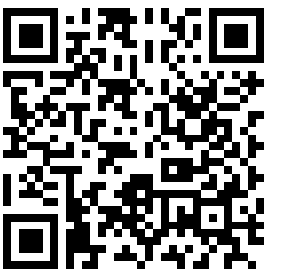
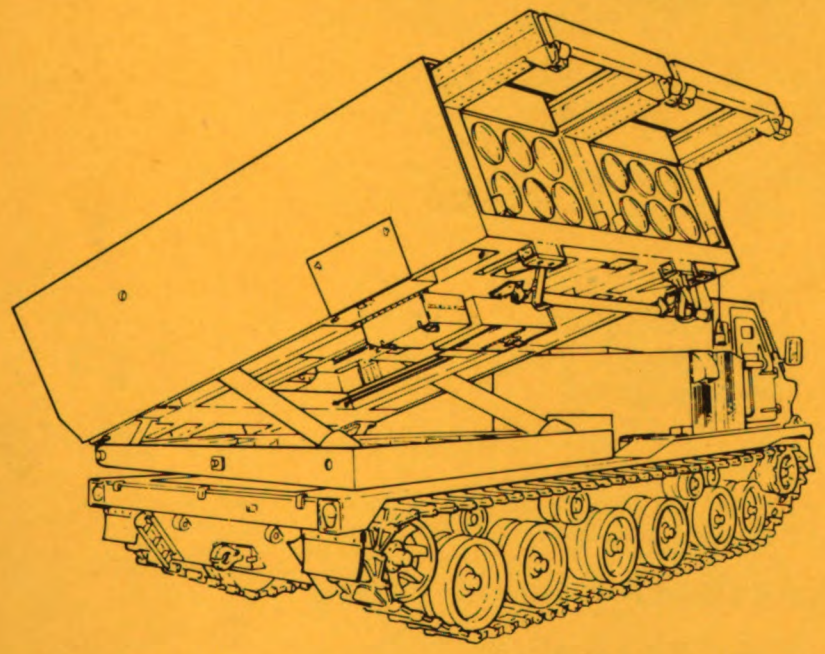


TM 9-1425-646-30-1

TECHNICAL MANUAL

MAINTENANCE INSTRUCTIONS
DIRECT SUPPORT

LAUNCHER, ROCKET, ARMORED VEHICLE MOUNTED: M270
(1055-01-092-0596)



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DEPARTMENT OF THE ARMY

JULY 1984

WARNING SUMMARY

Listed below is a summary of all warnings that appear in this manual. Warnings relating to the same hazard or those repeated several times throughout the manual are summarized and appear only once on this page. Safety instructions, hazard identification, and warnings for ammunition handling are contained in TM 9-1300-206.

WARNING

Electrical shock.

WHENEVER POSSIBLE, shut off system power before beginning work on equipment.

DO NOT come in contact with electrical connections. Don't be misled by low voltage. Low potentials can be dangerous.

DO NOT work on electrical equipment alone. Be sure another person is nearby who can give first aid.

WARNING

Battery acid and explosive gases.

DO NOT work on batteries unless you are wearing safety goggles, rubber gloves, and rubber apron.

DO NOT allow sparks or flame near batteries.

IF ACID gets on your skin, immediately wash it off with water.

IF ACID gets in your eyes, wash your eyes out with water. Get medical help immediately.

WARNING

Accomplishing concurrent tasks.

IF IT IS NECESSARY to perform more than one maintenance task at the same time, carefully observe safety precautions contained in all warnings. Also, be sure to let other mechanics know before applying electrical or hydraulic power, and before moving the LLM. Let everyone know what you are going to do before you do it.

WARNING SUMMARY – Continued

WARNING

SPLL has moving surfaces.

DO NOT work under an elevated launcher loader module (LLM) without the jury struts installed.

WARNING

Heavy objects.

SOME OBJECTS covered in this manual are heavy and need two soldiers to lift them.

WARNING

Hydraulic pressure.

BE SURE hydraulic pressure is zero before performing maintenance on any hydraulic component.

WHEN CHECKING for hydraulic leaks with the system pressurized, be sure to wear eye protection to prevent injury by a stream of hydraulic fluid under high pressure.

WARNING

Drycleaning solvent.

P-D-680 SOLVENT vapors are toxic. Avoid prolonged or repeated breathing of vapors or solvent contact with skin. Use only with adequate ventilation. Solvent is flammable and should not be used near open flame. Fire extinguishers should be readily available when solvent is used.

WARNING SUMMARY – Continued

WARNING

Load test.

ALL PERSONNEL must remain clear of suspended loads and cables during load test. If cable breaks, it could cause injury or death.

WARNING

Intermediate beam.

DO NOT stand under beam when removing or installing intermediate beam. Beam is heavy and could fall, swing, or tip causing injury.

WARNING

Primer and coating.

PRIMER AND COATING vapors are toxic. Avoid prolonged or repeated breathing of vapors or contact with skin. Use only with adequate ventilation. Observe all precautions printed on containers.

WARNING

Methyl-ethyl-ketone.

METHYL-ETHYL-KETONE vapors are toxic. Avoid prolonged or repeated breathing of vapors or contact with skin. Use only with adequate ventilation. Methyl-ethyl-ketone is flammable and should not be used near open flame. Fire extinguisher should be available when solvent is used.

WARNING SUMMARY – Continued

WARNING

Elevation transmission/brake.

IF CAGE is not down against turret or vehicle sponson bumpers, support cage with wrecker and hoisting sling when removing transmission to prevent injury or death from falling cage.

WARNING

Isopropyl alcohol.

ISOPROPYL ALCOHOL vapors are toxic. Avoid prolonged or repeated breathing of vapors or contact with skin. Use only with adequate ventilation. Solvent is flammable and should not be used near open flame. Fire extinguishers should be readily available when isopropyl alcohol is used.

FOR ARTIFICIAL RESPIRATION, REFER TO FM 21-11.

CAUTION

Prior to electric welding on the SPLL, insure that the following precautions are observed:

1. Disconnect all cables from the Electronics Unit, Fire Control Unit, SRP/PDS, and SNVT. This is a safety precaution to insure protection for the electronic circuits in these LRUs.

2. Connect the welder ground return as near as possible to the item being welded.

After welding is completed, reconnect cables and perform system tests in accordance with procedures for LRU removal and replacement in TM 9-1425-646-20.

LIST OF EFFECTIVE PAGES

INSERT LATEST CHANGED PAGES DESTROY SUPERSEDED PAGES.

NOTE: The portion of the text affected by the changes is indicated by a vertical line in the outer margins of the page. Changes to illustrations are indicated by miniature pointing hands or vertical lines in outer margin of page. Extensively changed illustrations are indicated by a miniature pointing hand symbol pointing to the words MAJOR CHANGE.

Dates of issue for original and changed pages are:

Original 0 . . . 16 July 1984

TOTAL NUMBER OF PAGES IN THIS PUBLICATION IS 264.

TOTAL NUMBER OF PAGES IN THIS PUBLICATION SERIES IS 599 CONSISTING OF THE FOLLOWING:

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ARMY

TECHNICAL MANUAL)
)
No. 9-1425-646-30-1)

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, D.C., *16 July 1984*

DIRECT SUPPORT MAINTENANCE MANUAL
LAUNCHER, ROCKET, ARMORED
VEHICLE MOUNTED: M270
(1055-01-092-0596)

MULTIPLE LAUNCH ROCKET SYSTEM

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HOW TO USE THIS MANUAL

This manual is your guide for performing direct support maintenance on the Armored Vehicle Mounted Rocket Launcher M270. It begins with general information you need, such as which forms and records you must have, a description of the equipment, something about the tools and equipment required, and some information about spare and repair parts.

To locate information in this manual, use the front cover index, the Table of Contents, the Chapter Contents, or the Alphabetical Index. The front cover index lists the major subjects contained in the manual and the page on which each subject is located. Black tabs on manual pages correspond to front cover index major subject tabs and to boxed heads in the Table of Contents. These black tabs may be used to locate each of the major subjects in the manual. The Table of Contents, in the front of the manual, locates general subjects. The Chapter Contents, in the front of each chapter, locates the specific subjects contained in the chapter. The Alphabetical Index is more detailed and will locate specific items. If you need to know where the Launcher Loader Module Maintenance is located, look in the Table of Contents. If you need to know where a specific subject such as the Launcher Loader Module Blast Shield is located, refer to the Chapter Contents. But if you need to know how to remove and install the Blast Shield Door Track Roller, look in the Alphabetical Index. Refer to the illustrated sample.

Maintenance information includes the principles of operation, preventive maintenance checks and services (PMCS), troubleshooting, and maintenance procedures. Read the principles of operation thoroughly. It will help you to better understand the equipment and make troubleshooting easier. The PMCS tables identify the equipment component and the time interval for periodic inspections. Troubleshooting tables will provide you with solutions to most equipment malfunctions. To simplify entry into troubleshooting tables, a symptom index is included to identify your trouble and direct you to the correct troubleshooting table and malfunction number within that table. The corrective action column in the troubleshooting table has a probable solution to your malfunction. The solution will often be a maintenance action described in the maintenance procedures. These procedures contain instructions for doing all the tasks that are necessary to restore the equipment to operating condition. You should familiarize yourself with the entire maintenance procedure before beginning the maintenance task.

The maintenance instruction paragraphs cover the maintenance tasks for the items of that component or assembly for which maintenance is authorized by the Maintenance Allocation Chart (MAC) in Appendix B of TM 9-1425-646-20. The maintenance task for each item within the paragraph may be completed as an individual task. It is not necessary to perform the tasks on all items in the paragraph if only one item requires maintenance.

Each maintenance instruction has a paragraph number, title, list of tasks, and initial setup information you need to know before starting the job. The initial setup includes, as required, the following critical information:

Test/Support Equipment – Lists all the test equipment required to perform adjustment or checkout. Also, will list all the support equipment needed for the maintenance procedure. If no test or support equipment is required, heading is omitted.

Tools – Lists the tool kit and any special tools required to perform the tasks. If no tools are required, heading is omitted.

Fabricated Tools – Lists any tool which must be fabricated along with the reference to the appendix containing the fabrication details. If no fabricated tools are required, heading is omitted.

Materials/Parts – Lists all consumable parts and materials required to perform the tasks with reference to an item in an appendix. If no parts or materials are required, heading is omitted.

Personnel Required – Lists the number of personnel and their MOS required to perform the tasks. Personnel listed in parentheses are required to assist in those tasks listed.

References – Lists all technical manuals required to complete the tasks. If no other technical manual is required, heading is omitted.

Troubleshooting – Lists the paragraph number that contains the troubleshooting procedure for the maintenance tasks. If no troubleshooting is required, heading is omitted.

Equipment Condition – Lists the condition the equipment must be in before starting the tasks. The normal equipment condition is with electrical power off, LLM stowed, and LP/Cs unloaded. If these are the only equipment conditions required, heading is omitted.

You are responsible for performing direct support maintenance to maintain the Armored Vehicle Mounted Rocket Launcher M270 equipment. This manual will help you do that job. So become familiar with it, read it all, including introductory and general information paragraphs. A complete understanding of this manual, as well as the equipment, will make your job considerably easier.

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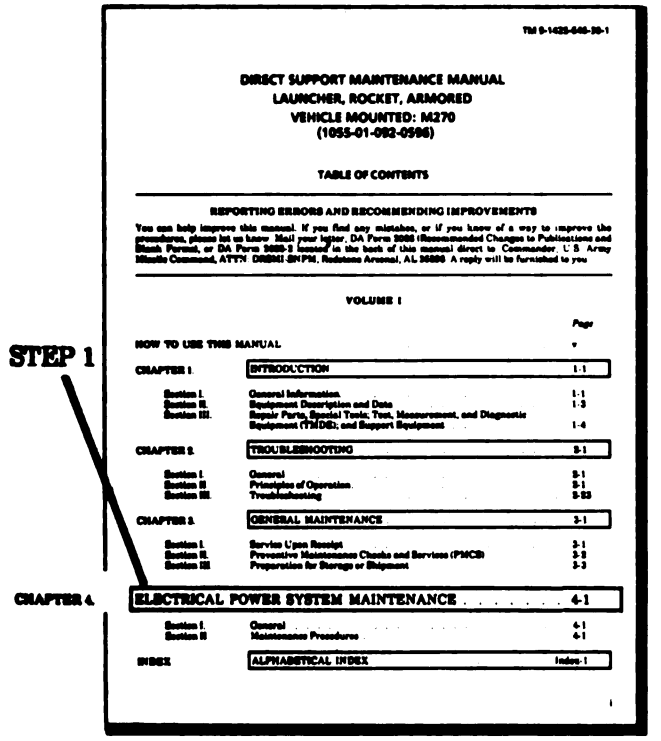

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DIRECT SUPPORT MAINTENANCE MANUAL
LAUNCHER, ROCKET, ARMORED
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(1055-01-092-0596)

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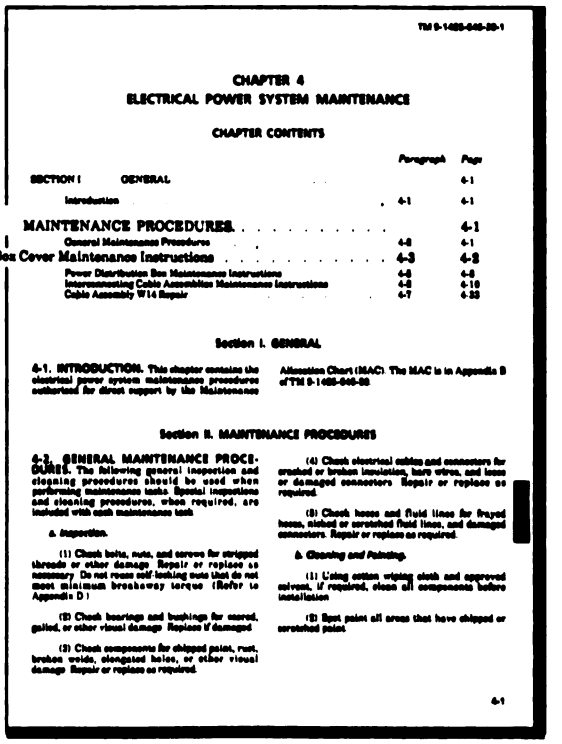
STEP 2

SECTION II.

Battery Box Cover Maintenance Instructions

STEP 2



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Section I. GENERAL

4-1. INTRODUCTION. This chapter contains the electrical power system maintenance procedures authorized for direct support by the Maintenance Allocation Chart (MAC). The MAC is in Appendix B of TM 9-1425-646-30.

Section II. MAINTENANCE PROCEDURES

4-2. GENERAL MAINTENANCE PROCEDURES. The following general inspection and cleaning procedures should be used when performing maintenance tasks. Special inspections and cleaning procedures, when required, are included with each maintenance task.

a. Inspection.

(1) Check bolts, nuts, and screws for stripped threads or other damage. Repair or replace as necessary. Do not reuse self-locking nuts that do not meet minimum breakaway torque (Refer to Appendix D).

(2) Check bearings and bushings for scored, galled, or other visual damage. Replace if damaged.

(3) Check components for chipped paint, rust, broken welds, elongated holes, or other visual damage. Repair or replace as required.

(4) Check electrical cables and connectors for cracked or broken insulation, bent wires, and loose or damaged connectors. Repair or replace as required.

(5) Check hoses and fluid lines for frayed hoses, kinked or scratched fluid lines, and damaged connectors. Repair or replace as required.

b. Cleaning and Painting.

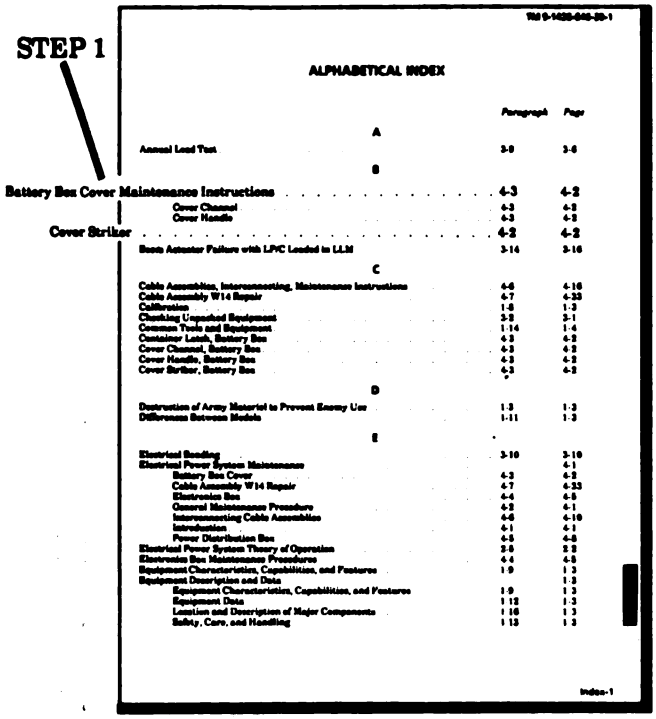
(1) Using cotton wiping cloth and approved solvent, if required, clean all components before installation.

(2) Spot paint all areas that have chipped or scratched paint.

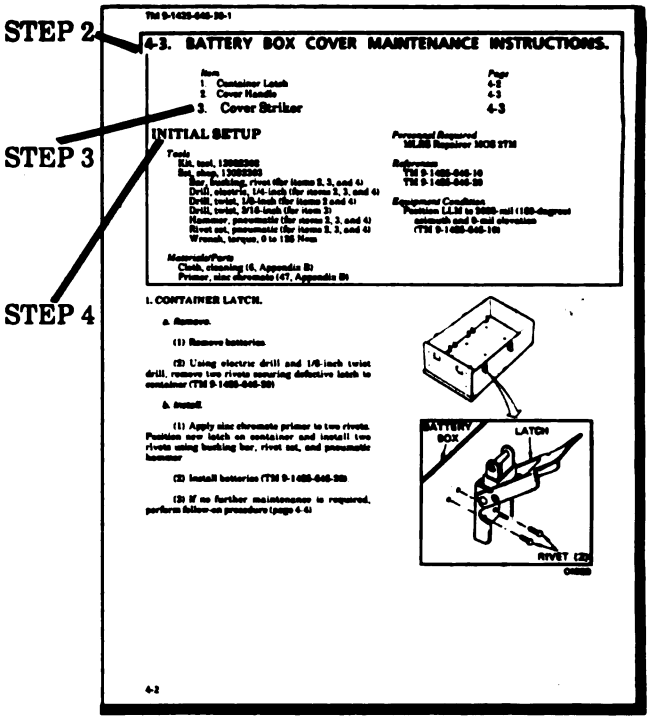
4-1

STEP 2. Find specific item in Chapter Contents, then refer to paragraph and page number indicated for desired information.

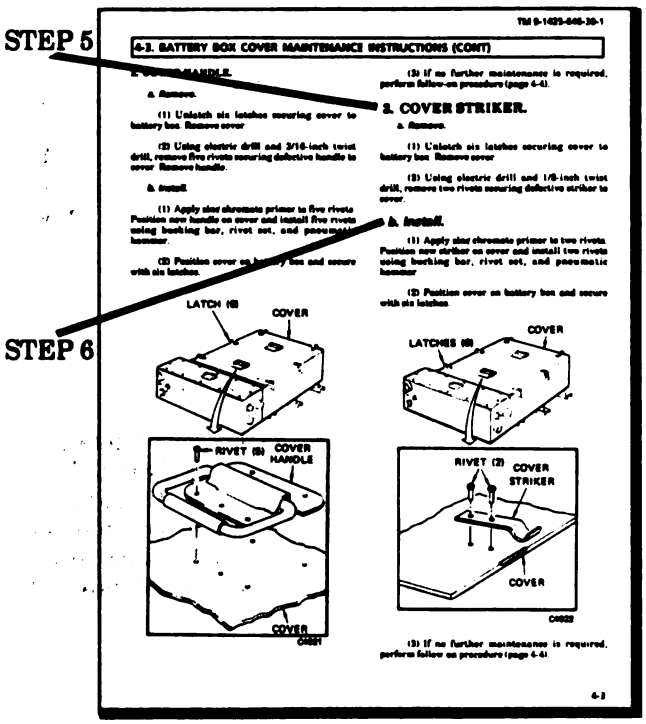
HOW TO USE ALPHABETICAL INDEX



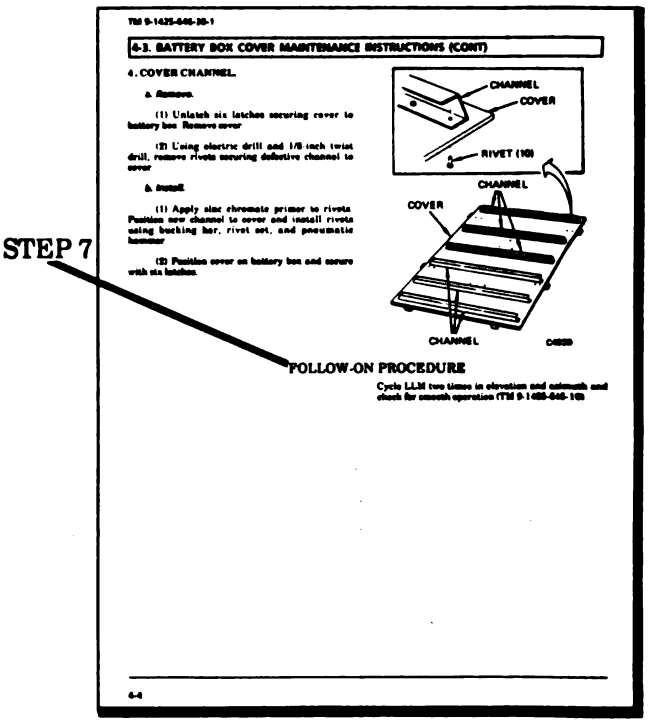
STEP 1. Find item in Alphabetical Index.



STEP 2. Locate paragraph.
STEP 3. Locate item and page.
STEP 4. Check initial setup.



STEP 5. Locate page and item.
STEP 6. Perform task.



STEP 7. Perform follow-on procedure.

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Section I. GENERAL INFORMATION

1-1. SCOPE. This manual contains the direct support maintenance instructions for the Armored Vehicle Mounted Rocket Launcher M270, which hereafter will be referred to as the self-propelled launcher loader (SPLL). This rocket launcher (figure 1-1) is a mobile, medium-range, rocket launching system which is a major component of the Multiple Launch Rocket System (MLRS). The MLRS consists of Tracked Vehicle M993 (carrier), Rocket Launcher M26, and two 296 Millimeter Rocket Pods. Each rocket pod contains six rockets. Direct support maintenance procedures for Tracked Vehicle M993 are in TM 9-1450-646-34.

1-1. SCOPE (CONT)

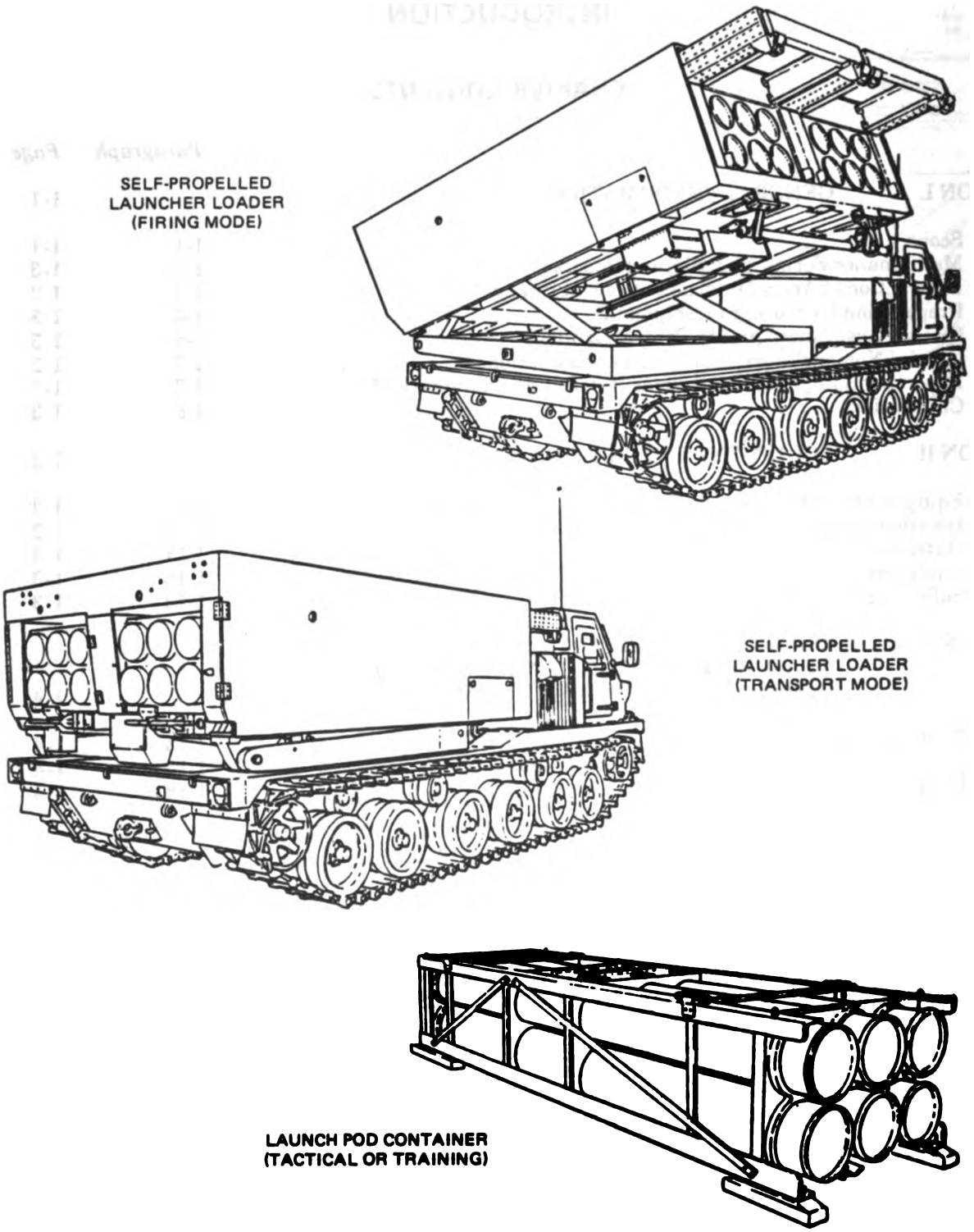

Figure 1-1. Armored Vehicle Mounted Rocket Launcher: M270

1-2. MAINTENANCE FORMS, RECORDS, AND REPORTS. Department of the Army forms and procedures used for direct support maintenance are those prescribed by DA Pamphlet 738-750, The Army Maintenance Management System. Accidents involving injury to personnel or damage to materiel will be reported on DA Form 285, Accident Report, in accordance with AR 385-40. Explosives and ammunition malfunctions will be reported in accordance with AR 75-1.

1-3. DESTRUCTION OF ARMY MATERIEL TO PREVENT ENEMY USE. Special instructions for the destruction of the SPLL are contained in TM 43-0002-26.

1-4. PREPARATION FOR STORAGE OR SHIPMENT. Instructions for storage or shipment for the SPLL are contained in paragraphs 3-5 and 3-6.

1-5. QUALITY ASSURANCE/QUALITY CONTROL (QA/QC). Criteria for quality control inspection for direct and general support shall be in accordance with TM 750-245-8.

1-6. OFFICIAL NOMENCLATURE, NAMES, AND DESIGNATIONS. Refer to table 1-1 for a listing of common names and the official nomenclature.

Table 1-1. Nomenclature Cross-Reference List

COMMON NAME	OFFICIAL NOMENCLATURE
Self-Propelled Launcher Loader (SPLL)	Launcher, Rocket, Armored Vehicle Mounted: M270
Launcher Loader Module (LLM)	Launcher, Rocket: M269
Launch Pod/Container (LP/C), Loaded	Rocket Pod, 298 Millimeter: M26
Launch Pod/Container (LP/C), Trainer	Rocket Pod, 298 Millimeter, Training: M27

1-7. REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR). If your SPLL needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design. Put it on a SF 368 (Quality Deficiency Report). Mail it to us at U.S. Army Missile Command, ATTN: DRSMI-SNEM, Redstone Arsenal, AL 35898. We'll send you a reply.

1-8. CALIBRATION. At the time calibration requirements are finally determined, the equipment requiring calibration will be identified and the publication containing calibration procedures will be listed. Refer to TB 750-25 for calibration records and procedures.

Section II. EQUIPMENT DESCRIPTION AND DATA

1-9. EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES. Information on the SPLL characteristics, capabilities, and features is contained in the Operator's Manual TM 9-1425-646-10.

1-10. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS. SPLL component location is shown in TM 9-1425-646-20. A description of the components is in TM 9-1425-646-10. Location and description of major components of the SPLL carrier are contained in TM 9-1450-646-10.

1-11. DIFFERENCES BETWEEN MODELS. There are no model differences between the SPLL.

1-12. EQUIPMENT DATA. Data regarding physical and operational characteristics of the SPLL is in TM 9-1425-646-10.

1-13. SAFETY, CARE, AND HANDLING. Instructions for the care, handling, and the safety precautions required to properly handle the rockets are provided in TM 9-1425-646-10. General ammunition safety, care, and handling instructions are contained in TM 9-1300-206. Safety, care, and handling instructions and important precautions to be observed for maintaining the SPLL are provided in the procedure as they occur. A summary of the warnings that appear throughout the manual is located in the front of this manual.

Section III. REPAIR PARTS, SPECIAL TOOLS; TEST, MEASUREMENT, AND DIAGNOSTIC EQUIPMENT (TMDE); AND SUPPORT EQUIPMENT

1-14. COMMON TOOLS AND EQUIPMENT. For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MTOE) applicable to your unit.

1-15. SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT. For authorized special tools, TMDE, and support equipment, refer to TM 9-1425-646-34P. Tools which require fabrication are described and illustrated in Appendix C.

1-16. REPAIR PARTS. Repair parts are listed and illustrated in the repair parts and special tools list (TM 9-1425-646-34P) covering direct and general support maintenance for this equipment.

CHAPTER 2
TROUBLESHOOTING

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Section I. GENERAL

2-1. INTRODUCTION. This chapter contains the principles of operation, a troubleshooting symptom index, and troubleshooting procedures for direct support maintenance of the self-propelled launcher loader (SPLL). Figures FO-1 through FO-12 are the electrical schematic diagrams and a hydraulic schematic diagram. These diagrams are provided to be used with the troubleshooting tables to help isolate an unusual fault.

2-2. OPERATIONAL TESTING. When the troubleshooting table has isolated a fault, it will reference a maintenance procedure to make the necessary repair. After the repair is made, be sure to reconnect all cables and hydraulic lines that may have been disconnected during troubleshooting and repair. Refer to TM 9-1425-646-10 and operate the repaired system to verify that the system is operating properly.

Section II. PRINCIPLES OF OPERATION

2-3. INTRODUCTION. This section contains the theory of operation for the SPLL systems. These systems are the electrical power system, the hydraulic system, and the mechanical system.

2-4. GENERAL THEORY OF OPERATION. The SPLL is an electrically controlled, hydraulic/mechanical operated system. The electrical power system supplies the necessary power to operate the fire control system (FCS), and when commanded by the FCS, to energize the hydraulic system. The hydraulic power supply is energized when the launcher drive system (LDS) contactor receives a signal from the FCS. This hydraulic power supply furnishes hydraulic pressure to the azimuth and elevation servomotors to position the launcher loader module (LLM) as commanded by the FCS. The servomotors are

2-4. GENERAL THEORY OF OPERATION (CONT)

connected to mechanical devices which position the LLM. The electrical power system also furnishes the power necessary to operate the boom and hoist mechanical devices and the travel lock. The boom and hoist mechanical devices are used to load and unload the launch pod container (LP/C) from the LLM. The travel lock is electrically controlled by a signal from the FCS to secure the LLM to the carrier for travel.

2-5. ELECTRICAL POWER SYSTEM THEORY OF OPERATION.

a. Electrical Power System.

(1) General. The electrical power system is rated at 24 volts direct current and normally ranges between 18 and 28 volts. Current drain is approximately 550 amperes during LDS operation. Current drain is reduced to approximately 15 amperes during FCS standby operations.

(a) The electrical power system may be operated independently or in conjunction with the carrier's electrical system. The carrier's electrical system, consisting of batteries and an alternator, is connected to the launcher's electrical power system when the launcher interconnect switch in the carrier's cab is in ON. The system may also be powered from an external source connected to the carrier's slave receptacle.

(b) The launcher's electrical power system consists of battery box, electronics box, power distribution box, and interconnecting cable assemblies.

(2) Battery Box. The battery box contains six lead acid-type, 12-volt, storage batteries. Four of these batteries are connected in series-parallel to provide 24-volt high current power for the LDS. The other two batteries are connected in series to provide 24 volts at a lower current for the electronics contained within the FCS.

(a) High current voltage from four series-parallel connected batteries is furnished to electronics box through connector J8.

(b) Low current voltage from two series connected batteries is furnished to electronics box through connector J7.

(3) Electronics Box. The electronics box is mounted on end of battery box. It contains necessary electronics equipment to monitor and provide system current requirements.

(a) When the launcher interconnect switch is on, carrier positive power is connected to the positive bus bar inside the electronics box along with four launcher batteries. The other two launcher batteries are also connected to the positive bus bar for charging, but are reverse isolated from carrier and launcher batteries by diode CR3 (figure FO-7) to prevent power fluctuations by either launcher or carrier systems. Negative leads are connected to the negative bus in electronics box.

(b) Output from electronics box to FCS components (electronic unit, fire control unit, and communications processor) is controlled by relay K1. Relay K1 is energized when SYS PWR switch on fire control panel is in ON. Output to LDS is controlled by relay K2 which is also energized when SYS PWR switch is in ON. Relay contacts for K1 are rated at 50 amperes sustained and 400 amperes sustained for K2.

