The Interactive features of this manual are currently disabled.

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If you see a yellow banner, do the following:

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CHAPTER 9
FLUID SERVICING AND SUPPORT EQUIPMENT

INTRODUCTION

Fluid servicing consists of adding new filtered hydraulic fluid to a system, which replaces fluid lost through leakage, system maintenance, or malfunction. The type of support equipment varies, depending on the type of aircraft. As an AM, you must know this equipment and how to operate it. Hydraulic support equipment (SE) is used to service and test hydraulic systems and components. To use the equipment, you must understand each piece of hydraulic SE so you can maintain aircraft hydraulic systems. The maintenance and operation of specific SE units are described in applicable manufacturer’s operation and service instructions manual (listed in the Naval Aeronautical Publications Index [NAPI], under “Test Equipment,” 17 series group), and in the maintenance instructions specific to the particular aircraft.

LEARNING OBJECTIVES

When you have completed this chapter, you will be able to do the following:

1. Identify the support equipment used to service and test aircraft hydraulic systems and components.
2. Recognize the contamination control requirements for support equipment.

FLUID SERVICING EQUIPMENT

All maintenance levels use SE. General types of hydraulic SE are hydraulic fluid dispensing equipment, portable hydraulic test stands, and stationary hydraulic test stands.

HYDRAULIC FLUID DISPENSING EQUIPMENT

Hydraulic fluid dispensing units are portable. They are used to replenish hydraulic fluid lost or otherwise removed from a system. They provide a means of dispensing new filtered fluid under pressure in a manner that minimizes the introduction of external contaminants. Several different types of hydraulic fluid dispensing equipment are available.

Model PMU-71/E Hydraulic Fluid Servicing Unit (HFSU)

The HFSU, P/N 061475-100, illustrated in Figure 9-1, is a portable hand-carried servicing unit for servicing aircraft hydraulic

Figure 9-1 — PMU-71/E (HFSU) Hydraulic Fluid Servicing Unit.
systems from its nominal 2-gallon capacity reservoir.

The HFSU has a black static dissipative polyethylene plastic reservoir housing with a red aluminum top plate and red reflective tape both around the base and on the carrying handles of the unit. The reservoir has a clear plastic fluid level sight glass that is marked every half gallon up to 2 gallons.

The manual single-acting self-priming piston pump delivers 3 ounces of fluid per stroke. The pump has an extendable pump handle that is locked in operational or storage position by a removable lanyard pin. Fluid pressure is controlled by both a relief and a bleed valve. The relief valve is factory set to prevent the delivery hose pressure from exceeding 150 psi in pressure. The manual bleed valve allows the operator to bleed any pressure in the hose back to the reservoir. A 0 to 160 psi pressure gauge monitors fluid pressure in the delivery hose.

The HFSU has a 15-ft wire braided hose encased within a smooth clear plastic sleeve. A 3-micron absolute filter is located near the end of the hose assembly. After the filter housing is another 18 inches of hose that ends with a dash 4-flared swivel nut fitting with an attached cap. This swivel nut can be attached to a quick fill adapter to lock in a hose for storage or for recirculation of the fluid back to the reservoir to remove trapped air in the system. Prongs on the sides of the reservoir housing are used as carrying handles and to hold the hose in place during storage or to transport the unit.

HFSU is designed to be filled by a Hydraulic Fluid Bulk Dispensing Unit (HFBDO). The HBDSU is a specially designed drum pump that fills the HFSU through its quick fill adapter. The HFSU can also be filled by cans, by removing the fill cap and pouring in new fluid with the aid of a funnel.

Model H-250-1 Hydraulic Servicing Unit

The Model H-250-1 hydraulic servicing unit is a 1-gallon servicing unit (Figure 9-2). It provides a way of servicing systems by hand-pumping filtered fluid directly from the original container without exposing the fluid to open air or to other atmospheric contamination. The unit accepts the standard, 1-gallon container, which, when installed, serves as a reservoir. The servicing unit has 3-micron (absolute) filtration to prevent particulate contamination of a system by new fluid that may not meet the prescribed cleanliness prior to packaging. Contamination in new fluid is rare, but it does occur.

The original fluid container serves as a reservoir for the H-250-1 servicing unit. This container is not opened until it is placed in the unit, and the handle assembly pressed into a locked position. When the handle is locked, the can is sealed into the unit by cleanly piercing its top and bottom. This action automatically destroys the can's potential for reuse. The H-250-1 servicing unit is equipped with an upper piercing pin, which is drilled to provide the can with atmospheric venting through a 5-micron filter. Also, it has a check valve to minimize airborne particulate and moisture.
contamination. The lower piercing pin is drilled so the hydraulic fluid can reach the pump through a passage in the base casting and a 3-micron filter. The filter is a nonbypass type. When it becomes loaded, the unit is inoperative. The filter housing is designed so that the pump won’t operate if a filter element has not been installed.

A pressure gauge, an air trap, and a manual air bleed valve are attached directly to the pump assembly base. The air trap automatically removes any air present in the fluid at the pump chamber and retains it in a separate trap. Air collected in the trap is vented from the unit by manually operating a spring-loaded, air bleed valve.

The H-250-1 servicing unit has an 8-foot service hose that is equipped with a 3-micron, in-line filter connected at the discharge end, which prevents reverse flow contamination through the hose. There are several types of disconnect fittings on the reservoir service units of naval aircraft. There are no mating fittings provided with the unit. Each activity must procure and install the disconnect fitting required for compatibility with the aircraft supported. Both male and female fittings are procured so that half can be installed on the hose end and half on the bracket provided. The bracket-mounted fittings will provide a contamination-free means of stowing the discharge end of the service hose when the equipment is not in actual use.

**Model HSU-1 Fluid Service Unit**

The Model HSU-1 fluid service unit (*Figure 9-3*) is operated similarly to the H-250-1 unit, except that it has a fluid-holding capacity of 3 gallons. Like the H-250-1 servicing unit, the HSU-1 accepts a standard 1-gallon container and uses it as a fluid reservoir. Additionally, it contains an integral 2-gallon reservoir assembly. It has 3-micron filtration incorporated to ensure delivery of contamination-free fluid.

The integral 2-gallon reservoir assembly is made of anodized cast aluminum and (along with a hand pump assembly) is mounted to a cast aluminum base. The lower can piercer is mounted on top of the reservoir and allows fluid to flow from the installed 1-gallon container into the reservoir, automatically replenishing it. A sight gauge indicates the fluid level of the reservoir. It reads from 0 to 2 gallons, in 1/4-gallon increments. An indicated level of 2 gallons or less means that the 1-gallon container is empty and can be removed for replacement. A capped deaeration port is located on top of the reservoir to permit bleeding the air from the pump and output hose.

