TECHNICAL MANUAL

OPERATOR, ORGANIZATIONAL, DS, AND GS MAINTENANCE MANUAL: GUIDED-MISSILE SYSTEM SHOP EQUIPMENT (XO-1) XM2, XM2E1, AND XM2E2 (IMPROVED HAWK AIR DEFENSE GUIDED MISSILE SYSTEM)

This copy is a reprint which includes current pages from Changes 1 through 5.

H E A D Q U A R T E R S , D E P A R T M E N T O F T H E A R M Y
A U G U S T 1 9 7 2

WARNING

DANGEROUS VOLTAGE

is used in the operation of this equipment

DEATH ON CONTACT

may result if personnel fail to observe safety precautions

Never work on electronic equipment unless there is another person nearby who is familiar with the operation and hazards of the equipment and who is competent in administering first aid. When the technician is aided by operators, he must warn them about dangerous areas.

Whenever possible, the power supply to the equipment must be shut off before beginning work on the equipment. Take particular care to ground every capacitor likely to hold a dangerous potential. When working inside the equipment, after the power has been turned off, always ground every part before touching it.

Use extreme caution when operating equipment protected by interlocks. Insure that interlocks (doors, | panels, and drawers) are functioning properly. (TM 9-1425-525-12-4)

Be careful not to contact high-voltage connections when installing or operating this equipment.

Whenever the nature of the operation permits, keep one hand away from the equipment to reduce the hazard of current flowing through the vital organs of the body.

WARNING

Do not be misled by the term "low voltage." Potentials as low as 50 volts may cause death under adverse conditions.

For artificial respiration, refer to FM 21-11.

WARNING

SAFETY MEASURES FOR HANDLING HIGH-PRESSURE AIR SYSTEMS

1. Personnel who handle high-pressure airhoses and components shall be thoroughly trained in the use and maintenance of the equipment, and in the application of safety measures to protect against existing hazards. Proper protective equipment shall be worn as required.

2. The system shall be used only for the purpose for which it was originally designed.

3. Inspect all systems using high-pressure air before, during, and after use for leaks, defective airhoses, improperly adjusted valves, malfunctioning regulators and relief valves, the presence of foreign materials in the system; and corrosion. Use only the lubricants that are specified for pneumatic components. Oils and greases can explode when compression heat is present.

4. Clear all airhoses and valves at regular intervals. Release pressure through bleeder valves before disconnecting any lines or hoses or making any repairs.

5. When pressurizing a system, personnel operating the valves shall stand clear of hose connections, and shall turn the valves slowly to prevent shock loading or pressure surges which may damage hoses or components. Close valves manually to prevent overtightening; never tighten with a wrench or tool.

NOTE

Large volume containers at low pressure have sufficient stored energy to cause death or serious injury.

6. Observe the following precautions pertaining to high-pressure airhoses:

a. The minimum bending radius for flexible airhoses shall be: 4 inches for 1/4-inch ID hose; 6 inches for 3/8-inch ID hose; 7 inches for 1/2-inch ID hose; 9-1/4 inches for 3/4-inch ID hose.

b. Never coat or paint an airhose, because this impairs the normal breathing tendency of the airhose.

c. Depressurize and protect airhoses from the sun when not in use.

d. Do not kink, twist, strike, walk on, run over, jerk, or otherwise abuse airhoses.

e. Allow 2 feet of slack for each 100 feet of airhose to compensate for contraction during pressurization.

f. Secure high-pressure airhose at 36-inch intervals. Use equipment straps, ground stakes, or sandbags as necessary.

g. 8500 PSIG air pressure is used in the operation of this equipment.

NOTE

For inspection and test of air and other gas compressors, refer to TB 43-0151.

WARNING

SAFETY MEASURES FOR HANDLING HIGH-PRESSURE HYDRAULIC SYSTEMS

1. Personnel who work with or handle high-pressure hydraulic systems or components shall be thoroughly trained in the use and maintenance of the equipment, and in the application of safety measures to protect against existing hazards. Proper protective equipment shall be worn as required.

2. The system shall be used only for the purpose for which it was originally designed.

3. Inspect all high-pressure hydraulic systems before, during, and after use for leaks, defective connections and lines, improperly adjusted valves, malfunctioning regulators and relief valves, the presence of foreign materials in the system, and corrosion.

4. Release pressure through bleeder valves before disconnecting lines or components or before making any repairs. Whenever the hydraulic system has been disassembled or opened, perform a fill and bleed exercise to ensure that all possible air contamination or entrapment is removed before operating the system.

5. When pressurizing a system, personnel operating the valves shall stand clear of hose connections, and shall turn the valves slowly to prevent damage to equipment. Close valves manually; never tighten them with a wrench or a tool.

WARNING

HIGH NOISE LEVEL WHEN SHOP EQUIPMENT IS OPERATING

Various combinations of the air conditioner, consoles, and accessories produce dangerously loud noises when operating. Without protection, long exposure to this noise can cause a hearing loss. Ear protectors should be worn when working in the shop for extended periods. See AR 40-5 for additional information.

WARNING

Toxic solvents are used in servicing this equipment. The safety measures described below should be observed in the handling and use of these solvents.

When using trichloroethane, be sure that the area is well ventilated as the fumes are toxic. Rapid evaporation of trichloroethane has a drying and irritating effect on the skin. The use of gloves is advised to prevent this. If contact occurs, quickly wash the affected parts with a soap solution, rinse, and dry thoroughly.

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HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., *28 August 1972*

OPERATOR, ORGANIZATIONAL, DS AND GS MAINTENANCE MANUAL: GUIDED-MISSILE SYSTEM SHOP EQUIPMENT (XO-1), XM2, XM2E1, AND XM2E2 (IMPROVED HAWK AIR DEFENSE GUIDED MISSILE SYSTEM)

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let u4 know. Mail your letter or DA Form 2028 (Recommended Changes to Publications and Blank Forms) direct to: Commander, U.S. Army Missile Command, ATTN: DRSMI-SNPM, Redstone Arsenal, Alabama 835898. A reply will be furnished to you.

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CHAPTER 1

INTRODUCTION

Section I. GENERAL

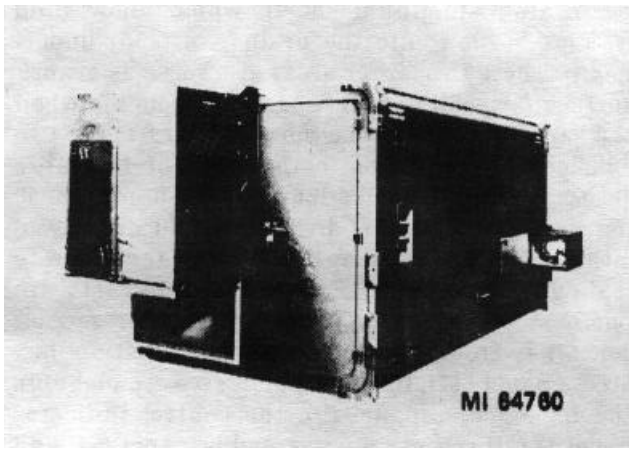


Figure 1-1. Transportable hydraulic shop 5.

1-1. Scope

a. This technical manual (TM) is published for the information and guidance of the personnel responsible for the operation, direct support, and general support maintenance of guided missile shop equipment (XO-1) XM2, XM2E1, and XM2E2 (transportable hydraulic shop 5) (fig. 1-1). This manual also contains instructions for testing the hydraulic components of the improved HAWK system at this shop.

b. This manual contains schematics, physical description, theory of operation, and procedures for the operation and maintenance of transportable hydraulic shop 5. The instructions in this manual are intended for maintenance specialists who have been thoroughly trained in the maintenance of similar type equipment.

1-2. Reporting Equipment Improvement Recommendations (EIR's)

If your IHAWK equipment needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design or performance. Put it on an SF 36X (Quality Deficiency Report). Instructions for preparing EIR's are provided in TM 38-750, The Army Maintenance Management System (TAMMS). EIR's should be mailed directly to Commander, US Army Missile Command, ATTN: DRSMI-SNEM, Redstone, Arsenal, Alabama 365898. A reply will be sent directly to you.

1-3. Forms, Records, and Reports

For the forms, records, and reports required of units maintaining this equipment, refer to TM 88-750.

1-4. Differences Among Models

Any differences among models that exist in this equipment are indicated in the text and on diagrams by the use of the serial number effectivity code. This code is given in appendix F.

1-5. Destruction of Materiel to Prevent Enemy Use

Destruction of materiel to prevent enemy use will be undertaken by the user upon order of the unit commander. His decision will be based upon orders and policies established by the Army Commander. Procedures for destruction of transportable hydraulic shop 5 and related materiel are contained in TM 43-0002-24.

Section II. DESCRIPTION AND DATA

1-6. Transportable Hydraulic Shop 5 (Fig. 1-2)

a. Description. Transportable hydraulic shop 5 is contained in an electrical equipment shelter of the improved HAWK air-defense guided-missile system. Transportable hydraulic shop 5 contains a hydraulic system, a pneumatic system, and a power distribution system, as described in chapters 2, 3, and 4, respectively.

b. Function. Transportable hydraulic shop 5 provides facilities for testing and maintaining hydraulic components of the improved HAWK missile system.

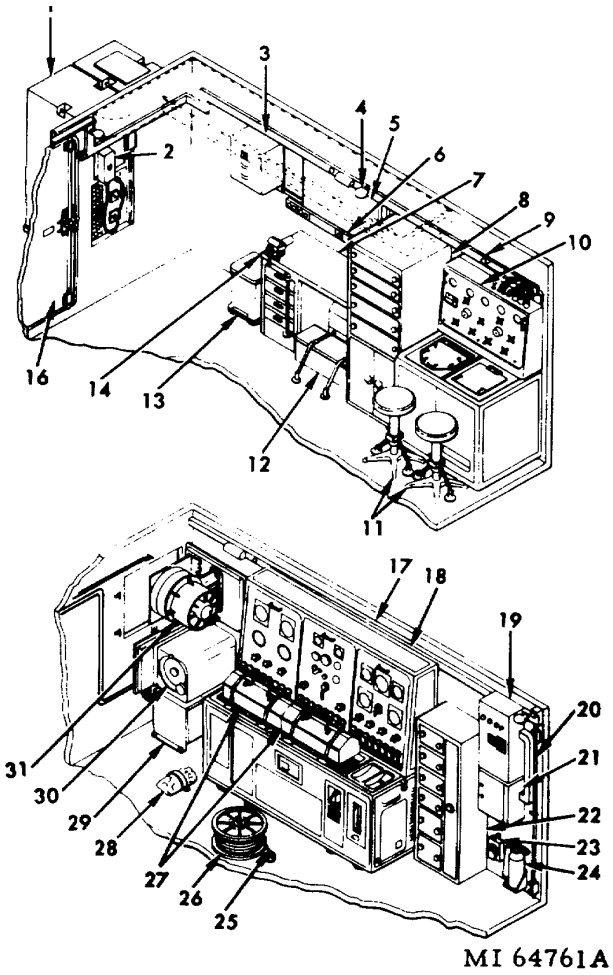
c. Electrical Equipment Shelter. Detailed information for the electrical equipment shelter and its related accessories is given in TMN 9--1125---58514/2.

1-7. Hydraulic Test Console (Fig. 1-3)

The hydraulic test console contains two systems for testing hydraulic components in the improved HAWK system. The transient system is used when the component under test requires a dynamic test. The handpump system is used when the component requires static pressures.

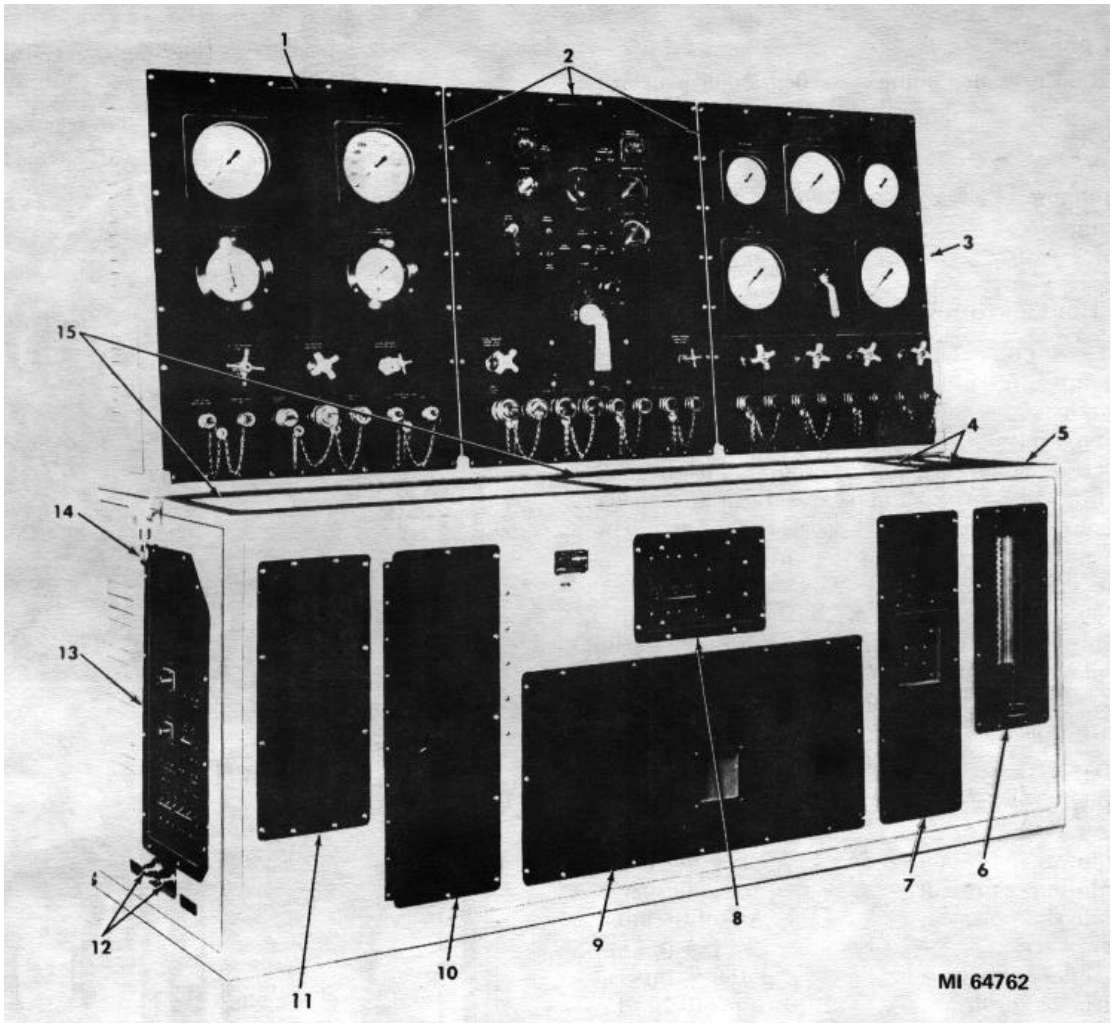
NOTE
The key numbers shown below in parentheses refer to figure 1-3.

a. Description. The console is a stationary, shockmounted aluminum stand divided into an upper and a lower section. The upper section of the console contains three hinged control panels (2) which are secured in p)lace along the top and both sides with stud fasteners. By disengaging these stud fasteners, the panels can be lowered to a 60-degree angle for access to the reverse side. The panels will move only to the length of the internal chain attachment and the flexible hoses. The top of the lower section contains four recessed areas. In the bottom of the two larger areas there are perforated aluminum sheets which allow fluid leakage to flow into the drain pans (15) underneath. These two larger areas also serve as a work surface for holding fixtures and components when they are connected to the console for tests. The two smaller recessed areas to the right of the large recessed areas are graduate drain pans. These pans permit porting of hydraulic fluid directly to either of the two leakage graduates for accurate leakage measurements when leakage tests are performed. The front side of the lower section contains, from left to right, the junction box access panel (11), the handpump access panel (10), the base access panel (9), the control indicator panel (8), the timer stop assembly panel (7), and the leakage graduate panel (6). All these panels are secured with stud fasteners for ease of



1-Air conditioner
2-Air conditioner control panel
3-Transformer box
4-Lamp
5-Tool rack
6-Utility outlet panel
7-Workbench
8-Storage cabinet
9-Raceway
10-Degreaser and accumulator test console
11-Stools
12-Portable dual-range deadweight tester assembly
13-Waste storage container
14-Vise
15-Deleted
16-Access door
17-Raceway
18-Hydraulic test console
19-Power distribution box
20-Ground rod and cable
21-Cable entry box
22-Storage cabinet
23-Battle lantern
24-Fire extinguisher
25-Cable reel tiedown
26-Cable storage reel and cable
27-General mechanics' tool set
28-Shelter lifting sling kit
29-Air reservoir assembly
30-Air compressor assembly
31-Heat exchanger

Figure 1-2. Transportable hydraulic shop 5 equipment location.



1-Pulldown handle
2-Hinged control panel
3-Upper section
4-Graduate drain pans
5-Lower section
6-Leakage graduate panel
7-Timer stop assembly panel
8-Control indicator panel
9-Base access panel
10-Handpump access panel
11-Junction box access panel
12-Heat exchanger inlet and outlet connectors
13-Junction box panel
14-Lifting eyebolt
15-Drain pans

Figure 1-3. Hydraulic test console.

removal. The handpump handle is stored in clamps behind the handpump access panel. The right end of the lower section, which is not shown in figure 1-3, contains the drain reservoir access panel. The drain reservoir sight level is visible through the cutout in the bottom of the panel. The left end of the lower section contains the junction box panel (13), the inlet and outlet hose connectors (12) for the heat exchanger, and the console grounding cable. A lifting eyebolt (14) is anchored to each end of the top of the lower section to facilitate removal or installation of the console.

b. Data.

Weight ..... 761 lb
Height ..... 68-1/8 in.
Width ..... 25-5/8 in.
Length ..... 78 in.
Power requirements ..... 416 vac, 400 Hz, 3 phase
Fluid type 9150-265-9408
Fluid capacity:
Main reservoir ..... 15 gal
Drain reservoir ..... 5 qt
Accumulator ..... 1 qt

Fluid pressure:
System pressure pump .....0 to 3000 psig at 8 gpm; 3000 to 4000 psig at 5 gpm
Handpump .....Static to 10,000 psig
Gage accuracy.....0.5% full scale
Motor rating.....19 hp

1-8. Heat Exchanger (Fig. 1-4)

a. Description. The heat exchanger is an air-to-oil cooling unit used to control fluid temperatures in the hydraulic console. It consists of a motor and fan assembly, a collar, a core-type cooler, and a protective screen. The unit is secured with eyebolts to a bracket at the right rear side of the shelter (as viewed from the access door). Before operating the heat exchanger, swing the entire assembly out of the shelter through the utility door at the rear, and secure in position with the lock handles. Flexible hydraulic hoses and a power cable permit free movement of the hinged mounting when the heat exchanger is swung from the stored to the operating position.

b. Data.
Weight .....80 lb (max)
Motor rating.....3.25 hp
Oil-side proof pressure ..... 200 psig
Oil-side burst pressure ..... 300 psig
Heat dissipation..... 600 btu/min
Oil flow..... 8 gpm (max)
Fluid inlet temperature ..... + 160 F (max)
Fluid pressure drop ..... 10 psig (at 160 F and 8 gpm)
Power requirements ..... 416 vac, 400 Hz, 3 phase
Rotation ..... Clockwise (facing motor end)

1-9. Air Compressor Assembly (Fig. 1-5)

a. Description. The air compressor assembly is secured with eyebolts to a bracket on the shelter wall. Before operating the compressor, swing the entire assembly out of the shelter through the utility door at the right rear side and lock it in position. Flexible air hoses and a power cable permit free movement of the hinged mounting when the assembly is swung from the stored to the operating position. The air compressor supplies all air pressures necessary for the operation of the degreaser and accumulator test console in the pneumatic test system. Energizing controls for the air compressor assembly are located on the degreaser and accumulator test console control panel. Air is drawn through a 40-micron air filter

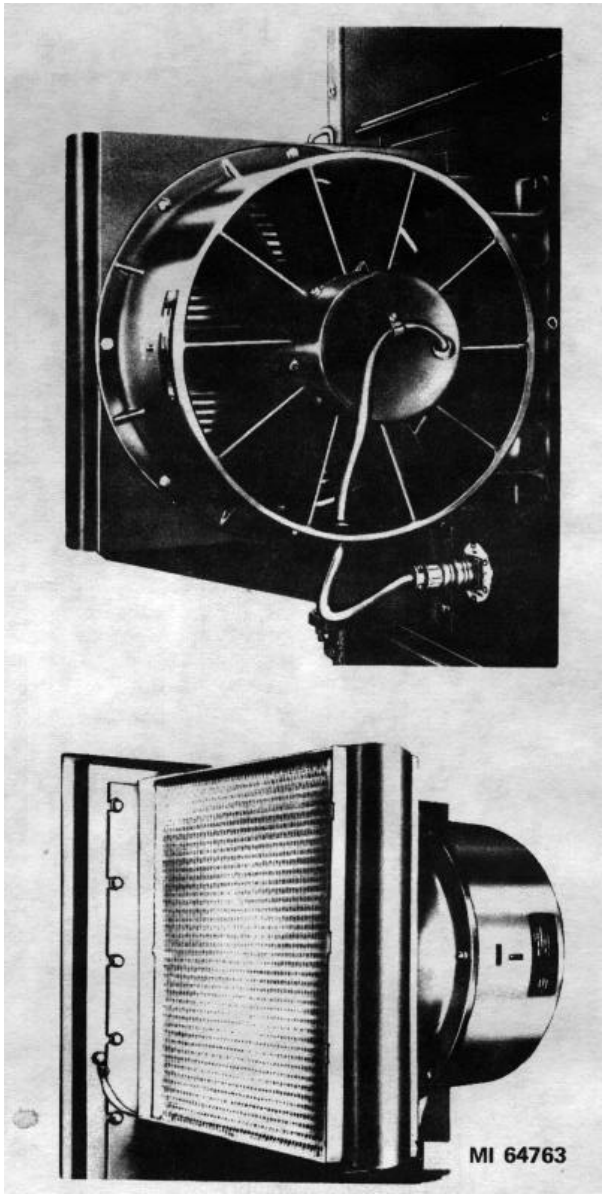
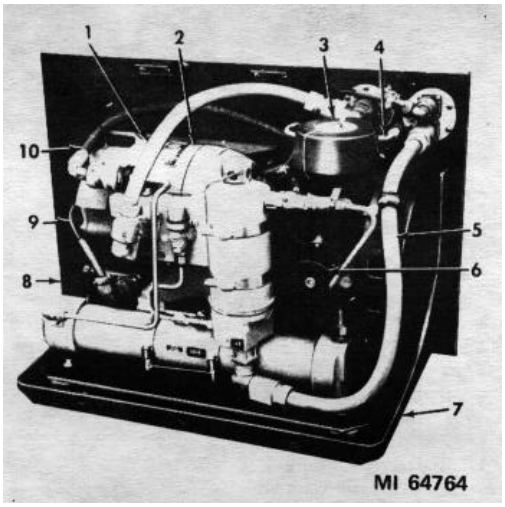


Figure 1-4. Heat exchanger.

into the air compressor, where it is filtered, compressed, and dried. After passing through four compression stages, the compressed air is discharged through a mechanical moisture separator and chemical dryer to the air reservoir assembly.

b. Data.
Weight .....45 lb (max)
Capacity.....4 standard cubic feet per minute (0.31 lb/min)
Inlet condition..... 29.92 in. of mercury absolute and 60SF at the inlet cap



1-Motor power cable
2-Motor
3-40-micron filter
4-Vent line
5-Moisture separator power cable
6-Compressor
7-Mounting bracket
8-Mounting door
9-Housing reactor cable
10-Air hose assembly

Figure 1-5. Air compressor assembly-cover removed.

Delivery pressure .....3000 psig/min
Rotation ..... Clockwise (facing fan)
Rated shaft speed .....3750 to 4200 rpm (max)
Relief valve relieving pressure ..... 3400 to 3500 psig
Reset pressure .....3100 psig/min
Power requirements:
Compressor motor ..... 416 vac, 400 Hz, 3 phase
Moisture separator heater.....28 vdc
Motor rating.....3.5 hp

1-10. Air Reservoir Assembly (Fig. 1-6)

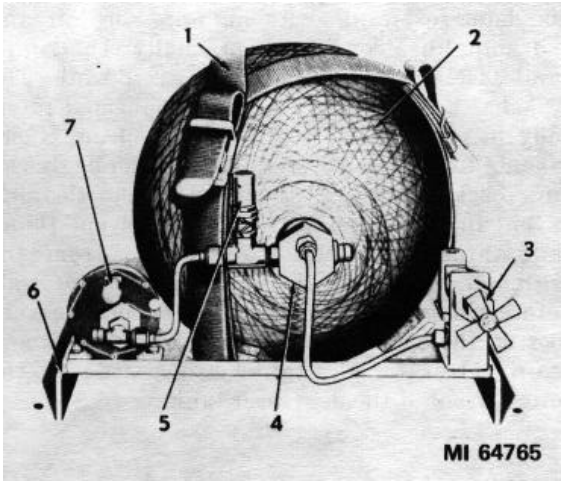
a. Description. The air reservoir assembly, a spherical steel tank covered with a protective shield, is secured by tiedown straps to a bracket mounted on the floor beneath the air compressor. The air reservoir assembly, which is connected to the air compressor for the storage and control of air under high pressure, supplies the degreaser and accumulator test console with the desired air pressures. The drain fitting of the air reservoir assembly incorporates a syphon and is connected to the manual blowdown valve. A relief valve, also connected to the drain fitting, is connected to the pressure switch located on the mounting bracket. The pressure switch controls the air compressor operation automatically, once the compressor is energized.

b. Data.

Weight (dry). .....28 lb
Service pressure ..... 2000 psig
Capacity..... 900 cu in.
Pressure switch closes at .....1600 to 1800 psig
Pressure switch opens at.....2000 to 2200 psig
Relief valve opens at .....2400 to 2500 psig
Relief valve reset pressure..... 2100 psig (min)

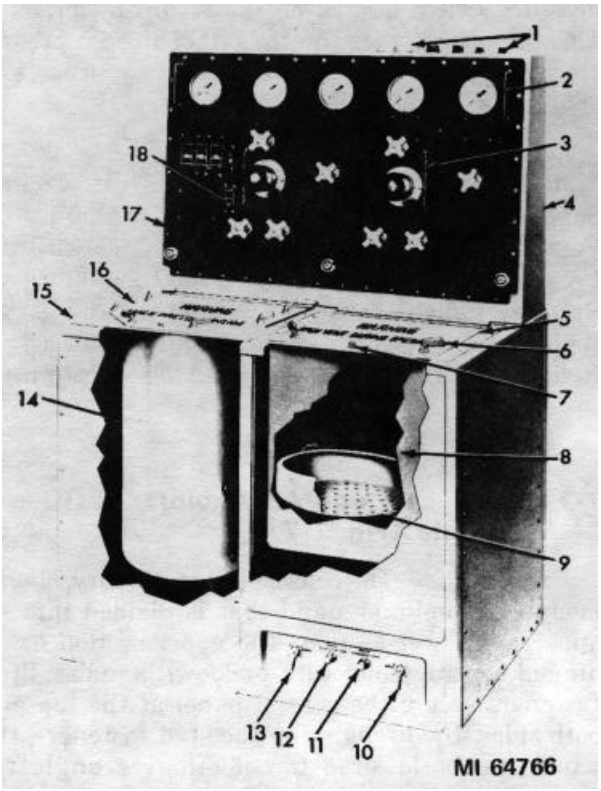
1-11. Degreaser and Accumulator Test Console (Fig. 1-7)

a. Description. The console is a stationary, shockmounted aluminum stand that is divided into an upper and lower section. The upper section has a hinged control panel with pulldown handles. Stud fasteners secure the control panel at the top and both sides. By disengaging the stud fasteners, the panel can be lowered to a 60-degree angle for access to the reverse side of the panel. The hose and cable connections for the console are located at the top right of the upper section. The lower section contains two tank assemblies with hinged covers that are secured by captive clamps. The cover tieback chains on the control panel secure the covers of the tank assemblies in raised



1-Tiedown strap
2-Tank
3-Manual blowdown valve
4-Drain fitting
5-Relief valve
6-Mounting bracket
7-Pressure switch

Figure 1-6. Air reservoir assembly-cover removed.



1-Hose and cable connections
2-Pulldown handle
3-Cover tieback chain
4-Upper section
5-Degreaser tank cover
6-Captive clamps
7-Cover tieback
8-Degreaser tank
9-Degreaser tank basket
10-Degreaser tank drain valve
11-Degreaser tank drain plug
12-Accumulator test tank drain plug
13-Accumulator test tank drain valve
14-Accumulator test tank
15-Lower section
16-Accumulator test tank cover
17-Control panel
18-DC ACTIVATE circuit breaker

Figure 1-7. Degreaser and accumulator test console.

positions. The left-hand assembly houses the accumulator test tank, with high-pressure air and hydraulic lines connected internally. The right-hand assembly houses the degreaser tank. The tank has a low-pressure air line connected internally to pneumatically agitate the solvent. Components to be cleaned are placed in the degreaser tank basket and are suspended in the cleaning solvent in the degreaser tank. The solvent fumes vent through an outlet -extending from the degreaser tank through the outside shelter wall. Before using the degreaser tank, open the vent door on the outside shelter wall. Drain plugs and drain valves for the tanks are located on the bottom front of the degreaser tank.

b. Data.

Weight	258 lb
Height	58 in.
Width	37-7/8 in.
Depth	26-3/8 in.
Air pressure	2000 to 2200 psig
Hydraulic pressure supply	3600 to 3800 psig
Power requirements	416 vac, 400 Hz, 3 phase

1-12. Deleted

Figure 1-8. Deleted.

Section III. DESCRIPTION OF HYDRAULIC TEST FIXTURES

1-13. General

Transportable hydraulic shop 5 contains test fixtures for making test or service connections between the unit under test (uut) and the hydraulic or pneumatic test equipment. Where possible, the fixtures simulate the actual mounting provisions for the uut. The uut is either clamped or face-mounted to the fixture and connected to the hydraulic test console by the necessary hydraulic lines and electrical connections. The test fixtures are stored in either of the two storage cabinets (8 and 22, fig. 1-2).

1-14. Transfer Valve Test Fixture (Fig. 1-9)

The transfer valve test fixture is basically a drilled block provided with bolts for mounting the 7.7-gpm or 20-gpm four-port transfer valves for testing. It provides connections for measuring the flow through the four-port transfer valves.

1-15. Actuator Pressure Blocking Units 9194953 and 9194956 (Figs 1-10 and 1-11)

The actuator pressure blocking units are used to seal the ports of the improved launcher (ILCHR) azimuth safety valve and the boom elevation actuating cylinder. The smaller blocking unit, shown in figure 1-10, is used only in testing the boom elevation actuating cylinder. The larger blocking unit, shown in figure 1-11, is used in testing both the azimuth safety relief valve and the boom elevation actuating cylinder.

1-16. Valve Assembly Test Clamp (Fig. 1-12)

The valve assembly test clamp is a general purpose vise which is used to hold components during test. It is used to hold valves and other components which do not require a special test fixture. The fixture has a maximum jaw spread of 4 inches and can be clamped to a working surface.

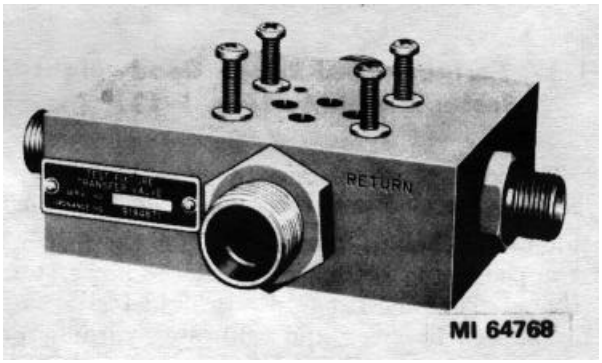


Figure 1-9. Transfer valve test fixture.

Figure 1-10. Actuator pressure blocking unit 9194953.

1-17. Portable Dual-Range Deadweight Tester Assembly (Fig. 1-13)

The portable dual-range deadweight tester assembly is located under the workbench on the left side of the shelter. The weights for the tester are strapped to the bottom shelf of the large storage cabinet. The dual-range deadweight tester assembly is used to check and calibrate hydraulic pressure gages. Operational procedures for the tester are given in chapter 25.

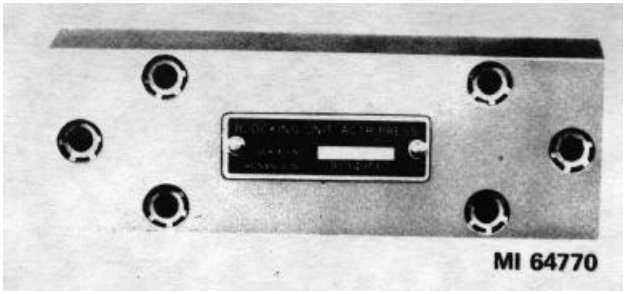


Figure 1-11. Actuator pressure blocking unit 9194956.

1-18. Actuator-to-Hose Adapter (Fig. 1-14)

Two actuator-to-hose adapters are provided to make connections between the ILCHR boom elevation actuating cylinder and the test hoses from the hydraulic test console.

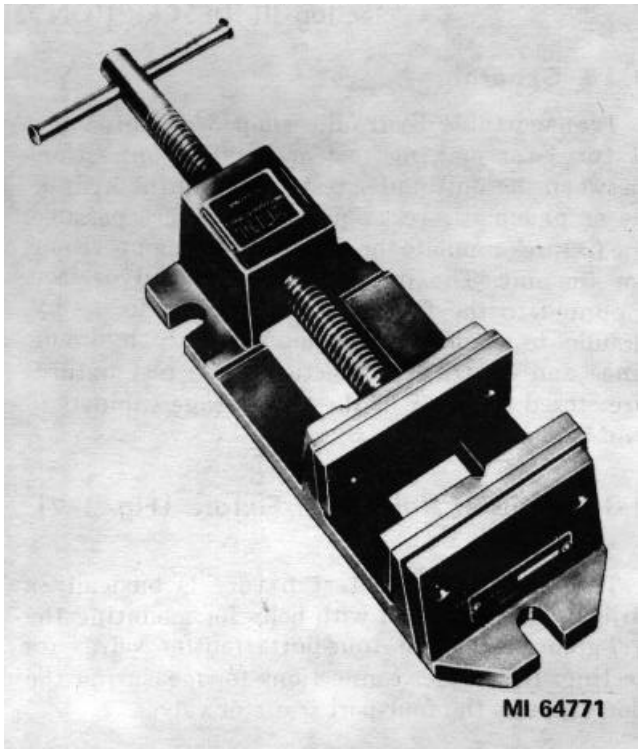


Figure 1-12. Valve assembly test clamp.

Figure 1-13. Portable dual-range deadweight tester assembly.

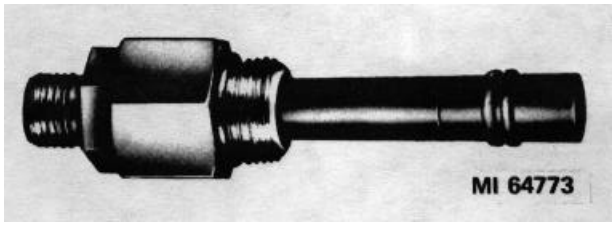


Figure 1-14. Actuator-to-hose adapter.

1-19. Actuator Test Holding Fixtures 9197431 and 9197432 (Figs. 1-15 and 1-16)

The actuator test holding fixtures are used to hold the ILCHR boom elevation actuating cylinder firmly in place during testing. Both holding fixtures are attached to the hydraulic test console with screws during testing and transit which may be removed when they interfere with other tests. The fixture shown in figure 1-15 attaches to the console above the graduate drain pans, while the fixture shown in figure 1-16 is secured above the right-hand drain pan.

1-20. Test Manifold Fixture (Fig. 1-17)

The test manifold fixture is used for testing the ILCHR azimuth safety relief valves. It serves as a blocking unit or as an adapter for connections to the test equipment.

1-21. Seal Block (Fig. 1-18)

The seal block provides a means for sealing the servo valve ports on the II,CHR azimuth safety valve during testing.

1-22. Transducer Test Fixture (Fig. 1-19)

The transducer test fixture is basically a drilled block which is used to check performance and proof pressure of the II,CHR transducer assembly (azimuth and elevation). Actual mounting of the transducer assembly on the major item is simulated by the fixture.

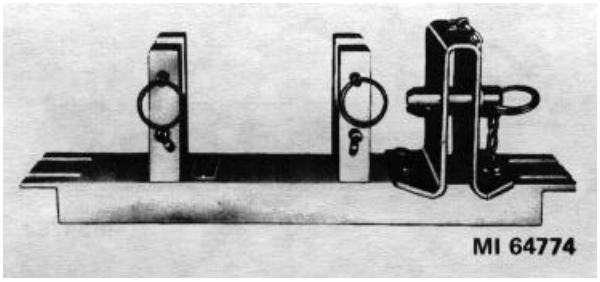


Figure 1-15. Actuator test holding fixture 9197431.

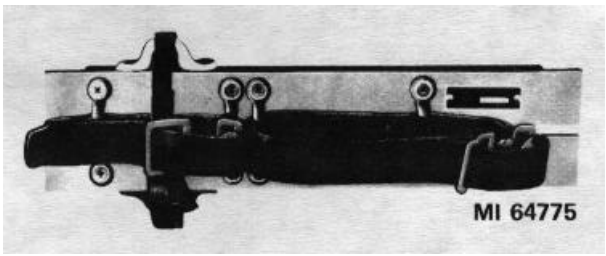


Figure 1-16. Actuator test holding fixture 919743.

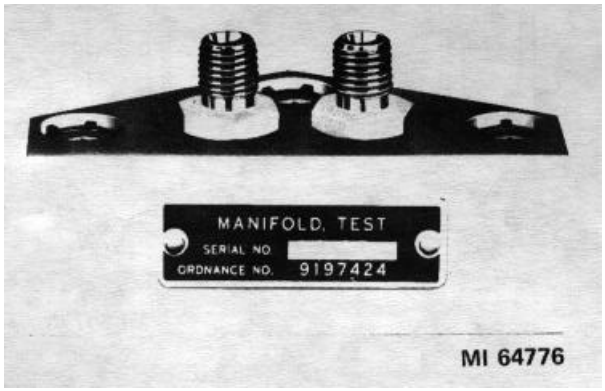


Figure 1-17. Test manifold fixture.

Figure 1-18. Seal block.

1-23. Switch Box (Fig. 1-20)

The switch box is basically a junction box which has an ON-OFF toggle switch. The switch box and the two special-purpose electrical cable assemblies (par. 1-24) provide 208-vac, 3-phase, 400-Hz power for testing. The switch box contains three 2-ampere fuses: one is a spare; two protect the pump motor.

1-24. Special-Purpose Electrical Cable Assemblies 9197420 and 9197421 (Figs. 1-21 and 1-22)

The two special-purpose electrical cable assemblies are used to route 208-vac, 3-phase, 400-Hz

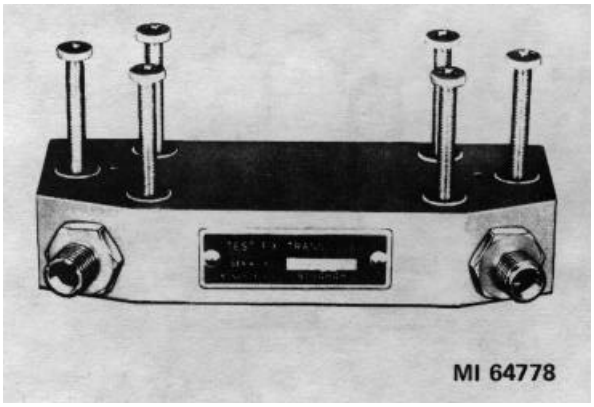


Figure 1-19. Transducer test fixture.

power from the outlet panel through the switch box (par. 1-23) for testing.

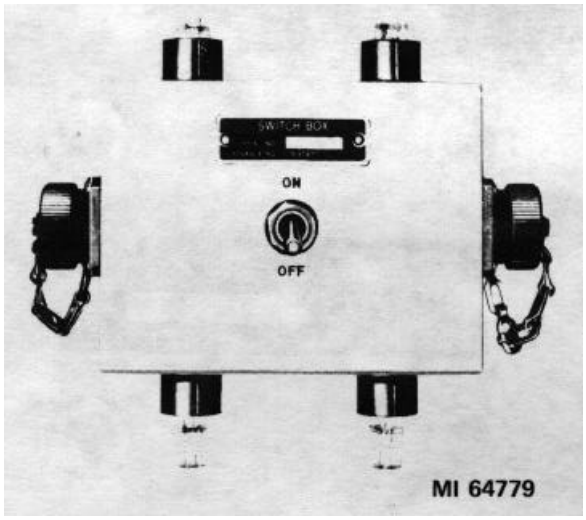


Figure 1-20. Switch box.

1-25. Relief Valve Assembly Test Fixture (Fig. 1-23)

The relief valve assembly test fixture is basically a drilled block which simulates the mounting for the ILCHR elevation actuator relief valve. This fixture is used for performing proof pressure, cracking and seating pressure, and flow checks on the relief valve.

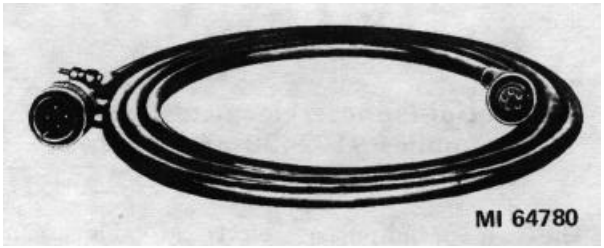


Figure 1-21. Special-purpose electrical cable assembly 9197420.

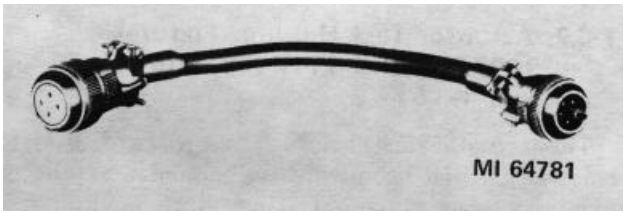


Figure 1-22. Special-purpose electrical able assembly 9197421.

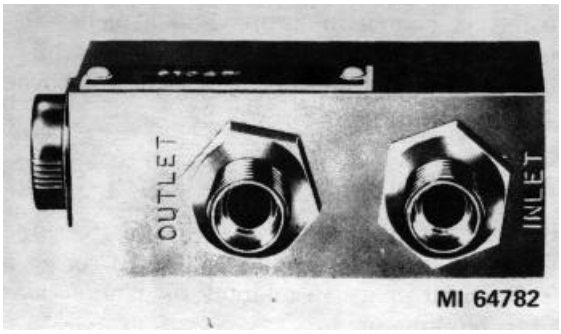


Figure 1-23. Relief valve assembly test fixture.

1-26. Pressure Regulator Tester (Fig. 1-24)

The pressure regulator tester is used for performing proof pressure, pressure regulation, and leakage tests on the ILCHR pressure regulator valve. The tester serves as a holding fixture during test.

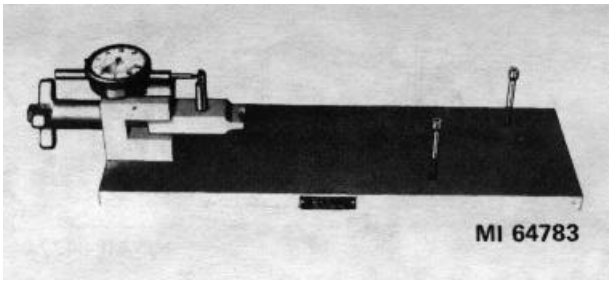


Figure 1-24. Pressure regulator tester.

1-27. Terminal Board (Fig. 1-25)

The terminal board is used for performing operation tests.

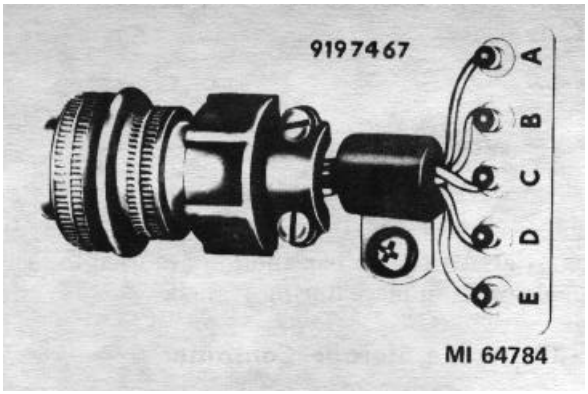


Figure 1-25. Terminal board.

1-28. Test Tank Fixture (Fig. 1-26)

The test tank fixture is used for performing operational tests on the II,CHR oil temperature switch.

1-29. Filter Plug Test Fixture (Fig. 1-27)

The filter plug test fixture is used for testing filter assemblies of the II,C H R.

1-30. Blocking Plate *(M)[1] (Fig. 1-28)

The blocking plate is used for performing the cracking pressure test on the IL,CHR hydraulic oil cooler relief valve.

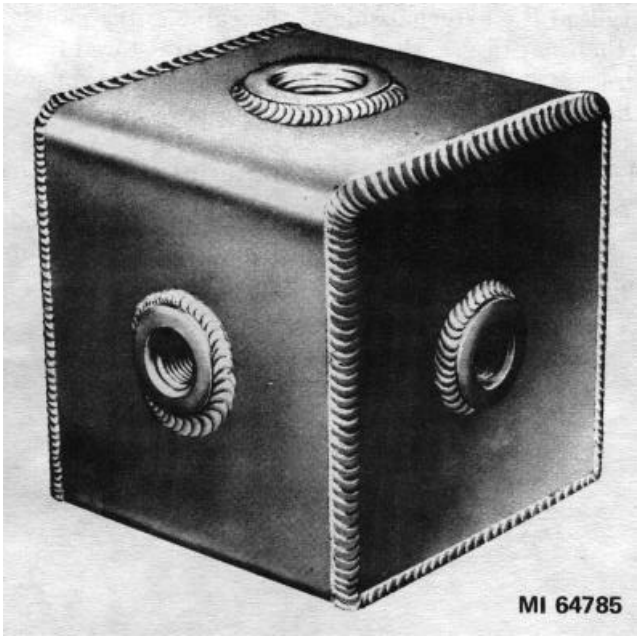


Figure 1-26. Test tank fixture.

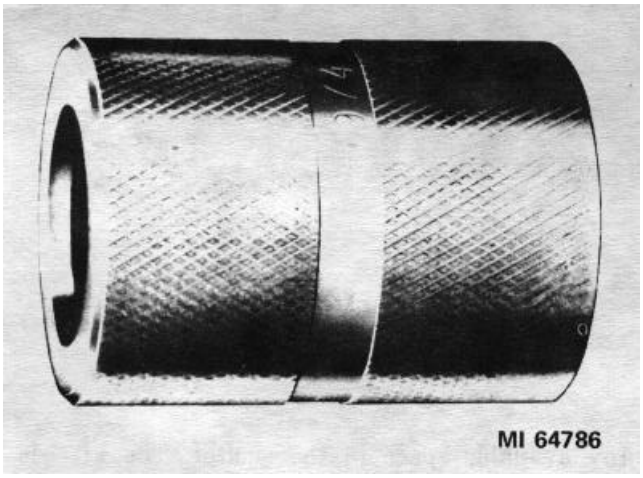


Figure 1-27. Filter plug test fixture.

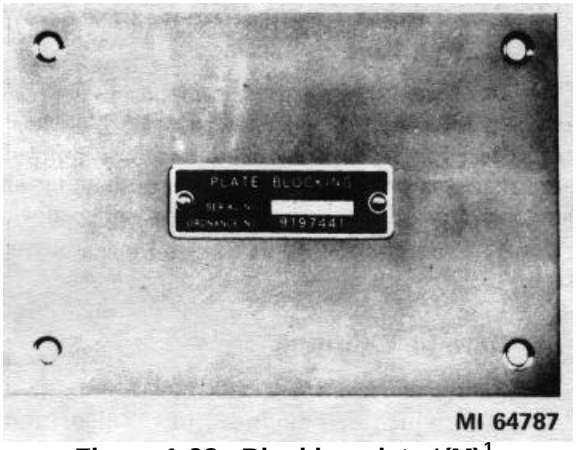


Figure 1-28. Blocking plate *(M)[1].

1-31. Accumulator Charging Manifold (Fig. 1-29)

The accumulator charging manifold is used for charging accumulators and for measuring static pressure in accumulators mounted on major items. The manifold provides a connection between an air supply and the accumulator being charged, and permits controlling and gaging the air pressure during the charging process.

1-32. Shelter Lifting Sling Kit

The shelter lifting sling kit (28, fig. 1-2) is contained in a carrying bag made of heavy canvas. The bag is stored in any available space in the shelter.

[1]Refer to appendix F for serial number effectivity.

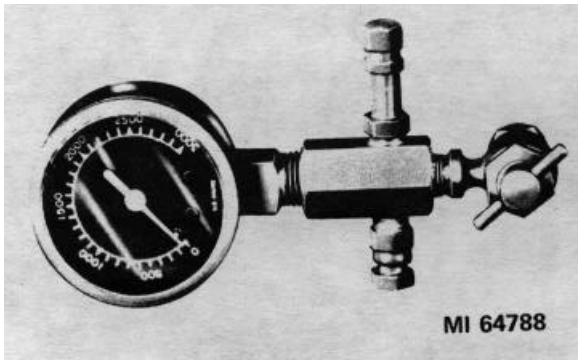


Figure 1-29. Accumulator charging manifold.

The kit is used as a sling for helicopter or crane lifting the shelter.

1-33. Power Input Cable (100-ft) and Cable Storage Reel

The 100-foot power input cable and the cable storage reel (26, fig. 1-2) are stored beside the hydraulic console and secured by floor-mounted tiedown straps during transportation. During shop operation, the cable connects the power generator to the 416-vac connector at the shelter cable entry panel.

1-34. Storage Cabinets

The shelter contains two storage cabinets (8 and 22, fig. 1-2) which are mounted to the floor and to the walls of the shelter. The cabinets store the test fixtures, technical manuals, and miscellaneous material required for the hydraulic shop.

1-35. Stools

Transportable shop 5 contains two portable stools (11, fig. 1-2). During travel the stools are secured to the floor with tiedown straps at the rear of the shelter.

1-36. Workbench

The workbench (7, fig. 1-2) contains a vise and four drawers for tools and miscellaneous test material. A tiedown bar and pin are used to secure the drawers in place during transit.

1-37. Waste Storage Container

A portable waste storage container (13, fig. 1-2) with a step-on-cover-lifting bracket is provided for the safe storage of oily rags.

1-38. Tool Rack

The tool rack (5, fig. 1-2) is a perforated aluminum sheet containing pegs and a shelf to store tools and small parts while performing maintenance or test.

1-39. Battle Lantern

The battle lantern (23, fig. 1-2) is a battery-powered hand lantern used in emergencies.

1-40. Ground Rod and Cable

The ground rod and cable (20, fig. 1-2) is used for shelter grounding. The rod is driven into the ground at the right front of the shelter and the attached ground cable is connected to a grounding stud on the external side of the cable entry panel. When not in use, the rod and cable are stored in a bracket on the inside shelter wall at the right of the access door.

1-41. Miscellaneous Test Material

For a description of additional miscellaneous materials required to perform maintenance in or on this shop, refer to TM 9-4935-507-40P.

CHAPTER 2

THEORY OF OPERATION OF THE HYDRAULIC SYSTEM

Section I. GENERAL BLOCK THEORY

21. General

The hydraulic system of transportable hydraulic shop 5 supplies monitored, pressurized hydraulic fluid for testing hydraulic components of the improved HAWK system. The hydraulic system controls the rate of flow, pressure, purity, and temperature of the fluid before it is used. Figure 2-1 shows that the hydraulic system is primarily contained in the hydraulic test console. The heat exchanger maintains the proper operating temperatures of the hydraulic fluid in the console.

2-2. Heat Exchanger

The heat exchanger cools the hydraulic fluid as the fluid returns to the main reservoir in the hydraulic test console. If the temperature of the fluid in the reservoir rises above the normal operating limits, the heat exchanger fan motor automatically energizes and accelerates the cooling process. This cooling process is necessary since the temperature of hydraulic fluid increases when the pressure increases.

2-3. Hydraulic Test Console

The hydraulic test console contains two systems of operation, the transient flow system and the handpump

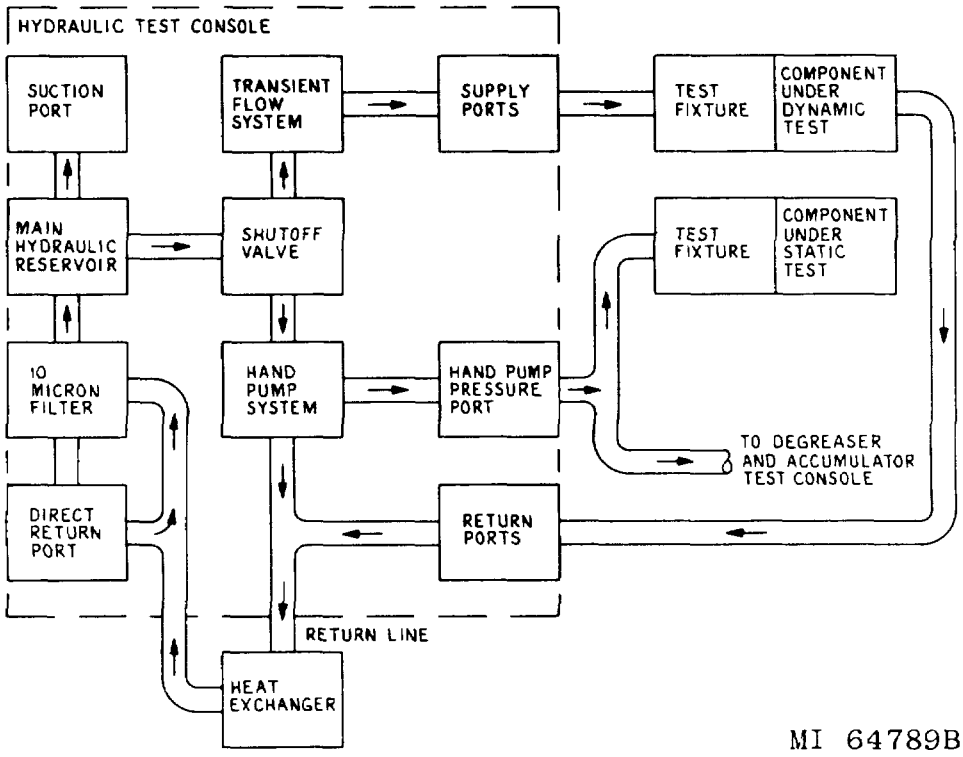


Figure 2-1. Hydraulic system-general block diagram.

system. Both systems draw fluid from the hydraulic main reservoir through the normally open shutoff valve. In the transient flow system, the fluid passes through the component under test to a return port on the center panel, and then through the heat exchanger and the 10-micron filter to the main hydraulic reservoir. There is no fluid flow when the handpump system is used, since the component under test or the degreaser and accumulator test console is "deadheaded." The hydraulic test console contains all the controls and monitoring devices used to regulate the flow, pressure, and temperature of the hydraulic fluid during test operations.

2-4. Transient Flow System

The transient flow system is used when a hydraulic component requires a dynamic test. This system uses clean hydraulic fluid from the main hydraulic reservoir and adjusts the rate of flow and pressure for the particular test being performed. Monitoring gages, meters, and indicator lamps are provided so that continuous checks can be made on the flow rate and pressure. The transient flow system returns the fluid through the return ports on the console panels to the reservoir.

2-5. Handpump System

The handpump system provides static pressures for proof, friction, and leakage tests on hydraulic components. The handpump system also supplies hydraulic pressure to the degreaser and accumulator test console for testing accumulators. Since this system has only one supply port, the HAND PUMP PRESSURE PORT, it can perform only one test at a time. The handpump supplies pressure either to the test fixture for the component under static test, or to the degreaser and accumulator test console. The fluid returns directly to the return line when we relieve the pressure.

2-6. Deleted

Section II. DETAILED THEORY

2-7. General

The hydraulic system maintains uniform pressures and flow rates. To do this, it must maintain uniform viscosity by operating within a given temperature range. This range is between 91°F and 1090F. The fluid is cooled by the heat exchanger. A heater in the main hydraulic reservoir heats the fluid when necessary. Figure 2-2 is the general flow diagram of the hydraulic test console. This diagram shows the relationship of the pressurized and unpressurized lines of the console.

2-8. Operation

a. Transient Flow System. We begin the operation of the transient flow system by charging the air side of the hydraulic test console accumulator to 450 to 550 psig. The accumulator is charged by performing the air-charging procedures specified in paragraph 6-10. The operation of the transient flow system is shown in figure 2-3 and described below in subparagraphs (1) through (9).

(1) The system pressure pump draws fluid from the main hydraulic reservoir through the manually operated shut-off valve which is normally open. If the system pressure pump is operated with the shut-off valve closed, the pump may be severely damaged. Two thermal switches in the reservoir control the operation of the pump. These switches are set to deenergize the pump motor when the fluid temperature falls below -10° ± 5°F or rises above 169° +5°F, and to energize the pump motor when the fluid temperature increases to 10° ± 5°F or decreases to 160° ± 4°F.

(2) The output of the pump passes through a check valve and the 5-micron filter. Contamination of the 5-micron filter is monitored by the pressure differential switch. If a clogged filter causes differential pressures in excess of 60 to 80 psig, the switch deenergizes a green lamp and energizes a red warning lamp on the upper center panel, which indicates that the filter needs cleaning.

(3) When the transient flow system is subjected to pressures greater than 3700 ± 100 psig, the pilot-operated relief valve bypasses the fluid to the main

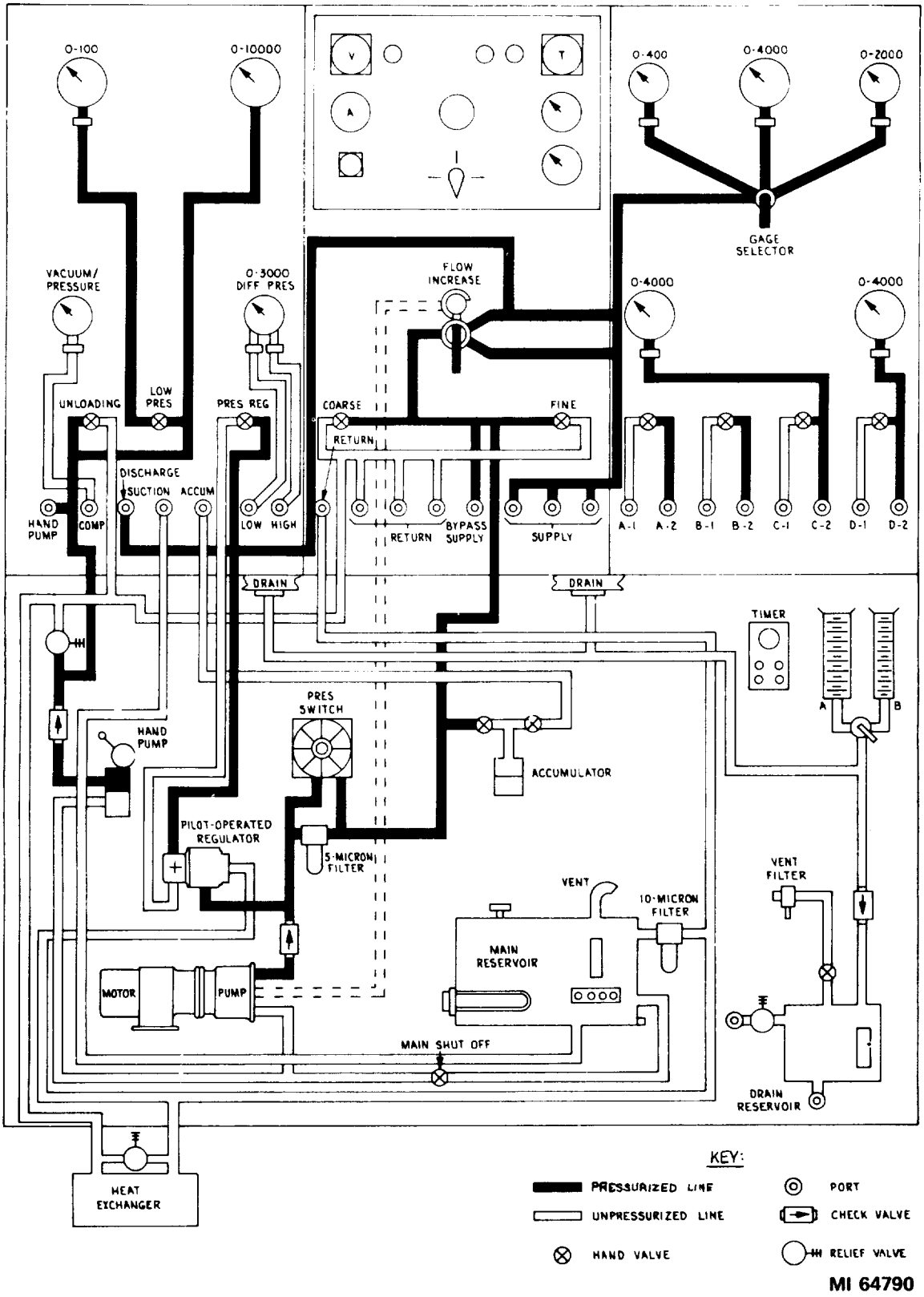


Figure 2-2. Hydraulic test console-general flow diagram.

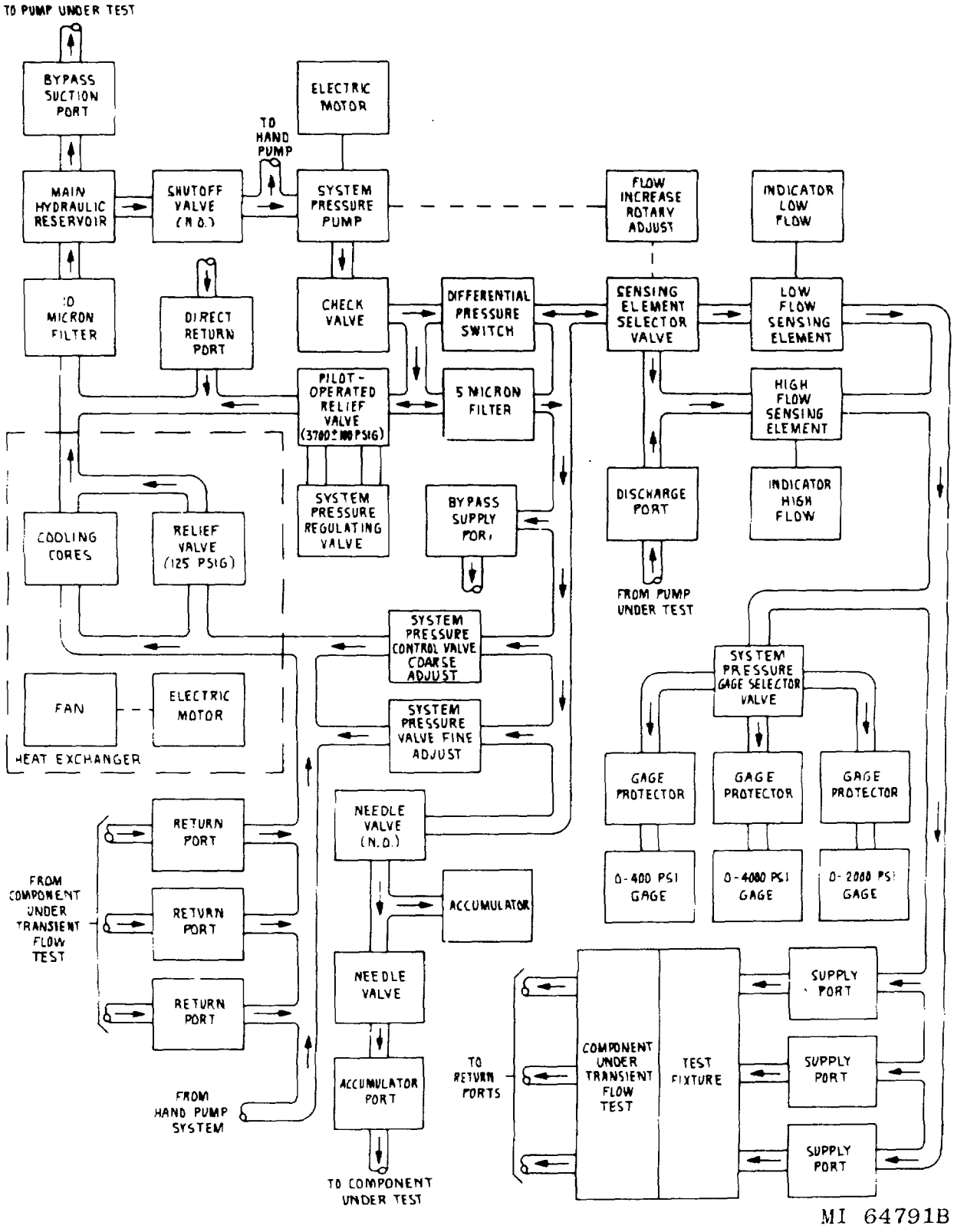


Figure 2-3. Transient flow system—detailed block diagram.

hydraulic reservoir through the 10micron filter. The fluid also bypasses the heat exchanger. The SYSTEM PRESSURE REGULATOR VALVE is normally set at 3700 i 100 psig and is connected to the pilot-operated relief valve so that it can be manually adjusted to trigger system relief at any pressure under 3700 f 100 psig.

(4) The SYSTEM PRESSURE CONTROL VALVE COARSE ADJUST and the SYSTEM PRESSURE CONTROL VALVE FINE ADJUST bypass fluid to the return line or divert fluid through the sensing elements and SUPPLY PORTS to components under test, thus regulating flow or pressure for the particular test. When these valves are fully open, all flow is directed through the return line. They are gradually closed until the desired amount of fluid flow, under pressure, is diverted through the sensing element selector valve to the applicable sensing element.

(5) The position of the selector valve handle determines which sensing element and indicator high or low will monitor the fluid flow. The low-flow sensing element and the INDICATOR LOW FLOW meter monitor flow rates from 0 to 1.3 gpm. The high-flow sensing element and the INDICATOR HIGH FLOW meter monitor flow rates from 1.25 to 9.0 gpm. The selector valve is mechanically interlocked with the FLOW INCREASE rotary adjustment knob. This mechanical interlock assures the proper flow rate setting for the sensing element selected. The FLOW INCREASE rotary adjustment knob is also mechanically connected to the system pressure pump to control the pump output.

(6) After passing through the sensing element, the flow is directed to one or more of the three SUPPLY PORTS, then through a test fixture to the component under dynamic test. Depending on the setting of the SYSTEM PRESSURE GAGE SELECTOR valve, the flow is also directed to an appropriate gage so that fluid pressures may be monitored.

(7) The fluid through the component under test returns to the main hydraulic reservoir through one or more of the three RETURN PORTS, the heat exchanger, and the 10-micron filter. The relief valve between the inlet and outlet lines of the heat exchanger protects the heat exchanger cores from back pressures in excess of 125 psig.

(8) The DISCHARGE PORT is used in conjunction with the BYPASS SUCTION PORT for testing hydraulic pumps from the ILCHR. These tests are monitored for pressure and flow by gages on the upper panels of the hydraulic console.

(9) The accumulator is connected to the system pressure line between the 5-micron filter and the sensing element selector valve through a needle valve, to reduce pressure surges. When the test procedures call for a component to be connected to the ACCUMULATOR PORT, the needle valve on the left side of the accumulator is opened.

b. Handpump System. Figure 2-4 shows that operating the handpump draws fluid from the main hydraulic reservoir and through the manually operated shutoff valve. The pump then discharges the fluid, under pressure, through the check valve on the down-stream side of the pump to the HAND PUMP PRESSURE PORT. From there, depending on the particular test being performed, the pressurized fluid is ported to a test fixture for static test of a component or to the degreaser and accumulator test console. The relief valve automatically relieves excess fluid pressure caused by prolonged operation of the handpump. When sustained high pressure is to be held by a test component, the check valve protects the pump from high back pressure. The two pressure gages monitor the pressure attained in the pressure line. The low-pressure gage has a gage protector and a shutoff valve to protect it when high pressure tests are performed. The static pressure in the system is relieved, after testing is completed, by opening the HANDPUMP PRESSURE UNLOADING VALVE. This valve returns the hydraulic fluid through the heat exchanger and the 10-micron filter to the main hydraulic reservoir.

c. Drain System. Figure 2-5 shows that fluid leakage from the components under test flows into the four drain pans and then to the drain reservoir. When it is necessary to measure fluid leakage, the component being tested is placed in either of the two smaller graduate drain pans. With the leakage graduate drain plug valve closed, the leakage can be measured in graduate A or B. Opening the leakage graduate drain plug valve allows the fluid to flow into the drain reservoir. The drain reservoir vents through the air filter and the normally open shutoff valve. The reservoir is emptied by closing the shutoff valve in the line to the air filter, connecting a hose to the reservoir drain fitting, and applying air pressure to the reservoir through the air-charge fitting. The check valve in the line between the air-charge fitting and the reservoir serves as a relief valve when air is applied to drain the reservoir. The check valve in the line to the graduate drain pans

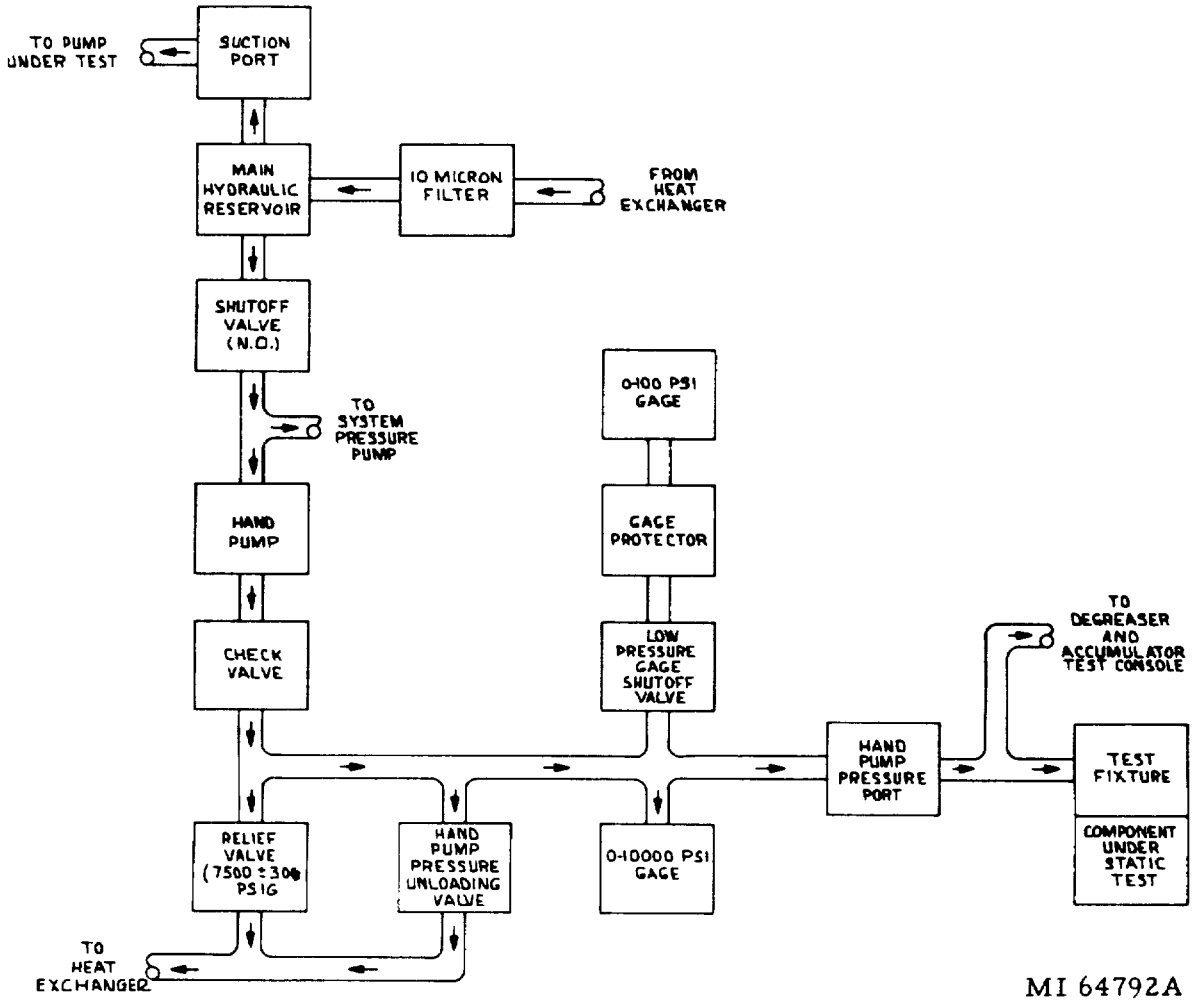


Figure 2-4. Handpump system-detailed block diagram.

prevents the back flow of fluid to the graduate pans.

d. Hydraulic Test Console Control-Monitoring Systems (Fig. 2-6). THROTTLING VALVES A through D are basically shutoff valves with inlet and outlet ports. These valves are mounted on the upper right control panel of the hydraulic test console. THROTTLING VALVES C and D are connected to gages so that pressure can be monitored while we control the flow of hydraulic fluid. The 0-3000 PSI DIFFERENTIAL GAGE on the upper left control panel measures differential pressure, through the HIGH and LOW DIFFERENTIAI, GAGE PORTS, as required in some tests.

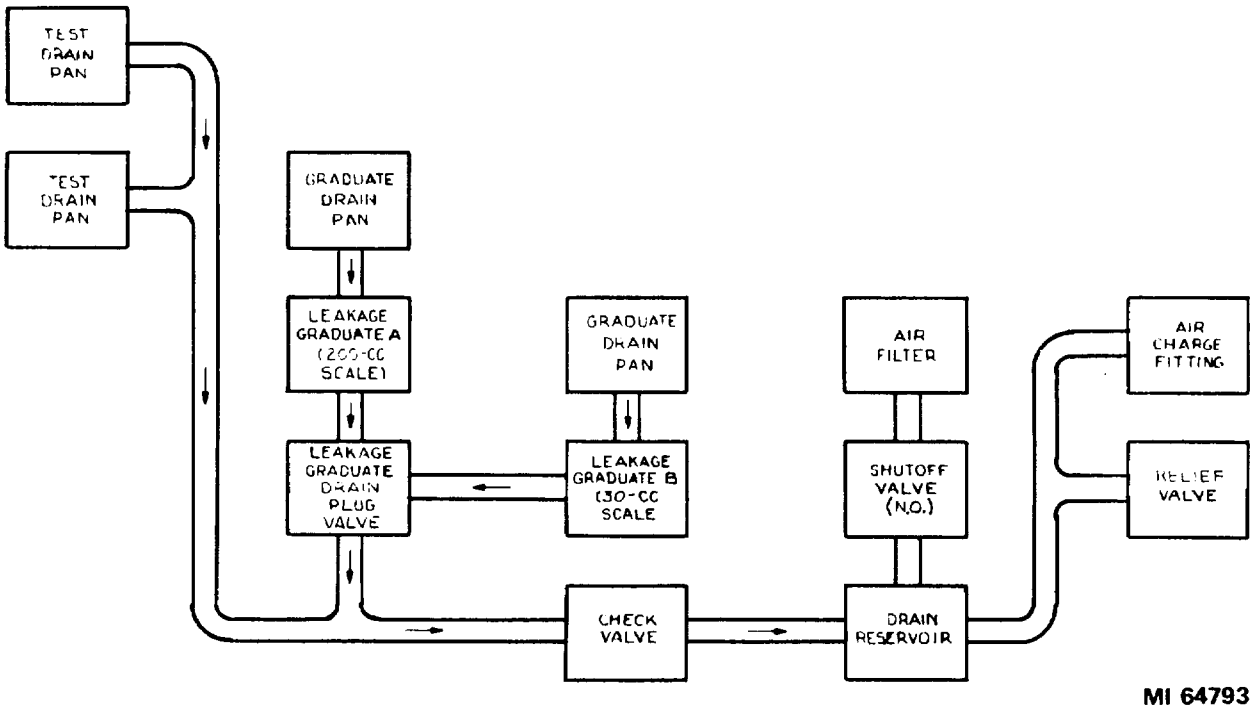


Figure 2-5. Hydraulic test console drain system-detailed block diagram.

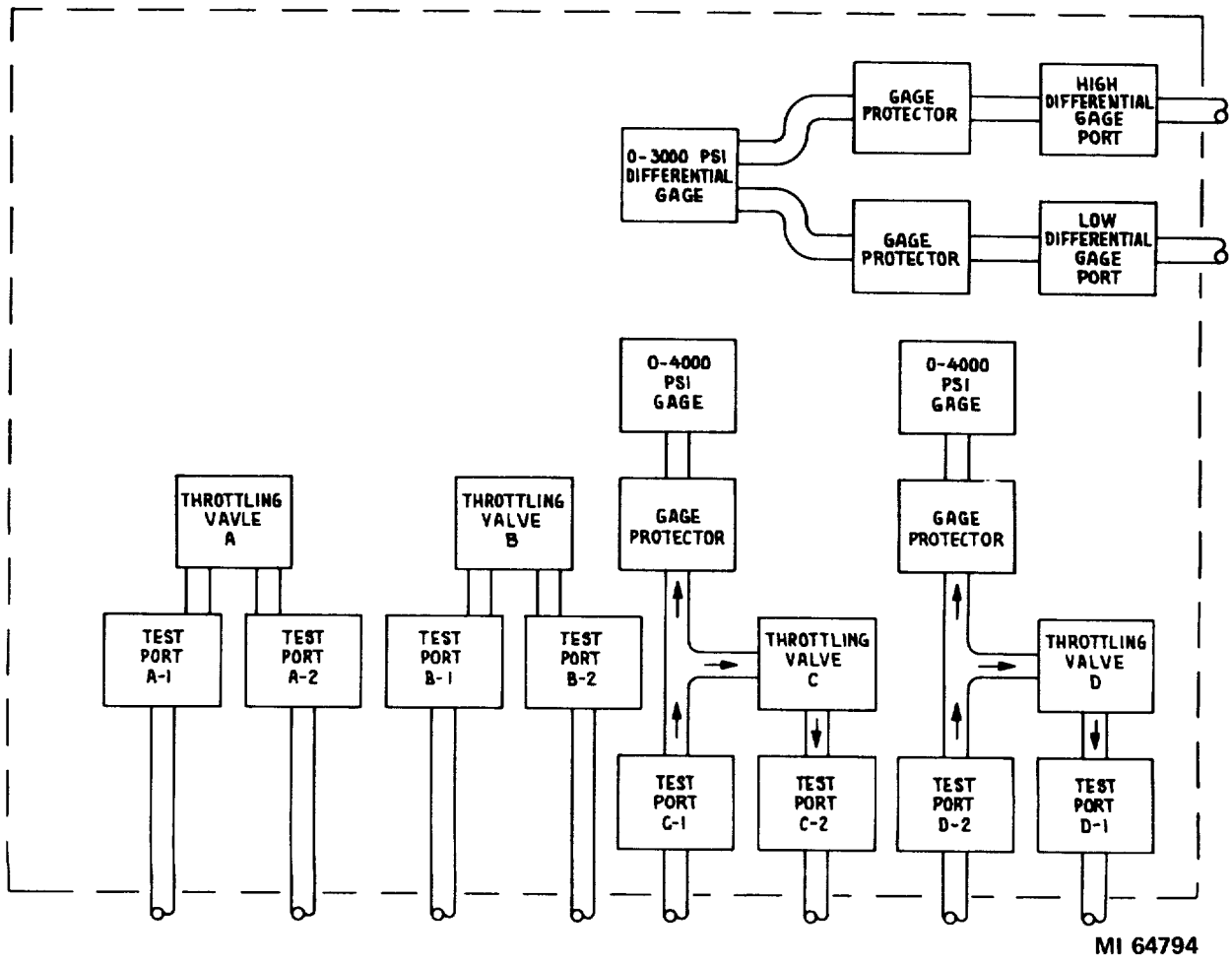


Figure 2-6. Hydraulic test console control-monitoring systems-detailed block diagram.

Figure 2-7. Deleted.

Section III. HYDRAULIC COMPONENTS

2-9. General

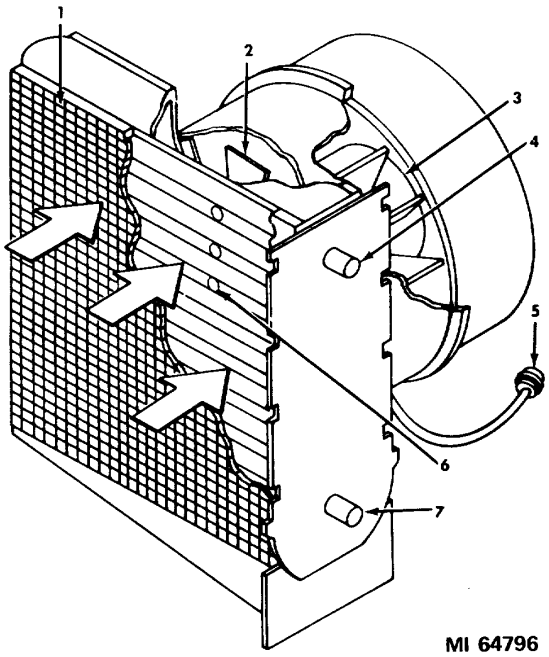
This section contains description and theory of operation for the individual components of the hydraulic system. If size is the only difference between similar components, only one detailed description is given.

2-10. Heat Exchanger

NOTE
The key numbers shown below in parentheses refer to figure 2-8.

a. Purpose. The heat exchanger cools and helps to maintain the hydraulic fluid within the normal operating range.

b. Operation. The heat exchanger is positioned outside the shelter before the hydraulic system is started. Hydraulic fluid from both the transient flow system and the handpump system enters the heat exchanger through the inlet port (4). The pressure of the fluid at the inlet will vary, depending on the test being performed. Fluid entering the heat exchanger flows through the core-type cooler (6) where it is cooled by convection with the outside air. When the fluid temperature in the main hydraulic reservoir reaches 105° i4°F, a thermostatic switch closes and starts the heat exchanger motor (3). The motor is connected by the electrical connector (5) to the hydraulic console, which supplies the power to the motor. The motor drives the fan (2) to accelerate the cooling process



1-Protective screen
2-Fan
3-Motor
4-Inlet port
5-Electrical connector
6-core-type cooler
7-Outlet port

Figure 2-8. Heat exchanger.

by passing more air through the cooling cores. The protective screen (1) prevents the cooling cores from being damaged or clogged. After the fluid passes through the cooling cores, it flows through the outlet port (7) and returns to the main hydraulic reservoir through the 10-micron filter. When the fluid temperature decreases to 96° ± 5°F, the thermostatic switch opens and deenergizes the heat exchanger motor.

2-11. Main Hydraulic Reservoir

NOTE
The key numbers shown below in parentheses refer to figure 2-9.

a. Purpose. The main hydraulic reservoir, which is located in the lower right section of the hydraulic console, stores and supplies fluid for all hydraulic operations of transportable shop 5.

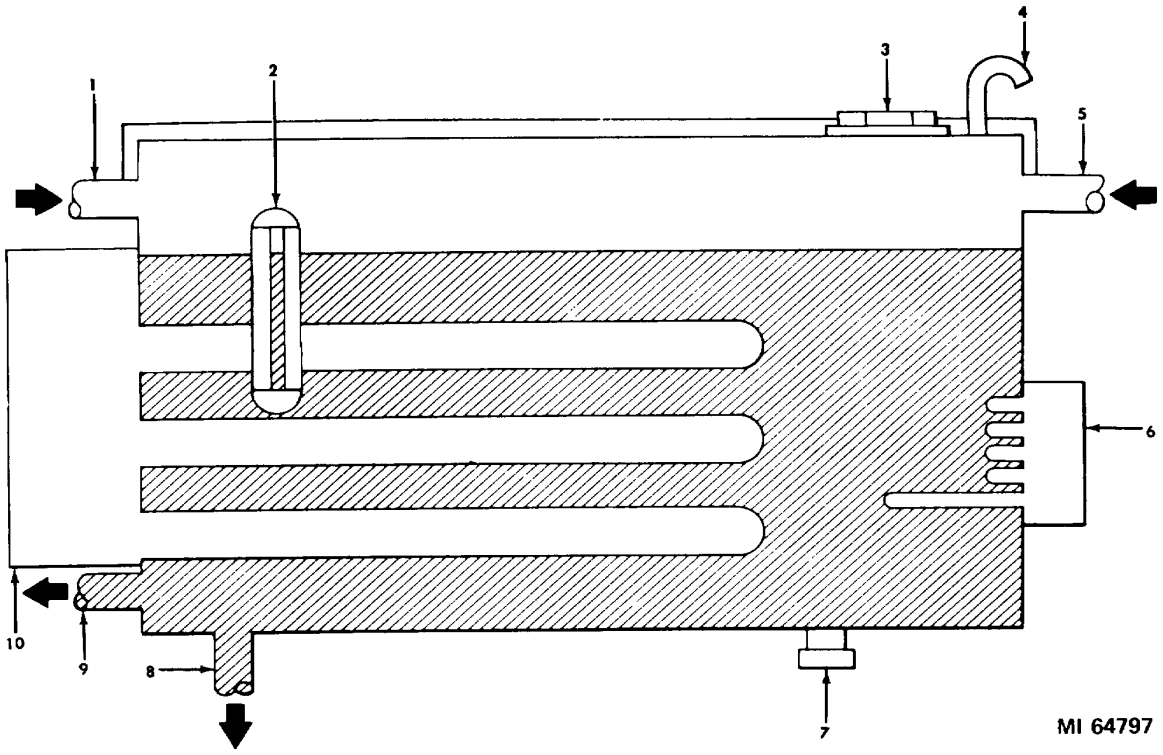
b. Operation. The reservoir is essentially a 15 gallon Lank which is filled either by removing the filler cap (3) and manually pouring the fluid into the tank or by using the portable filtration unit. The fluid level in the reservoir can be seen on the oil-level indicator (2). When either the transient flow or handpump system is used, the fluid is drawn from the tank through the system supply port (9). The three heater elements (10) are energized when the fluid temperature has decreased to 15 ± 4°F and are deenergized when the fluid temperature has increased to 24° ±5°F. These heater elements and the heat exchanger (par. 2-10) are controlled by the thermostatic switches (6), which energize or deenergize these units according to the temperature of the fluid. The temperature probe (6) is connected to the INDICATOR OIL TEMPERATURE gage, which is located on the upper center panel of the hydraulic test console. When an ILCHR pump is tested, it is connected through the SUCTION PORT on the upper left panel of the hydraulic console to the 1-inch suction test port (8) and draws fluid directly from the reservoir. Fluid returns to the reservoir through the return port (5) after passing through a 10micron filter. The system pressure pump bypass return port (1) receives fluid directly from the system pressure pump when the demands on the pump are such that only a low-flow rate is required. When necessary, the reservoir can be drained manually through the drain port (7). The air vent (4) at the top of the reservoir equalizes inside and outside pressures.