(c) Overall power distribution within power system is monitored by a BITE circuit card in the electronics box (figure 2-1). Marginal power conditions are detected by BITE to cause a signal to electronic unit (EU) which in turn causes BATTERY BOX FAILURE message to be displayed on fire control panel. This message is an operator warning and does not necessarily indicate an operational failure. Output of all launcher batteries is monitored by the circuit card. Output from two series connected batteries is applied to integrated circuit U2 and the four series-parallel batteries are applied to U4. Integrated circuits U2 and U4 are low voltage detectors. If two electronics battery voltages fall below 17 volts or four (LDS) battery voltages fall below 14.5 volts, the output of U2 or U4 goes positive (high). A positive (high) output from either or both circuits turns on transistor Q1 causing the input to U3-A to go low. Circuit U3-A has two outputs, one inverted and the other noninverted. The inverted output goes high and is routed through noninverting buffer U3-B to pin 9 as a 4-volt NO GO signal to the electronic unit. The noninverted output of U3-A is routed through noninverting buffer U3-C to pin 7 as a 0-volt NO GO signal to the electronic unit. This condition causes BATTERY BOX FAILURE to be printed by fire control panel. Integrated circuit U1 is a voltage-regulator-reference device and supplies U2, U3, U4, and Q1 with the required operating voltages.

(4) Power Distribution Box. The power distribution box (PDB) is the main distribution point for electrical power and for command signals to the launcher systems. It contains EMI filters, isolation diodes, electrical connectors, bus bars, and power switching relays.

2-5. ELECTRICAL POWER SYSTEM THEORY OF OPERATION (CONT)

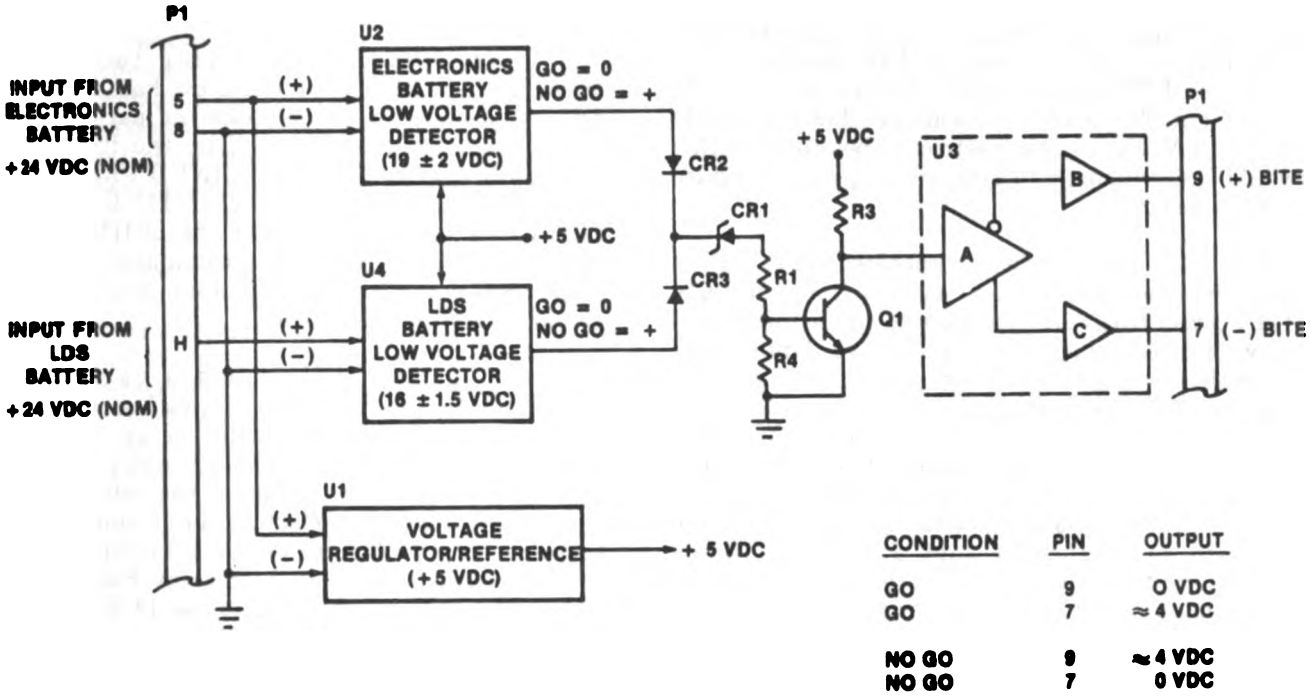


Figure 2-1. Electronics Box BITE Circuit Card

(a) The 24 volts is received from electronics box through connector J2. This power is connected to positive (+) bus bar and then routed to using circuits.

(b) Input power is routed to short/no-voltage tester (SNVT) through connector J9 and to control boxes in boom and hoist systems through connectors J5, J6, J7, and J8.

(c) Most of the final application of power is made on a conditional basis through signal direction of the electronics box current through the fire control unit.

(5) Power Distribution. (Figure FO-7.) Initial power distribution occurs when the SYS PWR switch on the fire control panel is placed in ON. Closing this switch provides 24 volts through the electronic unit to the coils of relays K1 and K2 in the electronics box. The energized contacts of K1 provide 24 volts across CB2 to the communications processor, across CB3 to the power supply inside the electronic unit, and across CB1 to the power supply inside the fire control unit. Energized contacts of relay K2 provide 24 volts to the positive bus inside the power distribution box and to the open contacts of relays inside LDS contactor.

(a) Power distribution to the launcher systems is controlled by switches on the fire control panel, limit switches, software, and fire control system commands. Signals from these components direct electrical power to the individual systems through the PDB.

b. Launcher Drive Electrical System. (Figures FO-7 and FO-8.)

(1) Description.

(a) Electrical motor for LDS is a 12.1-horsepower, 18- to 28-volt dc, rated 4000 rpm at 21 volts motor. Steady state power consumption is 12 kilowatts. The motor drives the hydraulic pump to provide fluid under pressure to azimuth and elevation servo valves. The motor is controlled by the LDS contactor and a system of limit switches.

(b) The contactor is a large power relay with contacts designed to carry high current demands of motor. Contactor is actuated by the FCS when a LDS ON CMD is received from the fire control unit (FCU). Current to the contactor may be interrupted by action of the limit switch system.

2-5. ELECTRICAL POWER SYSTEM THEORY OF OPERATION (CONT)

(c) Limit switches (figure FO-7) are single-pole switches connected in series with the LDS contactor circuit to interrupt LDS power in the event the FCS software limits fail to control LLM movement. The switches are actuated mechanically if the LLM moves into restricted positions which would cause damage to system components (figure FO-7, sheet 2).

(d) The electrically operated servo valves are controlled by command signals from the FCS. They direct hydraulic pressure to the azimuth and elevation servomotors. A 4-way, 2-position, solenoid-operated elevation pressure regulator (figure FO-9) reduces pressure to the elevation servo valve during the last 35 mils of down movement during stow, to prevent damage to the mechanical actuators. A 2-way, 2-position, solenoid-operated valve removes hydraulic pressure from the azimuth servo for the last 35 mils of down movement to allow azimuth freewheeling. This prevents damage to the cage centering mechanism. Both of these valves are controlled by fire control system commands.

(e) The azimuth and elevation position transducers (figure FO-10) provide servo loop closures to the FCS. The transducer shafts are coupled to the LLMs azimuth and elevation mechanical axis. They are adjusted on installation to indicate 0 mils when the LLM is in the stowed position. The FCS supplies an ac, 400-hertz, 18-volt signal to transducer S1 and S3 terminals. This voltage is inductively coupled to the R2-R4 and R1-R3 windings in phase and amplitude to the direction and amount of movement of the transducer shaft. The transducer position output from R1-R3 and R2-R4 is converted to digital position data and is supplied to the FCS as servo loop feedback. The transducers are also used to backup the stabilization reference package/position determining system (SRP/PDS) position signals to the FCS during firing. The 2-position signals are compared and if they are more than 5 mils apart, a fault message is generated.

(f) The travel lock actuator (figure FO-8) is a jackscrew type used to lock and unlock the cage for travel. The actuator is controlled by FCS commands.

(g) The boom controller (BC) (figure FO-11) is a hand-held remote switch box used to control LLM and boom and hoist movements during loading and maintenance operations. The BC is enabled by selecting an option from the boom control menu.

(2) Function.

(a) Firing mode. During tactical fire mission operations, after the crew has moved the SPLL to designated firing point and parked within proper azimuth and slope limits, the fire control panel will display WHEN PARKED PRESS INIT. After INIT is pressed, TO CONTINUE PRESS LCHR LAY will appear. When the LCHR LAY key is pressed, the FCS initiates commands to unlock cage and move LLM to proper azimuth and elevation attitudes for firing.

1 The FCU issues a cage unlock command to the power distribution box. This command provides a return for relay K4 (figure FO-8) to energize the relay. This allows positive (+) bus bar voltage to be applied to the retract side of travel lock actuator. When actuator completes its travel, a limit switch inside the actuator opens the retract circuit and closes LDS relay K2. The cage unlocked signal will be sent to the FCS. The FCU will then send an LDS ON CMD to the PDB to provide a return for LDS on relay K2. When relay K2 energizes, 24 volts are provided at X1 pole of the LDS contactor relay by way of PDB connector J4 pin 23 and the limit switch circuitry.

2 The LDS limit switches (figure FO-7, sheet 2) are connected in a series-parallel arrangement with the 24 volts to the LDS contactor relay from the PDB K2 relay. The limit switch system causes interruption of LDS power before the LLM moves in azimuth or elevation sufficient to cause damage to components. Movement of the LLM is controlled by software in the FCS. The limit switch system functions only if the FCS fails to control the LLM. There are four azimuth limit switches. Three of these switches are located in the azimuth position transducer. The switches are set at 73 degrees, 106 degrees, and 196 degrees. The other switch, 1.25 degrees, is mounted on the base and is actuated by a cam on the turret. There are four elevation limit switches. The 15- and 27-degree switches are mounted on the right rear hinge point of the turret and are actuated by cams on the cage. The other two switches are 61-degree limit switches located inside the elevation actuators.

3 Initially, the 1.25-degree azimuth switch limits LLM azimuth movement until the cage has been elevated to at least 15 degrees. This is necessary to prevent the front of the cage from hitting the carrier cab and engine compartment. When the cage is traversed to ±73 degrees, the 15-degree minimum elevation limit is bypassed. After ±106 degrees in azimuth has been reached,

2-5. ELECTRICAL POWER SYSTEM THEORY OF OPERATION (CONT)

elevation is limited to a maximum of 27 degrees to prevent interference between the rear of the cage and carrier components. The 196-degree azimuth switch protects electrical cables that are connected from the base to the turret and cage. The 61-degree limit switch prevents extension of elevation actuators beyond their mechanical limits.

4 Return for contactor relays is available through PDB connector J4, pin 24. When the contactor relay K1 energizes, 24 volts from the batteries pass through the resistor contacts to the LDS motor for 50 milliseconds due to a time delay device in relay K2. The resistor circuit limits surge current to 1650 amperes. When the time delay expires, the resistor circuit is bypassed and full battery current will be available to the LDS motor. The motor will drive the hydraulic pump which develop operating pressure after approximately 1 second.

5 The LDS BITE consists of six sensor switches (figure FO-7, sheet 3) in hydraulic power supply components that monitor pump pressure, reservoir fluid level, hydraulic fluid temperature, hydraulic filter cleanliness, and the electric motor temperature. An additional sensor is installed in the elevation valve module to monitor pressure during stow operation. Abnormal LDS conditions actuate the sensor switches which in turn causes a fault message to be displayed on the fire control panel.

6 If the BIT is successful, the FCS will issue an elevation signal from the FCU to the elevation servo valve through PDB connector J4 pins 3, 4, 25, and 26 (figure FO-10). The signal will be controlled by software to elevate the LLM to 310 (±8) mils. During this elevation, the LLM reference angle will be obtained from the azimuth and elevation resolvers and the azimuth position will be maintained at 0.0 (±2.5) mils. Once elevation is reached, the FCS will command azimuth movement of the LLM to the proper firing azimuth through PDB connectors J1 (pins 49, 50, 51, and 52) and J4 (pins 29, 30, 27, and 28) to the azimuth servo valve. The FCS will then command the LLM to the proper elevation for firing if it has not already been reached (lower or higher than 310 (±8) mils). During the final firing alinement, LLM reference angle will be supplied by the SRP/PDS. If the ARM switch on the fire control panel (FCP) is not placed in ARM within 10 seconds after the LLM has reached the aimpoint, the FCS will remove the LDS on command and the LDS will shut off. When the ARM switch is placed in ARM, the LDS will start up and run until all selected rockets have fired and ARM switch is placed in SAFE. During firing, the FCS will monitor LLM position by SRP reference signals and issue azimuth and elevation commands to the servo valves to maintain the aimpoint.

7 After firing is complete, the gunner will be prompted to stow the LLM. When the LLM STOW key on the FCP is pressed, the FCS will issue servo valve signals to position the LLM to 310 (±8) mil elevation. After this elevation is obtained, the FCS will then signal the servo valve to position the LLM to 0.0 (±2.5) mil azimuth. When proper azimuth position is obtained, the FCS will command the LLM to lower. When LLM elevation is lowered to 35 (±5) mils, the FCS will issue a HYD RGLTR AND BYPASS CMD from the FCU to the PDB through PDB connector J1 pin 54. This energizes relay K1 (figure FO-9) which will cause 24 volts to be applied to the 2-way, 2-position hydraulic solenoid valve to allow freewheeling of the LLM in azimuth. At the same time, 24 volts is applied to the 4-way, 2-position hydraulic solenoid valve. This valve reduces hydraulic pressure to the elevation servo valve and slows the LLM down.

8 When the LLM reaches the full down position, a cage down switch (figure FO-8) completes a signal circuit to FCS through PDB connector J1 pins 70 and 71. The FCS will remove the unlock command and supply 24 volts to the travel lock actuator extend circuit to lock the LLM. When the travel lock actuator has extended, a limit switch inside the actuator sends a cage locked signal to the FCS through PDB connector J1 pin 73. As the cage unlocked signal is removed, 24 volts is provided by LDS RELAY PWR CMD to PDB relay K3 to maintain LDS power until a cage locked signal is received by the FCS (figure FO-7, sheet 1). When a cage down-and-locked signal is received by the FCS, the LDS contactor relay opens, the hydraulic motor stops, and an LLM STOWED prompt appears on the FCP.

(b) Reload mode. The sequence of events for a reload operation begins when a selection is made from the FCP boom control menu. Initially, the FCS controls the LLM automatically as it does during the firing mode. When the LLM has been positioned to the selected position, the FCS enables the boom controller by supplying 24 volts to boom controller connector J1 pins 15 and 21 (figure FO-11). This voltage to pin 21 causes a green indicator light on the boom controller and also on the FCP to come on, telling the operator that the boom controller is enabled and ready for use. When the operator wants to move the LLM, he presses the necessary switch, LLM UP, LLM DN, LLM CW, or LLM CCW. When the switch is pressed, a signal from the BC is sent to the FCS through the PDB and

2-5. ELECTRICAL POWER SYSTEM THEORY OF OPERATION (CONT)

the FCU. The FCS issues an LDS ON CMD and the azimuth or elevation servo valve moves the LLM. When the LLM reaches the desired position, the operator releases the switch and the FCS servo valve command is removed. The FCS maintains the LDS ON CMD for 10 seconds. If no further LLM commands are received from the boom controller in that time, the FCS removes the LDS ON CMD. When reload is complete, the operator presses the LLM STOW key and the LLM will stow in the same manner it does during firing mode. During reload all azimuth and elevation reference angles are provided by the transducers.

c. Boom Electrical System. (Figure FO-11.)

(1) Description. Each LP/C bay is equipped with a boom mechanism. The left and right mechanisms are identical. Only the left is discussed and illustrated.

(a) The boom motor is a 2.5-horsepower, 24-volt dc, electrically operated device that drives the boom gear train to extend and retract the booms. The motor is controlled by the BC and has a self-contained mechanically applied, electrically released brake.

(b) The boom control box contains the relays necessary to act upon FCS commands for switch operation.

(c) The BC is a remote manual switch box which is enabled by the FCS. Switches are provided for selecting of right, left, or both and boom in and out and hook up and down. A green indicator light is provided to inform the operator that the BC is powered.

(2) Function. Initial power distribution to the boom electrical system occurs when the SYS PWR switch on the FCP is placed in ON. Battery box voltage is routed from the electronics box connector J6 pin E to the PDB positive bus (figure FO-7). The 24 volts from PDB connector J5 pin A (figure FO-11) are cabled directly to the boom control assembly where 24 volts is available for motor operation through contacts on control box relays K1 and K2. Pin E of power distribution box connector J6 is the 24 volts for K3, K4, and K5 relays. Voltage at pin E is routed through the hoist up limit switch to prevent boom movement when the hoist is not up and locked. Power to move the booms in and out is initiated by pressing the switches on the BC. The operator may select left, right, or both booms by use of the selector switch.

(a) When the boom out switch is pressed, a signal is sent from the BC connector J1 pin 14 to the FCU connector J2 pin 14. The FCU in turn sends a boom out command to the boom electrical control assembly J2 pin B. This command is from FCP connector J2 pin 29 through PDB connector J1 pin 29 and through the boom out limit switch connector J1. The boom out command provides a ground return inside the FCU. The connection of pin B on the electrical control assembly connector J2 to ground energizes relays K3 and K5. The energized contacts of K3 provide 24 volts to the coil of K1. When K5 is energized, the boom brake is released. When K1 is energized, it connects the boom motor armature lead to a return which determines the rotation direction of the motor. The boom out limit switch is connected in series with the out command circuit to stop boom movement at the full out position.

(b) When the operator presses the left boom in switch, a signal is sent to the FCU. The signal causes the FCU to send a boom in command to control assembly J2 pin D. This relay energizes relay K5. Relay K5 releases the brake and energizes K4. The energized contacts of K4 provides 24 volts to the coil of relay K2. Energized contacts of K2 connect the boom motor armature to a return which determines motor rotation direction. The in command is connected in series with the boom in limit switch to stop the booms when they are retracted.

d. Hoist Electrical System. (Figure FO-12.)

(1) Description. Each LP/C bay is equipped with a hoist assembly. The left and right hoists are identical. Only the left is discussed and illustrated.

(a) Hoist motor assembly consists of a 2.5-horsepower motor and a motor brake.

(b) Hoist control box is an electrical switching relay box used to route electrical power to lower and raise the hoist cable.

(c) Two limit switches, up and down, are connected in series with the up and down commands from the FCU. The switches are mechanically actuated to open the command circuits at the full up or down position of the hoist hook.

(2) Function.

(a) Hoist down. Initial power distribution to the hoist assembly is initiated when the operator

2-5. ELECTRICAL POWER SYSTEM THEORY OF OPERATION (CONT)

presses the hoist down switch. The selector switch on the BC allows for operation of the right, left, or both hoists. When the operator presses hoist down, a signal is sent from the BC to the FCU. The FCU provides a hoist down command to the hoist control box connector J1 pin D. This command is a return for relays K2, K4, and K6. Energized contacts of relay K5 causes K6 to energize providing 24 volts to the coils of relays K2 and K4. Relay K2 provides 24 volts to the hoist motor and K4 releases the brake. The hoist will lower until the operator releases the switch or until the mechanically actuated down limit switch is opened. The down limit switch prevents the operator from unwinding the entire cable from the hoist drum.

(b) Hoist up. The hoist up operation is essentially the same sequence of operation as hoist down except the hoist up command causes relays K1 and K3 to energize instead of K2 and K4. The up limit switch is used to protect the hoist motor by preventing stalling at the full up position. A thermal protection device is installed in the motor power circuit for heat protection.

2-6. HYDRAULIC SYSTEM THEORY OF OPERATION.

a. General. The hydraulic system (figures FO-3 and FO-6), is electrically controlled by command signals from the FCS. The hydraulic system provides the hydraulic power to drive the mechanical devices to elevate and rotate the LLM for rocket launching, LP/C reloading, and maintenance. Two hydraulic servomotors are used to position the LLM, one rotates the turret on the base assembly, and the other elevates and lowers the cage. The exact position of the LLM is monitored by the FCS at all times. Position feedback devices generate signals to the FCS to indicate the angles between the LLM and the carrier. If the hydraulic system fails, the LLM can be manually cranked in azimuth and elevation.

b. Description and Location of Components. (Figure 2-2.)

(1) Electrical Power Supply. Electrical power for the hydraulic system is supplied by the four series-parallel connected batteries mounted in the battery box. This high current, 24 volts, is routed through the electronics box to the LDS contactor. Refer to paragraph 2-5 for a complete description of the electrical power supply.

(2) LDS Contactor Assembly. LDS contactor assembly, mounted in the base assembly, is a relay with contacts large enough to carry the high current required to operate the hydraulic power supply. The contactor relay is opened and closed by a signal from the FCS. If the FCS fails to control the contactor, limit switches (figure FO-7) connected in series with the contactor will be mechanically actuated to interrupt electrical power to the contactor. This prevents the LLM from moving into restricted positions which could cause damage to system components.

(3) Hydraulic Power Supply. Hydraulic power supply consists of an electric motor driving a hydraulic pump which has a self-contained reservoir. This hydraulic power supply is located to the rear in the base assembly. Electrical power for the electric motor is supplied through the LDS contactor relay contacts. Switches are incorporated in the hydraulic power supply to display a fault message on the FCP. These switches monitor the electric motor temperature, hydraulic fluid temperature, hydraulic fluid pressure, and the condition of the pressure and return filters. The self-contained reservoir contains a sight gage to visually check fluid level in the reservoir and a sensor switch which actuates when the reservoir level drops to 0.56 liter. This switch causes a LOW FLUID message to appear on the FCP.

(4) Hydraulic Swivel. Hydraulic swivel is mounted in the center of the base assembly. It provides fluid flow from the hydraulic power supply in the fixed base to the elevation drive components mounted in the rotating turret. The flexible pressure and return lines are connected to the swivel by quick-disconnect couplings.

(5) Elevation Valve Module. Elevation valve module, mounted in the turret, contains the valves necessary to control fluid flow to the elevation servomotor and to the elevation brake during elevation and stow cycles. The module contains a 4-way, 2-position solenoid valve, a pressure relief valve, a shuttle valve, a pressure reducer valve, a pilot-operated valve, and a pressure switch. Provisions are also incorporated in the module for servicing the hydraulic system and installing a pressure gage for use during system trouble-shooting.

(6) Elevation Servomotor Assembly. The servomotor assembly is bolted to the elevation transmission which is mounted in the turret. It provides the interface between the hydraulic and mechanical elements of the elevation system by converting hydraulic pressure to mechanical torque. The servomotor assembly consists of a servo valve and a hydraulic motor along with the necessary relief and check valves. The servo valve is controlled

2-6. HYDRAULIC SYSTEM THEORY OF OPERATION (CONT)

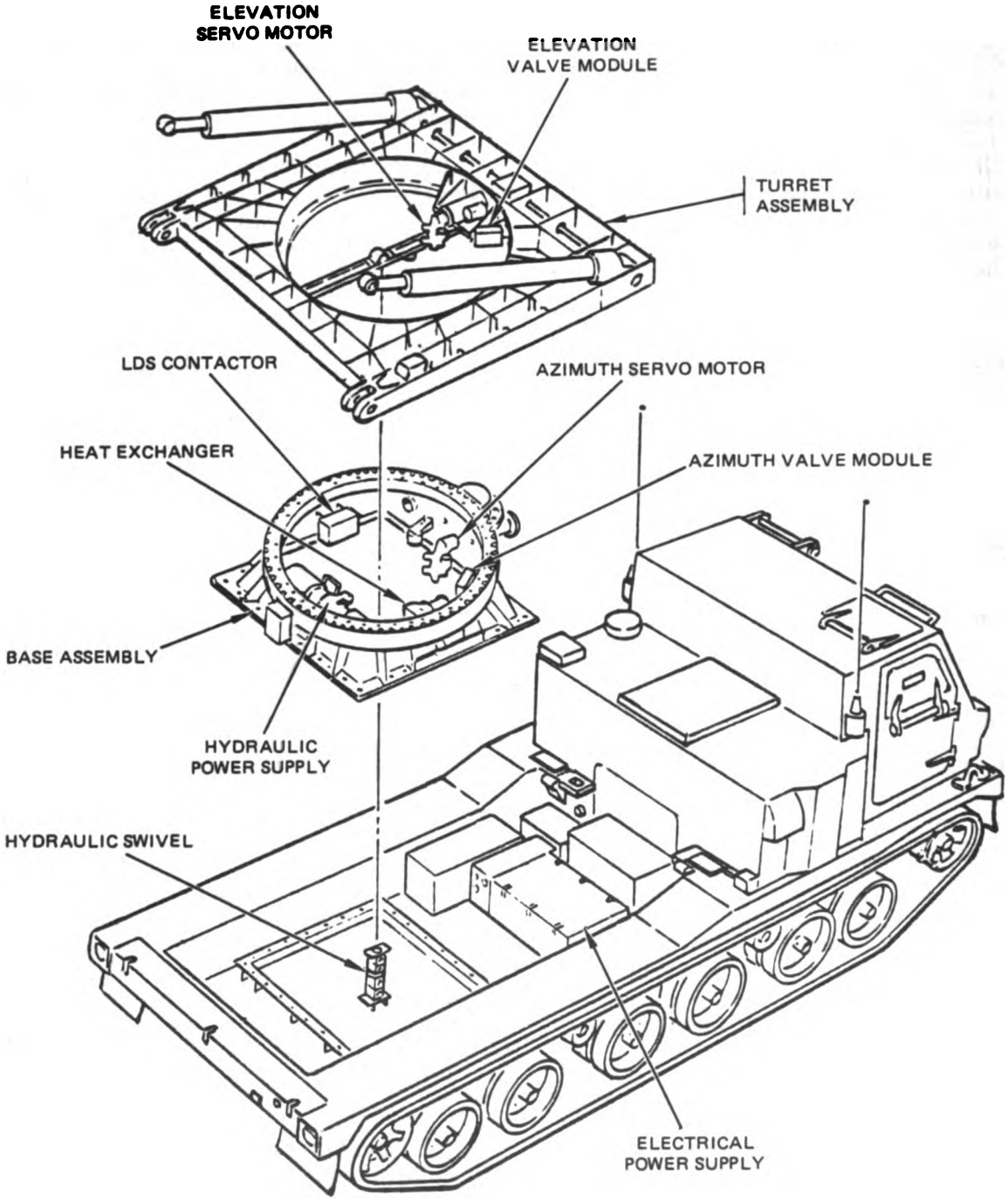


Figure 2-2. Hydraulic System Components

2-6. HYDRAULIC SYSTEM THEORY OF OPERATION (CONT)

by an electrical signal from the FCS. This signal controls the direction of hydraulic fluid flow through the servo valve to rotate the motor in the direction commanded by the FCS. The hydraulic motor is a seven piston, constant displacement motor with internal valves for flow and pressure control.

(7) Azimuth Valve Module. The azimuth valve module, mounted in the base assembly, contains the valves necessary to control fluid flow to the azimuth servomotor and azimuth brake during traversing and stow cycles. Contained within the module are a 2-way, 2-position solenoid valve and a system high pressure relief valve. The 2-way, 2-position solenoid valve is actuated by a signal from the FCS during the last few mils of elevation when stowing the LLM. When activated, hydraulic fluid to the azimuth servomotor is blocked allowing the LLM to move freely in azimuth. This permits the LLM probe to engage the centering socket to aline the LLM at 0-mil azimuth. The system high pressure relief valve opens at 26.9 MPa (3900 psi) to prevent damage to hydraulic system components.

(8) Azimuth Servomotor Assembly. The servomotor assembly is bolted to the azimuth drive speed reducer mounted in the base assembly. It provides the interface between the hydraulic and mechanical elements of the azimuth system by converting hydraulic pressure to mechanical torque. The servomotor assembly consists of a servo valve and a hydraulic motor along with the necessary relief and check valves. The servo valve is controlled by an electrical signal from the FCS. This signal controls the direction of hydraulic fluid flow through the servo valve to rotate the motor in the direction command by the FCS. The hydraulic motor is a seven piston, constant displacement motor with internal valves for flow and pressure control.

(9) Heat Exchanger. The heat exchanger is bolted to the right side of the base assembly and is connected in the return line to the hydraulic power supply. The heat exchanger consists of an electric blower assembly, a radiator, and a bypass valve mounted in a manifold. The electric blower assembly receives power directly from the hydraulic power supply electric motor. Therefore, when the hydraulic power supply is operating, the heat exchanger blower is operating. Return fluid, from the elevation and azimuth hydraulic systems, enters the manifold and flows through the radiator and bypass valve. When the fluid flows through the radiator, the heat from the fluid is removed by the airflow from the blower assembly over the radiator coils. The hydraulic fluid from the heat exchanger is then returned to the hydraulic power supply.

c. Component Function.

(1) Hydraulic Power Supply. The hydraulic power supply (figure 2-3) electric motor is controlled by the FCS through the LDS contactor. The motor is a 4000 rpm, 24-volt dc, 12.1-horsepower motor, which is cooled by fan driven air passing through the casting passages as well as an internal airflow provided by an internal fan. The motor contains a temperature sensor to monitor the motor temperature. If the motor temperature exceeds 600°F, a switch closes causing a MOTOR OVER TEMPERATURE message to appear on the FCP.

(a) The electric motor drives a nine piston, variable displacement, pressure-compensating pump capable of delivering 12 gpm of hydraulic fluid at 20.7 MPa (3000 psi). The constant pressure characteristic is maintained by a pressure compensator and spring arrangement that control the yoke angle. The yoke varies the piston stroke to control fluid flow and pressure according to the system demand. With the pump rotating, system flow and pressure build up to the preset value of the compensator which acts to move the yoke thus reducing the pump flow while maintaining system pressures. The pump drive shaft has a built-in leakage for lubrication of the shaft seal. This leakage is scavenged from the drive shaft area to scavenge reservoir bowl. The bowl has three vertical windows for visual checks of the amount of seal leakage. The maximum allowable leakage is 5 cc per hour.

(b) Fluid flow to the pump is from the internally pressurized reservoir bolted to the pump housing. The reservoir uses system pressure acting upon a 41:1 piston to supply approximately 504 kPa (73 psi) fluid pressure to the pump. This pressurized fluid flow prevents pump cavitation. The level of fluid in the reservoir should be checked at ambient temperature by observing the indicator on top of the reservoir. A low volume switch is mounted on the bottom of the reservoir. This switch is normally open and is actuated closed by a piston cam if the fluid level in the reservoir drops to 0.56 liter. When the switch closes, a LOW FLUID message will appear on the FCP.

(c) The hydraulic pump is equipped with two 5-micron filters, one in the pressure outlet and one in the return inlet. Each filter is equipped with mechanical and electrical devices for clogged filter indications. Red pins will extend from the filter

2-6. HYDRAULIC SYSTEM THEORY OF OPERATION (CONT)

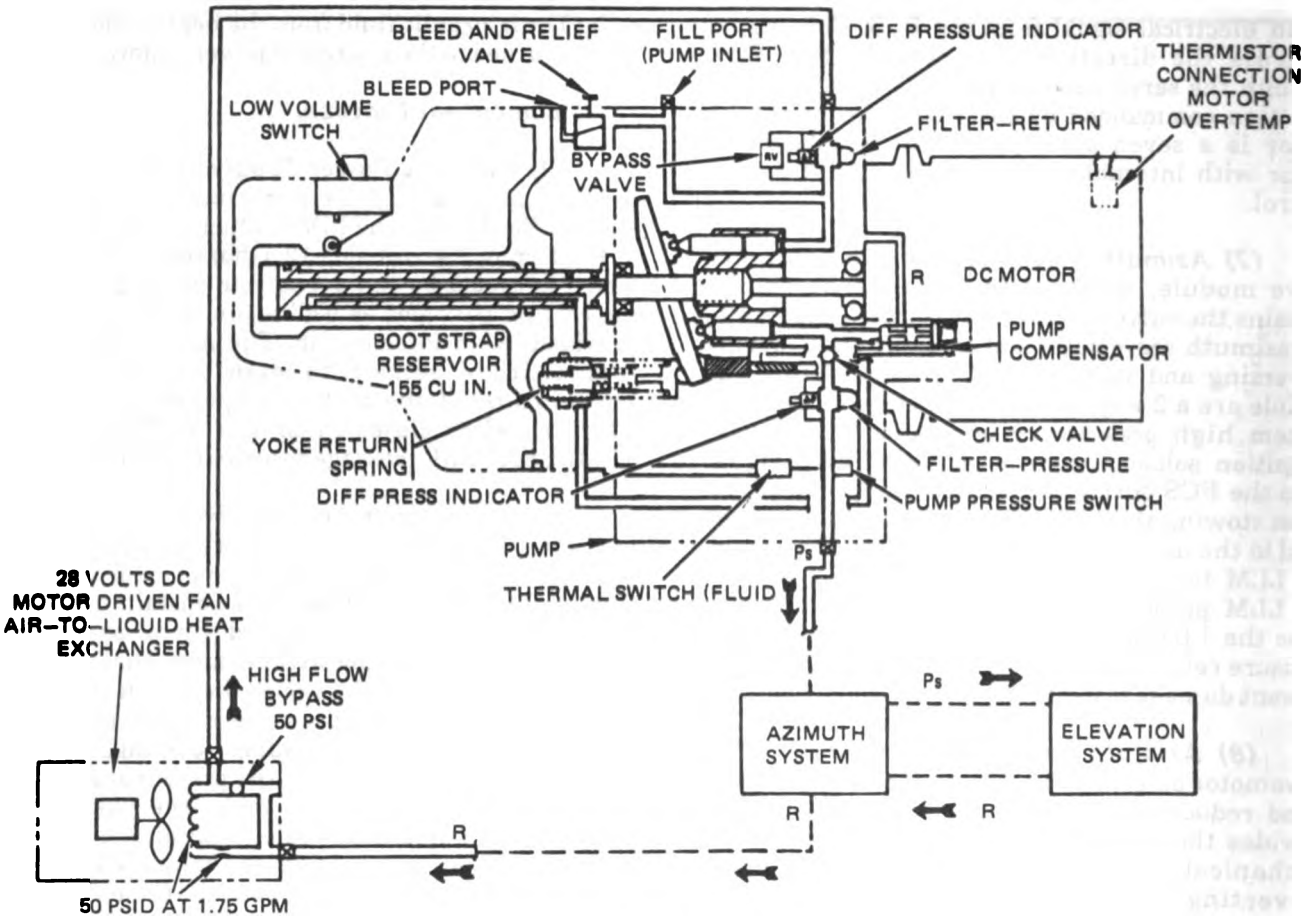


Figure 2-3. Hydraulic Power Supply Schematic

when contamination restricts the fluid flow and causes a pressure differential of 482 (±69)kPa (70 (±10)psi) across the filter inlet and outlet. The pins have a thermal lockout protection to prevent pin extension from low fluid temperature or pressure surges. The pins will not extend if the temperature is below 322 (±27)K (120°F). A bypass feature incorporated in the return filter allows system operation if the filter is clogged. The pressure opens a valve in the head of filter and allows the fluid to bypass the element. The clogged filter electrical switches are actuated by the mechanical red pins. The switches are normally closed. When the filter is clogged, the switch opens causing a FILTER IS CLOGGED message to appear on the FCP.

