TM 55-4920-428-13

TECHNICAL MANUAL
OPERATOR'S,
AVIATION INTERMEDIATE MAINTENANCE
AND
ILLUSTRATED PARTS BREAKDOWN

TEST SET, BENCH
INTEGRATED LOWER CONTROL
ACTUATOR (ILCA)
145GS278-1
NSN 4920-01-121-0604

HEADQUARTERS, DEPARTMENT OF THE ARMY
11 OCTOBER 1983

CHANGE
NO. 3

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 30 December 1992

Aviation Intermediate Maintenance
and
Illustrated Parts Breakdown

Test Set, Bench
Integrated Lower Control
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TM 55-4920-428-13
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CHANGE NO. 2

HEADQUARTERS
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Aviation Intermediate Maintenance
and
Illustrated Parts Breakdown

Test Set, Bench
Integrated Lower Control
Actuator (ILCA)
145GS278-1
NSN 4920-01-121-0604

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URGENT

CHANGE NO. 1

HEADQUARTERS
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WASHINGTON,D.C., 27 March 1987

OPERATOR'S,
AVIATION INTERMEDIATE MAINTENANCE
AND
ILLUSTRATED PARTS BREAKDOWN
TEST SET, BENCH, INTEGRATED LOWER
CONTROL ACTUATOR (ILCA) 145GS278-1
NSN 4920-01-121-0604

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1-11 through 1-14	1-11 through 1-14
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SAFETY SUMMARY

The following are general safety precautions that are not related to any specific procedures and therefore do not appear elsewhere in this publication. These are recommended precautions that personnel must understand and apply during many phases of operation and maintenance.

KEEP AWAY FROM LIVE CIRCUITS.

Maintenance personnel must at all times observe all safety regulations. Do not replace components or make adjustments inside the equipment with the high voltage supply turned on. To avoid casualties, always remove power from a circuit before touching it.

DO NOT SERVICE OR ADJUST ALONE.

Under no circumstances should any person service or adjust the equipment except in the presence of someone who is capable of rendering aid.

RESUSCITATION.

Personnel working with or near high voltage should be familiar with modern methods of resuscitation (CPR). (Refer to FM 21-11.)

The following warnings appear in the text in this volume, and are repeated here for emphasis.

WARNING

The hydraulic unit weighs approximately 165 pounds. Be careful when lifting the unit to prevent personal injury.

WARNING

Use goggles when operating at high pressure hydraulic settings. . Otherwise, personnel injury can result.

WARNING

HIGH VOLTAGE is used in this equipment. DEATH ON CONTACT or SEVERE INJURY can result if personnel fail to observe safety precautions.

Learn the equipment areas containing high voltage. Before working inside this equipment, turn off the equipment and disconnect all power at the source. Be careful not to touch high voltage connections when performing maintenance on this equipment.

WARNING

NAPHTHA and DRY CLEANING SOLVENT are combustible and toxic. Keep away from open flame.

Contact CLEANER and HYDRAULIC FLUID are toxic.

Use these chemicals with adequate ventilation. They can irritate skin. In case of contact, immediately flush skin or eyes with water for 15 minutes. Get medical attention for eyes.

Technical Manual
TM 55-4920-428-13

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON,D.C.,
11 October 1983

OPERATOR'S, AVIATION INTERMEDIATE MAINTENANCE AND ILLUSTRATED PARTS BREAKDOWN TEST SET, BENCH, INTEGRATED LOWER CONTROL ACTUATOR (ILCA) 145GS278-1 NSN 4920-01-121-0604

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 us know. Mail your letter or DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in the back of this manual directly to: Commander, US Army Aviation and Troop Command. ATTN: AMSAT-I-MP, 4300 Goodfellow Blvd., St. Louis, MO 63120-1798. A reply will be furmished directly to you.

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Chapter 1

INTRODUCTION

SECTION I GENERAL INFORMATION

1-1. General.

a. This manual describes the Integrated Lower Control Actuator (ILCA) Bench Test Set 145GS278-1 and provides operation, maintenance, and parts information for the equipment.

b. The test set tests integrated lower control actuators 145H7300 series which are installed in the CH-47D flight control system. The ILCA is hydraulically operated by the flight control hydraulic systems. Some functions of the ILCA are controlled mechanically by the flight controls. Other functions are controlled electrically by the helicopter's Advanced Flight Control System (AFCS).

1-2. Forms and Records.

a. Reports of Maintenance and Unsatisfactory Equipment. Use equipment forms and records in accordance with instructions in DA PAM 738-751.

b. Reports of Damage or Improper Shipment. Fill out and forward DD Form 6 (Report of Damaged or Improper Shipment) is prescribed in AR 700-58.

1-3. Reporting Equipment Improvement Recommendations (EIRs)

If your ILCA Bench Test Set needs improvement, let us know. Send us an EIR. You, the user, arc 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. Tell us why a procedure is hard to perform. Put it on a SF368 (Quality Deficiency Report). Mail it to us at Headquarters Commander, US Army Aviation and Troop Command, ATTN: AMSAT-I-MDO, 4300 Goodfellow Blvd., ST. Louis, MO 63120-1798. We'll send you a reply.

1-4. Administrative Storage.

Temporary storage of equipment issued to and used by Army activities shall be in accordance with TM 55-1500-204-25/1, General Aircraft Maintenance Manual.

1-5. Destruction of Army Equipment to Prevent Enemy Use.

Destruction of Army equipment to prevent enemy use shall be in accordance with TM 750-244-2.

1-6. Notes, Cautions, and Warnings.

Warnings, cautions, and notes emphasize important and critical instructions. They are defined as follows:

WARNING

An operating procedure-or practice which, if not correctly followed, will result in personnel injury or loss of life.

CAUTION

An operating procedure or practice which, if not strictly observed, will result in damage or destruction of equipment.

NOTE

An operating procedure or condition which it is essential to highlight.

SECTION II EQUIPMENT DESCRIPTION AND DATA

1-7. Test Set Description.

a. (See fig. l-l.) The test set includes electrical unit 145GS278-3 and hydraulic unit 145GS278-2. Both of these units include stored accessories.

b. The electrical unit provides electrical control voltage and excitation voltage to the ILCA extensible link, and monitors its feedback. The electrical unit is electrically interlocked with the hydraulic unit to provide emergency hydraulic shutoff control from the electrical unit or the hydraulic unit.

c. The hydraulic unit contains attachment manifolds for an ILCA or an extensible link. It has meters and valves for monitoring and controlling inlet or outlet pressures of the ILCA or link. Mechanical output is monitored using dial indicators. Leak tests can be performed.

d. Electrical cables and instruction manuals are stored in the cover of the electrical unit.

1-8. Electrical Unit Description.

(See fig. 1-2.) The electrical unit provides the electrical excitation and control necessary to test an ILCA which includes an extensible link or an extensible link separately. Direction, rate, and amount of extensible link movement can be controlled and monitored by the test set. The link can be operated in an open loop or closed loop system. Link position is monitored by sensing feedback signals from two transducers. The test set panel is divided by system: SYSTEM 1, left side and SYSTEM 2, right side. Each side contains controls and an analog meter for selecting a specific actuator function and monitoring the result. A digital voltmeter (DVM), with SYSTEM SELECTOR switch, monitors test results for both systems. External meter connections are provided for both systems.

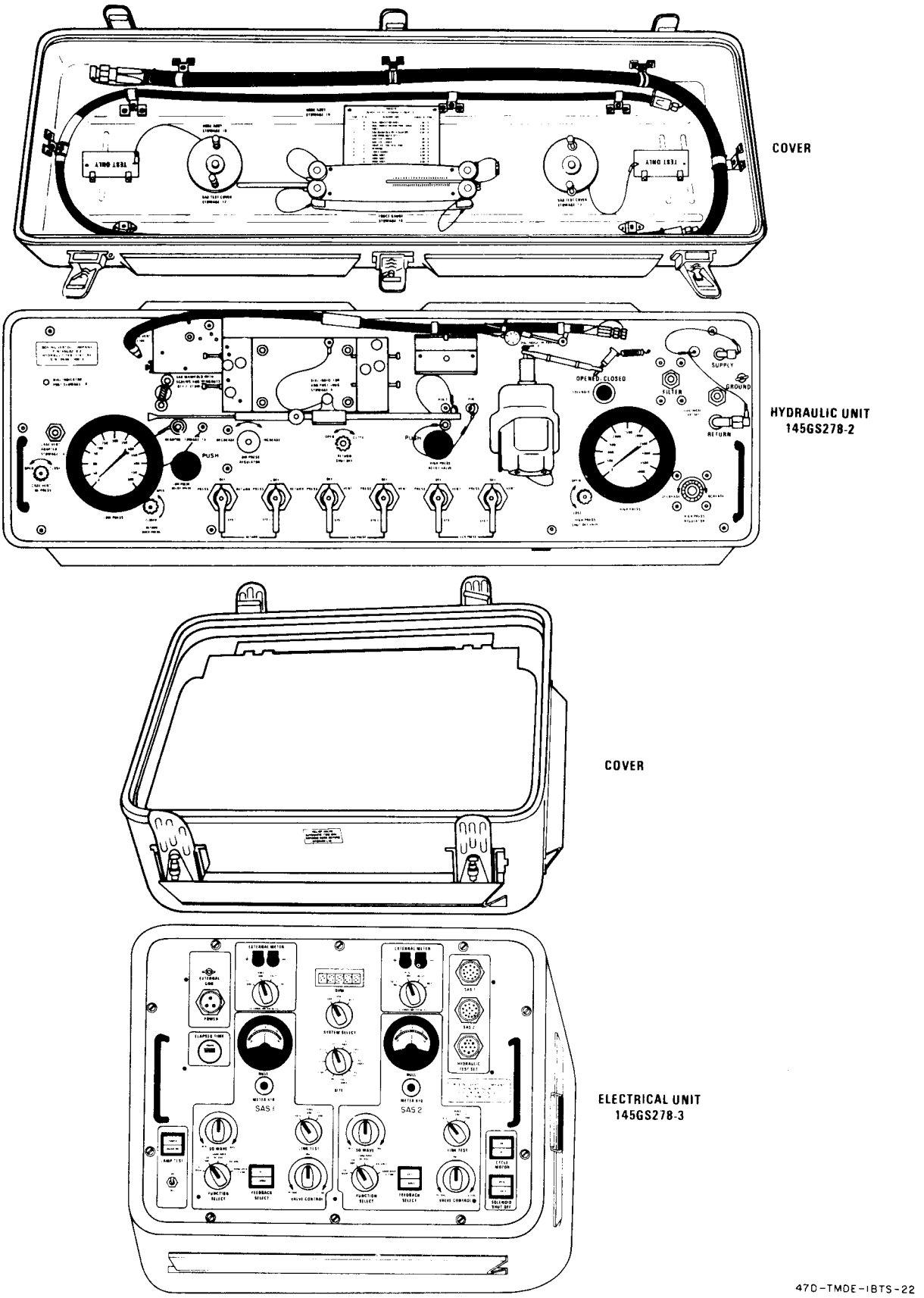


Figure 1-1. ILCA Bench Test Set 145GS278-1

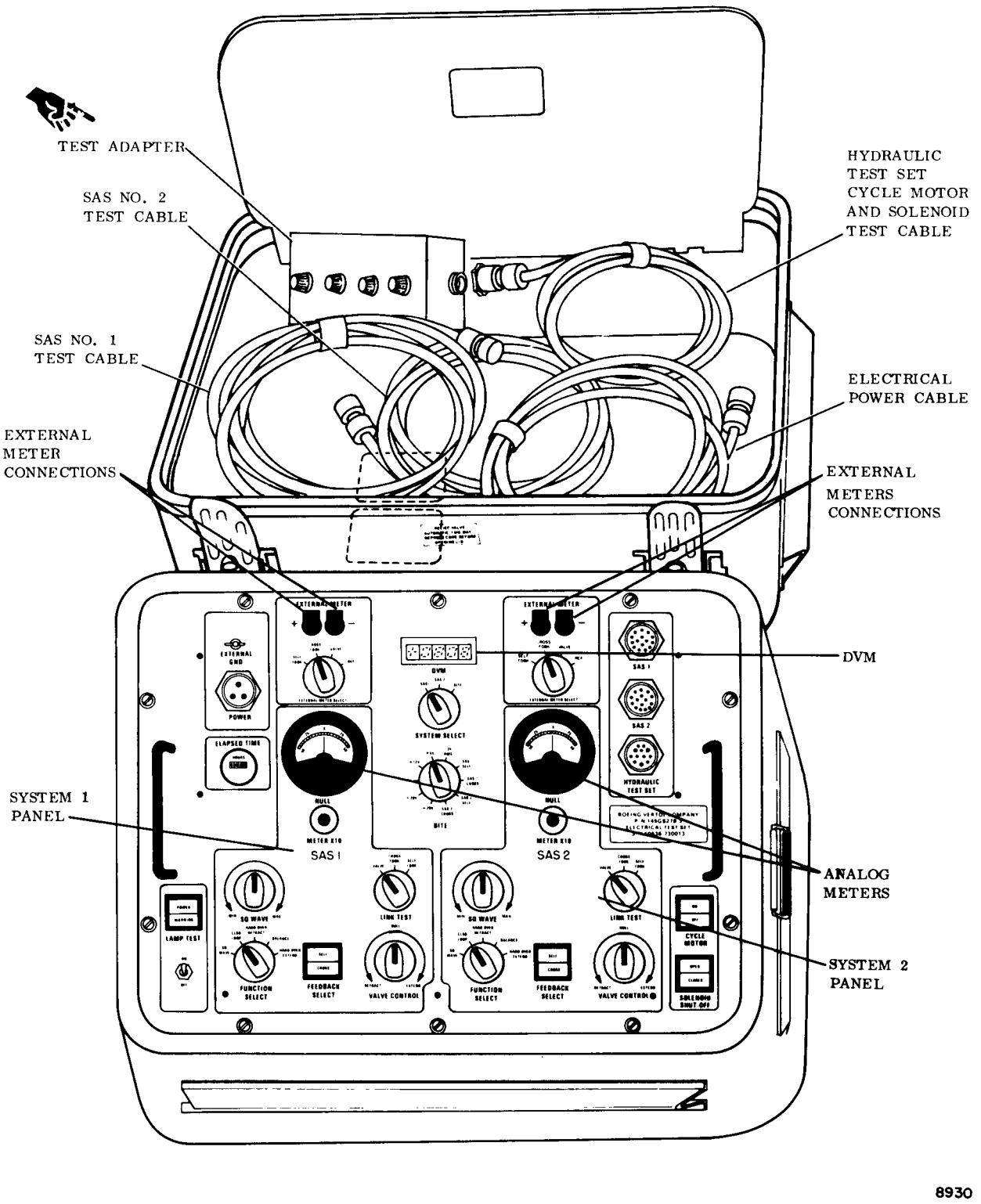


Figure 1-2. Electrical Unit and Cover

1-9. Hydraulic Unit Description.

(See fig. 1-3.) The hydraulic unit provides control of fluid pressures at the pressure and return sides of the ILCA or link under test. Hydraulic fluid MIL-H-83282 is supplied to the unit from an external test stand and controlled by the hydraulic unit. Pressure requirements range from 300 to 2250 psig on the pressure side and 60 to 190 psig on the return side. The unit includes a 5-micron filter with a contamination indicator in the pressure supply line.

a. *Cycling Motor. (See* fig. 1-3.)

(1) The cycling motor on the panel is controlled by the electrical unit. It is used to cycle the ILCA under test, simulating mechanical input from the flight control system.

(2) The cycling motor consists of a gear motor, a crank arm, and a driver crank. The crank arm is 5.03 in. nominal length.

(3) The crank arm is attached to the driver crank by a shear bolt. The crank arm is secured in stowed position by a quick-release pin and a spring.

b. PIN 1. (See fig. 1-3.)

(1) PIN 1 is stored in a hole in the panel and attached to the panel by a flexible cable. The pin is a quick-release type, 1.1 in. long.

(2) PIN 1 is used to connect the cycle motor crank arm to the ILCA input arm.

c. PIN 2. (See fig. 1-3.)

(1) PIN 2 is stored in a hole in the panel and attached to the panel by a flexible cable. The pin is a quick-release type, 2 in. long.

(2) PIN 2 is used to lock the ilca input arm at neutral position.

d. PIN 3. (See fig. 1-3.)

(1) PIN 3 is stored in a hole in the panel and attached to the panel by a flexible cable. The pin is a quick-release type, 1.3 in. long.

(2) PIN 3 is used for neutral rig checks and to secure the bearing to the ILCA output arm for the travel checks. The pin also secures bearing 145GS278-15 to the panel in stowed position.

e. Rigging Fixture. (See fig. 1-3.)

(1) The rigging fixture is an aluminum angle secured to the panel. A slot in the fixture locks the ILCA input arm in neutral, using PIN 2.

(2) The fixture is 3 in. high and 4 in. long with a 1/4 in. slot n the center. The slot extends down 1 in. from the top.

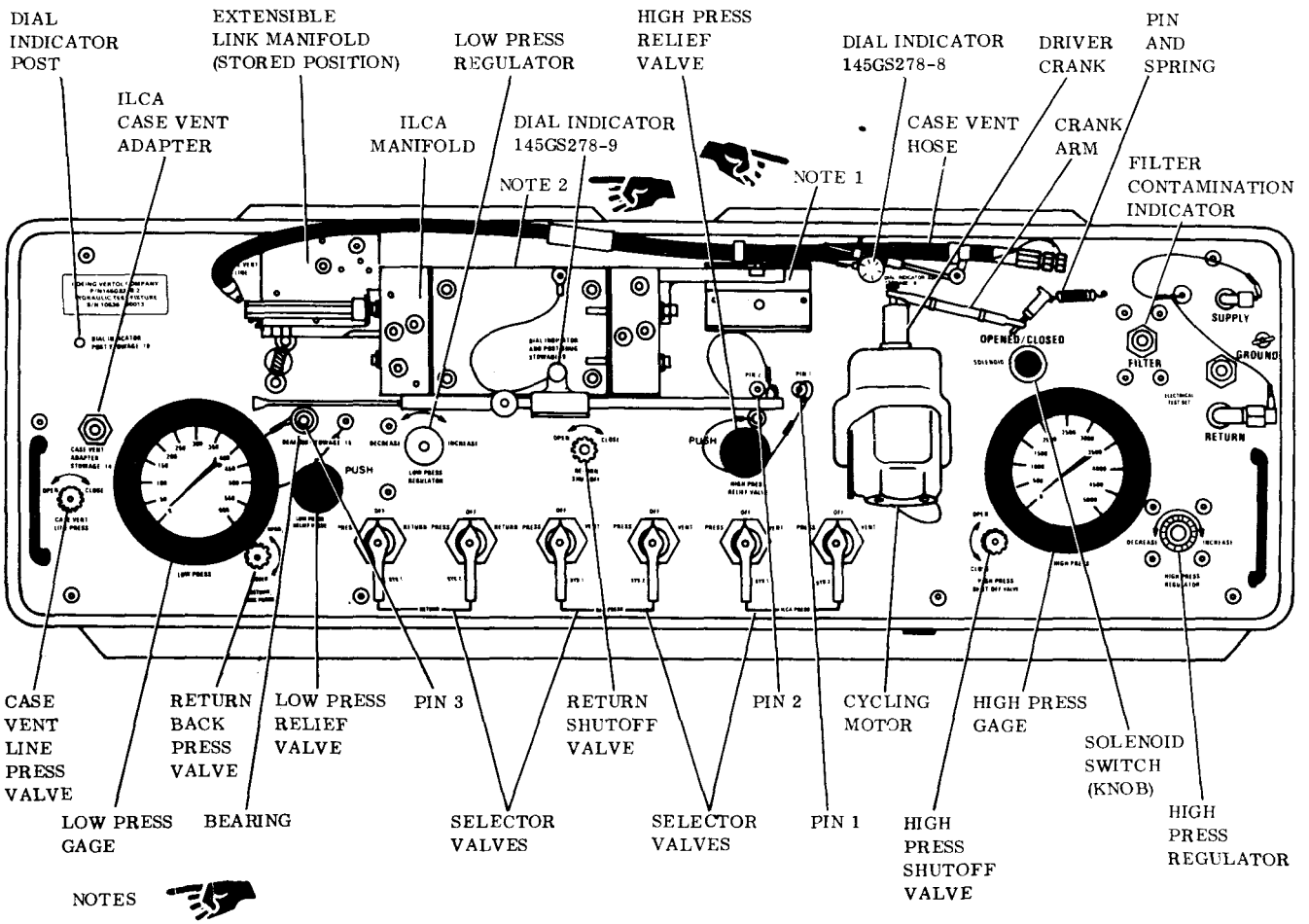
f. ILCA Manifold. (See fig. 1-3.)

(1) The manifold is aligned on the unit panel by two pins and secured by screws.

(2) The manifold provides fluid connections and a mounting for the ILCA to be tested. The aluminum manifold contains four ILCA mounting bolts and six check valves arranged to match the ILCA to be tested. There are three pairs of ports: ILCA pressure, extensible link pressure, and return pressure ports. The manifold on unit No. 2 and subq includes a rigging handle and improved rigging fixtures.

g. SOLENOID Shutoff Valve. (77, fig. 6-5.)

(1) The valve is near the right side of the hydraulic unit, below the panel. The SOLENOID manual lens (knob) is accessible from the top. The valve body is accessible from beneath the panel.



NOTES

1 SEPARATE RIGGING FIXTURE EFFECTIVE ON UNIT NO. 1
2 MANIFOLD W/O RIGGING FIXTURES EFFECTIVE ON UNIT NO. 1

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Figure 1-3. Hydraulic Unit Without Cover

(2) The valve is a four-way two-position spool type with an electrical receptacle on the solenoid. The solenoid piston directly operates the valve spool. The valve cannot be energized open until the manual button is pulled up, actuating a switch. Manually pressing the button electrically deenergizes the solenoid, closing the valve.

h. Filter. (71, Fig. 6-5.)

(1) The filter is a 5-micron assembly with a visual contamination indicator. The filter is mounted below the panel, near the right side of the test unit. The filter includes a contamination indicator, which can be reset, and a bypass. The indicator and filter mounting screws are accessible from the top of the panel.

(2) The filter is 6.299 in. wide port to port, 6.102 in. deep and 11.89 in. high.

(3) The filter head is ductile iron with threaded connections. The bowl is a forged steel screw-in type. The element is a corrosion-resistant metal-fiber assembly that can withstand a differential pressure of 4500 psi. Element nominal flow rate is 7.7 gpm.

i. HIGH PRESS SHUTOFF Valve. (See fig. 1-3.)

(1) The shutoff valve is near the HIGH PRESS gage. The valve control knob is above the panel. The body is accessible from below the panel.

(2) The valve is a needle type which has a slotted spindle for accurate flow control. The control knob includes a 0 to 9 scale on the lower side to indicate fractions of a turn and a full turns indicator on the top of the knob. A set screw in the side of the knob can be used to lock the shutoff valve.

(3) The valve mounting is an inline type. Port openings are ¼ in. with standard machine thread. The valve body is steel. Seals have a pressure rating of 5000 psi.

j. CASE VENT LINE PRESS Valve. (See fig. 1-3.)

(1) The CASE VENT LINE PRESS shutoff valve is near the LOW PRESS gage. The valve control knob is above the panel. The body is accessible from below the panel.

(2) The valve has a round spindle for accurate flow control. The control knob includes a 0 to 9 scale on the lower side to indicate fractions of a turn and a full turns indicator on the top of the knob. A set screw in the side of the knob can be used to lock the shutoff valve.

(3) The valve mounting is an inline type. Port openings are ¼ in. with standard machine thread. The valve body is steel. Seals have a pressure rating of 5000 psi.

k. RETURN BACK PRESS Valve. (See fig. 1-3.)

(1) The RETURN BACK PRESS valve is near the LOW PRESS gage. The control knob is above the panel. The valve body is accessible from below the panel.

(2) The valve is a needle type which has a slotted spindle for accurate flow control. The control knob includes a 0 to 9 scale on the lower side to indicate fractions of a turn and a full turns indicator on the top of the knob. A set screw in the side of the knob can be used to lock the shutoff valve.

(3) The valve mounting is an inline type. Port openings are ¼ in. with standard machine thread. The valve body is steel. Seals have a pressure rating of 5000 psi.

l. RETURN SHUTOFF VALVE. (See fig. 1-3.)

(1) The shutoff valve is near the ILCA manifold. The control knob is above the panel. The valve body is accessible from below the panel.

(2) The valve has a round spindle for accurate flow control. The control knob includes a 0 to 9 scale on the lower side to indicate fractions of a turn and a full turns indicator on the top of the knob. A set screw in the side of the knob can be used to lock the shutoff valve.

(3) The valve mounting is an inline type. Port openings are ¼ in. with standard machine thread. The valve body is steel. Seals have a pressure rating of 5000 psi.

m. HIGH PRESS REGULATOR., (See fig. 1-3.)

(1) The HIGH PRESS REGULATOR is on the panel to the right of the HIGH PRESS gage. The control knob is above the panel. The valve body is accessible from below the panel.

(2) The valve is pilot operated, inline type. Port openings are ¼ in. with standard machine thread. The unit is rated at 3000 psi and 6 gpm flow maximum. The valve is steel. The valve seals are synthetic rubber with teflon retaining rings.

n. SYS 1 and 2 *Selector Valves. (See* fig. 1-3.)

(1) The six selector valves marked are panel mounted at the near side of the panel. The control handles are above the panel. The valve bodies are accessible from below the panel.

(2) The valves are low torque, three-position units. Ports are on the bottom, ¼ in. with standard machine thread. Rated pressure is 3000 psi. Valve bodies and handles are aluminum.

o. *HIGH and LOW PRESS RELIEF VALVES. (See* fig. 1-3.)

(1) The relief valves are mounted in the panel with push-to-relieve buttons above the panel. Valve bodies are accessible from below. The HIGH PRESS valve is near the cycle motor. The LOW PRESS valve is near the LOW PRESS gage.

(2) The valves are spring-loaded push-to-open two-way type. Maximum working pressure is 6000 psi. The valve body is aluminum, the slide is steel, and the knob plastic.

p. *Pressure Redwing Valve VR6.* (106, Fig. 6-5.)

(1) The pressure reducing valve is under the panel, below the cycling motor.

(2) The valve is a direct pressure operated poppet-type pressure-relief valve. The pressure adjustment is a set screw with a protective cap. Adjustment range is 0 to 1500 psi, but it is adjusted for 285 to 315 psi. Rated pressure is 6000 psi.

q. Check Valves, 60 *PSI.* (95, Fig. 6-5.)

(1) Two check valves are located below the panel, one on each side of the LOW PRESS REGULATOR.

(2) The valves are non-adjustable inline type, and cracks at 60 psi. Rated pressure is 3000 psi.

r. *Check Valve,* 3 *PSI.* (98, Fig. 6-5.)

(1) The check valve is in the return system under the ILCA manifold.

(2) The valve is a non-adjustable inline type, and cracks at 3 psi. Rated pressure is 5000 psi.

s. *LOWPRESS Gage. (See* fig. 1-3.)

(1) The LOW PRESS gage is at the left end of the panel. Mounting hardware and connections are accessible from below.

(2) The dial is marked 0 to 600 psi with 5-psi scale divisions. The gage is accurate within ±5 psi.

t. HIGH PRESS Gage. (See fig. 1-3.)

(1) The HIGH PRESS gage is at the right end of the panel. Mounting hardware and connections are accessible from below.

(2) The dial is marked 0 to 5000 psi with 50-psi scale divisions. The gage is accurate within ±50 psi.

u. Snubber, HIGH PRESS Gage. (72, Fig. *6-5.)*

(1) The snubber is screwed into the high pressure gage port, accessible after fittings are disconnected.

(2) The snubber blocks surges from the gage. It is a ¼-28threaded section, ½ in.long, with a 0.008 to 0.012 in. diameter hole through it. The snubber contains a screwdriver slot in one end for installation.

v. Low Pressure Limiter Valve VR9. (82, Fig. 6-5.)

(1) The low pressure limiter is below the ILCA manifold.

(2) The limiter is in the low-pressure side of the system. It controls flow to the LOW PRESS gage and selected valves. The valve is it-dine mounted and includes a knurled adjustment knob with a positive lock. Flow can be controlled up to 3 gpm. The valve includes a corrosion-resistant steel piston in a carbon steel housing.

1-10. Accessories.

Accessories are stored in the covers of both units. Descriptions of these items are given below.

a. Test Authority Covers 145GS278-12 and -13. (See fig. 1-4.)

(1) The authority covers are stored in the cover of the test unit. They are mounted on the ILCA extensible link during test.

(2) The covers are made of aluminum. The covers are interchangeable and are used during test to establish a standard stroke for an extensible link. The standard established by the cover is equivalent to the authority of an extensible link in the yaw axis.

b. Pressure Hose 145GS278-18. (See fig. 1-4.)

(1) The pressure hose is stored in the cover, secured with seven quick-release type clamps.

(2) The hose is a ½ in. x 96 in. long pressure hose with flared fittings. It connects the pressure fitting of the AVIM hydraulic shop set to the hydraulic test unit SUPPLY fitting.

c. Return Hose 145GS278-19. (See fig. 1-4.)

(1) The return hose is stored with seven quick-release type clamps in the cover of the unit.

(2) The hose is a ½ in. x 96 in. low pressure hose with flared fittings. It connects the return fitting of the AVIM hydraulic shop set to the hydraulic test unit RETURN fitting.

d. Force gage 145GS278-16. (See fig. 1-4.)

(1) The force gage is stored in the center of the hydraulic unit cover by four thumb screws. The thumb screws are attached to the cover by cables.

(2) The gage is a push-to-indicate type, capable of indicating 0 to 80 lb (38 kg) of force. The gage is used to measure the force applied to the jam simulation button during an ILCA test.

e. Electrical Power Cable 145GS278-4. (See fig. 1-2.)

(1) The cable is stored in the cover of the electrical unit.

(2) The cable is 3 conductor and 6 ft long. It connects the electrical unit to a source of single-phase 115-volt 60-Hz ac power.

f. Test Cables 145GS278-5 *and-6.* (See fig. 1-2.)

(1) The cables are stored in the cover of the electrical unit. When in use, No. 1 cable is connected between the electrical unit and No. 1 extensible link of an ILCA under test. No. 2 cable is connected between the electrical unit and No. 2 extensible link.

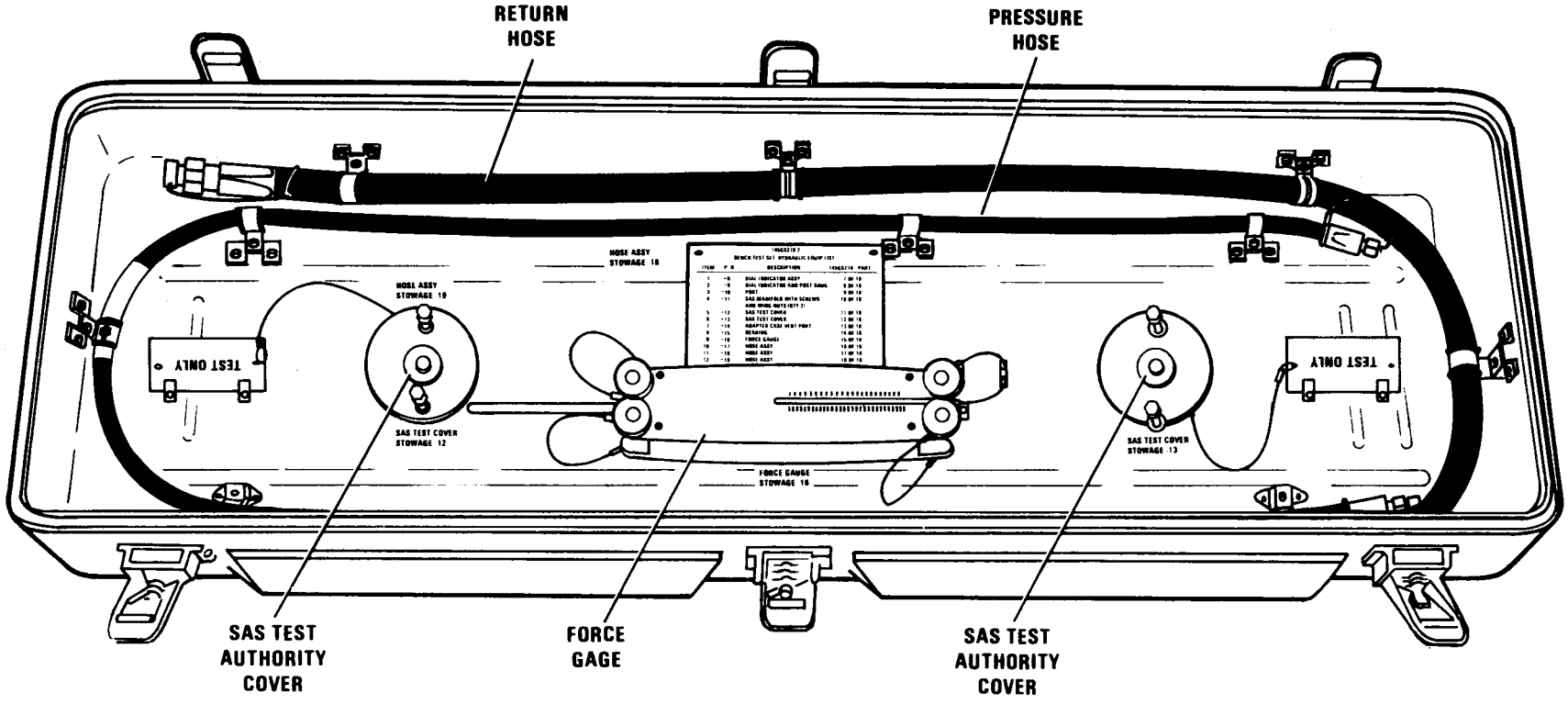

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Figure 1-4. Hydraulic Unit Cover With Accessories

(2) The test cables are 15 conductor and 15 ft long. They are interchangeable but are marked No. 1 and No. 2 to help in making test connections to the ILCA. No. 1 cable is used when an extensible link is being tested separately.

g. Cycle Motor and Solenoid Test Cable 145GS278-7. (See fig. 1-2.)

(1) The cable is stored in the cover of the electrical unit. When in use, the cable is connected between the electrical unit HYDRAULIC TEST SET connector and the hydraulic unit ELECTRICAL TEST SET connector.

(2) The cable provides control of the hydraulic unit motor and valve from the electrical unit. The cable is 10 conductor and 15 ft long.

h. Dial Indicator 145GS278-8. (See fig. 1-3.)

(1) The dial indicator is attached to the panel by a swivel type post. It stays in this location during use and storage.

(2) The indicator has a 0.015 to 0.000 to 0.015 in. range. It is used to measure ILCA input for a deadband check.

i. Dial Indicator with Post Snug 145GS278-9. (See fig. 1-3.)

(1) During use, the dial indicator is attached to the dial indicator post by a post snug. For storage the indicator is attached to the ILCA manifold by a thumb screw.

(2) The dial indicator has a 0 to 5 in. range. It is used to measure lLCA or extensible link output stroke.

j. Dial Indicator Post 145GS278-10. (See fig. 1-3.)

(1) The dial indicator post is mounted on the left side of the panel.

(2) The post is 6 in. long and is threaded on one end. It is used for mounting the 0 to 5-in. dial indicator.

k. Extensible Link Manifold 145GS278-11. (See fig. 1-3.)

(1) The extensible link manifold is stored on the panel, at the left end of the ILCA manifold. When in use the manifold is attached by two storage screws to the left end of the ILCA manifold and mates with the system 1 extensible link pressure and return ports.

(2) The manifold is an aluminum block with fluid passages. It includes a transfer spool for fluid port connections and two screws with wingnuts for securing the authority cover to the link. The manifold adapts the fluid connections of the test set ILCA manifold and an extensible link when the link is tested separately.

l. Ilca Vent Port Adapter 145GS278-14. (See fig. 1- 3.)

(1) The adapter is stored in a threaded hole in the left end of the panel. It is used in the ILCA pressure relief port during tests.

(2) The adapter is a special unit which reduces the ¾ in. relief valve opening to the 7/16 in. adapter attachment for the case vent hose.

m. Bearing 145GS278-15. (See fig. 1-3.)

(1) The bearing is stored at the left end of the panel, secured by quick-release PIN 3.

(2) The bearing is a ball bearing with a steel bushing in its inner race. It is used to measure the ILCA output stroke using the 0 to 5-in. dial indicator.

n. CASE Vent Hose 145GS278-17. (See fig. 1-3.)

(1) The hose is attached to the left end of the unit and is stored with two plastic quick-release clips on the back of the panel.

(2) The hose is a ¼ in. x 36 in. high pressure hose with flared fittings. It is used to pressurize the ILCA case cavity during a relief valve test.

o. Transducer Test Adapter 145GS278-20. (See fig. 1-2.)

(1) The adapter is stored in the cover of the electrical unit and is connected to SAS 1 connector by Test cable 145GS278-5 or -6.

(2) The adapter enables the internal transducer of an ILCA to be turned during adjustment without interconnecting the wiring to the ILCA WIRE HARNESS.

1-11. Test Set Capabilities.

The test set provides control functions to test thrust ILCA 145H7300-8, the boost actuator and extensible link sections of spare ILCA 145H7300-16, and spare extensible link 145H7350-8.

NOTE

Pitch actuator 145H7300-13, roll actuator 145H7300-14, and yaw actuator 145H7300-15 are tested as spare actuators 145H7300-16.

1-12. Technical Charactaristics.

a. Line-voltage input - 115 volt ± 10, 60-Hz, single-phase ac

b. Maximum current - 7 amperes

c. Hydraulic pressure power source - MIL-H-83282, 2250 psi at 2.0 gpm

d. Extensible link feedback excitation - 13-volt 400-Hz ac

e. Servo valve drive voltage:
Extend - 0 to +17 volt dc
Retract - 0 to-17 volt dc

1-13. Leading Particulars.

a. Each ILCA test unit is contained in a two-piece combination case. Each case is airtight and watertight.

b. Each unit includes manually operated relief valves which permit the equalizing of test unit internal air pressure to atmosphere. The electrical unit has two relief valves, one in the cover and one in the case. The hydraulic unit has one relief valve in the case.

c. The physical dimensions and weights of the units are as follows:

(1) Electrical unit.

(a) Length - 22.6 in. (57.48 cm)

(b) Width - 17.6 in. (44.78 cm)

(c) Height - 17.8 in. (45.29 cm)

(d) Weight - 63 lb (28.35 kg)

(2) **Hydraulic unit.**

(a) Length — 50.3 in. (127.64 cm)

(b) Width — 18 in. (45.72 cm)

(c) Height — 14 in. (35.56 cm)

(d) Weight — 165 lb (74.25 kg)

d. The equipment and accessories included in the electrical unit are listed in table 1-1. The equipment and accessories included in the hydraulic unit are listed in table 1-2.

Table 1-1. Equipment Furnished — Electrical Unit

QUANTITY	ITEM DESCRIPTION	PART NUMBER
1 ea	Electrical Unit	145GS278-3
1 ea	Cable, Electrical Power, 115V, 60-Hz	145GS278-4
1 ea	Cable, Test, No. 1 Extensible Link	145GS278-5
1 ea	Cable, Test, No. 2 Extensible Link	145GS278-6
1 ea	Cable, Test, Motor and Solenoid	145GS278-7
1 ea	Test Adapter, LVDT	145GS278-20

Table 1-2. Equipment Furnished — Hydraulic Unit

QUANTITY	ITEM DESCRIPTION	PART NUMBER
1 ea	Hydraulic Unit	145GS278-2
1 ea	Dial Indicator (0.015 to 0.000 to 0.015 in.)	145GS278-8
1 ea	Dial Indicator and Post Snug (0 to 5 in.)	145GS278-9
1 ea	Dial Indicator Post	145GS278-10
1 ea	Manifold, Extensible Link	145GS278-11
1 ea	Authority Cover, Test	145GS278-12
1 ea	Authority Cover, Test	145GS278-13
1 ea	Adapter, ILCA Case Vent Port	145GS278-14
1 ea	Bearing	145GS278-15
1 ea	Gage, Force	145GS278-16
1 ea	Hose, Case Vent	145GS278-17
1 ea	Hose, Pressure	145GS278-18
1 ea	Hose, Return	145GS278-19

1-14. Equipment Required But Not Furnished.

a. For equipment required but not furnished to perform an ILCA or extensible link test, refer to table 1-3.

b. For consumables required to perform component tests, refer to table 1-4.

Table 1-3. Equipment Required But Not Furnished

QUANTITY	DESCRIPTION	PART NUMBER
1 ea	AVIM Hydraulic Shop Set or Shop Hydraulic Power Supply	
1 ea	Hydraulic Repairer Tool Kit	NSN 5180-00-323-4891
1 ea	5/32 in. Socket Head Wrench	NSN 5120-00-198-5392
2 ea	Safety Ground Wire	MS25083. Length as required

Table 1-4. Consumables Required for Tests

QUANTITY	DESCRIPTION	PART NUMBER
	Hydraulic Fluid	MIL-H-83282
	Lockwire	MS20995C32
1 ea	Hydraulic Filter Hycon No. 0060D	0060D010BHHC
8 ea	Cap Screw (for SAS Authority Cover Holddown)	NAS1352-06H10P
2 ea	Cap Screw (for SAS Authority Cover Removal/Install Clamp)	NAS1352-06H32P
2 ea	Hex Nut (for SAS Authority Cover Removal/Install Clamp)	MS2582-1
6 ea	Packing (for ILCA Manifold Check Valves)	MS28778-13
2 ea	Packing (for Test Authority Covers)	MS28775-128
1 ea	Packing (for Relief Valve Adapter)	MS28775-012
1 ea	Packing (for Link Manifold Adapter)	MS28775-012
2 ea	Cap Screws (for Extensible Link to Manifold Holddown)	NAS1351-4H14P
1 ea	Cap Screws (for Extensible Link to Manifold Holddown)	NAS1351-4H28P

SECTION III. TECHNICAL PRINCIPLES OF OPERATION

1-15. ELECTRICAL UNIT 145GS278-3.

1-16. Block Diagram (fig. 1-5).

a. The electrical unit includes No, 1 and No, 2 ILCA control circuits, No. 1 and No. 2 metering circuits, power supply circuits, an undervoltage detector circuit, a hydraulic unit control circuit, a BITE circuit, automatic range control circuit, and a digital voltmeter (DVM). The electrical parts of an ILCA or extensible link under test are included in fig. 1-5 to show the interface,

b. No. 1 ILCA control circuit processes the signals associated with No. 1 extensible link. No. 2 circuit processes the same type signals for No. 2 extensible link, Otherwise, th e two circuits are identical.

c. The ILCA control circuit is a servo system that provides a drive signal to the extensible link servo valve. The servo system responds to five internally generated command signals selected by the FUNCTION SELECT switch. When the FUNCTION SELECT switch is at SQ WAVE, CLSD LOOP, or BALANCE, the servo loop is closed through feedback circuits from self and cross transducers. When the FUNCTION SELECT switch is at HARDOVER EXTEND or HARDOVER RETRACT, the loop is open. When the loop is closed, self and cross feedback signals are algebraically added to the command signal to ensure the extensible link is at the commanded position. The command signals and their functions are as follows:

(1) The balance command signal drives the extensible link to its mechanical center.

(2) The closed loop command signal is generated at the VALVE CONTROL. This signal drives the extensible link to any position between fully extended and fully retracted.

(3) The square wave command signal alternately extends and retracts the extensible link once every second. Stroke is controlled by the SQ WAVE variable resistor.

(4) The hardover retract command signal drives the extensible link to maximum retract position. The hardover extend command signal drives the extensible link to maximum extend position.

d. No. 1 metering circuit processes signals from No. 1 ILCA control circuit. No. 2 circuit processes the same type signals from No. 2 metering circuit. Otherwise, the two circuits are identical.

e. The metering circuit selectively routes control circuit output signals and reference voltage to meter jacks on the front panel. At the jacks they can be measured with external test equipment. ILCA output signals are selectively routed to the DVM. Signals amplitude is reduced to the range of the DVM. The metering circuit also ineludes a 50-0-50 ua meter.

f. The power supply section includes three power supplies and four voltage regulators. These provide +28, – 20, +20, – 12, +12, –7, +7, and +5 volts dc. The power supply section also includes a 400 Hz inverter. The inverter is powered from 28 volts dc and supplies 13 volts ac 400 Hz.

g. An undervoltage detector circuit turns on the WARNING indicator when line voltage to the test set is less than 105 volts ac.

h. The hydraulic unit control circuit includes two switches that close or open 115 volts ac circuits to the hydraulic unit.

i. The BITE circuit measures on the DVM the -20, +20, – 12, +12, and +5 volts dc power sources. It also selectively provides simulated self and cross feedback signals to No. 1 and No. 2 ILCA control circuits. The demodulated feedback signals are measured on the DVM.

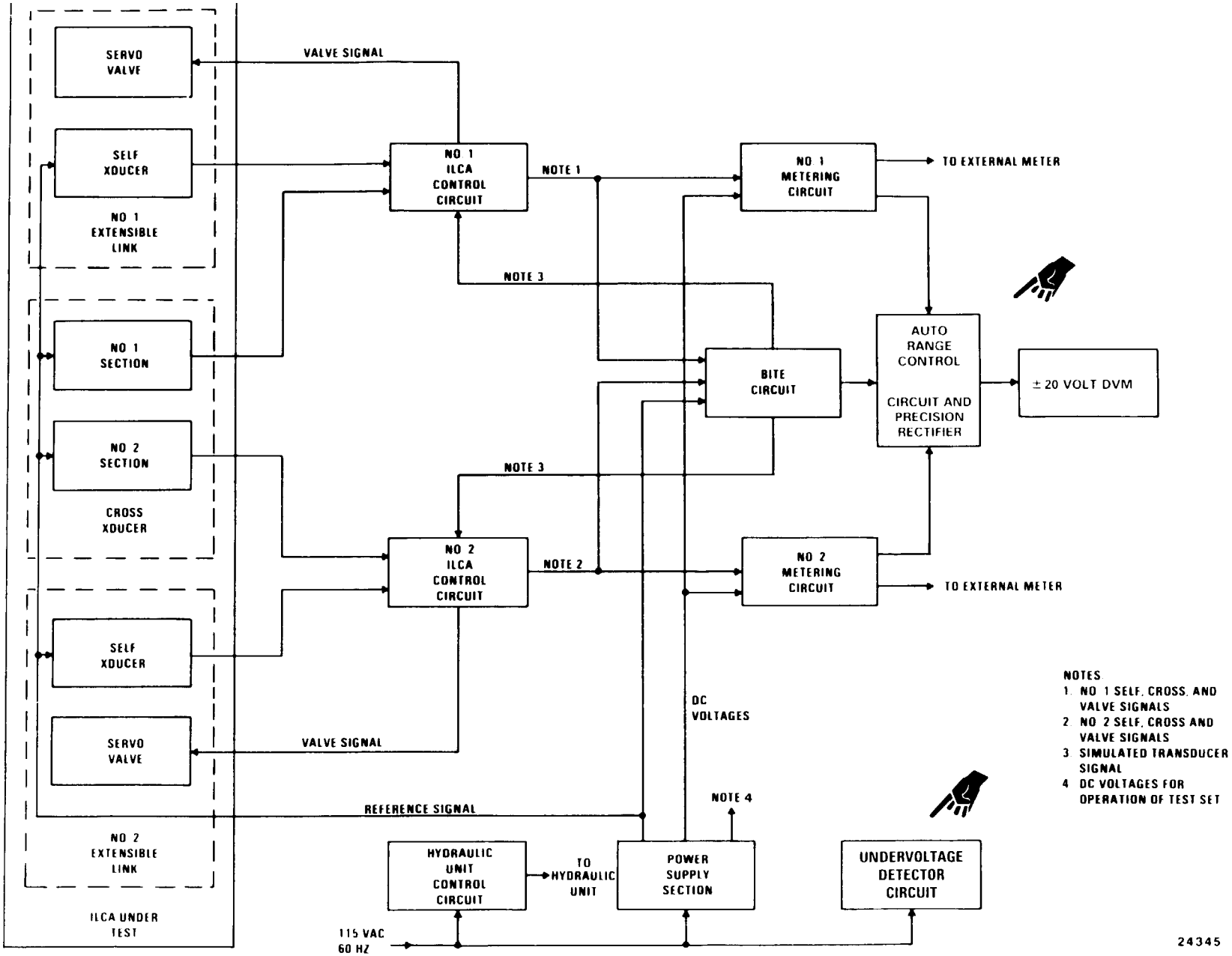


Figure 1-5. Electrical Unit Block Diagram

1-17. ILCA Control Circuits. *(See FO-1.)*

a. *General.* The ILCA control circuit includes the command signal circuit, demodulator control circuit, self and cross demodulators, and servo amplifier.

b. Command signals circuit.

(1) The command signals circuit includes the 0.5 Hz oscillator, the VALVE CONTROL variable resistor, and wafer B of the FUNCTION SELECT switch. This circuit provides the square wave, closed loop, hardover retract, balance, or hardover extend command signal to servo amplifier U2.

(2) The oscillator includes nor gates U4A and U4B and associated resistors, capacitor, and diode. The circuit alternately charges C2 to about *14* volts in each direction for about 1 second. When the input applied through R10 to gate U4A is -7-volt dc, the output of gate U4A is +7-volt dc. The output of gate U4B is –7-volt dc. Current from the output of gate U4B flows through C2, R11 and CR3 to the output of gate U4A. In about 1 second, the voltage at the junction of R11 and C2 increases to about +7-volts. This voltage, applied through R10, changes the state of gate U4A. The -7-volt dc output from gate U4A changes the output of gate U4B to +7-volt dc. In about 1 second, the voltage at the junction of R11 and C2 decreases to about -7-volts. This negative voltage reverses the state of gate U4A and the cycle repeats. The output of the oscillator is a square wave. Its frequency is 0.35 to 0.65 Hz. Both half cycles are 6.5 to 7-volts. They are evenly distributed about a O reference. The signal is applied through the SQ WAVE variable resistor to the FUNCTION SELECT switch at SQ WAVE, the signal is applied as a command to servo amplifier U2.

(3) The closed-loop command signal is obtained from the moving contact of VALVE CONTROL variable resistor. When the control is rotated toward RETRACT, the command signal increases toward +12-volt dc. When the control is rotated toward EXTEND, the signal increases toward -12-volt dc. When the FUNCTION SELECT switch is at CLSD LOOP, the signal is applied through R58 or R68 as a command to servo amplifier U2.

(4) The hardover retract and extend command signals are +12-volt and -12-volt dc, respectively. With the FUNCTION SELECT switch at HARDOVER RETRACT or HARDOVER EXTEND, the selected signal is applied as a command to U2.

(5) With the FUNCTION SELECT switch at BALANCE, a ground is applied to the input of U2.

c. Demodulator control circuit.

(1) This circuit includes operational amplifier (op-amp) U5D, four *nor* gates U1A through U1D, wafer A of the FUNCTION SELECT switch, and associated resistors. With the FUNCTION SELECT switch at SQ WAVE, CLSD LOOP, or BALANCE, the output of each *nor* gate is a square wave. This square wave controls the associated demodulator. When the FUNCTION SELECT switch is at HARDOVER EXTEND or HARDOVER RETRACT, the output of each *nor* gate is a logic low. The logic low turns off the associated demodulator.

(2) The 13-volt ac reference voltage is applied through voltage divider R20 and R19 to the non-inverting input of op-amp U5D. The op-amp has infinite gain. The sinewave input produces a square wave output that is in-phase with the input. The amplitude of the square wave is +7- to -7-volt dc. The amplitude of the square wave is reduced to +6.4- and -6.4-volt dc by voltage divider R18 and R23. The reduced square wave is applied to UIA and UIC.

(3) With the FUNCTION SELECT switch at either HARDOVER position, 5-volt dc from the power supply is applied through the FUNCTION SELECT switch to the four *nor* gates. The 5-volt dc drives the *nor* gates output to -7-volt dc. These logic lows hold the four demodulators at off.

(4) With the FUNCTION SELECT switch at SQ WAVE, CLSD LOOP, or BALANCE, -7-volt dc from the power supply is applied through RI to one input of the four *nor* gates. Thus, the output of each *nor* gate is controlled by the square wave signal applied to the other input. The in-phase square wave from the op-amp is applied to *nor* gates U1A and U1C. The *nor* gates invert the square waves and route them to self-demodulator U3A and cross demodulator U3B. The same signals are also applied to nor gates U1B and U1D. In U1B and U1D, the signals are inverted to produce in-phase square waves for self-demodulator U3D and cross-demodulator U3C.

d. Self-demodulator circuit.

(1) The self-demodulator includes out-of-phase self demodulator U3A, in-phase self-demodulator U3D, self-amplifier uSA, and associated resistors and capacitors.

(2) Each demodulator operates like an electronic switch. When the demodulator control signal is positive, the switch is closed. When the demodulator control signal is negative, the switch is open.

(3) Self-amplifier USA is an op-amp that operates with a gain near unity. Gain is set by the ratio of R13 and R6. C3 and C19 integrate the pulsating dc output. R12 and R14 reference the input signals to ground.

(4) During the positive half cycle of reference voltage, demodulator U3D is closed and U3A is open. The transducer signal is applied through R6 and U3D to the non-inverting input of U5A. During the negative half cycle of reference voltage, demodulator U3A is closed and U3D is open. The transducer signal is applied through R6 and U3A to the inverting input of U5A.

(5) When the extensible link is nulled, the transducer provides 0-volt and the output of U5A is 0-volt. When the extensible link is extended, the transducer voltage is in-phase with the reference. The output of USA is positive. When the extensible link is retracted, the transducer voltage is out-of-phase with the reference. The output of U5A is negative.

e. Cross demodulator circuit.

(1) The cross demodulator circuit includes out-of-phase cross demodulator U3B, in-phase cross demodulator U3C, cross amplifier U5B, and associated resistors and capacitors.

(2) Operation is the same as for those in the self-demodulator circuit (step *d.)* The cross transducer signal is 180° out-of-phase with the self-transducer signal.

f. The servo amplifier circuit.

(1) The servo amplifier circuit includes servo amplifier U2 and associated resistors and capacitor. This circuit algebraically adds the command signal from R22, the self-feedback signal from R9, and the cross feedback signal from R21. The resultant output current from U2 drives the extensible link servo valve.

(2) Servo amplifier U2 is an inverting op-amp. Resistor R4 keeps the non-inverting input of the amplifier at 0-volt. The feedback loop for the amplifier includes resistor R8. Resistor R93 sets the ratio between servo valve current and feedback current.

1-18. Metering Circuit (fig. 1-6).

NOTE

Fig. 1-6 includes reference designations for SAS 1 and SAS 2 components. Only SAS 1 reference designations are used in the following description.

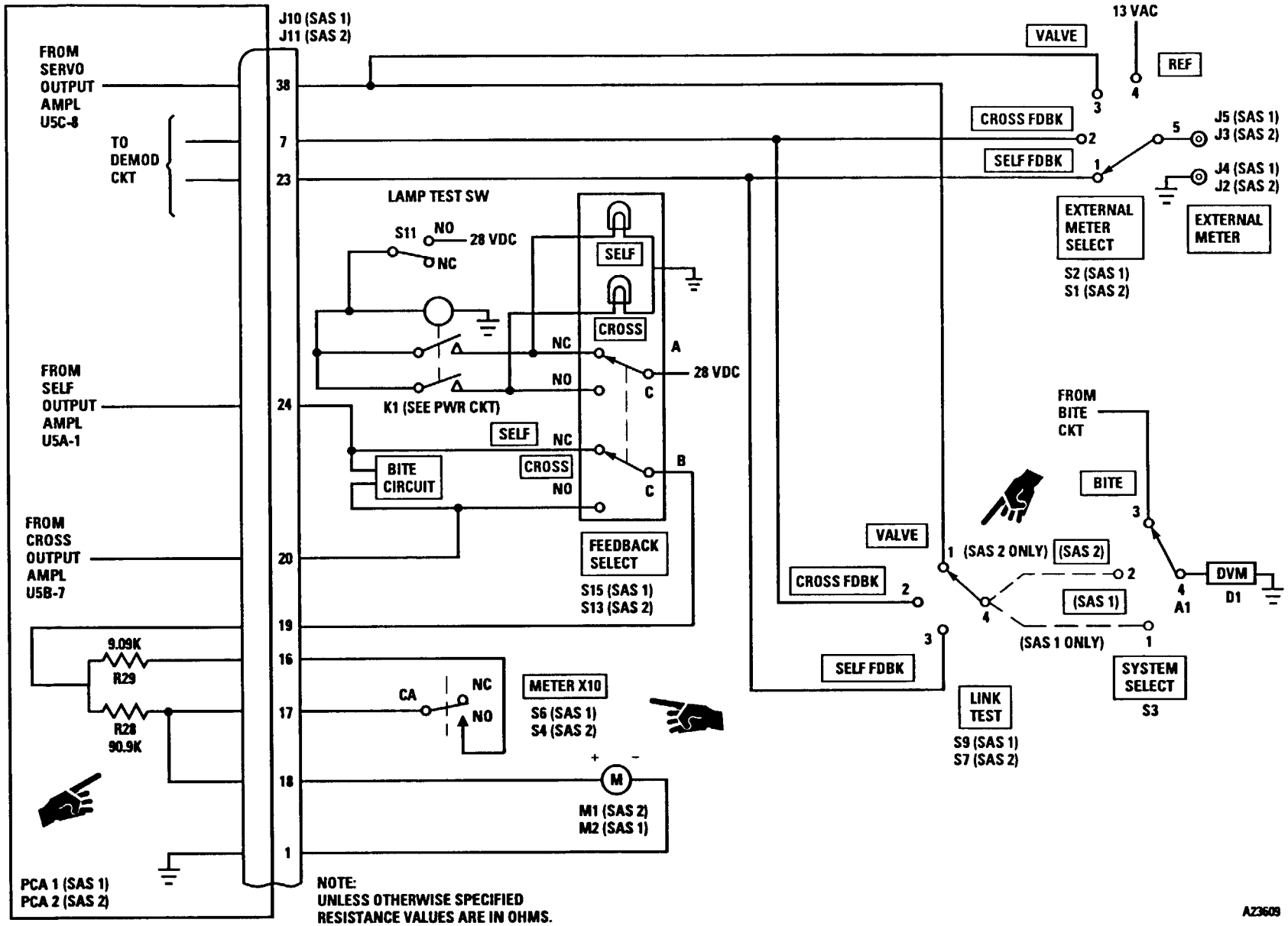


Figure 1-6. Metering Circuit Schematic Diagram

a. External metering circuit. This circuit includes EXTERNAL METER SELECT switch S2 and EXTERNAL METER jacks J4 and J5. The switch selects one of four voltages. At VALVE, the valve drive signal is selected. At CROSS FDBK, the cross signal is selected, At SELF FDBK, the self signal is selected. At REF, the 13 volts ac reference voltage is selected. The selected signal is applied to the jacks, At the jack, it can be measured with external test equipment.

b. DVM metering circuit. (fig. 1-6).

(1) The DVM has an auto range circuit on TB6B to protect the meter from high voltage surges.

(2) The DVM voltages are selected by SYSTEM SELECT switch S3 and LINK TEST switch S7 or S9.

(3) The DVM is connected to SYSTEM SELECT switch S3. S3 selects BITE, SAS 1, or SAS 2 voltages to be read by the DVM. The voltages going to S3 (SAS 1 or SAS 2) are selected by the LINK TEST switch S7 or S9. S7, like S9, can select VALVE, CROSS FEEDBACK or SELF FEEDBACK.

(4) The auto range circuit will then automatically range the selected voltages to be read by the DVM.

c. NULL meter circuit..

(1) This circuit includes FEEDBACK SELECT switch S13 and S15, R28 and R29 in PCA 1 and PCA 2, METER X10 switch S4 and S6, and NULL meter Ml and M2.

(2) FEEDBACK SELECT switch selects SELF or CROSS output current. METER X10 switch when pressed connects R29 in parallel with R28 changing the NULL METER range to 5 microamps maximum from center.

(3) When METER X10 switch S4 or S6 is not pressed, all current goes through R28. The range of NULL METER Ml or M2 is 50 microamps maximum right or left of center,

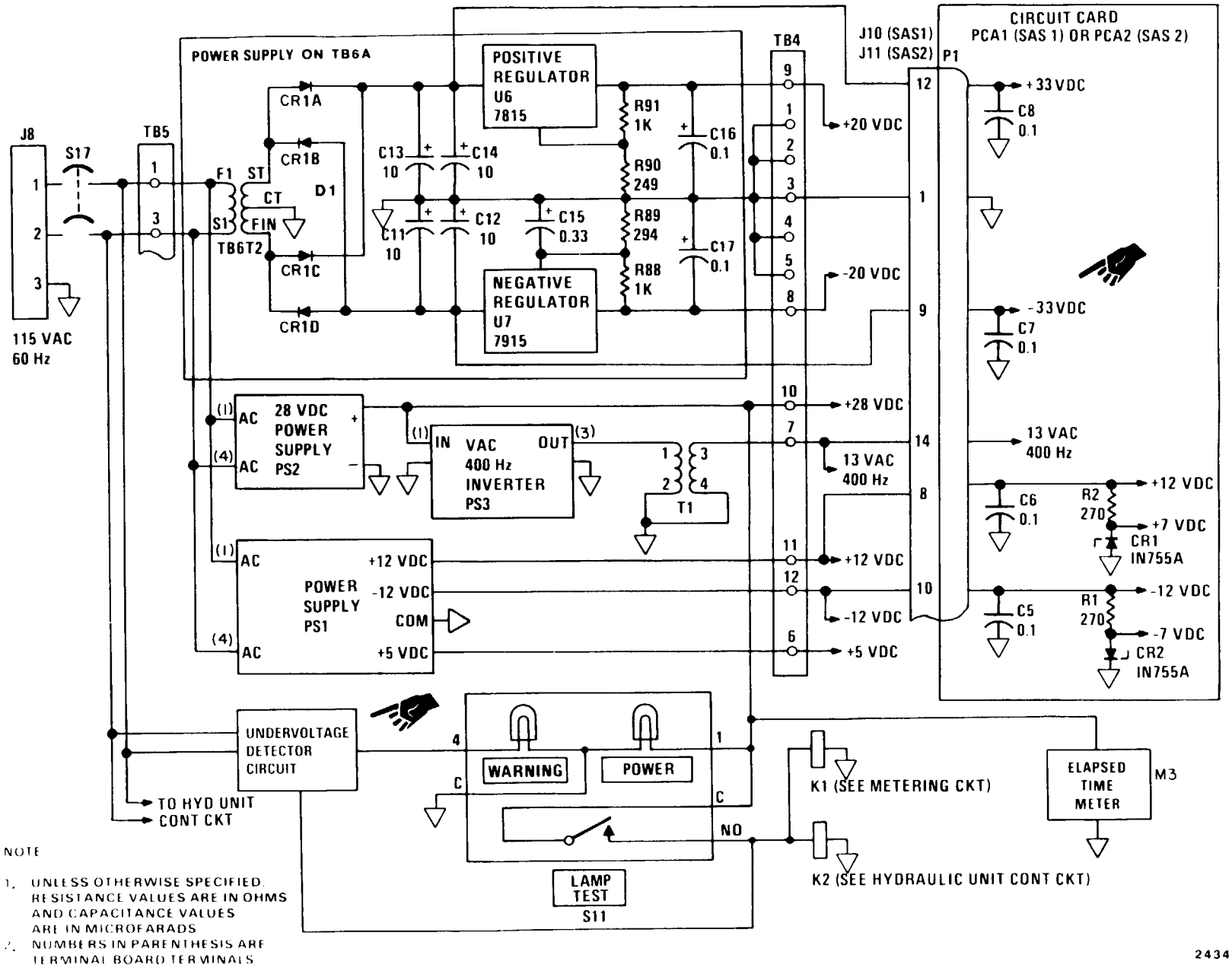
(4) Do not press METER X10 switch when reading more than 5 microamps.

1-19. Power Circuits (fig. 1-7),

a. The 115 volts ac 60 Hz is applied through POWER receptacle J8 and circuit breaker S17 to terminal board TB5. The ac is distributed to the power supplies, undervoltage detector circuit, and the hydraulic unit control circuit.

b. Power supply PS2 provides 28 volts dc. The dc lights the indicators, provides an input to inverter PS3, and drives the elapsed time indicator.

c. The dc is applied to inverter PS3. Inverter PS3 provides 26 volts ac 400 Hz output to T1. The output of transformer T1 is a 13 volts ac 400 Hz reference signal.



NOTE

1. UNLESS OTHERWISE SPECIFIED, RESISTANCE VALUES ARE IN OHMS AND CAPACITANCE VALUES ARE IN MICROFARADS
2. NUMBERS IN PARENTHESIS ARE TERMINAL BOARD TERMINALS

Figure 1-7. Power Circuit Schematic Diagram

d. Power supply on TB6A provides the +20 volts dc, –20 volts dc, +33 volts dc, and –33 volts dc. These dc voltages are used in the BITE circuit. They are also used to power the servo amplifiers.

e. Power supply PS1 provides the +12 and – 12 volts dc. This power supply also includes a 5 volts dc regulator powered from the +12 volts supply. The +12 and – 12 volts dc are used in the BITE and ILCA control circuits. The 5 volts dc powers the DVM,

f. The +7 and -7 volts dc are obtained from zener diode circuits that are powered from the +12 and -12 volts dc respectively. The +7 and –7 volts dc power the NOR gates and the demodulators.

g. LAMP TEST switch S11 is pressed to check all tester light bulbs. When S11 is pressed, K1 and K2 are energized, supplying dc voltage to all bulbs.

1-20. Under-voltage Detector Circuit TB-6B (fig. 1-8).

a. The undervoltage detector circuit samples line voltage at transformer TB6T1. A reduced sample is applied to the input of comparator U1. When the positive peak of ac voltage is higher than the threshold voltage, the comparator output is a low.

b. When line voltage is above 105 volts, the comparator provides a series of low pulses. When line voltage is below 105 volts, the comparator output at pin 8 goes high enough to turn Q1 on. With Q1 on, there is a ground path and the WARNING indicator is turned on.

c. When the line voltage goes back above 105 volts, U1 pin 8 output goes low. The low from pin 8 turns off transistor Q1.

d. This interrupts the ground path and the WARNING indicator light will be off. R10 is used to adjust the undervoltage detector threshold voltage level.

e. When LAMP TEST switch S11 is pressed, +dc voltage is applied through R9 to pin 10 of U1. This causes output pin 8 to go high and energize Q1, turning on the WARNING light.

f. When LAMP TEST switch S11 is released, the first positive pulse at pin 9 makes the pin 8 output go low, turning Q1 off.

g. That removes the ground path and the WARNING indicator will be off.