Can holder and handle assemblies are mounted above the 2-gallon reservoir. The can holder positions the installed 1-gallon fluid container directly above the reservoir, and also provides a means of placing the handle assembly over the
container top. The handle assembly is hinged to a bracket on the can holder assembly. It is provided with a spring-loaded latch to lock the handle in the closed position. In addition to the carrying handle itself, the handle assembly contains an upper can piercer, a vent check valve, and a filter. A vent hose is connected between the top of the reservoir (sight gauge) and the upper can piercer.

Fluid is delivered by a single-action, piston hand pump that displaces 1.5 fluid ounces per full stroke at 0 to 250 psi in pressure. The pump is operated with a sliding pump handle, which is held in the extended or retracted position by a spring-loaded ball detent. A replaceable 3-micron (absolute) disposable filter on the pump base removes particulate contamination from the hydraulic fluid being delivered to the suction side of the pump. The filter unseats a shutoff valve, which closes the suction port whenever the filter element is being replaced.

The HSU-1 service unit is equipped with a 7-foot service hose connected to the unit’s fluid output port at the pump assembly. The hose assembly ends with a short bent-tube assembly for direct connection to fill fittings on the aircraft or components being serviced. A 3-micron, in-line filter is located between the hose end and the tube. This prevents reverse-flow contamination and serves as a final filter. When the fluid service unit is not in use, it is stored by wrapping the hose assembly around the can holder assembly and fastening the tube end to the hose storage fitting on the base.

CHECKING AIRCRAFT HYDRAULIC FLUID LEVELS

There are specific procedures for checking hydraulic fluid levels in each model of aircraft. These procedures must be followed to make sure the system operates at the required fluid level. Fluid level is generally determined by an indicating device at the system reservoir. The type of indicator used varies with the aircraft model. Sight-glass, gauge, and piston-style indicators are commonly used.

There is close tolerance between the operating parts of equipment used in aircraft hydraulic systems and the level of hydraulic fluid contamination; therefore, DO NOT introduce foreign matter into a system being serviced. All servicing must be accomplished by qualified personnel using authorized fluid-dispensing equipment.

The information given here gives general guidance and requirements to follow when fluid-servicing hydraulic systems and components. Procedures contained in the applicable technical manuals must be followed when hydraulic systems and components are actually serviced. When these systems are serviced, approved fluid-dispensing equipment that is equipped with 3-micron (absolute) filtration must be used. Equipment must be maintained according to the applicable maintenance instruction manual (MIM) and maintenance requirements card (MRC). Hydraulic fluid dispensing equipment must be kept clean and stored in a clean, protected environment. This equipment, including filters, must be serviced on a periodic basis. All fittings and hose ends must be protected with approved metal closures when not in use.

The correct fluids for each piece of fluid-dispensing equipment should be used, and the equipment marked to indicate the type of fluid. Specified hydraulic fluid should be used to service hydraulic systems. Precautions should be taken to avoid accidental use of any other fluid. Hydraulic fluid should not be left in an open container any longer than necessary, particularly in dusty environments. Exposed fluid will readily collect contaminants, which could jeopardize system performance. With the exception of fluid cans or drums installed in approved dispensing units, open cans of hydraulic fluid are prohibited. Containers for disposal of used fluid must be prominently marked and
identified. Empty fluid containers must be destroyed or returned to supply as appropriate.

Hydraulic fluid drained from hydraulic equipment or components should NOT be reused. The drained fluid should immediately be disposed of so it will not accidentally be reused. In the event hydraulic fluid is spilled on other parts of equipment on the aircraft, spilled fluid should be removed by using approved wiping materials and dry cleaning solvent MIL-PRF-680.

PORTABLE HYDRAULIC TEST STANDS

Portable hydraulic test stands are mobile sources of external hydraulic power. They can be connected to an aircraft hydraulic system to provide power normally obtained from the aircraft hydraulic pumps. The test stands provide a means of energizing the aircraft’s hydraulic systems. SE is used on the flight line and in hangar work areas. In addition, portable test stands are important tools for hydraulic contamination control. They are the primary means of aircraft hydraulic decontamination.

Several types of portable stands are available. Their primary difference is their prime power source (electric motor or engine driven), functional features, and maximum flow capability.

Figure 9-4 — A/M27T-5A portable hydraulic power supply, rear and right-hand side view.
A/M27T-5A Portable Hydraulic Power Supply

The A/M27T-5A portable hydraulic power supply (Figure 9-4), made by Janke and Company, Inc., is replacing the AHT-64 hydraulic test stand made by Teledyne Sprague Engineering. The A/M27T-5A is a modified AHT-64 portable, table hydraulic power supply unit. It is a self-contained, diesel-powered, trailer-mounted unit capable of providing a source of hydraulic fluid at controlled pressures and flow rates from 0 gallons per minute (gpm) at 0 psi to 20 gpm at 3,000 psi, or 10 gpm at 5,000 psi, 2500 revolutions per minute (rpm) under ambient temperatures of -20° F to +125° F and relative humidity of 95 percent. The Model 3-53 Detroit diesel engine is used in the A/M27T-5A. Minor changes were made to the physical location of system components to make maintenance easier. See Figure 9-5 for a view of the A/M27T-5A central panel. Table 9-1 explains the functions of each control and indicator on the panel.