(d) A fluid temperature switch is mounted on the pump housing. This switch is normally open but closes when the fluid temperature rises to 411 (±3)K (280°F). When the switch closes, a FLUID OVER TEMPERATURE message will appear on the FCP.

(e) A fluid pressure switch, installed in the pressure outlet, is a normally open switch that closes when the pump pressure drops to 5.5 MPa (800 psi). When the switch closes, a PUMP PRESSURE IS LOW message will appear on the FCP. A check valve, mounted in the pump outlet, protects the pump from pressure line surges or back loading on the pump drive motor.

(2) Heat Exchanger. The heat exchanger (figure 2-3) is used to maintain the system hydraulic fluid at a safe operating temperature. The manifold controls the flow of fluid through the radiator or the bypass valve. A low flow orifice in the return passage of the manifold, sized for a flow of 0.11 liter per second (1.6 gpm) at 0.34 MPa (50 psi), allows the fluid to flow through the radiator. A high return flow causes the bypass valve to open when the differential pressure exceeds the orifice limits. This bypass valve opens at 0.234 MPa (34 psi) providing a flow rate of 0.82 liter per second (13 gpm). This high return flow bypasses the radiator and is

2-6. HYDRAULIC SYSTEM THEORY OF OPERATION (CONT)

returned directly to the hydraulic power supply. An adjustment screw on the bypass valve is preset and should not be changed. The blower assembly consists of a two bladed fan driven by a 24-volt dc motor. This fan provides an airflow over the radiator coils to remove the heat from the hydraulic fluid.

d. Azimuth System Operation.

(1) Azimuth System Hydraulic Operation. Hydraulic pressure from the hydraulic power supply is directed through the azimuth valve module to the hydraulically released azimuth brake in the azimuth drive speed reducer. This brake is applied when the hydraulic pressure is below 10.3 MPa (1493 psi) and released when the pressure is or above 15.2 MPa (2204 psi). Hydraulic pressure is also directed through the 2-way, 3-position solenoid valve in the azimuth valve module to the azimuth servomotor assembly.

(a) When the FCS commands azimuth movement, an electrical signal is transmitted to the servo valve on the servomotor assembly. The spool within the servo valve is then positioned to direct hydraulic fluid to the servomotor for either right or left azimuth movement as commanded by the FCS. The servo valve is a directional control, 4-way, 3-position valve containing an integral torque motor controlled by an electrical signal from the FCS. When no command is made by the FCS, internal passages in the servo valve direct operating pressure to both ends of the valve spool to maintain the valve in the neutral position.

(b) The servomotor is a fixed displacement, bidirectional, radial piston motor. A series of relief and check valves is incorporated in the motor to control the internal fluid flow during different cycles of operation. An antipower lock valve, installed across the motor passages, closes when operating pressure reaches 1.39 MPa (202 psi). This valve prevents the LLM from freewheeling. As the LLM is commanded to stow by the FCS, the FCS energizes the 2-way, 2-position valve in the valve module when the LLM reaches 35 mils in elevation from the stowed position. When the valve is energized, hydraulic pressure to the servomotor is removed. As the hydraulic pressure to the servomotor decreases to 344.5 MPa (50 psi), the antipower lock valve in the servomotor opens to connect the motor passages which allows the motor to rotate (freewheel) as the LLM probe enters the centering socket.

(c) Also incorporated in the servomotor are two check valves in the return passages to maintain hydraulic pressure loading during rocket firing. Two relief valves are also in the servomotor return passages which open independently at 1.38 MPa (200 psi) to relieve internal hydraulic pressure differential when the servo valve is closed to stop LLM movement, or to decrease rocket blast loads through the LLM to the servomotor. A manually operated bleed valve is mounted on top of the servomotor to allow bleeding of air from the servomotor.

(d) The servomotor shaft has a built-in leakage for lubrication of the shaft seal. This leakage is scavenged from the drive shaft area to a 0.5-liter (1-pint) scavenge reservoir bowl. The bowl has three vertical windows for visual checking of the amount of seal leakage. The maximum allowable seal leakage is 5 cc per hour.

(e) The servomotor splined shaft rotates the azimuth drive speed reducer causing the azimuth drive speed reducer pinion gear to traverse the LLM in azimuth. An azimuth position transducer/switch, coupled through a gear train to the azimuth drive geared bearing, detects the position of the LLM with respect to the carrier. This transducer/switch generates a position signal which is transmitted to the FCS. The FCS uses this signal to prevent traversing the LLM into an angle which would activate a limit switch. Whenever a limit switch is activated, electrical power to the hydraulic power supply is removed by deenergizing the LDS contactor.

(2) Azimuth System Manual Drive. The LLM can be rotated manually by a flexible shaft coupled to the azimuth drive speed reducer. To traverse the LLM manually, a socket is attached to the 24mm flexible shaft nut on the rear of the SPLL. Turning the nut to the left causes the LLM to rotate to the left and turning the nut to the right causes the LLM to rotate to the right.

e. Elevation System Operation.

(1) Elevation System Hydraulic Operation. Hydraulic pressure from the hydraulic power supply is directed through the azimuth valve module and the hydraulic swivel to the elevation valve module. This hydraulic pressure passes through the pilot-operated valve in the elevation valve module to the elevation servomotor. The fluid also passes through the 4-way, 2-position solenoid valve and brake shuttle valve to the elevation brake. The brake is released when the hydraulic pressure is above 6.2 MPa (899 psi) and is engaged when the pressure is below 3.4 MPa (495 psi).

2-6. HYDRAULIC SYSTEM THEORY OF OPERATION (CONT)

(a) A pressure switch in the valve module senses the hydraulic pressure directed to the servomotor. If the hydraulic pressure to the servomotor has not been reduced by the pressure reducer valve to below 1500 psi, after the 4-way, 2-position solenoid valve has been energized during LLM stow, the normally open switch will close causing a STOW PRESSURE FAILURE message to appear on the FCP. The brake system isolates the hydraulic system from the manual system by locking and unlocking the input shaft in the elevation transmission. Operation of the elevation servomotor is the same as the azimuth servomotor described in paragraph d with the exception of the antipower lock valve. The elevation system does not require an antipower lock valve as freewheeling is not required.

(b) During LLM stow operation, when the LLM reaches 35-mil elevation, the 4-way, 2-position valve is energized by a signal from the FCS. When the valve is energized, hydraulic fluid is routed through the pressure reducing valve in the elevation valve module causing the hydraulic pressure to drop to 10.3 MPa (1494 psi). This reduced pressure is supplied to the servomotor through a pilot-operated valve and to the elevation brake through a check valve and a shuttle valve. This reduced hydraulic pressure is required at the servomotor to reduce the mechanical load on the elevation actuators when the cage is stowed. After the hydraulic system is shut down, the reduced hydraulic pressure to the elevation brake through the check valve traps the pressure in the brake. Holding the brake release allows the cage to relax, relieving the mechanical load on the elevation components, when the LLM is stowed. A thermal relief valve is also incorporated in the brake hydraulic system to relieve trapped fluid pressure caused by thermal expansion.

(c) The servomotor output shaft drives the elevation transmission which drives the two elevation actuators through an angle drive unit. An elevation position monitor transducer is connected between the cage and the turret to generate a position signal which is transmitted to the FCS. The FCS uses this signal to prevent moving the cage into a position which would activate a limit switch. When a limit switch is activated, electrical power to the hydraulic power supply is removed by deenergizing the LDS contactor.

(d) A manual bleed valve is provided to bleed hydraulic pressure from the elevation brake. If hydraulic pressure is trapped in the brake system, the LLM cannot be elevated manually. Manual bleed valves are also located on the servomotor and elevation brake to allow bleeding of air from the system.

(e) The servomotor shaft seal has a built-in leakage for lubrication of the shaft seal. This leakage is scavenged from the drive shaft area to a 0.5-liter (1-pint) scavenge reservoir bowl. The bowl has three vertical windows for visual checking of the amount of seal leakage. The maximum allowable seal leakage is 5 cc per hour.

(2) Elevation System Manual Drive. The LLM can be elevated or lowered manually by a flexible shaft coupled to the elevation transmission. To manually elevate the LLM, a socket is attached to the 24mm flexible shaft nut on the lower left turret wall. Turning the nut to the left causes the LLM to lower and turning the nut to the right causes the LLM to elevate.

2-7. MECHANICAL SYSTEM THEORY OF OPERATION.

a. General. The mechanical system consist of the LDS mechanical components and the mechanical components mounted in the cage. The LDS mechanical components interface the turret and cage with the hydraulic system. These mechanical components convert the hydraulic pressure into mechanical drive to rotate and elevate the LLM for rocket firing, LP/C loading or unloading, and maintenance. The mechanical components, mounted in the cage, are the travel lock to secure the cage to the carrier, the LP/C holddown latch assembly for securing the LP/C in the cage, the boom and hoist assemblies for loading and unloading the LP/C, and the blast shield to protect the components within the cage from the rocket blast.

b. Azimuth Drive Mechanism. (Figure 2-4.)

(1) Description. The azimuth drive mechanical components are the base, azimuth drive geared bearing, azimuth drive speed reducer, and the flexible shaft for manual drive. The base is bolted to the carrier bed. Mounted on the base is the azimuth geared bearing with the inner race bolted to the base. The outer race of the geared bearing is bolted to and supports the turret. Between the inner and outer races of the geared bearing are two rows of roller bearings which allow the inner and outer races to rotate independently. The azimuth drive speed reducer, which is driven by the azimuth servomotor, is bolted to the base with its pinion gear meshed with the ring gear on the azimuth gear bearing outer race.

2-7. MECHANICAL SYSTEM THEORY OF OPERATION (CONT)

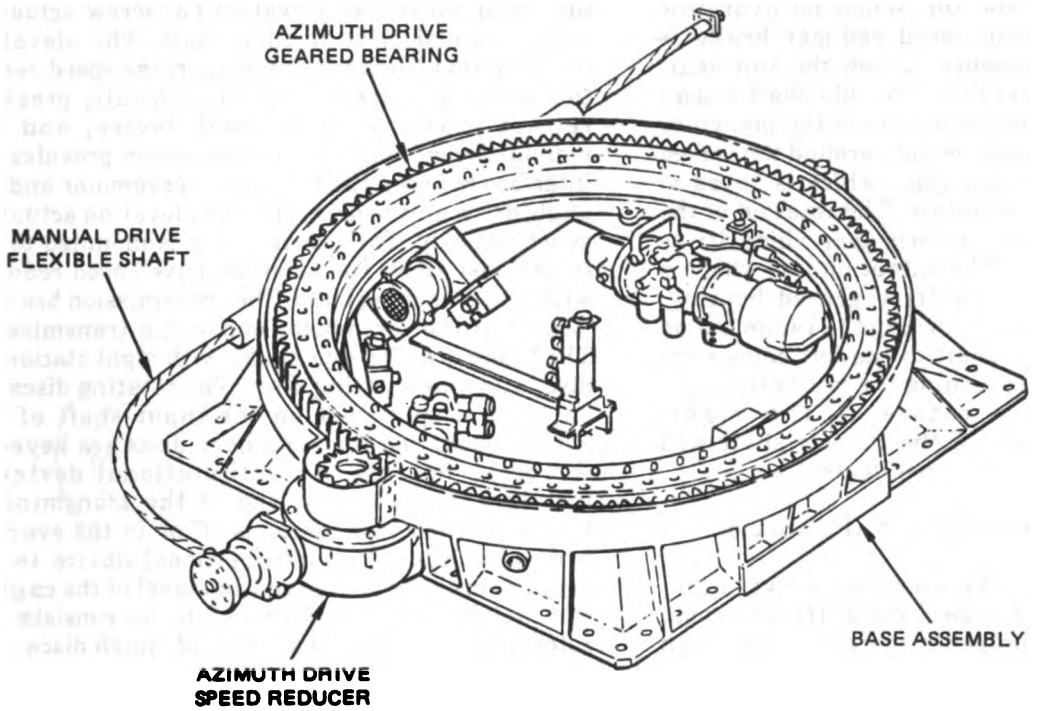


Figure 2-4. Azimuth Drive Mechanical Components

(a) The azimuth drive speed reducer incorporates a speed reduction gearing with right angle shafting, a bidirectional, spring-loaded, hydraulic pressure released brake, a pinion gear on the output shaft, and provisions for manual drive. This speed reducer transmits hydraulic servomotor torque to the azimuth drive geared bearing outer race through the pinion gear. The output pinion gear is covered, for protection of the meshing gears of the pinion gear and the azimuth drive geared bearing.

(b) An internal brake assembly is incorporated in the azimuth drive speed reducer. This brake prevents azimuth freewheeling, if hydraulic pressure fails, by providing a bidirectional restraining force to the speed reducer output. The brake is a disc-type brake with the stationary discs keyed to grooves in the housing and the rotating discs are keyed to the rotating shaft. The brake is released when hydraulic pressure reaches 15.2 MPa (2204 psi). When hydraulic pressure decreases to 10.3 MPa (1494 psi), the piston is forced against the brake discs by springs. The spring force squeezes the rotating discs against the stationary discs and applies a braking action to the speed reducer output pinion through a gear train. The brake is adjusted to slip at not less than 6562 N•m (58,070 in/lb). The brake drag will not exceed 0.5 N•m (4.4 in/lb) when released. A manual bleed valve is mounted on the brake housing to permit bleeding trapped air from the brake.

(c) A manual drive on the azimuth drive speed reducer is connected by a flexible shaft which is routed to the rear of the carrier where it is terminated at a 24mm drive flexible shaft nut.

(2) Power Operation. When azimuth movement is commanded by the FCS, the hydraulic power supply is energized. As hydraulic pressure builds up to 15.2 MPa (2204 psi), the azimuth brake is released unlocking the azimuth drive speed reducer planetary gear set. The hydraulic servomotor, which is bolted to the azimuth drive speed reducer, is splined to the speed reducer main worm gear. As the servomotor rotates the main worm gear, a spur gear keyed to the opposite end of the worm gear shaft rotates the planet gears on the axles of the planetary carrier. The sun gear is free to rotate since the brake has been released. The manual drive worm gear is antirotational by the arrangement of the sun gear shaft through a bushing in the center of the planetary carrier and the planetary gears rotating on their axles.

2-7. MECHANICAL SYSTEM THEORY OF OPERATION (CONT)

(3) Manual Operation. When no hydraulic pressure available, the speed reducer brake is engaged by spring pressure to lock the sun gear. Rotation of the manual drive flexible shaft causes the manual input worm gear to turn the planetary carrier. The planetary gears walk around the locked sun gear causing the spur gear, which is keyed to the main worm shaft, to rotate. The rotation of the spur gear rotates the main worm gear which drives the output pinion gear. The output pinion, which is meshed with the azimuth drive geared bearing, causes the LLM to rotate. Turning the 14mm nut on the end of the flexible shaft to the left causes the LLM to rotate left, and turning the nut to the right causes the LLM to rotate to the right. Approximately one turn of the flexible shaft will turn the LLM 1 mil (19 turns per degree).

c. Elevation Drive Mechanism. (Figure 2-5.)

(1) Description. The elevation drive mechanical components are a mechanical transmission, angle drive unit, two propeller shafts equipped with universal joints, two elevation ballscrew actuators and a manual drive flexible shaft. The elevation transmission (figure 2-6) incorporates speed reduction gearing, a spring-applied hydraulic pressure release brake, antirotational device, and the manual drive input. The transmission provides the interface between the hydraulic servomotor and the angle drive unit to drive the two elevation actuators synchronously. The transmission is mounted to the turret, just above the azimuth drive speed reducer, with four attaching bolts. The transmission brake is located at the servomotor end of the transmission. The brake is a disc-type brake with eight stationary discs and nine rotating discs. The rotating discs are keyed to a spur gear on the input shaft of the transmission and the stationary discs are keyed to the brake housing. An antirotational device is installed in the output end of the transmission housing. When LDS power is off or in the event of hydraulic failure, the antirotational device is the primary brake to prevent down travel of the cage by ram weight. The antirotational device consists of a ratchet-type clutch and a series of clutch discs. The

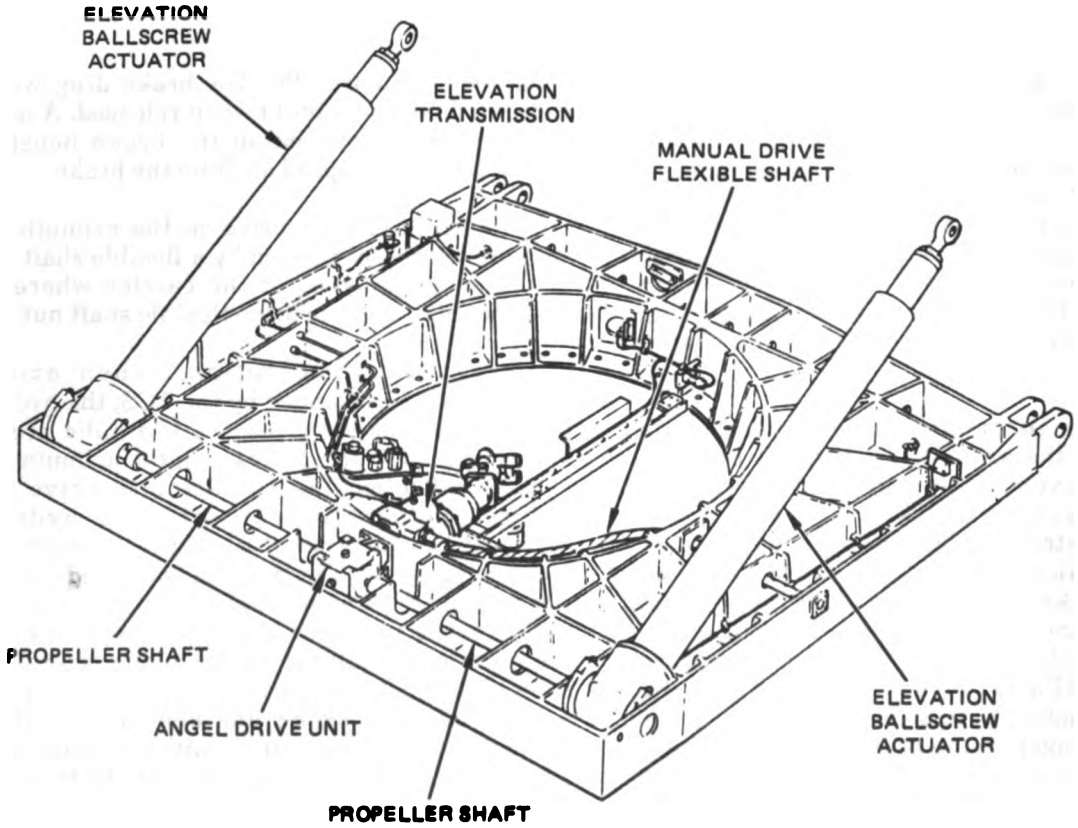


Figure 2-5. Elevation Drive Mechanical Components

2-7. MECHANICAL SYSTEM THEORY OF OPERATION (CONT)

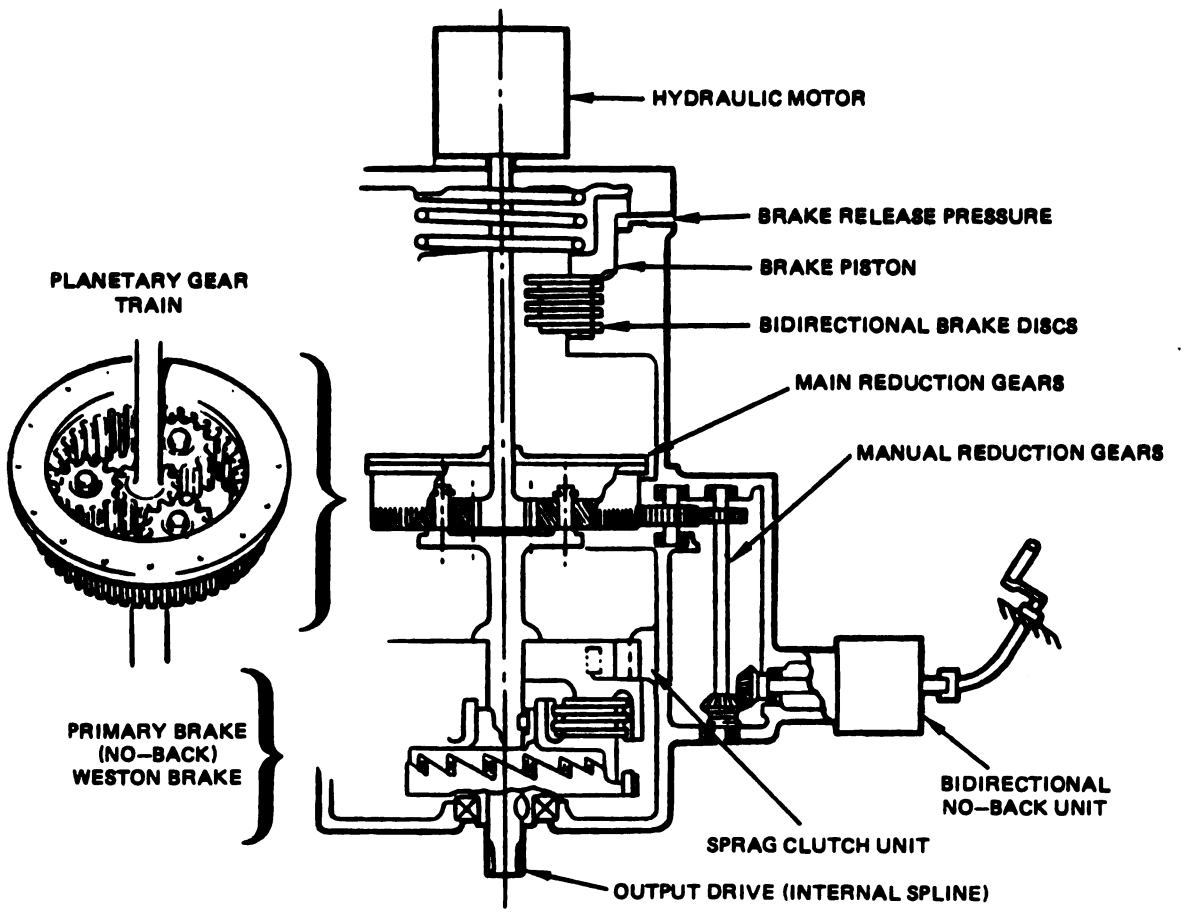


Figure 2-6. Elevation Transmission Diagram

rotating clutch discs are keyed to the clutch assemblies and the stationary discs are locked to the housing that supports the clutch. The clutch is locked to the transmission output shaft by its interface with splines on the end of the spur gear shaft. The clutch housing mates with splines on the angle drive unit. A flexible drive input to the transmission connects to a set of bevel gears through a manual drive no-back mechanism. The no-back mechanism is an arrangement of pinned springs that prevent reverse rotation of the manual drive during hydraulic power operation.

(a) The angle drive unit is mounted to the turret just forward of the transmission. A splined shaft connects the unit to the transmission output. The bevel gears within the unit are bidirectional and transmit torque to the right and left propeller shafts. The bevel gears are splash lubricated during operation.

(b) The two propeller shafts are connected between the angle drive unit and the elevation actuators. They transmit torque from the angle drive unit to the elevation actuators. The propeller shafts are splined connected at each end and has two universal joints. The universal joints are not interchangeable. Slip joints at the inner end of each shaft provide length adjustments.

(c) The elevation actuators are ballscrew type actuators. These actuators are mounted to the turret by support fittings and to the cage by rod end fittings. Each actuator incorporates a bevel gear assembly, ballnut and ballscrew assembly, position indicator switch, mechanical limit stops, and an antirotation device. The internal antirotation device prevents the rotation of the actuators by the cage weight. A telescoping tube covers the ballnut and ballscrew assembly.

2-7. MECHANICAL SYSTEM THEORY OF OPERATION (CONT)

(2) Power Operation. The hydraulic pressure unlocks the elevation brake in the transmission when the hydraulic pressure increases to 6.2 MPa (899 psi). The servomotor is splined to the transmission input shaft, which is splined to a set of planetary gears housed within the spur gear (gear holder) assembly. Rotation of the input drive shaft rotates the planetary gears and their gear holder which is the output shaft of the angle drive unit. The spur gear is prevented from rotating by its interface with an idler gear and the auxiliary reduction gears to the manual drive no-back device. Bidirectional rotation of the servomotor is transmitted through the input drive sun gear to the planetary gear holder for output to the angle drive unit. The angle drive unit bevel gears drive the elevation actuator bevel gears through the propeller shafts. A ballnut is pinned to the elevation actuator extension tube and interlocks with the screw shaft by steel balls. Rotation of the screw shaft by the bevel gears will load the steel balls against the ballnut. Three ball return tubes provide a continuous run of the steel balls as the screw shaft rotates. The ballnut retains the balls on the screw shaft as the nut rides along the screw shaft. The ballnut is prevented from rotating by an antirotation keyway on the extension tube interfacing with a guide key installed in the outer tube shield. Counterclockwise rotation of the propeller shafts will extend the elevation actuators. The actuator gear ratio is 3:1.

(3) Manual Operation. The manual drive flexible shaft input connects to a set of bevel gears and an auxiliary set of gears through a no-back unit. The no-back unit is an arrangement of pinned springs which prevents reverse rotation of the manual drive during hydraulic power operation. The no-back unit restrains the planetary ring (spur) gear in the main reduction gear set. Movement of the manual drive gear set will drive the main reduction ring gear causing the planetary gears to walk around the sun gear. This will rotate the planetary gear holder for output to the angle drive unit.

d. Travel Lock System. (Figure 2-7.)

(1) Description. The travel lock system consists of two travel lock hooks, two bumpers, a torque tube, and an electrical actuator with provisions for manual operation. The travel lock is automatically engaged or disengaged by a signal from the FCS. The travel lock secures the cage to the carrier when the LLM is stowed.

(2) Functional Operation. The travel lock actuator, installed under the forward left side of the cage, is attached to a torque tube mounted on the bottom forward edge of the cage. Connected to the torque tube by bellcranks and links are two hooks. When the LLM is moved to the stowed position, the cage down limit switch is activated. This switch transmits a LLM lock command to energize the travel lock actuator. This LLM lock command extends the actuator to rotate the torque tube. The rotation of the torque tube causes the hooks to engage the rollers on carrier to secure cage to carrier. A microswitch in the actuator then transmits a status signal to FCS. This status indication is displayed as a LLM STOWED message on FCP. If electrical power to the travel lock actuator fails, the travel lock may be manually operated by inserting a 3/8-inch speeder wrench in the actuator manual socket through the side of cage. Turning wrench clockwise will unlock the travel lock hooks.

e. LP/C Latch Assembly. (Figure 2-8.)

(1) Description. The LP/C latch assembly is mounted in the bottom of each cage bay. Each latch assembly consists of three hook assemblies, which is operated by linkage attached to a manually operated latch handle that is mounted at the rear of the cage.

(2) Functional Operation. With the LP/C loaded in the cage, moving the latch handle to the left rotates the hooks to the locked position. As the hooks are rotated, they engage and secure the LP/C to the cage. Moving the latch handle to the right rotates the hooks to the unlocked position and disengages the hooks from the LP/C.

f. Boom Assembly Mechanism. (Figure 2-9.)

(1) Description. The boom assembly mechanism consists of a fixed beam, intermediate beam, carriage assembly, boom extension actuators, a ballnut drive assembly, two drive shafts, a boom motor and reduction gearbox, and an electrical control assembly. This mechanism is used in conjunction with the hoist assembly mechanism to load and unload LP/C. Refer to paragraph g for description and functional operation of the hoist assembly mechanism. The boom assembly mechanism is controlled by the BC. Refer to paragraph i for description and functional operation of the BC.

