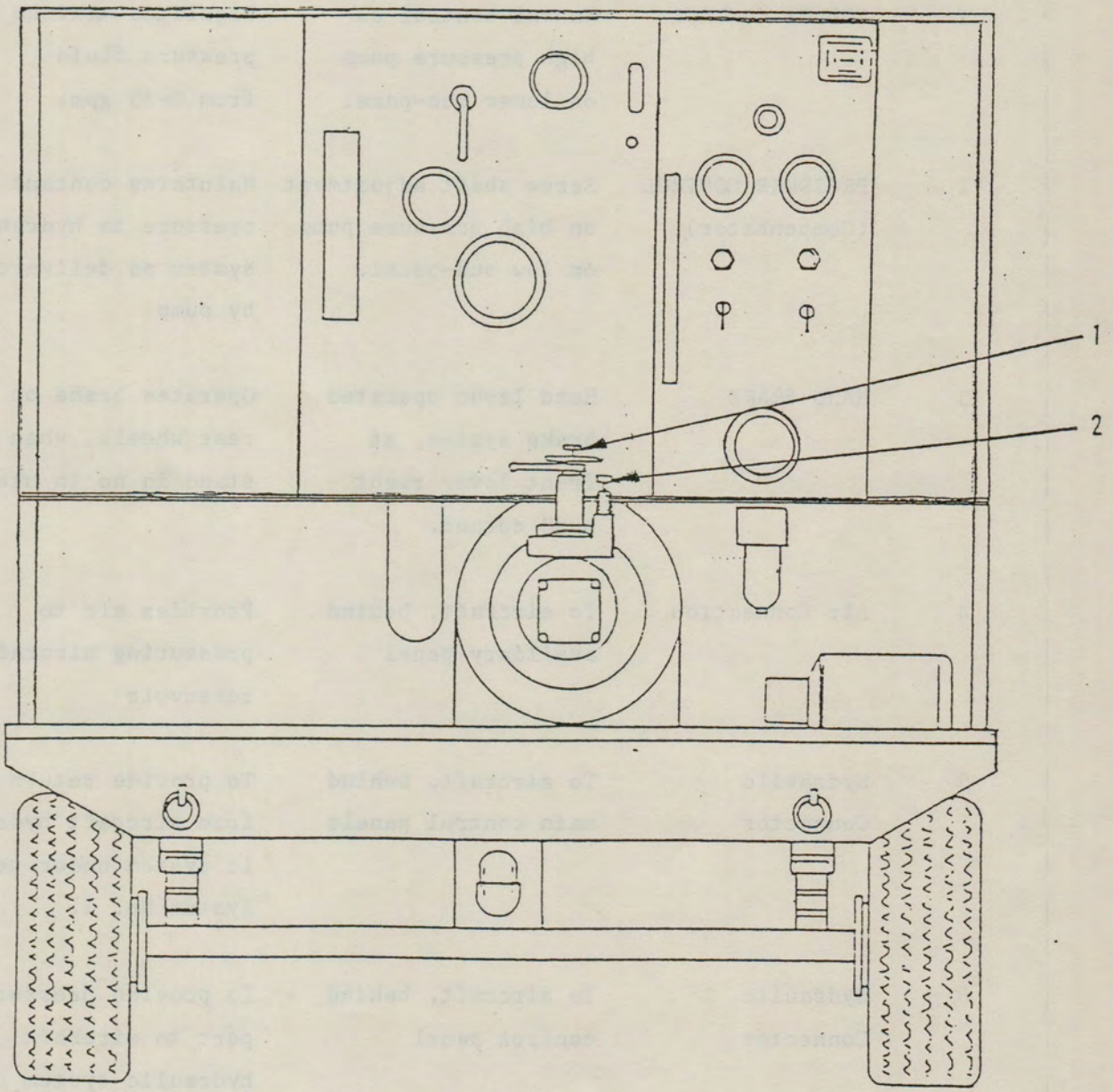


Figure 4-3. Miscellaneous Controls (Sheet 1 of 2)

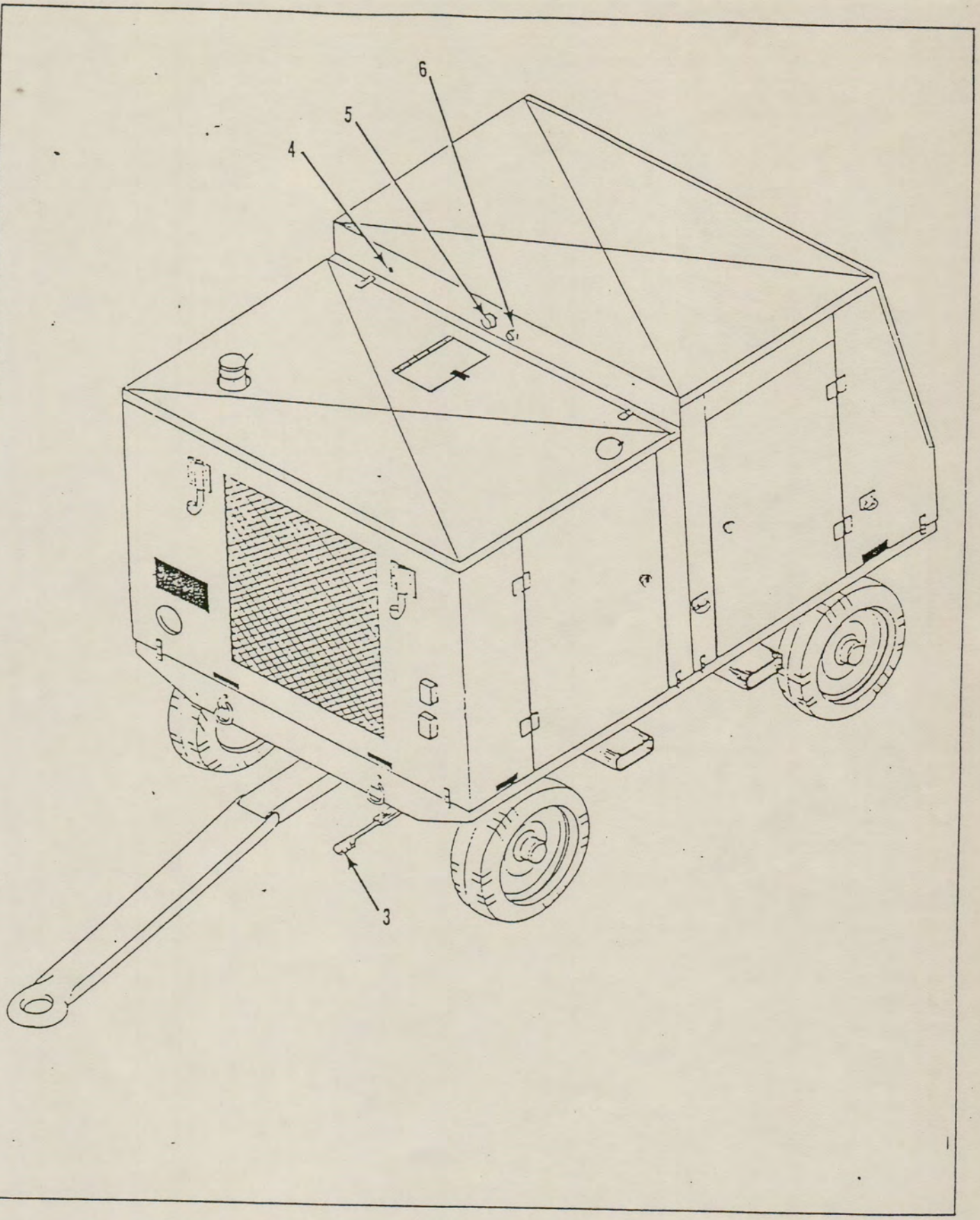


Figure 4-3. Miscellaneous Controls (Sheet 2 of 2)

4-7. OPERATING INSTRUCTIONS.

4-8. PRELIMINARY PROCEDURES. Make the following checks before operating the Test Stand.

a. Housing doors shall be closed. Open control panel door.

b. Ensure fuel tank contains adequate fuel supply.

c. Check hydraulic reservoir fluid level. For proper operation of Test Stand maintain hydraulic fluid level in reservoir 3/4 full minimum.

4-9. PRE-OPERATION CONTROL SETTING. Place the controls listed below in the positions indicated.

CAUTION

With pressure and return hoses disconnected from aircraft RESERVOIR SELECTOR VALVE must be in STAND RESERVOIR position prior to operation or unit will be damaged. When operation through run around block RESERVOIR SELECTOR VALVE must be in STAND RESERVOIR position or damage to unit will result.

	Control	Position	Method
a.	H.P. GAGE SHUT-OFF valve (11, Figure 4-2)	1/4 turn from full closed	CW to close then CCW 1/4 turn.
b.	GAGE SELECTOR valve (18, Figure 4-2)	HP pump inlet	Select
c.	PRESSURE CONTROL (2, Figure 4-3)	Opened to lowest pressure setting	Rotate CCW

	Control	Position	Method
d.	FLOW CONTROL Valve (15, Figure 4-2)	Closed	Rotate CCW
e.	HP RELIEF VALVE (17, Figure 4-2)	Lowest pressure setting	Rotate CCW
f.	VOLUME CONTROL (1, Figure 4-3)	To be set to 'zero' flow	Rotate CCW
g.	HP BYPASS Valve (16, Figure 4-2)	Open	Rotate CW
h.	RESERVOIR SELECTOR Valve (2, Figure 4-2)	"Stand Reservoir"	Select
i.	Engine Shutdown Control	Fully In	Select
j.	Engine Throttle Control	Full out and then push in to 1/4 open position	Select

4-10. PRE-OPERATION FILL AND BLEED PROCEDURE. With controls set in the positions specified in paragraph 4-9, proceed as follows:

a. Remove the hoses from the top of Test Stand.

b. Check that the connector fittings on the hoses and outlet and return fittings on the top of the Test Stand are clean. If the fittings are dirty, wash the fittings with solvent, Federal Specification P-D-680 Type II.

c. Connect hoses to corresponding outlet and return fittings. Connect high pressure hose to low pressure hose using run around connections at front of stand.

d. Set reservoir selector valve (2) to AIRCRAFT RESERVOIR position to perform fill and bleed procedures.

e. Turn on Ignition Switch (1, Figure 4-1).

f. Push FILL PUMP ON push button (14, Figure 4-2)

g. Press and hold FILTER BLEED valve (5) until system is free of air (bubbles) as shown on sight gage.

h. Release FILL PUMP ON pushbutton (14) when L.P. Gage indicates approximately 80 psi.

i. When the hydraulic systems have been prefilled, check OIL LEVEL Indicator (16, Figure 4-1). Refill the oil reservoir, if necessary, with hydraulic oil, Military Secification MIL-H-5606.