1-21. Hydraulic Unit Control Circuit (fig. 1-9). The hydraulic unit control circuit includes SOLENOID SHUTOFF switch S18, CYCLE MOTOR switch S12, and relay K2.

a. When the SOLENOID SHUTOFF switch is pressed to CLOSED, 28 volts dc is applied through the A contacts. The dc lights the CLOSED indicator. When the SOLENOID SHUTOFF switch is pressed to OPEN, 28 volts dc is applied through the A contacts. The dc lights the OPEN indicator. At the same time, 115 volts ac is applied through the B contacts to the hydraulic unit. When the SOLENOID switch S1 is closed, 115 volts ac lights OPEN indicator S1 and energizes the hydraulic solenoid.

b. When the CYCLE MOTOR switch is pressed to OFF, 28 volts dc is applied through the A contacts to light the OFF indicator. When the CYCLE MOTOR switch is pressed to ON, 28 volts dc is applied through the A contacts to light the ON indicator. At the same time, 115 volts ac is applied through the B contacts to operate the cycle motor.

c. Relay K2 operates when LAMP TEST switch S11 is momentarily pressed (fig. 1-7). The 28 volts dc is applied through the relay contacts to light OPEN, CLOSED, ON, and OFF indicators. When the LAMP TEST switch is released, relay K2 is deenergized. One indicator in each switch goes out.

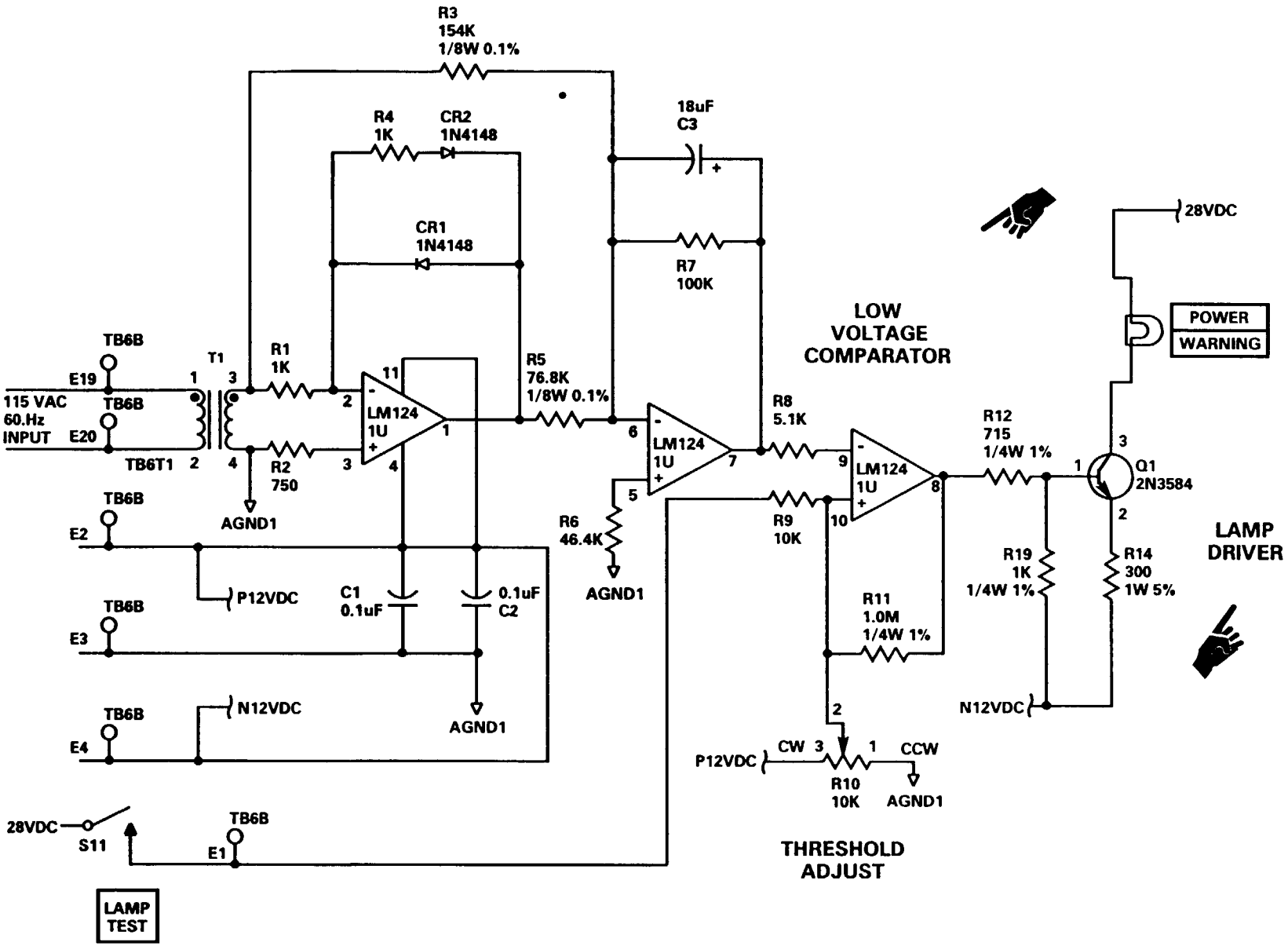


Figure 1-8. Undervoltage Detector Circuit Schematic Diagram

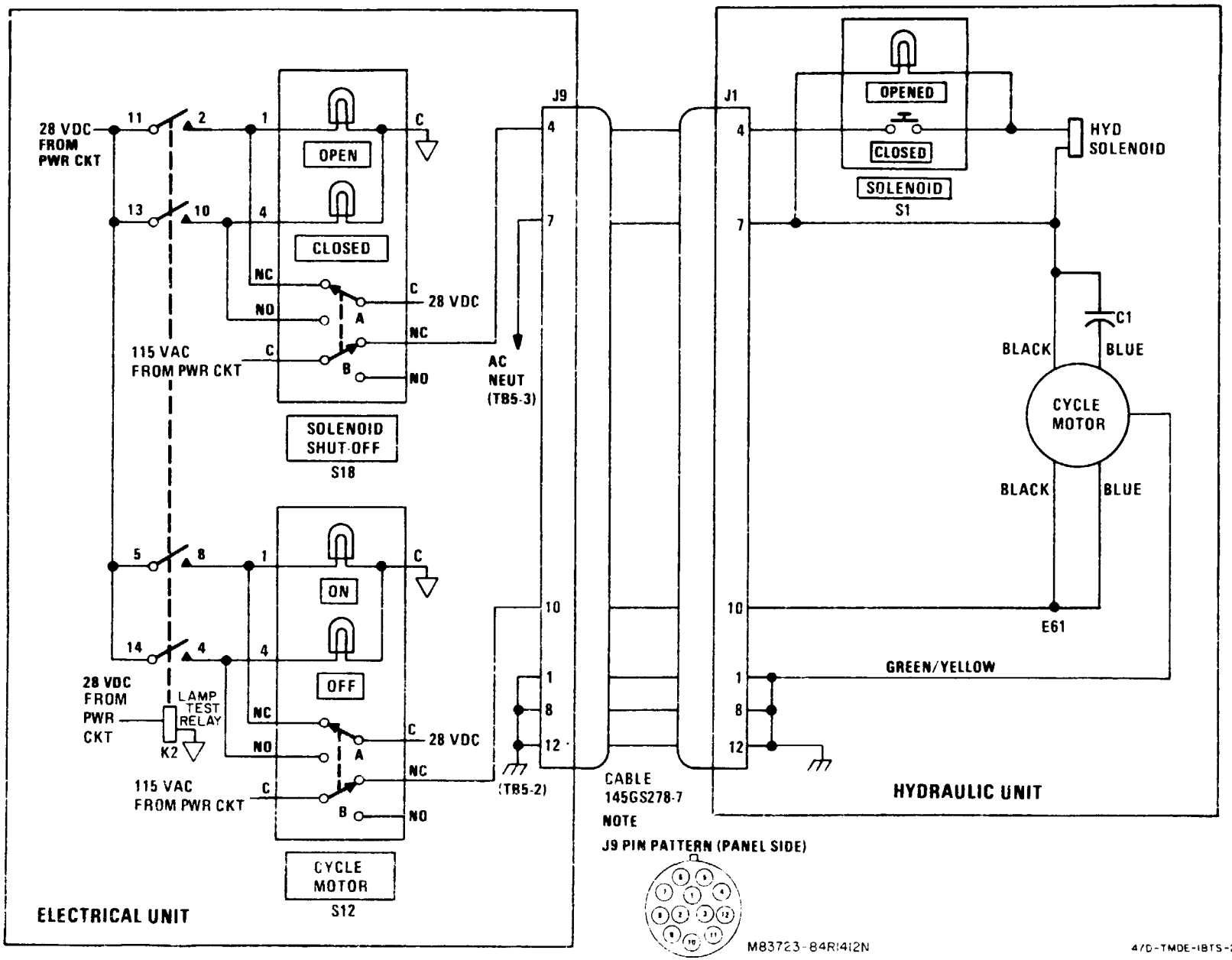


Figure 1-9. *Hydraulic Unit Control Circuit Schematic Diagram*

1-22. BITE Circuit (FO-2).

a. When SYSTEM SELECT switch S3 is at BITE, the following circuits are completed.

(1) The DVM is connected to BITE switch S5A moving contact 11A, At each BITE switch position, a voltage is displayed on the DVM.

(2) A simulated transducer signal is connected to BITE switch S5B moving contact llB. The simulated transducer signal is applied through the BITE switch to the selected demodulator circuit.

(3) Load resistors R59 and R69 are connected to the SAS 1 and SAS 2 servo output amplifiers, respectively. The load resistors substitute for the extensible link servo valves,

(4) BITE switch S5C contacts llC and 6 have +28 volts dc available for K1 operation on TB6B.

b. The five dc power supply voltages are applied to voltage divider networks. When the BITE switch is at –20V, +20V, – 12V, + 12V, or +5V, the voltage from the associated network is displayed on the DVM.

c. The 13 volts ac 400 Hz reference is applied to voltage divider R71 and R70, S3 B3, and S5B. When the BITE switch is at SAS 1 SELF, SAS 1 CROSS, SAS 2 SELF, or SAS 2 CROSS, the signal is applied to the corresponding demodulator. The demodulator processes the signal and produces a self or cross output signal. The output signal is applied through S5A contacts of the BITE switch and fed to S3 A1. From pin 4 it goes through the precision rectifier and auto range circuit to DVM D1.

1-23. HYDRAULIC UNIT 145GS278-2.

1-24. Circuit Description (FO-3). The hydraulic unit provides high-pressure and low-pressure hydraulic fluid from a test stand at two controllable supply pressures up to 2500 psig (high-pressure side) and 300 psig (low-pressure side) to the ILCA under test. The return line operates at 60 psig controlled by preset check valves between RETURN selector valves VR1 and VR2 that connect the return flow from the ILCA to the RETURN port. Pressure reducing valve VR6 allows bypass flow from LOW PRESS REGULATOR VR7 at pressure levels above the 300 psi set point. HIGH PRESS RELIEF VALVE VP6 and LOW PRESS RELIEF VALVE VR8 relieve trapped pressure from the high and low pressure circuits to return at shutdown.

Fluid from the test stand enters the hydraulic unit through SOLENOID valve VP5 and the 5-micron filter, At this point, the flow is divided: one branch flows into a high-pressure circuit; the other branch flows through flow limiter valve VR9 to a low-pressure circuit.

In the high-pressure circuit, the flow is through HIGH PRESS REGULATOR valve VP4 to HIGH PRESS gauge G1. Variable area HIGH PRESS SHUTOFF VALVE VP3 controls flow to the four selector valves: ILCA PRESS SYS-1 VPl, ILCA PRESS SYS-2 VP2, SAS PRESS SYS-1 VS1, SAS PRESS SYS-2 VS2 and these control flow to the ILCA manifold, With HIGH PRESS SHUTOFF VALVE VP3 set to PRESS, regulated pressure flows to the four selector valves, which permits flow to the ILCA manifold. At VENT, these valves connect the pressure ports of the manifold to return through the low pressure check valve that is preset to 3 to 5 psig. Normally closed HIGH PRESS RELIEF VALVE VP6 relieves pressure from the regulated supply to return at shutdown.

In the low-pressure circuit, the flow is through flow limiter valve VR9 and LOW PRESS REGULATOR valve VR7 to LOW PRESS gage G2. Low pressure reducing valve VR6 bypasses flow to return as required to prevent pressure from exceeding 300 psig. This valve is manually adjustable. Flow continues in the low-pressure circuit to two selector valves: RETURN SYS1 VR1 and RETURN SYS2 VR2. The flow from these valves is directed to the ILCA manifold. At RETURN, these valves allow flow through [he two preset (60 psig) back-pressure check valves through the variable area RETURN SHUTOFF VALVE VR3, through the 3 to 5 psi check valve to the return line. Normally closed LOW' PRESS RELIEF VALVE VR8 relieves trapped pressure from the regulated supply to return at shutdown. The variable area CASE VENT LINE PRESS shutoff valve VR5 permits positive shutoff of flow to the auxiliary port and the short length of flex hose.

Chapter 2

OPERATING INSTRUCTIONS

SECTION I UNPACKING

2-1. General. unpacking instructions are given in para 2-2. CHECKING UNPACKED EQUIPMENT IS GIVEN in para 2-3.

2-2. Unpacking the Equipment.

a. Packaging Data. When packed for shipment, each unit of the ILCA test set is surrounded by styrofoam cushioning material and placed in a cleated plywood box. A typical shipping box for each unit and its contents is shown in fig. 2-1.

b. Removing Contents.

(1) Use a nailpuller to remove the nails from the cleated plywood cover and remove the cleated plywood cover.

(2) Use the nailpuller to remove the nails from one side panel of the box and remove the side panel.

(3) Remove the top and side pads of cushioning material.

WARNING

The hydraulic unit weighs approximately 165 pounds. Be careful when lifting the unit to prevent personal injury.

(4) Remove the test unit from the box.

2-3. Checking Unpacked Equipment.

a. Inspect the equipment for damage incurred during shipment. If the equipment has been damaged, report the damage as specified in para 1-2.

b. *See* that the equipment is complete as listed on the packing slip, Report discrepancies in accordance with para 1-2.

c. If the equipment has been used or is reconditioned, see whether it has been changed by a modification work order (MWO). If the equipment has been modified, the MWO number will appear on the cover near the nameplate. If modified, see that any operational instruction changes resulting from the modification have been entered in the equipment manual.

NOTE

Current MWO'S applicable to the equipment are listed in DA Pam 310-1.

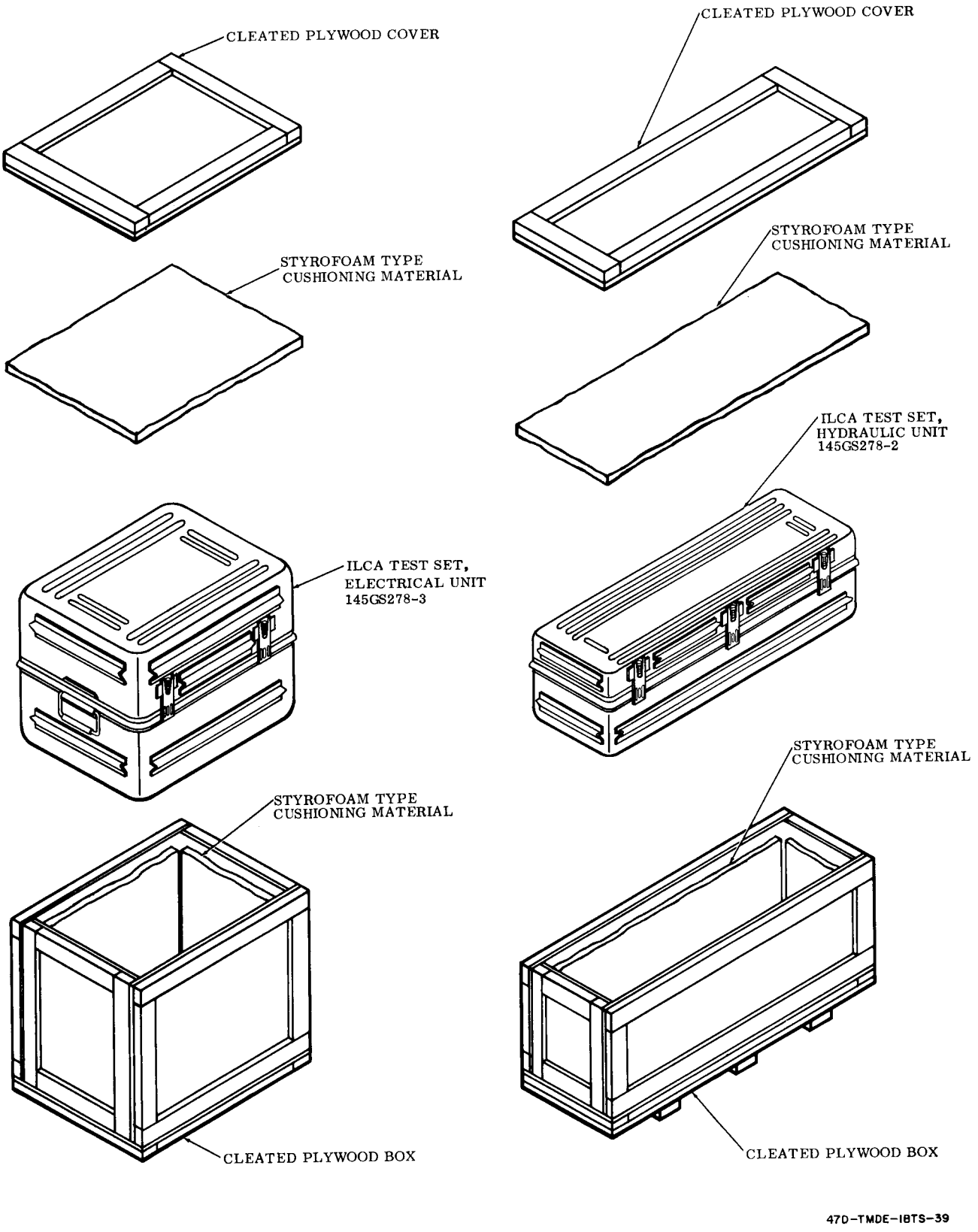


Figure 2-1. Typical Packaging, ILCA Test Set

SECTION II OPERATION

2-4. Electrical Unit Controls and Indicators.

CONTROL OR INDICATOR (Fig. 2-2)	DESCRIPTION
Power switch S17	Toggle circuit breaker switch, 7 amperes. OFF - Disconnects input power (115-volt 60 Hz) from test set. ON - Connects input power to test set and protects test set from overload.
LAMP TEST switch/ indicator S11	Momentary pushbutton switch/indicator. When switch is pressed, all test set indicators come on. POWER - Comes on when power switch is at ON. WARNING - Comes on when input power falls below 105-volt ac.
DVM D1	Ac digital voltmeter. Displays SAS 1, SAS 2, or BITE Feedback level, as selected by SYSTEM SELECT switch.
SYSTEM SELECT switch S3	3-position rotary switch. SAS 1 - No. 1 self, cross, or valve voltage, as selected by LINK TEST switch S9, is selected for display on DVM. SAS 2 - No. 2 self, cross, or valve voltage, as selected by LINK TEST switch S7, is selected for display on DVM. BITE - Self, cross, or dc voltage, as selected by BITE switch, is selected for display on DVM. Simulated transducer signal is applied to demodulators selected by BITE switch. Load resistors are substituted for extensible link servo valves.
CYCLE MOTOR switch/ indicator S12	Push on/push off indicating switch. Push to latch - ON indicator comes on and 115-volt-ac cycle motor rotates. Push to unlatch - OFF indicator comes on and cycle motor stops.
SOLENOID SHUTOFF switch indicator S18	Push on/push off indicating switch. Push to latch - OPEN indicator comes on and 115-volt ac is applied to solenoid in hydraulic unit. When SOLENOID switch in hydraulic unit is closed, solenoid valve is energized open. Push to unlatch - CLOSED indicator comes on and power circuit to solenoid opens to close solenoid valve.
ELAPSED TIME meter M3	HOURS up to 999.9 are displayed on four digit wheels. Meter indicates total time that electrical unit is operated.

CONTROL OR INDICATOR (Fig. 2-2)	DESCRIPTION
BITE switch S5	10-position rotary switch. When SYSTEM SELECT switch is at BITE, BITE switch provides simulated transducer signals and selects voltages for measurement on DVM as follows: -20V - Output of –20-volt dc power supply is selected for display. +20V - Output of +20-volt dc power supply is selected for display. -12V - Output of -12-volt dc power supply is selected for display. +12V - Output of +12-volt dc power supply is selected for display. +5V - Output of +5-volt dc power supply is selected for display. 13V RMS - Output of 13-volt 400 Hz power supply is selected for display. SAS 1 SELF - Simulated transducer signal is applied to No. 1 self demodulators and No. 1 self voltage is indicated on DVM. SAS 1 CROSS - Simulated transducer signal is applied to No. 1 cross demodulators and No. 1 cross voltage is indicated on DVM. SAS 2 SELF - Simulated transducer signal is applied to No. 2 self demodulators and No. 2 self voltage is indicated on DVM. SAS 2 CROSS - Simulated transducer signal is applied to No. 2 cross demodulators and No. 2 cross voltage is indicated on DVM.

NOTE

SAS 1 and SAS 2 sections of the test set panel have identical controls and indicators. Only one set is described. Reference designations for SAS 1 components are given. Reference designations for SAS 2 components are in parentheses.

FUNCTION SELECT switch S16 (S14)	5-position rotary switch. SQ WAVE - Corresponding extensible link oscillates at 30 strokes per minute. Maximum length of stroke is controlled by SQ WAVE control. CLSD LOOP - Corresponding extensible link is manually controlled by VALVE CONTROL. HARDOVER RETRACT - Corresponding extensible link goes to hardover retract. BALANCE - Corresponding extensible link goes to null position. HARDOVER EXTEND - Corresponding extensible link goes to hardover extend.

CONTROL OR INDICATOR (Fig. 2-2)	DESCRIPTION
VALVE CONTROL R4 (R3)	Variable resistor. When corresponding FUNCTION SELECT switch is at CLSD LOOP, sets corresponding extensible link to any position between hardover retract and hardover extend.
SQ WAVE control R2 (RI)	Variable resistor. When corresponding FUNCTION SELECT switch is at SQ WAVE, sets maximum stroke length of extensible link. Extensible link oscillates at 30 strokes per minute.
FEEDBACK SELECT switch/ indicator S15 (S13)	Push on/off indicating switch. Push to latch – SELF indicator comes on and self feedback voltage is indicated on corresponding NULL meter. Push to unlatch – CROSS indicator comes on and cross feedback voltage is indicated on corresponding NULL meter.
LINK TEST switch S9 (S7)	3-position rotary switch. Functional when SYSTEM SELECT switch is at corresponding SAS position. VALVE – Servo valve voltage is indicated on DVM. CROSS FDBK – Cross feedback voltage is indicated on DVM. SELF FDBK – Self feedback voltage is indicated on DVM.
METER X10 switch S6 (S4)	Momentary pushbutton switch. Changes range of NULL meter. Displays null selected by the SYSTEM SELECT switch. Released – Corresponding NULL meter indicates a 50-0-50 microampere range. Pressed – Corresponding NULL meter indicates a 5-O-5 microampere range.
NULL meter M2 (Ml)	**50-0-50** microammeter. Meter indicates amplitude and polarity of corresponding self or cross feedback voltage as selected by FEEDBACK SELECT switch.
EXTERNAL METER SELECT switch S2 (S1)	4-position rotary switch. Connects voltages to associated EXTERNAL METER jacks as follows: SELF FDBK – Corresponding self voltage is displayed. CROSS FDBK – Corresponding cross voltage is displayed, REF – 13 volts ac 400 Hz reference voltage is displayed.
EXTERNAL METER jacks J5 and J4 (J3 and J2)	Covered + and – pin jacks for connection of external meter, Used with EXTERNAL METER SELECT switch.

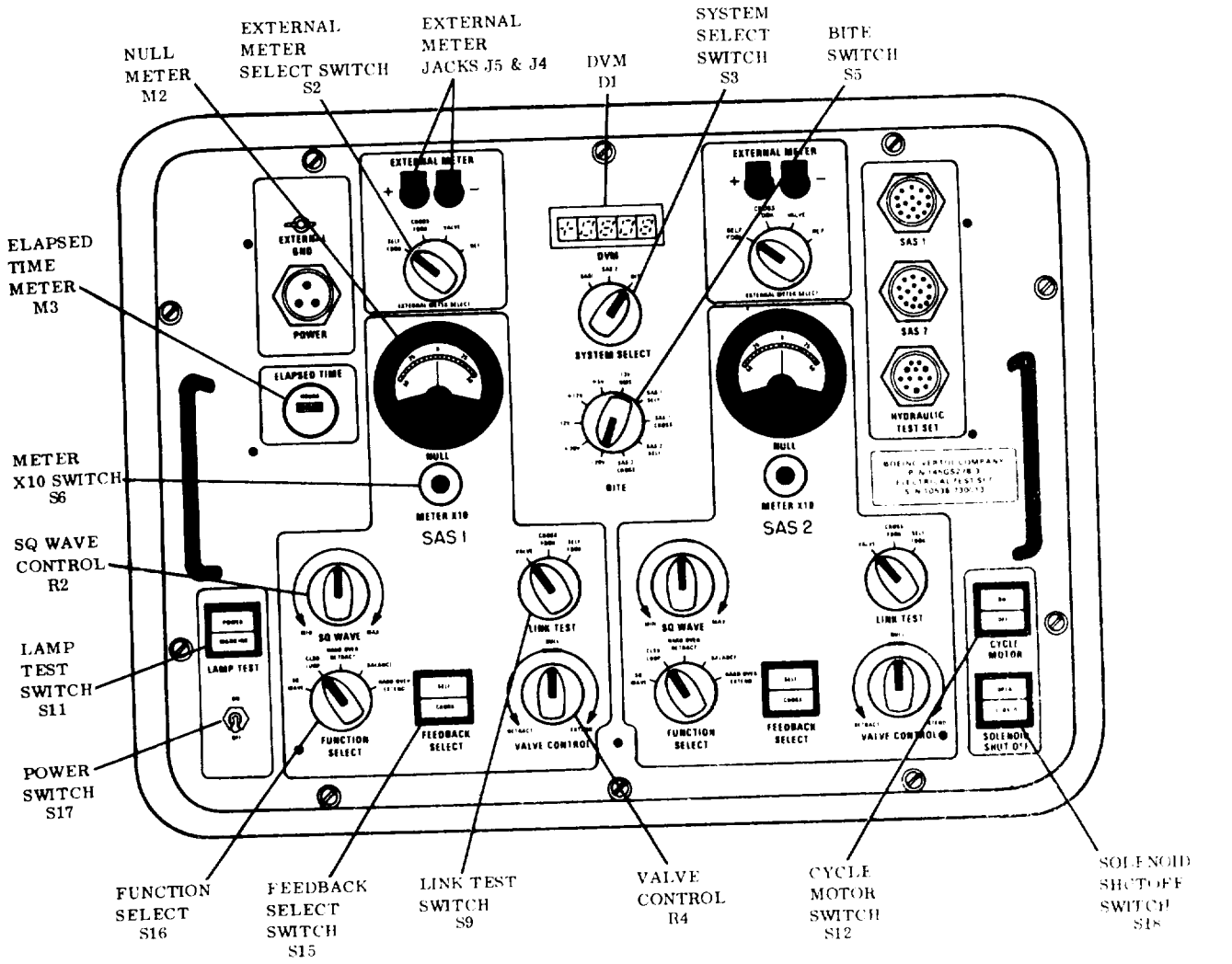


Figure 2-2. Electrical Unit Controls and Indicators

2-5. Hydraulic Unit Controls and Indicators.

CONTROL OR INDICATOR (Fig. 2-3)	DESCRIPTION
FILTER indicator	Press to reset pop-out visual indicator. Extends to indicate that differential pressure across filter element exceeds 45 psid (contaminated filter). Bypass will occur at 87 psid.
SOLENOID valve (VP5)	The solenoid valve is electrically controlled by SOLENOID SHUTOFF switch on the electrical unit and the SOLENOID push-pull knob. Lamp inside knob lights to indicate valve is open. OPEN - Supply hydraulic pressure is connected to unit valves. CLOSE - Hydraulic pressure to unit is shut off.
HIGH PRESS REGULATOR valve (VP4)	Regulates fluid pressure to pressure controls of test set. Includes 3450 psig relief valve. DECREASE - Fully open to return. Pressure at manifold is 250 to 350 psig. INCREASE - Fully closed to return. Pressure at pressure controls is supply line pressure.
HIGH PRESS gage (G1)	0 to 5000 psi panel indicator. Indicates pressure downstream of the HIGH PRESS REGULATOR.
HIGH PRESS SHUTOFF VALVE (VP3)	Needle type valve with indicating scales. Controls flow to pressure valves. OPEN - Opens pressure passage. CLOSE - Closes pressure passage.
HIGH PRESS RELIEF VALVE (VP6)	Push-to-open 2-way valve. Opens pressure passage to return system.
RETURN SHUTOFF VALVE (VR3)	Spindle type valve with indicating scales. Blocks return flow from return system. OPEN - Opens return passage. CLOSE - Closes return passage.
LOW PRESS REGULATOR (VR7)	Regulates fluid pressure to return controls of test set. Includes 300 psi relief valve. DECREASE - Fully open to return. INCREASE - Fully closed to return. Applies pressure to LOW PRESS gage (G2).
LOW PRESS RELIEF VALVE (VR8)	Push-to-open two-way valve. Opens return pressure passage to return system.
RETURN BACK PRESS valve (VR4)	Needle type valve with indicating scales. Controls pressure to return selector valves. OPEN - Fully open to return selector valves. CLOSED - Fully closed to return selector valves.

CONTROL OR INDICATOR (Fig. 2-3)	DESCRIPTION
LOW PRESS gage (G2)	0 to 600 psi panel indicator. Indicates pressure downstream of the LOW PRESS REGULATOR (VR7).
CASE VENT LINE PRESS valve (VR5)	Needle type valve with visual indicating scales. Controls flow to CASE VENT LINE hose. OPEN - Opens valve passage. CLOSED - Closes valve passage.
	NOTE The panel of the hydraulic unit includes two sets of identical selector valves, marked SYS 1 and SYS 2. Only SYS 2 set of the valves is described. SYS 1 reference designations are given in parentheses.
ILCA PRESS SYS 2 (1) control valve VP2 (VP 1)	3-position manual selector. Directs fluid flow to selected positions. OFF - Blocks flow from all ports. PRESS - Connects pressure to SYS 2 (1) ILCA stick boost manifold port P2 (P1). VENT - Connects SYS 2 (1) ILCA stick boost manifold port P2 (P1) to return.
SAS PRESS SYS 2 (1) control valve VS2 (VS1)	3-position manual selector. Directs fluid flow to selected positions. OFF - Blocks flow from all ports. PRESS - Connects pressure to SYS 2 (1) extensible link manifold port S2 (S1). VENT - Connects SYS 2 (1) extensible link manifold port S2 (S1) to return.
RETURN SYS 2 (1) control valve VR2 (VR1)	3-position manual selector. Directs fluid flow to selected positions. OFF - Blocks flow from all ports. PRESS — Connects pressure to the SYS 2 (1) ILCA manifold return port R2 (R1). RETURN - Connects ILCA manifold return port R2 (R1) to return.

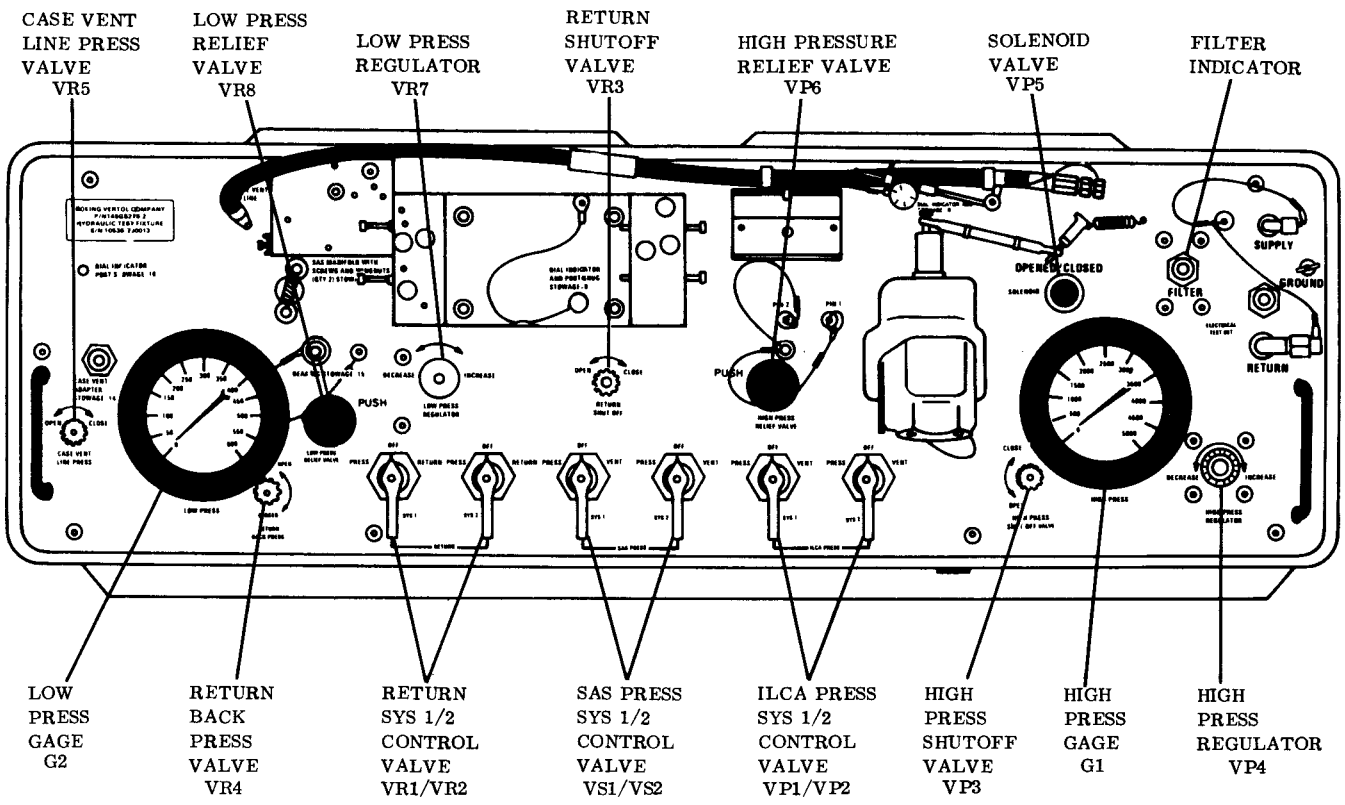
2-6. Preparation for Use.

Prepare the units for operation as follows:

NOTE

This test set is designed for use with the AVIM hydraulic shop set.

a. Position the electrical and hydraulic units on a work table. Press the air relief valves to equalize air pressure.



47D-TMDE-IBTS-17

Figure 2-3. Hydraulic Unit Controls and Indicators

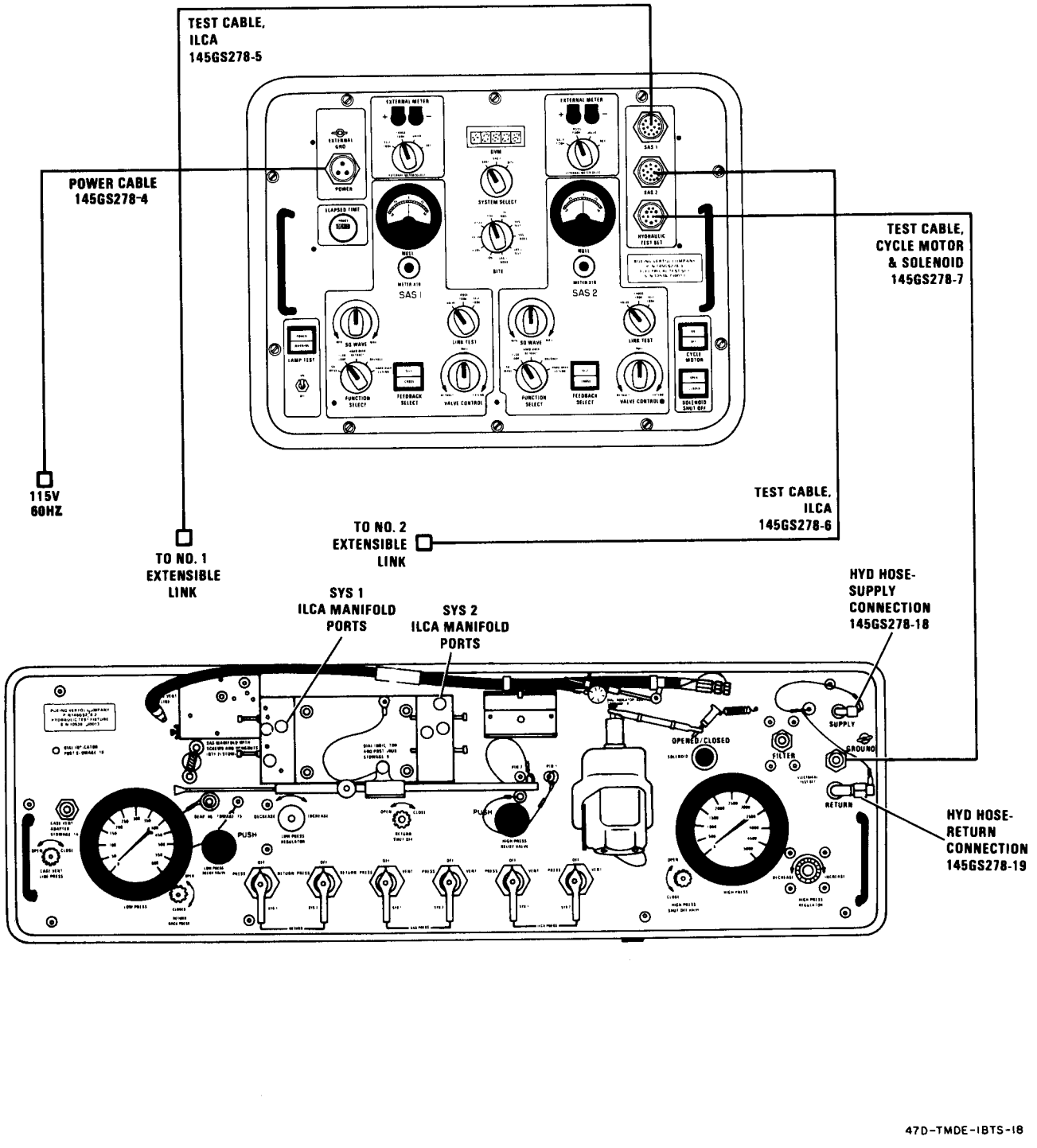


Figure 2-4. Test Set Electrical Cable Connections

b. Release four latches and remove the cover from the electrical unit.

c. Check contents of unit against the inventory on the label inside the cover or table 1-1.

d. Release six latches and remove the cover from the hydraulic unit.

e. Check contents of unit against the inventory on the label inside the cover or table 1-2.

f. Remove power cable 145GS278-4 from the cover of the electrical unit. Connect the POWER plug to the POWER connector on the electrical unit. (See fig. 2-4.)

g. Remove cycle motor and solenoid test cable 145GS278-7 from the cover. Connect the ELECTRICAL UNIT plug to the HYDRAULIC TEST SET receptacle. Do not connect the HYDRAULIC UNIT plug.

h. Connect a ground wire between the EXTERNAL GND terminal and a shop ground. Check that the electrical unit power switch is at OFF. Connect the power cable to a 115-volt 60 Hz ac power source.

i. Set the electrical unit power switch to ON. Check that the POWER indicator of the LAMP TEST switch comes on.

j. Press and hold the LAMP TEST switch. Check that the upper and lower indicators are on in the following switches:

(1) LAMP TEST switch.

(2) Both FEEDBACK SELECT switches.

(3) CYCLE MOTOR switch.

(4) SOLENOID SHUTOFF switch.

k. Release the LAMP TEST switch. Check that one light within each switch goes out.

l. Check that the CYCLE MOTOR switch is at OFF.

m. Check that the SOLENOID SHUTOFF switch is at CLOSED.

n. Set the power switch to OFF.

o. Remove pressure hose 145GS278-18 and return hose 145GS278-19 from the stowed position inside the hydraulic unit cover.

p. Remove dial indicator 145GS278-9 from the stowed position on the ILCA manifold. Place the dial indicator in the cover of the hydraulic unit to prevent damage.

CAUTION

Make sure the plumbing of the shop hydraulic power supply is thoroughly purged/cleaned/filtered prior to use. Contaminants can damage the ILCA. Make sure filter kit ADHT6814M9716M is installed on the hydraulic power supply.

CAUTION

Before operation of hydraulic unit, check that there are no closed valves or blockages in the return line to the shop hydraulic power supply. Operation with blockage can result in damage to the low press gage.

q. At the hydraulic unit, remove the RETURN connection cap and the return hose plug. Connect the return hose to the RETURN connection. (See fig. 2-5.) Connect the other end to the hydraulic power supply.

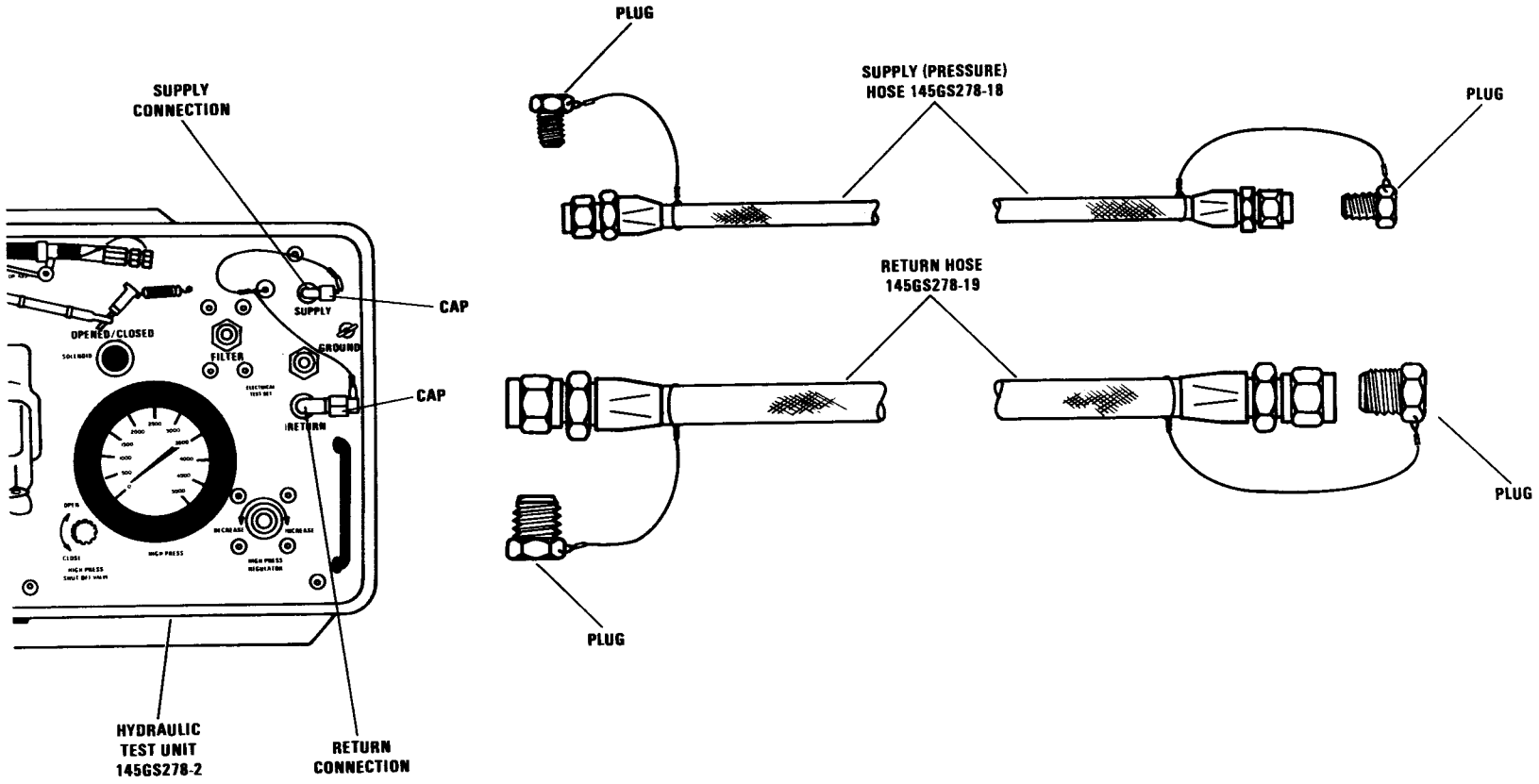


Figure 2-5. Hydraulic Unit Hose Connections

r. Remove the SUPPLY connection cap and the supply hose plug. Connect the supply hose to the SUPPLY connection.

s. Connect the supply hose to the pressure port of the shop hydraulic power supply. The hydraulic power supply line shall have a needlc type shutoff valve. (See fig. 2-6.)

t. Check that the electrical unit controls are at their initial settings. (Refer to table 2-1.) The SOLENOID SHUTOFF switch, CYCLE MOTOR switch, and FEEDBACK SELECT switches cannot be set until power is applied. (Refer to para 2-7.)

u. Check that the hydraulic unit valves and controls are at their initial settings. (Refer to table 2-2.)

2-7. SELF TEST Procedures.

Perform the self test of the electrical and hydraulic units as follows:

a. Perform the preparation for use procedures in para 2-6.

b. Set the power switch to ON. Check that SOLENOID SHUTOFF switch is at close, CYCLE MOTOR switch is at OFF, and FEEDBACK SELECT switches are at CROSS. (Refer to table 2-1.)

NOTE

The SELF TEST procedure must be accomplished with SAS 1 and SAS 2 cables disconnected, Otherwise, self test indications can be incorrect

c. (See fig. 2-2.) Check that the BITE switch is at -20V and the SYSTEM SELECT switch is at BITE. The DVM shall indicate -19 to -21.

d. Set the BITE switch to +20V. The DVM shall indicate +19 to +21.

e. Set the BITE switch to –12V. The DVM shall indicate –11 to –13.

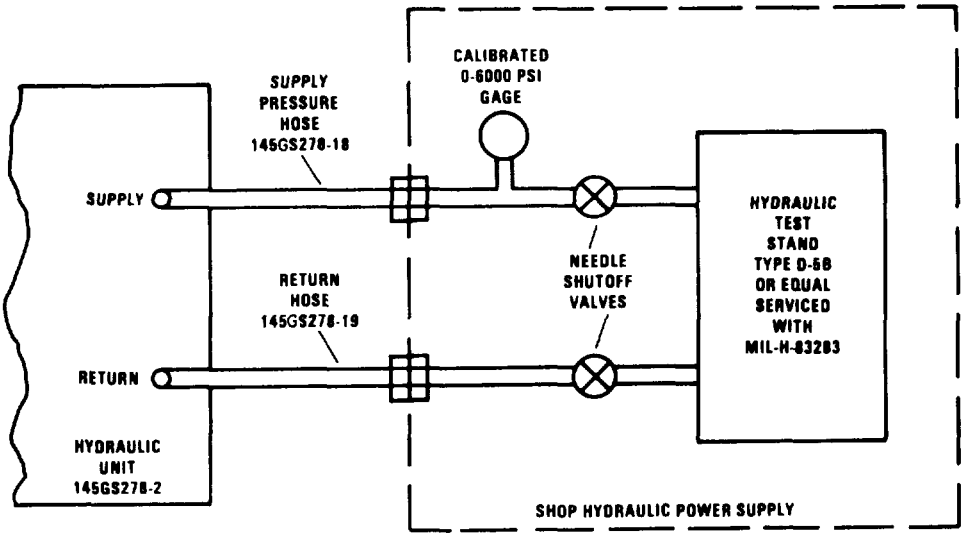


Figure 2-6. Hydraulic Unit Operating Setup

Table 2-1. Initial Settings of Controls, Electrical Unit

SWITCH IDENTIFICATION	SWITCH POSITION REQUIRED
Power switch	ON
Both FUNCTION SELECT switches	CLSD LOOP
Both FEEDBACK SELECT switches	CROSS
Both VALVE CONTROLS	NULL
Both SQ WAVE controls	MINIMUM
Both LINK TEST switches	VALVE
Both EXTERNAL METER SELECT switches	SELF FDBK
BITE switch	−20V
SYSTEM SELECT switch	BITE
SOLENOID SHUTOFF switch	CLOSED
CYCLE MOTOR switch	OFF
LAMP TEST switch	Released (out)
Power switch	OFF

Table 2-2. Initial Settings of Controls, Hydraulic Unit

VALVE/WITCH IDENTIFICATION	VALVE/WITCH POSITION
CASE VENT LINE PRESS valve	Full CLOSE
RETURN BACK PRESS valve	Full CLOSE
LOW PRESS REGULATOR valve	Full DECREASE
CAUTION **The RETURN SHUTOFF VALVE shall be at OPEN unless otherwise required for a specific test.**	
RETURN SHUTOFF VALVE	Full OPEN
Both RETURN valves	OFF
Both SAS PRESS valves	OFF
Both ILCA PRESS valves	OFF
HIGH PRESS SHUTOFF VALVE	Full CLOSE
HIGH PRESS SHUTOFF VALVE	Full CLOSE
HIGH PRESS REGULATOR valve	Full DECREASE
SOLENOID valve	CLOSED (in)

f. Set the BITE switch to +12V. The DVM shall indicate +11 to +13.

g. Set the BITE switch to +5V. The DVM shall indicate +4.5 to +5.5.

h. Set the BITE switch to 13V RMS. The DVM shall indicate +12 to +14.

i. Set the BITE switch to SAS 1 CROSS. The DVM shall indicate + 1.0 ±0.05 volt. SAS 1 NULL meter shall read 10 ±2 microamps.

j. Press the SAS 1 FEEDBACK SELECT switch to SELF. Set the BITE switch to SAS 1 SELF. The DVM shall indicate + 1.0 ±0.05 volt. SAS 1 NULL meter shall read 10 ±2 microamps.

k. Set the BITE switch to SAS 2 CROSS. The DVM shall indicate + 1.0 ±0.05 volt. SAS 2 NULL meter shall read 10 ±2 microamps.

l. Set the BITE switch to SAS 2 SELF. Press the SAS 2 FEEDBACK SELECT switch to SELF. The DVM shall indicate + 1.0 ±0.05 volt. SAS 2 NULL meter shall read 10 ±2 microamps.

(1) Servo Amplifier Valve Drive Test. Set SYSTEM SELECT to SAS 1.

(2) Set SAS 1 link test switch to VALVE,

(3) Set SAS 1 FUNCTION SELECT switch to BALANCE,

(4) Connect breakout adapter box (145GS278-20) to SAS 1 cable (145GS278-5) and SAS 1 of the tester. DVM reads 0 ±0.1 volt,

(5) Set SAS 1 FUNCTION SELECT switch to HARDOVER EXTEND. DVM reads +8.5 ±0.5 volts.

(6) Set SAS 1 FUNCTION SELECT switch to HARDOVER RETRACT. DVM reads –8.5 ±0.5 volts.

(7) Disconnect breakout adapter box. Set SYSTEM SELECT switch to SAS 2.

(8) Set SAS 2 link test switch to VALVE,

(9) Set SAS 2 FUNCTION SELECT switch to BALANCE.

(10) Connect breakout adapter box (145GS278-20) to SAS 2 cable (145GS278-6) and SAS 2 of the tester. DVM reads 0 ±0.1 volt.

(11) Set SAS 2 FUNCTION SELECT switch to HARDOVER EXTEND. DVM reads +8.5 ±0.5 volts.

(12) Set SAS 2 FUNCTION SELECT switch to HARDOVER RETRACT. DVM reads -8.5 ±0.5 volts.

(13) Set SAS 1 and SAS 2 FUNCTION SELECT switch to BALANCE.

(14) Disconnect breakout adapter box.

m. Connect the ELECTRICAL TEST SET connector to the HYDRAULIC UNIT RECEPTACLE.

n. Press the CYCLE MOTOR switch to ON. The cycle motor shall rotate. The CYCLE MOTOR switch OFF light shall go out and the ON light shall come on.

o. Press the CYCLE MOTOR switch to OFF. The cycle motor shall stop. The CYCLE MOTOR switch ON light shall go out and the OFF light shall come on.

p. (Fig. 2-3.) On the hydraulic unit, pull the SOLENOID valve to OPEN position. The valve knob light shall not come on.

q. (Fig. 2-2.) On the electrical unit, press the SOLENOID SHUTOFF switch to OPEN. The CLOSED light shall go out and the OPEN light shall come on. On the hydraulic unit, the SOLENOID valve light shall come on.

r. (Fig. 2-3.) Press the SOLENOID valve down to CLOSED position. The knob light shall go out.

s. Pull the SOLENOID valve to OPEN position. The knob light shall come on.

t. (Fig. 2-2.) On the electrical unit, press the SOLENOID SHUTOFF switch to CLOSED. The SOLENOID SHUTOFF OPEN light shall go out, and the CLOSED light shall come on. On the hydraulic unit, the SOLENOID valve knob light shall go out.

u. On the electrical unit, press the SOLENOID SHUTOFF switch to OPEN and then to CLOSED. The SOLENOID valve in the hydraulic unit shall be heard to operate.

v. Set all switches and valves to the positions listed in tables 2-1 and 2-2.

w. Perform fill and bleed procedures (para 2-8) and high pressure self test (para 2-9) before mounting a component to be tested.

2-8. Fill and Bleed Procedures.

Fill and bleed procedures are to be accomplished any time air has entered the lines or the hydraulic unit is disconnected from the hydraulic test stand. A 2-quart container with a pint of clean hydraulic fluid is required. If leaks occur, shut down the equipment and repair the leak. Fill and bleed as follows:

WARNING

Hydraulic fluid is toxic. It can irritate skin and cause burns. Avoid inhaling. Use only with adequate ventilation. Avoid contact with skin, eyes, or clothing. In case of contact, immediately flush skin or eyes with water for at least 15 minutes. Get medical attention for eyes.

a. Set the switches and valves to the initial settings. (Tables 2-1 and 2-2.)

b. Perform the self-test procedures in para 2-7.

c. (Fig. 2-3.) Check that the hydraulic unit HIGH PRESS and LOW PRESS gauges indicate O, within 1 scale division.

d (Fig. 2-6.) Check that the hydraulic supply valve is closed and the return valve is open.

e. Start the shop hydraulic power supply. Adjust for 500 psi and 1.5 gpm output.

j (Fig. 2-2.) Set the electrical unit power switch to ON. The LAMP TEST and POWER light shall come on. Press the SOLENOID SHUTOFF switch to OPEN.

g. (Fig. 2-6.) Check that the external hydraulic power supply valve on the return line is open. Then open the valve on the pressure supply line.

CAUTION

Do not operate SOLENOID SHUTOFF VALVE when the HIGH PRESSURE REGULATOR is at partial or full increase. The HIGH PRESSURE gauge can be damaged.

h. (Fig. 2-3.) Pull the SOLENOID valve to OPEN. The LOW PRESS gauge shall indicate 50 to 60 psi. The SOLENOID lens light shall come on.

i. Rotate the HIGH PRESS REGULATOR toward INCREASE until the HIGH PRESS gauge increases 50 psi.

WARNING

If the HIGH PRESS SHUTOFF VALVE is opened too fast, excessive fluid under pressure can flow from the check valve, Personnel injury can result.

j. PUSH and hold the HIGH PRESS RELIEF VALVE while opening the HIGH PRESS SHUTOFF VALVE. Hold this condition for 1 minute to bleed air from the hydraulic unit, Release the HIGH PRESS RELIEF VALVE after 1 minute.

k. CLOSE the HIGH PRESS SHUTOFF VALVE.

l. Remove six covers from the check valves in the ILCA manifold.

m. Set the ILCA PRESS SYS 1 selector valve to PRESS.

WARNING

If the HIGH PRESS SHUTOFF VALVE is opened too fast, excessive fluid under pressure can flow from the check valve. Personnel injury can result.

n. (See fig. 2-7.) Press and hold the ILCA manifold check valve plunger P1. At the same time, crack (CCW) the HIGH PRESS SHUTOFF VALVE to control the flow of bleed fluid from the check valve. Wipe up excess fluid with a cloth. Continue to bleed until flow from the check valve is air free.

NOTE

If the plunger on the check valve cannot be pressed, set the selector valve to VENT, press the plunger, and rotate the selector valve to PRESS.

o. (See fig. 2-3.) CLOSE the HIGH PRESS SHUTOFF VALVE.

p. Set the ILCA PRESS SYS 1 selector valve to OFF.

q. Set the SAS PRESS SYS 1 selector valve to PRESS.

WARNING

If the HIGH PRESS SHUTOFF VALVE is opened too fast, excessive fluid under pressure can flow from the check valve. Personnel injury can result.

r. (See fig. 2-7.) Press and hold the ILCA manifold check valve S1 plunger. At the same time, crack the HIGH PRESS SHUTOFF VALVE to control the flow of bleed fluid from the check valve. Wipe up excess fluid with a cloth. Continue bleeding until flow is air free.

s. (See fig. 2-3.) CLOSE the HIGH PRESS SHUTOFF VALVE.

t. Set the SAS PRESS SYS 1 selector valve to OFF.

u. Set the ILCA PRESS SYS 2 select valve to PRESS.

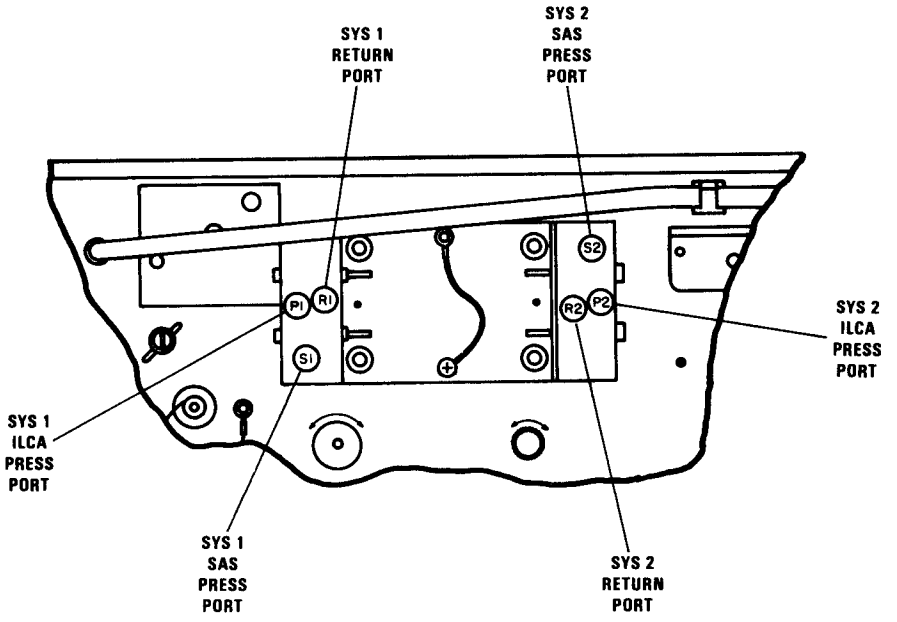


Figure 2-7. ILCA Manifold Check Valve Locations

If the HIGH PRESS SHUTOFF VALVE is opened too fast, excessive fluid under pressure can flow from the check valve. Personnel injury can result.

v. (See fig. 2-7.) Press and hold the ILCA manifold check valve P2 plunger. At the same time, crack the HIGH PRESS SHUTOFF VALVE to control the flow of bleed fluid from the check valve. Wipe up excess fluid with a cloth. Continue bleeding until flow is air free.

w. (See fig. 2-3.) CLOSE the HIGH PRESS SHUTOFF VALVE.

x. Set the ILCA PRESS SYS 2 selector valve to OFF.

y. Set the SAS PRESS SYS 2 selector valve to PRESS.

WARNING

If the HIGH PRESS SHUTOFF VALVE is opened too fast, excessive fluid under pressure can flow from the check valve. Personnel injury can result.

z. Press and hold ILCA manifold check valve S2 plunger. At the same time, crack the HIGH PRESS SHUTOFF VALVE to control the flow of bleed fluid from the check valve. Wipe up excess fluid with a cloth. Continue bleeding until flow is air free.

aa. CLOSE the HIGH PRESS SHUTOFF VALVE.

ab. Set the SAS PRESS SYS 2 selector valve to OFF.

ac. Rotate the HIGH PRESS REGULATOR ccw to full DECREASE.

ad. PUSH (open) the LOW PRESS RELIEF VALVE. Hold open for 1 minute.

ae. Free the end of the CASE VENT hose and remove the plug. Place the end of hose in a container, with the end submerged in clean hydraulic fluid.

af. Rotate the CASE VENT LINE PRESS valve toward OPEN to bleed air from the CASE VENT system. Continue to bleed for 10 seconds after flow is air free.

ag. CLOSE the CASE VENT LINE PRESS valve.

ah. Install the plug in the CASE VENT hose. Secure the CASE VENT hose.

ai. Set the RETURN SYS 2 selector valve to PRESS.

aj. (See fig. 2-7.) Press and hold the ILCA manifold check valve R2 plunger. At the same time, crack the RETURN BACK PRESS valve toward OPEN to control bleed flow from the check valve. Wipe up excess fluid with a cloth. Continue bleeding until flow is air free.

ak. (See fig. 2-3.) CLOSE the RETURN BACK PRESS valve. Set RETURN SYS 2 selector valve to OFF.

al. Set the RETURN SYS 1 selector valve to PRESS.

am. (See fig. 2-7.) Press and hold ILCA manifold check valve R1 plunger. At the same time, crack the RETURN BACK PRESS valve toward OPEN to control fluid flow from the check valve. Wipe up excess fluid with a cloth. Continue bleeding until flow is air free.

an. (See fig. 2-3.) CLOSE the RETURN BACK PRESS valve. Set RETURN SYS 1 selector valve to OFF.

ao. Perform a high pressure self-test (para 2-9) before mounting a component for test. If a component is not to be mounted, perform a normal shutdown (para 2-10).

ap (Fig. 2-3.) On the electrical unit, press the SOLENOID SHUTOFF switch to CLOSE. The OPEN light shall go out and the CLOSE light shall come on. On the hydraulic unit, the SOLENOID valve light shall go out.

aq On the hydraulic unit, push the SOLENOID valve to CLOSED.

2-9. High Pressure Self-Test.

The high pressure self-test must be performed prior to test set operation to ensure satisfactory operation of the hydraulic unit SOLENOID valve and HIGH PRESS RELIEF VALVE. Proceed as follows:

a. Perform the preparation for use procedures (para 2-6).

b. Perform the self test procedures (para 2-7),

c. Perform the fill and bleed procedures (para 2-8).

d. Check that the switches and valves are at their initial settings (tables 2-1 and 2-2).

e. Adjust the shop hydraulic power supply for 2600 psi. Open the supply needle valve.

f. (Fig. 2-3.) Rotate the HIGH PRESS REGULATOR to full INCREASE. Observe the HIGH PRESS gage for one minute. The pressure indication shall not increase.

g. Rotate the HIGH PRESS REGULATOR to full DECREASE.

h. (Fig. 2-2.) Set the electrical unit POWER switch to ON. The LAMP TEST switch POWER light shall come on.

i. Press the electrical unit SOLENOID SHUTOFF valve switch to OPEN. The switch OPEN light shall come on and the CLOSED indicator light shall go out.

j. (Fig. 2-3.) Open the hydraulic unit SOLENOID valve. HIGH PRESS and LOW PRESS gages shall indicate pressure.

k. Rotate the HIGH PRESS REGULATOR toward INCREASE until the HIGH PRESS gage indicates 1000 psi,

1. Rotate the HIGH PRESS SHUTOFF VALVE to OPEN.

m. Push on the HIGH PRESS RELIEF VALVE. Fluid flow through the valve shall be heard. Release the valve.

NOTE

At this point the test set is ready for use. If components are to be mounted for testing, perform normal shutdown (para 2-10).

NOTE

The test set is ready for use. If ILCA or extensible link tests are to be performed, refer to the test procedures in TM 55-1520-240-23.

2-10. Normal Shutdown Procedures.

Normal shutdown procedures shall be followed when component test procedures are complete and no other test procedures are scheduled or when shutdown is required during test operations. Proceed as follows:

a. (Fig. 2-2.) Check that the electrical unit CYCLE MOTOR switch is at OFF. (See fig. 2-3.) Position the cycle motor linkage in stored position.

b. Check that the hydraulic unit HIGH PRESS REGULATOR is at full DECREASE.

c. Rotate the HIGH PRESS SHUTOFF VALVE to CLOSE.

d. Set both ILCA PRESS and SAS PRESS valves to VENT.

e. (Fig. 2-6.) Reduce the shop hydraulic supply pressure to zero and close the supply (pressure) valve.

f. (See fig. 2-3.) PUSH and hold the LOW PRESS RELIEF VALVE and HIGH PRESS RELIEF VALVE. Release the relief valves after 15 seconds.

g. Set the RETURN, SAS PRESS, and ILCA PRESS valves to OFF.

h. Press the hydraulic unit SOLENOID valve to CLOSED. Pressure indications on the LOW and HIGH PRESS gages shall drop to 0 and the SOLENOID valve light shall go out.

i. (See fig. 2-2.) Set the electrical unit SOLENOID SHUTOFF switch to CLOSED. The switch OPEN light shall go out and the CLOSED light shall come on.

j. Set the electrical unit power switch to OFF. The LAMP TEST switch POWER light shall go out.

NOTE

The test set is ready for use. If ILCA or extensible link tests are to be performed, refer to the test procedures in TM 55-1520-240-23.

2-11. Emergency Shutdown Procedures.

When there is not sufficient time to perform a normal shutdown, perform an emergency shutdown as follows:

a. Shut down hydraulic pressure by performing the task that is most expedient:

(1) (See fig. 2-3.) Push the SOLENOID valve knob on the hydraulic unit to CLOSED.

(2) (See fig. 2-2.) Push the SOLENOID SHUTOFF switch on the electrical unit to CLOSED.

(3) Set the electrical unit power switch to OFF.

(4) (See fig. 2-6.) Close the shop hydraulic SUPPLY needle valve.

6. Following an emergency shutdown, secure the test set as follows:

(1) (See fig. 2-3.) Set the ILCA PRESS and SAS PRESS selector valves to VENT and then to OFF.

(2) Set the RETURN selector valves to RETURN and then to OFF.

(3) PUSH and hold the HIGH PRESS and LOW PRESS RELIEF VALVES. Release the valves after 15 seconds.

(4) Set the HIGH PRESS SHUTOFF VALVE to CLOSED

(5) Set the HIGH PRESS REGULATOR to DECREASE.

c. Correct reason for emergency shutdown prior to reapplying power.

2-12. Disconnect and Securing Procedures.