2-12. System Pressure Pump

NOTE
The key numbers shown below in parentheses refer to figure 2-10.

a. Purpose. The system pressure pump supplies hydraulic pressure for operation of the transient flow system. The system pressure pump is located in the lower section of the hydraulic console.

b. Operation. This pump is a fixed displacement, axial-piston pump with a flow rate that can be varied manually from 0 to 8 gpm. The electric motor, which drives the pump, rotates at a constant rate of 12,000 rpm. A reduction geartrain from the motor drives the pump at 3750 rpm. As the drive shaft (16) rotates, the drive cam (17) also rotates and advances the nine pistons alternately in their cylinders. The nutating plate (15) is a circular disk which does not rotate, but is connected to each piston in such a manner that its relative position will always be parallel to the drive cam. The nutating plate is mounted on a pivot so that, as one piston advances, the piston which is diametrically opposite is withdrawn. Each piston (1) has a ball joint (14) which allows the drive cam to rotate freely. The drive cam advances the pistons and the nutating plate withdraws



1-System pressure pump bypass return port
2-Oil-level indicator
3-Filler cap
4-Air vent
5-Return port
6-Thermostatic switches and temperature probe
7-Drain port
8-1-inch suction test port
9-System supply port
10-Heater elements

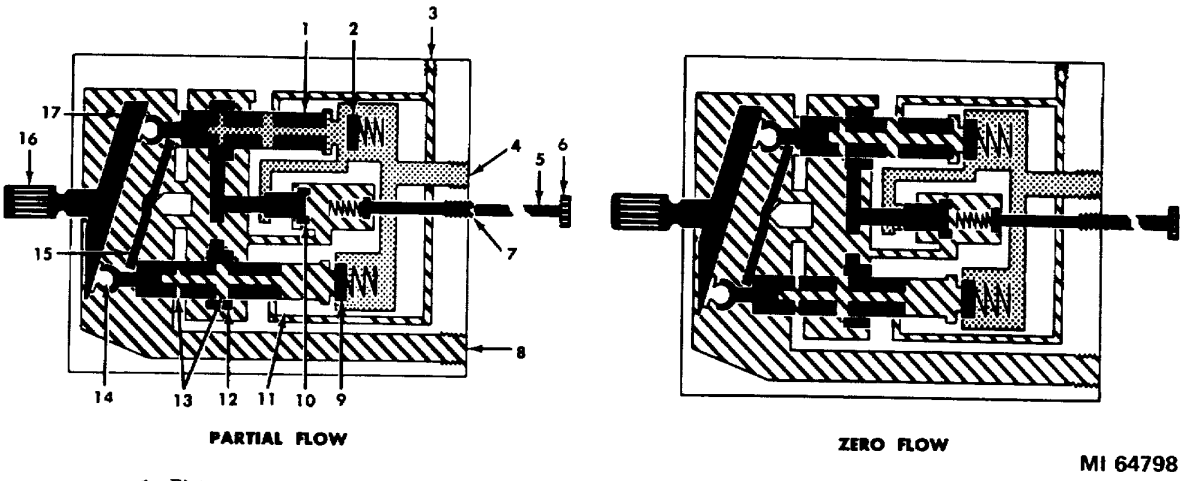
Figure 2-9. Main hydraulic reservoir.

them. Fluid is drawn into the pump through the SUCTION PORT (8). As the drive cam rotates, the piston moving on the intake or suction stroke creates a partial vacuum in the cylinder (11) which draws the check valve (9) closed and keeps it closed. As the relief ports (13) in the piston pass the areas on both sides of the compensator sleeve (12), fluid is drawn into the cylinder. On the discharge stroke, the piston advances and forces the fluid within the cylinder against the check valve (2). The pressure of the fluid then unseats the check valve and allows the fluid to flow out the pressure port (4). The effective output of the discharge stroke is determined by the piston of the compensator sleeve. The position of the compensator sleeve is set with the FLOW INCREASE adjustment knob (6), which is connected by the cable (5) to the manual compensator adjustment (7). The FILOW INCREASE adjustment knob is located on the upper center panel of the hydraulic console. The manual compensator adjustment, which moves the compensator piston (10) in or out, controls the position of the compensator sleeves. The length of time the relief ports on the piston remains uncovered during the discharge stroke determines the amount of fluid that can be displaced by the piston. Since the working parts of the pump need lubricating and cooling, some fluid must always circulate in the pump. This need is fulfilled by the bypass passages which are connected to the cylinders through the pistons during the last portion of the discharge stroke. Therefore, when the compensator sleeve is set in the zero flow position, 0.25 gpm is displaced through the small bypass port (3). This amount is adequate for lubrication and cooling.

2-13. Handpump

NOTE
The key numbers shown below in parentheses refer to figure 2-11.

a. Purpose. The handpump supplies hydraulic pressures up to 7800±300 psig to the handpump system (par. 2-8b) of the hydraulic test console.

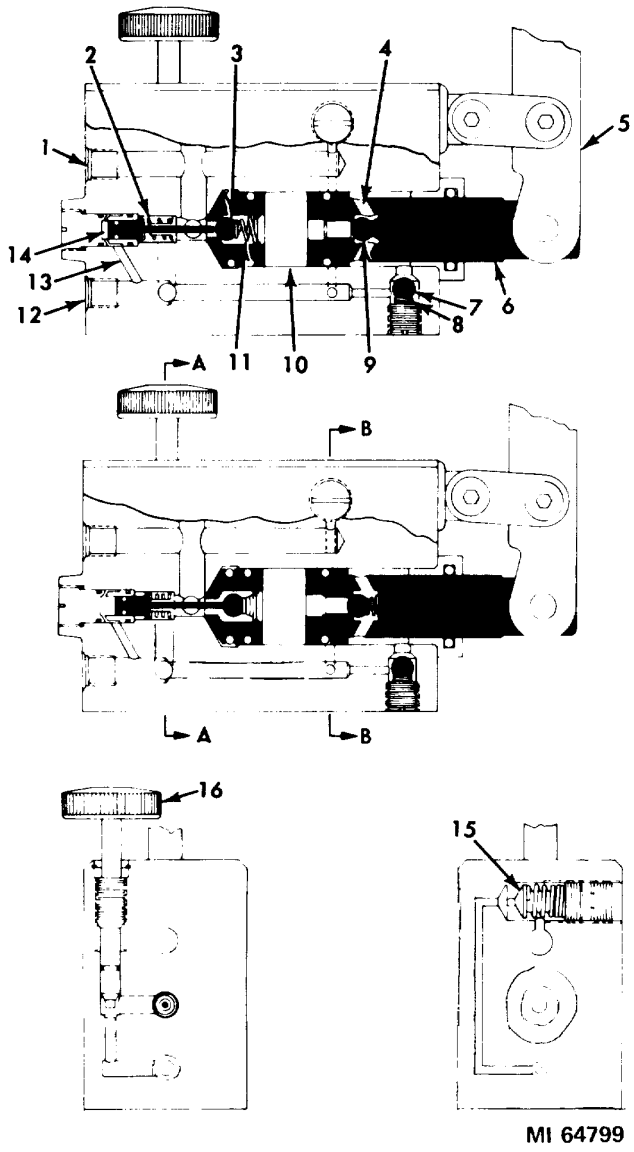


1-Piston
2-Check valve open
3-Bypass port
4-Pressure port
5-Cable
6-FLOW INCREASE adjustment knob
7-Manual compensator adjustment
8-SUCTION PROT
9-Check valve (closed)
10-Compensator piston
11-Cylinder
12-Compensator sleeve
13-Relief ports
14-Ball joint
15-Nutating plate
16-Drive shaft
16-Drive shaft
17-Drive cam

Figure 2-10. System pressure pump.

Because of an external relief valve which is connected to the pump, no more than 7500 ± 300 psig is applied to the components under test. The handpump is also used to supply hydraulic pressure to the degreaser and accumulator test console. The pump is located behind the hinged handpump access door on the lower left side of the hydraulic test console.

b. Operation. This pump is a two-stage reciprocating hand-driven unit which operates alternately through a high-volume low-pressure stage and a high-pressure low-volume stage. In figure 2-11, the fluid enters the pump through the inlet port (1). Fluid flow through the outlet port (12) occurs during both the up and down strokes of the pump handle (5) when the pump is in the high-volume low-pressure stage. However, during the low-volume high-pressure stage, fluid flow occurs only during the down stroke of the handle. Fluid flow is not continuous, and the output depends on the speed at which the pump handle is operated. The pump is capable of producing pressures up to 10,000 psig but, since the internal relief valve (15) relieves at 7800 ± 300 psig, this is the maximum pressure output that the pump will develop. The high-volume low-pressure stage begins with the initial downstroke of the handle. This creates a partial vacuum in the cylinder (10). Because of the vacuum in the cylinder, the fluid inlet pressure unseats the check ball (3) and fluid is drawn into the cylinder. At the end of the downstroke, the spring (11) reseats the check ball to prevent the fluid from returning to the inlet port. On the initial upstroke, pressure causes the check ball (9) to unseat so that fluid flows through the piston ports (4) into the area between the piston and cylinder, past the unseated check ball (7), and out the outlet port (12). On the second downstroke of the handle, fluid is again drawn into the cylinder past the unseated check ball, and the fluid which is trapped by the seated check ball (9), between the piston and the cylinder, overcomes the pressure of the spring (8). This fluid flows past the check ball (7) and out of the pump through the outlet port. Fluid flow through the pump continues in this manner for each succeeding up or down stroke of the handle until 700 ± 100 psig of pressure is exerted on the bypass control valve (14) through the bypass port (13). This pressure is sufficient to overcome the spring (2), and the bypass control valve moves forward and unseats the check ball (3). The check ball remains unseated as long as a pressure of 700 ± 100 psig or more is exerted on the bypass control valve. It is at this pressure that the pump uses only the high-pressure low-volume stage. During the high-pressure, low-volume stage, fluid enters the cylinder on the downstroke, moving past the now unseated check ball (3), while the fluid which is trapped by the seated check ball (9), between the piston and the cylinder, is forced past



1-Inlet port
2-Spring
3-Check ball
4-Piston port
5-Handle
6-Piston
7-Check ball
8-Spring
9-Check ball
10-Cylinder
11-Spring
12-Outlet port
13-Bypass port
14-Bypass control valve
15-Relief valve
16-Handpump unloading valve

Figure 2-11. Handpump.

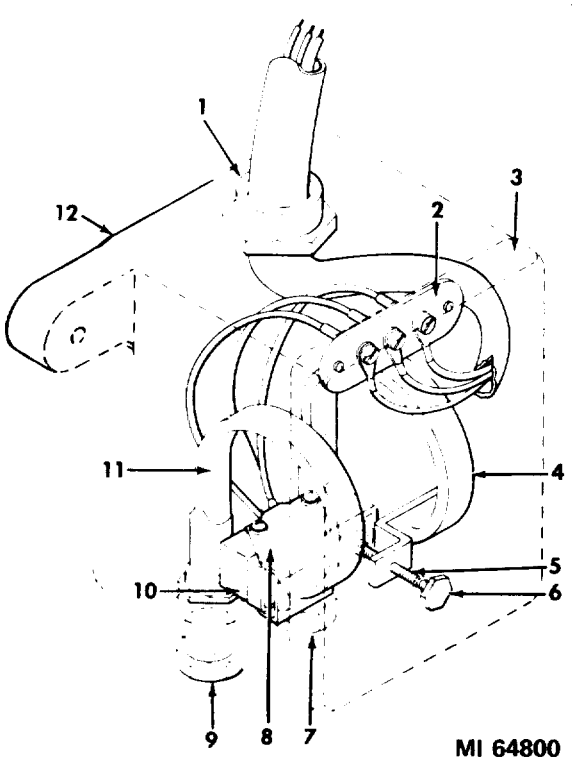
the check ball (7) to the outlet port. On each succeeding upstroke of the handle, the pressure unseats the check ball (9), and fluid flows through the piston ports to fill the area between the piston and the cylinder. The check ball (7) remains seated, no fluid is directed to the outlet port, and the excess fluid in the intake side of the cylinder is forced through the inlet port. On each succeeding downstroke, the following action takes place: the check ball (9) seats, and the check ball (7) is forced off its seat. Only the fluid trapped in the space between the piston and cylinder is directed out of the pump through the outlet port. The handpump unloading valve (16) is opened to relieve internal pressures in the pump.

2-14. Pressure Differential Switch

NOTE
The key numbers shown below in parentheses refer to figure 2-12.

a. Purpose. The pressure differential switch monitors the pressure drop which results from contamination of the filter element in the 5-micron filter unit. The pressure differential switch is located in the lower section of the hydraulic console.

b. Operation. No fluid flows through the pressure differential switch. However, there are two pressure ports: one is a reference port (9) which receives fluid directly from the system pressure pump through a check valve, and the other is a variable pressure port (7) which receives fluid from the outlet line of the filter. The switch assembly (10) is a single-pole, double-throw switch which operates on 28 vdc. This switch assembly controls the FILTER PRESSURE DROP indicator lamps on the upper center panel provided that an actuating pressure of 30 to 70 psig is present at both pressure ports. Pressurized fluid enters through both ports into the bourdon tubes (4 and 11). If the difference in pressure is less than 60 to 80 psig, both tubes will expand and maintain the same relative position of the contacts in the switch. If the pressure difference is more than 60 to 80 psig, the pressure in the variable pressure port will not expand the bourdon tube far enough to keep the switch in its normally open position. When this happens, the switchplate (8) moves the switch into contact with the adjustment screw (5) and closes the switch. This deenergizes the green FILTER PRESSURE DROP indicator lamp and energizes the red FILTER PRESSURE DROP indicator lamp. When the red lamp lights, the filter element in the 5-micron filter is contaminated and should be cleaned or replaced. The plug (6) screws into the cover (3) and is



1-Conduit connector
2-Terminal strip
3-cover
4-Variable pressure bourdon tube
5-Adjustment screw
6-Plug
7-Variable pressure port
8-Switchplate
9-Reference pressure port
10-Switch assembly
11-Reference pressure bourdon tube
12-Case

Figure 2-12. Pressure differential switch.

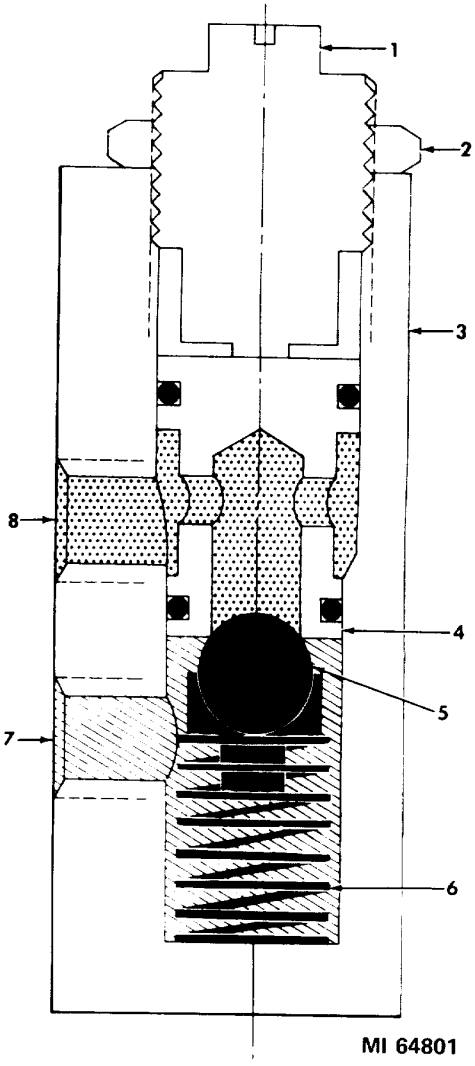
removed whenever access to the adjustment screw is necessary. The cover is fastened to the case (12), and together they enclose the other parts of the switch. The terminal strip (2) provides wiring connections so that the switch assembly can be disconnected separately.

2-15. Hydraulic Relief Valves

NOTE
The key numbers shown below in parentheses refer to figure 2-13.

a. Purpose. Hydraulic relief valves remove excessive fluid pressures to prevent damage to other components. There are three relief valves in the hydraulic test console: the handpump system contains two relief valves, one internal and one external. The third relief valve, which is discussed in paragraph 2-16, is in the transient flow system. The heat exchanger and the portable filtration unit each have a relief valve connected across their inlet and outlet ports.

b. Operation. The relief valve in the portable filtration unit and the one in the heat exchanger differ only in size and operating pressures.. The relief valves in the handpump system differ both in configuration and operating pressures. The handpump external and



1-Adjusting screw
2-Locknut
3-Body
4-Seat
5-Ball
6-Spring
7-Return port
8-Pressure port

Figure 2-13. Hydraulic relief valve.

internal relief valves are ball-type valves where the ball fits against an inserted seat and is held there by spring pressure. The relief valve in the portable filtration unit and the relief valve in the heat exchanger lines are piston-type valves with the pistons seating against the body of the valves. However, the basic principle of all the relief valves is the same. In figure 2-13, fluid under pressure enters the pressure port (8) and exerts pressure against the ball (5). The ball is held against the seat (4) by the spring (6). When the hydraulic pressure becomes greater than the spring pressure, the ball unseats and fluid flows out the return port (7). The spring pressure is adjusted by loosening the locknut (2) and turning the adjusting screw (1) in or out of the threaded valve body (3). The handpump external relief valve has a second pressure port, with a plug and bleeder attached, to bleed air from the system while it is under pressure.

2-16. Pilot-Operated Relief Valve

NOTE
The key numbers shown below in parentheses refer to figure 2-14.

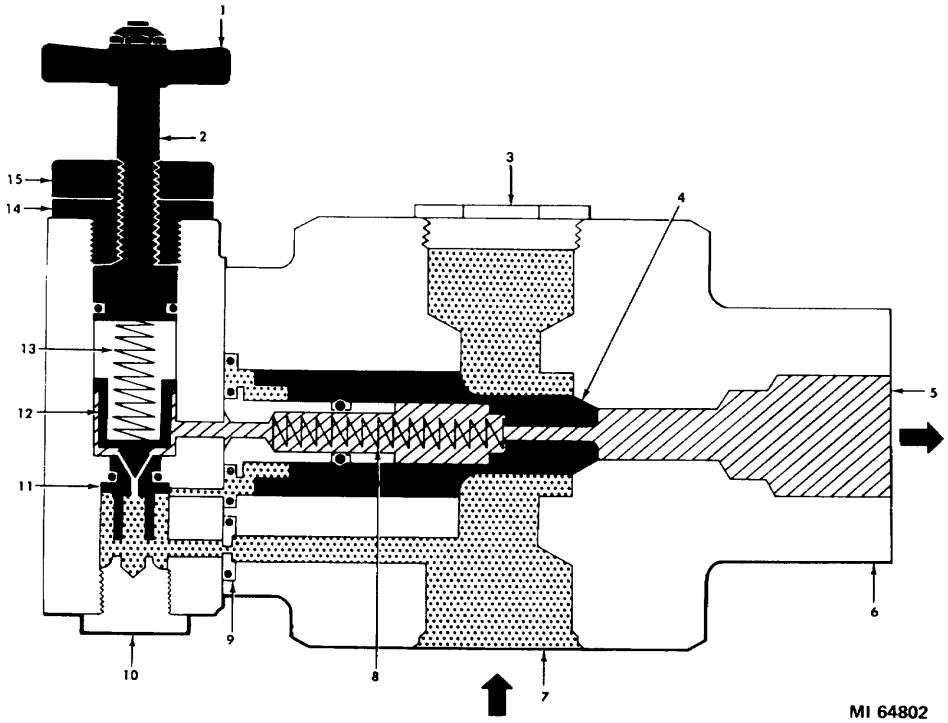
a. Purpose. The pilot-operated relief valve is located in the lower left section of the hydraulic console to protect components in the transient flow system from excessive pressure. A pilot in the relief valve is set remotely to relieve at any desired pressure lower than 3700 f 100 psig. The pilot is set by adjusting the SYSTEM PRESSURE REGULATOR VALVE on the upper left panel of the hydraulic console.

b. Operation. The valve has two pressure ports and it can also be used as a flow-through relief valve. However, in this system, a plug (3) is installed in the second pressure port and there is no flow through the valve until the cracking pressure is reached. The valve is preset to open at 3700 + 100 psig by turning the handle (1). The adjusting screw (2) sets the tension on the pilot spring (13). Fluid entering the pressure inlet port (7) is routed through the orifice plate (9) to the pilot of the valve. Fluid pressure raises the inserted seat (11) against the pilot (12) to allow fluid to flow through the opening to the top of the piston (4). There the fluid pressure and the piston spring (8) hold the piston in a closed or seated position. When pressure surges increase the inlet pressure to more than 3700 + 100 psig, the pilot is forced off the inserted seat so that fluid will flow through the pilot and through the center of the piston to the return port (5). If the overpressure is sustained, the pilot unseats and remains unseated, and the hydraulic pressure holding the piston in the closed position relieves back through the pilot. This creates unequal pressures on the piston and allows the higher pressure at the seated end of the piston to overcome the pressure of the piston spring, causing the piston to unseat from the body of the valve. Fluid will now flow directly from the pressure port to the return port. Fluid through the return port flows directly through the return line to the 10-micron filter and the main hydraulic reservoir, by-passing the heat exchanger. When the piston unseats, the pressure to the pilot drops. The spring then has enough force to overcome the lowered fluid pressure and pushes the inserted seat down. As the seat lowers, it blocks the opening to the top of the piston, leaving some fluid in that area, which cushions the travel of the piston. The pilot portion of the valve has two ports (not shown) which connect directly to the SYSTEM PRESSURE REGULATOR VALVE (par. 2-17). One port connects to the pressure side of the pilot and the other port connects to the return side. When the SYSTEM PRESSURE REGULATOR VALVE is manually adjusted to relieve at a pressure lower than 3700 100 psig, fluid will flow through the regulator valve, back through the main valve piston, and out the return port of the relief valve. This action causes the pressure in the pilot portion of the relief valve to drop. The action of the piston will now be the same as when the pilot unseats. Fluid will relieve through the opening at the top of the piston until the pilot spring forces the inserted seat down and blocks the opening. The piston will unseat and relieve directly to the return port until the SYSTEM PRESSURE REGULATOR VALVE closes. When the SYSTEM PRESSURE REGULATOR VALVE closes, the pressure again builds up in the pilot, forcing the seat up against the pilot and reseating the piston. When the transient flow system is not in operation, the inserted seat rests on the seat retainer (10) in the lower part of the pilot portion of the valve.

2-17. System Pressure Regulator Valve

NOTE
The key numbers shown below in parentheses refer to figure 2-15.

a. Purpose. The SYSTEM PRESSURE REGULATOR VALVE is, in effect, a manually adjusted relief valve which provides remote control for the pilot-operated relief valve (par. 2-16) in the transient flow system. It is located on the upper left panel of the hydraulic test console.



1-Handle
2-Adjusting screw
3-Plug
4-Piston
5-Return port
6-Body
7-Pressure inlet port
8-Piston spring
9-Orifice plate
10-Seat retainer
11-Inserted seat
12-Pilot
13-Pilot spring
14-Adjusting screw cap
15-locknut

Figure 2-14. Pilot-operated relief valve.

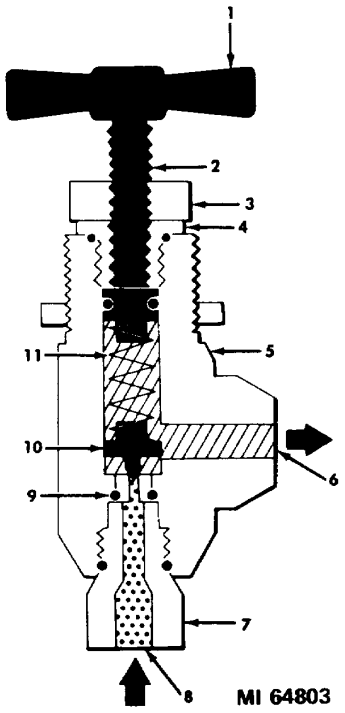
b. Operation. Both the inlet and outlet ports of the regulator valve are connected to ports on the pilot portion of the pilot-operated relief valve. The pressure through the inlet port (8) is the same as the pressure through the inlet port of the relief valve. The pressure through the outlet port (6) depends on the pressure setting of the pilot spring (11). The pressure on the pilot spring is set by turning the handle (1). As fluid flows through the inlet port, the pilot (10) remains seated until the adjusted cracking pressure is reached. Then the pilot unseats and fluid flows through the outlet port.

2-18. Sensing Elements

NOTE
The key numbers shown below in parentheses refer to figure 2-16.

a. Purpose. The two sensing elements measure the rate of fluid flow through the transient flow system to the component under test. They are located behind the upper center panel of the hydraulic console and are identical in appearance and operation.

b. Operation. The low-flow sensing element has a linear range of 0.25 to 1.30 gpm, and the highflow sensing element has a linear range of 1.25 to 9.00 gpm. In each sensing element the hydraulic flow turns the turbine-wheel type rotor (5). The rotor spins at a rate directly proportional to the velocity of flow. The input flow rate of either



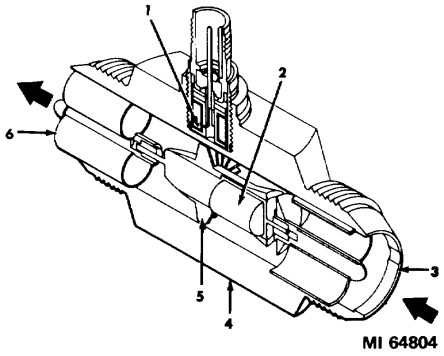
1-Handle
2-Adjusting screw
3-Locknut
4-Adjusting screw cap
5-Valve body
6-Outlet port
7-Seat retainer
8-inlet port
9-Inserted seat
10-Pilot
11-Pilot spring

Figure 2-15. System pressure regulator valve.

sensing element depends on the position of the FLOW INCREASE adjustment knob because of a mechanical interlock. As the rotor spins, a small permanent magnet (2) sets up an alternating current in the pickup coil (1). The total number of generated pulses produced per unit time by the sensing element is directly proportional to the flow rate through the element. To measure the flow, the electrical output is applied to either sensing element meter, INDICATOR LOW FLOW meter or INDICATOR HIGH FLOW meter, where it is converted to read in gallons per minute. Both meters are on the upper center panel of the hydraulic test console.

2-19. Indicator Flowmeters

a. Purpose. The two indicator flowmeters, located on the upper center panel of the hydraulic test Figure 2-



1-Pickup coil
2-Magnet
3-Inlet port
4-Body
5-rotor
6-Outlet port

Figure 2-16. Sensing element.

console, give an accurate, visual indication of the rate of flow through the transient flow system during testing procedures. The INDICATOR LOW FLOW meter has a range of 0.25 to 1.3 gpm; the INDICATOR HIGH FLOW meter has a range of 1.25 to 9.0 gpm.

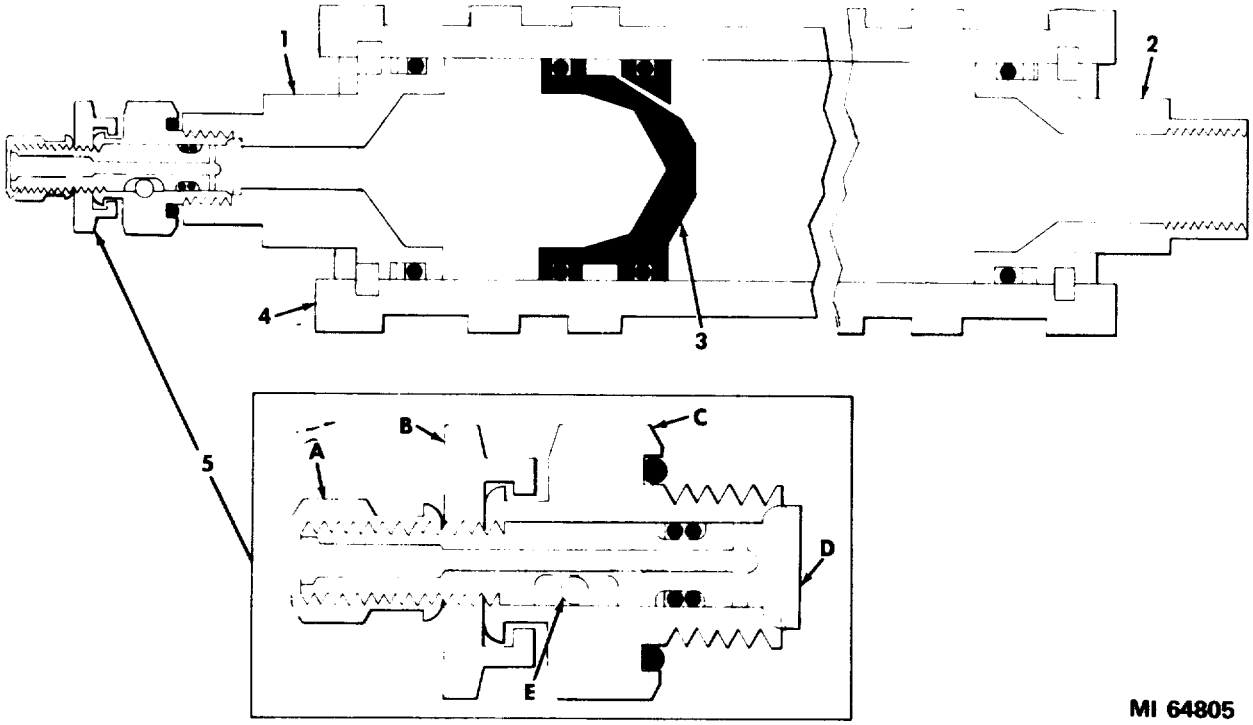
b. Operation. Both meters operate the same. A relatively weak ac signal from the sensing element (par. 2-18) is received by the indicator. This signal is then amplified and rectified in a transistorized circuit within the indicator, and applied to the meter coil. The meter coil deflects the indicator needle, which indicates the rate of flow on the dial of the meter.

2-20. Accumulator

NOTE
The key numbers shown below in parentheses refer to figure 2-17.

a. Purpose. The accumulator is used in the transient flow system to reduce pressure surges and to help maintain fluid pressures. It does this by supplying fluid under pressure whenever the system pressure drops because of large demands on the output of the system pressure pump. The accumulator is mounted on the top of the main hydraulic reservoir in the lower section of the hydraulic console.

b. Operation. Before any hydraulic operation is started, the air side of the accumulator must be charged to 500 psig. To do this, the cap (5A) is removed and the



1-Air port head

2-Oil port head

3-Piston

4-Cylinder

5-Air charge valve
A-Cap
B-Nut
C-Body
D-Stem
E-Pin retainer

Figure 2-17. Accumulator and air charge valve.

accumulator air charging manifold (fig. 1-29) is connected to the stem (5D). An air hose is connected between the accumulator air-charging manifold and the HIGH PRESSURE AIR port of the degreaser and accumulator test console. Then the nut (5B), which is part of the body (5C), is turned. The nut is threaded on the stem (5D), so that as the nut is turned, the stem is moved in or out. When the stem is moved in, its end unseats from the body, and air pressure enters the accumulator. After 500 psig of air pressure has been applied to the air side of the accumulator, the nut is turned counterclockwise to move the stem away from the accumulator, thereby seating the stem against the body. The air hose and accumulator air-charging manifold are then disconnected, and the cap (5A) is screwed onto the stem to insure an airtight air seal in the accumulator. The pin retainer (5E) limits the travel of the stem when the nut is turned. As the transient flow system is operated, hydraulic pressure will be exerted against the piston (3). When the hydraulic pressure begins to exceed 500 psig, the piston moves toward the air port head (1) and compresses the air on the air side of the piston. Therefore, with hydraulic pressure above 500 psig, the air pressure will always equal the hydraulic pressure. When the hydraulic pressure drops, the air side of the accumulator will force the piston back toward the oil side. This will apply a high hydraulic pressure to the system for a brief period. The accumulator has a maximum air volume of 54 cubic inches and a minimum air volume of 46 cubic inches, and its hydraulic capacity is one quart.

CHAPTER 3
THEORY OF OPERATION OF THE PNEUMATIC SYSTEM

3-1. General

The pneumatic system provides filtered, dried air, under high pressure, to charge and proof-test accumulators. The pneumatic system is also used for cleaning and degreasing components. The major assemblies of the pneumatic system are the air compressor assembly, the air reservoir assembly, and the degreaser and accumulator test console (fig. 3-1). The console houses both a low-pressure and a high-pressure air system.

3-2. Air Compressor Assembly

a. Purpose. The air compressor assembly filters, dries, and compresses the air which is used in the pneumatic system.

b. Operation.

(1) Flexible air hoses and electrical cables permit free movement of the hinged compressor mount so that the entire air compressor assembly can be swung out of the shelter and locked into position before the start of any operational procedures. This outside position prevents the compressor (fig. 3-2) from overheating. The compressor is driven by an electrical motor which is energized by the COMPRESSOR, DC ACTIVATE, and 28 VDC circuit breakers on the front panel of the degreaser and accumulator test console.

(2) The time delay and pressure switch is connected electrically in series with the pressure switch in the air reservoir assembly; together these switches control the operation of the motor. The time delay and pressure switch, which operates by oil pressure from the compressor crankcase, closes between 35 and 45 psig. The time delay relay in the switch assembly bypasses the pressure switch for 11 seconds while the compressor's lubrication system is developing oil pressure. If the oil pressure to the switch does not reach 35 to 45 psig after 11 seconds, the switch remains open, the time delay relay opens, and the compressor motor stops. The time delay and pressure switch prevents the compressor from being operated with insufficient oil pressure, while the pressure switch in the air reservoir assembly prevents the compressor from building up pressures in excess of the system requirements.

(3) Air intake to the first of the four-stage cylinders of the compressor is through the 40-micron filter. The first-stage cylinder pumps a large volume of air at a low pressure into the second-stage cylinder, increasing or supercharging the second stage. The second stage, in turn, supercharges the third stage, and the third stage supercharges the fourth stage. The original volume of air from the first-stage cylinder is compressed in four progressive steps. The compressed air is then vented through the bleed valve to the moisture separator for preliminary drying.

(4) The bleed valve (fig. 3-3) operates on oil pressure supplied by the compressor oil pump. When the compressor is operating, the oil pressure moves the poppet to block the bleed air port. The compressed air then flows directly through the valve from the inlet port to the outlet port. When the compressor stops, the oil pressure drops to 0 psig, and the poppet moves in the opposite direction. This opens the bleed valve air port and exhausts the air in the compressor and the moisture separator.

(5) The moisture separator (fig. 3-4) mechanically removes moisture from the air. Air from the compressor flows through the inlet port and acts on the piston and the poppet. The poppet, in turn, closes the drain port. The piston blocks the air inlet to the separator chamber until a pressure of 750 psig is attained. At this pressure, the piston compresses the spring, and air flows through the guide and tube assembly to the baffle in the upper section of the separator. Here the moisture collects on the baffle and drips into the lower section of the separator. The dried air is then vented through the outlet port. When the compressor stops, the poppet in the separator continues to block the drain port until the bleed valve exhausts the pressure from the compressor and inlet tubing. Then the poppet moves to unblock the drain port and allow the separator to vent. These two "blowdowns" are heard 2 to 10 seconds apart, just after the compressor stops. The heater prevents the moisture in the bottom of the separator chamber from freezing during cold weather operation. This moisture is expelled through the drain port during the moisture separator "blowdown".

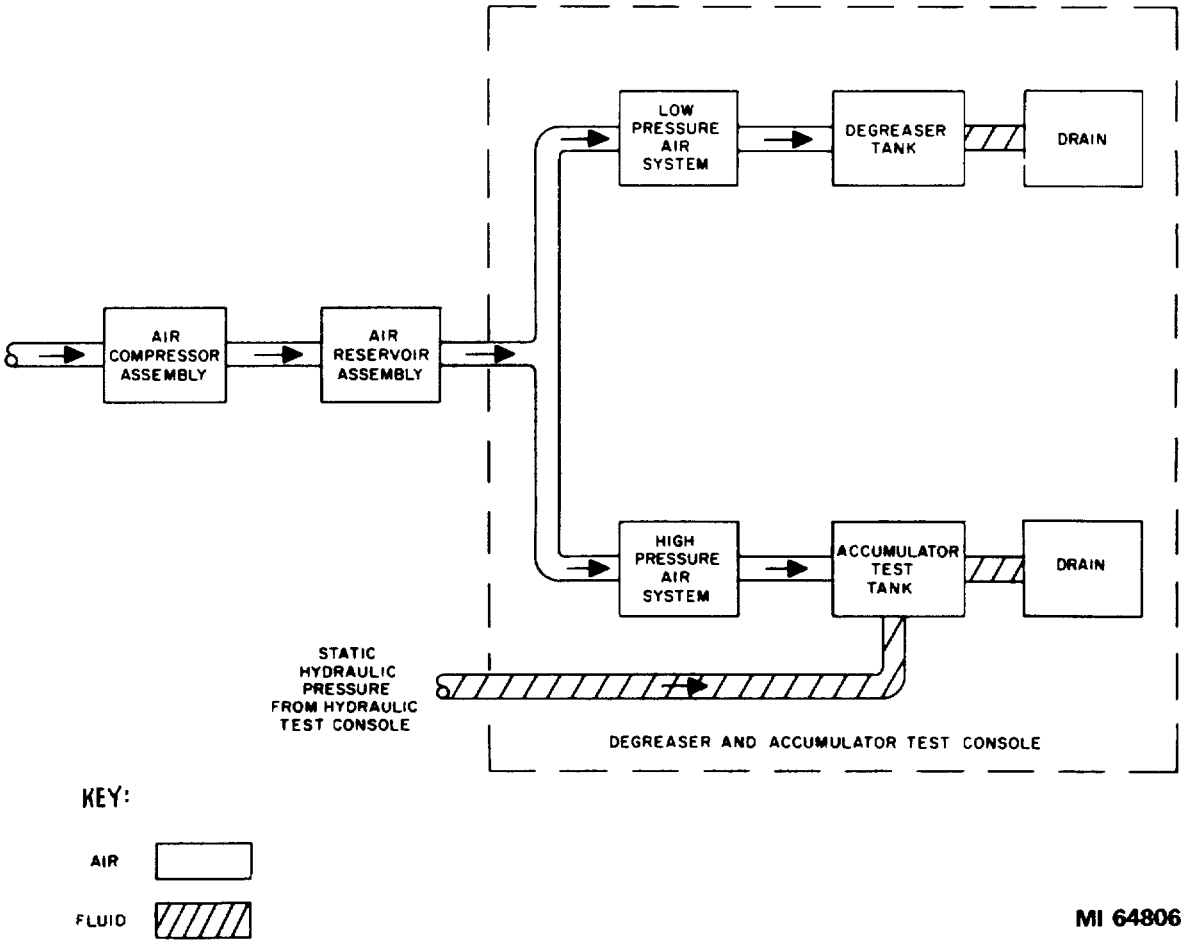


Figure 3-1. Pneumatic system-general block diagram.

(6) To refer again to figure 3-2, the dried compressed air flows to the back pressure valve. This valve aids in accomplishing a more efficient moisture separation by preventing downstream air flow until the pressure from the moisture separator reaches 1700 psig. The check valve prevents reverse flow from the air reservoir. The relief valve protects the air compressor components from excess air pressures. Filtering and final drying of the air are accomplished by the chemical dryer before the air reaches the air reservoir assembly.

3-3. Air Reservoir Assembly

a. Purpose. High pressure air from the air compressor assembly is stored in the air reservoir assembly to supply, on demand, the degreaser and accumulator test console.

b. Operation. Dry compressed air is supplied to the air reservoir assembly from the air compressor (fig. 3-5). When the air pressure in the air reservoir sphere reaches 2000 to 2200 psig, the pressure switch automatically deenergizes the air compressor motor. When the air pressure in the reservoir decreases to 1600 to 1800 psig, the pressure switch energizes the compressor motor. The pressure switch maintains the reservoir pressure between 1600 to 2200 psig. The relief valve relieves the pressure in the reservoir between 2400 and 2500 psig. Manual "blowdown" of the reservoir is accomplished by opening the needle valve.

3-4. Degreaser and Accumulator Test Console

a. Purpose. The degreaser and accumulator test console regulates, controls, and directs air pressure for charging and proof-testing improved HAWK system accumulators and for cleaning and degreasing components before and after testing.

b. Operation. The degreaser and accumulator test console houses both a high- and a low-pressure air system. Figure 3-6 shows that pressurized air from the air reservoir assembly enters the console through air hoses which have quick-disconnect

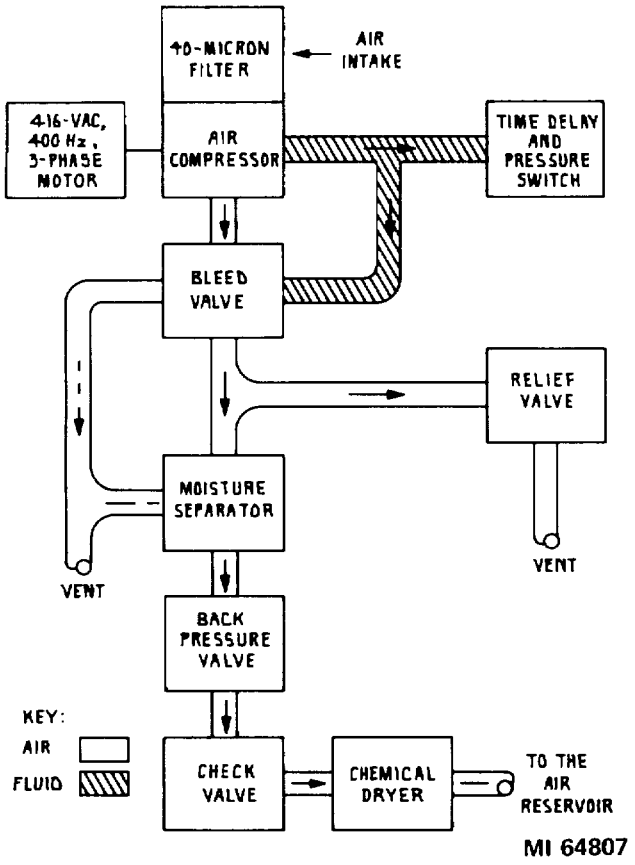


Figure 3-2. Air compressor assembly-detailed block diagram.

couplings. The pressure of the inlet air from the reservoir is indicated on the COMPRESSOR PRESSURE gage on the control panel. When the HIGH PRESSURE AIR valve is opened, pressurized air is applied to the high pressure system and the air flow is directed through the HIGH PRESSURE AIR REGULATOR where it is regulated to the desired system pressure. This regulated pressure is indicated on the HIGH PRESSURE AIR gage. From the regulator, the high pressure air is directed either to the HIGH PRESSURE AIR port by opening the HIGH PRESSURE AIR OUTLET valve, or to the accumulator test tank by opening the HIGH PRESSURE AIR TO TEST TANK valve. To charge or test an accumulator in the accumulator test tank, flexible hoses are connected between the HAND PUMP PRESSURE console and the hydraulic fluid inlet line on the rear wall of the shelter. This inlet line, in turn, is connected to the degreaser and accumulator test console. The HYDRAULIC PRESSURE gage, on the upper section of' the degreaser and accumulator test console. indicates the inlet fluid pressure. The degreaser tank drain plug and the drain plug valve, located at the base of the console, are for draining the tank of any fluid leakage which may occur during tests. When the LOW PRESSURE AIR valve is opened, pressurized air from the air reservoir assembly is applied to the low pressure system. This pressure is indicated on the LOW PRESSURE AIR AND AIR GUN gage and is available to us at the LOW PRESSURE AIR port by opening the LOW PRESSURE AIR OUTLET valve, or at the AIR GUN port by opening the AIR GUN OUTLET valve. When the DEGREASER valve is open, air flows through the check valve to the degreaser tank. There it agitates the degreaser solvent. The check valve prevents the solvent from entering the air line. The check valve in the vent line prevents the back pressure from the air reservoir and air compressor "blowdowns" from entering the degreaser tank. The degreaser tank is drained through the drain plug and the manual plug valve which are located at the base of the console.

3-5. Air Regulator Valves

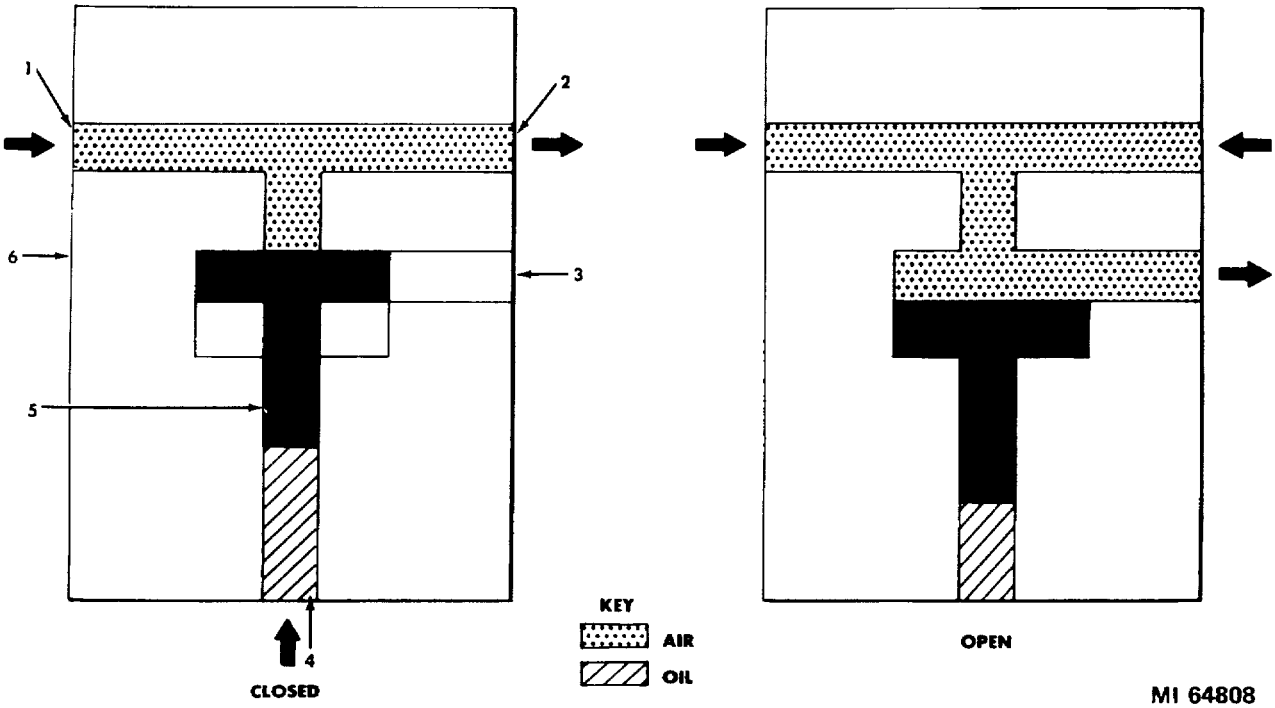
NOTE

The key numbers shown below in parentheses refer to figure 3-7.

a. Purpose. The air regulator valves, on the control panel of the degreaser and accumulator test console, provide constant air pressures for the high- and low-pressure air systems of the console. They also provide the means for manually venting the high- and low-pressure air systems at the completion of normal operations or in an emergency.

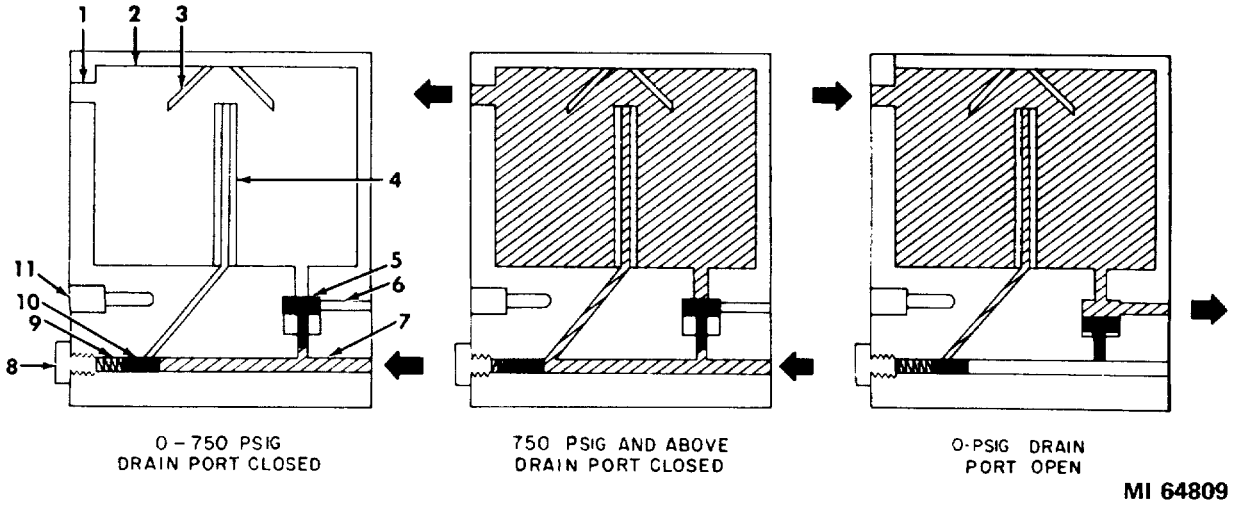
b. Operation. Input air from the LOW PRESSURE AIR valve and HIGH PRESSURE AIR valve enters the pressure inlet port of the air regulator valve of the low- or high-pressure air system. From there, depending on the position of the spring-centered cam (1), the air is either ported out the regulated pressure outlet port (12) or vented out one or both vent ports (8 and 17).

(1) When the air regulator valve is set, the constant dome pressure (4) becomes a reference pressure which is the same as the regulated outlet pressure. The dome area is the space between the top of the piston (13) and the block (16). In this position, the spring-centered cam is in a neutral position and all valves within the air regulator valve are seated or closed. When the regulated outlet pressure decreases, the constant dome pressure forces the piston down. As the piston moves down, it forces the balanced main poppet (9) off its seat and allows pressure through the pressure inlet port (7) to flow directly to the regulated pressure



1—Air inlet port
2—Air outlet port
3—Bleed air port
4—Oil port
5—Poppet
6—Valve body

Figure 3-3. Bleed valve operation.



1—Outlet port
2—Separator chamber
3—Baffle
4—Guide and tube assembly
5—Poppet
6—Drain port
7—Inlet port
8—Retaining screw
9—Spring
10—Piston
11—Heater

Figure 3-4. Moisture separator operation.

outlet port (12). As the regulated pressure increases, the constant dome pressure forces the piston to rise. When the regulated pressure again equals the constant dome pressure, the balanced main poppet will be reseated on the main seat (11) and the inlet pressure is blocked. The air regulator valve, by repeating this action, maintains a constant regulated outlet pressure regardless of the inlet pressure.

(2) When the air regulator valve is being "loaded" to the desired regulated outlet pressure,

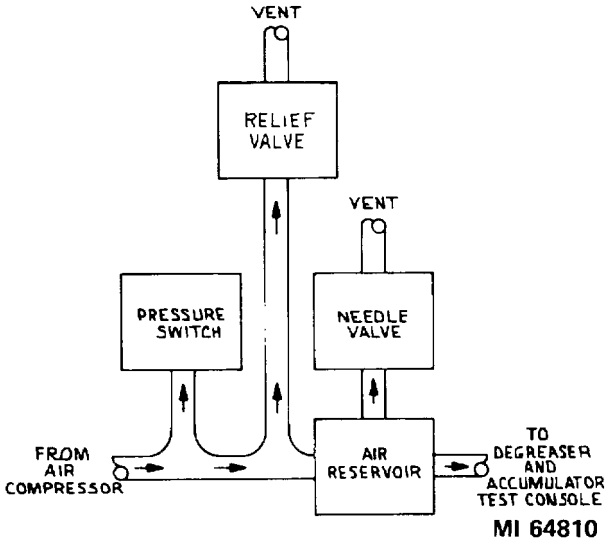


Figure 3-5. Air reservoir assembly--detailed block diagram.

all valves immediately downstream from the air regulator must be closed. The spring-centered cam is turned clockwise to open both metering valves. Inlet pressure now flows through the filter (6) to the metering valves (3) and starts building in the piston dome. The increasing pressure in the dome closes the relief seat (5) and unseats the balanced main poppet. The "out" pressure increases continuously until the gage pressure through the gage port (10) reaches the pressure at which the valve will be set. Then the spring-centered cam is returned to the neutral position. At this point, the constant dome pressure is the same as the desired regulated outlet pressure and the valve is set for operation. The safety relief valve (14) is externally adjustable to vent at a predetermined maximum outlet pressure to eliminate the possibility of setting the pressure too high.

(3) When the air regulator valve is in the venting configuration, the spring-centered cam is turned counterclockwise, and the metering valve to the piston dome area is opened. Dome pressure decreases gradually as the air is bled out through the metering valve and the bleed orifice (2). As the dome pressure decreases, the regulated outlet pressure causes the piston to rise off the relief seat, and the outlet pressure is vented through the balanced main poppet and the screened vent port (8). Venting can be performed manually regardless of the inlet pressure.

(4) For emergency venting the spring-centered cam is turned to its full counterclockwise limit of 62 degrees, which opens the emergency vent valve (15) and the metering valve to the piston dome area. The dome pressure decreases rapidly through the metering and emergency vent valves to the emergency vent port (17). As the dome pressure decreases, the piston rises fully, leaving the relief seat fully open. The regulated outlet pressure then vents rapidly through the balanced main poppet and the screened vent.

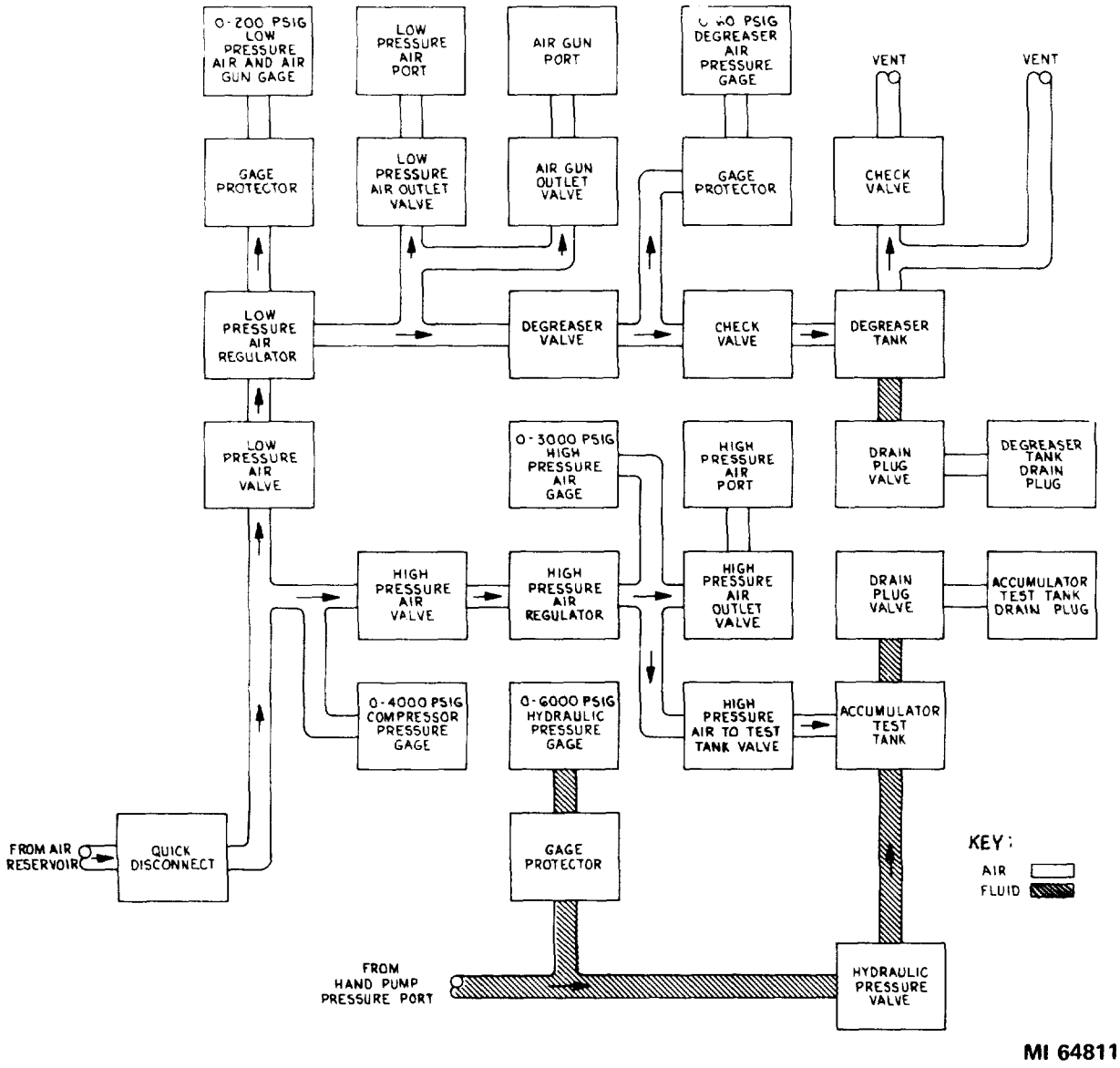
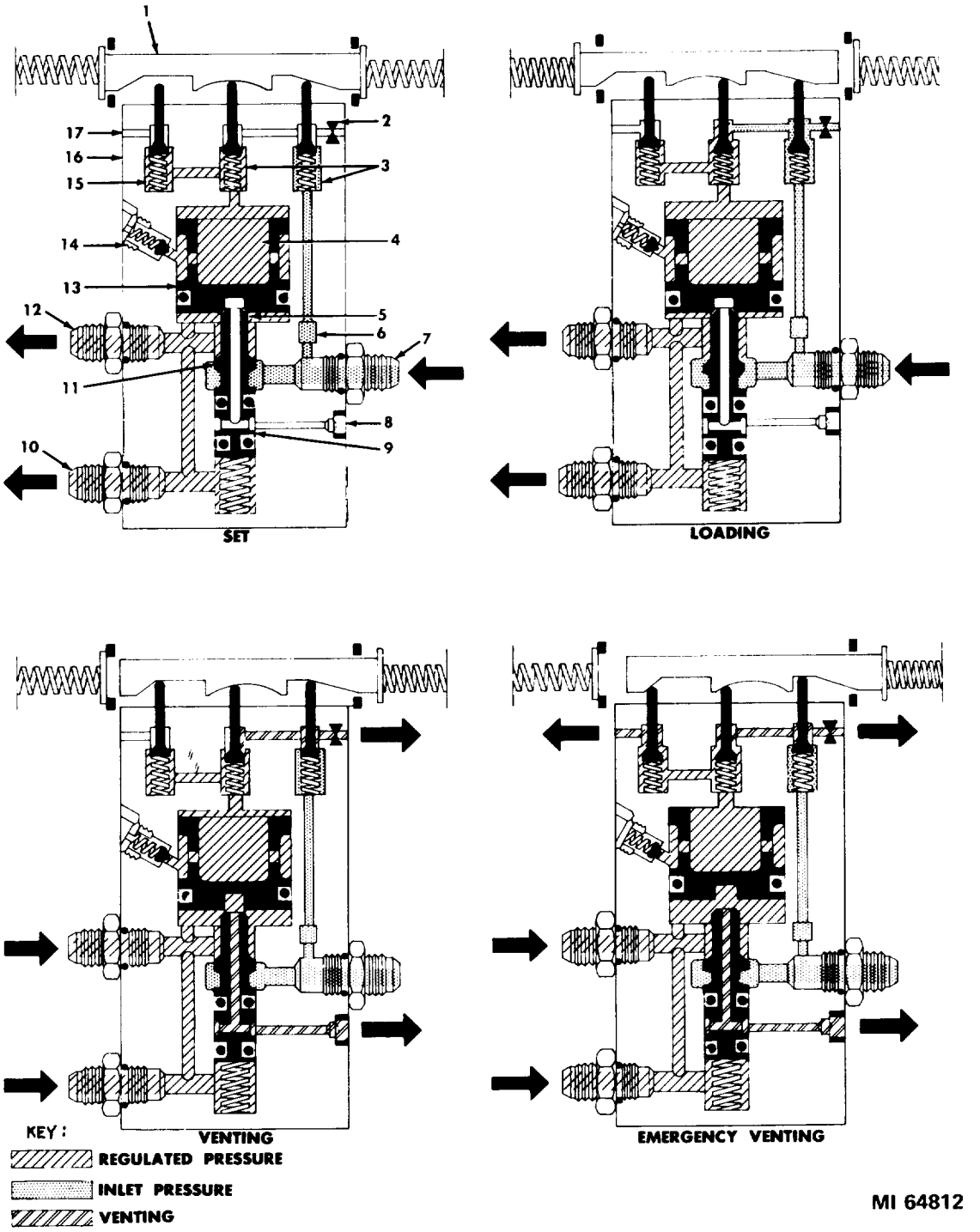


Figure 3-6. Degreaser and accumulator test console-detailed block diagram.



1—Spring-centered cam
2—Bleed orifice
3—Metering valves
4—Constant dome pressure
5—Relief seat
6—Filter
7—Pressure inlet port
8—Screened vent port
9—Balanced main poppet
10—Gage port
11—Main seat
12—Regulated pressure outlet port
13—Piston
14—Safety relief valve
15—Emergency vent valve
16—Block
17—Emergency vent port

Figure 3-7. Air regulator valve operation.

CHAPTER 4
POWER DISTRIBUTION SYSTEM

4-1. General

Figure 4-1 is a functional schematic showing power distribution of the hydraulic test console, degreaser and accumulator test console, and transportable shop 5.

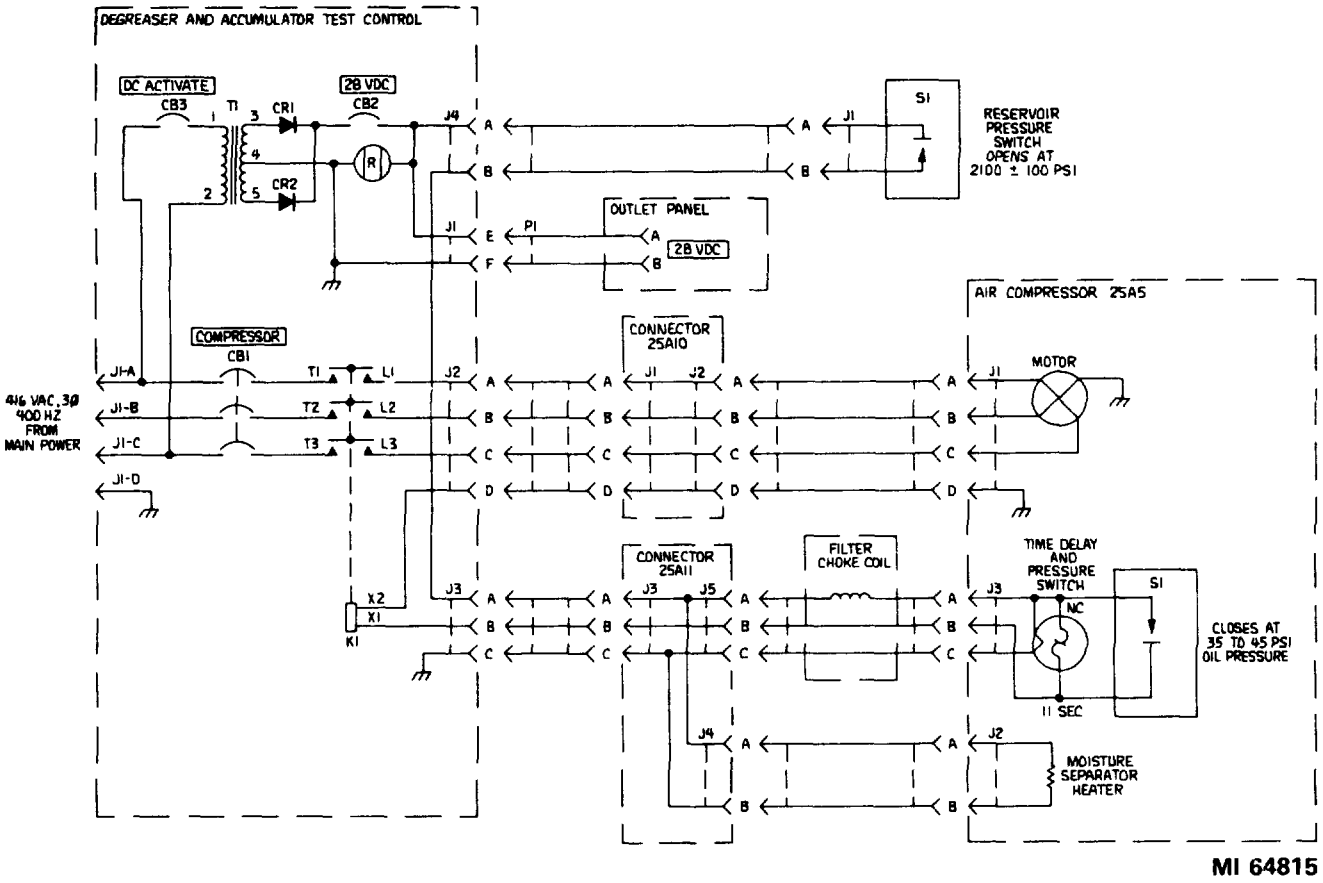


Figure 4-1. Power distribution system-functional schematic (sheet 1 of 3).

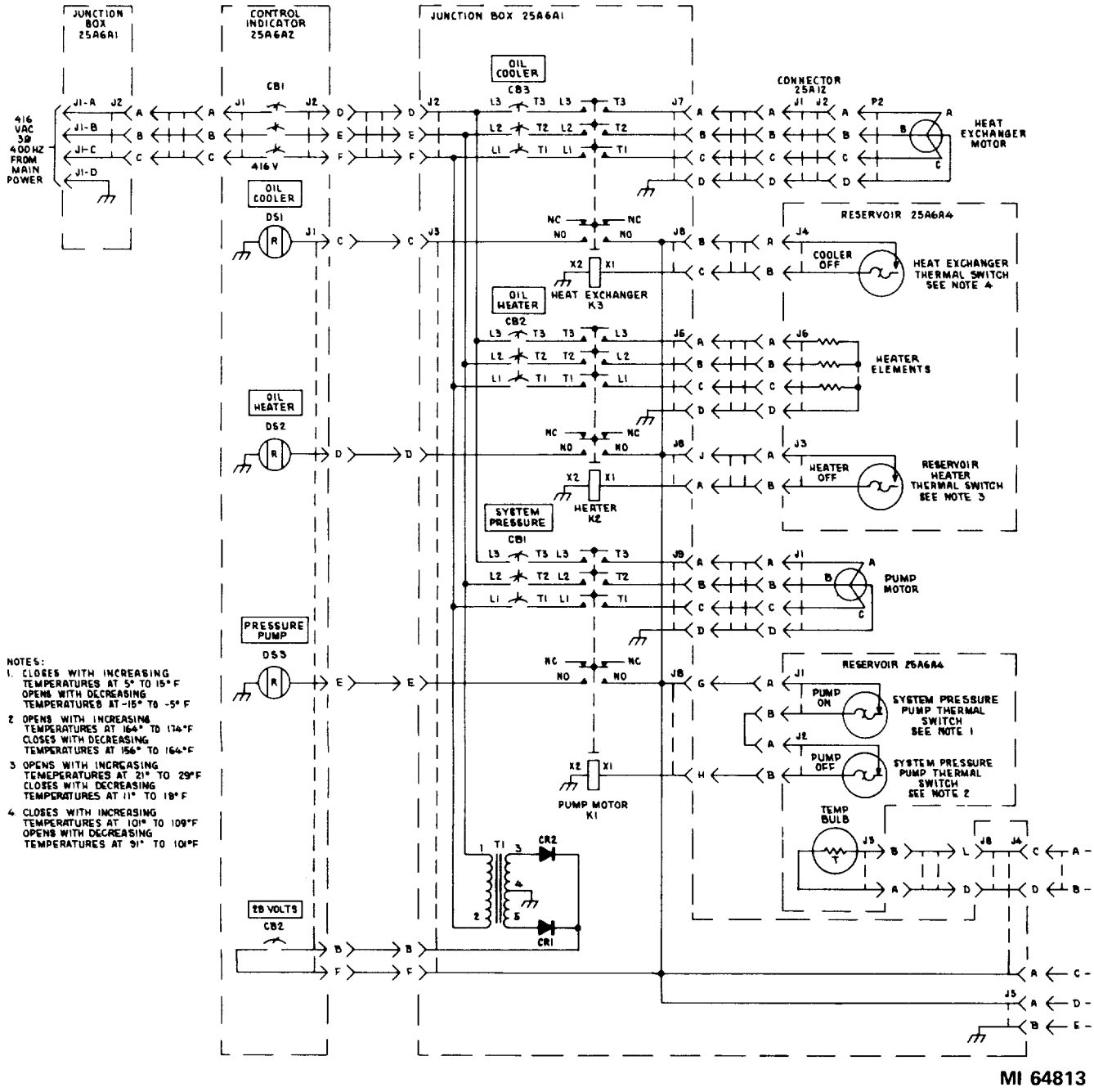


Figure 4-1. Power distribution system-functional schematic (sheet 2 of 3).

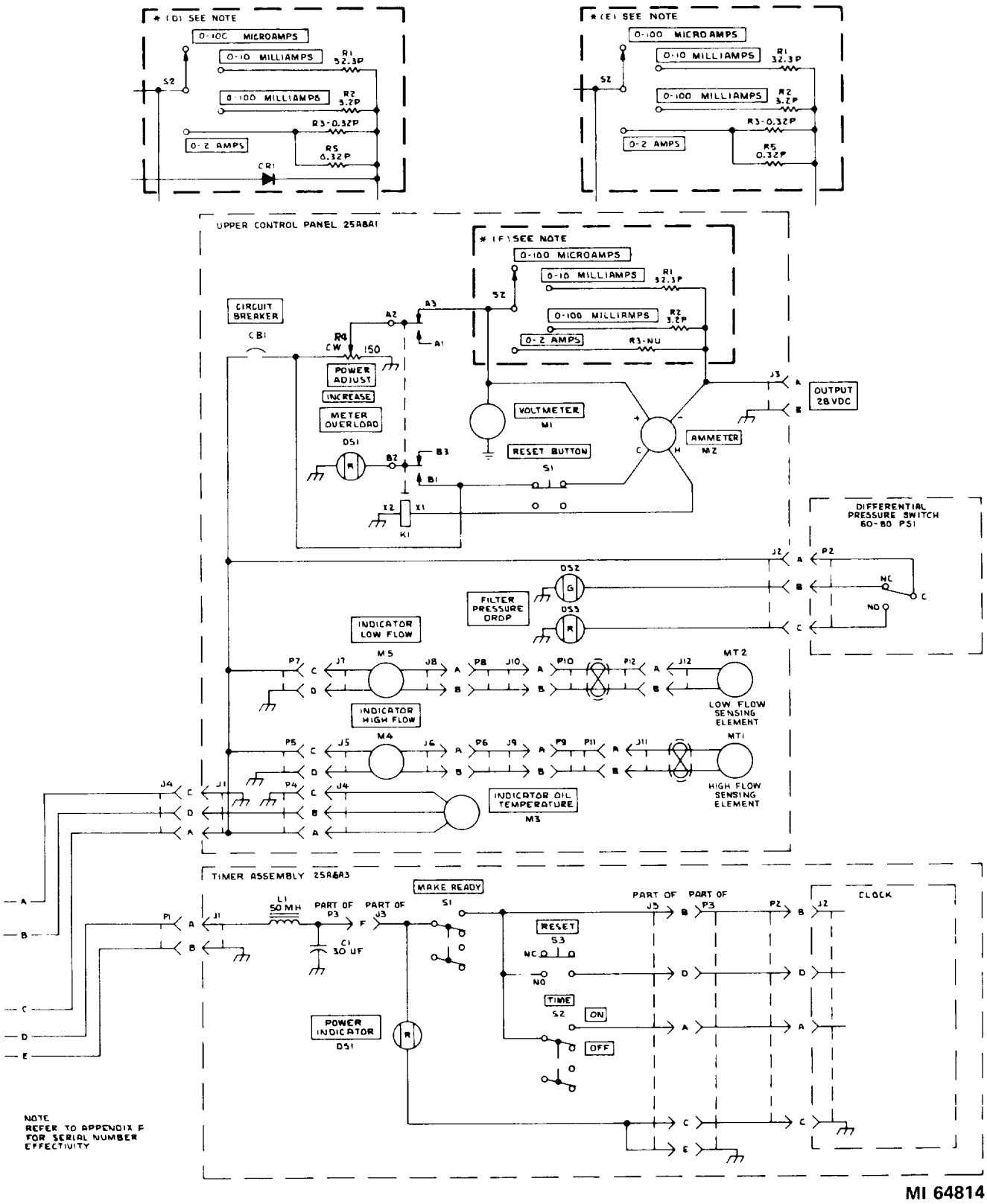


Figure 4-1. Power distribution system-functional schematic (sheet 3 of 3).

CHAPTER 5
OPERATING INSTRUCTIONS

Section I. SERVICE UPON RECEIPT

5-1. General

a. When a new or reconditioned transportable hydraulic shop 5 is first received by the using organization, it is the responsibility of the officer in charge to determine whether the equipment has been properly prepared for service by the supplying organization, and to insure that it is in condition to perform its assigned mission when placed in service. For this purpose, inspect all major units, assemblies, subassemblies, and equipment to make sure that they are properly assembled, secure, clean, correctly adjusted, and lubricated. Check all spare parts, tools, and equipment to determine that they are in good condition, clean, properly mounted, and stowed.

b. Make a record of any missing parts and of any malfunctions. Correct any deficiencies as quickly as possible. Pay special attention to the small parts, as they are more likely to become lost and may seriously affect the use of the materiel.

5-2. Duties of the Direct or General Support Maintenance Mechanic

The direct or general support maintenance mechanic performs the inspection to determine whether the materiel has been properly prepared for service and is in condition to perform its assigned mission.

Section II. CONTROLS AND INDICATORS

5-3. General

This section describes, locates, and illustrates the controls and indicators of transportable hydraulic shop 5.

5-4. Controls and Indicators

The controls and indicators are listed in tabular form in tables 5-1 through 5-10, and are shown in figures 5-1 through 5-10. Placarded items are indicated by upper-case letters.

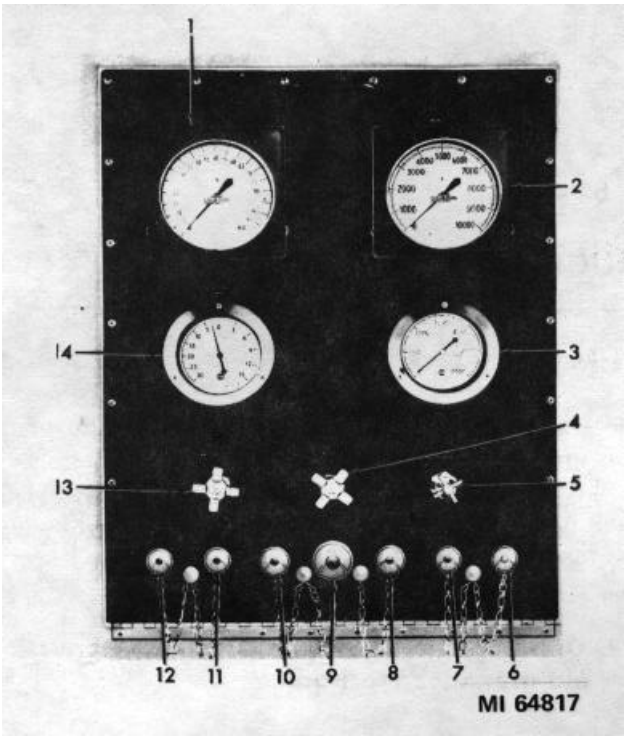


Figure 5-1. Hydraulic test console upper left control panel-controls and indicators.

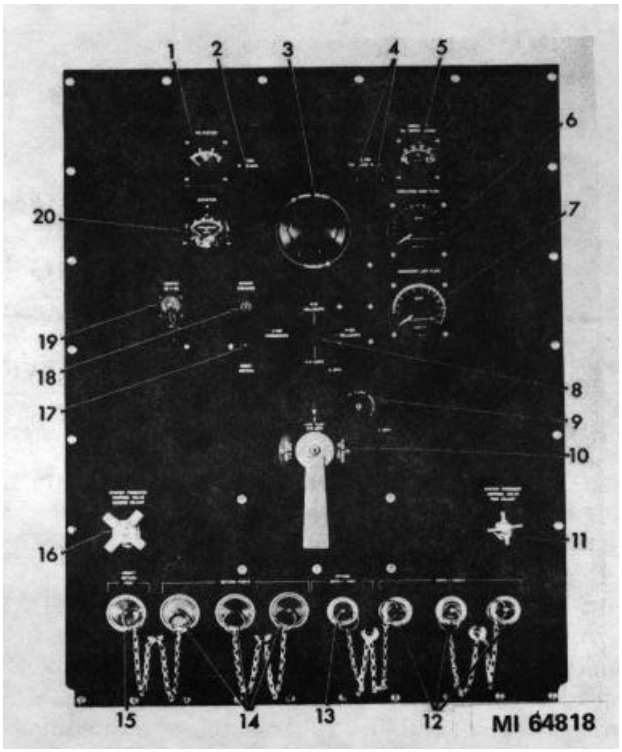


Figure 5-2. Hydraulic test console upper center control panel-controls and indicators.

Table 5-1. Hydraulic Test Console Upper Left Control Panel--Controls and Indicators (Fig. 5-1)

Key	Control or Indicator	Function or Use
1	0-100 PSI GAGE	Indicates the low pressure developed by the hydraulic hand pump.
2	0- 10000 PSI GAGE	Indicates the high pressure developed by the hydraulic hand pump.
3	0-3000 PSI DIFFERENTIAL GAGE	Indicates the pressure drop across components connected to the differential gage ports.
4	LOW PRESSURE GAGE SHUTOFF VALVE	When opened, directs fluid flow to the low pressure gage.
5	SYSTEM PRESSURE REGULATOR VALVE	Provides remote control of the pilot-operated relief valve.
6	HIGH DIFFERENTIAL GAGE PORT quick-disconnect coupling	Connects the component under test to the high side of the differential gage.
7	LOW DIFFERENTIAL GAGE PORT quick-disconnect coupling	Connects the component under test to the low side of the differential gage.
8	ACCUMULATOR PORT quick-disconnect coupling	Connects the component under test to the accumulator.
9	SUCTION PORT quick-disconnect coupling	Connects the main hydraulic reservoir to the suction line of the hydraulic pump under test.
10	DISCHARGE PORT quick-disconnect coupling	Connects the discharge line of the hydraulic pump under test to the hydraulic console monitoring devices.
11	COMPOUND GAGE PORT quick-disconnect coupling	Connects the component under test to the 30" HG VACUIJM-15 PSI GAGE.
12	HAND PUMP PRESSURE PORT quick-disconnect coupling	Connects the handpump pressure line to the component under test.
13	HAND PUMP PRESSURE UNLOADING VALVE	When opened, It relieves the pressure in the handpump flow system.
14	30" HG VACUUM-15 PSI GAGE	Indicates the pressure or vacuum present at the COMPOUND GAGE PORT.

Table 5-2. Hydraulic Test Console Upper Center Control Panel Controls and Indicators (Fig. 5-2)

Key	Control or Indicator	Function or Use
1	VOLTMETER	Monitors the voltage at the OUTPUT 28 VDC connector.
2	METER OVERLOAD lamp	Illuminates when the AMMETER is overloaded.
3	POWER ADJUST control	Adjusts the voltage to the component under test.
4	FILTER PRESSURE DROP lamps	Red lamp illuminates when fluid flow is restricted due to the 5-micron filter being contaminated; green lamp illuminates when fluid flow through the filter is normal.
5	INDICATOR OIL TEMPERATURE thermometer	Indicates the temperature of the fluid in the hydraulic reservoir from 30° to 2300F.
6	INDICATOR HIGH FLOW meter	Indicates the rate of fluid flow from 1 to 9 gpm.
7	INDICATOR LOW FLOW meter	Indicates the rate of fluid flow from 0.2 to 1.3 gpm.
8	Range selector switch	Selects the AMMETER range.
9	FLOW INCREASE control	Mechanically varies the displacement of the system pressure pump from 0 to 8 gpm.
10	Sensing element selector valve	Provides manual selection of either the INDICATOR HIGH FLOW or INDICATOR LOW FLOW meter or directs fluid flow to only the DISCHARGE PORT.
11	SYSTEM PRESSURE CONTROL VALVE FINE ADJUST	Provides a fine adjustment of both the system pressure and the fluid flow in the transient flow system.
12	SUPPLY PORTS quick-disconnect couplings	Supplies monitored hydraulic fluid to the components under transient flow test.
13	BYPASS SUPPLY PORT quick-disconnect coupling	Provides direct fluid flow by bypassing the hydraulic console monitoring devices.
14	RETURN PORTS quick-disconnect coupling	Returns fluid from the components under test to the reservoir through the heat exchanger.
15	DIRECT RETURN PORT quick-disconnect coupling	Returns fluid directly to the main hydraulic reservoir, bypassing the heat exchanger.
16	SYSTEM PRESSURE CONTROL VALVE COARSE ADJUST	Provides a coarse adjustment of both the system pressure and the fluid flow in the transient flow system.
17	RESET BUTTON pushbutton switch	Reset switch for the AMMETER when overload occurs.
18	CIRCUIT BREAKER switch	Provides dc voltage to the OUTPUT 28 VDC connector.
19	OUTPUT 28 VDC (4J3) jack	Provides dc voltage to the component under test.
20	AMMETER	Monitors the current to the component under test.

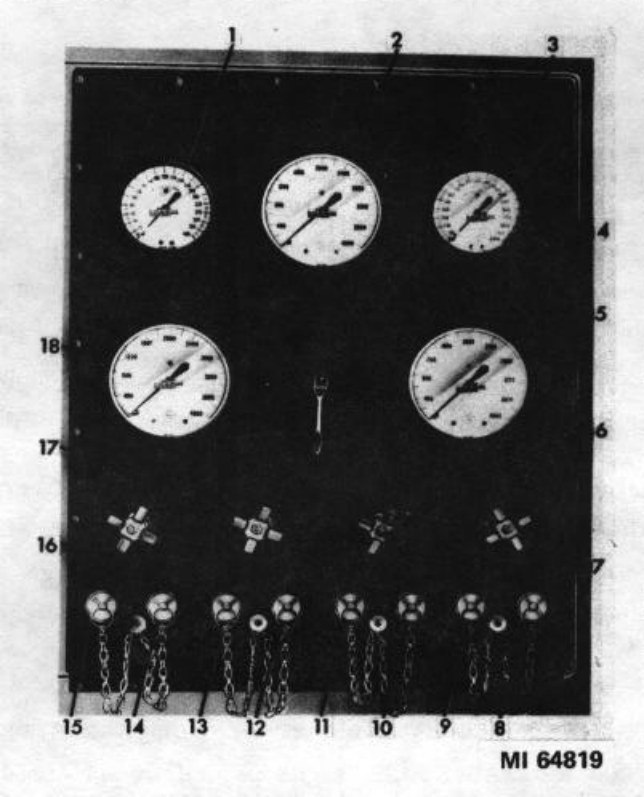


Figure 5-3. Hydraulic test console upper right control panel-controls and indicators.