4-11. DIESEL ENGINE STARTING PROCEDURE.

CAUTION

Do not impose a load of high ressure pumps when starting engine. HP BYPASS VALVE (16, Figure 4-2) shall be open at starting.

a. Preform prelimiary procedures (paragraph 4-8, 4-9, and 4-10).

b. Push START Switch (2, Figure 4-1) until engine starts.

CAUTION

Do not press start switch for periods longer then 30 sconds or damage to engine or starter may result.

c. After engine starts, observe oil pressure gage. If pressure in not indicated in 10 seconds, pull out ENGINE SHUTDOWN CONTROL (4) to stop engine and set ignition switch to OFF. Refer to Section V for trouble-shooting procedures.

CAUTION

Do no impose load on engine at speeds less than 1500 rpm. Damage to engine may result.

d. After proper engine startup, allow engine to warm up. Observe TACHOMETER/HOURMETER (5), and adjust THROTTLE control (3) to set engine speed to 1000 rpm.

e. After warmup adjust THROTTLE control (3) to 2500 rpm.

NOTE

If warning horn sounds continously, shut down engine by pulling ENGINE SHUT-DOWN control (4) and refer to Section V for troubleshooting procedure.

With engine running perform fill and bleed operation.

f. Press FILTER BLEED valve (5, Figure 4-2) to free system of trapped air.

NOTE

Any fluid bled from systems must be replaced using fill pump and fill valve. Monitor system pressure on compound gage (21, Figure 4-1) with gage selector valve (18, Figure 4-2)

in HP PUMP INLET position. Pressure shall not exceed 140 psi.

4-12. ADJUSTING VOLUME AND PRESSURE SETTINGS.

CAUTION

Before hydraulic fluid passes through high pressurefilters, warm fluid to 80 degrees F minimum, per FLUID TEMP gage (3), by circulating fluid within the Test Stand. HP RELIEF VALVE (17) shall be partially closed (do not exceed 2500 psi) per HP GAGE (7) and HP BYPASS VALVE (16) shall be closed. When the fluid temperature reaches 80 degrees F, flow fluid through high pressure filters by partially opening HP BYPASS VALVE (16) until filter housing is warmed. At fluid temperatures below 80 degrees F the high viscosity of the hydraulic fluid will cause excessive differential pressure which actuate the differential pressure switch and may rupture the primary filter elements. During this warm-up operation the HP FILTER LAMP (14A) may come on. Lamp should go out when fluid warms up. If lamp does not go out after 5 minutes, replace filter element.

a. Perform preliminary procedures (paragraphs 4-8, 4-9, 4-10, and 4-11).

b. Open FLOW CONTROL valve (15, Figure 4-2).

c. Slowly close HP BYPASS valve (16).

d. Repeat paragraph 4-10f until entire system is free of air.

e. Observe output pressure HP GAGE (7), for reading of 100 to 500 psig.

f. Check condition of flow in flowmeter (20). If air is still present, bleed system per preceeding step d.

g. Adjust VOLUME CONTROL valve (1, Figure 4-3) to desired rate of flow.

NOTE

Flowmeter readings are correct at fluid temperature or 100 degrees F. For operating temperatures other than 100 degrees F refer to Figure 4-4 to obtain corrected flow.

h. Slowly close FLOW CONTROL valve (15, Figure 4-2) to check or reset HP RELIEF VALVE (17, Figure 4-2) and/or set PRESSURE CONTROL (2, Figure 4-3).

i. Reset HP RELIEF valve (17, Figure 4-2) setting to 200/250 psig above desired PRESSURE CONTROL setting.

j. Adjust PRESSURE CONTROL (2, Figure 4-3) setting to desired value. Readjust flow if necessary.

4-13. STOPPING THE TEST STAND.

a. Reduce VOLUME CONTROL setting (1, Figure 4-3) to minimum.

b. Open HP BYPASS VALVE, (16, Figure 4-2).

c. Close FLOW CONTROL valve (15).

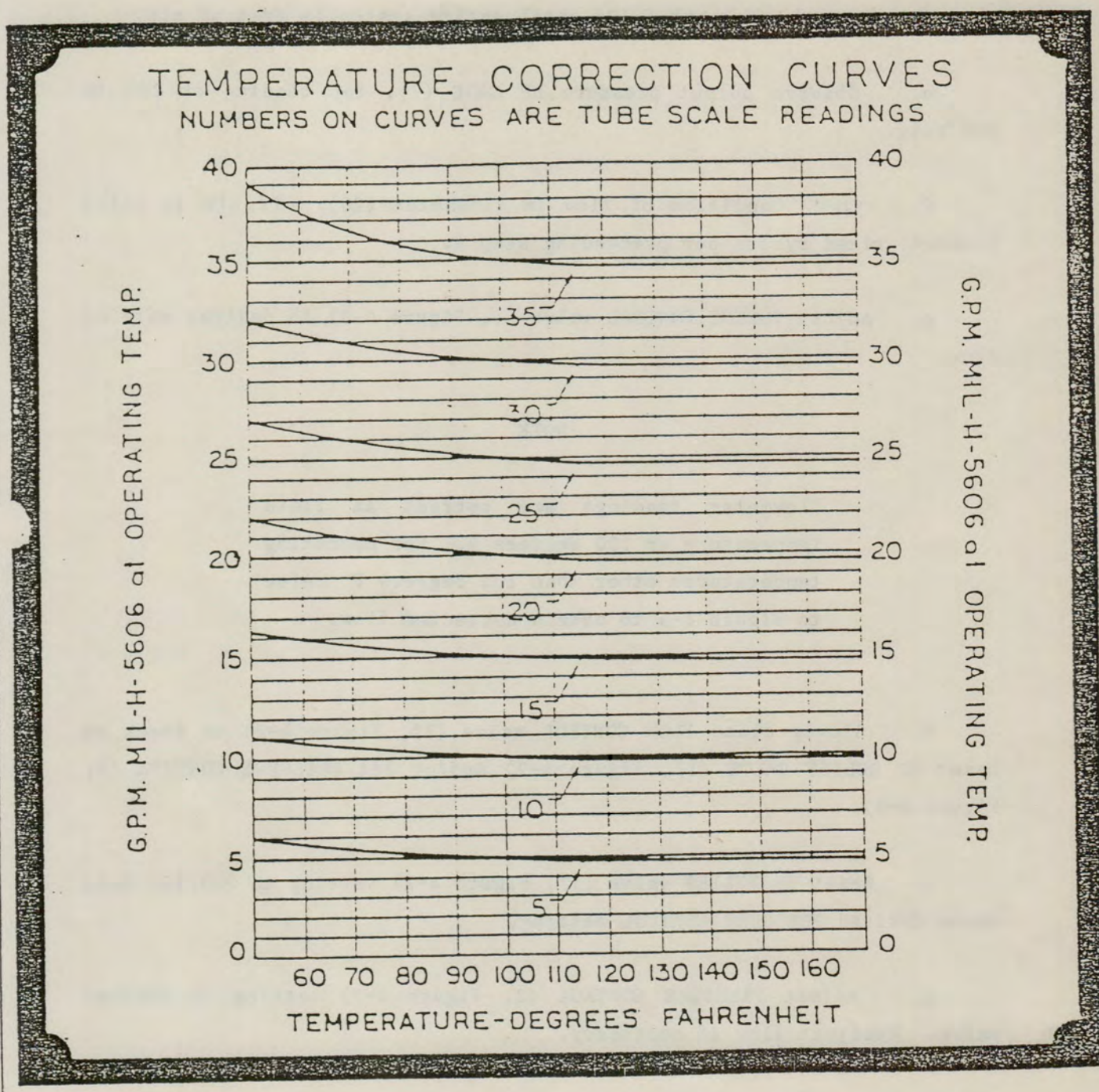


Figure 4-4. Temperature Correction Curve

d. Position RESERVOIR SELECTOR valve (2) to Test Stand reservoir.

e. Adjust THROTTLE control for engine speed of 1000 rpm.

f. Allow engine to idle for 3 minutes.

g. Pull out engine SHUTDOWN control.

h. Disconnect hoses and place on hose retainer hooks. Cap all external connections. Do not disconnect hoses from Test Stand, unless necessary.

i. Place IGNITION SWITCH (1, Figure 4-1) in OFF position.

4-14. EMERGENCY STOP. Perform emergency stop procedures as follows:

a. Open HP BYPASS valve (16, Figure 4-2).

b. Pull out engine SHUTDOWN control.

c. Place IGNITION Switch in OFF position.

4-15. FLUID SAMPLING. Needle-valve type sampling valves are provided in each system to aid in taking samples for fluid contamination anaylsis. The valves are located on the control panel. To take fluid samples, operate the unit with the HP BYPASS valve (16, Figure 4-2) open and open sample valve (12), and tube sample of fluid from HP SAMPLING port (13).

4-16. AIRCRAFT FILL AND TEST PROCEDURES.

4-17. POSITIONING AND CONNECTING THE TEST STAND TO AIRCRAFT. Position and connect the Test Stand for aircraft test as follows:

a. Move the Test Stand to the operating site using a suitable towing vehicle.

b. Position the Test Stand with respect to the aircraft so that the hoses can be connected between the aircraft and the Test Stand without sharp bends or kinks.

c. Set the brakes by pulling up on the hand brake lever. (3, Figure 4-3).

d. Raise the tow bar and secure it is its vertical position using the tow bar latch.

e. Remove the hoses from the front of the Test Stand.

f. Check that the connector fittings on the hoses and the outlet and return fittings on the top of the Test Stand are clean. If the fittings are dirty, wash the fittings with solvent, Federal Specification P-D-680, Type II.

g. Make the necessary hose connections between the aircraft and the aircraft and the outlet and return fittings on the top of the Test Stand. Accessory fittings and adapters for use in making aircraft connections are supplied with the Test Stand.

4-18. FILLING THE AIRCRAFT RESERVOIR. The following procedure can be used to fill an aircraft reservoir or to replace any fluid lost when connecting the hoses. To completely fill and bleed an aircraft system that has been drained, refer to paragraph 4-20.