Proceed as follows:

u. (See fig. 2-.3.) Check that the electrical unit power switch is at OFF.

b. Disconnect the CYCLE MOTOR and SOLENOID cable, the power cable, and the NO. 1 and NO. 2 system electrical cables from the hydraulic and electrical unit receptacles. Stow the cables in the cover of the electrical unit. (See fig. 1-2.)

c. Disconnect the SUPPLY and RETURN hoses from the hydraulic power supply and the hydraulic unit. Drain fluid and plug the ends of each hose. Plug the SUPPLY and RETURN ports.

d. (See fig. 1-3.) Secure the CASE VENT LINE hose to the hydraulic unit panel.

e. Secure the 5-in. dial indicator, contact point to the left, to the ILCA manifold, using the thumb screw.

f. Stow the bearing using PIN 3. Stow PIN 1 and PIN 2.

g. Stow the extensible link test covers, force gage, SUPPLY hose and RETURN hose in the cover of the hydraulic unit. (See fig. 1-4.)

h. Plug the CASE VENT ADAPTER. Stow it on the left side.

i. Install protective covers on the ilca manifold check valves and the extensible link manifold ports.

j. Wipe spilled fluid from the unit.

k. Close the door over cables and manuals in the cover of the electrical unit.

l. Position the covers on thd electrical and hydraulic unit. Secure the covers.

SECTION III PREVENTIVE MAINTENANCE CHECKS AND SERVICES

2-13. Preventive Maintenance.

Preventive maintenance is the systematic care, servicing, and inspection of equipment to prevent the occurrence of trouble, to reduce out-of-service time, and to ensure that the equipment is serviceable.

a. Systematic Care. The procedures in para 2-14 cover routine systematic care and cleaning essential to proper upkeep and operation of the test set.

b. Preventive Maintenance Checks and Services. The preventive maintenance checks and services chart (para 2-14) outlines functions to be performed at specific intervals. These checks and services are performed to maintain the test set in serviceable condition; that is, in good general (physical) condition and in good operating condition. Certain checks are performed before, during, and after operation of the test set.

(1) Before you operate. Perform your *before* (B) checks and services.

(2) While you operate. Keep in mind the WARNINGS in the self test, fill and bleed, and high pressure self test procedures (para 2-7 through 2-9). Perform your *during* (D) checks. If the test set fails to operate, troubleshoot using the specified test equipment and the procedures in Chapters 4 and 5. Report deficiencies using the proper forms. (Refer to TM 38-750.)

(3) After you operate. Perform your *after* (A) checks.

2-14. Operator Preventive Maintenance Checks and Services Chart.

WARNING

Dry cleaning solvent is combustible and toxic. It can irritate skin and cause burns. Use only with adequate ventilation, away from open flame. In case of contact, immediately flush skin or eyes with water for at least 15 minutes. Get medical attention for eyes.

NOTE

Within designated interval, these checks are to be performed in the order listed.

B-Before D-During A-After

Item No.	Interval B	Interval D	Interval A	Item to be Inspected	Procedures Check for and have repaired or adjusted as necessary	Equipment Is Not Ready/ Available If:
1			●	Case and cover	Clean exterior, using cloth. For stubborn dirt, use cloth damp with cleaning solvent.	
2	●			Nameplate	Condition, legibility.	
3	●			Handles	Condition, secure mounting, positive closure.	
4	●			Latches	Condition, secure mounting.	
5	●			Air valve	Cleanliness, operation.	
6	●			Cables	Insulation for condition. Repair damaged insulation using tape. Connector shells for condition. Replace cable if shell is damaged. Contacts for cleanliness. Clean as required. Straighten bent pins.	
6.1	●			Adapter	Aluminum box for damage which interferes with use. Receptacle pins for straightness and cleanliness. Clean or straighten pins as required. Binding posts for thumb nuts and condition of thread.	
7	●			Panel	Clean, using paint brush. For stubborn dirt, use cloth damp with cleaning solvent.	
8	●			Receptacles	Straightness of pins. Straighten bent pins.	Damage exceeds bent pins.
9	●			Control knobs	Tight on shaft. Tighten setscrew if necessary.	
				lights	place if damaged.	
11	●			Meters and gage	Condition, secure mounting. Check glass for cracks.	Glass is cracked.
12	●			Variable resistors (controls)	Smooth operation. Secure mounting. Tighten loose controls.	Control operation is rough or erratic.
13			●	Elapsed time indicator	Appropriate change since last check.	

Item No.	Interval B	D	A	Item to be Inspected	Procedures Check for and have repaired or adjusted as necessary	Equipment Is Not Ready/ Available If:
14	•			Rotary switches	Secure mounting, positive detent. Tighten loose switches.	Switch detents are not positive.
15	•			Hoses	Cracks, breaks, frayed covering and weak spots. Replace damaged or defective hoses.	
16	•			ILCA manifold check valves	Bent shaft and distortion. Replace defective check valve.	
17	•			ILCA manifold, SAS manifold, relief valve adapter, preformed packings	Condition. Replace if defective.	
18	•			Dial indicating post	Damage which prevents securing dial indicators. Replace post.	
19	•			Control and selector valves	Leaks, loose hardware and proper operation. Tighten hardware or replace valve.	
20	•			Dial indicators	Bent shafts, smooth operation, condition of lens, proper attachment. Replace defective indicator.	
21	•			Rig pins	Damage which prevents proper insertion. Replace defective pin.	
22	•			Push-on push-off switches	Secure mounting and positive operation.	Requirements of check are not met.
23	•			Momentary switches	Secure mounting and positive operation.	Requirements of check are not met.
24	•			Toggle switch	Secure mounting and positive operation.	Requirements of check are not met.
25	•			Filter contamination indicator	Check for extended indicator. If extended, reset with hydraulic power applied.	Requirements of check are not met.

Item No.	Interval B	Interval D	Interval A	Item to be Inspected	Procedures Check for and have repaired or adjusted as necessary	Equipment Is Not Ready/ Available If:
				POWER ON CHECKS		
2 6	●			Test set	Perform self test and fill and bleed procedures (para 2-7 and 2-8). During self-test, check cycle motor for binding or excessive vibration.	Binding or vibration are excessive or other requirements of check are not met.
2 7	●			Test set	Perform high press self test (para 2-9).	Requirements of check are not met.
2 8		●		Test set	Perform shutdown (para 2-10).	

Chapter 3

AVIM OPERATOR'S MAINTENANCE INSTRUCTIONS

3-1. General.

This chapter provides procedures for maintenance tasks authorized at the operator's level. Except for the procedures covered in this chapter, no special maintenance instructions are required. Tool Kit TK-100/G is required. Repair at this level is limited to:

a. Lamp and lens replacement.

b. Knob and handle replacement.

c. Hose replacement.

d. Rig and retaining pin replacement.

e. Manifold component replacement.

f. Accessory replacement.

g. Crank arm and driver replacement.

h. Electrical cable repair.

3-2. Servicing.

a. Servicing is limited to lubrication of the cycle motor gear box. (Refer to para 3-5 b.)

b. No special tools or test equipment are required to perform operator's maintenance on the test set.

3-3. Cleaning.

a. Inspect the exterior of the equipment. The exterior surfaces should be free of dust, dirt, hydraulic fluid, grease, and fungus. Remove dust and loose dirt with a clean, soft cloth.

WARNING

Dry cleaning solvent is combustible and toxic. It can irritate skin and cause burns. Use only with adequate ventilation, away from open flame. In case of contact, immediately flush skin or eyes with water for at least 15 minutes. Get medical attention for eyes.

b. Remove grease, fungus, and ground-in dirt from the equipment using a cloth damp with dry cleaning solvent (item 1, table 3-1).

CAUTION

Do not press on the glass of the null meters or hydraulic gages. Damage can result.

c. Clean the front panel, meters, gages, control knobs, and switches. Use a clean, soft cloth. If necessary, dampen the cloth (item 2, table 3-1) with water. Mild soap (item 3, table 3-1) can be used for more effective cleaning.

Table 3-1. Consumable Materials, A VIM Operator

ITEM NUMBER	NOMENCLATURE	MILITARY SPECIFICATION
1	Dry Cleaning Solvent	P-D-680, Type 2
2	Cloth, Cleaning	CCC-C-46A
3	Soap, Toilet, Liquid and Paste	P-S-624
4	Epoxy Primer	MIL-P-23377
5	Hydraulic Fluid	MIL-H-83282
6	Cloth, Abrasive, Type II Class 1, 220 Grit or Finer	GGG-C-520
7	Naphtha, Aliphatic, Type II	TT-N-95
8	Enamel, Light Gray, Type 111 Class 2	MIL-E-15090
9	Urethane Coating, Light Gray Color No. 26492	MIL-C-83286
10	Urethane Coating, Black, Color No. 17038	MIL-C-83286
11	Oil, Lubricating	Bodine No. LO 38

3-4. Touchup Painting.

a. Remove corrosion from metal surfaces by sanding them with abrasive cloth (item 6, table *3-1).*

WARNING

Naphtha is combustible and toxic. It can irritate skin and cause burns. Use only with adequate ventilation, away from open flame. In case of contact, immediately flush skin or eyes with water for at least 15 minutes. Get medical attention for eyes.

b. Clean sanded surfaces using aliphatic naphtha (item 7, table *3-1).*

c. Apply epoxy primer MIL-P-23377 (item 4, table 3-1) to sanded areas.

d. Apply finish coats as follows:

(1) Case finish - Light gray enamel MIL-E-15090 semi-gloss, Type 111, class 2 (item 8, table 3-l).

(2) Panel finish - Light gray urethane coating MIL-C-83286, color 26492 (item 9, table 3-1).

(3) Panel markings - Black urethane coating MIL-C-83286, color 17038 (item 10, table 3-1).

e. Refer to applicable cleaning and refinishing practices in TM 43-0139.

3-5. Lubrication.

a. Switches, crank arm bearings and the bearing secured by No. 3 rig pin, are permanently lubricated. No lubrication is required.

b. The hydraulic unit cycle motor gear box is lubricated with oil (item 11, table 3-1). Add oil as follows: (See fig. 3-1.)

(1) Remove the oil level plug.

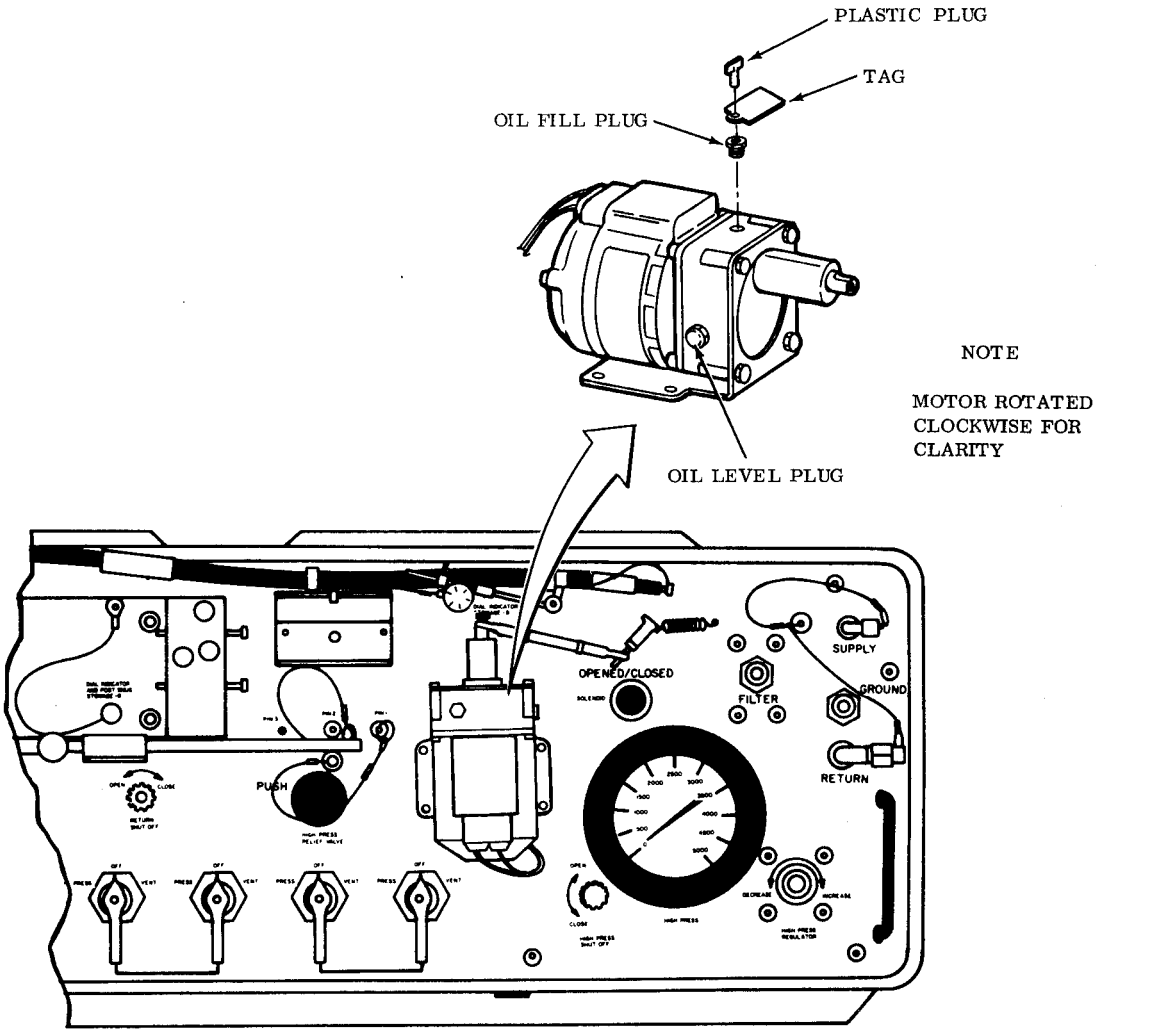


Figure 3-1. Cycle Motor Gear Box Servicing

(2) Remove the oil fill plug.

(3) Add oil through the fill port until oil appears at the oil level port.

(4) Install the oil level and oil fill plugs.

3-6. Electrical Unit Push On/Push Off Switch Lamp Replacement.

a. (See fig. 6-3.) Pry the lens retainer from the switch (64, 65,66, or 67). Use a knife blade or equal.

b. Remove the retainer and lens by pulling upon the retainer until the lens unsnaps from the switch.

c. Remove the lens and packing from the retainer.

d. Pull the defective lamp from the lamp socket. Use fingers to remove lamp.

e Insert the replacement lamp into the lamp socket. Use fingers to insert lamp.

f. Position the lens and packing into the retainer. Position the retainer on the switch.

g. Snap the retainer into position by pressing down.

h. Snap the lens into position by pressing down.

i. Perform an operational check of the lamp (para 2-6).

3-7. Electrical Unit Knob Replacement.

a. (See fig. 6-3.) Loosen the two recessed screws on the knob (49 and 50).

b. Remove the knob from the shaft.

c. Position the replacement knob on the shaft.

d. Tighten the two screws on the flat.

3-8. Hydraulic Unit SOLENOID Lamp Replacement.

a. (See fig. 6-4.) Unscrew the lens (51) from the SOLENOID switch (50).

b. Lift out the defective lamp.

c. Insert the replacement lamp.

d Position the lens on the switch and hand tighten.

3-9. Hydraulic Unit Selector Valve Handle Replacement.

a. Remove screw in top of selector valve.

b. Remove defective handle by pulling up.

c. Position the replacement handle on the valve.

d. Install the screw into the valve, Tighten the screw.

3-10. Hydraulic Unit Relief Valve Knob Replacement.

a. Remove knob by rotating counterclockwise. Do not remove the spring under the knob.

b. Make sure that spring is on shaft. Install replacement knob. Hand tighten the knob.

3-11. Hydraulic Unit Shutoff Valve Knob Replacement.

a. Pry round head pin from knob. Use a knife blade or equal.

b. Loosen the lock screw in the side of the knob.

c. Remove the knob from the valve shaft.

d Install the replacement knob on the valve shaft.

e . Tighten the lock screw in the side of the knob until it is flush with the outside of the knob.

f . Install round head pin into the knob. Tighten until the head is seated against the knob.

3-12. Hydraulic Unit HIGH PRESS REGULATOR Knob Replacement.

a. Rotate the knob one to two turns toward INCREASE.

b. Remove the retaining ring from the top of knob.

c. Rotate the knob toward DECREASE until it can be lifted from the valve.

d. Position the replacement knob on the valve. Rotate the knob toward INCREASE until the shaft extends through the knob with clearance for the retaining ring.

e. Install the retaining ring on the shaft.

3-13. Hydraulic Unit Cycle Motor Crank Arm Replacement.

a. (See fig. 6-4, sheet 3 of 4.) Remove the quick-release storage pin (45) from the crank arm.

b. (See fig. 6-7.) Remove the plug and loosen the smallest recessed screw (10) in the cycle motor driver crank (12).

C. Remove the bolt (2) and washer (7) securing the crank arm (3) to the driver crank (12). Remove the crank arm (3).

d. Install the bolt through the replacement crank arm bearing. Install the washer between the bearing and the driver crank. Install the bolt in the driver crank arm. Tighten the bolt.

e. Tighten the smallest recessed screw in the input arm and install the plug.

f. Store the crank arm using the quick-release storage pin.

3-14. Hydraulic Unit Cycle Motor Driver Crank Replacement.

a. Remove crank arm (para 3-13).

b. Loosen the two larger recessed screws (11) in the driver crank (12).

c. Remove the driver crank from the cycle motor shaft.

d. Install the replacement driver crank on the cycle motor shaft. Make sure the two larger recessed screws align with the slot in the motor shaft.

e. Attach the driver crank to the motor shaft by tightening the two larger recessed screws.

f. Attach the crank arm to the driver crank (para 3-13).

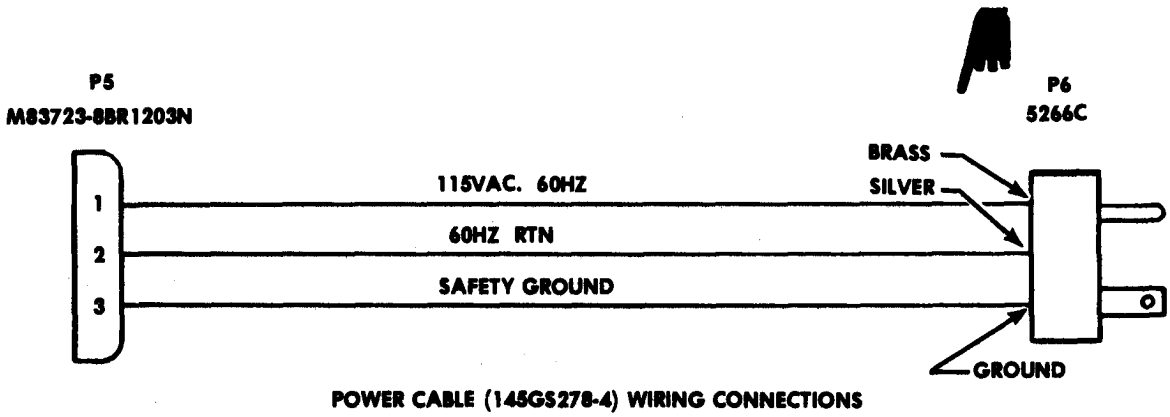
3-15. Hydraulic Unit ILCA Mount Bolt Replacement.

a. (See fig. 6-9.) Remove the roll pin (8) from the manifold (13).

b. Remove the mount bolt (9) and washer (10).

c. Install washer and replacement bolt.

d. Install the roll pin.



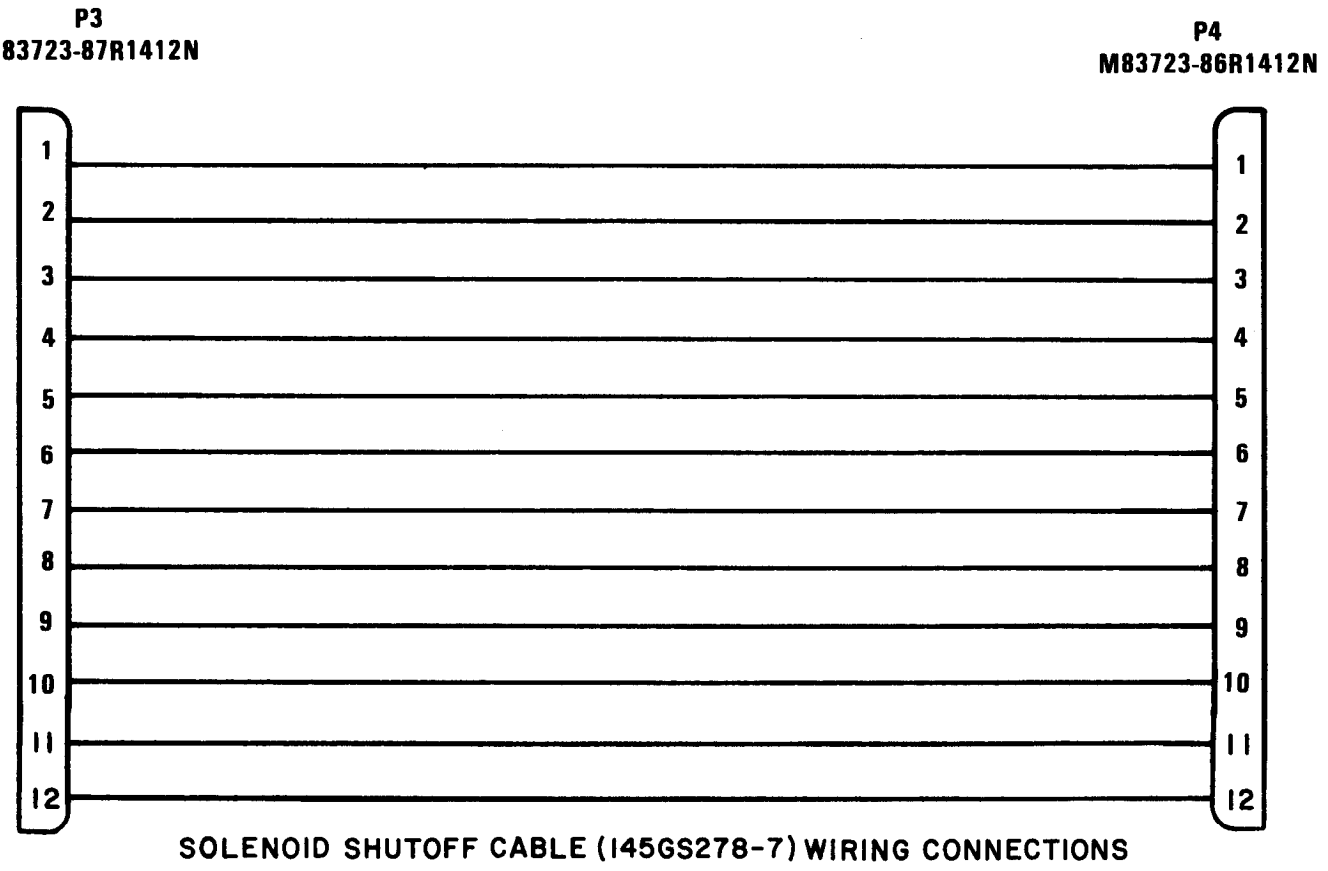
POWER CABLE (145GS278-4) WIRING CONNECTIONS

NOTE:

1. ALL WIRES NO. 16 AWG

Figure 3-2. Power Cable 145GS278-4 Wiring Connection

*U.S.Government Printing Office:1987-754-043/40609

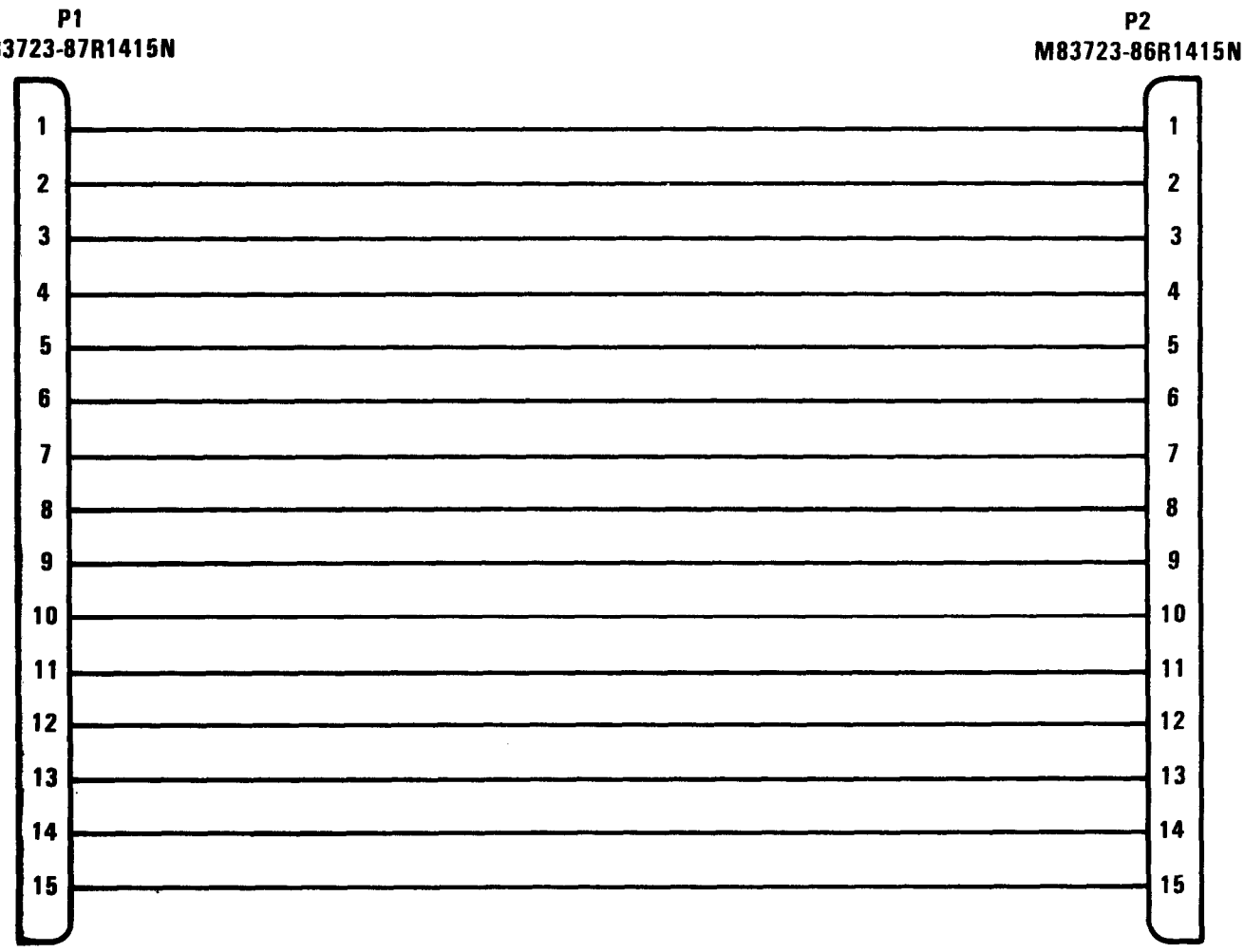


NOTE:

1. **ALL WIRES NO. 20 AWG**

47D-TMDE-IBTS-44

Figure 3-3. Solenoid Shutoff Cable 145GS278-7 Wiring Connections



AFCS NO.1 CABLE (145GS278-5)
AND
AFCS NO.2 CABLE (145GS278-6)
WIRING CONNECTIONS

NOTE:

1. ALL WIRES NO. 20 AWG

47D-TMDE-IBTS-46

Figure 3-4. AFCS 1 Cable 145GS278-5 and AFCS 2 Cable 145GS278-6 Wiring Connections

3.16. Hydraulic Unit ILCA Manifold Check Valve Replacement.

a. Remove the protective cap (2) from the defective check valve (5) (fig. 6-9).

b. Remove the check valve (5) and packing (3 and 4) by rotating counterclockwise.

c. Lubricate the replacement check valve body and bottom packing. Use clean hydraulic fluid (item 5, table 3-1).

d. Lubricate the packing with hydraulic fluid (item 5, table 3-1) and install the packing in the bottom annular groove on the check valve.

e. Screw the check valve into the manifold. When properly installed, the check valve is bottomed in the manifold.

f. Test the installation for leaks and perform the fill and bleed procedures (para 2-8).

g. Install the protective cap on the check valve.

3-17. Cable/Connector/Adapter Repair. (TM 55-1500-323-24).

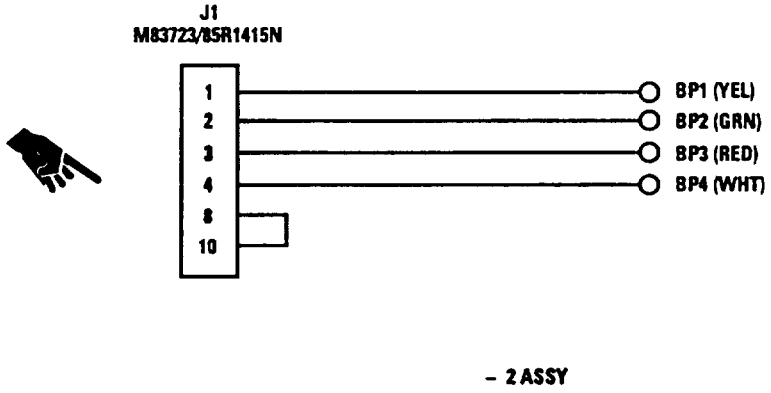


Figure 3-5. LVDT Test Adapter Wiring Diagram

Chapter 4

ELECTRICAL UNIT INTERMEDIATE MAINTENANCE

SECTION I TROUBLESHOOTING

4-1. General Instructions.

a. Troubleshooting procedures are provided in logic tree format. They are correlated to power supply and DVM tests (para 4-40) and final test (para 4-42). Use the schematic diagrams *(FO-1, fig 1-6 through 1-9, and FO-2)* and the wiring diagram (FO-21) as aids in troubleshooting. For each failure that can occur during the tests, there is a trouble symptom with a similar title. The troubleshooting is also presented in the sequence as the tests. Find the troubleshooting paragraph which corresponds to the test paragraph. Then use the logic tree to isolate the defective circuit or component.

b. During troubleshooting, observe the following precautions.

(1) Perform continuity and resistance checks with electrical power off.

(2) When measuring voltage, use tape or plastic sleeving (spaghetti) to insulate the entire test probe, except for the extreme tip.

WARNING

High voltage (115-volt 60 Hz ac) is used in this equipment. Death on contact or serious injury can result if personnel do not observe safety precautions. Be careful not to touch high voltage connections when performing maintenance.

4-2. Test Equipment Required. For test equipment required, see table 4-1.

Table 4-1. Equipment Required for Troubleshooting Electrical Unit

QUANTITY REQUIRED	EQUIPMENT	SPECIFICATION
1 ea.	Digital Multimeter	AC: 50 mV to 150V, 0.5% DC: 10 mV to 50V, 0.1%
1 ea.	Frequency Counter	0.5 Hz to 1 KHz, 0.1%
1 ea.	Oscilloscope, Dual Trace	0 to 10 MHz, 1 us to 500 ms/div 5 mV to 20V/div
1 ea.	Autotransformer, Variable	0-150 Vac, 1500 W
1 ea.	Test Aid, Locally Fabricated	13 Vac to 0-6 Vat, in-phase or out-of-phase (fig. 4-1)
2 ea.	Load Resistor, 2000 Ohms, 1 Watt	
1 ea.	Tool Kit TK- 101/G	

NOTE

Page identification for foldout pages has been designated as FO-1, FO-2, etc. and the pages are placed in the back of the manual at time of printing. Upon receipt of this manual, insert foldout pages FO-4 through FO-20 after page 4-2.

SECTION II MAINTENANCE PROCEDURES (AVIM)

4-17. General.

Electrical unit Aviation Intermediate Maintenance (AVIM) procedures are those accomplished with the panel removed from the case. Procedures include inspection and cleaning of the interior, replacement of components, and adjustment and testing. Test equipment required for maintenance is listed in table 4-1. Consumables are included in table 4-2.

WARNING

High voltage (115-volt 60-Hz ac) is used in this equipment. Death on contact or serious injury can result if personnel do not observe safety precautions. Be careful not to touch high voltage connections when performing maintenance.

Table 4-2. Consumable Materials

ITEM NUMBER	NOMENCLATURE	MILITARY SPECIFICATION OR SUPPLIER
1	Dry Cleaning Solvent	P-D-680
2	Cloth, Cleaning	CCC-C-46
3	Solder	QQ-S-571
4	Contact Cleaner	MIL-C-83360
5	Naphtha	TT-N-95
6	Adhesive EC1870	MMM Co

4-18. Removal of Panel.

a. Release four latches and remove the cover from the case.

b. Loosen 10 captive screws (55, fig. *6-3)* securing the panel/chassis (7, fig. *6-1)* to the case.

c. Lift the panel from the case. Use the handles.

d Remove three screws (2, fig. 6-3) securing the rear hinged panel to the chassis. Open the rear panel.

4-19. Inspection.

a. Make sure the rear panel can be opened and closed without binding.

b. Inspect all parts for loose or missing mounting hardware.

c. Inspect the power supplies and circuit boards for overheated or cracked components.

d. Make sure meter cases are not cracked or otherwise damaged.

e. Inspect wiring. Make sure wires are not broken or insulation frayed or otherwise damaged.

4-20. Cleaning.

a. Remove dust and dirt from the interior of the test set. Use a stiff bristle brush and cleaning cloth CCC-C-46.

WARNING

Dry cleaning solvent is combustible and toxic. It can irritate skin and cause burns. Use only with adequate ventilation, away from open flame. In case of contact, immediately flush skin or eyes with water for at least 15 minutes. Get medical attention for eyes.

b. For stubborn stains on the chassis, use cleaning cloth CCC-C-46 (Item 2, table 4-2) moist with dry cleaning solvent P-D-680 (Item 1, table 4-2).

WARNING

Contact cleaner is toxic. It can irritate skin and cause burns. Avoid inhaling. Use only with adequate ventilation. Avoid contact with skin, eyes, or clothing. In case of contact, immediately flush skin or eyes with water for at least 15 minutes. Get medical attention for eyes.

c. Clean all rotary switches and controls. Use contact cleaner MIL-C-83360 (Item 4, table 4-2).

4-21. Replacement of Circuit Board PCA1 or PCA2. (CRC)

CAUTION

Do not handle or store circuit cards, except in a static-free environment, using static free materials. Microcircuits can be damaged by static.

a. Remove the panel. (Ref para 4- 17.)

b (See fig. 6-3.) Remove two screws (72) securing the circuit board receptacle (74) to the two brackets.

c. Remove three screws (75), nuts (79), washers ('9), and spacers (76) securing the circuit board (78) to the chassis.

d. Pull the circuit board from the receptacle.

e. Insert the replacement circuit board, component side up, into the circuit board receptacle.

f. Install three screws and spacers.

g. Position the circuit board on the three screws. Secure the circuit board with three washers and nuts.

h. Install two screws through the two brackets into the circuit board receptacle.

i. Perform the power supply and DVM tests. (Ref para 4-40.)

j. Install the panel. (Ref para 4-41.)

k. Perform the final test. (Ref para 4-42.)

4-22. Replacement of Receptacles. (CRC)

a. Replacement of card receptacle.

(1) Remove the panel. (Ref para 4-18.)

(2) ***(See fig. 6-3.) Remove the screw (73) and nut (10) securing each of two brackets to the chassie.***

(3) Remove two screws (72) securing the two brackets to the circuit board receptacle (74). Remove the two brackets.

(4) Pull the receptacle from the circuit board (78).

(5) Tag and disconnect the wires from the receptacle. Use an insertion/extraction tool.

(6) Replace defective contacts. (Ref TM 55-1500-323 -25.)

(7) Connect the wires to the replacement receptacle. Use an insertion/extraction tool. (See wiring diagram, *FO-21.)*

(8) Remove the tags.

(9) Insert the receptacle on the circuit board.

(10) Install two brackets on the receptacle. Secure each bracket with a screw. Secure the other end of each bracket to the chassis. Use a screw and nut.

(11) Perform the power supply and DVM tests. (Ref para 4-40.)

(12) Install the panel. (Ref para 4-41.)

(13) Perform the final test. (Ref para 4-42.)

b. Replacement of panel receptacle.

(1) Remove the panel. (Ref para 4-18.)

(2) (See fig. *6-3.)* Tag and disconnect the wires from the receptacle (33, 53, or 54). Use an insertion/extraction tool.

(3) Remove the nut from the receptacle shell.

(4) Install the replacement receptacle shell. Secure it with a nut.

(5) Connect wires to the receptacle. Use an insertion/extraction tool. (See wiring diagram, *FO-21.)*

(6) Remove the tags.

(7) Perform the power supply and DVM tests. (Ref para 4-40.)

(8) Install the panel. (Ref para 4-41.)

(9) Perform the final test. (Ref para 4-42.)

4-23. Replacement of EXTERNAL METER Jacks.

a. Remove the panel. (Ref para 4-18.)

b. (See fig. 6-3.) Unsolder the wire from the jack (35 or 36).

c. Remove the attaching hardware. Remove the jack (35 or 36) and cover (37).

d. Install the replacement jack.

e. Install the attaching hardware.

f. Solder the wire to the jack. Use solder QQ-S-571 (Item 3, table 9-2). (See wiring diagram, FO-21.)

g. Install the panel. (Ref para 4-41.)

h. Perform the final test. (Ref para 4-42.)

4-24. Replacement of Terminal Boards (TB1, TB2, TB3 - CRC. TB4, TB5, TB7 - AVIM).

a. Remove the panel. (Ref para 4-18.)

b. (See fig. 6-3.) On terminal board TB5 (26), loosen the thumbscrews and remove the cover.

c. Tag and disconnect the wires.

d. If TB1 (83) is to be removed, refer to para 4-25 for removal of solenoid shutoff switch to gain access to TB1 mounting hardware.

e. Remove the attaching hardware. Remove the terminal board (21, 22, 26, 83, 84 or 85).

f. Position the replacement terminal board on the rear panel. Align the mounting holes. Install the mounting hardware.

g. Connect the wires. (See wiring diagram, FO-21.)

h. Remove the tags.

i. On terminal board TB5, install the cover.

j. Install the panel. (Ref para 4-41.)

k. Perform the final test. (Ref para 4-42.)

4-25. Replacement of Pushbutton Switches.

a. Remove the panel. (Ref para 4-18.)

b. (See fig. 6-3.) Tag and unsolder the wires from the switch (62, 63,64, or 65).

c. Remove the attaching hardware.

d. Remove the switch.

e. Install the replacement switch. Secure it with the hardware.

f. Solder the wires to the switch. Use solder QQ-S-571. (See wiring diagram, FO-21.)

g. Remove the tags.

h. Install the panel, (Ref para 4-41.)

i. Perform the final test. (Ref para 4-42.)

4-26. Replacement of Controls and Rotary Switches.

a. Remove the panel. (Ref para 4-18.)

b. (See fig. 6-3.) Tag and unsolder the wires.

c. Loosen the set screws and remove the knob.

d. Remove the attaching hardware. Remove the potentiometer (67) or switch (51, 52,61, or 68).

e. Install the replacement control or switch and attaching hardware.

f. Solder the wires to the control or switch. Use solder QQ-S-571 (Table 4-2, item 3). (See wiring diagram, *FO-21.)*

g. Remove the tags.

h. Rotate control or switch shaft fully counterclockwise.

i. Install the knob, pointer aligned with the most counterclockwise panel marking. Tighten the set screws.

j. Install the panel. (Ref para 4-41.)

k. Perform the final test. (Ref para 4-42.)

4-27. Replacement of Elapased Time Meter.

a. Remove the panel. (Ref para 4-18.)

b. (See fig. 6-3.) Tag and unsolder the wires from the meter (70).

c. Remove the attaching hardware. Remove the meter.

d. Install the replacement meter. Secure it with the hardware.

e. Solder the wires to the meter. Use solder QQ-S-571 (Table 4-2, item 3). (See wiring diagram, *FO-21.)*

f. Remove the tags.

g. Install the panel. (Ref para 4-41.)

h. Perform the final test and check meter for appropriate time change. (Ref para 4-42.)

4-28. Replacement of NULL Meter. (CRC)

a. Remove the panel. (Ref para 4-18.)

b. (See fig. 6-3.) Tag and disconnect the wires from the meter (59).

c. Remove the attaching hardware. Remove the meter and gasket (60).

d. Install the gasket (60) and replacement meter. Secure it with the hardware.

e. Connect the wires to the meter and install the nuts and washers. (See wiring diagram *FO-21.)*

f. Remove the tags.

g. Install the panel. (Ref para 4-41.)

h. Perform the final test. (Ref para 4-42.)

4-29. Replacement of DVM. (CRC)

a. Remove the panel. (Ref para 4-18.)

b. (See fig. 6-3.) Remove the cover from the rear of the meter (47).

c. Remove the retainer from the rear of the meter.

d. Tag and unsolder the wires from the meter.

WARNING

Naphtha is combustible and toxic. It can irritate skin and cause burns. Use only with adequate ventilation, away from open flame. In case of contact, immediately flush skin or eyes with water for at least 15 minutes. Get medical attention for eyes.

e. Remove the DVM. Use naphtha (Item 5, table 4-2) to loosen adhesive if necessary.

f. Clean old adhesive from the panel. Use naphtha (Item 5, table 4-2).

g. Coat the mating surface of the panel with adhesive (Item 6, table 4-2).

h. Remove the cover from the replacement meter.

i. Place retainer on the replacement meter. Secure the retainer to the panel with the hardware.

j. Solder the wires to the meter. Use solder QQ-S-571 (Item 3, table *4-2).* (See wiring diagram, *FO-21.)*

k. Remove the tags.

l. Install the cover on the rear of the meter,

m. Perform the power supply and DVM tests. (Ref para 4-40.)

n. Install the panel. (Ref para 4-41.)

o. Perform the final test. (Ref para 4-42.)

4-30. Replacement of Power Supply Circuit Board TB6A. (CRC)

a. (See fig. 6-3.) Remove the panel. (Ref para 4-18.)

b. Remove the hardware attaching circuit board TB6B (19). Move circuit board TB6B as needed for access to terminals of TB6A (18).

c. Tag and unsolder the wires from the terminals of TB6A.

d. Remove the attaching hardware. Remove circuit board TB6A.

e. Install replacement circuit board TB6A. Secure it with the hardware.

f. Solder the wires to the terminals. Use solder QQ-S-571 (Item 3, table *4-2).* (See wiring diagram, *FO-21.)*

g. Remove the tags.

h. install circuit board TB6B. Secure it with the hardware.

i. Install the panel. (Ref para 4-41.)

j. Perform the final test. (Ref para 4-42.)

4-31. Replacement of Undervoltage Detector/Precision Rectifier Circuit Board TB6B. (CRC)

a. Remove the panel (para 4-18).

b. Remove the screws securing the circuit board (19) to the spacers (fig. 6-3).

c. Tag and unsolder the wires from the circuit board.

d. Solder the wires to the replacement circuit board. Use solder QQ-S-571 (wiring diagram, FO-21).

e. Remove the tags.

f. Align the circuit board mounting holes with the spacers. Secure the circuit board with screws.

g. Perform the power supply and DVM tests (para 4-40) (Adj. para 4-35).

h. Install the panel (para 4-41).

i. Perform the final test (para 4-42).

4-32. Replacement of Transformer T1. (CRC)

a. Remove the panel (para 4-18).

b. Tag and unsolder the wires from the transformer (11) (fig. 6-3).

c. Remove the attaching hardware. Remove the transformer.

d. Install the replacement transformer. Secure it with the hardware.

e. Solder the wires to the transformer. Use solder QQ-S-571 (wiring diagram, FO-21).

f. Remove the tags.

g. Perform the power supply and DVM tests (para 4-40).

h. Install the panel (para 4-41).

i. Perform the final test (para 4-42).

4-33. Replacement of Power Supplies PS1, PS2, and PS3. (CRC)

a. Remove the panel (para 4-18).

b. Tag and unsolder the wires from the power supply (5, 7, or 32) (fig, 6-3).

c. Remove the attaching hardware. Remove the power supply.

d. Install the replacement power supply. Secure it with the hardware.

e. Solder the wires to the power supply. Use solder QQ-S-571 (wiring diagram, FO-21).

f. Remove the tags,

g. Perform the power supply and DVM tests (para 4-40).

h. Install the panel (para 4-41).

i. Perform the final test (para 4-42).

4-34. Adjustment of 13 Volt Ac Power Supply PS3. (CRC)

a. Remove the panel (para 4-18).

b. Ensure the power switch is at OFF.

c. Connect power cable 145GS278-4 to POWER receptacle and output receptacle of the autotransformer. Connect the autotransformer to 115 volts ac 60 Hz power source.

d. Adjust the output of the autotransformer to 115 volts ac.

e. Set the multimeter to measure ac volts. Connect it to terminals TB4-7 (line) and TB4-1.

f. Remove the cover from the ADJ POT opening in top of power supply PS3 (fig. 4-1).

g. Set the power switch to ON,

h. Adjust the variable resistor directly below the ADJ POT opening until the multimeter indicates 13 volts ac.

i. Install the cover.

j. Set the power switch to OFF.

k. Disconnect the multimeter and the power cable from the autotransformer,

l. Perform the power supply and DVM tests (para 4-40).

m. Install the panel (para 4-41).

n. Perform the final test (para 4-42).

4-35. Adjustment of Undervoltage Detector Circuit. (CRC)

a. Remove the panel (para 4-18).

b. Ensure the power switch is at OFF (fig. 4-1).

c. Connect power cable 145GS278-4 to POWER receptacle and output receptacle of the autotransformer. Connect the autotransformer to 115 volts ac 60 Hz power source.

d. Adjust the output of the autotransformer to 115 volts ac.

e. Set the power switch to ON.

f. Reduce the output of the autotransformer to 105 volts ac.

g. On circuit board TB6B (fig. 4-l), adjust variable resistor (potentiometer) R10 until the WARNING indicator just changes from on to off or from off to on. Turn variable resistor R10 in the other direction until the WARNING indicator changes to its original state. Then set resistor R10 midway between the two positions,

h. Turn off the power switch.

i. Disconnect the power cable from the autotransformer.

j. Perform the power supply and DVM tests (para 4-40).

k. Install the panel (para 4-41).

1. Perform the final test (para 4-42).

4-36. Adjustment of – 12 Volt Dc Power Supply PSI. (CRC)

a. Remove the panel (para 4-18).

b. Ensure the power switch is at OFF.

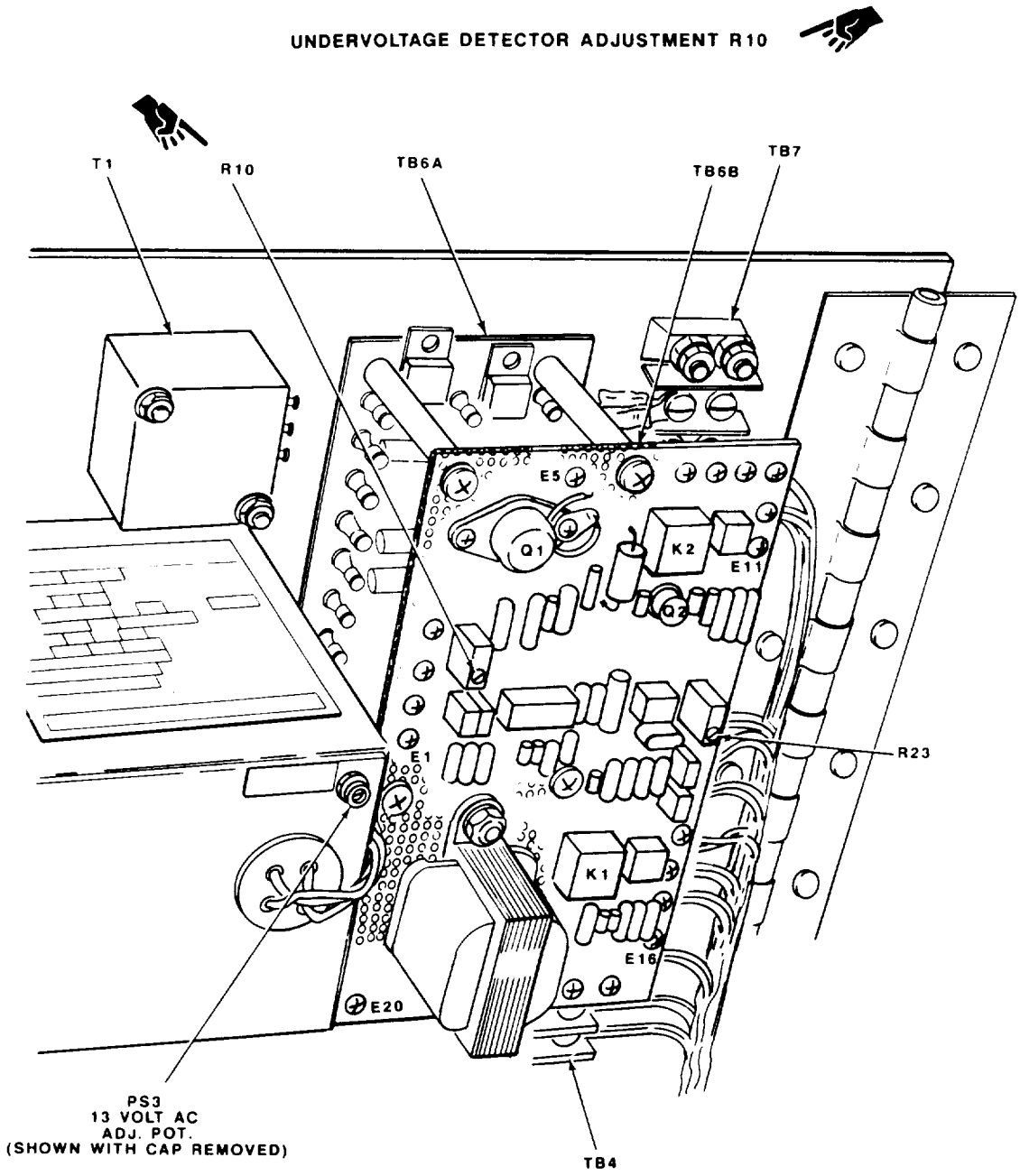
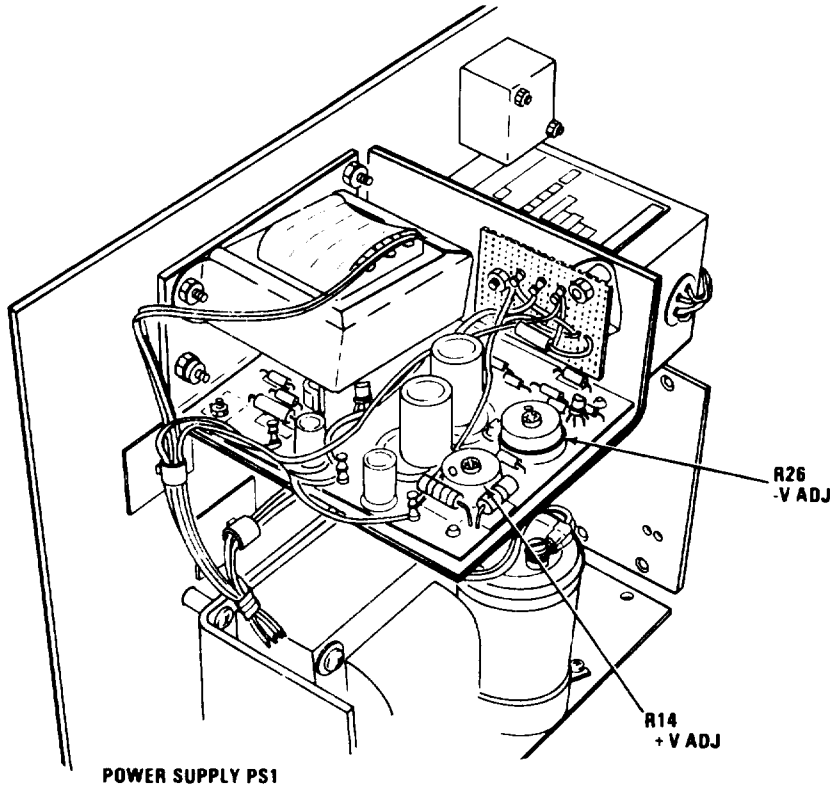


Figure 4-1. Calibration Adjustments, PS3 and R10



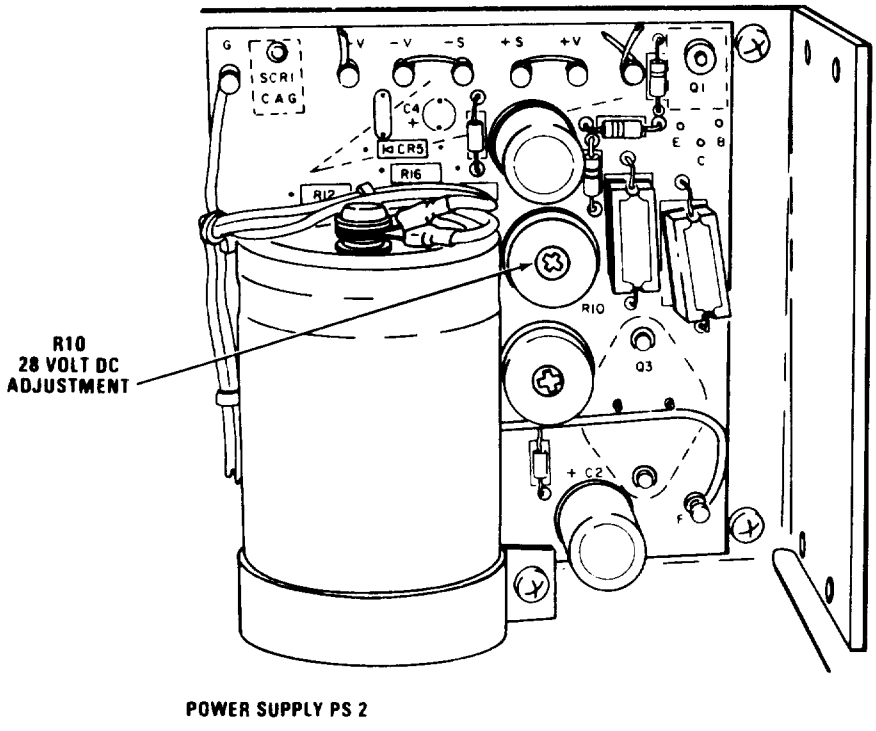


Figure 4-2. Calibration Adjustments, PS1 and PS2

c. Connect power cable 145GS278-4 to POWER receptacle and output receptacle of the autotransformer. Connect the autotransformer to 115-volts 60 Hz ac power source.

d. Adjust the output of the autotransformer to 115-volts ac.

e. Set the multimeter to measure dc volts at terminal board TB4(fig *4-1),* connect it to terminal TB4-12 (+) and TB4-1.

f. Set the power switch to ON.

g. (See fig. *4-2.)* On circuit board PS 1, adjust -V ADJ variable resistor R26 until the multi meter indicates -12. 0-volts dc.

h. Set the power switch to OFF.

i. Disconnect the multimeter and the power cable from the autotransformer.

j. Perform the power supply and DVM tests. (Ref para 4-40.)

k. Install the panel. (Ref para 4-41.)

l. Perform the final test. (Ref para 4-42.)

4-37. Adjustment of +12-Volt Dc Power Supply PS1. (CRC)

a. Remove the panel. (Ref para 4- 18.)

b. Ensure the power switch is at OFF.

c. Connect power cable 145GS278-4 to POWER receptacle and output receptacle of the autotransformer. Connect the autotransformer to 115-volts 60 Hz ac power source.

d. Adjust the output of the autotransformer to 115-volts ac.

e. Set the multimeter to measure dc volts. At terminal board TB4 (fig. *4-1)* connect it to terminals TB4-11 (+) and TB4-1.

f. Set the power switch to ON.

g. (See fig. 4-2.) On circuit board PS1, adjust +V ADJ variable resistor R14 until the multimeter indicates 12.0 volts dc.

h. Set the power switch to OFF.

i. Disconnect the multimeter and the power cable from the autotransformer.

j. Perform the power supply and DVM tests. (Ref para 4-40.)

k Install the panel. (Ref para 4-41.)

l. Perform the final test. (Ref para 4-42.)

4-38. Adjustment of 28-Volt Dc Power Supply PS2. (CRC)

a. Remove the panel. (Ref para 4-18.)

b. Ensure the power switch is at OFF.

c. Connect power cable 145GS278-4 to the POWER receptacle and output receptacle of the autotransformer. Connect the autotransformer to 115-volts 60 Hz ac power source.

d. Adjust the output of the autotransformer to 115-volts ac.

e. Set the multimeter to measure dc volts. On terminal board TB4 (fig. *4-1),* connect it to terminals TB4-10 (+) and TB4-1.

f. Set the power switch to ON.

g. (See fig. 4-2.) On circuit board PS2, adjust variable resistor R10 until the multimeter indicates 28.0 volts dc.

h. Set the power switch to OFF.

i. Disconnect the multimeter and the power cable from the autotransformer.

j. Perform the power supply and DVM tests. (Ref para 4-40.)

k Install the panel. (Ref para 4-41.)

l. Perform the final test. (Ref para 4-42.)

4-39. Adjustment of DVM.

The DVM is not adjusted at AVIM level.

4-40. Power Supply and DVM Preliminary Test.

Test the power supplies and the digital voltmeter whenever their performance is suspect and prior to final test. (Ref para 4-42.) Perform the test procedure in the sequence in which it is presented.

a. Test Equipment Required. The following test equipment is required.

EQUIPMENT	SPECIFICATION
Multimeter	AC: 50mV to 150V, 0.5% DC: 10mV to 50V, 0.1%
Frequency Counter	0.5 Hz to 1 KHz, 0.1%

b. Preliminary Procedures.

(1) Remove the panel. (Ref para 4-18.)

(2) (See fig. 6-3.) Loosen two thumbscrews securing the cover to terminal board TB5 (26). Remove the cover.

(3) Set the power switch to OFF.

(4) Connect power cable 145GS278-4 to POWER receptacle and 115-volt 60 Hz source.

c. Input Voltage Test.

(1) Set the multimeter to measure ac volts. Connect the multimeter to terminals TB5-1 (line) and TB5-3.

(2) Set the power switch to ON.

(3) The multimeter shall indicate 112.5 to 117.5 volts ac.

(4) Set the power switch to OFF. Disconnect the multimeter.

(5) Install the cover on terminal board TB5.

d. Dc Voltage Tests.

(1) Set the multimeter to measure dc volts.

(2) On terminal board TB4 (22), connect the negative multimeter probe to terminal TB4-1.

(3) Set the power switch to ON.

(4) In turn, connect the positive multimeter probe to the following terminals. The multimeter indications shall be as specified. When measuring at terminal TB4-9, record the multimeter indication for use during the DVM test.

TERMINAL	MULTIMETER INDICATION (dc volts)
TB4-10	27 to 29
TB4-9 (record)	19 to 22
TB4-8	-19 to -22
TB4-11	11.5 to 12.5
TB4-12	-11.5 to -12.5
TB4-6	4.7 to 5.3

e. Reference Voltage Test.

(1) Set the multi meter to measure ac volts.

(2) Connect the multi meter to terminals TB4-7 (line) and TB4-1. The multimeter shall indicate 12.9 to 13.1 volts ac.

(3) Connect the frequency counter to terminals TB4-7 (line) and TB4-1. The frequency counter shall indicate 395 to 402 Hz.

f. DVM Test.

(1) Set the SYSTEM SELECT switch to BITE.

(2) Set the BITE switch to +20V. The DVM shall indicate within 2% the voltage recorded at terminal TB4-9. (Ref step *d.)*

g. Concluding Procedure.

(1) Set the power switch to OFF.

(2) Disconnect the power cable.

(3) Install the panel. (Ref para 4-41.)

4-41. Installation of Panel.

a. Ensure the power switch is at OFF and the power cable is disconnected.

b. Close the rear panel. Secure it with three screws.

c. Install the panel in the case. Use the handles.

d. Tighten the 10 captive screws to secure the panel to the case.

4-42. Final Test. (CRC)

Test the electrical unit whenever performance is suspect and whenever the unit is repaired. Perform the final test in the sequence in which the individual tests are presented. To check operation of a particular circuit, perform the preliminary procedures (para 4-44); then perform the selected circuit test (para 4-45 through 4-53). Where required, additional conditions are included in notes at the beginning of the circuit test.

4-43. Test Equipment Required. The following test equipment is required.

EQUIPMENT	SPECIFICATION
No. 1 Digital Multimeter	AC: 50mV to 150V, 0.5%
No. 2 Digital Multimeter	DC: 10mV to 50V, 0.1%
Autotransformer, Variable	0-150 Vac, 1500W
Test Aid (Locally Fabricated)	13 Vac to 0-6 Vac in-phase or out-of-phase (See fig. 4-1)
Frequency Counter	0.5 Hz to 1 KHz, 0.1%
Oscilloscope, Dual Trace	0 to 10 MHz 1 us to 500 ms/div 5mV to 20V/div
Resistor (2 ea)	2,000 ohms, 1 W, 0.1 %

4-44. Preliminary Setup. The following must be performed prior to testing.

a. Test the power supplies and DVM. (Ref para 4-40.)

b. Set the front panel controls and switches as follows:

CONTROL OR SWITCH	POSITION
Power switch	OFF
SYSTEM SELECT switch	SAS 1
BITE switch	-20V
EXTERNAL METER SELECT switches (both)	VALVE
SQ WAVE controls (both)	MIN
LINK TEST switches (both)	VALVE
FUNCTION SELECT switches (both)	CLSD LOOP
VALVE CONTROL (both)	NULL

c. Connect power cable 145GS278-4 to the POWER receptacle on the test set and to the autotransformer.

d. Connect the autotransformer to 115-volt 60 Hz ac. Set the autotransformer for an output of 115-volts.

4-45. Lamp Circuit Test. This test ensures the lamp test circuit and indicator lamps function as required.

a. On the test set, set the power switch to ON. The POWER indicator shall come on. One lamp in the upper or lower indicator in the SAS 1 and SAS 2 FEEDBACK SELECT, CYCLE MOTOR, and SOLENOID SHUTOFF switches shall come on.

NOTE

The POWER indicator is in the upper section of the LAMP TEST switch,

b. In turn, press and release SAS 1 and SAS 2 FEEDBACK SELECT, CYCLE MOTOR, and SOLENOID SHUTOFF switches. In each switch, the lighted indicator shall go out. Both lamps in the unlit indicator shall come on. If necessary, press and release each switch so that the upper indicator comes on.

c. Momentarily press the LAMP TEST switch. Both lamps in lower indicators of the five switches shall come on.

d. Press and release the SAS 1 FEEDBACK SELECT switch. The CROSS indicator shall come on and the shelf indicator shall go out,

e. Press and release the SAS 2 FEEDBACK SELECT switch. The CROSS indicator shall come on and the self indicator shall go out.

f. Press and release the CYCLE MOTOR switch. The OFF indicator shall come on and the ON indicator shall go out.

g. Press and release the SOLENOID SHUTOFF switch. The CLOSED indicator shall come on and the open indicator shall go out.

h. Momentarily press the LAMP TEST switch. The lower (warning) indicator of the TEST switch and the upper indicators of the other four switches shall come on.

4-46. **Undervoltage Detection Circuit Test.** This test ensures undevoltage detector circuit functions as required.

a. Reduce the autotransformer output voltage until the WARNING indicator comes on. The autotransformer voltmeter shall indicate 103 to 107 volts ac.

b. Reduce the autotransformer output until its voltmeter indicates 100 volts ac.

c. Increase the autotransformer output until the WARNING indicator goes out. The voltmeter shall indicate 103 to 107 volts ac.

d. Increase the autotransformer output voltage until its voltmeter indicates 115 volts ac.

4-47. SAS 1 **Self-Feedback and Metering Circuits Test.** This test ensures the SAS 1 self-feedback and metering circuits function as required.

a. Set the power switch to OFF.

b. Connect the 2,000 ohms 1W 0.1% load resistor to receptacle pins J1-8 and J1-10 (FO-1 for pin pattern).

c. Connect a jumper wire to receptacle pins J1-3 and J1-4.

d. Connect a jumper wire to receptacle pins J1-13 and J1-14.

e. Set No. 2 multimeter to measure dc volts. Connect it to the SAS 1 EXTERNAL METER + and – jacks.

f. Set the power switch to ON.

g. Press SAS 1 FEEDBACK SELECT switch to SELF.

h. Adjust SAS 1 VALVE CONTROL until the DVM indicates –0.09 to +0.09 volt. Check that No. 2 multimeter indicates -0.03 to +0.03 volt.

NOTE

Do not adjust SAS 1 VALVE CONTROL again until specified. Otherwise, correct test results will not be obtained. If the control is moved, step h must be repeated.

i. Remove the jumper from receptacle pins J1-3 and J1-4.

j. provide an in-phase input signal to the SAS 1 self demodulators as follows:

(1) Fabricate the test aid. See fig. 4-3.

(2) Turn the power switch to OFF.

(3) Connect the primary winding of the test aid transformer to receptacle pins J1-1 and J1-2.

(4) Connect the in-phase wire from the test aid to receptacle pin J1-4.

(5) Set No. 1 multimeter to measure ac volts. Connect it to the test aid in-phase wire and the moving contact of the variable resistor.

(6) Set the power switch to ON.

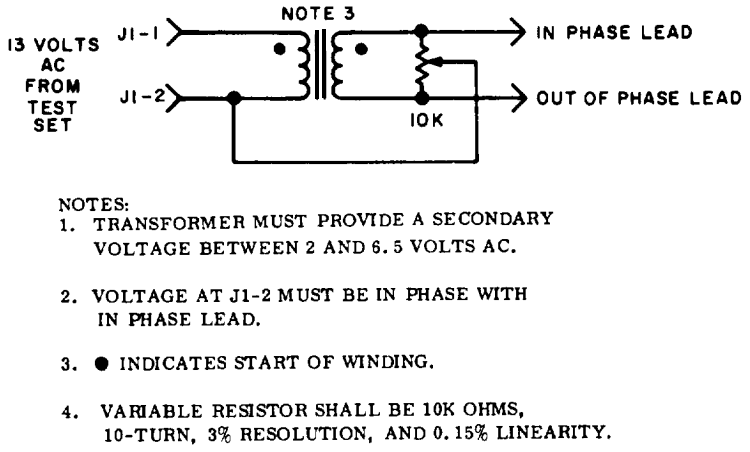


Figure 4-3. Test Aid Schematic Diagram

CAUTION

Do not press meter X10 pushbutton switch unless the associated nullmeter indicates less than 5 microampere. Otherwise, the null meter can be damaged.

k. Set the SAS 1 EXTERNAL METER SELECT and the SAS 1 LINK TEST switches to SELF FDBK.

l. **Adjust the test aid variable resistor until No. 1 multimeter indicates 2.0 volts ac. The meters shall indicate as follows:**

METER	INDICATION
No. 2 Multimeter	1.90 to 2.10 volts dc
DVM	1.93 to 2.06 volts dc
SAS 1 NULL Meter	9 to 11 microampere

m. Set the SAS 1 EXTERNAL METER SELECT and the SAS 1 LINK TEST switches to VALVE. The meters shall indicate as follows:

METER	INDICATION
No. 2 Multimeter	-0.57 to -0.63 volts dc
DVM	-.560 to -.640 volts dc

n. Adjust the test aid variable resistor until No. 1 multimeter indicates l.0-volt ac.

o. Set the SAS 1 EXTERNAL METER SELECT and the SAS 1 LINK TEST switches to SELF FDBK. The meters shall indicate as follows:

METER	INDICATION
No. 2 Multimeter	0.95 to 1.05 volts dc
DVM	0.96 to 1.03 volts dc
SAS 1 NULL Meter	4 to 6 microampere

p. Press and release meter X10 pushbutton switch. SAS 1 NULL meter pointer shall momentarily move upscale.

q. Set SAS 1 EXTERNAL METER SELECT and SAS 1 LINK TEST switches to VALVE. The meters shall indicate as follows:

METER	INDICATION
No. 2 Multimeter	–0.285 to –0.315 volts dc
DVM	–.275 to -.325 volts dc

r. Provide an out-of-phase input signal to the SAS 1 self-demodulators as follows:

(1) Set the power switch to OFF.