(2) Functional Operation. (Figure 2-10.) The boom assembly is electrically controlled by the BC. With the BC enabled, pressing one of the boom switches on the BC transmits a signal through the PDB to the FCU. A command signal is then sent

2-7. MECHANICAL SYSTEM THEORY OF OPERATION (CONT)

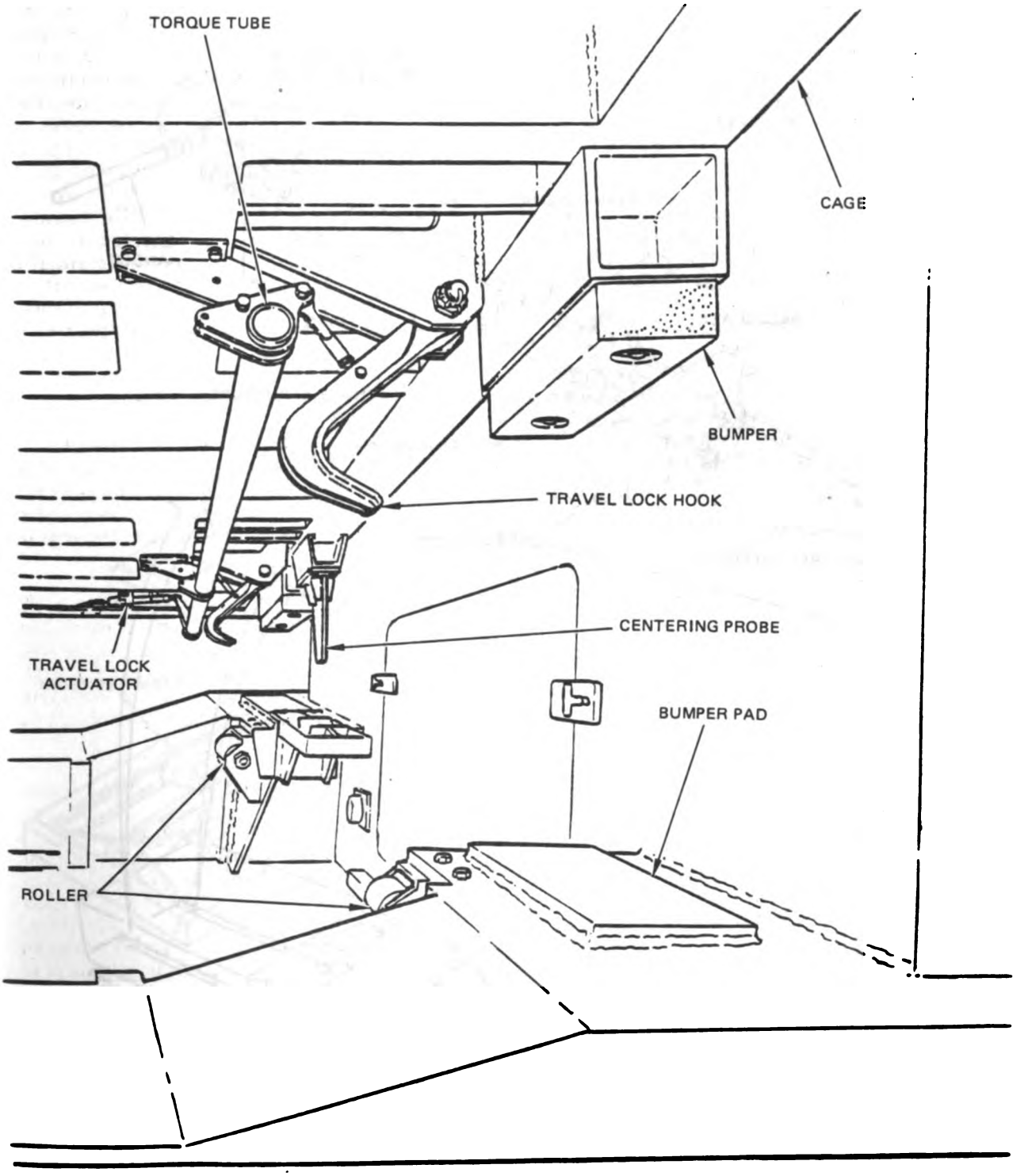


Figure 2-7. Travel Lock System

2-7. MECHANICAL SYSTEM THEORY OF OPERATION (CONT)

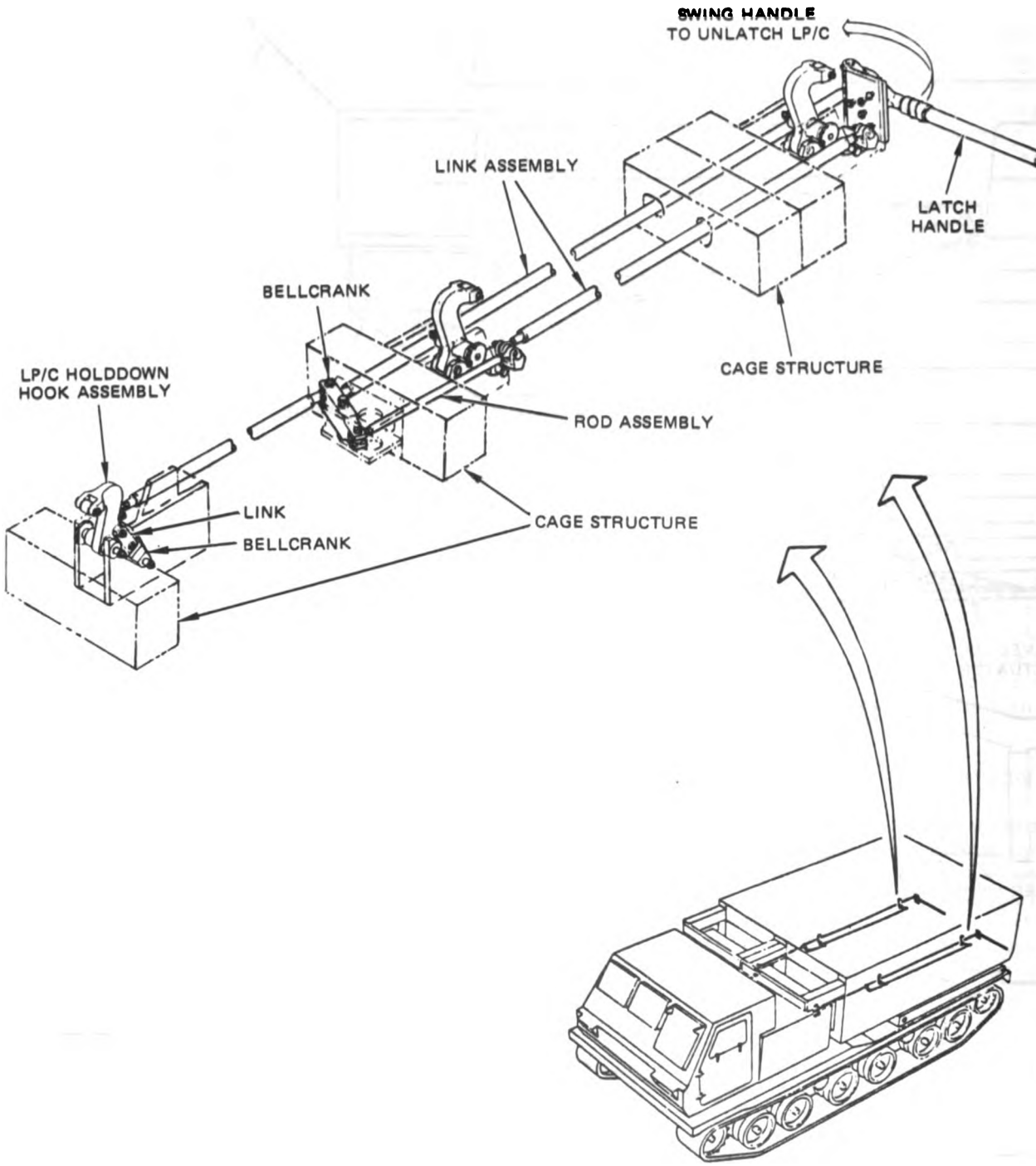


Figure 2-8. LP/C Latch Assembly

2-7. MECHANICAL SYSTEM THEORY OF OPERATION (CONT)

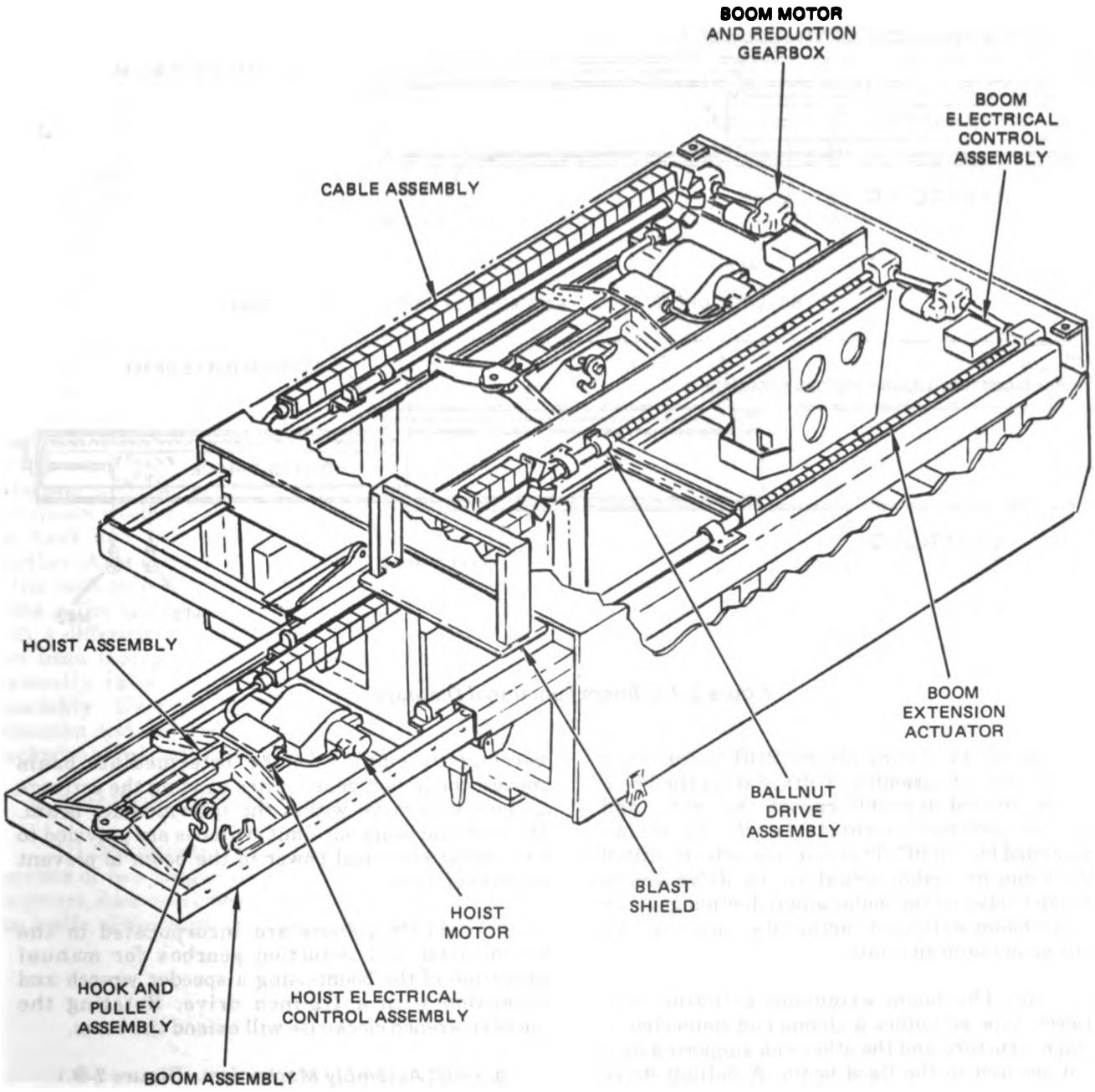


Figure 2-9. Boom and Hoist Assembly

2-7. MECHANICAL SYSTEM THEORY OF OPERATION (CONT)

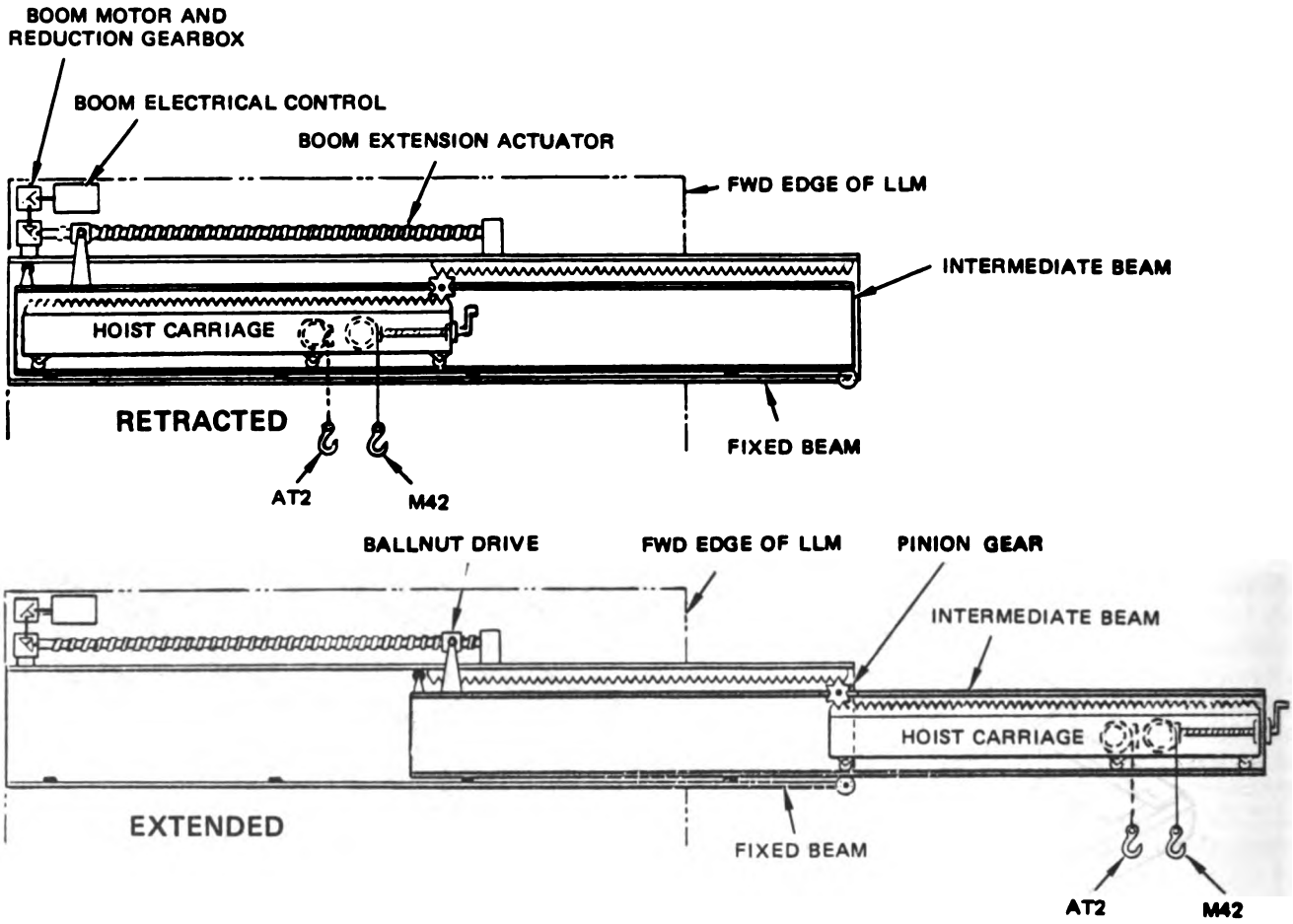


Figure 2-10. Boom Functional Diagram

back from the FCU through the PDB to the boom electrical control assembly. Voltage from the boom electrical control assembly causes the motor and reduction gearbox to rotate in the direction commanded by the BC. This rotation is transmitted to the boom extension actuators, by drive shafts connected between the motor and reduction gearbox and the boom extension actuators, causing the extension actuator to rotate.

(a) The boom extension actuators are ballscrew-type actuators with one end connected to the cage structure and the other end supported by a mount secured to the fixed beam. A ballnut drive assembly, mounted on the actuator shaft, is secured to the intermediate beam. As the extension actuator shaft rotates, the ballnut drive assembly causes the intermediate beam to move. A pinion gear is mounted on the intermediate beam between a rack gear on the fixed beam and a rack gear on the carriage assembly. As the intermediate beam moves, the pinion gear rotates causing the carriage assembly to move within the intermediate beam. Boom in and boom out limit switches are provided to disconnect electrical power to the boom to prevent boom overtravel.

(b) Provisions are incorporated in the boom motor and reduction gearbox for manual operation of the boom using a speeder wrench and extension with a 1/2-inch drive. Rotating the speeder wrench clockwise will extend the boom.

g. Hoist Assembly Mechanism. (Figure 2-9.)

(1) Description. The hoist assembly mechanism consists of a hoist electrical control assembly, hoist motor, hook and pulley assembly, and a hoist pulley support assembly. All the components for the hoist assembly mechanism are

2-7. MECHANICAL SYSTEM THEORY OF OPERATION (CONT)

mounted on the carriage assembly in the intermediate beam. The hoist assembly mechanism is controlled by the BC. Refer to paragraph i for description and functional operation of the boom controller.

(2) Functional Operation. The hoist assembly is electrically controlled by the BC. With the BC enabled, pressing one of the hook switches on the BC transmits a signal through the PDB on the FCU. A command signal is then sent back from the FCU through the PDB to the hoist electrical control assembly. Voltage from the hoist electrical control assembly causes the hoist motor to rotate the hoist cable drum in the direction commanded by the BC. The drum-mounted hoist cable is routed through a series of pulleys in the hoist pulley support assembly and terminated with the swaged ball end secured in a cable socket mounted on the pulley support assembly. Mounted on the hoist cable is a hoist hook and pulley assembly. A hoist down limit switch, which is part of the hoist motor and drum, is actuated by an actuating screw mounted on the cable guide. This switch disconnects electrical power to the hoist motor to prevent complete payout of the hoist cable. A hoist up limit switch is mounted on the hoist pulley support to disconnect electrical power to the hoist motor when the hook and pulley assembly is in the full up position. A handcranked jacking screw is provided in the hoist pulley support to permit the positioning of the pulley support for loading or unloading LP/Cs with a different center-of-gravity. Provisions have also been incorporated in the hoist assembly to manually raise or lower the hook and pulley assembly. Using a speeder wrench with an extension and reducer, turn the speeder wrench clockwise to raise the hook and pulley assembly.

h. Blast Shield Mechanism. (Figure 2-11.)

(1) Description. The blast shield mechanism consists of two hinged doors attached to the cage structure, door operating linkage from the doors to the inside of the cage, and the door open and close cams mounted on the intermediate beam. The blast shield is designed to protect the cage components from rocket exhaust during firing. The blast shield is always closed except when the booms are extended.

(2) Functional Operation. As the boom is extended, the door open cam on the intermediate beam contacts the door open cam roller on the door linkage and opens the door. After the door is opened, the overcenter link and a spring retainer hold the door in the open position. The spring retainer hooks over a roller in the linkage. When the boom is retracted, the door close cam on the intermediate beam contacts the door close roller on the door linkage. This action releases the overcenter link and the door is closed.

i. Boom Controller. (Figure 2-12.)

(1) Description. The BC is a hand-held box containing the switches necessary to operate the hoist assembly, the boom assembly, and the LLM in azimuth and elevation. Also included in the BC is an indicator light, which comes on when the BC is enabled, and a switch which permits the operation of both boom and hoist together or the left or right boom and hoist individually.

(2) Functional Operation. The BC is provided with a series of switches to allow control of the LLM boom and hoist and the positioning of the LLM by the operator while outside the carrier cab. After the BC is enabled, full control of the LLM movement is switched to the BC. Depressing a switch transmits a signal through the power distribution box to the FCU. A command signal is then transmitted by the FCU to the appropriate system for the operation commanded by the BC. Switches are provided to move the LLM in azimuth and elevation, to extend or retract the booms, and to raise or lower the hoist hook and pulley. Left or right boom or hoist may be operated separately or simultaneously by the use of a selector switch.

2-7. MECHANICAL SYSTEM THEORY OF OPERATION (CONT)

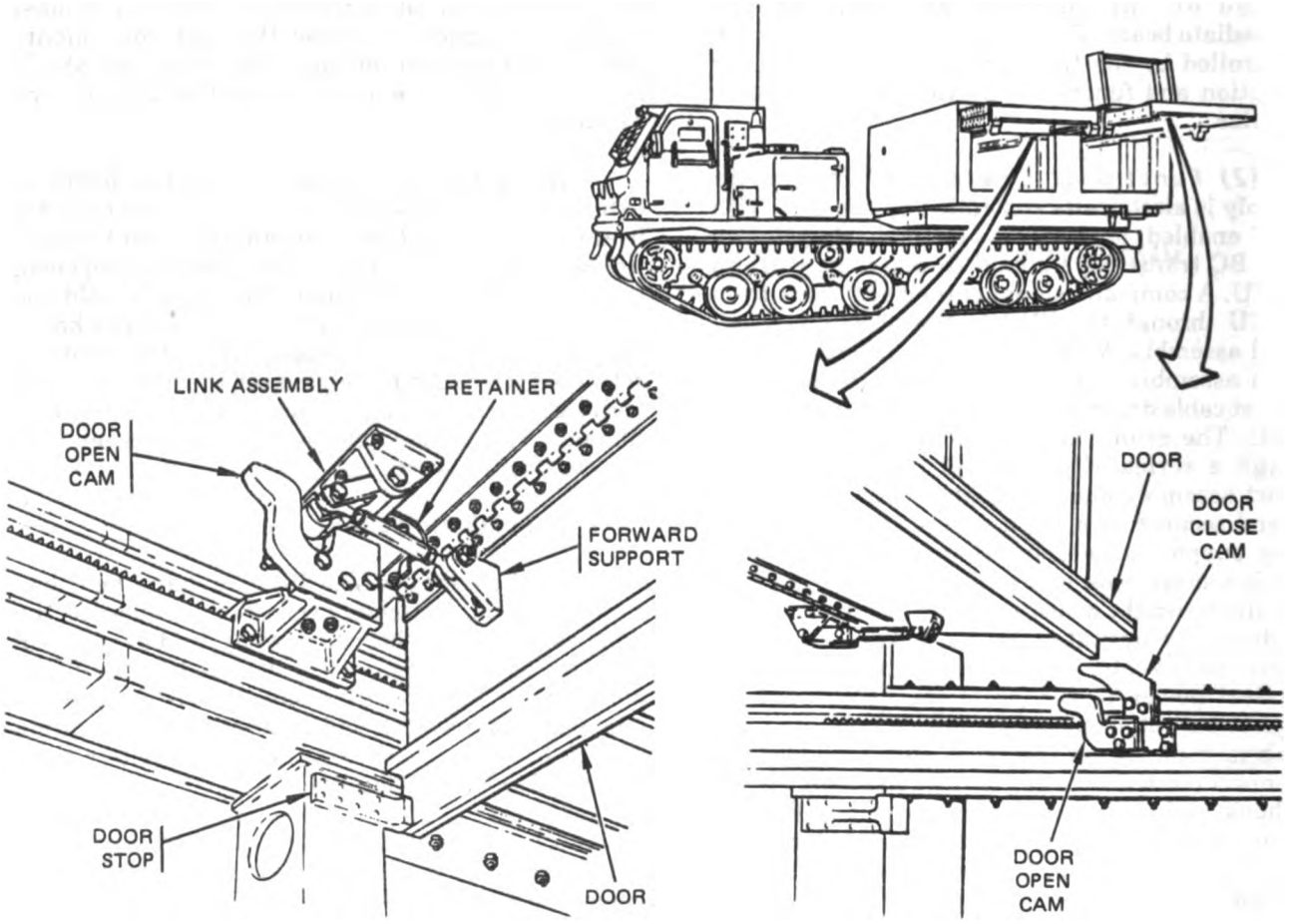


Figure 2-11. Blast Shield Mechanism

2-7. MECHANICAL SYSTEM THEORY OF OPERATION (CONT)

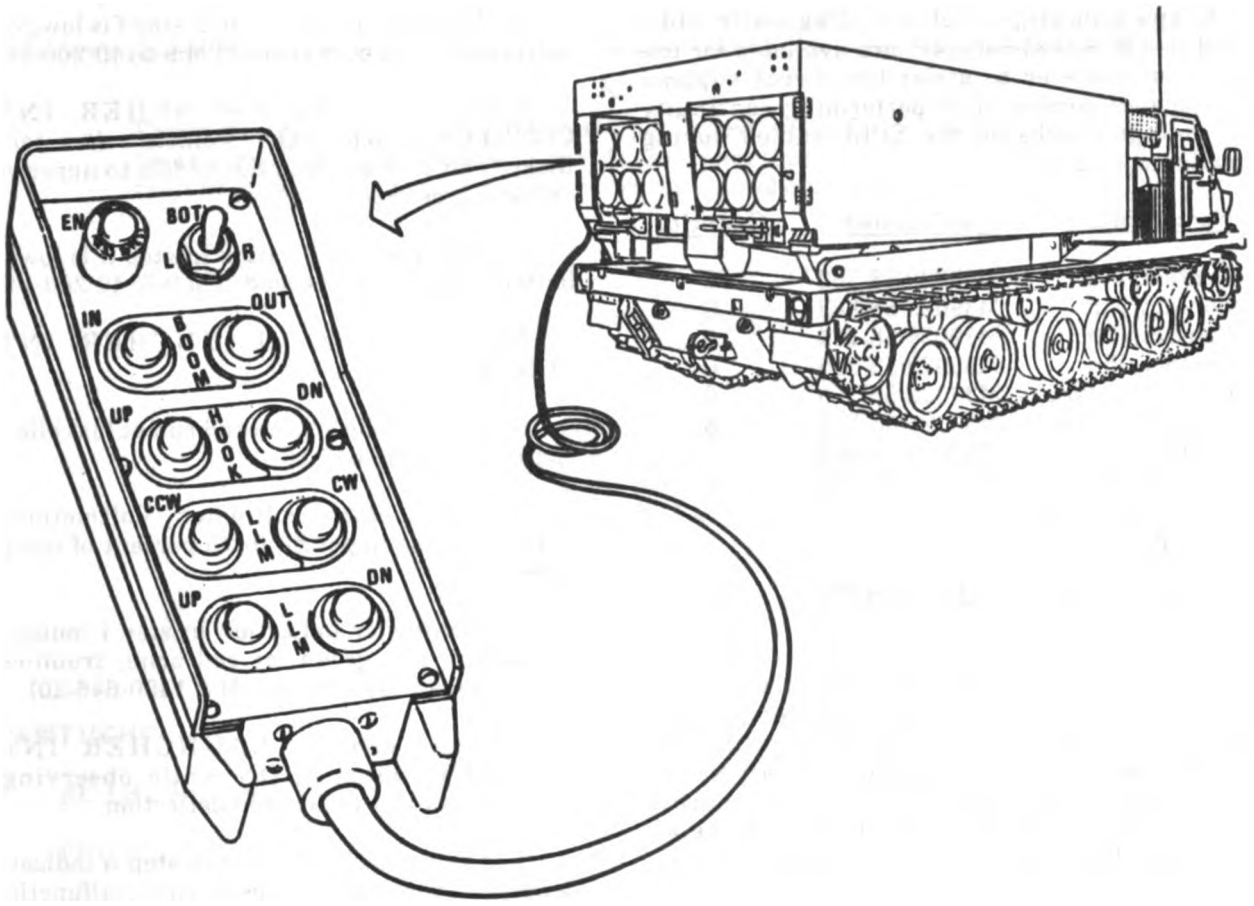


Figure 2-12. Boom Controller

Section III. TROUBLESHOOTING

2-8. SYMPTOM INDEX. The symptom index, table 2-1, lists the symptoms that may be observed during SPLL operation. Some of the symptoms listed are fault messages and BIT indications that appear on the FCP in the event of a malfunction during operation. These symptoms are printed in capital letters for easy recognition. Most symptoms have other possibilities listed under them to further isolate the malfunction. Each symptom has a malfunction number that is listed within troubleshooting table 2-2 where procedures to isolate the malfunction can be found.

2-9. TROUBLESHOOTING. Troubleshooting procedures are in table 2-2. Each troubleshooting procedure is a continuation of the organizational maintenance troubleshooting procedures. Before starting a troubleshooting procedure, verify that organizational maintenance has performed the troubleshooting procedure contained in TM 9-1425-646-20 for that malfunction.

a. Each troubleshooting procedure has been taken to a logical conclusion to rectify the malfunction. If the malfunction still exists, the repairer should reevaluate the malfunction procedure to verify that the line replacement unit (LRU) was serviceable, electrical cables are properly connected, and the procedure was correctly completed. The schematics, FO-1 through FO-12, should also be used to assist in rectifying a malfunction.

2-9. TROUBLESHOOTING (CONT)

b. The following electrical diagnostic aids, listed in TM 9-1425-646-34P, are available for use with a multimeter to assist the direct support maintenance personnel in performing continuity and voltage checks on the SPLL cables during troubleshooting.

Nomenclature	Part Number	Quantity
Contact, Pin	M39029/58-362	6
Contact, Pin	M39029/58-363	6
Contact, Pin	M39029/58-364	6
Contact, Pin	M39029/58-365	6
Contact, Socket	M39029/56-350	6
Contact, Socket	M39029/56-351	6
Contact, Socket	M39029/56-352	6
Contact, Socket	M39029/56-353	6
Insulated Alligator Clip Lead (ITT Pomona Electronics)	ALB24BLACK	2

c. During troubleshooting, check electrical cables for loose or broken connectors before replacing a component. When performing the troubleshooting procedures, observe all safety precautions and always take all possible precautions to work safely. Read and observe all warnings listed in the front of this manual.

d. Refer to figures FO-1 through FO-4 for electrical wiring diagrams, figure FO-5 for electrical interconnect cabling diagram, figure FO-6 for hydraulic schematic diagram, and figures FO-7 through FO-12 for simplified electrical functional schematics.

2-10. POWER INDICATION CHECK BEFORE TROUBLESHOOTING.

a. Shut down vehicle engine if running.

b. Place FCP SYS PWR switch to OFF.

c. Place vehicle LAUNCHER INTERCONNECT switch to OFF.

d. Place vehicle MASTER switch to OFF.

e. Place vehicle MASTER switch to ON.

f. Check vehicle voltmeter. Voltmeter shall indicate in the middle to upper yellow or lower green zone.

g. If voltmeter indication in step f is low, vehicle batteries should be checked (TM 9-6140-200-14).

h. Place vehicle LAUNCHER INTERCONNECT switch to ON. Vehicle voltmeter may flicker and then settle in the middle to upper yellow or lower green zone.

i. If voltmeter indication in step h is low, LLM batteries should be checked (TM 9-6140-200-14).

j. Place vehicle LAUNCHER INTERCONNECT switch to OFF.

k. Start vehicle engine and run at fast idle (1500 rpm) (TM 9-1450-646-10).

l. Check vehicle voltmeter. Voltmeter shall indicate in the upper 50 to 75 percent of the green zone.

m. If voltmeter indication in step l indicates in the yellow, low green, or red zone, troubleshoot vehicle generator system (TM 9-1450-646-20).

n. Place vehicle LAUNCHER INTERCONNECT switch to ON while observing the vehicle voltmeter for a slight deflection.

o. If voltmeter indication in step n indicates no deflection, perform troubleshooting malfunction 56. If voltmeter indicates in the yellow, low green, or red zone, troubleshoot vehicle generator system (TM 9-1450-646-20).

p. Place FCP SYS PWR switch to ON. Vehicle voltmeter should remain in the upper 50 to 75 percent of the green zone.

q. If voltmeter indication in step p indicates in the yellow, low green, or red zone, troubleshoot vehicle generator system (TM 9-1450-646-20).

r. Enable BC and press LLM L or R switch. Observe voltmeter. Voltmeter shall remain within yellow band. If voltmeter drops into red band, perform battery maintenance (TM 9-6140-200-14). If batteries check good, troubleshoot vehicle generating system (TM 9-1450-646-20).

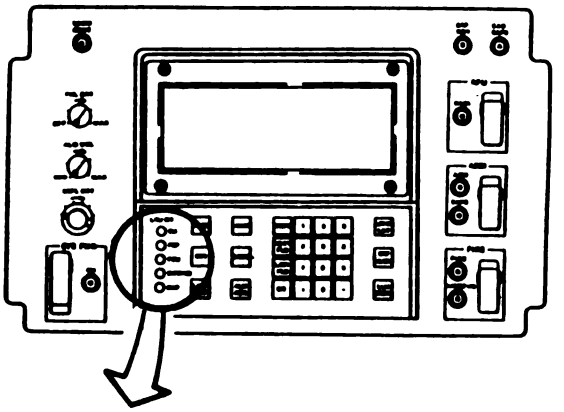
s. If the power indication check is good, troubleshooting a malfunction can begin. Leave vehicle running or use external power source with LAUNCHER INTERCONNECT switch on while troubleshooting unless otherwise directed.

Table 2-1. Symptom Index

MALFUNCTION NO.	TROUBLESHOOTING PROCEDURE PAGE

NOTE

Power indication check should always be performed only before electrical troubleshooting begins. This will provide assurance that the failures (BIT lights, fault messages, and other symptoms) were not caused by inadequate power.