Figure 9-5 — A/M27T-5A main panel controls and indicators.
<table>
<thead>
<tr>
<th>Item No.</th>
<th>Control / Indicator</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Panel light (DS1)</td>
<td>Provides main control panel lighting. Illuminates if ignition switch S1 is set to IGNITION ON.</td>
</tr>
<tr>
<td>2</td>
<td>AMMETER</td>
<td>Indicates charging condition of batteries B1 and B2. When discharging, indicates negative. When charging, indicates positive (-60 to +60 amp scale).</td>
</tr>
<tr>
<td>3</td>
<td>COLD WEATHER STARTING AID handle</td>
<td>Facilitates cold weather diesel engine starting. Handle pulling action is transmitted by sheathed cable to cold weather starting aid 6 cc valve lever. Ether is injected into diesel engine air inlet housing when handle is pushed back in.</td>
</tr>
<tr>
<td>4</td>
<td>START switch (S6)</td>
<td>When pressed, initiates diesel engine start sequence, if ignition switch S1 is set to IGNITION ON.</td>
</tr>
<tr>
<td>5</td>
<td>Diesel engine OIL PRESSURE gauge</td>
<td>Indicates diesel engine oil pressure (0-100 psi scale, 54 to 58 psi nominal from 2000 to 2500 rpm).</td>
</tr>
<tr>
<td>6</td>
<td>Fuse (F2)</td>
<td>Protects electrical circuits.</td>
</tr>
<tr>
<td>7</td>
<td>FLUID TEMP WARNING LIGHT (DS7)</td>
<td>Illuminates when hydraulic fluid temperature increases to trip setting (160°F) of fluid temperature thermoswitch S5.</td>
</tr>
<tr>
<td>8</td>
<td>TACHOMETER/HOURMETER</td>
<td>TACHOMETER indicates diesel engine rpm (0-3500 rpm). HOURMETER (0.01 to 9999 hours) counts diesel engine revolutions in terms of time (indicates 0.1 hour [6 minutes] per 12318 revolutions).</td>
</tr>
<tr>
<td>9</td>
<td>EMERGENCY STOP handle</td>
<td>Used for emergency diesel engine shutdown. Handle pulling action is transmitted by sheathed cable to diesel engine air inlet housing shutdown valve lever.</td>
</tr>
<tr>
<td>10</td>
<td>PULL TO STOP/ENGINE STOP handle</td>
<td>Used for normal diesel engine shutdown. Handle pulling action is transmitted by sheathed cable to diesel engine variable speed, closed linkage, mechanical governor stop lever.</td>
</tr>
<tr>
<td>11</td>
<td>THROTTLE control handle</td>
<td>Handle pulling action is transmitted by sheathed cable to diesel engine variable speed, closed linkage, mechanical governor throttle lever.</td>
</tr>
<tr>
<td>12</td>
<td>Panel light (DS2)</td>
<td>Provides main control panel lighting. Illuminates if ignition switch S1 is set to IGNITION ON.</td>
</tr>
<tr>
<td>13</td>
<td>EMERGENCY STOP RESET handle</td>
<td>Used to open diesel engine air inlet housing shutdown valve after diesel engine emergency shutdown. Handle pulling action is transmitted by sheathed cable to valve lever.</td>
</tr>
<tr>
<td>14</td>
<td>PRESS. OUTLET FLOWMETER</td>
<td>Indicates hydraulic fluid flow to high pressure port (2 to 30 gpm).</td>
</tr>
<tr>
<td>15</td>
<td>COMPENSATOR CONTROL</td>
<td>Adjusts pressure at which compensation occurs in high pressure pump when power supply is being used as a high pressure system.</td>
</tr>
<tr>
<td>16</td>
<td>PUMP CASE FILTER indicator (DS5)</td>
<td>Illuminates when pump case drain filter high differential pressure switch S3 closes. S3 will close if the pump case drain filter input and output pressure differ by 35 psi or more.</td>
</tr>
<tr>
<td>17</td>
<td>LOW PRESS FILTER indicator (DS6)</td>
<td>Illuminates when low pressure filter differential pressure switch S4 closes. S4 will close if low pressure filter and inlet and outlet pressures differ by 50 psi or more.</td>
</tr>
<tr>
<td>18</td>
<td>COMPOUND GAUGE</td>
<td>Function depends on setting of PRESSURE SELECTOR VALVE (Index 21). Calibrated to indicate 0 to 30 inches Hg vacuum and 0 to 300 psi pressure.</td>
</tr>
</tbody>
</table>
A/M27T-7A Portable Hydraulic Power Supply

The portable hydraulic test stand A/M27T-7A is identical to the A/M27T-5A test stand, except that it is powered by an electric motor. The motor is capable of operating on 220/440-V, 3-phase, and 60-Hz current. The principles of operation and operating procedures for the A/M27T-7A test stand are basically the same as for the A/M27T-5A test stand, with the exception of the starting and stopping procedures and the use of electrical power to operate the stand. Refer to applicable equipment manual (Table 9-2) for operational and maintenance instructions. Figure 9-6 shows a typical A/M27T-7A hydraulic power supply unit. Figure 9-7 shows the primary control panel controls and
indicators, and Figure 9-8 shows the secondary control panel controls and indicators. Table 9-3 gives a description of the primary control panel controls and functions. Table 9-4 gives a description of the secondary control panel controls and functions.

### Table 9-2 — Portable Hydraulic Test Stands

<table>
<thead>
<tr>
<th>MODEL (NOTE1)</th>
<th>MFR &amp; P/N (CAGE)</th>
<th>PUBLICATION</th>
<th>MRC</th>
<th>TEC</th>
<th>FLOW CAPACITY</th>
<th>POWER SOURCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>A/M27T-7</td>
<td>68A5-J1000 (56529)</td>
<td>NAVAIR 17-15BF-91</td>
<td>17-600-150-6-1</td>
<td>GGJV GGJ9</td>
<td>20 gpm @ 3000 psi 10 gpm @ 5000 psi (Note 3)</td>
<td>Electric</td>
</tr>
<tr>
<td>A/M27T-7A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A/M27T-3</td>
<td>Greer 636AS100-1 (26637)</td>
<td>NAVAIR 17-15BF-76</td>
<td>17-600-101-6-1</td>
<td>GGJU</td>
<td>6 gpm @ 3000 psi 3 gpm @ 4500 psi</td>
<td></td>
</tr>
<tr>
<td>A/M27T-5</td>
<td>Hydraulic International 68A4-J1000-1 (30003)</td>
<td>NAVAIR 17-15BF-89</td>
<td>17-600-127-6-1</td>
<td>GGJZ GGJ8</td>
<td>20 gpm @ 3000 psi 10 gpm @ 5000 psi (Note 3)</td>
<td>Diesel</td>
</tr>
<tr>
<td>A/M27T-5A</td>
<td></td>
<td></td>
<td>17-600-127-6-2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A/M27T-14</td>
<td>Hydraulic International, 0449-100 (56529)</td>
<td>NAVAIR 17-15BF-120</td>
<td>17-600-BF120-6-1</td>
<td>GGJB</td>
<td>32 gpm @ 3000 psi 22 gpm @ 5000 psi</td>
<td>Electric</td>
</tr>
<tr>
<td>A/M27T-15</td>
<td>Hydraulic International, 04489-100 (56529)</td>
<td>NAVAIR 17-15BF-110</td>
<td>17-600-BF110-6-1</td>
<td>GGJE</td>
<td>32 gpm @ 3000 psi 22 gpm @ 5000 psi</td>
<td>Diesel</td>
</tr>
<tr>
<td>PHPS</td>
<td>Hydraulic International</td>
<td>AG-140V22-MIB-000</td>
<td>AG-140V22-MRC-100</td>
<td>S7DJ</td>
<td>50 gpm @ 3000 psi 32 gpm @ 5000 psi</td>
<td>Diesel</td>
</tr>
<tr>
<td></td>
<td>Diesel P/N: (000850-100)</td>
<td></td>
<td>AG-140V22-MRC-200</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Electric P/N: (98612-100)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
1. A/M27T-5/-7 test stands are preferred equipment and shall be used whenever available. Other equipment may be used if it conforms to configurations as specified in Paragraph 8.
2. All electric motor-driven units operate from 220/440-V, 60-Hz, 3 phase power source except the A/M27T-14 which operates only on 440-V, 60Hz, 3 phase power.
3. The A/M27T-5A and A/M27T-7A are upgraded A/M27T-5 and A/M27T-7 for the F/A-18E/F/G with quick disconnects and flowmeters rated for 5000-PSI operation.
Figure 9-6 — Portable electric motor-driven hydraulic power supply (A/M27T-7A).