(2) Disconnect the test aid in-phase wire from receptacle 1-4.

(3) Connect the test aid out-of-phase wire to receptacle pin J1-4.

(4) Connect No. 1 multimeter to the test aid out-of-phase wire and the moving contact of the variable resistor.

(5) Set the power switch to ON.

s. Repeat steps k through p. The meter indications shall be as stated except the dc voltage indications shall be opposite in polarity.

4-48. SAS 1 Cross-Feedback and Metering Circuits Test. This test ensures the SAS 1 cross feedback and metering circuits function as required. (See FO-1 *for* J1 pin pattern.)

NOTE

When performing this test, make sure the test aid and multimeters are as follows:

1. The primary winding of the test aid transformer is connected to receptacle pins J1-1 and J1-2. See fig. *4-3.*

2. No. 1 multimeter is set to measure ac volts,

3. No. 2 multimeter is connected to SAS 1 EXTERNAL METER + and - jacks, set to measure dc.

a. Provide an in-phase input signal to the SAS 1 cross demodulators as follows:

(1) Set the power switch to OFF.

(2) Disconnect jumper wire from receptacle pins J1-13 and J1-14.

(3) Disconnect the test aid out-of-phase wire from receptacle 1-4.

(4) Connect a jumper wire to receptacle pins J 1-3 and J 1-4.

(5) Connect the in-phase wire to receptacle pin J 1-14.

(6) Connect No. 1 multimeter to the test aid in-phase wire and the moving contact of the variable resistor.

b. Set the power switch to ON.

c. Press SAS 1 FEEDBACK SELECT switch to CROSS.

d. Set SAS 1 EXTERNAL METER SELECT and SAS 1 LINK TEST switches to CROSS FDBK.

CAUTION

Do not press meter X10 pushbutton switch unless the associated null meter indicates less than 5 microampere. Otherwise, the null meter can be damaged.

e. Adjust the test aid variable resistor until No. 1 multimeter indicates 2.0 volts ac. The meters shall indicate as follows:

METER	INDICATION
No. 2 multimeter	1.90 to 2.10 volts dc
DVM	1.93 to 2.06 volts dc
SAS 1 NULL Meter	9 to 11 microamperes

f. Set SAS 1 EXTERNAL METER SELECT and SAS 1 LINK TEST switches to VALVE. The meters shall indicate as follows:

METER	INDICATION
No. 2 Multimeter	-1.23 to -1.37 volts dc
DVM	-1.230 to -1.375 millivolts dc

g. Adjust the test aid variable resistor until No. 1 multimeter indicates 1.0-volt ac.

h. Set SAS 1 EXTERNAL METER SELECT and SAS 1 LINK TEST switch to CROSS FDBK. The meters shall indicate as follows:

METER	INDICATION
No. 2 Multimeter	0.95 to 1.05 volts dc
DVM	0.96 to 1.04 volts dc
SAS 1 NULL Meter	4 to 6 microamperes

i. Set SAS 1 EXTERNAL METER SELECT and SAS 1 LINK TEST switches to VALVE. The meters shall indicate as follows:

METER	INDICATION
No. 2 Multimeter	-0.617 to -0.683 volts dc
DVM	-.607 to -.693 millivolts dc

j. Provide an out-of-phase input signal to the SAS 1 cross demodulators as follows:

(1) Set the power switch to OFF.

(2) Disconnect the test aid in-phase wire from receptacle J1-14.

(3) Connect the test aid out-of-phase wire to receptacle pin J1-14.

(4) Connect No. 1 multimeter to the test aid out-of-phase wire and the moving contact of the variable resistor.

(5) Set the power switch to ON.

k. Repeat steps d through i. The meter indications shall be as stated except the dc voltage indications shall be opposite in polarity.

l. Set the power switch to OFF. Disconnect the test aid and jumper wire.

4-49. SAS 1 Command Circuit Test. This test ensures the command circuits, including the square wave generator, function as required. ***(See FO-1* for J1** pin pattern.)

NOTE

When performing this test, make sure the 2,000 ohm 1 W 0.1% load resistor is connected to receptacle pins J1-8 and J1-10.

a. Connect the oscilloscope to the SAS 1 EXTERNAL METER + and - jacks.

b. Set the SAS 1 EXTERNAL METER SELECT switch to VALVE.

c. Set the SAS 1 FUNCTION SELECT switch to SQ WAVE.

d. Connect jumper wires between receptacle pins J1-3 and J1-4 and between J1-13 and J1-14.

e. Set the power switch to ON.

f. Rotate the SAS 1 SQ WAVE control to MAX. The oscilloscope shall display a symmetrical square-wave. Square-wave amplitude shall increase with rotation of the control. At MAX, peak-to-peak amplitude of the square wave shall be 2.5 to 3.5 volts.

g. Disconnect the oscilloscope and connect the frequency counter.

h. The frequency counter shall indicate 1.538 to 2.857 sec. Set SAS 1 SQ WAVE control to MIN.

i. Disconnect the frequency counter.

j. Set No. 2 multimeter to measure dc volts. Connect it to SAS 1 EXTERNAL METER + and - jacks.

k. Set the SAS 1 FUNCTION SELECT switch to CLSD LOOP.

l. Rotate the SAS 1 VALVE CONTROL to RETRACT. No. 2 multimeter shall indicate -1.2 to -2.0 volts dc.

m. Rotate the SAS 1 VALVE CONTROL to EXTEND. No. 2 multimeter shall indicate 1.2 to 2.0 volts dc.

n. Set the SAS 1 FUNCTION SELECT switch to HARDOVER RETRACT. No. 2 multimeter shall indicate -1.2 to -2.0 volts dc.

o. Set SAS 1 FUNCTION SELECT switch to HARDOVER EXTEND. No. 2 multimeter shall indicate 1.2 to 2.0 volts dc.

p. Set the power switch to OFF. Disconnect No. 2 multimeter.

4-50. SAS 2 Self-and Cross-Feedback Control and Metering Circuits Test. Repeat the procedures in para 4-47 and 4-48 except as follows to ensure the SAS 2 self- and cross-feedback control and metering circuits are operational. (SW FO-1 for J7 pin pattern.)

a. Connect the test aid, jumper wires, and the 2,000 ohm 1 W 0.1% load resistor to the pins on receptacle J7 instead of J1.

b. Set the SYSTEM SELECT switch to SAS 2.

c. Substitute SAS 2 controls, receptacles, and indicators for SAS 1 controls, receptacles, and indicators.

4-51. SAS 2 Command Circuit Test. Repeat the procedures given in para 4-49 except as follows to ensure the SAS 2 command circuit is operational. (See FO-1 for Jl/J7 pin pattern.)

a. Set the SYSTEM SELECT switch to SAS 2.

b. Substitute SAS 2 controls, receptacles, and indicators for the SAS 1 controls, receptacles, and indicators.

NOTE

Before starting the BITE test, ensure test aid, jumper wires, and 2000 ohm resistors are removed from receptacles J1 and J7.

4-52. BITE Circuit Test. This test ensures the BITE circuit is operational.

a. Set the power switch to ON.

b. Set the SYSTEM SELECT switch to BITE.

c. Set the BITE switch, in turn, to each of the following positions. At each position, the DVM shall indicate within the specified range.

BITE SWITCH POSITION	DVM INDICATION (millivolts dc)
-20V	-19 to -21
+20V	+19 to +21
-12V	-11.5 to -12.5
+12V	+11.5 to +12.5
+5V	+4.7 to +5.3
13V RMS	+12.9 to +13.l

NOTE

Ensure all switches and controls are set to initial positions specified in para 4-44 b. Leave SYSTEM SELECT switch in BITE.

d. Set No. 1 multimeter to measure ac volts. Connect it to receptacle pin J 1-4 and ground.

e. Set the BITE switch to SAS 1 SELF. No. 1 multimeter shall indicate 0.83 to 0.93 volts ac. The DVM shall indicate 8.00 to 10.00 millivolts dc. Set SAS 1 FEEDBACK SELECT switch to CROSS.

f. Connect No. 1 multimeter to receptacle pin J1-14 and ground.

g. Set the BITE switch to SAS 1 CROSS. No. 1 multimeter shall indicate 0.83 to 0.93 volts ac. The DVM shall indicate 8.00 to 10.00 millivolts dc. Set SAS 1 FEEDBACK SELECT switch to SELF.

h. Connect No. 1 multimeter to receptacle pin J7-4 and ground.

i. Set the BITE switch to SAS 2 SELF and the SAS 2 FEEDBACK SELECT switch to CROSS. No. 1 multimeter shall indicate 0.83 to 0.93 volts ac. The DVM shall indicate 8.00 to 10.00 millivolts dc.

j. Connect No. 1 multimeter to receptacle pin J7-14 and ground.

k. Set the BITE switch to SAS 2 CROSS and the SAS 2 FEEDBACK SELECT switch to SELF No. 1 multimeter shall indicate 0.83 to 0.93 volts ac. The DVM shall indicate 8.00 to 10.00 millivolts dc.

4-53. Hydraulic Unit Control Circuit Test. *(See fig. 1-9 for J9* pin pattern.)

a. Press the SOLENOID SHUTOFF switch to CLOSED.

b. Set No. 1 multimeter to measure ac volts. Connect it to receptacle pins J9-4 and J9-7. The multimeter shall indicate 0 volt.

c. Press the SOLENOID SHUTOFF switch to OPEN. No. 1 multimeter shall indicate 110 to 120 volts ac.

d. Press the SOLENOID SHUTOFF switch to CLOSED.

e . Press the CYCLE MOTOR switch to OFF.

f. Connect No. 1 multimeter to receptacle pins J9-10 and J9-1. No. 1 multimeter shall indicate 0 volt.

g. Press the CYCLE MOTOR switch to ON. No. 1 multimeter shall indicate 110 to 120 volts ac.

h. Set the power switch to OFF.

i. Turn off and disconnect the autotransformer.

j- Disconnect the power cable.

Chapter 5

HYDRAULIC UNIT INTERMEDIATE MAINTENANCE

SECTION I TROUBLESHOOTING

5-1. General Instructions.

a. Troubleshooting procedures are provided in logic tree format. They are related to the operational setup and test procedures in chapter 2, Use the schematic diagrams *(fig. 1-9 and FO-3)* **as** aids in troubleshooting. For each failure to meet an operational setup and test requirement, there is a trouble symptom with a similar title.

b. During troubleshooting, **observe the following precautions:**

(1) Perform continuity checks with electrical power off.

WARNING

High voltage (115-volt 60-Hz ac) is used in this equipment. Death on contact or serious injury can result if personnel do not observe safety precautions. Be careful not to touch high voltage connections when performing maintenance.

(2) When measuring voltage, use tape or plastic sleeving (spaghetti) to insulate **the** entire test probe, except for the extreme tip.

WARNING

Use goggles when operating at high pressure hydraulic settings. Otherwise, personnel injury can result.

5-2. Test Equipment Required.

For test equipment required see table 5-1.

Table 5-1. Equipment Required For Troubleshooting Hydraulic Unit

QUANTITY	TEST EQUIPMENT	SPECIFICATION
1 ea.	Digital Multimeter	AC: 50mV to 150V, 0.5% DC: 10mV to 50V, 0.1%
1 ea.	Calibrated Pressure Gage	0 to 5000 psi
1 ea.	Calibrated Pressure Gage	0 to 600 psi
1 ea.	Stopwatch	
1 ea.	Container	16 oz. with 1 oz. graduations

NOTE

Page identification for foldout pages has been designated as FO-1, FO-2, etc. and the pages are placed in the back of the manual at time of printing. Upon receipt of this manual, insert foldout pages FO-22 through FO-27 after page 5-2.

SECTION II MAINTENANCE PROCEDURES (AVIM)

5-16. General.

Hydraulic unit Intermediate Aviation Unit (AVIM) Maintenance procedures are those accomplished with the panel removed from the case. Repair is limited to component replacement. (Ref appx B.) Tools and equipment are listed in table 5-1. A list of consumables is included in table 5-2. For general information on replacement of hydraulic components, refer to TM 55-1500-204-25/1.

Table 5-2. Consumable Materials

ITEM NUMBER	NOMENCLATURE	MILITARY SPECIFICATION
1	Dry Cleaning Solvent	P-D-680
2	Hydraulic Fluid	MIL-H-83282
3	Teflon Tape	MIL-I-23594
4	Cloth, Cleaning	CCC-C-46

5-17. Servicing.

a. Cleaning - Cleaning procedures are covered in para 3-3.

b. Filter Servicing - Servicing the filter is accomplished by cleaning or replacing the element (Ref para 5-26).

c. Cycle Motor Gear Box - Servicing gear box with oil is covered in para 3-5b.

5-18. Operational Check.

NOTE

The electrical unit and accessories are required to perform an operational check on the hydraulic unit.

a. Perform the operation check as follows.

(1) Prepare the test set for use. (Ref para 2-6.)

(2) Perform the self-test. (Ref para 2-7.)

(3) Perform the fill and bleed procedure. (Ref para 2-8.)

(4) Perform the high pressure self-test. (Ref para 2-9.)

b. If no additional tests are required.

(1) Perform the normal shutdown procedures. (Ref para 2-10.)

5-19. Exterior Inspection.

No special inspections are required at AVIM for the assembled hydraulic unit.

5-20. Replacement of Cycle Motor Capacitor.

a. (See fig. 6-7.) Remove the cover from the capacitor (14) terminals and slide it over the wires

b. Tag and unclip the wires from the capacitor terminals.

c. Remove the two screws securing the capacitor to the motor. Remove the capacitor.

d. Position the replacement capacitor on the motor. Install two screws.

e. Connect the wires to the capacitor. Remove the tags. Install the cover over the terminals.

f. Perform an operational check. (Ref para 5-18.)

5-21. Replacement of Cycle Motor and Gearbox.

a. (See fig. 6-7.) Remove crank arm (3). (Ref para 3-13.)

b. Remove the cover from motor capacitor (14).

c. Tag and unclip the wires from the capacitor and cut the motor wires near the butt splice.

d. Remove four nuts, spacers, and screws attaching the cycle motor (15) to the bracket. Remove the cycle motor and gearbox.

e. Install four screws, four spacers and four nuts through the gearbox. Tighten the nuts.

f. Remove driver crank (8). (Para 3-14.)

g. Remove the capacitor from the motor. (Ref para 5-20.)

h Install the capacitor on the replacement motor. (Ref para 5-20.)

i. Install the driver crank on the replacement motor. (Ref para 3- 14.)

j. Remove four nuts, screws, and spacers from the replacement motor and gearbox.

k. Position the motor and gearbox on the bracket. Install the four screws, spacers, and nuts.

l. Splice the motor wires below the panel. Connect the wires to the capacitor. Remove the two tags. Install the cover.

m. Install the crank arm (Ref para 3-1 3).

n. Perform an operational test. (Ref para 5-18.)

5-22. Hydraulic Unit Panel Removal.

a. (See fig. 1-3, 1-4, and 1-5.) Unlatch the six latches and remove the cover from the hydrauli *t* unit.

b. Remove dial indicator and post snug 145GS278-9 from the manifold. Store it in the cover.

c. Remove dial indicator post 145GS278-10 from the panel by turning it ccw. Store the post in the cover.

d. Remove manifold assembly 145GS278-11 from the panel. Store the manifold assembly in the cover.

e. Remove the CASE VENT HOSE from the two stowage clamps. Position hose for access to the panel retaining screw.

f. Remove the cap from the RETURN hose fitting. Wipe up any spilled fluid which may drain from the fitting. Use care to prevent contamination from entering the system.

g. Remove the flat head panel retaining screw near the RETURN hose fitting.

h. Cap the RETURN hose attachment fitting.

i. Remove the remaining 11 panel retaining screws around the edge of the panel.

WARNING

The panel weighs about 130 pounds. Be careful when lifting the panel to prevent personnel injury.

j. Carefully lift the panel from the case. Tilt it so that the tubes below the panel clear the case.

k. Support the panel face upon wood blocks.

5-23. Interior Inspection.

a. (See fig. 6-5.) Inspect below the panel for leaks or damage to hydraulic tubes and components.

b. Inspect case and chassis for damage and loose or missing hardware.

c. Inspect controls, valves, wires and switches for loose, damaged, or missing parts.

d. Inspect wiring for damage. Check electrical connectors for damaged or broken wiring at the pins.

5-24. Cleaning.

a. Clean electrical components (switches and wiring) with a clean dry cloth (Item 4, table 5-2).

WARNING

Dry cleaning solvent is combustible and toxic. It can irritate skin and cause burns. Use only with adequate ventilation, away from open flame. In case of contact, immediately flush skin or eyes with water for at least 15 minutes. Get medical attention for eyes.

b. Clean hydromechanical parts with a clean cloth (Item 4, table 5-2) and dry cleaning solvent (Item 1, table 5-2).

5-25. Replacement of Solenoid Valve.

a. (See fig. 6-5.) Remove the panel from the case. (Ref para 5-22.)

b. (See fig. 5-1.) Remove the solenoid electrical connector attaching screw.

c. Disconnect the solenoid connector and remove the gasket.

d. Remove the four screws which attach solenoid to subplate.

e. Remove the solenoid from the subplate. Remove the packings between the solenoid and the subplate.

f. Position replacement packings and solenoid on the subplate. Install the four mounting screws.

g. Position the gasket and connect the solenoid connector.

h. Install and tighten the solenoid electrical connector attaching screw.

i. Perform an operational check. (Ref para 5-18.)

j. Perform a proof pressure test. (Ref para 5-44.)

k. Install the panel into the case. (Ref para 5-45.)

5-26. Replacement of Filter Element.

a. (See fig. 6-5.) Remove the panel from the case (Ref para 5-22).

b. (See fig. 6-11.) Remove bowl (8) on filter (1) by rotating CCW.

c. Remove packings (7 and 10) and filter element.

WARNING

Dry cleaning solvent is combustible and toxic. It can irritate skin and cause burns. Use only with adequate ventilation, away from open flame. In case of contact, immediately flush skin or eyes with water for at least 15 minutes. Get medical attention for eyes

d. Clean the inside of the filter bowl. Use dry cleaning solvent (Item 1, table 5-2) and cloths (Item 4, table 5-2.)

e. Install packing (7) on filter bowl. Lubricate packing.

f. Install replacement filter element and packing (10). Lubricate packing.

WARNING

Hydraulic fluid is toxic, It can irritate skin and cause burns. Avoid inhaling, Use only with adequate ventilation. Avoid contact with skin, eyes, or clothing. In case of contact, immediately flush skin or eyes with water for at least 15 minutes. Get medical attention for eyes.

g. Lubricate the thread of the bowl and the packing with hydraulic fluid (Item 2, table 5-2).

h. Screw bowl into filter subplate. Hand tighten the bowl snug against the mount.

i. Perform an operational check. (Ref para 5-18.)

j. Perform a proof pressure test. (Ref para 5-44.)

k. Install the panel in the case. (Ref para 5-45.)

5-27. Replacement of Filter Assembly.

a. (See fig. *6-5.)* Remove the panel from the case (para 5-22).

b. Disconnect two tubes from filter assembly (72).

c. Remove the four screws securing the filter assembly to the panel. Remove the filter.

NOTE

Record the positions of fittings.

d. Remove the contamination indicator, two reducers, and two elbows from the filter assembly.

e. Install the contamination indicator, two elbows, and two reducers in the mount. Use teflon tape (item ***3,*** table 5-2) as required.

f. Position the replacement filter assembly on the panel, inlet port near the solenoid valve. Install four screws.

g. Connect the two tubes to the filter assembly.

h. Perform an operational check. (Ref para 5-18.)

i. Perform a proof pressure test. (Ref para 5-44.)

j. Install the panel into the case. (Ref para 5-45.)

5-28. Replacement of High Pressure Regulator Valve.

a. (See fig. 6-5. ***)*** Remove the panel from the case (para 5-22).

b. Disconnect the three tubes from regulator valve (81).

c. Remove the four screws which attach the regulator to the panel. Remove the regulator.

NOTE

Record the positions of fittings.

d. Remove two elbows and one reducer from the regulator. Install the fittings in the replacement regulator. Use teflon tape (item 3, table 5-2) as required.

e. Position the regulator on the panel. Install the four screws.

f. Connect the three tubes to the regulator.

g. Perform an operation check. (Ref para 5-18.)

h. Perform the proof pressure test. (Ref para 5-44.)

i. Install the panel in the case. (Ref para 5-45.)

5-29. Replacement of HIGH PRESS SHUTOFF VALVE, RETURN SHUTOFF VALVE, or RETURN BACK PRESS valve.

a. (See fig. 6-5.) Remove the panel from the case. (Ref para 5-22.)

NOTE

The removal procedures for the three components are identical. The task are written for the HIGH PRESS SHUTOFF VALVE.

b. Disconnect the two tubes from the valve unions.

c. Remove the valve knob. (Ref para 3-11.)

d. Remove the hardware which secures valve (40 or 46) to the panel. Remove the valve.

e. Remove the two unions and packings from the valve.

f. Install the two unions and packings. Coat them with hydraulic fluid (item 2, table 5-2).

g. Position the valve on the panel. Install the retaining hardware.

h. Install the knob and pin. Tighten set screw.

i. Connect and tighten the two tubes to the unions.

j. Perform an operational check. (Ref para 5-18.)

k. Perform the proof pressure test. (Ref para 5-44.)

l. Install the panel in the case. (Ref para 5-45.)

5-30. Replacement of Selector Valve.

NOTE

Procedure is typical for six valves.

a. (See fig. 6-5.) Remove the panel from the case (para 5-22).

b. Disconnect the two tubes from the unions on valve (89). Disconnect the two tubes from the tee.

c. Remove the valve handle (para 3-9).

d. Remove the valve retaining hardware. Remove the valve from the panel.

NOTE

Record the location and angle of the tee.

e. Remove the tee from the union. Record the location of the plug.

f. Remove the three unions and packings from valve (89). Remove the plug from the valve.

g. Install the plug in the valve. Install the three unions and packings. Coat them with hydraulic fluid (item 2, table 5-2).

h. Install the tee in the union (step e.).

i. Install the valve in the panel. Install and tighten attaching hardware.

j. Position the handle on the valve. Install and tighten the screw holding the handle in position.

k. Perform an operational check. (Ref para 5-18.)

l. Perform the proof pressure test. (Ref para 5-44.)

m. Install the panel in the case. (Ref para 5-45.)

5-31. Replacement of LOW or HIGH PRESS Relief Valves.

a. (See fig. 6-5.) Remove the panel from the case (para 5-22).

b. Remove the knob by rotating it CCW. Remove the spring.

c. Disconnect the two tubes from the elbows at the relief valve (95).

d. Remove two (or four) mounting screws.

e. Remove the valve from the panel.

NOTE

Record the position of the elbows.

f. Remove the two elbows from the valve.

g. Install the elbows in the replacement valve.

h. Position the valve on the panel.

i. Install the attaching screws.

j. Connect the two tubes to the relief valve elbows.

k. Perform an operational check. (Ref para 5-18.)

l. Perform a proof pressure test. (Ref para 5-44.)

m. Install the panel in the case. (Ref para 5-45.)

5-32. Replacement of LOW PRESS REGULATOR Valve.

a. (See fig. 6-5.) Remove the panel from the case. (Ref para 5-22.)

b. At regulator valve (94), disconnect two tubes from the reducers and two tubes from the tee.

c. Remove the two nuts, washers, and screws which attach the valve to the bracket.

d. Loosen the setscrew and remove the knob. Unscrew the limiter knob.

e. Remove the valve from the panel.

NOTE

Record the positions of fittings.

f. Remove the reducers, packings, tee, and nut from the valve.

g. Install the fittings and packings in the replacement valve. Coat with hydraulic fluid (Item 2, Table 5-2).

h. Position the valve on the panel. Secure the valve with two screws, washers, and nuts.

i. Connect the four tubes.

j. Screw the limiter knob on the valve shaft.

k. Install the knob on the valve. Tighten the knob setscrew.

l. Perform an operational check. (Ref para 5-18.)

m. Perform the proof pressure test. (Ref para 5-44.)

n. Install the panel in the case. (Ref para 5-45.)

5-33. Replacement of Pressure Reducing Valve.

a. (See fig. 6-5.) Remove the panel from the case. (Ref para 5-22.)

b. At valve (78), disconnect the two tubes from the nipples.

c. Remove the four screws attaching the valve to the standoffs. Remove the valve.

d. Remove the two nipples from the valve.

e. Install the nipples in the replacement valve. Use teflon tape (item 3, table 5-2).

f. Position the valve on the standoffs. Install and tighten the four attaching screws.

g. Connect the two tubes.

h. Adjust the valve. (Ref para 5-43.)

i. Perform an operational check. (Ref para 5-18.)

j. Perform the proof pressure test. (Ref para 5-44.)

k. Install the panel in the case. (Ref para 5-45.)

5-34. Replacement of CASE VENT LINE PRESS Valve.

a. (See fig. 6-5.) Remove the panel from the case. (Ref para 5-22.)

b. Disconnect the two tubes from the valve (40).

c. Remove the valve knob. (Ref para 3-11.)

d. Remove the hardware which attaches the valve to the panel. Remove the valve.

e. Remove the union, elbow, and packings from the valve.

f. Install the union, elbow with nut and packings. Coat with hydraulic fluid (item 2, table 5-2).

g. Position the valve on the panel. Install the retaining hardware.

h. Install knob and pin. Tighten setscrew.

i. Connect the two tubes to the unions.

j. Perform an operational check. (Ref para 5-18.)

k. Perform the proof pressure test. (Ref para 5-44.)

l. Install the panel in the case. (Ref para 5-45.)

5-35. Replacement of Low Pressure Limiter Valve.

a. (See fig. 6-5.) Remove the panel from the case. (Ref para 5-22.)

b. Disconnect the two tubes from the valve fittings. Remove the valve (103).

c. Remove the two nipples from the valve.

d. Install the two nipples on the replacement valve. Use teflon tape. (item 3, Table 5-2,) as required.

e. Position the valve. Connect the two tubes.

f. Adjust the low pressure limiter valve. (Ref para 5-43.)

g. Perform a proof pressure test. (Ref para 5-44.)

h. Install the panel in the case. (Ref para 5-45.)

5-36. Replacement of Check Valves.

a. (See fig. 6-5.) Remove the panel from the case. (Ref para 5-22.)

NOTE

Prior to removing a check valve, record the direction of the free flow arrow.

b. Disconnect the two tubes from the valve (61) fitting. Remove the valve.

c. Remove the two nipples from the valve.

d. Install the two nipples on the replacement valve. Use teflon tape (item 3, table 5-2) as required.

e. Position the valve. Check the direction of the free flow arrow. Connect the two tubes.

f. Perform an operational check. (Ref para 5-18.)

g. Perform a proof pressure test. (Ref para 5-44.)

h. Install the panel in the case. (Ref para 5-45.)

5-37. Replacement of ILCA Manifold.

a. (See fig. *6-5.)* Remove the panel from the case, (Ref para 5-22.)

b. Disconnect the six tubes from manifold (104).

c. Remove the four nuts and screws attaching the manifold to the panel. Remove the manifold.

d. Remove the six unions and packings from the manifold.

e. Install the six unions and packings in the replacement manifold. Coat them with hydraulic fluid (item 2, table. 5-2). Tighten the unions.

f. Clean the panel area with a cloth (item 4, table 5-2).

g. Align the pins and position the manifold on the panel. Install and tighten the four screws and nuts.

h. Connect the six tubes to the unions.

i. Perform an operational check. (Ref para 5-18.)

j. Perform the proof pressure test. (Ref para 5-44.)

k. Install the panel in the case. (Ref para 5-45.)

5-38. Replacement of Gages.

a. (See fig. 6-5.) Remove the panel from the case (para 5-22).

b. At gage (85 or 101), disconnect the two tubes from the tee elbows.

c. Loosen the thumb screw on the gage coverplate. Remove the coverplate.

CAUTION

Be careful when removing the screws. If a tool slips, the pointer or dial can be damaged.

d. Remove the three nuts and screws securing the gage to the panel. Remove the gage.

NOTE

Record the location of the tee.

e. Remove the tee and attaching hardware.

f. Install the tee and attaching hardware on the gage. Use teflon tape (item 3, table 5-2) as required.

g. Position the gage on the panel. Install the three screws and nuts.

h. Install the coverplate and tighten the thumbscrew.

i. Connect the two tubes to the elbows.

j. Perform an operational check. (Ref para 5-18.)

k. Perform a proof pressure test (para 5-44).

l. Install the panel in the case (para 5-45.)

5-39. Replacement of Plumbing.

a. (See fig. 6-5.) Tag and remove the tube.

b. For replacement of tubes, cut. and bend new tubes per TM 55-1500-204-25/1. Use the defective tube as a guide. Replace fittings ‘as required.

c. Install the tube and remove the tag.

5-40. Replacement of Electrical Receptacle.

a. (See fig. 6-4.) Remove the panel from the case. (Ref para 5-22.)

b. Remove nut securing connector (64) to the panel.

c. Push connector through panel for access to pins.

d. Tag and disconnect wires per TM 55-1500-323-25. Use insertion/extraction tool. Inspect pins for damage and replace as required. Connect pins to replacement connector.

e. Install replacement receptacle in panel. Install retaining nut.

f. Perform an operational check. (Ref para 5-18.)

g. Install panel in case. (Ref para 5-45.)

5-41. Replacement of SOLENOID Switch.

a. (See fig. 6-4.) Remove the panel from the case. (Ref para 5-22.)

b. Tag and disconnect five wires from the switch (52).

c. Unscrew switch knob (51). Remove the locknut and washer from the switch.

d. Remove the switch contact block.

e. Position the replacement on the panel. Install the washer and locknut.

f. Install the switch knob.

g. Connect the five wires to the switch.

h. Perform an operational check. (Ref para 5-18.)

i. Install the panel in the case. (Ref para 5-45.)

5-42. Lubrication.

Refer to para 3-5.

5-43. Flow Limiter and RELIEF VALVE Adjustment.

a. (See fig. 5-1.) Prepare the unit for use. (Ref para 2-6.)

b. Perform self-test procedures. (Ref para 2-7.)

c. Remove the hydraulic unit panel from the case. (Ref para 5-22.)

d. Perform fill and bleed procedures. (Ref para 2-8.)

se. Perform high pressure self-test. (Ref para 2-9.)

f. Check that switches and valves are at initial settings. (Ref tables 2-1 and 2-2.)

g. Set the electrical unit power switch to ON. Check that the LAMP TEST switch POWER lamp comes on.

***h.* Set the SOLENOID SHUTOFF switch to OPEN. Check that the OPEN lamp comes ON.**

***i.* Start and adjust the shop hydraulic power supply for 3000 psi on the test gage.**

***j.* Check that the hydraulic return needle valve is open. Open the needle valve in the line.**

***k.* (See fig. 5-1.) Remove the cover from the adjustment on relief valve VR6. Loosen the locknut and turn socket head stem fully ccw (maximum relief pressure).**

***l.* OPEN the SOLENOID valve on the hydraulic unit by pulling on the knob. The lamp inside the knob shall come on. The LOW PRESS gage shall indicate 50 to 60 psi.**

***m.* Loosen the nut on flow limiter valve VR9. Close the limiter by turning the stem fully cw. The LOW PRESS gage shall indicate 50 to 60 psi.**

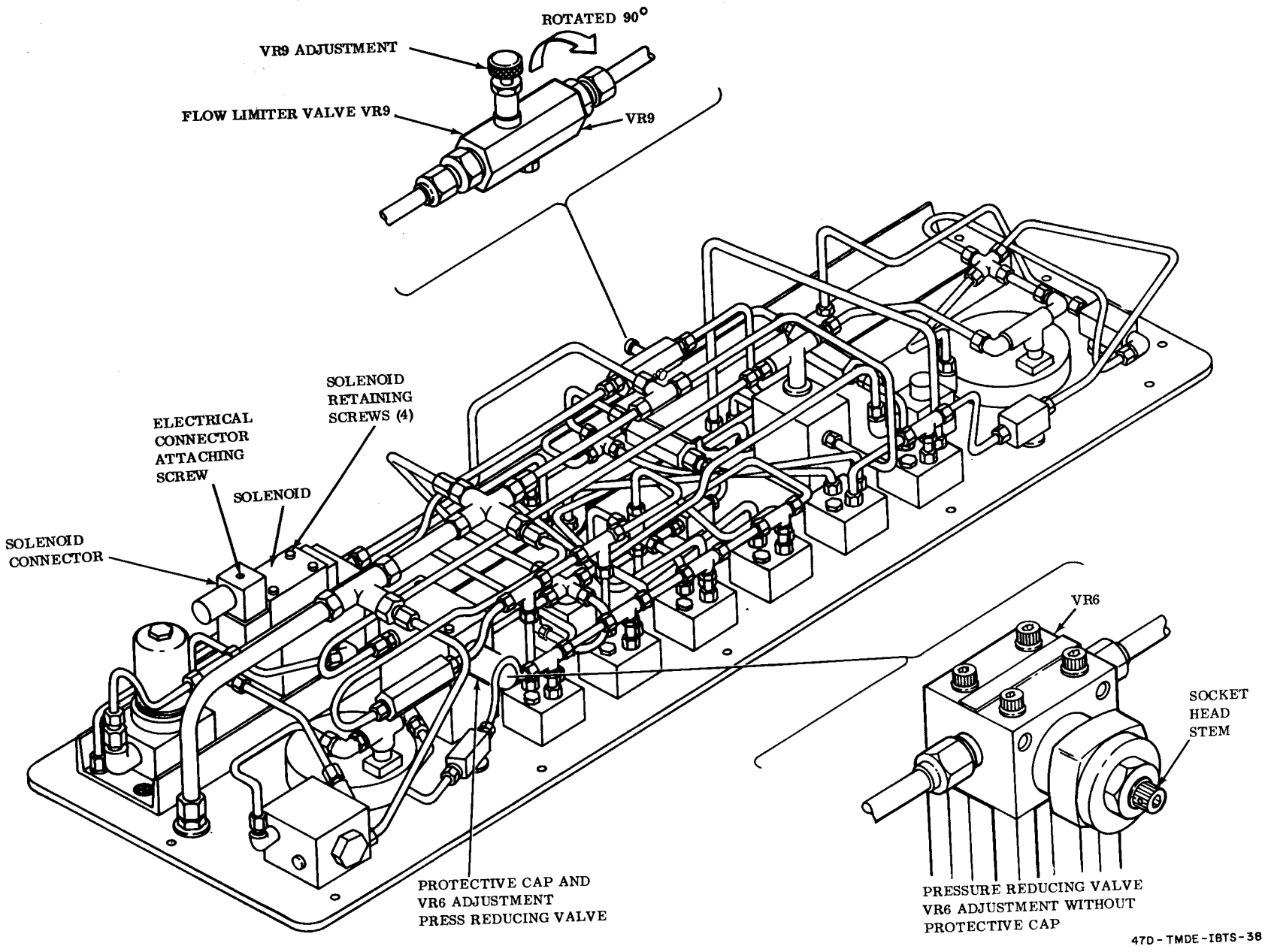


Figure 5-1. Flow Limiter and Relief Valve Adjustment

n. Remove the CASE VENT LINE hose from the clamps. Remove the protective plug from the hose. Place the hose in a graduated container.

o. Set the LOW PRESS REGULATOR to full INCREASE.

p. OPEN the CASE VENT LINE PRESS valve to full OPEN. Measure fluid flow. Adjust flow limiter for a flow of 0.125 to 0.375 gpm.

NOTE

Oil flow for 15 seconds should be 0.013 to 0.094 gallons (4 to 12 ounces, 115 to 340 ml). Use a suitable container to catch oil.

q. Set the LOW PRESS REGULATOR to full DECREASE.

r. Set the CASE VENT LINE PRESS valve to the full CLOSE.

s. Tighten the nut on the flow limiter.

t. Turn the LOW PRESS REGULATOR toward INCREASE until the LOW PRESS gage indicates 300 psi.

u. Adjust valve VR6 by turning the stem ccw until the LOW PRESS gage indicates 250 psi.

v. Turn the LOW PRESS REGULATOR to full DECREASE, then to full INCREASE. The LOW PRESS gage will read approximately 300 psi.

w. Adjust valve VR6 until the LOW PRESS gage indicates 300 psi.

x. Turn the LOW PRESS REGULATOR to full DECREASE, then to full INCREASE. The LOW PRESS gage shall read 285 to 315 psi.

y. Tighten the nut on valve VR6.

z. If no other tests are required, perform the shutdown procedure. (Ref para 2-10.)

5-44. Proof Pressure Test.

The proof pressure test includes four separate test. They are performed at 4500 psi, 3750 psi, 3375 psi, and 450 psi.

a. *Test Setup*.

(1) Prepare the unit for use. (Ref para 2-6.)

(2) Perform the self-test procedures. (Ref para 2-7.)

(3) Remove the hydraulic unit panel from the case. (Ref para 5-22.)

(4) Perform the fill and bleed procedures. (Ref para 2-8.)

(5) Perform the high pressure self-test. (Ref para 2-9.)

(6) Adjust the flow limiter and relief valves. (Ref para 5-43.)

b. Proof *Pressure Test,*

WARNING

Safety goggles must be worn by operator and observers during this test. Otherwise, injury to personnel can result.

(1) Set the shop hydraulic power supply to 4500 psi. Check that the return needle valve is open. Open the supply needle valve. Hold pressure for 1 minute. There shall be no leaks. The HIGH PRESS gage shall indicate 0 ± one scale division.

(2) Reduce the hydraulic power supply to 3750 psi.

(3) Check that the electrical unit SOLENOID SHUTOFF switch is OPEN. The switch OPEN light shall be ON.

(4) Pull the hydraulic unit SOLENOID valve to OPENED. The knob light shall come ON.

(5) Set the HIGH PRESS REGULATOR to full INCREASE. The HIGH PRESS gage shall indicate 3450 to 3550 psi. Hold this pressure for 1 minute. There shall be no leaks.

(6) Set the HIGH PRESS REGULATOR to full DECREASE.

(7) Push the SOLENOID valve knob to CLOSED the knob light shall go out.

(8) Reduce the hydraulic power supply to 3375 psi.

(9) Pull the SOLENOID valve knob to OPEN. The knob light shall come ON.

(10) Set the selector valves to the positions listed below.

ILCA PRESS SYS 2 - PRESS
ILCA PRESS SYS 1 - PRESS
SAS PRESS SYS 2 - PRESS
SAS PRESS SYS 1 - PRESS

(11) Turn the HIGH PRESS REGULATOR toward INCREASE until the HIGH PRESS gage indicates 3375 psi or until the regulator is fully clockwise.

(12) Set the HIGH PRESS SHUTOFF VALVE to OPEN. Holding the pressure for 1 minute. There shall be no leaks.

(13) Set the HIGH PRESS REGULATOR to full DECREASE.

(14) Set the HIGH PRESS SHUTOFF VALVE to full CLOSED.

(15) Push the SOLENOID valve knob to CLOSED. The knob light shall go out.

(16) Set the following selector valves to VENT, then to OFF.

ILCA PRESS SYS 2
ILCA PRESS SYS 1
SAS PRESS SYS 2
SAS PRESS SYS 1

(17) Reduce hydraulic power supply pressure to 450 psi.

(18) Pull the hydraulic unit SOLENOID valve knob to OPENED. The knob light shall come ON.

(19) Set the LOW PRESS REGULATOR to full INCREASE.

(20) Set the RETURN SHUTOFF VALVE to full OPEN.

(21) Set the RETURN BACK PRESS valve to full OPEN.

(22) Set the CASE VENT LINE PRESS valve to full OPEN.

(23) Turn the hydraulic power supply return needle valve toward the closed direction until the hydraulic unit LOW PRESS gage indicates 450 psi. Hold the pressure for 1 minute. There shall be no leaks.

(24) Set the hydraulic power supply return needle valve to full OPEN position.

(25) If no additional test are required. perform normal shutdown procedures per para 2-10. Install panel in the case. (Ref para 5-45)

5-45. Hydraulic Unit Panel Installation.

WARNING

The panel weighs about 130 pounds. Be careful when lifting the panel to avoid personel injury.

a. Carefully lift the panel and position it in the case, tilting it as required to prevent tube damage.

b. Remove the cap from the RETURN hose attachment fitting. Use care to prevent contamination from entering the system.

c. Install the 12 flat head panel retaining screws.

d. Install the capon the RETURN hose attachment fitting.

e. Secure the case vent hose with the two stowage clamps.

f. If there are no additional requirements, secure SAS manifold 145HS278-11, dial indicator post 145HS278-10, dial indicator 145HS278-9, and equipment listed in para 2-12, as required.

5-46. Final Test.

This test will be accomplished to verify operation of the hydraulic unit after repair. The test is to be performed after the panel is installed in the case and prior to releasing the unit for operation.

5-47. Test Preparation. The following shall be performed prior to testing.

a. Remove power cable 145GS278-4 from the cover of the electrical unit.

b. Check that the electrical unit power switch is at OFF. Connect the power cable plug to the POWER receptacle and to a 115-volt 60-Hz power supply. Connect ground wires between the electrical unit and hydraulic unit ground terminals and a shop ground.

c. Check that the hydraulic unit SOLENOID switch is pushed to CLOSED.

d. Remove cycle motor and solenoid test cable 145GS278-7 from the electrical unit cover.

e. Remove pressure hose 145GS278-18 and return hose 145GS278-19 from the stowed position inside the hydraulic unit cover.

f. At the hydraulic unit, remove the RETURN connection cap and the return hose plug. Connect the return hose to the RETURN connection. Connect the other end of the return hose to the return port of the shop hydraulic power supply.

g. Remove the SUPPLY connection cap and the supply hose plug. Connect the supply hose to the SUPPLY connection.

h. Connect the supply hose to the pressure port of the shop hydraulic power supply. The hydraulic power supply line shall have a needle-type shutoff valve.

i. Connect the ELECTRICAL UNIT plug to the HYDRAULIC TEST SET receptacle. Connect the HYDRAULIC UNIT plug to the ELECTRICAL TEST SET receptacle.

j. Check that the hydraulic unit valves and controls are set as follows:

(1) CASE VENT LINE PRESS valve - Full CLOSE

(2) RETURN BACK PRESS valve - Full CLOSE

(3) LOW PRESS REGULATOR valve - Full DECREASE

(4) RETURN SHUTOFF VALVE - Full OPEN

(5) Both RETURN valves - OFF

(6) Both SAS PRESS valves - OFF

(7) Both ILCA PRESS valves - OFF

(8) HIGH PRESS SHUTOFF VALVE - Full CLOSE

(9) HIGH PRESS REGULATOR valve - Full DECREASE

(10) SOLENOID valve - CLOSED (in)

5-48. Solenoid Leak Test. Perform the test preparation (para 5-47), then proceed as follows:

a. Set the shop hydraulic power supply at to 2500 psi. Check that the power supply return and pressure needle valves are open. (See fig. 2-6.)

b. The HIGH PRESS and LOW PRESS gages shall indicate 0 ± one scale division.

c. Set the HIGH PRESS REGULATOR to full INCREASE. Hold the pressure for 1 minute. There shall be no increase in indicated pressures.

d. Set the HIGH PRESS REGULATOR to full DECREASE.

e. If no additional testing is required, reduce and shut off the shop hydraulic pressure.

5-49. Cycle Motor Operational Check. Perform the final test preparation (para 5-47), then proceed as follows:

a. Set the electrical unit power switch to ON. The POWER light shall come ON.

b. Check that the CYCLE MOTOR switch is at OFF.

c. Check that the SOLENOID SHUTOFF switch is at CLOSED.

d. Set the CYCLE MOTOR switch to ON. The cycle motor link shall cycle.

e. Set the CYCLE MOTOR switch to OFF. The cycle motor shall stop.

f. If no additional testing is required perform the normal shutdown procedure (para 2-10).

5-50. Gage Test. Perform the test preparation (para 5-47.), then proceed as follows:

a. If component or tubes have been disconnected or replaced, perform the fill and bleed task (para 2-8).

b. Set the shop hydraulic power supply for 3750 psi.

C. Check that valves are set as follows:

(1) CASE VENT LINE PRESS valve - Full CLOSE

(2) RETURN BACK PRESS valve - Full CLOSE

(3) LOW PRESS REGULATOR valve - Full DECREASE

(4) RETURN SHUTOFF VALVE - Full OPEN

(5) Both RETURN valves - OFF

(6) Both SAS PRESS valves - OFF

(7) Both ILCA PRESS valves - OFF

(8) HIGH PRESS SHUTOFF VALVE - Full CLOSE

(9) HIGH PRESS REGULATOR valve - Full DECREASE

(10) SOLENOID valve - CLOSED (in)

d Set the electrical unit power switch to ON. The POWER light shall come on.

e. Set the SOLENOID SHUTOFF switch to OPEN. The OPEN light shall come on.

f. Pull the SOLENOID knob on the hydraulic unit to OPEN (up). The SOLENOID knob light shall come on. The HIGH PRESS gage shall not indicate more than 315 psi. The LOW PRESS gage shall not indicate more than 60 psi.

g. Set the HIGH PRESS REGULATOR to full INCREASE. The HIGH PRESS gage shall not indicate more than 3550 psi. The LOW PRESS gage shall not indicate more than 60 psi.

h. Set the shop hydraulic power supply at 500 psi.

i. Set the LOW PRESS REGULATOR to full INCREASE. The LOW PRESS gage shall not indicate more than 315 psi.

j. Set the HIGH and LOW PRESS REGULATORS to full DECREASE.

k. If no additional testing is required, perform the normal shutdown procedure. (Ref para 2-10.)

5-51. Repackaging for Shipment or Limited Storage.

(See fig. 2-1.) The exact procedure for repackaging depends on the material available and the conditions under which the equipment is to be shipped or stored. Adapt the procedure below whenever circumstances permit.

5-52. Packing. The information concerning the original packaging (para 2-2) will be helpful. For stock numbers of material, refer to SB 38-100.

a. Material Requirements. Obtain 40 sq. ft. of styrofoam cushioning material or equal for packaging the test set.

b. Packaging. Place styrofoam cushioning material around each unit.

c. Packing. Place each unit into a cleated plywood box.

5-53. Preparation for Storage.

No special preparations are required before storing the test set. Refer to table 1-1 and 1-2 to be certain that the test set is complete before closing the covers and storing the units. The unit should be stored in a clean dry area.

5-54. Preparation for Shipment.

Prepare the test set for shipment as follows:

a. Disconnect and secure loose components. (Ref para 2-12.)

b. Refer to tables 1-1 and 1-2 to be certain that the test set is complete.

c. Place the cover on each unit. Secure the four latches on the electrical unit. Secure the six latches on the hydraulic unit. Pack the unit. (Ref para 5-51.) The equipment is now ready for shipment.

Chapter 6

PARTS BREAKDOWN

SECTION I INTRODUCTION

6-1. Purpose.

This chapter describes and illustrates the assemblies and detail parts required for maintenance of the *ILCA Bench Test Set 145GS278-1. Part numbers are for reference only. Refer to TM 55-4920-428-30P for parts requisition.*

a. This chapter consists of an Introduction, Index of Reference Designations, Index of Part Numbers, and Detailed Parts List.

6-2. Reference Designation Index. This index consists of all the reference designations shown on schematic and wiring diagrams and on subassemblies of this test set. The index is arranged in columns as follows:

a. The Reference Designation column contains the reference designations in alphanumerical sequence. Reference Designation Numbers for detail parts of electronic or subassembly are prefixed with the Reference Designation Number for the component.

b. The Figure and Index number columns contain the figure, and item number assigned to parts having electrical and electronic reference designation codes.

REFERENCE DESIGNATION	FIGURE	INDEX
D 1	6-3	48
J 1	6-3	54
J 2	6-3	37
J 3	6-3	36
J 4	6-3	37
J 5	6-3	36
J 6	6-3	35
J 7	6-3	54
J 8	6-3	34
J 9	6-3	55
M 1	6-3	60
M 2	6-3	60
PCA-1	6-3	82
PCA-2	6-3	82
P S 1	6-3	5
P S 2	6-3	33
P S 3	6-3	8
R1 thru R4	6-3	69

REFERENCE DESIGNATION	FIGURE	INDEX
S1, S2	6-3	62
S3	6-3	52
S4	6-3	74
S5	6-3	53
S6	6-3	74
S7, S9	6-3	63
S11	6-3	67
S12	6-3	64
S13	6-3	66
S14	6-3	70
S15	6-3	66
S16	6-3	70
S17	6-3	71
S18	6-3	65
T1	6-3	12
TB1	6-3	87
TB2	6-3	88
TB3	6-3	89
TB4	6-3	23
TB5	6-3	27
TB6	6-3	20
TB6B	6-3	19
TB7	6-3	22

6-3. Index of Part Numbers. This index contains a complete listing of all items shown in the Detailed Parts List compiled in alphanumeric sequence. The index is arranged in columns as follows:

a. The Part Number Column contains the part numbers of the manufacturer of the part or the part number assigned to it by the Boeing Vertol Co. *Requisition parts thru TM55-4920-428-30P.*

(1) Part number arrangement begins at the extreme left position and continues, one position at a time, until all parts are arranged in sequence. The order of precedence, beginning the part number arrangement at the extreme left (first) position, is as follows:

Letters A through Z for the alpha index
Numerals 0 through 9 for the numeric index.

(2) The order of precedence in continuing the part number arrangement on the second and succeeding positions of the part number from left to right is as follows:

Space (blank column)
Diagonal (/)
Point (.)
Dash or hyphen (-)
Letters A through Z, then
Numerals 0 through 9

Alphabetic (letter) 0 is listed as numerical zero's

Examples of part number sequence
ABC0158
AN509-10
AN509C10R7

A39539-10-001
ZB45-37C
10-60732-3
10001
11
112304
5008CW
65-2716-27
6553

b. The Figure and Index number columns contain the figure and index number listing/s assigned to a part.

PART NUMBER	FIGURE	ITEM
.375 X 6-32	6-3	16
.50 X8-32	6-3	30
AN43B-7	6-4	43
AN806-4D	6-4	11
AN806-4D	6-4	26
AN806-8D	6-4	18
AN814-4D	6-5	88
AN814-4S	6-5	88
AN815-4	6-5	27
AN815-4	6-9	6
AN815-4D	6-5	27
AN815-4S	6-5	27
AN816-4-4	6-5	77
AN816-4-4D	6-5	77
AN816-4-4S	6-5	77
AN816-6	6-5	102
AN816-6S	6-5	102
AN818-12	6-5	69
AN818-12S	6-5	69
AN818-6	6-5	64
AN818-6S	6-5	64
AN818-8J	6-5	6
AN824-4	6-5	16
AN824-4D	6-5	16
AN824-4S	6-5	16
AN824-8	6-5	7
AN824-8S	6-5	7
AN827-8	6-5	12
AN827-8S	6-5	12
AN834-4S	6-5	87
AN834-6	6-5	90
AN834-6D	6-5	90
AN834-6S	6-5	90
AN894-12-8	6-5	99
AN894D12-8	6-5	99
AN894S12-8	6-5	99
AN912-1	6-5	44
AN912-1S	6-5	44
AN912-2	6-5	63
AN912-2S	6-5	63
AN912-5J	6-5	82
AN917-2J	6-5	43
AN917-4	6-5	83
AN917-4D	6-5	83

PART NUMBER	FIGURE	ITEM
AN917-4S	6-5	83
AN919-6	6-5	92
AN919-6S	6-5	92
AN919D6	6-5	92
AN924-4	6-5	29
AN924-4D	6-5	29
AN924-4S	6-5	29
AN924-6	6-5	93
AN924-6D	6-5	93
AN924-6S	6-5	93
AN924-8	6-5	96
AN924-8D	6-5	96
AN924-8S	6-5	96
AN929A45	6-4	55
AN929A85	6-4	62
AN933-2	6-5	80
AN933-3	6-5	86
AN933D2	6-5	80
AN933D3	6-5	86
AN933S2	6-5	80
AN933S3	6-5	86
AN960-1016	6-4	91
AN960-816L	6-2	21
AN960C416L	6-4	42
AN960C416L	6-10	7
AN960D1016	6-4	91
AN960D416	6-10	12
AN960KD1216	6-5	97
AN960KD716	6-5	38
AN960-4L	6-3	9
AN960-10L	6-3	28
AN960-416	6-9	10
AN960-416	6-4	47
AN960-416L	6-4	67
AN960D516	6-4	59
AN960-516	6-4	59
AN960-6	6-3	81
AV8-1.0/12PS	6-5	40
BACC10T3	6-10	4
BACC13Y3-40	6-4	7
BACC13Y-3B60	6-4	70
BACC13Y-3B60	6-4	79
BACC13Y-3B60	6-4	82
BACC13Y-3B60	6-4	88
BACC13Y-3B60	6-10	15
BACF22U2	6-4	69
BACF32D-1	6-5	106
BACH10G2B	6-5	105
BACJ1lAB1-02	6-3	36
BACJ1lAB1-03	6-3	35
BACS53B1EA2	6-3	34
BACT12AC2	6-3	92
BACT12AC3	6-3	93
BACT12AC54	6-4	68
BACT12AC7	6-3	82
BACP18L6P-100	6-4	92
BP249-A2G4	6-3	50
BP249-105R	6-3	49
BP30GN	6-2	18

PART NUMBER	FIGURE	ITEM
BP30R	6-2	19
BP30WT	6-2	20
BP30Y	6-2	17
CV-3P-65	6-5	61
DBDS6G1X/25/12	6-5	78
DFBHHC60G10B1.0/5	6-5	72
DFBHHC60G10B1.0/5	6-11	1
DV-8-1.1/12-V-S	6-5	46
E3464B	6-5	101
FH1032-10	6-3	97
FH632-10	6-3	96

PART NUMBER	FIGURE	ITEM
J-1304-4	6-3	37
KLF250S	6-5	103
KT19783-HO	6-3	70
MD35338-41	6-3	80
MIL-H-8788	6-4	14
MIL-H-8788	6-4	21
MIL-H-8788	6-4	29
MODEL 461	6-7	15
MODEL 957	6-7	14
MODEL 968	6-7	13
MR26W5T5DCVAR	6-3	59
MS16562-36	6-9	8
MS16624-1050	6-10	16
MS16998-33	6-6	7
MS16998-40	6-4	66
MS16998-42	6-4	48
MS16998-45	6-4	31
MS17984-405	6-4	45
MS17984-410	6-4	78
MS17984-411	6-4	78
MS17984-413	6-4	81
MS17984-420	6-4	87
MS17984-425	6-4	87
MS18029-2S-6	6-3	24
MS20822-12	6-5	71
MS20822-12S	6-5	71
MS20822-4-4	6-5	42
MS20822-4-4D	6-5	42
MS20822-4-4S	6-5	42
MS20822-6-6	6-5	62
MS20822-6-6D	6-5	62
MS20822-6-6S	6-5	62
MS20826-4S	6-5	45
MS21044N3	6-3	27
MS21044N04	6-3	10
MS21044N06	6-3	77
MS2104N08	6-3	4
MS21243-4	6-7	4
MS24394-4	6-5	28
MS24394-6	6-5	91
MS2394-8	6-5	98
MS24394D4	6-5	28
MS24394D8	6-5	98
MS24394S4	6-5	28
MS24394S6	6-5	91
MS24394S8	6-5	98
MS24585C229	6-10	8
MS24586-678	6-4	44
MS24693-S320	6-4	57
MS27212-2-6	6-3	26
MS28759-4-36	6-4	27
MS28759-4-96	6-4	12
MS28759-8-96	6-4	19
MS28760-4	6-4	13
MS28760-4	6-4	28
MS28760-8	6-4	20
MS28775-011	6-6	4

PART NUMBER	FIGURE	ITEM
MS28775-012	6-6	12
MS28775-012	6-4	96
MS28775-013	6-9	3
MS28775-014	6-9	4
MS2775-128	6-4	5
MS28778-4	6-9	7
MS28778-4	6-5	30
MS28778-6	6-5	100
MS3417-12N	6-2	13
MS3417-14N	6-2	5
MS3417-14N	6-2	9
MS35191-293	6-4	22
MS35333-38	6-3	94
MS35338-41	6-3	84
MS35338-43	6-3	39
MS35426-13	6-6	8
MS35426-29	6-4	60
MS35426-30	6-4	60
MS35649-202	6-3	38
MS35650-3312	6-7	5
MS39086-37	6-4	92
MS39087-201AN	6-3	58
MS51525-B4S	6-5	110
MS51527-B4S	6-5	111
MS51963-222	6-7	10
MS51963-242	6-7	11
MS51967-50	6-4	93
MS51967-51	6-4	93
M39019/03-249	6-3	69
M83723-84R1412N	6-3	54
M83723-84R1415N	6-3	53
M83723-84R1203N	6-3	33
M83723-85R1412N	6-4	64
M83723-86R1203N	6-2	11
M83723-86R1412N	6-2	8
M83723-86R1415N	6-2	4,16
M83723-87R1412N	6-2	7
M83723-87R1415N	6-2	3
NAS1068-A3	6-3	91
NAS1068A4	6-10	18
NAS1189E4P24	6-10	9
NAS1334-13	6-4	81
NAS1773-4	6-10	18
NAS1786A06-6	6-3	16
NAS1786A08-8	6-3	30
NAS43DD0-18	6-3	76
NAS43DD1-52	6-3	14
NAS43DD1-56	6-3	15
NAS43DD3-16	6-3	40
NAS514P1032-6P	6-3	6
NAS514P440-20P	6-3	8
NAS514P440-8P	6-3	25
NAS514P632-5P	6-3	17
NAS514P832-6P	6-3	31
NAS5141032-10P	6-3	2
NAS514P832-10P	6-3	3
NAS514P832-12P	6-3	20
NAS600-4P	6-3	72
NAS600-5P	6-3	73
NAS600-11P	6-3	75
NAS601-32P	6-3	12

PART NUMBER	FIGURE	ITEM
NAS602-4P	6-3	29
NAS603-9P	6-3	86
NAS603-6P	6-3	56
NAS604-12P	6-10	11
NAS607-44	6-4	33
NAS607-4-6	6-9	12
NAS620-6	6-3	13
NAS620-416	6-7	7
NAS671-6	6-3	79
NAS679A4M	6-10	6
NAS679A4M	6-10	6
NAS679A4M	6-10	13
NAS679A4	6-8	7
NAS679A4	6-4	41
NAS679A4	6-4	46
NAS679A4	6-10	13
NAS679A5	6-4	58
NAS679C5M	6-4	58
NAS1304-8	6-7	2
PMHH152BW4DG-99	6-3	64
PMHH152GR4DG-63	6-3	63
PMHH152GR4DG-64	6-3	62
PMHH152GR4DC-99	6-3	65
PMZ15D	6-3	66
PRV2-10-K-6T-35	6-5	94
PR6701-2-1/4S2-1/4P	6-5	81
RV6SAYSD103A	6-3	67
S1D-27A-400	6-3	7
SLS92-28	6-3	32
SP01-18	6-5	74
STBS12EZ10BD6	6-3	55
TA5000BH14-02	6-10	3
TC354A	6-5	107
TRBTX6-4SS	6-5	11
TRBTX8-4SS	6-5	5
TRTX12-4SS	6-5	70
TRTX6-4SS	6-5	11
TRTX8-4SS	6-5	5
UR7028-4-0.50	6-4	33
UT7028-4-3/4	6-9	12
UT7101-8-L	6-4	56
UT7101-8-L	6-4	63
UT7101-8-L	6-4	79
UT7101-8-L	6-4	82
UT7101-8-L	6-4	88
UT7101-8	6-4	70
UT7101-8-RL	6-4	7
UT7101-8-RL	6-4	10
UT7101-8-RL	6-4	17
UT7101-8-RL	6-4	25
UT7113-848	6-10	17
VS25113-4	6-1	9
WW-4	6-6	2
0060D010BHHC	6-11	9
10250TC53	6-4	51
10250T5	6-4	52
10250T51	6-4	50
10250T63	6-4	53
12-141	6-3	22
136PLAIN	6-2	15
140J-1	6-3	23

PART NUMBER	FIGURE	ITEM
145GS278-1	6-1	1
145GS278-2	6-1	13
145GS278-2	6-4	1
145GS278-3	6-1	2
145GS278-4	6-1	6
145GS278-4	6-2	10
145GS278-5	6-1	3
145GS278-5	6-2	1
145GS278-6	6-1	4
145GS278-6	6-2	2
145GS278-7	6-1	5
145GS278-7	6-2	6
145GS278-8	6-4	98
145GS278-9	6-4	73
145GS278-10	6-4	38
145GS278-11	6-4	30
145GS278-12	6-4	3
145GS278-13	6-4	3
145GS278-14	6-4	95
145GS278-15	6-4	83
145GS278-16	6-4	2
145GS278-17	6-4	23
145GS278-18	6-4	8
145GS278-19	6-4	15
145GS278-20	6-1	13
145GS278-20	6-2	14
145H1288-1	6-9	5
182-14884-1	6-3	87
182-14884-2	6-3	88
182-14884-3	6-3	89
182-14884-4	6-3	90
182-14887-1	6-3	5
182-14890-1	6-1	7
182-14890-1	6-3	1
182-14890-8	6-1	7
182-14890-9	6-3	83
182-14890-10	6-3	84
182-14890-11	6-3	85
182-14890-12	6-3	18
182-14892-14	6-3	78
182-14894-1	6-3	95
182-14894-2	6-3	48
182-14894-3	6-3	45
182-14894-8	6-3	46
182-14894-9	6-3	44
182-14894-11	6-3	42
182-14894-12	6-3	43
182-14894-15	6-3	41
182-14895-1	6-3	60
182-14895-2	6-1	8
182-14896-1	6-1	3
182-14896-2	6-1	4
182-14896-3	6-1	5
182-14896-5	6-1	6
182-14897-2	6-1	13
182-14899-2	6-1	10
182-14899-3	6-1	11
182-14899-4	6-1	2
182-14900-2	6-1	1
182-14937-2	6-4	100
182-14937-3	6-4	101
182-14937-4	6-4	23

PART NUMBER	FIGURE	ITEM
182-14937-5	6-4	8
182-14937-6	6-4	15
182-14937-7	6-4	9
182-14937-7	6-4	24
182-14937-8	6-4	16
182-14937-9	6-4	54
182-14937-10	6-4	61
182-14937-11	6-4	102
182-14937-12	6-4	1
182-14939-2	6-4	97
182-14940-1	6-5	104
182-14940-1	6-9	1
182-14941-1	6-9	13
182-14942-1	6-9	11
182-14943-1	6-6	1
182-14943-2	6-6	1
182-14944-1	6-6	10
182-14944-2	6-6	15
182-14944-3	6-6	13
182-14944-4	6-6	14
182-14944-5	6-6	11
182-14945-2	6-6	5
182-14946-1	6-6	6
182-14946-2	6-9	9
182-14947-1	6-4	3
182-14947-2	6-4	6
182-14947-3	6-4	4
182-14948-1	6-4	32
182-14948-2	6-4	34
182-14949-2	6-4	84
182-14950-1	6-4	49
182-14950-1	6-7	1
182-14951-1	6-7	3
182-14951-2	6-7	6
182-14952-1	6-7	8
182-14952-2	6-7	12
182-14952-3	6-7	9
182-14957-1	6-4	40
182-14961-1	6-4	99
182-14961-1	6-5	1
182-14961-2	6-5	108
182-14962-1	6-5	109
182-14962-1	6-8	1
182-14962-2	6-8	34
182-14962-4	6-8	3
182-14962-5	6-5	79
182-14962-6	6-8	8
182-14962-7	6-8	5
182-14963-1	6-4	77
182-14963-2	6-4	80
182-14963-3	6-4	86
182-14964-1	6-5	76
182-14965-1	6-10	5
182-14965-2	6-10	10
182-14966-1	6-4	103
182-14966-1	6-10	1
182-14966-2	6-10	19
182-14966-3	6-10	14
182-15106-1	6-4	89
182-15106-2	6-4	94
182-15171-1	6-4	65
182-15171-2	6-4	72
182-15171-3	6-4	71
182-15178-1	6-5	84

PART NUMBER	FIGURE	ITEM
182-15288-10	6-5	25
182-15288-11	6-5	24
182-15288-12	6-5	23
182-15288-13	6-5	22
182-15288-14	6-5	20
182-15288-15	6-5	21
182-15288-16	6-5	53
182-15288-17	6-5	52
182-15288-18	6-5	55
182-15288-19	6-5	51
182-15288-20	6-5	56
182-15288-24	6-5	49
182-15288-25	6-5	54
182-15288-28	6-5	57
182-15288-33	6-5	58
182-15288-35	6-5	59
182-15288-36	6-5	60
182-15288-37	6-5	13
182-15288-38	6-5	66
182-15288-39	6-5	65
182-15288-40	6-5	34
182-15288-41	6-5	48
182-15288-43	6-5	50
182-15288-44	6-5	19
182-1528845	6-5	47
182-15288-46	6-5	41
182-15288-47	6-5	39
182-15288-48	6-5	36
182-15288-49	6-5	10
182-15288-50	6-5	35
182-15288-51	6-5	17
182-15288-52	6-5	9
182-15288-53	6-5	14
182-15288-54	6-5	8
182-15288-56	6-5	4
182-15288-57	6-5	67
182-15288-58	6-5	68
182-15288-59	6-5	18
182-15288-60	6-5	31
182-15288-61	6-5	32
182-15288-62	6-5	33
182-15288-63	6-5	37
182-15288-64	6-5	15
182-15288-65	6-5	3
182-15288-66	6-5	2
182-19549-1	6-3	19
182-19555-1	6-3	47
2PB901-T2	6-3	71
202KLL2	6-4	85
25-5041J	6-4	74
280-35001-115	6-3	75
3C11-4T3	6-5	26
396KA2L32P33C1A	6-1	11
4WE6D51/NZ4/5	6-5	75
45-1377DS04B	6-5	85
5002BH10-02	6-10	2
5-11101	6-5	74
5-16311-316BAM1	6-3	68
5-21611-313BAM1	6-3	51
5-22381-327BAM3	6-3	52
5266C	6-2	12
5-41541-312AM2	6-3	61
6-141	6-3	21

PART NUMBER	FIGURE	ITEM
600-3130-10	6-3	57
657F	6-4	38
657H	6-4	75
657R	6-4	39
6632/20	6-4	76
68913- ¼D2	6-5	95
7/16SCX3/8	6-6	3
711HS	6-4	36
711-28-29-30	6-4	37
744-1001MDF60-2	6-11	8
744-1001MDF60-3	6-11	6
744-1001MDF60-4	6-11	4
744-1001MDF60-5	6-11	2
744-1001MDF60-6	6-11	7
744-1001MDF60-7	6-11	10
744-1001MDF60-8	6-11	3
744-1001MDF60-9	6-11	5
833365	6-5	73
8422E4D2P	6-5	89
8593	6-3	11
9/16SCX7/8	6-9	2

6-4. Detailed Parts List. The text portion of the Detailed Parts Lists is arranged in columns as follows:

a. Figure and Index Number - The number in the left position in the first column of each text page is the figure number. The number in the right hand position is the index number which keys the part number to the illustration when the part is illustrated. When a breakdown consists of both left- and right-hand assemblies, only left-hand parts are illustrated.

b. Part Number - This column contains the identifying number assigned to each part. If an item does not have a part number, NO NUMBER will appear in this column. A complete description of the item will be included in the description column. *Requisition parts thru TM55-4920-428-30P.*

c. Description - This column lists a description of each part by Government standard vendor, or manufacturer's drawing title. *Included in this column, when* required, are the following:

(1) A five-digit vendor code, preceded by the capital letter V. Vendor codes used in the Detailed Parts List are as follows:

Vendor Code Index

Code	Vendor Name end Address
15755	Abbott Laboratories, Inc. 5200 W. Jefferson Blvd. Los Angeles, CA
15084	Aerospace Knob Co. Elmonte, CA
15084	Dupree Inc. Aerospace Knob Co., Div. 9835 Dupree St P.O. Box 3156 S. Elmonte, CA 91733
	Air Pax Chesire Div. Chesire Industrial Park Chesire, CO

Vendor Code Index (Continued)

Code	Vendor Name and Address
00779	AMP Inc. PC). Box 3608 Harrisburg, PA 17015
07829	Bodine Electric Co. 2500 W. Bradley Pl. Chicago, IL 60618
99017	Caplugs Division, Protective Closures Inc. 2150 Elmwood Ave. Buffalo, N.Y. 14207
17419	Deutsch Fastener Co. 1315 F. Grand Ave. El Segundo, CA
17419	The Deutsch Co. 7001 W. Imperial Highway Los Angeles, CA 17419
01526	General Electric Co. Data Communication Products Dept General Electric Dr. Waynesboro, VA 29980
yy~13	Jan Hardware Manufacturing Co., Inc. Long Island City, NY
26664	Litton Industries Inc. Triad Distributor Div. Huntington, IN
65159	LMB Heeger Los Angeles, CA 90023
91929	Honeywell, Inc. Microswitch Div 11 W. Spring St. Freeport, IL 61032
27014	National Semiconductor Santa-Clara, CA
03626	Non-Linear Systems, Inc. 533 Stevens Ave. Solana Beach, CA 92075
76854	Oak Switch Systems, Inc. Sub Oak Technology Inc. 100 S. Main St. P.O. Box 514 Crystal Lake, IL
83259	Parker- Hannifin Corp. O-Seal Division 10567 Jefferson Blvd. Culver City, CA
46365	Penn Engineering & Mfg. Corp. Doylestown, PA
58114	Rexroth Corp. 1700 Old Mansfield Rd. Wooster, OH 44691
V18677	Scanbe Corp. Elmonte, CA

Vendor Code Index (Continued)

Code	Vendor Name and Address
08779	Signal Transformer Co. Inwood, N.Y.
	Standard Supplies Santa Ana, CA
91407	Superior Electric Co. Bristol, CT 06010
01295	Texas Instruments Dallas, TX
81205	The Boeing Co. Kent, WA
V82893	Vector Board Electric Co., Inc. Sylmar, CA
12969	Unitrode Corp. Watertown, MA

(2) Abbreviations are used to describe parts. Abbreviations used in the Detailed Parts List areas follows:

ABBREVIATION	DESCRIPTION
ALT	Alternate
AC	Alternating Current
AFCS	Advanced Flight Control System
ASSY	Assembly
BKDN	Breakdown
BLKHD	Bulkhead
CK	Check
CPLG	Coupling
DIA	Diameter
DIV	Division
FH	Flat Head
FIG	Figure
ILCA	Integrated Lower Control Actuator
IN	Inch
L	Long
NHA	Next Higher Assembly
NPT	National Taper Pipe Thread
OD	Outside Diameter
PL	Plate
Press	Pressure
PSI	Pounds Per Square Inch
PSIG	Pounds Per Square Inch, Gage
SAS	Stability Augmentation System
SCH	Socket Head
SERNO	Serial No.
SOC	Socket
STL	Steel
TB	Terminal Board
U/O	Used On
U/W	Used With
W	Wall
W/SEAL	With Seal

(3) Oversize and undeIrsize parts such as studs and bushings are listed immediately following the standard size part. The degree of fit is also stated.