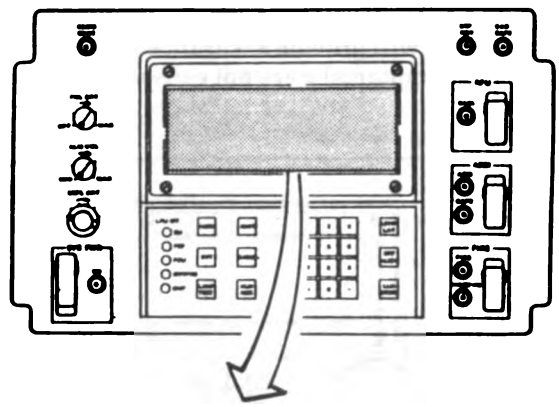


LRU BIT LIGHT

1. EU LRU BIT LIGHT ON 2-34
2. FCU LRU BIT LIGHT ON 2-36
3. SRP/PDS LRU BIT LIGHT ON 2-38
4. CMP LRU BIT LIGHT ON 2-40

Table 2-1. Symptom Index – Continued

MALFUNCTION NO.	TROUBLESHOOTING PROCEDURE PAGE



FAULT MESSAGE

5. BATTERY BOX FAILURE (This message will be displayed on FCP if the FCS (EU) receives a signal from the electronics box indicating a battery undervoltage or overvoltage condition.) 2-42

6. COMMS CONTROLLER FAILURE (This message will be displayed on FCP if the automatic built-in test for the comms controller CCA in EU detects a failure.) 2-43

7. COMMS PROCESSOR FAILURE (This message will be displayed on FCP if the BITE status discrete from the Comms Processor indicates a failure.) . . . 2-44

8. EU CANNOT SEND MESSAGE TO CMP (This message will be displayed on FCP if the interface data controller cannot communicate with the comms controller or if the comms controller cannot communicate with the comms processor.) 2-45

9. FILTER IS CLOGGED (This message will be displayed on FCP if the LDS is on and three consecutive readings indicate the differential pressure across either of the two filters on the LDS hydraulic power supply is too great.) 2-46

10. FLUID OVER TEMPERATURE (This message will be displayed on FCP if the LDS is on and three consecutive readings of the fluid temperature sensor on the LDS hydraulic power supply indicate that the hydraulic fluid is too hot.). 2-50

11. FUZE SETTER MALFUNCTION (This message will be displayed on FCP if the event initiated built-in test indicates that both fuze setter circuit card assemblies (CCAs) in FCU are faulty. This test is performed at the beginning of each fire mission.) 2-53

12. FUZE SETTER 1 BAD (This message will be displayed on FCP if the event initiated built-in test indicates that the fuze setter CCA in FCU for LP/C 1 is faulty. This test is performed at the beginning of each fire mission.) 2-53

Table 2-1. Symptom Index – Continued

MALFUNCTION NO.		TROUBLESHOOTING PROCEDURE PAGE
FAULT MESSAGE (CONT)		
13.	FUZE SETTER 2 BAD (This message will be displayed on FCP if the event initiated built-in test indicates that the fuze setter CCA in FCU for LP/C 2 is faulty. This test is performed at the beginning of each fire mission.)	2-54
14.	HARDWARE FAILURE – ILLEGAL KEYBOARD CODE (This message will be displayed on FCP if an interrupt is generated from the keyboard and the code for the key pressed is not one which can be recognized as valid.)	2-55
15.	LDS MALFUNCTION (This message will be displayed on FCP if built-in test on LDS interface CCA in FCU indicates a failure. This built-in test is performed prior to power being applied to LDS motor each time the motor is to be turned on.)	2-57
	LLM POSITION FAILURE (THIS MESSAGE WILL ONLY APPEAR DURING A FIRE MISSION) (This message will be displayed on FCP if the LLM does not reach the first aimpoint within 2 minutes of leaving the stowed position or does not reach the next aimpoint within 1 minute of leaving the previous aimpoint. This may be caused by either an elevation or azimuth mode malfunction. Fault isolation should always begin with elevation mode. When it is determined that the elevation mode is correct, fault isolate the azimuth mode.)	
16.	ELEVATION MODE	2-58
17.	AZIMUTH MODE	2-64
18.	LOW FLUID (This message will be displayed on FCP if the LDS is on and three consecutive readings of the fluid level indicate low fluid.)	2-67
19.	LP/C 1 INTERFACE TEST BAD – REPLACE FCU (This message will be displayed on FCP if the built-in test on the LP/C interface CCA in FCU for LP/C 1 indicates that more than one rocket is selected by the rocket selection relay matrix. This test is performed before each rocket is fired.)	2-69
20.	LP/C 2 INTERFACE TEST BAD – REPLACE FCU (This message will be displayed on FCP if the built-in test on the LP/C interface CCA in FCU for LP/C 2 indicates that more than one rocket is selected by the rocket selection relay matrix. The test is performed before each rocket is fired.)	2-69
21.	MINE SETTER MALFUNCTION (This message will be displayed on FCP if the built-in test on both mine setter interface CCAs in FCU indicates a failure.)	2-70
22.	MINE SETTER 1 BAD (This message will be displayed on FCP if the built-in test on the mine setter interface CCA for LP/C 1 in FCU indicates a failure.)	2-70
23.	MINE SETTER 2 BAD (This message will be displayed on FCP if the built-in test on the mine setter interface CCA for LP/C 2 in FCU indicates a failure.)	2-70

Table 2-1. Symptom Index – Continued

MALFUNCTION NO.	TROUBLESHOOTING PROCEDURE PAGE
FAULT MESSAGE (CONT)	
24. MOTOR OVER TEMPERATURE (This message will be displayed on FCP if, while the LDS is on, three consecutive readings of a motor overtemperature condition are monitored.)	2-70
25. PDS DATA BAD (This message will be displayed on FCP if the PDS data across the UART interface contains an error in three consecutive transmissions of any block of data.)	2-73
26. PUMP PRESSURE IS LOW (This message will be displayed on FCP if, while the LDS is on, the FCS monitors three consecutive readings of low pump pressure.)	2-75
27. RESOLVERS NOT INITIALIZED WITHIN BOUNDS (This message will be displayed on FCP if the resolvers do not read 0 (±5) mils when LCHR LAY is pressed.)	2-77
28. SQUIB DRIVER MALFUNCTION (This message will be displayed on FCP if the built-in test indicates that both squib drivers in FCU are faulty (two consecutive misfires occur).)	2-77
29. SQUIB DRIVER 1 BAD (This message will be displayed on FCP if the built-in test on the squib driver in FCU for LP/C 1 indicates a failure. This test is performed before each rocket is fired.)	2-78
30. SQUIB DRIVER 2 BAD (This message will be displayed on FCP if the built-in test on the squib driver in FCU for LP/C 2 indicates a failure. This test is performed before each rocket is fired.)	2-79
31. SRP/PDS MALFUNCTION (This message will be displayed on FCP, if the built-in test status discrete from the SRP/PDS indicates a failure, if the SRP fails to align within 8 minutes, or if the SRP fails to realign within 2 minutes 30 seconds.)	2-80
32. SRP/RESOLVER TEST BAD (This message will be displayed on FCP if the SRP data is not within 5 degrees of the resolver data. This comparison is made prior to firing each rocket.)	2-81
33. V24 INTERFACE TEST BAD (This message will be displayed on FCP if the V24 interface test fails when EXEC is pressed the first time after FCS power is turned on and the operator goes through comms startup.)	2-83
34. BOOMS EXTENDED – STOW ILLEGAL	2-83
35. STOW PRESSURE FAILURE (This message will be displayed on FCP if the hydraulic pressure switch indicates high pressure after the command has been issued to go low pressure while stowing.)	2-84
36. UNABLE TO STOW LLM (This message will be displayed on FCP when LLM STOW is pressed and the LLM is not down and travel locks are not locked within 20 seconds after LLM reaches 12 mils in elevation.)	2-87

Table 2-1. Symptom Index – Continued

MALFUNCTION NO.		TROUBLESHOOTING PROCEDURE PAGE
	SYMPTOM	
	BOOM CONTROLLER	
37.	BC ENABLE LIGHT DOES NOT COME ON	2-91
38.	BC WILL NOT MOVE LLM CW/CCW	2-93
39.	BC WILL NOT MOVE LLM UP OR DN	2-95
	BOOM	
40.	BOOM COAST TO A STOP (The boom coasts to a stop when finger is removed from the BC switch.)	2-97
41.	BOOM OPERATION IS ERRATIC (Boom movement is not smooth but jumps and hesitates as it moves.)	2-97
42.	LEFT OR RIGHT BOOM WILL NOT EXTEND	2-97
43.	LEFT OR RIGHT BOOM WILL NOT RETRACT	2-106
	ELECTRICAL AND COMMUNICATIONS	
44.	AUDIBLE ALARM AND KEYBOARD BEEP DO NOT SOUND IN HEADSET	2-113
45.	AUDIBLE ALARM NOT OPERATING	2-114
46.	COMMUNICATIONS COMPLETELY INOPERATIVE	2-116
47.	ELECTRICAL CABLES DAMAGED	2-116
48.	SYSTEM POWER WILL NOT TURN ON	2-116
	FIRE CONTROL PANEL	
49.	ALL FCP INDICATOR LIGHTS INOPERATIVE	2-122
50.	ARM LIGHT WILL NOT COME ON	2-125
51.	CAB SAFE LIGHT WILL NOT COME ON	2-125
52.	CMP BIT LIGHT WILL NOT COME ON	2-126
53.	EU BIT LIGHT WILL NOT COME ON	2-127
54.	FCP BOOM CONT LIGHT WILL NOT COME ON	2-128
55.	FCP ELAPSE TIME INDICATOR INOPERATIVE	2-128
56.	FCP GOES BLANK DURING OPERATION	2-130

Table 2-1. Symptom Index – Continued

MALFUNCTION NO.		TROUBLESHOOTING PROCEDURE PAGE
SYMPTOM (CONT)		
57.	FCU BIT LIGHT WILL NOT COME ON	2-131
58.	FIRE LIGHT WILL NOT COME ON	2-132
59.	HANGFIRE LIGHT WILL NOT COME ON	2-132
60.	KYBD FUNCTIONS INOPERATIVE	2-133
61.	PLASMA DISPLAY FUNCTIONS INOPERATIVE	2-134
62.	SAFE LIGHT WILL NOT COME ON	2-136
63.	SRP/PDS BIT LIGHT WILL NOT COME ON	2-137
64.	SRP RDY LIGHT WILL NOT COME ON	2-138
HOIST		
65.	HOIST CABLE ASSEMBLY DAMAGED	2-138
66.	LEFT OR RIGHT HOIST WILL NOT LOWER	2-139
67.	LEFT OR RIGHT HOIST WILL NOT RAISE	2-145
LAUNCHER DRIVE SYSTEM		
68.	HEAT EXCHANGER CLOGGED	2-150
69.	LDS PUMP MOTOR HAS SHUT OFF AND WILL NOT TURN BACK ON	2-151
70.	STOW DISCONTINUED AT 35-MIL ELEVATION	2-157
71.	DURING A FIRE MISSION, THE LDS SHUTS OFF BEFORE CAGE ELEVATES TO CLEAR CAB (PUMP PRESSURE LOW message may be displayed.)	2-158
LIMIT SWITCHES		
	NOTE The limit switch troubleshooting procedure is used to correct a malfunction noted during organizational maintenance annual preventive maintenance checks and services (PMCS).	
72.	AZIMUTH CENTERING SWITCH (+1.25 DEGREE) DEFECTIVE	2-158
73.	AZIMUTH CENTERING SWITCH (–1.25 DEGREE) DEFECTIVE	2-158
74.	AZIMUTH TRANSDUCER/SWITCH LIMIT FOR MAXIMUM TRAVEL TO THE RIGHT DEFECTIVE	2-158
75.	AZIMUTH TRANSDUCER/SWITCH LIMIT FOR MAXIMUM TRAVEL TO THE LEFT DEFECTIVE	2-158

Table 2-1. Symptom Index – Continued

MALFUNCTION NO.		TROUBLESHOOTING PROCEDURE PAGE
SYMPTOM (CONT)		
76.	AZIMUTH TRANSDUCER/SWITCH AT +1340 MIL AZIMUTH AND 36-MIL ELEVATION DEFECTIVE	2-158
77.	AZIMUTH TRANSDUCER/SWITCH AT −1340 MIL AZIMUTH AND 36-MIL ELEVATION DEFECTIVE	2-159
78.	ELEVATION ACTUATOR SWITCH AT MAXIMUM ELEVATION DEFECTIVE	2-159
79.	27-DEGREE (480-MIL) SWITCH LIMIT FOR MAXIMUM ELEVATION AT +3200 MIL AZIMUTH DEFECTIVE	2-159
80.	27-DEGREE (480-MIL) SWITCH LIMIT FOR MAXIMUM ELEVATION AT −3200 MIL AZIMUTH DEFECTIVE	2-159
81.	+15 DEGREE (267-MIL) SWITCH AT 302-MIL ELEVATION AND +200 MIL AZIMUTH DEFECTIVE	2-159
82.	+15 DEGREE (267-MIL) SWITCH AT 302-MIL ELEVATION AND −200 MIL AZIMUTH DEFECTIVE	2-159
83.	27-DEGREE (480-MIL) SWITCH AT +1860 MIL AZIMUTH AND 510-MIL ELEVATION DEFECTIVE	2-159
84.	27-DEGREE (480-MIL) SWITCH AT −1860 MIL AZIMUTH AND 510-MIL ELEVATION DEFECTIVE	2-160
LAUNCHER LOADER MODULE		
85.	ABLATIVE MATERIAL DAMAGE	2-160
86.	AZIMUTH OR ELEVATION MOVEMENT ERRATIC (Elevation or azimuth movement of LLM is not smooth but jumps and hesitates as it moves.)	2-160
87.	BLAST SHIELD DOOR DOES NOT CLOSE PROPERLY	2-160
88.	LLM AZIMUTH FAILURE (LDS comes on but LLM moves slowly in azimuth.)	2-161
89.	LLM CANNOT BE ELEVATED MANUALLY	2-161
90.	LLM CANNOT BE ROTATED MANUALLY IN AZIMUTH	2-162
91.	LLM DOES NOT STOW (LLM STOWED display appears on FCP. The resolver indications do not show that the LLM has stowed.)	2-162
92.	LLM ELEVATION FAILURE (LDS comes on but LLM moves slowly in elevation.)	2-162
93.	LLM REMAINS STRESSED AFTER STOW	2-163
94.	LLM WILL NOT MOVE (See figure 2-13.)	2-163

Table 2-1. Symptom Index – Continued

MALFUNCTION NO.	TROUBLESHOOTING PROCEDURE PAGE
SYMPTOM (CONT)	
95. LOAD TEST OUTDATED	2-163
96. LP/C LATCH MECHANISM DOES NOT ENGAGE PROPERLY	2-164
POSITION DETERMINING SYSTEM	
97. PDS CALIBRATION VALUES ARE NOT WITHIN LIMITS	2-164
Calibration Value — Limit	
Odometer (encoder) scale factor — 18 710 to 19 222	
Azimuth crab angle — 65 280 to 65 535; 0 to 00 256	
Elevation crab angle — 65 024 to 65 535; 0 to 00 512	
98. SPLL LOCATION ERROR (SPLL location error is more than 60 meters in either Northing, Easting, or Altitude after 6 to 8 kilometers of travel with loaded LP/C.)	2-164
SHORT/NO-VOLTAGE TESTER	
99. SHORT/NO-VOLTAGE TESTER FAILS SELF-TEST	2-164
100. UMBILICAL CABLE FAILS SNVT TEST	2-164
TRAVEL LOCK SYSTEM	
101. TRAVEL LOCK HOOKS DO NOT ENGAGE PROPERLY	2-167
102. TRAVEL LOCK WILL NOT UNLATCH	2-167

2-8. SYMPTOM INDEX (CONT)

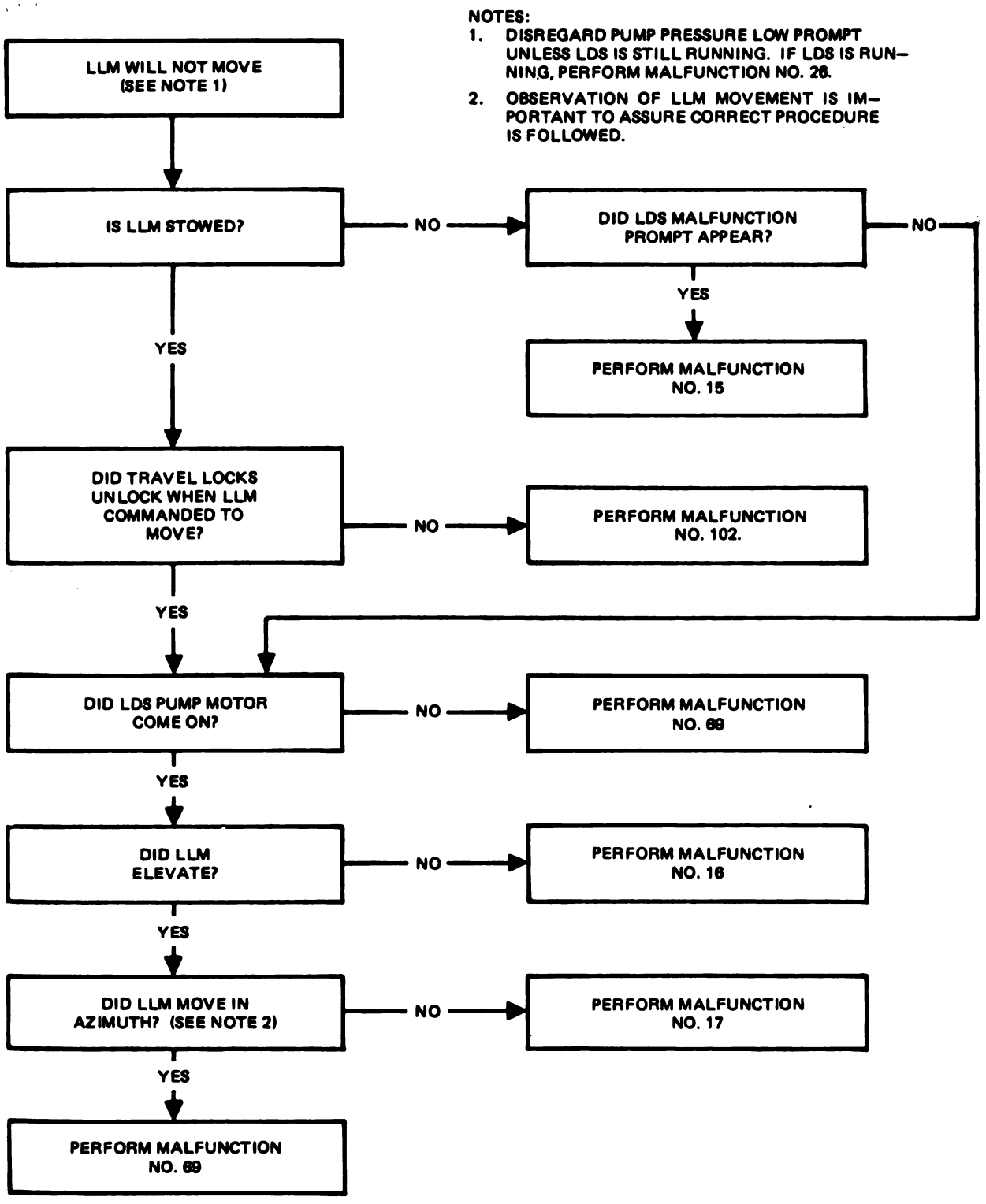


Figure 2-13. LLM Will Not Move Logic Diagram

Table 2-2. Troubleshooting

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

1. EU LRU BIT LIGHT ON

NOTE

A BIT light is properly turned on by a circuitry in the EU applying a ground to the individual ground return line for that BIT light. A BIT light can also be turned on by the ground return line becoming shorted to ground someplace along its length. This condition will cause the BIT light to come on without a failure occurring in the unit the BIT light is monitoring. Steps 1 through 4 are checks for this short to ground condition.

Step 1. Verify system power is off. Disconnect W1P2 from FCP J1. Connect FCP breakout box P1 to FCP J1. Using multimeter, check for continuity between breakout box test points J1-32 and J1-27.

Continuity

Replace FCP (TM 9-1425-646-20).

No continuity

Continue.

Step 2. Connect FCP breakout box to W1P2. Disconnect W59P1 from electronic unit (EU) J1. Using multimeter, check for continuity between breakout box test points J1-32 and J1-27, and then between breakout box test point J1-32 and W1P2 connector shell.

No continuity

Go to step 5.

Continuity

Continue.

Step 3. Tilt carrier cab forward (TM 9-1450-646-10). Disconnect W68P1 from W1J2. Using multimeter, check for continuity between breakout box test points J1-32 and J1-27 and between breakout box test point J1-32 and W1P2 connector shell.

Continuity

Replace cable W1 (paragraph 4-6). Disconnect breakout box.

No continuity

Continue.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

Step 4. Connect W68P1 to W1J2. Disconnect W68J1 from W59P2. Using multimeter, check for continuity between breakout box test points J1-32 and J1-27, and then between breakout box test point J1-32 and W1P2 connector shell.

Continuity

Replace cable W68 (paragraph 4-6). Disconnect breakout box and connect W1P2 to FCP J1.

No continuity

Replace cable W59 (paragraph 4-6). Disconnect breakout box and connect W1P2 to FCP J1.

Step 5. Disconnect W1P1 from FCP J2. Connect W1P1 to breakout box J2. Disconnect W60P2 from EU J2. Using multimeter, check for continuity of the following pins and then check each pin to W1P1 connector shell for infinity. Record any defective indication.

Breakout Box J2	W60P2
14	14
19	19
20	20
22	22
37	37
48	48
50	50
53	53
54	54
55	55
56	56
62	62
63	63

Continuity

Replace EU (TM 9-1425-646-20). Disconnect breakout box. Connect W1P1 to FCP J2.

No continuity

Continue.

Step 6. Disconnect W60P1 from W67J1. Using multimeter, check for continuity between pins and for infinity on pins to connector shell which were found defective in step 5.

Indications correct

Replace cable W60 (paragraph 4-6).

Indications incorrect

Continue.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

Step 7. Connect W60P1 to W67J1. Disconnect W67P1 from W1J1. Using multimeter, check for continuity between pins and for infinity on pins to connector shell which were found defective in step 5.

Indications correct

Replace cable W67 (paragraph 4-6).

Indications incorrect

Replace cable W1 (paragraph 4-6).

2. FCU LRU BIT LIGHT ON

NOTE

A BIT light is properly turned on by a circuitry in the EU applying a ground to the individual ground return line for that BIT light. A BIT light can also be turned on by the ground return line becoming shorted to ground someplace along its length. This condition will cause the BIT light to come on without a failure occurring in the unit the BIT light is monitoring. Steps 1 through 4 are checks for this short to ground condition.

Step 1. Verify system power is off. Disconnect W1P2 from FCP J1. Connect FCP breakout box P1 to FCP J1. Using multimeter, check for continuity between breakout box test points J1-34 and J1-27.

Continuity

Replace FCP (TM 9-1425-646-20).

No continuity

Continue.

Step 2. Connect FCP breakout box to W1P2. Disconnect W59P1 from EU J1. Using multimeter, check for continuity between breakout box test points J1-34 and J1-27, and then between breakout box test point J1-34 and W1P2 connector shell.

No continuity

Go to step 5.

Continuity

Continue.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	Step 3. Tilt vehicle cab forward (TM 9-1450-646-10). Disconnect W68P1 from W1J2. Using multimeter, check for continuity between breakout box test points J1-34 and J1-27, and then between breakout box test point J1-34 and W1P2 connector shell.	
	Continuity	Disconnect breakout box. Replace cable W1 (paragraph 4-6).
	No continuity	Continue.
	Step 4. Connect W68P1 to W1J2. Disconnect W59P2 from W68J1. Using multimeter, check for continuity between breakout box test points J1-34 and J1-27, and then between breakout box test point J1-34 and W1P2 connector shell.	
	Continuity	Replace cable W68 (paragraph 4-6). Disconnect breakout box and connect W1P2 to FCP J1.
	No continuity	Replace cable W59 (paragraph 4-6). Disconnect breakout box and connect W1P2 to FCP J1.
	Step 5. Disconnect breakout box and connect W1P2 to FCP J1. Disconnect W9P1 from EU and W9P2 from FCU. Obtain a good W9 cable assembly. Place cable on vehicle bed under turret along left side of base. Connect cable W9P1 to EU J3 and W9P2 to FCU J7. Turn system power on (TM 9-1425-646-20) and verify correction of malfunction.	
	Malfunction	Remove replacement cable W9, reconnect original cable W9, and then continue.
	No malfunction	Replace cable W9 (paragraph 4-6).

Table 2-2. Troubleshooting - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

Step 6. Disconnect W12P2 from FCU J6 and W12P1 from electronics box (EB) J4. Using multimeter, check for continuity between the following pins:

W12P1	W12P2	W12P1	W12P2
1	1	11	11
2	2	12	12
3	3	13	13
4	4	14	14
5	5	15	15
6	6	16	16
7	7	17	17
8	8	19	18
9	9	20	20
10	10	21	21

No continuity

Replace cable W12 (paragraph 4-6).

Continuity

Replace EU (TM 9-1425-646-20). Connect W12P2 to FCU J6 and W12P1 to EB J4.

3. SRP/PDS LRU BIT LIGHT ON

NOTE

A BIT light is properly turned on by a circuitry in the EU applying a ground to the individual ground return line for that BIT light. A BIT light can also be turned on by the ground return line becoming shorted to ground someplace along its length. This condition will cause the BIT light to come on without a failure occurring in the unit the BIT light is monitoring. Steps 1 through 5 are checks for this short to ground condition.

Step 1. Perform PDS DATA BAD (malfunction 25, step 1).

No fault is detected.

Continue.

Step 2. Verify system power is off. Disconnect W1P2 from FCP J1. Connect FCP breakout box P1 to FCP J1. Using multimeter, check for continuity between breakout box test points J1-31 and J1-27.

Continuity

Replace FCP (TM 9-1425-646-20).

No continuity

Continue.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	Step 3. Connect FCP breakout box to W1P2. Disconnect W59P1 from EU J1. Using multimeter, check for continuity between breakout box test points J1-31 and J1-27, and then between breakout box test point J1-31 and W1P2 connector shell.	
	No continuity	Go to step 6.
	Continuity	Continue.
	Step 4. Tilt vehicle cab forward (TM 9-1450-646-10). Disconnect W68P1 from W1J2. Using multimeter, check for continuity between breakout box test points J1-31 and J1-27, and then between breakout box test point J1-31 and W1P2 connector shell.	
	Continuity	Replace cable W1 (paragraph 4-6). Disconnect breakout box.
	No continuity	Continue.
	Step 5. Connect W68P1 to W1J2. Position LLM 1600 mils right or left (TM 9-1425-646-10). Disconnect W59P2 from W68J1. Using multimeter, check for continuity between breakout box test points J1-31 and J1-27, and then between breakout box test point J1-31 and W1P2 connector shell.	
	Continuity	Replace cable W68 (paragraph 4-6). Disconnect breakout box and connect W1P2 to FCP J1.
	No continuity	Replace cable W59 (paragraph 4-6). Disconnect breakout box and connect W1P2 to FCP J1.
	Step 6. Disconnect W9P1 from EU J3 and W9P2 from FCU J7. Place a good W9 cable on vehicle bed under turret on left side of base. Connect W9P1 to EU J3 and W9P2 to FCU J7. Turn system power on and verify correction of malfunction.	
	No malfunction	Replace cable W9 (paragraph 4-6).
	Malfunction	Remove replacement cable W9, reconnect original cable W9, and then continue.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

Step 7. Disconnect breakout box and connect W1P2 to FCP J1. Disconnect W15P2 from SRP/PDS and W15P1 from FCU. Using multimeter, check for continuity between P1 and P2 as follows:

P1 to P2		P1 to P2	
A	A	H	H
B	B	C	C
F	F	D	D
Z	Z	E	E
C	C	X	X
B	B	Y	Y
C	C	A	A
E	E	V	V
F	F	R	R
G	G	P	P
H	H		

Continuity

Replace EU (TM 9-1425-646-20). Reconnect W15P2 to J1 on SRP and W15P1 to J5 on FCU.

No continuity

Replace cable W15 (paragraph 4-6).

4. CMP LRU BIT LIGHT ON

NOTE

A BIT light is properly turned on by a circuitry in the EU applying a ground to the individual ground return line for that BIT light. A BIT light can also be turned on by the ground return line becoming shorted to ground someplace along its length. This condition will cause the BIT light to come on without a failure occurring in the unit the BIT light is monitoring. Steps 1 through 4 are checks for this short to ground condition.

Step 1. Verify system power is off. Disconnect W1P2 from FCP J1. Connect FCP breakout box P1 to FCP J1. Using multimeter, check for continuity between breakout box test points J1-45 and J1-27.

Continuity

Replace FCP (TM 9-1425-646-20).

No continuity

Continue.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	Step 2. Connect FCP breakout box to W1P2. Disconnect W59P1 from EU J1. Using multimeter, check for continuity between breakout box test points J1-45 and J1-27, and then between breakout box test point J1-45 and W1P2 connector shell.	
	No continuity	Go to step 5.
	Continuity	Continue.
	Step 3. Tilt carrier cab forward (TM 9-1450-646-10). Disconnect FCP breakout box from FCP. Disconnect W68P1 from W1J2. Using multimeter, check for continuity between breakout box test point J1-45 and J1-27, and then between breakout box test point J1-45 and W1P2 connector shell.	
	Continuity	Replace cable W1 (paragraph 4-6). Disconnect breakout box.
	No continuity	Continue.
	Step 4. Connect W68P1 to W1J2. Disconnect W59P2 from W68J1. Using multimeter, check for continuity between breakout box test points J1-45 and J1-27, and then between breakout box test point J1-45 and W1P2 connector shell.	
	Continuity	Replace cable W68 (paragraph 4-6). Disconnect breakout box and connect W1P2 to FCP J1.
	No continuity	Replace cable W59 (paragraph 4-6). Disconnect breakout box and connect W1P2 to FCP J1.
	Step 5. Disconnect breakout box and connect W1P2 to FCP J1. Disconnect W61P2 from EU J4. Disconnect W4P1 from communication processor. Using multimeter, check for continuity between W61P2 and W4P1 on pins R and S.	
	Continuity	Replace EU (TM 9-1425-646-20). Connect W61P2 to EU J4 and W4P1 to communication processor J1.
	No continuity	Continue.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	Step 6. Disconnect W4P2 from W83J2. Using multimeter, check for continuity between W4P1 and W4P2 on pins R and S.	
	No continuity	Replace cable W4 (paragraph 4-6).
	Continuity	Continue.
	Step 7. Connect W61P2 to EU J4. Disconnect W61P1 from W74J1. Using multimeter, check for continuity between W4P1 and W74J1 on pins R and S.	
	Continuity	Replace cable W61 (paragraph 4-6). Connect W4P1 to communication processor J1.
	No continuity	Continue.
	Step 8. Connect W61P1 to W74J1. Disconnect W74P1 from W83J1. Using multimeter, check for continuity between W4P1 and W83J1 on pins R and S.	
	No continuity	Replace cable W83 (paragraph 4-6). Connect W4P1 to communication processor J1.
	Continuity	Replace cable W74 (paragraph 4-6). Connect W4P1 to communication processor J1.

5. BATTERY BOX FAILURE

NOTE

Perform malfunction 16, step 9 and malfunction 17, step 11 if battery box failure is a frequent problem.

Step 1. Manually position LLM to 3200-mil azimuth and 0-mil elevation.

Step 2. Remove 12 screws and washers securing cover on EB and remove cover.

Step 3. Enable BC (TM 9-1425-646-20).

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

NOTE

Check battery voltage under a loaded condition (raise or lower LLM).

Step 4. Using multimeter, check for 17 to 28 V dc between positive bus bar E6 and return bus bar E1 in electronics box.

Voltage low

Replace or service batteries (TM 9-1425-646-20).

Voltage correct

Continue.

Step 5. Using multimeter, check for 3 to 5 V dc between terminals A6(–) and A7(+) on filter FL3.

Voltage incorrect

Replace EB (paragraph 4-4).

Voltage correct

Continue.

Step 6. Turn system power off. Install EB cover and secure with 12 screws and washers.

Step 7. Disconnect W6P1 from EB J1 and W6P2 from EU J6. Using multimeter, check for continuity between W6P1 and W6P2 on pins 5 and 11.

No continuity

Replace cable W6 (paragraph 4-6).

Continuity

Replace EB (paragraph 4-4). Connect W6P2 to EU J6.

6. COMMS CONTROLLER FAILURE

Step 1. Verify system power is off. Disconnect W4P1 from J1 on communication processor and W4P2 from W83J2. Using multimeter, check for continuity between W4P1 and W4P2 on pins A through J, R, S, X, Y, and Z.

No continuity

Replace cable W4 (paragraph 4-6).

Continuity

Continue.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	Step 2. Connect W4P1 to J1 on communication processor. Disconnect W61P1 from W74J1. Using multimeter, check for continuity between W83J2 and W74J1 on pins A through J, R, S, X, Y, and Z.	
	Continuity	Replace cable W61 (paragraph 4-6). Connect W4P2 to W83J2.
	No continuity	Continue.
	Step 3. Disconnect W74P1 from W83J1. Using multimeter, check for continuity between W83J2 and W83J1 on pins A through J, R, S, X, Y, and Z.	
	Continuity	Replace cable W74 (paragraph 4-6). Connect W4P2 to W83J2.
	No continuity	Replace cable W83 (paragraph 4-6). Connect W61P1 to W74J1.
7. COMMS PROCESSOR FAILURE		
	Step 1. Disconnect W40P2 from EB J2. Turn system power on. Using multimeter, check for 21 to 28 V dc on EB test connector J2-A(+) and J2-B(–).	
	Voltage incorrect	Replace EB (paragraph 4-4).
	Voltage correct	Continue.
	Step 2. Disconnect cable W84P2 at communication processor. Using multimeter, check for 21 to 28 V dc at connector W84P2 pins A(+) and B(–).	
	Voltage correct	Troubleshooting communication controller (TM 9-1425-646-20).
	Voltage incorrect	Continue.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

Step 3. Shut down system power. Connect W40P2 to EB J2. Disconnect W40P1 from W41J1. Using multimeter, check for continuity between W84P2 and W41J1 on pins A and B.

Continuity

Replace cable W40 (paragraph 4-6). Reconnect W84P2 to communication processor J2.

No continuity

Continue.

Step 4. Reconnect W40P1 to W41J1. Disconnect W84P1 from W82J1. Using multimeter, check for continuity between W84P2 and W84P1 on pins A and B.

No continuity

Replace cable W84 (paragraph 4-6).

Continuity

Continue.

Step 5. Connect W84P2 to communication processor J2. Disconnect W41P1 from W82J2. Using multimeter, check for continuity between W82J1 and W82J2 on pins A and B.

Continuity

Replace cable W41 (paragraph 4-6). Connect W84P1 to W82J1.

No continuity

Replace cable W82 (paragraph 4-6).

8. EU CANNOT SEND MESSAGE TO CMP

Step 1. Verify system power is off. Disconnect W4P1 from J1 on communication processor (CMP) and W61P2 from J4 on EU. Using multimeter, check for continuity between W4P1 pin Y and W61P2 pin Y. Then check continuity between W4P1 pin Z and W61P2 pin Z.

Continuity

Troubleshoot communications system (TM 9-7440-648-12). Connect W4P1 to J1 on CMP and W61P2 to J4 on EU.

No continuity

Continue.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	Step 2. Disconnect W4P2 from W83J2. Using multimeter, check for continuity between W4P1 and W4P2 on pins Y and Z.	
	No continuity	Replace cable W4 (paragraph 4-6).
	Continuity	Continue.
	Step 3. Connect W4P1 to J1 on CMP. Disconnect W74P1 from W83J1. Using multimeter, check for continuity between W83J2 and W83J1 on pins Y and Z.	
	No continuity	Replace cable W83 (paragraph 4-6).
	Continuity	Continue.
	Step 4. Connect W83J1 to W74P1. Disconnect W61P1 from W74J1. Using multimeter, check for continuity between W83J2 and W74J1 on pins Y and Z.	
	No continuity	Replace cable W74 (paragraph 4-6). Connect W83J2 to W4P2.
	Continuity	Replace cable W61 (paragraph 4-6). Connect W83J2 to W4P2.
9. FILTER IS CLOGGED		
	Step 1. Verify system power is off. Check hydraulic power supply pressure filter indicator button.	
	Indicator button in	Go to step 4.
	Indicator out	Continue.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

Step 2. Remove filter bowl from hydraulic power supply pressure filter. Check for contamination. Light contamination is defined as no discernible particles seen on filter and just visible silting with or without evidence of bronze. Heavy contamination is defined as particles on filter or within bowl, bronze contamination present or not.

Light contamination

Replace filter assembly (paragraph 6-5).

Heavy contamination (bronze present)

Replace hydraulic pump (paragraph 6-5).

Heavy contamination (bronze not present)

Continue.

WARNING

The pressure lines may extend when pressurized with one end disconnected. Care should be taken when checking pressure within turret.

Step 3. Replace filter assembly (paragraph 6-5). Install pressure gage on elevation valve module (paragraph 3-13). Disconnect hydraulic pressure line quick-disconnect coupling at azimuth and elevation servomotors. Enable boom controller (TM 9-1425-646-20). While pressing the LLM UP switch on BC, read the hydraulic pressure gage.

Pressure reading not between 20 to 21.3 MPa

Replace hydraulic pump (paragraph 6-5). Remove pressure gage (paragraph 3-13). Connect hydraulic pressure lines to servomotors.

Pressure reading between 20 to 21.3 MPa

Remove pressure gage (paragraph 3-13). Connect hydraulic pressure lines to servomotors.

Step 4. Check the hydraulic power supply return filter indicator button.

Indicator button in

Go to step 6.

Indicator button out

Continue.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	Step 5. Remove filter bowl from hydraulic power supply return filter and check for visible contamination.	
	Minor contamination (silting)	Replace return filter assembly (paragraph 6-5).
	Gross contamination	Replace return and pressure filter assemblies (paragraph 6-5).
	Step 6. Disconnect W23P1 from PDB J4. Connect PDB breakout box to W23P1. Using multimeter, check for continuity between breakout box test points J4-19 and J4-20.	
	Continuity	Go to step 9.
	No continuity	Continue.
	Step 7. Disconnect W34P3 and W34P4 from hydraulic pump. Using multimeter, check for continuity between W34P3-B and W34P4-B.	
	No continuity	Replace cable W34 (paragraph 4-6). Disconnect PDB breakout box and connect W23P1 to PDB J4.
	Continuity	Continue.
	Step 8. Disconnect W34P7. Using multimeter, check for continuity between W34P3-A and W34P7-Z.	
	No continuity	Replace cable W34 (paragraph 4-6). Disconnect PDB breakout box and connect W23P1 to PDB J4.
	Continuity	Continue.