NOTE

Refer to the applicable aircraft publication for proper fill procedures.

a. Turn the applicable PRESSURE SELECTOR valve (18, Figure 4-2) to the BOOST OUTLET position.

b. Position Reservoir Selector valve (2) to AIRCRAFT RESERVOIR.

c. Start fill pump, by pushing the pushbutton (14).

d. Fill the aircraft reservoir and leave the system fill valve opened until the filling operation is complete.

NOTE

The fill system output pressure can by monitored by observing the BOOST PUMP PRESSURE gage (19).

e. Bleed the air from the system by pressing the FILTER BLEED valve (5). Observe the sight tube and hold the FILTER BLEED valve depressed until clear fluid flows through the sight tube with no evidence of air bubbles.

WARNING

Always set PRESSURE RESERVOIR VALVE (15, Figure 4-1) to VENT prior to removing reservoir fill cap. Failure to comply may result in injury to personnel.

NOTE

Any fluid bled from systems must be replaced using fill pump and appropriate SYSTEM FILL valve. Monitor system pressure on compound FILL PRESSURE gage (21, Figure 4-1) with GAGE SELECTOR VALVE (18, Figure 4-2) in HP PUMP INLET position. Pressure shall not exceed 140 psi.

f. After the bleeding operation is complete, check the Test Stand fluid level. Refill the Test Stand reservoir by removing reservoir fill cap.

4-19. AIRCRAFT FILL/BLEED PROCEDURE. If the aircraft system has been drained, fill and air bleed the aircraft system as follows:

CAUTION

Do not exceed the rated gpm of the individual system aircraft pumps. Refer to applicable aircraft publication for flow capacities of the respective systems.

NOTE

Two persons are required for this operation: one to operate the Test Stand and one the aircraft to observe the filling operation.

a. perform all procedures described in paragraph 4-6 through 4-10

b. Open FLOW CONTROL valve (15, Figure 4-2).

c. Slowly close HP BYPASS valve (16).

d. with fill system operating press FILTER BLEED VALVE (5) while continually cycling the aircraft controls until all the air is bled from the aircraft system.

NOTE

When the pressure indicated by the BOOST PUMP PRESSURE gage (19) drops below 45 psig, release the filter bleed valve and allow pressure to build up to at least 50 psig before again pressing the FILTER BLEED valve.

e. Slowly increase the volume output of the Test Stand system and repeat the air bleed operation at one-quarter turn increments of the pump volume control until the rated flow of the aircraft system has been reached.

4-20. AIRCRAFT TESTING PROCEDURE. To test an aircraft hydraulic system, proceed as follows:

CAUTION

If the warning horn sounds, refer to Section V for trouble shooting before attempting to operate the Test Stand for testing and aircraft system.

Do not let BOOST OUTLET PRESSURE fall below 50 psig when operating Test Stand in open loop (Test Stand reservoir).

a. Perform all procedures described in paragraph 4-7 through 4-11. If the aircraft system has been drained, fill and air bleed the aircraft system as described in paragraph 4-19.

b. Open the FLOW CONTROL valve (15, Figure 4-2).

c. Slowly close the HP BYPASS valve (16).

d. Position Reservoir Selector valve (2) as required per the applicable aircraft publication.

e. Proceed with tests in accordance with the applicable aircraft publication.

f. System output pressure is indicated by the output pressure HP gage (7) for each system. To vary the output pressure, refer to paragraph 4-9.

g. System volume is indicated by the flowmeter (20). To vary the output volume, refer to paragraph 4-12.

h. Fluid temperature is indicated by the FLUID TEMPERATURE gage (3).

i. To check the return pressure from the aircraft, set the PRESSURE SELECTOR valve (18) to the RETURN position.

j. Shut down Test Stand after test (paragraph 4-13).

4-21. RESERVOIR PRESSURIZING PROCEDURE. The following procedure can be used to pressurize either the Stand or Aircraft reservoir when required by aircraft T.O.

a. The AIR COMPRESSOR in part of the diesel engine and will self-engage to maintain a pressure of 85-100 psi.

b. Close AIR OUTLET selector valve (14).

c. (Deleted)

d. Air pressure at air outlet is controlled by AIR PRESSURE REGULATOR (13) and read on AIRCRAFT AIR PRESSURE gage (11).

e. To pressurize reservoir, set PRESSURE RESERVOIR VALVE (15) to the PRESSURIZE position, adjust AIR PRESSURE REGULATOR (24) to the required pressure on reservoir air pressure gage (12).

f. If pressurization of reservoir is not required. PRESSURE RESERVOIR VALVE (15) should be place in VENT position and AIR PRESSURE REGULATOR (24) backed out to it lowest pressure position.

SECTION V

MAINTENANCE INSTRUCTIONS

5-1. GENERAL. Maintenance of the Test Stand consist of periodic inspection, cleaning, service adjustment, minor repairs or replacement of parts and components, and lubrication of main motor. The procedures described in this section must be performed regularly and thoroughly, even though Test Stand is operating satisfactorily. Through proper inspection, maintenance, and lubrication, equipment that is not in continous use is kept ready for operation when necessary, and the Test Stand is maintained at peak performance levels for the maximum life of the equipment.

5-2. COMPONENT REMOVAL. When it is necessary to remove any component of the Test Stand, observe the following precautions and general practices:

WARNING

Release all system pressures prior to removal of components from hydraulic systems, and ensure that the input power to the Test Stand is disconnected to avoid possible injury to personnel.

CAUTION

Do not use adjustable jaw-type wrenches on hydraulic tube fittings. Slippage may result in damage to hexagonal fitting surfaces.

a. Make certain all hydraulic pressure is completely relieved before removing hydraulic system components.

b. Do not attempt to remove or repair any electrical component unless input power is disconnected (battery cable)

c. If it is necessary to remove system lines connected to hydraulic components, loosen fitting at end of each line, and remove attaching parts securing component to structure. Do not bend system lines on removal, as thread damage or misalignment may result. Cap or plug open lines or ports with protective closures, Military Sepcification MIL-C-5501, or equivalent.

d. When removing electrical components, disconnect electrical leads from terminals and tag each for ease of identification during reassembly.

5-3. PREVENTATIVE MAINTENANCE. Maintenance is generally limited to cleaning, service adjustments, and minor repair or replacement of parts and components that require attention through normal service use. Generally, instructions for minor repair or replacement consist essentially of carefully noting method of installation when removing defective parts, performing the necessary repair or adjustment, and installing parts in reverse order of removal. Change oil and air filters every six months.

5-4. ENGINE MAINTENANCE.

a. General Engine Maintenance.

(1) Check fuel level. Add fuel as required. If fuel level is satifactory, check low fuel level warning switch. Replace if defective.

(2) Check engine coolant temperature gage. Normal engine

coolant temperature is 160-185°F. Consult Table 5-1 if limits are exceeded.

(3) Check engine oil pressure gage. Minimum oil pressure should be 18 psi at 1200 rpm. The oil pressure at normal operating speed should be 40-60 psi. Consult Table 5-1 if limits are exceeded.

5-5. CHECKING CRANKCASE OIL LEVEL. To check the crankcase oil level proceed as follows:

a. Check oil level on dipstick.

b. Add lubricating oil (Table 1-2) as required to bring the oil level up to FULL mark on the dipstick.

NOTE

Do not add more oil than required to bring oil level to FULL mark.

c. Replace dipstick. Push firmly to reseat.

5-6. CHANGING ENGINE LUBRICATING OIL. To change engine lubricating oil proceed as follows:

a. Remove crankcase drain plug and drain oil into a suitable container.

b. Service engine oil filter in accordance with paragraph 5-7.

c. Install drain plug. Torque to 25 to 35 ft.-lbs.

d. Remove filler cap on left valve cover and fill crankcase with 11 quarts of MIL-L-2104 lubricating oil (Table 1-2). If engine oil filter is replaced, add 13 quarts of oil.

e. Replace filler cap.

f. Start engine (Section IV) and check for oil leaks around crankcase drain plug and engine oil filter.

5-7. Servicing Oil Filter. The oil filter (1, Figure 5-1) may be serviced as follows:

a. With the engine stopped place a container underneath the oil filter.

b. With a spin-on element remover tool, carefully remove element (2, Figure 5-2) and clean cover bottom (1) with a rag.

c. Lightly moisten new element rubber gasket with clean oil.

d. Install element and firmly hand tighten. Do not overtighten as element may warp.

e. When refilling crankcase allow two extra quarts of oil for oil filter.

5-8. SERVICING FUEL STRAINER/FUEL FILTER. The procedure for replacing the element is the same for the fuel strainer and fuel filter (2,3 Figure 5-1).

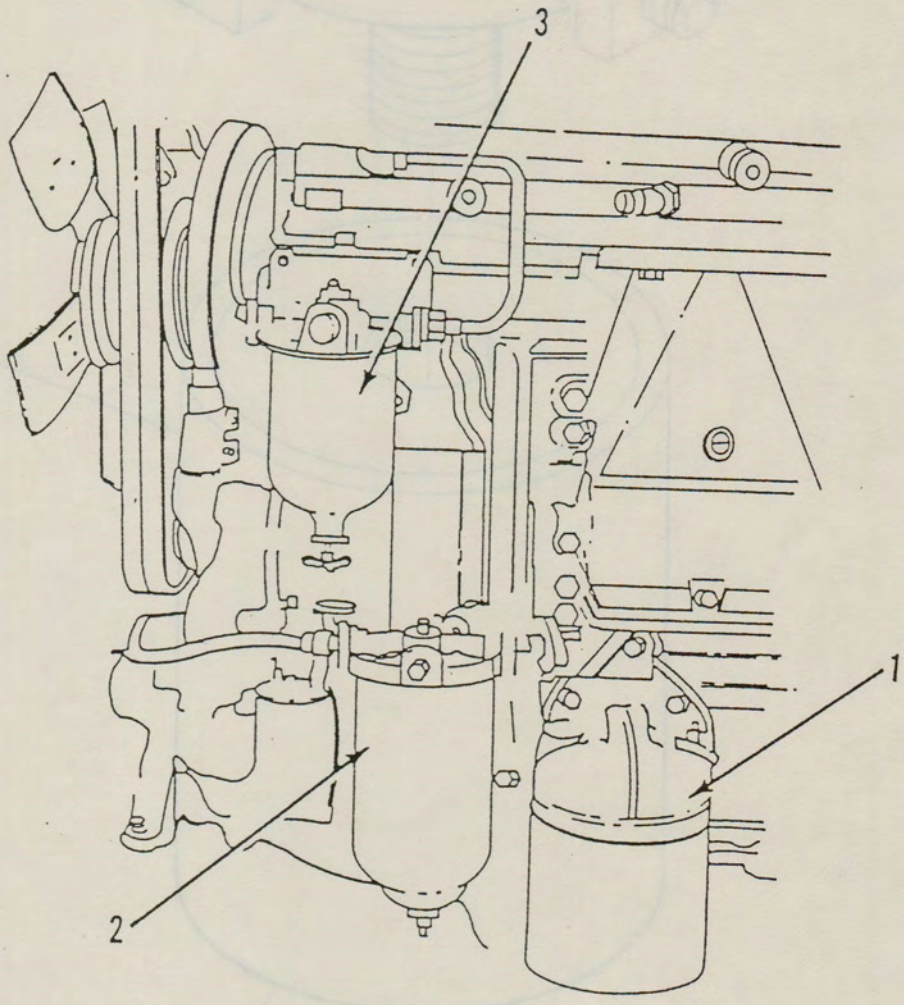
a. With the engine stopped, place a container under the fuel strainer or fuel filter.