(4) When an assembly is broken down in another figure, a reference to that figure is provided.

(5) When the next higher assembly appears in another figure, a reference to that figure is provialed.

(6) Manufacturer's specification and source control drawing numbers are listed in the part number column. Equivalent vendor part numbers and codes are listed in the description column.

(7) For proper identification of details and next assemblies. The listings are subordinated in an indention system. The indention system shows the subordination of assembly in accordance with the following outline:

```
1 2 3 4 5 6 7
DEVICE
  ATTACHING PARTS FOR ASSEMBLY
  ASSEMBLY
. . ATTACHING PARTS FOR SUBASSEMBLY
. . SUBASSEMBLY OF DEVICE
. . . DETAIL PARTS OF SUBASSEMBLY
```

(8) Each Boeing part is given the number of the drawing from which the part is made. The drawings are numbered according to a system in which a prefix of three digits is used. Boeing-Vertol part numbers are prefixed with the numbers: 114, 145, 165, 173, 234, 308, and 414. Boeing-Kent part numbers are prefixed with 182.

(9) Specification and Source Control part numbers are listed in the part number column. Vendor equivalent part numbers are listed in the Nomenclature column.

In addition to the above, Boeing-Vertol standard parts listed are prefixed by the letters BAC and VS.

NOTE

Vendor codes are not used for Boeing-Vertol, Boeing standard parts, Boeing-Kent, and military standard part numbers.

(10) Usable On Code — This column indicates the applicability of an item to other types or makes or equipment.

(11) Units per Assembly – This column lists the number of units required per assembly or subassembly. When more than one assembly is required, the total for these assemblies will be listed. The letters AR indicate as required. The letters REF are used on items that are listed for reference purposes.

SECTION II DETAILED PARTS LIST

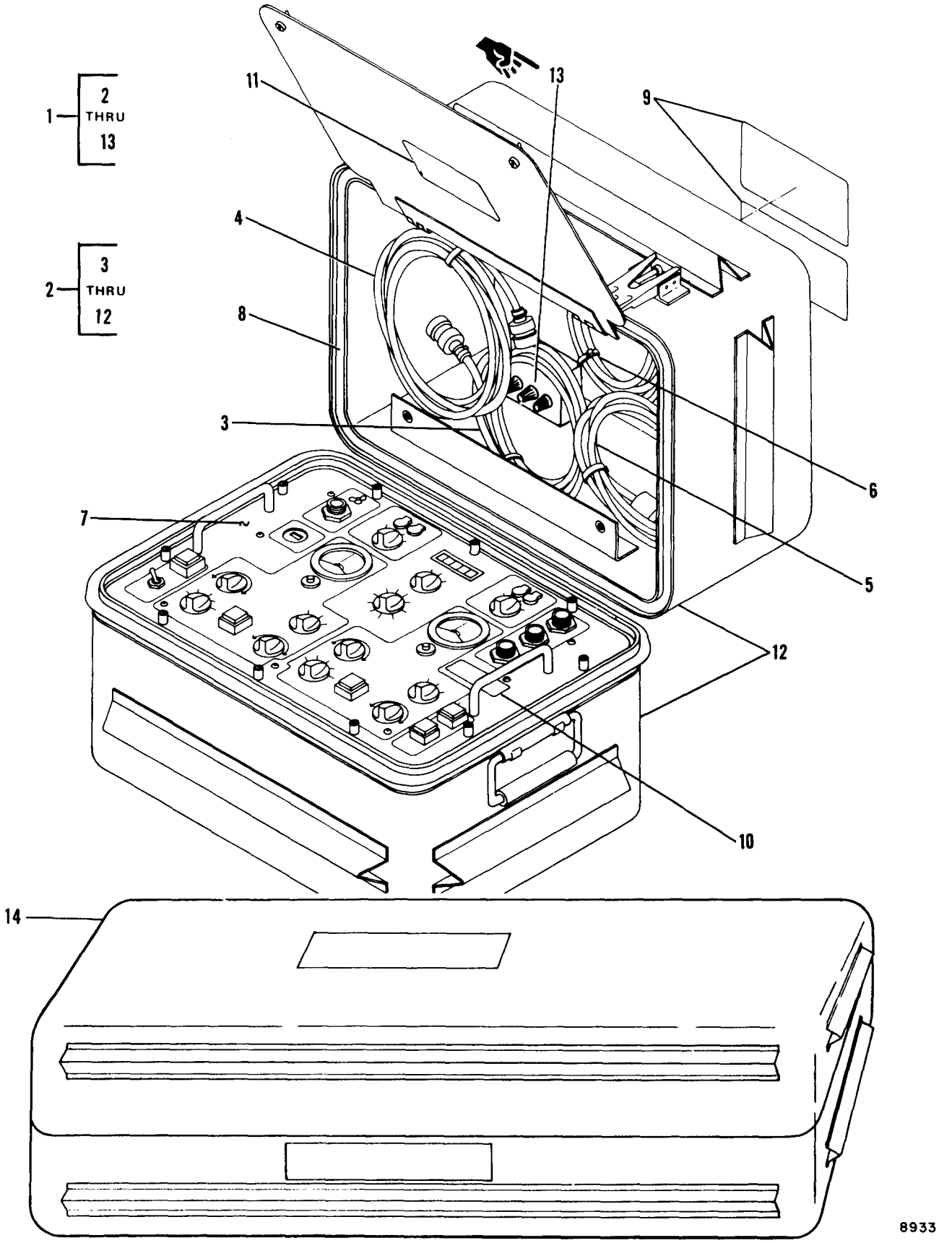


Figure 6-1. ILCA Bench Test Set

FIGURE AND INDEX NO.	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	QTY PER ASSY	USABLE ON CODE
6-1- 1	145GS278-1	TEST SET, ILCA BENCH ..... (182-14900-2)	1	
2	145GS278-3	. ELECTRICAL UNIT, ILCA ..... (182-14899-4)	1	
3	145GS278-5	. . CABLE ASSY, AFCS 1 ..... (182-14896-1) fig. 6-2 for bkdn	1	
4	145GS278-6	. . CABLE ASSY, AFCS 2 ..... (182-14896-2) fig. 6-2 for bkdn	1	
5	145GS278-7	. . CABLE ASSY, solenoid ..... shutoff (182-14896-3) fig. 6-2 for bkdn	1	
6	145GS278-4	. . CABLE ASSY, AC power ..... (182-14896-5) fig. 6-2 for bkdn	1	
7	182-14890-8	. . CHASSIS ASSY, unit ..... fig. 6-3 for bkdn	1	
8	182-14895-2	. . GASKET	1	
9	VS25113-4	. . NAMEPLATE	2	
10	182-14899-2	. . NAMEPLATE	1	
11	182-14899-3	. . NAMEPLATE	1	
12	396KA232P33C1A	. . CASE (V33414)	1	
13	145GS278-20	. . TEST ADAPTER, LVDT ..... (182-14897-2) fig. 6-2 for bkdn	1	
14	145GS278-2	. HYDRAULIC UNIT, ILCA/SAS ..... (182-14937-12) fig. 6-4 for bkdn	1	

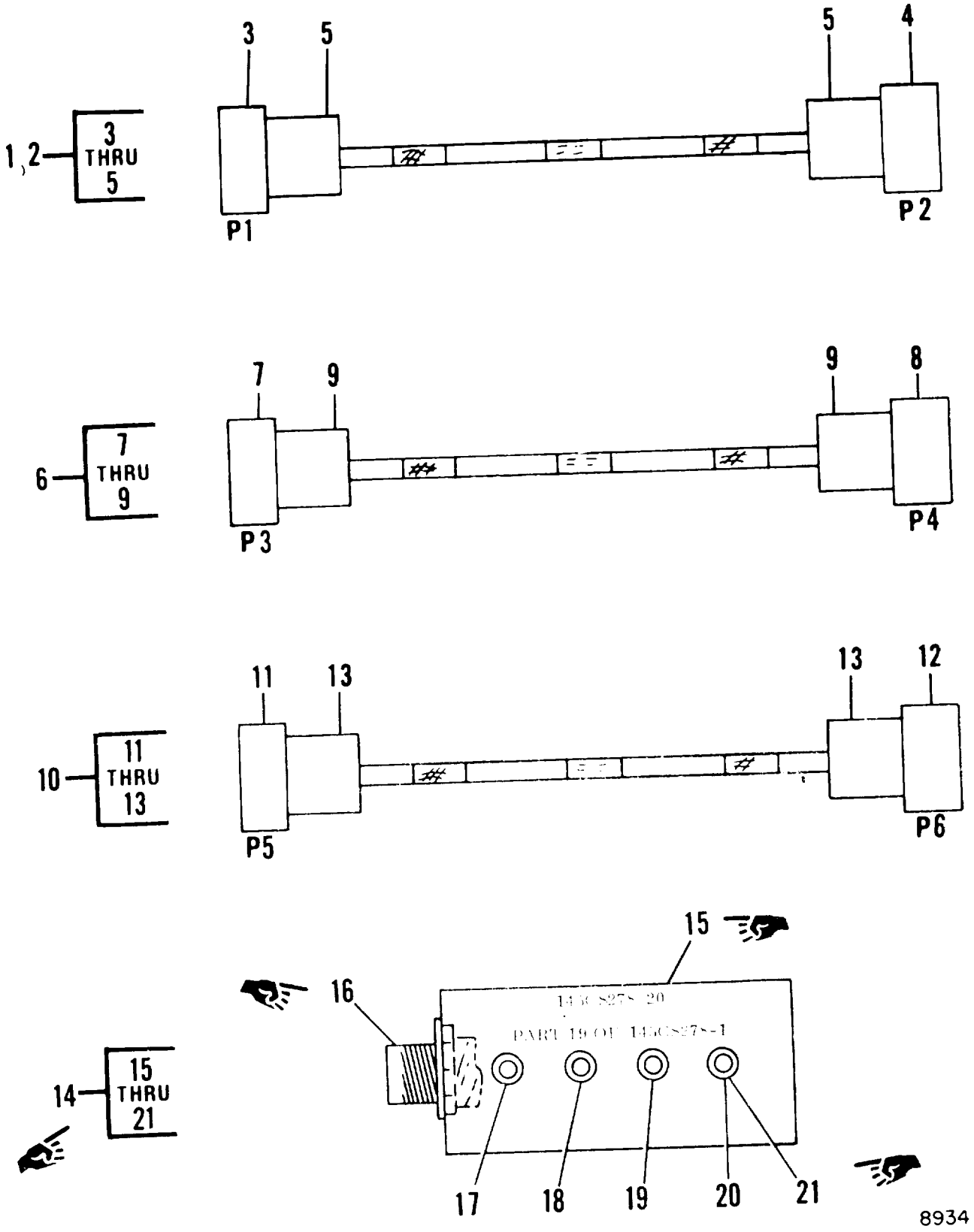


Figure 6-2. Cable Assemblies, AFCS 1 and 2 and LVDT Test Adapter

FIGURE AND INDEX NO.	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	QTY PER ASSY	USABLE ON CODE
6-2- 1	145GS278-5	CABLE ASSY, AFCS 1 (182-14896-1) fig. 6-1 for NHA	1	
2	145GS278-6	CABLE ASSY, AFCS 2 (182-14896-2) fig. 6-1 for NHA	1	
3	M83723-87R1415N	. CONNECTOR (P1)	1	
4	M83723-86R1415N	. CONNECTOR (P2)	1	
5	MS3417-14N	. BACKSHELL	2	
6	145GS278-7	CABLE ASSY, solenoid shutoff (182-14896-3) fig. 6-1 for NHA	1	
7	M83723-87R1412N	. CONNECTOR (P3)	1	
8	M83723-86R1412N	. CONNECTOR (P4)	1	
9	MS3417-14N	. BACKSHELL	2	
10	145GS278-4	CABLE ASSY, AC POWER (182-14896-5) fig. 6-1 for NHA	1	
11	M83723-86R1203N	. CONNECTOR (P5)	1	
12	5266C	. CONNECTOR (P6)	1	
13	MS3417-12N	. BACKSHELL	2	
14	145GS278-20	TEST ADAPTER,LVDT (182-14897-2) fig. 6-1 for NHA	1	
15	136 PLAIN	. BOX ALUMINUM (465159)	1	
16	M83723/85R1415N	. CONNECTOR (J1)	1	
17	BP30Y	. BINDING POST, YEL (BP1) (V91407)	1	
18	BP30GN	. BINDING POST, GRN (BP2) (V91407)	1	
19	BP30R	. BINDING POST, RED (BP3) (V91407)	1	
20	BP30WT	. BINDING POST, WHT (BP4) (V91407)	1	
21	AN960-816L	. WASHER	4	

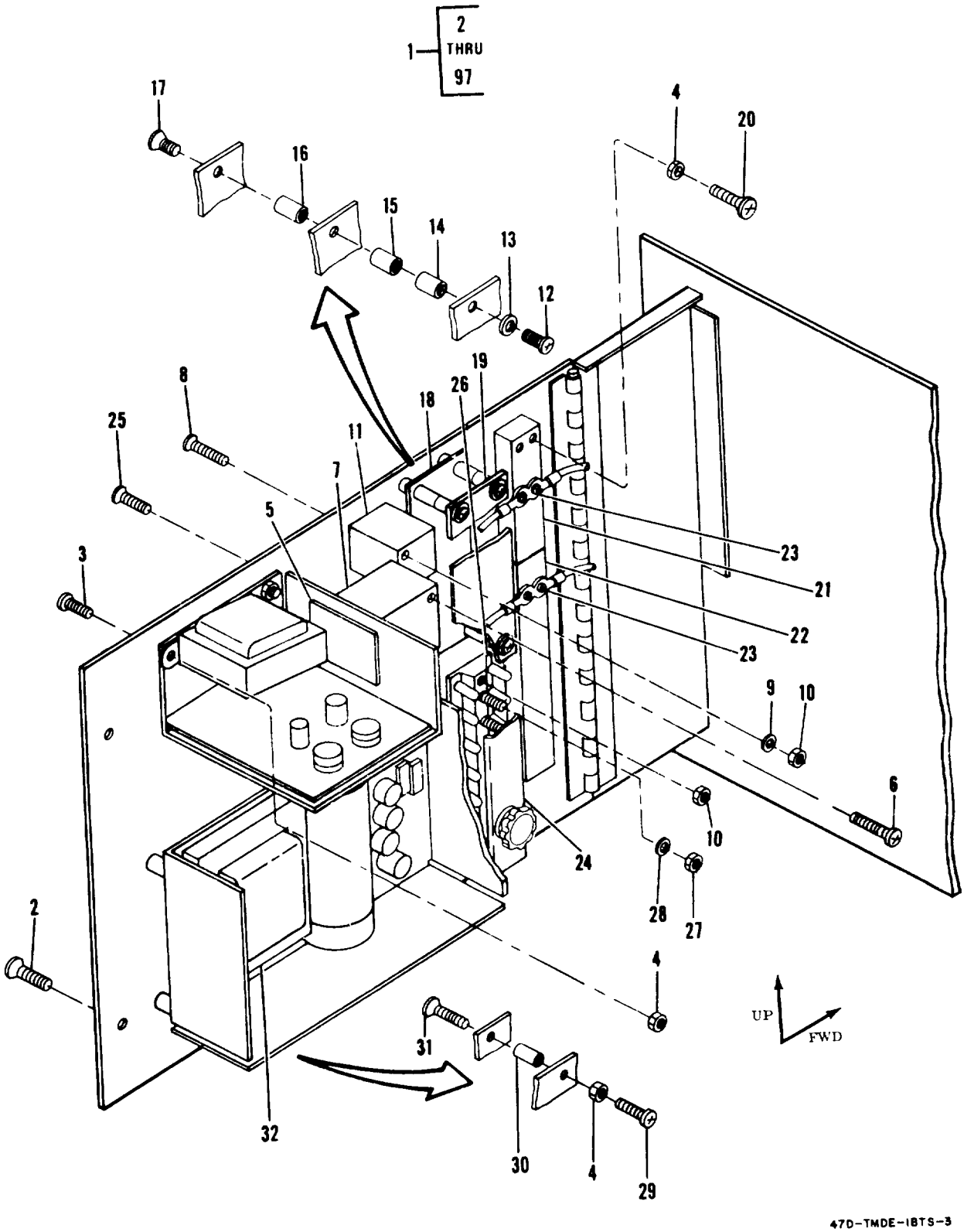


Figure 6-3. *Chassis Assy, Electrical Unit (Sheet 1 of 3)*

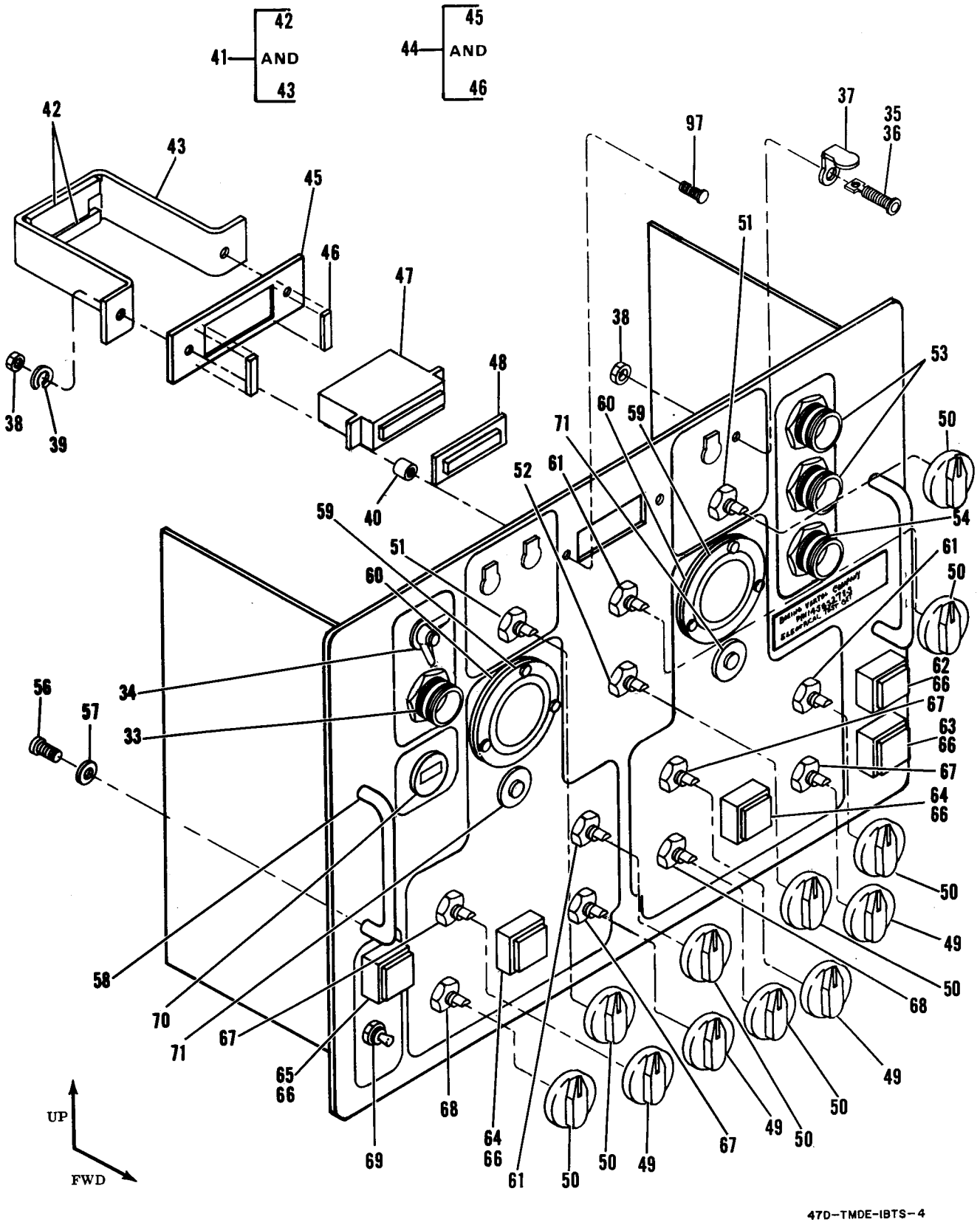


Figure 6-3. Chassis Assy, Electrical Unit (Sheet 2 of 3)

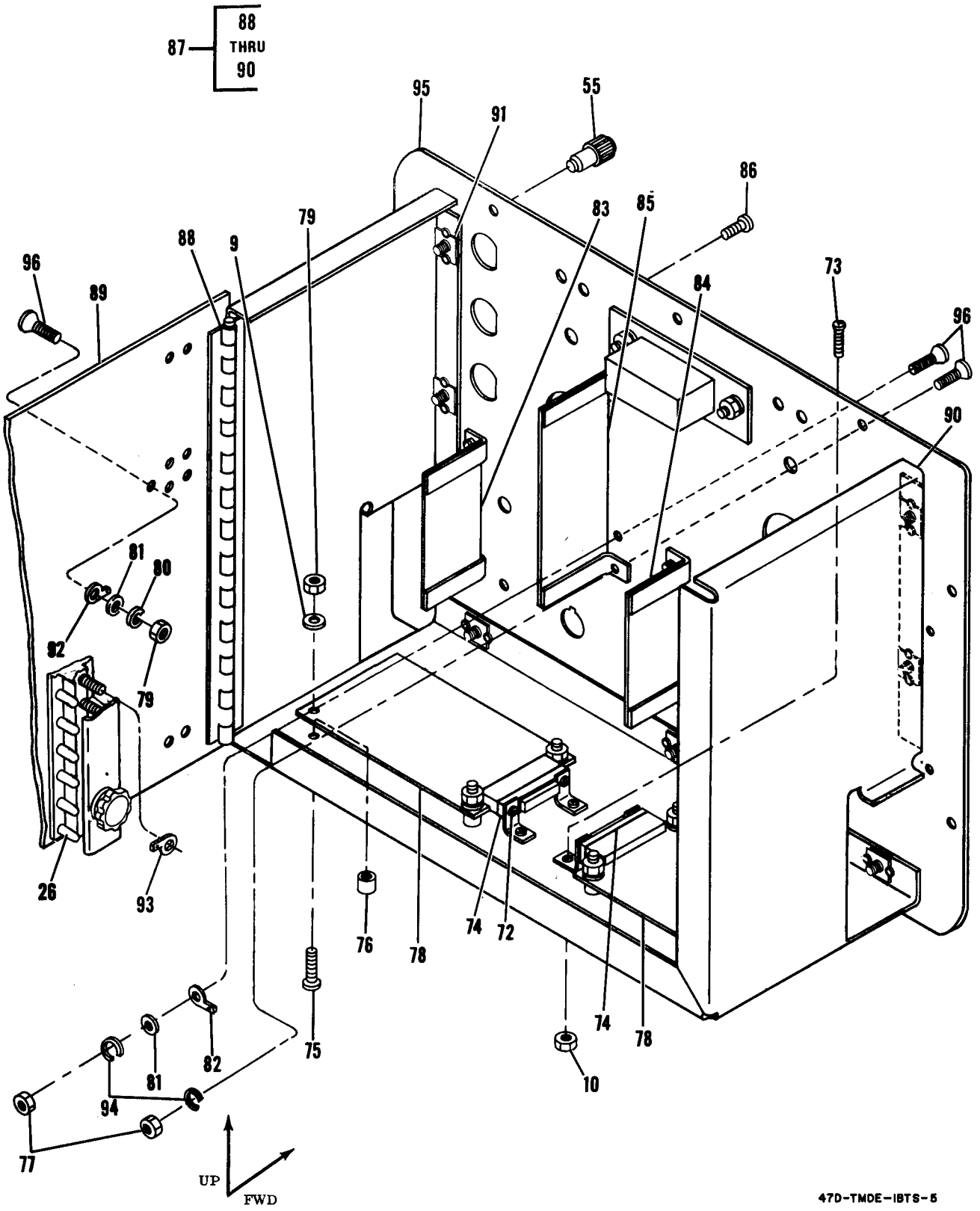


Figure 6-3. Chassis Assy, Electrical Unit (Sheet 3 of 3)

FIGURE AND INDEX NO.	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	QTY PER ASSY	USABLE ON CODE
6-3-	182-14890-8	CHASSIS ASSY, electrical unit	REF	
1		Fig. 6-1 for NHA		
2	NAS5141032-10P	. SCREW	3	
3	NAS514P832-10P	. SCREW	2	
4	MS21044N08	. NUT	10	
5	182-14887-1	. REGULATOR, supply, 5 volts (PS1)	1	
6	NAS514P1032-6P	. SCREW	4	
7	SID-27A-400	. INVERTER (PS3	1	
8	NAS514P440-20P	. SCREW	2	
9	AN960-4L	. WASHER	10	
10	MS21044N04	. NUT	16	
11	8593	. TRANSFORMER (T1)	1	
12	NAS601-32P	. SCREW, pan head	6	
13	NAS620-6	.WASHER	6	
14	NAS43DD1-52	. SPACER	6	
15	NAS43DD1-56	. SPACER	6	
16	NAS1786A06-6	. SPACER, threaded 375 x 6-32	6	
17	NAS514P632-5P	. SCREW, flat head	6	
18	182-14890-12	. BOARD ASSY, terminal (TB6A)	1	
19	182-19549-1	. TERMINAL BOARD ASSY (TB6B), UNDERVOLTAGE DETECTOR	1	
20	NAS514P832-12P	. SCREW	8	
21	6-141	. TERMINAL STRIP (TB7)	1	
22	12-141	. TERMINAL STRIP (TB4)	1	
23	140J-1	. JUMPERS	5	
24	MS18029-2S-6	. TERMINAL BOARD COVER	1	
25	NAS514P440-8P	. SCREW	2	
26	MS27212-2-6	. TERMINAL STRIP (TB5)	1	
27	MS21044N3	. NUT	6	
28	AN960-10L	. WASHER	6	
29	NAS602-4P	. SCREW	4	
30	NAS1786A08-8	. SPACER, threaded .50 x 8-32	4	
31	NAS514P832-6P	. SCREW	4	
32	SLS92-28	. POWER SUPPLY (PS2) (Standard Supplies, Santa Ana, CA)	1	
33	M83723-85R1203N	. CONNECTOR (J8)	1	
34	BACS53B1EA2	. GROUND STUD (J6) (V4635)	1	
35	BACJ11AB1-03	. JACK, banana (J3,J5)	2	
36	BACJ11AB1-02	. JACK, banana (J2,J4)	2	
37	J-13044-4	. JACK, cover (V99813)	4	
38	MS35679-202	. NUT	2	
39	MS35338-43	. WASHER, lock	2	
40	NAS43DD3-16	. SPACER	2	
41	182-14894-15	. RETAINER ASSY	1	
42	182-14894-11	.. PAD	1	
43	182-14894-12	.. RETAINER (U/O 182-14894-15)	1	
44	182-14894-9	. RETAINER ASSY	1	
45	182-14894-3	.. RETAINER	1	
46	182-14894-8	.. PAD	2	
47	182-19555-1	. METER, digital (DMI)	1	
48	182-14894-2	. LENS	1	
49	BP249-105R	. KNOB	4	
50	BP249-A2G4	. KNOB	8	
51	5-21611-313BAM1	. SWITCH, 4-position, 3-pole (S1,S2)	2	

FIGURE AND INDEX NO.	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	QTY PER ASSY	USABLE ON CODE
6-3- 52	5-22381-327BAM3	. SWITCH, 10-position, 3-pole (S5)	1	
53	M83723-84R1415N	. CONNECTOR (J1, J7)	2	
54	M83723-84R1412N	. CONNECTOR (J9)	1	
55	STBS12EZ10BD6	. SCREW, locking (Deutsch Fastener Co. El Segundo, CA)	10	
56	NAS603-6P	. SCREW	4	
57	600-3130-10	. WASHER	4	
58	MS39087-201AN	. HANDLE	2	
59	MR26W5T5DCVAR	. METER, panel, 2521 (M1,M2)	2	
60	182-14895-1	. GACKET, meter	2	
61	5-41541-312AM2	. SWITCH, 3 position, 10-pole (S3,S7,S9)	3	
62	PMHH152GR4DG-64	. SWITCH, cycle motor (S12)	1	
63	PMHH152GR4DG-63	. SWITCH, solenoid shutoff (S18)	1	
64	PMHH152GR4DG-99	. SWITCH, (S13,S15)	2	
65	PMHH152GR4DG-99	. SWITCH, indicator power; warn; lamp test (S11)	1	
66	PMZ15D	.. LAMP	2	
67	RV6SAYSD103A	. POTENTIOMETER (R1,R2,R3,R4)	4	
68	5-16311-316-BAM1	. SWITCH, 5-position, 2-pole (S14,S16)	2	
69	M639019/03-249	. CIRCUIT BREAKER W/SEAL (S17)	1	
70	KT19783H0	. METER, elapsed time	1	
71	2PB901-T2	. SWITCH (S4,S6) (X10 SW)	2	
72	NAS600-4P	. SCREW	4	
73	NAS600-5P	. SCREW	4	
74	280-35001-115	. CONNECTOR, edge 41 pin	2	
75	NAS600-11P	. SCREW	8	
76	NAS43DD0-18	. SPACER	8	
77	MS21044N06	. NUT	2	
78	182-14892-14	. BOARD, printed, wiring, activator control (PCA-1, PCA-2)	2	
79	NAS671-6	. NUT	6	
80	MD35338-41	. WASHER, lock	6	
81	AN960-6	. WASHER, flat	2	
82	BACT12AC7	. LUG	1	
83	182-14890-9	. BOARD ASSY, terminal (TB1)	1	
84	182-14890-10	. BOARD ASSY, terminal (TB2)	1	
85	182-14890-11	. BOARD ASSY, terminal (TB3)	1	
86	NAS603-9P	. SCREW	10	
87	182-14884-1	. BRACKET ASSY	1	
88	182-14884-2	.. HINGE	1	
89	182-14884-3	.. PANEL,rear	1	
90	182-14884-4	.. BRACKET	1	
91	NAS1068-A3	.. NUTPLATE	12	
92	BACT12AC2	. LUG, wire	AR	
93	BACT12AC3	. LUG, wire	AR	
94	MS35333-38	. WASHER, lock	2	
95	182-14894-1	. PANEL, front	1	
96	FH632-10	.. STUD, self-clinching	9	
97	FH1032-10	.. STUD, self-clinching	2	

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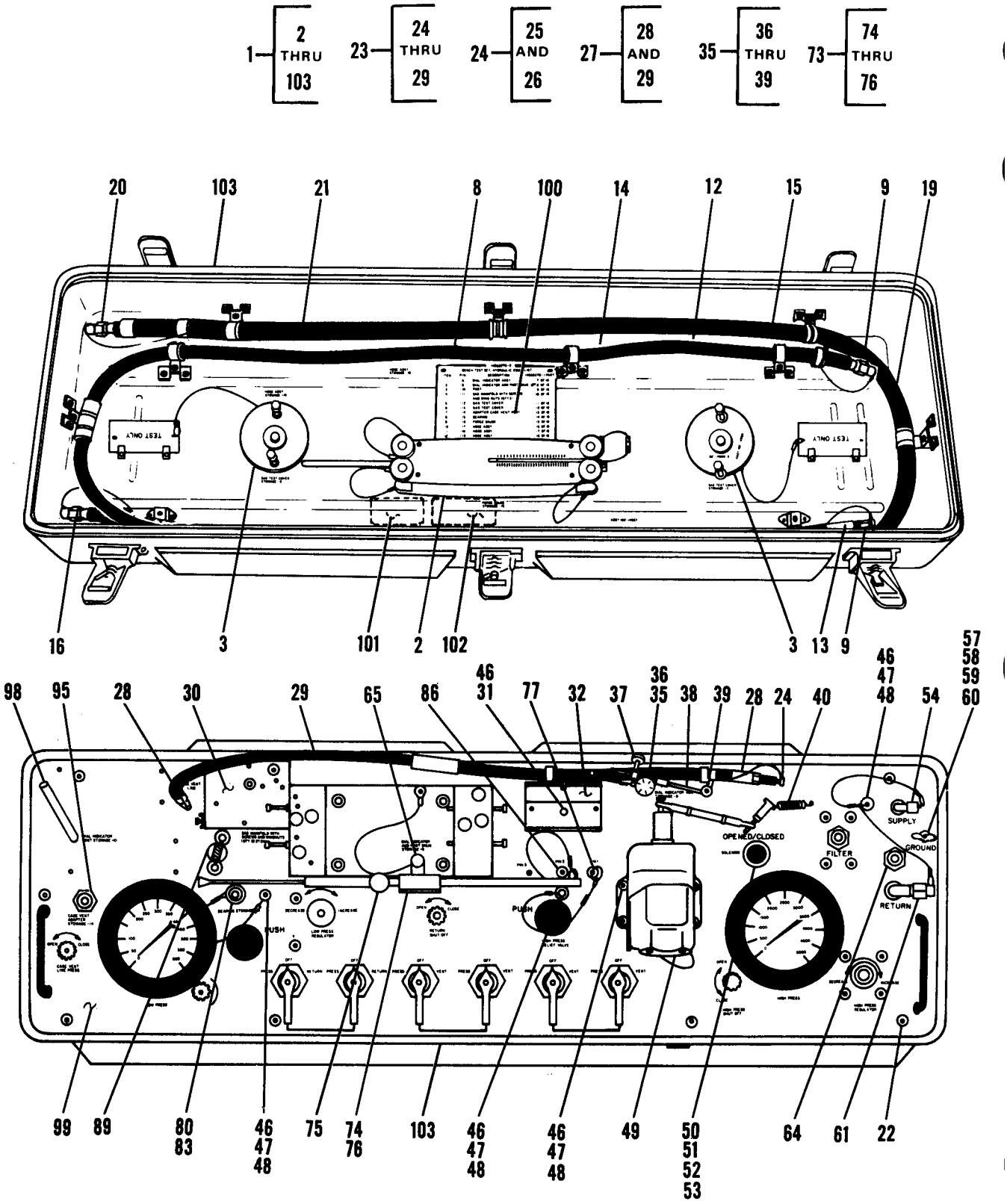

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Figure 6-4. Hydraulic Unit (Sheet 1 of 4)

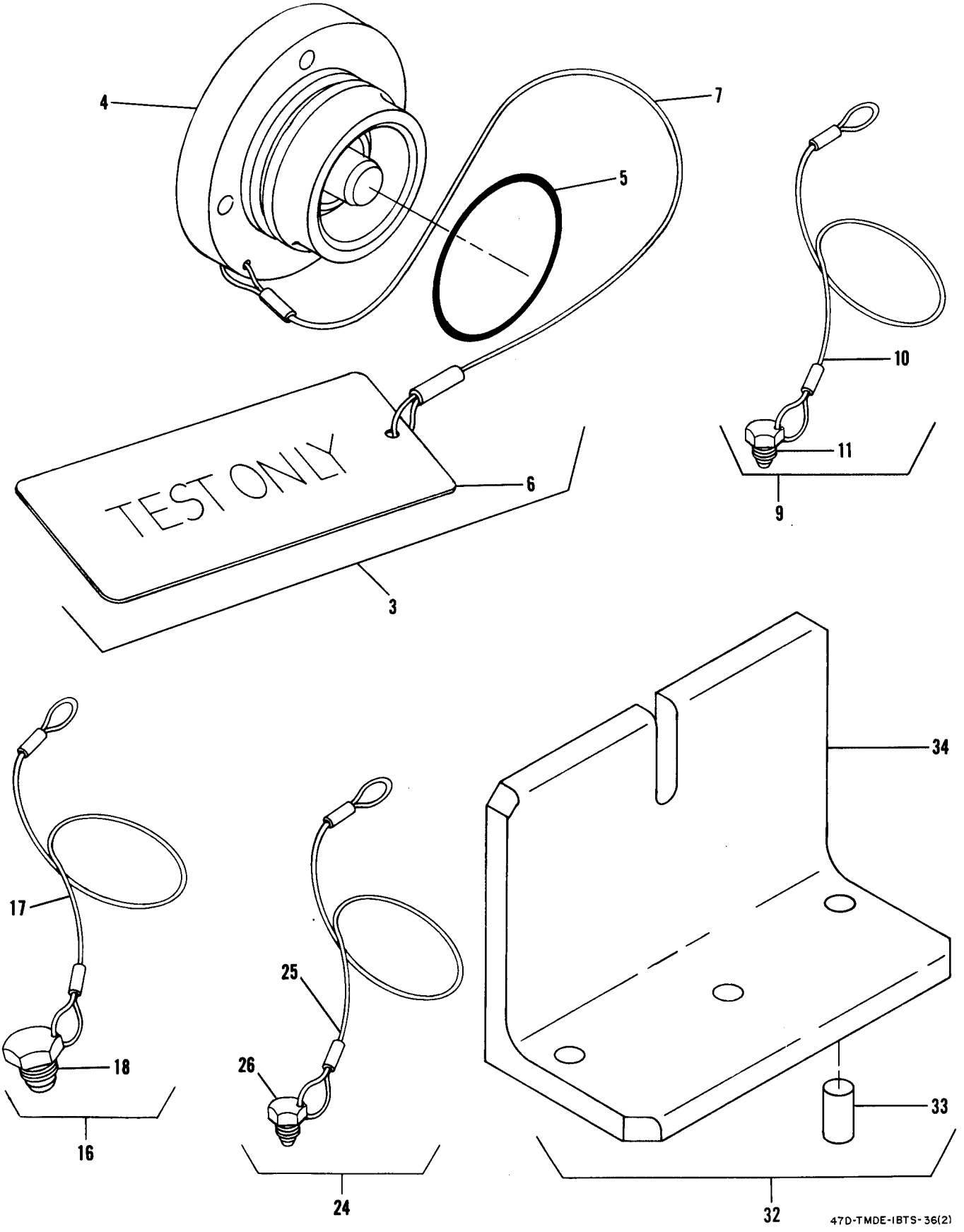

Figure 6-4. Hydraulic Unit (Sheet 2 of 4)

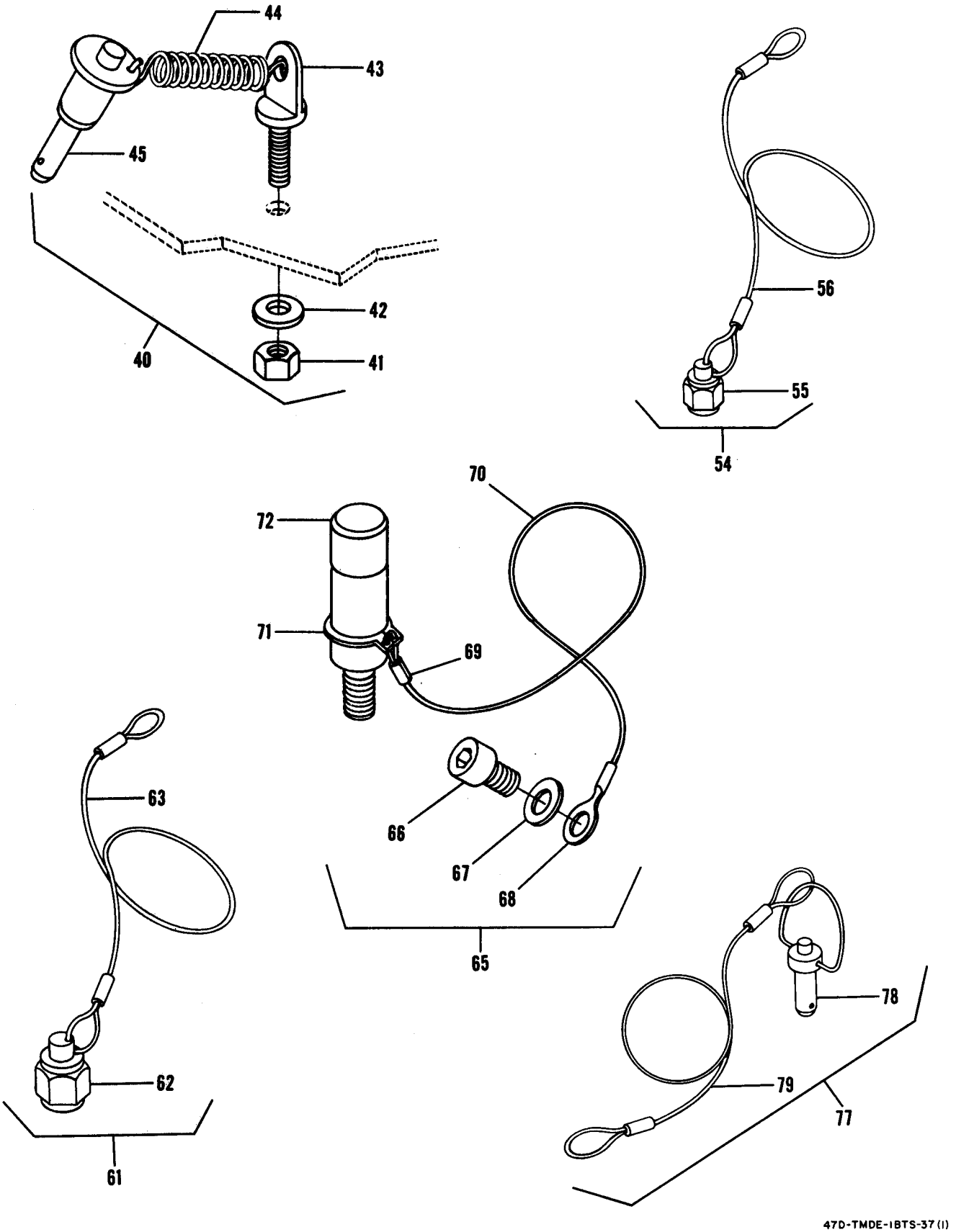

Figure 6-4. Hydraulic Unit (Sheet 3 of 4)

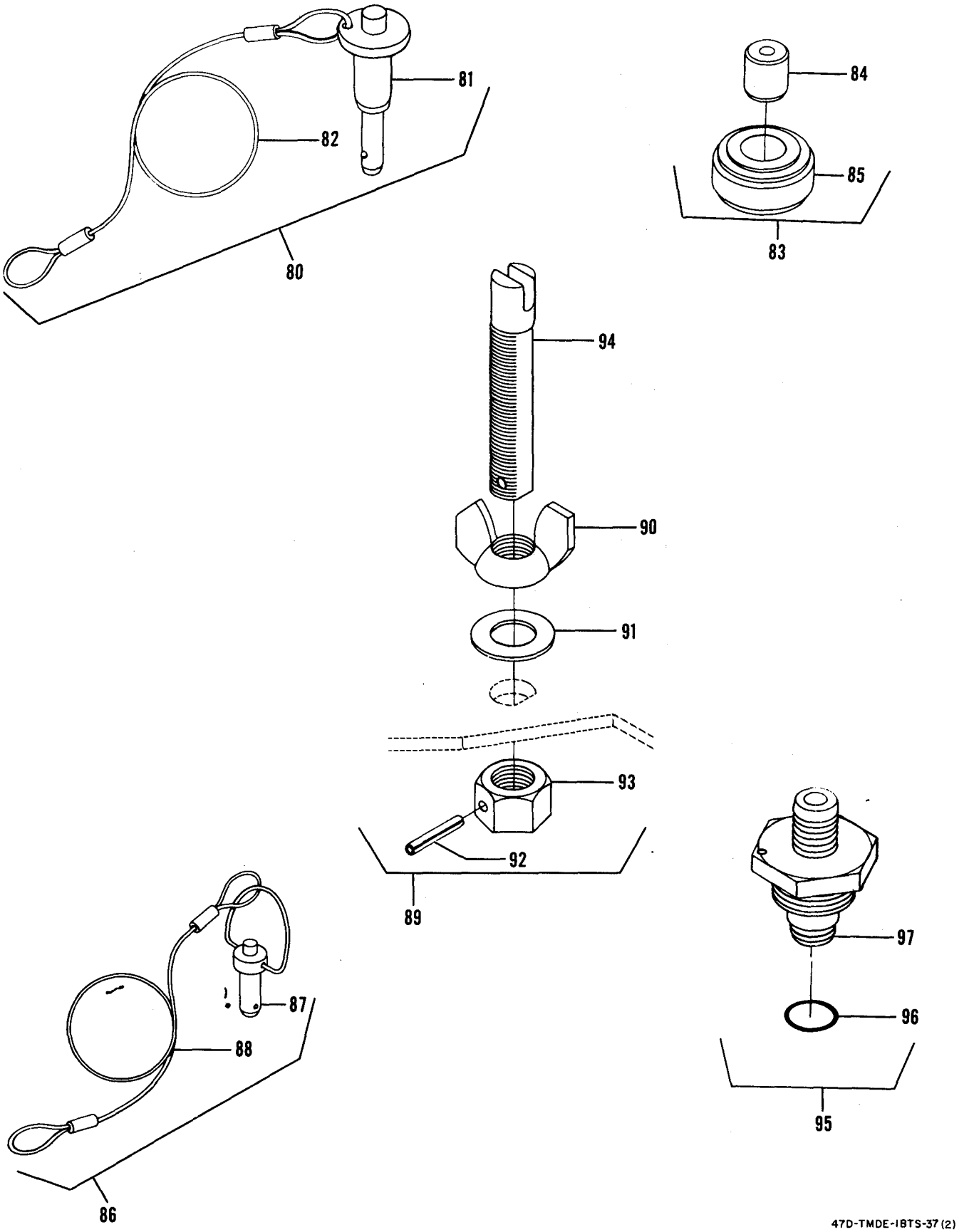

Figure 6-4. Hydraulic Unit (Sheet 4 of 4)

FIGURE AND INDEX NO.	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	QTY PER ASSY	USABLE ON CODE
6-4- 1	145GS278-2	HYDRAULIC UNIT, ILCA/SAS (182-14837-12) fig. 6-1 for NHA	REF	
2	145GS278-16	. GAUGE, force (80D, Chatillon)	1	
3	145GS278-12	. COVER, test, SAS (182-14947-1)	1	
3	145GS278-13	. COVER, test, SAS (182-14947-1)	1	
4	182-14947-3	.. COVER	1	
5	MSS28775-128	.. PACKING, preformed	1	
6	182-14947-2	.. TAG, cover	1	
7	BACC13Y3-40	.. CABLE ASSY	1	
7	UT7101-8-RL	.. CABLE ASSY (alt for BACC13Y3-40)	1	
8	145GS278-18	. HOSE ASSY (182-14937-5)	1	
9	182-14937-7	.. CABLE/PLUG ASSY	2	
10	UT7101-4-RL	…CABLE ASSY	1	
11	AN806-4D	… PLUG	1	
12	MS28759-4-96	.. HOSE ASSY	1	
13	MS28760-4	… FITTING, end	2	
14	MIL-H-8788	… HOSE, 0.50 OD X 94.0 in. L.	1	
15	145GS278-19	. HOSE ASSY (182-14937-6)	1	
16	182-14937-8	.. PLUG/CABLE ASSY	1	
17	UT7101-8-RL	… CABLE ASSY	1	
18	AN806-8D	… PLUG	1	
19	MS28759-8-96	.. HOSE ASSY	1	
20	MS28760-8	… FITTING, end	2	
21	MIL-H-8788	… HOSE, 0.50 OD X 96.0 in. L	1	
22	MS35191-293	. SCREW, cap, soc, fh	12	
23	145GS278-17	. HOSE ASSY (182-14937-4)	1	
24	182-14937-7	.. CABLE/PLUG ASSY	1	
25	UT7101-8-RL	… CABLE ASSY	1	
26	AN806-4D	… PLUG	2	
27	MS28769-4-36	.. HOSE ASSY	1	
28	MS28760-4	… FITTING, end	2	
29	MIL-H-8788	… HOSE, 0.25 OD X 36.0 in. L	1	
30	145GS278-11	. MANIFOLD ASSY (182-14943-2) fig. 6-6 for bkdn	1	
31	MS16998-45	. SCREW, cap, sch	1	
32	182-14948-1	. FIXTURE, rigging	1	Unit 1
33	NAS607-4-4	.. PIN, dowel	2	
33	UT7028-4-0.50	.. PIN, dowel (alt for NAS607-4-4)	2	
34	182-14948-2	.. ANGLE	1	
35	145GS278-8	. INDICATOR, dial,assy	1	
36	711HS	.. INDICATOR, dial, test (V64204)	1	
37	711-28-29-30	.. CLAMP, complete, body (V64204)	1	
38	145GS278-10	.. INDICATOR, swivel post assy (V64204) 657G	1	
39	657R	… SWIVEL POST BUSHING	1	
40	182-14957-1	. TIEDOWN, assy	1	
41	NAS679A4	.. NUT, lock	1	
42	AN960C416L	.. WASHER	1	
43	AN43-7	.. BOLT, eye	1	
44	MS24586-678	.. SPRING,extension	1	
45	MS17984-405	.. PIN , quick release	1	
46	NAS679A4	. NUT, lock	8	
47	AN960-416	. WASHER	8	
48	MS16998-42	. SCREW, cap, soc	7	
49	182-14950-1	. MOTOR ASSY, cycling, fig. 6-7 for bkdn	1	

FIGURE AND INDEX NO.	PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	QTY PER ASSY	USABLE ON CODE
6-4-50	10250T51	. BLOCK, contact (Eaton)	1	
51	1025OTC53	. LENS(EATON)	1	
52	10250T5	. OPERATOR(EATON)	1	
53	10250T63	. LIGHT MODULE (EATON)	1	
54	182-14937-9	. CAP/CABLE ASSY	1	
55	AN929A45	. . CAP	1	
56	UT7101-8-L	. . CABLE ASSY.....	1	
57	MS24693-S320	. SCREW,cap,soc,fh	1	
58	NAS679C5M	. LOCKNUT	1	
58	NAS679A5	. LOCKNUT(ALT FOR NAS679C5M)	1	
59	AN960D516	. WASHER	2	
59	AN960-516	. WASHER(ALT FOR AN960D516)	2	
60	MS35426-30	. WINGNUT	1	
60	MS35426-29	. WINGNUT(ALT FOR MS35426-30)	1	
61	182-14937-10	. CABLE/CAP ASSY	1	
62	AN929A85	. . CAP	1	
63	UT7101-8-L	. . CABLE ASSY	1	
64	M83723-85R1412N	. CONNECTOR,electrical	1	
65	182-15171-1	. THUMBSCREW REW ASSY	1	
66	MS16998-40	. . SCREW.....	1	
67	AN960-416L	. . WASHER	1	
68	BACT12AC54	. . LUG TERMINAL	1	
69	BACF22U2	. . FERRULE	1	
70	UT7101-8	. . CABLE	1	
70	BACC13Y-3B60	. . CABLE(ALT FOR UT7101-8)	1	
71	182-15171-3	. . RING,retaining	1	
72	182-15171-2	. . THUMBSCREW	1	
73	145GS278-9	. INDICATOR,dial assy	1	
74	25-5041J	. . INDICATOR,dial	1	
75	657H	. . SNUG SWIVEL POST	1	
76	6632/20	. . NO.20 CONTACT HEAD	1	
77	182-14963-1	. PIN,rigging	1	
78	MS17984-411	. . PIN,quick release	1	
78	MS17984-410	. . PIN,quick release(alt for ..... MS17984-411)	1	
79	BACC13Y-3B60	. . CABLE ASSY	1	
79	UT7101-8-L	. . CABLE ASSY(ALT FOR BACC13Y3B60).	1	
80	182-14963-2	. PIN,rigging	1	
81	MS17984-413	. . PIN,quick release	1	
81	NAS1334-13	. . PIN,quick release(alt for ..... MS17984-413)	1	
82	BACC13Y3B60	. . CABLE ASSY	1	
82	UT7101-8-L	. . CABLE ASSY(ALT FOR BACC13Y3B60).	1	
83	145GS278-15	. BEARING ASSY(182-14949-1)	1	
84	182-14949-2	. . BUSHING	1	
85	202KLL 2	. . BEARING(V21335)	1	
86	182-14963-3	. PIN,rigging	1	
87	MS17984-420	. . PIN,quick release	1	
87	MS17984-425	. . PIN,quick release(alt for ..... MS17984-420)	1	
88	BACC13Y3B60	. . CABLE ASSY	1	
88	UT7101-8-L	. . CABLE ASSY(ALT FOR BACC13Y3B60).	1	
89	182-15106-1	. PIN,measuring	1	
90	FF-N-8450,TYPE A	. . NUT,wing	1	
91	AN960D1016	. . WASHER	1	

FIGURE AND INDEX NO.	PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	QTY PER ASSY	USABLE ON CODE
6-4-91	AN960-1016	. . WASHER(ALT FOR AN960D1016)	1	
92	BACP18L6P-100	. . PIN,roll	1	
92	MS39086-37	. . PIN,roll(alt for BACP18L6P-100) . .	1	
93	MS51967-50	. . NUT, hex	1	
93	MS51967-51	. . NUT,hex(alt for MS51957-50)	1	
94	182-15106-2	. . PIN	1	
95	145GS278-14	. ADAPTER ASSY,vent(182-14939-1)	1	
96	MS28775-012	. . PACKING,preformed	1	
97	182-14939-2	. . ADAPTER	1	
98	145GS278-8	. POST(V64204) (657F)	1	
99	182-14961-1	CHASSIS ASSY,hydraulic unit see . . . fig 6-5 for bkdn	1	
100	182-14937-2	. LABEL,equip AL6061-T40 0.040x5.5 . . x7.0	1	
101	182-14937-3	. LABEL,equip (VS 25113-4)	1	
102	182-14937-11	. LABEL,equip(VS 25113-4)	1	
103	182-14966-1	. CASE,see fig 6-10 for bkdn	1	

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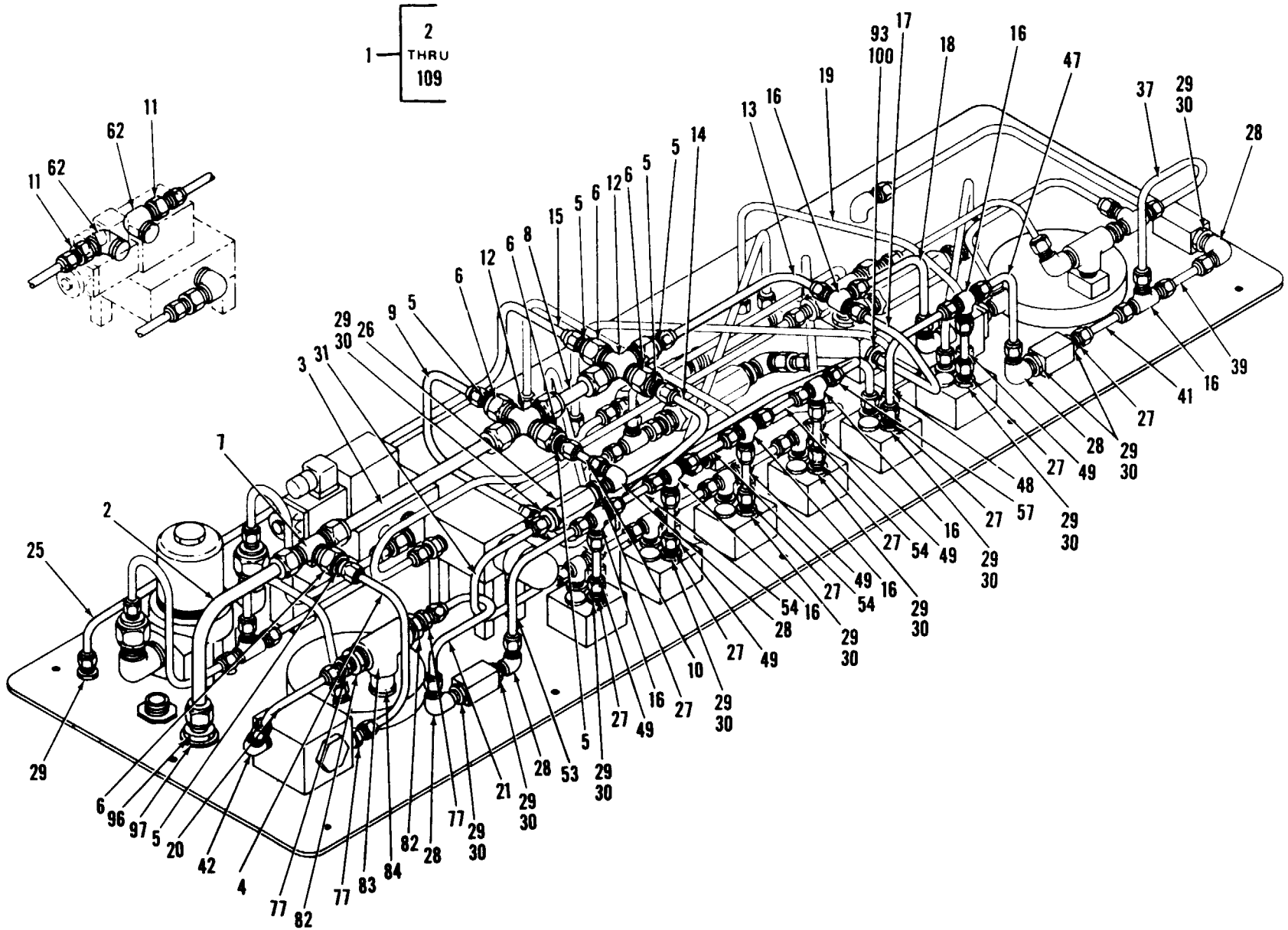

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Figure 6-5. Chassis Assy, Hydraulic Unit (Sheet 1 of 5)

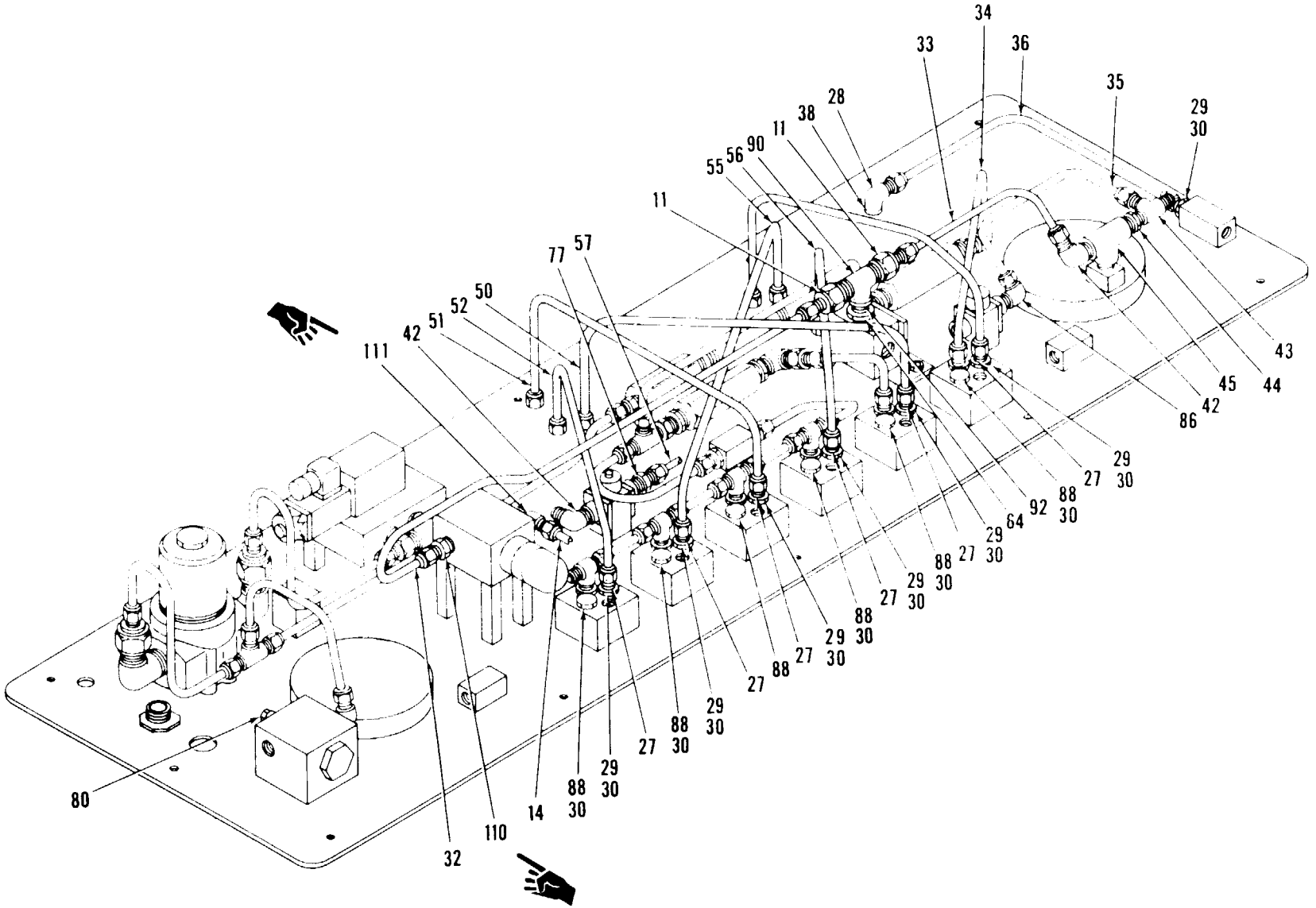

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Figure 6-5. Chassis Assy, Hydraulic Unit (Sheet 2 of 5)