Table 5-3. Hydraulic Test Console Upper Right Control Panel-Controls and Indicators (Fig. 5-3)

Key	Control or Indicator	Function or Use
1	0-400 PSI GAGE	Indicates the low pressures in the transient flow system.
2	0-4000 PSI GAGE	Indicates the high pressures in the transient flow system.
3	0-2000 PSI GAGE	Indicates the medium pressures in the transient flow system.
4	SYSTEM PRESSURE GAGE SELECTOR valve	Provides manual selection of the desired transient flow system pressure gage range.
5	GAGE D 0-4000 PSI	Indicates the hydraulic pressure to components under test at TEST PORT D-2.
6	THROTTLING VALVE C	Controls the pressure and fluid flow through TEST PORTS C-1 and C-2.
7	THROTTLING VALVE D	Controls the pressure and fluid flow through TEST PORTS D-1 and D-2.
8	TEST PORT D-2 quick-disconnect coupling	Provides a return connection for components under test.
9	TEST PORT D-1 quick-disconnect coupling	Provides a return connection for components under test to the hydraulic reservoir.
10	TEST PORT C-2 quick-disconnect coupling	Provides a return connection from components under test.
11	TEST PORT C-1 quick-disconnect coupling	Provides a return connection from components under test to the hydraulic reservoir.
12	TEST PORT B-2 quick-disconnect coupling	Provided as a supply or return connection for the component under test.
13	TEST PORT B-1 quick-disconnect coupling	Provided as a supply or return connection for the component under test.
14	TEST PORT A-2 quick-disconnect coupling	Provided as a supply or return connection for the component under test.

Table 5-3. Hydraulic Test Console Upper Right Control Panel-Controls and Indicators (Fig. 5-3) Continued

Key	Control or Indicator	Function or Use
15	TEST PORT A-1 quick-disconnect coupling	Provided as a supply or return connection for the component under test.
16	THROTTLING VALVE A	Controls the pressure and fluid flow through TEST PORTS A-1 and A-2.
17	THROTTLING VALVE B	Controls the pressure and fluid flow through TEST PORTS B-1 and B-2.
18	GAGE C 0-4000 PSI	Indicates the hydraulic pressure to components under test at TEST PORT C-2.

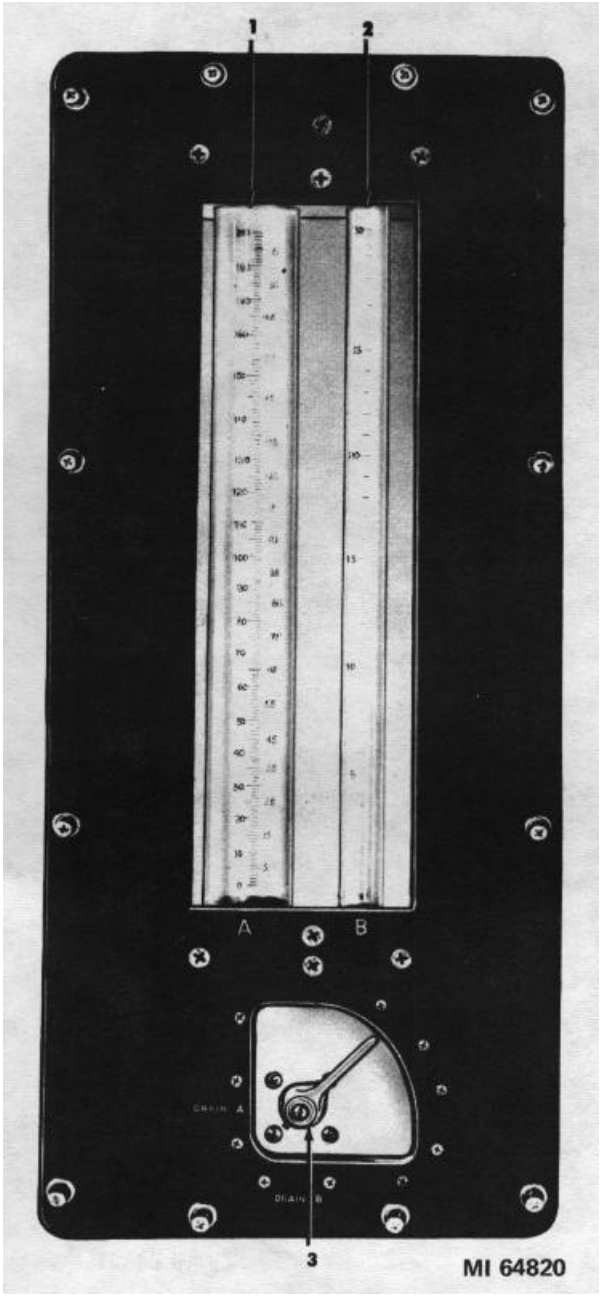


Figure 5-4. Hydraulic test console leakage graduate panel-controls and indicators.

Table 5-4. Hydraulic Test Console Leakage Graduate Panel-Controls and Indicators (Fig. 5-4)

Key	Control or Indicator	Function or Use
1	Graduate A (200 cc)	Measures high leakage flow from components under test.
2	Graduate B (30 cc)	Measures low leakage flow from components under test.
3	DRAIN A - DRAIN B valve	Manually operated valve for draining the leakage graduates.

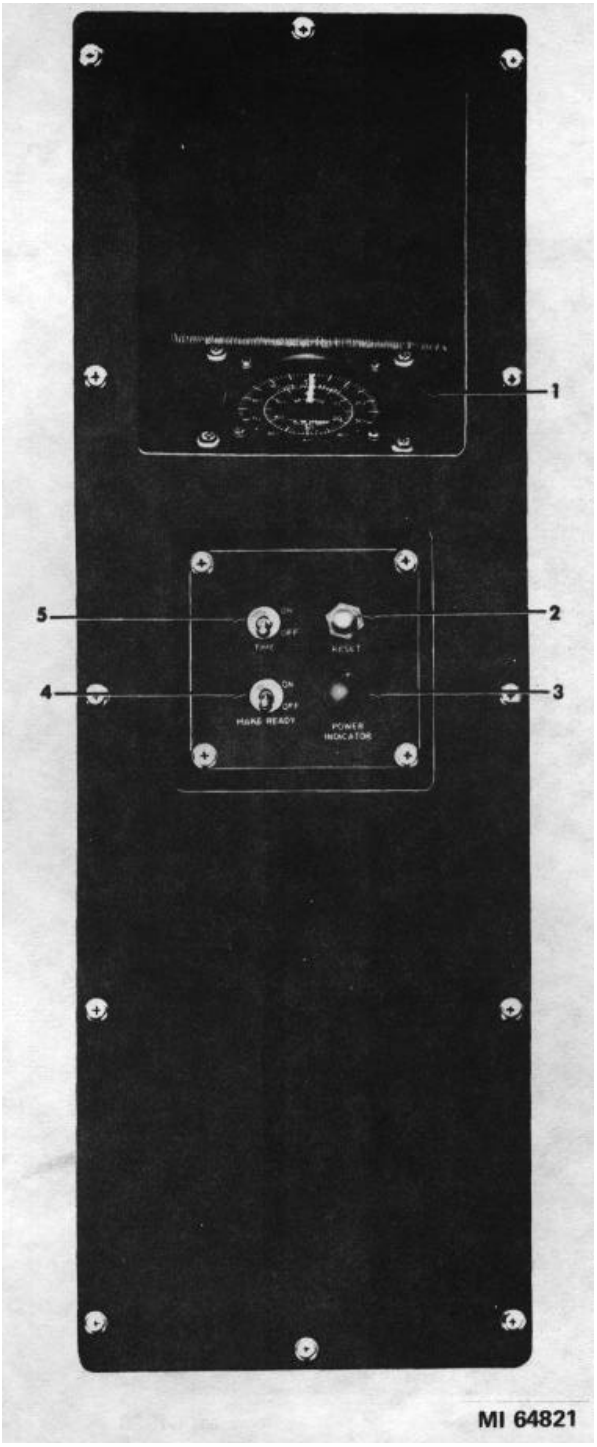


Figure 5-5. Hydraulic test console timer stop assembly panel-controls and indicators.

Table 5-5. Hydraulic Test Console Timer Stop Assembly Panel-Controls and Indicators (Fig. 5-5)

Key	Control or Indicator	Function or Use
1	Timer	Timing device for components under test.
2	RESET pushbutton switch	Resets the timer to the zero position.
3	POWER INDICATOR lamp	Illuminates when power is available to the timer.
4	MAKE READY switch	Starts the timer motor.
5	TIME switch	Energizes the motor clutch to set the timer hands in motion.

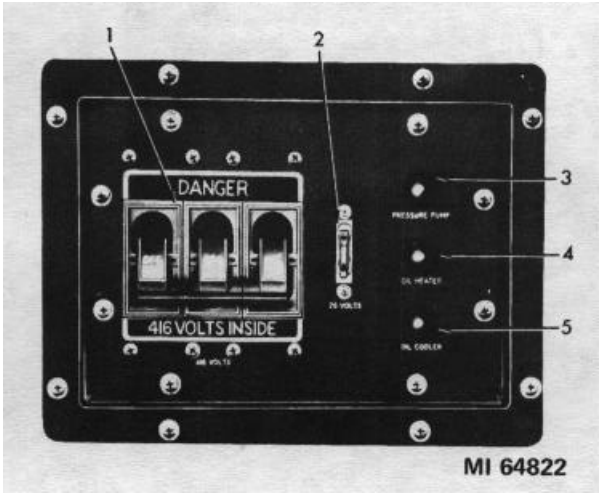


Figure 5-6. Hydraulic test console control indicator panel-controls and indicators.

Table 5-6. Hydraulic Test Console Control Indicator Panel-Controls and Indicators (Fig. 5-6)

Key	Control or Indicator	Function or Use
1	416 VOLTS circuit breaker	Supplies 416-vac, 400-Hz, 3-phase power to the hydraulic console junction box.
2	28 VOLTS circuit breaker	Supplies 28-vdc to junction box relays K1, K2. and K3.
3	PRESSURE PUMP lamp	Illuminates when pressure pump motor relay K1 is energized.
4	OIL HEATER lamp	Illuminates when oil heater relay K2 is energized.
5	OIL COOLER lamp	Illuminates when oil cooler relay K3 is energized.

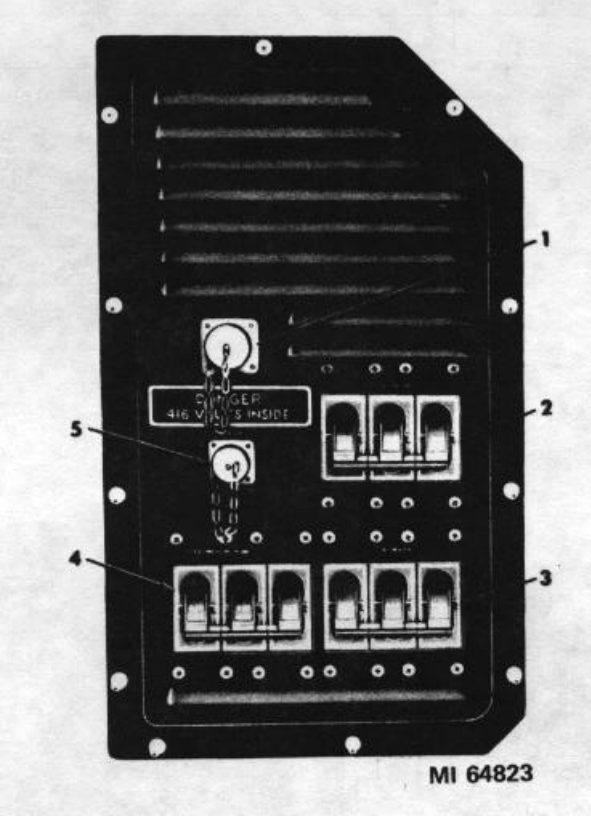


Figure 5-7. Hydraulic test console junction box-controls.

Table 5-7. Hydraulic Test Console Junction Box-Controls (Fig. 5-7)

Key	Control or Indicator	Function or Use
1	416 - 400 INPUT jack	416-vac input to the hydraulic console from the distribution box.
2	OIL COOLER circuit breaker	Supplies 416-vac, 400-Hz, 3-phase power to heat exchanger relay K3.
3	OIL HEATER circuit breaker	Supplies 416-vac, 400-Hz, 3-phase power to reservoir heater relay K2.
4	SYSTEM PRESSURE PUMP circuit breaker	Supplies 416-vac, 400-Hz, 3-phase power to system pressure pump motor relay K 1.
5	416V - 400 ~ OIL COOLER SUPPLY jack	416-vac output from the hydraulic console to the heat exchanger.

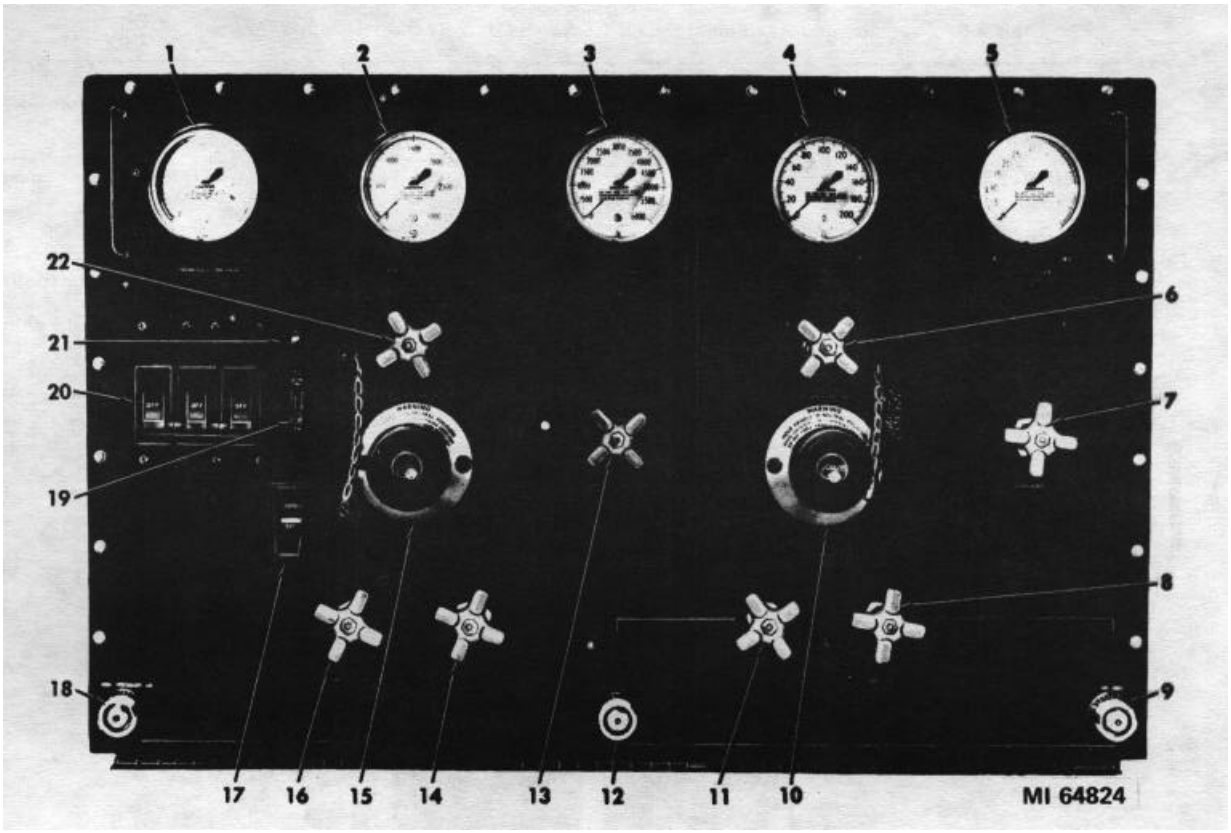


Figure 5-8. Degreaser and accumulator test console-controls and indicators.

Table 5-8. Degreaser and Accumulator Test Console-Controls and Indicators (Fig. 5-8)

Key	Control or Indicator	Function or Use
1	COMPRESSOR PRESSURE gage (4000 psig)	Indicates the pressure in the air reservoir assembly.
2	HIGH PRESSURE AIR gage (3000 psig)	Indicates the regulated air pressure in the high pressure system.
3	HYDRAULIC PRESSURE gage (6000 psig)	Indicates the hydraulic pressure supplied to the degreaser and accumulator test console from the hydraulic console.
4	LOW PRESSURE AIR AND AIR GUN gage (200 psig)	Indicates the regulated air pressure in the low pressure system.
5	DEGREASER AIR PRESSURE gage (60 psig)	Indicates the regulated air pressure supplied to the degreaser tank.
6	LOW PRESSURE AIR valve	Admits air to the low pressure system.
7	DEGREASER valve	Admits air pressure to the degreaser tank.
8	AIR GUN OUTLET valve	Admits air pressure to the AIR GUN port.
9	AIR GUN port quick-disconnect coupling	Provides a regulated air connection for components under test.
10	LOW PRESSURE AIR REGULATOR control	Regulates the air pressure for the low pressure system.
11	LOW PRESSURE AIR OUTLET valve	Admits regulated air pressure to the LOW PRESSURE AIR port.
12	LOW PRESSURE AIR port quick-disconnect coupling	Provides a regulated air connection for components under test.
13	HYDRAULIC PRESSURE TO TEST TANK valve	Admits hydraulic oil to the accumulator test tank.
14	HIGH PRESSURE AIR TO TEST TANK valve	Admits regulated high pressure air to the accumulator test tank.
15	HIGH PRESSURE AIR REGULATOR control	Regulates the air pressure for the high pressure system.
16	HIGH PRESSURE AIR OUTLET valve	Admits regulated air pressure to the HIGH PRESSURE AIR port.

Table 5-8. Degreaser and Accumulator Test Console-Controls and Indicators (Fig. 5-8) Continued

Key	Control or Indicator	Function or Use
17	DC ACTIVATE circuit breaker	Applies power to the 28-vdc power supply.
18	HIGH PRESSURE AIR port quick-disconnect coupling	Supplies regulated high pressure air to the component under test.
19	28 VDC circuit breaker	Provides 28 vdc to the pneumatic system.
20	COMPRESSOR circuit breaker	Provides 416-vac, 400-Hz, 3-phase power to the pneumatic system.
21	Indicator lamp	Illuminates when the 28-vdc power supply is energized and the 28 VDC circuit breaker is on.
22	HIGH PRESSURE AIR valve	Admits air pressure to the high Pressure system.

Figure 5-9. Deleted.

Table 5-9. Deleted

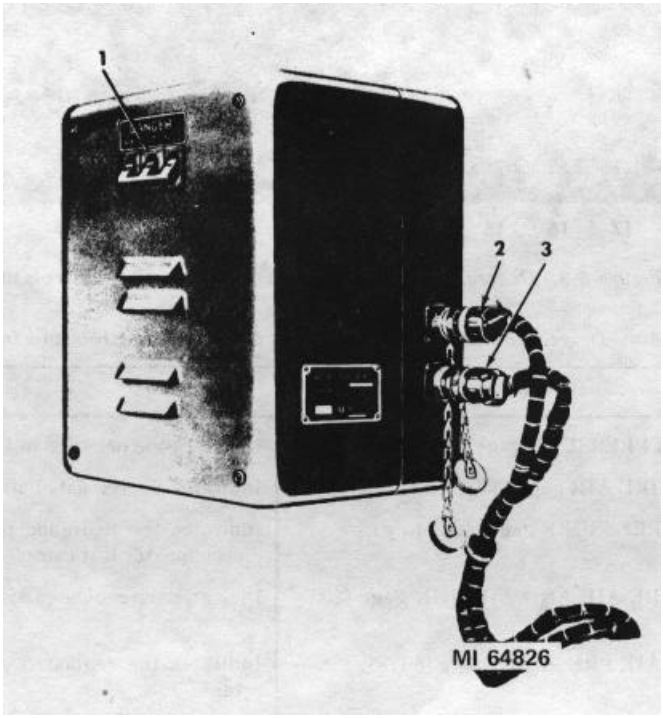


Figure 5-10. Transformer box-controls

Table 5-10. Transformer Box-Controls (Fig. 5-10)

Key	Control or Indicator	Function or Use
1	Circuit breaker	Supplies power to the jacks and outlets over the workbench area.
2	J1 jack	Receives 416-vac, 400-Hiz, 3-phase power from the distribution box.
3	J2 jack	Supplies 416-vac, 400-Hz, 3-phase and 208-vac, 400-Hz, 3-phase power to the utility outlet panel over the workbench.

Section III. OPERATION UNDER USUAL CONDITIONS

5-5. General

This section describes the procedures for the normal operation of transportable hydraulic shop 5. Prior to operation, it is assumed that the shelter has been properly energized and is ready for operation. Refer to TM 9-1425-585-14-2 for detailed energizing procedures for the shelter.

5-6. Preparation Before Energizing the Transportable Hydraulic Shop 5

a. Unlock the shelter utility doors for the heat exchanger and the air compressor units, and secure the doors open.

b. Loosen the eyebolts which secure the heat exchanger and air compressor mountings to the brackets on the inside wall of the shelter. Carefully swing the heat exchanger and the air compressor out through the open doors, and secure them in the swing-out position.

c. Insure that the heat exchanger inlet and outlet hose assemblies are correctly connected to the heat exchanger inlet and outlet connectors (12, fig. 1-3).

d. Check the ground straps on the heat exchanger, air compressor, hydraulic test console, and degreaser and accumulator test console.

e. Check the pneumatic and hydraulic systems thoroughly for loose connections and components.

f. Place the air conditioner in the operating condition (TM 9-1425-585-14-2).

5-7. Position of Controls Prior to Application of Standby Power

Before applying power to the transportable hydraulic shop 5, set the controls to the positions indicated in table 5-11. The controls not listed in this table may be set to any position since they do not directly affect the energizing procedure.

5-8. Preparation Before Energizing the Hydraulic Test Console

Upon receipt of a new, reconditioned, or used transportable hydraulic shop 5, it is necessary to fill the hydraulic test console main reservoir with clean fluid MIL-H-5606 (par. 6-7), and to charge the air side of the accumulator with 450 to 550 psig of clean. pre-conditioned air or nitrogen (par. 6-10). It is then necessary to perform the periodic test procedures (par. 6-20) and the test procedures (pars. 6-16 through 6-19).

CAUTION

Insure that the lower case drain plug in the bottom of the system pressure pump (60, fig. 7-7) is removed.

5-9. Position of Controls Prior to Operating the Hydraulic Test Console

Before operating the hydraulic test console, set the controls to the positions indicated in table 5-12.

5-10. Operating Procedures for the Hydraulic Test Console

Insure that all precheck conditions are met (par. 6-14) and perform the hydraulic test console test procedures (par. 6-16).

5-11. Position of Controls Prior to Operating the Degreaser and Accumulator Test Console

Before operating the degreaser and accumulator test console, set the controls to the positions indicated in table 5-13.

5-12. Operating Procedures for the Degreaser and Accumulator Test Console

Insure that all precheck conditions are met (par. 6-14) and perform the pneumatic system test procedures (par. 6-17).

5-13. Deleted

Table 5-11. Position of Controls Prior to Application of Standby Power

Illustration		Location	Control	Control setting
Figure	Key			
5-7	2	Hydraulic test console junction box	OIL COOLER circuit breaker	OFF
	3		OIL HEATER circuit breaker	OFF
	4		SYSTEM PRESSURE PUMP circuit breaker	OFF
5-5	4	Timer stop assembly panel	MAKE READY switch	OFF
	5	TIME switch	OFF	
5-6	1	Control indicator panel 2	416 VOLTS circuit breaker	OFF
			28 VOLTS circuit breaker	OFF
5-8	17	Degreaser and accurn-ulator test console	DC ACTIVATE circuit breaker	OFF
	19		28 VDC circuit breaker	OFF
	20		COMPRESSOR circuit breaker	OFF
5-10	1	Transformer box	Circuit breaker	OFF

Table 5-12. Position of Controls Prior to Operating the Hydraulic Test Consol

Illustration		Location	Control	Control setting
Figure	Key			
5-7	2	Hydraulic test console junction box	OIL COOLER circuit breaker	OFF
	3	OIL HEATER circuit breaker	OFF	
	4		SYSTEM PRESSURE PUMP circuit breaker	OFF
5-5	4	Timer stop assembly panel	MAKE READY switch	OFF
	5		TIME switch	OFF
5-6	1	Control indicator panel	416 VOLTS circuit breaker	OFF
	2		28 VOLTS circuit breaker	OFF
5-1	4	Upper left control panel	LOW PRESSURE GAGE SHUTOFF valve	Fully counterclock-wise
	13		HAND PUMP PRESSURE UNLOADING VALVE	Fully counterclock-wise
5-2	3	Upper center control panel	POWER ADJUST control	Fully counterclock-wise
	8	Range selector switch	0-2 AMPS position	
	9	FLOW INCREASE control	Fully clockwise	
	10		Sensing element selector valve	HIGH FLOW 2-8 GPM position
	11		SYSTEM PRESSURE CONTROL VALVE FINE ADJUST	Fully counterclock-wise
	16		SYSTEM PRESSURE CONTROL VALVE COARSE ADJUST	Fully counterclock-wise
	18		CIRCUIT BREAKER switch	Off (down)
5-3	4	Upper right control panel	SYSTEM PRESSURE GAGE SELECTOR valve	0-4000 position

Table 5-12. Position of Controls Prior to Operating the Hydraulic Test Console-Continued

Illustration		Location	Control	Control setting
Figure	Key			
	16, 17, 6, and 7		THROTTLING VALVES A, B, C, and D	Fully counterclockwise
7-7	24	Lower section	Accumulator shutoff valve	Fully counterclockwise
	16		Accumulator charging port shutoff valve	Fully clockwise
	37		System suction line shutoff valve	Fully counterclockwise
7-6	4		Drain reservoir air vent shutoff valve	Fully counterclockwise

Table 5-14. Position of Controls Prior to Operating the Degreaser and Accumulator Test Console

Illustration		Location	Control	Control setting
Figure	Key			
5-8	6	Degreaser and accumulator test console	LOW PRESSURE AIR valve	Fully clockwise
	7		DEGREASER valve	Fully clockwise
	8		AIR GUN OUTLET valve	Fully clockwise
	11		LOW PRESSURE AIR OUTLET valve	Fully clockwise
	13		HYDRAULIC PRESSURE TO TEST TANK valve	Fully clockwise
	14		HIGH PRESSURE AIR TO TEST TANK valve	Fully clockwise
	16		HIGH PRESSURE AIR OUTLET valve	Fully clockwise
	22		HIGH PRESSURE AIR valve	Fully clockwise
	17		DC ACTIVATE circuit breaker	OFF
	19		28 VDC circuit breaker	OFF
	20		COMPRESSOR circuit breaker	OFF
1-7	10	Degrease and accumulator test console lower section	Degreaser tank drain valve	CLOSED
	13		Accumulator tank drain valve	CLOSED
1-6	3	Air reservoir assembly	Manual blowdown valve	Fully clockwise

Section IV. PREPARATION FOR TRAVEL

5-14. General

This section describes the preparation for travel procedures for the transportable hydraulic shelter (shop 5) by prime mover (par. 5-16) and by helicopter (par. 5-17). The M36 cargo truck and 5-ton wrecker are considered to be standard transportation equipment for the improved HAWK system shelters. Refer to TM 9-2320-211-10 for operating instructions for the 5-ton wrecker.

5-15. Preparation of Shelter Procedures

a. Perform the following procedures to prepare the transportable hydraulic shelter for travel.

(1) Deenergize the shelter by setting the controls to the position specified in table 5-14.

NOTE

Do not deenergize the LIGHTS or MAIN POWER switches at this time.

(2) Check all stud fasteners on the hydraulic test console and the degreaser and accumulator test console to see that they are engaged.

(3) Place all electrical switches in the OFF position (except the power distribution box switches).

(4) Swing the heat exchanger and air compressor assemblies inside the shelter, and secure the doors.

(5) Secure the two adjustable stools in place.

(6) Secure the degreaser and accumulator covers.

(7) Place the dead-weight tester in place under the work bench, and secure it with straps.

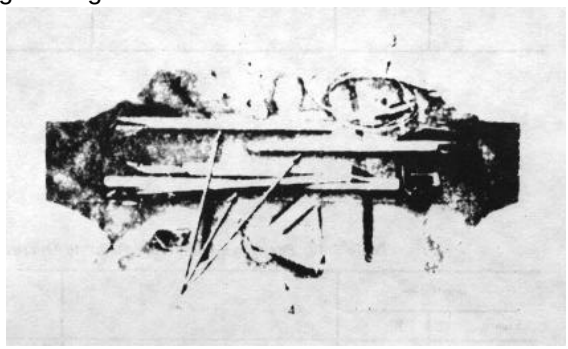
(8) Check that the fire extinguisher and the battle lantern are in their brackets and are properly secured.

(9) Disconnect the ground cable from the ground rod and the shelter connection point.

NOTE

If the stake puller kit (fig. 5-11) is required to remove the ground rod, omit step (10) and perform step (11) below.

(10) Pull up the ground rod and stow it in the designated ground rod stow brackets in the shelter.



1-Ground rod grip
2-Straight-jawed grip
3-Retrieving cable
4-Pulley
5-Tripod (disassembled)

Figure 5-11. Stake puller kit.

Table 5-14. Position of Controls-Operate to Shutdown

Illustration		Location	Control	Control setting
Figure	Key			
5-7	2	Hydraulic test console junction box	OIL COOLER circuit breaker	OFF
	3		OIL HEATER circuit breaker	OFF
	4		SYSTEM PRESSURE PUMP circuit breaker	OFF
5-6	1	Hydraulic test console indicator panel	416 VOLTS circuit breaker	OFF
	2		28 VOLTS circuit breaker	OFF
5-8	20	Degreaser and accumulator test console	COMPRESSOR circuit breaker	OFF
	19		28 VDC circuit breaker	OFF
	17		DC ACTIVATE circuit breaker	OFF
Refer to TM 9-1425-585-14-2.		Air conditioner	Selector switches	

(11) Remove the ground rod as described in (a) through (q) below.

NOTE

The key numbers shown in parentheses refer to figure 5-12 unless otherwise indicated.

(a) Position the tripod (1) so that the pulley (6) is directly over the ground rod.

(b) Drive the prime mover toward the tripod and hook the retrieving cable (2) to a tow point on the front of the vehicle.

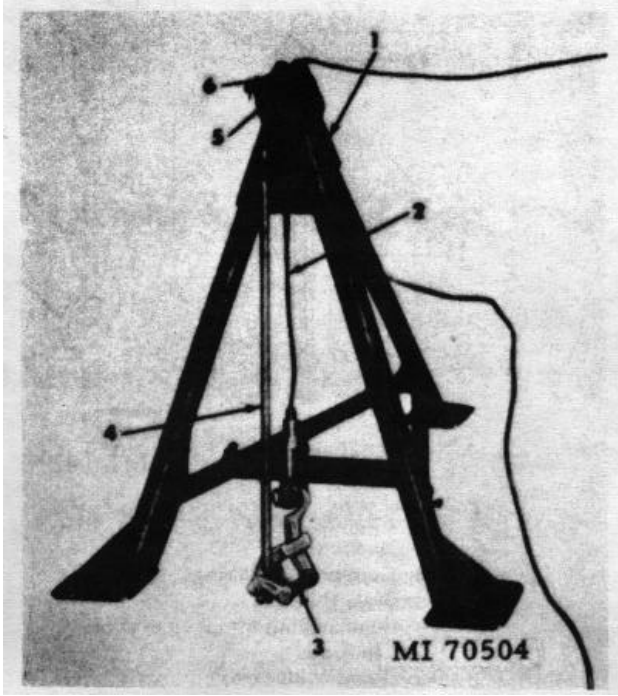
(c) Place the ground rod grip (3) on the ground rod (4) and secure the latch.

(d) Attach the cable yoke to the eye of the grip.

(e) Insure that the other tripod pad is directly under the retrieving cable.

(f) Back off the prime mover, stopping when the cable yoke has run to the cable restraining pin (5).

(g) If the ground rod has not pulled free, and cannot be removed by hand, unlatch the grip and drive the truck forward. Reattach the grip to the cable yoke and back off the prime mover once more. After the ground rod has been removed, stow it in the designated ground rod stow brackets.



1-Tripod
2-Retrieving cable
3-Ground rod grip
4-Ground rod
5--Cable restraining pin
6-Pulley

Figure 5-12. Removal of ground rod.

(12) Check that all tools and equipment are in place and properly secured.

(13) Place caps on all electrical outlets on the outside of the shelter.

(14) Close the degreasing tank vent.

(15) Place all switches in the power distribution box in the OFF position.

(16) Relieve the pressure in the hydraulic console accumulator.

(17) Relieve the pressure in the air reservoir.

(18) Drain the degreasing tank.

5-16. Preparation for Travel Procedures-Prime Mover

a. The lifting sling set and the tiedown kit are provided for each major item in the improved HAWK system to be used when transporting the shelter on the M36 cargo truck. These consist of cables for the shelter, the common-point ring for attaching the boom, and the web strapping to secure the shelter on the M36 cargo truck. The preparation for travel procedures, using the prime mover, are listed below.

(1) Remove the lifting sling set and the tiedown kit from the shop, and secure the shelter door.

NOTE

The key numbers shown in parentheses below refer to figure 5-13 unless otherwise indicated.

(2) Shorten each cable of the lifting sling set by removing one turnbuckle body (11) and shackle with attached eye bolt (5), then attach the eyebolt (12) to the remaining turnbuckle body (7).

(3) Connect each cable of the lifting sling set to the common-point ring (3), using the eyehooks (2).

(4) Carry the assembled lifting sling set to the roof of the shelter. Connect one cable from the lifting sling set to each of the shelters lifting and tiedown points with eyehooks (9).

(5) Fasten guide ropes (at least 15 feet long) to the shelter lifting and tiedown points.

WARNING

The weight of a fully loaded shelter significantly, exceeds the rated capacity of the wrecker when the wrecker boom is extended to the required maximum radius of 18 feet. The following precautions must be taken when lifting the

shelter from or onto the M36 cargo truck with the 5-ton wrecker:

(1) Site of lifting should be level.

(2) The hookup crew should stand a minimum of 20 feet clear of area after hookup is completed.

(3) Personnel should never stand between the M36 cargo truck and the 5-ton wrecker during lifting operations.

(4) Personnel using guide ropes should stand a minimum of 15 feet clear of the M36 cargo truck while guiding the shelter from or onto the truck bed.

(5) Use caution while guiding the M36 cargo truck into position for loading or unloading to prevent bumping or catching of shelter.

(6) Insure that the truck brakes are set prior to loading or unloading of shelters.

CAUTION

Use only the 5-ton wrecker and the wire rope lifting sling set (modified as in a(2) above) to lift a fully loaded shelter onto or off the M36 cargo truck.

NOTE

The key numbers shown in parentheses refer to figure 5-14 unless otherwise indicated.

(6) Drive the 5-ton wrecker (3) to a position, parallel to and 6 feet from the shelter, which will allow the cable hook (1) to hang over the center of the shelter when the boom (2) swings 90 degrees from its travel position toward the shelter.

(7) Stabilize the 5-ton wrecker with the outriggers (4).

(8) Extend the 5-ton wrecker boom to 18 feet and position it to cause the cable hook to hang over the center of the shelter.

(9) Lower the cable hook, attach it to the common-point ring (9), and lift the shelter as high as possible.

(10) Lower the M36 cargo truck tailgate (5) and back the truck (7) underneath the shelter (6) until the shelter is positioned squarely over the truck bed.

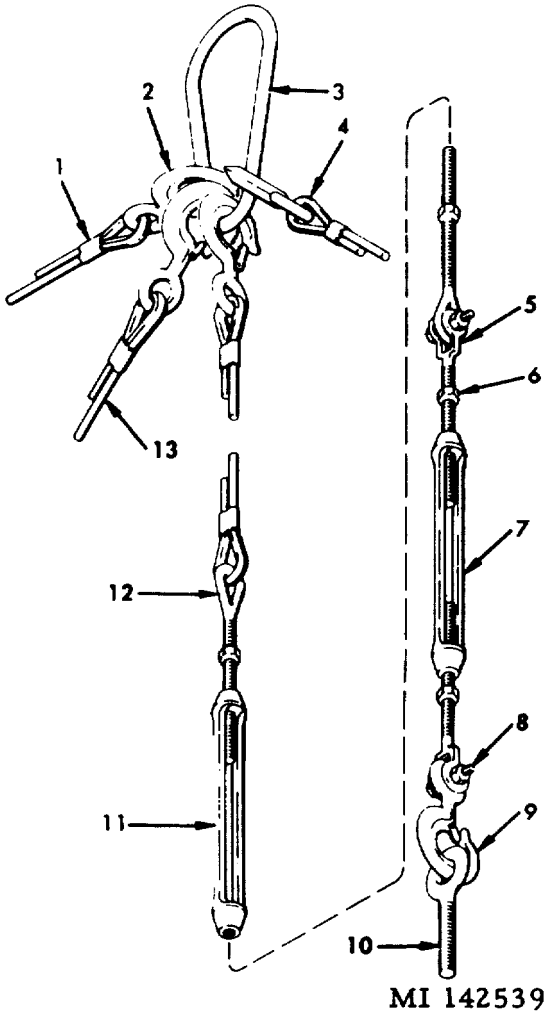
(11) Lower the shelter to the truck bed using the guide ropes as necessary.

(12) Remove the common-point ring from the cable hook, and the assembled sling set and guide ropes from the shelter.

(13) Replace the turnbuckle bodies and shackles with attached eyebolts on the lifting sling set. Stow the lifting sling set and common-point ring inside the shelter, and secure the shelter door.

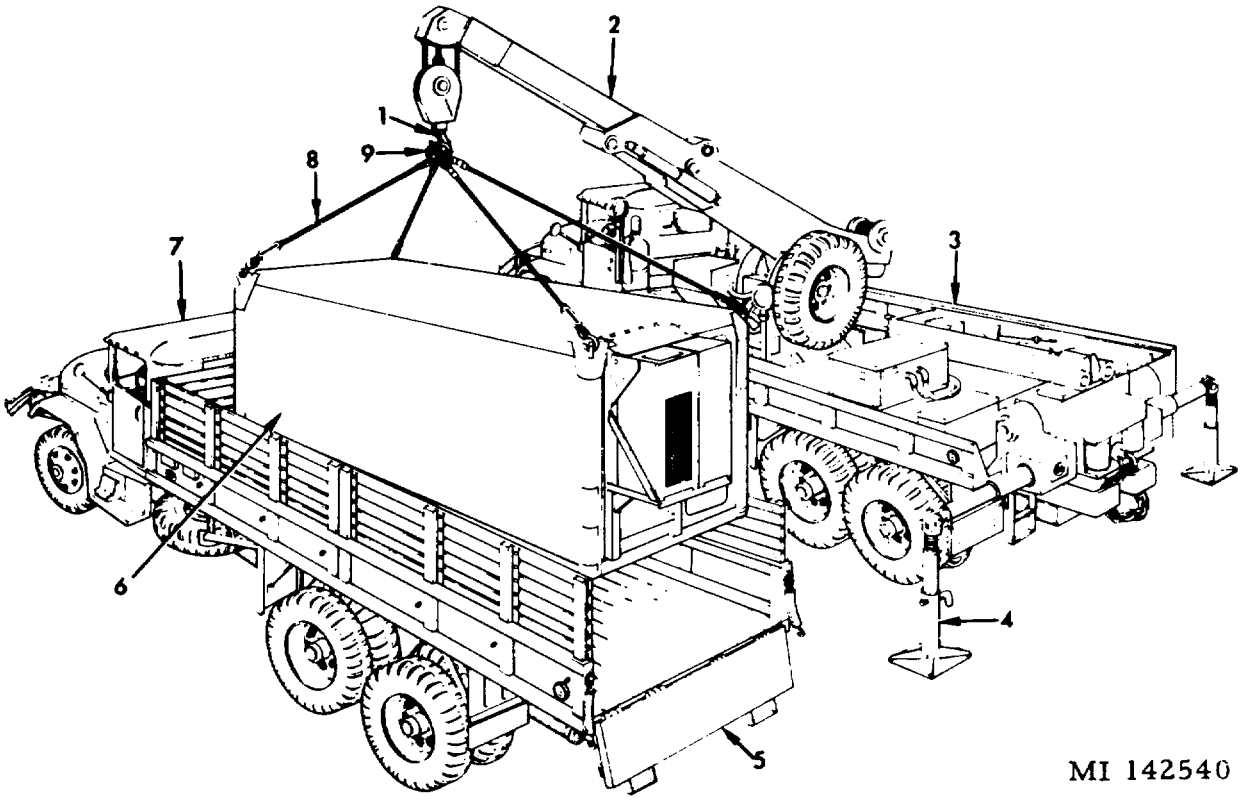
(14) Tie down the rear end of the shelter with six web strap assemblies (fig. 5-15), using three on each lifting and tiedown point.

(15) Tie down the front end of the shelter with eight web strap assemblies (fig. 5-15), using three



1-Swaging sleeve
2-Eyehook
3-Common-point ring
4-Steel thimble
5-Shackle with attached eyebolt
6-Checknut
7-Turnbuckle body
8-Bolt and nut
9-Eyehook
10-Eyebolt
11-Turnbuckle body
12-Eyebolt
13-Steel cable

Figure 5-13. Lifting sling set.



1-Cable hook
2-Boom
3-5-ton wrecker
4-Outrigger
5-Tailgate
6-Shelter
7-M36 cargo truck
8-Lifting sling set
9--Common-point ring

Figure 5-14. Emplacement of shelter by 5-ton wrecker.

on each lifting and tiedown point, and one on each tow point (fig. 5-15).

(16) Raise the 5-ton wrecker cable hook and retract the boom.

(17) Rotate the wrecker boom to the travel position, remove and stow the outriggers, and drive the 5-ton wrecker from the area.

b. Make the following checks before driving the loaded M36 cargo truck from the area.

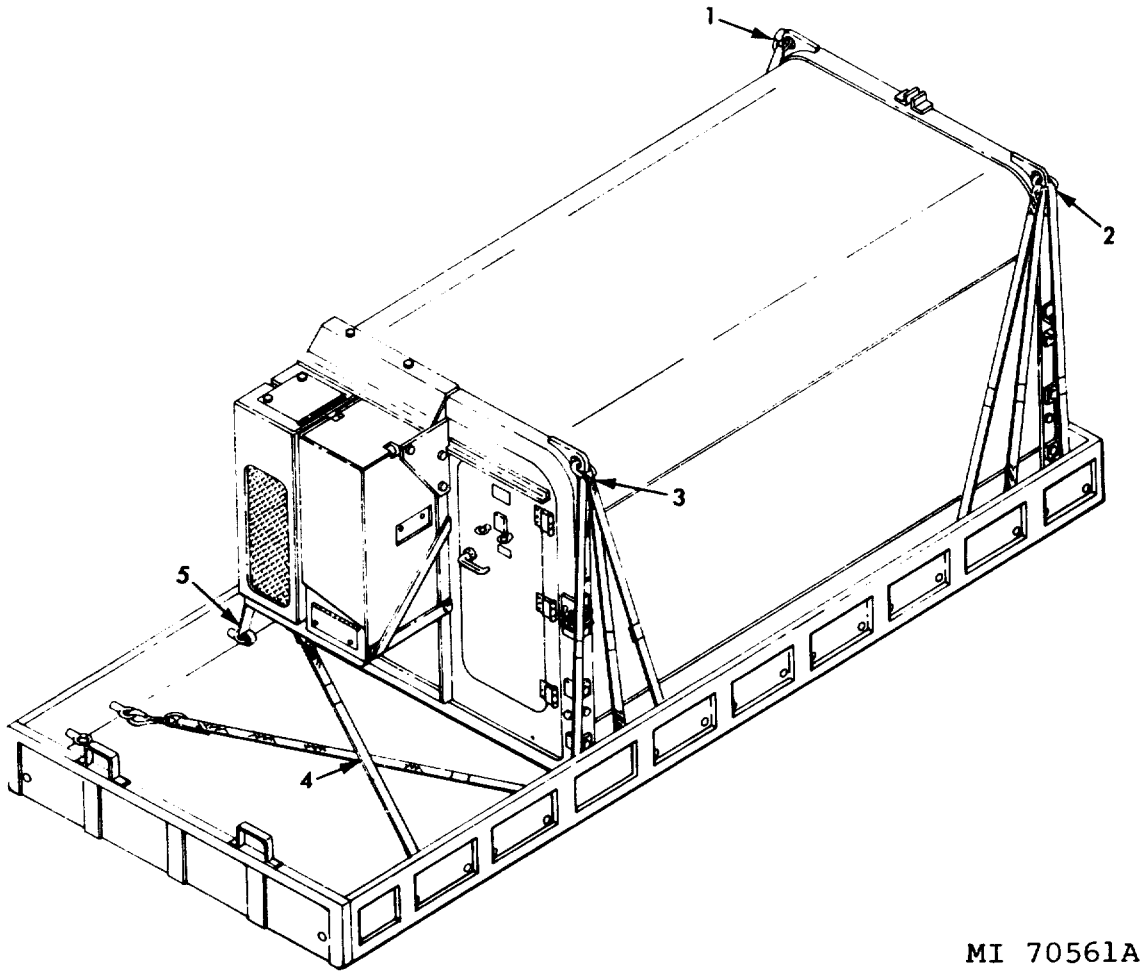
(1) All cables and receptacles are capped.

(2) All vents are closed and secured.

(3) The shelter door is closed and secured, and all tiedowns are properly secured.

5-17. Preparation for Travel Procedures-Helicopter

a. The helicopter lifting kit (fig. 5-16) is provided for each major item in the improved HAWK system. The kit contains the items necessary to form the suspension sling assembly for each major item. The suspension sling assembly required to lift the transportable hydraulic shelter (shop 5) by helicopter consists of twelve 8-foot web loops (7, fig. 5-16), and one 10-inch web ring (9, fig. 5-16). Three 8-foot web loops are daisy-chained (fig. 5-17) together to form one suspension sling for each of the two front lift points. The rear suspension slings consist of three 8-foot web loops with the first 8-foot web loop formed into a triple loop which provides an 11-foot suspension sling for each of the two rear lift points. Because of the excess weight in the rear of the shops, the rear suspension slings are one foot shorter in length to permit the shop to travel in the horizontal or level position. The preparation for travel procedures, using the helicopter, are listed below.



1-Left front tiedown web straps
2-Right front tiedown web straps
3-Right rear tiedown web straps
4-Tow point tiedown web straps
5-Left rear tiedown web straps

Figure 5-15. Shelter tied down on the prime mover.

b. Prepare the shop suspension sling assembly, as described below.

WARNING

Before using, inspect the web loops for defects (burns, cut edges, or broken threads) to prevent injury to personnel or damage to equipment by breaking of the loops.

(1) Place an 8-foot web loop through the left-front clevis (2, fig. 5-18).

(2) Daisy-chain two 8-foot web loops to the free ends of the 8-foot web loop on the left-rear clevis, forming a 12-foot left-front suspension sling (3, fig. 5-18).

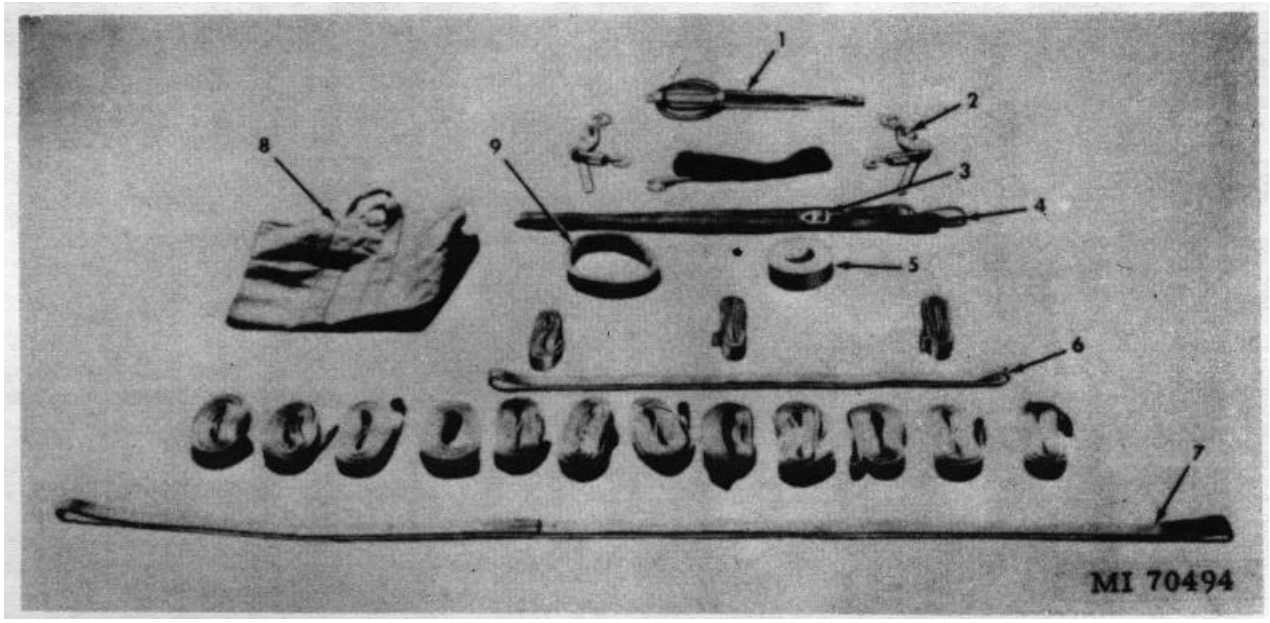
(3) Attach the free ends of the 12-foot suspension sling to the 10-inch web ring (16, fig. 5-18).

(4) Repeat steps (1) through (3) above for the right-front clevis (7, fig. 5-18).

(5) Form a triple loop (fig. 5-19), using an 8-foot web loop.

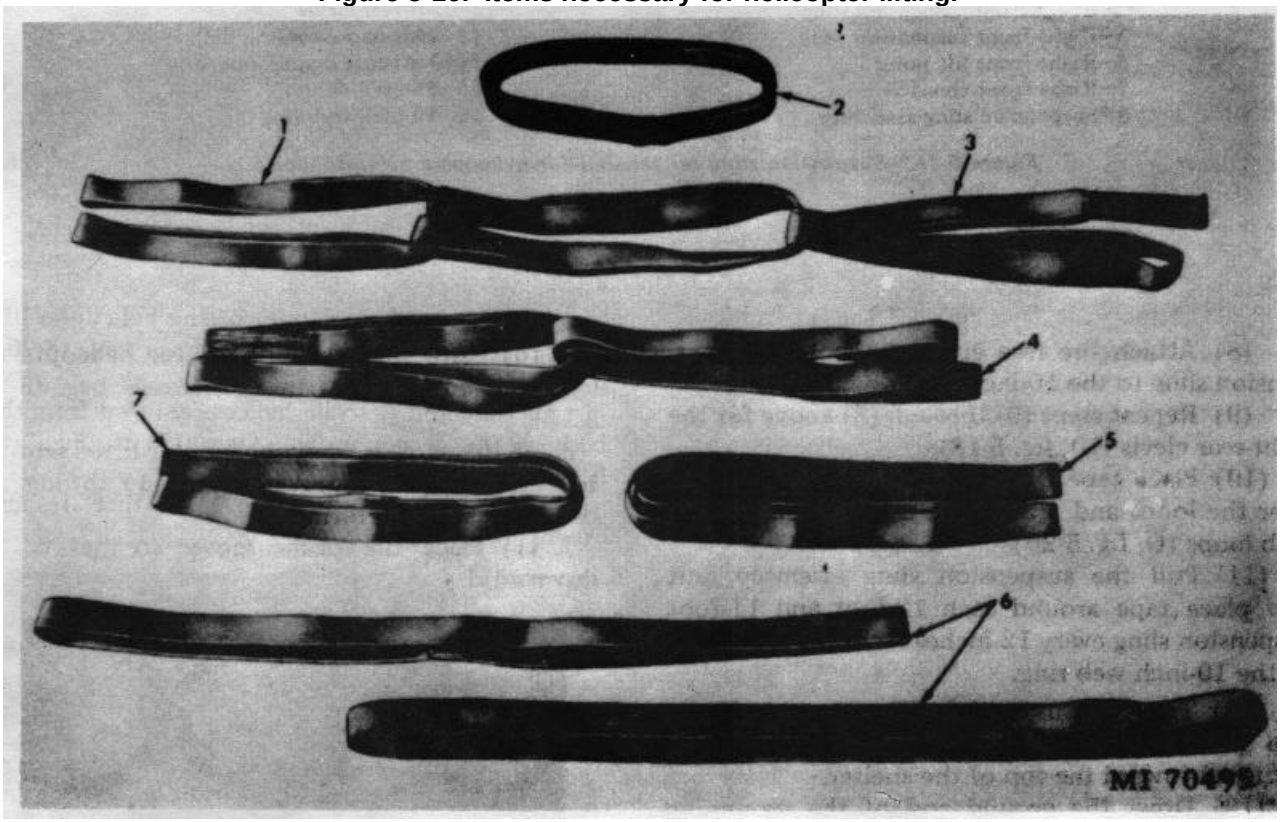
(6) Remove the clevis from the left-rear lift point (12, fig. 5-18). Place the triple loop through the clevis and reattach the clevis to the left-rear lift point.

(7) Daisy-chain two 8-foot web loops to the triple loop on the left-rear clevis forming an 11-foot suspension sling (14, fig. 5-18).



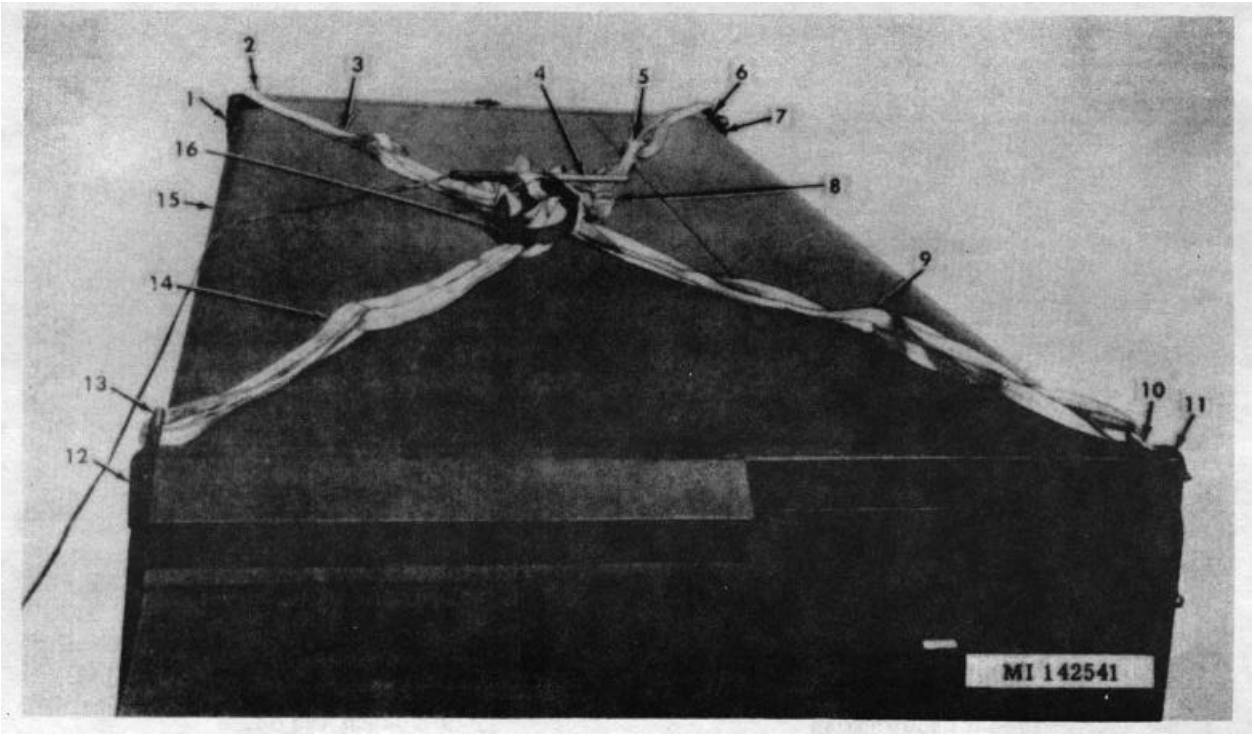
1-Grounding device assembly
2-Load binder
3-Quick-fit tiedown fastener
4-15-foot tiedown strap
5-Tape
6-4-foot web loop
7-8-foot web loop
8-Storage bag
9-10-inch web ring

Figure 5-16. Items necessary for helicopter lifting.



1-8-Foot web loop
2-10-Inch web ring
3-12-Foot suspension sling
4-Daisy chain
5-4-Foot loop
6-8-Foot web loops
7-4-Foot loop

Figure 5-17. Helicopter suspension sling-daisy chain (typical).



1-Left-front lift point
2-Left-front clevis
3-Left-front suspension sling
4-Grounding device
5-Right-front suspension sling
6-Right-front lift point
7-Right-front clevis
8-Suspension sling assembly
9-Right-rear suspension sling
10-Right-rear clevis
11-Right-rear lift point
12-Left-rear lift point
13-Left-rear clevis
14-Left-rear suspension sling
15-Shelter
16-10-inch web ring

Figure 5-18. Suspension sling set secured for helicopter pickup (typical).

(8) Attach the free ends of the 11-foot suspension sling to the 10-inch web ring.

(9) Repeat steps (6) through (8) above for the right-rear clevis (10, fig. 5-18).

(10) Place tape through the 10-inch web ring over the loops and around the knot formed by the web loops (D, fig. 5-20).

(11) Pull the suspension sling assembly taut and place tape around each 12-foot and 11-foot suspension sling every 12 inches from the lift points to the 10-inch web ring.

(12) Tape the suspension sling assembly to the top of the shelter and make certain that each clevis is turned toward the top of the shelter.

(13) Drive the ground rod of the grounding device assembly (1, fig. 5-16) into the ground next to the shelter.

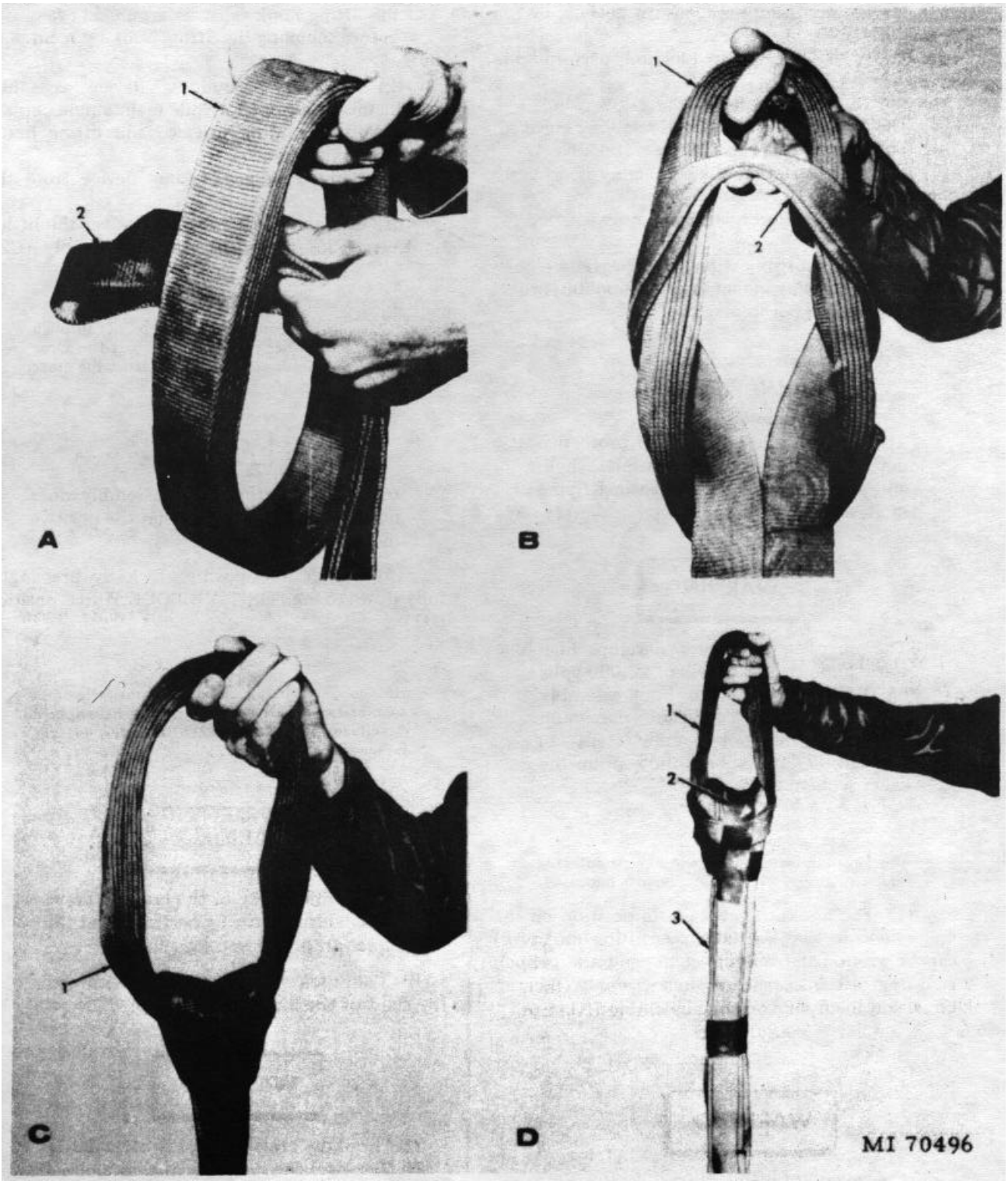
(14) Place the opposite end of the grounding device assembly (4, fig. 5-18) on the suspension sling assembly on top of the shelter.

(15) Stow the remainder of the helicopter lifting sling components in the storage bag, (8, fig. 5-16).

c. If the shop is to be helicopter-lifted from the bed of the prime mover, steps (1) through (3) below must be performed.

(1) Place the prime mover so that it faces downwind.

Figure 5-19. Triple web-loop (typical).



A
1-10-Inch web ring
2-Suspension sling

B
1-10-Inch web ring
2-Suspension sling

C
1-10-Inch web ring (bottom)

D
1-10-Inch web ring
2-Tape
3-Suspension slings

Figure 5-20. Attaching suspension slings to 10-inch web ring.

(2) Engage the prime mover handbrake.

(3) Secure the prime mover tailgate in the horizontal position.

d. Prior to helicopter pickup, perform the following checks.

(1) The prime mover is facing downwind.

(2) The prime mover handbrakes are engaged.

(3) The shop is prepared for travel.

(4) The suspension sling assembly is properly attached.

(5) The suspension sling assembly is taped for pickup.

e. The using organization may be required to perform the following helicopter hookup procedures for each major item.

WARNING

The hookup crew must wear protective devices consisting of helmet liner, shell, and goggles for protection against flying sand, dirt, dust, and debris.

WARNING

The hovering helicopter develops high static potentials in excess of 20,000 volts on the helicopter lifting hook assembly (A1, fig. 5-21). To insure maximum safety for the hookup crew, steps (1) through (7) must be followed in the exact sequence given.

NOTE

The key numbers shown below in parentheses refer to figure 5-21, unless otherwise indicated.

(1) The hookup crew takes a position on the major item so that the helicopter lifting hook (A1) can be grounded from the right, and the 10-inch web ring of the suspension sling assembly (B1) can be put on the hook from the left.

WARNING

The ground connection must remain on the helicopter lifting hook until the hook is grasped by hand. If the hand grasp is released before the hookup is completed, the lifting hook must be grounded again before touching the lifting hook by hand.

(2) Using the grounding device assembly, ground the lifting hook. While maintaining contact between the grounding device and lifting hook, grasp the hook by hand.

(3) Remove the grounding device from the hook.

(4) Slip the 10-inch web ring over the lifting hook and close the lifting hook assembly (C2).

NOTE

By using the procedures in steps (2) through (4) above, either crewman is prepared to close the lifting hook assembly or to assist the other crewman.

CAUTION

Closing the lifting hook assembly does not lock it. make certain that the positive lock (C1) is engaged.

(5) Engage the positive lock by pressing it fully down to the POSITIVE LOCK HERE position (D1).

NOTE

If necessary, in an emergency, the helicopter will release the shelter and move to the left of the line-of-flight (fig. 5-22).

WARNING

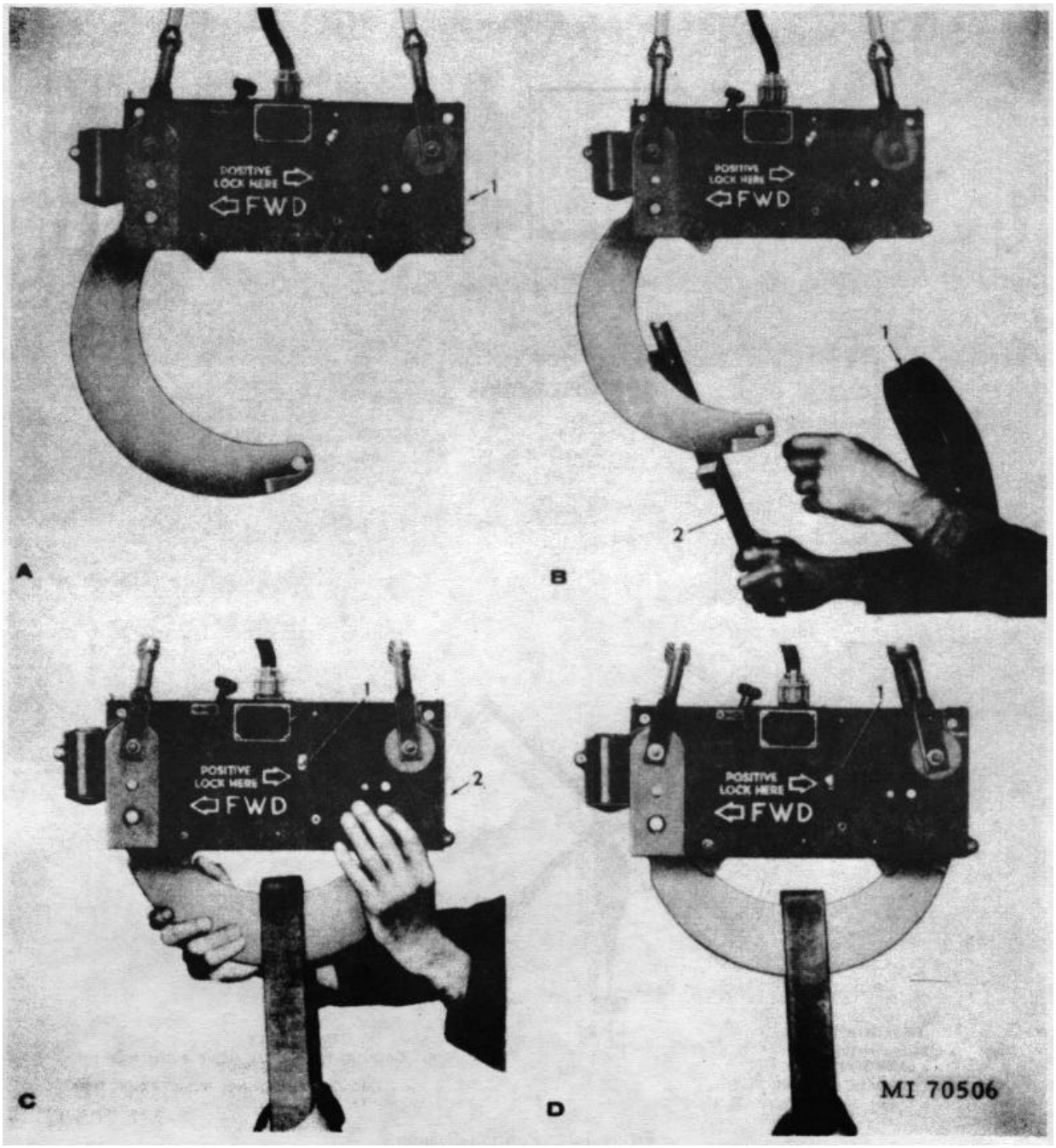
To insure the safety of the hookup crew, step (6) below must be performed at the completion of the hookup.

(6) The hookup crew must move immediately to the right of the line-of-flight.

WARNING

The hookup crew must stay clear 20 to 30 feet until the shelter is airborne.

(7) Retrieve the grounding device assembly and stow it in the storage bag.



A
1-Helicopter lifting hook

B
1-10-Inch web ring
2-Grounding device

C
1-POSITIVE LOCK
2-Helicopter lifting hook-closed

D
1-POSITIVE LOCK-locked

Figure 5-21. Hookup of suspension sling set to helicopter lifting hook.

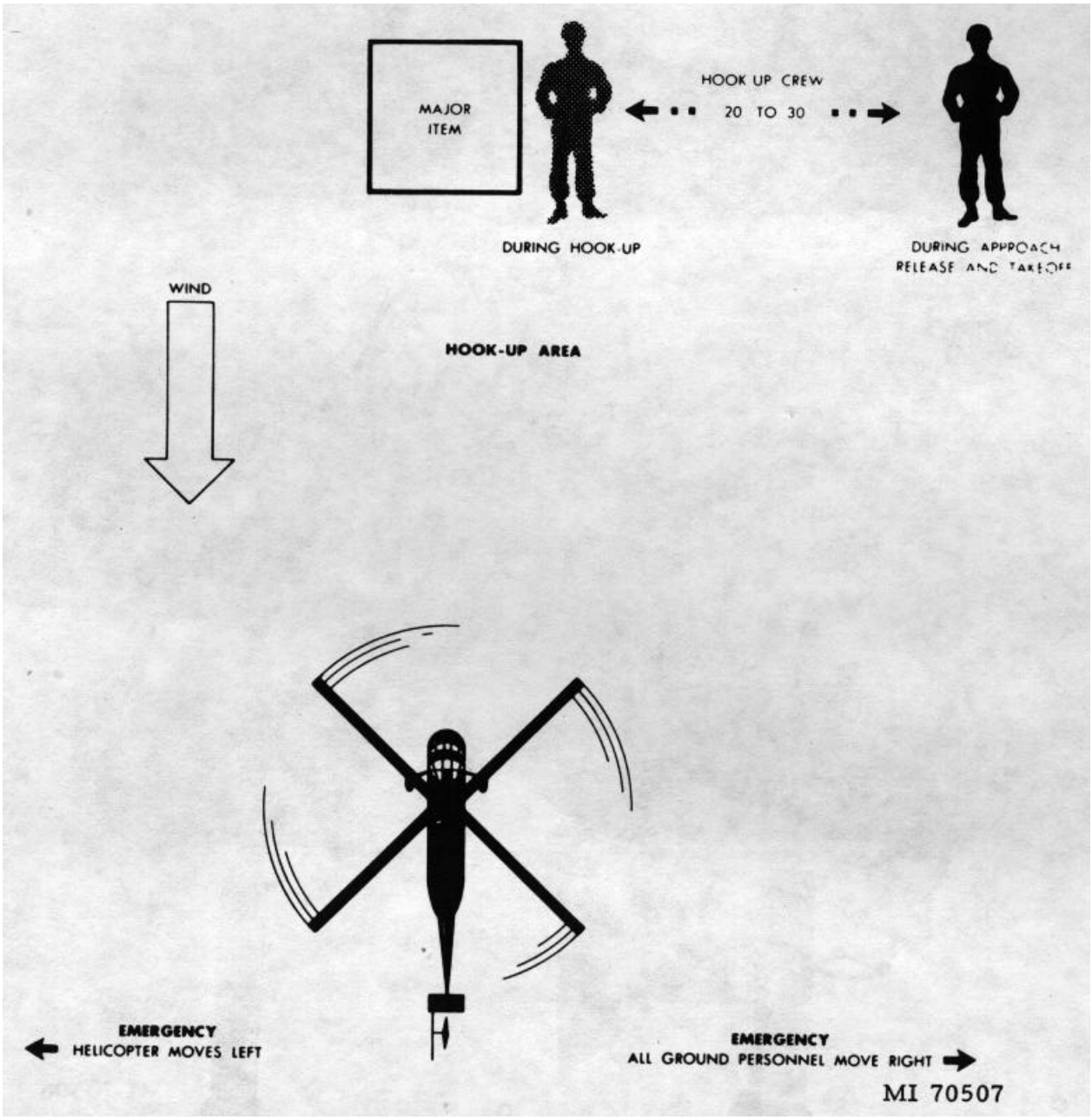


Figure 5-22. Position diagram

Section V. EMPLACEMENT OF THE SHELTER

5-18. General

This section describes the emplacement procedures for the transportable hydraulic shelter (shop 5) by prime mover (par. 5-19) and helicopter (par. 5-20). The emplacement site should be as level as possible with a slope not exceeding 10 degrees in a clearing 27 feet by 27 feet minimum.

5-19. Shelter Emplacement Procedures Prime Mover

a. Detailed procedures for emplacing the transportable hydraulic shelter, while located on the prime mover or placed on the ground, are as follows.

NOTE

If the shelter is to remain emplaced on the M36 cargo truck, perform steps (10) through (15) below.

(1) Drive the M36 cargo truck (7, fig. 5-14) to the selected site and lower the tailgate (5, fig. 5-14).

(2) Remove and stow the tiedowns (fig. 5-15) that secure the shelter to the truck bed.

(3) Remove the lifting sling set (fig. 5-13) from the shelter. Secure the shelter door.

(4) Perform steps (2) through (8) of paragraph 5-16a.

(5) Lower the cable hook and attach it to the common-point ring. Lift the shelter off the truck bed so that the lowest part of the shelter is a minimum of one foot from the truck bed.

(6) Drive the M36 cargo truck forward from underneath the shelter and lower the shelter to the ground.

(7) Remove the common-point ring from the cable hook, and the assembled lifting sling and the guide ropes from the shelter and stow.

(8) Replace the turnbuckle bodies and shackles with the attached eyebolts on the lifting sling set. Store the lifting sling set and tiedown kit in the shelter.

(9) Prepare the 5-ton wrecker for travel and drive it from the area.

(10) Open the entrance door.

(11) Open the air vents on the inside and outside of the entrance door.

(12) Remove the ground rod from the bracket. Emplace the ground rod a minimum of 2 feet (0.6 meters) into the ground. Connect the ground rod cable between the ground rod and the cable attach point on the side of the shelter near the entrance door.

(12.1) Insure that the resistance to ground of the ground rod is 25 ohms or less.

NOTE

Refer to TM 9-1425-525-1, appendix I, for detailed instructions for measuring the resistance of the ground rod. It may be necessary to use additional ground rods and/or buried wire to achieve 25-ohm or less resistance to ground.

(13) Raise the condenser air discharge door on the air conditioner.

(14) Set all switches and circuit breakers on the power distribution panel to OFF. Insure that the POWER circuit breaker on the power supply control is set to OFF.

(15) Connect the power cable.

b. Prior to energizing the shelter, the following checks should be made:

(1) The door vents are open.

(2) The ground rod and ground rod cable are properly emplaced.

(3) The air conditioner condenser air discharge door is opened.

(4) All switches and circuit breakers on the power distribution panel are in the OFF position.

(5) The POWER circuit breaker on the power supply control is in the OFF position.

(6) The power cable is properly connected.

c. Energize the shelter as described in section III.

5-20. Shelter Emplacement Procedures Helicopter

a. Remove and disassemble the suspension slings.

b. Stow the helicopter lifting kit in the storage bag and stow the bag.

c. The shelter is emplaced as described in paragraph 5-19a(10) through (15).

d. The shelter is energized as described in paragraphs 5-19b and 5-19c.

Section VI. LIGHTNING PROTECTION

5-21. Scope

a. This section contains instructions for protecting the electrical equipment shelters from direct and indirect lightning strikes. Standard battery emplacement procedures require equipment grounding. However, lightning protection is also required in areas where the battery site is higher than the surrounding terrain and in areas where severe electrical storms are experienced.

b. Individual site requirements may dictate changes in the procedures described in this section. Changes are permissible as long as equivalent protection is provided for the system.

5-22. Lightning Rod Design and Construction

a. General. The procedures contained in this paragraph are used to design, construct, and emplace a lightning rod for the electrical equipment shelters. Once emplaced, the lightning rod is connected to the shelter lightning protection ground system. The presence of a well-grounded lightning rod for each major item protects the IHAWK system from direct lightning strikes and lightning-induced current surges.

b. Cone of Protection. The "cone of protection" concept is used in the following procedures to protect the IHAWK major items. A cone of protection starts at the highest point of a vertical shielding conductor, and extends conically downward. The shielding conductor provides lightning protection for all items or structures completely enclosed by the cone. The radius of the circular base of the cone defines the ground area protected by the vertical shielding conductor. This radius is equal to twice the height of the vertical shielding conductor (fig. 5-23).

c. Design and Construction. Fabricate a lightning protection assembly for the shelters in accordance with figure 5-24. Refer to table 5-15 for a list of materials required.

5-23. Lightning Rod Employment Procedures

The following are the detailed procedures for emplacing the vertical shielding conductor and mast assemblies fabricated according to paragraph 5-22c.

NOTE:
THE RADIUS OF THE CONE IS EQUAL TO TWICE ITS HEIGHT.

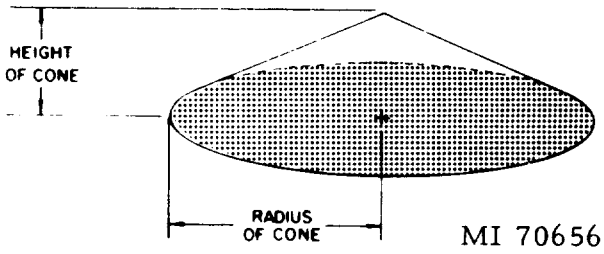


Figure 5-23. Cone of protection concept.

CAUTION
Do not connect the equipment ground system to the lightning protection ground system. To do so will result in serious damage to electronic equipment in the event of a lightning strike.

a. Emplace the shielding conductor mast with vertical shielding conductor 1.8 m (6 ft) from the equipment being protected.

b. If the shielding conductor mast must be emplaced more than 1.8 m (6 ft) from the equipment, increase the height of the mast by one-half the added distance. This keeps the equipment within the cone of protection.

NOTE
If the equipment is located on a mound or tower, increase the height of the shielding conductor mast by an amount equal to the height of the mound or tower.

c. Extend the shielding conductor 60 cm (2 ft) above the top of the mast. This provides an air terminal to intercept the electrical discharge at a safe distance above vulnerable and flammable parts or structures.

d. Use a 1.8 m (6 ft} length of hollowed wood molding to protect the shielding conductor from mechanical (damage at ground level.

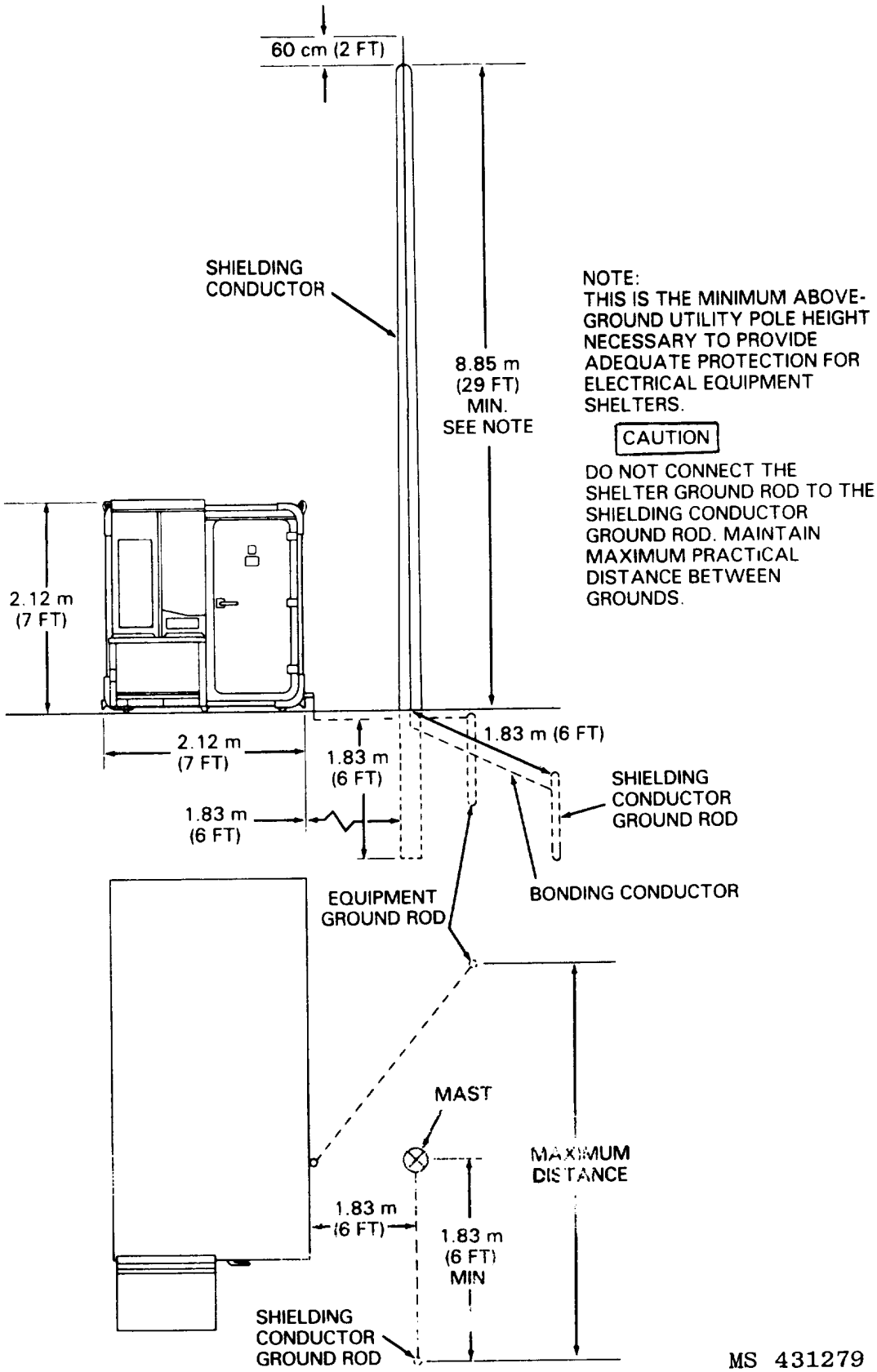


Figure 5-24. Typical lightning protection layout for electrical equipment shelters.

e. Emplace a 1.8 m (6 ft) shielding conductor ground rod at least 1.8 m (6 ft) beyond the mast and at least 3.6 m (12 ft) from the equipment being protected. The distance between the shielding conductor ground rod and the equipment ground rod should be as large as possible.

NOTE

If bedrock prevents driving the shielding conductor ground rod 1.83 m (6 ft) deep, dig a radial trench 3.66 m long by 0.914 m deep (12 ft by 3 ft) from the base of the mast and away from the equipment 'being protected. Connect No. 2 copper wire to the vertical shielding conductor, and bury the wire in the trench.

f. Drive the shielding conductor ground rod at least flush with the ground. If possible, drive the ground rod 30 cm (1 ft) below the soil surface.

g. Refer to TM 9-1425-525-1, appendix I, for detailed instructions for measuring the resistance of the major item lightning protection ground rod. If the measured resistance is more than 10 ohms, use the procedures contained in TM 9-1425-525-1, appendix I to reduce the resistance to 10 ohms or less.

h. Connect a bonding conductor of No. 2 AWG copper wire between the base of the shielding conductor and the ground rod using silver epoxy material. Bury the bonding conductor at least 60 cm (2 ft) underground. The soil above the buried wire should be compressed to increase soil contact.

Table 5-15. Materials Required for Each Shelter installation

Description	Part Nr.	NATO/National Stock No.
Pole, utility, 10.7 m (35 ft)		
Rod, ground, 1.83 m X 1.59 cm (6 ft X 5/8 in.)	9175247	5975-00-296-0762
Wire, copper, No. 2, 30.5 m (100 ft)		
Staples, 2.54 cm X 0.953 cm (1 in. X 3/8 in.)		5315-00-161-9862
Molding, Ranier wood ground wire No. RGM-2, 1.83 m (6 ft)		
Staples, 7.62 cm X 3.81 cm (3 in. X 1 1/2 in.)		

CHAPTER 6

MAINTENANCE INSTRUCTIONS

Section I. REPAIR PARTS, TOOLS, AND EQUIPMENT

6-1. General
Repair parts, tools and equipment are issued to direct and general support maintenance units for operating, maintaining, and repairing the materiel. Tools and equipment should not be used for purposes other than prescribed, and when not in use should be properly stored. For equipment storage refer to figure 1-2.

6-2. Repair Parts
Repair parts are supplied for replacement of those parts likely to become worn, broken, or otherwise unserviceable, provided such operations are within the scope of prescribed maintenance functions. Repair parts for the transportable hydraulic shop 5 are listed in TM 9-4935-50740P which is the authority for requisitioning replacements.

6-3. Common Tools and Equipment
Standard and commonly used tools and equipment having general application to this materiel are authorized for issue by tables of allowances (TA) and the table of organization and equipment (TOE).

6-4. Special Tools and Equipment
No special tools and equipment are authorized or required for direct and general support maintenance of transportable hydraulic shop 5.

Section II. PREVENTIVE MAINTENANCE SERVICES

6-5. General The purpose of preventive maintenance is to detect the first signs of electrical and mechanical failures and to insure that appropriate corrective action is taken before expensive and time-consuming repairs or replacements are required. This system is based on frequent inspections and services accomplished by operators or maintenance personnel under active supervision by all commanders and supervisors.

6-5.1. Responsibility
Operators and crew chiefs are personally responsible for assigned materiel. Section and platoon leaders are charged with supervisory responsibility for materiel pertaining to their commands. Unit and organization commanders are required to insure that materiel issued or assigned to their commands is properly maintained.

6-5.2. Intervals
The principal criteria for determining the frequency of preventive maintenance services are operating hours and road movement. Since these cannot be accurately predicted, prescribed intervals will be used. Operation under adverse conditions such as extreme temperature or inclement weather may require that preventive maintenance services be performed more frequently. Reduce the intervals when environmental conditions indicate the need. Do not exceed the intervals unless authorized to do so.