b. With a spin-on element remover tool, carefully remove element (2, Figure 5-2) and clean cover bottom (1) with a clean rag.

c. Fill new spin-on filter with clean fuel (2/3 full).

d. Lightly moisten new element rubber gasket with clean oil.

e. Install element and firmly hand tighten. Do not overtighten as element may warp.



Key: 1. Oil Filter
2. Fuel Strainer
3. Fuel Filter

Figure 5-1. Fuel/Oil Filters

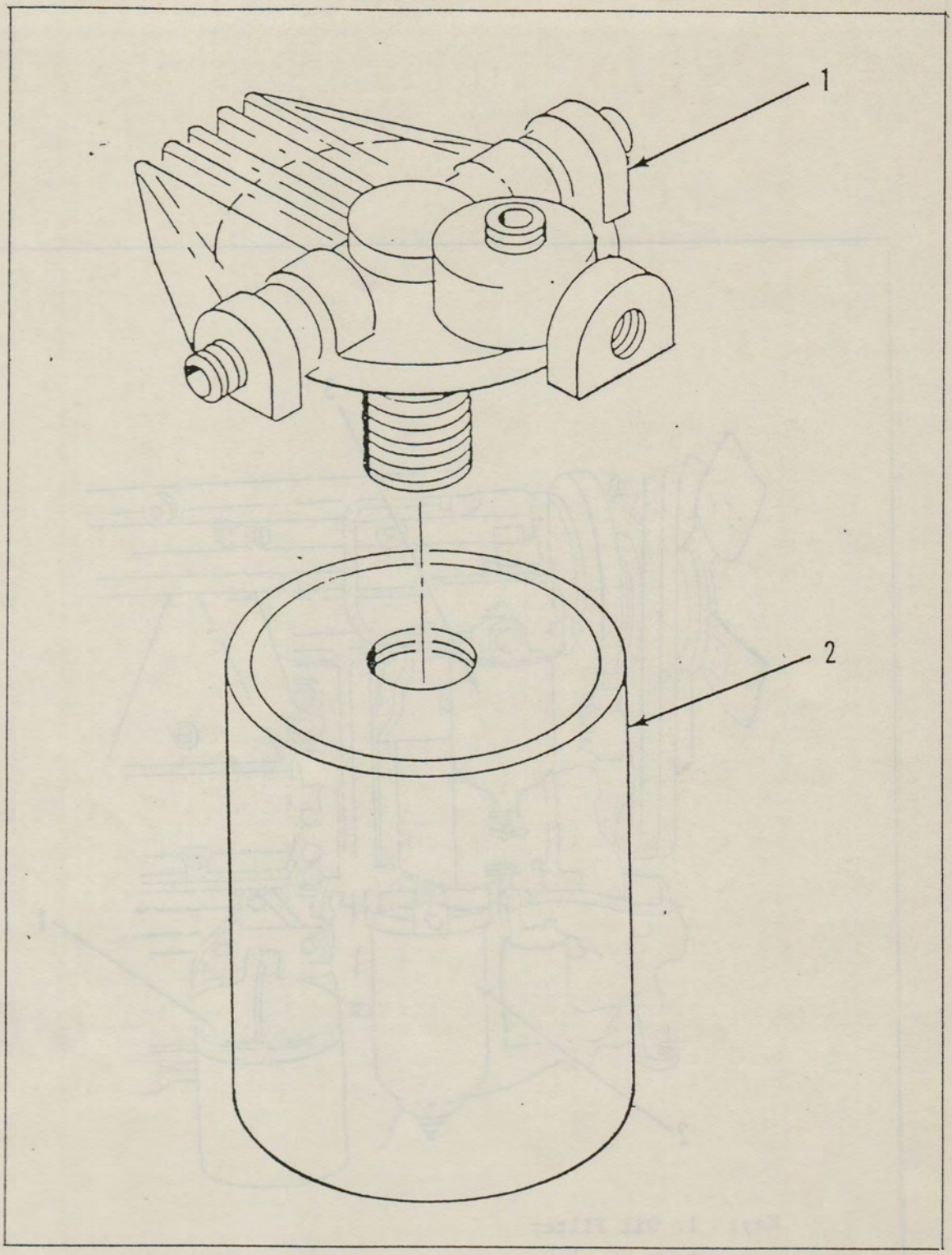


Figure 5-2. Fuel/Oil Filters (Typical)

5-9. AIR CLEANER. The air cleaner is designed to remove foreign matter from the air, pass the required volume of air for proper combustion and scavenging, and maintain efficient operation for a reasonable period of time before requiring service.

The importance of keeping dust and grit-laden air out of the engine cannot be over-emphasized, since clean air is so essential to satisfactory engine operation and long engine life. Should dust in the air supply enter the engine, it would be carried directly into the cylinders and, due to its abrasive properties, cause premature wear of the moving parts. Dirt, which is allowed to build-up in the air cleaner passages, will eventaully restrict the air supply to the engine and result in heavy carbon deposits on the valves and pistons due to incomplete combustion. The air cleaner sump must have a capacity large enough to retain the material separated from the air to permit operation for a reasonable length of time before cleaning is required.

Although the air cleaner is highly efficient, this efficiency depends upon proper maintenance and periodic servicing.

Damaged gaskets, loose hose connections or leaks in the duct work, which permit dust-laden air to completely by-pass the cleaner and enter the engine directly, will lower the efficiency of the air cleaner. If the air cleaner is not serviced periodically, the engine will not receive a sufficient amount of clean air. An air cleaner operating in severe dust will require more frequent service than an air cleaner.

5-10. OIL BATH AIR CLEANER. The oil bath air cleaner (Fig. 5-3) consists of a metal wool cleaning element supported inside a housing beneath which is contained a bath of oil. The lower portion of the housing incorporates a chamber which serves as a silencer for the incoming air to the blower.

Air drawn into the cleaner by the blower passes over the top of the oil bath, where a major portion of the dirt is trapped, then up through the metal wool where the finer particles are removed, then down the central duct to the blower.

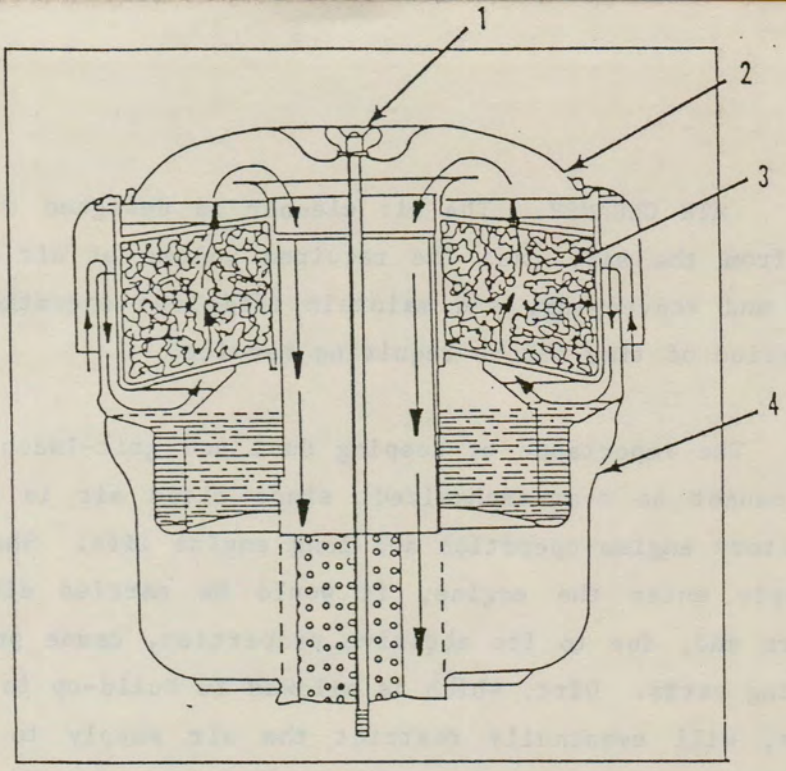


Fig. 5-3. Oil Bath-Type Air Cleaner

a. SERVICE. Service the oil bath air cleaner as follows (see Figure 5-3).

(1) Loosen the wingbolt (1) and remove the cleaner from the air inlet housing. the cleaner may then be separated into three sections: the upper section (2) the metal wool element (3), and the lower section (4) containing the oil sump.

(2) Soak the element in fuel oil to loosen the dirt; then flush the element with clean fuel oil and allow it to drain thoroughly.

(3) Empty the sump and clean it with fuel oil to remove all sediment.

(4) Push a lint-free cloth through the center tube to remove dirt or oil from the walls.

(5) Clean and check all gaskets and sealing surfaces to insure air tight seals.

(6) Refill the sump to the oil level mark ONLY, with the same grade of oil used in the engine.

(7) Before installing the air cleaner on the engine, check the air inlet housing for dirt. If the service period has been too long, or if dust-laden air has been leaking past the air cleaner to the air inlet housing seals, the inlet will be dirty. This will serve as a good check on the servicing of the air cleaner. When installing the cleaner (and its seal) on the inlet housing, be sure the cleaner seats properly, then tighten the wingbolt securely until the cleaner is rigidly mounted.