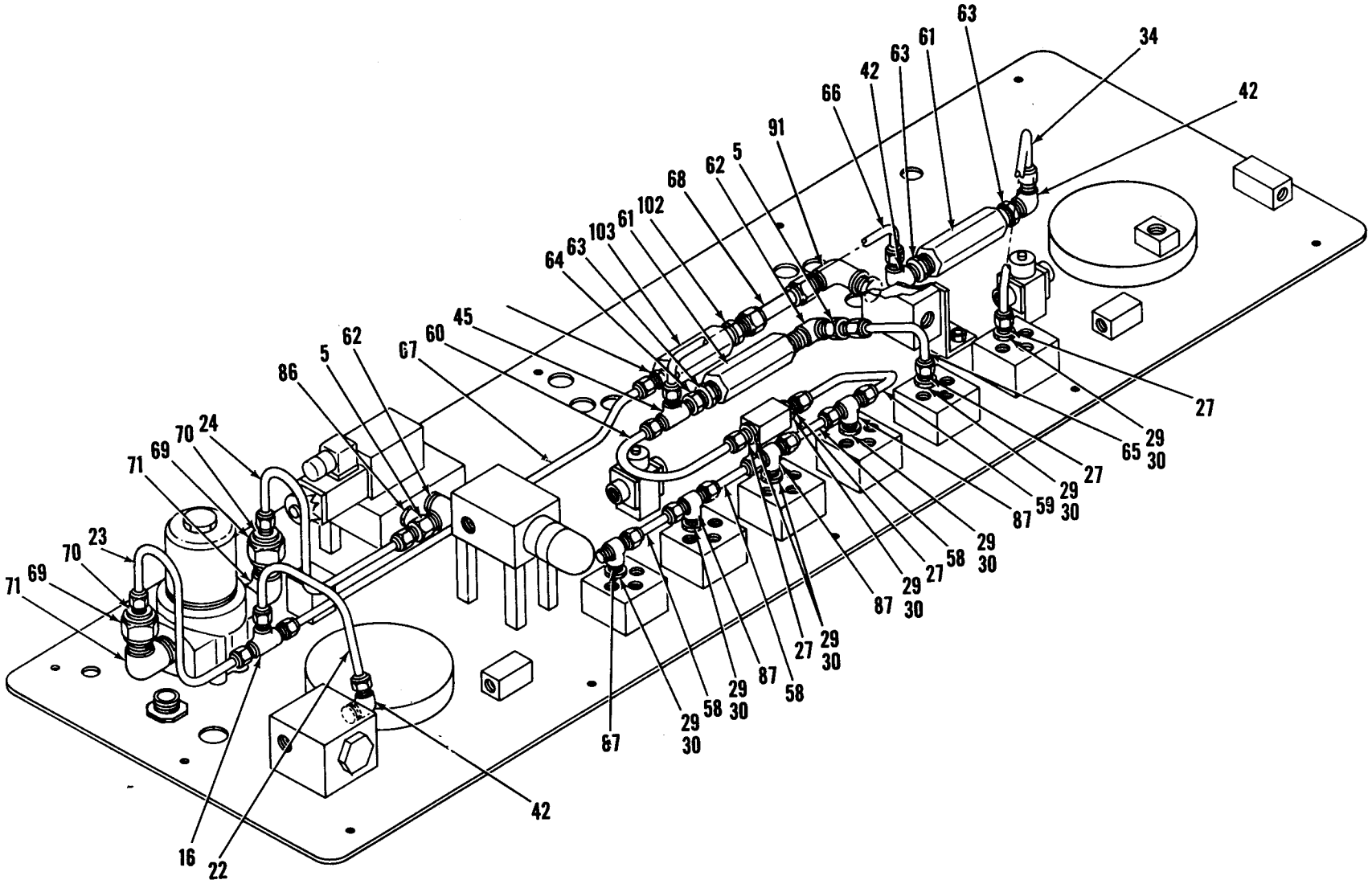

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Figure 6-5. Chassis Assy, Hydraulic Unit (Sheet 3 of 5)

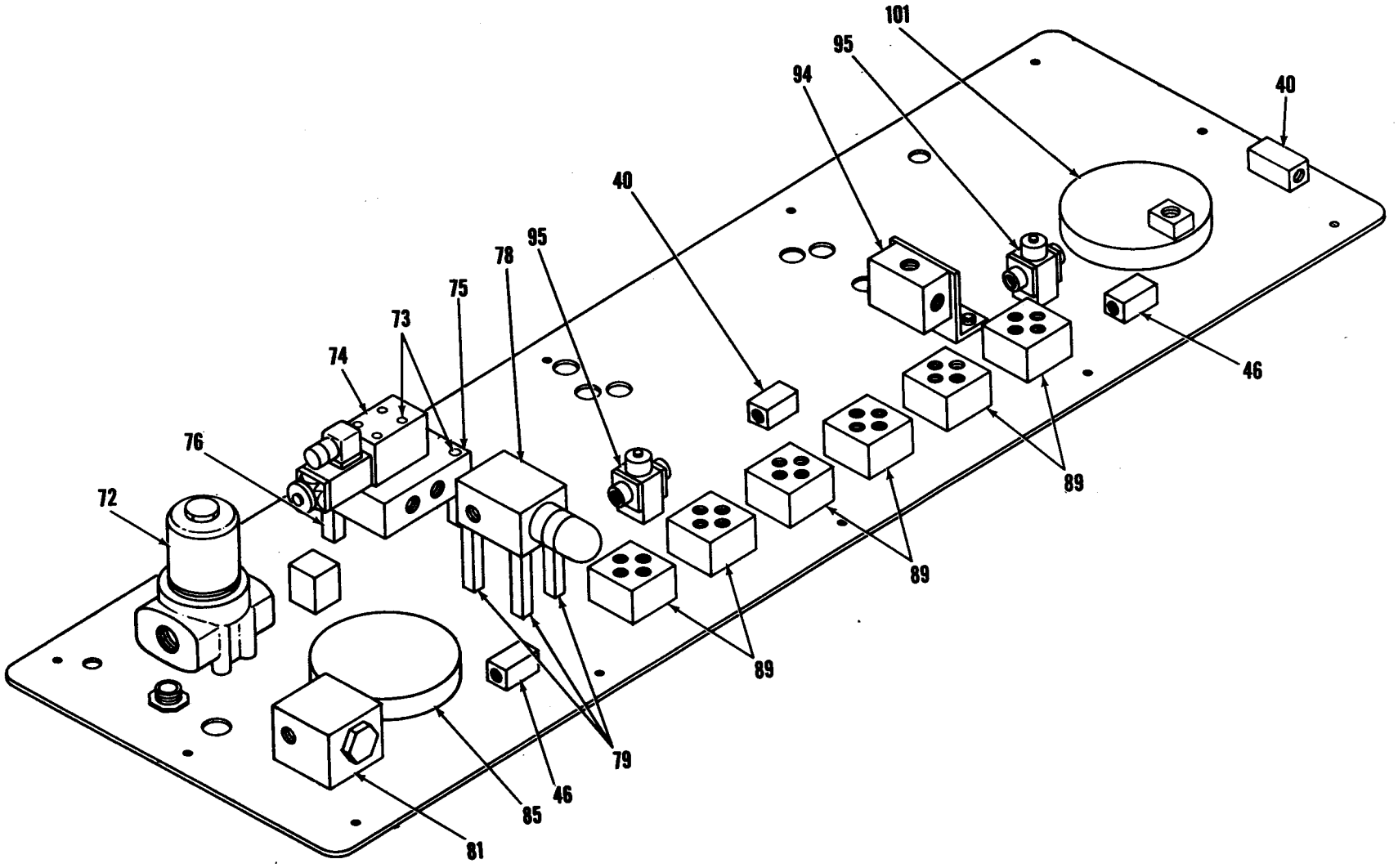

Figure 6-5. Chassis Assy, Hydraulic Unit (Sheet 4 of 5)

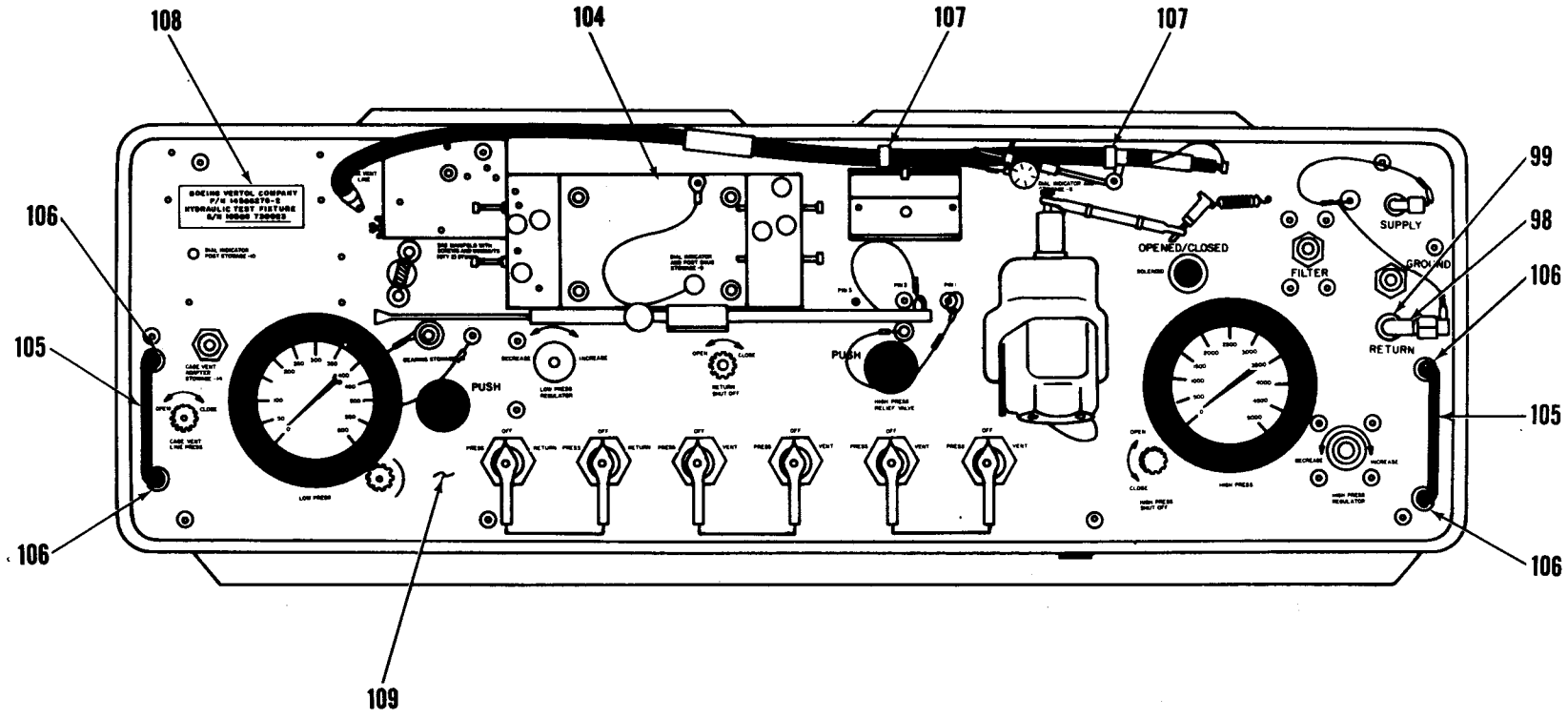

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Figure 6-5. Chassis Assy, Hydraulic Unit (Sheet 5 of 5)

FIGURE AND INDEX NO.	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	QTY PER ASSY	USABLE ON CODE
6-5- 1	182-14961-1	CHASSIS ASSY, HYDRAULIC UNIT FIG. 6-4 FOR NHA		
2	182-15288-66	. TUBE ASSY	1	
3	182-15288-65	. TUBE ASSY	1	
4	182-15288-56	. TUBE ASSY	1	
5	TRTX8-4SS	. REDUCER, tube end (TRBTX8-4SS)	11	
6	AN818-8J	. NUT	6	
7	AN824-8S	. TEE (AN824-8)	1	
8	182-15288-54	. TUBE ASSY	1	
9	182-15288-52	. TUBE ASSY	1	
10	182-15288-49	. TUBE ASSY	1	
11	TRTX6-4SS	. REDUCER, tube end (TRBTX6-4SS)	6	
12	AN827-8S	. CROSS (AN827-8)	2	
13	182-15288-37	. TUBE ASSY	1	
14	182-15288-53	. TUBE ASSY	1	
15	182-15288-64	. TUBE ASSY	2	
16	AN824-4S	. TEE, flared tube (AN824-4, AN824-D)	7	
17	182-15288-51	. TUBE ASSY	1	
18	182-15288-59	. TUBE ASSY	1	
19	182-15288-44	. TUBE ASSY	1	
20	182-15288-14	. TUBE ASSY	1	
21	182-15288-15	. TUBE ASSY	1	
22	182-15288-13	. TUBE ASSY	1	
23	182-15288-12	. TUBE ASSY	1	
24	182-15288-11	. TUBE ASSY	1	
25	182-15288-10	. TUBE ASSY	1	
26	3C11-4T3	. VALVE, check, 3 PSI	1	
27	AN815-4S	. UNION (AN815-4, AN815-4D)	19	
28	MS24394S4	. ELBOW BLKHD (MS24394-4,MS24394D4)	7	
29	AN924-4S	. NUT (AN815-4, AN815-4D)	11	
30	MS28778-4	. PACKING, preformed	34	
31	182-15288-60	. TUBE ASSY	1	
32	182-15288-61	. TUBE ASSY	1	
33	182-15288-62	. TUBE ASSY	1	
34	182-15288-40	. TUBE ASSY	1	
35	182-15288-50	. TUBE ASSY	1	
36	182-15288-48	. TUBE ASSY	1	
37	182-15288-63	. TUBE ASSY	1	
38	AN960KD716	. WASHER	2	
39	182-15288-47	. TUBE ASSY	1	
40	AV8-1.0/12PS	. VALVE, SHUTOFF	3	
41	182-15288-46	. TUBE ASSY	1	
42	MS20822-4-4S	. ELBOW, 1/4 NPT MS20822-4, MS20822-4D)	8	
43	AN917-2J	. TEE, 1/4 NPT	1	
44	AN912-1S	. BUSHING (AN912-1)	2	
45	MS20826-4S	. TEE	2	
46	DV8-1.1/12-V-S	. VALVE, NEEDLE	2	
47	182-15288-45	. TUBE ASSY	1	
48	182-15288-41	. TUBE ASSY	1	
49	182-15288-24	. TUBE ASSY	5	
50	182-15288-43	. TUBE ASSY	1	
51	182-15288-19	. TUBE ASSY	1	
52	182-15288-17	. TUBE ASSY	1	
53	182-15288-16	. TUBE ASSY	1	

FIGURE AND INDEX NO.	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	QTY PER ASSY	USABLE ON CODE
6-5- 54	182-15288-25	. TUBE ASSY	3	
55	182-15288-18	. TUBE ASSY	1	
56	182-15288-20	. TUBE ASSY	1	
57	182-15288-28	. TUBE ASSY	1	
58	182-15288-33	. TUBE ASSY	3	
59	182-15288-35	. TUBE ASSY	1	
60	182-15288-36	. TUBE ASSY	1	
61	CV-3P-65	. VALVE, check, 60 PSI	2	
62	MS20822-6-6S	. ELBOW, 3/8 NPT (MS20822-6-6, MS20822-6-6D)	4	
63	AN912-2S	. BUSHING (AN912-2)	3	
64	AN818-6S	. NUT, CPLG (AN818-6)	6	
65	182-15288-39	. TUBE ASSY	1	
66	182-15288-38	. TUBE ASSY	1	
67	182-15288-57	. TUBE ASSY	1	
68	182-15288-58	. TUBE ASSY	1	
69	AN818-12S	. NUT, coupling (AN818-12)	2	
70	TRTX12-4SS	. REDUCER	2	
71	MS20822-12S	. ELBOW (MS20822-12)	2	
72	DFBHHC60G10B1.0/5	. FILTER, FIG. 6-11 FOR BKDN	1	
73	833365	. BOLT KIT	1	
74	SP01-18	. SUBPLATE (5-11101)	1	
75	4WE6D51/NZ4/5	. VALVE, SLND	1	
76	182-14964-1	. STANDOFF	2	
77	AN816-4-4S	. NIPPLE, 1/4-1/4 (AN816-4-4, AN816-4-4D)	5	
78	DBDS6G1X/25/12	. VALVE, press rdeg, 300 psi	1	
79	182-14962-5	. STANDOFF	4	
80	AN933S2	. PLUG, 1/4 NPT (AN933-2, AN933D2)	1	
81	PR6701-2-1/4S2-1/4P	. VALVE, press rdeg	1	
82	AN912-5J	. REDUCER, bushing	2	
83	AN917-4S	. TEE, int, 1/2 NPT (AN917-4,AN917-4D)	1	
84	182-15178-1	. SNUBBER, pressure	1	
85	45-1377DS04B	. GAUGE, 0-5000 psi	1	
86	AN933S3	. PLUG, 3/8 npt (AN933-3, AN834-6D)	3	
87	AN834-4S	. TEE, blkhd	4	
88	AN814-4S	. PLUG (AN814-4D)	6	
89	8422E-4D2P	. VALVE, selector (TRM)	6	
90	AN834-6S	. TEE, blkhd (AN834-6, AN834-6D)	1	
91	MS24394S6	. ELBOW, blkhd (MS24394-6)	1	
92	AN919-6S	. REDUCER, 3/8 to 1/4 (AN919-6, AN919D6)	1	
93	AN924-6S	.NUT, tube (AN924-6, AN924-6D)	2	
94	PRV2-10-K-6T-35	. VALVE, press reducing 300 PSI	1	
95	68913-3-1/4D2	. VALVE, push	2	
96	AN924-8S	. NUT, tube (AN924-8,AN924-8D)	1	
97	AN960KD1216	. WASHER	1	
98	MS24394S8	. ELBOW, 90° blkhd (MS24394-8, MS24394D8)	1	
99	AN894S-12-8	. BUSHING, 1/2 to 3/4 (AN894-12-8, AN894D12-8)	1	
100	MS8778-6	. PACKING, preformed	3	
101	E3464B	. GAUGE, 0-600 PSI	1	
102	AN816-6S	. REDUCER (AN816-6)	1	
103	KLF250S	VALVE, low press limiter	1	

FIGURE AND INDEX NO.	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	QTY PER ASSY	USABLE ON CODE
6-5- 104	182-14940-1	. MANIFOLD ASSY, fig. 6-9 for bkdn	1	S/N 1
	182-14940-2	. MANIFOLD ASSY, fig. 6-9.1 for bkdn	1	S/N 2 and
105	BACH10G2B	. HANDLE	2	Subq
106	BACF32D-1	. FERRULE	4	
107	TC32D-1	. TIEDOWN	2	
108	TC354A	. IDENTIFICATION PLATE	1	
109	182-14961-2	. PANEL ASSY, lower case hydraulic unit, fig. 6-8 for bkdn	1	
110	182-14962-1	. ADAPTER, STRAIGHT	1	
110	MS51525-B4S	. ELBOW, 90°	1	
111	MS51527-B4S			

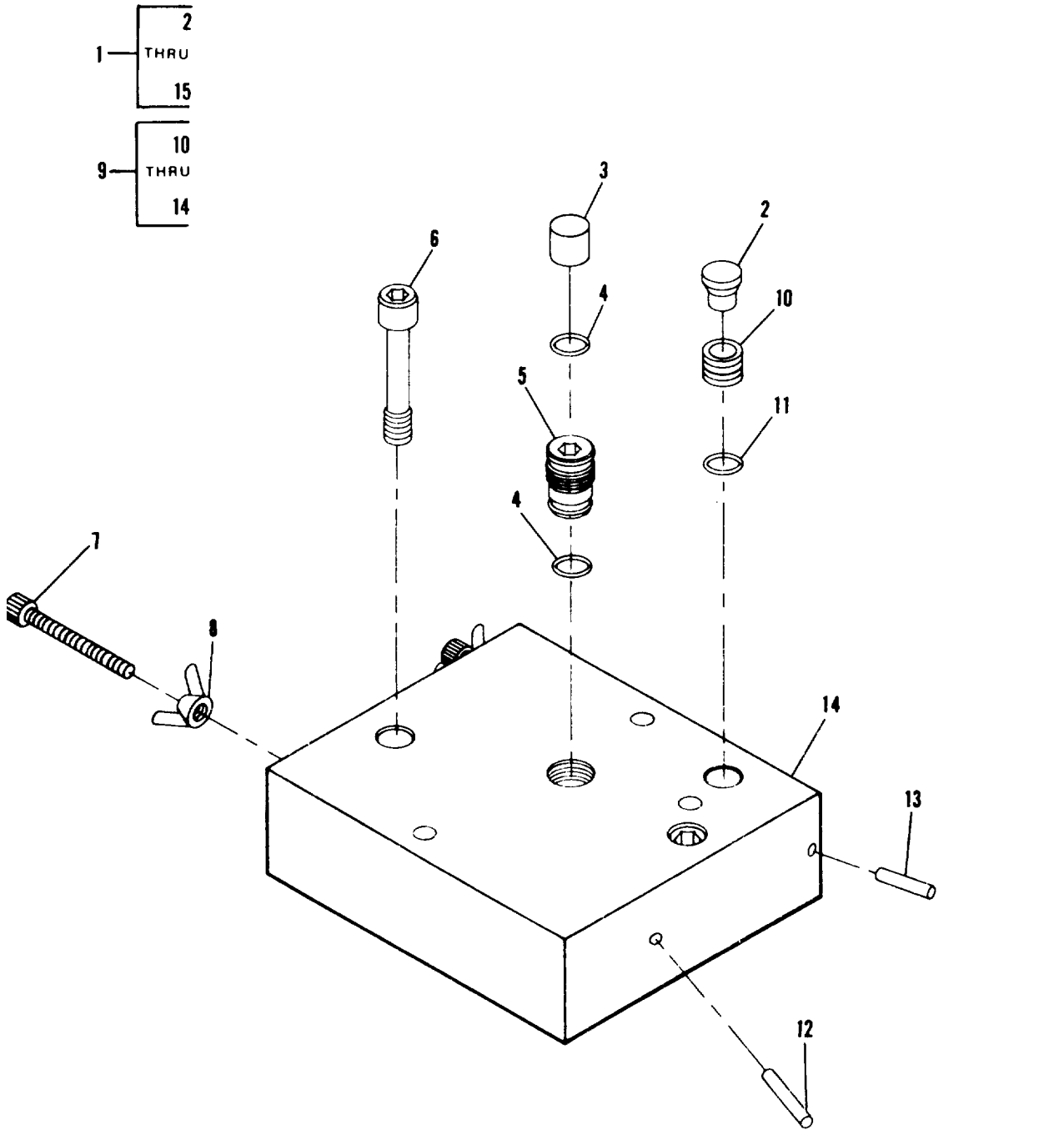

Figure 6-6. Manifold Assy

FIGURE AND INDEX NO.	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	QTY PER ASSY	USABLE ON CODE
6-6- 1	182-14943-2	MANIFOLD ASSY, fig. 6-4 for NHA		
2	WW4	. CAPLUG, tapered (V99017)	1	
3	7/16SCX3/8	. CAP, protective (V99017)	1	
4	MS28775-011	. PACKING, preformed	2	
5	182-14945-2	. SPOOL, transfer	1	
6	182-14946-1	. SCREW	2	
7	MS16998-33	. SCRW, cap, sch, alloy stl	2	
8	MS35426-13	. NUT, plain, wing	2	
9	182-14944-1	. MANIFOLD	1	
10	182-14944-5	.. INSERT	1	
11	MS28775-012	.. PACKING, preformed	1	
12	182-14944-3	.. PLUG	1	
13	182-14944-4	.. PLUG	1	
14	182-14944-2	.. BLOCK	1	

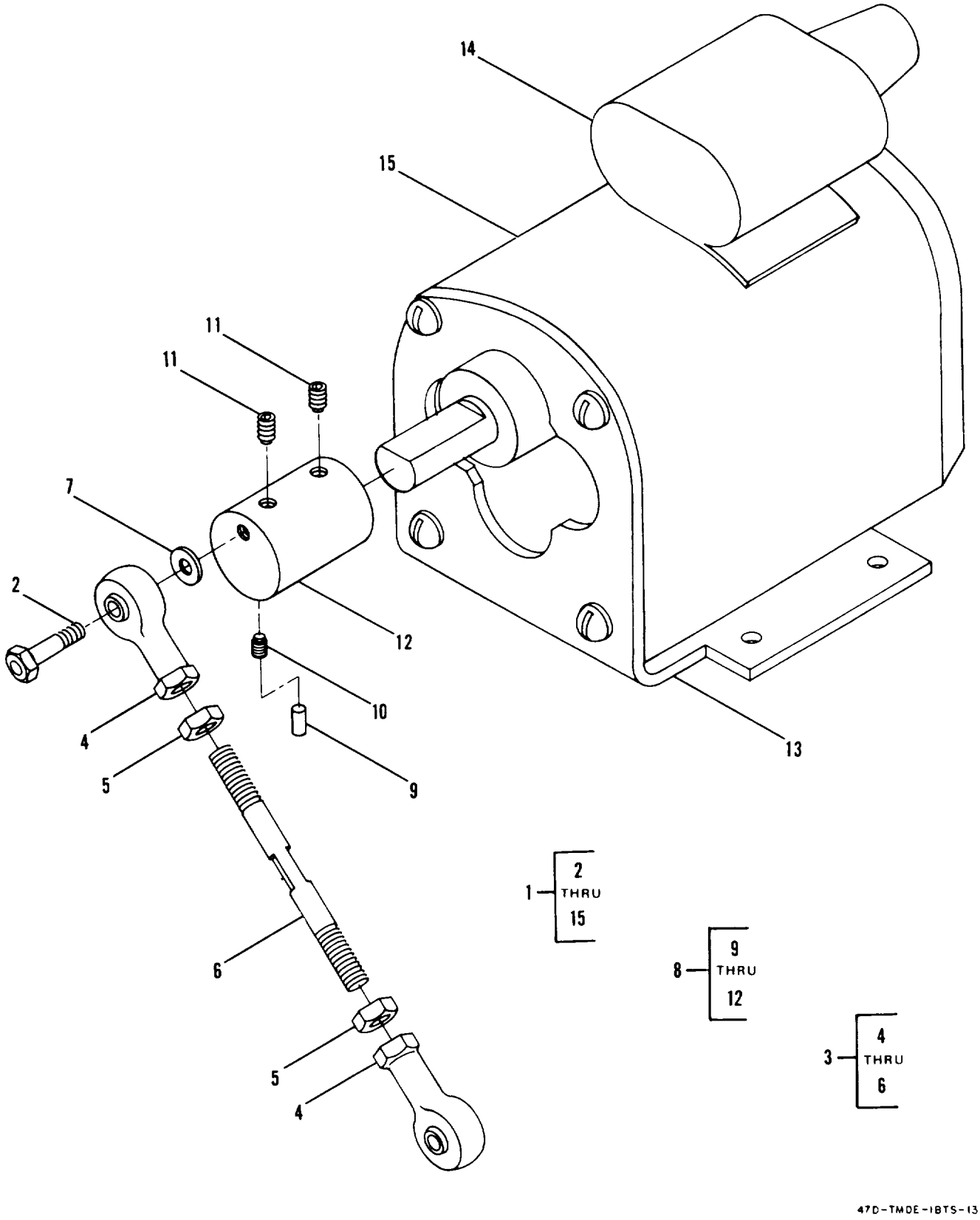

Figure 6-7. Cycling Motor Assy

FIGURE AND INDEX NO.	PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	QTY PER ASSY	USABLE ON CODE
6-7- 1	182-14950-1	MOTOR ASSY, cycling(V07829)		
2	NAS1304-8	. BOLT, shear	1	
3	182-14951-1	. CRANK ARM ILCA	1	
4	MS21243-4	. . BEARING,rod end	2	
5	MS35650-3312	. . NUT JAM	2	
6	182-14951-2	. . ARM	1	
7	NAS620-416	. WASHER,flat	1	
8	182-14952-1	. DRIVER CRANK ASSY	1	
9	182-14952-3	. . PLUG	1	
10	MS51963-222	. . SET SCREW	1	
11	MS51963-242	. . SET SCREW	2	
12	182-14952-2	. . DRIVER	1	
13	968	. MOUNTING KIT (CONSISTS OF L- ..... BRACKET,screws,and washers)	1	
14	957	. CAPACITOR	1	
15	461	. MOTOR,N-1D gear	1	

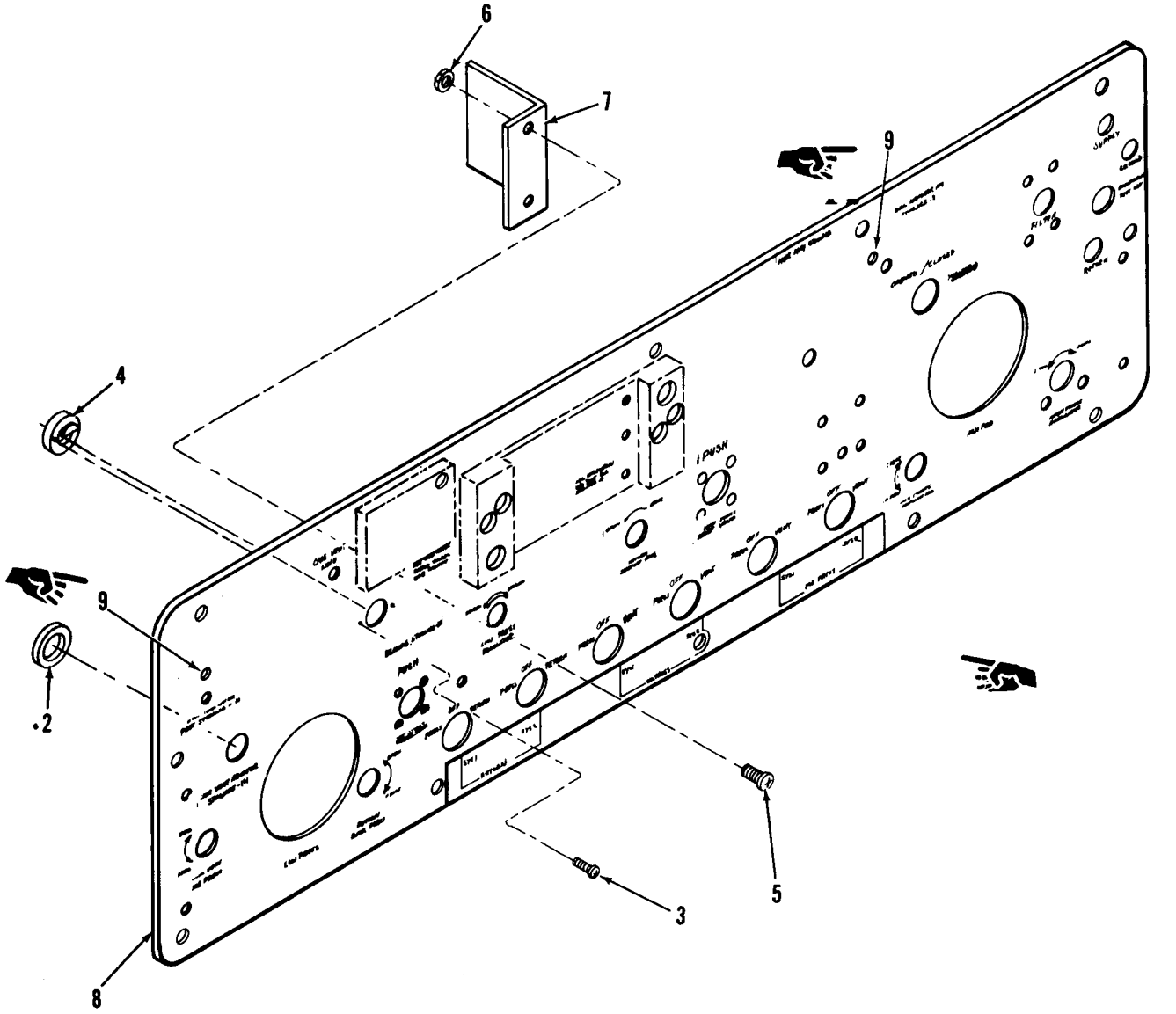

Figure 6-8. Panel Assy, Hydraulic Unit, Lower Case

FIGURE AND INDEX NO.	PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	QTY PER ASSY	USABLE ON CODE
6-8- 1	182-14962-1	PANEL ASSY,lower case, hydraulic unit. see fig 6-5 for NHA	REF	
2	182-14962-4	. DISK	1	
3	MS35190-238	. SCREW,cap,82° fh	2	
4	182-14962-7	. FILLER	1	
5	MS35191-291	. SCREW,cap,82° fh	2	
6	NAS679A4	. NUT,lock	2	
7	182-14962-6	. BRACKET	1	
8	182-14962-2	. PANEL	1	
9	MS51831-102	. INSERT	2	Unit 8 & Subq

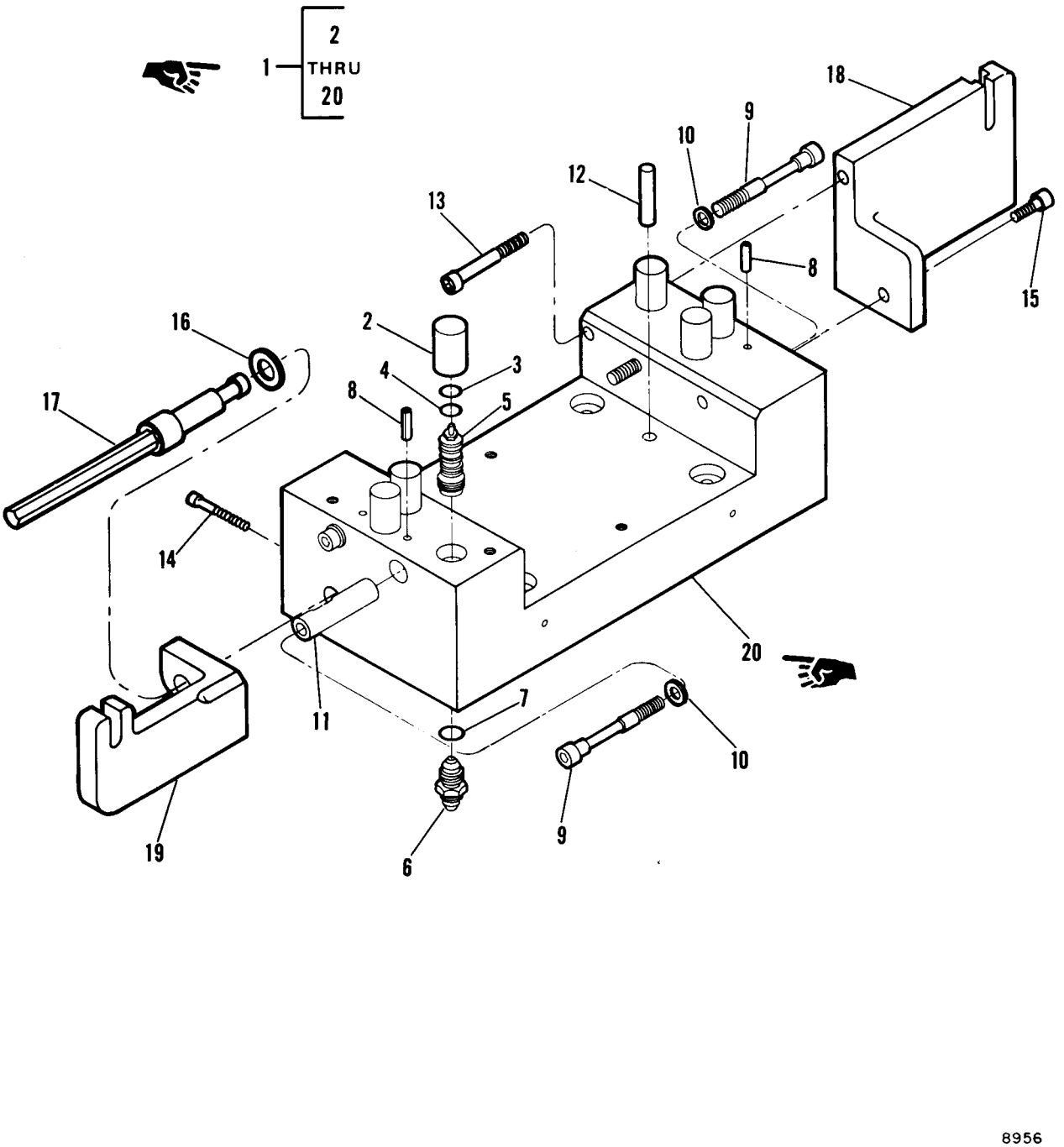

Figure 6-9. Manifold Assy

FIGURE AND INDEX NO.	PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	QTY PER ASSY	USABLE ON CODE
6-9- 1	182-14940-1	MANIFOLD ASSY, see fig 6-5 for NHA	REF	Unit 1
	182-14940-2	MANIFOLD ASSY,see fig 6-5 for NHA	REF	Unit 2 & Subq
2	9/16SCX7/8	. CAP,protective(V99017)	6	
3	MS28775-013	. PACKING,preformed	6	
4	MS28775-014	. PACKING,preformed	6	
5	145H1288-1	. VALVE ASSY,check	6	
6	AN81 5-4	. UNION	6	
7	MS28778-4	. PACKING,preformed	6	
8	MS16562-36	. PIN SPRING	4	
9	182-14946-2	. SCREW,cap,sch	4	
10	AN960-416	. WASHER	4	
11	182-14941-1	. BUSHING	2	
12	UT7028-4-3/4	. PIN,dowel	2	
12	NAS607-4-6	. PIN,dowel(alt for UT7028-4-3/4) . .	2	
13	MS16998-49	. CAP SCREW, SCH	1	*
14	MS16997-26	. CAP SCREW, SCH	1	*
15	MS16998-43	. CAP SCREW, SCH	1	*
16	AN960-816	. WASHER	1	*
17	182-15596-1	. HANDLE, RIG	1	*
18	182-15595-1	. FIXTURE, RIG, INPUT	1	*
19	182-15595-2	. FIXTURE, RIG, OUTPUT	1	*
20	182-14941-1	. MANIFOLD	1	

*Unit 2 and Subq

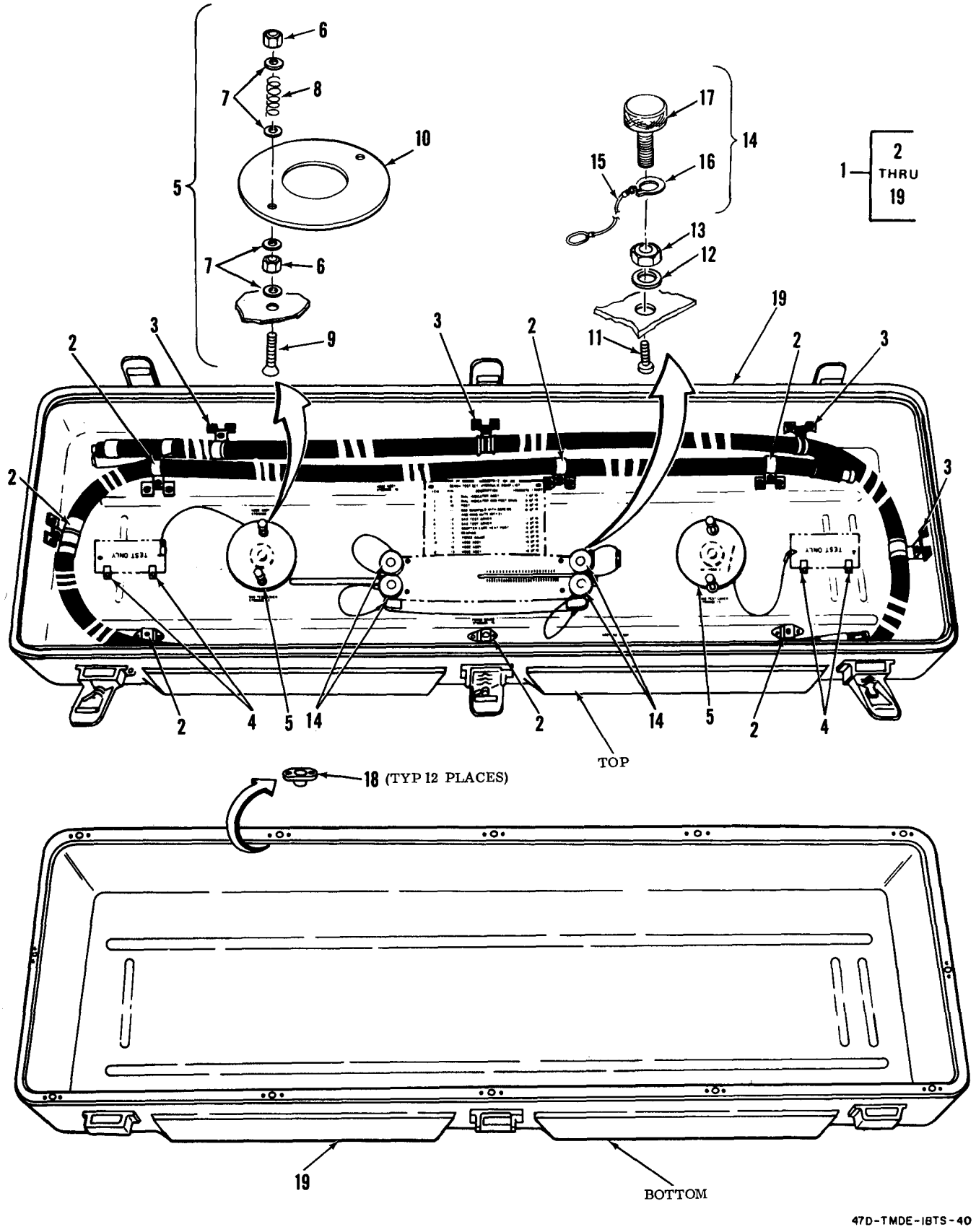

Figure 6-10. Case Assy

FIGURE AND INDEX NO.	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
6-10- 1	182-14966-1	CASE ASSY, seefiz 6-4 ..... for NHA(V33414~	REF	
2	5002BH10-O2	.CLAMP, hose.....	7	
3	TA5000BH14-02	.CLAMP, hose.....	7	
4	BACC10T3	.CLIP.....	4	
5	182-14965-1	.RETAINER ASSY	2	
6	NAS679A4M	..NUT , lock	4	
7	AN960C416L	..WASHER	8	
8	MS24585C229	..SPRING	2	
9	NAS1189E4P24	..SCREW FH.....	2	
10	182-14965-2	..DISK	1	
11	NAS604-12P	.SCREW, RD HA	4	
12	AN960D416	.WASHER.....	4	
13	NAS679A4M	.NUT, lock.....	4	
13	NAS679A4	.NUT, lock alt for NAS679A4M	4	
14	182-14966-3	.THUMB SCREW ASSY	4	
15	BACC13Y-3B60	..CABLE.....	1	
16	MS16624-1050	..RING, retainer.....	1	
17	UT7113-848	..SCREW, thumb.....	1	
18	NAS1773-4	.NUTPLATE.....	12	
18	NAS1068A4	.NUTPLATE alt for NAS1773-4	12	
19	182-14966-2	.CASE.....	1	

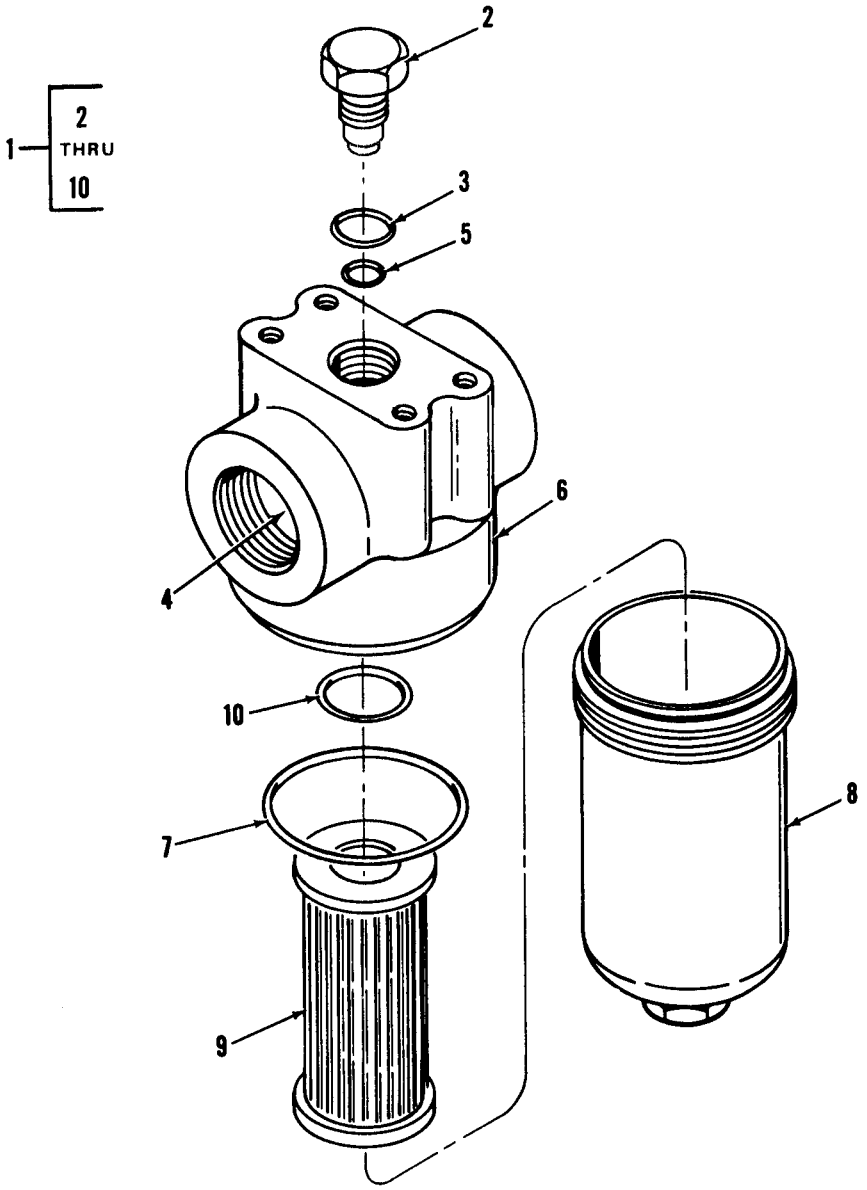

Figure 6-11. Filter

FIGURE AND INDEX NO.	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	QTY PER ASSY	USABLE ON CODE
6-11- 1	BFDHHC60G10B1.0/5	FILTER, FIG. 6.5 FOR NHA		
2	744-1001MDF60-5	. PLUG	1	
3	744-1001MDF60-8	. PACKING, PREFORMED	1	
4	744-1001MDF60-4	. BYPASS	1	
5	744-1001MDF60-9	. PACKING, PREFORMED	1	
6	744-1001MDF60-3	. HEAD	1	
7	744-1001MDF60-6	. PACKING, PREFORMED	1	
8	744-1001MDF60-2	. BOWL	1	
9	0060D010BHHC	. ELEMENT	1	
10	744-1001MDF60-7	. PACKING, PREFORMED	1	

APPENDIX A

REFERENCES

Following is a list of references available to the organizational and intermediate repairman of the ILCA Bench Test Set.

AR-700-58	Reports of Damage or Improper Shipment
DA Pam 25-30	Consolidated Index of Army Publications and Blank Forms
DA Pam 738-751	Functional Users Manual for the Army Maintenance Management System-Aviation (TAMMS-A)
FM21-11	First Aid, Solders
TB 750-25-1	Maintenance of Supplies and Equipment Army Metrology and Calibration System
TM43-0139	Painting Instruction for Field Use
TM 55-1500-204-25/1	General Aircraft Maintenance Manual
TM 55-1500-323-25	Organizational, Direct Support, General Support and Depot Maintenance Manual: Installation Practices for Aircraft Electric and Electronic Wiring
TM 55-1520-240-23	Maintenance Manual, Army Model CH-47D Helicopter
TM 55-4920-428-30P	ILCA Bench Test Set Repair Parts and Special Tools List
TM 750-244-2	Procedures for Destruction of Equipment to Prevent Enemy Use

APPENDIX B

MAINTENANCE ALLOCATION CHART

SECTION I INTRODUCTION

B-1. MAINTENANCE ALLOCATION CHART.

a. This Maintenance Allocation Chart (MAC) assigns maintenance functions in accordance with the Three Levels of Maintenance concept for army aircraft. These maintenance levels: Aviation Unit Maintenance (AVUM), Aviation Intermediate Maintenance (AVIM) and Depot Maintenance are depicted on the MAC as:

AVUM which corresponds to the O code in the Repair Parts and Special Tools List (RPSTL).

AVIM which corresponds to the F code in the Repair Parts and Special Tools List (RPSTL).

Depot which corresponds to the D code in the Repair Parts and Special Tools List (RPSTL).

b. The maintenance to be performed below depot and in the field is described as follows:

(1) Aviation Unit Maintenance (AVUM). AVUM activities will be staffed and equipped to perform high frequency *On-Equipment* maintenance tasks required to retain or return equipment to a serviceable condition. The maintenance capability of the AVUM will be governed by the MAC and limited by the amount and complexity of support equipment, facilities required, and number of spaces and critical skills available. The range and quantity of authorized spare modules/components will be consistent with the mobility requirements dictated by the air mobility concept.

(2) Aviation Intermediate Maintenance (AVIM). AVIM provides mobile, responsive *One Stop* maintenance support. (Maintenance functions which are not conductive to sustaining air mobility will be assigned to depot maintenance.) Performs all maintenance functions authorized to be done at AVUM. Repair of equipment for return to user will emphasize support or operational readiness requirements. Authorized maintenance includes replacement and repair of modules/components and end items which can be accomplished efficiently with available skills, tools, and equipment. Establishes the Direct Exchange (DX) program for AVUM units by repairing selected items for return to stock when such repairs cannot be accomplished at the AVUM level. Inspects, troubleshoots, tests, diagnoses, repairs, adjusts, calibrates, and aligns system modules/components. Module/component disassembly and repair will support the DX program and will normally be limited to tasks requiring cleaning and the replacement of seals, fittings and items of common hardware. Unserviceable reparable modules/components and end items which are beyond the capability of AVIM to repair will be evacuated to Depot Maintenance. This level will perform special inspections which exceed AVUM capability. Provides quick response maintenance support, on-the-job-training, and technical assistance through the use of mobile maintenance contact teams. Maintenance authorized operational readiness float. Provides collections and classification services for serviceable/unserviceable material. Operates a cannibalization activity in accordance with AR 750-50.

(3) At AVIM level, complex electronic repair and testing are performed by Calibration Repair Center (CRC) personnel of the Army TMDE Support Team (ATST).

B-2. Use of the Maintenance Allocation Chart.

a. The MAC assigns maintenance functions to the lowest level of maintenance based on past experience and the following considerations.

(1) Skills available.

(2) Time required.

(3) Tools and test equipment required and/or available.

b. Only the lowest level of maintenance authorized to perform a maintenance function is indicated. if the lowest level of maintenance cannot perform all tasks of any single maintenance function (e.g., test, repair), then the higher maintenance level(s) that can accomplish additional tasks will also be indicated.

c. A maintenance function assigned to a maintenance level will automatically be authorized to be performed at any higher maintenance level.

d. A maintenance function that cannot be performed at the assigned level of maintenance for any reason may be evacuated to the next higher maintenance organization. Higher maintenance levels will perform the maintenance-functions of lower maintenance levels when required or directed by the appropriate commander.

e. The assignment of a maintenance function will not be construed as authorization to carry the associated repair parts in stock. Authority to requisition, stock, or otherwise secure necessary repair parts will be as specified in the repair parts and special tools list appendix.

f. Normally there will be no deviation from the assigned level of maintenance. In cases of operational necessity, maintenance functions assigned to a maintenance level may, on a one-time basis and at the request of the lower maintenance level, be specifically authorized by the maintenance officer to the level of maintenance to which the function is assigned. The special tools, equipment, etc., required by the lower level of maintenance to perform this function will be furnished by the maintenance level to which the function is assigned. This transfer of a maintenance level does not relieve the higher maintenance level of the responsibility of the function. The higher level of maintenance has the authority to determine:

(1) If the lower level is capable of performing the work.
(2) If the lower level will require assistance or technical supervision and on-site inspection.
(3) If the authorization will be granted.

g. Changes to the MAC will be based on continuing evaluation and analysis by responsible technical personnel and on reports received from field activities.

B-3. Definitions.

a. Inspect. To determine serviceability of an item by comparing its physical, mechanical and electrical characteristics with established standards.

b. Test. To verify serviceability and detect incipient failure by measuring the mechanical or electrical characteristics of an item and comparing those characteristics with prescribed standards.

c. Service. To clean, to preserve, to charge, and to add fuel, lubricants, cooling agents and air.

d. Adjust. To rectify to the extent necessary to bring into proper operating range.

e. AIign. To adjust specified variable elements of an item to bring to optimum performance.

f. Calibrate. To determine the corrections to be made in the readings of instruments or 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 or test equipment being compared with the certified standard.

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g. Install. To set up for use in an operational environment such as an emplacement, site or vehicle.

h. Replace. To replace unserviceable items with serviceable assemblies, subassemblies or parts.

i. Repair. To restore an item to serviceable condition through correction of a specific failure or unserviceable condition. This includes, but is not limited to, inspection, cleaning, preserving, adjusting, replacing, welding, riveting, and strengthening.

j. Overhaul. To restore an item to a completely serviceable condition as prescribed by maintenance serviceability standards prepared and published for the specific item to be overhauled.

k. Rebuild. To restore an item to a standard as nearly as possible to the original or new condition in appearance, performance, and life expectancy. This is accomplished through the maintenance technique of 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.

B-4. Functional Groups. Group numbers correspond to the breakdowns in Repair Parts and Special Tools List (RPSTL) TM 55-4920-428-30P.

B-5. Maintenance Categories and Work Times. The maintenance categories (levels) AVUM, AVIM, and DEPOT are listed on the Maintenance Allocation Chart with individual columns that indicate the work times for maintenance functions at each maintenance level. Work time presentations such as 0.1 indicate the average time it requires a maintenance level to perform a specified maintenance function. If a work time has not been, established, the columnar presentation shall indicate "-.-". Maintenance levels higher than the level of maintenance indicated are authorized to perform the indicated function.

B-6. Tools and Test Equipment (Section III). Common tool sets (not individual tools), special tools, test and support equipment required to perform maintenance functions are listed alphabetically with a reference number to permit cross-referencing to column 5 in the MAC. In addition, the maintenance category authorized to use the device is listed along with the item National Stock Number (NSN) and, if applicable, the tool number to aid in identifying the tool/device.

SECTION II MAINTENANCE ALLOCATION CHART

NOMENCLATURE OF END ITEMS
ILCA BENCH TEST SET 145 GS278-1

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Category AVUM	AVIM	DEPOT	(5) Tools and Equipment	(6) Remarks
01	ILCA BENCH TEST SET						
02	ELECTRICAL UNIT						
0201	Cable Assemblies	Inspect		— . —			
		Test		— . —		5,6	
		Replace		— . —		8,9	
		Repair		— . —		8,9	
0202	Case Assembly	Inspect		— . —			
		Service		— . —		8,9	
		Replace		— . —		8,9	
		Repair		— . —		8,9	
0203	Power Supplies	Inspect		— . —			
		Test		— . —		5,6	
		Adjust		— . —*		5,6	
		Replace		— . —*		8,9	
		Repair			— . —	8,9	
		Calibrate		— . —*		8,9	
0204	Terminal Boards and Card Assemblies	Inspect		— . —			
		Test		— . —		5,6	
		Replace		— . —*		8,9	
		Repair			— . —	8,9	
0205	Meters, Digital, Analog and Elapsed Time	Inspect		— . —			
		Test		— . —		5,6	
		Adjust		— . —*		5,6,8,9	
		Replace		— . —*		8,9	
		Repair			— . —	8,9	
		Calibrate		— . —*		8,9	
0206	Switches, Potentiometers, and Circuit Breaker	Inspect		— . —			
		Test		— . —		5,6	
		Replace		— . —		8,9	
0207	Panel Assembly, Front and Rear	Inspect		— . —			
		Replace		— . —		8,9	
		Repair		— . —		8,9	

* Performed by CRC personnel

SECTION II MAINTENANCE ALLOCATION CHART

NOMENCLATURE OF END ITEMS
ILCA BENCH TEST SET 145

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Category AVUM	AVIM	DEPOT	(5) Tools and Equipment	(6) Remarks
03	HYDRAULIC UNIT						
0301	Gage, Force	Inspect		— . —			
		Service		— . —			
		Calibrate		— . —*			
		Replace		— . —			
		Repair			— . —		
0302	Cover, SAS Test	Inspect		— . —			
		Replace		— . —			
0303	Hoses	Inspect		— . —			
		Test		— . —		10	
		Replace		— . —		10	
		Repair		— . —			
0304	Manifold Assembly SAS	Inspect		— . —			
	SAS	Install		— . —		10	
		Replace		— . —		10	
		Repair		— . —		10	
0305	Fixture, Rigging	Inspect		— . —			
		Replace		— . —			
		Repair		— . —			
0306	Indicators, Dial	Inspect		— . —			
		Service		— . —			
		Calibrate		— . —*			
		Replace		— . —			
0307	Switch, Solenoid	Inspect		— . —			
		Test		— . —		5	
		Replace		— . —		8	
		Repair		— . —		9	
0308	Connector, Electrical and Wiring	Inspect		— . —			
		Test		— . —		5	
		Replace		— . —		8	
		Repair		— . —		9	
0309	Thumbscrew Assembly	Inspect		— . —			
		Replace		— . —			
		Repair		— . —			

* Performed by CRC personnel

SECTION II MAINTENANCE ALLOCATION CHART

NOMENCLATURE OF END ITEMS
ILCA BENCH TEST SET 145 GS278-1

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Category AVUM	AVIM	DEPOT	(5) Tools and Equipment	(6) Remarks
0310	Adapter, Vent	Inspect		— · —			
		Replace		— · —		10	
		Repair		— · —		10	
0311	Tiedown, Assembly	Inspect		— · —			
		Replace		— · —			
		Repair		— · —			
0312	Pins, Rigging	Inspect		— · —			
		Replace		— · —			
0313	Case	Inspect		— · —			
		Service		— · —		8,10	
		Replace		— · —		8	
		Repair		— · —		10	
0304	Crank Arm, ILCA	Inspect		— · —			
		Adjust		— · —			
		Replace		— · —			
		Repair		— · —			
0315	Driver Crank	Inspect		— · —			
		Replace		— · —			
		Repair		— · —			
0316	Mounting Kit, Motor	Inspect		— · —			
		Replace		— · —		10	
0317	Capacitor, Motor	Test		— · —		8	
		Replace		— · —		8	
0318	Motor and Gearbox	Inspect		— · —			
		Service		— · —		8	
		Replace		— · —		9	
		Repair			— · —		
0319	Label	Inspect		— · —			
		Replace		— · —			
0320	Tubing	Replace		— · —			
0321	Filter	Inspect		— · —			
		Service		— · —			
		Clean		— · —			

SECTION II MAINTENANCE ALLOCATION CHART

NOMENCLATURE OF END ITEMS
ILCA BENCH TEST SET 145 GS278-1

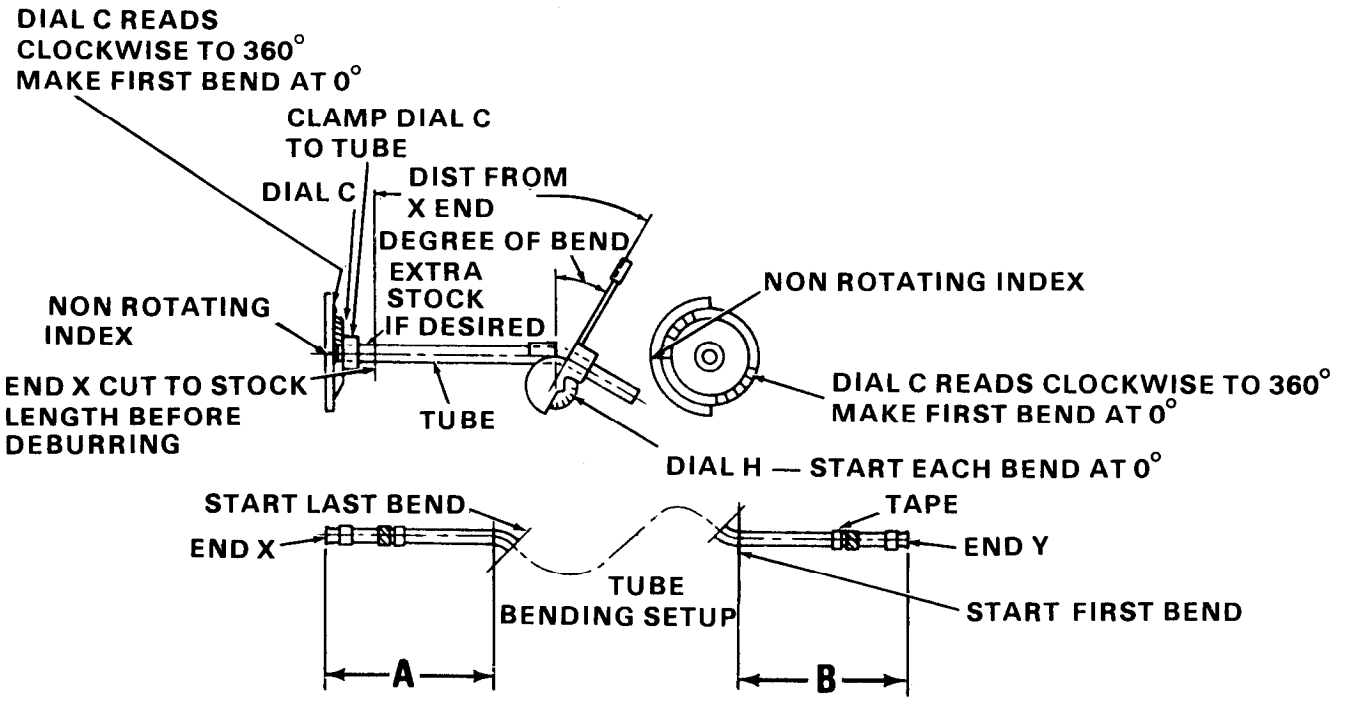
(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Category AVUM	AVIM	DEPOT	(5) Tools and Equipment	(6) Remarks
0322	Gage, Pressure	Inspect		— · —			
		Test		— · —		4,3,11	
		Calibrate		— · — *		10	
		Replace		— · —		10	
		Repair			— · —		
0323	Valve, Solenoid	Inspect		— · —			
		Test		— · —			
		Replace		— · —		5	
		Repair			— · —	8,10	
0324	Valve, Pressure Reducing	Test		— · —			
		Adjust		— · —		4,11	
		Replace		— · —		10	
		Repair			— · —	10	
0325	Valve, Pressure Limiting	Test		— · —			
		Adjust		— · —		4,11	
		Replace		— · —		10	
		Repair			— · —	10	
0326	Valve, Shutoff	Inspect		— · —			
		Test		— · —			
		Replace		— · —		4,11	
		Repair			— · —	10	
0327	Valve, Selector	Inspect		— · —			
		Test		— · —			
		Replace		— · —		4,11	
		Repair			— · —	10	
0328	Valve, Check	Test		— · —			
		Replace		— · —		4,11	
0329	Valve, Needle	Inspect		— · —			
		Test		— · —			
		Replace		— · —		4,11	
		Repair			— · —	10	
0330	Manifold, ILCA	Inspect		— · —			
		Replace		— · —		10	
		Repair		— · —			
0331	Panel Assembly	Service		— · —			
		Replace		— · —		8,10	
		Repair		— · —		8,10	

* Performed by CRC personnel

SECTION III TOOL AND TEST EQUIPMENT REQUIREMENTS

TOOL OR TEST EQUIPMENT REF CODE	MAINTENANCE CATEGORY	NOMENCLATURE	NATIONAL/NATO STOCK NUMBER	TOOL NUMBE
1	F	Autotransformer, Variable General Radio W10MT3AS3		
2	F	Counter, Frequency Fluke 72614		
3	F	Gage, Hydraulic, 0-600 psi		
4	F	Gage, Hydraulic, 0-5000 psi		
5	F	Multimeter, Digital Fluke 8800A		
6	F	Multimeter, Digital HP 3459B		
7	F	Oscilloscope Tektronix 5540 w/plug in 55-14N		
8	F	Tool Kit Electronic Eqpt Repair TK-100/G	5180-00-605-0079	
9	F	Tool Kit, Electronic Eqpt Repair TK-101/G	5180-00-064-5178	
10	F	Shop Set, Hydraulic	4920-00-165-1454	
11	F	Valve, Fine Needle, ¼ inch, 6,000 psi		DV-8-1.0/12P

APPENDIX C
TUBE ASSEMBLY



TUBE END TYPES					
1.	2.	3.	4.	5. TUBE CUT ANGLE 'P'	6.
STRAIGHT	BEADED	SINGLE FLARE	DOUBLE FLARE	CUT END	FLARELESS

NOTES:

1. FABRICATE AND TEST PER TM 55-1500-204-25/1 AIRCRAFT MAINTENANCE MANUAL.
2. BEND RADII TO BE IN ACCORDANCE WITH MS33611.
3. INSTALL VINYL TAPE 1 INCH WIDE AND IDENTIFY WITH PART NUMBER SHOWN ON TUBE ASSEMBLY CHART.
4. ALL DIMENSIONS ARE IN INCHES.
5. ALLOW .03 INCH ES AT EACH END FOR DE BURRING.

47D-TMDE-IBTS-53

Tube Assembly Chart (Sheet 1 of 5)

NOTE

Page identification for foldout pages has been designated as FO-1, FO-2, etc. and the pages are placed in the back of the manual at time of printing. Upon receipt of this manual, insert foldout pages FO-28 through FO-31 after page 5-2.