Table 2-2. Troubleshooting - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	Step 9. Connect W34P3 to hydraulic pump. Using multimeter, check for continuity between W34P4-A and W34P7-A.	
	No continuity	Replace cable W54 (paragraph 4-6). Disconnect PDB breakout box and connect W23P1 to PDB J4.
	Continuity	Continue.
	Step 10. Connect W34P4 to hydraulic pump. Using multimeter, check for continuity between W34P7-A and W34P7-Z.	
	No continuity	Replace hydraulic pump (paragraph 6-5). Disconnect PDB breakout box and connect W23P1 to PDB J4. Connect W34P7 to W23J1.
	Continuity	Continue.
	Step 11. Using multimeter, check for continuity between breakout box test point J4-19 and W23J1-Z and between PDB breakout box test point J4-20 and W23J1-A.	
	No continuity	Replace cable W23 (paragraph 4-6).
	Continuity	Continue.
	Step 12. Disconnect PDB breakout box from W23P1 and connect PDB breakout box to PDB J4. Disconnect W24P1 from PDB J1 and connect PDB breakout box to PDB J1. Using multimeter, check for continuity between PDB breakout box test points J4-20 and J1-68 and between test points J4-19 and J1-69.	
	No continuity	Replace PDB (paragraph 4-5).
	Continuity	Continue.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

Step 13. Disconnect PDB breakout box from PDB J4 and connect W23P1 to PDB J4. Connect W24P1 to PDB breakout box J1. Disconnect W24P2 from FCU J2. Using multimeter, check for continuity between PDB breakout box test point J1-68 and W24P2 pin 68, and then between test point J1-69 and W24P2 pin 69.

No continuity

Replace cable W24 (paragraph 4-6).

Continuity

Continue.

Step 14. Disconnect PDB breakout box from PDB and cable W24. Connect W24P1 to PDB J1. Disconnect W9P1 from EU J3 and W9P2 from FCU J7. Place a good W9 cable on vehicle bed under turret on left side of base. Connect W9P1 to EU J3 and W9P2 to FCU J7. Turn system power on and verify correction of malfunction.

No malfunction

Replace cable W9 (paragraph 4-6).

Malfunction

Replace FCU (TM 9-1425-646-20). Remove replacement cable W9 and reconnect original cable W9.

10. FLUID OVER TEMPERATURE

NOTE

Before proceeding, insure that LDS limits of 210 seconds on with a minimum of 30 seconds rest have not been exceeded.

Step 1. Visually inspect heat exchanger air intake for obstructions.

Obstructions

Remove obstructions.

No obstructions

Continue.

NOTE

Before performing step 2, verify LLM is stowed.

Step 2. Disconnect hydraulic pressure line quick-disconnect coupling at azimuth and elevation servomotors. Enable BC (TM 9-1425-646-20). Place hand in front of heat exchanger motor and press boom controller LLM DN switch. Verify heat exchanger motor operates simultaneously with the LDS pump motor and is moving air.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

Heat exchanger motor operating

Proceed to step 4.

Heat exchanger motor not operating

Continue.

Step 3. Shut down BC (TM 9-1425-646-20). Disconnect W38P1 from heat exchanger. Using multimeter, check for continuity between W38P1 pin B and LDS pump motor negative (–) terminal, and between W38P1 pins A and C and pump motor positive (+) terminal.

No continuity

Replace cable W38 (paragraph 4-6). Connect hydraulic pressure lines to azimuth and elevation servomotors.

Continuity

Replace heat exchanger (paragraph 6-4). Connect hydraulic pressure lines to azimuth and elevation servomotors.

Step 4. Connect hydraulic pressure lines to azimuth and elevation servomotors. Shut down BC (TM 9-1425-646-20). Disconnect W34P5 from hydraulic power supply. Using multimeter, check for continuity between pins 3 and 5 of connector J5 on hydraulic power supply.

No continuity

Replace hydraulic pump (paragraph 6-5).

Continuity

Continue.

Step 5. Disconnect W23P1 from PDB J4. Connect PDB breakout box to W23P1. Using multimeter, check for continuity between PDB breakout box test point J4-35 and W34P5-3, and then between PDB breakout box test point J4-36 and W34P5-5.

Continuity

Proceed to step 7.

No continuity

Continue.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
Step 6.	Connect W34P5 to hydraulic power supply J5. Disconnect W34P7 from W23J1. Using multimeter, check for continuity between PDB breakout box test points J4-35 and W23J1-W, and then between test points J34-36 and W23J1-C.	
	Continuity	Replace cable W34 (paragraph 4-6). Disconnect PDB breakout box from W23P1 and connect W23P1 to PDB J4.
	No continuity	Replace cable W23 (paragraph 4-6). Disconnect PDB breakout box from W23P1 and connect W23P1 to PDB J4.
Step 7.	Connect PDB breakout box to PDB J4. Disconnect W24P1 from PDB J1. Connect PDB breakout box to PDB J1. Using multimeter, check for continuity between PDB breakout box test points J4-35 and J1-60, and then between test points J4-36 and J1-59.	
	No continuity	Replace PDB (paragraph 4-5).
	Continuity	Continue.
Step 8.	Connect W23P1 to PDB J4. Disconnect PDB breakout box from PDB J1. Connect W24P1 to PDB breakout box J1. Disconnect W24P2 from FCU. Using multimeter, check for continuity between PDB breakout box test points J1-60 and W24P2-60, and then between breakout box test points J1-59 and W24P2-59.	
	No continuity	Replace cable W24 (paragraph 4-6).
	Continuity	Continue.
Step 9.	Disconnect PDB breakout box and connect W24P1 to PDB J1. Disconnect W9P1 from EU J3 and W9P2 from FCU J7. Place a good W9 cable on vehicle bed under turret on left side of base. Connect W9P1 to EU J3 and W9P2 to FCU J7. Turn system power on and verify correction of malfunction.	
	No malfunction	Replace cable W9 (paragraph 4-6).
	Malfunction	Replace FCU (TM 9-1425-646-20). Remove replacement cable W9 and reconnect original cable W9.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

11. FUZE SETTER MALFUNCTION

Disconnect W9P2 from FCU J7. Disconnect W9P1 from EU J3. Obtain a good W9 cable. Place the good cable on vehicle bed under turret on left side of base. Connect W9P1 to EU J3 and W9P2 to FCU J7. Turn system power on and verify correction of malfunction.

No malfunction

Replace cable W9 (paragraph 4-6).

Malfunction

Replace EU (TM 9-1425-646-20). Remove replacement cable W9 and reconnect original cable W9.

12. FUZE SETTER 1 BAD

Step 1. Verify system power is off. Disconnect W19P2 from the left LP/C J1 or stow connector. Disconnect W19P1 from FCU J4. Using multimeter, check for continuity between W19P1 and W19P2 as follows:

W19P1 Pins	W19P2 Pins	W19P1 Pins	W19P2 Pins
27	21	31	27
30	28	32	26
38	35	42	42
41	43	39	34
44	49	43	39
50	47	45	48
28	20	46	41
29	19	51	40
40	33	52	32

No continuity

Replace cable W19 (paragraph 4-6).

Continuity

Continue.

Step 2. Connect W19P1 to FCU J4 and W19P2 to stow connector. Disconnect W9P2 from FCU J7. Disconnect W9P1 from EU J3. Obtain a good W9 cable. Place on SPLL bed under turret along left side of base. Connect W9P1 to EU J3 and W9P2 to FCU J7. Turn system power on and verify correction of malfunction.

No malfunction

Replace cable W9 (paragraph 4-6).

Malfunction

Replace EU (TM 9-1425-646-20). Remove replacement cable W9 and reconnect original cable W9.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

13. FUZE SETTER 2 BAD

Step 1. Verify system power is off. Disconnect W19P3 from right LP/C J1 or stow connector. Disconnect W19P1 from FCU J4. Using multimeter, check for continuity between W19P1 and W19P3 as follows:

W19P1 Pins	W19P3 Pins	W19P1 Pins	W19P3 Pins
101	21	110	34
106	28	111	33
109	35	113	42
112	43	114	39
116	49	117	48
119	47	118	41
102	20	120	40
103	19	127	32
107	27		

No continuity

Replace W19 cable (paragraph 4-6).

Continuity

Continue.

Step 2. Connect W19P3 to stow connector and W19P1 to FCU J4. Disconnect W9P2 from FCU J7. Disconnect W9P1 from EU J3. Obtain a good W9 cable. Place cable on SPLL bed under turret along left side of base. Connect cable W9P1 to EU J3 and W9P2 to FCU J7. Turn system power on and verify correction of malfunction.

No malfunction

Replace cable W9 (paragraph 4-6).

Malfunction

Replace EU (TM 9-1425-646-20). Remove replacement cable W9 and reconnect original cable W9.

Table 2-2. Troubleshooting - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

14. HARDWARE FAILURE - ILLEGAL KEYBOARD CODE

Step 1. Verify system power is off. Disconnect W60P2 from EU J2. Disconnect W1P1 from FCP J2 and connect FCP breakout box to W1P1. Using multimeter, check for continuity between the following and record failures:

W60P2 Pins	FCP Breakout Box Test Points	W60P2 Pins	FCP Breakout Box Test Points
1	1	35	35
4	4	40	40
5	5	43	43
10	10	44	44
15	15	51	51
16	16	52	52
18	18	58	58
23	23	59	59
24	24	60	60
25	25	61	61
31	31	64	64
34	34		

Continuity

Go to step 4.

No continuity

Continue.

Step 2. Disconnect W60P1 from W67J1. Using multimeter, check for continuity between W67J1 and FCP breakout box test points that failed the continuity check in step 1.

Continuity

Replace cable W60 (paragraph 4-6). Remove breakout box and connect W1P1 to FCP J2.

No continuity

Continue.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

Step 3. Connect W60P2 to EU J2. Disconnect W67P1 from W1J1. Using multimeter, check for continuity between W1J1 and breakout box test points that failed continuity check in step 1.

Continuity

Replace cable W67 (paragraph 4-6). Disconnect FCP breakout box and connect W1P1 to FCP J2.

No continuity

Replace cable W1 (paragraph 4-6). Connect W60P1 to W67J1.

Step 4. Disconnect W1P2 from FCP J1 and connect FCP breakout box to W1P2. Disconnect W59P1 from EU J1. Using multimeter, check for continuity between W59P1 and FCP breakout box J1 test points as follows:

W59P1 Pins	FCP Breakout Box J1 Test Points	W59P1 Pins	FCP Breakout Box J1 Test Points
64	64	83	83
65	65	84	84
66	66	85	85
75	75	92	92
76	76	93	93
18	18	27	27
19	19	31	31
21	21	32	32
22	22	34	34
23	23	45	45
24	24		

Continuity

Replace EU (TM 9-1425-646-20). Disconnect breakout box and connect W1P2 to FCP J1.

No continuity

Continue.

Step 5. Disconnect W59P2 from W68J1. Using multimeter, check for continuity between W68J1 and breakout box test points that failed continuity check in step 4.

Continuity

Replace cable W59 (paragraph 4-6). Disconnect breakout box and connect W1P2 to FCP J1.

No continuity

Continue.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

Step 6. Connect W59P1 to EU J1. Disconnect W68P1 from W1J2. Using multimeter, check for continuity between W1J2 and breakout box test points that failed continuity check in step 4.

Continuity

Replace cable W68 (paragraph 4-6). Disconnect FCP breakout box and connect W1P2 to FCP J1.

No continuity

Replace cable W1 (paragraph 4-6). Connect W59P2 to W68J1.

15. LDS MALFUNCTION

NOTE

Refer to the LLM Will Not Move Logic Diagram (figure 2-13).

The LDS MALFUNCTION message will appear on the FCP if the travel lock actuator fails to unlatch, if the LDS hydraulic pump motor fails to operate, or if the hydraulic pump pressure remains low.

Step 1. Is LLM in the stowed position?

No

Go to step 3.

Yes

Continue.

Step 2. Do the travel lock hooks unlatch when the FCP BC enable or LLM position selections are made?

No

Perform TRAVEL LOCK WILL NOT UNLATCH (malfunction 102).

Yes

Continue.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

Step 3. Does the hydraulic pump motor operate after travel lock actuator unlocks?

No

Perform LDS PUMP MOTOR HAS SHUT OFF AND WILL NOT TURN BACK ON (malfunction 69).

Yes

Continue.

Step 4. Verify hydraulic pump pressure. Turn system power off. Disconnect hydraulic presssure line quick-disconnect couplings at azimuth and elevation servomotors. Enable BC. Install hydraulic pressure gage in elevation module (paragraph 3-13). Press BC LLM UP switch and observe hydraulic pressure gage in the elevation module. Pressure should read 20 to 21.4 MPa. If pressure is low, replace hydraulic power supply (paragraph 6-5).

16. LLM POSITION FAILURE (ELEVATION MODE)

NOTE

Before proceeding, check that SPLL is operating with power interlock switch in ON; battery box failure message did not occur; pump pressure low message did not occur; and LLM has been positioned to stow by crew.

Step 1. Turn on FCS and select resolver readout on the test menu. Display shall indicate + 2 mils to –2 mils.

Display incorrect

Adjust elevation position monitor transducer (paragraph 6-21).

Display correct

Continue.

Step 2. Enable BC (TM 9-1425-646-20) and check that travel lock unlocks and LDS pump motor is operating.

LLM elevates

Turn system power off, and then go to step 12.

LLM will not elevate

Continue.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

WARNING

The pressure lines may extend when pressurized with one end disconnected. Care should be taken when checking pressure lines in base/turret.

Step 3. Turn system power off. Install hydraulic pressure gage (paragraph 3-13). Disconnect the quick-disconnect couplings connecting the two pressure lines to the elevation and azimuth servomotors. Enable BC (TM 9-1425-646-20). While the LLM UP switch is being pressed, read the hydraulic pressure on gage, and check the pressure line to azimuth servomotor. If line is pressurized, the line will be rigid. If line has no pressure, the line will be limp.

No pressure on gage and azimuth pressure line is limp.

Replace relief valve (paragraph 6-9). Connect pressure lines to servomotors. Remove hydraulic pressure gage (paragraph 3-13).

No pressure at gage

Replace pilot-operated valve (paragraph 6-22). Remove hydraulic pressure gage (paragraph 3-13).

Pressure normal at gage and at azimuth servomotor pressure line

Continue.

Step 4. Remove pressure gage (paragraph 3-13). Manually elevate the LLM and check for binding in the mechanical drive.

Binding

Connect pressure lines to azimuth and elevation servomotors, and then go to step 14.

Not binding

Continue.

Step 5. Turn system power off. Manually elevate LLM to about 310 mils and install jury struts. Disconnect W23P1 from PDB J4 and connect PDB breakout box to PDB J4. Connect W23P1 to PDB breakout box J4. Enable BC (TM 9-1425-646-20). While pressing the BC LLM UP switch and using multimeter, check for 0.8 to 1.0 V dc between breakout box test points J4-4(+) and J4-3(–), and then between J4-26(+) and J4-25(–). Release LLM UP switch and press LLM DN switch. With DN switch pressed, repeat voltage check between pins J4-26(–) and J4-25(+), and then between J4-3(+) and J4-4(–). Release DN switch.

Voltage incorrect

Go to step 10.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	Voltage correct	Continue.
Step 6.	Shut down BC. Disconnect W35P4 from the elevation servo valve J1. Using multimeter, check for continuity between W35P4 and PDB breakout box J4 test points as follows: W35P4 Pins — Breakout Box J4 Test Points A — 3 B — 4 C — 25 D — 26	
	Continuity	Go to step 8.
	No continuity	Continue.
Step 7.	Disconnect W23P5 from W35J1. Using multimeter, check for continuity between W23P5 and breakout box J4 test points as follows: W23P5 Pins — Breakout Box J4 Test Points 11 — 3 12 — 4 13 — 25 14 — 26	
	Continuity	Replace cable W35 (paragraph 4-6). Remove PDB breakout box and connect W23P1 to PDB J4. Connect pressure lines to azimuth and elevation servomotors.
	No continuity	Replace cable W23 (paragraph 4-6). Connect W35P5 to elevation servomotors. Connect pressure lines to azimuth and elevation servomotors.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

WARNING

The pressure lines may extend when pressurized with one end disconnected. Care should be taken when checking pressure lines in base/turret.

Step 8. Remove the PDB breakout box and connect W23P1 to PDB-J4. Enable BC (TM 9-1425-646-20). While pressing the LLM UP switch, check the brake line to the transmission brake. If brake is pressurized, the brake line will be rigid. If the line is not pressurized, the line will be limp.

Line not pressurized

Replace shuttle valve (paragraph 6-22) and reconnect pressure lines.

Line pressurized

Continue.

Step 9. Complete the following task to check brake operation. Disconnect the two pressure lines to the elevation and azimuth servomotors. Remove four bolts and washers securing the elevation servomotor to the transmission. Remove servomotor from transmission. Manually elevate the LLM, the manual drive should operate normally indicating the brake is applied. Enable BC (TM 9-1425-646-20). While pressing the LLM UP switch (this applies pressure to the brake; therefore, the brake is released), try to manually elevate the LLM. The handle used to manually elevate the LLM should spin with no or little resistance indicating the brake is released.

Brake releases.

Replace elevation servomotor (paragraph 6-15). Connect pressure line to azimuth servomotor.

Brake fails to release.

Replace elevation transmission (paragraph 6-16). Connect pressure line to azimuth servomotor.

Step 10. Turn system power off. Disconnect W24P1 from PDB J1. Connect PDB breakout box to PDB J1. Connect W24P1 to PDB breakout box J1. Enable BC (TM 9-1425-646-20). Press BC LLM UP switch. Using multimeter, check for 0.8 to 1.0 V dc between breakout box test points J1-56(+) and J1-47(–), and then between J1-48(+) and J1-46(–). Release LLM UP switch and press LLM DN switch. With DN switch pressed, repeat voltage check between pins J1-48(–) and J1-46(+), and then between J1-47(+) and J1-56(–). Release DN switch.

Voltage correct

Replace PDB (paragraph 4-5).

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	Voltage incorrect	Continue.
Step 11. Shut down BC (TM 9-1425-646-20). Disconnect W24P2 from FCU J2. Using multimeter, check for continuity between PDB breakout box J1 test points and W24P2 as follows: W24P2 Pins: 46, 56, 47, 48 Breakout Box J1 Test Points: 46, 56, 47, 48		
	No continuity	Replace cable W24 (paragraph 4-6). Connect pressure lines to azimuth and elevation servomotors. Remove jury struts.
	Continuity	Perform malfunction 39. Disconnect PDB breakout box and connect W24P1 to PDB J1. Connect pressure lines to azimuth and elevation servomotors. Remove jury struts.

WARNING

The pressure lines may extend when pressurized with one end disconnected. Care should be taken when checking pressure lines in base/turret.

Step 12. Turn system power off. Install pressure gage (paragraph 3-13). Disconnect hydraulic pressure line quick-disconnect coupling at azimuth and elevation servomotors. Enable BC (TM 9-1425-646-20). Press BC LLM UP switch and observe hydraulic pressure gage in the elevation module.		
	Pressure low	Replace 4-way, 2-position solenoid valve (paragraph 6-22). Connect hydraulic lines to azimuth and elevation servomotors. Remove pressure gage (paragraph 3-13). Tighten couplings until rocket-lock begins to click, and then turn one-half turn further to insure lock.
	Pressure normal (20.7 MPa)	Continue.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

Step 13. Remove pressure gage (paragraph 3-13). Connect hydraulic lines to azimuth and elevation servomotors. Tighten couplings until ratchet-lock begins to click, and then turn one-half turn further to insure lock. Manually elevate LLM (TM 9-1425-646-10) and check for binding in mechanical drive system.

WARNING

Do not remove elevation system components unless LLM is down or jury struts installed.

Not binding

Replace elevation servomotor (paragraph 6-15).

Binding

Continue.

Step 14. Remove right and left elevation drive propeller shafts (paragraph 6-18). Manually drive the elevation transmission and check for binding of the elevation transmission and the angle drive unit.

Binding

Go to step 16.

Not binding

Continue.

Step 15. Turn the yoke on each actuator support and check for binding.

Binding

Replace elevation actuator (paragraph 6-20).

Step 16. Remove transmission (paragraph 6-16), but leave manual drive connected. Manually drive the transmission and check for binding in the transmission.

Binding

Replace elevation transmission (paragraph 6-16). Reinstall elevation drive propeller shafts and elevation angle drive unit removed in steps 14 and 15.

Not binding

Replace elevation angle drive unit (paragraph 6-19). Reinstall elevation drive propeller shafts removed in step 14.

Table 2-2. Troubleshooting - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

17. LLM POSITION FAILURE (AZIMUTH MODE)

NOTE

Before proceeding, check that SPLL is operating with power interlock switch in ON; battery box failure message did not occur; pump pressure low message did not occur; LDS comes on when BC is enabled in step 3.

Step 1. Is LLM in the stowed position?

No

Go to step 3.

Yes

Continue.

Step 2. Turn FCS on and select RESOLVER READ OUT on test menu. Readout on FCP should read +1.8 to –1.8 mils.

Readout incorrect

Adjust or replace azimuth position transducer switch (paragraph 6-14).

Readout correct

Continue.

Step 3. Enable BC (TM 9-1425-646-20) and check that LDS pump motor is operating. Try to move LLM right and left.

LLM moves

Turn system power off, and then go to step 10.

LLM will not move

Continue.

WARNING

The pressure lines may extend when pressurized with one end disconnected. Care should be taken when checking pressure lines in base/turret.

Step 4. Turn system power off. Install hydraulic pressure gage (paragraph 3-13). Disconnect the two pressure lines to the elevation and azimuth servomotors. Enable BC (TM 9-1425-646-20). While pressing the LLM UP switch, read the hydraulic pressure on the pressure gage and check the pressure line to the azimuth servomotor. If the line is pressurized, the line will be rigid. If the line is not pressurized, the line will be limp.

No pressure at gage and azimuth servomotor pressure line

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

Replace relief valve (paragraph 6-9). Connect pressure lines to servomotors. Remove hydraulic pressure gage (paragraph 3-13).

No pressure at azimuth servomotor pressure line and normal pressure at gage

Replace 2-way, 2-position solenoid valve (paragraph 6-9). Connect pressure lines to servomotors. Remove hydraulic pressure gage (paragraph 3-13).

Pressure at azimuth servomotor pressure line and at gage

Continue.

Step 5. Remove hydraulic pressure gage (paragraph 3-13). Connect pressure lines to azimuth and elevation servomotors. Manually traverse the LLM and check for binding in mechanical drive system.

Binding

Replace azimuth drive speed reducer (paragraph 6-10).

Not binding

Continue.

Step 6. Turn system power off. Disconnect W23P1 from PDB J4 and connect PDB breakout box to PDB J4. Connect W23P1 to PDB breakout box J4. Enable BC (TM 9-1425-646-20).

Press LLM CW switch. Using multimeter, check for 0.5 to 1.0 V dc between breakout box test points J4-27(+) and J4-28(–). Release CW switch and press CCW switch. With CCW switch pressed, repeat voltage check on pins J4-29(+) and J4-30(–).

Voltage incorrect

Go to step 8.

Voltage correct

Continue.

Step 7. Turn system power off. Disconnect W23P3 from azimuth servo valve. Using multimeter, check for continuity between PDB breakout box J4 test points and W23P3 as follows:

W23P3 Pins	PDB Breakout Box J4 Test Points
A	27
B	28
C	29
D	30

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	Continuity	Connect W23P3 to azimuth servo valve, and then go to step 11.
	No continuity	Replace cable W23 (paragraph 4-6).
Step 8.	Turn system power off. Disconnect W24P1 from PDB J1. Connect PDB breakout box to PDB J1. Connect PDB breakout box to PDB J1. Connect W24P1 to PDB breakout box J1. Enable BC (TM 9-1425-646-20). Press BC LLM CW switch. Using multimeter, check for 0.5 to 1.0 V dc between breakout box test points J1-49(+) and J1-50(–). Release LLM CW switch and press LLM CCW switch. Repeat voltage check on pins J1-51(+) and J1-52(–).	
	Voltage correct	Replace PDB (paragraph 4-5).
	Voltage incorrect	Continue.
Step 9.	Shut down BC (TM 9-1425-646-20). Disconnect W24P2 from FCU J2. Using multimeter, check for continuity between PDB breakout box J1 test points and W24P2 as follows:	

W24P2 Pins	Breakout Box J1 Test Points
49	49
50	50
51	51
52	52

	No continuity	Replace cable W24 (paragraph 4-6). Remove breakout box from PDB and connect W23P1 to PDB J4.
	Continuity	Perform BC WILL NOT MOVE LLM CW/CCW (malfunction 38). Remove breakout box from PDB and connect W23P1 to PDB and W24P1 to PDB J1.
Step 10.	Manually rotate LLM (TM 9-1425-646-10) and check for binding in the mechanical drive system.	
	Binding	Replace azimuth drive speed reducer (paragraph 6-10).

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	No Binding	Continue.
	Step 11. Connect W23P1 to PDB-J4. Complete the following to check brake operation. Disconnect the pressure lines to the azimuth and elevation servomotors. Remove the four bolts and washers securing the azimuth servomotor to the azimuth drive speed reducer. Remove the servomotor. Manually traverse the LLM. The manual drive should operate normally indicating the brake is applied. Enable BC (TM 9-1425-646-20). While pressing the LLM UP switch (this applies pressure to brake, releasing the brake), try to manually traverse the LLM. The handle used for manual drive should spin with no or little resistance indicating the brake is released.	
	Brake releases	Replace azimuth servomotor (paragraph 6-8).
	Brake fails to release	Replace azimuth drive speed reducer (paragraph 6-10).
18. LOW FLUID		
	Step 1. Check hydraulic components for leakage.	
	Components leaking	Replace defective components.
	Components not leaking	Continue.
	Step 2. Verify system power is off. Disconnect W23P1 from PDB J4. Connect W23P1 to PDB breakout box J4. Using multimeter, check for continuity between breakout box test points J4-21 and J4-22.	
	Continuity	Go to step 5.
	No continuity	Continue.
	Step 3. Disconnect W34P7 from W23J1. Using multimeter, check for continuity between breakout box test points J4-21 and W23J1-S and J4-22 and W23J1-T.	
	No continuity	Replace cable W23 (paragraph 4-6).
	Continuity	Continue.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
Step 4.	Connect W34P7 to W23J1. Disconnect W34P2 from hydraulic power supply J2. Using multimeter, check for continuity between breakout box test points J4-21 and W34P2-A and J4-22 and W34P2-C.	
	Continuity	Replace hydraulic power supply (paragraph 6-5). Disconnect PDB breakout box and connect W23P1 to PDB J4.
	No continuity	Replace cable W34 (paragraph 4-6). Disconnect PDB breakout box and connect W23P1 to PDB J4.
Step 5.	Connect PDB breakout box to PDB J4. Disconnect W24P1 from PDB J1. Connect breakout box to PDB J1. Using multimeter, check for continuity between breakout box test points J1-62 and J4-21 and J1-61 and J4-22.	
	No continuity	Replace PDB (paragraph 4-5).
	Continuity	Continue.
Step 6.	Connect W24P1 to PDB breakout box J1. Disconnect W24P2 from FCU J2. Using multimeter, check for continuity between breakout box test points J1-61 and W24P2-61 and J1-62 and W24P2-62.	
	No continuity	Replace cable W24 (paragraph 4-6). Remove breakout box and connect W23P1 to PDB J4.
	Continuity	Continue.
Step 7.	Disconnect breakout box and connect W23P1 to PDB J4 and W24P1 to PDB J1. Disconnect W9P1 from EU J3 and W9P2 from FCU J7. Place a good W9 cable on vehicle bed under turret on left side of base. Connect W9P1 to EU J3 and W9P2 to FCU J7. Turn system power on and verify correction of malfunction.	
	No malfunction	Replace cable W9 (paragraph 4-6).
	Malfunction	Replace FCU (TM 9-1425-646-20). Remove replacement cable W9 and reconnect original cable W9.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

19. LP/C 1 INTERFACE TEST BAD – REPLACE FCU

Step 1. Verify system power is off. Disconnect W19P2 from LP/C or stow connector. Disconnect W19P1 from FCU J4. Using multimeter, check for continuity between W19P1 and W19P2 as follows:

W19P1 Pins	W19P2 Pins	W19P1 Pins	W19P2 Pins
7	17	88	38
8	18	91	45
85	23	90	46
84	24	98	51
32	26	99	52
87	30	100	54
86	31	99	55
89	37		

No continuity

Replace cable W19 (paragraph 4-6).

Continuity

Continue.

Step 2. Connect W19 to FCU J4 and stow connector. Disconnect W9P2 from FCU J7 and W9P1 from EU J3. Obtain a good W9 cable and place cable on SPLL bed under turret along left side of base. Connect W9P1 to EU J3 and W9P2 to FCU J7. Turn system power on and verify correction of malfunction

No malfunction

Replace cable W9 (paragraph 4-6).

Malfunction

Replace EU (TM 9-1425-646-20). Remove replacement cable W9. Reconnect W9P2 to FCU J7 and W9P1 to EU J3.

20. LP/C 2 INTERFACE TEST BAD – REPLACE FCU

Step 1. Verify system power is off. Disconnect W19P3 from left LP/C J1 or stow connector, and disconnect W19P1 from FCU J4. Using multimeter, check for continuity between W19P1 and W19P3 as follows:

W19P1 Pins	W19P3 Pins	W19P1 Pins	W19P3 Pins
13	17	48	38
14	18	60	45
12	23	59	46
11	24	96	51
108	26	95	52
81	30	83	54
80	31	22	55
49	37		

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	No continuity	Replace cable W19 (paragraph 4-6).
	Continuity	Continue.
	Step 2. Connect W19 to FCU J4 and stow connector. Disconnect W9P2 from FCU J7 and W9P1 from EU J3. Obtain a good W9 cable and place cable on SPLL bed under turret along left side of base. Connect W9P1 to EU J3 and W9P2 to FCU J7. Turn system power on and verify correction of malfunction.	
	No malfunction	Replace cable W9 (paragraph 4-6).
	Malfunction	Replace EU (TM 9-1425-646-20). Remove replacement cable W9. Reconnect W9P2 to FCU J7 and W9P1 to EU J3.
21. MINE SETTER MALFUNCTION		
	None	Replace cable W20 (paragraph 4-6).
22. MINE SETTER 1 BAD		
	None	Replace cable W20 (paragraph 4-6).
23. MINE SETTER 2 BAD		
	None	Replace cable W20 (paragraph 4-6).
24. MOTOR OVER TEMPERATURE		
	NOTE	
	Before proceeding, insure that LDS limits of 210 seconds on with a minimum of 30 seconds rest have not been exceeded.	
	Step 1. Does MOTOR OVER TEMPERATURE disappear when the motor is allowed to cool and restart?	
	No	Continue.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

Yes

Perform step 2.

Step 2. Verify that system power is off. Disconnect W34P7 from W23J1. Using multimeter, check for continuity between W34P7 pins A and V.

Continuity

Replace hydraulic power supply (paragraph 6-5).

No continuity

Connect W34P7 to W23J1 and continue.

Step 3. Verify that system power is off. Disconnect W23P1 from PDB J4. Connect W23P1 to PDB breakout box J4. Using multimeter, check between PDB breakout box J4 test points as follows:

PDB Breakout Box
J4 Test Points

33 to 37 for continuity
34 to 33 for infinity

Both resistance values correct

Go to step 6.

Either resistance value incorrect

Continue.

Step 4. Disconnect W34P1 from hydraulic power supply motor J1. Using multimeter, check for continuity between PDB breakout box J4 and W34P1 as follows:

J4 to W34P1

37	A
33	B
34	C

Continuity

Replace hydraulic power supply electric motor (paragraph 6-5). Disconnect breakout box and connect W23P1 to PDB J4.

No continuity

Continue.

Table 2-2. Troubleshooting - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	Step 5. Connect W34P1 to hydraulic power supply J1. Disconnect W34P7 from W23J1. Using multimeter, check for continuity between breakout box J4 test points and W23J1 as follows: W23J1 — PDB Breakout Box J4 Test Points U — 37 V — 33 A — 34	
	Continuity	Replace cable W34 (paragraph 4-6). Disconnect PDB breakout box and connect W23P1 to PDB J4.
	No continuity	Replace cable W23 (paragraph 4-6).
	Step 6. Connect PDB breakout box to PDB J4. Disconnect W24P1 from PDB J1 and connect PDB breakout box to PDB J1. Using multimeter, check for continuity between PDB breakout box test points as follows: PDB Breakout Box J1 Test Points — PDB Breakout Box J4 Test Points 43 — 37 42 — 33 44 — 34	
	No continuity	Replace PDB (paragraph 4-5).
	Continuity	Continue.
	Step 7. Connect W24P1 to PDB breakout box J1. Disconnect W24P2 from FCU J2. Using multimeter, check for continuity between PDB breakout box J1 test points and W24P2 as follows: W24P2 Pins — PDB Breakout Box J1 Test Points 42 — 42 43 — 43 44 — 44	

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	No continuity	Replace cable W24 (paragraph 4-6). Disconnect PDB breakout box and connect W23P1 to PDB J4.
	Continuity	Replace FCU (TM 9-1425-646-20). Disconnect PDB breakout box. Connect W23P1 to PDB J4 and W24P1 to PDB J1.

25. PDS DATA BAD

Step 1. Turn system power off. Disconnect encoders from vehicle final drives. Leave cable W80 connected to encoders. Perform startup procedure (TM 9-1425-646-10). Check that SRP RDY light comes on. Using multimeter, check for a digital indication change of approximately 3.5 volts between SRP test connector J3 pins and ground as each encoder is slowly turned by hand. Meter scale is 5 volts dc. See pulse polarity. Record failures.