5-11. Servicing Fuel Tank. Locate drain plug under fuel tank and drain off any water or sediment prior to starting engine.

5-12. SERVICING COOLING SYSTEM.

WARNING

Always remove radiator cap slowly and carefully to avoid a possible flash of hot coolant. Failure to comply may result in injury to personel.

a. Coolant Level. maintain coolant level near top of radiator expansion chamber accessiable from top of test stand. Check prior to use and add clean water as required.

b. Hoses. Inspect hoses at least once every 500 hours for signs of deterioration. Replace as needed.

WARNING

Use cleaning solvent P-D-680, Type II, in a well ventilated area. Do not inhale

solvent vapor or allow solvent to contact skin. Keep solvent away from open flame. Failure to comply may result in injury to personnel.

c. Radiator. Inspect exterior of radiator at least once every week. Clean with solvent P-D-680, Type II, and dry with clean, dry compressed air at 5-15 psi maximum. it may be necessary to clean the radiator more frequently, if the test stand is being operated in an extremely dusty of dirty area. Clean the cooling system in accordance with paragraph 5-13.

5-13. CLEANING COOLING SYSTEM. The cooling system should be flushed and refilled every six months with fresh coolant. Scale and/or rust may be removed with a cleaner and the system reverse-flushed as soon as any scale or rust is detected.

5-14. Not Used

5-15. REMOVING SCALE AND/OR RUST FROM THE COOLING SYSTEM. Rust and scale are removed from the cooling system by first cleaning system with a descaling solvent and then reverse-flushing the radiator and engine block(if equipment available). To use descaling solvent, proceed as follows:

a. Open coolant drain-cock and drain coolent into a suitable container.

b. Close coolant drain-cock and fill cooling system with clean water.

c. Use descaling solvent in accordance with manufacturer's instructions.

d. Re-fill system with a 50-50 mix of anti-freeze and water.

5-16. ELECTRICAL STARTING. The electrical system on the engine generally consists of a battery-charging alternator, a starting motor, voltage regulator, storage battery, starter switch and the necessary wiring.

a. Starting Motor. The starting motor has a Sprag overrunning clutch. Pressing the starting switch engages the starting motor pinion with the teeth of the flywheel ring gear and energizes the starting motor. The starting motor drives the pinion and rotates the crankshaft. When the enginge begins to operate, the Sprag clutch permits the pinion to overrun on its shaft, until the starting switch is released, and prevents overspeeding the starting motor.

b. Starter Switch. To start the engine, a switch is used to energize the starting motor. Release the switch immediately after the engine starts.

c. Battery-Charging Alternator. The battery-charging alternator provides the electrical current required to maintain the storage battery in a charged condition and to supply sufficient current to carry any other electrical load requirements up to the rated capacity of the alternator.

d. Alternator Precautions. Precautions must be taken when working on or around an alternator. The diodes and transistors in the alternator circuit are very sensitive and can be easily destroyed.

(1) Avoid grounding the output wires or the field wires between the alternator and the regulator. Never run an alternator on an open circuit.

(2) Grounding an alternator's output wire or terminals which are always hot regardless whether or not the engine is running, and accidental reversing of the battery polarity will destroy the diodes. Grounding the field circuit will also result in the destruction of the diodes. Some voltage regulators provide protection against some of these circumstances. However, it is recommeded that extreme caution be used.

(3) Accidentally reversing the battery connections must be avoided.

(4) Never disconnect the battery while an alternator is in operation. Disconnecting the battery will result in damage to the diodes, due to the momentary high voltage and current generated by the rapid collapse of the magnetic field surrounding the field windings.

(5) In marine applications which have two sets of batteries, switching from one set of batteries to the other while the engine is running will momentarily disconnect the batteries and result in damage to the alternator diodes.

(6) If a booster battery is to be used, the batteries must be connected correctly (negative to negative and positive to positive).

(7) Never use a fast charger with the battery connected or as a booster for battery output.

(8) Never attempt to polarize an alternator. Polarization is not necessary and is harmful.

(9) The alternator diodes are also sensitive to heat, and care must be exercised to prevent damage to them from soldering irons, etc.

(10) If faulty operation of an alternator occurs on an engine equipped with an insulated starting motor, check to be sure that a ground strap is present and is correctly installed.

e. Regulator. A voltage regulator is introduced into the electrical system to regulate the voltage and current output of the battery-charging alternator and to maintain a fully charged storage battery.

5-17. BATTERY MAINTENANCE. Engine batteries are serviced as follows:

CAUTION

When handling batteries, use face shield or goggles, rubber gloves and apron.

a. Maintain electrolyte level approximately three-eights inch over plates. Check level daily and add distilled water as necessary.

CAUTION

To prevent battery damage, keep soda solution out of cells.

b. Keep top of battery clean. When necessary, wash with a baking soda solution and rinse with fresh water.

c. Inspect cables, clamps, and holddown bracket every 100 hours. Clean and apply to coat of grease when needed. Replace corroded or damaged parts.

d. Check condition of battery every 300 hours with a hydrometer. Specific gravity of a fully charged battery should be 1.275 to 1.285. Charge battery if specific gravity goes below 1.150. Check electrical system if battery becomes discharged repeatedly.

5-18. SERVICING STARTING MOTOR. Service starter motor as follows:

a. Remove pipe plugs.

b. Lubricate the starting motor with five or six drops of engine oil at each oiling hole.

c. Install pipe plug.

5-19. Servicing Drive Belts.

CAUTION

Too much tension on belt may damage bearings of the driven part. A loose belt will slip and wear out belt.

NOTE

When installing or adjusting drive belt, ensure that bolt at the adjusting pivot point is properly tightened.

a. Adjust belt tension. Adjust belt tension so that a firm push with the thumb, at a point midway between the two pulleys, will press the belt one-half to three-quarters inch.

Belt(s)	Tension (lbs/belt)
Alternator drive	40-50
Water pump	40-50

NOTE

Replace all belts in a matched set when one is worn. Do not substitute a single belt of similar in a matched set.

b. Run engine for 15 minutes and re-tension belts.

5-20. TROUBLESHOOTING. Table 5-1 provides a quick check list of possible trouble, which may be encountered in the operation of the Test Stand, their probable cause and suggested remedy.

Table 5-1. Troubleshooting

TROUBLE	PROBABLE CAUSE	REMEDY
Fluid temperature too high	Heat exchanger clogged	Flush and clean
	Defective pump compensator	Replace
Reservoir level indicator does not indicate	Hydraulic lines plugged or damaged	Replace
	Blocked tubing connection	Clean or replace
	Reservoir empty	Fill
Pump fails to deliver sufficient volume	Insufficient fluid supply (Test stand will shut down)	Fill Reservoir; fill systems
	Air in suction line	Tighten connections, bleed lines
	Dirty, clogged boost pressure filter	Clean or replace elements
	Pump volume control set too low	Adjust
Pump Fails to delivery sufficient pressure	Low boost pump pressure (Test Stand will shutdown)	Check boost pump pressure
	Clogged low pressure and high pressure filters	Clean and replace
	Pump Compensator not set properly	Reset

Table 5-1 Troubleshooting - Continued

TROUBLE	PROBABLE CAUSE	REMEDY
Pump fails to deliver sufficient pressure	High pressure relief valve set too low (dumping before compensator setting)	Reset
	Defective pressure gauge	Inspect and replace, if necessary
Noisy operation	Pump cavitating; insufficient fluid supply low boost pressure, pump case not filled with fluid	Check for adeguate fluid supply boost pressure check boost pressure check boost pressure filter; fill pump case with pressure filter, fill system filters; use clean, filtered fluid
	Air in system	Fill and bleed
	Defective boost pump if necessary	Check and replace.
	Defective check valve in high pressure line	Inspect and replace, if necessary
	Pressure outlet closed or flow control valve and bypass valves closed	Open bypass valve
	Chattering high pressure relief valve	Remove valve assembly clean and replace worn or defective parts
	Defective pump compensator	Repair or replace
Excessive backpressure	Check valve fail(closed)	Repair or replace

Table 5-1 Troubleshooting - Continued

TROUBLE	PROBABLE CAUSE	REMEDY
Control circuit inoperative	Control circuit breakers off	Reset circuit breakers
	Power on switch off	Switch to on
	Faulty control circuit transformer	Test and replace, if necessary
	Defective relays	Test and replace, if necessary
Indicating light fails to flow on "press to test"	Defective lamps	Test and replace
	Defective lamps	Test and replace
	Defective lamps	Test, repair/replace
Hourmeter does not register	Deffective wire leads	Repair or replace
	Defective instrument	Replace
Fill pump motor fails to start	Control power off	Connect power lines properly. Depress push button
	Circuit breaker open	Close circuit breaker
Fill pump does not pump	Pump suction is dry, lost it prime	Instroduce fluid to pump inlet
	Pump worn or damaged	Repair or replace
	Air leaks insuction line	Tighten all connections
	Motor rotation wrong	Check rotation and correct wiring for proper rotation

Table 5-1 Troubleshooting - Continued

TROUBLE	PROBABLE CAUSE	REMEDY
No power to high pressure pumps	Defective gearbox	Check gearbox, replace if defective.
	Defective high pressure pumps	Check high pressure pumps, repair/replace if defective
Engine will not start	Engine shutdown handle	Ensure shutdown handle is fully in.
	Defective starter button	Replace.
	Low battery charge	Test and recharge battery. Replace battery if it will not hold a charge.
	Battery connection dirty or loose	Clean battery cable terminals and battery posts. Tighten.
	Starter connection dirty or loose	Clean starter connections and tighten.
	Defective starter solenoid	Replace starter solenoid.
	Insufficient fuel	Fill tank above suction line and bleed system if necessary in accordance with engine technical order.
	Air leaks	Tighten joints and replace gaskets if necessary at fuel leakage points. Bleed system if necessary in accordance with engine technical order.

Table 5-1 Troubleshooting - Continued

TROUBLE	PROBABLE CAUSE	REMEDY
Engine will not start-continued	Dirty fuel filters	Check filters and replace elements if necessary in accordance with engine technical order.
	Starter worn	Inspect starter commutator and brushes for wear. Replace brushes and overhaul starter if commutator is damaged. See engine technical order.
	Improper grade of oil	Drain crankcase and refer to engine technical order for proper grade of oil for existing condition.
	Ambient temperatures to cold	Apply heat to engine.
	Exhaust valves sticking or burned	Remove cylinder head and recondition exhaust valves.
	Faulty fuel pump	Replace defective pump.
	Cylinder head gasket leaking	Replace damaged cylinder head gasket or cylinder head if cracked.
	Internal seizure	Disassemble engine and replace damaged parts.
Engine starting motor inoperative	Batteries giving low output	Check and recharge batteries.
	Poor ground connection	Check, clean and tighten.
	Broken starter pinion	Replace starter motor.