Figure 9-7 — Primary control panel controls and indicators.

Figure 9-8 — Secondary control panel controls and indicators.
<table>
<thead>
<tr>
<th>Item No.</th>
<th>Control / Indicator</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Panel Lights (DS1, DS2, DS8)</td>
<td>Provide illumination for primary control panel. Light if OFF-MASTER-ON switch S1 is set to ON.</td>
</tr>
<tr>
<td>2</td>
<td>HIGH PRESSURE FILTER Indicator Light (DS4)</td>
<td>Lights when high pressure filter element requires service.</td>
</tr>
<tr>
<td>3</td>
<td>PUMP CASE FILTER Indicator Light (DS5)</td>
<td>Lights when pump case filter requires service.</td>
</tr>
<tr>
<td>4</td>
<td>LOW PRESSURE FILTER Indicator Light (DS6)</td>
<td>Lights when low pressure filter element requires servicing.</td>
</tr>
<tr>
<td>5</td>
<td>FLUID TEMP WARNING LIGHT (DS7)</td>
<td>Lights when hydraulic fluid temperature increases to +160°F (+71.11°C). This is trip setting of thermoswitch.</td>
</tr>
<tr>
<td>6</td>
<td>STOP Pushbutton Switch (S9)</td>
<td>Used to stop electric drive motor.</td>
</tr>
<tr>
<td>7</td>
<td>COMPENSATOR CONTROL</td>
<td>Adjusts pressure at which compensation occurs in high pressure pump when power supply is used as a high pressure system.</td>
</tr>
<tr>
<td>8</td>
<td>FLUID TEMPERATURE GAUGE</td>
<td>Indicates temperature of hydraulic fluid going to inlet of high pressure pump.</td>
</tr>
<tr>
<td>9</td>
<td>SELECTOR VALVE</td>
<td>Provides selection of BOOST PUMP INLET, H.P. PUMP INLET, or RETURN BACK PRESSURE line readings on compound gauge; 4th position CALIBRATE GAUGE is for calibration of gauge.</td>
</tr>
<tr>
<td>10</td>
<td>COMPOUND GAUGE</td>
<td>Indicates (as selected by SELECTOR VALVE) back pressure or suction in low pressure return line, inlet to boost pump, and inlet to high pressure pump.</td>
</tr>
<tr>
<td>11</td>
<td>L.P. GAUGE TEST Fitting</td>
<td>Provides connection for external hydraulic source to calibrate COMPOUND GAUGE. SELECTOR VALVE must be in CALIBRATE GAUGE position.</td>
</tr>
<tr>
<td>12</td>
<td>PRESSURE BYPASS VALVE</td>
<td>When opened, causes high pressure relief valve to dump flow to return line at no pressure.</td>
</tr>
<tr>
<td>13</td>
<td>H.P. GAUGE TEST Fitting</td>
<td>Provides connection for external hydraulic source to test and calibrate HIGH PRESSURE GAUGE. SELECTOR VALVE must be in CALIBRATE GAUGE position.</td>
</tr>
<tr>
<td>14</td>
<td>HIGH PRESSURE GAUGE</td>
<td>Indicates hydraulic fluid pressure at PRESSURE OUTLET ports.</td>
</tr>
<tr>
<td>15</td>
<td>HOURMETER</td>
<td>Indicates total elapsed operating hours of power supply.</td>
</tr>
<tr>
<td>16</td>
<td>POWER ON Indicator Light (DS9)</td>
<td>Lights when control circuit is energized and MASTER switch is placed to ON.</td>
</tr>
<tr>
<td>17</td>
<td>OFF-MASTER-ON Switch (S1)</td>
<td>Energizes electrical control circuit.</td>
</tr>
<tr>
<td>18</td>
<td>START Pushbutton Switch (S10)</td>
<td>Starts electric drive motor.</td>
</tr>
<tr>
<td>19</td>
<td>PRESSURE OUTLET Flow Meter</td>
<td>Indicates hydraulic fluid flow (in gallons per minute) to PRESSURE OUTLET ports.</td>
</tr>
<tr>
<td>20</td>
<td>COMPOUND GAUGE Calibration Screw</td>
<td>Used to calibrate COMPOUND GAUGE when SELECTOR VALVE is in CALIBRATE GAUGE position.</td>
</tr>
<tr>
<td>21</td>
<td>HIGH PRESSURE GAUGE Calibration Screw</td>
<td>Used to calibrate HIGH PRESSURE GAUGE when SELECTOR VALVE is in CALIBRATE GAUGE position.</td>
</tr>
<tr>
<td>Item No.</td>
<td>Control / Indicator</td>
<td>Function</td>
</tr>
<tr>
<td>---------</td>
<td>-------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>1</td>
<td>AIRCRAFT FILL SYSTEM PRESSURE Gauge</td>
<td>Indicates hydraulic pressure at AIRCRAFT FILL SYSTEM OUTLET Port, when AIRCRAFT FILL SYSTEM SHUTOFF valve is open.</td>
</tr>
<tr>
<td>2</td>
<td>AIRCRAFT FILL SYSTEM RELIEF VALVE</td>
<td>Used to manually adjust fill system pressure and provide system pressure relief.</td>
</tr>
<tr>
<td>3</td>
<td>HIGH PRESSURE GAUGE SHUT OFF</td>
<td>When closed, isolates HIGH PRESSURE GAUGE for calibration or service. Also acts as pulsation snubber.</td>
</tr>
<tr>
<td>4</td>
<td>AIRCRAFT FILL SYSTEM SHUTOFF VALVE</td>
<td>Used to shut off or turn on the flow through the fill system hose.</td>
</tr>
</tbody>
</table>

**MAINTENANCE PROCEDURES**

The A/M27T-5A and the A/M27T-7A operate in basically the same manner. They differ in their starting and stopping procedures. Before using the A/M27T-5A or the A/M27T-7A test stands—how they work and the location and function of all switches, controls, and instruments need to be known. For specific instructions on its use, refer to the *Handbook of Operation, Service, and Overhaul Instruction*, NA 17-15BF-65, and the applicable MIM.