6-5.3. General Procedures for All Services and Inspections
Refer to TM 9-1425-525-12-4 and TM 9-1425-525-34 for information on general procedures for all services and inspections.

6-5.4. Preventive Maintenance Checks and Services
a. These checks and services are to be performed by the organizational maintenance mechanic and the operator. Only those procedures beyond the responsibilities of the operator will be performed by the mechanic. The battery maintenance supervisor will determine the specific areas of responsibility.

b. If the equipment must be kept in continuous operation, check and service only those items that can be checked and serviced without endangering personnel and without disturbing operation. Make the complete checks and services when the equipment can be shut down. The daily procedures need not be performed on the days the shop or the hose assemblies are not used. If preventive maintenance listed in the tables has been performed during normal operating checks, it is not necessary to repeat inspection.

NOTE

Use technical trichloroethane (TM 740-525, table D-1, item 122) to clean electrical parts. Use mineral spirits, paint thinner (TM 740-525, table D-1, item 174), or dry cleaning solvents for metal surfaces other than electrical parts.

WARNING

Trichloroethane is toxic. Avoid breathing fumes or exposure to skin.

CAUTION

Do not paint weather seals, gaskets, or any sealing material. Paint causes sealing material to deteriorate and leak.

c. Report any deficiencies using the proper forms (see TM 38-750). Any defects noted that are beyond the scope of the organizational maintenance mechanic will be reported immediately to the maintenance supervisor.

d. The specific checks and services for shop 5 are listed in table 6-1. The personnel responsible for performing the checks and services at the various intervals are as follows:

Interval	*Responsible Personnel*
Daily	Operator, organizational
Weekly	Operator, organizational
Monthly	Operator, organizational
Quarterly	Operator, organizational
Semiannually	Operator, organizational
Annually	Operator, organizational

Table 6-1. Preventive Maintenance Checks and Services

D - Daily **W - Weekly**
S - Semi-Annually **A - Annually** **M - Monthly** **Q - Quarterly**

Item No.	Interval						Item to be Inspected	Procedures Check for and have repaired or adjusted as necessary	For readiness reporting, equipment is not ready/available if:
	D	W	M	Q	S	A			
1.							Work Surfaces	Check work surfaces, storage cabinets, equipment, and tools for cleanliness. Stow all loose equipment and tools. Secure all drawers, doors, covers, and access panels.	
2.							Accumulator	Check the accumulator air charge. Recharge the accumulator if necessary (par. 6-10).	
3.							Hydraulic and pneumatic test hose assemblies	Visually inspect the hose assemblies for evidence of deterioration or for stripped coupling thread.	
4.							Consoles, equipment, and cabinets	Check cabinet doors, hinges, locking pins, and control panels for dirt, corrosion, chipped paint, and illegible caution plates and nameplates. Clean, paint, lubricate, repair, or replace as required. Check for loose or broken wires, indicators, receptacles, quick-disconnect couplings, hose assemblies, and tube assemblies for physical damage. Check the leakage graduate pans for dirt. Remove the graduate pan strainers and wipe out the graduate pans. Check tiedown straps for damage. Check cable assemblies for frayed insulation, bent pins, and damaged connectors. Check portable lamps. Repair or replace lamps, bulbs, or batteries as required (TM 1425-525-12-4 and TM 9-1425-525-34).	
5.							Exterior surfaces	Inspect for rust, dirt, chipped paint, breaks, or cracks. Clean, paint, and repair as required.	
6.							Leakage graduates A and B	Flush each graduate tube with petroleum ether or Freon TF-113, 6838-00-584-2957, to remove coagulated oil films.	
7.							Main reservoir	Filter the hydraulic fluid in the reservoir (par. 6-7).	
8.							Drain reservoir vent line filter	Degrease and air-dry the filter with low pressure air.	
9.							Fire extinguisher	Check for dirt and corrosion. Clean and weigh. Replace if necessary.	
10.							Hydraulic console fluid filters	Clean both the 5- and 10-micron hydraulic fluid filters. Degrease and air-dry with low air pressure.	
11.							Compressor dehydrator cartridge and housing	Replace the dehydrator cartridge 4440-00-833-6944. Inspect the chemical drier housing for evidence of corrosion. Replace the housing if excessive corrosion is present.	
12.							Thermometers	Check the thermometers (par. 24-1).	
13.							Hydraulic test console dc circuits	Check the hydraulic test console dc circuits (par. 6-20).	
14.							Hydraulic console gages	Check the hydraulic console pressure gages (par. 25-1).	
15.							Degreaser console gages	Check the degreaser console air gages (par. 6-18).	
16.							Timer stop assembly panel	Check the panel (table 6-10).	
17.							Hydraulic and pneumatic test hose assemblies	Inspect and proof-pressure-test-the hose assemblies (table 22-2).	

Tables 6-2 thru 6-6 Deleted

Section III. HYDRAULIC AND PNEUMATIC MAINTENANCE SERVICES

6-6. General

This section describes the procedures for filling the hydraulic test console main reservoir, draining the waste fluids from the hydraulic test console drain reservoir, and charging the accumulator of the hydraulic test console.

6-7. Main Reservoir Filling and Filtration Procedures

a. Preparation.

(1) Remove the hydraulic main reservoir fill cap (3, fig. 2-9).

(2) Add MIL-H-5606 hydraulic fluid (TM 740-525, table D-1, item 65) to the main reservoir until the reservoir sight level gage (2, fig. 2-9) indicates full.

(3) Replace the main reservoir fill cap.

b. Filtration.

(1) 416 VOLTS (1, fig. 5-6)..... ON.

(2) 28 VOLTS (2, fig. 5-6)..... ON.

(3) OIL COOLER (2, fig. 5-7)..... ON.

(4) OIL HEATER (3, fig. 5-7) ..... ON.

(5) SYSTEM PRESSURE CONTROL VALVE COARSE ADJUST (16, fig. 5-2) ..... full ccw.

(6) SYSTEM PRESSURE PUMP (4, fig. 5-7) ..... ON.

(7) Allow the hydraulic test console to operate for thirty minutes.

c. Shutdown.

(1) SYSTEM PRESSURE PUMP (4, fig. 5-7) ..... OFF.

(2) SYSTEM PRESSURE CONTROL VALVE COARSE ADJUST (16, fig. 5-2) ..... full cw.

(3) OIL HEATER (3, fig. 5-7) ..... OFF
(4) OIL COOLER (2, fig. 5-7)..... OFF
(5) 28 VOLTS (2, fig. 5-6)..... OFF
(6) 416 VOLTS (1, fig. 5-6)..... OFF

6-8. Deleted

6-9. Draining Procedures for the Hydraulic Test Console Drain Reservoir

NOTE
The key numbers shown below in parentheses refer to figure 5-8, unless otherwise indicated.

a. Purpose. The hydraulic test console drain reservoir collects and stores waste fluids accumulated during the performance of the uut procedures. The drain reservoir (34, fig. 7-6) must be emptied whenever the drain reservoir sight level indicates three-quarters or more full.

b. Preparation.

(1) Remove the drain access panel (1, fig. 7-5).

(2) Perform the pneumatic system test procedures (par. 6-17). Perform only steps 1 through 4 and 9 through 11 of table 6-11.

(3) Adjust the LOW PRESSURE AIR REGULATOR control (10) counterclockwise to the VENT position. Maintain the control in this position until the LOW PRESSURE AIR AND AIR GUN gage (4) reads zero, then release the control.

(4) LOW PRESSURE AIR OUTLET (11) full cw.

(5) Connect to one end of hose assembly MS28762-4-3000, in the following order, flareless union MS21902D4, tube assembly 9197495, and quick-disconnect coupling 9074508. Connect the quick-disconnect coupling to the LOW PRESSURE AIR port (12).

(6) Connect to the other end of the hose assembly self-sealing coupling half 9194683. Connect the coupling half to the drain reservoir air charge fitting (11, fig. 7-6).

(7) Connect hose assembly 10068949 to the drain quick-disconnect coupling of the drain reservoir and place the open end of the hose assembly into metal pot 9074948.

NOTE
This hose assembly is marked "For Waste Only".

(8) Drain reservoir vent line shutoff valve (4, fig. 7-6) full cw.

(9) Momentarily adjust the LOW PRESSURE AIR REGULATOR control clockwise to the LOAD position, and then release it until the LOW PRESSURE AIR AND AIR GUN gage reads 25 psig.

(10) turn the LOW PRESSURE AIR OUTLET valve counterclockwise until the waste fluids from the drain reservoir flow into the metal pot.

NOTE
Unseating of the drain reservoir relief valve (9, fig. 7-6) indicates excessive regulated pressure; to correct this condition, turn the LOW PRESSURE AIR OUTLET valve slightly clockwise. No waste fluid flow indicates a defective quick-disconnect coupling. Slow exhausting of waste fluids indicates insufficient

regulated air pressure; to correct this condition turn the LOW PRESSURE AIR OUTLET valve slightly counterclockwise. Waste fluids backing up into one of the leakage graduate tubes indicates that the drain reservoir check valve (23, fig. 7-6) is defective. Air or waste fluid exhausting or leaking from the drain reservoir vent line air filter indicates that the reservoir vent line shutoff valve is defective.

c. Shutdown Procedures.

(1) LOW PRESSURE AIR OUTLET full cw.

(2) Remove all hose assemblies and quick disconnect couplings. Wash the hose assembly couplings and the quick-disconnect couplings with Stoddard solvent from an orificed plastic squeeze bottle.

(3) Turn the drain reservoir vent line shutoff valve (4, fig. 7-6) fully counterclockwise, and cap the drain reservoir drain fitting.

(4) Install the drain reservoir access panel (1, fig. 7-5).

(5) Perform the pneumatic system shutdown procedures (step 14, table 6-11).

6-10. Checking and Charging the Air Side of the Accumulator

a. General. This paragraph describes the procedures for checking the air charge in the hydraulic test console accumulator, charging the accumulator upon receipt of a new, reconditioned, or used transportable hydraulic shop 5, and charging the accumulator in an operational hydraulic shop.

NOTE

The key numbers shown below in parentheses refer to figure 2-17 unless otherwise indicated.

b. Checking the Air Charge.

(1) Set the hydraulic test console controls to the positions indicated in table 5-12.

(2) Remove the accumulator cap (5A).

(3) Connect the accumulator charging manifold (fig. 1-29) to the accumulator.

NOTE

Insure that the accumulator charging manifold bleed valve is closed (turned fully clockwise).

(4) Turn the accumulator stem nut (5B) counterclockwise two turns.

(5) If the accumulator charging manifold gage reads 450 to 550 psig, proceed with step (6) below. If the manifold gage indication is less than 450 psig, perform subparagraph c below.

(6) Turn the accumulator stem nut fully clockwise.

(7) Open the accumulator charging manifold bleed valve (turn fully counterclockwise).

(8) Remove the accumulator charging manifold and reinstall the accumulator cap.

c. Charging the Air Side of the Accumulator.

NOTE

The key numbers shown below in parentheses refer to figure 5-8 unless otherwise indicated.

(1) Perform the pneumatic system test procedures (par. 6-17). Perform only steps 1 through 7 of table 6-11.

(2) Adjust the HIGH PRESSURE AIR REGULATOR control (15) counterclockwise in the VENT position. Hold the control in this position until the HIGH PRESSURE AIR gage (2) reads zero, then release the control.

(3) HIGH PRESSURE AIR OUTLET (16) ..... full cw.

(4) Remove the coupling and tube assembly.

(5) Control quick-disconnect coupling 9074508 to hose assembly 9172956.

(6) Connect the quick-disconnect coupling to the HIGH PRESSURE AIR port (18).

(7) Momentarily adjust the HIGH PRESSURE AIR REGULATOR control clockwise in the LOAD position, and then release it, until not more than 100 psig is indicated on the HIGH PRESSURE AIR gage.

WARNING

In performing the next step, firmly grip the free end of the hose assembly and point it in a safe direction.

(8) Slightly turn the HIGH PRESSURE AIR OUTLET valve counterclockwise and purge the hose assembly for 5 to 6 seconds.

(9) HIGH PRESSURE AIR OUTLET full cw.

(10) Connect the free end of the hose assembly to the accumulator charging manifold.

CAUTION

Perform the next step upon receipt of a new, used, or reconditioned transportable hydraulic shop to prevent sudden bottoming of the accumulator piston. Perform step (12) below if the accumulator being charged contains a partial air charge.

(11) Very slightly turn the HIGH PRESSURE AIR OUTLET valve counterclockwise to put an initial air charge in the accumulator, then turn the HIGH PRESSURE AIR valve fully clockwise.

(12) Momentarily adjust the HIGH PRESSURE AIR REGULATOR control clockwise in the LOAD position, and then release it, until 550 psig is indicated on the HIGH PRESSURE AIR gage. Wait for the gage indication to stabilize.

(13) Turn the HIGH PRESSURE AIR OUTLET valve fully counterclockwise. Allow the accumulator charging manifold gage indication to stabilize (450 to 550 psig).

(14) Accumulator stem nut (5B, fig. 2-17) ..... full cw.

(15) Adjust the HIGH PRESSURE AIR REGULATOR control counterclockwise to the VENT position. Maintain the knob in this position until the HIGH PRESSURE AIR gage reads zero, then release it.

(16) Accumulator charging manifold bleed valve ..... full ccw.

(17) Remove the hose assembly, accumulator charging manifold, and quick-disconnect coupling, and store them.

(18) Install the accumulator cap (5A, fig. 2-17) and the base access panel (9, fig. 1-3).

(19) Perform the pneumatic system shutdown procedures (step 14, table 6-11).

Section IV. HYDRAULIC AND PNEUMATIC SYSTEM CHECKS

6-11. General

This section contains periodic test procedures, test procedures, and precheck conditions for the hydraulic and pneumatic systems of transportable hydraulic shop 5. These checks are designed to ascertain the accuracy and operational readiness of the equipment.

6-12. Periodic Test Procedures

The periodic test procedures are used to certify the accuracy of test and measuring equipment by comparing equipment of unknown accuracy with test equipment of known accuracies. Refer to TM 9-4935-540-14-1 and TM 9-4935-154014-1 for units of transportable hydraulic shop 5 requiring periodic testing.

6-13. Test Procedures

Test procedures are used to determine the operational readiness, and to isolate malfunctioning units, of the hydraulic system, and the pneumatic system. They are performed before the equipment is used for unit-under-test or operational procedures, but not more than once a week.

6-14. Precheck Conditions

The following conditions must be established prior to performing the test procedures.

(1) Set all controls to the OFF position (table 5-11).

(2) Check the hydraulic console main reservoir fluid level. Replenish the hydraulic fluid in the reservoir if necessary (par. 6-7).

(3) Insure that the heat exchanger and the air compressor units are swung out of the shelter and secured in the operating position.

(4) Open the degreaser and accumulator vent door which is located on the outside of the shelter directly behind the degreaser and accumulator test console.

(5) Check the hydraulic console drain reservoir. Drain it if necessary (par. 6-9).

(6) Air reservoir assembly blowdown valve (3, fig. 1-6) ..... full cw.

(7) Insure that the hydraulic test console controls are set to the positions indicated in table 5-12.

(8) Insure that the degreaser and accumulator test console controls are set to the positions indicated in table 5-13.

6-15. Test Procedure Tables

The test procedure tables list the operations to be performed, the normal indications, and, when applicable, the corrective procedures. The normal indication is given in boldface type. The corrective procedures lists the most probable defective part and any adjustments that can be made.

6-16. Hydraulic Test Console and Heat Exchanger Periodic Test Procedures

a. General. Tables 6-7 through 6-10 contain detailed procedures for testing the handpump, hydraulic test console and heat exchanger, leakage graduate panel, and timer stop assembly panel. These checks, which establish operational readiness, are also used for isolating faulty components.

b. Preparation for Test.

(1) Remove the base and drain reservoir access panels (2 and 1, fig. 7-5).

(2) Set the controls to the positions indicated in table 5-12.

(3) Check the hydraulic console main reservoir fluid level. Replenish the hydraulic fluid in the reservoir if necessary (par. 6-7).

(4) Check the drain reservoir fluid level. Drain the reservoir if the sight level indicates three-quarters full or more (par. 6-9).

(5) Check the hydraulic console air accumulator (par. 6-10). Recharge the accumulator to 500 ± 50 psig if necessary.

(6) Check the hydraulic motor (61, fig. 7-7) oil level. Replenish with MIL-L-6086 if necessary.

CAUTION

The INDICATOR OIL TEMPERATURE thermometer (5, fig. 5-2) must be constantly monitored while performing the checks of table 6-8. If the thermal switch (11, fig. 7-13) fails to energize the heat exchanger motor when the hydraulic fluid temperature increases to between 1010 and 1090F, shut down the system, determine the defective component, and repair it before proceeding with the operational maintenance check procedures. Perform subparagraph c below to cool the hydraulic system fluid if the thermal switch (7, fig. 7-13) does not deenergize the system pressure pump motor when the hydraulic fluid temperature increases to a maximum temperature of 185°F.

c. Hydraulic Fluid Cooling Procedures.

(1) 416 VOLTS (1, fig. 5-6)..... OFF

(2) SYSTEM PRESSURE CONTROL VALVE FINE ADJUST (11, fig. 5-2)..... full ccw.

(3) SYSTEM PRESSURE CONTROL VALVE COARSE ADJUST (16, fig. 5-2)..... full ccw.

(4) THROTTLING VALVE B (17, fig. 5-3) ..... full ccw.

(5) FLOW INCREASE (9, fig. 5-2). ..... full ccw.

(6) SENSING ELEMENT SELECTOR VALVE (10, fig. 5-2)..... HIGH FLOW 28 GPM

7) OIL COOLER (2. fig. 5-7)..... OFF.

(8) 416 VOLTS..... ON.

(9) Wait for the system pressure pump motor to start, then set the OIL COOLER circuit breaker to ON.

(10) Allow the hydraulic test console to operate until the heat exchanger motor deenergizes automatically. Perform the shutdown procedure (step 11, table 6-8). Repair the defective component and then repeat the applicable test procedure.

d. Test. Perform the test procedures and periodic test procedures in tables 6-7 through 6-10.

Table 6-7. Handpump Test Procedures

Step	Operation Normal Indication Corrective procedure
	NOTE The key numbers shown below in parentheses refer to figure 5-1 unless otherwise indicated.
1	**Quick-Disconnect Couplings and Handpump Air Purge.**
	Open the handpump access panel (10, fig. 1-3) and insert the handpump handle into the handpump.
	Handpump unloading valve (16, fig. 2-11) .....full cw.
	HAND PUMP PRESSURE UNLOADING VALVE (13).....partial cw.
	Actuate the handpump handle six to seven strokes to purge the handpump of air.
	Connect hose assembly MS28762-4-0250 with quick-disconnect coupling 9194683 to the HAND PUMP PRESSURE PORT (12).
	Actuate the handpump handle to purge the handpump system of air.
	Hydraulic fluid flows from the open-end hose assembly.
	HAND PUMP PRESSURE PORT, quick-disconnect coupling.
	Remove the hose assembly.
2.	**Handpump low Pressure**.
a.	HAND PUMP PRESSURE UNLOADING VALVE full cw.
	Actuate the handpump handle until the 0-100 PSI GAGE (1) indicates 10 psig; maintain this pressure for 3 minutes.
	The 0-100 PSI GAGE reads 10 psig. No fluid leakage is observed.
	Gage, handpump, HAND PUMP PRESSURE UNLOADING VALVE.
b.	Actuate the handpump handle until the 0-100 PSI GAGE indicates 90 psig, and maintain this pressure for 3 minutes.
	CAUTION **Do not exceed the 100-psig indication on the 0-100 PSI GAGE if the gage protector is not functioning properly.**
	The 0–100 PSI GAGE reads not less than 88 psig. No fluid leakage is observed.
	Gage, handpump, HAND PUMP PRESSURE UNLOADING VALVE.
c.	Actuate the handpump handle until the 0-10000 PSI GAGE (2) indicates 500 psig. Observe all connections for leakage.

Table 6-7. Handpump Test Procedures-Continued

Step	Operation Normal Indication Corrective procedure
2c. Con t.	**The 0--100 PSI GAGE reads 90 to 100 psig. No fluid leakage is observed**. 0-100 PSI GAGE, gage protector.
d.	HAND PUMP PRESSURE UNLOADING VALVE .....slowly full ccw. **The 0-100 PSI GAGE and the 0-10000 PSI GAGE readings drop to zero.** HAND PUMP PRESSURE UNLOADING VALVE.
3.	**Handpump High Pressure.** LOW PRESSURE GAGE SHUTOFF (4). .....full cw. HAND PUMP PRESSURE UNLOADING VALVE .....full cw. Actuate the handpump handle until the 0-10000 PSI GAGE reads 6600 psig, and maintain this pressure for 3 minutes. **The 0-10000 PSI GAGE reading gradually decreases to and stabilizes at not less than 5000 psig. No fluid leakage is observed.** Handpump, HAND PUMP PRESSURE UNLOADING VALVE, handpump external relief valve (14, fig. 7-8), hydraulic fittings.
4.	**Handpump External Relief Valve.** **CAUTION** **Do not exceed 8000 psig as indicated on the 0-10000 PSI GAGE.**
a.	Actuate the handpump handle until no further increase in pressure is indicated on the 0-10000 PSI GAGE. **The 0--10000 PSI GAGE reads 7500 ± 300 psig. No fluid leakage is observed.** Handpump external or internal relief valve.
b.	HAND PUMP PRESSURE UNLOADING VALVE. .....slowly full ccw. **The 0-10000 PSI GAGE reading decreases to zero.** HAND PUMP PRESSURE UNLOADING VALVE.
5.	**Shutdown Procedures.** Remove, clean, and store the test hose assemblies and fittings. Cap the HAND PUMP PRESSURE PORT. Store the handpump handle and secure the handpump access panel.

Table 6-8. Hydraulic Test Console and Heat Exchanger Test Procedures

Step	Operation Normal Indication Corrective procedure
1.	**Energizing Circuits.** 416 VOLTS (1, fig. 5-6) .....ON. 28 VOLTS (2, fig. 5-6) .....ON. CIRCUIT BREAKER (18, FIG. 5-2) .....ON (UP). Power ADJUST (3, fig. 5-2) .....FULLY CW. **VOLTMETER (1, fig. 5-2) indicates 26 to 30 volts.** T1, CR1, CR2, POWER ADJUST R4, overload K1, VOLTMETER. **FILTER PRESSURE DROP green lamp (4, fig. 5-2) illuminates.** Indicator lamp, pressure differential switch (47, fig. 7-8). **OIL COOLER lamp (5, fig. 5-6) illuminates provided that the hydraulic fluid temperature is above 100°F.** Indicator lamp, heat exchanger thermal switch (11, fig. 7-13), relay K3. **NOTE** **The following indications may not be obtained because of low fluid temperature (below 30°F). Check the fluid temperature by inserting thermometer 9074946 with thermometer protector 9074947 into the hydraulic test console main reservoir as specified in step 2 below.** **PRESSURE PUMP lamp (3, fig. 5-6) illuminates provided that the hydraulic fluid temperature is not less than 5° to 15°F or more than 160° to 185°F.** Indicator lamp, system pressure pump thermal switches (5 and 7, fig. 7-13), relay K1. **0110 HEATER lamp (4, fig. 5-6) illuminates provided that the hydraulic fluid temperature is below 29°F.** Indicator lamp, oil heater thermal switch (9, fig. 7-13), relay K2.
2.	**INDICATOR OIL TEMPERATURE Thermometer (5, fig. 5-2).** Remove the hydraulic main reservoir fill cap and insert thermometer 9074946 with protector 9074947 into the reservoir. Allow the thermometer indication to stabilize. **THE INDICATOR OIL TEMPERATURE thermometer indicates ± 5° of the thermometer reading at hydraulic fluid temperatures above 30°F.** INDICATOR OIL TEMPERATURE thermometer.
3.	**System Pressure Pump Motor Rotation.** Remove the thermometer from the reservoir and replace the reservoir fill cap. 28 VOLTS.....OFF.

Table 6-8. Hydraulic Test Console and Heat Exchanger Test Procedures-Continued

Step	Operation Normal Indication Corrective procedure
3. Cont.	**SYSTEM PRESSURE PUMP (4, fig. 5-7)** .....ON. OIL COOLER (2, fig. 5-7) .....ON. OIL HEATER (3, fig. 5-7) .....ON. Momentarily set the 28 VOLTS circuit breaker to ON and then to OFF. **The pump motor rotates counterclockwise as viewed from the motor fan end.** CB1, pump motor.
4.	**Low-Pressure Leakage.** Connect hose assembly MS28762-8-0490 between TEST PORT B-1 (13, fig. 5-3) and one of the SUPPLY PORTS (12, fig. 5-2) after connecting quick-disconnect coupling 9194685 to each end of the hose assembly. Connect quick-disconnect coupling 9194685 to one end of another hose assembly, MS28762-8-0490. To the other end of the hose assembly, connect reducer MS21916D12-8, tube assembly 9197359, and quick-disconnect coupling 9194686. Connect the assembled hose assembly between TEST PORT B-2 (12, fig. 5-3) and one of the RETURN PORTS (14, fig. 5-2). 28 VOLTS.....ON. SYSTEM PRESSURE CONTROL VALVE COARSE ADJUST (16, fig. 5-2).....full cw. SYSTEM PRESSURE CONTROL VALVE FINE ADJUST (11, fig. 5-2) .....full cw. **The indicator HIGH FLOW meter (6, fig. 5-2) indicates fluid flow.** Sensing element selector valve (10, fig. 5-2). Adjust FLOW INCREASE CONTROL (g, fig. 5-2) to 3 to 5 GPM. **The system pressure 0-4000 PSI GAGE (2, fig. 5-3) indicates pressure.** Pump, gage. **No leakage.** Hydraulic fittings.
5.	**High-Pressure Leakage and the SYSTEM PRESSURE REGULATOR VALVE (5, fig. 5-1).** Gradually increase the system fluid pressure while maintaining a fluid flow of 4 to 5 gpm, as monitored by the INDICATOR HIGH FLOW meter, by alternately adjusting the FLOW INCREASE control (9, fig. 5-2), the SYSTEM PRESSURE CONTROL VALVE FINE ADJUST, and the THROTTLING VALVE B (17, fig. 5-3) until the system pressure relief valve unseats. **The relief valve audibly unseats. The 0-4000 PSI GAGE indicates 3600 to 3800 psig.**

Table 6-8. Hydraulic Test Console and Heat Exchanger Test Procedures-Continued

Step	Operation / Normal Indication	Corrective procedure
5. Cont.		Gage (chapter 25), gage protector, SYSTEM PRESSURE REGULATOR VALVE.
		NOTE
	If the gage is correct, adjust the SYSTEM PRESSURE REGULATOR VALVE as follows:	
		(1) SYSTEM PRESSURE CONTROL VALVE FINE ADJUST.....full ccw.
		(2) Loosen the knurled locknut on the stem of the SYSTEM PRESSURE REGULATOR VALVE.
		(3) Turn the SYSTEM PRESSURE REGULATOR VALVE incremently clockwise to increase the valve setting or counterclockwise to decrease the valve setting.
		(4) Tighten the knurled locknut.
		(5) Repeat step 5.
	No leakage.	Hydraulic fittings.
6.	**System Pressure Pump.**	
	SYSTEM PRESSURE CONTROL VALVES COARSE and FINE ADJUST	.....full cw.
	FLOW INCREASE	.....5 to 6 gpm on INDICATOR HIGH FLOW meter.
	Adjust the THROTTLING VALVE B and the FLOW INCREASE control, as required, to obtain the following indications.	
	The 0-4000 PSI GAGE indicates 3600 to 3700 psig.	High flow sensing element (35, fig. 7-3).
	The INDICATOR HIGH FLOW meter indicates 5 gpm.	Sensing element selector valve.
	The FILTER PRESSURE DROP green indicator lamp is illuminated.	Pump, 5-micron filter element, pressure differential switch.
b.	FLOW INCREASE	8 to 8.5 gpm.....on INDICATOR HIGH FLOW meter.
	Adjust the THROTTLING VALVE B and FLOW INCREASE control, as required, to obtain the following indications.	
	The 0-4000 PSI GAGE indicates 3150 to 3250 psig.	High flow sensing element.
	The INDICATOR HIGH FLOW meter indicates 8 gpm.	Sensing element selector valve.
	The FILTER PRESSURE DROP green indicator lamp is illuminated.	Pump, 5-micron filter element, pressure differential switch.

Table 6-8. Hydraulic Test Console and Heat Exchanger Test Procedures-Continued

Step	Operation Normal Indication Corrective procedure
7.	**Low Fluid and FLOW METER BYPASS.**
a.	FLOW INCREASE ..... full cw. SYSTEM PRESSURE CONTROL VALVE COARSE ADJUST ..... full ccw. SYSTEM PRESSURE CONTROL VALVE FINE ADJUST ..... full ccw. THROTTLING VALVE B ..... full ccw. **The INDICATOR HIGH FLOW meter indicates less than 1 gp m.** FLOW INCREASE control, SYSTEM PRESSURE CONTROL VALVES FINE and COARSE ADJUST. **The 0-4000 PSI GAGE indication decreases to 0.** THROTTLING VALVE B.
b.	Sensing element selector valve ..... LOW FLOW 0-2 GPM. Flow increase ..... Approximately 1/4 turn ccw. Adjust the SYSTEM PRESSURE CONTROL VALVE FINE ADJUST, and the SYSTEM PRESSURE CONTROL VALVE COARSE ADJUST, as required, to obtain the following indication. **The INDICATOR LOW FLOW meter (7, fig. 5-2) indicates 1.3 gpm.** INDICATOR LOW FLOW meter, low flow sensing element (55, fig. 7-2).
c.	SYSTEM PRESSURE CONTROL VALVE FINE ADJUST ..... full ccw. SYSTEM PRESSURE CONTROL VALVE COARSE ADJUST ..... full ccw. Sensing element selector valve FLOWMETER BYPASS. FLOW INCREASE 1/4 turn ccw. SYSTEM PRESSURE CONTROL VALVE COARSE ADJUST ..... full cw. **No flow indicated on both the INDICATOR HIGH FLOW and the INDICATOR LOW FLOW meters.** Sensing element selector valve.
8.	**Heat Exchanger.** **NOTE** **If the heat exchanger is not operating and the hydraulic fluid temperature is below 100°F, perform substep a followed by substep b. If the heat exchanger is operating, perform substep b followed by substep a.**
a.	SYSTEM PRESSURE CONTROL VALVE COARSE ADJUST ..... full ccw. Sensing element selector valve ..... HIGH FLOW 2-8 GPM. SYSTEM PRESSURE CONTROL VALVE COARSE ADJUST ..... full cw. SYSTEM PRESSURE CONTROL VALVE FINE ADJUST ..... full cw.

Table 6-8. Hydraulic Test Console and Heat Exchanger Test Procedures-Continued

Step	Operation Normal Indication Corrective procedure
	Adjust the THROTTLING VALVE B and the FLOW INCREASE control until the INDICATOR HIGH FLOW meter indicates 8 gpm and the 0-4000 PSI GAGE indicates 3400 to 3600 psig. Maintain this condition until the heat exchanger motor energizes. **The heat exchanger motor energizes when the INDICATOR OIL TEMPERATURE thermometer indicates 100° to 115°F.** Thermal switch (11, fig. 7-13). CB3, and relay K3. **The OIL COOLER lamp is illuminated.** Heat exchanger motor, indicator lamp.
b.	THROTTLING VALVE B — full ccw. Turn the SYSTEM PRESSURE CONTROL VALVE FINE ADJUST and the SYSTEM PRESSURE CONTROL VALVE COARSE ADJUST counterclockwise until the INDICATOR HIGH FLOW meter indicates 5 to 6 gpm. Allow the system to operate until the heat exchanger motor deenergizes. **The INDICATOR OIL TEMPERATURE meter indicates 90° to 1000F.** Thermal switch (11, fig. 7-13), CB3, and relay K3. **The OIL COOLER lamp extinguishes.** Heat exchanger motor.
9.	**System Return Flow.** THROTTLING VALVE B .....full ccw. SYSTEM PRESSURE CONTROL VALVE FINE ADJUST .....full cw. SYSTEM PRESSURE CONTROL VALVE COARSE ADJUST .....full cw. FLOW INCREASE.....8 gpm on INDICATOR HIGH FLOW meter. SYSTEM PRESSURE GAGE SELECTOR (4, fig. 5-3) .....0-400. **The 0-400 PSI GAGE (1, fig. 5-3) indicates not more than 150 psig.** 10-Micron filter element.
10.	**Switch Pressure Pump Thermal Switch.** **CAUTION** **Check the historical record and perform this step only at 6-month intervals.**

Table 6-8. Hydraulic Test Console and Heat Exchanger Test Procedures-Continued

Step	Operation Normal Indication Corrective procedure
	WARNING **In performing this step, the hydraulic fluid approaches the flash point. Insure that no one is smoking while this procedure is being performed. Avoid splashing the hot hydraulic fluid when inserting the thermometer into the reservoir.**
a.	SYSTEM PRESSURE GAGE SELECTOR valve .....0-4000. OIL COOLER .....OFF. Adjust the THROTTLING VALVE B and the FLOW INCREASE control until the INDICATOR HIGH FLOW meter indicates 8 gpm and the 0-4000 PSI GAGE indicates 2800 psig. Maintain this condition until the system pressure pump motor deenergizes. **The hydraulic fluid temperature is 160° to 185°F as checked by the thermometer in step 2 above.** System pressure pump thermal switch (7, fig. 7-13), relay K1.
b.	THROTTLING VALVE B .....full ccw. When the system pressure pump motor energizes, set the OIL COOLER circuit breaker to ON and then check the hydraulic fluid temperature. Turn the SYSTEM PRESSURE CONTROL VALVE COARSE ADJUST and the SYSTEM PRESSURE CONTROL VALVE FINE ADJUST until the INDICATOR HIGH FLOW meter indicates 5 to 6 gpm. **The hydraulic fluid temperature is 155° to 170°F as checked by the thermometer in a above. The OIL COOLER and PRESSURE PUMP lamps illuminate.** System pressure pump thermal switch (7, fig. 7-13), relay K1.
11.	**Shutdown Procedures.** OIL COOLER .....OFF. OIL HEATER .....OFF. SYSTEM PRESSURE PUMP .....OFF. 416 VOLTS.....OFF. 28 VOLTS.....OFF. Remove and disassemble all test hose assemblies from the console panels. Clean and store the hose assemblies and fittings. If step 10 above was performed, remove, clean, and store thermometer 9074946 and replace the reservoir fill cap. Replace the drain reservoir access panel and the base access panel. Cap all test ports.

Table 6-9. Leakage Graduate Panel, Test Procedures

Step	Operation Normal Indication Corrective procedure
1.	**Graduate A.**
a.	Connect hose assembly MS28762-4-0250 to the HAND PUMP PRESSURE PORT (12, fig. 5-1), using quick-disconnect coupling 9194683.
	HAND PUMP PRESSURE UNLOADING VALVE (13, fig. 5-1).....full cw.
	Place the open end of the hose assembly into leakage graduate 9074944.
	Actuate the handpump handle to fill the leakage graduate with 200 cc of fluid.
	Fluid flows from the open end of the hose assembly into the leakage graduate. The system shutoff valve (37, fig. 7-7) is not turned fully counterclockwise. Handpump, HANDPUMP PRESSURE UNLOADING VALVE.
b.	DRAIN A - DRAIN B valve (3, fig. 5-4).....DRAIN B.
	Fill graduate A (1, fig. 5-4) to 100 cc of fluid from the leakage graduate. Wait 5 minutes and observe the graduate scale for leakage.
	The graduate A scale indicates 100 cc of fluid. DRAIN A - DRAIN B valve, graduate A.
	No fluid leakage is observed.
c.	DRAIN A - DRAIN B valve.....DRAIN A.
	Graduate A empties into the drain reservoir.
	DRAIN A - DRAIN B valve.
2.	**Graduate B.**
a.	Fill graduate B (2, fig. 5-4) to 30 cc of fluid from the liquid graduate. Wait 5 minutes and observe the graduate scale for leakage.
	The graduate B scale indicates 30 cc of fluid. Graduate B.
	No fluid leakage is observed.
b.	DRAIN A - DRAIN B valve.....DRAIN B.
	Graduate B empties into the drain reservoir.
	DRAIN A - DRAIN B valve.
3.	**Shutdown Procedures.**
	HAND PUMP PRESSURE UNLOADING VALVE.....full ccw.
	Remove the hose assembly and quick-disconnect coupling.
	Cap the HAND PUMP PRESSURE PORT.
	Clean and store the liquid graduate, hose assembly, and quick-disconnect coupling.

Table 6-10. Timer Stop Assembly Panel Periodic Test Procedures

Step	Operation Normal Indication Corrective procedure
	NOTE **The key numbers shown below in parentheses refer to figure 5-5 unless otherwise indicated.**
1.	**Timer Stop Assembly Panel De Power.**
a.	416 VOLTS (1, fig. 5-6).....ON. 28 VOLTS (2, fig. 5-6).....ON. **The POWER INDICATOR lamp (3) illuminates.** Indicator lamp.
b.	MAKE READY(4).....ON. **The timer (1) motor energizes.** MAKE READY switch, timer motor.
2.	**TIME Switch.**
a.	TIME (5).....ON. **The timer begins to record elapsed time.** TIME switch.
b.	TIME .....OFF. **The timer stops recording elapsed time.** TIME switch.
3.	**RESET Pushbutton Switch.**
	RESET (2).....press. **The timer pointers return to the zero position.** RESET pushbutton switch.
4.	**Timer Accuracy.**
	Set the TIME switch to ON and then to OFF, as required, and check the timer against stopwatch 9173493 at 15-sec, 30-sec, 60-sec, and 3-min intervals. **NOTE** **Stopwatch 9173493 is contained in transportable electronic shop 1. The timer and stopwatch read ± 1 see of each other for all time intervals.** Timer.

Table 6-10. Timer Stop Assembly Panel Periodic Test Procedures-Continued

Step	Operation Normal Indication Corrective procedure
5.	Shutdown Procedures.
	TIME .....OFF.
	RESET .....press.
	MAKE READY .....OFF.
	416 VOLTS.....OFF.
	28 VOLTS.....OFF.

6-17. Pneumatic System Test Procedures

a. General. Table 6-11 contains the test procedures for the degreaser and accumulator test console, the air compressor, and the air reservoir assembly, which comprise the pneumatic system of transportable hydraulic shop 5.

b. Preparation for Test.

(1) Set the degreaser and accumulator test console controls to the positions indicated in table 5-13.

(2) Check the air compressor lubrication oil level through the sight glass at the rear of the compressor. Replenish with oil MIL-L-6085 if necessary.

CAUTION

Add oil incrementally to the air compressor. Wait for the sight glass indication to stabilize before adding more oil. Do not overfill by adding oil beyond the sight glass indication.

NOTE

The oil fill cap is secured to the top of the 40micron filter (3, fig. 1-5) with a lanyard.

(3) Insure that the 40-micron filter air intake ports are free of obstructions and that they are not clogged.

(4) Make certain that all electrical and pneumatic connections are properly secured.

(5) Manually rotate the compressor fan blade to insure that it turns freely and that it does not strike the fan blade guard.

(6) Remove the chemical drier cartridge from the chemical drier housing. Carefully wipe out the interior of the housing with a clean lint-free cloth to remove residual moisture or oil film accumulation.

(7) Check the chemical drier cartridge performed packing and filters for damage. Make certain that the cartridge inlet and outlet ports are unobstructed.

(8) Replace the chemical drier cartridge in the chemical drier housing. The performed packing end of the cartridge is installed at the cap plug end of the housing.

(9) Connect quick-disconnect coupling 9074508 to tube assembly 9197495. Cap the open end of the tube assembly with plug MS21913D4.

NOTE

This preassembled quick-disconnect coupling and tube assembly will be used as a test fixture.

(10) Perform the pneumatic system test procedures in table 6-11.

Table 6-11. Pneumatic System Test Procedures

Step	Operation Normal Indication Corrective procedure
	NOTE **The key numbers shown below in parentheses refer to figure 5-8 unless otherwise indicated.**
1.	**28Volt Circuit.**
	DC ACTIVATE (17).....ON.
	28 VDC (19) .....ON.
	The indicator lamp (21) illuminates. CB2, CB3, CR1, CR2, T1, indicator lamp.
2.	**Air Compressor Time Delay and Pressure Switch.**
a.	28 VDC.....OFF.
	The indicator lamp extinguishes. CB2.
b.	Wait 10 seconds, then set the 28 VDC circuit breaker to ON.
	The K1 contacts audibly open within 30 seconds from the time the 28 VDC circuit breaker is set to ON. Time delay and pressure switch, K1.
c.	COMPRESSOR (20).....ON.
	The air compressor does not start. Time delay and pressure switch, CB 1, K 1.
d.	DC ACTIVATE.....OFF.

Table 6-11. Pneumatic System Test Procedures Continued

Step	Operation Normal Indication Corrective procedure
2*d*. Cont.	Wait 30 seconds, then set the DC ACTIVATE circuit breaker to ON. **The air compressor energizes and continues to operate.** CB 1, K 1, compressor motor, time delay and pressure switch.
3.	**Low Pressure and Pneumatic System Purging.**
a.	Allow the air compressor to operate until the COMPRESSOR PRESSURE gage (1) indicates 600 to 650 psig, then set the DC ACTIVATE circuit breaker to OFF. **The air compressor shuts down and the indicator lamp extinguishes. The compressor bleed valve (fig. 3-3) and mechanical moisture separator (fig. 3-4) blow down in two distinct audible actions after shutdown. There is no evidence of air leakage.** COMPRESSOR PRESSURE gage, bleed valve, mechanical moisture separator, pneumatic fittings.
b.	Manual blowdown (3, fig. 1-6).....full ccw. **The air reservoir assembly audibly blows down. The COMPRESSOR PRESSURE gage reading decreases to zero.** Manual blowdown valve. **CAUTION** **Do not allow the air pressure to exceed the COMPRESSOR PRESSURE gage limits. If the air reservoir pressure switch fails to cut out the air compressor at 2100 ± 100 psig, shut down the air compressor, bleed the system down, correct the condition, and repeat the pneumatic system test procedures from the beginning.**
4.	**Air Reservoir Pressure Switch.**
a.	Manual blowdown full cw. DC ACTIVATE ON. Allow the air pressure to increase to 2100 ± 100 psig as monitored by the COMPRESSOR PRESSURE gage. Check carefully for air leakage. **The air compressor cuts out when 2000 to 2200 psig is indicated on the COMPRESSOR PRESSURE gage. The bleed valve and mechanical moisture separator audibly blow down in two distinct actions. There is no evidence of air leakage.** Air reservoir pressure switch, pneumatic fittings.

Table 6-11. Pneumatic System Test Procedures-Continued

Step	Operation Normal Indication Corrective procedure
b.	Turn the manual blowdown valve slightly counterclockwise to relieve air pressure from the air reservoir assembly. Monitor the COMPRESSOR PRESSURE gage. **The air compressor reenergizes when the COMPRESSOR PRESSURE gage indicates 1600 to 1800 psig.** Air reservoir pressure switch.
5.	**HIGH PRESSURE AIR Valve.**
a.	Manual blowdown .....full cw. **NOTE** **Wait until the COMPRESSOR PRESSURE gage indicates 2,000 ±100 psig before performing this step.** Adjust the HIGH PRESSURE AIR REGULATOR control (15) clockwise in the LOAD direction. Hold the control in this position for 5 to 6 seconds, then release it. **The HIGH PRESSURE AIR REGULATOR control rotates freely through 60 degrees of travel until it engages its limit stops. The HIGH PRESSURE AIR gage (2) indicates zero psig. The HIGH PRESSURE AIR REGULATOR control returns automatically to the neutral position.** **NOTE** **Partial air venting may occur due to residual air in the pneumatic lines. HIGH PRESSURE AIR valve (22), HIGH PRESSURE AIR REGULATOR.**
b.	Adjust the HIGH PRESSURE AIR REGULATOR control counterclockwise to the VENT position. Hold the control in this position for 5 to 6 seconds, then release it. **There is no audible sound of air venting. The HIGH PRESSURE AIR REGULATOR control returns automatically to the neutral position.** HIGH PRESSURE AIR valve, HIGH PRESSURE AIR REGULATOR. **NOTE** **Wait until the COMPRESSOR PRESSURE gage indicates 2100 ± 100 psig before performing this step.**
6.	**HIGH PRESSURE AIR REGULATOR.**
a.	HIGH PRESSURE AIR.....full ccw. Incrementally build up pressure by repeatedly adjusting the HIGH PRESSURE AIR REGULATOR control clockwise, then releasing it, until maximum pressure is indicated on the HIGH PRESSURE AIR gage.

Table 6-11. Pneumatic System Test Procedures-Continued

Step	Operation Normal Indication Corrective procedure
6 a. Cont.	**The HIGH PRESSURE AIR RECUI^ATOR control returns to the neutral position and the HIGH PRESSURE AIR gage indications stabilize each time the HIGH PRESSURE AIR REGULATOR control is released. The HICH PRESSURE AIR gage reads 1700 to 1900 psig.** HIGH PRESSURE AIR REGULATOR, HIGH PRESSURE AIR gage.
b.	Momentarily adjust the HIGH PRESSURE AIR REGULATOR control counterclockwise to the VENT position, then release it. Repeat this action several times, until the HIGH PRESSURE AIR gage reads zero. **The HIGH PRESSURE; AIR REGULATOR audibly vents; the HIGH PRESSURE AIR REGULATOR control returns to the neutral position; and the HICH PRESSURE AIR gage indication stabilizes each time the control is turned and for released.** HIGH PRESSURE AIR REGULATOR, HIGH PRESSURE AIR gage.
7.	**HIGH PRESSURE AIR OUTLET Valve and HIGH PRESSURE AIR Port.**
a.	Connect quick-disconnect coupling 9074508 to the HIGH PRESSURE AIR port (18). HIGH PRESSURE AIR OUTLET (16.....full ccw. Momentarily adjust the HIGH PRESSURE AIR REGULATOR control clockwise, then release it. **Air is discharged from the open-ended quick-disconnect coupling.** HIGH PRESSURE AIR OUTLET valve, HIGH PRESSURE AIR port.
b.	HIGH PRESSURE AIR OUTLET.....full cw. Repeatedly adjust the HIGH PRESSURE AIR REGULATOR control clockwise, then release it until the HIGH PRESSURE AIR gage reads 1750 to 1800 psig. Check for air leakage. **There is no evidence of air leakage.** HIGH PRESSURE AIR OUTLET valve.
c.	Remove the quick-disconnect coupling from the HIGH PRESSURE AIR port. HIGH PRESSURE AIR OUTLET.....full ccw. Check for air leakage. **There is no evidence of air leakage**. HIGH PRESSURE AIR port.
d.	Adjust the HIGH PRESSURE AIR REGULATOR control counterclockwise to the VENT position until the HIGH PRESSURE AIR gage indication decreases to zero.

Table 6-11. Pneumatic System Test Procedures-Continued

Step	Operation Normal Indication Corrective procedure
7 d. Cont.	Connect the preassembled quick-disconnect coupling and tube assembly to the HIGH PRESSURE AIR OUTLET port. Adjust the HIGH PRESSURE AIR REGULATOR control clockwise to the LOAD position until the HIGH PRESSURE AIR gage reads 1650 to 1750 psig. Check for air leakage. There is no evidence of air leakage. HIGH PRESSURE AIR port.
8.	**HIGH PRESSURE AIR TO TEST TANK Valve.**
a.	Adjust the HIGH PRESSURE AIR REGULATOR control counterclockwise to the VENT position until the HIGH PRESSURE AIR gage indicates 0 psig. Remove the preassembled coupling and tube assembly. Open and secure the accumulator test tank cover. Adjust the HIGH PRESSURE AIR REGULATOR control clockwise to the LOAD position until the HIGH PRESSURE AIR gage indicates 500 psig. HIGH PRESSURE AIR TO TEST TANK (14).....slightly ccw. **Air is discharged from the bottom port in the accumulator test tank.** HIGH PRESSURE AIR TO TEST TANK valve.
b.	HIGH PRESSURE AIR TO TEST TANK . full cw. **No air is discharged from the accumulator test tank bottom port.** HIGH PRESSURE AIR TO TEST TANK valve.
9.	**LOW PRESSURE AIR OUTLET Valve.**
a.	Close and secure the accumulator test tank cover. Adjust the HIGH PRESSURE AIR REGULATOR control counterclockwise to the VENT position. Adjust the LOW PRESSURE AIR REGULATOR control (10) clockwise in the LOAD direction. Hold the control in this position for 5 to 6 seconds, then release it. **The LOW PRESSURE AIR REGULATOR control rotates freely through 60 degrees of travel until it engages its limit stops. The LOW PRESSURE AIR AND AIR GUN gage (4) indicates zero psig. The LOW PRESSURE AIR REGULATOR control returns automatically to the neutral position.** **NOTE** **Partial air venting may occur due to residual air in the pneumatic lines** LOW PRESSURE AIR REGULATOR, LOW PRESSURE AIR OUTLET valve (11).
b.	Adjust the LOW PRESSURE AIR REGULATOR control counterclockwise to the VENT position. Hold the control in this position for 5 to 6 seconds, then release it.

Table 6-11. Pneumatic System Test Procedures-Continued

Step	Operation Normal Indication Corrective procedure
9 b Cont.	**There is no audible sound of air venting. The LOW PRESSURE AIR REGULATOR control returns automatically to the neutral position.** LOW PRESSURE AIR REGULATOR, LOW PRESSURE AIR OUTLET valve.
10.	**LOW PRESSURE AIR REGULATOR.**
a.	LOW PRESSURE AIR .....full ccw. Incrementally build up pressure by repeatedly adjusting the LOW PRESSURE AIR REGULATOR control clockwise, then releasing it, until 185 psig is indicated on the LOW PRESSURE AIR AND AIR GUN gage. **The LOW PRESSURE AIR REGULATOR control returns to the neutral position and the LOW PRESSURE AIR AND AIR GUN gage indications stabilize each time the LOW PRESSURE AIR REGULATOR control is released.** LOW PRESSURE AIR REGULATOR, LOW PRESSURE AIR AND AIR GUN gage, gage protector.
b.	Adjust the LOW PRESSURE AIR REGULATOR control counterclockwise to the VENT position until the LOW PRESSURE AIR AND AIR GUN gage reads zero psig. **The LOW PRESSURE AIR REGULATOR audibly vents and the LOW PRESSURE AIR REGULATOR control returns to the neutral position.** LOW PRESSURE AIR REGULATOR, LOW PRESSURE AIR AND AIR GUN gage, gage protector.
11.	**LOW PRESSURE AIR OUTLET Valve and LOW PRESSURE AIR Port.**
a.	Connect quick-disconnect coupling 9074508 to the LOW PRESSURE AIR port (12). LOW PRESSURE AIR OUTLET (11) .....full ccw. Adjust the LOW PRESSURE AIR REGULATOR control clockwise until 40 psig is indicated on the LOW PRESSURE AIR AND AIR GUN gage. **Air is discharged from the open-ended quick-disconnect coupling.** LOW PRESSURE AIR OUTLET valve, LOW PRESSURE AIR port.
b.	LOW PRESSURE AIR OUTLET.....full cw. Repeatedly adjust the LOW PRESSURE AIR REGULATOR control clockwise, then release it, until 170 to 190 psig is indicated on the LOW PRESSURE AIR AND AIR GUN gage. Check for air leakage. **There is no evidence of air leakage.** LOW PRESSURE AIR OUTLET valve.
c.	Remove the quick-disconnect coupling from the LOW PRESSURE AIR port.

Table 6-11. Pneumatic System Test Procedures-Continued

Step	Operation Normal Indication Corrective procedure
11.c. Cont.	LOW PRESSURE AIR OUTLET.....full ccw. Check for air leakage. **There is no evidence of air leakage.** LOW PRESSURE AIR port.
d.	Adjust the LOW PRESSURE AIR REGULATOR control counterclockwise to the VENT position until the LOW PRESSURE AIR AND AIR GUN gage indication decreases to zero. Connect the preassembled coupling and tube assembly to the LOW PRESSURE AIR port. Adjust the LOW PRESSURE AIR REGULATOR control clockwise to the LOAD position until the LOW PRESSURE AIR AND AIR GUN gage reads 170 to 190 psig. Check for air leakage. **There is no evidence of air leakage.** LOW PRESSURE AIR port.
12.	**AIR GUN OUTLET Valve and AIR GUN Port.**
a.	Adjust the LOW PRESSURE AIR REGULATOR control counterclockwise to the VENT position until the LOW PRESSURE AIR AND AIR GUN gage indicates 40 psig, and then release it. Connect quick-disconnect coupling 9074508 to the AIR GUN port (9). AIR GUN OUTLET (8) .....full ccw. **Air is discharged from the open-ended quick-disconnect coupling.** LOW PRESSURE OUTLET valve, LOW PRESSURE AIR AND AIR GUN gage.
b.	AIR GUN OUTLET .....full cw. Repeatedly adjust the LOW PRESSURE AIR REGULATOR control clockwise, then release it, until 170 to 190 psig is indicated on the LOW PRESSURE AIR AND AIR GUN GAGE. Check for air leakage. **There is no evidence of air leakage.** LOW PRESSURE AIR OUTLET valve.
c.	Remove the quick-disconnect coupling. AIR GUN OUTLET.....full ccw. Check for air leakage. **There is no evidence of air leakage.** AIR GUN port.
d.	Adjust the LOW PRESSURE AIR REGULATOR control counterclockwise to the VENT position until the LOW PRESSURE AIR AND AIR GUN gage indication decreases to zero.

Table 6-11. Pneumatic System Test Procedures-Continued

Step	Operation Normal Indication Corrective procedure
12d. Cont.	Transfer the coupling and tube assembly from the LOW PRESSURE AIR port to the AIR GUN port. Adjust the LOW PRESSURE AIR REGULATOR control clockwise to the LOAD position until the LOW PRESSURE AIR AND AIR GUN gage reads 170 to 190 psig. Check for air leakage. **There is no evidence of air leakage.** AIR GUN port.
13.	**DEGREASER Valve.**
a.	Adjust the LOW PRESSURE AIR REGULATOR control counterclockwise to the VENT position until the LOW PRESSURE AIR AND AIR GUN gage indication decreases to zero. Remove the coupling and tube assembly from the AIR GUN port. Adjust the LOW PRESSURE AIR REGULATOR control clockwise to the LOAD position until the LOW PRESSURE AIR AND AIR GUN GAGE reads 100 psig. Open and secure the degreaser tank cover. DEGREASER (7).....full ccw. **The DEGREASER AIR PRESSURE gage (5) indicates 55 to 60 psig. Air audibly flows into the degreaser tank.** DEGREASER valve, DEGREASER AIR PRESSURE gage or gage protector.
b.	DEGREASER (7).....full cw. Close and secure the degreaser tank cover. Turn the DEGREASER valve counterclockwise until the DEGREASER AIR PRESSURE gage indicates 30 psig. **Air is discharged through the vent door which is outside the shelter and behind the degreaser and accumulator test console.** DEGREASER valve, DEGREASER AIR PRESSURE gage or gage protector.
c.	DEGREASER .....full cw. Close and secure the vent door which is outside the shelter. 28 VDC.....OFF. Turn the DEGREASER valve counterclockwise until the DEGREASER AIR PRESSURE gage indicates 50 psig. Turn the DEGREASER valve fully clockwise after the following indication is observed. **Air is discharged through the vent pipe under the air compressor.** Defective seals on the vent door, defective seals for the degreaser tank cover, loose pneumatic connections, defective check valve (15, fig. 7-26).

Table 6-11. Pneumatic System Test Procedures-Continued

Step	Operation Normal Indication Corrective procedure
	Shutdown Procedures
	COMPRESSOR .....OFF.
	DC ACTIVATE.....OFF.
	28 VDC .....OFF.
	LOW PRESSURE AIR .....full ccw.
	AIR GUN OUTLET .....full ccw.
	LOW PRESSURE AIR OUTLET .....full ccw.
	HIGH PRESSURE AIR OUTLET .....full ccw.
	HIGH PRESSURE AIR.....full ccw.
	Adjust the LOW PRESSURE AIR REGULATOR and HIGH PRESSURE AIR REGULATOR controls counterclockwise to the VENT position. Maintain them in this position until they are completely vented.
	Turn the manual blowdown valve fully counterclockwise until the COMPRESSOR PRESSURE gage indicates zero; then turn the blowdown valve fully clockwise.

6-18. Degreaser and Accumulator Test Console Air Gage Periodic Test Procedures

a. General. Table 6-12 contains detailed periodic test procedures for the degreaser and accumulator air gages.

b. Preparation for Test.

(1) Set the hydraulic test console controls to the positions indicated in table 5-12.

(2) Perform the pneumatic system test procedures (par. 6- 17). Perform only steps 1 through 3 of table 6-11.

(3) Connect quick-disconnect coupling 9194685 to each end of hose assembly MS287628-0490.

(4) Connect the assembled hose assembly between one of the SUPPLY PORTS (12, fig. 5-2) and TEST PORT B-1 (13, fig. 5-3).

(5) Connect quick-disconnect coupling 9194685 to one end of another hose assembly MS28762-8-0490.

(6) Connect to the other end of the hose assembly, in the following order, reducer MS21916D12-8, tube assembly 9197359, and quick-disconnect coupling 9194686.

(7) Connect the assembled hose assembly between TEST PORT B-2 (12, fig. 5-3) and the DIRECT RETURN PORT (15, fig. 5-2).

(8) Connect to one end of hose assembly MS28762-8-0490, in the following order, reducer MS21916D8-4, tube assembly 9197495, and quick-disconnect coupling 9074508.

(9) To the other end of the hose assembly connect, in the following order, the end section of tee MS21905D8, tube assembly 9197361, and quick-disconnect coupling 9194685.

(10) To the center section of the tee, connect, in the following order, tube assembly 9197361, reducer MS21916D8-4, hose assembly MS28762-40250, and quick-disconnect coupling 9194683.

(11) Connect quick-disconnect coupling 9194683 to the HAND PUMP PRESSURE PORT (12, fig. 5-1); quick-disconnect coupling 9194685 to the DISCHARGE PORT (10, fig. 5-1); and quick-disconnect coupling 9074508 to the HIGH PRESSURE AIR port (18, fig. 5-8).

(12) Disconnect the tube assembly from the tee (28 and 29, fig. 7-26).

(13) Install a cap MS21914D4 on each end of the tee.

(14) Sensing clement selector valve (10, fig. 5-2) FLOWMETER BYPASS.

(15) THROTTLING VALVE B (17, fig. 5-3) .....full cw.

(16) SYSTEM PRESSURE GAGE SELECTOR (4, fig. 5-3) .....0.-2000.

(17) HAND PUMP PRESSURE UNLOADING VALVE (13, fig. 5-1) .....full cw.

(18) LOW PRESSURE GAGE SHUTOFF (4, fig. 5- 1) .....full cw.

(19) HIGH PRESSURE AIR (22, fig. 5-8) .....full ccw.

(20) HIGH PRESSURE AIR OUTLET (16, fig. 5-8) full cow.

(21) Manual blowdown (3, fig. 1-6).....full cw.

(22) Disconnect the heater exchanger inlet and outlet lines from the inlet and outlet connectors (12, fig. 1-3).

NOTE

The above precautionary measure is taken to insure that the heat exchanger cores are not damaged if the hydraulic test console THROT-TLING VALVE: B is defective.

(23) Perform the degreaser and accumulator air gage periodic test procedures in table 6- 12.

Table 6-11. Pneumatic System Test Procedures-Continued

Step	Operation Normal Indication Corrective procedure
	NOTE **The key numbers shown below in parentheses refer to figure 5-8 unless otherwise indicated.**
1.	**COMPRESSOR PRESSURE and HIGH PRESSURE AIR Gages**
a.	DC ACTIVATE (17) ON. Allow the air compressor to operate until the COMPRESSOR PRESSURE gage (1) indicates 525 psig, then set the DC ACTIVATE circuit breaker to OFF. **WARNING** **Combining high pressure air and hydraulic fluid produces explosions. Throughout the remainder of this procedure, never turn the HIGH PRESSURE AIR REGULATOR control (15) to the VENT position, as this will siphon hydraulic fluid from the hydraulic test console into the pneumatic system. If it becomes necessary to vent the air regulator, perform the following procedures:** (1) HIGH PRESSURE AIR OUTLET (16) full cw. (2) HIGH PRESSURE AIR REGULATOR (15) .....VENT. (3) Slightly turn the THROTTLING VALVE B(17, fig. 5-3) counter-clockwise until the 0-2000 PSI GAGE (3, fig. 5-3) reads zero. (4) HIGH PRESSURE AIR OUTLET ..... full ccw. (5) Repeat the applicable loading procedure. Adjust the HIGH PRESSURE AIR REGULATOR control clockwise to the LOAD position. Hold the control in this position until the 0-2000 PSI GAGE indication stabilizes. **With the HIGH PRESSURE Ally REGULATOR control held in the LOAD position, the COMPRESSOI] PRESSURE gage and the HIGH PRESSURE AIR gage (2) read ± 5% psig of the 0-2000 PSI GAGE.** **NOTE** **Pressure variations between the HIGH PRESSURE AIR and the COMPRESSOR PRESSURE gages are due to the pressure drop across the AIR REGULATOR.** COMPRESSOR PRESSURE gage, HIGH PRESSURE AIR gage.
b.	DC ACTIVATE.....ON. Allow the air compressor to operate until the COMPRESSOR PRESSURE gage indicates 1025 psig, then set the DC ACTIVATE circuit breaker to OFF. Adjust the HIGH PRESSURE AIR REGULATOR control clockwise to the LOAD position. Hold the control in this position until the 0-2000 PSI GAGE indication stabilizes.

Table 6-12. Degreaser and Accumulator Air Gage Periodic Test Procedures -Continued

Step	Operation Normal Indication Corrective procedure
1*b.* Cont.	**With the HIGH PRESSURE AIR REGULATOR control held in the LOAD position, the COMPRESSOR PRESSURE and the HIGH PRESSURE AIR gages read ± 5 % psig of the 0-2000 PSI GAGE.** COMPRESSOR PRESSURE gage, HIGH PRESSURE AIR gage.
c.	DC ACTIVATE.....ON. Allow the air compressor to operate until the COMPRESSOR PRESSURE gage indicates 1525 psig, then set the DC ACTIVATE circuit breaker to OFF. Adjust the HIGH PRESSURE AIR REGULATOR control clockwise to the LOAD position. Hold the control in this position until the 0-2000 PSI GAGE indication stabilizes. **With the HIGH PRESSURE AIR REGULATOR control held in the LOAD position, the COMPRESSOR PRESSURE and the HIGH PRESSURE AIR gages read ± 5 % psig of the 0-2000 PSI GAGE.** COMPRESSOR PRESSURE gage, HIGH PRESSURE AIR gage.
d.	.DC ACTIVATE.....ON. Allow the air compressor to operate until the COMPRESSOR PRESSURE gage indicates 1925 psig, then set the DC ACTIVATE circuit breaker to OFF. Adjust the HIGH PRESSURE AIR REGULATOR control clockwise to the LOAD position. Hold the control in this position until the 0-2000 PSI GAGE indication stabilizes. **With the HIGH PRESSURE AIR REGULATOR control held in the LOAD position, the COMPRESSOR PRESSURE and the HIGH PRESSURE AIR gages read ± 5 % psig of the 0-2000 PSI GAGE.** COMPRESSOR PRESSURE gage, HIGH PRESSURE AIR gage.
e.	HIGH PRESSURE AIR OUTLET.....full cw. Slightly turn THROTTLING VALVE B (17, fig. 5-3) counterclockwise to relieve the pressure on the 0-2000 PSI GAGE. SYSTEM PRESSURE GAGE SELECTOR ....0-4000. THROTTLING VALVE B ....full cw. Slowly turn the HIGH PRESSURE AIR OUTLET valve fully counterclockwise. Allow the 0-4000 PSI GAGE (2, fig. 5-3) indication to stabilize. DC ACTIVATE.....ON. Allow the air compressor to operate until it automatically deenergizes. Adjust the HIGH PRESSURE AIR REGULATOR control held in the LOAD position, Hold the control in this position until the 0-4000 psi GAGE indication stabilizes. **With the HIGH PRESSURE AIR REGULATOR control held in the LOAD position, the COMPRESSOR PRESSURE and the HIGH PRESSURE AIR gages read ±5% psig of the 0-4000 PSI GAGE.** COMPRESSOR PRESSURE GAGE, HIGH PRESSURE AIR gage.

Table 6-12. Degreaser and Accumulator Air Gage Periodic Test Procedures -Continued

Step	Operation Normal Indication Corrective procedure
2.	**LOW PRESSURE AIR AND AIR GUN Gage and DEGREASER AIR PRESSURE Gage.**
a.	HIGH PRESSURE AIR OUTLET.....full cw. HIGH PRESSURE AIR REGULATOR .....vent. THROTTLING VALVE B .....slightly ccw. SYSTEM PRESSURE GAGE SELECTOR .....0-400. THROTTLING VALVE B .....full cw. Disconnect the hose assembly from the HIGH PRESSURE AIR port and reconnect it to the LOW PRESSURE AIR port (12). LOW PRESSURE GAGE SHUTOFF (4, fig. 5-1) .....full cw. LOW PRESSURE AIR OUTLET (11) .....full ccw. DEGREASER (7) .....full ccw. **WARNING** **Combining high pressure air and hydraulic fluid produces explosions. Throughout the remainder of this step, never turn the LOW PRESSURE AIR REGULATOR control (10) to the VENT position, as this will siphon hydraulic fluid from the hydraulic test console into the pneumatic system. If it becomes necessary to vent the air regulator, perform the following procedures:** (1) LOW PRESSURE AIR OUTLET.....full cw. (2) LOW PRESSURE AIR REGULATOR.....VENT. (3) Slightly turn the THROTTLING VALVE B counterclockwise until the 0-100 PSI GAGE (1, fig. 5-1) reads zero. (4) THROTTLING VALVE B .....full cw. (5) LOW PRESSURE AIR OUTLET.....full ccw. (6) Repeat the applicable loading procedure. Adjust the LOW PRESSURE AIR REGULATOR control clockwise to the LOAD position until 8 to 12 psig is indicated on the LOW PRESSURE AIR AND AIR GUN gage (4). Allow the DEGREASER AIR PRESSURE gage (5) and the 0-100 PSI GAGE (1, fig. 5-1) readings to stabilize. **The LOW PRESSURE AIR AND AIR GUN gage and the DEGREASER AIR PRESSURE gage read +5% of the 0--100 PSI GAGE.** LOW PRESSURE AIR AND AIR GUN gage, DEGREASER AIR PRESSURE gage.
b.	Adjust the LOW PRESSURE AIR REGULATOR control clockwise to the LOAD position until 48 to 52 psig is indicated on the LOW PRESSURE AIR AND AIR GUN gage. Allow the DEGREASER AIR PRESSURE gage and the 0-100 PSI GAGE readings to stabilize.

Table 6-12. Degreaser and Accumulator Air Gage Periodic Test Procedures -Continued

Step	Operation Normal Indication Corrective procedure
2b. Cont.	**The LOW. PRESSURE AIR AND AIR GUN gage and the DEGREASER AIR PRESSURE gage read ± 5% of the 0-100 PSI GAGE.** LOW PRESSURE AIR AND AIR GUN gage, DEGREASER AIR PRESSURE gage.
c.	DEGREASER .....full cw. LOW PRESSURE GAGE SHUTOFF .....full cw. Adjust the LOW PRESSURE AIR REGULATOR control clockwise to the L6AD position until the LOW PRESSURE AIR AND AIR GUN gage reads 98 to 102 psig. Allow the gage indication to stabilize. **The LOW PRESSURE AIR AND AIR GUN gage reads ± 5% psig of the 0-400 PSI GAGE (1, fig. 5-3).** LOW PRESSURE AIR AND AIR GUN gage.
d.	Adjust the LOW PRESSURE AIR REGULATOR control clockwise to the LOAD position until the LOW PRESSURE AIR AND AIR GUN gage reads 148 to 152 psig. Allow the gage indication to stabilize. **The LOW PRESSURE AIR AND AIR GUN gage reads ± 5% psig of the 0-400 PSI GAGE.** LOW PRESSURE AIR AND AIR GUN gage.
e.	Adjust the LOW PRESSURE AIR REGULATOR control clockwise to the LOAD position until the LOW PRESSURE AIR AND AIR GUN gage reads 178 to 182 psig. Allow the gage indication to stabilize. **The LOU- PRESSURE AIR AND AIR GUN gage reads ±5% prig of the 0-400 PSI GAGE.** LOW PRESSURE AIR AND AIR GUN gage.
3.	**Shutdown Procedures.** LOW PRESSURE AIR OUTLET .....full cw. LOW PRESSURE AIR REGULATOR.....vent. Turn the THROTTLING VALVE B fully counterclockwise until the O-400 PSI GAGE indication decreases to zero. LOW PRESSURE GAGE SHUTOFF.....full ccw. Disconnect and disassemble all test hose connections. Wash all fittings and hose assembly couplings with Stoddard solvent from an orificed plastic squeeze bottle and store them. DEGREASER .....full ccw. Perform the pneumatic system test procedures (step 14, table 6-11). Remove the caps from the tee and reconnect the tube assembly (29 and 28, fig. 7-26) Reconnect the heat exchanger inlet and outlet lines to the connectors (12, fig. 1-3).

6-19. Deleted

Table 6-13. Deleted

6-20. Hydraulic Test Console Dc Circuits Periodic Test Procedures

a. Test Equipment and Accessories. Test equipment and accessories used to test the hydraulic test console dc circuits are listed in table 6-14.

b. Preparation for Test.

(1) Visually inspect the electrical components on the hydraulic test console upper center panel (fig. 5-2) to insure that they are properly positioned, secured, and undamaged.

(2) Set all of the hydraulic test console circuit breakers to OFF (table 5-12).

(3) Perform a continuity check on test cable 9197355 to determine which clip is connected to pin A and which clip is connected to pin B of the test cable connector.

(4) Calibrator standard (CAL STD) FUNCTION MULTI.

(5) Momentarily set the CAL STD VDC switch to the down position.

Table 6-14. Test Equipment and Accessories

Item	FSN no.	Part no.
Calibrator standard		10178692
Resistor: 301K, 1/2w., 1% tol	5905-615-1474	9052931
Resistor: 4.02K, 1/2w, 1% tol	5905-998-0155	RN70D-4021F
Resistor: 453 ohm, 10w, 1% tol	5905-995-6658	9059641
Resistor: 10 ohm, 15w, 1% tol	5905-824-3125	RE70G-10RO
Cable		9197355

(6) Connect the test cable to the OUTPUT 28 VDC connector (19, fig. 5-2).

(7) Connect the CAL STD COMMON test lead to the pin B clip of the test cable connector.

(8) Connect the CAL STD DC VOLTS test lead to the pin A clip of the test cable connector.

(9) Perform the periodic test procedures described in table 6-15.

Table 6-15. Hydraulic Test Console Dc Circuits Periodic Test Procedures

Step	Operation Normal Indication Corrective procedure
	NOTE **The key numbers shown below in parentheses refer to figure 5-2 unless otherwise indicated.**
1.	**VOLTMETER.**
a.	416 VOLTS (1, fig. 5-6).....ON. 28 VOLTS (2, fig. 5-6) .....ON. CIRCUIT BREAKER (18) .....ON (UP). POWER ADJUST (3) cw.....5 volts on cal std. **The VOLTMETER (1) indicates 4 to 6 volts.** VOLTMETER.
b.	POWER ADJUST cw.....10 volts on cal std. **The VOLTMETER indicates 9 to 11 volts.** VOLTMETER.
c.	POWER ADJUST cw .....15 volts on cal std. **The VOLTMETER indicates 14 to 16.** VOLTMETER.
d.	POWER ADJUST cw.....20 volts on cal std. **The VOLTMETER indicates 19 to 21 volts.** VOLTMETER.
e.	POWER ADJUST cw.....25 volts on cal std. **The VOLTMETER indicates 24 to 26 volts.** VOLTMETER.
2.	**AMMETER Shunts.**
a.	POWER ADJUST .....full ccw. CIRCUIT BREAKER .....off (down). Connect the 4.02K resistor between the test cable clips. Range selector (8) .....0-10 MILLIAMPS. CIRCUIT BREAKER .....on (up). POWER ADJUST clockwise .....20 volts on cal std. **The AMMETER (20) indicates 47 to 53 ma.** **NOTE** **The actual current through the 4.02K resistor is 100 x this indication.** Adjust R5. R1, S2.

Table 6-15. Hydraulic Test Console Dc Circuits Periodic Test Procedures -Continued

Step	Operation Normal Indication Corrective procedure
2b. Cont.	POWER ADJUST .....full ccw. CIRCUIT BREAKER .....off (down). Replace the 4.02K resistor with the 453-ohm resistor. Range selector.....0-100 MILLIAMPS. CIRCUIT BREAKER .....on (up). POWER ADJUST cw .....20 volts on cal std. **The AMMETER indicates 41 to 47 μa.** **NOTE** **The actual current through the 453-ohm resistor is 1000 x this indication.** R2, S2.
c.	POWER .....ADJUSTfull ccw. CIRCUIT BREAKER .....off (down). Replace the 453-ohm resistor with the 10-ohm resistor. Range selector .....0-2 AMPS. CIRCUIT BREAKER .....on (up). POWER ADJUST cw .....10 volts on cal std. **The AMMETER indicates 47 to 53 ma.** **NOTE** **The actual current through the 10-ohm resistor is 20000 x this indication.** R3, S2.
3.	**AMMETER and Overload Circuits.**
a.	POWER ADJUST .....full ccw. CIRCUIT BREAKER .....off (down). Replace the 10-ohm resistor with the 301K resistor. Adjust the AMMETER overload adjust screw (the red pointer of the AMMETER) to the 100- μ a position. Range selector.....0-100 MICROAMPS. CIRCUIT BREAKER .....on (up). POWER ADJUST cw .....10 volts on cal std **The AMMETER indicates 29 to 36 μ a.** AMMETER.

Table 6-15. Hydraulic Test Console Dc Circuits Periodic Test Procedures-Continued

Step	Operation Normal Indication Corrective procedure
3b. Cont.	POWER ADJUST cw.....20 volts on cal std. **The AMMETER indicates 62 to 70 ma.** AMMETER.
c.	POWER ADJUST cw.....27 volts on cal std. **The AMMETER indicates 84 to 93 ma (record).** AMMETER.
d.	Slowly adjust the AMMETER overload adjust screw counterclockwise until the METER OVERLOAD lamp (2) illuminates. **Both the VOLTMETER and the cal std indicate zero. The red pointer of the AMMETER indicates ± 3 ma of the reading recorded in step 3c above.** DS1, overload relay K1, M2.
e.	Adjust the AMMETER overload adjust screw clockwise until the AMMETER red pointer indicates 100 µ a. Press the RESET BUTTON (17). **The AMMETER indicates 84 to 93 ma.** **The cal std indicates 27 volts.** **The METER OVERLOAD lamp extinguishes.** RESET BUTTON.
4.	Shutdown Procedures. POWER ADJUST .....full ccw. CIRCUIT BREAKER .....off (down). 416 VOLTS.....OFF. 28 VOLTS.....OFF. Remove the test cable and the 301K ohm resistor. Store the test cable and test resistors.

Section V. LOAD-TESTING THE MISSILE HOISTING BEAM

6-21. General

This section contains instructions for load-testing the guided missile hoisting beam and for constructing a missile load test fixture mounting block. The missile hoisting beam (TM 9-1410530-14) is tested annually, or immediately following any modification or repair of the beam which might affect its lifting capability. Table 6-16 lists the materials required to construct the fixture mounting block. Requisition these materials through normal supply channels.

Table 6-16 Materials Required to Construct the Load Test Fixture Mounting Block

Item	Part No.	Quantity
Bar, flat steel, 1/2 in. by 2 in., type QQ-S-6332	Fed Spec QQ-S-6332	21 ft.
Bar, round steel, 1 in., type CD1018	Fed Spec158 ft. QQ-S-6332	
Concrete, 1-2-4 mix		3-1/3 cu yd
Nut, plain, hex, S, plain fin., 1-8 NC-2B, 1/2-in. w, 35/64 in. thk	5310-021-8545	4
Washer, flat, S, plain fin., 1-1/32 in. id, 0.109 thk	5310-050-2242	4

6-22. Constructing the Load Test Fixture Mounting Block

a. Construct a sturdy 3 x 3 x 10-foot form to hold the concrete mix.

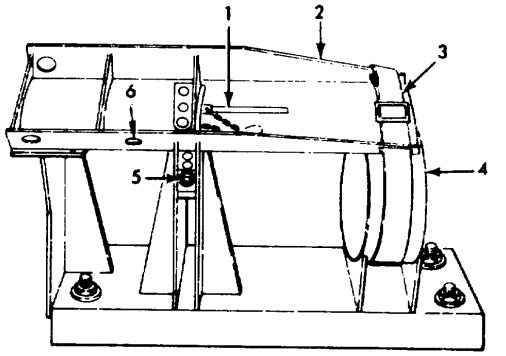
NOTE

The form may be constructed in the ground so that the top surface of the finished mounting block is at ground level.

b. Fabricate four L-shaped rods, at least 3 feet long, from the round bar stock.

c. Place the L-shaped rods in the form. Make certain that the rods are properly spaced to receive the load test fixture (4, fig. 6-1), and then firmly secure them stationary.

d. Use the flat bar stock and the remainder of the round bar stock in the form as reinforcing rods.



1-Captive wrench
2-Missile hoisting beam
3-Belt
4-Load test fixture
5-Shoulder bolt
6-Can hole

Figure 6-1. Missile hoisting beam attached to the load test fixture.

e. Fill the form with the concrete mix. Allow the concrete to cure 72 hours before performing the next step.

f. Thread the protruding round bars to fit the hexagon nuts listed in table 6-16.

6-23. Missile Hoisting Beam Test Procedure

NOTE

The key numbers shown below in parentheses refer to figure 6-1.

a. Test.

(1) Secure the load test fixture (4) to the mounting block, using the four flat washers and the hexagon nuts listed in table 6-16.

(2) Bolt the missile hoisting beam (2) to the test fixture. Tighten the two shoulder bolts (5) with the captive wrench (1).

(3) Wrap the belt (3) around the test fixture. Take up the slack in the belt until it is tight.

NOTE

The key numbers shown below in parentheses refer to figure 6-2.

(4) Attach the dynamometer (3) to the hoisting beam (5) with the shackle (4) through one of the three holes in the beam. Then attach the link (2) to the dynamometer.

NOTE

The dynamometer shackle, and the link are contained in Army tool kit SC 5180-92-CLAOA and in USMC field maintenance hydraulic tool kit NSN 5180-00-724-098.

(5) Attach the link to the hoisting cable hook (1) of the M62 wrecker.

WARNING

In performing the following steps, use extreme caution while the equipment is under tension.

(6) Very gradually and steadily apply tension to the hoisting beam until the dynamometer indicates 2600 pounds.

(7) While the beam is under tension, examine the beam for evidence of fatigue or yield.

(8) Slowly release the tension on the beam.

(9) Remove the shackle from the hoisting beam. Repeat steps (4) through (8) above to test the remaining holes in the hoisting beam.

(10) Remove the beam from the test fixture and examine the beam for the following: (a) Twisted, bent, or cracked beam members.

(a) Deformed or damaged bolts.

(c) Frayed or damaged belt.

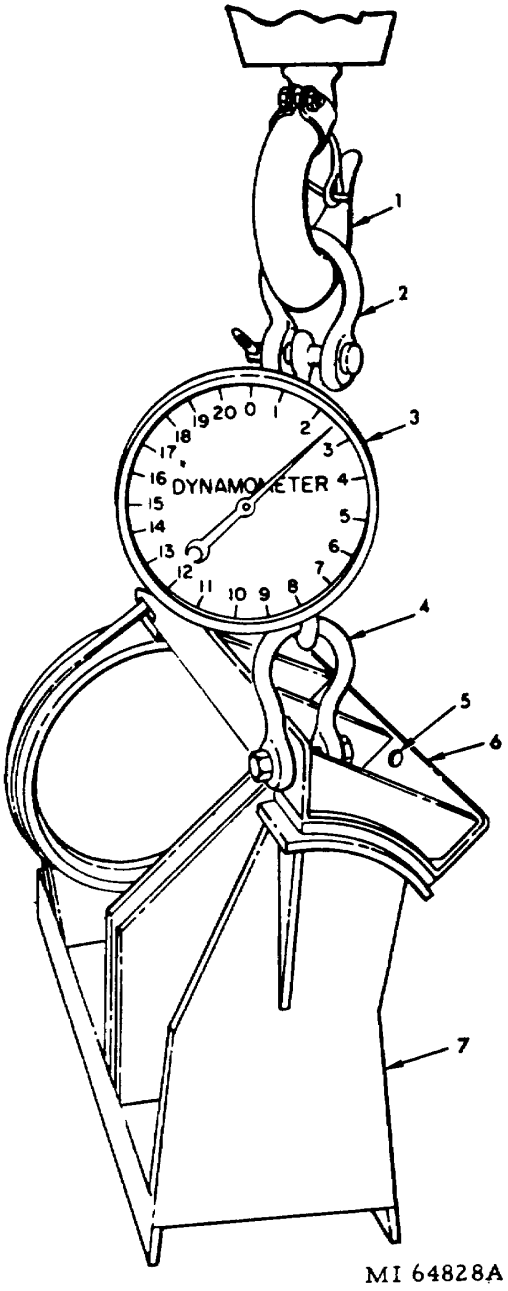
(d) Handling damage that may have resulted in burs, gouges, or other unsatisfactory conditions requiring repair..

NOTE

Hoisting beams which require repair beyond the capabilities of the general support unit will be returned to depot.

b. Stamp the date of the load test and the rated capacity of the hoisting beam on the side of the beam, using the universal stamping kit (SB 9-185). Coat the number with varnish.

c. Remove and store the test equipment and the test fixture.



1-Hoisting cable hook
2-Link
3-Dynamometer
4-Shackle
5-Can hole
6-Missile hoisting beam
7-Load test fixture

Figure 6-2. Dynamometer attached to the hoisting bean.

CHAPTER 7

MAINTENANCE OF TRANSPORTABLE HYDRAULIC SHOP 5

Section I. GENERAL MAINTENANCE

7-1. General
For general maintenance instructions, refer to TM 9-1425-525-12-4 and TM 9-1425-525-34.

7-2. Repair
It may be necessary to remove some components to gain access to those needing repair. Where repair or replacement is complex, specific instructions and exploded view illustrations are provided in sections II through VII.

Section II. MAINTENANCE OF THE HYDRAULIC TEST CONSOLE

WARNING

416 Volts is present in the hydraulic test console with the 416 VOLTS circuit breaker (1, fig. 5-6) in either the ON or OFF position. Deenergize the electrical equipment shelter (TM 9-1425-58514-2) prior to performing any maintenance on the hydraulic test console.

7-3. Removal of Components from the Hydraulic Test Console Upper Section Control Panels
Tables 7-1, 7-2, and 7-3 list the principal components of the hydraulic console upper section control panels, key the components to accompanying illustrations, and provide references to test procedures when applicable. No special instructions are required or provided for the removal or installation of these components. However, typical assembly views are provided in the accompanying illustrations for the components that are installed on these control panels.

7-4. Removal of Components from the Hydraulic Test Console Lower Section
Table 7-4 lists components of the hydraulic console lower section, keys the components to accompanying illustrations, and provides references to test procedures when applicable. No special instructions are required or provided for the removal or installation of these components. However, typical assembly views are provided in the accompanying illustrations for the various components that are installed on the console lower section.

7-5. Repair of the Hydraulic Test Console Handpump

WARNING

Before performing any maintenance on the handpump, set the hydraulic test console controls to the positions indicated in table 5-12.

a. Removal.

(1) Turn the system shutoff valve (37, fig. 7-7) fully clockwise.

(2) Insure that the HAND PUMP PRESSURE UNLOADING VALVE (13, fig. 5-1) is turned fully clockwise.

(3) Completely cover the system pressure pumpmotor (61, fig. 7-7) with protective cloths.

(4) Remove the handpump (79, fig. 7-6). Catch any hydraulic fluid leakage.

b. Disassembly. Disassemble the handpump (fig. 7-12).

Table 7-1. Components of the Hydraulic Test Console Upper Left Control Panel (Fig. 7-1)

Component	Key	Test
Coupling	13	Table 23-3
Gage protector	8, 34, and 51	
HAND PUMP PRESSURE UNLOADING VALVE	63	Table 6-8
LOW PRESSURE GAGE SHUTOFF VALVE	20	Table 6-8
SYSTEM PRESSURE REGULATOR VALVE	64	Table 6-8
0-100 PSI GAGE	59	Table 25-3
0-10000 PSI GAGE	61	Table 25-3
0-3000 PSI DIFFERENTIAL GAGE	62	Table 25-3
30" HG VACUUM-15 PSI GAGE	43	

c. Assembly. Assemble the handpump (fig. 7-12). Do not install the plug, washer, and seal (35, 36, and 37, fig. 7-12) at this time.

d. Installation and Test.

(1) Install the handpump (79, fig. 7-6).

(2) Lower the upper left control panel (fig. 5-1) and remove the tube assembly (1, fig. 7-8).

(3) Plug the open end of the relief valve and the tee, which were connected to the tube assembly with caps MS21914D4.

(4) Secure the upper left control panel in place.

(5) Check the hydraulic test console 0-10000 PSI GAGE (2, fig. 5-1) (test No. 2, gage test procedures, table 25-3).

(6) System shutoff valve (37, fig. 7-7) full ccw.

(7) LOW PRESSURE GAGE SHUTOFF (4, fig. 5-1) .....full cw.

(8) HAND PUMP PRESSURE UNLOADING VALVE ..... full ccw.