Encoder No. 1 (Left)		Encoder No. 2 (Right)	
SRP J3 Pin	SRP Ground J3 Pin 2	SRP J3 Pin	SRP Ground J3 Pin 2
15(+)	(–)	16(+)	(–)
17(+)	(–)	18(+)	(–)

All voltage checks fail

Replace cable W15 (paragraph 4-6). Connect encoders to vehicle final drives.

All voltage checks good

Inspect encoder adapters and drive tips for broken or worn condition. Replace if defective. If adapters and drive tips are good, troubleshoot carrier final drive (TM 9-1450-646-20).

One voltage check fails

Continue.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

Step 2. Shut system power off. Disconnect W81P2 from SRP J2. Disconnect W81P1 from W80J1. Using multimeter, check for continuity between left or right connectors as follows:

Encoder No. 1 (Left)		Encoder No. 2 (Right)	
W81P2 Pins	W81P1 Pins	W81P2 Pins	W81P1 Pins
1	1	7	7
15	15	18	18
3	3	9	9
16	16	19	19
5	5	11	11
17	17	20	20

No continuity

Replace cable W81 (paragraph 4-6). Connect encoders to vehicle final drives.

Continuity

Continue.

Step 3. Connect W81P2 to SRP J2. Disconnect W80P1 from No. 1 (left) encoder or W80P2 from No. 2 (right) encoder. Using multimeter, check for continuity between left or right connectors as follows:

Encoder No. 1 (Left)		Encoder No. 2 (Right)	
W80J1 Pins	W80P1 Pins	W80J1 Pins	W80P1 Pins
1	D	7	D
15	F	18	F
3	A	9	A
16	C	19	C
5	B	11	B
17	E	20	E

No continuity

Replace cable W80 (paragraph 4-6).

Continuity

Replace encoder from side of failure indication in step 1 (paragraph 7-5). Connect W81P1 to W80 J1.

Table 2-2. Troubleshooting - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

26. PUMP PRESSURE IS LOW

Step 1. Wait at least 20 seconds, and then turn system power on and enable BC.

LDS does not come on and LDS MALFUNCTION prompt appears.

Perform LDS MALFUNCTION (malfunction 15).

LDS comes on.

Continue.

WARNING

The pressure lines may extend when pressurized with one end disconnected. Care should be taken when checking pressure lines in base/turret.

Step 2. Verify system power is off. Install hydraulic pressure gage (paragraph 3-13). Disconnect hydraulic pressure line quick-disconnect couplings at azimuth and elevation servomotors. Enable BC (TM 9-1425-646-20). Press boom controller LLM UP switch and observe hydraulic pressure gage. Pressure should read 20 to 21.4 MPa (2900 to 3100 psi).

Pressure low

Replace hydraulic power supply (paragraph 6-5). Remove hydraulic pressure gage (paragraph 3-13).

Pressure normal

Continue.

Step 3. Remove hydraulic pressure gage (paragraph 3-13). Shut down BC (TM 9-1425-646-20). Disconnect W34P6 from hydraulic power supply J6. Using multimeter, check for continuity across pins 1 and 3 of J6 on hydraulic power supply.

No continuity

Replace hydraulic pump (paragraph 6-5). Connect hydraulic pressure lines to servomotors.

Continuity

Continue.

Step 4. Connect W34P6 to hydraulic power supply J6. Disconnect W23P1 from PDB J4. Connect W23P1 to PDB breakout box J4. Using multimeter, check for continuity between PDB breakout box test points J4-31 and J4-32.

Continuity

Go to step 6.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	No continuity	
		Continue.
	Step 5. Disconnect W34P7 from W23J1. Using multimeter, check for continuity between PDB breakout box test points J4-31 and W23J1-X, and between breakout box test points J4-32 and W23J1-Y.	
	Continuity	
		Replace cable W34 (paragraph 4-6). Remove breakout box and connect W23P1 to PDB J4.
	No continuity	
		Replace cable W23 (paragraph 4-6).
10 3	Step 6. Disconnect W24P1 from PDB J1. Connect PDB breakout box to PDB J1. Using multimeter, check for continuity between PDB breakout box test points J4-31 and J1-64, and between J4-32 and J1-63.	
	No continuity	
		Replace PDB (paragraph 4-5).
	Continuity	
		Continue.
	Step 7. Connect W23P1 to PDB J4. Connect W24P1 to PDB breakout box J1. Disconnect W24P2 from FCU J2. Using multimeter, check for continuity between PDB breakout box test points J1-64 and W24P2-64, and between breakout box test points J1-63 and W24P2-63.	
	No continuity	
		Replace cable W24 (paragraph 4-6).
	Continuity	
		Continue.
	Step 8. Disconnect breakout box and connect W24P1 to PDB J1. Disconnect W9P1 from EU J3 and W9P2 from FCU J7. Place a good W9 cable on vehicle bed under turret on left side of base. Connect W9P1 to EU J3 and W9P2 to FCU J7. Turn system power on and verify correction of malfunction.	
	No malfunction	
		Replace cable W9 (paragraph 4-6).

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
Malfunction		Replace FCU (TM 9-1425-646-20). Remove replacement cable W9 and reconnect the original cable W9.

27. RESOLVERS NOT INITIALIZED WITHIN BOUNDS

Observe FCP resolver readout indications and perform one or both of the following adjustments as determined necessary from the readout indications.

Adjust azimuth position transducer/switch (paragraph 6-14).

Adjust elevation position monitor transducer (paragraph 6-21).

If malfunction still exists, perform malfunction 32, steps 1 through 4 for azimuth malfunction or steps 5 and 6 for elevation malfunction.

28. SQUIB DRIVER MALFUNCTION

Step 1. Disconnect W19P1 from FCU J4, W19P2 from left LP/C J1, and W19P3 from right LP/C J1. Using multimeter, check for continuity between the following pins.

W19P1	W19P2	W19P1	W19P3
54	1	16	1
55	2	17	2
56	3	18	3
57	7	19	7
61	5	20	5
62	6	21	6
63	8	22	8
64	9	23	9
65	10	33	10
66	11	34	11
67	12	9	12
68	13	10	13
7	17	13	17

No continuity

Replace cable W19 (paragraph 4-6).

Continuity

Continue.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

Step 2. Obtain a good W9 cable. Place cable on carrier bed under turret along left side of base. Connect W9P1 to EU J3 and W9P2 to FCU J7. Turn system power on and verify correction of malfunction.

No malfunction

Replace cable W9 (paragraph 4-6).

Malfunction

Replace EU (TM 9-1425-646-20). Remove replacement cable W9 and reconnect original cable W9.

29. SQUIB DRIVER 1 BAD

Step 1. Disconnect W19P1 from FCU J4 and W19P2 from left LP/C J1. Using multimeter, check for continuity between the following pins.

W19P1	W19P2	W19P1	W19P2
54	1	64	9
55	2	65	10
56	3	66	11
57	7	67	12
61	5	68	13
62	6	7	17
63	8		

No continuity

Replace cable W19 (paragraph 4-6).

Continuity

Continue.

Step 2. Obtain a good W9 cable. Place cable on carrier bed under turret along left side of base. Connect W9P1 to EU J3 and W9P2 to FCU J7. Turn system power on and verify correction of malfunction.

No malfunction

Replace cable W9 (paragraph 4-6).

Malfunction

Replace EU (TM 9-1425-646-20). Remove replacement cable W9 and reconnect original cable W9.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

30. SQUIB DRIVER 2 BAD

Step 1. Disconnect W19P1 from FCU J4 and W19P3 from right LP/C J1. Using multimeter, check for continuity between the following pins.

W19P1	W19P3	W19P1	W19P3
16	1	23	9
17	2	33	10
18	3	34	11
19	7	9	12
20	5	10	13
21	6	13	17
22	8		

No continuity

Replace cable W19 (paragraph 4-6).

Continuity

Continue.

Step 2. Obtain a good W9 cable. Place cable on carrier bed under turret along left side of base. Connect W9P1 to EU J3 and W9P2 to FCU J7. Turn system power on and verify correction of malfunction.

No malfunction

Replace cable W9 (paragraph 4-6).

Malfunction

Replace EU (TM 9-1425-646-20). Remove replacement cable W9 and reconnect original cable W9.

Table 2-2. Troubleshooting - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

31. SRP/PDS MALFUNCTION

NOTE

This procedure assumes that the SRP/PDS was replaced and the fault message still appears.

Step 1. Disconnect W15P1 from FCU J5 and W15P2 from SRP/PDS J1. Using multimeter, check continuity on the following pins.

W15P1	W15P2	W15P1	W15P2	W15P1	W15P2
A	A	Y	Y	U	U
B	B	Z	Z	V	V
C	C	A	A	X	X
D	D	B	B	Y	Y
E	E	C	C	Z	Z
F	F	D	D	BB	BB
G	G	E	E	CC	CC
H	H	F	F	DD	DD
N	N	G	G	EE	EE
P	P	H	H	FF	FF
R	R	K	K	GG	GG
S	S	M	M	LL	LL
T	T	N	N	MM	MM
U	U	P	P	NN	NN
V	V	Q	Q	PP	PP
W	W	R	R		
X	X	S	S		
		T	T		

No continuity

Replace cable W15 (paragraph 4-6).

Continuity

Connect W15P1 to FCU J5 and W15P2 to SRP/PDS J1, and then continue.

Step 2. Disconnect W9P1 from EU J3 and W9P2 from FCU J7. Place a good W9 cable on vehicle bed under turret on left side of base. Connect W9P1 to EU J3 and W9P2 to FCU J7. Turn system power on and verify correction of malfunction.

No malfunction

Replace cable W9 (paragraph 4-6).

Malfunction

Replace FCU (TM 9-1425-646-20). Remove replacement cable W9 and reconnect the original cable W9.

Fault still exists

Replace EU (TM 9-1425-646-20).

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

32. SRP/RESOLVER TEST BAD

Azimuth Checks

Step 1. Check adjustment of azimuth position transducer/switch (paragraph 6-14).

Out of adjustment

Adjust azimuth position transducer/switch (paragraph 6-14).

Unable to adjust

Continue.

Able to adjust

Go go step 5.

Step 2. Verify system power is off. Disconnect W23P7 from azimuth transducer. Disconnect W24P2 from FCU J2. Using multimeter, check for continuity between W24P2 and W23P7 as follows:

W24P2 Pins	W23P7 Pins	W24P2 Pins	W23P7 Pins
86	7	89	13
87	8	84	11
88	9	85	12

Continuity

Replace azimuth transducer/switch (paragraph 6-14). If still unable to adjust transducer/switch, replace FCU (TM 9-1425-646-20).

No continuity

Continue.

Step 3. Disconnect W24P1 from PDB J1 and connect W24P1 to PDB breakout box J1. Connect PDB breakout box to PDB J1. Disconnect W23P1 from PDB J4 and connect W23P1 to PDB breakout box J4. Connect PDB breakout box to PDB J4. Using multimeter, check for continuity between PDB breakout box J1 and J4 test points as follows:

PDB Breakout Box J1 Test Points	PDB Breakout Box J4 Test Points
86	8
87	9
88	10
89	11
84	12
85	13

Table 2-2. Troubleshooting - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	No continuity	Replace PDB (paragraph 4-5).
	Continuity	Continue.
Step 4.	Using multimeter, check for continuity between PDB breakout box J1 test points and W24P2 as follows:	

W24P2 Pins	PDB Breakout Box J1 Test Points
86	86
87	87
88	88
89	89
84	84
85	85

	No continuity	Replace cable W24 (paragraph 4-6). Remove breakout box and connect W23P1 to PDB J4.
	Continuity	Replace cable W23 (paragraph 4-6). Remove breakout box and connect W24P1 to PDB J1 and W24P2 to FCU J2.
Elevation Checks		
Step 5.	Check adjustment of elevation position monitor transducer (paragraph 6-21).	
	Out of adjustment	Adjust elevation position monitor transducer (paragraph 6-21).
	Unable to adjust	Continue.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

Step 6. Verify system power is off. Disconnect W24P3 from the elevation monitor transducer. Disconnect W24P2 from FCU J2. Using multimeter, check for continuity between W24P2 and W24P3 as follows:

W24P2 Pins	W24P3 Pins
90	7
91	8
92	9
93	13
94	11
95	12

No continuity

Replace cable W24 (paragraph 4-6).

Continuity

Replace elevation position monitor transducer (paragraph 6-21). If still unable to adjust transducer, replace FCU (TM 9-1425-646-20).

33. V24 INTERFACE TEST BAD

Troubleshoot COMMS CONTROLLER FAILURE (malfunction 6).

34. BOOMS EXTENDED – STOW ILLEGAL

NOTE

Insure that the SPLL is not positioned on a slope greater than 5 degrees.

Step 1. Perform boom in limit switch adjustment (paragraph 5-12).

Fault still exists

Continue.

Step 2. Disconnect W26P1(L) or W27P1(R) from PDB connector J5(2) or J7(R). Attach PDB breakout box to W26P1/W27P1. Disconnect W26P3 or W27P3 from boom in limit switch. Using multimeter, check for continuity between boom in switch connector and breakout box test points as follows:

Breakout Box	W26P3(L)/W27P3(R)
J5-F	Pin 4
J7-H	Pin 6

No continuity

Replace cable W26(L) or W27(R) (paragraph 4-6).

Continuity

Continue.

Table 2-2. Troubleshooting - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

Step 3. Attach breakout box to PDB connector J5(L) or J7(R). Disconnect W24P1 from PDB connector J1. Attach breakout box to PDB connector J1. Using multimeter, check for continuity between breakout box test points as follows:

J1-17 to J7-H(R)
J1-16 to J5-F(L)
J5-H to J7-F(BOTH)

No continuity

Replace PDB (paragraph 4-5).

Continuity

Continue.

Step 4. Attach W24P1 to breakout box connector J1. Disconnect W24P2 from FCU connector J2. Using multimeter, check for continuity between breakout box J1 test points and W24P2 as follows:

Breakout Box J1 Pins	W24P2 Pins
16	16
17	17

No continuity

Replace cable W24 (paragraph 4-6).

Continuity

Replace FCU (TM 9-1425-646-20).

35. STOW PRESSURE FAILURE

NOTE

Normal stow occurs when hydraulic pressure reduces during stow. This message may occur because of a hydraulic system component failure or a circuit monitoring component failure. Steps 1 through 5 test for hydraulic component failure and steps 6 through 10 test for circuit monitoring component failure. It is generally considered best to begin the fault isolation at step 1.

Step 1. Verify system power is off. Disconnect W23P1 from PDB J4. Connect PDB breakout box to PDB J4. Connect W23P1 to PDB breakout box J4. Enable BC (TM 9-1425-646-20) and position LLM from stow to approximately 100 mils. Press LLM STOW on FCP and using multimeter, check for 21 to 28 V dc between PDB breakout box test points J4-14(+) and J4-15(–) as the LLM stows.

Table 2-2. Troubleshooting – Continued

MALFUNCTION TEST OR INSPECTION	CORRECTIVE ACTION
Voltage incorrect	Go to step 4.
Voltage correct	Continue.
Step 2. Turn system power off. Disconnect W35P6 from 4-way, 2-position solenoid valve. Using multimeter, check for continuity between PDB breakout box test points J4-14 and W35P6-A, and then between test points J4-15 and W35P6-B.	
No continuity	Continue.
Continuity	Replace 4-way, 2-position solenoid valve, pressure reducer valve, and pilot-operated hydraulic valve (paragraph 6-22). Remove breakout box and connect W23P1 to PDB J4.
Step 3. Connect W35P6 to 4-way, 2-position solenoid valve. Disconnect W23P5 from W35J1. Using multimeter, check for continuity between PDB breakout box test points J4-14 and W23P5-1, and then between PDB breakout box test points J4-15 and W23P5-2.	
Continuity	Replace cable W35 (paragraph 4-6). Disconnect breakout box and connect W23P1 to PDB J4.
No continuity	Replace cable W23 (paragraph 4-6).
Step 4. Turn system power off. Disconnect W24P1 from PDB J1. Connect PDB breakout box to PDB J1. Connect W24P1 to PDB breakout box J1. Enable BC (TM 9-1425-646-20). Position LLM from stow position to approximately 310 mils. Slowly lower LLM (press and release LLM DN switch). Using multimeter, check for 21 to 28 V dc between PDB breakout box test points J1-38(+) and J1-54(–). Voltage should be observed when LLM is lowered to within 30 to 40 mils.	
Voltage correct	Replace PDB (paragraph 4-5).
Voltage incorrect	Continue.

Table 2-2. Troubleshooting - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	Step 5. Turn system power off. Disconnect W24P2 from FCU J2. Using multimeter, check for continuity between PDB breakout box test points J1-54 and W24P2-54, and then between breakout box test points J1-38 and W24P2-38.	
	No continuity	Replace cable W24 (paragraph 4-6). Remove breakout box and connect W23P1 to PDB J4.
	Continuity	Remove PDB breakout box and connect W23P1 to PDB J4 and W24P1 to PDB J1 and continue.
	Step 6. Verify system power is off. Disconnect W35P7 from hydraulic pressure switch on hydraulic valve module. Disconnect W24P2 from FCU J2. Using multimeter, check for continuity between W35P7-A and W24P2-80 and between W35P7-B and W24P2-81.	
	Continuity	Replace hydraulic pressure switch (paragraph 6-22). Connect W24P2 to FCU J2.
	No continuity	Continue.
	Step 7. Disconnect W24P1 from PDB J1. Connect PDB breakout box J1 to W24P1. Using multimeter, check for continuity between W24P2-80 and PDB breakout box test point J1-80, and then between W24P2-81 and breakout box test point J1-81.	
	No continuity	Replace cable W24 (paragraph 4-6). Connect W35P7 to hydraulic pressure switch.
	Continuity	Continue.
	Step 8. Connect W24P2 to FCU J2. Connect PDB breakout box to PDB J1. Disconnect W23P1 from PDB J4. Connect PDB breakout box to PDB J4. Using multimeter, check for continuity between PDB breakout box test points J1-80 and J4-16, and then between J1-81 and J4-17.	
	No continuity	Replace PDB (paragraph 4-5).
	Continuity	Continue.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

Step 9. Disconnect PDB breakout box from PDB J1. Connect W24P1 to PDB J1. Connect W23P1 to PDB breakout box J4. Disconnect W23P5 from W35J1. Using multimeter, check for continuity between breakout box test points J4-16 and W23P5-3, and then between breakout box test points J4-17 and W23P5-4.

No continuity

Replace cable W23 (paragraph 4-6). Connect W35P7 to hydraulic pressure switch.

Continuity

Continue.

Step 10. Connect W23P5 to W35J1. Using multimeter, check for continuity between breakout box test points J4-16 and W35P7-A, and then between breakout box test points J4-17 and W35P7-B.

No continuity

Replace cable W35 (paragraph 4-6). Disconnect PDB breakout box and connect W23P1 to PDB J4.

Continuity

Replace FCU (TM 9-1425-646-20). Connect W35P7 to hydraulic pressure switch. Disconnect PDB breakout and connect W23P1 to PDB J4.

36. UNABLE TO STOW LLM

Step 1. a. LLM lowered to stow position and travel lock hooks failed to engage properly. Perform malfunction 101. If fault still exists, go to step 2.

b. LLM did stow and travel lock has locked but message still appears. Position LLM to 1600 mils left. Press STOW. If UNABLE TO STOW LLM prompt still appears, go to step 9.

Step 2. Verify that system electrical power is off. Disconnect W25P1 from PDB J3. Connect PDB breakout box to PDB J3 and connect W25P1 to PDB breakout box J3. Turn system power on. Using multimeter, check for 21 to 28 V dc between PDB breakout box test points J3-S(+) and J3-H(–) and between J3-G(+) and J3-H(–).

Voltage incorrect

Go to step 4.

Voltage correct

Continue.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

Step 3. Turn system power off. Disconnect W25P2 from LLM travel lock actuator. Using multimeter, check for continuity between PDB breakout box J3 test points and W25P2 as follows:

W25P2 Pins	PDB Breakout Box J3 Test Points
A	S
C	G
B	N
H	T
D	H

Continuity

Replace LLM travel lock actuator (paragraph 5-23). Disconnect PDB breakout box and reconnect cables.

No continuity

Replace cable W25 (paragraph 4-6).

Step 4. Disconnect PDB breakout box P3 from PDB J3. Shut down BC (TM 9-1425-646-20). Using multimeter, check for continuity between PDB breakout box test points J3-P and J3-Q.

Continuity

Go to step 6.

No continuity

Continue.

Step 5. Remove cover from cage down limit switch. Disconnect W25P3 or W25-101P1 from cage down limit switch. Connect switch test cable to cage down limit switch. Using multimeter, check for continuity between test cable pins 1 and 3 (cage down).

No continuity

Adjust or replace cage down switch (paragraph 5-26). Remove breakout box and connect cables.

Continuity

Replace cable W25 (paragraph 4-6).

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

Step 6. Disconnect W24P1 from PDB J1. Connect PDB breakout box to PDB J1. Using multimeter, check for continuity between PDB breakout box J1 and J3 test points as follows:

J1 Test Points	J3 Test Points
71	P
70	Q
72	N

No continuity

Replace PDB (paragraph 4-5).

Continuity

Continue.

Step 7. Connect W24P1 to PDB breakout box J1. Disconnect W24P2 from FCU J2. Using multimeter, check for continuity between PDB breakout box J1 test points and W24P2 as follows:

W24P2 Pins	PDB Breakout Box J1 Test Points
70	70
71	71
72	72

No continuity

Replace cable W24 (paragraph 4-6). Disconnect PDB breakout box and reconnect cables to PDB.

Continuity

Connect W24P2 to FCU, and then continue.

Step 8. Attach multimeter to PDB breakout box test points J1-38(+) and J1-53(–). Repeat stow procedure and verify that voltage drops to approximately zero.

Voltage correct

Replace PDB (paragraph 4-5).

Voltage incorrect

Replace FCU (TM 9-1425-646-20). Remove PDB breakout boxes and reconnect cables to PDB.

Table 2-2. Troubleshooting - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

Step 9. Shut down BC (TM 9-1425-646-20). Disconnect W25P1 from PDB J3. Connect W25P1 to PDB breakout box J3. Using multimeter, check for continuity between PDB breakout box test points J3-M and J3-G and between J3-M and J3-S.

Continuity

Go to step 11.

No continuity

Continue.

Step 10. Disconnect W25P2 from travel lock actuator. Using multimeter, check for continuity between PDB breakout box J3 test points and W25P2 as follows:

W25P2 Pins	PDB Breakout Box J3 Test Points
A	S
C	G
F	M

No continuity

Replace cable W25 (paragraph 4-6).

Continuity

Adjust LLM travel lock actuator. If unable to adjust, replace LLM travel lock actuator (paragraph 5-23). Remove breakout box and reconnect cables to PDB.

Step 11. Disconnect W24P1 from PDB J1. Connect PDB breakout box to PDB J1. Using multimeter, check for continuity between PDB breakout box test points J1-73 and J3-M.

No continuity

Replace PDB (paragraph 4-5).

Continuity

Continue.

Table 2-2. Troubleshooting - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

Step 12. Connect W24P1 to PDB breakout box J1. Disconnect W24P2 from FCU J2. Using multimeter, check for continuity between PDB breakout box test points J1-73 and W24P2-73.

No continuity

Replace cable W24 (paragraph 4-6). Remove breakout box and connect cables to PDB.

Continuity

Replace FCU (TM 9-1425-646-20). Remove breakout box and connect cables to PDB.

37. BC ENABLE LIGHT DOES NOT COME ON

Step 1. Verify system power is off. Disconnect W25P1 from PDB J3. Connect W25P1 to PDB breakout box J3. Connect PDB breakout box to PDB J3. Enable BC (TM 9-1425-646-20). Using multimeter, check for 21 to 28 V dc between PDB breakout box test points J3-S(+) and J3-G(−).

Voltage incorrect

Go to step 4.

Voltage correct

Continue.

Step 2. Shut down BC (TM 9-1425-646-20). Disconnect W18P2 from BC. Using multimeter, check for continuity between PDB breakout box test points J3-S and W18P2-21 and between J3-G and W18P2-6.

Continuity

Replace BC (paragraph 7-3). Remove breakout box and connect W25P1 to PDB J3.

No continuity

Continue.

Step 3. Connect W18P2 to BC. Disconnect W18P1 from W25J1. Using multimeter, check for continuity between PDB breakout box test point J3-S and W25J1-21, and between breakout box J3-G and W25J1-6.

No continuity

Replace W25 cable (paragraph 4-6).

Continuity

Replace W18 cable (paragraph 4-6). Disconnect breakout box and connect W25P1 to PDB J3.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

Step 4. Shut down BC (TM 9-1425-646-20). Disconnect W18P2 from BC. Using multimeter, check for continuity between boom controller pins 8 and 9.

No continuity

Replace BC (paragraph 7-3). Remove breakout box and connect W25P1 to PDB J3.

Continuity

Continue.

Step 5. Using multimeter, check for continuity between PDB breakout box test points J3-Z and W18P2-8 and J3-I and W18P2-9.

Continuity

Go to step 7.

No continuity

Continue.

Step 6. Connect W18P2 to BC. Disconnect W18P1 from W25J1. Using multimeter, check for continuity between PDB breakout box test points J3-Z and W25J1-8 and J3-I and W25J1-9.

No continuity

Replace W25 cable (paragraph 4-6).

Continuity

Replace W18 cable (paragraph 4-6). Remove breakout box and connect W25P1 to PDB J3.

Step 7. Connect W18P2 to BC. Disconnect W24P1 from PDB J1. Connect W24P1 to PDB breakout box J1. Connect PDB breakout box to PDB J1. Using multimeter, check for continuity between the following test points.

PDB Breakout Box J1 Test Points	PDB Breakout Box J3 Test Points
21	S
8	Z
6	G
9	I

No continuity

Replace PDB (paragraph 4-5).

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

Continuity

Continue.

Step 8. Disconnect W24P2 from FCU J2. Using multimeter, check for continuity between PDB breakout box test point J1 and W24P2 as follows:

W24P2 Pins	PDB Breakout Box J1 Test Point
21	21
8	8
6	6
9	9

No continuity

Replace W24 cable (paragraph 4-6). Disconnect PDB breakout box and connect W25P1 to PDB J3.

Continuity

Continue.

Step 9. Disconnect PDB breakout box and connect cables to PDB. Connect W24P2 to FCU J2. Disconnect W9P1 from EU J3. Disconnect W9P2 from FCU J1. Using multimeter, check for continuity between W9P1-56 and W9P2-56 and W9P1-57 and W9P2-57.

Continuity

Replace FCU (TM 9-1425-646-20). Connect W9P1 to EU J3.

No continuity

Replace W9 cable (paragraph 4-6).

BC WILL NOT MOVE LLM CW/CCW

Step 1. Turn system power off and disconnect W25P1 from PDB J3. Connect W25P1 to PDB breakout box J3. Using multimeter, check for continuity between breakout box test point J3 pins as follows:

J3 to J3

C D BC LLM CW switch pressed
C E BC LLM CCW switch pressed

Continuity

Go to step 4.

No continuity

Continue.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

Step 2. Disconnect W18P2 from BC. Using multimeter, check for continuity between BC pins as follows:

Pin to Pin

15 5 BC LLM CW switch pressed
15 4 BC LLM CCW switch pressed

No continuity

Replace BC (paragraph 7-3). Disconnect breakout box and connect W25P1 to PDB J3.

Continuity

Continue.

Step 3. Disconnect W18P1 from W25J1. Using multimeter, check for continuity between W18P1 and W18P2 as follows:

W18P1 to W18P2

4	4
5	5
15	15

No continuity

Replace cable W18 (paragraph 4-6). Disconnect breakout box and connect W25P1 to PDB J3.

Continuity

Replace cable W25 (paragraph 4-6).

Step 4. Connect breakout box to PDB J3. Disconnect W24P1 from PDB J1. Connect breakout box to PDB J1. Using multimeter, check for continuity between breakout box test points as follows:

J1 to J3

15	C
5	D
4	E

No continuity

Replace PDB (paragraph 4-5).

Continuity

Continue.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

Step 5. Connect W24P1 to breakout box J1. Disconnect W24P2 from FCU J2. Using multimeter, check for continuity between breakout box test points J1 and W24P2 as follows:

J1 to W24P2

4	4
5	5
15	15

No continuity

Replace cable W24 (paragraph 4-6). Disconnect breakout box and connect cables to PDB.

Continuity

Replace FCU (TM 9-1425-646-20). Disconnect breakout box and connect cables to PDB.

39. BC WILL NOT MOVE LLM UP OR DOWN

Step 1. Turn system power off and disconnect W25P1 from PDB J3. Connect W25P1 to PDB breakout box J3. Using multimeter, check for continuity between breakout box test point J3 pins as follows:

J3 to J3

C	B	BC LLM UP switch pressed
C	C	BC LLM DN switch pressed

Continuity

Go to step 4.

No continuity

Continue.

Step 2. Disconnect W18P2 from BC. Using multimeter, check for continuity between BC pins as follows:

Pin to Pin

15	3	BC LLM UP switch pressed
15	2	BC LLM DN switch pressed

No continuity

Replace BC (paragraph 7-3). Disconnect breakout box and connect W25P1 to PDB J3.

Continuity

Continue.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	Step 3. Disconnect W18P1 from W25J1. Using multimeter, check for continuity between W18P1 and W18P2 as follows: W18P1 to W18P2 2 2 3 3 15 15 No continuity	Replace cable W18 (paragraph 4-6). Disconnect breakout box and connect W25P1 to PDB J3.
	Continuity	Replace cable W25 (paragraph 4-6).
	Step 4. Connect breakout box to PDB J3. Disconnect W24P1 from PDB J1. Connect breakout box to PDB J1. Using multimeter, check for continuity between breakout box test points as follows: J1 to J3 15 C 2 C 3 B No continuity	Replace PDB (paragraph 4-5).
	Continuity	Continue.
	Step 5. Connect W24P1 to breakout box J1. Disconnect W24P2 from FCU J2. Using multimeter, check for continuity between breakout box J1 test points and W24P2 as follows: J1 to W24P2 2 2 3 3 15 15 No continuity	Replace cable W24 (paragraph 4-6). Disconnect breakout box and connect cables to PDB.
	Continuity	Replace FCU (TM 9-1425-646-20). Disconnect breakout box and connect cables to PDB.

Table 2-2. Troubleshooting – Continued

MALFUNCTION TEST OR INSPECTION	CORRECTIVE ACTION
40. BOOM COAST TO A STOP	
	Replace boom motor and brake assembly (paragraph 5-4).
41. BOOM OPERATION IS ERRATIC	
Step 1. Enable BC (TM 9-1425-646-20). Position LLM to 1600 mils.	
Step 2. Using BC, extend and retract the booms and check for smooth operation.	
Erratic operation	Clean and lubricate the boom rack gears, pinion gears, and ballnut drive assembly (TM 9-1425-646-20).
Still erratic operation	Perform LEFT OR RIGHT BOOM WILL NOT EXTEND (TM 9-1425-646-20). Perform LEFT OR RIGHT BOOM WILL NOT RETRACT (TM 9-1425-646-20).

42. LEFT OR RIGHT BOOM WILL NOT EXTEND

CAUTION

Continuous operation of boom without stopping to allow motor to cool may damage the motor.

NOTE

If boom failure occurred with an LP/C loaded and the boom cannot be used to unload the LP/C manually or electrically, refer to paragraph 3-14.

Normal operating time for boom to fully extend or retract electrically, without an LP/C loaded, shall be less than 35 seconds.

Cables W19 and W20 must be properly connected in the stowed configuration before operation of the hoist or boom can be accomplished. If the left side operation fails, verify that W19P2 and W20P2 are properly connected. If right side operation fails, verify that W19P3 and W20P3 are properly connected.

Step 1. Position LLM at 3200 mils and turn system power off. Inspect the booms, boom extension actuators, ballnut drives, and drive shafts for obvious damage.

Damage found — Replace drive shaft (paragraph 5-5); ballnut drive (paragraph 5-7); and extension actuator (paragraph 5-6).

Table 2-2. Troubleshooting - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	No damage	Continue.
Step 2.	Attempt to manually extend boom and check for free movement.	
	Manually spins free (boom will not extend)	Repair manual drive (paragraph 5-4).
	Boom extends with difficulty. Feel shaft with hand while manually extending boom. If drive feels rough or abnormal, one drive shaft may be broken.	Replace drive shaft (paragraph 5-5).
	Boom extends normally	Go to step 4.
	Booms will not extend	Continue.
Step 3.	Disconnect drive shaft from motor and reduction gearbox. Manually operate gearbox and check for binding.	
	Binding	Replace motor and reduction gearbox (paragraph 5-4).
	No binding	Replace boom extension actuator (paragraph 5-6).
Step 4.	Disconnect W26P2(L)/W27P2(R) from boom control J2. Connect W26P2 or W27P2 to boom control breakout box J2. Connect breakout box to boom control. Enable BC and using multimeter, check for 21 to 28 V dc between breakout box test point J2 pins as follows: J2 to J2 A(+) G(-) E(+) B(-) BC BOOM OUT switch pressed	
	Voltage incorrect	Go to step 6.

Table 2-2. Troubleshooting - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

Voltage correct

Continue.

Step 5. Turn system power off and disconnect the boom cable from boom electrical control J1. Connect boom motor cable to breakout box J1. Connect breakout box to boom electrical control J1. Enable BC and using multimeter, check for 21 to 28 V dc between breakout box test point J1 pins each time the BC BOOM OUT switch is pressed.

J1 to J1

G(+) W(-)
P(+) W(-)
N(+) W(-)
T(+) N(-)
J(+) W(-)

Voltage correct

Replace motor and brake assembly (paragraph 5-4). Disconnect breakout box and connect cables.

Voltage incorrect

Replace boom electrical control (paragraph 5-3). Disconnect breakout box and connect cables.