Before operating the portable hydraulic test stand, the specific instructions need to be followed for its inspection, turnup, aircraft connection, and operation from the applicable maintenance manuals. It is important to know some of the minimum general requirements about the use of all portable test stands. It must be determined where the test stand is located to ensure adequate room and ventilation, and where engine heat can be dissipated. Parking brakes should be securely set and all necessary access doors opened. The hydraulic fluid level of the test stand reservoir should be checked. It should be three-fourths full, as indicated on the gauge and fluid added if required. The fuel gauge, radiator level, and engine oil level in engine-driven stands should be checked and determined they are adequate for the anticipated operating period. The power connections in electric-powered stands should be checked for correct phasing and frequency and the pointers of all other gauges should be checked that they are at or near zero. The service ends of the external pressure and return line hoses to the hose storage (recirculation) manifold on the equipment should be cleaned and connected. If the manifold is equipped with a shutoff valve, the valve should be placed in open position.

The test stand engine (or motor) should be started according to the applicable operating instructions and allowed to warm up to its normal operating temperature. Recirculation cleaning and deaerating of the hydraulic fluid in the test stand should be performed, with both operations being done at the same time.

**NOTE**

When actually cleaning and deaerating the test stand, you should follow the procedures contained in the applicable manuals.

To provide fluid flow from the internal reservoir through the external service hoses and interconnecting manifold, the test stand should be set up. With the pump pressure compensator placed at its lowest setting, the manifold and service outlet valves (if
present) should be in the open position. The high-pressure gauge should indicate a value less than 600 psi. The test stand should be allowed to recirculation clean for 3 to 5 minutes while monitoring the fluid temperature throughout the cleaning cycle. The maximum operating limits should NOT be exceeded. All filter differential pressure indicators, particularly those associated with the 3-micron filter assemblies need to be monitored. If there is an indication of a loaded filter after the fluid reaches normal operating temperature (85°F minimum), the test stand should be shut down and the replacement filter elements installed. On test stands that have a fluid sight glass and manual air bleed valve, the valve should be periodically opened and the sight glass monitored throughout the cleaning cycle to eliminate visible indications of entrapped air.

When recirculation cleaning and deaeration are complete, the hydraulic fluid should be analyzed for contamination. Next, the fluid flow to the external service hoses should be terminated in preparation for connecting them to the aircraft. The service hoses should then be disconnected from manifold assembly and the manifold dust covers reinstalled.

**Applying Hydraulic Power**

Before connecting a test stand to an aircraft system, all personnel, work stands, and other ground-handling equipment must be clear of flight control surfaces, movable doors, and other units. Personnel must stay clear of these areas when either electric power or hydraulic pressure is applied to the aircraft. Sudden movement can cause injury or damage.

Before the hydraulic test stand is connected to the aircraft, the test stand controls should be set to the positions and values required to accomplish the aircraft tests. The test stand should be operated to confirm the settings. The volume adjustment is then reduced to minimum flow and the stand shut down. The test service hoses should then be connected to the aircraft ground power quick-disconnects, making sure that all connectors are clean before connection. All attached dust caps and plugs should be mated to protect against contamination during test stand operation.

It is important not to kink or damage the test stand hose when connecting it to an aircraft system. The hose should be uniformly bent while bending around structures or equipment, maintaining and following the recommended minimum inside bend radius for the hose. A 1/2-inch pressure hose should have a 2.30-inch radius; a 5/8-inch pressure hose, a 5.37-inch radius; and a 1-inch hose a 5.90-inch radius.

Before hydraulic power can be applied, the aircraft reservoir level needs to be checked. It should be filled to the level specified in the applicable MIM or MRC. If necessary, the reservoir should be serviced using the approved fluid service unit. Then, the test stand should be set up for either aircraft or test stand reservoir operation, as specified in the applicable MIM. The required mode of operation can be set by using the reservoir selector valve on stands that have this equipment, or the reservoir fluid supply valve can be used. When the test stand reservoir supply valve is closed, the aircraft reservoir will operate. The test stand reservoir is preferred because the vented reservoir allows

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**NOTE**

Refer to the applicable maintenance manual for the specific procedures to follow when applying external electric and hydraulic power.

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Before hydraulic power can be applied, the aircraft reservoir level needs to be checked. It should be filled to the level specified in the applicable MIM or MRC. If necessary, the reservoir should be serviced using the approved fluid service unit. Then, the test stand should be set up for either aircraft or test stand reservoir operation, as specified in the applicable MIM. The required mode of operation can be set by using the reservoir selector valve on stands that have this equipment, or the reservoir fluid supply valve can be used. When the test stand reservoir supply valve is closed, the aircraft reservoir will operate. The test stand reservoir is preferred because the vented reservoir allows
aircraft fluid deaeration during system operation (Figure 9-9). This mode should be used whenever practical.

When a test stand is equipped with a return line and back pressure reducing valves, test stand reservoir operation can be used even in situations where the aircraft reservoir is normally used. The back pressure reducing valve can be adjusted by presetting the value equivalent to normal aircraft reservoir pressure.

The aircraft controls should be in the specified ground check positions required for obtaining normal reservoir fluid level. External hydraulic power should be applied and the pressure reducing valve should be trimmed back until a stable, proper fluid level is obtained in the aircraft reservoir. The fluid level should be checked periodically. The back pressure reducing valve must be set properly or the aircraft could be damaged by overpressurization.

After the back pressure reducing valve has been adjusted, the test stand can be started and allowed to warm up with the controls set for bypass fluid flow. The flow rate and operating pressures should be set to the required values using the volume and pump compensator controls. If so equipped, the emergency relief valve should be set to the operating pressure, plus 10 percent. The bypass control should be fully closed during aircraft operation. The operating pressure should be adjusted using only the pump compensator. The test stand is now ready to power the aircraft hydraulic system.

**Operational Checks**

When operating the test stand, the condition of the system fluid needs to be checked periodically through the sight glass. If there is evidence of air, the system should be bled at both the test stand and air bleed points in the aircraft until the fluid appears clear. Also, it is necessary to monitor the filter differential pressure indicators, particularly those associated with the 3-micron filter assemblies. In some cases, loaded filter indicators may extend due to cold starting conditions. The indicator should then be reset and monitored until the equipment reaches the normal operating temperature. If a loaded filter is indicated, the equipment should be shut down and returned to the
supporting activity. Another condition that would require the equipment to be returned to the supporting activity is if the fault indicators light up. In this case, the unit would need to be shut down and returned to the supporting activity. In case of an emergency (for example, a ruptured hydraulic hose in aircraft), the bypass valve should be opened to relieve pressure and stop the flow of hydraulic fluid to the aircraft. It is important to watch for warning signs, such as a sudden drop in engine oil pressure or any unusual engine noise. If any engine part fails, the engine should be stopped immediately.