(9) Insert the handpump handle into the handpump. Actuate the handle several times to purge the handpump of air.

(10) Turn the HAND PUMP PRESSURE UNLOADING VALVE fully clockwise, and then turn it back again fully counterclockwise.

(11) Actuate the handpump handle several times to purge the hydraulic test console handpump system of air. End the pumping action with the pump handle in the completely raised position.

(12) HAND PUMP PRESSURE UNLOADING VALVE .....full cw.

(13) While monitoring the 0-10000 PSI GAGE, push the pump handle all the way down, and then pull it all the way up. Note that the 0-10000 PSI GAGE reading increases on both the down and up strokes of the pump handle.

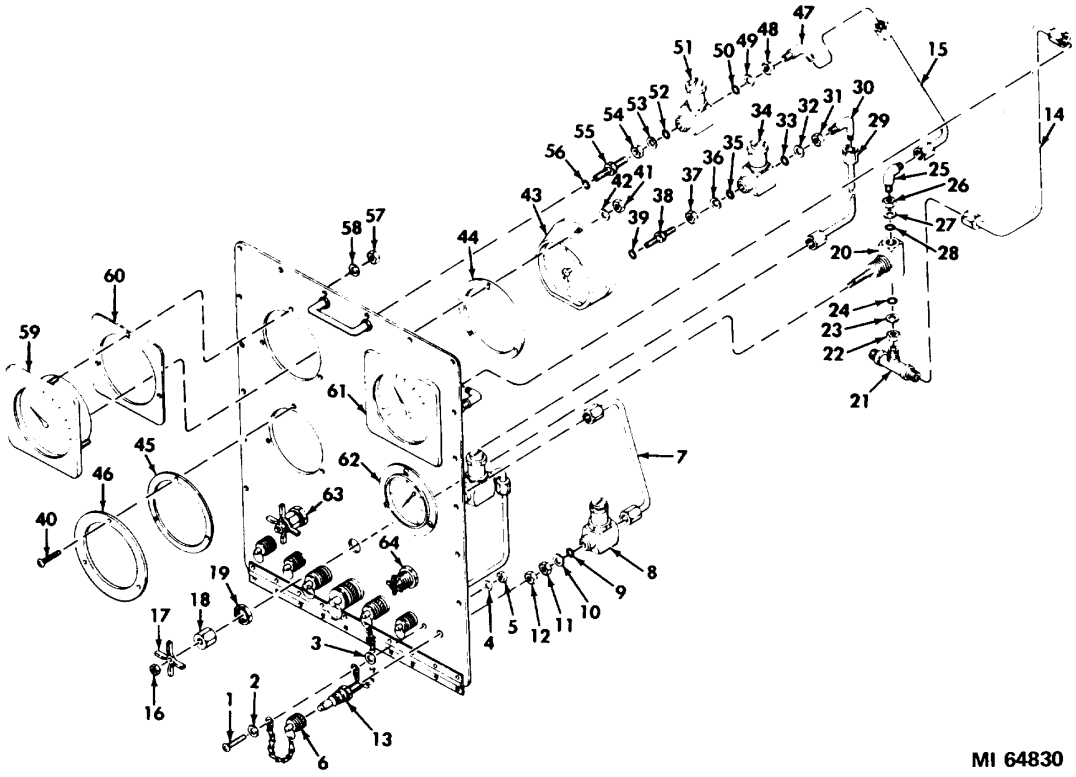
(14) Slowly turn the HAND PUMP PRESSURE UNLOADING VALVE fully counterclockwise, and then turn it back fully counterclockwise.

(15) While monitoring the 0-10000 PSI GAGE, slowly actuate the pump handle. Note that the 0-10000 PGI GAGE reading increases on both the up and down strokes of the pump handle until 600 to 800 psig is indicated. At 600 to 800 psig the gage reading increases only on the upstroke of the pump handle.

CAUTION

In performing the next step, do not exceed 8500 psig as indicated on the 0-10000 PSIG GAGE.

(16) While monitoring the 0-10000 PSI GAGE, actuate the handpump handle. Observe at what pressure the relief valve check ball (41, fig. 7-12) unseats.



1-No. 8 x 7/8 panhead screw
2-No. 8 flat washer
3-No. 8 flat washer
4-No. 8 flat washer
5-No. 8 self-locking nut
6-Cap
7-Tube assembly
8--Gage protector
9-Preformed packing
10-Backup ring
11-Hexagon nut
12-Hexagon nut
13-Tube nipple (coupling)
14-Tube assembly
15-Tube assembly
16-Hexagon nut
17-Valve handle
18-Packing nut
19-Hexagon nut
20-Low pressure gage shutoff valve
21-Tee
22-Hexagon nut
23-Backup ring
24-Preformed packing
25-Elbow
26-Hexagon nut
27-Backup ring
28-Preformed packing
29-Tube assembly
30-Elbow
31-Hexagon nut
32-Backup ring
33-Preformed packing
34-Gage protector
35-Preformed packing
36-Backup ring
37-Hexagon nut
38-Tube nipple
39-Preformed packing
40-No. 10 x 3-9/32 cross-recess bolt
41-No. 10 hexagon nut
42-No. 10 flat washer
43-Vacuum-pressure gage
44-Gasket
45-Gasket
46-Ring
47-Elbow
48-Hexagon nut
49-Backup ring
50-Preformed packing
51-Gage protector
52-Preformed packing
53-Backup ring
54-Hexagon nut
55-Tube nipple
56-Preformed packing
57-Hexagon nut
58-Flat washer
59-0-100 psi pressure gage
60-Gasket
61-0-10000 psi pressure gage
62--0-3000 psi differential gage
63-Hand pump pressure unloading valve
64-System pressure regulator valve

Figure 7-1. Components of the hydraulic test console upper left control panel-partial exploded view.

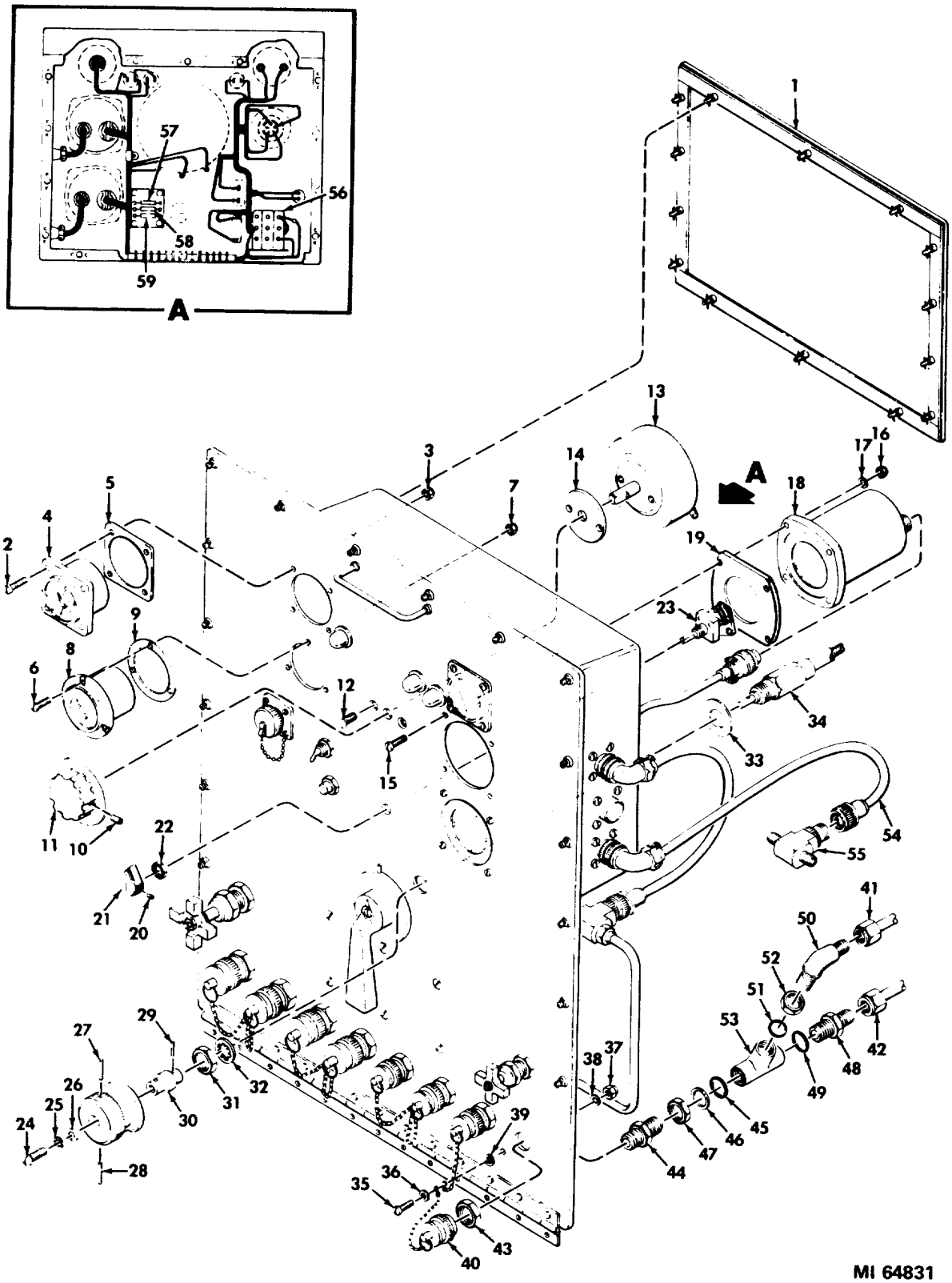


Figure 7-2. Components of the hydraulic test console upper center control panel-partial exploded view (part I).

1-Cover
2-No. 6 x 7/8 panhead screw
3-No. 6 hexagon nut
4-Ammeter
5--Gasket
6-No. 6 x 7/8 panhead screw
7-No. 6 hexagon nut
8-Voltmeter
9-Gasket
10-Setscrew
11-Knob
12-1/4-20 x 1/2 machine screw
13-Resistor
14-Gasket
15-No. 6 x 7/8 flat countersunk screw
16-No. 6 hexagon nut
17-No. 6 flat washer
18-Indicator high flow
19-Gasket
20-Setscrew
21-Knob
22-Hexagon nut
23-Switch
24-No. 8 x 5/8 socket head capscrew
25-No. 8 lockwasher
26-No. 8 flat washer
27-Pin
28-Pin
29-Pin
30-Coupling
31-7/16-20 hexagon nut
32-7/16-inch lockwasher
33-7/16-inch flat washer
34-Shaft assembly
35-No. 8 x 7/8 panhead screw
36-No. 8 flat washer
37-No. 8 hexagon nut
38-No. 8 flat washer
39-No. 8 flat washer
40-Dust cap
41-Tube assembly
42-Tube assembly
43-7/16-20 hexagon nut
44-Tube nipple
45-Preformed packing
46-Backup ring
47-3/4-16 locknut
48-Union
49-Preformed packing
50-Elbow
51-Preformed packing
52-3/4-16 locknut
53-Tee
54-Cable assembly
55-Low flow sensing element
56-Relay
57-Resistor R1
58-Resistor R2
59-Resistor R3

Figure 7-2-Continued.

Table 7-2. Components of the Hydraulic Test Console Upper Center Control Panel (Figs. 7-2 and 7-3)

Component	Key	Figure	Test
AMMETER	4	7-2	Table 6-15
VOLTMETER	8	7-2	Table 6-15
INDICATOR HIGH FLOW	18	7-2	
Low flow sensing element	55	7-2	
CIRCUIT BREAKER	8	7-3	Table 6-15
RESET BUTTON switch	10	7-3	Table 6-15
SYSTEM PRESSURE CONTROL VALVE COARSE ADJUST	23	7-3	Table 6-8
High flow sensing element	35	7-3	
Selector valve	46	7-3	Table 6-8
SYSTEM PRESSURE CONTROL VALVE FINE ADJUST	60	7-3	Table 6-8
INDICATOR LOW FLOW	61	7-3	

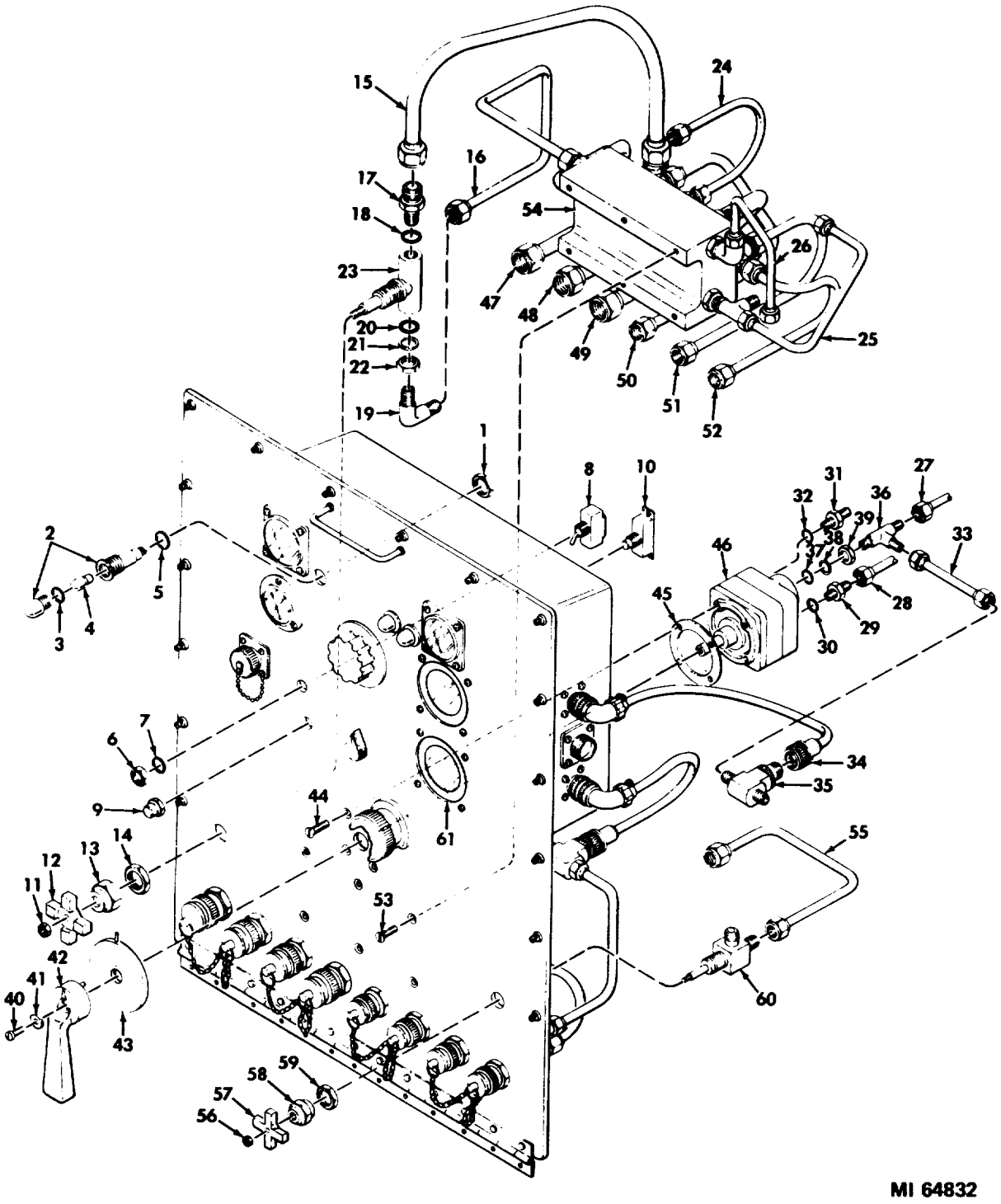


Figure 7-3. Components of the hydraulic test console upper center control panel-partial exploded view (part II).

1-Hexagon nut
2-Indicator light
3-Preformed packing
4-Indicator lamp
5-Preformed packing
6-Hexagon nut
7-Gasket
8-Circuit breaker
9-Boot
10-Reset button switch
11-Hexagon nut
12-Valve handle
13--Gland nut
14-Hexagon nut
15-Tube assembly
16-Tube assembly
17-Reducer
18-Preformed packing
19-Elbow
20--Performed packing
21-Backup ring
22-3/4-16 locknut
23-System pressure control valve coarse adjust
24-Tube assembly
25-Tube assembly
26-Tube assembly
27-Hose assembly
28-Tube assembly
29--Union
30-Preformed packing
31-Union
32-Preformed packing
33-Tube assembly
34-Cable assembly
35-High flow sensing element
36-Tee
37-Preformed packing
38-Backup ring
39-3/4-16 locknut
40-Screw
41-Flat washer
42-Valve handle
43-Plate
44-No. 10 x 7/16 machine screw
45-Gasket
46-Selector valve
47-Tube assembly
48-Tube assembly
49-Tube assembly
50-Tube assembly
51-Tube assembly
52-Tube assembly
53-1/4-28 x 9/64 self-locking screw
54-Block
55-Tube assembly
56-Hexagon nut
57-Valve handle
58-Gland nut
59-Hexagon nut
60-System pressure control valve fine adjust
61-Indicator low flow

Figure 7-3-Continued.

(17) Adjust the adjusting screw (38, fig. 7-12) and repeat step (16) above until the check ball unseats between 8000 to 8200 psig.

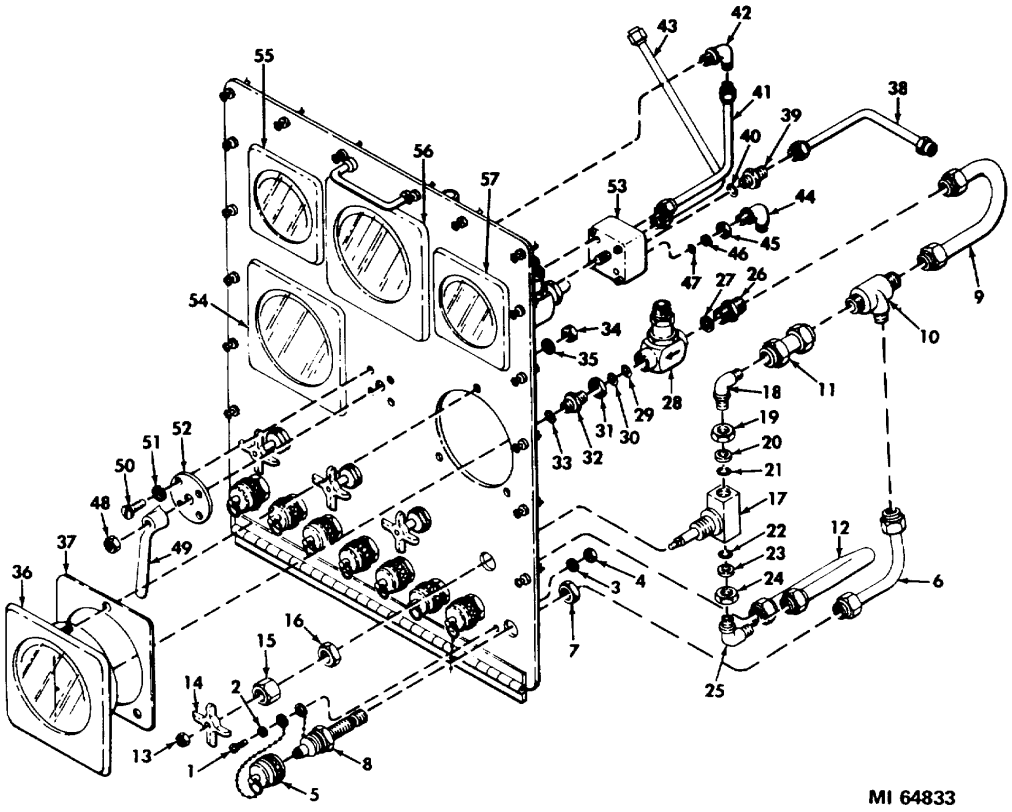
(18) Turn the HAND PUMP PRESSURE UNLOADING VALVE fully counterclockwise, and then turn it back fully clockwise.

(19) Install the plug, washers, and seal (35, 36, and 37, fig. 7-12).

(20) Adjust the plug (35, fig. 7-12), and repeat step (16) above until the relief valve check ball (41, fig. 7-12) unseats between 7500 to 8100 psig.

Table 7-3. Components of the Hydraulic Test Console Upper Right Control Panel (Fig. 7-4)

Component	Key	Test
Coupling	8	Table 23-3
Gage protector	28	
SYSTEM PRESSURE GAGE SELECTOR valve	53	Table 6-8
THROTTLING VALVE	17	Table 6-8
0-400 PSI GAGE	55	Table 25-3
0-2000 PSI GAGE	57	Table 25-3
0-4000 PSI GAGE	36, 54, and 56	Table 25-3



1-No. 8 x 7/8 panhead screw
2-No. 8 flat washer
3-No. 8 flat washer
4-No. 8 self-locking nut
5-Cap
6-Tube assembly
7-3/4-16 hexagon nut
8-Tube nipple (coupling)
9-Tube assembly
10-Tee
11-Tube assembly
12-Tube assembly
13-Hexagon nut
14-Valve handle
15-Packing nut
16-Hexagon nut
17-Throttle valve
18-Elbow
19-3/4-16 hexagon nut
20-Backup ring
21-Preformed packing
22-Preformed packing
23-Backup ring
24-3/4-16 hexagon nut
25-Elbow
26-Reducer
27-Preformed packing
28-Gage protector
29-Preformed packing
30-Backup ring
31-7/16-20 hexagon nut
32-Tube nipple
33-Preformed packing
34-1/4-20 hexagon nut
35-1/4-inch flat washer
36 -04000 psi gage
37-Gasket
38-Tube assembly
39-Tube nipple
40-Preformed packing
41-Tube assembly
42-Elbow
43-Tube assembly
44-Elbow
45-7/16-20 hexagon nut
46-Gasket
47-Preformed packing
48-Hexagon nut
49-Valve handle
50-No. 10 panhead screw
51-No. 10 lockwasher
52-Plate
53-System pressure gage selector valve
54-0-4000 psi gage
55-0-400 psi gage
56-0-4000 psi gage
57-0-2000 psi gage

Figure 7-4. Components of the hydraulic test console upper right control panel-partial exploded view.

Table 7-4. Components of the Hydraulic Test Console Lower Section (Figs. 7-5 through 7-11)

Component	Key	Figure	Test
Drain reservoir vent shutoff valve	4	7-6	Paragraph 6-9
Relief valve	9	7-6	Paragraph 6-9
Accumulator	43	7-6	
Main reservoir	53	7-6	
Filter	69	7-6	
Handpump	79	7-6	Table 6-7
Accumulator charging line shutoff valve	16	7-7	
Accumulator shutoff valve	24	7-7	
System suction line shutoff valve	37	7-7	
Pump	60	7-7	Table 6-8
Pump motor	61	7-7	Table 6-8
Relief valve	14	7-8	
Pressure regulator valve	38	7-8	
Pressure differential switch	47	7-8	
Circuit breaker	6	7-9	
Drain valve	17	7-10	Table 6-9
Graduate tube	27	7-10	
Graduate tube	32	7-10	
Timer	36	7-11	Table 6-10

(21) HAND PUMP PRESSURE UNLOADING VALVE ....full ccw.

(22) Remove the caps previously installed on the relief valve and the tee.

(23) Install the tube assembly (1, fig. 7-8).

(24) Perform the handpump test procedures in table 6-7.

7-6. Repair of the Hydraulic Test Console Main Reservoir

a. *Removal*. Remove the main reservoir (53, fig. 7-6).

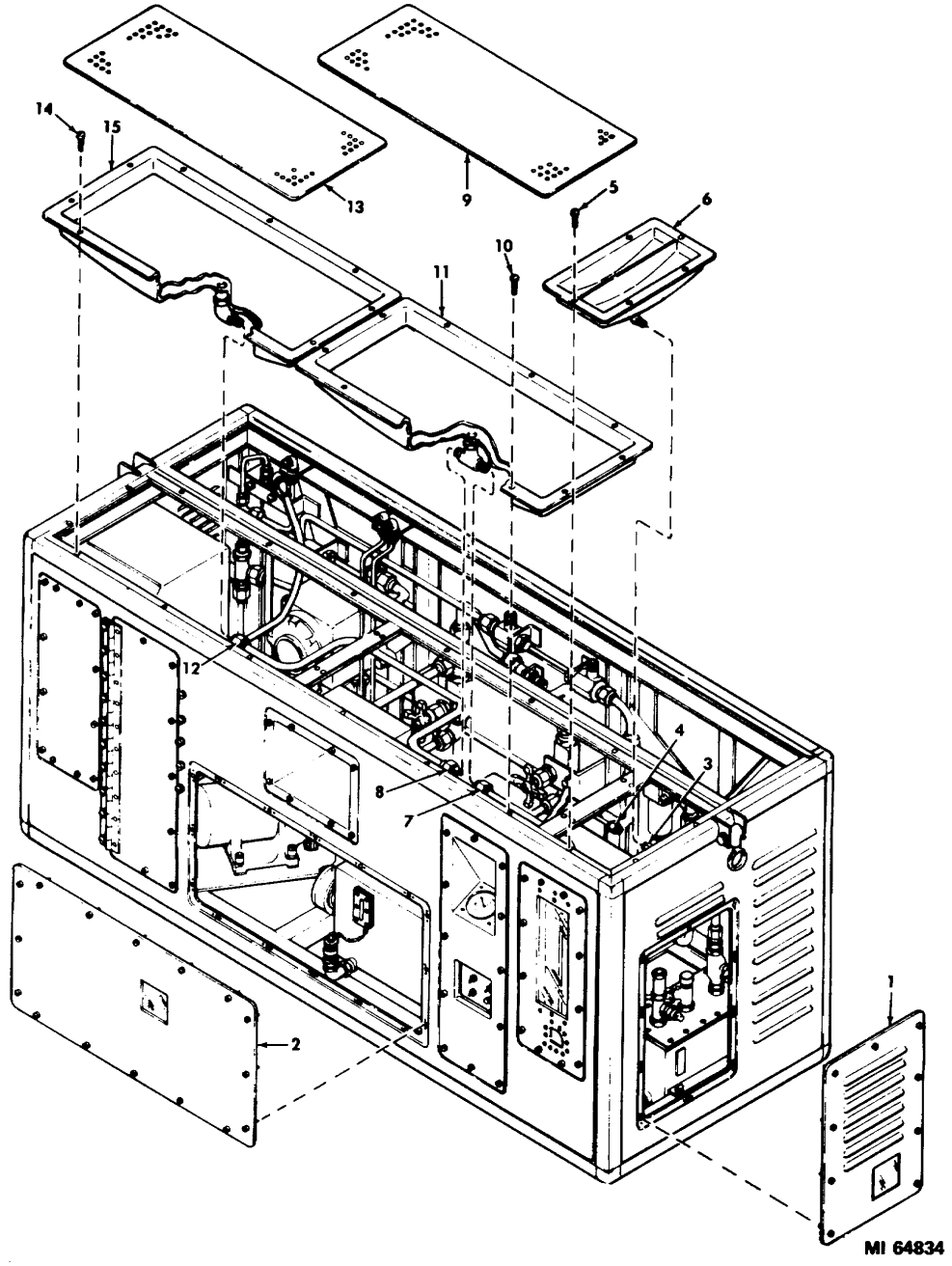
b. Disassembly and Assembly. Disassemble and assemble the main reservoir (fig. 7-13).

c. Installation and Test.

(1) Install the main reservoir.

(2) Fill the reservoir with hydraulic fluid MIL-H-5606 (par. 6-7).

(3) Perform the hydraulic test console and heat exchanger test procedures (par. 6-16, table 6-8).



1-Drain access panel
2-Base access panel
3-Tube assembly
4-Tube assembly
5-No. 10 x 21/32 flathead screw
6-Leakage graduate drain pan
7-Tube assembly
8-Iube assembly
9-Strainer
10-No. 10 x 21/32 flathead screw
11-Drain pan
12-Tube assembly
13-Strainer
14-No. 10 x 21/32 flathead screw
15-Drain pan

Figure 7-5. Components of the hydraulic test console lower section-partial exploded view (part I).

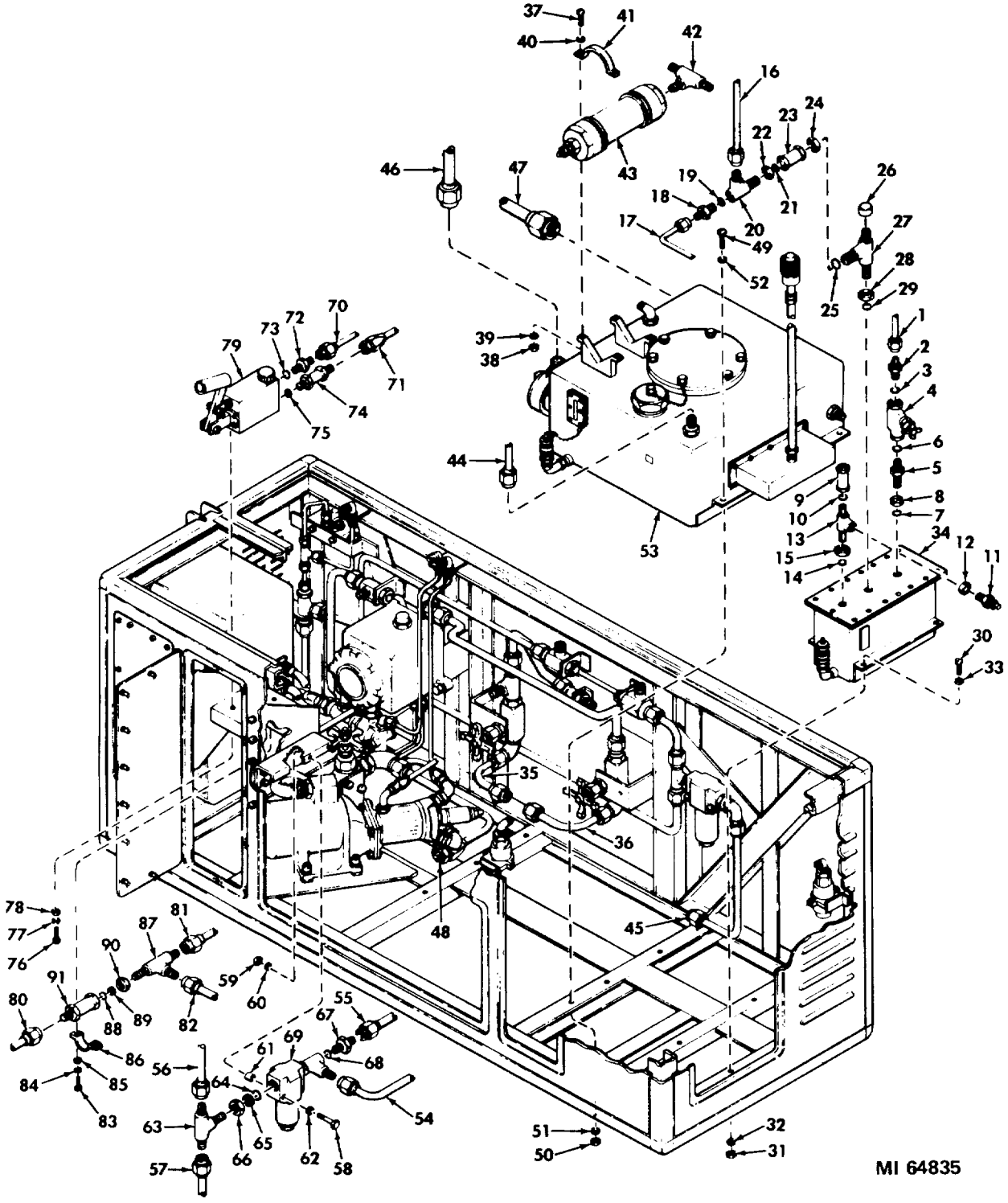


Figure 7-6. Components of the hydraulic test console lower section-partial exploded view (part II).

1-Tube assembly
2-Union
3-Preformed packing
4-Shutoff valve
5-Union
6-Preformed packing
7-Preformed packing
8--9/16-18 hexagon nut
9-Relief valve
10-Preformed packing
11--Nipple
12-7/16-20 hexagon nut
13-Tee
14-Preformed packing
15-7/16-20 hexagon nut
16-Tube assembly
17-Tube assembly
18-Reducer
19-Preformed packing
20-Tee
21-Preformed packing
22-1-1/16-12 hexagon nut
23-heck valve
24-1-1/16-12 hexagon nut
25-Preformed packing
26-Cap
27-Tee
28-1-1/16-12 hexagon nut
29-Preformed packing
30-1/4 x 7/8 socket head capscrew
31-1/4 hexagon nut
32-1/4-inch flat washer
33-1/4-inch flat washer
34-Drain reservoir
35-Tube assembly
36-Tube assembly
37-No. 8 x 1 panhead screw
38-No. 8 hexagon nut
39-No. 8 flat washer
40-No. 8 flat washer
41-Strap
42-Tee
43-Accumulator
44--Tube assembly
45-Tube assembly
46-Cable assembly
47-Tube assembly
48-Tube assembly
49-1/4 x 7/8 socket head capscrew
50--1/4 hexagon nut
51-1/4-inch flat washer
52-1/4-inch flat washer
53-Main reservoir
54-Tube assembly
55-Tube assembly
56-Tube assembly
57-Tube assembly
58-1/4-28 x 3-1/4 bolt
59-1/4-inch safety nut
60-1/4-inch flat washer
61-Spacer
62-1/4-inch flat washer
63-Tee
64-Preformed packing
65-Backup ring
66-1-1/16-12 hexagon nut
67-Reducer
68-Preformed packing
69-Filter
70-Tube assembly
71-Hose assembly
72-Reducer
73-Preformed packing
74-Check valve
75-Preformed packing
76-5/16-24 x 3/4 bolt
77-5/16-inch lockwasher
78-5116-inch flat washer
79-Handpump
80-Hose assembly
81-Tube assembly
82-Tube assembly
83-1/4 x 3/4 panhead screw
84-1/4-inch lockwasher
85-1/4-inch flat washer
86-Strap
87-Tee
88-Preformed packing
89-Backup ring
90-1-1/16-12 hexagon nut
91-Check valve

Figure 7-6-Continued.

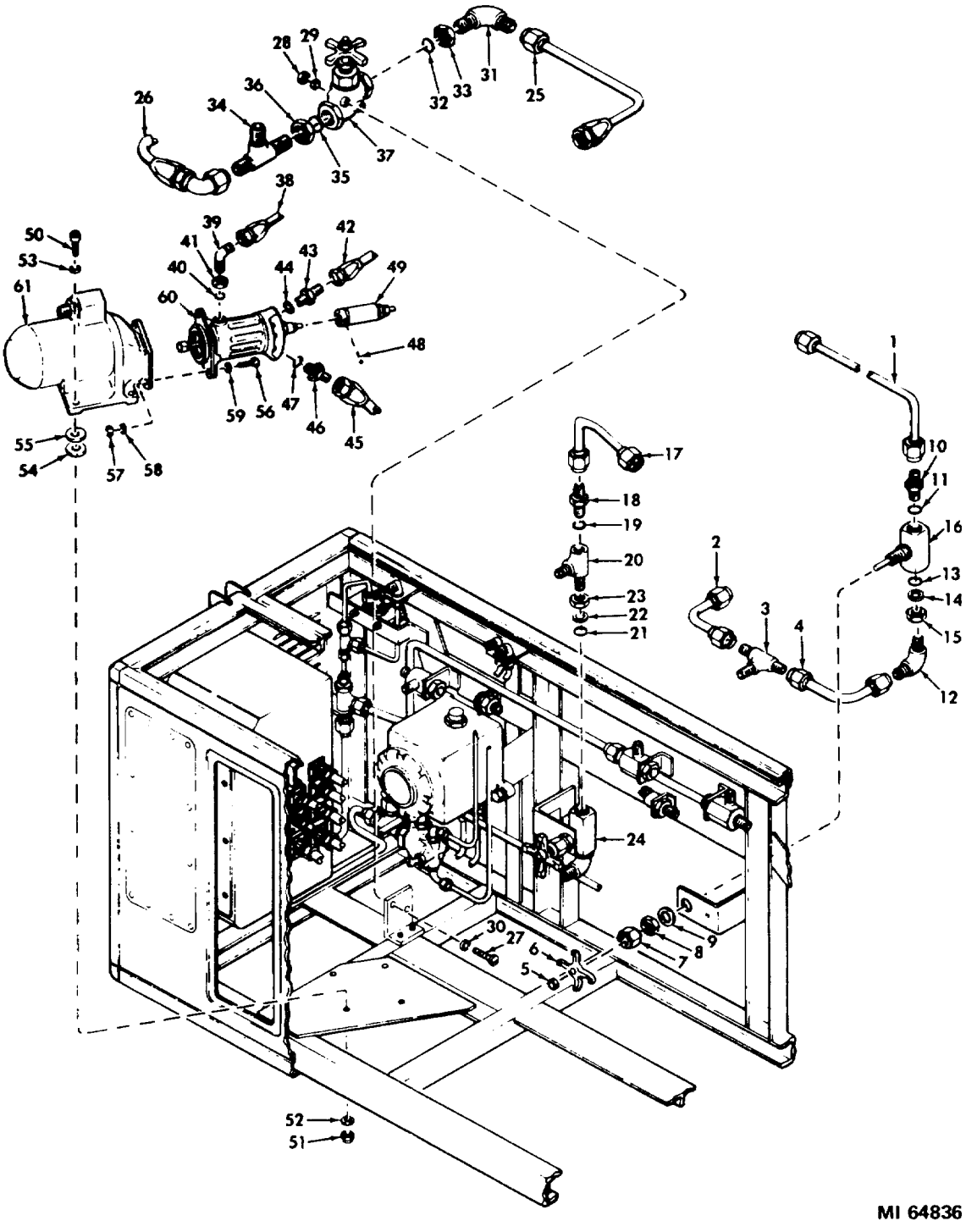


Figure 7-7. Components of the hydraulic test console lower section - partial exploded view (part III)

1-Tube assembly
2-Tube assembly
3-Tee
4-Tube assembly
5-Hexagon nut
6-Valve handle
7-Gland nut
8-Hexagon nut
9-1-1/4-inch flat washer
10-Reducer
11-Preformed packing
12-Elbow
13-Preformed packing
14-Backup ring
15-1-1/16-12 hexagon nut
16-Valve
17-Tube assembly
18-Reducer
19-Preformed packing
20-Tee
21-Preformed packing
22-Backup ring
23-1-1/16-12 hexagon nut
24-Valve
25-Tube assembly
26-Hose assembly
27-No. 10 x 2-1/2 socket head capscrew
28-No. 10 hexagon nut
29-No. 10 flat washer
30-No. 10 flat washer
31-Elbow
32-Preformed packing
33-1-5/16-12 hexagon nut
34-Tee
35-Preformned packing
36-1-5/16-12 hexagon nut
37-Shutoff valve
38-Hose assembly
39-Elbow
40-Preformed packing
41-9/16-18 hexagon nut
42-Hose assembly
43-Union
44-Preformed packing
45-Hose assembly
46-Union
47-Preformed packing
48-Pin
49-Flexible shaft
50-1/4-28 x 1-3/4 socket head capscrew
51-1/4 hexagon nut
52-1/4-inch flat washer
53-1/4-inch flat washer
54-Mount
55-9/32-inch flat washer
56-5/16 x 1-3/8 hexagon head capscrew
57-5/16 hexagon nut
58-5/16-inch flat washer
59-5/16-inch flat washer
60-Pump
61-Motor

Figure 7-7-Continued.

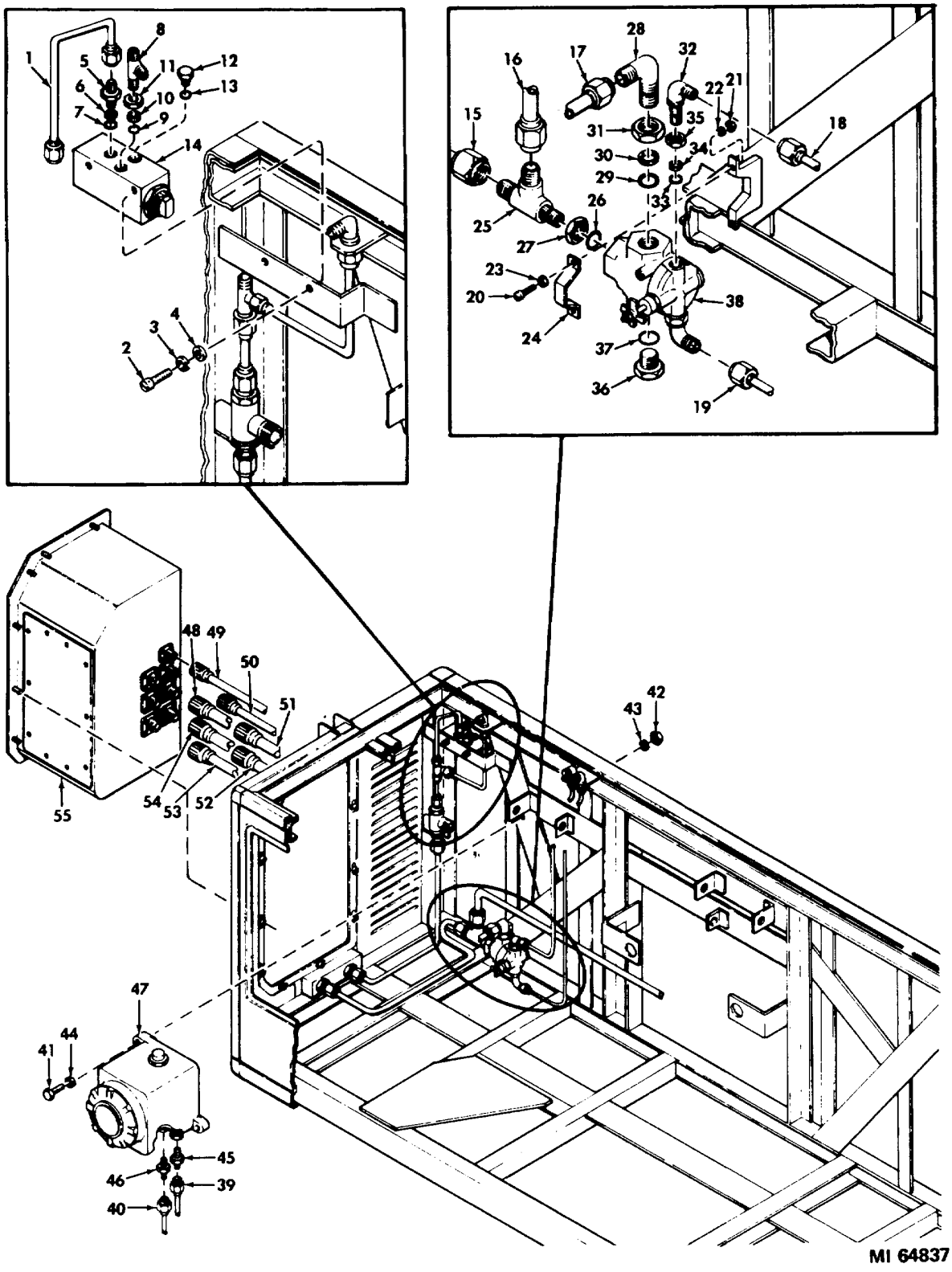
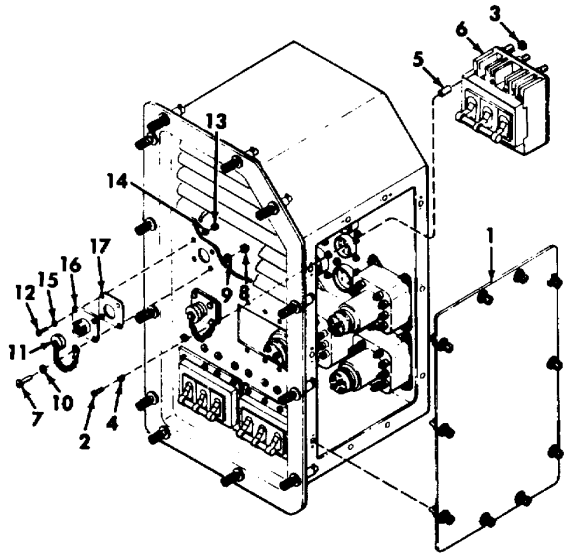


Figure 7-8. Components of the hydraulic test console lower section-partial exploded view (part IV).

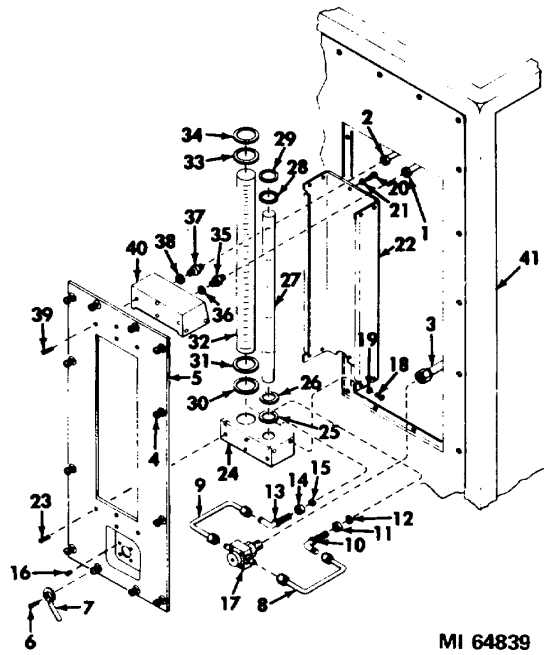
1-Tube assembly
2-5/16-7/8 socket head capscrew
3-5/16-inch lockwasher
4-5/16-inch flat washer
5-Union
6-Backup ring
7-Preformed packing
8-Tee
9-Preformed packing
10-Backup ring
11-7/16-20 hexagon nut
12-Plug
13-Preformed packing
14-Relief valve
15-Tube assembly
16-rube assembly
17-Tube assembly
18-Tube assembly
19-Tube assembly
20-1/4 x 7/8 socket head capscrew
21-1/4 hexagon nut
22-1/4-inch flat washer
23-1/4-inch flat washer
24-Strap
25-Tee
26-Preformed packing
27-1-1/16-12 hexagon nut
28-Elbow
29-Preformed packing
30-Backup ring
31-1-1/16-20 hexagon nut
32-Elbow
33-Preformed packing
34-Backup ring
35-7/16-20 hexagon nut
36-Plug
37-Preformed packing
38-Preasure regulator valve
39-Tube assembly
40-Tube assembly
41-3/8 x 1-3/4 socket head capscrew
42-3/8 hexagon nut
43-3/8-inch flat washer
44-3/8-inch flat washer
45-Union
46-Union
47-Pressure differential switch
48-Cable assembly
49able assembly
50-Cable assembly
51-Cable assembly
52-Cable assembly
53-Cable assembly
54-Cable assembly
55-Junction box

Figure 7-8-Continued.



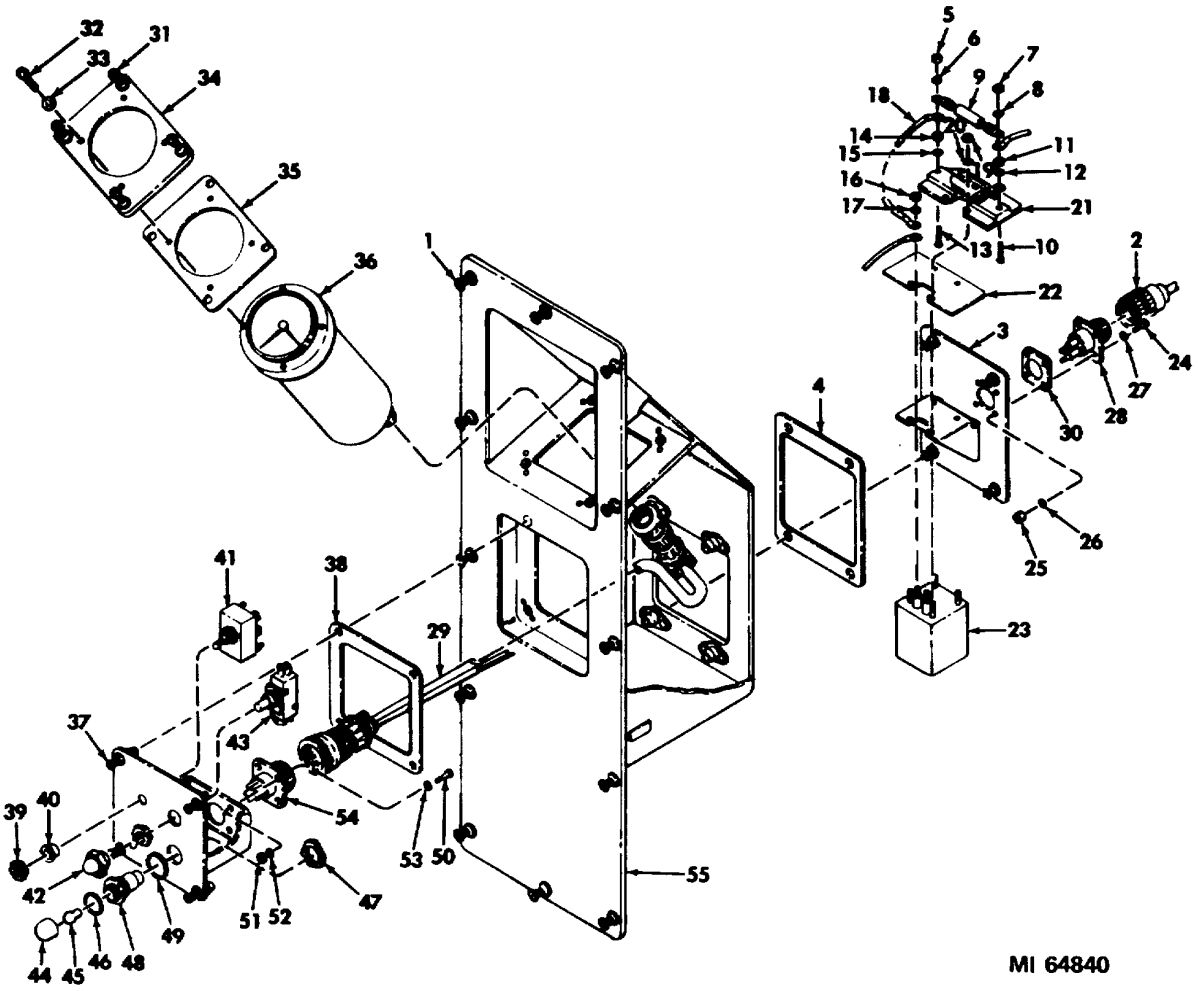
1-Panel
2-No. 10 x 4-11/32 self-locking screw
3-No. 10 hexagon nut
4-No. 10 flat washer
5-Spacer
6-Circuit breaker
7-No. 6 x 7/8 machine screw
8-No. 6 hexagon nut
9-No. 6 flat washer
10-No. 6 flat washer
11-Dust cap
12-No. 6 x 5/8 machine screw
13-No. 6 hexagon nut
14-No. 6 flat washer
15-No. 6 flat washer
16-Connector
17-Gasket

Figure 7-9. Disassembly and assembly of the junction box.



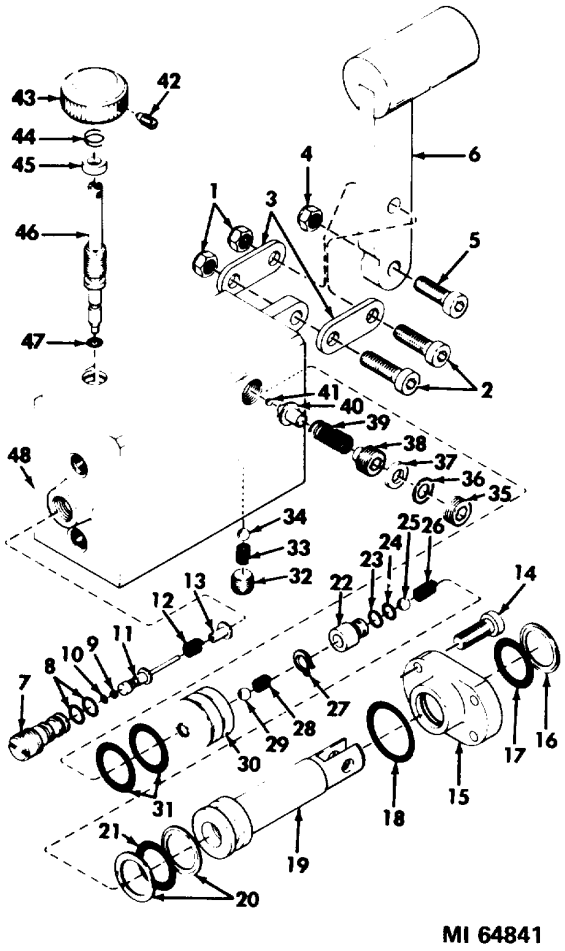
1--Tube assembly
2-Tube assembly
3--Tube assembly
4-Stud fastener
5--Mounting plate
6-Screw
7-Valve handle
8-Tube assembly
9-Tube assembly
10-Elbow
11-7/16-20 hexagon nut
12-Preformed packing
13-Elbow
14-7/16-20 hexagon nut
15-Preformed packing
16-No. 6 x 5/16 panhead screw
17-Drain valve
18-No. 4 x 3/8 panhead screw
19-No. 4 lockwasher
20-No. 4 x 3/8 panhead screw
21-No. 4 lockwasher
22-Shield
23-No. 10 x 7/16 self-locking screw
24-Tube support
25-Gasket
26-Preformed packing
27-Graduate tube
28-Preformed packing
29-Gasket
30-Gasket
31-Preformed packing
32-Graduate tube
33-Preformed packing
34-Gasket
35-Union
36-Preformed packing
37-Union
38-Preformed packing
39-No. 10 x 7/16 self-locking screw
40-Tube support
41-Hydraulic test console

Figure 7-10. Disassembly and assembly of the leakage graduate panel.



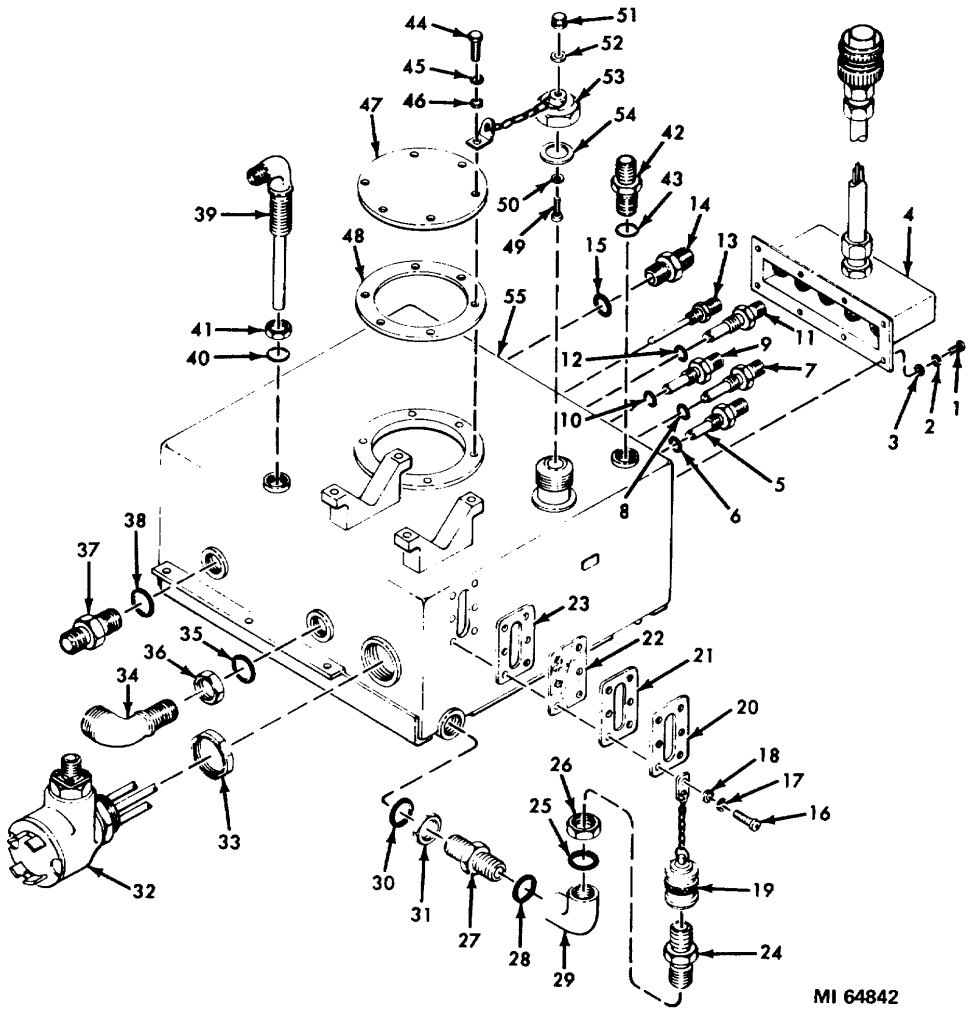
1-Stud fastener
2--Cable assembly
3-Support plate
4-Gasket
5-No. 6 hexagon nut
6-No. 6 hexagon nut
7-No. 6 flat washer
8-No. 6 flat washer
9-Capacitor
10-No. 6 round head screw
11-No. 6 flat washer
12-No. 6 flat washer
13-No. 6 round head screw
14-No. 6 hexagon nut
15-No. 6 flat washer
16-No. 4 self-locking nut
17-No. 4 flat washer
18-Wire lead
19-No. 4 self-locking nut
20-No. 4 flat washer
21-Terminal board
22-Insulator
23-Reactor
24-No. 4 x 1/2 fillister head screw
25-No. 4 self-locking nut
26-No. 4 flat washer
27-No. 4 flat washer
28-Lead assembly
29-Cable assembly
30-Gasket
31-Stud fastener
32-No. 6 x 7/8 panhead screw
33-No. 6 flat washer
34-Frarne
35-Gasket
36-Timer
37-Stud fastener
38-Gasket
39-Hexagon nut
40-Seal
41-Switch
42-Boot
43-Switch
44-Indicator
45-Lamp
46-Gasket
47-Hexagon nut
48-Lamp holder
49-Gasket
50-No. 4 x 1/2 fillister head screw
51-No. 4 self-locking nut
52-No. 4 flat washer
53-No. 4 flat washer
54-Lead assembly
55-Chassis

Figure 7-11. Disassembly and assembly of the timer stop assembly panel.



1-Hexagon nut
2-Socket head capscrew
3-Link
4-Hexagon nut
5-Socket head capscrew
6-Pump handle
7-Bypass control valve plug
8-Preformed packing
9-Backup ring
10-Preformed packing
11-Bypass control valve
12-Spring
13-Guide
14-Socket head capscrew
15-Piston gland
16-Backup ring
17-Preformed packing
18-Preformed packing
19-Piston
20-Backup ring
21-Preformed packing
22-Gage
23-Backup ring
24-Preformed packing
25-Check ball
26-Spring
27-Retaining ring
28-Spring
29-Check ball
30-Gage
31-Preformed packing
32-Plug
33-Spring
34-Check ball
35-Plug
36-Washer
37-Seal
38-Adjusting screw
39-Spring
40-Guide
41-Check ball
42-Setscrew
43-Knob
44-Retaining ring
45-Bushing
46-Valve stem
47-Preformed packing
48-Pump body

Figure 7-12. Disassembly and assembly of the handpump.



1-No. 6 x 7/16 panhead screw
2-No. 6 lockwasher
3-No. 4 flat washer
4-Cable assembly
5-Thermal switch
6-Preformed packing
7 -Thermal switch
8-Preformed packing
9-Thermal switch
10-Preformed packing
11-Therrnal switch
12-Preformed packing
13-Temperature bulb
14-Union
15-Preformed packing
16-No. 6 x 5/8 panhead screw
17-No. 6 lockwasher
18-No. 6 flat washer
19-Cap
20-Frame
21-Gasket
22-Window
23-Gasket
24-Tube nipple
25-Preformed packing
26-3/4-16 hexagon nut
27-Union
28-Preformed packing
29-Elbow
30-Preformed packing
31-3/4-16 hexagon nut
32-Heater
33-Locknut
34-Elbow
35-Preformed packing
36-3/4-16 hexagon nut
37-Reducer
38-Preformed packing
39-Tube assembly
40-Preformed packing
41-3/4-16 hexagon nut
42-Union
43-Preformed packing
44-1/4-28 hexagon head bolt
45-1 /4-inch lockwasher
46-1/4-inch flat washer
47-Cover
48-Gasket
49-1/4-28 hexagon head bolt
50-1/4-inch flat washer
51-Hexagon nut
52-1/4-inch flat washer
53-Cap
54-Gasket
55-Reservoir

Figure 7-13. Disassembly and assembly of the hydraulic test console main reservoir

Section III. MAINTENANCE OF THE HEAT EXCHANGER AND THE HEAT EXCHANGER RELIEF VALVE

7-7. Repair of the Heat Exchanger and the Heat Exchanger Relief Valve

WARNING

Prior to performing any maintenance on the heat exchanger, set the OIL COOLER and the SYSTEM PRESSURE PUMP circuit breakers (2 and 4, fig. 5-7) to OFF, then disconnect the heat exchanger power cable from the 416V-400 OIL COOLER SUPPLY jack (5, fig. 5-7) and cap :the jack.

a. Removal. Remove the heat exchanger and the heat exchanger relief valve (fig. 7-14).

NOTE

The heat exchanger can be removed without removing the heat exchanger relief valve.

b. Disassembly and Assembly. Disassemble and assemble the heat exchanger (fig. 7-15).

c. Installation and Test.

(1) Install the heat exchanger and the heat exchanger relief valve.

(2) Perform the hydraulic test console and heat exchanger test procedures (par. 6-16, table 6-8).

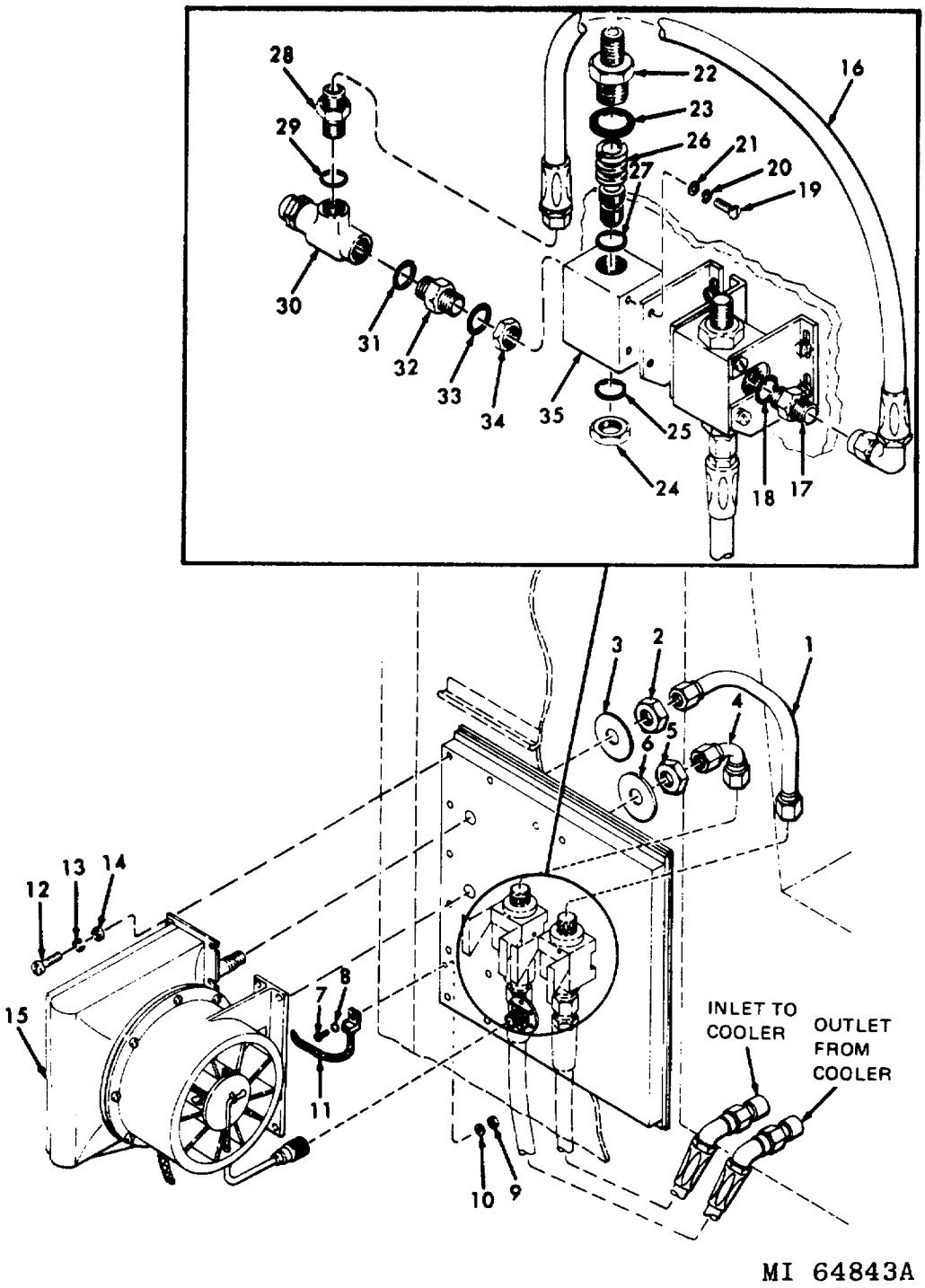
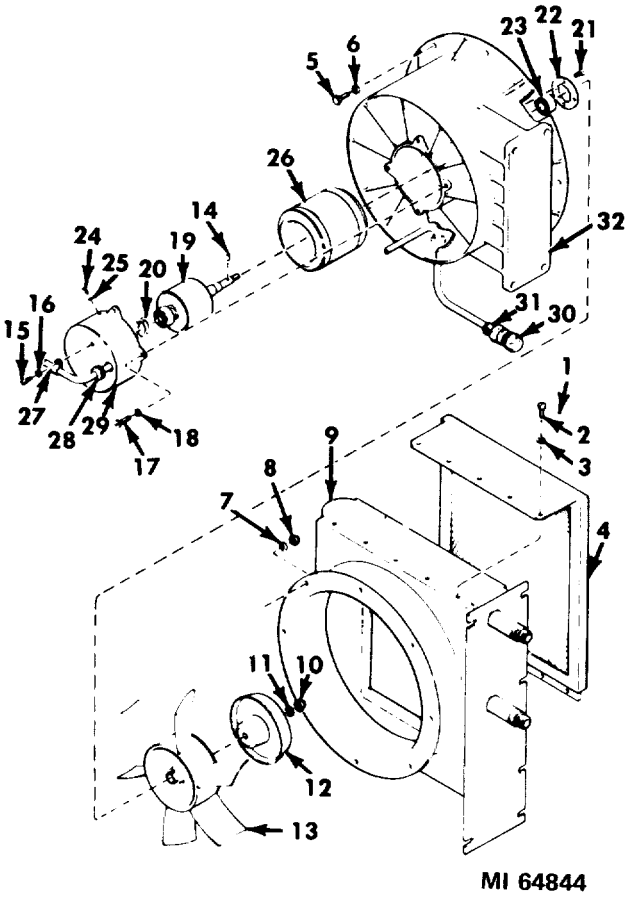


Figure 7-14. Removal and installation of the heat exchanger and the heat exchanger relief valve.

1-Elbow
2-1-1/4 hexagon nut
3-1-5/16-inch flat washer
4-Elbow
5-1-1/4 hexagon nut
6-1-5/16-inch flat washer
7-5/16 x 2-3/4 hexagon head capscrew
8-5/16-inch flat washer
9-5/16 hexagon nut
10-5/16-inch flat washer
11-Ground lead
12-5/16 x 1-1/4 hexagon head capscrew
13-5/16-inch lockwasher
14-5/16-inch flat washer
15-Heat exchanger
16-Hose assembly
17-Tube nipple
18-Preformed packing
19-No. 10 x 3/8 panhead screw
20-No. 10 lockwasher
21-No. 10 flat washer
22-Tube reducer
23-Preformed packing
24-1-1/16 hexagon nut
25-Preformed packing
26-Connector
27-Preformed packing
28-Tube reducer
29-Preformed packing
30-Relief valve
31-Preformed packing
32-Tube nipple
33-Preformed packing
34-3/4 hexagon nut
35-Connector

Figure 7-14-Continued.



1-Lockwire
2-No. 10 x 1/4 fillister head screw
3-No. 10 flat washer
4-Screen assembly
5-5/16 x 27132 machine bolt
6-5/16-inch flat washer
7-5/16-inch flat washer
8-5/6-24 self-locking nut
9-Heat exchanger
10-1/2-20 self-locking nut
11-1/2-inch flat washer
12-Fairing
13-Rotor fan
14-Spring pin
15-No. 8 x 7/16 fillister head screw
16-No. 8 flat washer
17-No. 10 x 1/2 fillister head screw
18-No. 10 flat washer
19-Rotor and shaft assembly
20-Loading spring
21-No. 6 x 3/8 fillister head screw
22-Bearing retainer
23-Bearing
24-1/4 x 3/8 fillister head screw
25-1/4-inch flat washer
26-Stator
27-Clamp
28-Grommet
29-Head
30--Connector
31-Adapter
32-Housing

Figure 7-15. Disassembly and assembly of the heat exchanger.

Section IV. DELETED

7-8 Through 7-11. Deleted

Table 7-5. Deleted

Figures 7-16 through 7-23. Deleted.

Section V. MAINTENANCE OF THE DEGREASER AND ACCUMULATOR TEST CONSOLE

WARNING

Before performing any maintenance on the degreaser and accumulator test console, deenergize the electrical equipment shelter (TM 9-1425-585-14-2), set the controls to the positions indicated in table 5-13, and turn the manual blowdown valve (3, fig. 1-6) fully counterclockwise.

7-12. Removal of Components From the Degreaser and Accumulator Test Console Control Panel

Table 7-6 lists the principal components of the degreaser and accumulator test console control panel, keys the components to accompanying illustrations, and provides test procedures when applicable. No special instructions are required or provided for the removal of these components. However, note that the pressure gages (41 through 44, fig. 7-24) are removed in the same manner as the DEGREASER AIR PRESSURE gage (40, fig. 7-24), and that the HIGH PRESSURE AIR REGULATOR valve (45, fig. 7-24) is removed in the same manner as the LOW PRESSURE AIR REGULATOR valve (37, fig. 7-24). Note also that the disassembly procedures for the needle valve, quick disconnect coupling, and gage protector (28, 3, and 18, fig. 7-25) are typical for all valves, couplings and gage protectors on the control panel.

7-13. Removal of Components From the Degreaser and Accumulator Test Console Lower Section

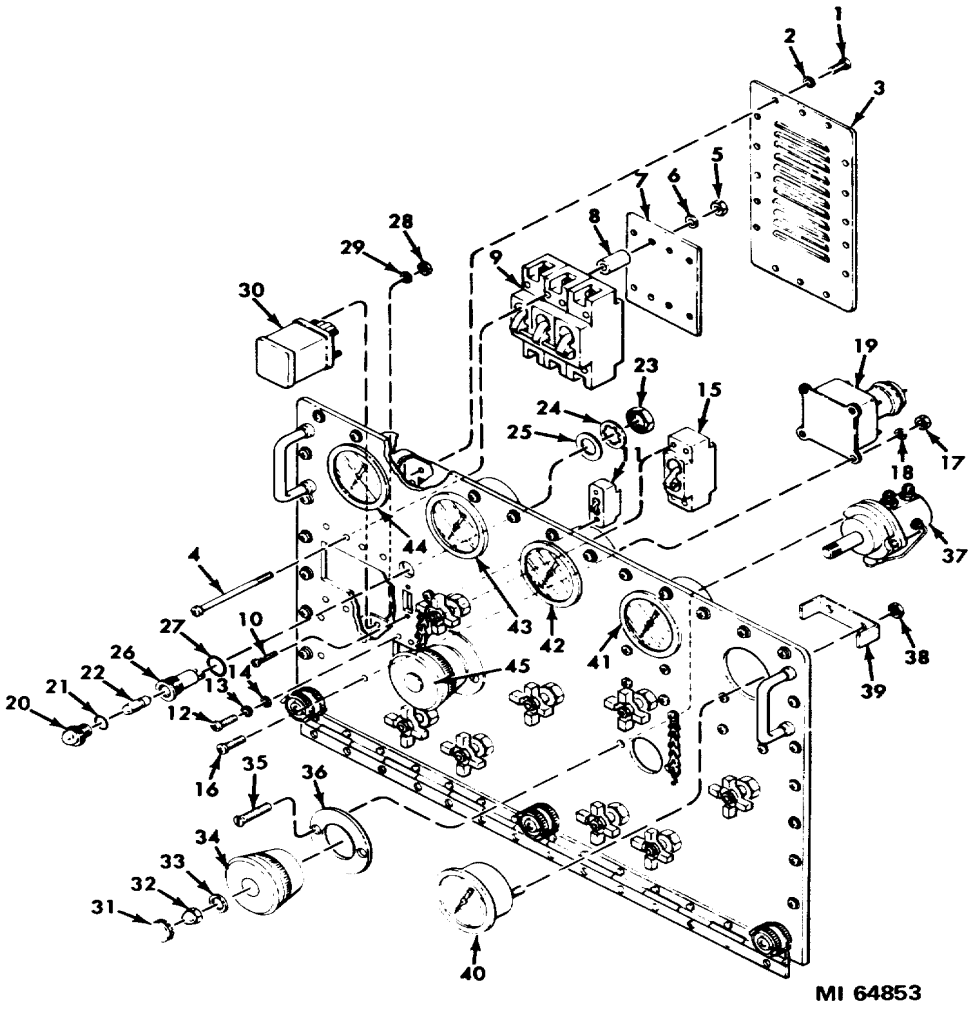
a. *General*. The degreaser and accumulator test console lower section is repaired while it is installed in transportable hydraulic shop 5.

b. *Disassembly and Assembly*. Disassemble and assemble the degreaser and accumulator test console lower section (fig. 7-26).

c. *Test*. Perform the pneumatic system test procedures (par. 6-17).

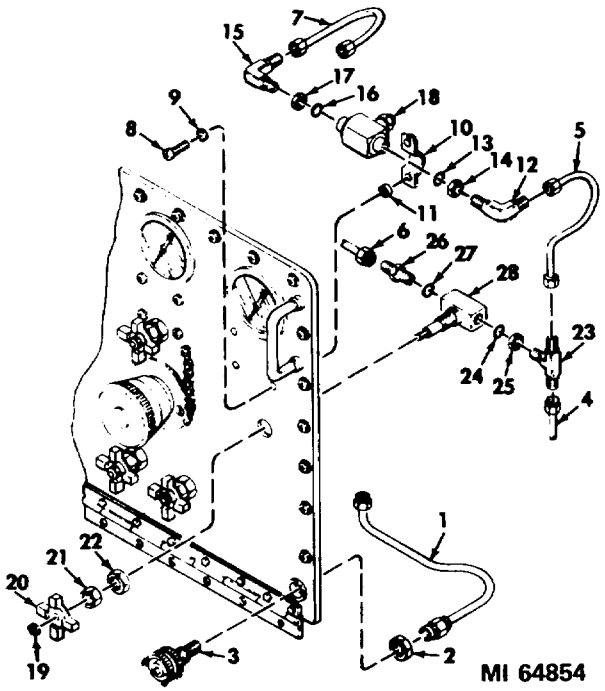
Table 7-6. Components of the Degreaser and Accumulator Test Console Control Panel (Figs. 7-24 and 7-25)

Component	Key	Figure	Test
COMPRESSOR circuit breaker	9	7-24	Table 6-11
28 VDC circuit breaker	11	7-24	Table 6-11
DC ACTIVATE circuit breaker	15	7-24	Table 6-11
Relay	19	7-24	Table 6-11
Transformer	30	7-24	Table 6-11
LOW PRESSURE AIR REGULATOR valve	37	7-24	Table 6-11
DEGREASER AIR PRESSURE gage	40	7-24	Paragraph 6-18
LOW PRESSURE AIR AND AIR GUN gage	41	7-24	Paragraph 6-18
HYDRAULIC PRESSURE gage	42	7-24	
HIGH PRESSURE AIR gage	43	7-24	Paragraph 6-18
COMPRESSOR PRESSURE gage	44	7-24	Paragraph 6-18
HIGH PRESSURE AIR REGULATOR valve	45	7-24	Table 6-11
Quick-disconnect coupling (typical)	3	7-25	Table 6-11
Gage protector (typical)	18	7-25	Table 6-11
Needle valve (typical)	28	7-25	Table 6-11



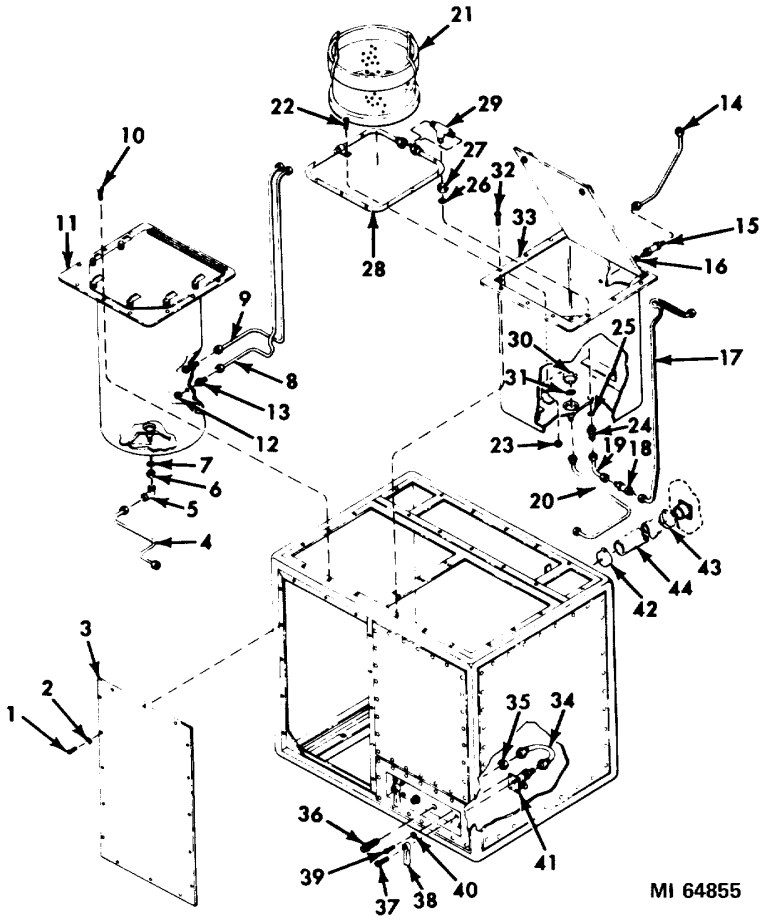
1-No. 10 x 5/8 panhead screw
2-No. 10 flat washer
3-Cover
4-No. 10 x 4-11/32 screw
5-No. 10 hexagon nut
6-No. 10 flat washer
7-Insulator
8-Insulator
9-Compressor circuit breaker
10-No. 6 x 1/4 panhead screw
11-28-volt circuit breaker
12-No. 8 x 7/16 panhead screw
13-No. 8 lockwasher
14-No. 8 flat washer
15-Dc activate circuit breaker
16-No. 10 x 3/4 panhead screw
17-No. 10 hexagon nut
18-No. 10 flat washer
19-Relay
20-Lamp indicator
21-Preformed packing
22-Lamp
23-Hexagon nut
24-Lockwasher
25-Flat washer
26-Lamp holder
27-Preformed packing
28-No. 8 hexagon nut
29-No. 8 flat washer
30-Transformer
31-Cap
32-Hexagon nut
33-Flat washer
34-Knob
35-Screw
36-Spacer
37-Low pressure air regulator valve
38-No. 8 hexagon nut
39-Clamp
40-Degreaser air pressure gage
41-Low pressure air and air gun gage
42-Hydraulic pressure gage
43-High pressure air gage
44-Compressor pressure gage
45-High pressure air regulator valve

Figure 7-24. Disassembly and assembly of the degreaser and accumulator test console control panel-partial exploded view (part I).



1-Tube assembly
2-7/16-20 hexagon nut
3-Quick-disconnect coupling
4-Hose assembly
5-Tube assembly
6-Tube assembly
7-Tube assembly
8-No. 4 x 5/8 panhead screw
9-No. 4 flat washer
1 0-Clamp
11-Spacer
12-Elbow
13-Preformed packing
14-7/16-20 hexagon nut
15-Elbow
16-Preformed packing
17-7/16-20 hexagon nut
18-Gage protector
19-Hexagon nut
20-Valve handle
21-Locknut
22-Hexagon nut
23-Tee
24-Preformed packing
25-7/16-20 hexagon nut
26-Union
27-Preformed packing
28-Needle valve

Figure 7-25. Disassembly and assembly of the degreaser and accumulator test console control panel-partial exploded view (part II).



1-No. 10 x 7/8 panhead screw
2-No. 10 flat washer
3-Front panel
4-Tube assembly
5-Elbow
6-3/4 hexagon nut
7-Preformed packing
8-Tube assembly
9-Tube assembly
10-1/4 x 7/8 flat countersunk head screw
11-Accumulator test tank
12-7/16 hexagon nut
13-Tube nipple
14-Tube assembly
15-Check valve
16-Preformed packing
17-Tube assembly
18-Check valve
19-Tube assembly
20-Tube assembly
21-Backet
22-No. 10 x 7/8 panhead screw
23-No. 10 self-locking nut
24-Tube nipple
25-Preformed packing
26-Preformed packing
27-7/16 hexagon nut
28-Tube assembly
29-Tee
30-Ring
31-Screen
32-1/4 x 7/8 flat countersunk head screw
33-Degreaser tank
34-Tube assembly
35-3/4 hexagon nut
36-Tube nipple
37-Valve handle screw
38-Valve handle
39-No. 10 x 7/16 panhead screw
40-No. 10 flat washer
41-Valve
42--Clamp
43-Clamp
44-Hose assembly

Figure 7-26. Disassembly and assembly of the degreaser and accumulator test console lower section.

Section VI. MAINTENANCE OF THE AIR COMPRESSOR AND THE AIR RESERVOIR ASSEMBLIES

WARNING

Before performing any maintenance on either the air compressor or the air reservoir assembly, set the DC ACTIVATE and COMPRESSOR circuit breakers (17 and 20, fig. 5-8) to OFF and turn the manual blowdown valve (3, fig. 1-6) fully counterclockwise.

7-14. Repair of the Air Compressor

a. *Removal*. Remove the air compressor assembly (fig. 7-27).

b. *Installation and Test.*

(1) Install the air compressor assembly (fig. 7-27).

(2) Perform the pneumatic system test procedures (par. 6-17).

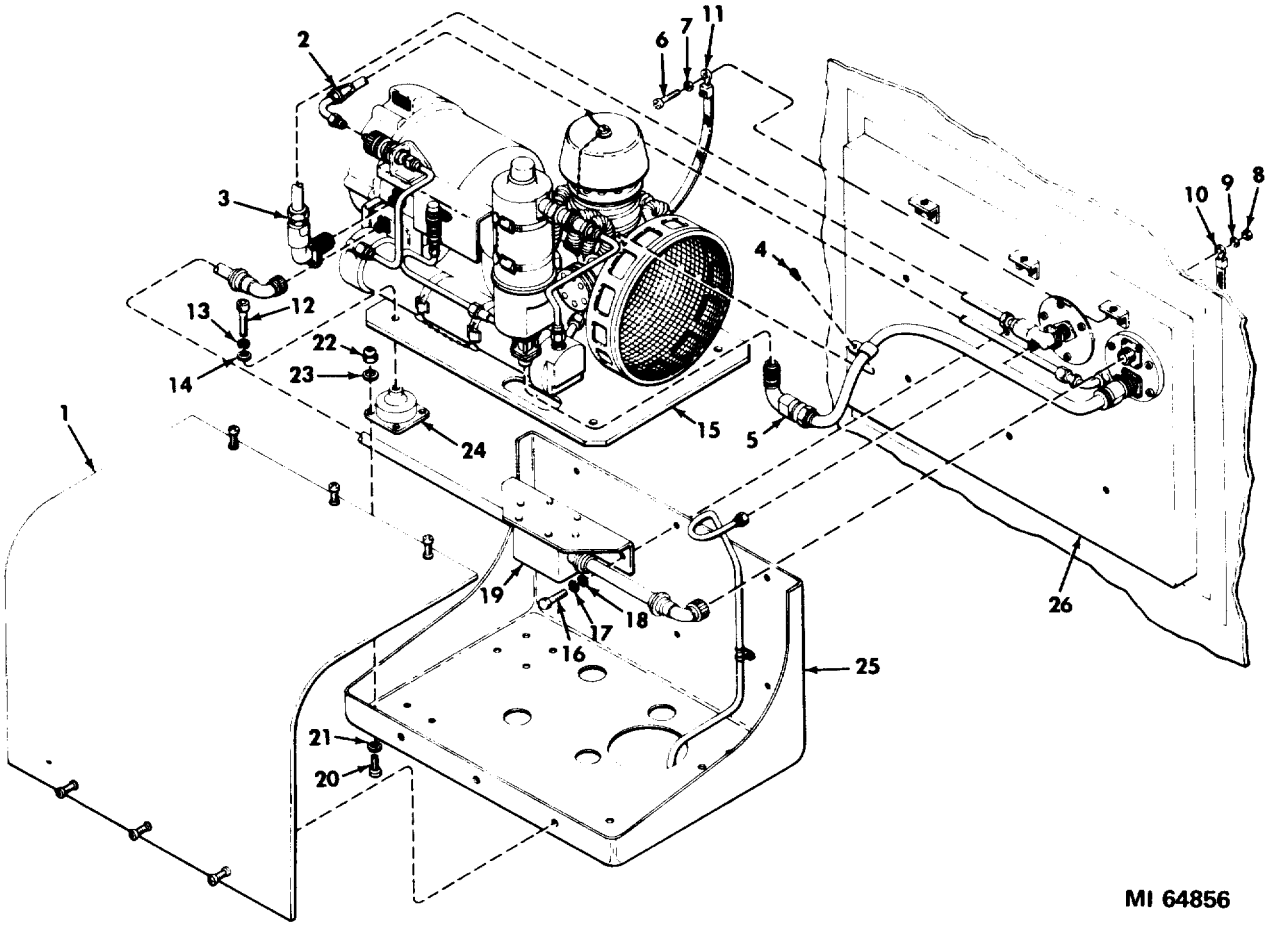
7-15. Repair of the Air Reservoir Assembly

a. *Removal*. Remove the air reservoir assembly (fig. 7-28).

b. *Installation and Test*.