Table 5-1 Troubleshooting - Continued

TROUBLE	PROBABLE CAUSE	REMEDY
Engine starting motor inopertive - continued	Faulty switch	Replace switch.
	Fuse blown	Check fuse. Investigate cause of overload.
	Faulty starter solenoid	Replace solenoid.
	Internal starter fault	Replace starter motor.
Engine runs unevenly or stalls	Fuel filters dirty	Check fuel filters and replace elements if necessary in accordance with engine technical order.
	Insufficient fuel	Fill tank above fuel suction line. Check for line leaks.
	Low coolant temperature	Thermostat not closing. Inspect and replace if necessary.
	Engine governor	Check governor linkage for binding.
	Leaking fuel injector	Replace faulty injector.
	Low compression	Check cylinder compression and
	Low compression-cont'd	Consult engine technical order if pressures are low.
	Insufficient air	Check for damaged or dirty air cleaners and clean or replace damaged parts.
	Needs a tune-up	Tune engine in accordance with engine technical order.

Table 5-1 Troubleshooting - Continued

TROUBLE	PROBABLE CAUSE	REMEDY
Detonation	Low coolant temperature	Thermostat not closing. Inspect and replace if necessary.
	Faulty injector	Replace faulty injectors.
Engine runs to fast	Excessive governor spring tension	Adjust governor spring.
Engine runs to slow	Insufficient governor spring tension	Adjust governor spring.
Engine overheats	Insufficient heat transfer	Clean and flush cooling system. Clean radiator core to unplug air passages. Adjust fan belts to proper tension. Check coolant level. Inspect for collapsed or disintegrated hoses. Replace faulty hose. Thermostat not opening. Replace thermostat if faulty. Check water pump for damaged impeller. Replace if necessary.
Engine runs cold	Thermostat not closing	Remove and inspect thermostat. Replace if necessary.

Table 5-1 Troubleshooting - Continued

TROUBLE	PROBABLE CAUSE	REMEDY
Engine emits grey or black smoke	High exhaust back pressure	Check exhaust piping or muffler for obstruction. Check exhaust back pressure with manometer.
	Restricted air inlet	Check cylinder lines parts, air cleaner and blower screen. Clean these items.
	Improperly timed injectors	Time the fuel injector in accordance with engine technical order.
	Improper grade of fuel	Drain and fill system with proper fuel grade. See engine technical order.
Engine emits blue smoke	Lubricating oil not fully burned in cylinder	Replace oil control rings.
	Excessive oil in crankcase	Fill crankcase to proper level.
Engine emits white smoke	Misfiring cylinders	Check for faulty injectors and replace as necessary.
	Low compression	Consult engine technical order for proper values and actions.
	Improper grade of fuel	Drain fuel tank and fill with proper fuel grade.
Air leaks	Loose fuel connections or cracked fuel line	Replace all damaged connectors and damaged fuel lines. Tighten.
	Filters leaks	Inspect fuel filters gasket and replace if necessary.

Table 5-1 Troubleshooting - Continued

TROUBLE	PROBABLE CAUSE	REMEDY
Fuel obstruction	Clogged fuel filters	Replace clogged or faulty filters.
	Clogged or bent fuel lines	Disconnect fuel lines and remove obstruction. Replace damaged fuel lines.
	Faulty fuel pump	Replace fuel pump.
High oil consumption	Loose connection	Tighten connections and replace defective connection.
	Oil filter gaskets leaking	Tighten and replace oil filter gasket if necessary.
Oil in coolant	Oil cooler core leaks	Replace oil cooler core and flush cooling system to remove oil from cooling system.
Low engine oil pressure	Low oil supply	Refill engine crankcase to full mark.
	Low oil viscosity	Drain engine oil sump; refill with fresh oil of specified grade.
	Clogged oil filter	Remove and clean or replace.
	Engine bearings worn	Remove and replace engine.
	Internal oil leaks	Remove and replace engine.
	Oil pressure gage and/or sensing unit defective	Replace gage and/or sensing unit.

Table 5-1 Troubleshooting - Continued

TROUBLE	PROBABLE CAUSE	REMEDY
Engine knocks	Engine operating under heavy load at low speed	Increase engine rpm.
	Improper fuel	Use specified grade of fuel.
	Defective valve lifter	Remove engine; replace valve lifter.
	Scored valve stems	Remove engine, replace cylinder assembly.
	Warped valves	Remove engine; replace cylinder assembly.
	Loose or burned connecting rod bearing	Remove engine.
	Worn or loose piston pin	Remove engine; replace cylinder assembly.
	Carbon or lead deposits in cylinder head	Remove engine; replace cylinder assembly.

TABLE 5-2

LUBRICATION AND PREVENTIVE MAINTENANCE CHART

Item Operation Hours	TIME INTERVAL								
	Daily	8	50	100	200	300	500	1,000	2,000
1. Engine Oil*	X								
2. Oil Filter **									
3. Coolant and Filter	X						X	X	
4. Hoses							X		
5. Radiator								X	
6. Heat Exchanger Electrodes and Core							X	X	
7. Raw Water Pump	X								
8. Fuel Tank	X						X		
9. Fuel Strainer and Filter						X			
10. Air Cleaner		X					X		
11. Air Box Drains							X	X	
12. Ventilating System								X	
13. Blower Screen								X	
14. Starting Motor***									
15. Battery-Charging Generator				X	X		X		X
16. Battery				X					
17. Tachometer Drive				X					
18. Throttle					X				
19. Drive Belts					X				
20. Overspeed Governor							X		
21. Shut-Down System						X			

* Change oil every 100 hours for new engines, then establish an interval based on experience with engine.

** Change filters with oil changes.

*** When removed from engine.

5-21. COMPONENT REPAIR. Component repair consists of performing any repair or part replacement necessary to restore the component to a serviceable condition. The operator shall limit repair to only the procedures detailed herein.

5-22. CLEANING. The Test Stand should be cleaned whenever there is an accumulation of dust or dirt on the exterior of the cabinet or control panel, or whenever grease, oil, or similar foreign matter is inadvertently spilled within the Stand. Clean the Test Stand in accordance with T.O. 35-1-12, and common shop practices.

WARNING

Use solvent in well ventilated area. Avoid contact with open flames and avoid inhalation of fumes, as injury could result.

a. Clean all disassembled components, except electrical parts and prelubricated bearings, with solvent, Federal Specification P-D-680. Use a stiff-bristle, non-metallic brush to ensure that all orfices, packing grooves, and ports are thoroughly clean.

b. Dry all cleaned parts using compressed air at approximately 15 psig, or a clean, lint-free cloth.

c. After cleaning, inspect all parts for wear and defects, such as nick, burrs, scoring, cracks, corrosion, or similar defects. Inspect all threaded area for stripped, crossed, or broken threads. Inspect mounting holes for elongation which would effect component performance.

CAUTION

Do not use abrasive cloth, Federal Specification P-C-458, on aluminum

or magnesium alloy parts, as is contains an iron oxide which causes rapid oxidation of these metals.

d. Polish out minor defects from noncritically dimensioned surfaces, using abrasive cloth, Federal Specification P-C-458, for ferrous alloy parts and abrasive cloth, Federal Specification P-C-451, for alumninum and magnesium alloy parts. Ensure that precision fits, and seating or sealing surfaces are not destroyed. Reclean any repaired parts.

e. Replace all performed packings, back rings, gaskets, and seals regardless of condition, each time a component is required.

f. During reassembly or hydraulic components, assemble parts dripping wet, dipping them in hydraulic fluid, Military Specification MIL-H-5606.

g. Perform hydraulic component tests using a clean source of hydraulic fluid, Military Specification MIL-H-5606, filtered to 10 microns, or better.

5-23. REPAIR or REPLACEMENT.

5-24. FILTERS. All systems filters have been covered in this section. Replace any damaged parts on these filters, especially o-rings. Do not attempt repair.

5-25. INSPECTION.

5-26. HYDRAULIC RESERVOIR INSPECTION. Refer to figure 5-4 and inspect the hydraulic reservoir as follows:

WARNING

Hydraulic system and reservoir must be depressurized before performing maintenance

or servicing of system. Failure to comply may result in injury to personnel.

a. Remove reservoir filler cap (1) and drain hydraulic fluid from reservoir by opening the drain valve (8) at the end of the drain tube. Empty into a suitable container. Close drain valve.

b. Remove reservoir access cover (2), and gasket (5) from reservoir (6) by removing bolts (4) and nuts (3).