**Shutdown Procedures**

In aircraft equipped with pressurized reservoirs, hydraulic accumulators, or surge dampers, a reverse flow of fluid through the aircraft filters could damage the system. The correct shutdown procedures need to be used. When the required aircraft tests are finished, the bypass valve should be left in the closed position. The volume setting should be reduced to zero and the pressure compensator adjusted to a minimum. Several minutes should be allowed for the stored pressure in the aircraft to bleed off, via normal internal leakage. On stands equipped with a pressure and return line shutoff valve, the valve should be closed instead of reducing the volume and pressure compensator.

The pressure bypass valve should be opened slowly while the engine is allowed to run at 1,000 rpm for about 5 minutes (engine-driven models only), then the throttle should be pushed completely down. The panel light switch is then placed in the OFF position. The external hoses should be removed from the aircraft hose ports and one end connected to the hose storage manifold disconnects on the test stand. The hose ends should NOT be dragged on the deck or exposed to contamination. All dust caps and plus need to be installed, including those at the aircraft quick disconnects. All access doors should also be closed to protect instruments and controls.

**Multisystem Operation**

When performing troubleshooting, rigging, and specific tests on dual flight control systems that have tandem actuators, SE hydraulic pressure often needs to be applied to two or three systems in an aircraft at the same time. Simultaneous, multisystem operation involves using separate hydraulic test stands for each system, or by manifolding two or more systems to a common test stand that has a sufficient flow capability. Less equipment is needed with the latter method, but it is important to know it has several limitations.

If a single test stand and manifold are used, hydraulic fluid between the connected systems is exchanged. If the fluid in one system is contaminated with particulate matter smaller than 3 microns, cross-contamination of the other system(s) will occur. Using a single test stand may not satisfy differing flow and back pressure requirements of the multiple systems to be powered. Depleting or overfilling aircraft reservoirs might result. If a single test stand is used, high transient flow demands in one system could adversely affect the performance of the other systems. Total isolation between systems could possibly degrade critical flight control system performance tests. The use of jury-rigged manifolds not specifically engineered for the purpose is a safety hazard to personnel and a possible source of system contamination. Properly designed hydraulic manifolds can be used in limited, specific applications to power multiple hydraulic systems to form a common hydraulic test stand. This configuration must be evaluated by the cognizant engineering activity to make sure it is acceptable and that its use is strictly limited to that particular application. All approved manifold use must be directed
in the applicable aircraft MIM, and complete information on the source of the required hardware must be provided. Do not use manifolds that are not authorized.

**STATIONARY HYDRAULIC TEST STANDS**

Stationary hydraulic test stands are permanently installed equipment used for shop-testing hydraulic system components. Except for specialized equipment, such as hose burst test stands, they are general-purpose equipment capable of performing a variety of tests on components such as hydraulic pumps, actuators, motors, valves, accumulators, and gauges. Typical component test stands consist of adjustable sources of hydraulic and shaft-driven (for pump drive) power, with associated regulator and indicating devices that allow monitoring of performance under simulated operating conditions. Stationary hydraulic test stands are used at the intermediate-maintenance level, ashore and afloat, and for depot-level maintenance.

**Model A/F27T-10 Hydraulic Component Test Stand**

Stationary hydraulic test stands, such as the Model A/F27T-10, are not part of the equipment allowance for most squadrons. Normally, they are issued to air stations and aircraft carriers for use by the supported squadrons.

NOTE

The following information is for training purposes only. Do not use it as operating instructions for testing hydraulic or pneumatic components. For specific operating instructions, you should refer to the applicable operational handbook, service, and overhaul instructions, or the MIM.

The A/F27T-10 Hydraulic component test stand (HCTS), as shown in Figure 9-10, provides the hydraulic, electrical and pneumatic power, and instrumentation and controls necessary for bench testing, diagnostic testing, and functional acceptance of repaired/overhauled components. The HCTS has two operating modes: automatic (keyboard entry and measurements with system status displayed on a monitor) and manual (switch panel controls and measurements with system status read from pressure gauges and flow/temperature display/readouts on manual switch panel).

The HCTS consists of two nonportable units: the hydraulic console (HC) and an electrical console (ECC).
HYDRAULIC CONSOLE (HC) — The HC contains the pneumatic static, hydraulic static and hydraulic test and conditioning circuits. The hydraulic static provides fluid to the unit under test (UUT) for proof pressure testing at pressures up to 16,000 psi. The hydraulic test circuit consists of two hydraulic circuits (i.e. Hydraulic Circuit 1 & 2) to provide UUT under controlled flow (rate and direction), and temperature conditions. Hydraulic Circuit 1 is capable of supplying the flows and pressures for the A/F27T-10 via test port P1 and is capable of developing return (back) pressures of up to 1,500 psi in hydraulic fluid leaving UUT via port P2. Hydraulic Circuit 2 can provide same pressures and flows as Hydraulic Circuit 1 except that hydraulic fluid flow can be cycled bidirectionally via Hydraulic Circuit 2’s ports P3 and P4. The pneumatic static circuit provides the nitrogen gas from the external nitrogen gas bottle for UUT pneumatic tests and uses a service air-driven pump to boost pressure above bottle pressure if required. The sink area of the HC is where UUTs can be mounted and tested and can be enclosed in the front by four sliding clear removable access panels. Along the walls of the cabinet area are the ports/connectors for hydraulic, pneumatic and electrical panel, sampling port and pressure gauge panel. On front of the HC (on the right side) is a switch panel which can be used to operate the stand manually. On the left side is a storage cabinet. In addition, the HC contains the power and control circuits, control circuit, and instrumentation interface.
**ELECTRICAL CONSOLE (ECC)** — The ECC contains power and control circuits, the system central processing unit (CPU), and CPU peripherals, e.g., computer display monitor, printer, and keyboard. The ECC receives primary input power from the HC and produces 115 VAC, 60 Hz, single-phase power for the CPU and HCTS peripherals. The ECC power and control circuits also develop AC and DC utility power for UUTs. The CPU and peripheral devices permit the operator to type in test parameters to generate and apply command instructions to various control circuits for implementation vice manually using switches and buttons to reach test parameters. The Video Display Unit (i.e. computer monitor) displays operational menus, measurements and status information, messages and operator’s prompts.