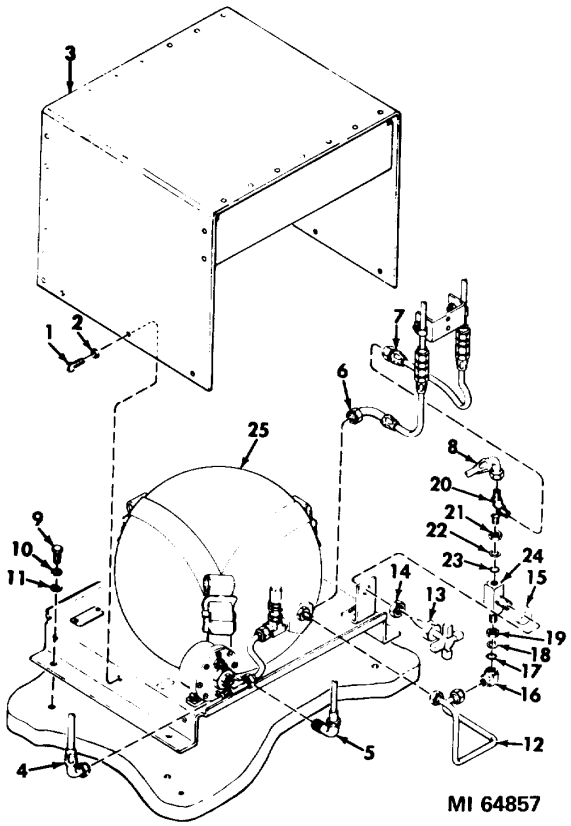
(1) Install the air reservoir assembly (fig. 7-28).

(2) Perform the pneumatic system test procedures (par. 6-17).



1-Cover
2-Hose assembly
3-Cable assembly
4-Panhead screw
5-Cable assembly
6-No. 10 x 2-3/4 thrust-head screw
7-No. 10 flat washer
8-No. 10 self-locking nut
9-No. 10 flat washer
10--Ground lead
11-Ground lead
12-1/4 x 3/4 socket head capscrew
13-1/4-inch lockwasher
14-1/4-inch flat washer
15-Air compressor
16-5/6 x 7/8 hexagon head capscrew
17-5/16-inch lockwasher
18-5/16-inch flat washer
19-Housing reactor
20-No. 10 x 3/4 panhead screw
21-No. 10 flat washer
22-No. 10 safety nut
23-No. 10 flat washer
24-Shockmount
25-Bracket
26-Shelter utility door

Figure 7-27. Removal and installation of the air compressor assembly and the housing reactor.



1-No. 10 x 3/4 panhead screw
2-No. 10 flat washer
3-Cover
4-Hose assembly
5-Cable assembly
6-Hose assembly
7-Hose assembly
8-Hose assembly
9-5/16-18 hexagon head capscrew
10-5/16-inch lockwasher
11-5/16-inch flat washer
12-Tube assembly
13-Valve stem
14-Hexagon nut
15-Bushing
16-Elbow
17-Preformed packing
18-Backup ring
19-7/16-20 locknut
20-Tee
21-7/16-20 locknut
22-Backup ring
23-Preformed packing
24-Blowdown valve
25-Air reservoir assembly

Figure 7-28. Removal and installation of the air reservoir assembly.

Section VII. MAINTENANCE OF THE STORAGE CABINETS AND WORKBENCH

7-16. Repair of the Small Storage Cabinet

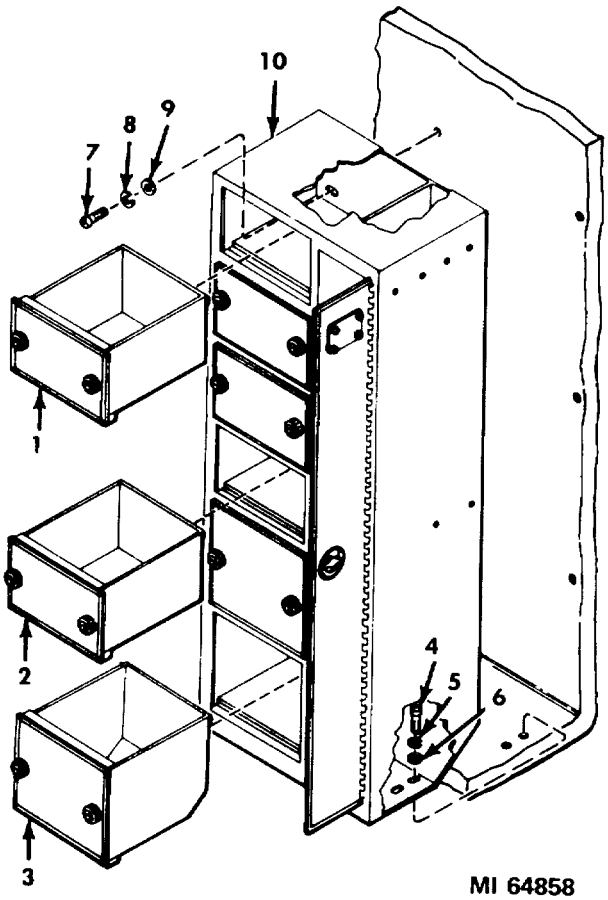
a. Remove the storage cabinet (fig. 7-29).
b. Install the storage cabinet (fig. 7-29).

7-17. Repair of the Large Storage Cabinet

a. Remove the storage cabinet (fig. 7-30).
b. Install the storage cabinet (fig 7-30).

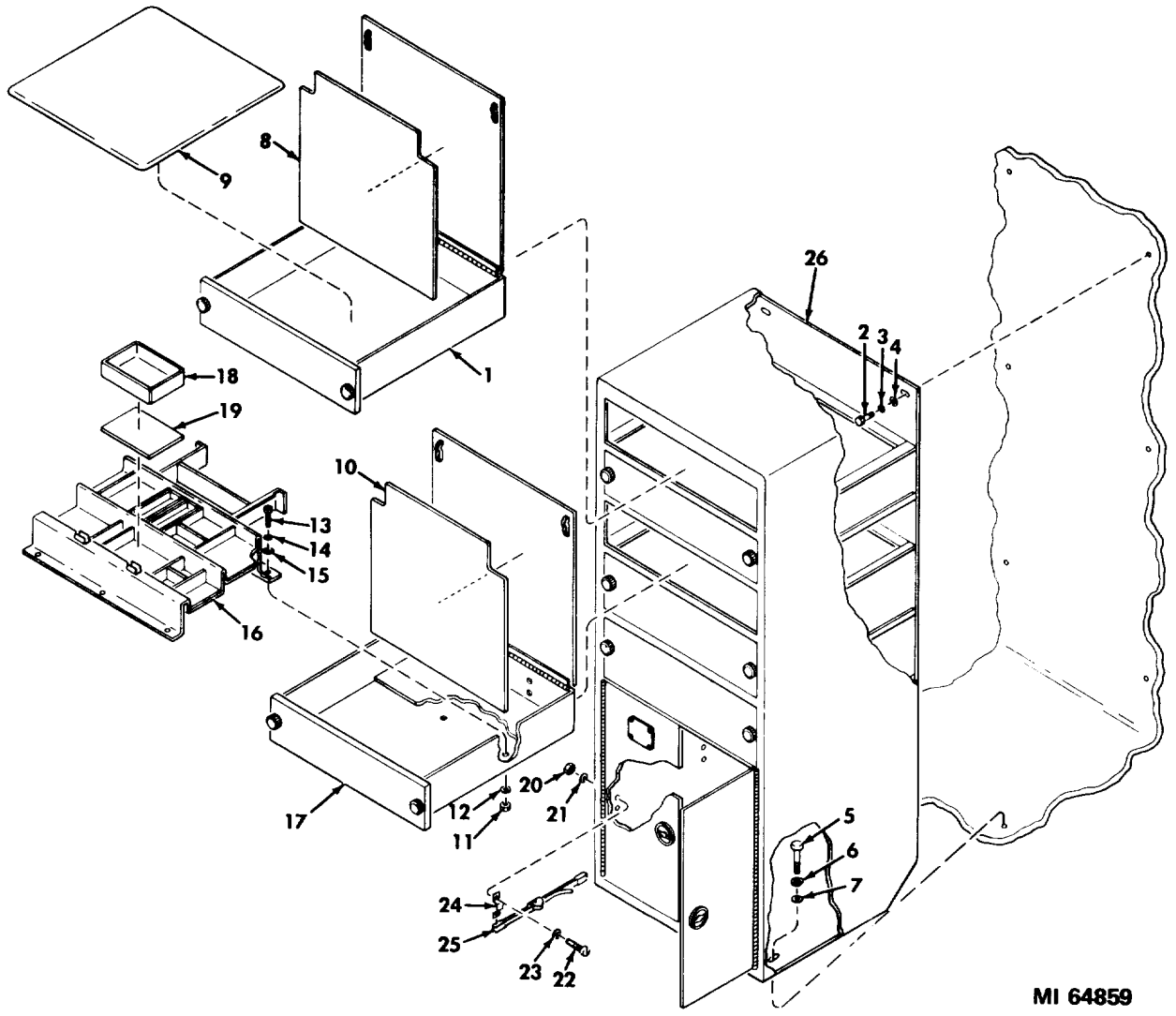
7-18. Repair of the Workbench

a. Remove the workbench (fig. 7-31).
b. Install the workbench (fig. 7-31).



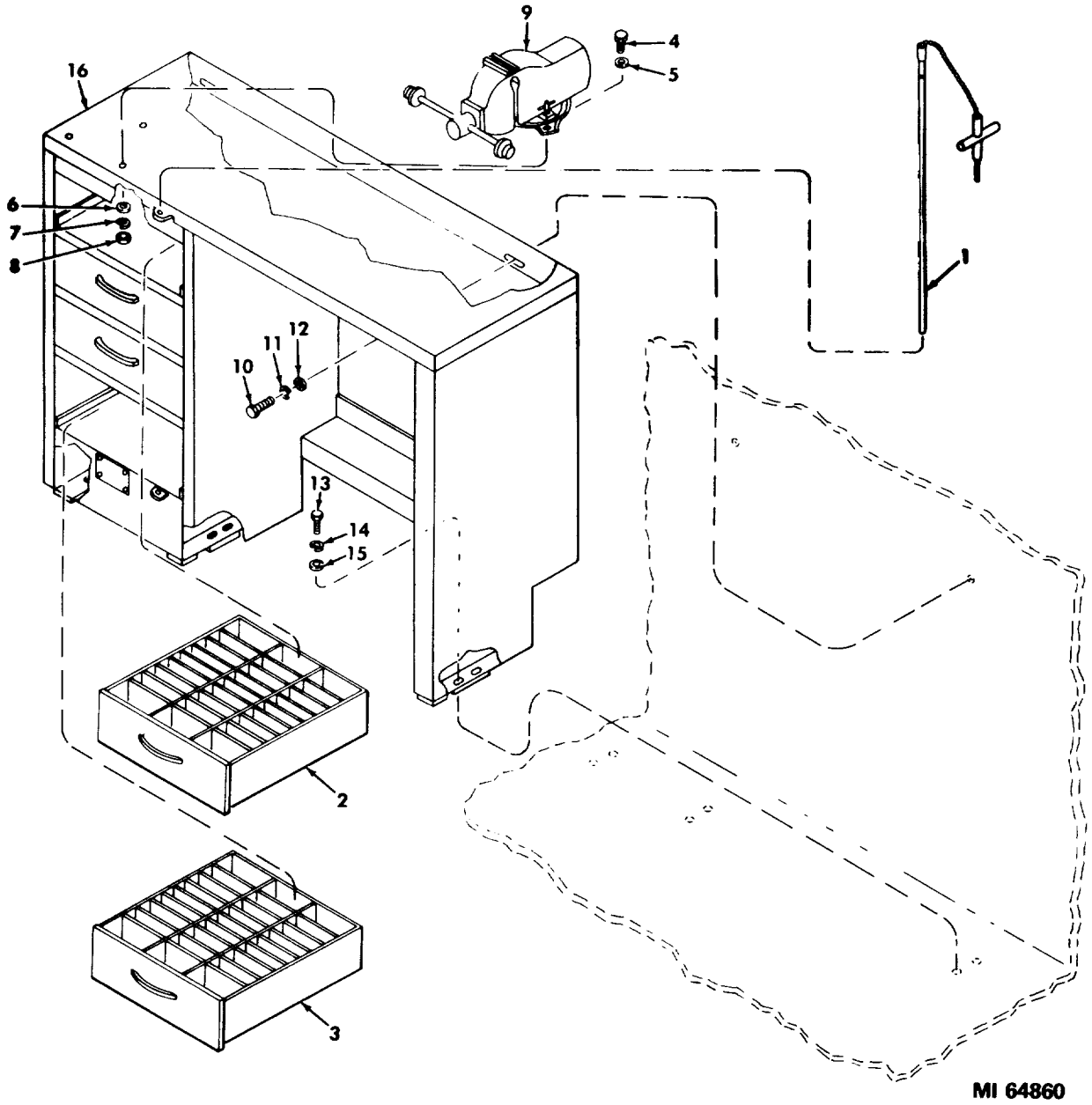
1-Drawer
2-Drawer
3-Drawer
4-5/16 x 7/8 hexagon head capscrew
5-5/16-inch lockwasher
6-5/16-inch flat washer
7-5/16 x 7/8 hexagon head capscrew
8-5/16-inch lockwasher
9-5/16-inch flat washer
10-Storage cabinet

Figure 7-29. Removal and installation of the small storage cabinet.



1-Drawer
2-5/16 x 7/8 hexagon head capscrew
3-5/16-inch lockwasher
4-5/16-inch flat washer
5-5/16 x 7/8 hexagon head capscrew
6-5/16-inch lockwasher
7-5/16-inch flat washer
8-Pad
9-Pad
10-Pad
11-No. 10 hexagon nut
12-No. 10 flat washer
13-No. 10 x 1/2 panhead screw
14-No. 10 lockwasher
15-No. 10 flat washer
16-Partition
17-Drawer
18-Pad
19-Pad
20-No. 8 hexagon nut
21-No. 8 fiat washer
22-No. 8 x 5/8 panhead screw
23-No. 8 flat washer
24-Holder
25-Strap
26-Storage cabinet

Figure 7-30. Removal and installation of the large storage cabinet.



1-Tie bar
2-Drawer
3-Drawer
4-3/8 x 1-29/64 machine bolt
5-3/8-inch flat washer
6-3/8-inch flat washer
7-3/8-inch lockwasher
8-3/8 hexagon nut
9-Vise
10-5/16 x 7/8 hexagon head capscrew
11-5/16-inch lockwasher
12-5/16-inch flat washer
13-5/16 x 7/8 hexagon head capscrew
14-5/16-inch lockwasher
15-5/16-inch flat washer
16-Workbench

Figure 7-31. Removal and installation of the workbench.

CHAPTER 8
PREPARATION FOR TEST

8-1. Explanation of Coverage

The test procedures in this manual are based upon the capability of the hydraulic test console and upon a standard method of testing hydraulic components. The test procedure tables list the operations to be performed, the normal indication, and, when applicable, the corrective procedures. The normal indication is given in boldface type. The corrective procedure lists the most probable defective parts and any adjustments that can be made.

NOTE

Possible defective parts are listed only when repair parts are authorized for the unit under test (uut). If the uut cannot be adjusted or repaired, the corrective procedure is omitted from the test procedure.

8-2. Positions of Controls Prior to Operating the Hydraulic Test Console

Before operating the hydraulic test console, set the controls to the positions indicated in table 5-12.

8-3. Precheck Procedures for Uut Test

The following procedures must be completed before the uut test is performed.

NOTE

It is assumed that the transportable shop 5 has been properly energized in accordance with chapter 5, section III.

a. Check the hydraulic test console main reservoir sight level. Replenish the hydraulic fluid if necessary (par. 6-7).

b. Swing the heat exchanger and the air compressor out of the shelter and secure them in the operating position.

c. Check the hydraulic console drain reservoir. Drain if necessary (par. 6-9).

8-4. Hydraulic Test Console Deenergizing Procedures

Refer to paragraph 5-15.

CHAPTER 9
ELEVATION SWIVEL JOINT 9096921

9-1. Preparation for Test

a. Clean and inspect the elevation swivel joint.

b. Make the proof pressure and operation test setup as shown in figure 9-1, but do not install the cap (3, fig. 9-2).

c. HAND PUMP PRESSURE UNLOADING VALVE .....CLOSE.

d. LOW PRESSURE GAGE SHUTOFF CLOSE.

e. Operate the handpump slowly until air-free oil flows from the uncapped port of the elevation swivel joint.

f. Install the cap.

g. 416 VOLTS .....ON.

h. 28 VOLTS .....ON.

i. MAKE READY .....ON.

j. Set the timer to zero.

9-2. Test Procedures

Perform the procedures in table 9-1 to complete the tests.

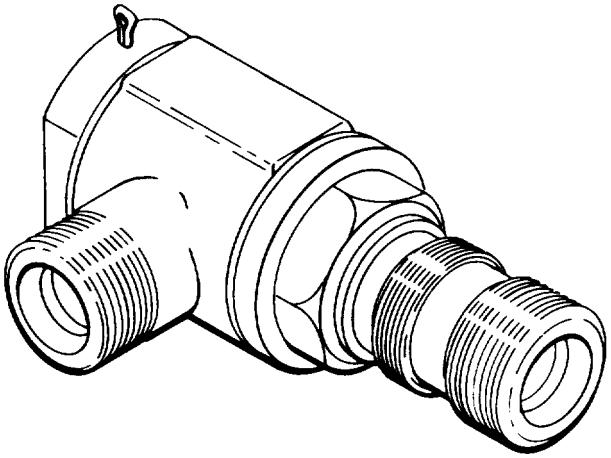
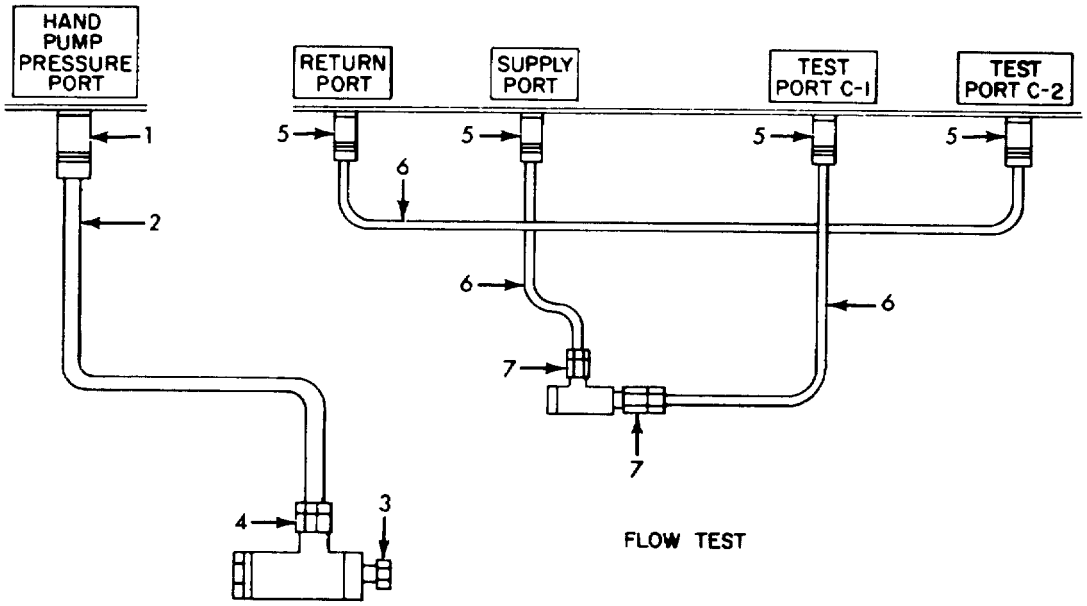


Figure 9-1. Elevation swivel joint 9096921.



1-Coupling 9194683
2-Hose assembly MS28762-4-0250
3-Cap MS21924010
4-Bushing MS21915010-4
5-Coupling 9194685 (4 required)
6-Hose assembly MS28762-8-0490 (3 required)
7-Bushing MS21915010-8 (2 required)

Figure 9-2. Elevation swivel joint-test setup.

Table 9-1 Elevation Swivel Joint Test Procedures

Step	Operation Normal Indication Corrective procedure
1.	**Proof Pressure.** Operate the handpump until the 0-10000 PSI GAGE indicates 4500. Start the timer and maintain the pressure for 3 minutes while observing the elevation swivel joint for leakage. **No external leakage.** Performed packing. Stop the timer and reset to zero.
2.	**Operation Pressure.**
a.	Slowly open the HAND PUMP PRESSURE UNLOADING VALVE and allow the pressure to reduce to 3000 psig. HAND PUMP PRESSURE UNLOADING VALVE .....close. Move the elevation swivel joint manually through 180 degrees. **No metal-to-metal binding during movement.** Anti-extension ring bearings, washers, housing, or swing nipple.

Table 9-1. Elevation Swivel Joint Test Procedures-Continued

Step	Operation Normal Indication Corrective procedure
	NOTE In the following step, open the LOW PRESSURE GAGE SHUTOFF valve to read the 0-100 PSI GAGE after the pressure drops below 100.
2 Cont.	
b.	Slowly open the HAND PUMP PRESSURE UNLOADING VALVE and allow the pressure to reduce to 10 psig. Start the timer and maintain the pressure for 3 minutes while observing the elevation swivel joint for leakage. **No external leakage.** Anti-extension ring bearings, washers, housing, or swing nipple. HAND PUMP PRESSURE UNLOADING VALVE .....open. Stop the timer and reset to zero. Disconnect the test setup.
3.	**Flow Rate.** Make the flow test setup as shown in figure 9-2. Flowmeter selector .....HIGHFLOW 2-8 GPM. SYSTEM PRESSURE CONTROL VALVE(s), COARSE and FINE ADJUST .....open. SYSTEM PRESSURE GAGE SELECTOR .....0-400. FLOW INCREASE .....2 gpm. OIL HEATER .....ON. OIL COOLER .....ON. SYSTEM PRESSURE PUMP .....ON. Slowly close the SYSTEM PRESSURE CONTROL VALVE(s), COARSE and FINE ADJUST, and adjust the FLOW INCREASE control until the INDICATOR HIGH FLOW meter indicates 8 gpm. Observe the indications on the 0-400 PSI GAGE and GAGE C. **The pressure differential between indications on the 0-400 PSI GAGE and GAGE C is not more than 100.** Housing or swing nipple. SYSTEM PRESSURE CONTROL VALVE(s), COARSE and FINE ADJUST. .....open slowly. SYSTEM PRESSURE PUMP .....OFF. Deenergize the console and disconnect the test setup.

CHAPTER 10
RELIEF VALVES

Section I. HYDRAULIC THERMAL RELIEF VALVE AN6245-B4

10-1. Preparation for Test

a. Clean and inspect the relief valve.

b. Make the test setup shown in figure 10-2, but do not install the plug (5, fig. 10-2).

c. HAND PUMP PRESSURE UNLOADING VALVE..... CLOSE.

d. LOW PRESSURE GAGE SHUTOFF CLOSE.

CAUTION

When performing the following step, do not exceed 3000 on the 0-10000 PSI GAGE. If 3000 is reached before fluid flows from the unplugged port, remove the safety wire and loosen the locknut (2, fig. 10-1). Turn the adjusting screw (1, fig. 10-1) counterclockwise two turns. Tighten the locknut and check to insure that fluid flows from the unplugged port at a pressure less than 3000. Repeat the procedure as required. If still unable to dump fluid as specified, disassemble the valve and clean the internal components. Install new safety wire.

d. Slowly operate the handpump until air-free oil flows from the unplugged port of the valve.

e. Place the performed packing (4, fig. 10-2) on the plug (5, fig. 10-2) and install the plug.

f. 416 VOLTS.....ON.

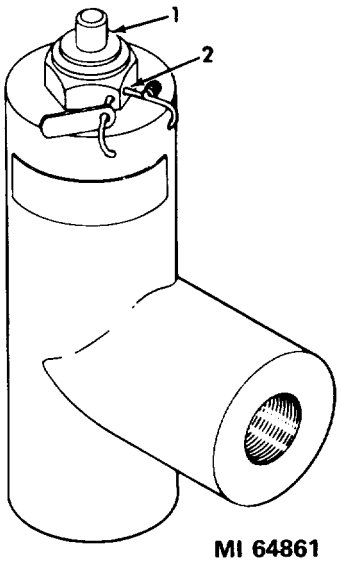
g. 28 VOLTS .....ON.

h. MAKE READY .....ON.

i. Set the timer to zero.

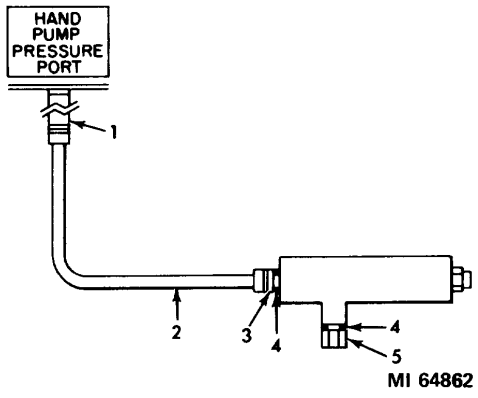
10-2. Test Procedures

Perform the procedures in table 10-1 to complete the tests. Adjustment of the valve is illustrated in figure 10-1. Replace the valve if adjustment does not produce a normal indication.



1-Adjusting screw
2-Locknut

Figure 10-1. Hydraulic thermal relief valve AN7245-B4.



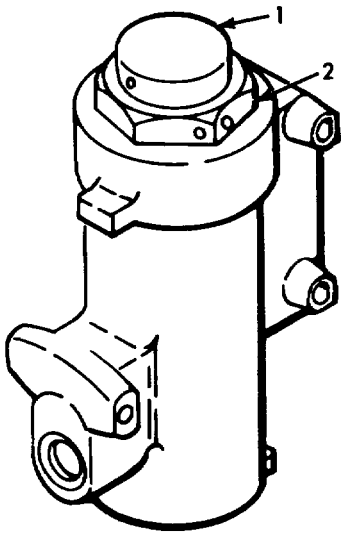
1-Coupling 9194683
2-Hose assembly MS28762-4-0250
3-Union MS21902D4
4-Preformed packing MS29512-4 (2 required)
5-Plug MS21913D4

Figure 10-2. Hydraulic thermal relief valve-test setup.

Table 10-1. Hydraulic Thermal Relief Valise Test Procedures

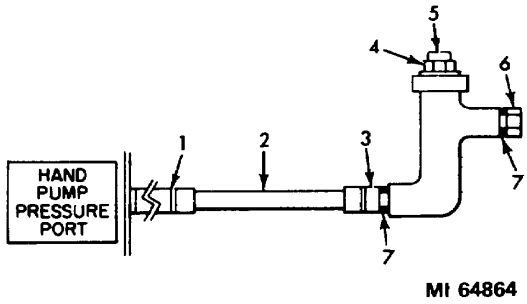
Step	Operation Normal Indication Corrective procedure
1.	**Proof Pressure.** Operate the handpump slowly until the 0-10000 PSI GAGE indicates 4500. Start the timer and maintain the pressure for 3 minutes while observing the valve for leakage. **No external leakage.** Adjusting screw (1, fig. 10-1). HAND PUMP PRESSURE UNLOADING VALVE .....open slowly. Stop the timer and reset to zero. Remove the plug (5, fig. 10-2) from the relief valve.
2.	**Cracking Pressure and Reseating.**
a.	HAND PUMP PRESSURE UNLOADING VALVE .....close. Operate the handpump slowly until oil flows from the unplugged port of the valve. Observe the maximum pressure indicated on the 0-10000 PSI GAGE as the valve relieves. **The gage indicates 2500 to 2700.** Loosen the locknut (2, fig. 10-1) on the pressure adjusting screw (1, fig. 10-1) and turn the screw as required to raise or lower the cracking pressure. Install new safety wire.
b.	Slowly open the HAND PUMP PRESSURE UNLOADING VALVE until the pressure indicated on the 0-10000 PSI GAGE starts to decrease. Close the HAND PUMP PRESSURE UNLOADING VALVE when the gage indicates 1950 psi. Start the timer and maintain the pressure for 1 minute. **Not more than 5 drops of oil per minute flows from the unplugged port.** Stop the timer and reset to zero. PUMP PRESSURE UNLOADING VALVE .....open slowly. Disconnect the test setup.

Section II. HYDRAULIC PRESSURE RELIEF VALVE AN6279-6CD OR MS28893-D6



1-Pressure adjusting screw
2-Locknut

Figure 10-3. Hydraulic pressure relief valve AN6279-6CD.



1-Coupling half 9194683
2-Hose assembly MS28762-4-0250
3-Reducer
4-Locknut
5-Pressure adjusting screw
6--Plug
7-Preformed packing

Figure 10-4. Hydraulic pressure relief valve - test setup.

10-3. Preparation for Test

a. Clean and inspect the relief valve.

b. Make the test setup shown in figure 10-4, but do not install the plug (6, fig. 10-4).

c. 416 VOLTS.....ON.

d. 28 VOLTS .....ON.

e. MAKE READY.....ON.

f. Set the timer to zero.

g. HAND PUMP PRESSURE UNLOADING VALVE .....CLOSE.

h. LOW PRESSURE GAGE SHUTOFF CLOSE.

CAUTION

When performing the following step, do not exceed 3000 on the 0-10000 PSI GAGE. If 3000 is reached before fluid flows from the unplugged port, loosen the nut (1, fig. 10-5) and turn the adjusting screw (2, fig. 10-5) counterclockwise two turns. Tighten the nut and check to insure that the fluid flows from the unplugged port at a pressure less than 4000. Repeat the procedure as required. If still unable to dump fluid as specified, disassemble the valve and clean the internal components.

i. Operate the handpump slowly until air-free oil flows from the unplugged port of the relief valve.

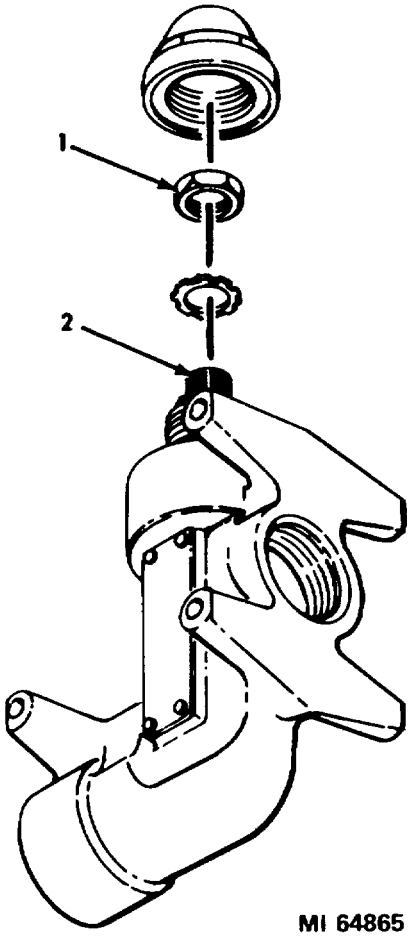
j. Place the preformed packing (7, fig. 10-4) on the plug (6, fig. 10-4) and install the plug.

10-4. Test Procedures

Perform the procedures in table 10-2 to complete the tests. Adjustment of the valve is illustrated in figure 10-5. Replace the valve if adjustment does not produce a normal indication.

Table 10-2. Hydraulic Pressure Relief Valve Test Procedures

Step	Operation Normal Indication Corrective procedure
1.	**Proof Pressure.** Operate the handpump until the 0-10000 PSI GAGE indicates 4500. Start the timer and maintain the pressure for 3 minutes while observing the relief valve for leakage. **No external leakage.** Adjusting screw (2, fig. 10-5). HAND PUMP PRESSURE UNLOADING VALVE .....open slowly. Stop the timer and reset to zero. Remove the plug (6, fig. 10-4) with the performed packing (7, fig. 10-4) from the relief valve.
2.	**Cracking Pressure and Reseating.**
a.	HAND PUMP PRESSURE UNLOADING VALVE close. Operate the handpump slowly until oil flows from the relief valve port. Check the pressure indication on the 0-10000 PSI GAGE as the valve relieves. **The cracking pressure of the relief valve is 2700 to 2900.** Loosen the nut (1, fig. 10-5) and turn the adjusting screw (2, fig. 10-5) as required to raise or lower the cracking pressure. After adjustment tighten the nut.
b.	Slowly open the HAND PUMP PRESSURE UNLOADING VALVE until the pressure indicated on the 0-10000 PSI GAGE starts to decrease. Close the HAND PUMP PRESSURE UNLOADING VALVE when the gage indicates 2100 psi. Start the timer and maintain the pressure for 1 minute. **Not more than 5 drops of oil per minute flows from the unplugged port.** Stop the timer and reset to zero. HAND PUMP PRESSURE UNLOADING VALVE .....open slowly. Disconnect the test setup.



1-Nut
2-Adjusting screw

Figure 10-5. Hydraulic pressure relief valve AN6279-6CD - adjustment.

Section III. AZIMUTH RELIEF VALVE 9089448

10-5. Preparation for Test

a. Clean and inspect the azimuth relief valve.

b. Mount the test fixtures on the valve as shown in figure 10-7.

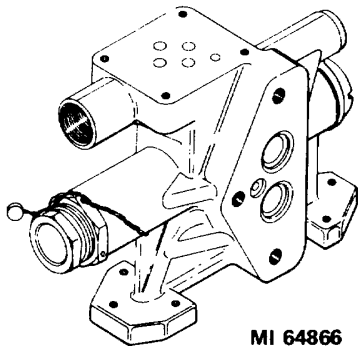
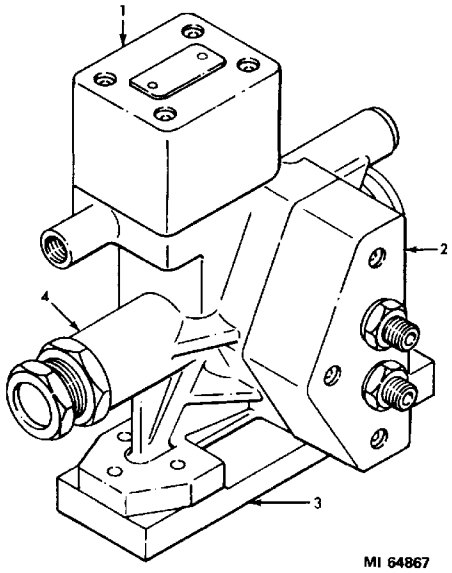


Figure 10-6. Azimuth relief valve 9089448.



1-Test fixture 9197426
2-Test fixture 9197424
3-Test fixture 9194956
4-Azimuth relief valve 9089448

Figure 10-7. Test fixtures mounted on the azimuth relief valve.

c. Make the proof and cracking pressure test setup as shown in figure 10-8, but do not install the cap (19, fig. 10-8) on the test fixture port No. 1 (15, fig. 10-8).

d. HAND PUMP PRESSURE UNLOADING VALVE.....CLOSE.

e. LOW PRESSURE GAGE SHUTOFF..CLOSE.

f. Operate the handpump slowly until air-free oil flows from the uncapped port of the valve.

g. Install the cap (19, fig. 10-8) on test fixture port No. 1(15, fig. 10-8).

h. 416 VOLTS.....ON.

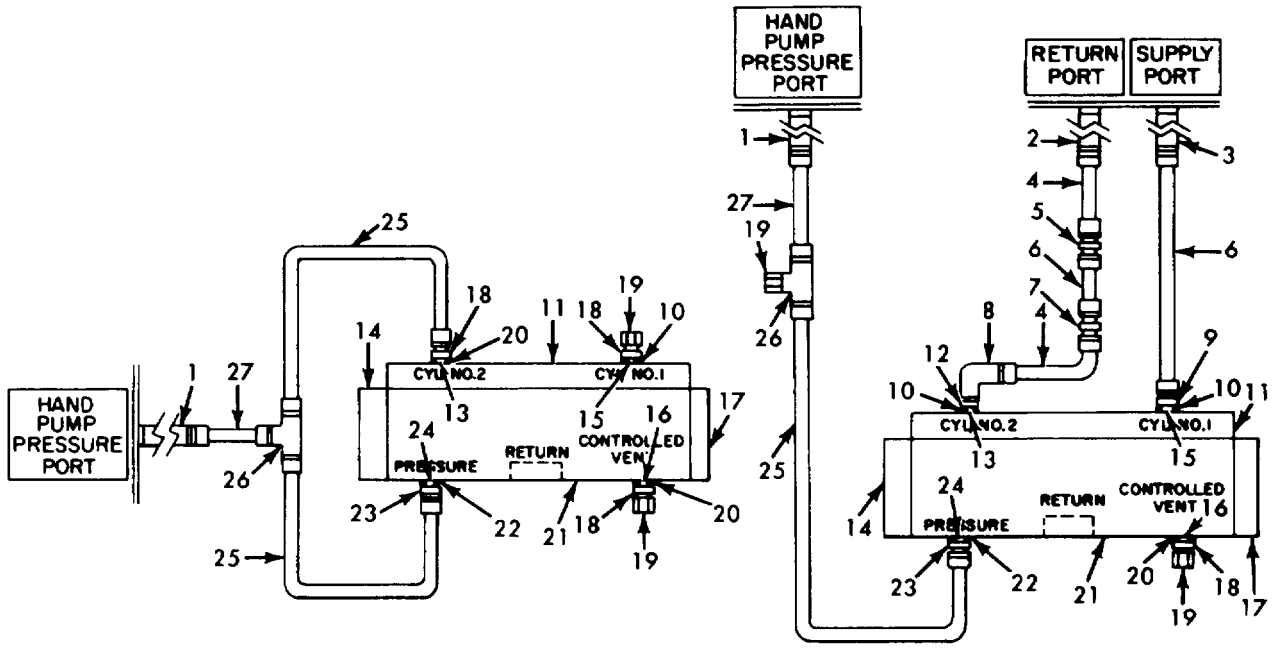
i. 28 VOLTS .....ON.

j. MAKE READY.....ON.

k. Set the timerto zero.

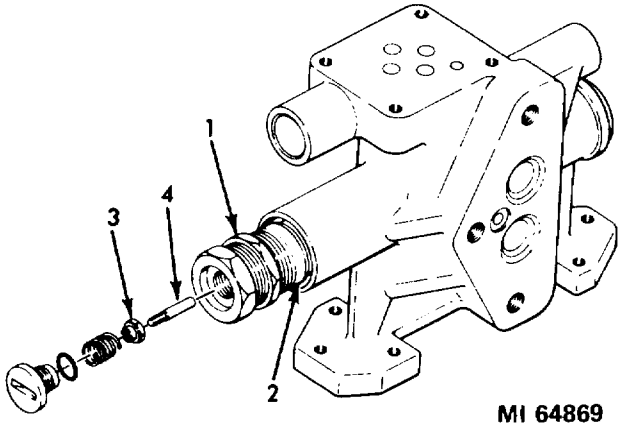
10-6. Test Procedures

Perform the procedures in table 10-3 to complete the tests.



1-Coupling 9194683
2-Coupling 9194686
3-Coupling 9194685
4-Tube assembly 9197359 (2 required)
5-Reducer MS21916D12-4
6-Hose assembly MS28762-8-0250 (2 required)
7-Reducer MS21908D-6
8-Elbow bulkhead fitting MS21908D4
9-Reducer MS21916D8-4
10-Preformed packing MS29512-4 (2 required)
11-Test fixture 9197424
12-Nut AN924D4
13-Test fixture port No. 2
14-Test fixture 9197426
15-Test fixture port No. 1
16-Controlled vent port
17-Test fixture 9194956
18-Union MS21902D4
19-Cap MS21914D4 (2 required)
20-Preformed packing MS29512-4 (3 required)
21-Azimuth relief valve 9089448
22-Preformed packing MS29512-6 (2 required)
23-Reducer MS21916D6-4
24-Pressure port
25-Hose assembly MS28762-4-0250 (2 required)
26-Tee MS21905D4
27-Tube assembly 9197357

Figure 10-8. Azimuth relief valve-test setup



1-Nut
2-Sleeve assembly
3-Nut
4-Poppet

Figure 10-9. Azimuth relief valve 9089448-djustment.

Table 10-3. Azimuth Relief Valve Test Procedures

Step	Operation Normal Indication Corrective procedure
	NOTE The key numbers shown below in parentheses refer to figure 10-9, unless otherwise indicated.
1.	**Proof Pressure.** Operate the handpump until the 0-10000 PSI GAGE indicates 6000. Start the timer and maintain the pressure for 3 minutes while observing the azimuth relief valve for leakage. **No leakage or distortion of valve.** Preformed packings. Stop the timer and reset to zero. HAND PUMP PRESSURE UNLOADING VALVE .....open slowly.
2.	**Cracking Pressure and Reseating.**
a.	Remove the cap (19, fig. 10-8) from test fixture port No. 1 (15, fig. 10-8). HAND PUMP PRESSURE UNLOADING VALVE .....closed. Operate the handpump slowly until oil flows from the uncapped port of the valve. Watch the 0-10000 PSI GAGE while you operate the handpump to see what the maximum pressure is when the valve relieves. **The gage indicates 2850 to 2950.** Remove the safety wire, loosen the nut (1), and adjust the sleeve assembly (2) as required to raise or lower cracking pressure. Backup rings, performed packing, poppets, pistons, and springs.
b.	Slowly open the HAND PUMP PRESSURE UNLOADING VALVE until the pressure indicated on the 0-10000 PSI GAGE starts to decrease. Close the HAND PUMP PRESSURE UNLOADING VALVE when the gage indicates 2750 psi. Start the timer and maintain the pressure for 1 minute. **Not more than 5 drops of oil per minute flows from the uncapped port.**
c.	HAND PUMP PRESSURE UNLOADING VALVE. .....open slowly. Remove the hose assembly (25, fig. 10-8) from the union (18, fig. 10-8) on test fixture port No. 2 (13, fig. 10-8) and attach it to the test fixture port No. 1 (15, fig. 10-8). HAND PUMP PRESSURE UNLOADING VALVE .....close. Operate the handpump slowly until oil flows from the uncapped port of the valve. Watch the 0-10000 PSI GAGE while operating the handpump to see what the maximum pressure is when the valve relieves. **The gage indicates 2850 to 2950.** Loosen or tighten the nut on the poppet (3 and 4) as required. Backup rings, performed packing, poppets, pistons, and springs.

Table 10-3. Azimuth Relief Valve Test Procedures -Continued

Step	Operation Normal Indication Corrective procedure
2.*d*. Cont.	Slowly open the HAND PUMP PRESSURE UNLOADING VALVE until the pressure indicated on the 0-10000 PSI GAGE starts to decrease. Close the HAND PUMP PRESSURE UNLOADING VALVE when the gage indicates 2750 psi. Start the timer and maintain the pressure for 1 minute. **Not more than 5 drops of oil per minute flows from the uncapped port.** HAND PUMP PRESSURE UNLOADING VALVE .....open slowly. Disconnect the test setup.
3.	**Flow.**
a.	Make the flow check test setup shown in figure 10-8. HAND PUMP PRESSURE UNLOADING VALVE .....close. SYSTEM PRESSURE CONTROL VALVE(s), COARSE and FINE ADJUST.....close. FLOW INCREASE.....full cw. SYSTEM PRESSURE GAGE SELECTOR .....0-4000. Operate the handpump slowly until the 0-10000 PSI GAGE indicates 3000. Flowmeter selector.....HIGH FLOW 2-8 .....GPM. OIL HEATER..... .....ON. OIL COOLER.....ON. SYSTEM PRESSURE PUMP.....ON. Adjust the FLOW INCREASE rotary control knob until the INDICATOR HIGH FLOW meter indicates 3.5 gpm. **The 0-4000 PSI GAGE indicates not more than 3500.** Backup rings, preformed packings, poppets, pistons, and springs.
b.	HAND PUMP PRESSURE UNLOADING VALVE .....open slowly. SYSTEM PRESSURE CONTROL VALVE(s), COARSE and FINE ADJUST.....open slowly. Reverse the test setup at test fixture port No. 1 (15, fig. 10-8), and test fixture port No. 2 (13, fig. 10-8), and repeat the flow check. **The 0-4000 PSI GAGE indicates not more than 3500.** Backup rings, preformed packings, poppets, pistons, or springs. Deenergize the console and disconnect the test setup.

Section IV. ELEVATION ACTUATOR CYLINDER RELIEF VALVE 9089718

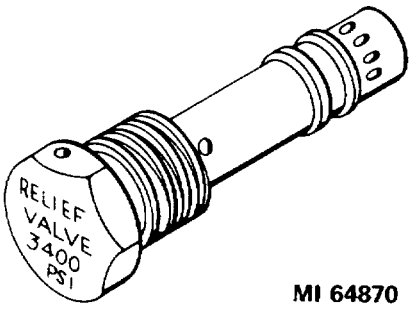


Figure 10-10. Elevation actuator cylinder relief valve 9089718.

10-7. Preparation for Test

a. Clean and inspect the relief valve.

b. Make the pressure test setup shown in figure 10-11, but do not install the cap (7, fig. 10-11).

c. LOW PRESSURE GAGE SHUTOFF CLOSE.

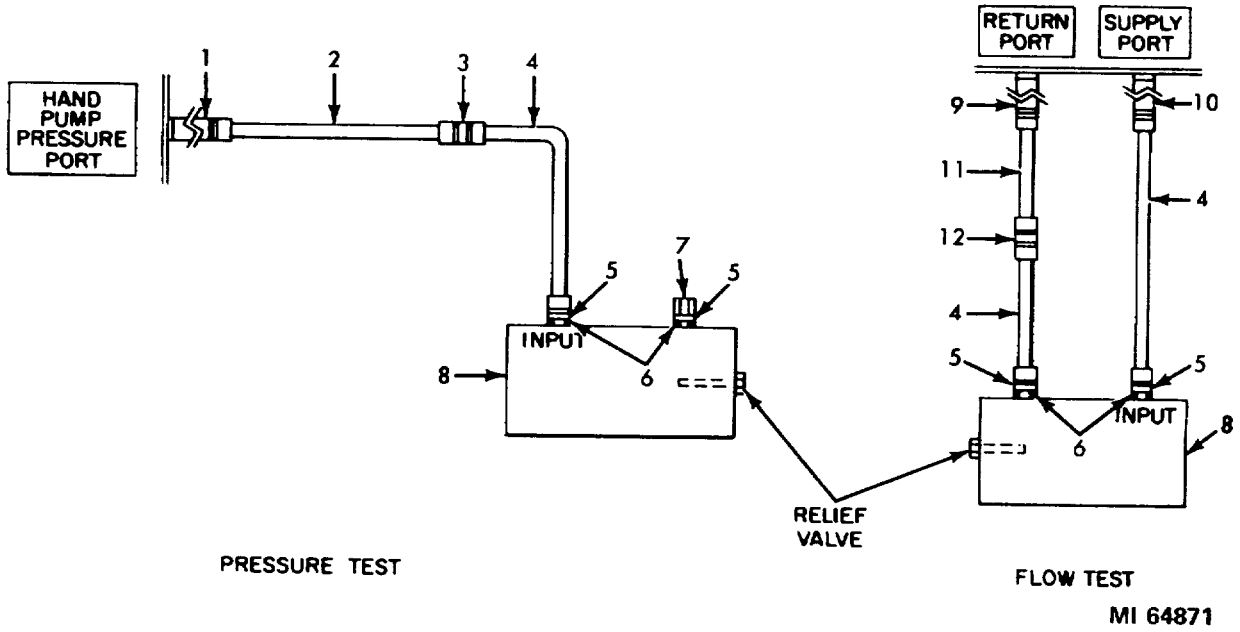
d. HAND PUMP PRESSURE UNLOADING VALVE CLOSE.

e. Operate the handpump until air-free oil flows from the uncapped port.

f. Install the cap (7, fig. 10-11).

10-8. Test Procedures

Perform the procedures in table 10-4 to complete the tests. Replace the valve if defective.



1-Coupling 9194683
2-Tube assembly 9197357
3-Reducer MS21916D8-4
4-Hose assembly MS28762-8-0250 (2 required)
5-Reducer MS21916D8-6 (2 required)
6-Preformed packing MS29512-6 (2 required)
7-Cap MS21916D8
8-Test block 9194950
9-Coupling 9194686
10-Coupling 9194685
11-Tube assembly 9197359
12-Reducer MS21916D12-8

Figure 10-11. Relief valve-test setup.

Table 10-4. Elevation Actuator Cylinder Relief Valve Test Procedures

Step	Operation Normal Indication Corrective procedure
1.	**Proof Pressure, Cracking Pressure, and Reseating.**
a.	Operate the handpump slowly until the 0-10000 PSI GAGE indicates 4500. Observe the relief valve for leakage. **No external leakage.**
b.	HAND PUMP PRESSURE UNLOADING VALVE .....open slowly. Remove the cap (7, fig. 10-11) from the test block (8, fig. 10-11). HAND PUMP PRESSURE UNLOADING VALVE ..... close. Operate the handpump slowly until the relief valve starts to relieve. Observe the 0-10000 PSI GAGE. **When the relief valve poppet unseats, there is a slight pressure drop.** **The valve relieves between 2700 and 3400.**
c.	Slowly open the HAND PUMP PRESSURE UNLOADING VALVE until the pressure indicated on the 0-10000 PSI GAGE starts to decrease. Close the HAND PUMP PRESSURE UNLOADING VALVE when the gage indicates 2550 psi. **Observe that the oil stops flowing from the test block.** HAND PUMP PRESSURE UNLOADING VALVE .....open slowly.
2.	**Flow.** Make the flow test setup shown in figure 10-11. SYSTEM PRESSURE CONTROL VALVE(s), COARSE and FINE open. ADJUST ..... FLOW INCREASE.....mid-position. Flowmeter selector .....HIGH FLOW 2-8 GPM. SYSTEM PRESSURE GAGE SELECTOR .....0-4000. OIL HEATER.....ON. OIL COOLER.....ON. SYSTEM PRESSURE PUMP .....ON. Close the SYSTEM PRESSURE CONTROL VALVE(s), COARSE and FINE ADJUST slowly until 3400 is indicated on the 0-4000 PSI GAGE. Observe the INDICATOR HIGH FLOW meter. **The meter indicates not less than 2 gpm.**

Table 10-4. Elevation Actuator Cylinder Relief Valve Test Procedures-Continued

Step	Operation Normal Indication Corrective procedure
2. Cont.	SYSTEM PRESSURE CONTROL VALVE(s), COARSE and FINE ADJUST .....open. SYSTEM PRESSURE PUMP .....OFF. Deenergize the console and disconnect the test setup.

Section V. PUMP RELIEF VALVES MS28720-8, 9090270, AND 9096790

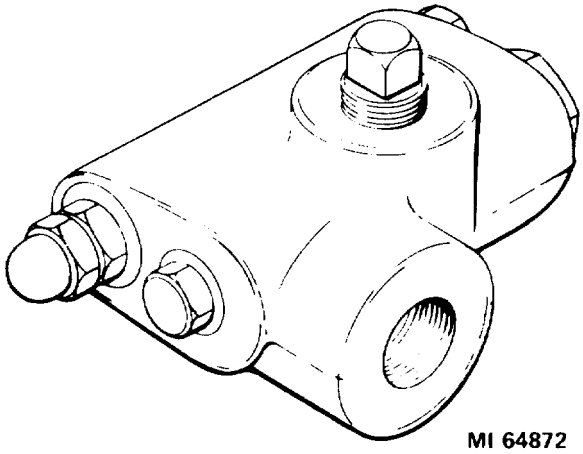


Figure 10-12. Pump relief valve.

10.9. Preparation for Test

a. Clean and inspect the valve.

b. Make the proof pressure test setup shown in figure 10-13, but do not install the cap (6, fig. 10-13).

c. HAND PUMP PRESSURE UNLOADING VALVE .....CLOSE

d. LOW PRESSURE GAGE SHUTOFF CLOSE.

CAUTION

When performing the following step, do not exceed 100 on the 0-10000 PSI GAGE. If 100 is reached before fluid flows from the unplugged port, remove the acorn nut (1, fig. 10-14), loosen the locknut (2, fig. 10-14), and turn the adjusting screw (3, fig. 10-14) counterclockwise two turns. Tighten the locknut and check to insure that the fluid flows from the unplugged port at a pressure below 100. Repeat the procedure as required. If still unable to dump fluid from the uncapped port at less than 100, disassemble the valve and clean the

e. Slowly operate the handpump until air-free oil flows from the uncapped port of the valve.

f. Install the cap (6, fig. 10-13).

g. 416 VOLTS.....ON.

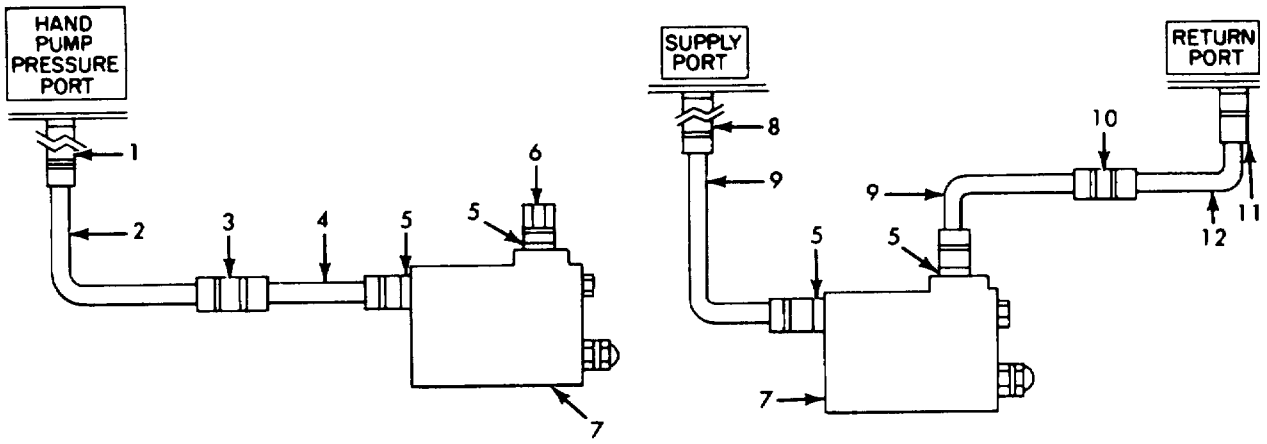
h. 28 VOLTS .....ON

i. MAKE READY.....ON.

j. Set the timer to zero.

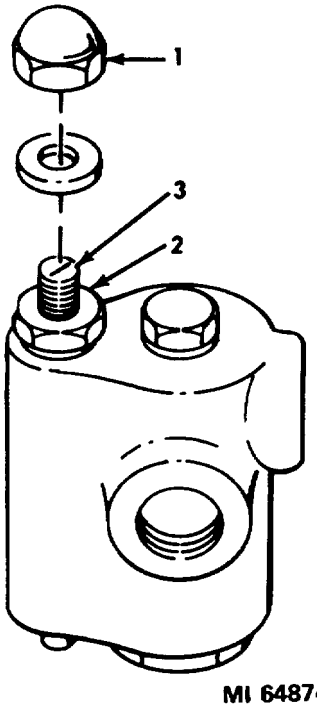
10-10. Test Procedures

Perform the procedures in table 10-5 to complete the tests.



1-Coupling 9194683
2-Hose assembly MS28762-4-0250
3-Reducer MS219106-4
4-Tube assembly 9197363
5-Union ER816-6-8 (2 required)
6-Cap MS21914D6
7-Pump relief valve
8-Coupling 9194685
9-Hose assembly MS28762-8-0250 (2 required)
10-Reducer MS21916D12-8
11-Coupling 9194686
12-Tube assembly 9197359

Figure 10-13. Pump relief valve - test setup.



1-Acorn nut
2-Locknut
3-Adjusting screw

Figure 10-14. Pump relief valve adjustment.

Table 10-5. Pump Relief Valve Test Procedures

Step	Operation Normal Indication Corrective procedure
1.	**Proof Pressure.** **NOTE** An indication of 200 cannot be read directly on the 0-10000 PSI GAGE and must be interpolated. Operate the handpump slowly until the 0-10000 PSI GAGE indicates 200. Start the timer and maintain the pressure for 2 minutes while observing the valve for leakage. **No external leakage.** Gaskets, hexagon nut, plugs, preformed packing, or body. HAND PUMP PRESSURE UNLOADING VALVE .....open slowly. Stop the timer and reset to zero. Disconnect the test setup.
2.	**Cracking Pressure and Reseating.**
a.	Make the cracking pressure test setup shown in figure 10-13. Flowmeter selector .....HIGH FLOW 2-8 .....GPM. FLOW INCREASE .....full ccw. SYSTEM PRESSURE GAGE SELECTOR .....0-400. SYSTEM PRESSURE CONTROL VALVE(s), COARSE and FINE ADJUST .....open. OIL HEATER .....ON. OIL COOLER .....ON. SYSTEM PRESSURE PUMP .....ON. Close the SYSTEM PRESSURE CONTROL VALVE(s), COARSE and FINE ADJUST, until the INDICATOR HIGH FLOW meter indicates 3 gpm. **The 0-400 PSI GAGE indicates 92 to 102.** Remove the acorn nut (1, fig. 10-14), loosen the locknut (2, fig. 10-14), and set the adjusting screw (3, fig. 10-14) for the required indication. Springs, cone, cone seat, spool, or seat.
b.	Open the SYSTEM PRESSURE CONTROL VALVE(s), COARSE and FINE ADJUST, until the INDICATOR HIGH FLOW meter just indicates 0 gpm. **The 0-400 PSI GAGE indicates 75 minimum.** Disassemble and inspect the relief valve. SYSTEM PRESSURE CONTROL VALVE(s), COARSE and FINE ADJUST .....open.

Table 10-5. Pump Relief Valve Test Procedures-Continued

Step	Operation Normal Indication Corrective procedure
2*b*. Cont.	SYSTEM PRESSURE PUMP .....OFF. 416 VOLTS .....OFF. 28 VOLTS .....OFF. Deenergize the console and disconnect the test setup.

CHAPTER 11
SHUTOFF VALVES

Section I. HYDRAULIC SHUTOFF VALVE 9089715

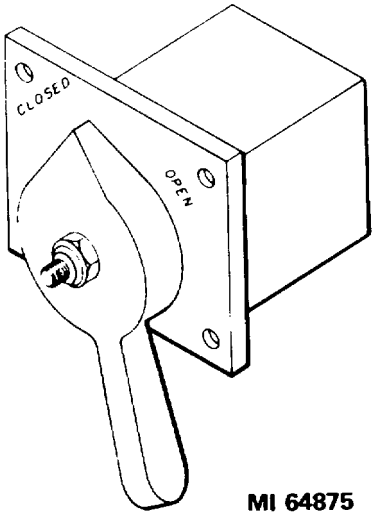


Figure 11-1. Hydraulic shutoff valve 9089715.

11-1. Preparation for Test

a. Clean and inspect the valve.

b. Make the proof pressure and leakage test setup as shown in figure 11-2. Do not tighten the pressure cap (11, fig. 11-2).

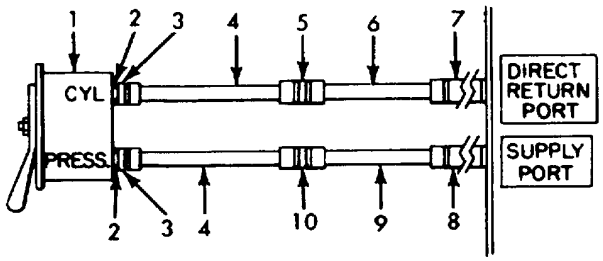
c. HAND PUMP PRESSURE UNLOADING VALVE.....CLOSE.

d. LOW PRESSURE GAGE SHUTOFF CLOSE.

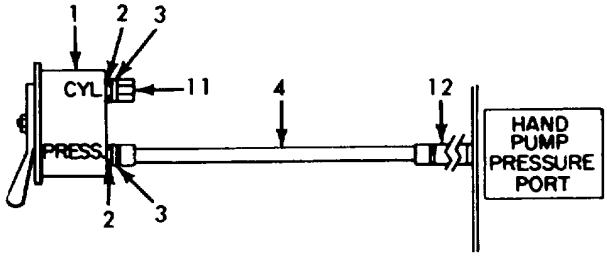
e. Operate the handpump until air-free oil flows from the valve cylinder port. Tighten the pressure cap.

11-2. Test Procedures

Perform the procedures in table 11-1 to complete the tests. Replace the valve if defective.



LEAKAGE AND OPERATION TEST



PROOF PRESSURE AND LEAKAGE TEST

MI 64876

1-Valve 9089715
2-Preformed packing MS29512-4 (2 required)
3-Union MS21902D4 (2 required)
4-Hose assembly MS28762-4-0250 (2 required)
5-Reducer MS21916D12-4
6--Tube assembly 9197359
7-Coupling 9194686
8-Coupling 9194685
9-Tube assembly 9197357
10-Reducer MS21916D8-4
11-Pressure cap MS21914-4
12-Coupling 9194683

Figure 11-2. Hydraulic shutoff valve-test setup.

Table 11-1. Hydraulic Shutoff Valve Test Procedures

Step	Operation Normal Indication Corrective procedure
1.	**Proof Pressure and Leakage.** Operate the handpump until the 0-10000 PSI GAGE indicates 4500. Start the timer and maintain the pressure for 3 minutes. **No external leakage.** Valve body, spool, or preformed packing. HAND PUMP PRESSURE UNLOADING VALVE .....open. Stop the timer and reset to zero.
2.	**Leakage and Operation.**
a.	Make the leakage and operation test setup as shown in figure 11-2. SYSTEM PRESSURE CONTROL VALVE(s), COARSE and FINE ADJUST .....open. Flowmeter selector valve .....HIGH FLOW 2-8 GPM. FLOW INCREASE .....2 gpm. SYSTEM PRESSURE GAGE SELECTOR .....0-4000. Shutoff valve .....CLOSE. SYSTEM PRESSURE PUMP .....ON. SYSTEM PRESSURE CONTROL VALVE COARSE ADJUST .....close. Apply pressure to the valve pressure port with the SYSTEM PRESSURE CONTROL VALVE FINE ADJUST and, if necessary with a slight increase on the FLOW INCREASE rotary control knob. **The 0-4000 PSI GAGE indicates 3000.** Gage, leaks in the system, system air bound, system pressure pump, or low fluid level in the reservoir.
b.	Alternately open and close the shutoff valve handle at least four times. Set the operating handle to the OPEN position. **The valve handle does not bind.** Spool, valve handle, preformed packing, and valve body. SYSTEM PRESSURE CONTROL VALVE(s), COARSE and FINE ADJUST .....open. SYSTEM PRESSURE PUMP .....OFF. Deenergize the console and disconnect the test setup.

Section II. ANGLE SHUTOFF VALVE 9090739

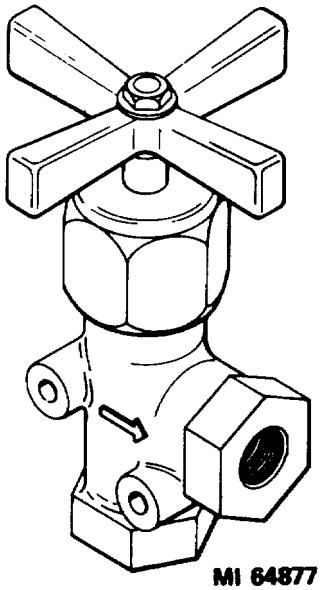


Figure 11-3. Angle shutoff valve 9090739.

Figure 11-4. Deleted.

11-3. Preparation for Test

a. Clean and inspect the valve.

b. Make the angle shutoff valve or bypass shutoff valve proof-pressure test setup shown in figure 11-5, but do not install the cap (3, fig. 11-5).

c. HAND PUMP PRESSURE UNLOADING VALVE.....CLOSE.

d. LOW PRESSURE GAGE SHUTOFF CLOSE.

e. Open the valve that is under test.

f. Operate the handpump slowly until air-free oil flows from the uncapped port of the valve.

g. Install the cap (3, fig. 11-5).

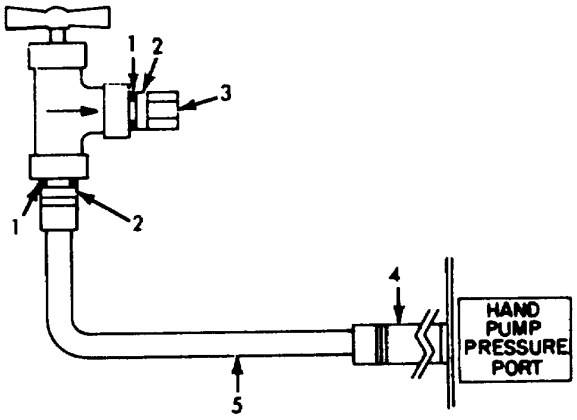
h. 416 VOLTS.....ON.

i. 28 VOLTS .....ON.

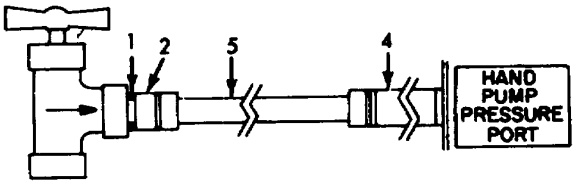
j. Set the timer to zero.

11-4. Test Procedures

Perform the procedures in table 11-2 to complete the tests. Replace the valve if defective.



ANGLE SHUTOFF VALVE PROOF PRESSURE TEST SETUP



ANGLE SHUTOFF VALVE LEAKAGE TEST SETUP

MI 64879A

1-Preformed packing M829512-4 (2 required)
2-Union MS21902D4
3-Cap M82194D4
4-Coupling 9194683
5-Hose assembly MS28762-4-0250

Figure 11-5. Angle shutoff valve-test setup.

Table 11-2. Angle Shutoff or Bypass Valve Test Procedures

Step	Operation Normal Indication Corrective procedure
1.	**Proof Pressure.** Operate the handpump slowly until 0-10000 PSI GAGE indicates 4500. Start the timer and maintain the pressure for 3 minutes while observing the angle shutoff valve for leakage. **No external leakage.** **NOTE** If there is leakage around the valve stem, tighten the valve stem packing gland nut. HAND PUMP PRESSURE UNLOADING VALVE .....open. Stop the timer and reset to zero. Disconnect the test setup.
2.	**Leakage.** Make the leakage check test setup as shown in figure 11-5. HAND PUMP PRESSURE UNLOADING VALVE .....close. Operate the handpump slowly until air-free oil flows from the uncapped port of the valve. Close the valve. Operate the handpump slowly until the 0-10000 PSI GAGE indicates 3000. Start the timer and maintain the pressure for 3 minutes while observing the valve for leakage. **The leakage through the uncapped port does not exceed 2 drops per minute. No evidence of leakage elsewhere.** Stop the timer and reset to zero. HAND PUMP PRESSURE UNLOADING VALVE .....open slowly. Disconnect the test setup.

Section III. PILOT-OPERATED HYDRAULIC SHUTOFF VALVE 9194240

11-5. Preparation for Test

a. Clean and inspect the valve.

b. Make the proof pressure and leakage test setup for steps 1 and 2 shown in figure 11-7, but do not install the cap (14, fig. 11-7) on the OUT port.

c. HAND PUMP PRESSURE UNLOADING VALVE.....CLOSE.

d. LOW PRESSURE GAGE SHUTOFF .CLOSE.

e. Range selector.....0.2 AMPS

f. Operate the handpump slowly until air-free oil flows from the uncapped port of the valve.

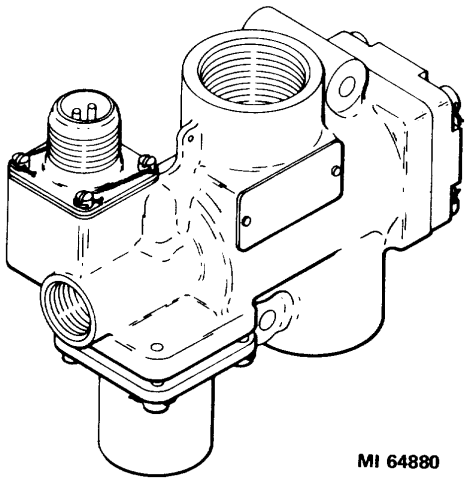


Figure 11-6. Pilot-operated hydraulic shutoff valve 9194240.

g. Install the cap (14, fig. 11-7) on the OUT port.
h. 416 VOLTS.....ON.
i. 28 VOLTS .....ON.
j. MAKE READY.....ON.
k. Set the timer to zero.

11-6. Test Procedures

Perform the procedures in table 11-3 to complete the tests. Replace the valve if defective.

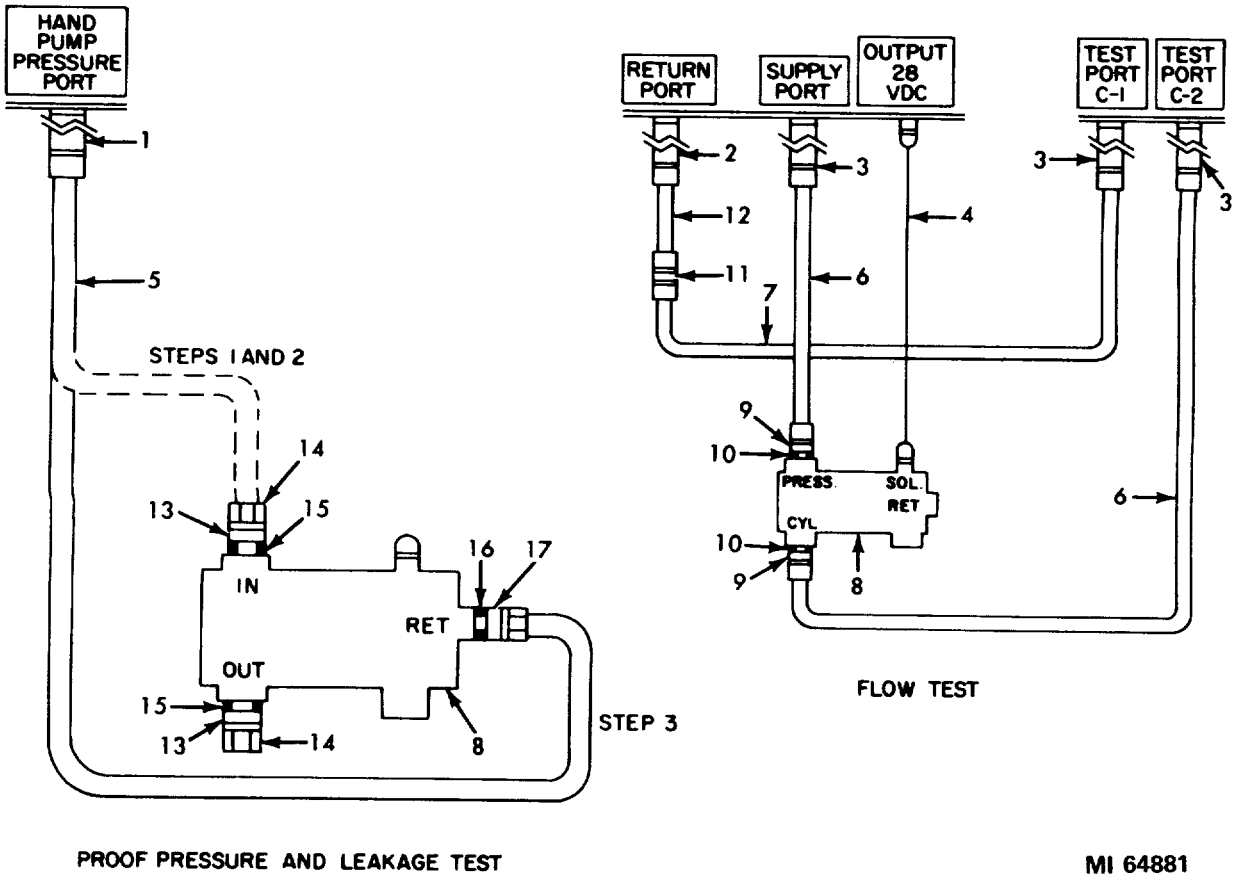


Figure 11-7. Pilot-operated hydraulic shutoff valve-test setup.

1-Coupling 9194683
2-Coupling 9194686
3-Coupling 9194685 (3 required)
4-Power test cable V5201-8007
5-Hose assembly MS28762-4-0250
6-Hose assembly MS28762-8-0250 (2 required)
7-Hose assembly MS28762-8-0490
8-Pilot-operated hydraulic shutoff valve 9194240
9-Reducer MS21916D10-8 (2 required)
10-Preformed packing MS29512-10 (2 required)
11-Reducer MS21916D12-8
12-Tube assembly 9197359
13-Reducer MS21916D10-4 (2 required)
14-Cap MS21914D4 (2 required)
15-Preformed packing MS29512-10 (2 required)
16-Preformed packing MS29512-4
17-Union MS21902D4

Figure 11-7-Continued.

Table 11-3. Pilot-Operated Hydraulic Shutoff Valve Test Procedures

Step	Operation Normal Indication Corrective procedure
1.	**IN and OUT Ports Proof Pressure.** Operate the handpump slowly until the 0-10000 PSI GAGE indicates 4500. Start the timer and maintain the pressure for 3 minutes while observing the valve for leakage. **No external leakage.** **NOTE** Disregard any leakage from the RET port of the valve. Packings, cap, or body. Stop the timer and reset to zero. HAND PUMP PRESSURE UNLOADING VALVE .....open slowly.
2.	**Internal Leakage.** HAND PUMP PRESSURE UNLOADING VALVE .....close DRAIN A - DRAIN B .....DRAIN A. Operate the handpump slowly until the 0-10000 PSI GAGE indicates 3000. Hold the valve over the drain pan for graduate drain B. Start the timer and maintain the pressure for 3 minutes while observing the valve for leakage. **Leakage from valve RET port does not exceed 5 cc per minute.** Packings, retainer, springs, or spool. Stop the timer and reset to zero. HAND PUMP PRESSURE UNLOADING VALVE .....open slowly. Disconnect the test setup.
3.	**RET Port Proof Pressure.** Make the proof pressure and leakage test setup as shown in figure 11-7, but do not tighten the connection between the hose assembly (5, fig. 11-7) and the union (17, fig. 11-7). HAND PUMP PRESSURE UNLOADING VALVE .....close. Operate the handpump slowly until air-free oil flows from the loose connection. Tight the connection.

Table 11-3. Pilot-Operated Hydraulic Shutoff Valve Test Procedures -Continued

Step	Operation Normal Indication Corrective procedure
3. Cont.	Operate the handpump slowly until the 0-10000 PSI GAGE indicates 1500. Start the timer and maintain pressure for 3 minutes while observing the valve for leakage. **No leakage.** Packings, retainer, springs, or body. Stop the timer, and reset to zero. HAND PUMP PRESSURE UNLOADING VALVE .....open slowly. Disconnect the test setup.
4.	**Flow.** Make the flow test setup as shown in figure 11-7, but do not connect the power test cable (4) to OUTPUT 28 VDC. Flowmeter selector .....HIGH FLOW 2-8 .....GPM. FLOW INCREASE .....full ccw. SYSTEM PRESSURE CONTROL VALVE(s), COARSE and FINE ADJUST .....open. CIRCUIT BREAKER .....ON. POWER ADJUST .....28 vdc, on VOLT- .....METER. CIRCUIT BREAKER .....OFF. Connect the power test cable (4, fig. 11-7) to OUTPUT 28 VDC. OIL HEATER .....ON. OIL COOLER .....ON. SYSTEM PRESSURE PUMP .....ON. Slowly close the SYSTEM PRESSURE CONTROL VALVE(s), COARSE and FINE ADJUST, until the INDICATOR HIGH FLOW meter indicates 8 gpm. CIRCUIT BREAKER .....on (up). **The INDICATOR HIGH FLOW meter indicates zero gpm.** Packings, retainers, springs, solenoids, pin, ball, seat, or filter. SYSTEM PRESSURE CONTROL VALVE(s), COARSE and FINE ADJUST .....open. SYSTEM PRESSURE PUMP .....OFF. Deenergize the console and disconnect the test setup.

CHAPTER 12
CHECK VALVES

Section I. HYDRAULIC CHECK VALVES AN6280-4, AN6280-6, AN6280-8, AND AN6280-12

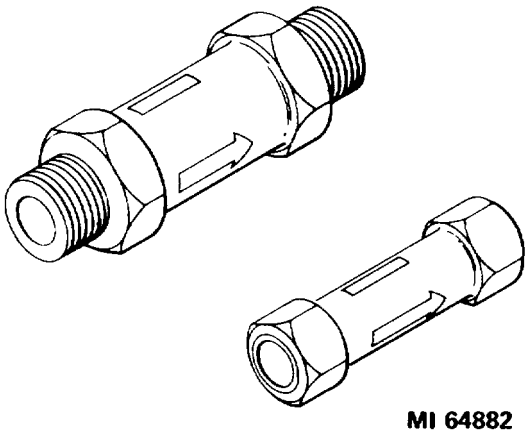


Figure 12-1. Hydraulic check valves AN6280-4, AN6280-6, AN6280-8 and AN6280-12.

12-1. Preparation for Test

a. Clean and inspect the check valve.

b. Make the cracking pressure test setup as shown in figure 12-2. Use the applicable fittings, listed in table 12-1, for the check valve under test.

c. HAND PUMP PRESSURE UNLOADING VALVE.....CLOSE.

d. LOW PRESSURE GAGE SHUTOFF .OPEN.

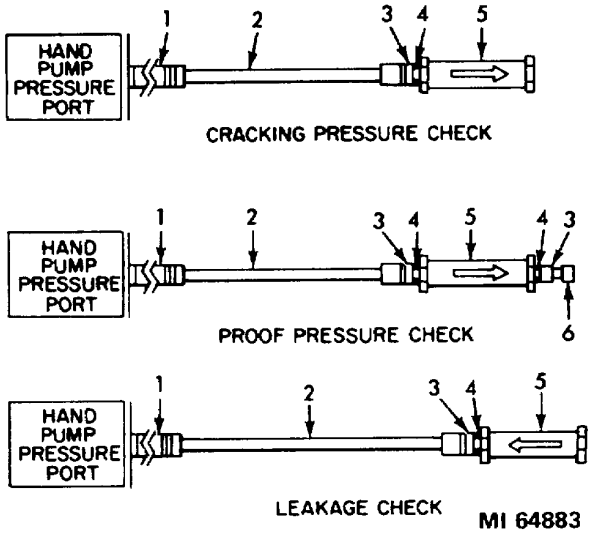
Table 12-1. Test Fittings

Item	Part no.	Quantity
Preformed packing	[1]MS29512-4	2
Preformed packing	[2]MS29512-6	4
Preformed packing	[3]MS29512-8	2
Preformed packing	[4]MS29512-12	2
Coupling	9194683	1
Union	[1]MS21902D4	2
Cap	MS21914D4	1
Hose assembly	MS28762-4-0250	1

Table 12-1. Test Fittings-continued

Item	Part No.	Qty.
Reducer	[2]MS21916D6-4	4
Reducer	[3]MS21916D8-4	2
Reducer	[4]MS21916D12-4	2

[1]Used with hydraulic check valve AN6280-4.
[2]Used with hydraulic check valve AN6280-6.
[3]Used with hydraulic check valve AN6280-8.
[4]Used with hydraulic check valve AN6280-12.



1-Coupling 9194683
2-Hose assembly MS28762-4-0250
3-Union or reducer
4-Preformed packing (2 required)
5-Check valve (2 required)
6-Cap MS2191402

Figure 12-2. Hydraulic check valve-test setup.

12-2. Test Procedures

Perform the procedures in table 12-2 to complete the tests. Replace the valve if defective.

Table 12-2. Hydraulic Check valve Test Procedures

Step	Operation Normal Indication Corrective procedure
1.	**Cracking Pressure.** While observing the 0-100 PSI GAGE, operate the handpump slowly until oil flows from the open end of the check valve. **The gage indicates not more than 10.** LOW PRESSURE GAGE SHUTOFF .....close.
2.	**Proof Pressure.** Install the applicable fittings (table 12-1) in the check valve outlet port as shown in figure 12-2. Operate the handpump slowly until the 0-10000 PSI GAGE indicates 4500. Start the timer and maintain the pressure for 2 minutes while observing the valve for leakage. **No external leakage or distortion.** Stop the timer and reset to zero. HAND PUMP PRESSURE UNLOADING VALVE .....open slowly. Disconnect the test setup.
3.	**Leakage.** Make the leakage test setup shown in figure 12-2, but do not tighten the connection between the hose assembly (2, fig. 12-2) and the union or reducer (3, fig. 12-2). HAND PUMP PRESSURE UNLOADING VALVE .....close. Operate the handpump slowly until air-free oil flows from the loose connection. Tighten the connection. **NOTE** Hold the check valve over the drain pan for graduate drain B. Insure that the DRAIN A - DRAIN B selector valve is set to DRAIN A. Operate the handpump until the 0-10000 PSI GAGE indicates 3000. Start the timer and maintain the pressure for 3 minutes while observing the valve for leakage. **Leakage is not more than 5 cc per minute (graduate A).** HAND PUMP PRESSURE UNLOADING VALVE .....open slowly. Stop the timer and reset to zero. Disconnect the test setup.

Section II. CONTROLLABLE CHECK VALVE 9090270

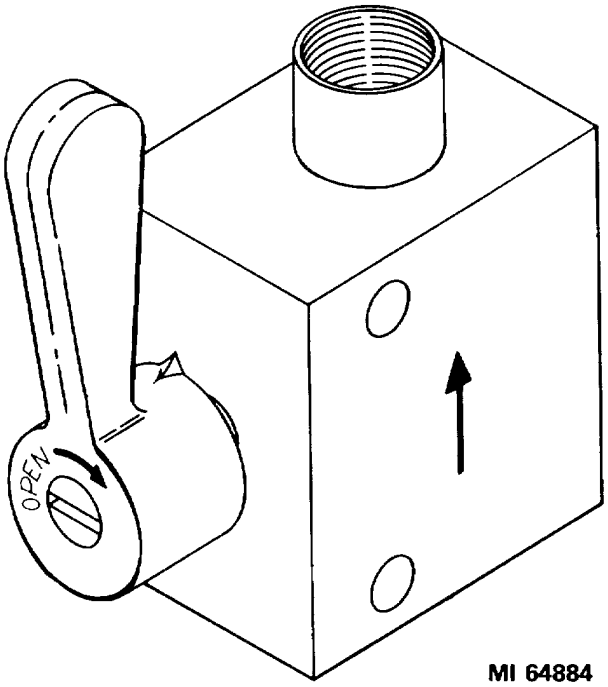


Figure 12-3. Controllable check valve 9090270.

12-3. Preparation for Test

a. Clean and inspect the valve.

b. Make test setup A as shown in figure 12-4, but do not install the plug (1, fig. 12-4).

c. Open the valve.

d. HAND PUMP PRESSURE UNLOADING VALVE CLOSE.

e. LOW PRESSURE GAGE SHUTOFF. CLOSE.

f. Operate the handpump until air-free oil flows from the unplugged port of the valve.

g. Install the plug (1, fig. 12-4) and the preformed packing (3, fig. 12-4).

h. 416 VOLTS.....ON.

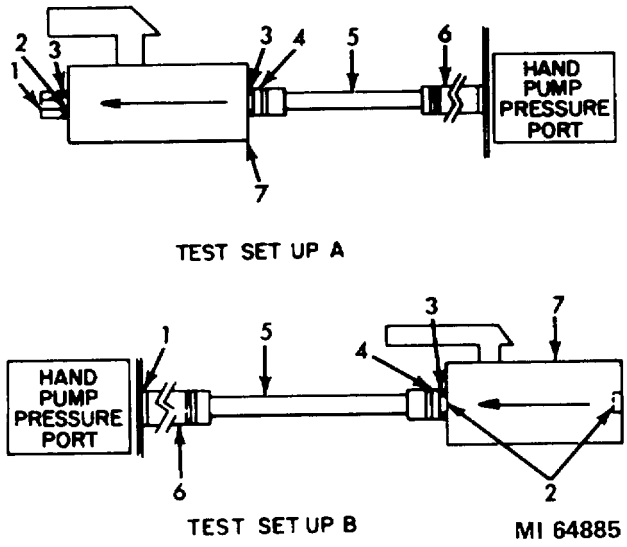
i. 28 VOLTS .....ON.

j. MAKE READY.....ON.

k. Set the timer to zero.

12-4. Test Procedures

Perform the procedures listed in table 12-3 to complete the tests.



1-Plug MS21913D4
2-Port
3-Preformed packing MS29512-4 (2 required)
4-Union MS21902D4
5-Hose assembly MS28762-4-0250
6-Coupling 1/4-inch 9194683
7-Controllable check valve 9090270

Figure 12-4. Controllable check valve-test setup.