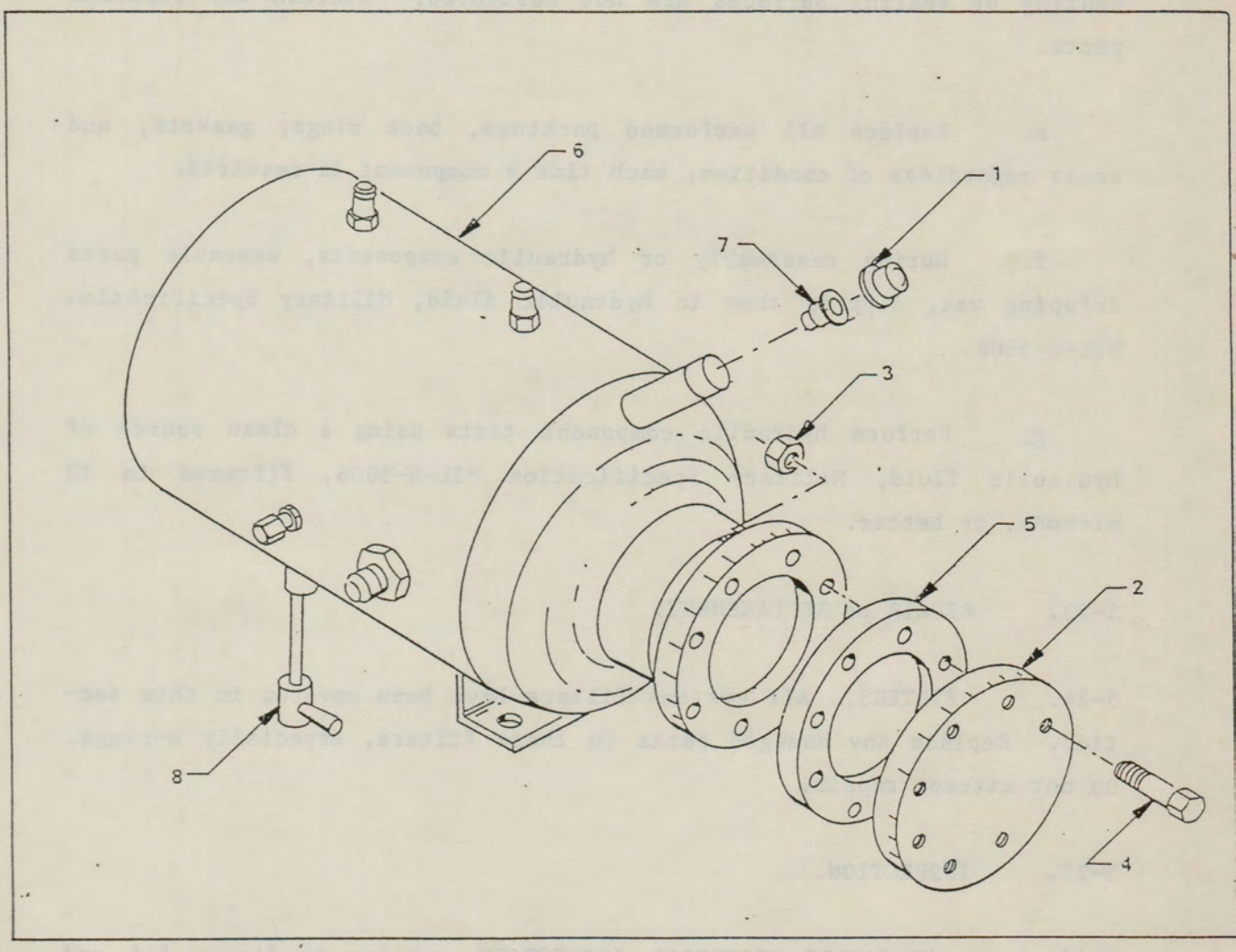


Figure 5-4. Hydraulic Reservoir

c. Inspect interior of reservoir for contaiminants.

WARNING

Use cleaning solvent, P-D-680, type II, in a well ventilated area. Do not inhale solvent vapors or allow solvent to contact skin. Keep solvent away from open flame. Failure to comply may result in injury to personnel.

d. Clean interior of reservoir, if required, by flushing and draining with cleaning solvent, Federal Specification P-D-680, Type II.

e. Install reservoir access cover (2), gasket (5), to reservoir with bolts (4) and nuts (3).

f. Fill reservoir with hydraulic fluid, Federal Specifications MIL-H-5606 or MIL-H-83282. Replace filler cap.

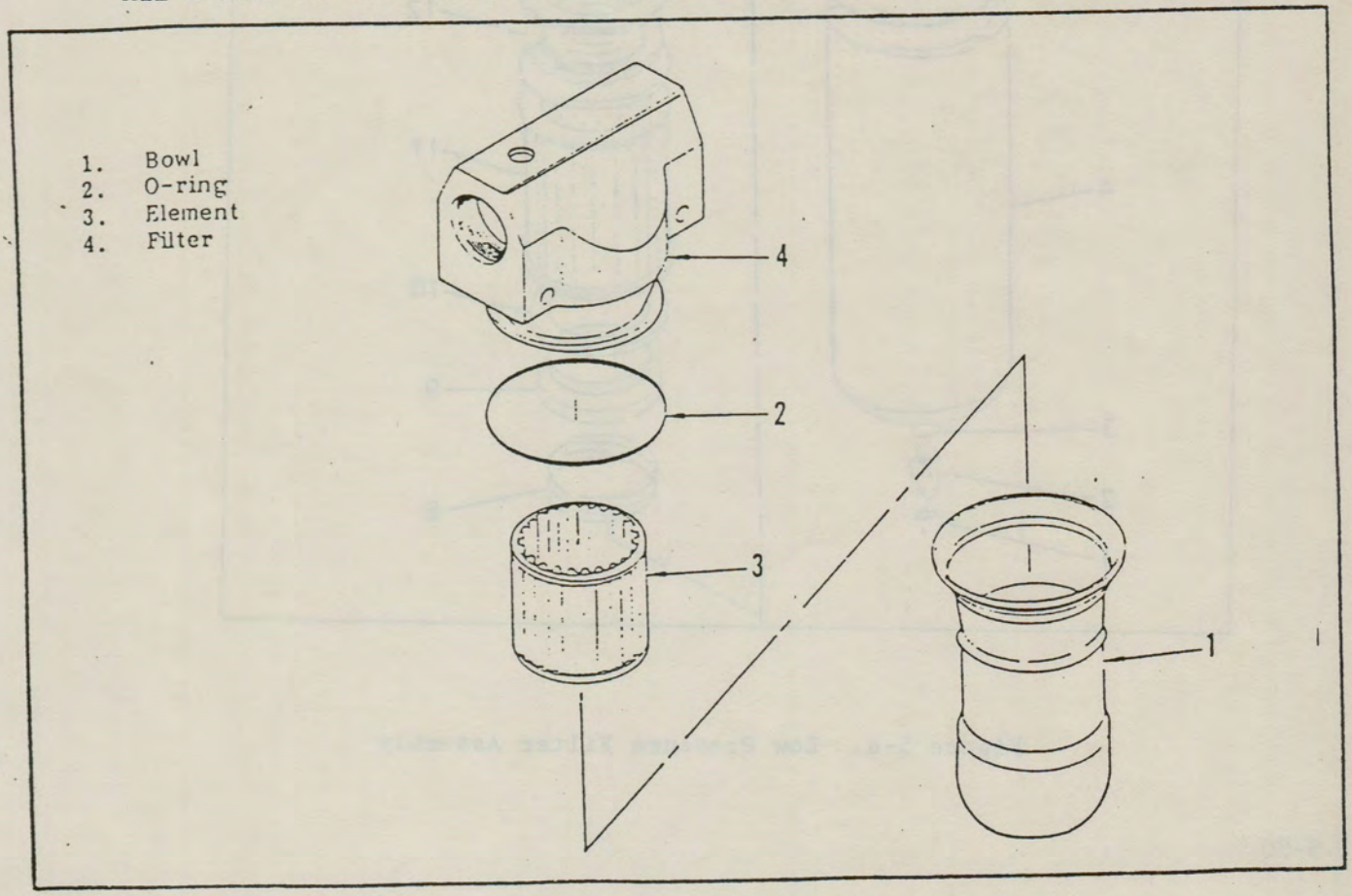


Figure 5-5. Fill System Filter

5-27. FILL SYSTEM FILTER INSPECTION. Check fill system filter for excessive pressure drop as follows:

a. Press the SYSTEM FILL valve (14, Figure 4-2).

b. Determine pressure drop by noting FILL PRESSURE gage (21, Figure 4-1). The difference between the readings of the red and black gage needles is the pressure drop across the filter.

c. When pressure drop reaches 50 psig, cleaner replace filter element (3, Figure 5-5) by unscrewing bowl (1) and removing the element.

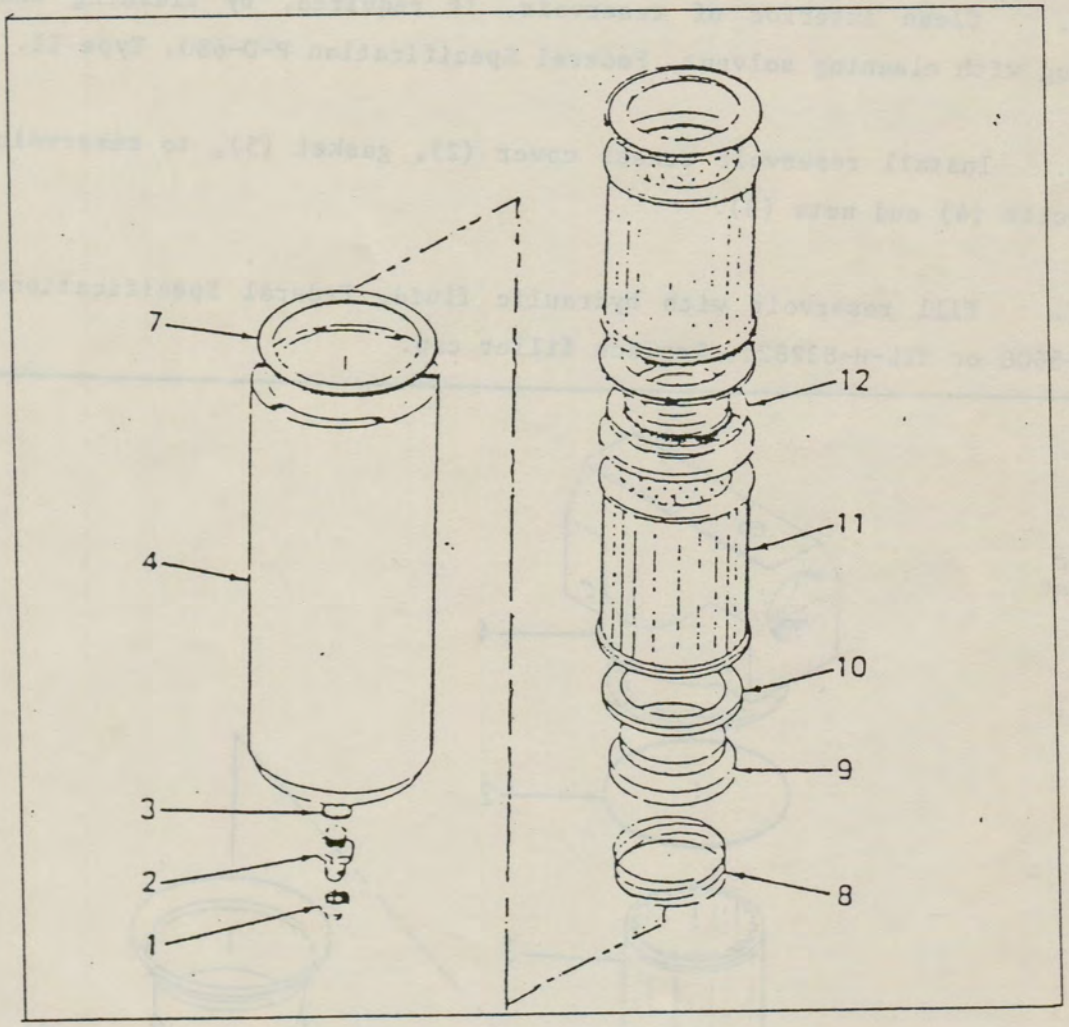


Figure 5-6. Low Pressure Filter Assembly

5-28. BOOST SYSTEM FILTER INSPECTION. Check boost system filter (7, Figure 6-1) for excessive pressure drop as follows:

a. Start the test stand. Ensure that engine is operating at 2500 rpm.

b. Turn GAGE SELECTOR valve (14, Figure 4-3) to boost outlet position and note reading of LOW PRESSURE gage (11).

c. Turn GAGE SELECTOR valve (14, Figure 4-3) to return and note reading of LOW PRESSURE gage (11).

d. Subtract pressure of step 3 from pressure of step 2 to determine pressure drop across filter element.

e. When pressure drop reaches 30 psig, replace filter elements as follows (see Figure 5-6).