ALPHABETICAL INDEX

D

E

S

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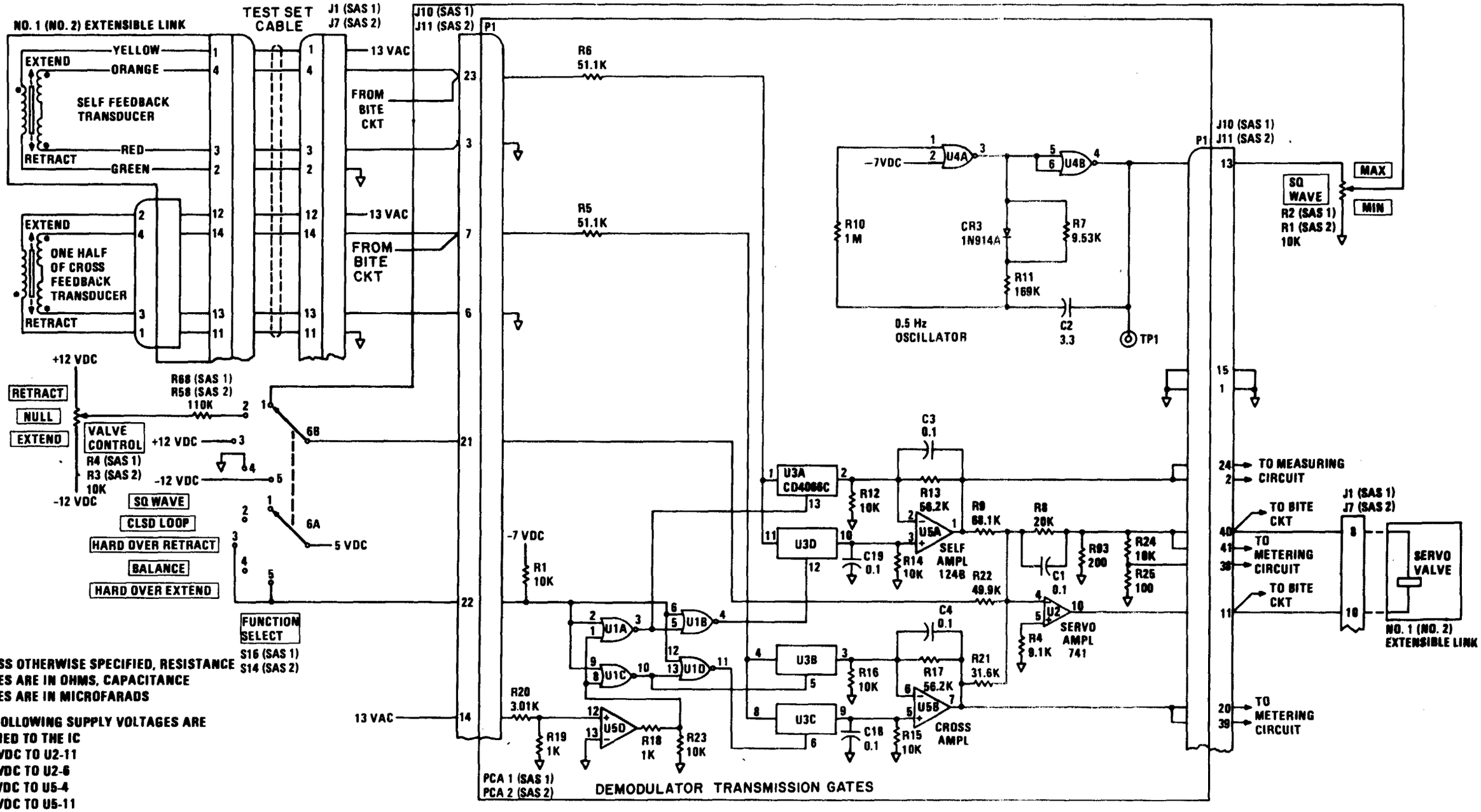
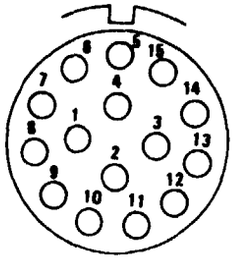


NOTES:

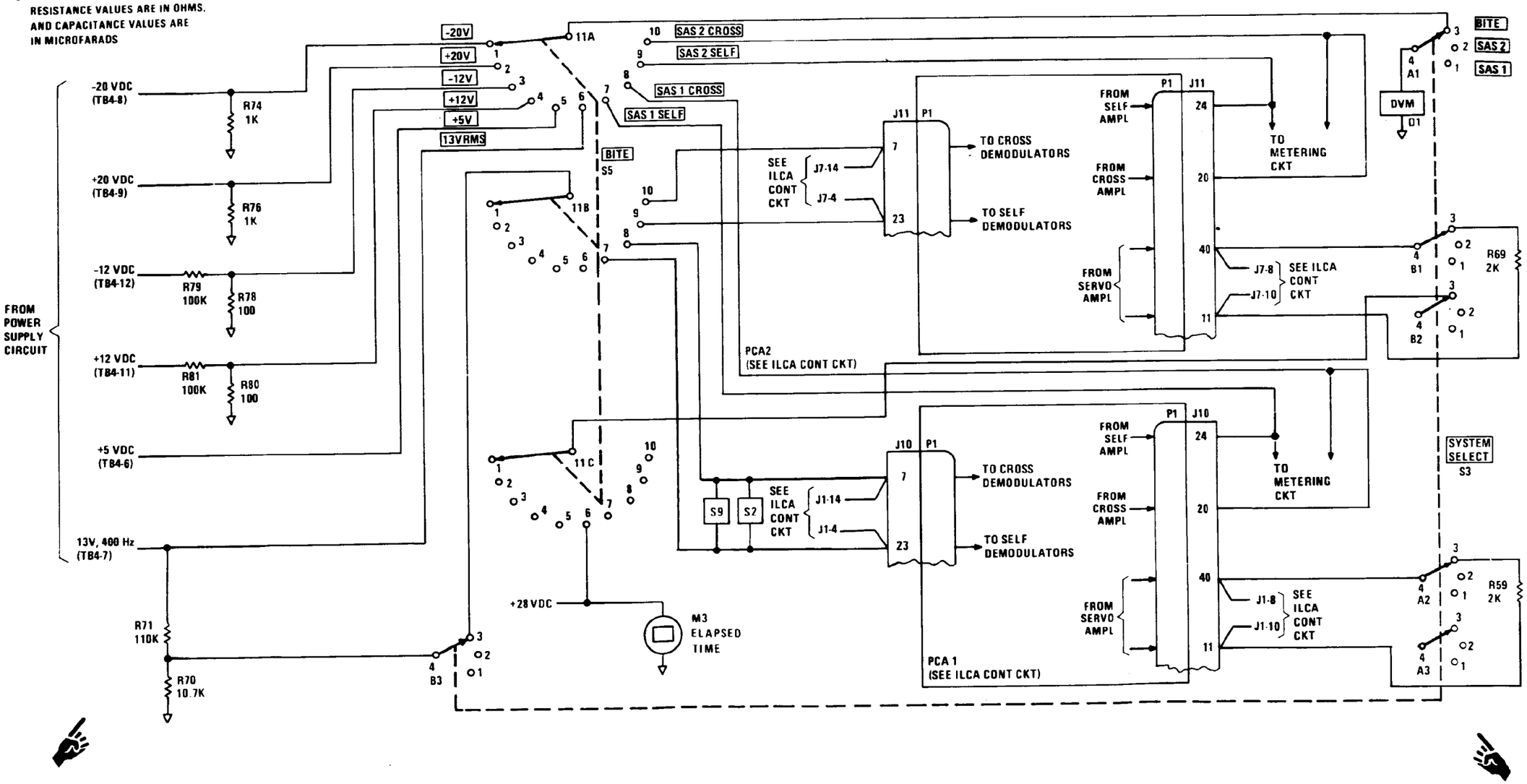
1. UNLESS OTHERWISE SPECIFIED, RESISTANCE VALUES ARE IN OHMS, CAPACITANCE VALUES ARE IN MICROFARADS
2. THE FOLLOWING SUPPLY VOLTAGES ARE APPLIED TO THE IC
   - +20VDC TO U2-11
   - −20VDC TO U2-6
   - +12VDC TO U5-4
   - −12VDC TO U5-11
   - +7VDC TO U1-14, U3-14, U4-14
   - −7VDC TO U1-7, U3-7, U4-7, U7-7
3. J1/J7 PIN PATTERN (PANEL SIDE)



47D-TMDE-18TS-27

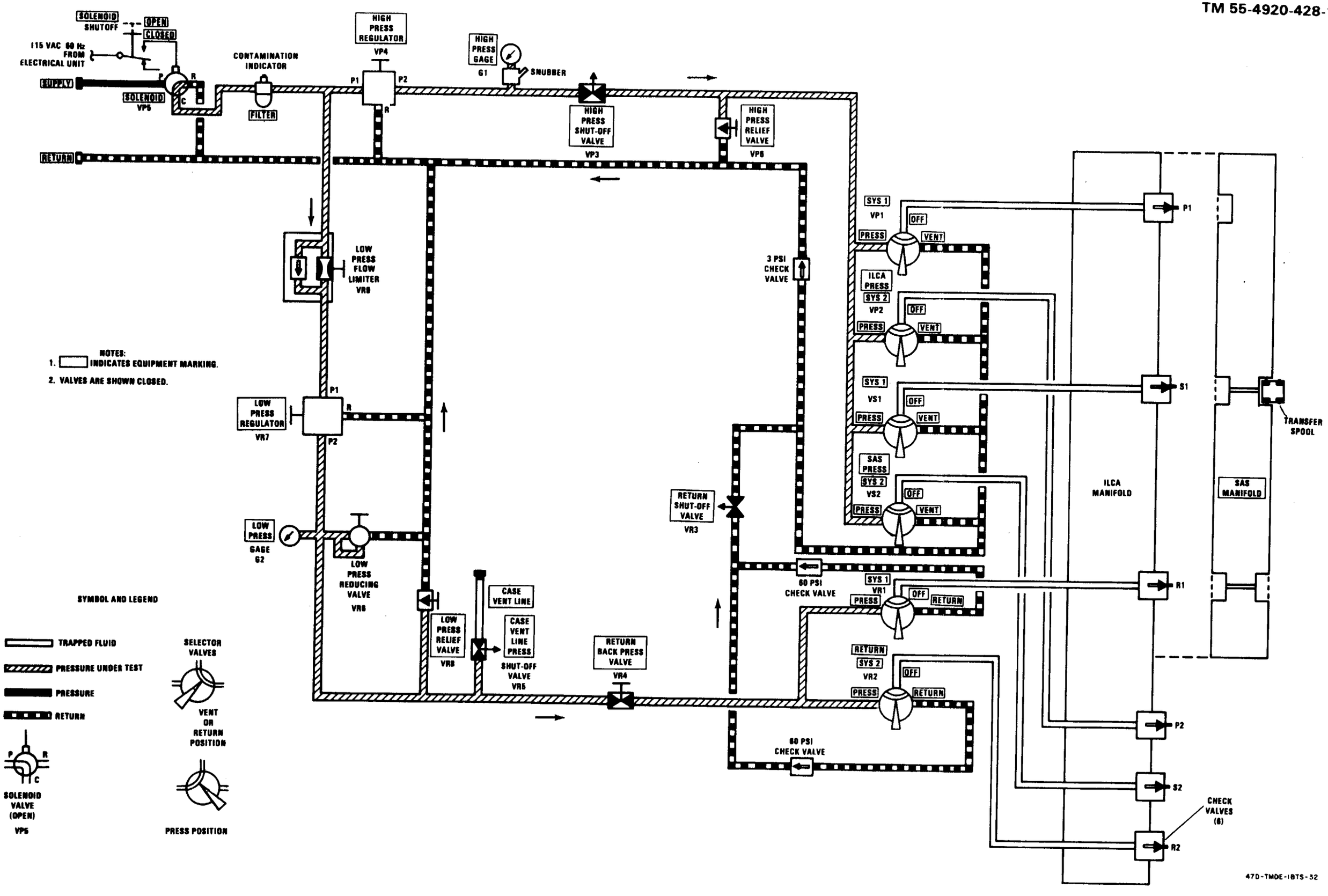
FO-1. ILCA Control Circuit Schematic Diagram

NOTES:
1. ▭ INDICATES PANEL MARKING
2. UNLESS OTHERWISE SPECIFIED, RESISTANCE VALUES ARE IN OHMS, AND CAPACITANCE VALUES ARE IN MICROFARADS



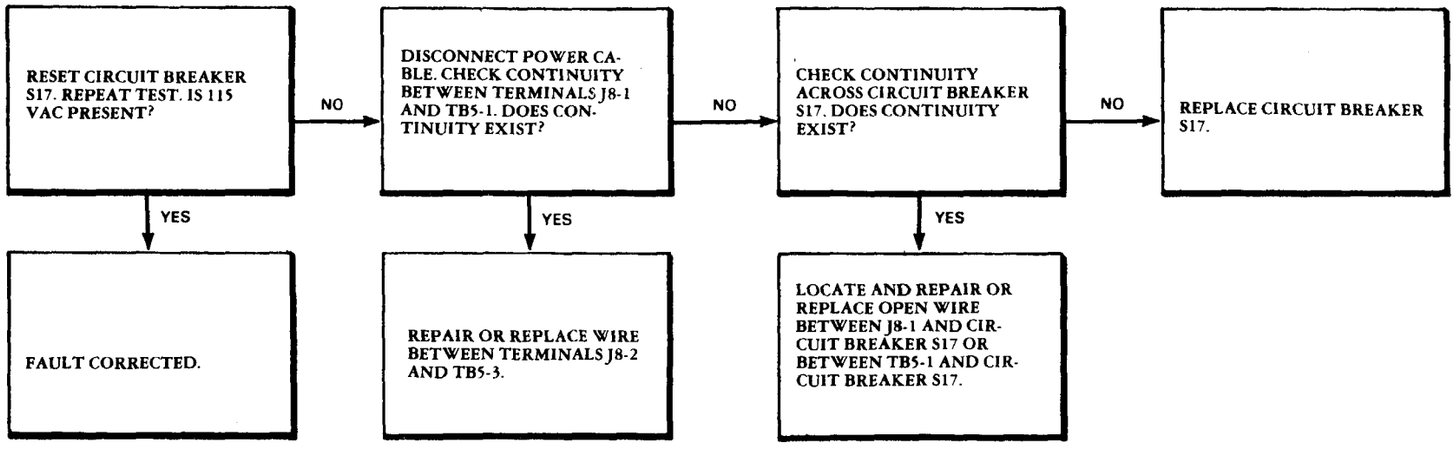
24347

FO-2. BITE Circuit Schematic Diagram



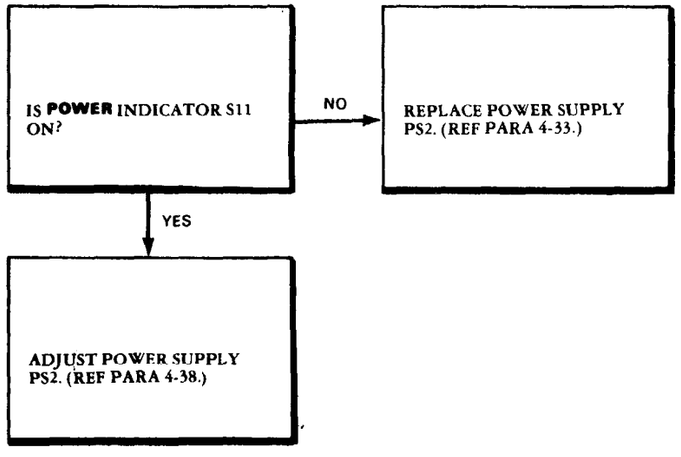
FO-3. *Hydraulic Unit Fluid Schematic*

4-3. Power Supply Input Voltage Circuit Troubleshooting. Multimeter does not indicate 115 vac between terminals TB5-1 and TB5-3.



4-4. Power Supply Dc Voltage Circuit Troubleshooting. (Ref para 4-40*d*.)

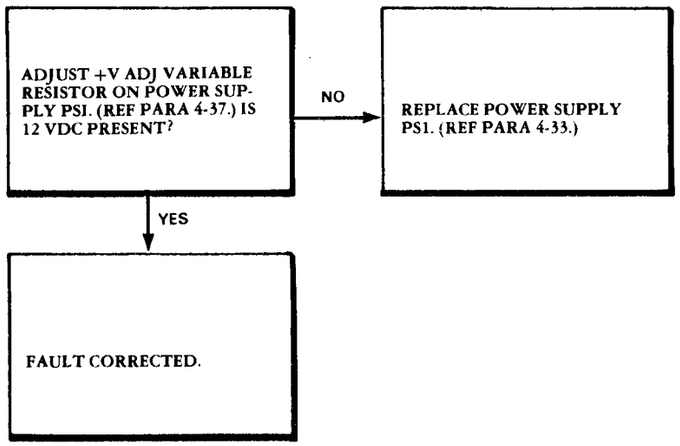
a. Multimeter does not indicate 28 vdc between terminals TB4-10 (+) and TB4-1.



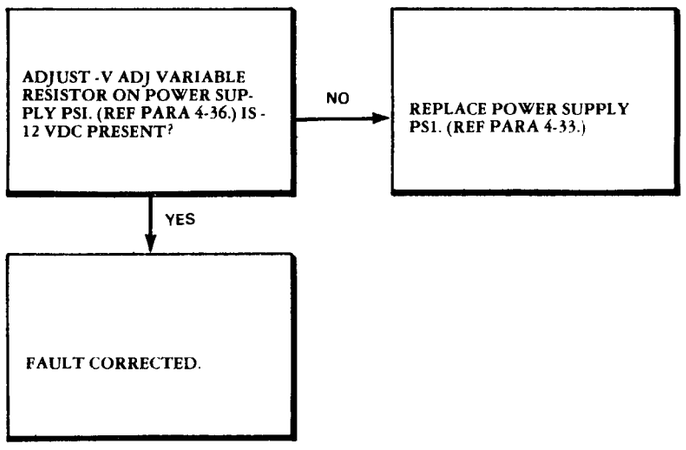
b. Multimeter does not indicate 20 vdc between terminals TB4-9 and TB4-1. Replace power supply TB6B. (Refer to para 4-31.)

c. Multimeter does not indicate −20 vdc between terminals TB4-8 (+) and TB4-1. Replace power supply TB6B. (Refer to para 4-31.)

d. Multimeter does not indicate 12 vdc between terminals TB4-11 (+) and TB4-1.



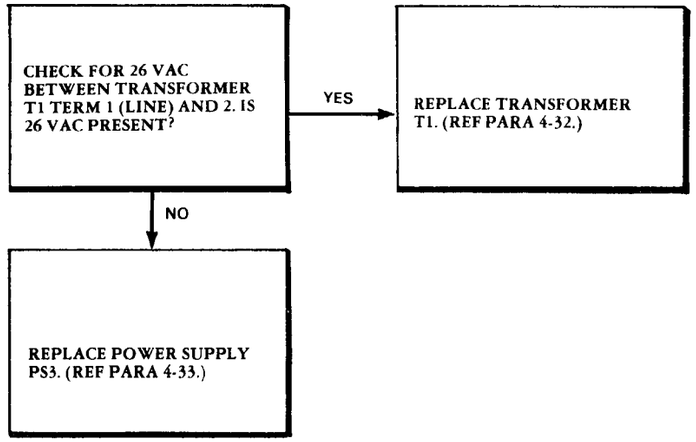
e. Multimeter does not indicate −12 vdc between terminals TB4-12 (+) and TB4-1.



f. Multimeter does not indicate 5 vdc between terminals TB4-6 (+) and TB4-1. Replace power supply PS1. (Refer to para 4-33.)

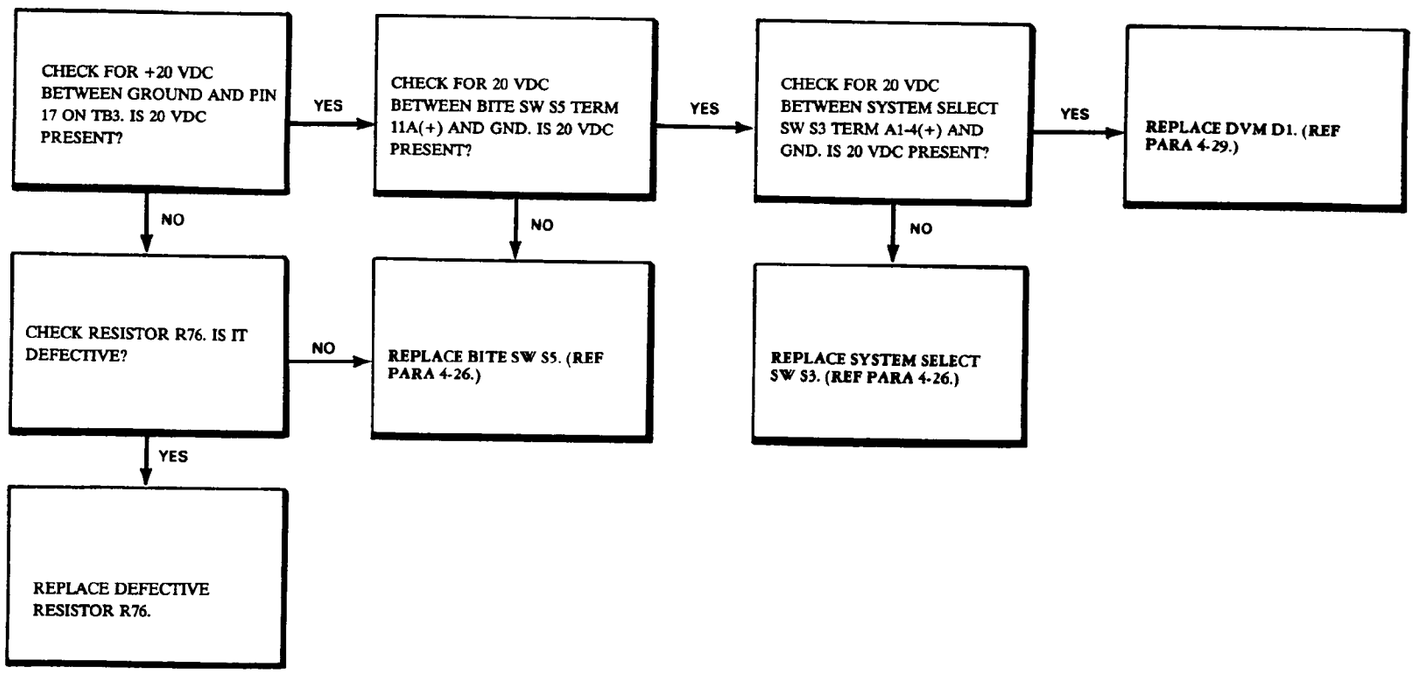
4-5. Power Supply Reference Voltage Circuit Troubleshooting.

a. Multimeter does not indicate 13 vac between terminals TB4-7 (line) and TB4-1.



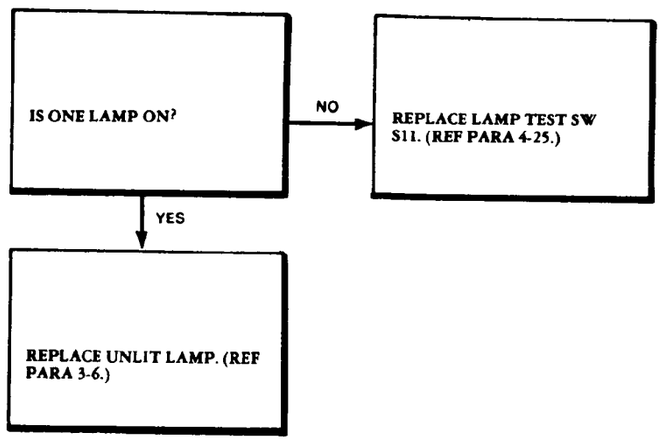
b. Frequency counter does not indicate 395 to 402 Hz between terminals TB4-7 (line) and TB4-1. Replace power supply PS3. (Refer to para 4-33.)

4-6. DVM Circuit Troubleshooting. DVM does not indicate 20 vdc.

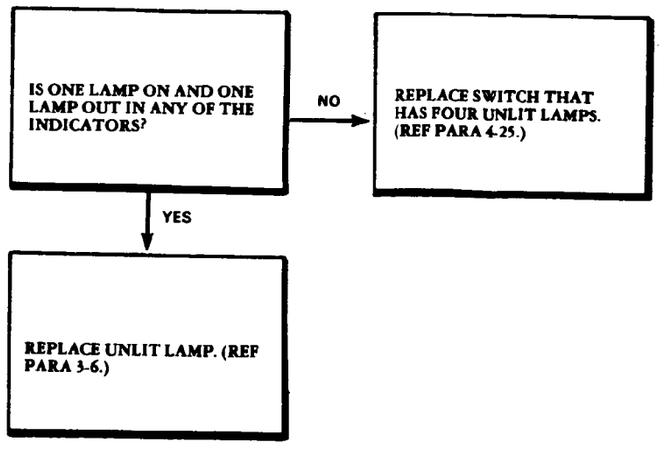


4-7. Lamp Circuit Troubleshooting.

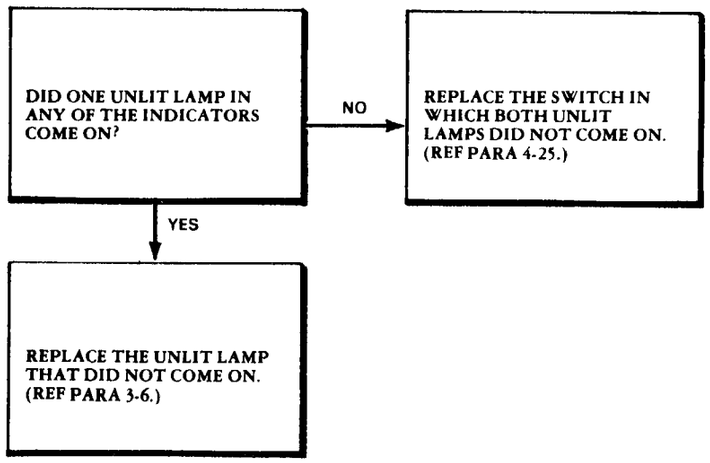
a. Both lamps in **POWER** indicator do not come on with power switch at ON.



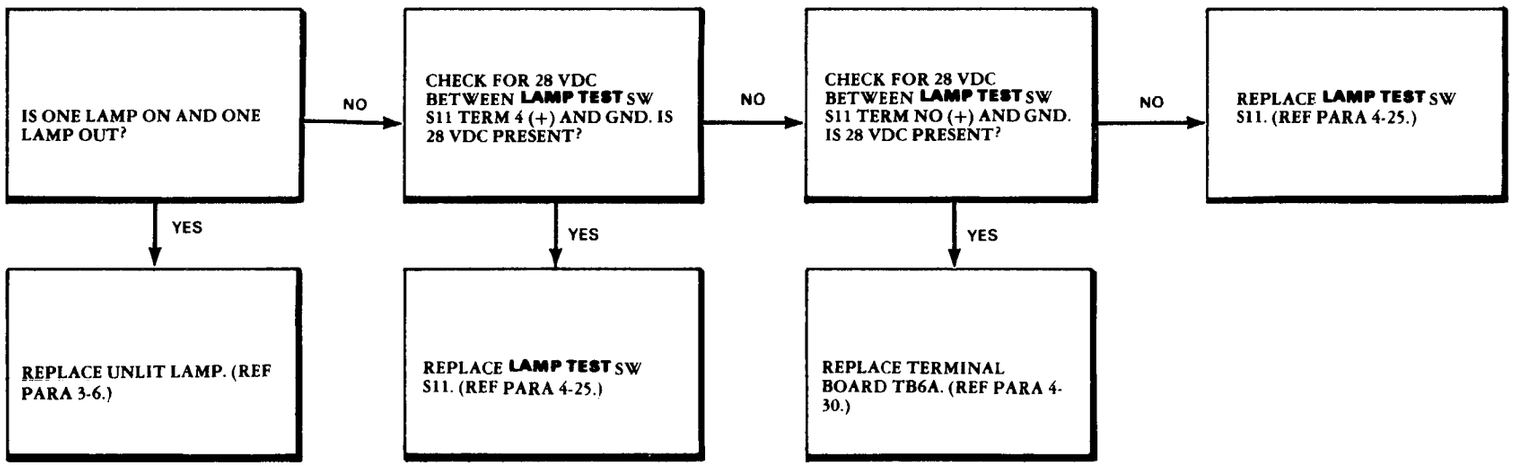
b. Both lamps in upper or lower indicator of **SAS 1** and **SAS 2 FEEDBACK SELECT, CYCLE MOTOR,** and **SOLENOID SHUTOFF** switches do not come on with power switch at ON.



c. Both lamps in the unlit indicator do not come on when **SAS 1** and **SAS 2 FEEDBACK SELECT, CYCLE MOTOR,** and **SOLENOID SHUTOFF** switches are pressed.



d. Both lamps in the **WARNING** indicator do not come on when **LAMP TEST** switch S11 is pressed.



e. **SAS 1** and **SAS 2 CROSS** indicators do not come on when **LAMP TEST** switch S11 is pressed. Replace terminal board TB2 (para 4-24).

f. **OFF** and **CLOSED** indicators do not come on when **LAMP TEST** switch S11 is pressed. Replace terminal board TB1 (para 4-24).

g. **SAS 1** and **SAS 2 CROSS, OFF,** and **CLOSED** indicators do not come on when each associated switch is pressed and release. Replace the associated switch (para 4-25).

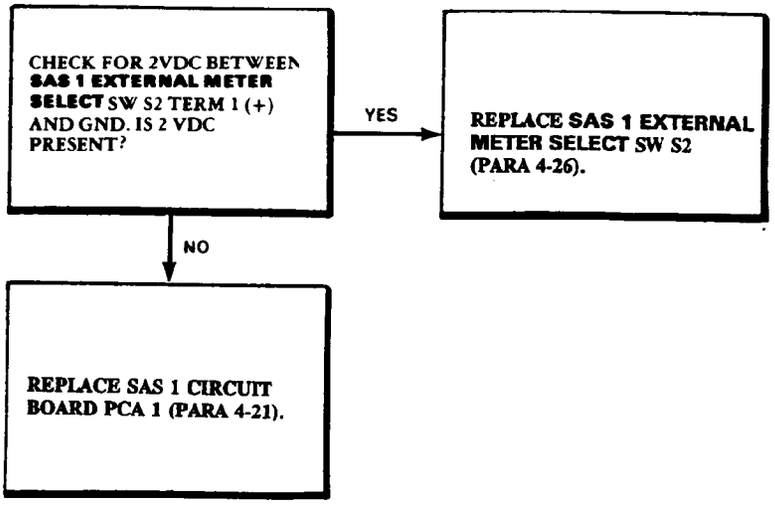
h. **SAS 1** and **SAS 2 SELF** indicators do not come on when **LAMP TEST** switch S11 is pressed. Replace terminal board TB2 (para 4-24).

i. **ON** and **OPEN** indicators do not come on when **LAMP TEST** switch S11 is pressed. Replace terminal board TB1 (para 4-24).

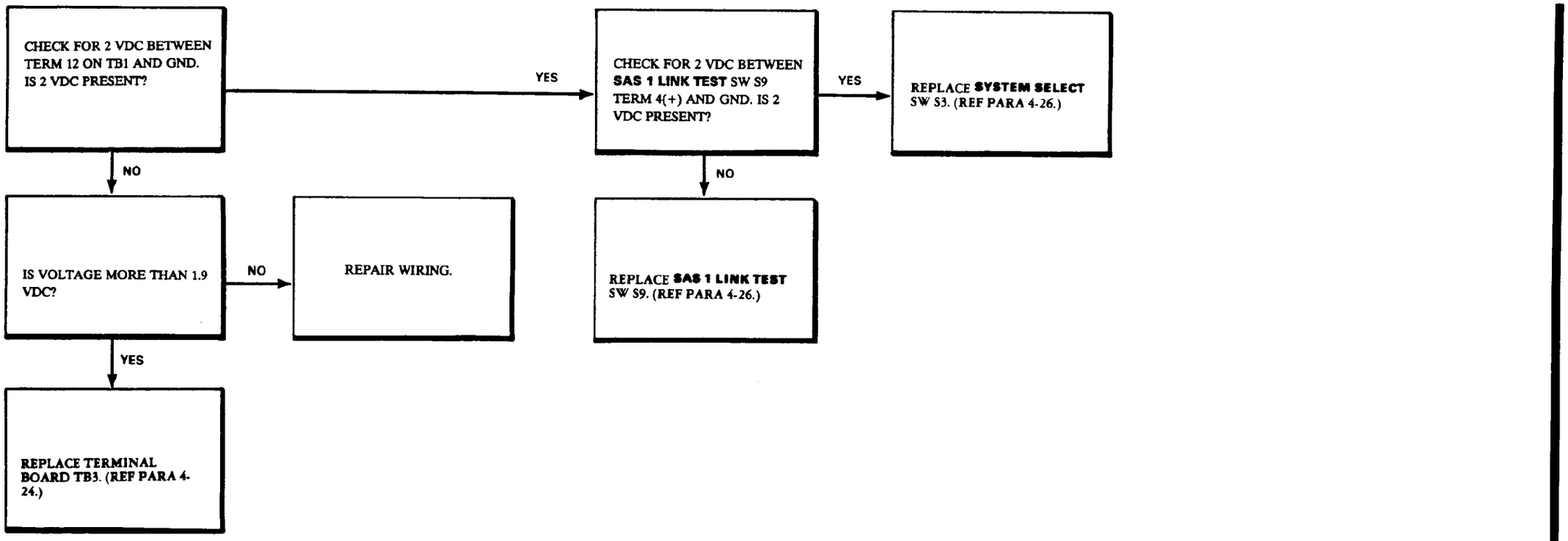
4-8. Undervoltage Detector Circuit Troubleshooting. WARNING indicator S11 does not come on when input voltage is less than 105 vac or does not go out when input voltage is more than 105 vac. Replace terminal board TB6B (para 4-30).

4-9. SAS 1 Self-Feedback and Metering Circuits Troubleshooting.

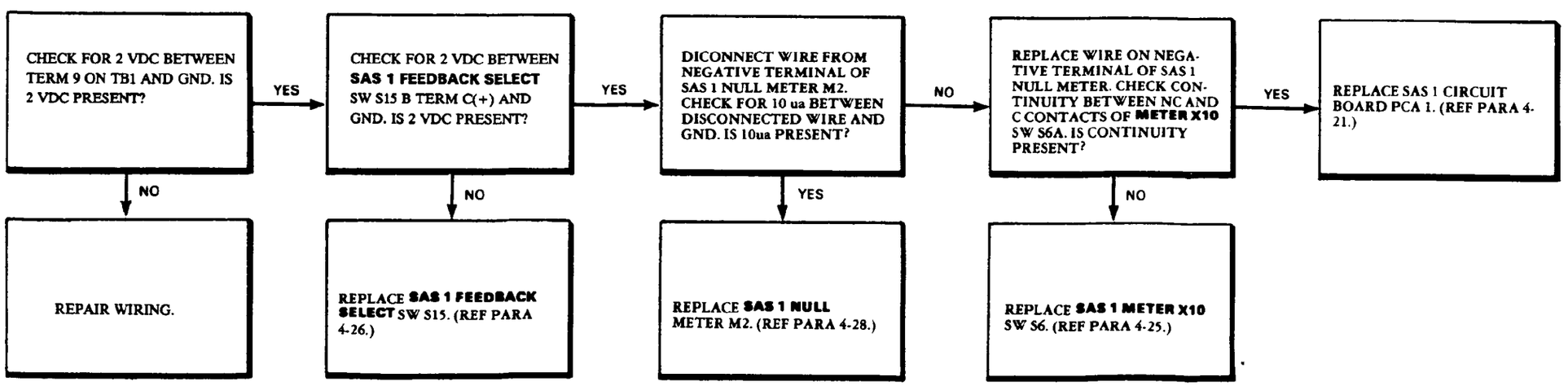
a. No. 2 multimeter does not indicate 2 vdc when input to SAS 1 self demodulators is an in-phase 2 vac signal.



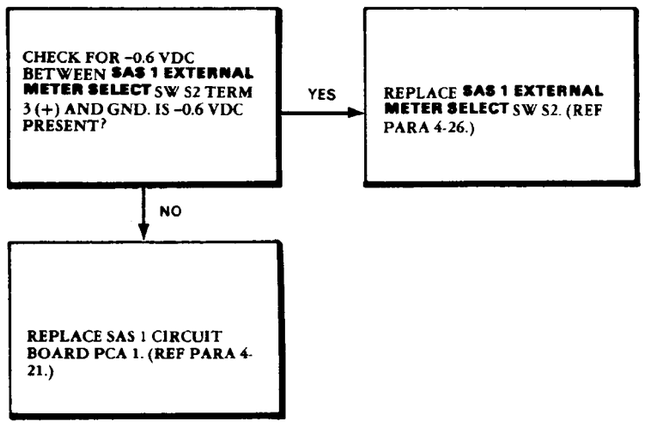
b. DVM does not indicate 2 vdc when input to SAS 1 self demodulators is an in-phase 2 vac signal.



c. **SAS 1 NULL** meter does not indicate 10 ua when input to SAS 1 self demodulators is an in-phase 2 vac signal.



d. No. 2 multimeter does not indicate −0.6 vdc when **SAS 1 EXTERNAL METER SELECT** switch S2 is at **VALVE.**



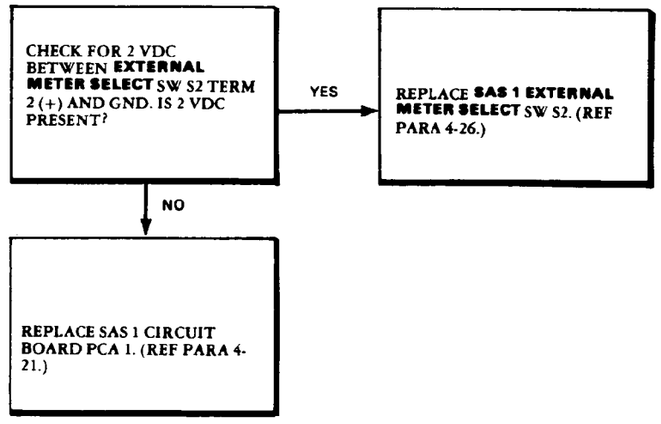
e. **DVM** does not indicate −6 vdc when **SAS 1 LINK TEST** switch S9 is at **VALVE.** Replace **SAS 1 LINK TEST** switch S9. (Refer to para 4-26.)

f. Normal indications are not obtained on No. 2 multimeter, **DVM,** and **SAS 1 NULL** meter when the input to SAS 1 self demodulators is an in-phase 1.0 vdc signal. Replace SAS 1 circuit board PCA 1. (Refer to para 4-21.)

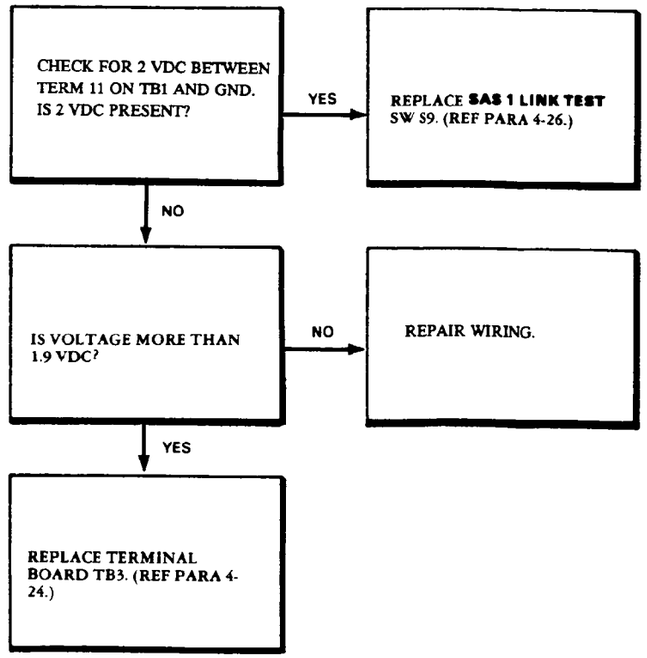
g. Normal indications are not obtained on No. 2 multimeter, **DVM,** and **SAS 1 NULL** meter when the input to SAS 1 self demodulators is an out-of-phase 2.0 or 1.0 vac signal. Replace SAS 1 circuit board PCA 1. (Refer to para 4-21.)

4-10. SAS 1 Cross-Feedback and Metering Circuits Troubleshooting.

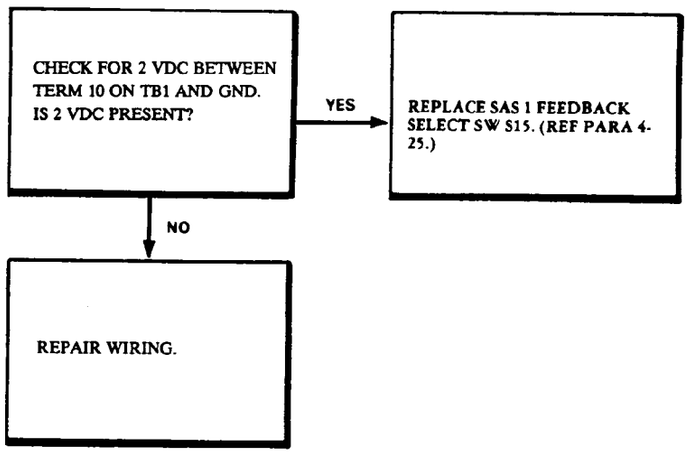
a. No. 2 multimeter does not indicate 2 vdc when input to SAS 1 cross demodulators is an in-phase 2 vac signal.



b DVM does not indicate 2 vdc when input to SAS 1 cross demodulators is an in-phase 2 vac signal.



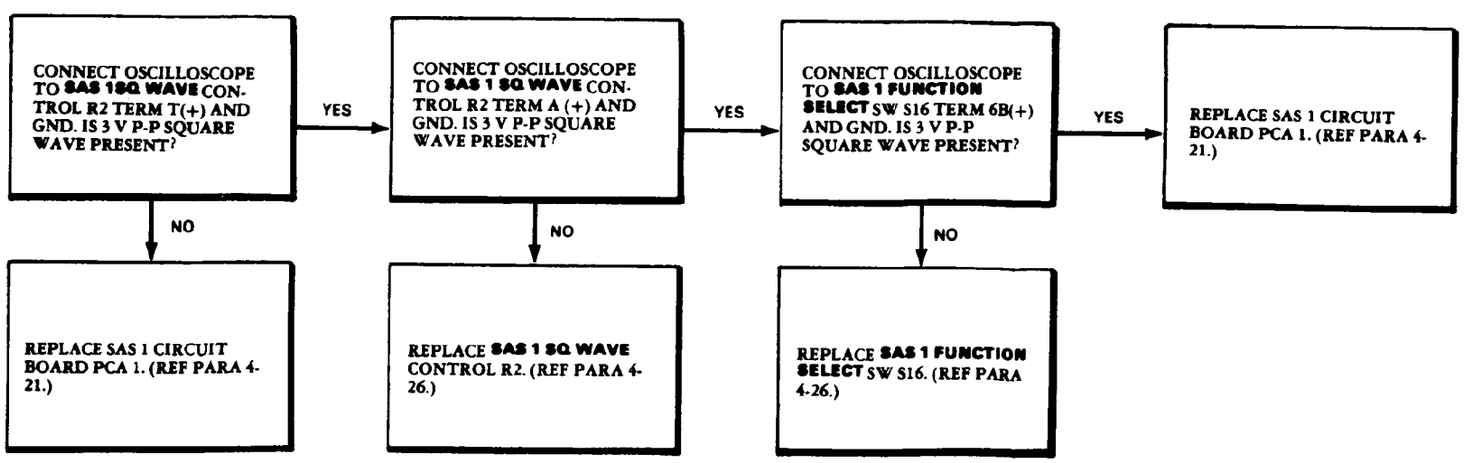
c. **SAS 1 NULL** meter does not indicate 10 ua when input to SAS 1 cross demodulators is an in-phase 2 vac signal.



d. Normal indications are not obtained during final test steps 4-48 h through 4-48 k. Replace SAS 1 circuit board PCA 1. (Refer to para 4-21.)

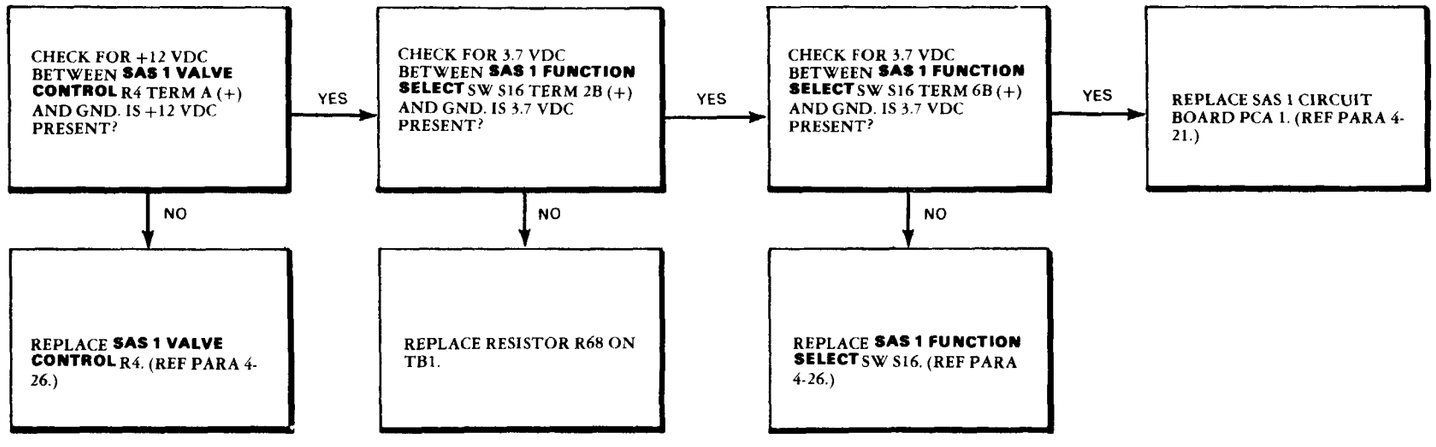
4-11. SAS 1 Command Circuit Troubleshooting.

a. Oscilloscope does not display a symmetrical square wave with peak-to-peak amplitude of 3 volts.



b. Frequency counter does not indicate 2.2 sec. Replace SAS 1 circuit board PCA 1. (Refer to para 4-20.)

c. No. 2 multimeter does not indicate −1.6 vdc when **SAS 1 VALVE CONTROL** R4 is at **RETRACT.**



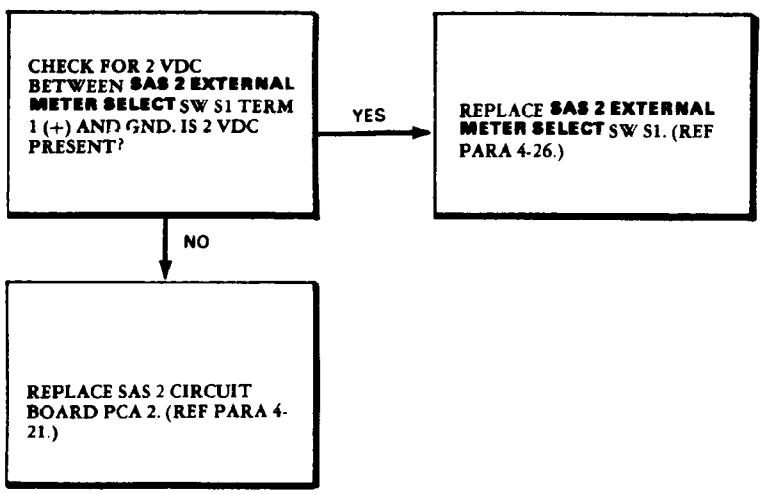
d. No. 2 multimeter does not indicate +1.6 vdc when **SAS 1 VALVE CONTROL** R4 is at **EXTEND.** Replace **SAS 1 VALVE CONTROL** R4. (Refer to para 4-26.)

e. No. 2 multimeter does not indicate −1.6 vdc when **SAS 1 FUNCTION SELECT** switch S16 is at **HARDOVER RETRACT.** Replace **SAS 1 FUNCTION SELECT** switch S16. (Refer to para 4-26.)

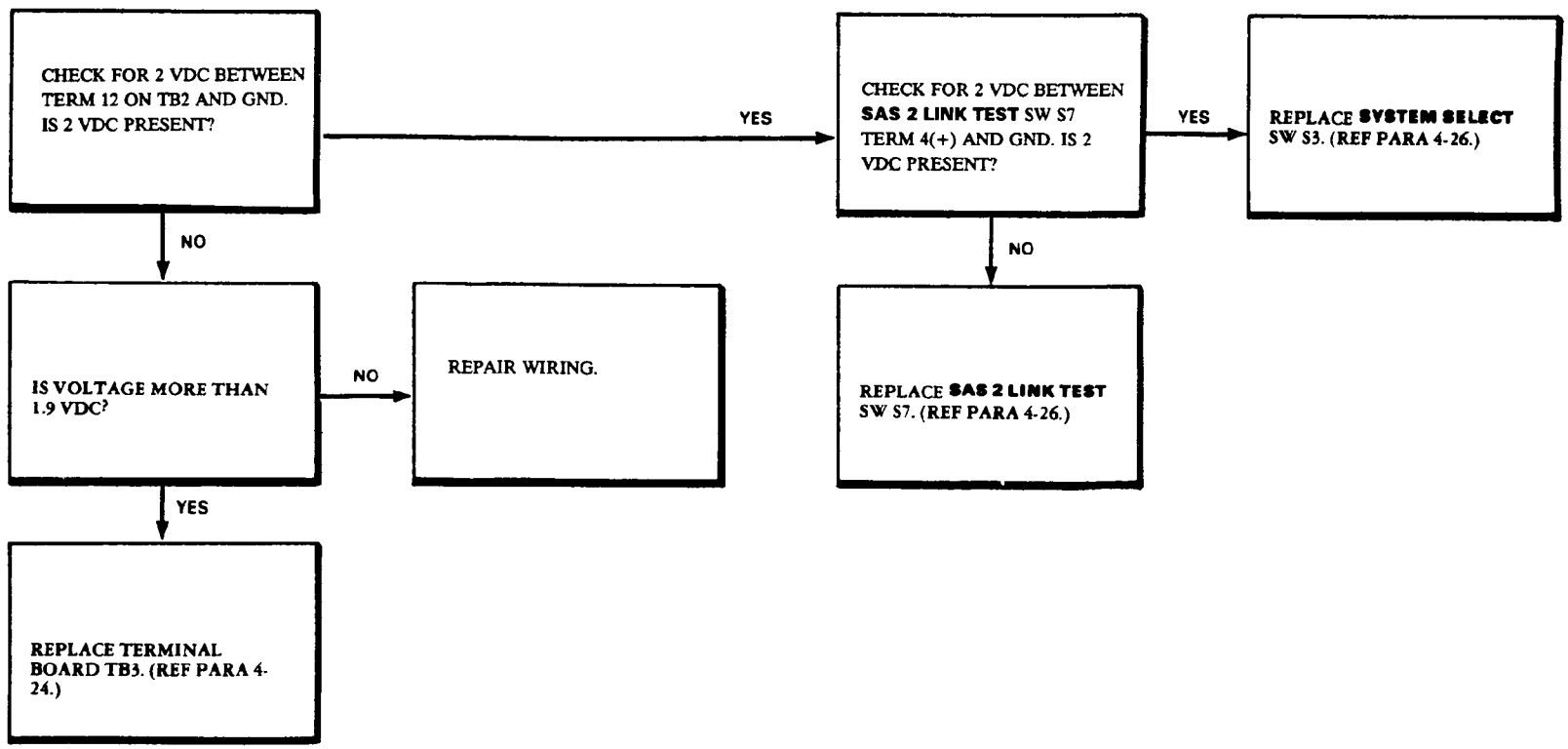
f. No. 2 multimeter does not indicate +1.6 vdc when **SAS 1 FUNCTION SELECT** switch S16 is at **HARDOVER EXTEND.** Replace **SAS 1 FUNCTION SELECT** switch S16. (Refer to para 4-26.)

4-12. SAS 2 Self-Feedback and Metering Circuits Troubleshooting.

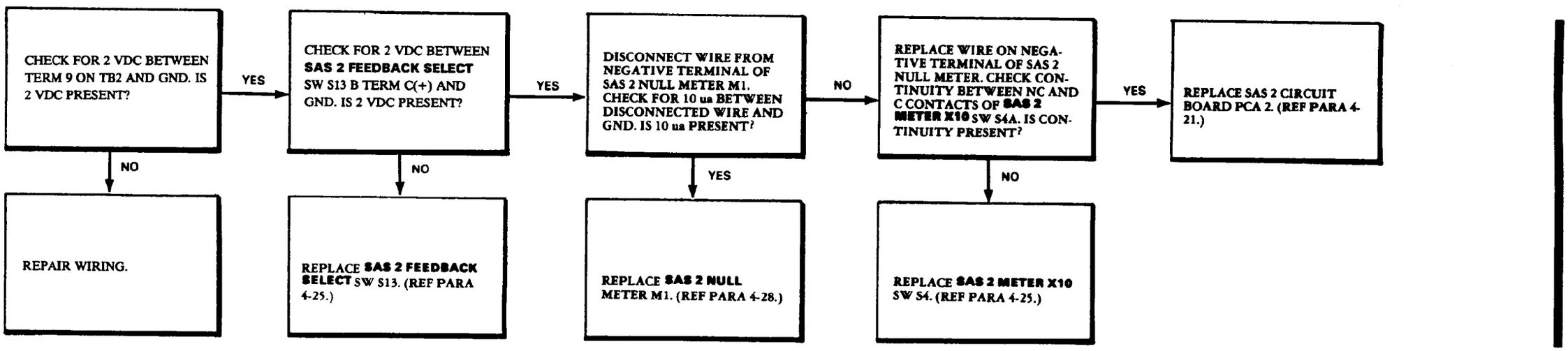
a. No. 2 multimeter does not indicate 2 vdc when input to SAS 2 self demodulators is an in-phase 2 vac signal.



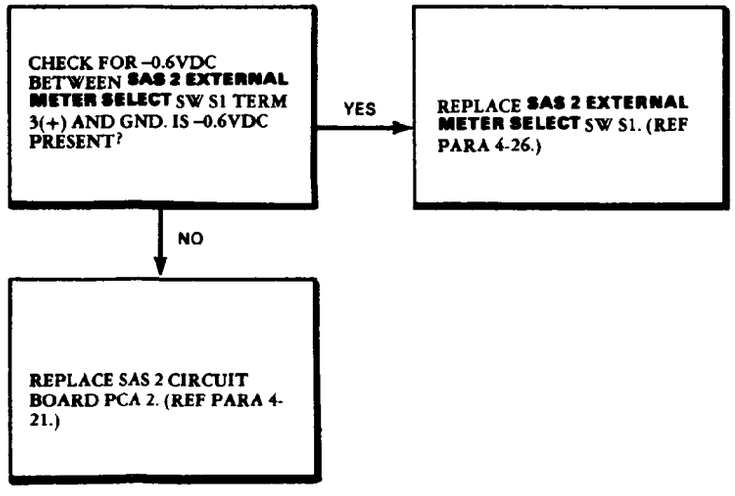
b. DVM does not indicate 2 vdc when input to SAS 2 self demodulators is an in-phase 2 vac signal.



c. SAS 2 NULL meter does not indicate 10 ua when input to SAS 2 self demodulators is an in-phase 2 vac signal.



d. No. 2 multimeter does not indicate −0.6 vdc when **SAS 2 EXTERNAL METER SELECT** switch S1 is at **VALVE.**



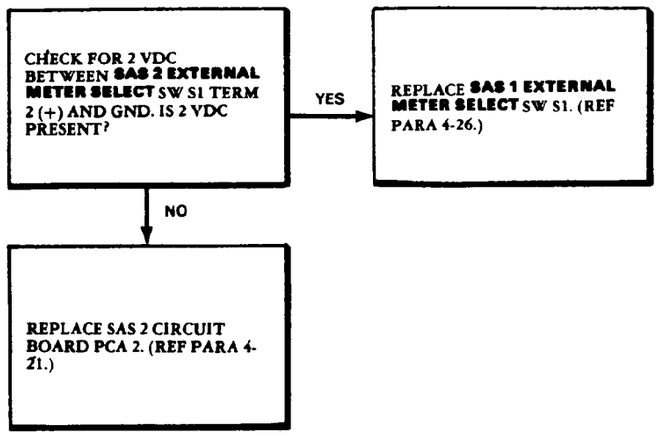
e. DVM does not indicate −6 vdc when **SAS 2 LINK TEST** switch S7 is at **VALVE.** Replace **SAS 2 LINK TEST** switch S7. (Refer to para 4-26.)

f. Normal indications are not obtained on No. 2 multimeter, **DVM,** and **SAS 1 NULL** meter when the input to SAS 2 self demodulators is an in-phase 1.0 vdc signal. Replace SAS 2 circuit board PCA 2. (Refer to para 4-21.)

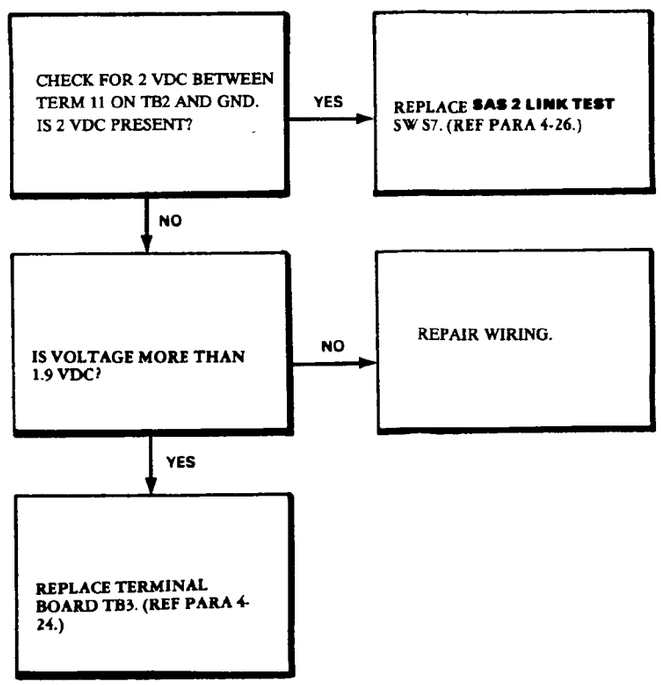
g. Normal indications are not obtained on No. 2 multimeter, **DVM,** and **SAS 2 NULL** meter when the input to SAS 2 self demodulators is an out-of-phase 2.0 or 1.0 vac signal. Replace SAS 2 circuit board PCA 2. (Refer to para 4-21.)

4-13. SAS 2 Cross-Feedback and Metering Circuits Troubleshooting.

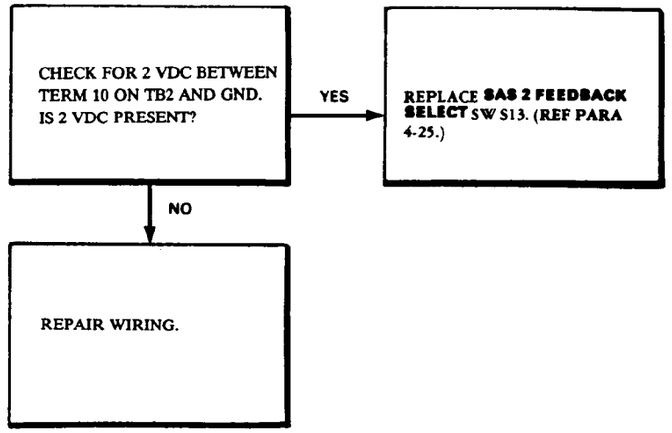
a. No. 2 multimeter does not indicate 2 vdc when input to SAS 2 cross demodulators is an in-phase 2 vac signal.



b. **DVM** does not indicate 2 vdc when input to SAS 2 cross demodulators is an in-phase 2 vac signal.



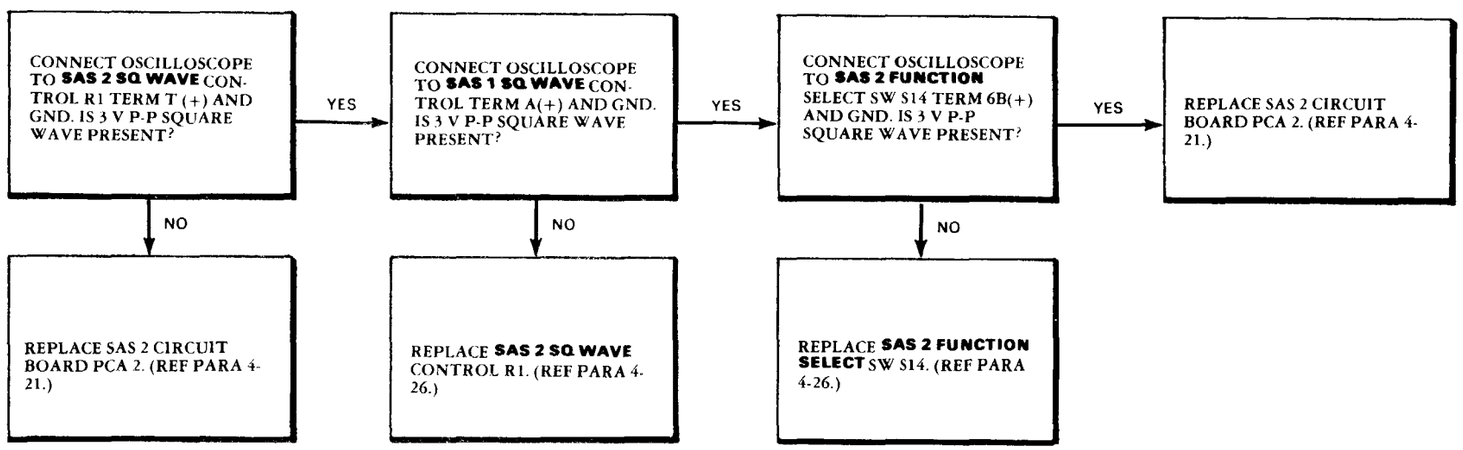
c. **SAS 2 NULL** meter does not indicate 10 ua when input to SAS 2 cross demodulators is an in-phase 2 vac signal.



d. Normal indications are not obtained during final test steps 4-48 h through 4-48 k. Replace SAS 2 circuit board PCA 2. (Refer to para 4-21.)

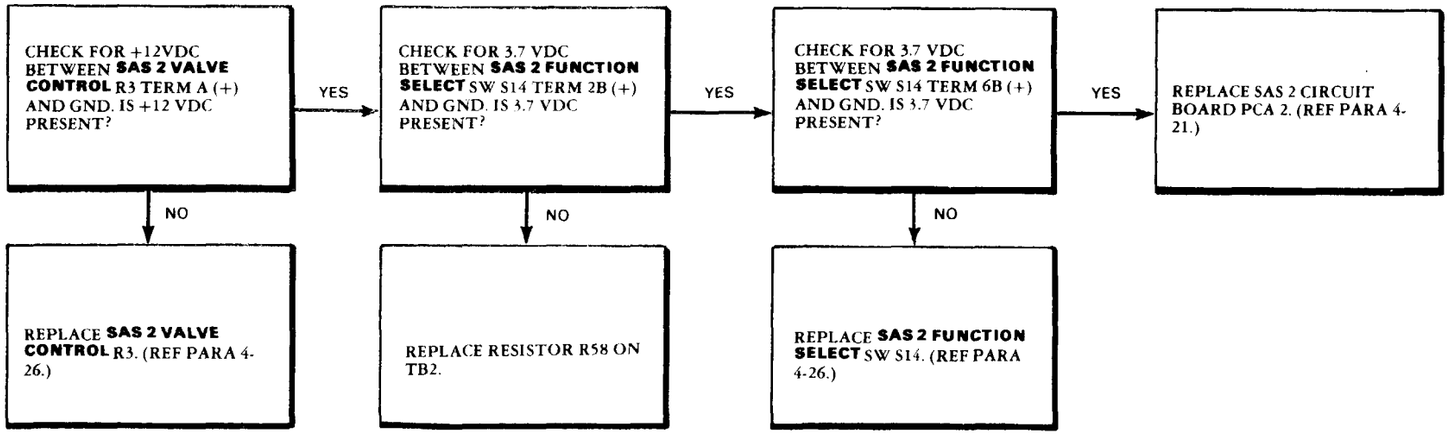
4-14. SAS 2 Command Circuit Troubleshooting.

a. Oscilloscope does not display a symmetrical square wave with peak-to-peak amplitude of 3 volts.



b. Frequency counter does not indicate 2.2 sec. Replace SAS 2 circuit board PCA 2. (Refer to para 4-21.)

c. No. 2 multimeter does not indicate −1.6 vdc when **SAS 2 VALVE CONTROL** R3 is at **RETRACT.** (Refer to para 4-26.)



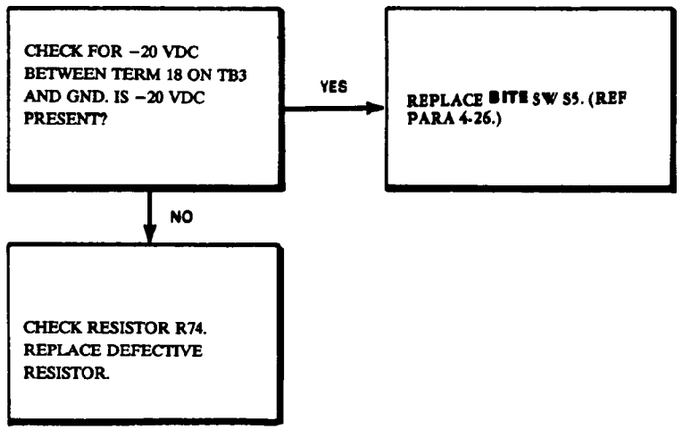
d. No. 2 multimeter does not indicate +1.6 vdc when **SAS 2 VALVE CONTROL** R3 is at **EXTEND.** Replace **SAS 2 VALVE CONTROL** R3. (Refer to para 4-26.)

e. No. 2 multimeter does not indicate −1.6 vdc when **SAS 2 FUNCTION SELECT** switch S14 is at **HARDOVER RETRACT.** Replace **SAS 2 FUNCTION SELECT** switch S14. (Refer to para 4-26.)

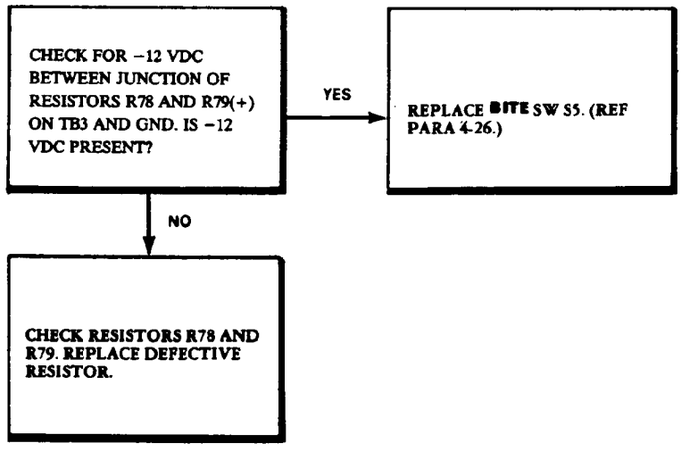
f. No. 2 multimeter does not indicate +1.6 vdc when **SAS 2 FUNCTION SELECT** switch S14 is at **HARDOVER EXTEND.** Replace **SAS 2 FUNCTION SELECT** switch S14. (Refer to para 4-26.)

4-15. BITE Circuit Troubleshooting.