Table 12-3. Controllable Check Valve Test Procedures

Step	Operation Normal Indication Corrective procedure
1.	**Proof Pressure.**
a.	Operate the handpump until the 0-10000 PSI GAGE indicates 4500. Start the timer and maintain the pressure for 3 minutes while observing the valve for leakage. **No external leakage.** Valve shaft, performed packings, retainers, or valve body.
b.	Stop the timer and reset to zero. HAND PUMP PRESSURE UNLOADING VALVE .....open slowly. Remove the plug (1, fig. 12-4) and close the valve (fully counterclockwise). HAND PUMP PRESSURE UNLOADING VALVE .....close. Operate the handpump until the 0-10000 PSI GAGE indicates 3000. Start the timer and maintain the pressure for 5 minutes while observing the valve for leakage. **After 1 minute, the leakage must not exceed 6 drops per minute.** Valve shaft, preformed packings, retainers, or valve body. Stop the timer and reset to zero. HAND PUMP PRESSURE UNLOADING VALVE .....open slowly.
2.	**Relief Valve Cracking Pressure.** LOW PRESSURE GAGE SHUTOFF .....open. HAND PUMP PRESSURE UNLOADING VALVE .....close. Open the valve. Operate the handpump until the oil flows from the unplugged port. Check the indication on the 0-100 PSI GAGE as the valve relieves. **The pressure required to unseat the valve relief poppet does not exceed 75.** Shaft, spring, poppet, or body. HAND PUMP PRESSURE UNLOADING VALVE .....open. Disconnect the test setup.
3.	**Valve Spool Function and Leakage.**
a.	Make test setup B shown in figure 12-4. Close the valve (full ccw). LOW PRESSURE GAGE SHUTOFF .....open. HANDPUMP PRESSURE UNLOADING VALVE .....close.

Table 12-3. Controllable Check Valve Test Procedures -Continued

Step	Operation Normal Indication Corrective procedure
	Operate the handpump until the 0-100 PSI GAGE indicates 10. Start the timer and maintain the pressure for 3 minutes while observing the valve for leakage. **No external leakage.** Shaft, preformed packings, retainers, poppet, or body.
b.	Stop the timer and reset to zero. HAND PUMP PRESSURE UNLOADING VALVE .....open. LOW PRESSURE GAGE SHUTOFF .....close. Disconnect test setup B, and make setup A shown in figure 12-4, but do not install the plug (1, fig. 12-4). HAND PUMP PRESSURE UNLOADING VALVE .....close. Operate the handpump slowly until air-free oil flows from the unplugged port of the valve. Install the plug (1, fig. 12-4). Operate the handpump until the 0-10000 PSI GAGE indicates 3000. Open and close the valve handle at least 3 times. **The valve operates smoothly.** Shaft or body. HAND PUMP PRESSURE UNLOADING VALVE .....open slowly. Disconnect the test setup.

CHAPTER 13
REGULATOR VALVES

Section I. PRESSURE REGULATOR VALVE 9090763

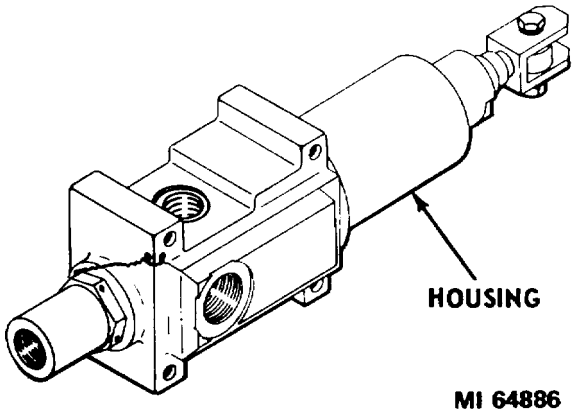


Figure 13-1. Pressure regulator valve 9090763.

13-1. Preparation for Test

a. Clean and inspect the pressure regulator valve.

b. Make the proof-pressure test setup as shown in figure 13-2, but do not install the cap (19, fig. 3-2).

c. HAND PUMP PRESSURE UNLOADING VALVE.....CLOSE

d. LOW PRESSURE GAGE SHUTOFF CLOSE.

e. Operate the handpump until air-free oil flows from the RETURN port.

f. Install the cap (19, fig. 13-2).

g. 416 VOLTS ON.

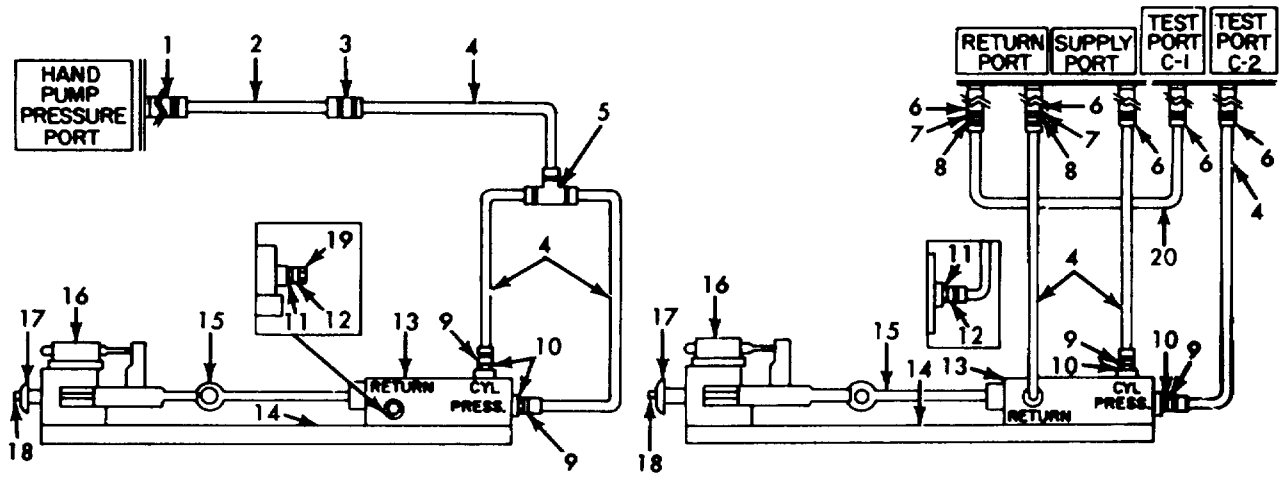
h. 28 VOLTS ON.

i. MAKE READY ON.

j. Set the timer to zero.

13-2. Test Procedures

Perform the procedures in table 13-1 to complete the tests.



1-Coupling 9194683
2-Tube assembly 9197357
3-Reducer MS2191608
4-Hose assembly MS28762-8-0250 (3 required)
5-Tee MS2191508
6-Coupling 9194686 (5 required)
7-Preformed packing MS29512-12 (2 required)
8-Reducer MS21916D12-8 (2 required)
9-Reducer MS21916D10-8 (2 required)
10-Preformed packing MS29512-10 (2 required)

Figure 13-2. Pressure regulator valve-test setup.

11-Preformed packing MS29512-8
12-Union MS21902D8
13-Pressure regulator valve 9090763
14-Test fixture 9181589
15-Valve rod
16-Dial indicator
17-Compression adjust knob
18-Compression adjust knob nut
19-Cap MS21914D8

Figure 13-2-Continued.

Table 13-1. Pressure Regulator Valve Test Procedures

Step	Operation Normal Indication Corrective procedure
1.	**Proof Pressure.** Operate the handpump until the 0-10000 PSI GAGE indicates 4500. Start the timer and maintain the pressure for 3 minutes while observing the valve for leakage. **No leakage or distortion.** Preform packings, housings, or body. Stop the timer and reset to zero. HAND PUMP PRESSURE UNLOADING VALVE .....open slowly. Disconnect the test setup, leaving the pressure regulator valve (13, fig. 13-2) with the fittings attached on the test fixture (14, fig. 13-2).
2.	**Pressure Regulation.**
a.	Make the pressure regulation and leakage test setup as shown in figure 13-2. Flowmeter selector valve .....HIGH FLOW 2-8 .....GPM. FLOW INCREASE .....full ccw. SYSTEM PRESSURE CONTROL VALVE(s), COARSE and FINE ADJUST .....open. THROTTLING VALVE C .....close. SYSTEM PRESSURE GAGE SELECTOR .....0-4000. OIL HEATER .....ON. OIL COOLER .....ON. SYSTEM PRESSURE PUMP .....ON. Close the SYSTEM PRESSURE CONTROL VALVE(s), COARSE and FINE ADJUST, slowly until the 0-4000 PSI GAGE indicates 2700. Open THROTTLING VALVE C until the INDICATOR HIGH FLOW meter indicates 1.5 gpm. **GAGE C indicates 1000. The pressure indication on the 0-4000 PSI GAGE drops slightly.** Adjust the housing (fig. 13-1) as required to obtain the normal indication. Springs, pistons, preformed packings, or sleeves.
b.	Adjust the SYSTEM PRESSURE CONTROL VALVE FINE ADJUST, until the 0-4000 PSI GAGE indicates 2700. **The INDICATOR HIGH FLOW meter indicates more than 1.5 gpm. GAGE C indicates between 950 and 1050.**

Table 13-1. Pressure Regulator Valve Test Procedures-Continued

Step	Operation Normal Indication Corrective procedure
2.*c* Cont.	Adjust the compression adjust knob (17, fig. 13-2) until the pressure indication on GAGE C just begins to rise. Preset the dial indicator (16, fig. 13-2) on the test fixture (14, fig. 13-2) for 0.334 inch. Turn the compression adjust knob until the dial indicator indicates zero inches. **GAGE C indicates between 2450 and 2550.** Adjust the housing (fig. 13-1) as required to obtain the normal indication. SYSTEM PRESSURE CONTROL VALVE(s), COARSE and FINE ADJUST .....open. SYSTEM PRESSURE PUMP .....OFF. Release the pressure on the valve rod (fig. 13-2) and allow the rod to expand fully.
3.	**Leakage.**
a.	Disconnect the hose assembly (4, fig. 13-2) from the coupling half (6, fig. 13-2) on the RETURN PORT, and insert the end of the hose over the pan for graduate drain A. DRAIN A - DRAIN B .....DRAIN B. Repeat step 2a above, but do not change the test setup. Start the timer and determine the leakage rate. **The leakage does not exceed 475 cc per minute.** Springs, pistons, preformed packings, or sleeves.
b.	Observe GAGE C. **GAGE C indicates between 2450 and 2550.** SYSTEM PRESSURE CONTROL VALVE(s), COARSE and FINE ADJUST .....open. SYSTEM PRESSURE PUMP .....OFF. Deenergize the console and disconnect the test setup.

Section II. FLOW REGULATOR VALVE 9090766

13-3. Preparation for Test

a. Clean and inspect the flow regulator valve.

b. Make the test setup as shown in figure 13-4, but do not install the pressure cap (6, fig. 13-4).

c. HAND PUMP PRESSURE UNLOADING VALVE.....CLOSE.

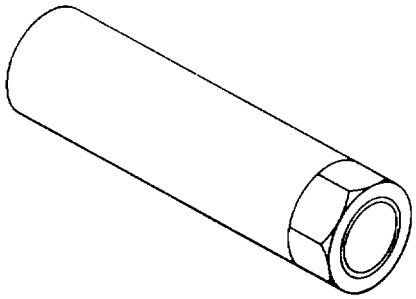
d. LOW PRESSURE GAGE SHUTOFF CLOSE.

e. Operate the handpump slowly until air-free oil flows from the uncapped port of the valve.

f. Install the pressure cap (6, fig. 13-4).

g. 416 VOLTS.....ON.

h. 28 VOLTS .....ON.



MI 64888

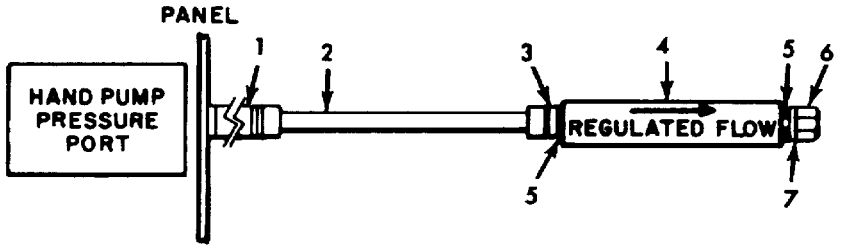
Figure 13-3. Flow regulator valve 9090766.

i. MAKE READY.....ON.

j. Set the timer to zero.

13-4. Test Procedures

Perform the procedures contained in table 13-2 to complete the tests. Replace the valve if defective.



MI 64889

1-Coupling 9194683
2-Hose assembly MS28762-4-0250
3-Reducer MS21916D10-4
4-Flow regulator valve 9090766
5-Preformed packing MS29512-10 (2 required)
6-Pressure cap MS21914D8
7-Reducer MS21916D10-8

Figure 13-4. Flow regulator valve-test setup.

Table 13-2. Flow Regulator Valve Test Procedures

Step	Operation Normal Indication Corrective procedure
	Operate the handpump until the 0-10000 PSI GAGE indicates 4500.
	Start the timer and maintain the pressure for 3 minutes while observing the valve for leakage.
	No external leakage.
	HAND PUMP PRESSURE UNLOADING VALVE .....open slowly.
	Stop the timer and reset to zero.
	Disconnect the test setup.

Section III. FLOW REGULATOR VALVE 9098890

13-5. Preparation for Test

a. Clean and inspect the flow regulator valve.

b. Make the proof pressure test setup as shown in figure 13-6, but do not install the pressure cap 6, fig. 13-6).

c. HAND PUMP PRESSURE UNLOADING VALVE.....CLOSE.

d. LOW PRESSURE GAGE SHUTOFF CLOSE.

e. Operate the handpump slowly until air-free oil flows from the uncapped port of the valve.

f. Install the pressure cap (6, fig. 13-6).

g. 416 VOLTS.....ON.

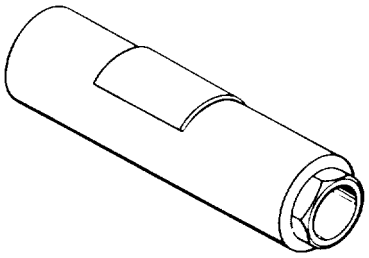
h. 28 VOLTS .....ON.

i. MAKE READY.....ON.

j. Set the timer to zero.

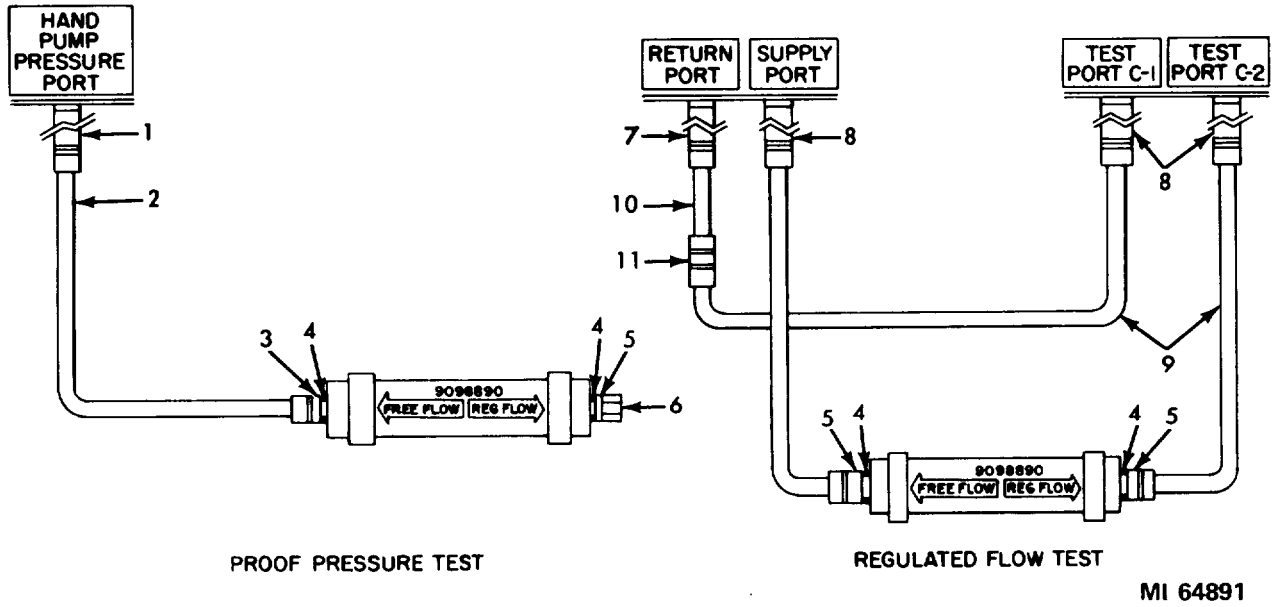
13-6. Test Procedures

Perform the procedures in table 13-3 to complete the tests.



MI 64890

Figure 13-5. Flow regulator valve 9098890.



1-Coupling 9194683
2-Hose assembly MS28762-4-0250
3-Reducer MS21916D6-4
4-Preformed packing MS29512-6 (2 required)
5-Reducer MS21916D8-6 (2 required)
6-Pressure cap MS21914D8
7-Coupling 9194686
8-Coupling 9194685 (3 required)
9-Hose assembly MS28762-8-0490 (2 required)
10-Tube assembly 9197359
11-Reducer MS21916D12-8

Figure 13-6. Flow regulator valve-test setup.

Table 13-3. Flow Regulator Valve Test Procedures

Step	Operation Normal Indication Corrective procedure
1.	**Proof Pressure.** Operate the handpump slowly until the 0-10000 PSI GAGE indicates 4500. Start the timer and maintain the pressure for 3 minutes while observing the valve for leakage. **No external leakage.** Preformed packing or body. HAND PUMP PRESSURE UNLOADING VALVE .....open slowly. Stop the timer and reset to zero. Disconnect the test setup.
2.	Regulated Flow. Make the regulated flow test setup as shown in figure 13-6. Flowmeter selector .....HIGH FLOW 2-8 .....GPM. FLOW INCREASE .....full ccw. SYSTEM PRESSURE GAGE SELECTOR .....0-4000. SYSTEM PRESSURE CONTROL VALVE(s), COARSE and FINE ADJUST .....open. THROTTLING VALVE C .....open. OIL HEATER .....ON. OIL COOLER .....ON. SYSTEM PRESSURE PUMP .....ON. SYSTEM PRESSURE CONTROL VALVE COARSE ADJUST .....close. Slowly close the SYSTEM PRESSURE CONTROL VALVE FINE ADJUST until the 0-4000 PSI GAGE indicates 3000. **The INDICATOR HIGH FLOW meter indicates 1.9 to 2.1 gpm.** Preformed packing, sleeve, spring, or body. SYSTEM PRESSURE CONTROL VALVE(s), COARSE and FINE ADJUST .....open. SYSTEM PRESSURE PUMP .....OFF. Deenergize the console and disconnect the test setup.

Section IV. PRESSURE REGULATOR VALVE 9194241

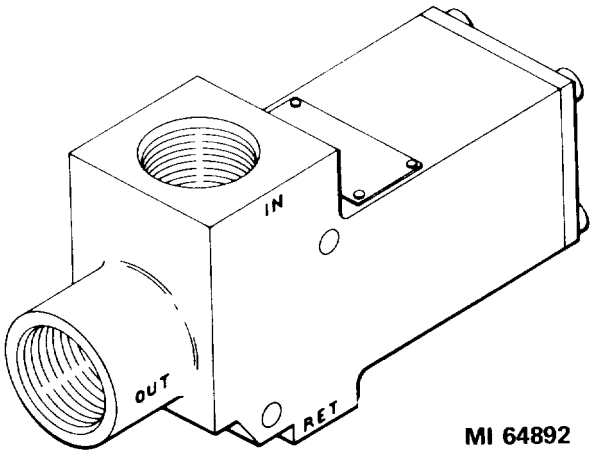


Figure 13-7. Pressure regulator valve 9194241.

13-7. Preparation for Test

a. Clean and inspect the pressure regulator valve.

b. Make the proof pressure test setup as shown in figure 13-8, but do not install the cap (9, fig. 13-8).

c. HAND PUMP PRESSURE UNLOADING VALVE.....CLOSE.

d. LOW PRESSURE GAGE SHUTOFF CLOSE.

e. Operate the handpump slowly until air-free oil flows from the uncapped port of the valve.

f. Install the cap (9, fig. 13-8).

g. 416 VOLTS.....ON.

h. 28 VOLTS .....ON.

i. MAKE READY.....ON.

j. Set the timer to zero.

k. Set the DRAIN A DRAIN B DRAIN B. valve to DRAIN B.

13-8. Test Procedures

Perform the procedures in table 13-4 to complete the tests.

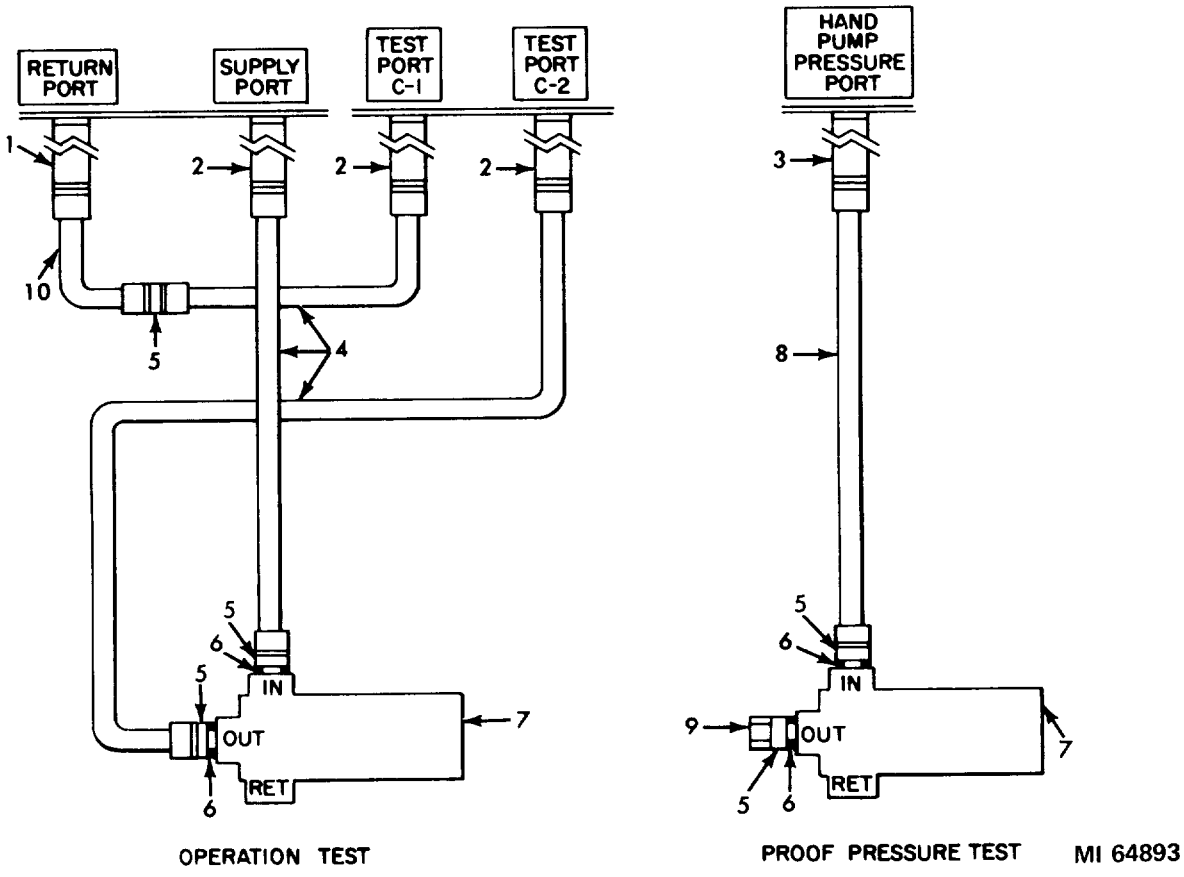


Figure 13-8. Pressure regulator valve-test setup.

1-Coupling 9194686
2-Coupling 9194685 (3 required)
3-coupling 9194683
4-Hose assembly MS28762-8-0250 (3 required)
5-Reducer MS21916D10-8 (3 required)
6-Preformed packing MS29512-10 (2 required)
7-Pressure regulator valve
8-Hose assembly M828762-4-0250
9-Cap MS21914D8
10-Tube assembly 9197459

Figure 13-8-Continued.

Table 13-4. Pressure Regulator Valve Test Procedures

Step	Operation Normal Indication Corrective procedure
1.	**Proof Pressure.**
a.	Operate the handpump slowly until the 0-10000 PSI GAGE indicates 500 while observing the valve for leakage. **No external leakage.** Preformed packings, spring, slide assembly, or body.
	NOTE In the following step, position the valve over the drain pan for graduate drain A to measure the leakage from the RET port.
b.	Increase the pressure slowly with the handpump to 4500. Start the timer and maintain the pressure for 2 minutes while observing the valve for leakage. **Leakage from the RET port is not more than 100 cc per minute.** Preformed packings, or spring.
	HAND PUMP PRESSURE UNLOADING VALVE .....open.
	Stop the timer and reset to zero.
	DRAIN A- DRAIN B .....DRAIN A.
2.	**Operation.**
a.	Make the operation test setup as shown in figure 13-8.
	Flowmeter selector .....HIGH FLOW 2-8 .....GPM.
	FLOW INCREASE .....full ccw.
	SYSTEM PRESSURE GAGE SELECTOR .....0-4000.
	THROTTLING VALVE C .....close.
	SYSTEM PRESSURE CONTROL VALVE(s), COARSE and FINE ADJUST .....open.
	OIL HEATER .....ON.
	OIL COOLER .....ON.
	SYSTEM PRESSURE PUMP .....ON.
	Adjust the SYSTEM PRESSURE CONTROL VALVE(s), COARSE and FINE ADJUST, until the 0-4000 PSI GAGE indicates 2650 ± 50. **GAGE C indicates not more than 1550.** Preformed packings, slide assembly, or body.

Table 13-4. Pressure Regulator Valve Test Procedures-Continued

Step	Operation Normal Indication Corrective procedure
2.*b*. Cont.	Open the THROTTLING VALVE C to increase the flow from zero to 8 gpm as indicated on the INDICATOR HIGH FLOW meter. Adjust the SYSTEM PRESSURE VALVE(s), COARSE and FINE ADJUST, as required to maintain the 2650± 50 indication on the 0-4000 PSI GAGE. **GAGE C indicates 1280 to 1320.** Preformed packings, spring, slide assembly, or body.
	NOTE In the following step, position the valve over the drain pan for graduate drain B to measure the leakage from the RET port.
c.	Start the timer and measure the leakage from the RET port of the valve for 3 minutes. **The leakage is not more than 10 cc per minute.** Preformed packings, spring, slide assembly, or body.
	Stop the timer andreset to zero.
	SYSTEM PRESSURE CONTROL VALVE(s), COARSE and FINE ADJUST .....open.
	SYSTEM PRESSURE PUMP .....OFF.
	DRAIN A - DRAIN B .....DRAIN B.
	Deenergize the console and disconnect the test setup.

CHAPTER 14
SOLENOID VALVE 9194068

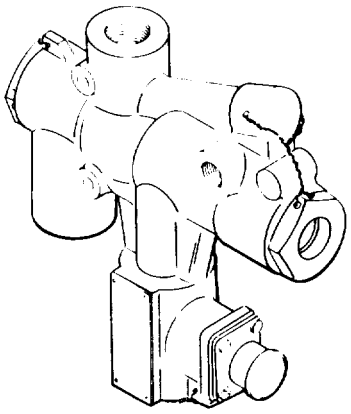


Figure 14-1. Solenoid valve 9194068.

14-1. Preparation for Test

a. Clean and inspect the solenoid valve.

b. Make the current drain and proof pressue test setup as shown in figure 14-2, but do not install the caps (15, fig. 14-2).

c. HAND PUMP PRESSURE UNLOADING VALVE.....CLOSE.

d. PRESSURE GAGE SHUTOFF CLOSE.

c. Operate the handpump slowly until air-free oil flows from the uncapped RETURN port of the solenoid valve.

f. Install the cap (15, fig. 14-2) on the RETURN port.

g. Operate the handpump until air-free oil flows from the CYL port of the solenoid valve.

h. Install the cap (15, fig. 14-2) on the CYI, port.

i. 416 VOLTS.....ON.

j. 28 VOLTS .....ON.

k. MAKE READY.....ON.

l. Set the timer to zero.

m. CIRCUIT BREAKER .....ON (UP).

n. Range selector..... 0-2 AMPS.

o. Set the red-hand safety dial indicator on the AMMETER to 1.5 amp.

14-2. Test Procedures

Perform the procedures in table 14-1 to complete the tests.

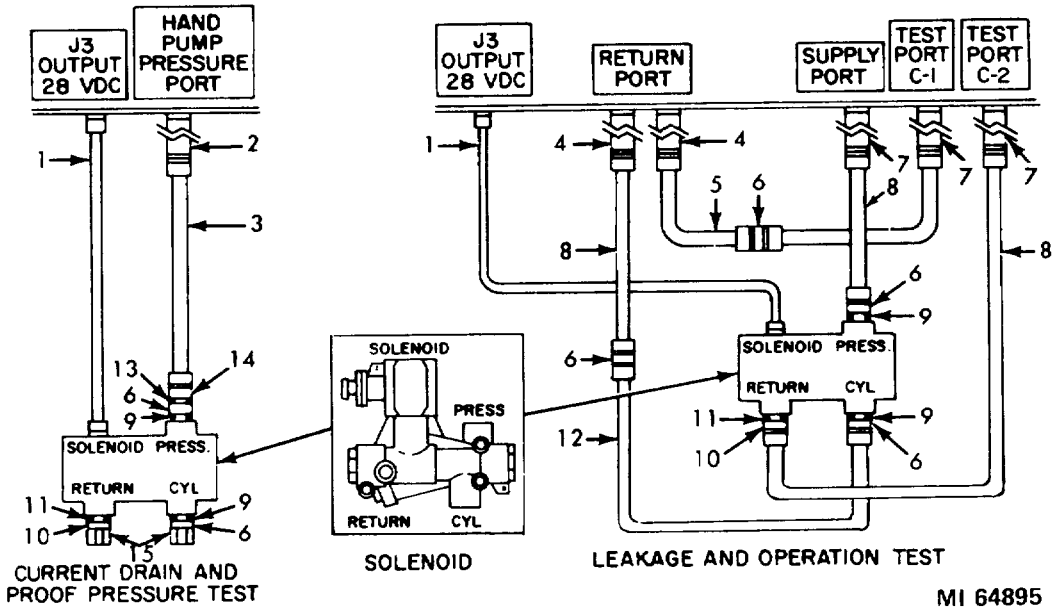


Figure 14-2. Solenoid valve-test setup.

1-Test cable assembly 9172745
2-Coupling 9194683
3-Hose assembly MS28762-4-0250
4-Coupling 9194686 (2 required)
5-Tube assembly 9197359
6-Reducer MS21916D12-8 (4 required)
7-Coupling 9194685 (3 required)
8-Hose assembly MS28762-8-0490 (3 required)
9-Preformed packing MS29512-12 (2 required)
10-Reducer MS21916D8-6
11-Preformed packing MS29512-6
12-Hose assembly MS28762-8-0250
13-Preformed packing MS29512-8
14-Bushing MS21915D8-4
15-Cap MS21914D8 (2 required)

Figure 14-2-Continued.

Table 14-1. Solenoid Valve Test Procedures

Step	Operation Normal Indication Corrective procedure
1.	**Solenoid Current Drain.** POWER ADJUST .....28 vdc on VOLT- .....METER. **The AMMETER indicates not more than 1.1 amp.** Solenoid coil assembly, armature, or connector. POWER ADJUST .....full ccw. CIRCUIT BREAKER .....off (down).
2.	**RETURN Port Proof Pressure.** Operate the handpump slowly until the 0-10000 PSI GAGE indicates 1500. Start the timer and maintain the pressure for 3 minutes while observing the valve for leakage. **No leakage.** Body, end caps, or preformed packings. HAND PUMP PRESSURE UNLOADING VALVE .....open slowly. Stop the timer and reset to zero.
3.	**CYL and PRESS Ports Proof Pressure.** CIRCUIT BREAKER .....on (up). POWER ADJUST .....28 vdc on VOLT- .....METER. HAND PUMP PRESSURE UNLOADING VALVE .....close. Remove the cap (15, fig. 14-2) from the RETURN port. Operate the handpump slowly until air-free oil flows from the RETURN port. Install the cap (15, fig. 14-2) on the RETURN port. Operate the handpump slowly until the 0-10000 PSI GAGE indicates 4500. Start the timer and maintain the pressure for 3 minutes while observing the valve for leakage. **No external leakage or deformation of parts.** Body, end caps, or preformed packings.

Table 14-1. Solenoid Valve Test Procedures-Continued

Step	Operation Normal Indication Corrective procedure
3. Cont.	HAND PUMP PRESSURE UNLOADING VALVE .....open slowly. CIRCUIT BREAKER .....off (down). Stop the timer and reset to zero.
4.	**Leakage.**
a.	DRAIN A - DRAIN B .....DRAIN A. Fill the graduate drain B with hydraulic oil to the 15-cc level. Make the leakage and operation test setup as shown in figure 14-2, but do not connect the hose assembly (12, fig. 14-2) to the reducer (6, fig. 14-2) on the CYL port. Flowmeter selector .....2-8 GPM. FLOW INCREASE .....full cw. SYSTEM PRESSURE GAGE SELECTOR .....0-4000. THROTTLING VALVE C .....open. OIL HEATER .....ON. OIL COOLER .....ON. Set the red-hand safety dial indicator on the AMMETER to 1 amp. SYSTEM PRESSURE CONTROL VALVE(s), COARSE and FINE ADJUST .....close. SYSTEM PRESSURE PUMP .....ON. Slowly turn the FLOW INCREASE rotary control knob clockwise until the INDICATOR HIGH FLOW meter indicates 3.5 to 5.5 gpm. Start the timer and allow the excess fluid to drain from the CYL port of the valve for 2 minutes. Stop the timer and reset to zero. Hold the valve over the drain pant for graduate drain B. Start the timer and measure the leakage from the CYL port of the valve for 5 minutes. **The leakage is not more than 1 cc during the 5-minute interval.** Body, end caps, preformed packings, springs, piston, seats, or poppet.
b.	Stop the timer and reset the hands to zero. Connect the hose assembly (12, fig. 14-2) to the reducer (6, fig. 14-2) on the CYL port. CIRCUIT BREAKER .....on (up). POWER ADJUST .....28 vdc on VOLT- .....METER.

Table 14-1. Solenoid Valve Test Procedures- Continued

Step	Operation Normal Indication Corrective procedure
4b. Cont.	Disconnect the hose assembly (8, fig. 14-2) from the reducer (10, fig. 14-2) on the RETURN port. Start the timer, and allow the excess fluid to drain from the RETURN port of the valve for 2 minutes. Stop the timer and reset to zero. Hold the valve over the drain pan for graduate drain B. Start the timer and measure the leakage from the RETURN port of the valve for 5 minutes. **The leakage is not more than 1 cc during the 5-minute interval.** Body, end caps, performed packings, springs, piston, seats or poppet. Stop the timer and reset to zero. Connect the hose assembly (8, fig. 14-2) to the reducer (10, fig. 14-2) on the RETURN port. CIRCUIT BREAKER .....off (down).
5.	**Operation.**
a.	Adjust the FLOW INCREASE rotary control knob as required until the INDICATOR HIGH FLOW meter indicates 3.5 to 5.5 gpm. Slowly close THROTTLING VALVE C until the pressure indication on GAGE C begins to rise. **The pressure on GAGE C rises to indicate flow through valve RETURN port.** Pin seats, piston, slug, liner, or electrical components.
b.	THROTTLING VALVE C .....open. CIRCUIT BREAKER .....on (up). **NOTE** When performing the step below, do not continue to close THROTTLING VALVE C if the pressure indication on GAGE C begins to rise. THROTTLING VALVE C .....close slowly. **The pressure indication on GAGE C does not rise, thus indicating a flow through the CYL port of the valve.** Pin, seats, piston, slug, liner, or electrical components. FLOW INCREASE .....full cw. THROTTLING VALVE C .....open. SYSTEM PRESSURE CONTROL VALVE(s), COARSE and FINE ADJUST .....open. SYSTEM PRESSURE PUMP .....OFF. Deenergize the console and disconnect the test setup.

CHAPTER 15 DELETED

CHAPTER 16

SHOCK ABSORBERS AND CYLINDERS

Section I. JACKING AND LEVELING CYLINDER 9089196

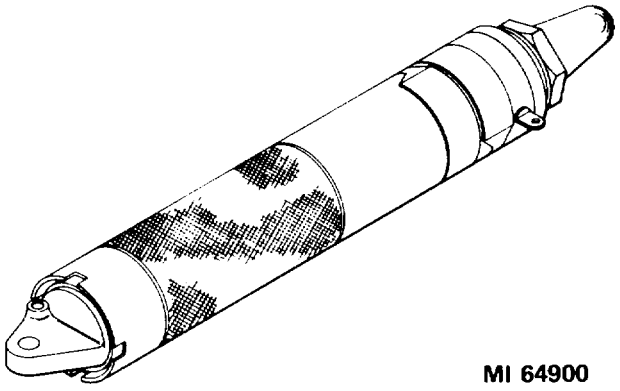


Figure 16-1. Jacking and Leveling cylinder 9089196.

16-1. Preparation for Test

NOTE
Refer to paragraph 16-3 for the preparation for test of a new jacking and leveling cylinder.

a. Clean and inspect the jacking and leveling cylinder.

b. Make the test setup as shown in figure 16-2, but do not connect the hose assembly (2, fig. 16-2) to the reducer (3, fig. 16-2).

c. HAND PUMP PRESSURE UNLOADING VALVE.....CLOSE.

d. LOW PRESSURE GAGE SHUTOFF CLOSE.

e. Operate the handpump slowly until air-free oil flows from the hose assembly.

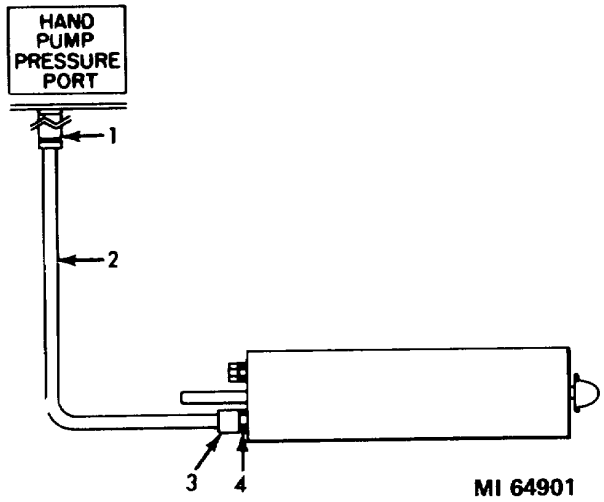
f. Connect the hose assembly to the reducer.

g. 416 VOLTS.....ON.

h. 28 VOLTS .....ON.

i. MAKE READY.....ON.

j. Set the timer to zero.



1-Coupling 9194683
2-Hose assembly MS28762-4-0250
3-Reducer MS21916D8-4
4-Preformed packing MS29512-8

Figure 16-2. Jacking and leveling cylinder-test setup.

16-2. Test Procedures

Perform the procedures in table 16-1 to complete the tests.

16-3. Preparation of a New Jacking and Leveling Cylinder

a. Remove the plug from the cylinder inlet port.

b. Drain all the MIL-H-6082 preservative fluid from the cylinder.

c. Flush the cylinder with clean MIL-H-5606 hydraulic fluid. Compress the cylinder several times during the flushing process.

d. Perform the test procedure in table 16-1.

e. Drain the fluid from the cylinder.

f. Flush the cylinder as described above.

g. Replace the plug.

Table 16-1. Jacking and Leveling Cylinder Test Procedures

Step	Operation Normal indication Corrective procedure
1.	**Proof Pressure.** Operate the handpump until the 0-10000 PSI GAGE indicates 4500. Start the timer and maintain the pressure for 3 minutes while observing the cylinder for leakage. **No leakage.** Cylinder, end cap, rod, packing material, or piston. HAND PUMP PRESSURE UNLOADING VALVE .....open slowly. Stop the timer and reset to zero. HAND PUMP PRESSURE UNLOADING VALVE .....close. LOW PRESSURE GAGE SHUTOFF .....open. Manually bottom the cylinder piston to the fully retracted position.
2.	**Operation.** Operate the handpump slowly until the piston rod is fully extended. Observe the 0-100 PSI GAGE while actuating the handpump to determine the maximum pressure applied to the cylinder when the piston rod is fully extended. **The gage indicates not more than 30. The movement of the rod is smooth and regular.** **Cylinder, rod, backup ring, or piston.**

Section II. DIRECT-ACTION SHOCK ABSORBERS 9089234, 9091309, AND 9096723

16-4. Preparation for Test

NOTE

Refer to paragraph 16-6 for the preparation for test of a new direct-action shock absorber.

Clean and inspect the direct-action shock absorber.

16-5. Test Procedures

Perform the procedures in table 16-3 to complete the tests.

16-6. Preparation of a New Direct-Action Shock Absorber

a. Remove the fill plug (fig. 16-3 or 16-4).

b. Hold the shock absorber so that the unplugged port is over the 2000-cc graduate beaker and drain the MIL-H-6083 preservative fluid from the shock absorber.

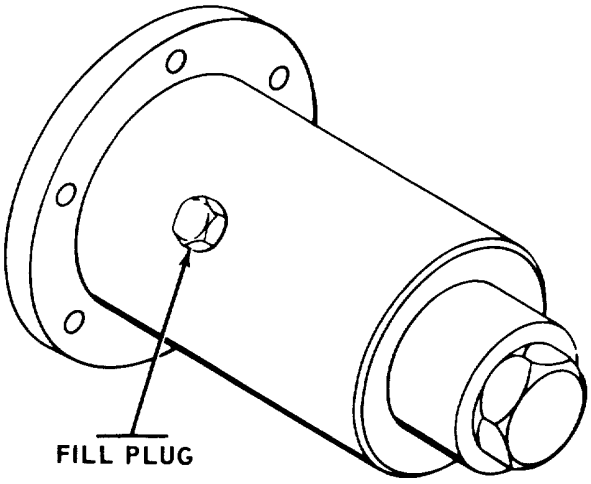


Figure 16-3. Direct-action shock absorbers 9089234 and 9096723.

c. Add the amount of hydraulic oil type MIL-H-5606, listed in table 16-2 to the shock absorber-through the unplugged port.

Table 16-2. Fluid Quantity

Shock absorber	Quantity
9089234	65 cc
9091309	220 to 230 cc
9096723	65 cc

NOTE

Be sure the performed packing around the fill plug is not damaged before performing step d below. Replace the packing, if necessary.

d. Replace the plug.

e. Perform the check in step 1 of table 16-3.

f. Repeat the check 12 times.

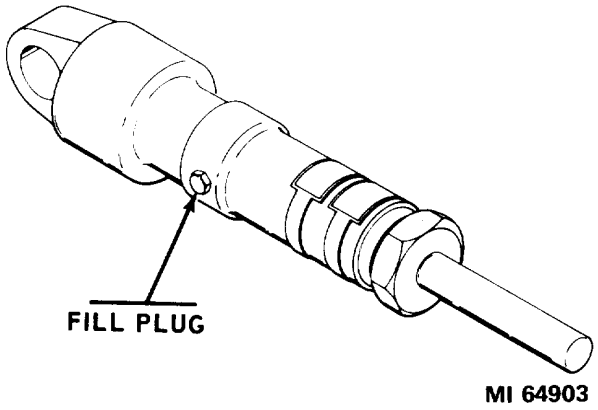


Figure 16-4. Direct-action shock absorber 9091309.

g. Remove the plug and drain the hydraulic fluid.

h. Repeat step c above.

i. Replace the plug and repeat steps e and f above.

Table 16-3. Direct-Action Shock Absorber Test Procedures

Step	Operation Normal indication Corrective procedure
1.	**Manual Compression and Retraction.** Position the shock absorber upright on the workbench with the piston end down. Grasp the shock absorber by the cylinder assembly, and force the piston into the cylinder assembly. **The piston retracts into the cylinder assembly as force is applied. As force is removed, the piston returns to normal position. No leakage.** Plug, preformed packings, piston, guide, spring, pin, poppet, or cylinder assembly. Repeat step 1 four times. **NOTE** If the snubbing action of the shock absorber has been satisfactorily demonstrated, omit the following procedure.
2.	**Fluid Quantity and Filling Procedure.** Remove the fill plug (fig. 16-3 or 16-4). Hold the shock absorber so that the unplugged port is over the 2000-cc graduate beaker, and drain the hydraulic oil from the shock absorber. **The quantity contained is 220 to 230 cc or 65 cc (see table 16-2).** Pressure plug preformed packings, piston, or cylinder assembly. Fill the shock absorber with clean, hydraulic oil (as listed in table 16-2). Replace the plug. Repeat step 1 above.

Section III. ELEVATION ACTUATOR CYLINDER 9089601

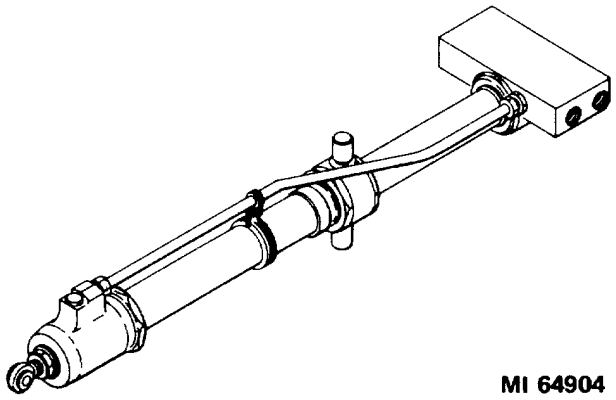


Figure 16-5. Elevation actuator cylinder 9089601.

16-7. Preparation for Test

a. Clean and inspect the cylinder.

b. Mount actuator test fixtures 9197431 and 9197432 on the hydraulic test console, and secure the elevation actuator cylinder in the test fixtures.

WARNING

The cylinder is capable of exerting great force. Be sure that it is securely mounted to the holding fixture.

c. Make the proof pressure test setup shown in figure 16-6 but do not tighten the connection between the hose assembly (2, fig. 16-6) and the reducer (9, fig. 16-6).

d. HAND PUMP PRESSURE UNLOADING VALVE .....CLOSE.

e. LOW PRESSURE GAGE SHUTOFF CLOSE.

f. Operate the handpump slowly until air-free oil flows from the loose connection.

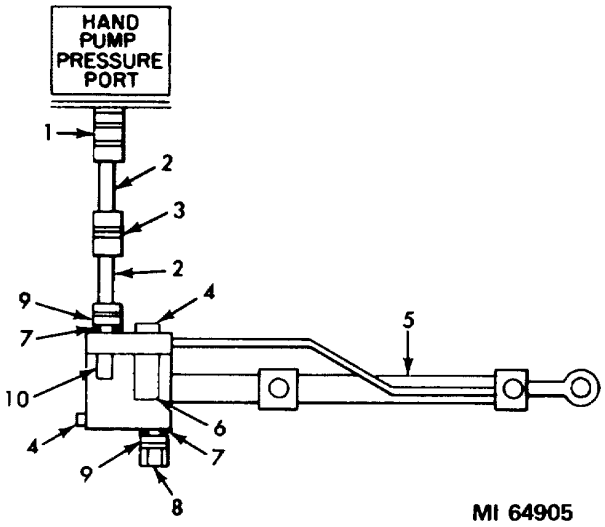
g. Tighten the connection.

h. 416 VOLTS.....ON.

i. 28 VOLTS .....ON.

j. MAKE READY.....ON.

k. Set the timer to zero.

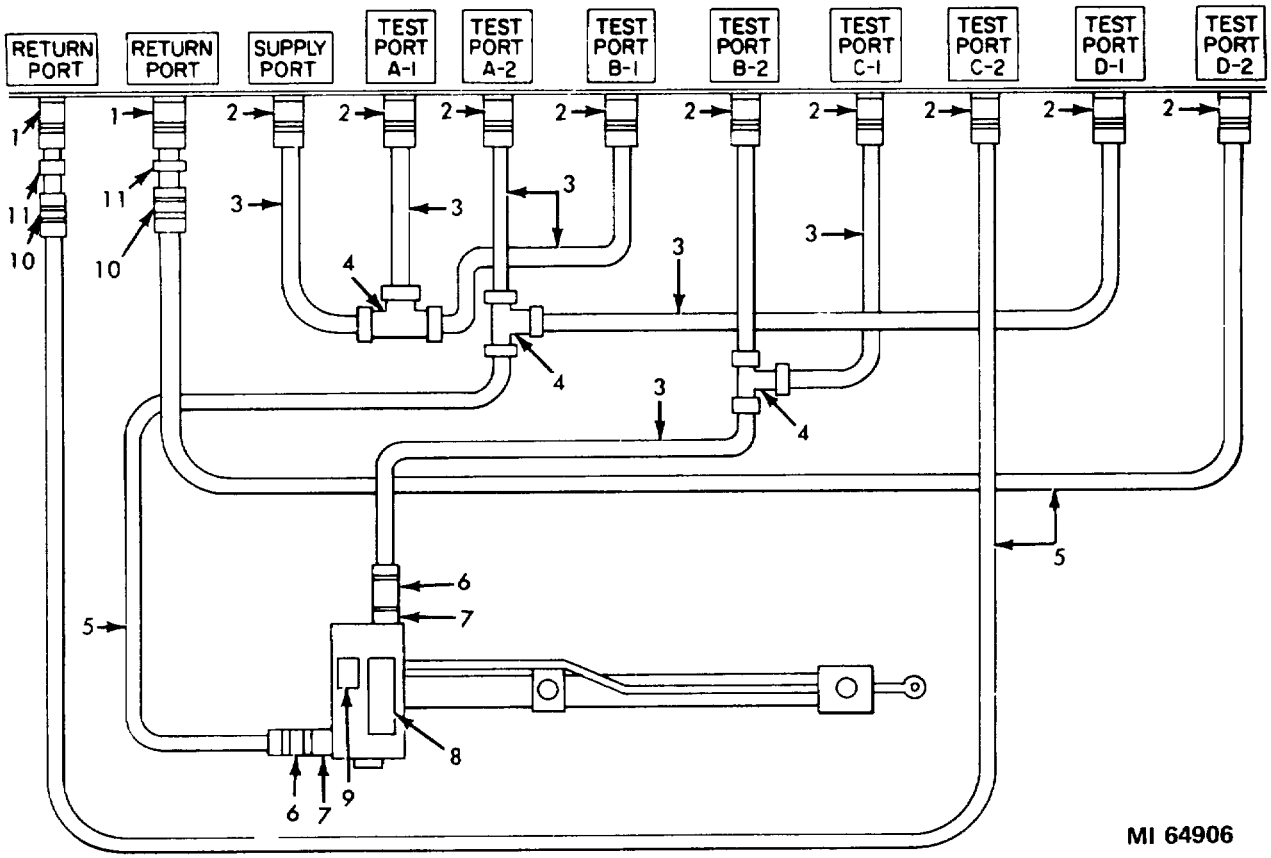


1-Coupling 9194683
2-Hose assembly MS28762-4-0490 (2 required)
3-Union MS21902D4
4-Relief valve 9089718 (2 required)
5-Elevation actuator cylinder 9089601
6-Actuator pressure blocking unit 9194953
7-Preformed packing MS29512-10 (2 required)
8-ap MS21914D4
9-Reducer MS21916D10-4 (2 required)
10-Actuator pressure blocking unit 9194956

Figure 16-6. Elevation actuator cylinder, proof pressure test setup.

16-8. Test Procedures

Perform the procedures in table 16-4 to complete the elevation actuator cylinder tests.



1-Coupling 9194686 (2 required)
2--Coupling 9194685 (9 required)
3-Hose assembly MS28762-8-0250 (7 required)
4-Tee MS21905D8 (3 required)
5-Hose assembly MS28762-8-0490 (3 required)
6--Reducer MS21916D8-6 (2 required)
7-Adapter 9194964 (2 required)
8-Actuator pressure blocking unit 9194953
9--Actuator pressure blocking unit 9194956
10-Reducer MS21916D12-8 (2 required)
11-Tube assembly 9197359 (2 required)

Figure 16-7. Elevation actuator cylinder, stroking leakage, piston leakage, and snubber-test setup.

Table 16-4. Elevation Actuator Cylinder Test Procedures

Step	Operation Normal indication Corrective procedure
1.	**Proof Pressure.**
	NOTE **During the proof pressure check, the piston should not move. Piston movement indicates leakage.**
a.	Operate the handpump until the 0-10000 PSI GAGE indicates 4500. Start the timer and maintain the pressure for 3 minutes while observing the cylinder for leakage. **No leakage.** Tube assembly, barrel, preformed packings, and/or manifold assembly.
b.	Stop the timer and reset to zero. HAND PUMP PRESSURE UNLOADING VALVE ..... open slowly. LOW PRESSURE GAGE SHUTOFF ..... open. HAND PUMP PRESSURE UNLOADING VALVE ..... close. Operate the handpump slowly until the 0-100 PSI GAGE indicates 10. Start the timer and maintain the pressure for 3 minutes while observing the cylinder for leakage. **No leakage.** Tube assembly, barrel, preformed packings, and/or manifold assembly. HAND PUMP PRESSURE UNLOADING VALVE ..... open. Disconnect the test setup.
2.	Stroking Leakage.
a.	Make the test setup as shown in figure 16-7. **NOTE** **Removal of relief valves 9089718 will be required in order to connect the adapters (7, fig. 16-7) to the manifold block.** SYSTEM PRESSURE CONTROL VALVE(s), COARSE and FINE ADJUST ..... open. Rotate the FLOW INCREASE control until the flowmeter selector valve can be set to LOW FLOW 0-2 GPM. Flowmeter selector ..... LOW FLOW 0-2 GPM. Adjust the rotary FLOW INCREASE control ccw against the stop on the flow selector valve. THROTTLING VALVE A and THROTTLING VALVE C ..... open. THROTTLING VALVE B and THROTTLING VALVE D ..... close. OIL HEATER ..... ON. OIL COOLER ..... ON.

Table 16-4. Elevation Actuator Cylinder Test Procedures-Continued

Step	Operation Normal indication Corrective procedure
2a. Cont.	SYSTEM PRESSURE PUMP.....ON. 416 VOLTS.....ON. 28 VOLTS.....ON. Slowly close the SYSTEM PRESSURE CONTROL VALVE COARSE ADJUST, until the piston begins to extend. **The piston extends.** Piston, packing, or barrel.
b.	Allow space for the piston to extend to its maximum length. THROTTLING VALVE B and THROTTLING VALVE D .....open. THROTTLING VALVE A and THROTTLING VALVE C .....close. Adjust the SYSTEM PRESSURE CONTROL VALVE COARSE ADJUST, as required to slowly retract the piston. Observe the cylinder for leakage as the piston moves. **The piston retracts smoothly. The external leakage is not more than three drops during movement.** Piston, packing, or barrel. Repeat these extension and retraction procedures 25 times, stopping with the piston fully extended. SYSTEM PRESSURE CONTROL VALVE COARSE ADJUST ..... open.
3.	**Piston Leakage.** 28 VOLTS.....OFF. THROTTLING VALVE A and THROTTLING VALVE D .....open. THROTTLING VALVE B and THROTTLING VALVE C .....close. Disconnect the reducer (6, fig. 16-7) on the top of the manifold block from the adapter (7, fig. 16-9). Completely retract the elevation actuator piston manually; then close THROTTLING VALVE D. **NOTE** **Manual retraction of the piston is difficult; however, under no circumstances should hydraulic pressure be utilized since this would cause failure of the leakage test.** Set the DRAIN A - DRAIN B selector valve to DRAIN B until the fluid level in the B graduate is at 0; then return the selector of DRAIN A. **NOTE** **If the B graduate is empty, add hydraulic oil until the level reaches 0.** **Place a hydraulic plug in the port marked PRESS, which is located on the top of the manifold block.** 28 VDC.....ON.

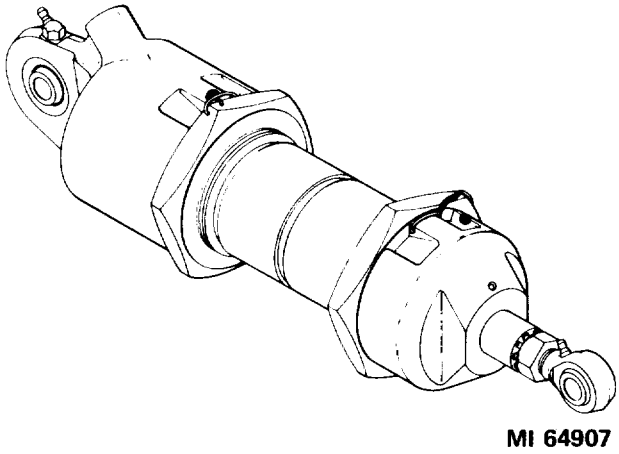
Table 16-4. Elevation Actuator Cylinder Test Procedures-Continued

Step	Operation Normal indication Corrective procedure
3. Cont.	Slowly close the SYSTEM PRESSURE CONTROL VALVE COARSE ADJUST, until the piston begins to extend slowly. **NOTE** The piston may extend with the valve fully open. Start the timer and hold a beaker under the manifold block on the cylinder in order to collect the leakage for 3 minutes. **NOTE** The leakage will flow out of the top adapter and over the manifold block. **NOTE** The piston must extend fully during the 3-minute interval; this is controlled by the SYSTEM PRESSURE CONTROL VALVE, COARSE ADJUST. Stop the timer after 3 minutes. 28 VOLTS.....OFF. Slowly pour the fluid from the beaker into the drain pan for graduate drain B, and measure the leakage. **The leakage is not more than 30 cc.** Preformed packing, retainers, piston, or barrel. SYSTEM PRESSURE CONTROL VALVE COARSE ADJUST .open. Reconnect the reducer (6, fig. 16-7) to the adapter (7, fig. 16-7).
4.	**Snubber.**
a.	THROTTLING VALVE B and THROTTLING VALVE D .....open. THROTTLING VALVE A and THROTTLING VALVE C .....close. Slowly close the SYSTEM PRESSURE CONTROL VALVE COARSE ADJUST, until the piston retracts slowly. **The piston retracts.** Poppet, piston, packing, or barrel.
b.	SYSTEM PRESSURE CONTROL VALVE COARSE ADJUST .....open. THROTTLING VALVE A and THROTTLING VALVE C .....open. THROTTLING VALVE B and THROTTLING VALVE D .....close. **NOTE** In the procedure below, (close the SYSTEM PRESSURE CONTROL VALVE, COARSE ADJUST, so that the piston extends smoothly and rapidly. Close the SYSTEM PRESSURE CONTROL VALVE COARSE ADJUST, to extend the piston. The piston extends. The snubbing effect can be felt by placing your hand on the piston as the piston nears the end of the stroke. Poppet, piston, packing, or barrel.

Table 16-4. Elevation Actuator Cylinder Test Procedures-Continued

Step	Operation Normal indication Corrective procedure
4. Cont.	SYSTEM PRESSURE CONTROL VALVE COARSE ADJUST ..... open. SYSTEM PRESSURE PUMP.....OFF. Deenergize the console and disconnect the test setup.

Section IV. HATCH ACTUATING CYLINDER 9089889



MI 64907

Figure 16-8. Hatch actuating cylinder 909889.

16-9. Preparation for Test

a. Clean and inspect the cylinder.

b. Make the test setup as shown in figure 16-9, but do not connect the hose assembly (2, fig. 16-9) to the reducer (7, fig. 16-9).

c. Place the open end of the hose assembly in one of the console drain pans.

d. HAND PUMP PRESSURE UNLOADING VALVE.....CLOSE.

e. LOW PRESSURE GAGE SHUTOFF .CLOSE.

f. Operate the handpump slowly until air-free oil flows from the hose assembly (2, fig. 16-9).

g. Connect the hose assembly (2, fig. 16-9) to the reducer (7, fig. 16-9).

h. 416 VOLTS.....ON.

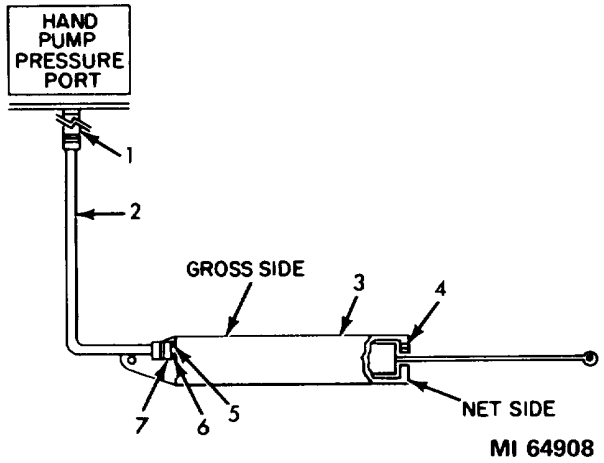
i. 28 VOLTS .....ON.

j. MAKE READY.....ON.

k. Set the timer to zero.

16-10. Test Procedures

Perform the procedures in table 16-5 to complete the tests.



MI 64908

1-Coupling 9194683
2-Hose assembly MS28762-4-0250
3-Cylinder 9089889
4-Vent port
5-Charging port
6-Preformed packing MS29512-4
7-Reducer MS21916D6-4

Figure 16-9. Hatch actuating cylinder-test setup.

Table 16-5. Hatch Actuating Cylinder Test Procedures

Step	Operation Normal indication Corrective procedure
1.	**Proof Pressure.**
	Operate the handpump until the 0-10000 PSI GAGE indicates 4500. Start the timer and maintain the pressure for 3 minutes while observing the cylinder for leakage.
	No leakage.
	End caps, piston, preformed packings, or housing.
	HAND PUMP PRESSURE UNLOADING VALVE .....open slowly.
	Stop the timer and reset to zero.
2.	**Operation.**
a.	Fully retract the cylinder piston.
	HAND PUMP PRESSURE UNLOADING VALVE .....close.
	Operate the handpump until the piston extends its full length from the cylinder. Note the maximum pressure on the 0-10000 PSI GAGE as the piston travels its full length.
	The gage indicates not more than 100 during travel.
	Piston, backup ring, preformed packing, or housing.
b.	Observe the cylinder.
	No leakage.
	Piston, backup ring, preformed packing, or housing.
	HAND PUMP PRESSURE UNLOADING VALVE .....open.
	Disconnect the test setup.

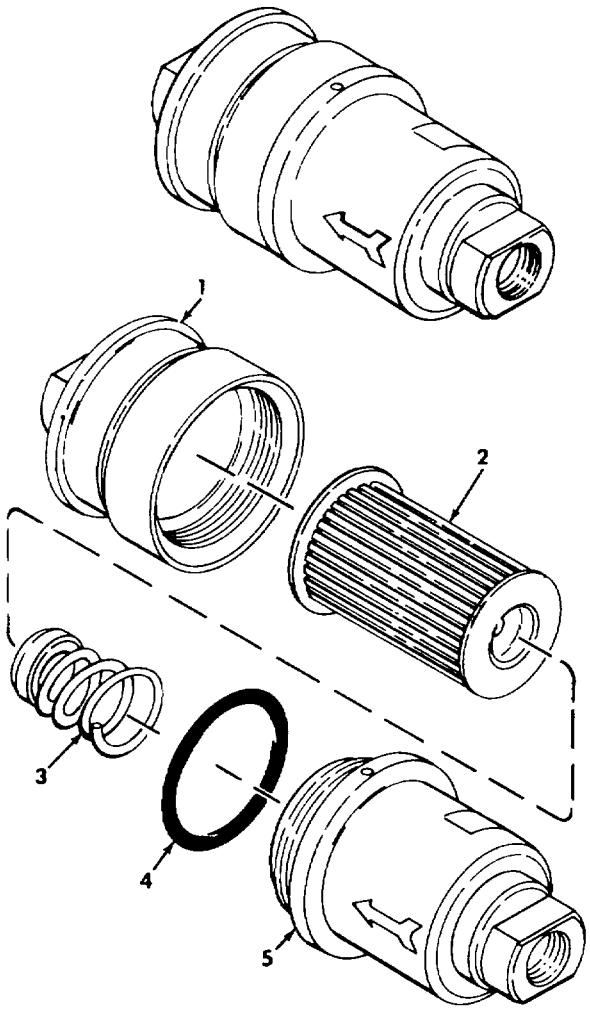
CHAPTER 17

FILTER ASSEMBLIES

Section I. VENT FILTER AN6240-1

17-1. General

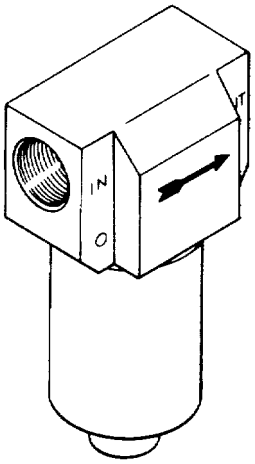
Disassemble the filter (fig. 17-1) and check the element for cleanliness. Replace the element if necessary.



1—Cap
2—Filter element AN6237-1
3—Spring
4—Preformed packing MS28775-223
5—Body

Figure 17-1. Vent filter AN6240-1.

Section II. FILTER ASSEMBLY MS28720-8



MI 64910

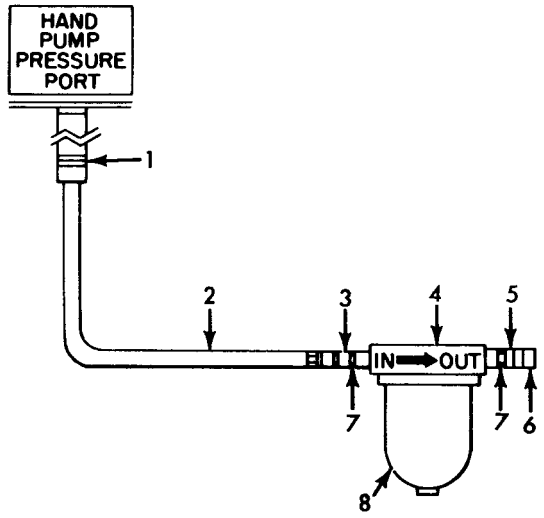
Figure 17-2. Filter assembly MS28 720-8.

17-2. Preparation for Test

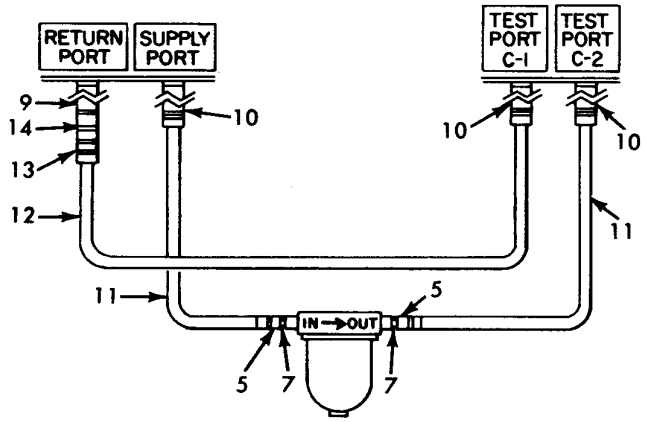
a. 416 VOLTS.....ON.
b. 28 VOLTS .....ON.
c. MAKE READY.....ON.
d. Set the timer to zero.
e. Make the proof and cracking pressure test setup as shown in figure 17-3, but do not install the cap (6, fig. 17-3).
f. HAND PUMP PRESSURE UNLOADING VALVE.....CLOSE.
g. LOW PRESSURE GAGE SHUTOFF..CLOSE.
h. Operate the handpump slowly until air-free oil flows from the uncapped port of the filter assembly.
i. Install the cap (6, fig. 17-3).

17-3. Test Procedures

Perform the procedures in table 17-1 to complete the tests.



PROOF AND CRACKING PRESSURE TEST



FREE FLOW TEST

MI 64911

1-Coupling 9194683
2-Hose assembly MS28762-4-0250
3-Bushing MS21915D8-4
4-Filter head
5-Union MS21902D8
6-Cap MS21914D8
7-Preformed packing MS29512-8 (2 required)
8-Filter bowl
9-Coupling 9194686
10-Coupling 9194685 (3 required)
11-Hose assembly MS28762-8-0250 (2 required)
12-Hose assembly MS28762-8-0490
13-Reducer MS21916D12-8
14-Tube assembly 9197359

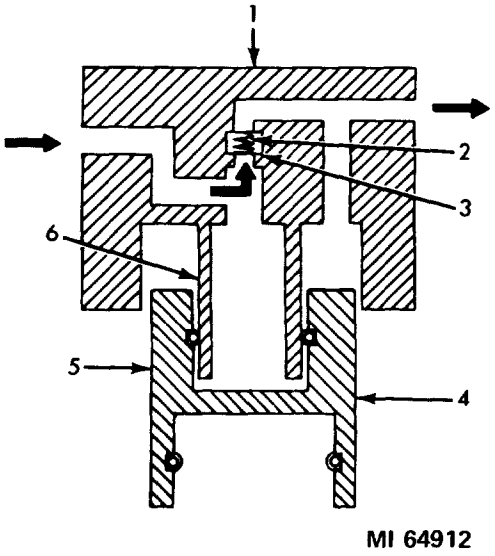
Figure 17-3. Filter assembly-test setup.

Table 17-1. Filter Assembly Test Procedures

Step	Operation Normal indication Corrective procedure
1.	**Proof Pressure.** Operate the handpump until the 0-10000 PSI GAGE indicates 4500. Start the timer and maintain the pressure for 3 minutes while observing the filter assembly for leakage. **No external leakage.** Filter bowl, preformed packings, poppet or filter head. Stop the timer and reset to zero. HAND PUMP PRESSURE UNLOADING VALVE .....open slowly. Disconnect the test setup.
2.	**Cracking Pressure.** Disassemble the filter assembly to separate the filter head (4, fig. 17-3) from the filter bowl (8, fig. 17-3). Remove the filter element. Locate the back pressure tube (6, fig. 17-4) on the filter head which houses the relief valve. Insert the test fixture adapter (4, fig. 17-4) on the filter head. Assemble the filter head to the filter bowl to complete the filter assembly. Make the proof and cracking pressure test setup as shown in figure 17-3, but do not install the cap (6, fig. 17-3). HAND PUMP PRESSURE UNLOADING VALVE .....close. LOW PRESSURE GAGE SHUTOFF .....open. Operate the handpump slowly until oil flows from the uncapped port of the filter assembly. Check the indication on the 0-100 PSI GAGE as the valve in the filter head unseats. **The gage indicates not more than 50.** Poppet spring, poppet, or poppet seat. HAND PUMP PRESSURE UNLOADING VALVE .....open slowly. Disconnect the test setup. Disassemble the filter assembly and remove the test fixture adapter. Install the filter element and assemble the filter assembly.
3.	**Free Flow.** Make the free flow test setup as shown in figure 17-3. THROTTLING VALVE C .....open. SYSTEM PRESSURE CONTROL VALVE(s), COARSE and FINE ADJUST.....open

Table 17-1. Filter Assembly Test Procedures-Continued

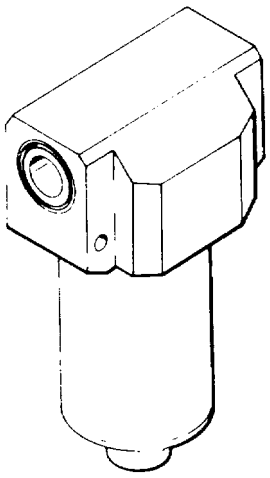
Step	Operation Normal indication Corrective procedure
3. Cont.	Flowmeter selector.....HIGH FLOW 2-8 GPM. FLOW INCREASE .....full cw. SYSTEM PRESSURE GAGE SELECTOR.....0-4000. OIL HEATER.....ON. OIL COOLER .....ON. SYSTEM PRESSURE PUMP.....ON. 416 VOLTS .....ON. 28 VOLTS .....ON. Turn the SYSTEM PRESSURE CONTROL VALVE(s), COARSE and FINE ADJUST, the FLOW INCREASE control, and THROTTLING VALVE C so that the INDICATOR HIGH FLOW meter indicates 6 gpm and the 0-4000 PSI GAGE indicates 2600. **Gage C indicates not less than 2400.** Filter element. SYSTEM PRESSURE CONTROL VALVE(s), COARSE and FINE ADJUST .....open. 416 VOLTS .....OFF. 28 VOLTS .....OFF. Deenergize the console and disconnect the test setup.



1-Filter head (part of filter MS28720-8)
2-Poppet spring (part of filter MS28720-8)
3-Relief poppet (part of filter MS28720-8)
4-Test fixture adapter 9197434
5-Fixture adapting open end for MS28720-8 filter (part of 9197434)
6-Back pressure tube (part of 9197434)

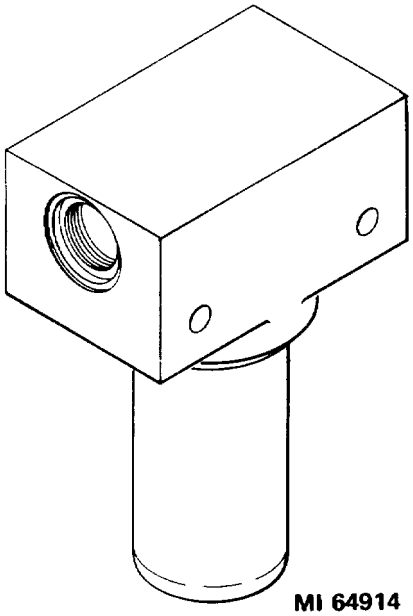
Figure 17-4. Test fixture adapter installation.

Section III. ELEVATION AND AZIMUTH FILTER ASSEMBLIES 9090764 AND 9091942



MI 64913

Figure 17-5. Elevation filter assembly 9090764.



MI 64914

Figure 17-6. Azimuth filter assembly 9091942.

17-4. Preparation for Test

a. Clean and inspect the filter assembly.

b. Make the proof pressure test setup as shown in figure 17-7, but do not install the cap (6, fig. 17-7). Refer to table 17-2 for the accessories.

c. HAND PUMP PRESSURE UNLOADING VALVE.....CLOSE.

d. LOW PRESSURE GAGE SHUTOFF CLOSE.

e. Operate the handpump slowly until air-free oil flows from the uncapped port of the filter assembly.

f Install the cap.

g. 416 VOLTS.....ON.

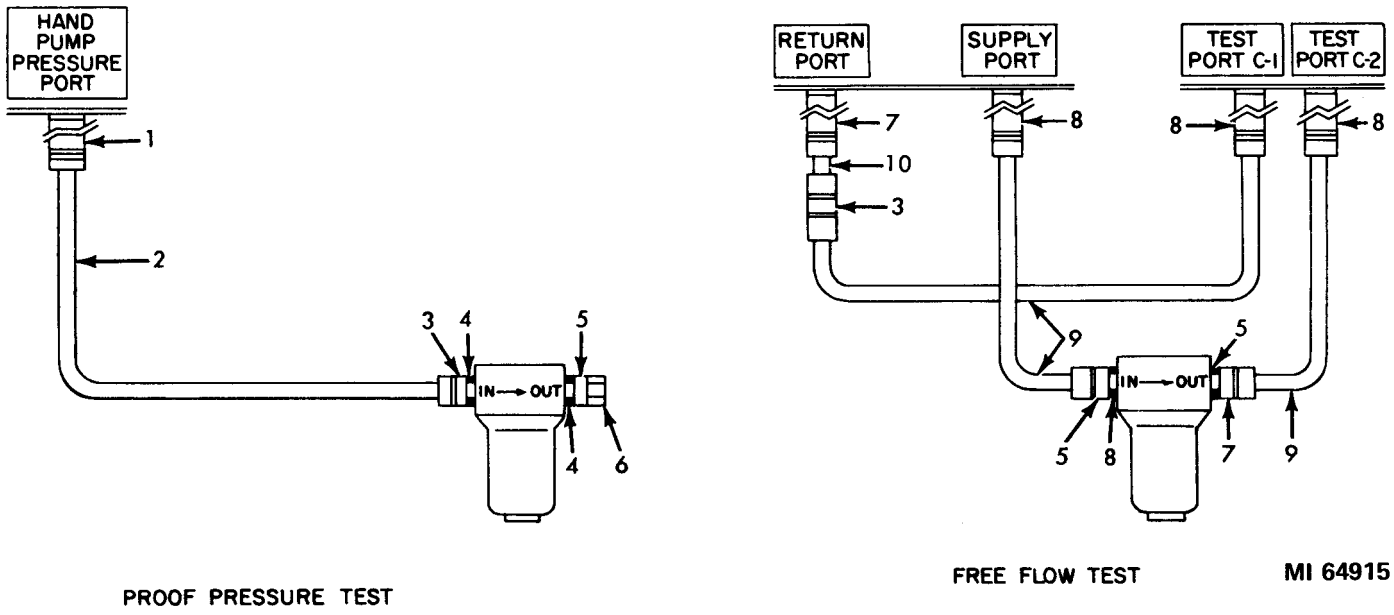
h. 28 VOLTS .....ON.

i. MAKE READY.....ON.

j. Set the timer to zero.

17-5. Test Procedures

Perform the procedures in table 17-3 to complete the tests. Refer to table 17-2 for the test accessories and differentials.



1-Coupling half 9194683
2--Hose assembly MS28762-4-0250
3-Reducer MS21916D8-4[1]
MS21916D12-4[2]
4-Preformed packing MS29512-8[2] (2 required)
MS21916D12-4[2] (2 required)

5-Union MS21902D8[2]
Reducer MS21916D12-8[1]
6-Cap MS21914D8
7-Coupling half 9194686
8-Coupling half 9194685 (3 required)
9-Hose assembly MS28762-8-0490 (3 required)
10-Tube assembly 9197359

[1]Used with filter assembly 9090764 only.
[2]Used with filter assembly 9091942 only.

Figure 17-7. Elevation and azimuth filter assemblies-test setup.

Table 17-2 Test Accessories and Pressure Differentials

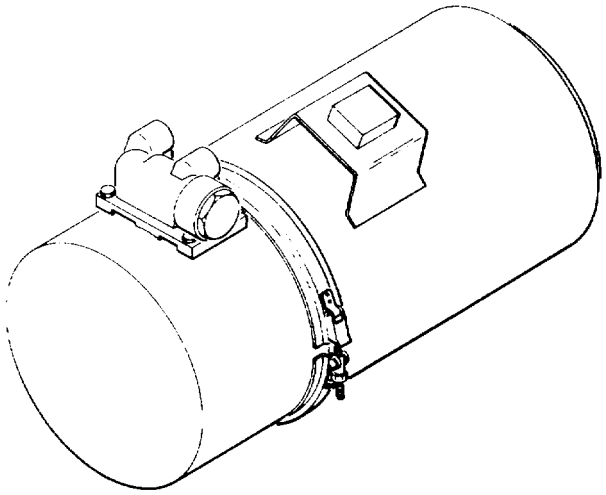
Item	Elevation filter assembly 9090764	Azimuth filter assembly 9091942
Port	AND10050-12	AND10050-8
Cap	MS21914D8	MS21914D8
Preformed packing	MS29512-12	MS20512-8
Union	None	MS21902D8
Reducer	MS21916D12-8	MS21916D8-4
Hose assembly	1/4 and 1/2 inch	1/4 and 1/2 inch
Coupling half	1/4, 1/2, and 3/4 inch	1/4, 1/2, and 3/4 inch
Pressure differential	50 psig	100 psig

Table 17-3. Elevation and Azimuth Filter Assemblies Test Procedures

Step	Operation Normal indication Corrective procedure
1.	**Proof Pressure.** Operate the handpump until the 0-10000 PSI GAGE indicates 4500. Start the timer and maintain the pressure for 3 minutes while observing the filter assembly for leakage. **No external leakage.** Filter heads, preformed packings, gasket, or filter bowls. HAND PUMP PRESSURE UNLOADING VALVE .....open slowly. Stop the timer and reset to zero. Disconnect the test setup.
2.	**Free Flow.** Make the free flow setup as shown in figure 17-7 using the equipment listed in table 17-2. Flowmeter selector.....HIGH FLOW 2-8 GPM. FLOW INCREASE .....full ccw. SYSTEM PRESSURE GAGE SELECTOR.....0-400. THROTTLING VALVE C .....open. SYSTEM PRESSURE CONTROL VALVE(s), COARSE and FINE ADJUST .....open. OIL HEATER..... ON. OIL COOLER..... ON. SYSTEM PRESSURE PUMP.....ON. Slowly close the SYSTEM PRESSURE CONTROL VALVE COARSE ADJUST, until the 0-400 PSI GAGE indicates 300. Observe the INDICATOR HIGH FLOW meter, the 0-400 PSI GAGE, and GAGE C. **The INDICATOR HIGH FLOW meter indicates 8 gpm maximum. The pressure differential across the filter assembly does not exceed the amount specified in table 17-2.** Preformed packings, gasket. Filter assembly airbound, filter elements dirty, or leaks in filter assembly. SYSTEM PRESSURE CONTROL VALVE COARSE ADJUST open. SYSTEM PRESSURE PUMP..... OFF. Deenergize the console and disconnect the test setup.

CHAPTER 18

HYDRAULIC OIL COOLER 9096790



MI 64916

Figure 18-1. Hydraulic oil cooler 909679(0.

18-1. Preparation for Test

a. Clean and inspect the hydraulic air cooler.

b. Remove the valve (7, fig. 18-2) from the hydraulic air cooler.

c. Make the proof pressure test setup as shown in figure 18-2, but do not install the cap (9, fig. 18-2).

d. HAND PUMP PRESSURE UNLOADING VALVE.....CLOSE.

e. Operate the handpump until oil flows from the uncapped port.

f. Install the cap (9, fig. 18-2).

g. LOW PRESSURE GAGE SHUTOFF VALVE.....CLOSE.

h. 416 VOLTS..... ON.

i. 28 VOLTS ..... ON.

j. MAKE READY..... ON.

k. Set the timer to zero.

18-2. Test Procedure

Perform the procedures in table 18-1 to complete
the tests. The parts of the hydraulic oil cooler are illustrated in TM 9-1440-531-24P.

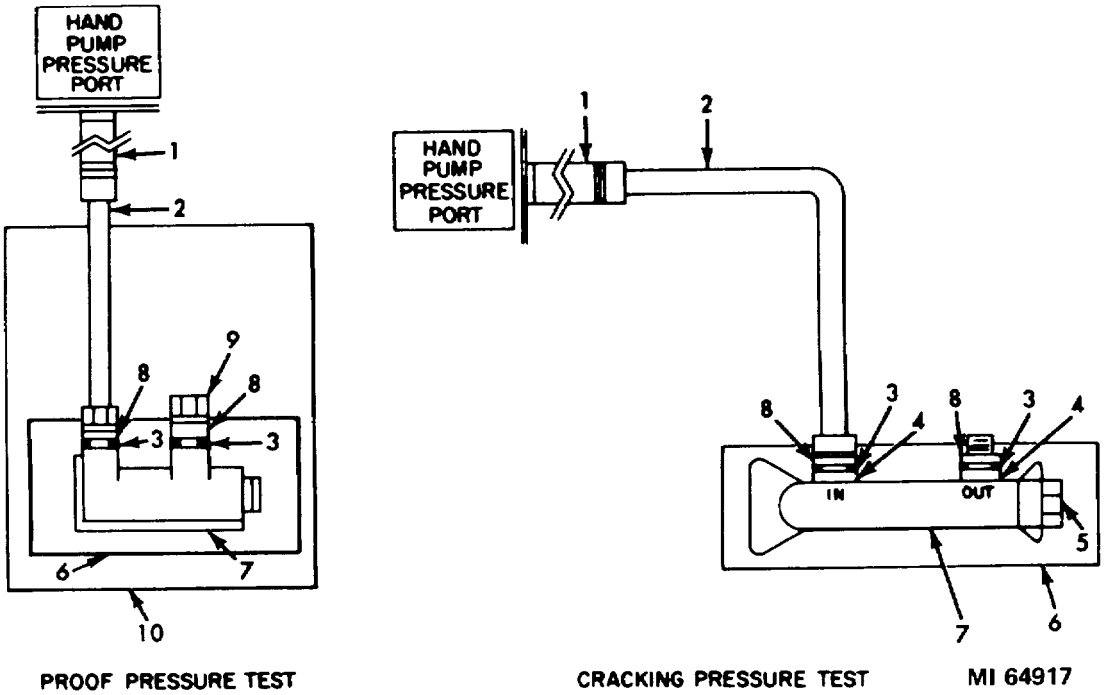


Figure 18-2. Hydraulic oil cooler-test setup.

1-Coupling 9194683
2-Hose assembly MS28762-4-0250
3-Preformed packing MS29512-10 (2 required)
4-Port
5-Valve adjustment
6-Blocking plate fixture
7-Valve
8-Reducer MS21916D10-4 (2 required)
9-Cap
10-Cooler assembly

Figure 18-2-Continued.

Table 18-1. Hydraulic Oil Cooler Test Procedures

Step	Operation Normal indication Corrective procedure
1.	**Proof Pressure.** **NOTE** An indication of 300 cannot be read directly on the 0-10000 PSI GAGE and must be interpolated. Operate the handpump until the 0-10000 PSI GAGE indicates 300. Start the timer and maintain the pressure for 3 minutes while observing the cooler for leakage. **No external leakage or deformation in the cooler structure.** Cooler assembly. HAND PUMP PRESSURE UNLOADING VALVE ..... open slowly. Stop the timer and reset to zero. Disconnect the test setup. Drain the cooler.
2.	**Cracking Pressure and Reseating of the Relief Valve.**
a.	Make the cracking pressure test setup as shown in figure 18-2. HAND PUMP PRESSURE UNLOADING VALVE ..... close. LOW PRESSURE GAGE SHUTOFF ..... open. Operate the handpump slowly while observing the 0-100 PSI GAGE to determine when the relief valve cracks. **The cracking pressure indication on the 0--100 PSI GAGE is between 15 to 25.** Adjust the valve (7, fig. 18-2) as required. Spring, poppet, or body.
b.	Open the HAND PUMP PRESSURE UNLOADING VALVE until the 0-100 PSI GAGE indicates 12 psi. **The flow rate decreases.** Relief valve spring, poppet, or body. HAND PUMP PRESSURE UNLOADING VALVE ..... open. Disconnect the test setup.