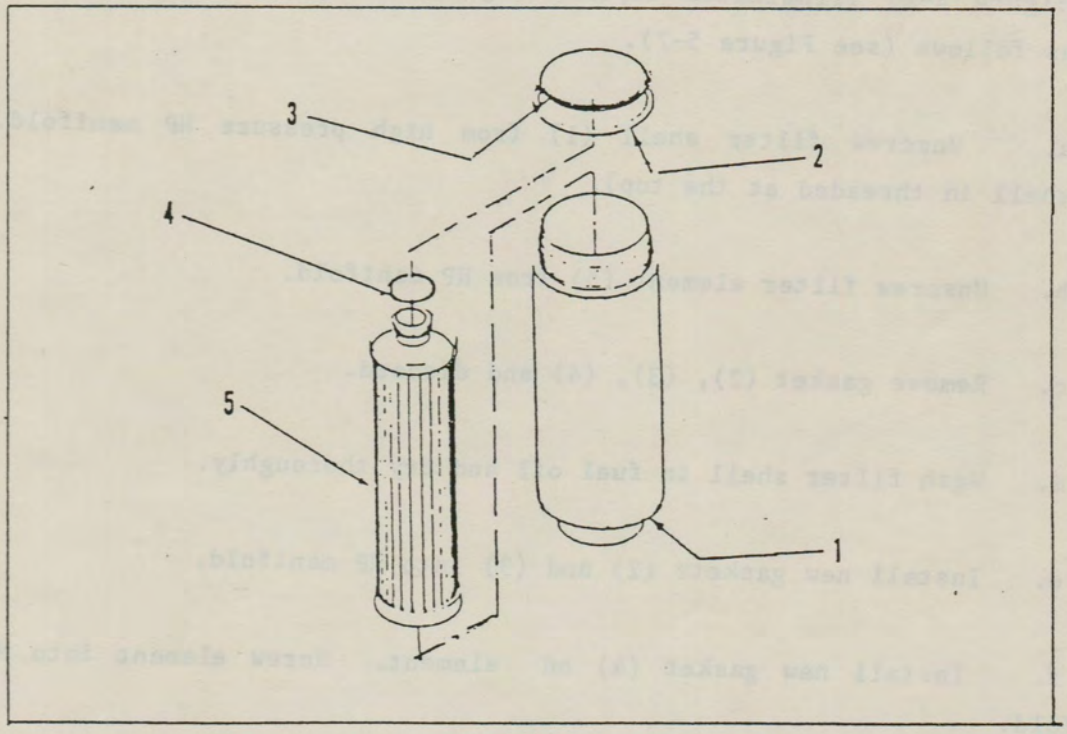


Figure 5-7. High Pressure Filter

(1) Unscrew the six bolts on top of the low pressure manifold .that secure the low pressure filter shell (4) to the manifold.

(2) Remove filter elements (11).

(3) Wash shell in fuel oil and dry.

(4) Insert spring (8), spring retainer (9), rubber gasket (10), filter (11), gasket (10), spacer (12), gasket (10), filter (11), gasket (10) into filter shell (4).

(5) Place gasket (7) on filter shell and match boler.

(6) Insert filter assembly into low pressure manifold and screw with six bolts.

5-29. HIGH-PRESSURE FILTERS INSPECTION. If the HP DIRTY indicator (14A, Figure 4-2) illuminates replace high-pressure filter (22, Figure 6-1) as follows (see Figure 5-7).

a. Unscrew filter shell (1) from high pressure HP manifold. (The shell in threaded at the top).

b. Unscrew filter element (5) from HP manifold.

c. Remove gasket (2), (3), (4) and discard.

d. Wash filter shell in fuel oil and dry thoroughly.

e. Install new gaskets (2) and (3) into HP manifold.

f. Install new gasket (4) on element. Screw element into HP manifold.

g. Screw filter shell (1) into HP manifold.

5-30. WARNING HORN. If the warning horn sounds during operation, isolate trouble as follows:

a. Check temperature gage (3). If fluid temperature exceeds +71°C (+160°F) proceed as follows:

NOTE

If fluid temperature is below +71°C (+160°F), skip to step b.

(1) Verify that cooler bypass valve (21) is closed.

(2) Verify that SYSTEM RELIEF (17) valve is properly adjusted.

(3) Open system BYPASS valve (21).

(4) Press SYSTEM FILL valve (14) to introduce cool fluid from stand reservoir into the system.

(5) Operate system with SYSTEM FILL VALVE (14) open until fluid temperature drops below +54°C (+130°F).

(6) Release SYSTEM FILL valve (14) and proceed with tests.

b. Check boost pressure in both systems as follows:

(1) Turn GAGE SELECTOR valve (14, Figure 4-3) to boost outlet position.

(2) Check boost PRESSURE gage (19). If bost pressure is below 75 psig, immediately shut down the stand and trouble-shoot the applicable system.

c. Check fuel level. Add fuel as required. If fuel level is

satisfactory, check low fuel level warning switch. Replace if defective.

d. Check engine coolant temperature gage. If gage reads above 220°F, refer to Table 5-1 Troubleshooting.

e. Check engine oil pressure gage. If gage reads 4 psi or less, refer to Table 5-1 Troubleshooting.

f. If all gage reading are within limits, check the faulty switches. Refer to Fig. 4-4.

5-31. CALIBRATION. Calibration of the entire Test Stand is not possible. Instruments which appear inaccurate or erratic during operation shall be individually calibrated as described in 5-20 thru 5-25 paragraphs.

5-32. HIGH PRESSURE GAGE. This output pressure gage can be zero adjusted with an adjusting screw on the face of the gage. Loosen knob on bottom of gage face to open front ring. Calibration shall be as follows:

a. Connect suitable 0-6000 psig standard test gage to high presure test port on control panel.

b. Operate Test Stand and compare Stand gage and testing gage readings at various prssures. The Test Stand gage must agree with the test gage within 1 percent full scale plus standard gage tolerance. If Test Stand gage readings are inaccurate or erractic, replace gage.

c. The gage may also be checked by connecting a test gage and hydraulic pressurizing equipment to te test port. The high pressure gage shutoff valve must be closed to isolate the stand gage and test gage from the hydraulic system. Thus hydraulic pressure may be applied to the gages to compare readings for calibration.

5-33. LOW PRESSURE GAGE. This gage shall be zero-adjusted and calibrated in the same manner as the high pressure gage (paragraph 5-18). Use low pressure test port on control panel. Isolate low pressure gage by turning selector valve on control panel to OFF position. Gage shall read within two percent full scale of test gage, plus test gage tolerance.

5-34. FLOWMETER. Calibration of the flowmeter, is not required as it is used for indication, only. However, the accuracy of the fluid volumne indicated on the flowmeter may be confirmed by connecting a calibrated test flowmeter in the suction return line of the Test Stand. Operate Stand accordinly.

5-35. FLUID TEMPERATURE GAGE. This gage is equipped with five-foot capillary tube and a sensing bulb. To calibrate, proceed as follows:

a. Disconnect sensing bulb at thermowell.

b. Place bulb and a test thermometer of known accuracy in a well agitated constant-temperature bath. Place bulb and thermometer as close together as possible.

c. The bath must be situated at an elevation relative to that of the thermowell, with the bath temperature approximating the mid-point reading of the gage.

d. Allow approximately five minutes before comparing the tempra-ture reading of the gage with that of the test thermometer.

e. If readings do not agree, remove face of gage and adjust-pointer to indicate the correct temperature.

f. Calibration is not required, provided reading is compared with and instrument of know accuracy.

5-36. HOURMETER. To verify the accuracy of the hourmeter, record a

specific period of operating time and compare the reading on the hourmeter with that of a standard meter of know accuracy. Replace hourmeter it not correct. Calibration is not required.

5-37. TEST. Bench Testing of individual components is not applicable to this equipment.

SECTION VI

DIAGRAMS

6-1. GENERAL. This section provides the diagrams and wire lists necessary for troubleshooting, maintenance and repair of the Test Stand. The Diagram for the Test Stand are as folows:

Hydraulic Diagram	Figure 6-1
Electrical Diagram	Figure 6-2

Key to Figure 6-2

1AH	Horn
AMP	Ammeter
1BT	Battery, 24 VAC
2BT	Battery, 24 VAC
CB1	Circuit Breaker, 30A
CB2	Circuit Breaker, 10A
G1	Gage, Fuel Level
G2	Gage, Oil Temperature
LS1	Level Switch, Low Fuel
MTR1	Motor Starter
MTR2	Fill Motor
PB1	Pushbutton Switch, Starter
PB2	Pushbutton Switch, Fill
PL1	Panel Light
PL2	Panel Light
PL3	Panel Light
PL4	Panel Light
PL5	Panel Light
PL6	Light, Panel, Filter, High Delta P
PS1	Pressure Switch, Filter
PS4	Pressure Switch, Low Boost
PS7	Pressure Switch, Engine Oil
R1	Relay
S1	Switch, Main Power
S2	Switch, Panel Light
S3	Overide (Horn Disable)
SOL1	Solenoid, Starter
SOL2	Solenoid, Fill
SU1	Sending Unit, Fuel Level
SU2	Sending Unit, Oil Temperature
TS1	Temperature Switch, High Oil
TS4	Temperature Switch, Engine