**CONTAMINATION CONTROL OF SUPPORT EQUIPMENT**

The direct connection between hydraulic SE and the systems or components being checked or serviced is necessary to minimize the introduction of external contaminants. Test units that are not properly configured, maintained, or used may severely contaminate hydraulic systems in operational aircraft. It is the AM’s responsibility to make sure that hydraulic SE is maintained and used according to existing contamination control requirements.

**CONFIGURATION**

All support equipment used to service or test aircraft hydraulic systems or components is equipped with adequate output filtration that has a rating of 3 microns (absolute). The 3-micron filter assembly is a nonbypass variety, preferably equipped with a differential pressure indicator. It is installed immediately upstream of the major fluid discharge ports.

Portable hydraulic test stands are equipped with recirculation cleaning manifolds and fluid sample valves for self-cleaning and fluid analysis before they are connected to equipment under test.

**CLEANLINESS**

Hydraulic SE is maintained in a clean state. All hydraulic SE is maintained as clean as practicable, consistent with its construction and use. External fluid connections, fittings, and openings should always be kept clean and free of contamination. When not in use, fittings or hose ends should be protected by using metal dust caps or other approved closures. Clean, polyethylene bags can be used if the approved metal closures are not available, providing the bags are adequately secured and protected from physical damage and the entrance of water. When equipment is not being used, it should be stored in clean, dry areas. It is important to minimize exposure of in-service equipment to precipitation, wind-driven sand, or other environmental contaminants.

**AIR BLEEDING**

Air bleeding is a service operation. In this operation, entrapped air is allowed to escape from a closed hydraulic system. For specific air bleed procedures for each model aircraft, you should refer to the applicable MIM. Excessive amounts of free or entrained air in an operating hydraulic system results in degraded performance, chemical deterioration of fluid, and premature failure of components. Therefore, when a component is replaced or a hydraulic system is opened for repairs, the hydraulic system must be bled of air to the maximum extent possible upon repair completion.
Hydraulic fluid can hold large amounts of air in solution. Fluid, as received, may contain dissolved air or gasses equivalent to 6.5 percent by volume, which may rise to as high as 10 percent after pumping. Dissolved air generates no problem in hydraulic systems as long as it stays dissolved, but when it comes out of solution (as extremely minute bubbles), it becomes entrained or free air. Free air could enter a system during component installation, filter element installation, or during repairs when the system is open.

Free air is harmful to hydraulic system performance. The compressibility of air acts as a soft spring in series with the stiff spring of the oil column in actuators or tubing, resulting in degraded response. Also, because free air can enter fluid at a very high rate, the rapid collapse of bubbles may generate extremely high local fluid velocities that can be converted into impact pressures. This is the phenomenon known as cavitation. Cavitation causes pump pistons and slide valve metering lands to wear rapidly, commonly causing component failure.

Any maintenance operation that involves breaking into the hydraulic system introduces air into the system. The amount of such air can be minimized by prefilling replacement components with new, filtered hydraulic fluid. Because some residual air may still be introduced, all maintenance of this type is followed by a thorough air bleed of the system. Most hydraulic systems in high-performance aircraft are of the closed, airless type; they are designed to self-scavenge free air back to the system reservoir. Air bleed valves are provided at the reservoir to remove this air. Because free air resulting from maintenance actions or other causes may enter the system at a point remote from the system reservoir, the system should be extensively cycled with full power to transfer air to the reservoir, where it can be bled off.

Air bleed valves are sometimes found at high points in the aircraft circulatory system, filter assemblies, and remote system components such as actuators. These valves make the removal of free air easier. Refer to the applicable MIMs for the location and use of additional bleed points. In systems not equipped with additional bleed points, the line connections may have to be loosened temporarily at strategic points in the system, which permits removal of entrapped air from remote or dead-end points. When a system is bled in this manner, care must be taken to avoid excessive loss of hydraulic fluid, and prevent the induction of air or contaminants into the system.

In many cases, air inspection procedures are inadequate. Support equipment specifically designed to detect and measure air is not presently available in the fleet. Indirect methods should be used to determine the amount of air present in a system. Operating the air bleed valve on

![Diagram: System Not Pressurized and System Pressurized]
the reservoir reveals whether or not there is air present in the reservoir. Large amounts of air might be present somewhere else in the system and go undetected. An effective means for measuring the air in your system is known as the reservoir sink check. In this method, the fluid level in the aircraft reservoir is checked with the system, both pressurized and nonpressurized. The presence of air or any compressible gas in the system causes the pressurized reading to be lower (reservoir sink), indicating the need for possible maintenance action (Figure 9-11). This check is particularly effective when performed after a long aircraft down period, in which case, dissolved air has had lots of time to come out of solution.

All air bleed operations must be followed by a check of the system hydraulic fluid level. Fluid replenishment may be required, depending upon the amount of air and fluid purged from the system.

**OPERATIONAL USE**

Operate test stands equipped with hydraulic manifolds for self-recirculation cleaning before they are connected to equipment or components under test. The test stand should be recirculation cleaned for a sufficient period of time to let a minimum of one pass of its total reservoir contents through the internal filtration. The differential pressure of loaded filter indicators should be closely monitored during all SE operations after the fluid reaches normal operating temperature (±85°F minimum). Equipment operation is terminated immediately upon appearance of loaded filter indications. The loaded element should then be replaced. If the reservoir or outlet fluid is, or is suspected to be, unacceptably contaminated, use of the SE should be stopped, and the supporting maintenance activity should immediately be informed so that required remedial action can be taken.

**PERIODIC MAINTENANCE**

Supporting activities for hydraulic SE perform periodic maintenance at prescribed intervals, unless otherwise directed. At this time, samples are taken from all hydraulic SE reservoirs (preferably at a low point drain) and analyzed for particulate level and water content. If the fluid is unacceptable, it is recirculation cleaned, purified, flushed, or purged. Hydraulic filter elements that can be cleaned are ultrasonically cleaned or replaced at the prescribed maintenance interval. Because of their large dirt-holding capacity, disposable 3-micron pressure line filters are replaced only upon actuation of their differential pressure indicators. Disposable filters that do not have differential pressure indicators are replaced at the prescribed interval.