CHAPTER 19

HANDPUMP AN6248-2

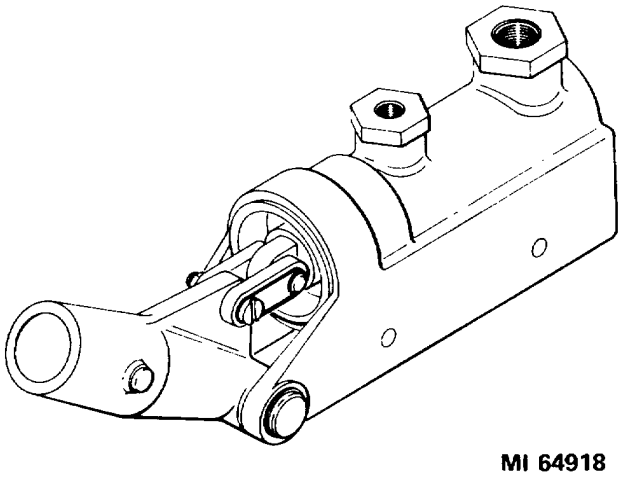


Figure 19-1. Handpump AN6248-2.

19-1. Preparation for Test

a. Clean and inspect the handpump.

b. Make the proof pressure test setup as shown in figure 19-2, but do not install the cap (6, fig. 19-2).

c. Secure the handpump in the bench vise.

d. HAND PUMP PRESSURE UNLOADING VALVE.....CLOSE.

e. LOW PRESSURE GAGE SHUTOFF..CLOSE.

f. Operate the console handpump slowly until air-free oil flows from the uncapped port of the handpump under test.

g. Install the cap (6, fig. 19-2).

h. 416 VOLTS.....ON.

i. 28 VOLTS .....ON.

j. MAKE READY.....ON.

k. Set the timer to zero.

19-2. Test Procedures

Perform the procedures in table 19-1 to complete
the tests.

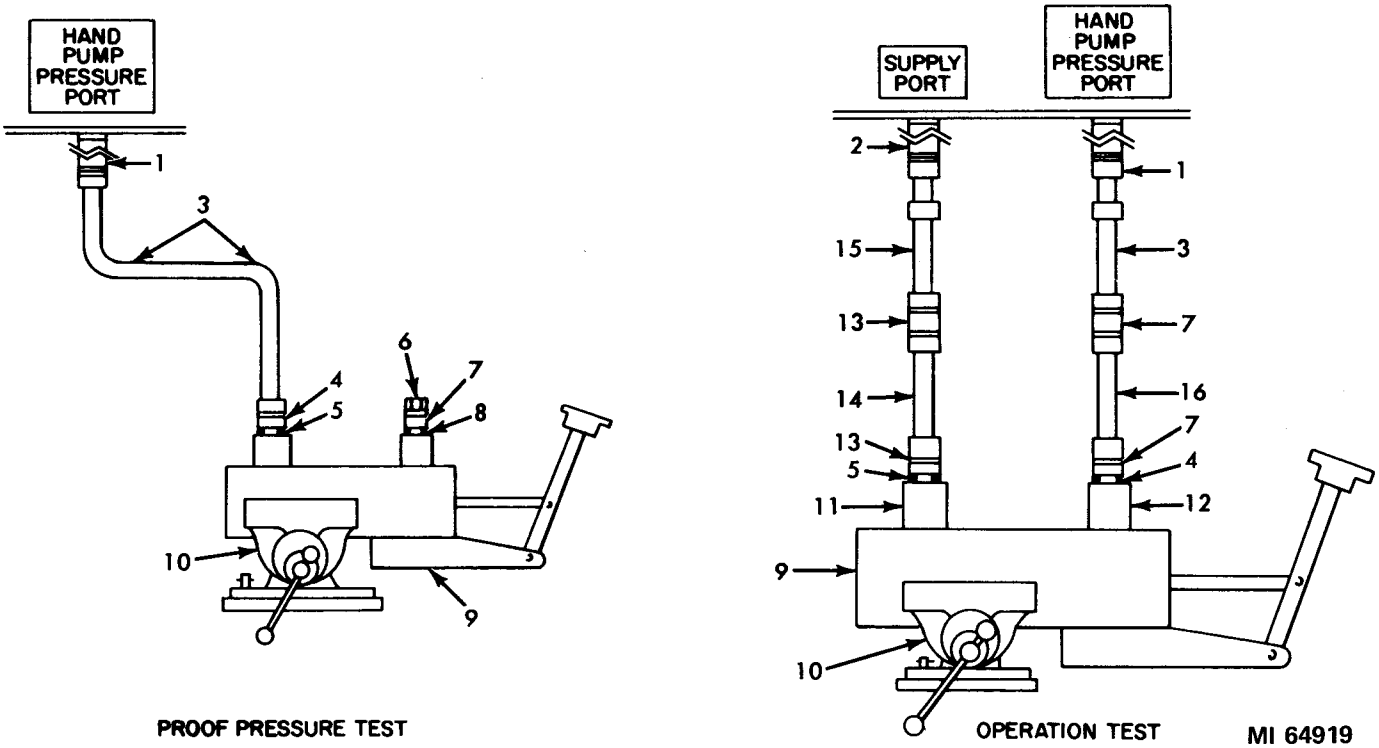


Figure 19-2. Handpump-test setup.

1-Coupling 9194683
2-Coupling 9194685
3-Hose assembly MS28762-4-0490
4-Reducer MS21916D8-4
5-Preformed packing MS29512-4
6-Cap MS21914D4
7-Union MS21902D4 (2 required)
8-Preformed packing MS29512-4
9-Handpump AN6248-2
10-Bench vise 9074943
11-SUCTION port
12-Preformed packing MS29512-8
13-Union MS21902D8 (2 required)
14-Hose assembly MS28762-8-0250
15-Hose assembly MS28762-8-0490
16-Hose assembly MS28762-4-0250

Figure 19-2-Continued.

Table 19-1. Handpump Test Procedures

Step	Operation Normal indication Corrective procedure
1.	**Proof Pressure.**
a.	Operate the console handpump until the 0-10000 PSI GAGE indicates 4500. Start the timer and maintain the pressure for 3 minutes while observing the handpump under test for leakage. **No external leakage.** Preformed packings, piston, body, or internal check valves.
b.	HAND PUMP PRESSURE UNLOADING VALVE. .....open slowly. Stop the timer and reset to zero. Remove the cap (6, fig. 19-2) from the union (7, fig. 19-2). Disconnect the hose assembly (3, fig. 19-2) from the reducer (4, fig. 19-2). Connect the hose assembly (3, fig. 19-2) to the union (7, fig. 19-2). Install the cap (6, fig. 19-2) on the reducer (4, fig. 19-2), but do not tighten the cap. HAND PUMP PRESSURE UNLOADING VALVE .....close. Operate the console handpump slowly until air-free oil flows from the loose connection. Tighten the connection. Operate the console handpump slowly until the 0-10000 PSI GAGE indicates 4500. Start the timer and maintain pressure for 3 minutes while observing the handpump under test for leakage. **No external leakage.** Preformed packings, piston, body, or internal check valves. Stop the timer and reset to zero. HAND PUMP PRESSURE UNLOADING VALVE .....open slowly. Disconnect the test setup.
2.	**Operation.** Make the operation test setup as shown in figure 19-2. Flowmeter selector.....HIGH FLOW 2-8 GPM. SYSTEM PRESSURE CONTROL VALVE(s), COARSE and FINE ADJUST.....open. FLOW INCREASE .....full cw.

Table 19-1. Handpump Test Procedures-Continued

Step	Operation Normal indication Corrective procedure
2. Cont.	OIL HEATER.....ON. OIL COOLER.....ON. SYSTEM PRESSURE PUMP.....ON. Operate the handpump under test slowly several strokes to purge air from the lines and pump. HAND PUMP PRESSURE UNLOADING VALVE .....close. **CAUTION** Insure that the LOW PRESSURE GAGE SHUTOFF valve is closed. Operate the handpump under test until the 0-10000 PSI GAGE indicates 3000. **The pressure indication on the gage increases to 3000 with each stroke, both in compression and retraction.** Preformed packings, pistons, body, or internal check valves. HAND PUMP PRESSURE UNLOADING VALVE .....open slowly. SYSTEM PRESSURE CONTROL VALVE(s), COARSE and FINE ADJUST.....open. SYSTEM PRESSURE PUMP.....OFF. Deenergize the console and disconnect the test setup.

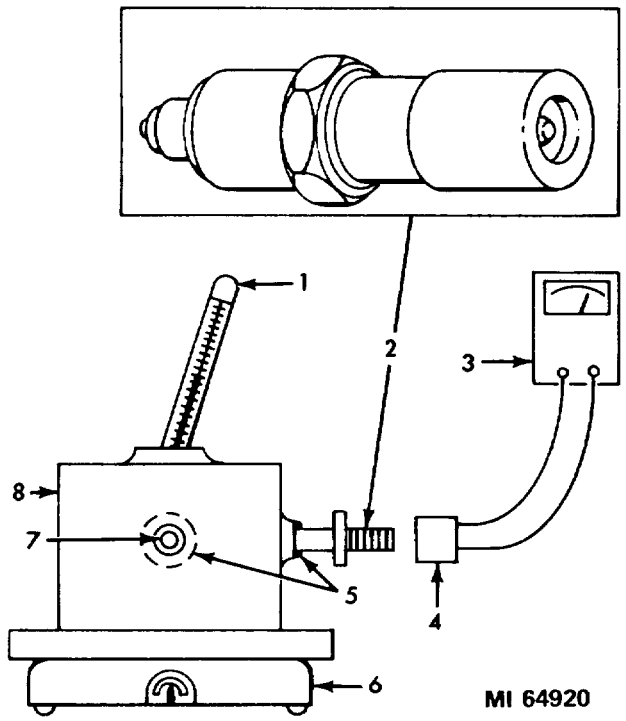
CHAPTER 20

HYDRAULIC SWITCH ASSEMBLIES

Section I. OIL TEMPERATURE SWITCH 9089182

20-1. Preparation for Test

a. Clean and inspect the oil temperature switch.
b. Make the test setup as shown in figure 20-1.



20-2. Test Procedures

Perform the procedures in table 20-1 to complete the tests. Replace the oil temperature switch if defective.

1-Thermometer 9074946
2-Oil temperature switch 9089182
3-Multimeter 6625-643-1686
4-Test cable 9172641
5-Preformed packing MS29512-4 (2 required)
6-Hotplate 9197287
7-Plug MS21913D4
8-Fixture 9172641

Figure 20-1. Oil temperature switch 9089182-test setup.

Table 20-1. Oil Temperature Switch Test Procedures

Step	Operation Normal indication Corrective procedure
	NOTE The key numbers given below in parentheses refer to figure 20-1.
1.	**Closing Temperature.** Insert the thermometer (1) in the fixture (8) and place the fixture on the hot plate (6). Connect the multimeter (3) to the switch (2) and set the meter to the ohms scale. Observe the multimeter and the thermometer as the water heats. **The multimeter indication changes from infinity to 0 when the oil temperature switch closes between 135° and 145° F.**

Table 20-1. Oil Temperature Switch Test Procedures

Step	Operation Normal indication Corrective procedure
2.	Opening Temperature. Unplug the hot plate and remove the fixture. Allow both to cool. Observe the multimeter and the thermometer as the water cools. **The oil temperature switch opens between 100° and 80°F. The multimeter indication changes from 0 to infinity.** Drain the test fixture and disassemble the test setup. Install new preformed packing (5) on the oil temperature switch (2). **CAUTION** Make sure that the hot plate is cold before storing. Store the fixture and the hot plate.

Section II. FLOAT SWITCH 9176824

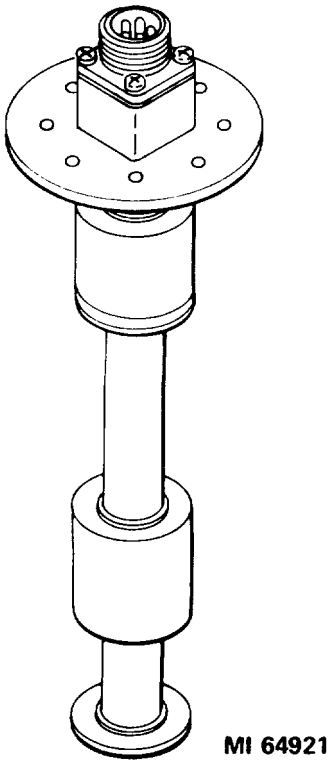


Figure 20-2. Float switch 9176824.

20-3. Preparation for Test

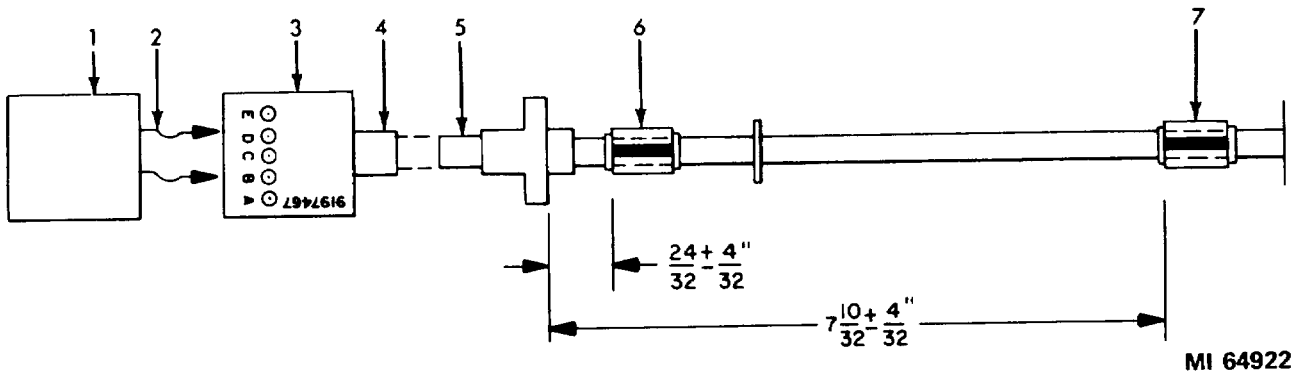
a. Make the test setup as shown in fgure 20-3.

b. Inspect the float switch for defects. Insure that the floats (6 and 7, fig. 20-3) slide freely.

c. Join the connector (4, fig. 20-3) to the connector (5, fig. 20-3).

20-4. Test Procedures

Perform the procedures in table 20-2 to complete
the tests. Replace the switch if defective.



1-Multimeter 6625-643-1686
2--Meter leads
3-Terminal board 9197467
4-onnector MS3206A-14S-5S
5-Connector
6-High-level float
7-Low-level float

Figure 20-3. Float switch-test setup.

Table 20-2. Float Switch Test Procedures

Step	Operation Normal indication Corrective procedure
	NOTE In all operations involving continuity, the float is positioned 1/4-inch inside the upper and lower limits, and rotated 360 degrees.
1.	**Low-Level Float.**
a.	Set the low-level float (7, fig. 20-3) to the position indicated in figure 20-3. Position the meter leads across pins C and E of the terminal board. **The meter indicates an open circuit.**
b.	Slide the low-level float to the left. **The meter indicates continuity from 7 f 4/32 inch to 5-26/32 ± 4/32 inch.**
c.	Set the low-level float to the position indicated in figure 20-3. Position the meter leads across pins A and B. **The meter indicates an open circuit.**
d.	Slide the low-level float to the left. **The meter indicates continuity from 5-30/32i4/32 inch to 5-26/32i4/32 inch.**
2.	**High-l.evel Float.**
a.	Set the high-level float (6, fig. 20-3) to the position indicated in figure 20-3. Position the meter leads across pins B and D. **The meter indicates an open circuit.**

Table 20-2. Float Switch Test Procedures -Continued

Step	Operation Normal indication Corrective procedure
2b. Cont.	Set the high-level float to the left. **The meter indicates continuity from 18/32 ± 4/32 inch to 13/32 ± 4/32 inch.** Disconnect the test setup. Store all equipment.

CHAPTER 21 DELETED

CHAPTER 22

FLEXIBLE HOSE ASSEMBLIES

NOTE

A flexible hose assembly has a maximum shelf life of 5 years if it is used in a pneumatic system with pressures exceeding 500 psig. The hydraulic hose assemblies on the equipment are assumed to be serviceable when visual inspection does not reveal deterioration, mechanical damage, or leakage. All hoses must be tested during major overhaul or rebuild. Hoses that fail the test must be replaced. Defective hoses must be disposed of immediately. All hydraulic hose assemblies in shop 5 must be proof-pressure-tested at least once every 12 months.

22-1. Preparation for Test

a. Clean and inspect the flexible hose assembly for corrosion and defects.

b. Make the test setup as shown in figure 22-1, but do not install the plug on the cap (5, fig. 22-1). Refer to table 22-1 to determine the part numbers of the fittings (3 and 5, fig. 22-1) required.

c. HAND PUMP PRESSURE UNLOADING VALVE.....CLOSE.

d. LOW PRESSURE GAGE SHUTOFF CLOSE.

e. Operate the handpump slowly until air-free oil flows from the open end of the hose assembly.

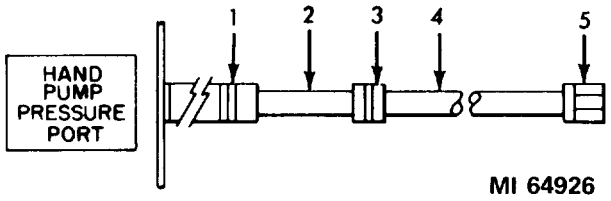
f. Install the cap (5, fig. 22-1).

g. 416 VOLTS.....ON.

h. 28 VOLTS .....ON.

i. MAKE READY.....ON.

j. Set the timer to zero.



1-Coupling 9194683
2-Tube assembly 9197357
3-Union or adapter
4-Flexible hose assembly
5-Cap

Figure 22-1. Flexible hose assembly-test setup.

WARNING

Be sure that all the air is bled from the lines before proof pressure tests are conducted. During tests, the capped end should be directed away from personnel. To minimize contamination, a flexible hose assembly designated for air use should be thoroughly drained and cleaned before being capped.

22-2. Test Procedures

Perform the procedures in table 22-2 to complete the tests.

22-3. Fabrication of Improved High-Powered Illuminator Radar (IHIPIR) Coolant Hose Assemblies

a. Cut the hose to the desired length using a sharp knife. (The old hose assembly may be used as a guide.)

b. Push the hose into the collar until it bottoms. (Water pump pliers may be used to hold the knurled fitting.)

c. Lubricate both the insert and the inside of the hose with ethylene glycol.

d. Thread the insert into the collar and the hose until it bottoms. Leave approximately 1/32-inch clearance between the swivel nut and the collar when installing the straight connector.

NOTE

When installing a straight connector, tighten an adapter into the swivel nut to hold the insert rigid and to enable the insert to be threaded into the collar and hose.

Table 22-1. Flexible Hose Assemblies and Associated Fittings

Flexible hose assembly	Use	Union or adapter	Cap or plug	Proof pressure (psig)
10105503-2	Glycol	MS21916-8-4c	MS21913-8c	600
10105503-3	Glycol	MS21916-8-4c	MS21913-8c	600
10105801	Glycol	MS21916-6-4c	MS21913-6c	300
10105802-1	Glycol	MS21916-8-4c	MS21913-8c	600
10105802-2	Glycol	MS21916-8-4c	MS21913-8c	600
10105802-3	Glycol	MS21916-8-4c	MS21913-8c	600
10105802-4	Glycol	MS21916-8-4c	MS21913-8c	600
10105802-5	Glycol	MS21916-8-4c	MS21913-8c	600
10105802-6	Glycol	MS21916-8-4c	MS21913-8c	600
10105802-7	Glycol	MS21916-8-4c	MS21913-8c	600
10105802-8	Glycol	MS21916-8-4c	MS21913-8c	600
10105802-9	Glycol	MS21916-8-4c	MS21913-8c	600
10105802-10	Glycol	MS21916-8-4c	MS21913-8c	600
10105802-11	Glycol	MS21916-8-4c	MS21913-8c	600
10105802-12	Glycol	MS21916-8-4c	MS21913-8c	600
10105802-13	Glycol	MS21916-6-4c	MS21913-6c	300
10105802-14	Glycol	MS21916-6-4c	MS21913-6c	300
10105802-15	Glycol	MS21916-6-4c	MS21913-6c	300
10105802-16	Glycol	MS21916-8-4c	MS21913-8c	600
10105802-17	Glycol	MS21916-6-4c	MS21913-6c	300
10105802-18	Glycol	MS21916-6-4c	MS21913-4c	300
10105802-19	Glycol	MS21916-8-4c	MS21913-8c	600
10105802-20	Glycol	MS21916-8-4c	MS21913-8c	600
10105802-21	Glycol	MS21916-8-4c	MS21913-8c	600
10105802-22	Glycol	MS21916-6-4c	MS21913-4c	300
10105802-23	Glycol	MS21916-8-4c	MS21913-8c	600
10105802-24	Glycol	MS21916-8-4c	MS21913-8c	600
10105802-25	Glycol	MS21916-8-4c	MS21913-8c	600
10105802-26	Glycol	MS21916-8-4c	MS21913-8c	600
10105802-27	Glycol	MS21916-8-4c	MS21913-8c	600
10105802-28	Glycol	MS21916-8-4c	MS21913-8c	600
10105803-1	Glycol	MS21916-6-4c	MS21913-6c	300
10105803-2	Glycol	MS21916-8-4c	MS21913-8c	600
10105803-3	Glycol	MS21916-8-4c	MS21913-8c	600
10105803-4	Glycol	MS21916-8-4c	MS21913-8c	600
10105803-5	Glycol	MS21916-6-4c	MS21913-6c	300
10105803-6	Glycol	MS21916-8-4c	MS21913-8c	600
10105803-7	Glycol	MS21916-8-4c	MS21913-8c	600
10105803-8	Glycol	MS21916-8-4c	MS21913-8c	600
10105803-9	Glycol	MS21916-6-4c	MS21913-6c	300
10105803-10	Glycol	MS21916-8-4c	MS21913-8c	600
10105803-11	Glycol	MS21916-6-4c	MS21913-6c	300
10105803-12	Glycol	MS21916-8-4c	MS21913-8c	600
10105803-13	Glycol	MS21916-8-4c	MS21913-8c	600
10105803-14	Glycol	MS21916-8-4c	MS21913-8c	600
10105803-15	Glycol	MS21916-8-4c	MS21913-8c	600
10105803-16	Glycol	MS21916-8-4c	MS21913-8c	600
10105803-17	Glycol	MS21916-8-4c	MS21913-8c	600
10105803-18	Glycol	MS21916-8-4c	MS21913-8c	600
10105803-19	Glycol	MS21916-8-4c	MS21913-8c	600
10105803-20	Glycol	MS21916-8-4c	MS21913-8c	600
10105803-21	Glycol	MS21916-8-4c	MS21913-8c	600
10105803-22	Glycol	MS21916-8-4c	MS21913-8c	600
10105803-23	Glycol	MS21916-8-4c	MS21913-8c	600
10105803-24	Glycol	MS21916-8-4c	MS21913-8c	600
10105803-25	Glycol	MS21916-8-4c	MS21913-8c	600

Flexible hose assembly	Use	Union or adapter	Cap or plug	Proof pressure (psig)
10105964-1	Glycol	MS21916-8-4c	MS21913-8c	600
10105964-2	Glycol	MS21916-8-4c	MS21913-8c	600
10105964-3	Glycol	MS21916-8-4c	MS21913-8c	300
10105964-4	Glycol	MS21916-8-4c	NMS21913-8c	600
10105964-5	Glycol	MS21916-8-4c	MS21913-8c	600
10105964-6	Glycol	MS21916-8-4c	MS21913-8c	600
10105964-7	Glycol	MS21916-8-4c	MS21913-8c	600
10105966-1	Glycol	MS21916-6-4c	MS21913-8c	300
10105966-2	Glycol	MS21916-8-4c	MS21913-8c	600
10105966-3	Glycol	MS21916-8-4c	MS21913-8c	600
10105966-4	Glycol	MS21916-6-4c	MS21913-6c	300
10105966-5	Glycol	MS21916-6-4c	MS21913-6c	300
10105966-6	Glycol	MS21916-6-4c	MS21913-6c	300
10105966-7	Glycol	MS21916-8-4c	MS21913-8c	600
10105966-8	Glycol	MS21916-8-4c	MS21913-8c	600
10105966-9	Glycol	MS21916-6-4c	MS21913-6c	300
129V007-4CR-0320	Oil	MS21902D4	MS21913D4	6000
129V 007-6CR-0320	Oil	MS21916D6-4	MS21913D6	6000
129V007-6CR-790	Oil	MS21916D6-4	MS21913D6	6000
9073895-1	Air	MS21902D4	MS21913D4	3000
9090767	Oil	MS21916D10-4	MS21913DIO	6000
9172956	Air	MS21900D4	10105862	6000
9197171	Air	MS21902D4	MS21913D4	6000
9197172	Oil	MS21916D16-4	MS21913D16	1600
9197173	Oil	MS21916D8-4	MS21913D8	6000
9197174	Oil	MS21916D8-4	MS21913D8	6000
9197175	Oil	MS21916D12-1	MS21913D12	3000
9197177	Oil	MIS21902D4	MS21913D4	6000
9197179	Oil	MS21916D6-4	MS21913D6	3500
9197180	Oil	MS21916D12-4	MS21913D] 2	6000
9197181	Oil	MS21916D16-4	MS21913D16	1600
9197183	Air	MS21902D4	MS21913D4	6000
9197184	Oil	MS21902D4	MS21913D4	6000
9197185	Air	MS21902D4	MS21913D4	6000
9197186	Oil	MS21916D12-4	MS21913D12	3000
9197187	Air	MS21900D4	MS21913D4	6000
9197188	Air	MS21902D4	MS21913D4	6000
9197192	Air	MS21902D4	MS21913D4	6000
9197263	Oil	MS21902D4	MS21913D4	6000
9197264	Oil	MS21902D4	MS21913D4	6000
9197523	Oil	MS21916D12-4	MS21913D1 2	3000
9197634	Oil	MS21916D8-4	MS21913D8	4000
MS28741-4-0184	Oil	MS21900D4	AN806D4	1000
MS28741-4-0200	Oil	MS21900D4	AN806D4	1000
MS28741-6-810A	Oil	10105832-2	AN806D6	1000
MS28741-8-0462	Oil	10105832-1	AN806D8	1000
MS28741-8-0482	Oil	10105832-1	AN806D8	1000
MS28759-4-0720	Air	MS21900D4	AN806D4	6000
MS28759-4-0960	Air	MS21900D4	AN806D4	6000
MS28759-4-1080	Air	MS21900D4	AN806D4	6000
MS28762-4-0120	Oil	MS21902D4	MS21913D4	6000
MS28762-4-0250	Oil	MS21902D4	MS21913D4	6000
MS28762-4-0290	Oil	MS21902D4	MS21913D4	6000
MS28762-4-0365	Oil	MS21902D4	MS21913D4	6000
MS28762-4-0400	Air	MS21902D4	MS21913D4	6000
MS28762-4-0490	Oil	MS21902D4	MS21913D4	6000
MS28762-4-3000	Oil	MS21902D4	MS21913D4	6000
MS28762-4-3780	Oil	MS21902D4	MS21913D4	6000
MS28762-6-0150	Oil	MS21916D6--t	MS21913D6	6000
MS28762-6-0200	Oil	MS21916D6-4	MS21913D6	6000
MS28762-6-0220	Oil	MS21916D6-4	MS21913D6	6000
MSS2s-62-6-0250	Oil	MS21916D6-4	MS21913D6	6000

Table 22-1. Flexible Hose Assemblies (td Assosiciated Fittings-Continued

Flexible hose assembly	Use	Union or adapter	Cap or plug	Proof pressure (psig)
MS28762-6-0290	Oil	MS21916D6-4	MS21913D6	6000
MS28762-6-0330	Oil	MS21916D6-4	MS21913D6	6000
MS28762-6-0380	Oil	MS21916D6-4	MS21913D6	6000
MS28762-6-0500	Oil	MS21916D6-4	MS21913D6	6000
MS28762-6-3000	Oil	MS21916D6-4	MS21913D6	6000
MS28762-6-4180	Oil	MS21916D6-4	MS21913D6	6000
MS28762-8-0220	Oil	MS21916D8-4	MS21913D8	6000
MS28762-8-0250	Oil	MS21916D8-4	MS21913D8	6000
MS28762-8-0310	Oil	MS21916D8-4	MS21916D8	6000
MS28762-8-0320	Oil	MS21916D8-4	MS21913D8	6000
MS28762-8-0330	Oil	MS21916D8-4	MS21913D8	6000
MS28762-8-0380	Oil	MS21916D8-4	MS21913D8	6000
MS28762-8-0490	Oil	MS21916D8-4	MS21913D8	6000
MS28762-8-0540	Oil	MS21916D8-4	MS21913D8	6000
MS28762-10-0500	Oil	MS21916D10-4	MS21913D10	6000
MS28762-10-0600	Oil	MS21916D10-4	MS21913D10	6000
MS28762-12-0170	Oil	MS21916D12-4	MS21913D12	3000
MS28762-12-0300	Oil	MS21916D12-4	MS21913D12	3000
MS28762-12-0420	Oil	MS21916D12-4	MS21913D12	3000

e. Install a connector on each end of the hose and test in accordance with paragraphs 22-1 and 22-2.

f. Thoroughly clean and drain the hose assembly after testing.

Table 22-2. Flexible Hose Assembly Test Procedures

Step	Operation Normal indication Corrective procedure
	Operate the handpump slowly until the 0-10000 PSI GAGE indicates the desired proof pressure. Start the timer and maintain the pressure for 3 minutes while observing the flexible hose assembly for leakage. **See table 22-1 for the correct pressure.** **CAUTION** If the flexible hose assembly is defective, destroy it. HAND PUMP PRESSURE UNLOADING VALVE .....open slowly. Stop the timer and reset to zero. Disconnect the test setup. Drain and cap the flexible hose assembly.

CHAPTER 23

COUPLINGS

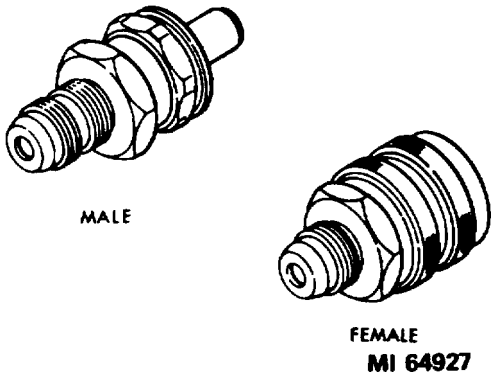


Figure 23-1. Couplings.

23-1. Preparation for Test

a. Clean and inspect the coupling.

b. Use the test equipment listed in table 23-1 and the couplings and fittings listed in table 23-2 to make the test setup shown in figure 23-2.

Table 23-1. Test Equipment Required

Item	Part no.
Bushing	MS21915D6-4
Bushing	MS21915D8-4
Bushing	MS21915D12-6
Coupling half	9194683
Hose assembly	MS28762-4-0250
Reducer	MS21916D6-4
Reducer	MS21916D8-4
Reducer	MS21916D12-4
Tube assembly	9197359
Tube assembly	9197361
Tube assembly	9197363
Tube assembly	9197495
Tube assembly	9197497
Tube assembly	9197499
Union	MS21902D4
Wooden drift pin	10043400

Table 23-2. Couplings and Fittings

Coupling	Tube assembly	Fitting
9082407	9197495	MS21902D4
9194678	9197495	MS21902D4
9194680	9197499	MS21916D8-4
9194681	9197359	MS21916D12-4
9194683	None (fits hose assembly)	None (fits hose assembly)
9194684	9197363	MS21916D6-4
9194685	9197361	MS21916D8-4
9194686	9197359	MS21916D12-4

c. HAND PUMP PRESSURE UNLOADING VALVE.....CLOSE.

d. LOW PRESSURE GAGE SHUTOFF OPEN.

e. Unseat the poppet in the coupling with the wooden drift pin, and purge the air from the lines by slowly pumping the handpump two or three times.

f Remove the wooden drift pin and wipe the coupling half dry.

g. 416 VOLTS.....ON.

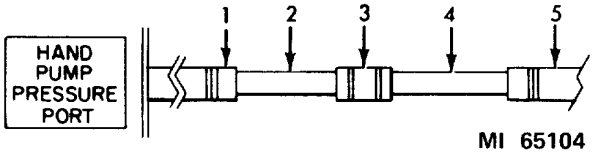
h. 28 VOLTS .....ON.

i. MAKE READY.....ON.

j. Set the timer to zero.

23-2. Test Procedures

Perform the test procedures in table 23-3 to complete the tests. Replace the coupling if defective.



1-Coupling 9194683
2-Hose assembly MS28762-4-0250
3-Reducer
4-Tube assembly
5--Coupling under test

Table 23-3. Coupling Test Procedures

Table 23-3. Coupling Test Procedures

Step	Operation Normal indication Corrective procedure
1.	Operate the handpump until the 0-100 PSI GAGE indicates 10. Start the timer and maintain the pressure for 3 minutes while observing the coupling half for leakage. **No leakage around the threaded boss portion of the coupling, and not more than 2 drops leakage elsewhere.**
2.	Stop the timer and reset to zero. LOW PRESSURE GAGE SHUTOFF .....close. Operate the handpump until the 0-10000 PSI GAGE indicates 4500. Start the timer and maintain the pressure for 3 minutes while observing the coupling for leakage. **No leakage around the threaded boss portion of the coupling, and not more than 2 drops leakage elsewhere.**
3.	HAND PUMP PRESSURE UNLOADING VALVE ..... open slowly. Unseat the poppet with the wooden drift pin and operate the handpump slowly until oil flows from the coupling half. Remove the wooden drift pin and wipe the coupling half dry. LOW PRESSURE GAGE SHUTOFF .....open. HAND PUMP PRESSURE UNLOADING VALVE ..... close. Repeat steps 1 through 3 above.
4.	LOW PRESSURE GAGE SHUTOFF .....open. Disconnect the test setup.

CHAPTER 24

THERMOMETER 9074946

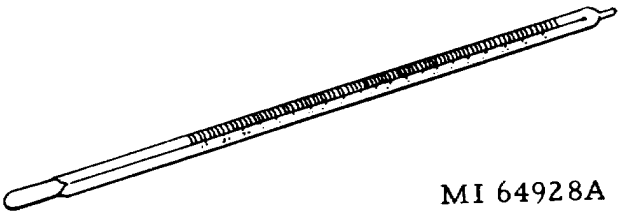


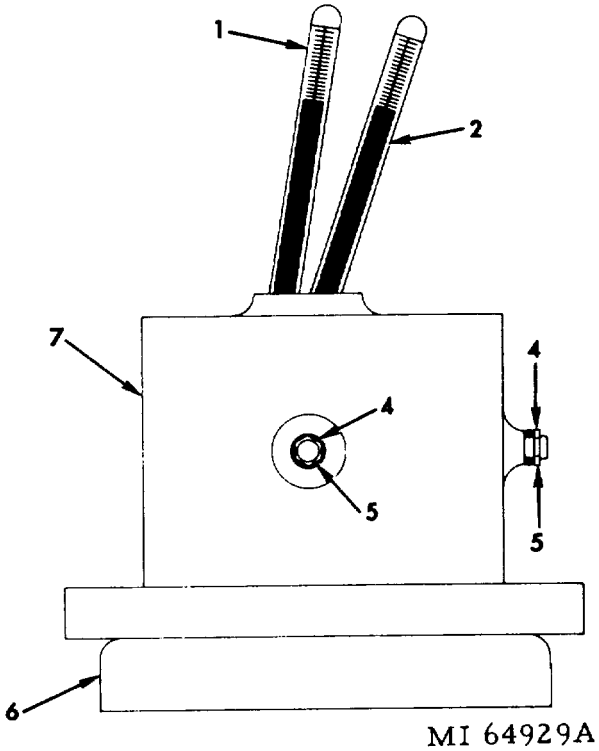
Figure 24-1. Thermometer.

24-1. Preparation for Test

a. Clean and inspect the thermometer.
b. Make the test setup as shown in figure 24-2.
c. Fill the test tank fixture with clean water.

24-2. Test Procedures

Perform the procedures in table 24-1 to complete the tests. Replace the thermometer if defective.



1-Standard thermometer 9074946
2--Thermometer 9074946
3-Deleted
4-Pressure plug MS21913D4 (2 required)
5-Preformed packing MS29512-4 (2 required)
6-Hot plate 9197287
7-Test tank fixture 9172641

Figure 24-2. Thermometer-test setup.

Table 24-1. Thermometer Periodic Test Procedures

Step	Operation Normal indication Corrective procedure
	Connect the hot plate and heat the water until the standard thermometer is stabilized at 180 ± 5°F. **The thermometer under test indicates within 5° of the standard thermometer.** Disconnect the hot plate, empty the tank fixture, and store the test equipment. **CAUTION** The hot plate must be cold before storing.

CHAPTER 25

PRESSURE GAGES

25-1. General

This section contains two test procedures for testing the pressure gages listed below.

Test No. 1	*Test No. 2*
8035247	9081192
9074257	9081193
9081758	9081194
9112775[1]	081291
10105733	9180611
1017504-5	9197332
11569667[2]	
MS28061-7	

1This is a gas pressure regulator containing a 0-400 and 0-4000 psig gage. Before testing the gages, remove them from the regulator.

2 Provided that MWO 9-4935-541-50-11 has been applied.

25-2. Test Equipment

Table 25-1 lists the equipment used for testing the gages. Tables 25-2 and 25-3 list the test requirements and the required indications. To select the proper weights necessary for performance of the gage tests, refer to table 25-4.

Table 25-1. Test Equipment

item	Part no.
Portable dual-range dead-weight tester assembly	9074620
Weight set	9194836
Union	ER816-7
Reducer	MS21916D8-4
Coupling half	9194683
Coupling half	9194685
Hose assembly	MS28762-8-0490
Tube assembly	9197357

25-3. Preparation for Test

NOTE

The key numbers shown below in parentheses refer to figure 25-1.

a. Carefully remove the deadweight tester assembly from the case.

b. Refer to the test setup in figure 25-1 and connect the offset tube assembly (15) to the pump body outlet (7). Remove the reducer, adapter, and connector (19, 18, and 17) from the upper end of the offset tube assembly.

NOTE

Before connecting the piston assembly, wipe the piston clean and cool it with light oil to insure free rotation.

c. Connect the piston assembly (4) and the cylinder assembly (5) to the piston body outlet (6) after removing the shipping bolt.

NOTE

Avoid pinching the preformed packings at the connections.

d. Check the oil level. Remove the oil fill plug (I 1) and fill the reservoir (12) if necessary.

e. Connect the gage (1) to be tested to the upper end of the offset tube assembly. Loosen the adapter (18) from the connector (17) several turns. Tighten the gage to the reducer (19) for a 1/4-inch thread connection or to the adapter for a 1/2-inch thread connection.

f: Position the gage for viewing by loosening the union (16), and set to the desired position. Retighten the union.

25-4. Test Procedures

Perform the test procedures in table 25-5 to complete the tests. Replace the gage if defective.

Table 25-2. Test No. 1 requirements and Test Indications

Hydraulic gage	Piston	Tolerance (±) (psig)	Interval (psig)
8035247 (0-5 psig)	Low pressure	0.05	1
9074257 (0-150 psig)	Low pressure	4	10
9081758 (0-500 psig)	High pressure	5	50
9112775 (0-400 psig)	High pressure	5	50
9112775 (0 -4000 psig)	High pressure	50	500
1015733 (0-3000 psig)	High pressure	90	500
101075045 (0-100 psig)	Low pressure	5	10
11569667 (0- 6000 psig)	High pressure	30	60
MS28061-7 (0-5000 psig)	High pressure	50	500

[1]Provided that MWO 9 -1935-541-50-11 has been applied.

Table 25-3. Test No. 2 Requirements and Test Indications

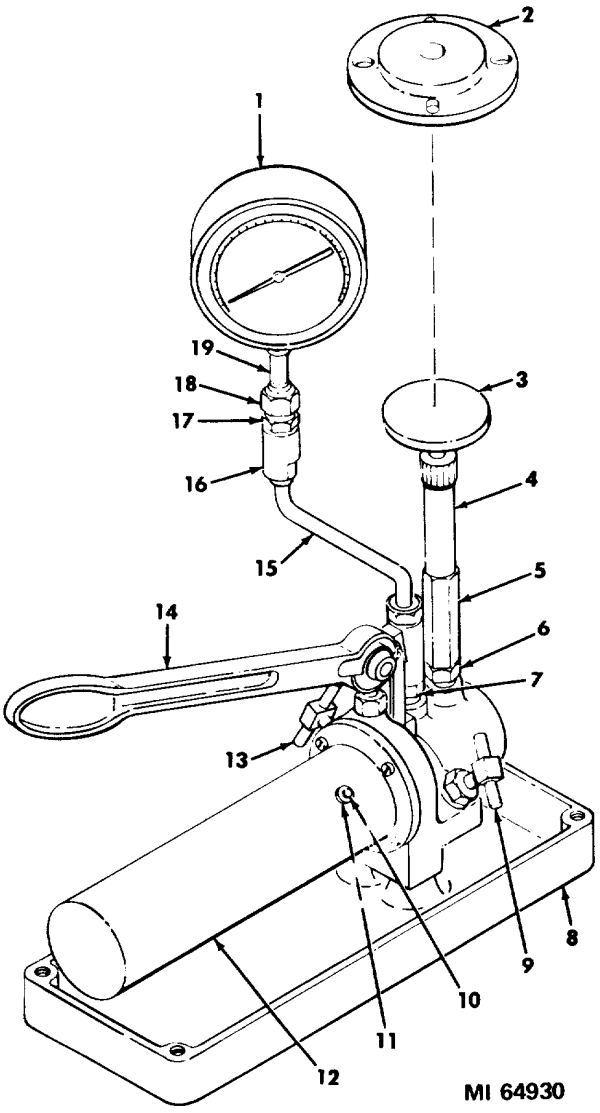
Hydraulic gage	Port	Valve	Valve position	Piston	Tolerance (+ psig)	Interval (psig)
908 1193 0- 100) PSI GAGE	HAND PUMP PRESSURE PORT	LOW PRESSURE GAGE SHUTOFF valve	Open fully	Low pressure-	2.5	10
		HAND PUMP PRESSURE UN-LOADING VALVE	Closed			
9081291 0-3000 PSI DIFFEREN-TIAL GAGE	DIFFEREN-TIAL GAGE HIGH PORT			High pressure	30	300
9197332 0-10000 PSI GAGE	HAND PUMP PRESSURE PORT	LOW PRESSURE GAGE SHUTOFF valve	Closed	high pressure	100	500
		HAND PUMP PRESSURE UN-LOADING	Closed			
	Note **The above gage can be tested in the hydraulic test console to 7500 psig only**					
9081194 GAGE C 0- 4000 PSI GAGE	TEST PORT C-2			High pressure	40	400
9081192 0-400 PSI GAGE	SUPPLY PORT	SYSTEM PRES-SURE GAGE SELECTOR valve	0-400	Low pressure	4	40
		SYSTEM PRES-SURE CONTROL VALVE, FINE ADJUST	Closed			
		SYSTEM PRES-SURE CONTROL VALVE, COARSE ADJUST	Closed			

Table 25-3. Test No. 2 Requirements and Test Indications-Continued

Hydraulic gage	Port	Valve	Valve position	Piston	Tolerance (± psig)	Interval (psig)
9081194 0-4000 PSI GAGE	SUPPLY PORT	SYSTEM PRESSURE GAGE SELECTOR valve	0-4000	High pressure	40	400
		SYSTEM PRESSURE CONTROL VALVE, FINE ADJUST	Closed			
		SYSTEM PRESSURE CONTROL VALVE, COARSE ADJUST	Closed			
9180611 0-2000 PSI GAGE	SUPPLY PORT	SYSTEM PRESSURE GAGE SELECTOR valve	0-2000	High pressure	20	200
		SYSTEM PRESSURE CONTROL VALVE, FINE ADJUST	Closed			
		SYSTEM PRESSURE CONTROL VALVE COARSE ADJUST	Closed			
9081194 GAGE D 0-4000 PSI GAGE	TEST PORT D-2			High pressure	40	400

Table 25-4. Table of Deadweights

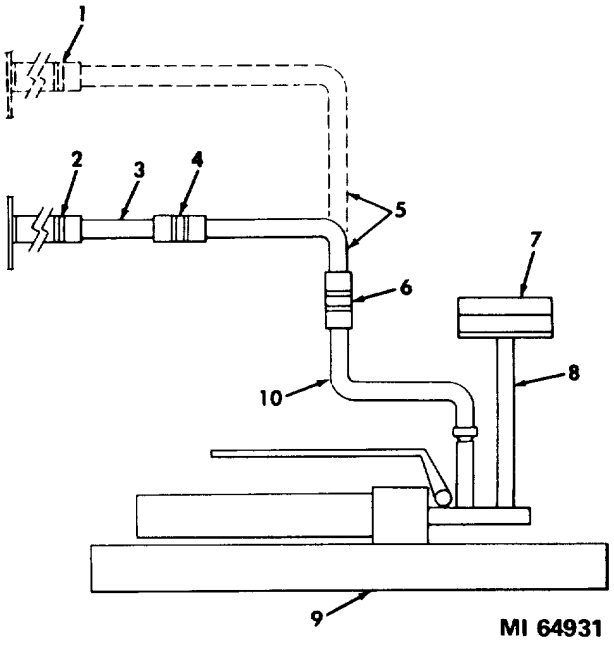
Quantity	Pressure equivalent (psig)		Actual weight (oz)	Weight stampings	
	Low	High			
3	10	50	10	L10	H50
2	20	100	20	L20	H100
3	40	200	40	L40	H200
8	100	500	100	L100	H500



1-Gage
2-Weights
3-Piston plate
4-Piston assembly
5-Cylinder assembly
6-Piston body outlet
7-Pump body outlet
8-Deadweight tester 9074620
9-Pressure release valve
10-Air vent
11-Oil fill plug
12-Reservoir
13-Displacement needle valve
14-Handle
15-Offset tube assembly
16-Union
17-Connector
18-Adapter
19-Reducer

Figure 25-1. Deadweight tester assembly and pressure gage-test No. 1 setup.

Figure 25-1 -Continued.



1-Coupling 9194683[1]
2-Coupling 9194685
3-Tube assembly 9197357
4-Reducer MS21916D8-4
5-Hose assembly MS28762-8-0490
6-Union
7-Weights
8-Piston
9-Deadweight tester
10-Offset tube assembly

[1] Used for testing pressure gages 9081193 and 9197332.

Figure 25-2. Pressure gage-test No. 2 setup.

Table 25-5. Pressure Gage Periodic Test Procedures

Step	Operation Normal Indication Corrective procedure
1.	Test No. 1. **NOTE** Table 25-2 lists the test requirements and indications for each gage. Table 25-4 lists the quantities and values of the weights which are used as pressure equivalents. Refer to this table for the combination of weights that corresponds to the pressure rating of the gage being tested. Place the weights (2, fig. 25-1) on the piston plate (3, fig. 25-1). Close the pressure release valve (9, fig. 25-1) and open the air vent (10, fig. 25-1). Spin the weights and operate the deadweight tester until the piston plate rises. The gage indicates within ± 5 percent of the equivalent value of added weights. **NOTE** Small pressure changes can be made by an adjustment of the displacement needle valve (13, fig. 25-1). Slowly open the pressure release valve until the pressure on the gage drops to zero. **CAUTION** Do not loosen any connections until the pressure on the gage indicates zero. **NOTE** The 0-100 PSI GAGE (10107504-5) is a duplexgage and should be tested twice, once for each port on the gage. **NOTE** If test No. 2 is not going to be performed, proceed with step 3.
2.	Test No. 2. Make the test setup as shown in figure 25-2 and refer to table 25-3 to determine the proper test port, valve positions, and test indications. Repeat test No. 1. The gage indicates within ± 5 percent of the equivalent value of added weights.
3.	Storage Procedures. **NOTE** After testing gages 10105733, 8035247, and 9112775,clean the inside of the gage with Freon precision cleaning agent solvent 6830-082-2411, Federal Specification 2374, to remove all contaminants and residue. Remove the offset tube assembly (15, fig. 25-1) and disconnect the gage. Remove the piston assembly and the cylinder assembly (4 and 5, fig. 25-1). Replace the reducer, adapter, and connector on the union. Install the shipping bolt on the piston body outlet.

Table 25-5. Pressure Gage Periodic Test Procedures-continued

Step	Operation Normal Indication Corrective procedure
3. Cont.	Close the displacement needle valve. Close the air vent. Store the deadweight tester in the case, reservoir first, with the handle up.

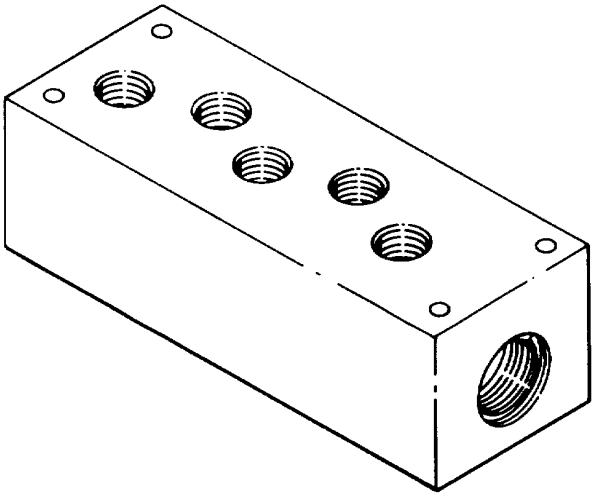
CHAPTER 26

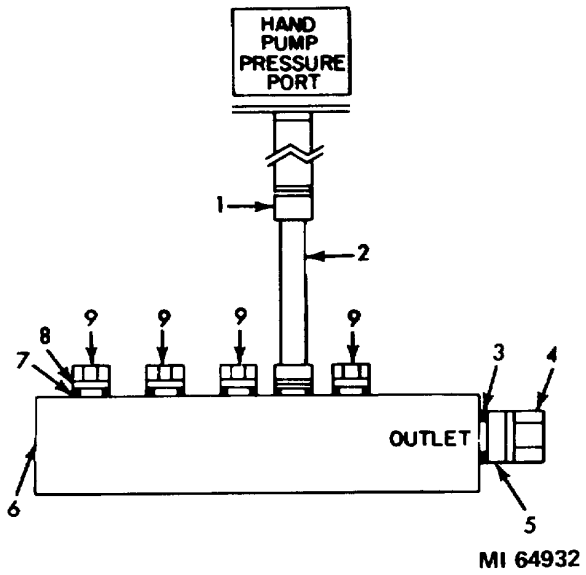
MULTIPLE FLUID LINE CONNECTOR 9089714

26-1. Preparation for Test

a. Clean and inspect the multiple fluid line connector.

b. Make the test setup as shown in figure 26-1, but do not install the four caps (9, fig. 26-1).





c. HAND PUMP PRESSURE UNLOADING VALVE.....CLOSE.

d. LOW PRESSURE GAGE SHUTOFF CLOSE.

e. Operate the handpump slowly until air-free oil flows from the uncapped ports of the connector.

f Install the caps.

g. 416 VOLTS .....ON.

h. 28 VOLTS .....ON.

i. MAKE READY.....ON.

j. Set the timer to zero.

26-2. Test Procedures

Perform the procedures in table 26-1 to complete the tests.

1-Coupling 9194683
2-Hose assembly MS28762-4-0250
3-Preformed packing MS29512-10
4-Cap MS21914D8
5-Reducer MS21916D10-8
6-Multiple fluid line connector 9089714
7-Preformed packing MS29512-4 (5 required)
8-Union MS21902D4 (5 required)
9-Cap MS21914D4 (4 required)

Figure 26-1. Multiple fluid line connector-test setup.

Table 26-1. Multiple Fluid Line Connector Test Procedures

Step	Operation Normal Indication Corrective procedure
	Operate the handpump until the 0-10000 PSI GAGE indicates 4500. Start the timer and maintain the pressurefor 3 minutes while observing the connector for leakage. No leakage. Preformed packings or connector housing. HAND PUMP PRESSURE UNLOADING VALVE open slowly. Stop the timer and reset to zero. Disconnect the test setup.

APPENDIX A

REFERENCES

Refer to TM 9-1425-525-L for a list of other publications pertinent to this material and associated equipment.

APPENDIX B

BASIC ISSUE ITEMS LIST

Section I. INTRODUCTION

B-1. Scope
This appendix lists items which accompany the Shop Equipment (Shop No. 5) or are required for installation, operation, or operator's maintenance.

B-2. General
This Basic Issue Items List is divided into the following sections:
a. Basic Issue Items-Section II. A list of items which accompany the Shop Equipment (Shop No. 5) and are required by the crew/operator for installation, operation, or maintenance.
b. Maintenance and Operating Supplies-Section III. Not Applicable.

B-3. Explanation of Columns.
The following provides an explanation of columns in the tabular list of Basic Issue Items, Section II.
a. Source, Maintenance, and Recoverability Codes (SMR), Column 1:
(1) Source code, indicates the selection status and source for the listed item. Source codes are: Not Applicable.
(2) Maintenance code, indicates the lowest category of maintenance authorized to install the listed item. Not Applicable.
(3) Recoverability code, indicates whether unserviceable items should be returned for recovery or salvage. Items not coded are expendable. Recoverability code is:

Cone	Explanation
R	Repair parts (assemblies and components) which are considered economically reparable at direct and general support maintenance levels. When the maintenance capability to repair these items does not exist, they are normally disposed of at the GS level. When supply considerations dictate, some of these repair parts may be listed for automatic return to supply for depot level repair as set forth in AR 710-50. When so listed, they will be replaced by supply on an exchange basis.

(4) This column also lists, below the SMR code, an index number for each item in ascending numerical sequence, which is used to locate items in the publication when the Federal stock number and/or reference number is known.
b. *Federal Stock Number, Column 2*. This number indicates the Federal stock number assigned to the item and will be used for requisitioning purposes.
c. *Description, Column 3.* This column indicates the Federal item name and any additional description of the item required. The abbreviation "w/e" when used as a part of the nomenclature, indicates the Federal stock number includes all armament, equipment, accessories, and repair parts issued with the item. A part number or other reference number is followed by the applicable five-digit Federal supply code for manufacturers in parentheses.

d. Unit of Measure (U/M), Column 4. A 2-character alphabetic abbreviation indicating the amount or quantity of the item upon which the allowances are based, e.g., ft, ea, pr, etc.

e. Quantity Incorporated in Unit, Column 5. This column indicates the quantity of the item used in the functional group.

f. Quantity Furnished with Equipment, Column 6. This column indicates the quantity of an item furnished with the equipment.

g. Illustration, Column 7. This column is divided as follows:

(1) *Figure Number, Column 7a*. Indicates the figure number of the illustration in which the item is shown.

(2) *Item Number, Column 7b*. Indicates the callout number used to reference the item in the illustration.

B-4. Explanation of Columns in the Tabular List of Maintenance and Operating Supplies Section iii.

B-5. Special Information.

Refer to TM 740-525, appendix C, for inventory list.

B-6. Abbreviations

Abbreviation	Explanation
W	watt(s), wide, width
W/E	with equipment
X	by (as in 2 x 4)

B-7. Federal Supply Codes for Manufacturers

Code	Manufacturer
18876	U. S. Army Missile Command Redstone Arsenal, Alabama 35809
81349	Military Specifications Promulgated by Standardization Division

SECTION II

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) QTY FURN WITH EQUIP	(7) ILLUSTRATON (a) FIGURE NO.	(7) ILLUSTRATON (b) ITEM NO.
		BASIC ISSUE ITEMS FOR					
---R 1	4935-714-3319	SHOP EQUIPMENT, GUIDED MISSILE SYSTEM, FIELD MAINTENANCE XM-2 (SHOP NO. 5) REF NO. 9194700 (SHOP SERIAL NO. 7001 THRU 7008.) (18876)	EA		-		
---R 2	4935-896-6219	SHOP EQUIPMENT, GUIDED MISSILE SYSTEM, FIELD MAINTENANCE XM2E1 (SHOP NO. 5) REF NO. 9197405 (SHOP SERIAL NO. 7009 THRU 9004.) (18876)	EA		-		
---R 3	4935-740-6220	SHOP EQUIPMENT, GUIDED MISSILE SYSTEM, FIELD MAINTENANCE XM2E2 (SHOP NO. 5) REF NO. 10104005 (18876)	EA		-		
-----	7510-889-3494	BINDER, LOOSE-LEAF U.S. ARMY EQUIPMENT LOG BOOK, FLEX. PLASTIC COVER, 3-RING TYPE FASTENER, SIDE OPNG, FOR 10 LG X 8 W SHEETS (FOR TAMMS FORMS) REF NO. MILB43064 (81349)	EA		1		
----		MANUAL, TECHNICAL TM 9-1430-509-34	EA		1		
		MANUAL, TECHNICAL TM 9-4935-502-15	EA		1		
		MANUAL, TECHNICAL TM 9-4935-507-34	EA		1		
		MANUAL, TECHNICAL TM 9-4935-507-35P	EA		1		
		SECTION III MAINTENANCE AND OPERATING SUPPLIES NOT APPLICABLE					

APPENDIX C

NOMENCLATURE AND REFERENCE DESIGNATIONS

Reference designation	TM nomenclature	Official nomenclature	Part no
25	Transportable hydraulic shop 5	Shop Equipment, Guided Missile System (XO-1) XM2, XM2E1, and XM2E2	0104005
25A1	Air conditioner		9195078
25A2	Transformer box		9194899
25A3	Degreaser and accumulator test console		9194500
25A4	Heat exchanger		9194887
25A5	Air compressor assembly		9194960
25A6	Hydraulic console lower section		Part of 9197500
25A6A1	Junction box		9187404
25A6A2	Control indicator panel		9187405
25A6A3	Hydraulic console timer stop assembly panel		9187407
25A6A4	Hydraulic console main reservoir		9194540
25A8	Hydraulic test console		9197500
25A8A1	Hydraulic console upper center control panel		10068908
25A8A1M1	Voltmeter		9081424
25A8A1M2	Ammeter		9081435
25A8A1M3	Indicator oil temperature		9081415
25A8A1M4	Indicator high flow		9081602
25A8A1M5	Indicator low flow		9081669
25A8A1TM 1	Sensing element		9081756
25A8A1TM2	Sensing element		9081520
25A9	Air reservoir assembly		9197648
	Hydraulic test console upper left control panel		9194567
	Hydraulic test console upper right control panel		9194564

APPENDIX D
APPARATUS LIST FOR TRANSPORTABLE HYDRAULIC SHOP 5 10104005

Reference designation	Nomenclature	Part no.
A1	AIR CONDITIONER	9195078
A2	TRANSFORMER BOX	9194899
A2CB1	CIRCUIT BREAKER: 3pst, 9 amp	9081838
A2J1	CONNECTOR, RECEPTACLE, ELECTRICAL: 7 pin	MS3102E20-15P
A2J2	CONNECTOR, RECEPTACLE, ELECTRICAL: 7 socket	MS3102E20-15S
A2T1	TRANSFORMER, POWER, STEPDOWN: 240v- 120v, 400 Hz, 3 phase	9074773
A2TB1	TERMINAL BOARD: 7 terminal	9081288
A3	DEGREASER AND ACCUMULATOR TEST CONSOLE	9194502
A3CB1	CIRCUIT BREAKER: 3p, 11 amp	9081270
A3CB2	CIRCUIT BREAKER: sp, 5 amp	9081100
A3CB3	CIRCUIT BREAKER: spst, 1 amp	9197368-1
A3CR1, A3CR2	SEMICONDUCTOR DEVICE, DIODE: TM27	9081548
A3DS1	LAMP, INCANDESCENT, SINGLE CONTACT, MINIATURE BAYONET BASE: 28v, 0.17 amp, clear	MS25231-313
A3J1	CONNECTOR, RECEPTACLE, ELECTRICAL: 7 pin	MS3100A20-15P
A3J2	CONNECTOR, RECEPTACLE, ELECTRICAL: 5 socket	MS3100A18-11S
A3J3	CONNECTOR, RECEPTACLE, ELECTRICAL: 4 socket	MS3100A14S2S
A3J4	CONNECTOR, RECEPTACLE, ELECTRICAL: 3 socket	MS3100A14S7S
A3K1	RELAY, ARMATURE: 28v, 25 amp	9081617
A3T1	TRANSFORMER, POWER, STEPDOWN: 416v- 64v, 420 Hz, single phase	9167716
A4	HEAT EXCHANGER	9194887
A5	AIR COMPRESSOR ASSEMBLY	9194960
A5J1	CONNECTOR, RECEPTACLE, ELECTRICAL: 4 pin	MS3102R18-4P
A5J2	CONNECTOR, RECEPTACLE, ELECTRICAL: 5 pin	MS3102R10OSL4P
A5J3	CONNECTOR, RECEPTACLE, ELECTRICAL: 4 pin	MS3102R14S2P
A6	HYDRAULIC TEST STAND	9187400
A6A1	DISTRIBUTION BOX	9187404
A6A1CB1	CIRCUIT BREAKER: 3pst, 45 amp	9081266
A6A1CB2	CIRCUIT BREAKER: spst, 4 amp	9081267

Reference designation	Nomenclature	Part no.
A6A1CB3	CIRCUIT BREAKER: 3pst, 10 amp	9081268
A6A1CR1, A6A1CR2	SEMICONDUCTOR DEVICE, DIODE	9081548
A6A1J1	CONNECTOR, RECEPTACLE, ELECTRICAL: 4 pin	MS3102R24-22P
A6A1J2	CONNECTOR, RECEPTACLE, ELECTRICAL: 7 socket	MS3102R24-10S
A6A1J3	CONNECTOR, RECEPTACLE, ELECTRICAL: 8 socket	MS3102R20-7S
A6A1J4	CONNECTOR, RECEPTACLE, ELECTRICAL: 5 socket	MS3102R14S5S
A6A1J5	CONNECTOR, RECEPTACLE, ELECTRICAL: 3 socket	MS3102R14S7S
A6A1J6	CONNECTOR, RECEPTACLE, ELECTRICAL: 4 socket	10105183
A6A1J7	CONNECTOR, RECEPTACLE, ELECTRICAL: 4 socket	MS3102R18-4S
A6A1J8	CONNECTOR, RECEPTACLE, ELECTRICAL: 11 socket	MS3102R24-20S
A6A1J9	CONNECTOR, RECEPTACLE, ELECTRICAL: 4 socket	MS3102E24-22S
A6A1K1	RELAY ARMATURE: 28 vdc, 50 amp	9081618
A6A1K2, A6A1K3	RELAY ARMATURE: 28 vdc, 18 amp	9081617
A6A1T1	TRANSFORMER, POWER, STEPDOWN: 416v - 64v, 420 Hz, single phase	9081307
A6A2	CONTROL-INDICATOR	9187405
A6A2CB1	CIRCUIT BREAKER: 3pst, 50 amp	9081109
A6A2CB2	CIRCUIT BREAKER: sp, 5 amp	9081100
A6A2DS1-A6A2DS3	LAMP, INCANDESCENT, SINGLE CONTACT, MINIATURE BAYONET BASE: 8v, 0.17 amp, clear	MS25231-313
A6A2J1	CONNECTOR, RECEPTACLE, ELECTRICAL: 7 pin	MS3102R20-7P
A6A2J2	CONNECTOR, RECEPTACLE, ELECTRICAL: 7 pin	MS3102R24-10P
A6A3	PANEL INDICATOR	9187407
A6A3C1	CAPACITOR, FIXED, ELECTROLYTIC: 30 uf, 75 vdc	9081084
A6A3DS1	LAMP, INCANDESCENT, SINGLE CONTACT, MINIATURE BAYONET BASE: 28v, 0.17 amp, clear	MS25231-313
A6A3J1	CONNECTOR, RECEPTACLE, ELECTRICAL: 5 pin	MS3102R14-5P
A6A3J2	CONNECTOR, PLUG, ELECTRICAL, STRAIGHT: 4 socket	MS3102R14S2P
A6A3J3	CONNECTOR, PLUG, ELECTRICAL, STRAIGHT: 8 socket	MS3102R18-8P
A6A3L1	REACTOR: dc, 50 mh, 700 ma, 3 ohm	9081062
A6A3P2	CONNECTOR, PLUG, ELECTRICAL, STRAIGHT: 4 socket	MS3106R14S2S
A6A3P3	CONNECTOR, PLUG, ELECTRICAL, STRAIGHT: 8 socket	MS3106R18-8S

Reference designation	Nomenclature		Part no.
A6A3S1, A6A3S2	SWITCH, TOGGLE: dpdt, 15 amp, 30 vdc		9081018
A6A3S3	SWITCH, PUSHBUTTON: spdt, 10 amp, 30 vdc		9081099
A6A4	TANK, OIL, HYDRAULIC SYSTEM		9194540
	BULB, TEMPERATURE, ELECTRICAL RESISTANCE: (-70° to +300°C)		MS29034-2
	HEATER, IMMERSION, ELECTRICAL: 416v, 400 Hz, 3 phase, 2500w		9081105
A6A4J6	CONNECTOR, RECEPTACLE, ELECTRICAL: 4 pin		MS3102R18-10P
	SWITCH,THERMOSTATIC:	opens with increasing temperature at 24° +5°; closes with decreasing temperatures at 15° +-4° F	10105980-1
	SWITCH,THERMOSTATIC:	opens with increasing temperatures at 169° + 5° F; closes with decreasing temperatures at 160° + 4°F	10105980-2
	SWITCH, THERMOSTATIC:	opens with decreasing temperatures at -10° ± 5°F; closes with increasing temperatures at 105° +5° F	10105980-3
	SWITCH, THERMOSTATIC:	opens with decreasing temperatures at 96° + 5°F; closes with increasing temperatures at 105° + 4°F	10105980-4
A6W6	CABLE ASSEMBLY, SPECIAL PURPOSE, ELECTRICAL: 55 inches		9197190
A6W6P1-A6W6P5	CONNECTOR, PLUG, ELECTRICAL, STRAIGHT: 2 socket		MS3106R12S3S
A6W6P8	CONNECTOR, PLUG, ELECTRICAL, STRAIGHT: 11 pin		MS3106A24-20P
A8	HYDRAULIC TEST CONSOLE		9197500
A8A1	PANEL, HYDRAULIC TEST STAND		10068908
A8A1CB1	CIRCUIT BREAKER: 28 vdc, 1.5 amp, 2 terminal		9081510
A8A1CR1	SEMICONDUCTOR DEVICE, DIODE: SM72		9081571 *(D)[1]
A8A1DS1-A8A1DS3	LAMP, INCANDESCENT, SINGLE CONTACT, MINIATURE BAYONET BASE: 28 vdc, 0.17 amp, clear		MS25231-313
A8A1J1	CONNECTOR, RECEPTACLE, ELECTRICAL: 5 pin		MS3102R14S5P
A8A1J2	CONNECTOR, RECEPTACLE, ELECTRICAL: 2 socket		MS3102R18-14S
A8A1J3	CONNECTOR, RECEPTACLE, ELECTRICAL: 2 socket		101068941
A8A1J9, A8A1J10	CONNECTOR, RECEPTACLE, ELECTRICAL: 3 pin		MS3100R10SL3P
A8AIKl	RELAY, SOLENOID: 28 vdc, 10 amp		MS24149D1
A8A1M1	VOLTMETER, ELECTRONIC: 0 to 30 vdc		9081424
A8A1M2	AMMETER: 0 to 100w a de, nominal coil voltage 28 vdc, maximum coil current 0.20 amp		9081435
A8A1M3	INDICATOR, TEMPERATURE, ELECTRICAL RESISTANCE: 28 vdc, 30° to 250°F (J4)		9081415

[1]Refer to appendix F for serial number effectivity.

Reference designation	Nomenclature	Part no.
A8A1M4	INDICATOR, RATE OF FLOW: 20 to 32 vdc, 1.25 to 9.0 gpm on a 250-degree scale (J5, J6)	9081602
A8A1M5	INDICATOR, RATE OF FLOW: 20 to 32 vdc, 0.25 to 1.3 gpm on a 250-degree scale (J7, J8)	9081669
A8A1MT1	SENSING ELEMENT, RATE OF FLOW: 1.25 to 9.0 gpm, linear +0.5% (6.5 to 9.0 gpm), repeatable +1.5% (1.25 to 9.0 gpm)	9081756
A8A1MT2	SENSING ELEMENT, RATE OF FLOW: repeatable +1.5% (0.5 to 1.3 gpm), repeatable +2.5% (0.25 to 0.5 gpm)	9081520
A8A1P4, A8A1P5	CONNECTOR, PLUG, ELECTRICAL, STRAIGHT: 4 socket	MS3106R14S2S
A8A1P6	CONNECTOR, PLUG, ELECTRICAL, STRAIGHT: 2 socket	MS3106R10OSL4S
A8A1P7	CONNECTOR, PLUG, ELECTRICAL, STRAIGHT: 4 socket	MS3106R14S2S
A8A1P8	CONNECTOR, PLUG, ELECTRICAL, STRAIGHT: 2 socket	MS3106R10SL4S
A8A1P9, A9A1P10	CONNECTOR, PLUG, ELECTRICAL, ANGLE-90 DEGREES: 2 socket	MS3108R10SL3S
A8A1P11, A8A1P12	CONNECTOR, PLUG, ELECTRICAL, STRAIGHT: 2 socket	MS3106R10OSL4S
ASA1R1	RESISTOR FIXED, WIRE WOUND: 0.25w, 32.3 ohm (±0.1%)	9081546
A8A1R2	RESISTOR FIXED, WIRE WOUND: 0.25w, 3.2 ohm (±0.1%)	9081545
A8A1R3	RESISTOR, FIXED, WIRE WOUND: 0.33w, 0.32 ohm (±0.1)	9081544 *(G)[1]
A8A1R3NU	RESISTOR, FIXED, WIRE WOUND: 1/2w, 0.14 ohm (±0.1 of 1%)	9197664-1 *(F)1
	RESISTOR, FIXED, WIRE WOUND: 1/2w, 0.15 ohm (±0.1 of 1%)	9081544-2 *(G)[1]
	RESISTOR, FIXED, WIRE WOUND: 1/2w, 0.155 ohm (±0.1 of 1%)	9197644-3 *(F)[1]
	RESISTOR, FIXED, WIRE WOUND: 1/2w, 0.16 ohm (±0.1 of 1%)	9197664-4 *(F)[1]
	RESISTOR, FIXED, WIRE WOUND: 1/2w, 0.165 ohm (±0.1 of 1%)	9197664-5 *(F)[1]
	RESISTOR, FIXED, WIRE WOUND: 1/2w, 0.17 ohm (±0.1% to 1)	9197664-6 *(F)[1]
A8A1R4	RESISTOR, VARIABLE, WIRE WOUND: 225w, 150 ohm (±10%)	RP351FG151KK
A8A1R5	RESISTOR, FIXED, WIRE WOUND 0.33w, 0.32 ohm (±0.1%)	9081544 *(G)[1]
A8A1S1	SWITCH, PUSHBUTTON: spdt, 10 amp, 30 vdc	9081099
A8A1S2	SWITCH ROTARY: 4 position	9081807
A9	TANK, PRESSURE	9197648
A9J1	CONNECTOR, RECEPTACLE, ELECTRICAL: 3 pin	MS3102E10OSL3P
A9S1	SWITCH, PRESSURE: spdt, 28 vdc, 5 amp (Walter Kidde part no. WK-871450-2)	
A10	CONNECTOR ASSEMBLY	9172569

[1]Refer to appendix F for serial number effectivity.

Reference designation	Nomenclature	Part no.
A10J1	CONNECTOR, RECEPTACLE, ELECTRICAL: 4 pin	MS3102R18-4P
A10J2	CONNECTOR, RECEPTACLE, ELECTRICAL: 4 socket	MS3102R18-4S
A11	CONNECTOR ASSEMBLY	9197294
A11J3	CONNECTOR, RECEPTACLE, ELECTRICAL: 4 pin	MS3102R14S2P
A11J4	CONNECTOR, RECEPTACLE, ELECTRICAL: 2 socket	MS3102R12S3S
A11J5	CONNECTOR, RECEPTACLE, ELECTRICAL: 4 socket	MS3102R14S2S
A12	CONNECTOR ASSEMBLY, ELECTRICAL	9172569
A12J1	CONNECTOR, RECEPTACLE, ELECTRICAL: 4 pin	MS3102R18-4P
A12J2	CONNECTOR, RECEPTACLE, ELECTRICAL: 4 socket	MS3102R18-4S
P3	CONNECTOR, PLUG, ELECTRICAL, ANGLE - 90 DEGREES: 4 socket	MS3108A14S2S
P4	CONNECTOR, PLUG, ELECTRICAL, ANGLE - 90 DEGREES: 4 pin	MS3108A14S2P
W1	CABLE ASSEMBLY, POWER, ELECTRICAL: 101 feet	9186362 *(F)[1]
W1	CABLE ASSEMBLY, POWER, ELECTRICAL: 101 feet	9186364 *(J) [1]
	CONNECTOR, PLUG, ELECTRICAL: 4 pin	9062582 *(K)[1]
	CONNECTOR, PLUG, ELECTRICAL: 4 pin	9072280 *(L) [1]
	CONNECTOR, PLUG, ELECTRICAL: 4 socket	9062583 *(K)[1]
	CONNECTOR, PLUG, ELECTRICAL: 4 socket	9072279 *(L) [1]
W3	CABLE ASSEMBLY, SPECIAL PURPOSE, ELECTRICAL: 137 inches	9172560
W3P1	CONNECTOR, PLUG, ELECTRICAL, ANGLE - 90 DEGREES: 4 socket	MS3108A18-4S
W3P2	CONNECTOR, PLUG, ELECTRICAL, STRAIGHT: 5 pin	MS3106A18S11P
W4	CABLE ASSEMBLY, SPECIAL PURPOSE, ELECTRICAL: 134 inches	9197302
W4P3	CONNECTOR, PLUG, ELECTRICAL, STRAIGHT: 4 pin	MS3106A14S2P
W4P3	CONNECTOR, PLUG, ELECTRICAL, ANGLE - 90 DEGREES: 4 socket	MS3108A14S2S
W5	CABLE ASSEMBLY, SPECIAL PURPOSE, ELECTRICAL: 124 inches	9172534
W5P1	CONNECTOR, PLUG, ELECTRICAL, ANGLE - 90 DEGREES: 3 socket	MS3108A1OSL3S
W5P4	CONNECTOR, PLUG, ELECTRICAL, STRAIGHT: 3 pin	MS3106A14-7P
W6	CABLE ASSEMBLY, SPECIAL PURPOSE, ELECTRICAL: 110 inches	9197584
W6P1	CONNECTOR, PLUG, ELECTRICAL, ANGLE - 90 DEGREES: 4 pin	MS3108A18-4P
W6P7	CONNECTOR, PLUG, ELECTRICAL, STRAIGHT: 4 socket	MS3106A18-4S
W7	CABLE ASSEMBLY, SPECIAL PURPOSE, ELECTRICAL: 19 inches	9172721
W7P1	CONNECTOR, PLUG, ELECTRICAL, ANGLE - 90 DEGREES: 4 socket	MS3108A18-4S

[1]Refer to appendix F for serial number effectivity.

Reference designation	Nomenclature	Part no.
W7P2	CONNECTOR, PLUG, ELECTRICAL, ANGLE - 90 DEGREES: 4 pin	MS3108A18-4P
W8	CABLE ASSEMBLY, SPECIAL PURPOSE, ELECTRICAL: 25 inches	9172668
W8P2	CONNECTOR, PLUG, ELECTRICAL, ANGLE - 90 DEGREES: 2 socket	MS3108A10SL4S
W8P4	CONNECTOR, PLUG, ELECTRICAL, STRAIGHT: 2 pin	MS3106A12S3P
	FILTER CHOKE OIL ASSEMBLY (HOUSING REACTOR)	9197628

APPENDIX E DELETED

APPENDIX F
SERIAL NUMBER EFFECTIVITY CODE

F-1. General

The serial number effectivity code is an alphabetical code used to indicate differences among models.

F-2. Symbols Used

Alphabetical symbols are used in the code. The symbol represents the serialization of the major assembly. An asterisk preceding the symbol indicates that the serialization is not of the major assembly, but instead is of the major item in which the assembly is normally located.

F-3. Symbols Not Used

To avoid possible confusion with classification markings, numerals, and certain units of equipment, the symbols (A), (B), (C), (I), (O), (S), and (U) are not used.

F-4. Serial Number Effectivity Code

The following is a list of the code symbols used in this manual:

*(D) 07001 through 07007

*(E) 07008 through 07013

*(F) 07014 and up

*(G) 07001 through 07013

*(H) 07001 through 07010

*(J) 07011 and up

*(K) 07001 through 07019

*(L) 09001 and up

*(M) 07012 and up

APPENDIX G

MAINTENANCE ALLOCATION CHART

G-1. General

This appendix provides a summary of the maintenance operations covered in the equipment manuals. It authorizes categories of maintenance for specific maintenance functions on repairable items and components, and the tools and equipment required to perform each function. This appendix may be used as an aid in planning maintenance operations.

G-2. Explanation of Format for MAC Page

a. Group Number. The numbers in this column identify components, assemblies, and modules within the next higher assembly.

b. Functional Group. This column lists the item names of component units, assemblies, subassemblies, and modules on which maintenance is authorized.

c. Maintenance Functions. This column indicates the maintenance category at which performance of the specific maintenance function is authorized. Authorization to perform a function at any category also includes authorization to perform that function at higher categories. Maintenance functions will be limited to and defined as follows:

(1) *Inspect*. To determine serviceability of an item by comparing its physical, mechanical, and electrical characteristics with established standards.

(2) *Test*. To verify serviceability and to detect electrical or mechanical failure by use of test equipment.

(3) *Service*. To clean, preserve, to charge, and to add fuel, lubricants, cooling agents, and air.

(4) *Adjust*. To rectify to the extent necessary to bring into proper operating range.

(5) *Aline*. To adjust specified variable elements of an item to bring to optimum performance.

(6) *Calibrate*. To determine the corrections to be made in the readings of instruments of test equipment used in precise measurement. Consists of the comparison of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared with the certified standard.

(7) *Install*. To set up for use in an operational environment such as an emplacement site or vehicle.

(8) *Replace*. To replace unserviceable items with serviceable assemblies, subassemblies, or parts.

(9) *Repair.* To restore an item to serviceable condition. This includes, but is not limited to, inspection, cleaning, preserving, adjusting, replacing, welding, riveting, and strengthening.

(10) *Overhaul.* To restore an item to a completely serviceable condition as prescribed by maintenance serviceability standards using the Inspect and Repair Only as Necessary (IROAN) technique.

(11) *Rebuild.* To restore an item to a standard as nearly as possible to original or new condition in appearance, performance, and life expectancy. This is accomplished through complete disassembly of the item, inspection of all parts or components, repair or replacement of worn or unserviceable elements (items) using original manufacturing tolerances and specifications, and subsequent reassembly of the item.

The codes used represent the various maintenance categories as follows:

Code	*Maintenance category*
C	Operator/crew
O	Organizational maintenance
F	Direct support maintenance
H	General support maintenance
D	Depot maintenance

d. Tools Required. The numbers appearing in this column refer to specific tools and equipment which are identified by these numbers in the tools required page.

e. Remarks. The letters appearing in this column refer to specific remarks which appear on the remarks page.

G-3. Explanation of Format for Tools Required Pages

a. Tool Code. The numbers in this column correspond to the numbers used in the tool required column of the MAC. The numbers indicate the applicable tool for the maintenance function.

b. Maintenance Category. The codes in this column indicate the maintenance category normally allocated the facility.

c. Nomenclature. This column lists tools, test, and maintenance equipment required to perform the maintenance functions.

d. Tool Number. This column lists the Federal stock number.

MAINTENANCE ALLOCATION CHART

FOR Shop Equipment, Guided MissileSystem Field Maintenance XM2E2

CHART NUMBER 10104005

MAC PAGE

GROUP NUMBER	FUNCTIONAL GROUP	MAINTENANCE FUNCTIONS												
		a INSPECT	b TEST	c SERVICE	d ADJUST	e ALIGN	f CALIBRATE	g INSTALL	h REPLACE	i REPAIR	j OVERHAUL	k REBUILD	l TOOL RECD.	m REMARKS
0100	Shop Equipment	H	H	H	H		H			H	H	D	1	A
0200	Compressor, reciprocating power driver	H	H	H				H	H	H	H	D	1-2	A
0300	Test Console, hydraulic systems components	H	H	H	H	H		H	H	H	H	D	1-3	A
0400	Test stand and degreaser, pneumatic system components	H	H	H	H			H	H	H	H	D	1-3	A
0500	Distribution box	H	H					H	H	H	H	D	1-3	A
0600	Shelter electrical equipment	H	H	H						H	H	D	1-3	

MAINTENANCE ALLOCATON CHART

FOR Shop Equipment Guided Missile System Field Maintenance XM 2E2

CHART NUMBER 10104005

TOOLS REQUIRED PAGE

TOOL CODE	CATEGORY	NOMENCLATURE	TOOL NUMBER
1	H	Vacuum Cleaner	7910-530-6260
	H	Brush Artist RD Taper pt Camel Hair ¼"	8020-264-3883
	H	Screwdriver Cross Tip Phillips Type Tip #2	5120-234-8913
	H	Wrench Combination Box and Open End ½	5120-895-9570
	H	Wrench Open End FXD DBLE H 3/8 - 7/16	5120-595-9028
	H	Wrench Combination Box and Open End 9/16	5120-895-9570
	H	Multimeter TS505/U	6625-376-4937
	H	Wrench Open End FXD DBLE HD 1 - 1 ½	5120-187-7133
	H	Multimeter AN/PSM-6	6625-957-4874
	H	Pliers Diagonal Cutting 6 inch long	5710-250-8253
	H	Solder (SN 60 WRAP 2) of MIL-S-6872	3439-269-9610
2	H	Wrench open end adjustable	5120-449-8083
	H	Screwdriver Flat Tip 3/8 inch 8 inch blade	5120-287-2502
	H	Wrench open end FXD DBLE HD 3/8 - 7/16	5120-595-9028
	H	Wrench Combination Box and Open 5/8	5120-895-9571
3	H	Wrench Open End FXD 1 3/16 - 1 5/16	5120-277-2695
	H	Wrench Open End FXD 1 - 1 1/8	5120-187-7133
	H	Wrench Open End FXD DBLE HD 1 1/16 - 1 7/16	5120-449-8135
	H	Wrench Open End FXD DBLE HD 1 ¼ - 1 3/8	5120-293-1212

MAINTENANCE ALLOCATION CHART

FOR Shop Equipment Guided MissileSystem Field Maintenance XM2E2

CHART NUMBER 10104005

REMARKS PAGE

REMARKS CODE	REMARKS
A-b	Testing to be performed in accordance with TM 9-4935-543-14.
A-f	Calibration will be performed on individual items in accordance with TB 750-236.
	Periodic tests will be performed in accordance with TM 9-4935-540-14-1.

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INDEX

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S

T

Paragraph

T - Continued

U

V

W

Yearly schedules (See Preventive maintenance services)

By Order of the Secretary of the Army:

BRUCE PALMER, JR.,
General, United States Army,
Acting Chief of Staff.

Official:

VERNE L. BOWERS,
Major General, United States Army,
The Adjutant General.

Distribution:

To be distributed in accordance with DA Form 12-32, (qty rqr block no. 13) Organizational maintenance requirements for HAWK Missile System.

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P.S.--IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR RECOMMENDATION MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS.

The Metric System and Equivalents

Linear Measure

1 centimeter = 10 millimeters = .39 inch
1 decimeter = 10 centimeters = 3.94 inches
1 meter = 10 decimeters = 39.37 inches
1 dekameter = 10 meters = 32.8 feet
1 hectometer = 10 dekameters = 328.08 feet
1 kilometer = 10 hectometers = 3,280.8 feet

Weights

1 centigram = 10 milligrams = .15 grain
1 decigram = 10 centigrams = 1.54 grains
1 gram = 10 decigram = .035 ounce
1 decagram = 10 grams = .35 ounce
1 hectogram = 10 decagrams = 3.52 ounces
1 kilogram = 10 hectograms = 2.2 pounds
1 quintal = 100 kilograms = 220.46 pounds
1 metric ton = 10 quintals = 1.1 short tons

Liquid Measure

1 centiliter = 10 milliters = .34 fl. ounce
1 deciliter = 10 centiliters = 3.38 fl. ounces
1 liter = 10 deciliters = 33.81 fl. ounces
1 dekaliter = 10 liters = 2.64 gallons
1 hectoliter = 10 dekaliters = 26.42 gallons
1 kiloliter = 10 hectoliters = 264.18 gallons

Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch
1 sq. decimeter = 100 sq.centimeters = 15.5 sq. inches
1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet
1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch
1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

Approximate Conversion Factors

To change	*To*	*Multiply by*	*To change*	*To*	*Multiply by*
inches	centimeters	2.540	ounce-inches	Newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29,573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	Newton-meters	1.356	metric tons	short tons	1.102
pound-inches	Newton-meters	.11296			

Temperature (Exact)

°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

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