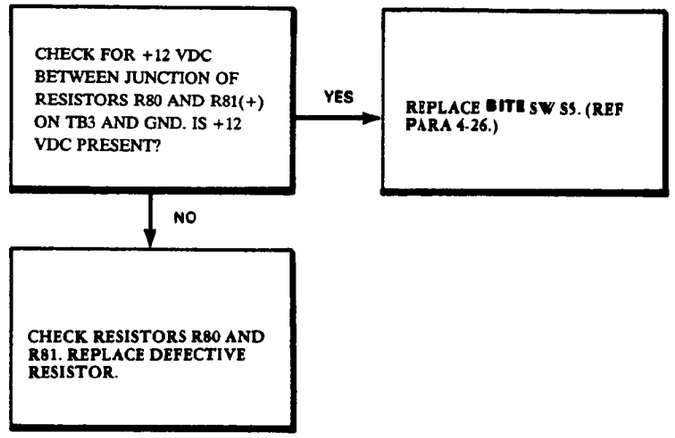
a. **DVM** does not indicate −20.00 vdc when **BITE** switch is at −20V.



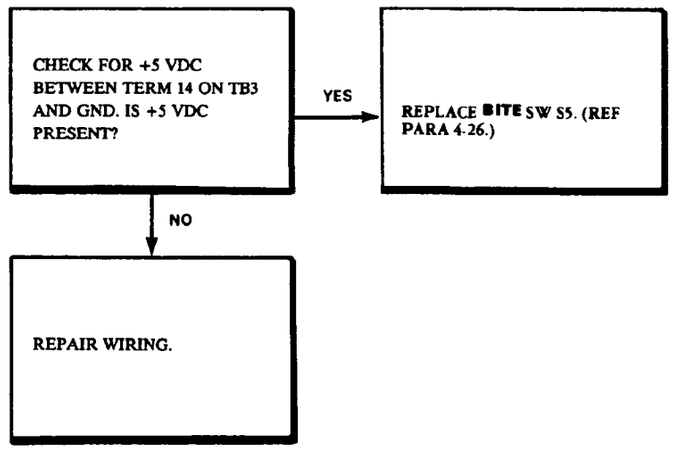
b. **DVM** does not indicate −12.00 vdc when **BITE** switch is at −12V.



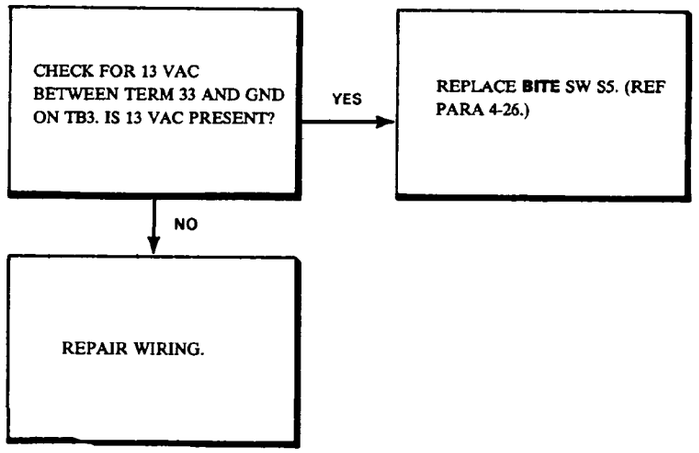
c. **DVM** does not indicate +12.00 vdc when **BITE** switch is at **+12V.**



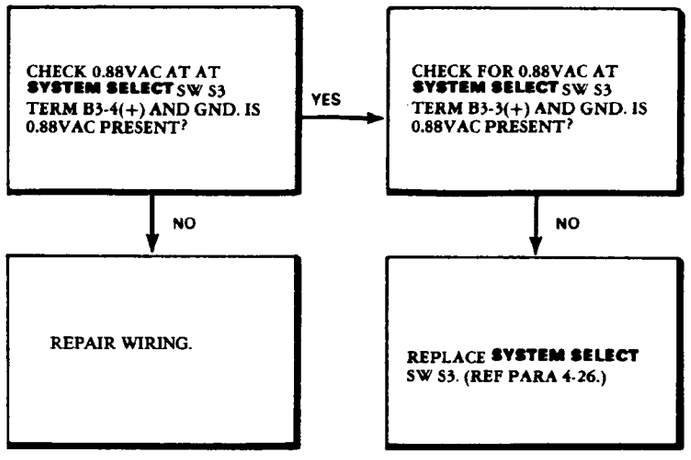
d. **DVM** does not indicate +5.00 vdc when **BITE** switch is at **5V.**



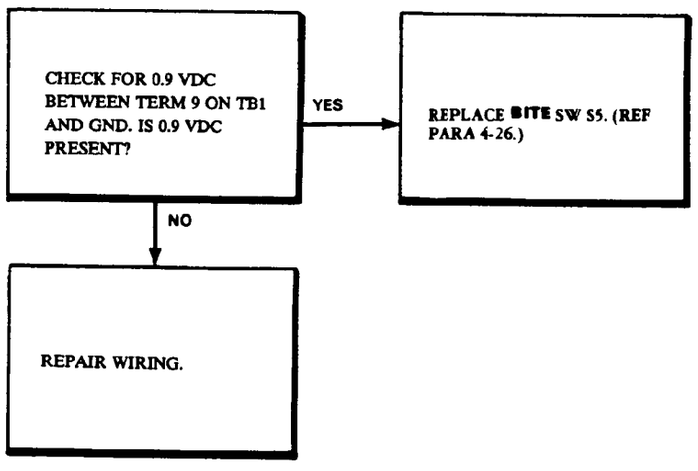
e. DVM does not indicate 13 volts when **BITE** switch is at **13 VRMS.**



f. No. 1 multimeter does not indicate 0.88 vac when **BITE** switch is at **SAS 1 SELF.**

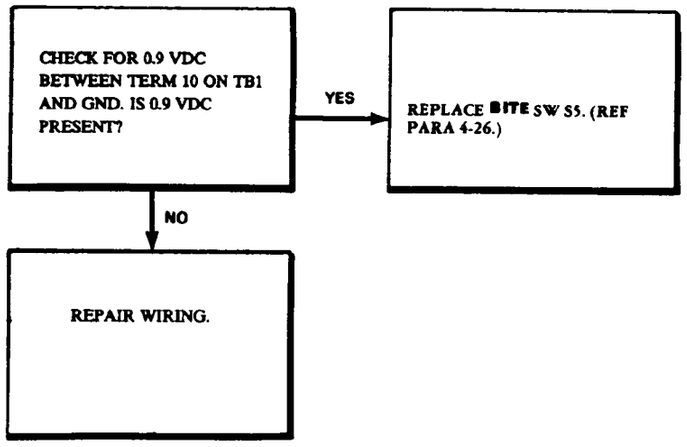


g. **DVM** does not indicate 0.9 volt when **BITE** switch is at **SAS 1 SELF.**



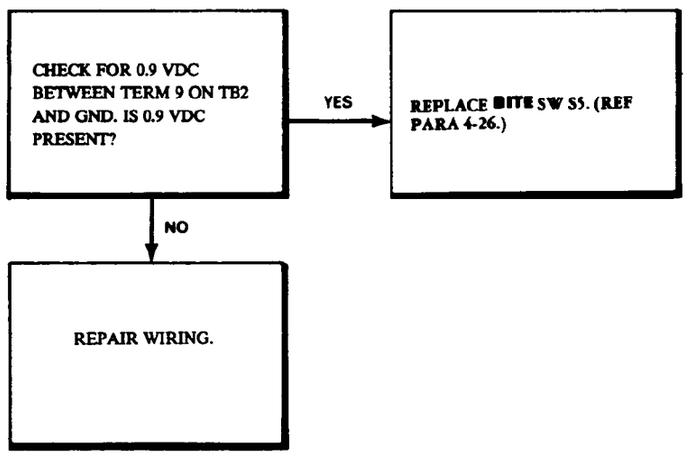
b. No. 1 multimeter does not indicate 0.88 vac when **BITE** switch is at **SAS 1 CROSS.** Replace **BITE** switch S5. (Refer to para 4-26.)

i. **DVM** does not indicate 0.9 vdc when **BITE** switch is at **SAS 1 CROSS.**



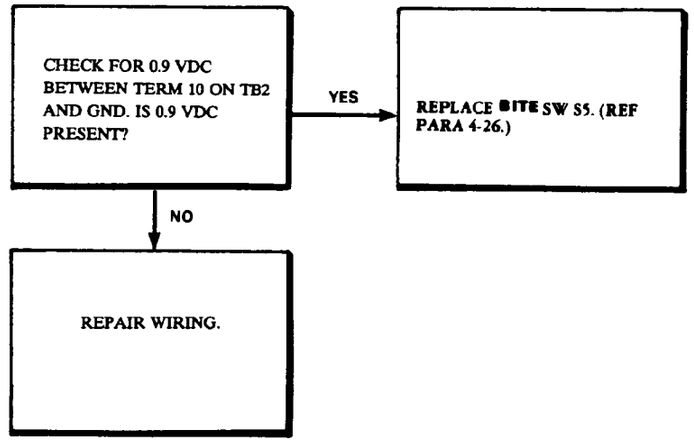
j. No. 1 multimeter does not indicate 0.88 vac when **BITE** switch is at **SAS 2 SELF.** Replace **BITE** switch S5. (Refer to para 4-26.)

k. DVM does not indicate 0.9 vdc when **BITE** switch is at **SAS 2 SELF.**



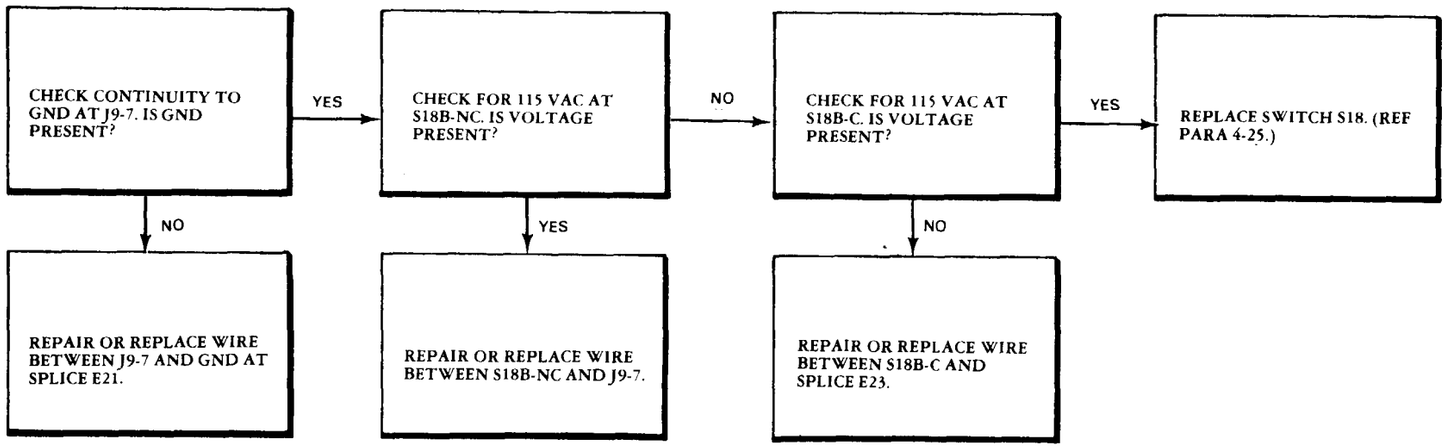
l. No. 1 multimeter does not indicate 0.88 vac when **BITE** switch is at **SAS 2 CROSS.** Replace **BITE** switch S5. (Refer to para 4-26.)

m. DVM does not indicate 0.9 vdc when **BITE** switch is at **SAS 2 CROSS.**

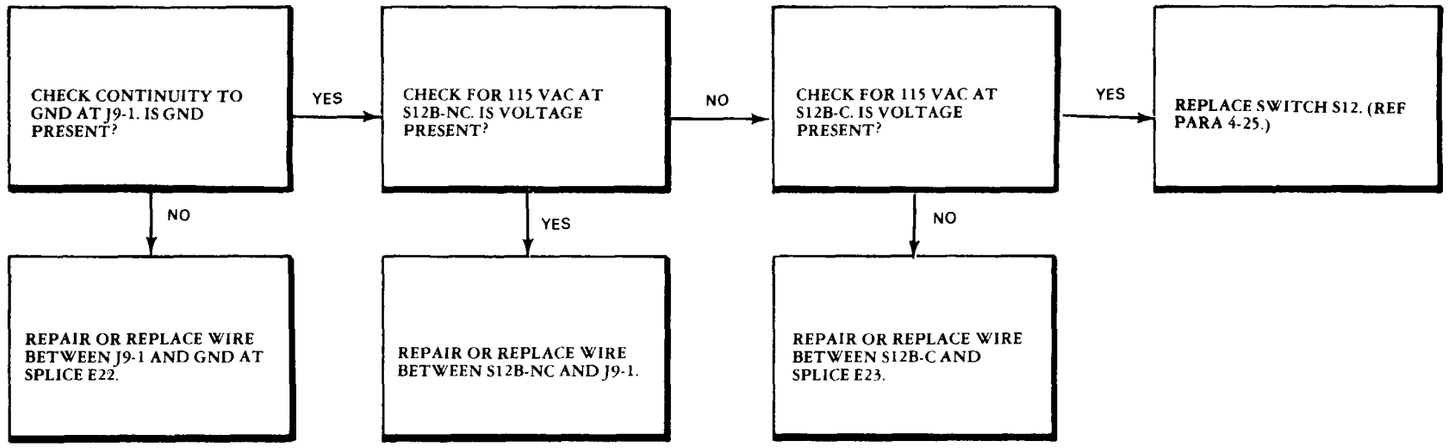


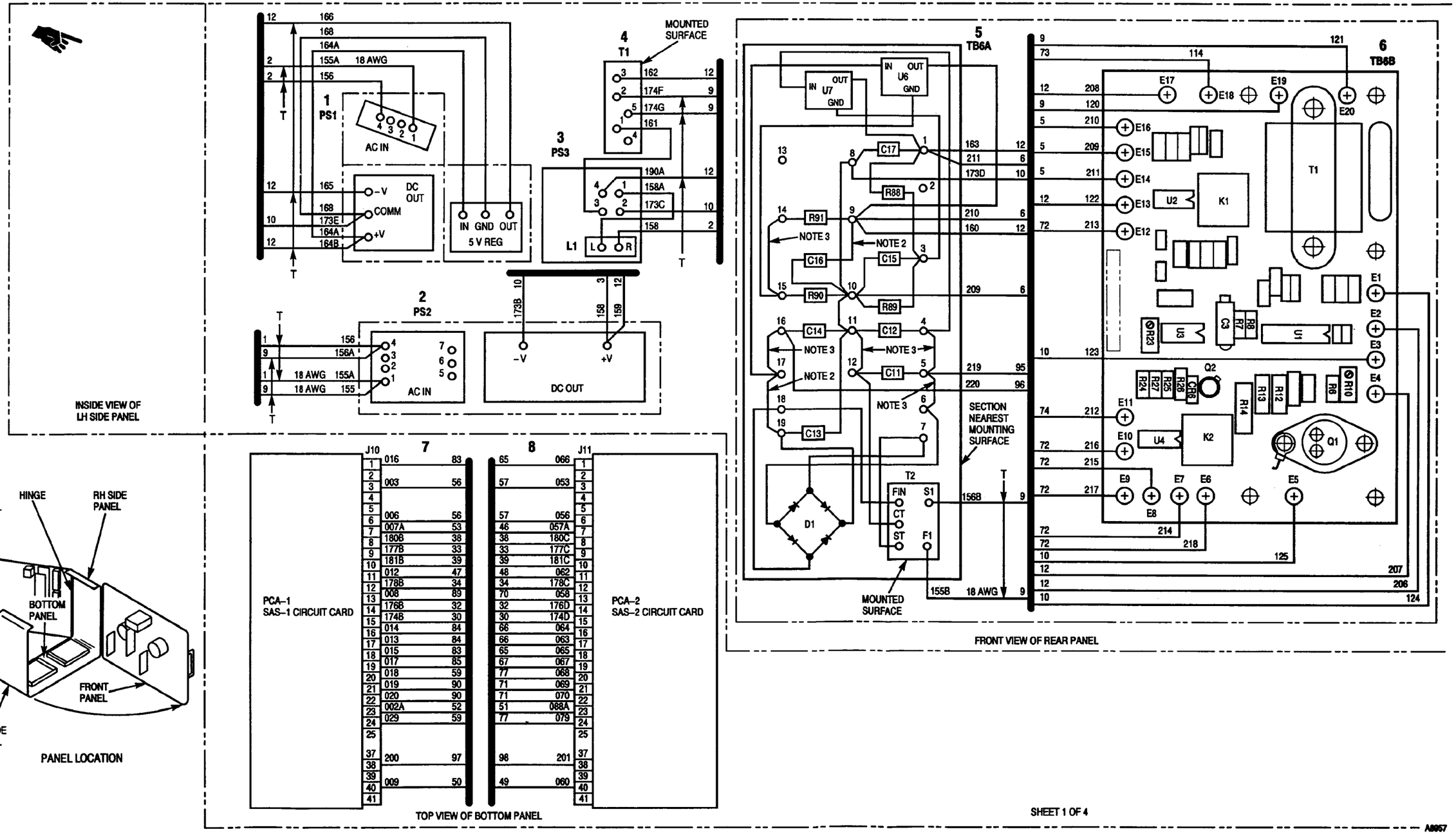
4-16. Hydraulic Unit Control Circuit Troubleshooting.

a. Multimeter does not indicate 115 vac between receptacle pins J9-4 (line) and J9-7 with **SOLENOID SHUTOFF** switch S18 at **OPEN.**



b. Multimeter does not indicate 115 vac between receptacle pins J9-10 (line) and J9-1 with **CYCLE MOTOR** switch S12 at **ON.**

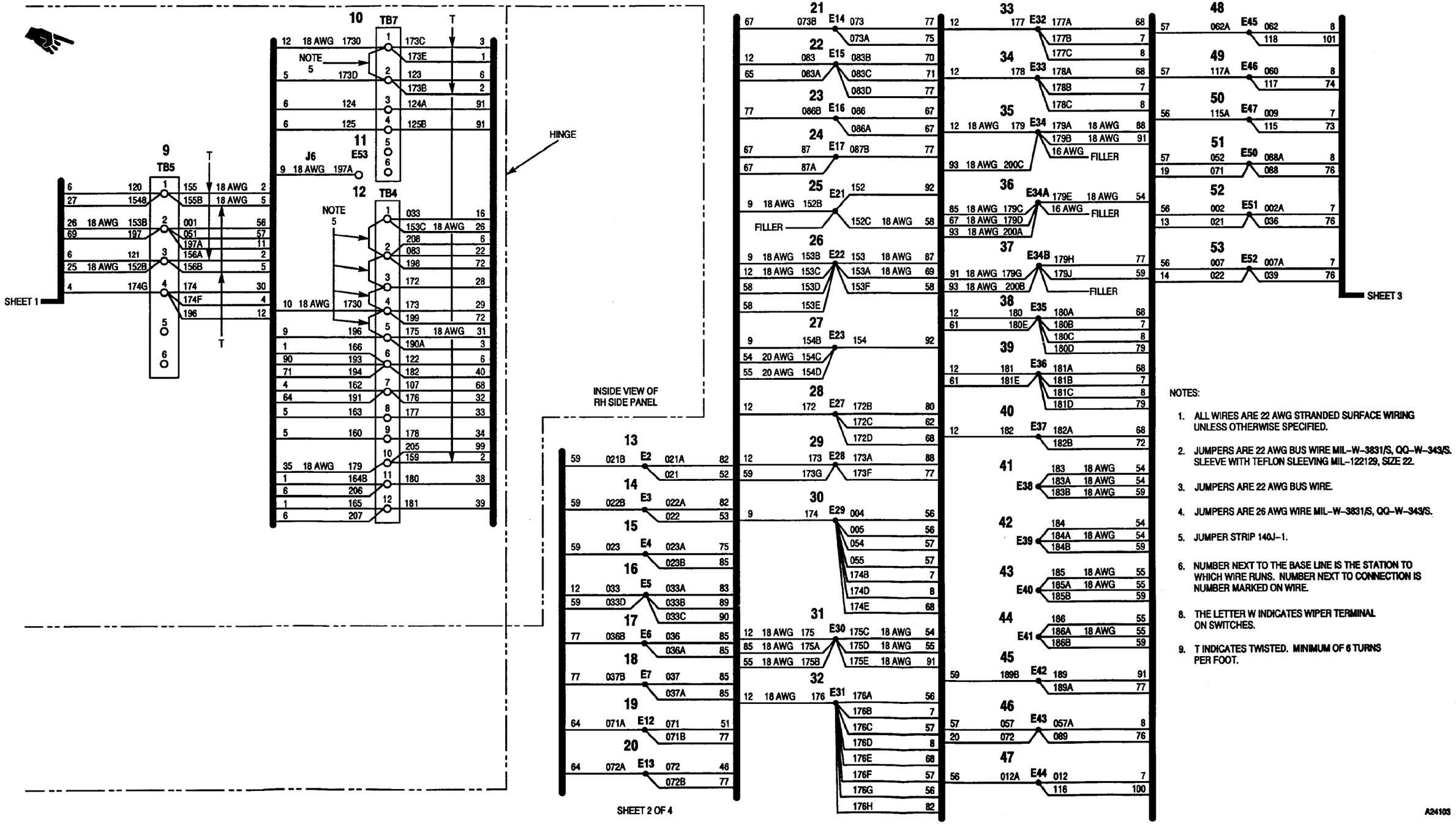




SHEET 1 OF 4

A8957

FO-21. Electrical Unit Wiring Diagram (Sheet 1 of 4)

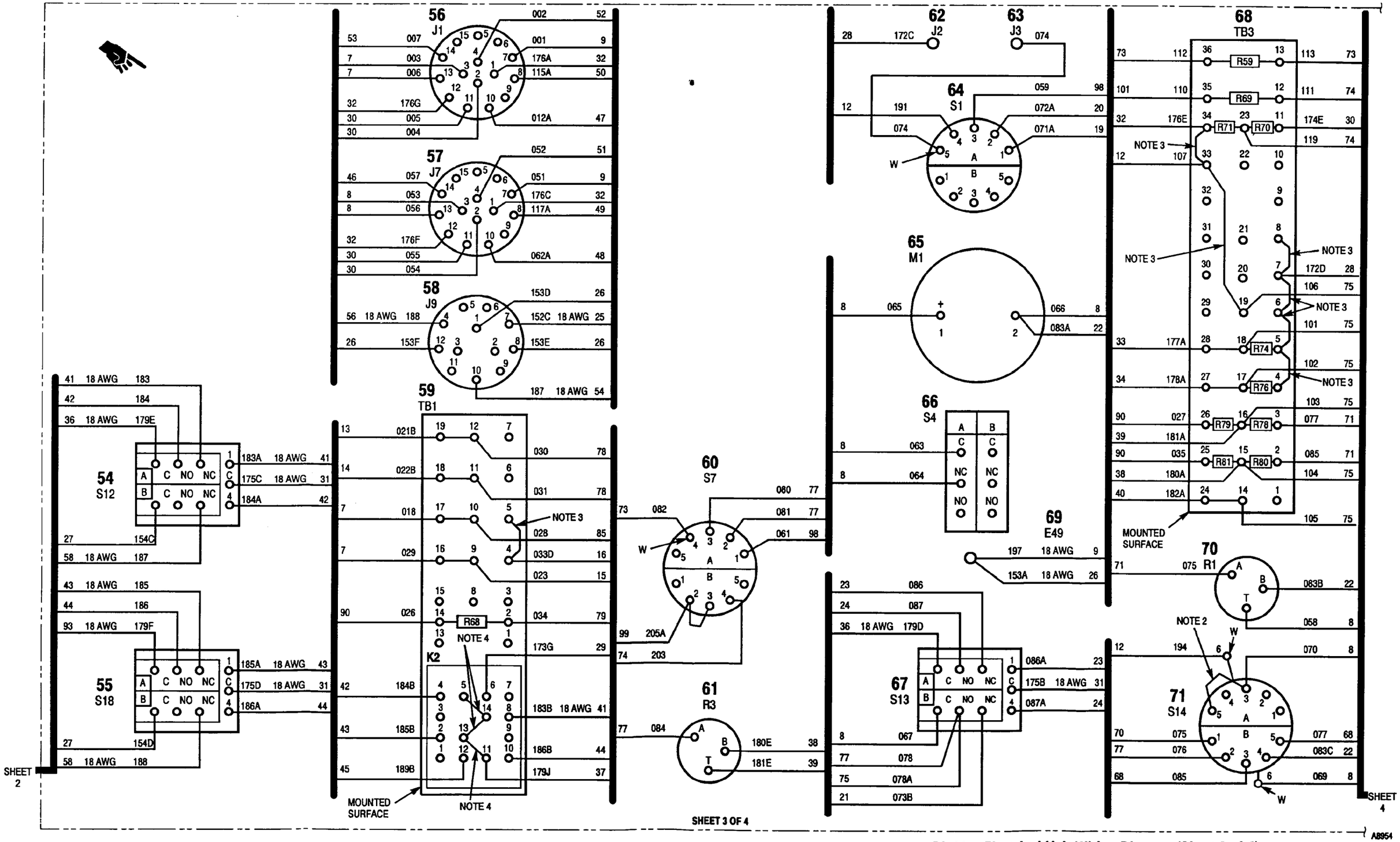


NOTES:

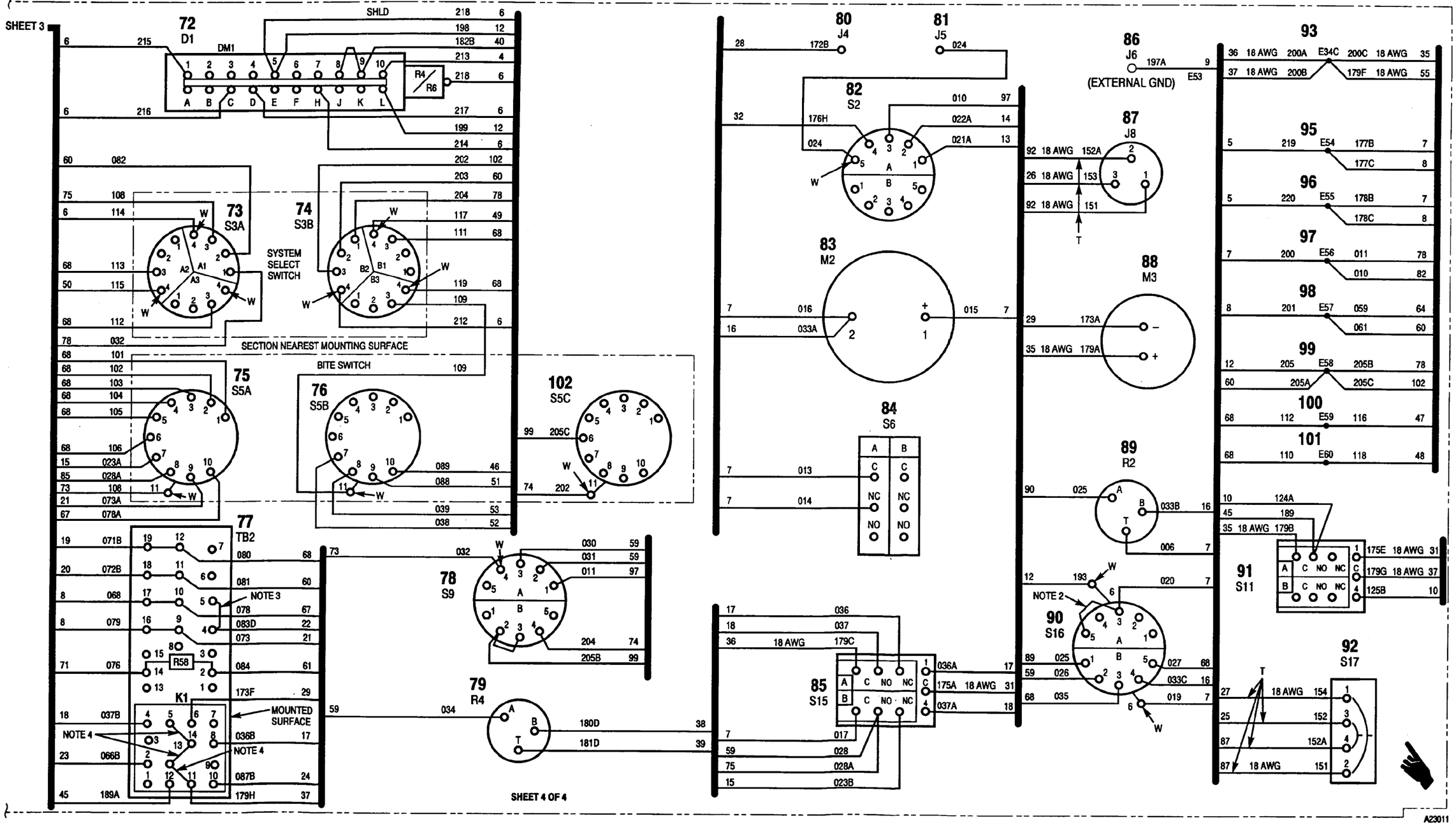
1. ALL WIRES ARE 22 AWG STRANDED SURFACE WIRING UNLESS OTHERWISE SPECIFIED.
2. JUMPERS ARE 22 AWG BUS WIRE MIL-W-3831/S, QQ-W-343/S. SLEEVE WITH TEFLON SLEEVING MIL-122129, SIZE 22.
3. JUMPERS ARE 22 AWG BUS WIRE.
4. JUMPERS ARE 26 AWG WIRE MIL-W-3831/S, QQ-W-343/S.
5. JUMPER STRIP 140J-1.
6. NUMBER NEXT TO THE BASE LINE IS THE STATION TO WHICH WIRE RUNS. NUMBER NEXT TO CONNECTION IS NUMBER MARKED ON WIRE.
8. THE LETTER W INDICATES WIPER TERMINAL ON SWITCHES.
9. T INDICATES TWISTED. MINIMUM OF 6 TURNS PER FOOT.

A24103

FO-21. Electrical Unit Wiring Diagram (Sheet 2 of 4)

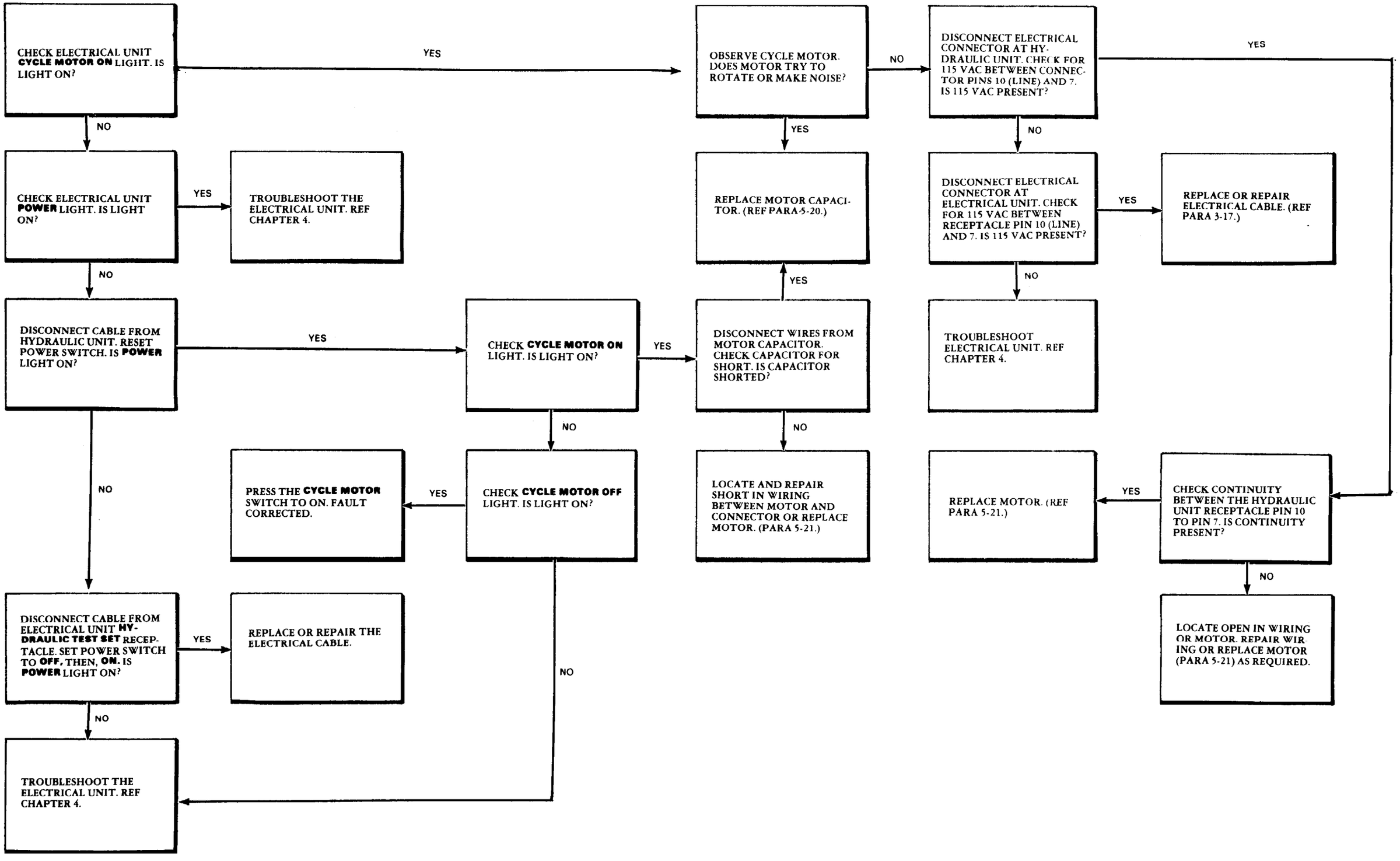


FO-21. Electrical Unit Wiring Diagram (Sheet 3 of 4)

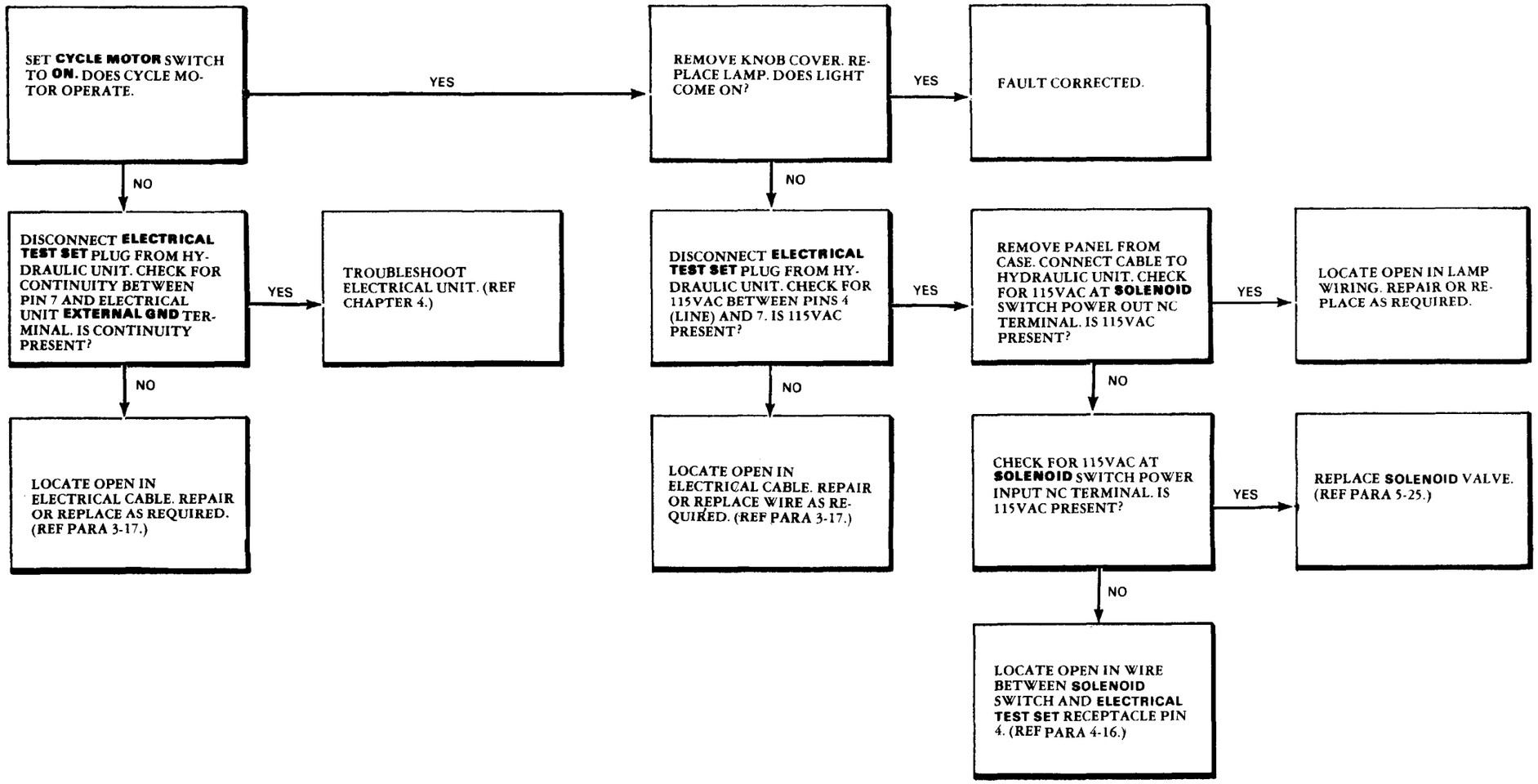


FO-21. Electrical Unit Wiring Diagram (Sheet 4 of 4)

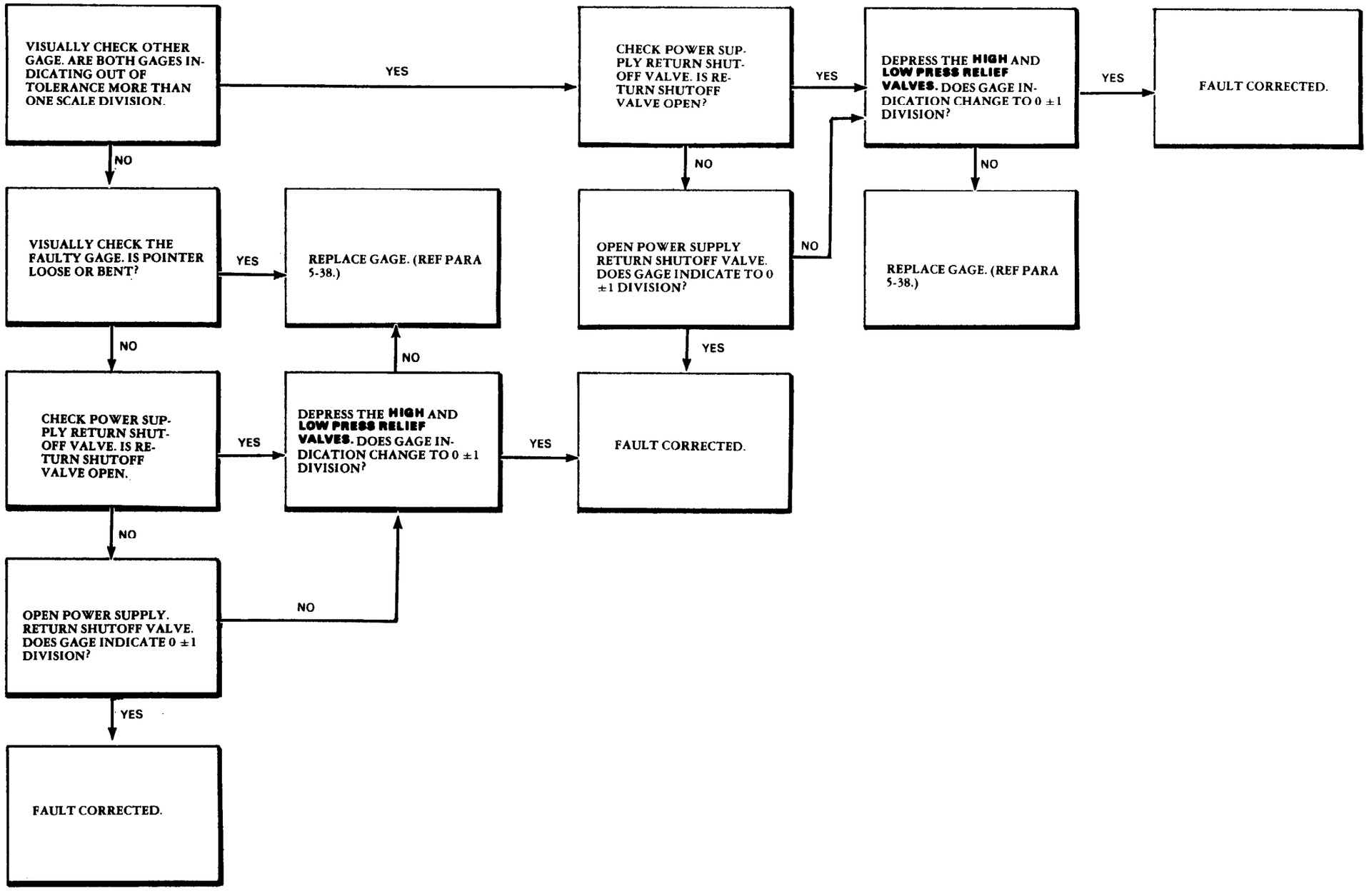
5-3. Cycle motor does not rotate when CYCLE MOTOR switch is set to ON. (Ref para 2-7 n.)



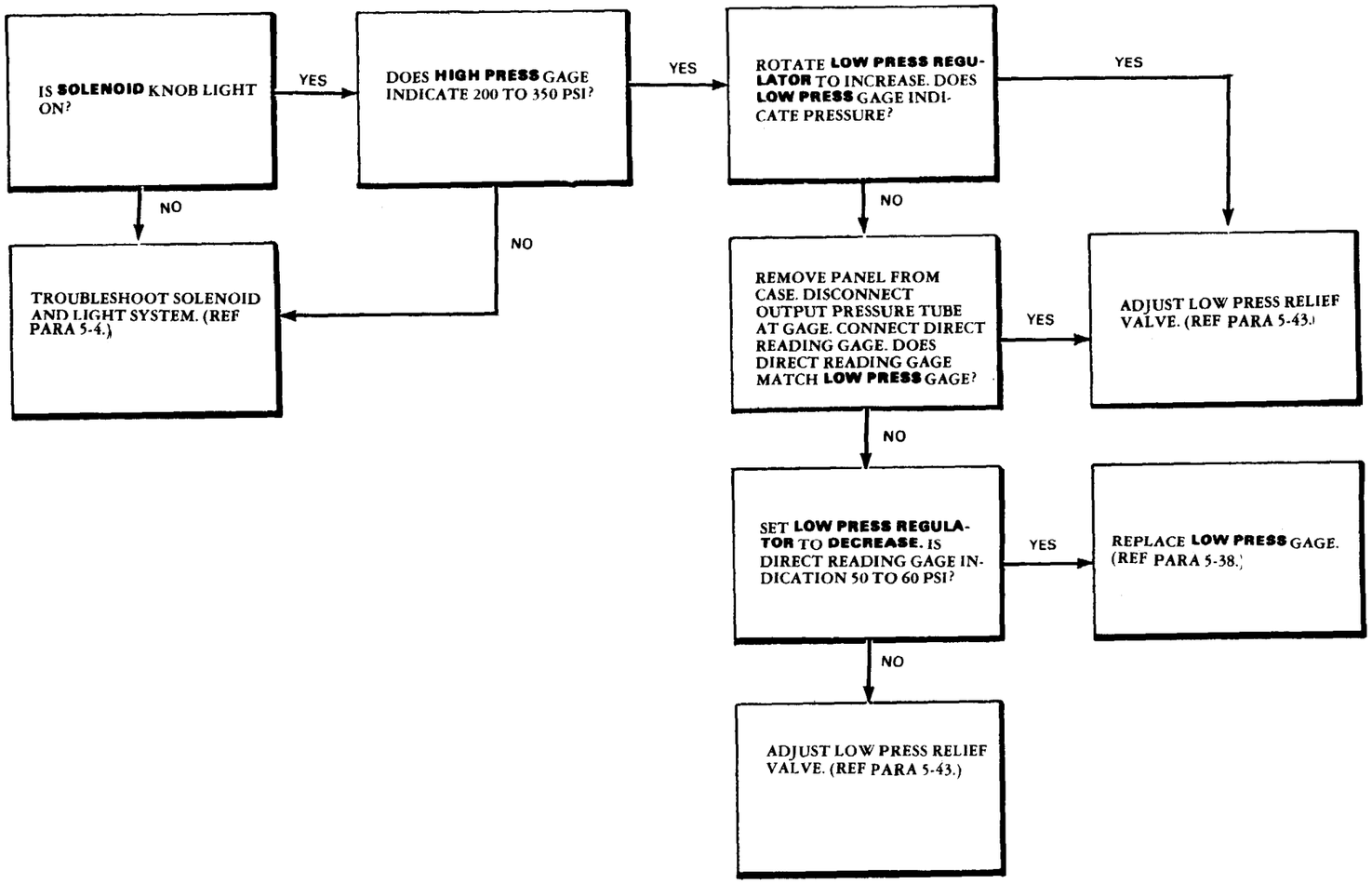
5-4. SOLENOID valve knob light does not come on at OPENED (up). (Ref para 2-7 q and para 2-7 s.)



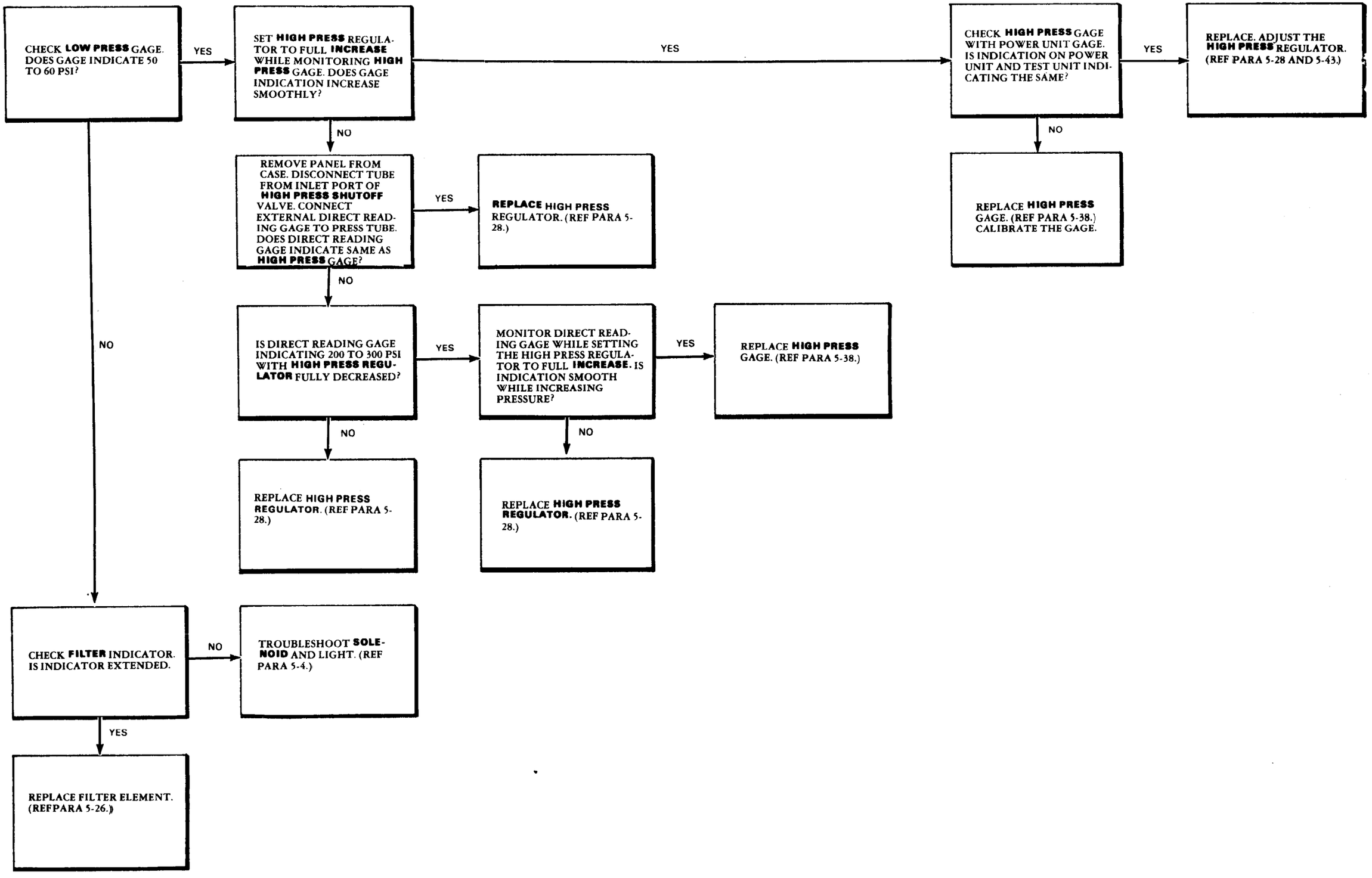
5-5. Pressure indication is not 0 ± 1 division with no hydraulic pressure applied. (Ref para 2-8 c.)



5-6. LOW PRESS gage does not indicate 50 to 60 psi when SOLENOID knob is OPENED. (Ref para 2-8 h.)



5-7. HIGH PRESS gage does not indicate 200 to 350 psi when SOLENOID knob is OPENED. (Ref para 2-8 h.)



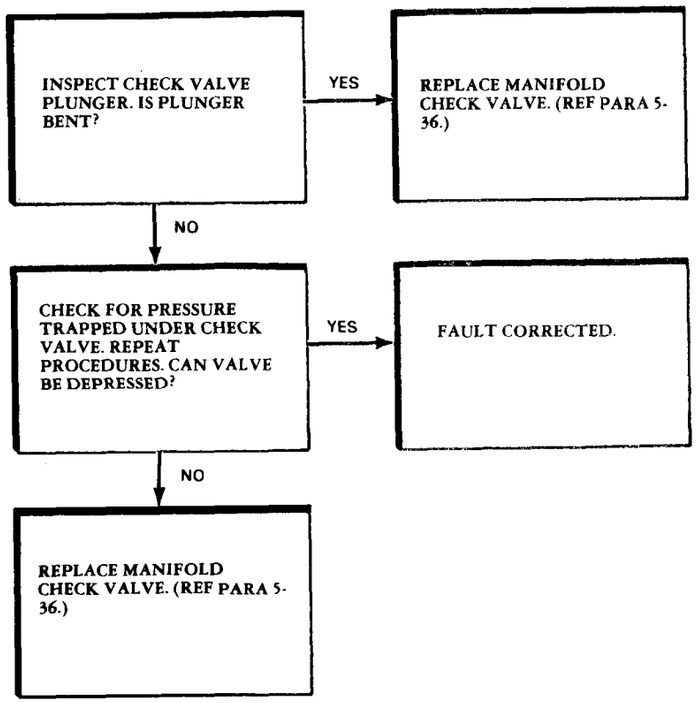
5-8. HIGH PRESS gage indication does not increase as HIGH PRESS REGULATOR is turned toward INCREASE. (Ref para 2-8 i.) Replace HIGH PRESS REGULATOR. (Ref para 5-28.)

5-9. HIGH PRESS or LOW PRESS RELIEF VALVE cannot be PUSHED down. (Ref para 2-8 j and ad.) Replace RELIEF VALVE. (Ref para 5-31.)

5-10. HIGH PRESS SHUTOFF VALVE cannot be OPENED or CLOSED. (Ref para 2-8 j and k.) Replace HIGH PRESS SHUTOFF VALVE. (Ref para 5-29.)

5-11. Selector valves will not rotate. (Ref para 2-8 m, p, q, t, u, x, y and ab.) Replace selector valve. (Ref para 5-30.)

5-12. ILCA manifold check valve plunger cannot be depressed. (Ref para 2-8 n, r, v, and z.)



5-13. CASE VENT LINE PRESS valve cannot be OPENED or CLOSED. (Ref para 2-8 af and ag.) Replace the CASE VENT LINE PRESS valve. (Ref para 5-34.)

5-14. RETURN BACK PRESS valve cannot be OPENED or CLOSED. (Ref para 2-8 ak and an.) Replace the RETURN BACK PRESS valve. (Ref para 5-29.)

5-15. SOLENOID valve leaks, allowing an increase in gage indication. (Ref para 2-9 f.) Replace SOLENOID valve. (Ref para 5-25.)

PART NUMBER	FABRICATE FROM NSN	END X FITTING		END Y FITTING		LENGTH	TUBE TYPE END		FINISH LENGTH ALONG CL
		NUT	SLEEVE	NUT	SLEEVE		END X	END Y	
182-15288-10	4710-00-278-3291	AN818-4S	MS20819-4S	AN818-4S	MS20819-4S	13"	3	3	11.75"
182-15288-11	4710-00-278-3291	AN818-4S	MS20819-4S	AN818-4S	MS20819-4S	12"	3	3	11.06"
182-15288-12	4710-00-278-3291	AN818-4S	MS20819-4S	AN818-4S	MS20819-4S	12"	3	3	10.97"
182-15288-13	4710-00-278-3291	AN818-4S	MS20819-4S	AN818-4S	MS20819-4S	9"	3	3	7.83"
182-15288-14	4710-00-278-3291	AN818-4S	MS20819-4S	AN818-4S	MS20819-4S	6"	3	3	4.42"
182-15288-15	4710-00-278-3291	AN818-4S	MS20819-4S	AN818-4S	MS20819-4S	9"	3	3	8.19"
182-15288-16	4710-00-278-3291	AN818-4S	MS20819-4S	AN818-4S	MS20819-4S	7"	3	3	6.32"
182-15288-17	4710-00-278-3291	AN818-4S	MS20819-4S	AN818-4S	MS20819-4S	16"	3	3	14.88"
182-15288-18	4710-00-278-3291	AN818-4S	MS20819-4S	AN818-4S	MS20819-4S	21"	3	3	19.65"
182-15288-19	4710-00-278-3291	AN818-4S	MS20819-4S	AN818-4S	MS20819-4S	18"	3	3	16.71"
182-15288-20	4710-00-278-3291	AN818-4S	MS20819-4S	AN818-4S	MS20819-4S	14"	3	3	13.37"
182-15288-24	4710-00-278-3291	AN818-4S	MS20819-4S	AN818-4S	MS20819-4S	3"	3	3	2.5"
182-15288-25	4710-00-278-3291	AN818-4S	MS20819-4S	AN818-4S	MS20819-4S	3"	3	3	1.89"
182-15288-28	4710-00-278-3291	AN818-4S	MS20819-4S	AN818-4S	MS20819-4S	15"	3	3	13.25"
182-15288-33	4710-00-278-3291	AN818-4S	MS20819-4S	AN818-4S	MS20819-4S	2"	3	3	1.8"
182-15288-35	4710-00-278-3291	AN818-4S	MS20819-4S	AN818-4S	MS20819-4S	8"	3	3	6.64"
182-15288-36	4710-00-278-3291	AN818-4S	MS20819-4S	AN818-4S	MS20819-4S	8"	3	3	7.0"
182-15288-37	4710-00-278-3291	AN818-4S	MS20819-4S	AN818-4S	MS20819-4S	9"	3	3	7.58"
182-15288-38	4710-00-278-3291	AN818-4S	MS20819-4S	AN818-4S	MS20819-4S	13"	3	3	12.35"
182-15288-39	4710-00-278-3291	AN818-4S	MS20819-4S	AN818-4S	MS20819-4S	7"	3	3	6.38"
182-15288-40	4710-00-278-3291	AN818-4S	MS20819-4S	AN818-4S	MS20819-4S	13"	3	3	11.91"
182-15288-41	4710-00-278-3291	AN818-4S	MS20819-4S	AN818-4S	MS20819-4S	6"	3	3	5.42"
182-15288-43	4710-00-278-3291	AN818-4S	MS20819-4S	AN818-4S	MS20819-4S	18"	3	3	16.93"
182-15288-44	4710-00-278-3291	AN818-4S	MS20819-4S	AN818-4S	MS20819-4S	18"	3	3	16.17"

SEE SHEET 4 FOR BEND DATA

PART NUMBER	FABRICATE FROM NSN	END X FITTING		END Y FITTING		LENGTH	TUBE TYPE END		FINISH LENGTH ALONG CL
		NUT	SLEEVE	NUT	SLEEVE		END X	END Y	
182-15288-45	4710-00-278-3291	AN818-4S	MS20819-4S	AN818-4S	MS20819-4S	6"	3	3	5.12"
182-15288-46	4710-00-278-3291	AN818-4S	MS20819-4S	AN818-4S	MS20819-4S	3"	3	3	1.75"
182-15288-47	4710-00-278-3291	AN818-4S	MS20819-4S	AN818-4S	MS20819-4S	2.5"	3	3	1.6"
182-15288-48	4710-00-278-3291	AN818-4S	MS20819-4S	AN818-4S	MS20819-4S	12"	3	3	11.25"
182-15288-49	4710-00-278-3291	AN818-4S	MS20819-4S	AN818-4S	MS20819-4S	2"	3	3	1.6"
182-15288-50	4710-00-278-3291	AN818-4S	MS20819-4S	AN818-4S	MS20819-4S	11"	3	3	9.95"
182-15288-51	4710-00-278-3291	AN818-4S	MS20819-4S	AN818-4S	MS20819-4S	7"	3	3	5.63"
182-15288-52	4710-00-278-3291	AN818-4S	MS20819-4S	AN818-4S	MS20819-4S	12"	3	3	11.25"
182-15288-53	4710-00-278-3291	AN818-4S	MS20819-4S	AN818-4S	MS20819-4S	13"	3	3	10.42"
182-15288-54	4710-00-813-9872	AN818-8S	MS20819-8S	AN818-8S	MS20819-8S	3"	3	3	2.25"
182-15288-56	4710-00-278-3291	AN818-4S	MS20819-4S	AN818-4S	MS20819-4S	10"	3	3	8.73"
182-15288-57	4710-00-278-3291	AN818-4S	MS20819-4S	AN818-4S	MS20819-4S	19"	3	3	17.92"
182-15288-58	4710-00-278-3282	AN818-6S	MS20819-6S	AN818-6S	MS20819-6S	3"	3	3	2.0"
182-15288-59	4710-00-278-3291	AN818-4S	MS20819-4S	AN818-4S	MS20819-4S	9"	3	3	8.35"
182-15288-60	4710-00-278-3291	AN818-4S	MS20819-4S	AN818-4S	MS20819-4S	11"	3	3	9.7"
182-15288-61	4710-00-278-3291	AN818-4S	MS20819-4S	AN818-4S	MS20819-4S	25"	3	3	24.62"
182-15288-62	4710-00-278-3291	AN818-4S	MS20819-4S	AN818-4S	MS20819-4S	8"	3	3	7.05"
182-15288-63	4710-00-278-3291	AN818-4S	MS20819-4S	AN818-4S	MS20819-4S	12"	3	3	10.72"
182-15288-64	4710-00-278-3291	AN818-4S	MS20819-4S	AN818-4S	MS20819-4S	12"	3	3	11.0"
182-15288-65	4710-00-813-9872	AN818-8S	MS20819-8S	AN818-8S	MS20819-8S	8"	3	3	7.13"
182-15288-66	4710-00-813-9872	AN818-8S	MS20819-8S	AN818-8S	MS20819-8S	10"	3	3	9.26"

SEE SHEET 5 FOR BEND DATA

	BEND DATA													
	BEND 1				BEND 2				BEND 3				FINISHED TUBE BEND	
PART NUMBER	DIST FROM X END	RAD	DIAL H DEG BEND	DIAL C SET	DIST FROM X END	RAD	DIAL H DEG BEND	DIAL C SET	DIST FROM X END	RAD	DIAL H DEG BEND	DIAL C SET	A	B
182-15288-10	10.06"	1.0"	100	0	2.00"	1.0"	10	240					1.85"	1.69"
182-15288-11	8.01"	1.0"	90	0	4.49"	1.0"	170	90					1.30"	3.00"
182-15288-12	8.84"	1.0"	90	0	4.62"	1.0"	175	90					1.43"	2.13"
182-15288-13	5.78"	1.0"	72	0	3.17"	1.0"	90	0					1.55"	2.10"
182-15288-14	3.43"	9/16"	90	0									.94"	2.46"
182-15288-15	7.06"	9/16"	180	0	2.98"	9/16"	90	270					2.10"	1.08"
182-15288-16	3.47"	1.0"	90	0									1.85"	2.80"
182-15288-17	12.25"	1.0"	90	0	2.55"	1.0"	90	0					.93"	2.58"
182-15288-18	17.02"	1.0"	90	0	2.55"	1.0"	90	0					.93"	2.58"
182-15288-19	12.90"	1.0"	90	0	3.73"	1.0"	90	0					2.11"	3.76"
182-15288-20	10.63"	1.0"	90	0	2.66"	1.0"	90	0					1.04"	2.69"
182-15288-24	STRAIGHT													
182-15288-25	STRAIGHT													
182-15288-28	12.20"	9/16"	90	0	7.05"	9/16"	90	0					6.14"	1.05"
182-15288-33	STRAIGHT													
182-15288-35	5.39"	1.0"	90	0	2.57"	1.0"	90	0					.95"	1.20"
182-15288-36	4.62"	1.0"	180	0									1.43"	2.33"
182-15288-37	2.70"	1.0"	90	0									1.08"	4.83"
182-15288-38	10.45"	1.0"	90	0	2.47"	1.0"	90	0					.90"	.90"
182-15288-39	3.11"	9/16"	133	0									1.75"	3.22"
182-15288-40	10.15"	1.0"	90	0	2.78"	1.0"	90	0					1.16"	1.71"
182-15288-41	3.22"	1.0"	90	0									1.60"	2.15"
182-15288-43	13.15"	1.0"	90	0	3.73"	1.0"	90	0					2.11"	3.72"
182-15288-44	12.06"	1.0"	90	0	7.28"	1.0"	32	270	4.03"	1.0"	90	0	2.41"	4.06"

	BEND DATA													
	BEND 1				BEND 2				BEND 3				FINISHED TUBE BEND	
PART NUMBER	DIST FROM X END	RAD	DIAL H DEG BEND	DIAL C SET	DIST FROM X END	RAD	DIAL H DEG BEND	DIAL C SET	DIST FROM X END	RAD	DIAL H DEG BEND	DIAL C SET	A	B
182-15288-45	1.89"	9/16"	90	0									.96"	3.18"
182-15288-46	STRAIGHT													
182-15288-47	STRAIGHT													
182-15288-48	5.77"	1.0"	90	0									4.15"	5.43"
182-15288-49	STRAIGHT													
182-15288-50	7.47"	1.0"	90	0	3.15"	1.0"	90	0					1.53"	2.43"
182-15288-51	4.10"	1.0"	90	0									2.48"	1.48"
182-15288-52	9.72"	1.0"	90	0	5.70"	1.0"	90	0					4.08"	1.48"
182-15288-53	8.77"	1.0"	90	0	2.60"	1.0"	90	0					.98"	1.60"
182-15288-54	STRAIGHT													
182-15288-56	7.25"	1.0"	90	0	2.70"	1.0"	90	270					1.08"	1.43"
182-15288-57	3.77"	1.0"	15	0	1.76"	1.0"	15	180					1.45"	14.10"
182-15288-58	STRAIGHT													
182-15288-59	6.97"	1.0"	90	0	3.15"	1.0"	90	0					1.53"	1.33"
182-15288-60	6.07"	1.0"	90	0	2.90"	1.0"	90	0					1.28"	3.58"
182-15288-61	12.89"	1.0"	20	0	9.83"	1.0"	20	180	4.52"	1.0"	180	165	1.33"	11.68"
182-15288-62	2.57"	1.0"	90	0									.95"	4.43"
182-15288-63	8.26"	1.0"	90	0	4.64"	1.0"	180	40					1.45"	2.41"
182-15288-64	8.62"	1.0"	90	0	5.75"	1.0"	90	90					4.25"	2.20"
182-15288-65	STRAIGHT													
182-15288-66	5.81"	1.5"	90	0									3.40"	3.40"

By Order of the Secretary of the Army:

JOHN A. WICKHAM, JR.
General, United States Army
Chief of Staff

Official:

ROBERT M. JOYCE
Major General, United States Army
The Adjutant General

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REGION NO. 4

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS

SOMETHING WRONG WITH THIS PUBLICATION?

FROM (PRINT YOUR UNIT'S COMPLETE ADDRESS)
CDR, 1st Br, 65th ADA
ATTN: SP4 J. Brown
Key West, FL 33040

DATE SENT
10 Jun 79

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE
TM 9-1430-550-34-1	7 Sep 72 .	Unit of Radar Set AN/MPQ-50 Tested at the HFC

BE EXACT PIN-POINT WHERE IT IS

PAGE NO	PARAGRAPH	FIGURE NO	TABLE NO
9-19		9-5	
21-2	step 1C	21-2	

IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:

"B" Ready Relay K11 is shown with two #9 contacts. That contact which is wired to pin 8 of relay K16 should be changed to contact #10.

Reads: Multimeter B indicates 600 K ohms to 9000 K ohms.

Change to read: Multimeter B indicates 600 K ohms minimum.

Reason: Circuit being checked could measure infinity. Multimeter can read above 9000 K ohms and still be correct.

SAMPLE

PRINTED NAME GRADE OR TITLE AND TELEPHONE NUMBER
SP4 J.T. Brown, Jr.

SIGN HERE
SP4 James Brown, Jr.

DA FORM 2 JUL 79 2028-2 REPLACES DA FORM 2028-2 1 APR 78 WHICH WILL BE USED UNTIL EXHAUSTED

P.S.--IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR RECOMMENDATION MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS.

TEAR ALONG . . . FOR MAILING

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS

SOMETHING WRONG WITH THIS PUBLICATION?

FROM: (PRINT YOUR UNIT'S COMPLETE ADDRESS)

DATE SENT

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE
TM 55-4920-428-13	11 Oct 83	Test Set, Bench Integrated Lower Control Actuator (ILCA) 145GS278-1

BE EXACT. PIN-POINT WHERE IT IS

PAGE NO	PARA-GRAPH	FIGURE NO	TABLE NO

IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:

PRINTED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER

SIGN HERE

TEAR ALONG PERFORATED LINE

DA FORM 1 JUL 79 2028-2

PREVIOUS EDITIONS ARE OBSOLETE.

DRSTS-M Overprint 2, 1 Nov 80.

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REVERSE OF DA FORM 2028-2 Reverse of DRSTS-M Overprint 2, 1 Nov 80

TEAR ALONG PERFORATED LINE

FILL IN YOUR UNITS ADDRESS

FOLD BACK

DEPARTMENT OF THE ARMY

OFFICAL BUSINESS

COMMANDER
U.S. ARMY AVIATION AND TROOP COMMAND
ATTN: AMSAT-I-MP
4300 GOODFELLOW BOULEVARD
ST. LOUIS, MO 63120-1798

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 dekagram = 10 grams = .35 ounce
1 hectogram = 10 dekagrams = 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