Age-controlled, deteriorative hoses used to carry hydraulic fluid in SE units are not to remain in service for more than 7 years beyond the manufacturer’s cure date. Additionally, hoses of this type that are internally located in the equipment are replaced at each prescribed major rework interval, not to exceed 4 years. The date of the required removal and serial number of the equipment is etched or peened on the hose collar. External deteriorative hoses used to transfer fluid between SE and aircraft or components under test that cannot be positively identified as having been in use for less than 2 years should be replaced as soon as possible, and at regular intervals thereafter, not to exceed 2 years. The date of required replacement and the SE serial number is etched or peened on the hose collars. Hoses should remain attached to the equipment until replacement is required. Upon completion of periodic maintenance, hydraulic SE is certified as having a fluid contamination level not in excess of Navy Standard Class 3.
Fluid Sampling

Fluid sampling points and procedures vary with the SE type and model. For specific procedures applicable to the particular equipment, you should refer to NAVAIR 01-1A-17. The SE should be run for a minimum of 5 minutes before a sample is taken. This results in fluid flow through SE reservoirs, which ensures a uniform distribution of contaminants. On some SE models, it is necessary for the return pressure outlet to the reservoir fill opening to achieve such a flow. Location and access to the reservoir drain valve and other sampling points and adapters is necessary to remove dirt and other visible contaminants from the exposed part of the drain valve and/or sampling adapter. When taking a sample for a particulate test, the valve or adapter must be wiped with a clean, disposable cloth. Then, a plastic wash bottle should be used to flush the fittings with clean MIL-PRF-680.

When the fittings have been flushed, the reservoir drain valve should be opened and 1 quart of fluid allowed into a waste receptacle. Without interrupting the flow of fluid, the required sample should be taken by letting an additional 4 ounces of fluid flow into a clean sample bottle (provided with the contamination analysis kit). After the sample bottle is removed from the fluid stream, the drain valve should be closed. The bottle should be labeled to indicate where the sample was taken. This sample-taking procedure should be repeated at other specific or available sampling points, collecting each sample in a separate bottle. The fluid collected in the waste receptacle should be visually inspected for free water. If free water is seen, the system should be decontaminated according to applicable procedures.

Decontamination

Decontamination of unacceptable SE equipment is performed by recirculation cleaning, purifying, flushing, or purging, as required; these actions are performed by the supporting activity.

RECIRCULATION CLEANING — Recirculation cleaning is used when equipment is unacceptably contaminated with particulate matter (in excess of Navy Standard Class 3), but the fluid is otherwise considered satisfactory. In recirculation cleaning, the equipment is self-cleaned using its internal filters—the 3-micron elements in particular. Cleaning begins by operating the contaminated SE so maximum circulation of fluid through the equipment reservoir and internal 3-micron filters occurs. The flow should be maintained long enough to allow a total flow equivalent to at least five times the total fluid capacity of the equipment reservoir. All filter differential-pressure indicators should be monitored throughout the operation. If elements appear to be loaded, they should be checked and replaced.

The fluid from the reservoir should be resampled and analyzed. If improvement is shown, but the contamination level is still excessive, the process should be repeated. If there is still no improvement, the internal contamination source must be located—such as a failed component. Any components determined to be contaminating the fluid must be replaced and decontamination continued by draining, flushing, and refilling the equipment with new filtered fluid. Recirculation cleaning and resampling should be done, as before, to determine acceptability. When the fluid samples from the reservoir are found to be within acceptable limits, recirculation cleaning may be terminated.

PURIFYING — Purification is the process of removing air, water, solid particles, and solvents from hydraulic fluids. A schematic of a typical commercially available purifier, P/N AD-A352-8Y17, P/N PE-00440-1H or equivalent, is illustrated in Figure 9-12. Contaminated fluid going to the purifier tower is first filtered by a 25-micron (absolute)
filter. The vacuum applied to the tower removes air and water from the contaminated fluid. As the fluid comes out of the tower, it is filtered through a 3-micron (absolute) filter to remove solid particles. This cycle is repeated until a desired level of cleanliness is attained. For support equipment contaminated with air and water, the use of a purifier to clean the equipment will reduce the consumption of oil and replace the need for flushing.

**FLUSHING** — Flushing is used to decontaminate support equipment that is heavily contaminated with particulate matter, or when the fluid contains a substance not readily removed by the internal filters. To begin the flushing procedure, the equipment reservoir should be drained, flushed, and reserviced using new filtered fluid. If the contamination originated at the pump, the hoses and lines directly associated with the pump output should be drained and flushed separately.

The equipment should be operated so fluid flows through all circuits. The output (or return line) fluid should be allowed to dump overboard into a waste receptacle. Flushing should be continued until a quantity of fluid equal to the equipment reservoir capacity has passed through the unit. The reservoir level must be closely monitored during the operation, adding new filtered fluid as required. This prevents the reservoir level from dropping below the one-third full point.

After taking a sample, the output and the reservoir fluids should be analyzed. If the contamination level shows improvement but is still unacceptable, the flushing operation should be repeated. If extensive flushing fails to decontaminate the equipment, assistance from the supporting engineering activity should be requested.

Upon successful completion of system flushing, the equipment should be recirculation cleaned for a minimum period. Then, a sample should be taken from the system to verify the contamination level as being acceptable. After this has been done, the reservoir should be serviced.

**PURGING** — Purging of a support equipment hydraulic system is performed only upon recommendation from, and under the direct supervision of, the cognizant engineering activity. It is the responsibility of the cognizant engineering activity to select the required cleaning agents, provide detailed cleaning procedures, and perform tests upon completion of purging to ensure satisfactory removal of all cleaning agents. Whenever possible, purging operations are to be accomplished at a naval aviation depot (NADEP) facility. Intermediate maintenance activities are not authorized to perform system purging without direct depot supervision.
Review Questions

9-1. What three factors contribute to fluid loss in a hydraulic system?

A. Fluid migration, faulty actuators, poor maintenance
B. Leaking actuators, faulty overboard drains, internal reservoir leak
C. Leakage, system evaporation, and malfunction
D. Leakage, poor system maintenance, and malfunction

9-2. What are the three types of hydraulic SE used in the Navy?

A. PMU-71/E (HFSU), HSU-1, A/M27T-7
B. Portable, fluid dispensing, and stationary
C. Portable test stands, replenishing, hand pumping units
D. Stationary, towable, motorized

9-3. What size filter does the H-250-1 hydraulic servicing unit use?

A. 2-micron absolute
B. 3-micron absolute
C. 5-micron absolute
D. 8-micron absolute

9-4. Where is the nonbypass filter installed on a support equipment unit used to test or service an aircraft hydraulic system?

A. Aft of the hydraulic pump
B. In-line on the system pressure hose
C. In the return system
D. Upstream of the major fluid discharge port

9-5. What can be used in place of an approved metal closure to protect fittings on a hydraulic test stand?

A. Approved plastic caps only
B. Clean, adequately secure polyethylene bag
C. Lint-free rag
D. Plastic bag, safety wire

9-6. What is the purpose of air bleeding a piece of hydraulic support equipment?

A. It allows entrapped air to escape from a closed hydraulic system
B. It is part of the pre-op
C. It replenishes low fluid levels
D. It helps achieve proper fluid levels