Step 6. Turn system power off and disconnect breakout box. Connect cables to boom control. Disconnect W26P1(L)/W27P1(R) from PDB J5(L)/J7(R). Connect W26P1(L) or W27P1(R) to breakout box J5(L) or J7(R). Connect breakout box to PDB J5(L) or J7(R). Enable BC and using multimeter, check for 21 to 28 V dc between breakout box test point J5(L) or J7(R) pins as follows:

J5(L)/J7(R) to J5(L)/J7(R)

A(+) G(-)
E(+) B(-) BC BOOM OUT switch pressed

Voltage incorrect

Go to step 8.

Voltage correct

Continue.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	Step 7. Turn system power off and disconnect W26P4(L) or W27P4(R) from boom out limit switch. Connect test cable to limit switch. Using multimeter, check for continuity between test cable pins 1 and 2. Check for infinity between pins 4 and 6.	
	Resistance incorrect	Replace limit switch (paragraph 5-13). Disconnect test cable and breakout box. Connect cables.
	Resistance correct	Replace cable W26 or W27 (paragraph 4-6).
	Step 8. Turn system power off and disconnect PDB breakout box and connect cables. Disconnect W75P1(L) or W76P1(R) from PDB J6(L) or J8(R). Connect W75P1(L) or W76P1(R) to breakout box J6(L) or J8(R). Using multimeter, check for continuity between pins E and H of breakout box test point J6(L) or J8(R) with hoist fully raised.	
	Continuity	Go to step 12.
	No continuity	Continue.
	Step 9. Disconnect W57P2 from hoist up limit switch. Connect test cable to limit switch. Using multimeter, check for continuity between test cable pins 4 and 6.	
	No continuity	Adjust or replace limit switch (paragraph 5-20). Remove breakout box and test cable. Connect cables.
	Continuity	Continue.

Table 2-2. Troubleshooting - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

Step 10. Disconnect W57P1 from hoist control. Using multimeter, check for continuity between W57P1 and W57P2 as follows:

W57P1 to W57P2

D	4
C	6

No continuity

Replace cable W57 (paragraph 4-6). Disconnect breakout box and connect cables to PDB.

Continuity

Continue.

Step 11. Connect W57P2 to hoist up limit switch and W57P1 to hoist control J2. Disconnect W75P2(L) or W76P2(R) from hoist control J1. Using multimeter, check for continuity between W75P2(L) or W76P2(R) and breakout box test points as follows:

W75P2(L)/W76P2(R) to J6(L)/J8(R)

E	E
H	H

No continuity

Replace cable W75(L) or W76(R) (paragraph 4-6). Remove breakout box and connect cables.

Continuity

Replace hoist control (paragraph 5-19). Disconnect breakout box and connect cables.

Step 12. Disconnect W24P1 from PDB J1. Connect W24P1 to PDB breakout box J1. Connect breakout box to PDB J1. Enable BC and using multimeter, check for 21 to 28 V dc between pins of breakout box test point J1 each time the BC left or right BOOM OUT switch is pressed as follows:

J1 to J1

37(+) 29(-) left boom
37(+) 33(-) right boom

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

Voltage correct

Replace PDB (paragraph 4-5).

Voltage incorrect

Continue.

Step 13. Turn system power off and disconnect W18P2 from BC. Using multimeter, check for continuity between pins of BC as follows:

BC pin to BC pin

15	14 BOOM OUT switch pressed
15	10 L-BOTH-R switch in L
15	11 L-BOTH-R switch in R

No continuity

Replace BC (paragraph 7-3). Disconnect breakout box and connect cable.

Continuity

Continue.

Step 14. Disconnect W25P1 from PDB J3. Connect W25P1 to PDB breakout box J3. Using multimeter, check for continuity between breakout box test point J3 and W18P2 as follows:

J3 to W18P2

W	10
V	11
C	15
A	14

Continuity

Go to step 16.

No continuity

Continue.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

Step 15. Disconnect W18P1 from W25J1. Using multimeter, check for continuity between W18P1 and W18P2 as follows:

W18P1 to W18P2	
14	14
10	10
11	11
15	15

No continuity

Replace cable W18 (paragraph 4-6). Disconnect breakout box and connect cables to PDB.

Continuity

Replace cable W25 (paragraph 4-6). Disconnect breakout box and connect cables to PDB.

Step 16. Connect PDB breakout box P5(L)/P7(R) to PDB J5(L)/J7(R). Using multimeter, check for continuity between breakout box test points as follows:

J1 to J6(L)/J8(R)		J1 to J5(L)/J7(R)		J1 to J3	
37	E	29	B(Left side)	15	C
		33	B(Right side)	10	W
				11	V
				14	A

No continuity

Replace PDB (paragraph 4-5). Connect W18P2 to BC and stow BC.

Continuity

Continue.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	Step 17. Connect W18P2 to BC. Disconnect W24P2 from FCU J2. Using multimeter, check for continuity between W24P2 and PDB breakout box test point as follows: J1 to W24P2 10 10 11 11 14 14 15 15 27 27 33 33 37 37 No continuity	Replace cable W24 (paragraph 4-6). Disconnect breakout box and connect cable to PDB.
	Continuity	Continue.
	Step 18. Disconnect breakout box and connect cables to PDB. Connect W24P2 to FCU J2. Disconnect W19P1 from FCU J4. Using multimeter, check for continuity between W19P1 pins as follows: W19P1(L) to W19P1(L) W19P1(R) to W19P1(R) 8 7 13 83 8 91 13 14 8 98 13 60 8 100 13 96 Continuity	Go to step 20.
	No continuity	Continue.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

Step 19. Disconnect W19P2(L) from W32J1(L) or W19P3(L) from W32J2(R). Using multimeter, check for continuity between W32J1(L) pins or W32J2(R) pins as follows:

W32J1(L) to W32J1(L)		W32J2(R) to W32J2(R)	
18	17	18	17
18	45	18	45
18	51	18	51
18	54	18	54

No continuity

Replace cable W32 (paragraph 4-6). Connect W19P1 to FCU J4.

Continuity

Replace cable W19 (paragraph 4-6).

Step 20. Connect W19P1 to FCU J4. Disconnect W20P1 from FCU J1. Using multimeter, check for continuity between W20P1 pins as follows:

W20P1 to W20P1	
60(L)	62(L)
65(R)	66(R)

Continuity

Replace FCU (TM 9-1425-646-20).

No continuity

Continue.

Step 21. Disconnect W20P2(L) from left stowage connector or W20P3(R) from right stowage connector. Using multimeter, check for continuity between left or right stowage connector pins as follows:

Left to Left		Right to Right	
50	52	50	52

No continuity

Replace stowage connector (paragraph 4-6). Connect W20P1 to FCU J1.

Continuity

Replace cable W20 (paragraph 4-6).

Table 2-2. Troubleshooting - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

43. LEFT OR RIGHT BOOM WILL NOT RETRACT

CAUTION

Continuous operation of boom without stopping to allow motor to cool may damage the motor.

NOTE

Normal operating time for boom to fully extend or retract electrically, without an LP/C loaded, shall be less than 35 seconds. If boom stops before fully retracted, check boom in limit switch adjustment.

Cables W19 and W20 must be properly connected in the stowed configuration before operation of the hoist or boom can be accomplished. If left side operation fails, verify that W19P2 and W20P2 are properly connected. If right side operation fails, verify that W19P3 and W20P3 are properly connected.

Step 1. Position LLM at 3200 mils and turn system power off. Inspect the booms, boom extension actuators, ballnut drives, and drive shafts for obvious damage.

Damage found

Replace drive shaft (paragraph 5-5); ballnut drive (paragraph 5-7); extension actuator (paragraph 5-6).

No damage

Continue.

Step 2. Attempt to manually retract boom and check for free movement.

Manually spins free (boom will not retract)

Repair manual drive (paragraph 5-4).

Boom retracts with difficulty. Feel shaft with hand while retracting boom. If drive shaft feels rough or abnormal, one drive shaft may be broken.

Replace drive shaft (paragraph 5-5).

Boom retracts normally

Go to step 4.

Booms will not retract

Continue.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

Step 3. Disconnect drive shaft from motor and reduction gearbox. Manually operate gearbox and check for binding.

Binding

Replace motor and reduction gearbox (paragraph 5-4).

No binding

Replace boom extension actuator (paragraph 5-6).

Step 4. Disconnect W26P2(L)/W27P2(R) from boom control J2. Connect W26P2 or W27P2 to boom control breakout box J2. Connect breakout box to boom control. Enable BC and using multimeter, check for 21 to 28 V dc between breakout box test point J2 pins as follows:

J2 to J2

A(+) G(–)
E(+) D(–) BC BOOM IN switch pressed

Voltage incorrect

Go to step 6.

Voltage correct

Continue.

Step 5. Turn system power off and disconnect the boom cable from boom control J1. Connect boom motor cable to breakout box J1. Connect breakout box to boom control J1. Enable BC and using multimeter, check for 21 to 28 V dc between breakout box test point J1 pins each time the BC BOOM IN switch is pressed as follows:

J1 to J1

G(+) W(–)
P(+) W(–)
N(+) W(–)
S(+) T(–)
J(+) W(–)

Voltage correct

Replace motor and brake assembly (paragraph 5-4). Disconnect breakout box and connect cables.

Voltage incorrect

Replace boom control (paragraph 5-3). Disconnect breakout box and connect cables.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	Step 6. Turn system power off and disconnect breakout box. Connect cables to boom control. Disconnect W26P1(L)/W27P1(R) from PDB J5(L)/J7(R). Connect W26P1(L) or W27P1(R) to breakout box J5(L) or J7(R). Connect breakout box to PDB J5(L) or J7(R). Enable BC and using multimeter, check for 21 to 28 V dc between breakout box test point J5(L) or J7(R) pins as follows: J5(L)/J7(R) to J5(L)/J7(R) A(+) G(–) E(+) D(–) BC BOOM IN switch pressed	
	Voltage incorrect	Go to step 8.
	Voltage correct	Continue.
	Step 7. Turn system power off and disconnect W26P3(L) or W27P3(R) from boom in limit switch. Connect test cable to limit switch. Using multimeter, check for continuity between test cable pins 1 and 2. Check for infinity between pins 4 and 6.	
	Resistance incorrect	Replace limit switch (paragraph 5-12). Disconnect test cable and breakout box. Connect cables.
	Resistance correct	Replace cable W26 or W27 (paragraph 4-6).
	Step 8. Turn system power off and disconnect PDB breakout box and connect cables. Disconnect W75P1(L) or W76P1(R) from PDB J6(L) or J8(R). Connect W75P1(L) or W76P1(R) to breakout box J6(L) or J8(R). Using multimeter, check for continuity between pins E and H of breakout box test point J6(L) or J8(R) with hoist fully raised.	
	Continuity	Go to step 12.
	No continuity	Continue.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

Step 9. Disconnect W57P2 from hoist up limit switch. Connect test cable to limit switch. Using multimeter, check for continuity between test cable pins 4 and 6.

No continuity

Adjust or replace limit switch (paragraph 5-20). Remove breakout box and test cable. Connect cables.

Continuity

Continue.

Step 10. Disconnect W57P1 from hoist control. Using multimeter, check for continuity between W57P1 and W57P2 as follows:

W57P1 to W57P2

D	4
C	6

No continuity

Replace cable W57 (paragraph 4-6). Disconnect breakout box and connect cables to PDB.

Continuity

Continue.

Step 11. Connect W57P2 to hoist up limit switch and W57P1 to hoist control J2. Disconnect W75P2(L) or W76P2(R) from hoist control J1. Using multimeter, check for continuity between W75P2(L) or W76P2(R) and breakout box test points as follows:

W75P2(L)/W76P2(R) to J6(L)/J8(R)

E	E
H	H

No continuity

Replace cable W75(L) or W76(R) (paragraph 4-6). Remove breakout box and connect cables.

Continuity

Replace hoist control (paragraph 5-19). Disconnect breakout box and connect cables.

Table 2-2. Troubleshooting - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

Step 12. Disconnect W24P1 from PDB J1. Connect W24P1 to PDB breakout box J1. Connect breakout box to PDB J1. Enable BC and using multimeter, check for 21 to 28 V dc between pins of breakout box test point J1 each time the BC left or right BOOM IN switch is pressed as follows:

J1 to J1

37(+) 27(-) left boom
37(+) 31(-) right boom

Voltage correct

Replace PDB (paragraph 4-5).

Voltage incorrect

Continue.

Step 13. Turn system power off and disconnect W18P2 from BC. Using multimeter, check for continuity between pins of BC as follows:

BC pin to BC pin

15 1 BOOM IN switch pressed
15 10 L-BOTH-R switch in L
15 11 L-BOTH-R switch in R

No continuity

Replace BC (paragraph 7-3). Disconnect breakout box and connect cable.

Continuity

Continue.

Step 14. Disconnect W25P1 from PDB J3. Connect W25P1 to PDB breakout box J3. Using multimeter, check for continuity between breakout box test point J3 and W18P2 as follows:

J3 to W18P2

W 10
V 11
C 15
U 1

Continuity

Go to step 16.

No continuity

Continue.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

Step 15. Disconnect W18P1 from W25J1. Using multimeter, check for continuity between W18P1 and W18P2 as follows:

W18P1 to W18P2

1	1
10	10
11	11
15	15

No continuity

Replace cable W18 (paragraph 4-6). Disconnect breakout box and connect cables to PDB.

Continuity

Replace cable W25 (paragraph 4-6). Disconnect breakout box and connect cables to PDB.

Step 16. Disconnect W26P1(L)/W27P1(R) from PDB J5(L)/J7(R). Connect PDB breakout box to PDB J5(L) or J7(R). Connect W25P1 to PDB J3. Using multimeter, check for continuity between breakout box test points as follows:

J1 to J6(L)/J8(R)		J1 to J5(L)/J7(R)		J1 to J3	
37	E	27	D	15	C
		31	D	10	W
				11	V
				14	A

No continuity

Replace PDB (paragraph 4-5). Connect W18P2 to BC and stow BC.

Continuity

Continue.

Step 17. Connect W18P2 to BC. Disconnect W24P2 from FCU J2. Using multimeter, check for continuity between W24P2 and PDB breakout box test point as follows:

J1 to W24P2

10	10
11	11
14	14
15	15
27	27
31	31
37	37

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	No continuity	Replace cable W24 (paragraph 4-6). Disconnect breakout box and connect cable to PDB.
	Continuity	Continue.
Step 18.	Disconnect breakout box and connect cables to PDB. Connect W24P2 to FCU J2. Disconnect W19P1 from FCU J4. Using multimeter, check for continuity between W19P1 pins as follows:	

W19P1(L) to W19P1(L)		W19P1(R) to W19P1(R)	
8	7	13	83
8	91	13	14
8	98	13	60
8	100	13	96

	Continuity	Go to step 20.
	No continuity	Continue.
Step 19.	Disconnect W19P2(L) from W32J1(L) or W19P3(L) from W32J2(R). Using multimeter, check for continuity between W32J1(L) pins or W32J2(R) pins as follows:	

W32J1(L) to W32J1(L)		W32J2(R) to W32J2(R)	
18	17	18	17
18	45	18	45
18	51	18	51
18	54	18	54

	No continuity	Replace cable W32 (paragraph 4-6). Connect W19P1 to FCU J4.
	Continuity	Replace cable W19 (paragraph 4-6).

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

Step 20. Connect W19P1 to FCU J4. Disconnect W20P1 from FCU J1. Using multimeter, check for continuity between W20P1 pins as follows:

W20P1 to W20P1

60(L) 62(L)
65(R) 66(R)

Continuity

Replace FCU (TM 9-1425-646-20).

No continuity

Continue.

Step 21. Disconnect W20P2(L) from left stowage connector or W20P3(R) from right stowage connector. Using multimeter, check for continuity between left or right stowage connector pins as follows:

Left to Left		Right to Right	
50	52	50	52

No continuity

Replace stowage connector (paragraph 4-6). Connect W20P1 to FCU J1.

Continuity

Replace cable W20 (paragraph 4-6).

44. AUDIBLE ALARM AND KEYBOARD BEEP DO NOT SOUND IN HEADSET

Perform AUDIBLE ALARM NOT OPERATING (TM 9-1425-646-20).

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

45. AUDIBLE ALARM NOT OPERATING

Step 1. Verify system power is off. Disconnect W1P3 from the door interlock system distribution box 4A10. Disconnect W59P1 from EU J1. Using multimeter, check for continuity between W1P3 and W59P1 as follows:

W1P3 Pins	W59P1 Pins
A	98
B	95
C	94

Continuity

Troubleshoot door interlock (TM 9-1450-646-20). If fault cannot be found, go to step 4. Connect W1P3 to distribution box 4A10.

No continuity

Continue.

Step 2. Disconnect W68P1 from W1J2. Check for continuity between W1P3 and W1J2 as follows:

W1P3 Pins	W1J2 Pins
A	98
B	95
C	94

No continuity

Replace W1 cable (paragraph 4-6). Connect W59 to EU J1.

Continuity

Continue.

Step 3. Connect W1P3 to distribution box and W68P1 to W1J2. Disconnect W59P2 from W68J1. Using multimeter, check for continuity between W59P1 and W59P2 as follows:

W59P1 Pins	W59P2 Pins
94	94
95	95
98	98

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	Continuity	Replace W68 cable (paragraph 4-6). Connect W59P1 to EU J1.
	No continuity	Replace W59 cable (paragraph 4-6).
Step 4.	Disconnect W4P3 from AM-1780/VRC intercom amplifier J510. Disconnect W61P2 from EU-J4. Using multimeter, check for continuity between W4P3 and W61P2 as follows:	

W4P3 Pins	W61P2 Pins
H	P
A	U
K	T

	Continuity	Troubleshoot communications set (TM 11-5820-401-12). Connect W61P2 to EU J4 and W4P3 to AM-1780/VRC.
	No continuity	Continue.
Step 5.	Connect W61P2 to EU J4. Disconnect W61P1 from W74J1. Using multimeter, check for continuity between W4P3 and W74J1 as follows:	

W4P3 Pins	W74J1 Pins
H	P
A	U
K	T

	Continuity	Replace W61 cable (paragraph 4-6). Connect W4P3 to AM-1780/VRC J510.
	No continuity	Continue.
Step 6.	Connect W61P1 to W74J1. Disconnect W83J1 from W74P1. Using multimeter, check for continuity between W4P3 and W83J1 as follows:	

W4P3 Pins	W83J1 Pins
H	P
A	U
K	T

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	Continuity	
		Replace W74 cable (paragraph 4-6). Connect W4P3 to AM-1780/VRC J510.
	No continuity	
		Continue.
	Step 7. Connect W83J1 to W74P1. Disconnect W4P2 from W83J2. Using multimeter, check for continuity between W4P3 and W4P2 as follows:	
	W4P3 Pins: H, A, K — W4P2 Pins: P, U, T	
	No continuity	
		Replace W4 cable (paragraph 4-6).
	Continuity	
		Replace W83 cable (paragraph 4-6). Connect W4P3 to AM-1780/VRC J510.
46. COMMUNICATIONS COMPLETELY INOPERATIVE		
		Perform COMMS PROCESSOR FAILURE (malfunction 7).
47. ELECTRICAL CABLES DAMAGED		
	None	
		Replace defective electrical cable (paragraph 4-6).
48. SYSTEM POWER WILL NOT TURN ON		
	Step 1. Turn system power on. Does switch remain in the on position?	
	No	
		Go to step 14.
	Yes	
		Continue.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

Step 2. Turn system power off. Disconnect W1P2 from FCP J1. Connect W1P2 to FCP breakout box J1. Connect FCP breakout box to FCP J1. Turn system power on. Using multimeter, check for 18 to 28 V dc between FCP breakout box test points J1-40 (+) and J1-56(–), and J1-39(+) and J1-56(–).

Voltage correct between J1-40 and J1-56 but missing between J1-39 and J1-56

Replace FCP (TM 9-1425-646-20).

Voltage incorrect at both tests

Continue.

Step 3. Verify system power is on. Using multimeter, check for 18 to 28 V dc between FCP breakout box test points J1-40(+) and J1-27(–).

Voltage correct

Go to step 10.

Voltage incorrect

Continue.

Step 4. Turn system power off. Remove electronics box (EB) cover. Using multimeter, check for 18 to 28 V dc between bus E5 (+) and E1 (–).

Voltage incorrect

Replace defective batteries (TM 9-1425-646-20). Disconnect FCP breakout box and connect W1P2 to FCP J1.

Voltage correct

Continue.

Step 5. Remove battery cover. Disconnect W7P1 from EB connector J7. Disconnect W8P1 from EB connector J8. Disconnect W33P2 from EB connector J3. Disconnect W6P1 from EB J1. Using multimeter, check for less than 5 ohms between the following EB connectors:

J9	J3	J1	
	A(+)	16(–)	(Observe polarity-diode test)
	C	19	
13(+)		7(–)	(Observe polarity-diode test)

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	Resistance incorrect	Replace EB (paragraph 4-4). Disconnect FCP breakout box and connect W1P2 to FCP J1.
	Resistance correct	Continue.
Step 6.	Connect all cables to EB except W6P1. Install battery box and EB cover. Disconnect W6P2 from EU J6. Using multimeter, check for continuity between W6P1 and W6P2 as follows: W6P1 Pins: 16, 19, 7 — W6P2 Pins: 16, 19, 7	
	No continuity	Replace W6 cable (paragraph 4-6). Disconnect FCP breakout box and connect W1P2 to FCP J1.
	Continuity	Continue.
Step 7.	Disconnect W59P1 from EU J1. Connect W6P1 to EB J1 and W6P2 to EU J6. Using multimeter, check for continuity between W59P1 and FCP breakout box J1 test point as follows: W59P1 Pins: 38, 39, 40, 41, 56 — FCP Breakout Box J1 Test Point: 38, 39, 40, 41, 56	
	Continuity	Replace EU (TM 9-1425-646-20). Disconnect FCP breakout box and connect W1P2 to FCP J1.
	No continuity	Continue.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

Step 8. Disconnect W59P2 from W68J1. Using multimeter, check for continuity between W59P1 and W59P2 as follows:

W59P1 Pins	W59P2 Pins
38	38
39	39
40	40
41	41
56	56

No continuity

Replace W59 cable (paragraph 4-6). Disconnect FCU breakout box and connect W1P2 to FCP J1.

Continuity

Continue.

Step 9. Disconnect W68P1 from W1J2. Connect W59P1 to EU J1. Connect W59P2 to W68J1. Using multimeter, check for continuity between FCP breakout box J1 test point and W1J2 as follows:

W1J2 Pin	FCP Breakout Box J1 Test Point
38	38
39	39
40	40
41	41
56	56

No continuity

Replace W1 cable (paragraph 4-6).

Continuity

Replace W68 cable (paragraph 4-6). Disconnect FCP breakout box and connect W1P2 to FCP J1.

Step 10. Using multimeter, check for 18 to 28 V dc between EB test connectors J9-12(+) and J9-13(–) and J9-10(+) and J9-13(–).

Voltage incorrect

Replace EB (paragraph 4-4). Disconnect FCP breakout box and connect W1P2 to FCP J1.

Voltage correct

Continue.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

Step 11. Disconnect W9P1 from EU J3. Using multimeter, check for continuity between FCP breakout box test point J1-56 and EU connector J3-116.

No continuity

Replace EU (TM 9-1425-646-20). Disconnect FCP breakout box and connect W1P2 to FCP J1.

Continuity

Continue.

Step 12. Connect W9P1 to EU J3. Disconnect W9P2 from FCU J7. Using multimeter, check for continuity between FCP breakout box test point J1-56 and W9P2-116.

No continuity

Replace W9 cable (paragraph 4-6). Disconnect FCP breakout box and connect W1P2 to FCP J1.

Continuity

Continue.

Step 13. Disconnect FCP breakout box and connect W1P2 to FCP J1. Disconnect W12P1 from EB J4. Disconnect W12P2 from FCU J6. Using multimeter, check for continuity between W12P1 and W12P2 as follows:

W12P1 Pins	W12P2 Pins	W12P1 Pins	W12P2 Pins
1	1	12	12
2	2	13	13
3	3	14	14
4	4	15	15
5	5	16	16
6	6	17	17
7	7	19	19
8	8	20	20
10	10	21	21
11	11		

No continuity

Replace W12 cable (paragraph 4-6).

Continuity

Replace FCU (TM 9-1425-646-20). Connect W12P1 to EB J4.

Table 2-2. Troubleshooting – Continued

MALFUNCTION TEST OR INSPECTION	CORRECTIVE ACTION

Step 14. Turn system power off. Disconnect W1P2 from FCP J1. Place SYS PWR switch to ON. Will switch remain in ON?

No

Replace FCP (TM 9-1425-646-20).

Yes

Continue.

Step 15. Verify system power is off. Connect FCP breakout box to FCP J1. Using multimeter, check for resistance of 2 ohms or more between FCP breakout box J1 test points as follows:

J1 to J1		J1 to J1		J1 to J1	
38	11	38	27	38	56
38	15	38	29	38	73
38	20	38	49	38	100

Resistance incorrect

Replace FCP (TM 9-1425-646-20).

Resistance correct

Continue.

Step 16. Disconnect FCP breakout box from FCP J1. Connect W1P2 to FCP breakout box J1. Using multimeter, check for resistance of 2 ohms or more between FCP breakout box test points J1 as follows:

J1 to J1		J1 to J1		J1 to J1	
38	11	38	27	38	56
38	15				
38	20				

Record failures and proceed to step 17.

Step 17. Disconnect W59P2 from W68J1. Using multimeter, check for 2 ohms or more between any test points that failed in step 16.

Resistance correct

Replace cable W59 (paragraph 4-6). Disconnect FCP breakout box and connect W1P2 to FCP J1.

Resistance incorrect

Continue.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

Step 18. Connect W59P2 to W68J1. Disconnect W68P1 from W1J2. Using multimeter, check for 2 ohms or more between any test points that failed in step 16.

Resistance correct

Replace cable W68 (paragraph 4-6). Disconnect FCP breakout box and connect W1P2 to FCP J1.

Resistance incorrect

Replace cable W1 (paragraph 4-6).

49. ALL FCP INDICATOR LIGHTS INOPERATIVE

Step 1. Turn system power off (TM 9-1425-646-10). Disconnect W1P1 from FCP J2. Connect W1P1 to breakout box J2. Disconnect W1P2 from FCP J1. Connect W1P1 to FCP breakout box J1. Connect FCP breakout box to FCP J1. Connect FCP breakout box to FCP J2. Turn system power on. Using multimeter, check for voltage between FCP breakout box test points as follows:

FCP Breakout Box Test Point	Meter Indication
J1-23(+) to J1-24(–)	+32 V dc (±10%)
J2-14(+) to J2-21(–)	+12 V dc (±10%)
J2-22(–) to J2-21(+)	–12 V dc (±10%)

Voltage correct

Replace FCP (TM 9-1425-646-20).

Voltage incorrect

Continue.

Step 2. Using multimeter, check for voltage between pins of EU test connector J8 as follows:

J8 to J8	Meter Indication
123(+) 103(–)	+32 V dc (±10%)
125(+) 103(–)	+12 V dc (±10%)
117(–) 103(+)	–12 V dc (±10%)

Voltage incorrect

Replace EU (TM 9-1425-646-20). Disconnect FCP breakout box and reconnect cables.

Voltage correct

Continue.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	Step 3. Turn system power off (TM 9-1425-646-10). Disconnect W60P2 from EU J2. Using multimeter, check for continuity between W60P2 and FCP breakout box test point J2 as follows: W60P2 to J2 14 14 21 21 22 22 Continuity	Go to step 6.
	No continuity	Continue.
	Step 4. Connect W60P2 to EU connector J2. Disconnect W60P1 from W67P1. Using multimeter, check for continuity between W67J1 and FCP breakout box test point J2 as follows: W67J1 to J2 14 14 21 21 22 22 Continuity	Replace cable W60 (paragraph 4-6). Disconnect FCP breakout box and connect cables to FCP.
	No continuity	Continue.
	Step 5. Connect W60P1 to W67J1. Disconnect W67P1 from W1J1. Using multimeter, check for continuity between W1J1 and FCP breakout box test point J2 as follows: W1J1 to J2 14 14 21 21 22 22 Continuity	Remove and replace cable W67 (paragraph 4-6). Disconnect FCP breakout box and connect cables to FCP.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	No continuity	Remove and replace cable W1 (paragraph 4-6). Disconnect FCP breakout box and connect cables to FCP.
	Step 6. Disconnect W59P2 from W68J1. Using multimeter, check for continuity between W68J1 and FCP breakout box test point J1 as follows: W68J1 to J1 23 23 24 24	
	Continuity	Remove cable W59 (paragraph 4-6). Disconnect FCP breakout box and connect cables to FCP.
	No continuity	Continue.
	Step 7. Connect W59P2 to W68J1. Disconnect W68P1 from W1J2. Using multimeter, check for continuity between W1J2 and FCP breakout box test point J1 as follows: W1J2 to J1 23 23 24 24	
	Continuity	Replace cable W68 (paragraph 4-6). Disconnect FCP breakout box and connect cable to FCP.
	No continuity	Replace cable W1 (paragraph 4-6). Disconnect FCP breakout box and connect cables to FCP.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

50. ARM LIGHT WILL NOT COME ON

Step 1. Turn system power off (TM 9-1425-646-10). Disconnect W1P2 from FCP connector J1. Connect W1P2 to FCP breakout box connector J1. Disconnect W59P1 from EU connector J1. Using multimeter, check for continuity between W59P1-78 and FCP breakout box test point J1-78.

Continuity

Replace EU (TM 9-1425-646-20). Disconnect FCP breakout box and connect W1P2 to FCP connector J1.

No continuity

Continue.

Step 2. Connect W59P1 to EU connector J1. Disconnect W59P2 from W68J1. Using multimeter, check for continuity between W68J1-78 and FCP breakout box test point J1-78.

Continuity

Replace W59 cable (paragraph 4-6). Disconnect FCP breakout box and connect W1P2 to FCP connector J1.

No continuity

Continue.

Step 3. Connect W59P2 to W68J1. Disconnect W68P1 from W1J2. Using multimeter, check for continuity between W1J2-78 and FCP test point J1-78.

Continuity

Replace W68 cable (paragraph 4-6). Disconnect FCP breakout box and connect W1P2 to FCP connector J1.

No continuity

Remove and replace W1 cable (paragraph 4-6).

51. CAB SAFE LIGHT WILL NOT COME ON

Step 1. Turn system power off (TM 9-1425-646-10). Disconnect W1P2 from FCP connector J1. Connect W1P2 to FCP breakout box connector J1. Disconnect W59P1 from EU connector J1. Using multimeter, check for continuity between W59P1-90 and FCP breakout box test point J1-90.

Continuity

Replace EU (TM 9-1425-646-20). Disconnect FCP breakout box and connect W1P2 to FCP connector J1.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	No continuity	Continue.
	Step 2. Connect W59P1 to EU connector J1. Disconnect W59P2 from W68J1. Using multimeter, check for continuity between W68J1-90 and FCP breakout box test point J1-90.	
	Continuity	Replace W59 cable (paragraph 4-6). Disconnect FCP breakout box and connect W1P2 to FCP connector J1.
	No continuity	Continue.
	Step 3. Connect W59P2 to W68J1. Disconnect W68P1 from W1J2. Using multimeter, check for continuity between W1J2-90 and FCP breakout box test point J1-90.	
	Continuity	Replace W68 cable (paragraph 4-6). Disconnect FCP breakout box and connect W1P2 to FCP connector J1.
	No continuity	Remove and replace W1 cable (paragraph 4-6).
52. CMP BIT LIGHT WILL NOT COME ON		
	Step 1. Turn system power off and disconnect W1P2 from FCP J1. Connect W1P2 to FCP breakout box J1. Disconnect W59P1 from EU J1. Using multimeter, check for continuity between W59P1-45 and breakout box test point J1-45.	
	Continuity	Replace EU (TM 9-1425-646-20). Disconnect breakout box and connect W1P2 to FCP J1.
	No continuity	Continue.
	Step 2. Connect W59P1 to EU J1. Disconnect W59P2 from W68J1. Using multimeter, check for continuity between W68J1-45 and breakout box test point J1-45.	
	Continuity	Replace cable W59 (paragraph 4-6). Disconnect breakout box and connect W1P2 to FCP J1.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	No continuity	Continue.
	Step 3. Connect W59P2 to W68J1. Disconnect W68P1 from W1J2. Using multimeter, check for continuity between W1J2-45 and breakout box test point J1-45.	
	Continuity	Replace cable W68 (paragraph 4-6). Disconnect breakout box and connect W1P2 to FCP J1.
	No continuity	Replace cable W1 (paragraph 4-6).
53. EU BIT LIGHT WILL NOT COME ON		
	Step 1. Turn system power off and disconnect W1P2 from FCP J1. Connect W1P2 to FCP breakout box J1. Disconnect W59P1 from EU J1. Using multimeter, check for continuity between W59P1-32 and breakout box test point J1-32.	
	Continuity	Replace EU (TM 9-1425-646-20). Disconnect breakout box and connect W1P2 to FCP J1.
	No continuity	Continue.
	Step 2. Connect W59P1 to EU J1. Disconnect W59P2 from W68J1. Using multimeter, check for continuity between W68J1-32 and breakout box test point J1-32.	
	Continuity	Replace cable W59 (paragraph 4-6). Disconnect breakout box and connect W1P2 to FCP J1.
	No continuity	Continue.
	Step 3. Connect W59P2 to W68J1. Disconnect W68P1 from W1J2. Using multimeter, check for continuity between W1J2-32 and breakout box test point J1-32.	
	Continuity	Replace cable W68 (paragraph 4-6). Disconnect breakout box and connect W1P2 to FCP J1.
	No continuity	Replace cable W1 (paragraph 4-6).

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

54. FCP BOOM CONT LIGHT WILL NOT COME ON

Step 1. Turn system power off (TM 9-1425-646-10). Disconnect W1P2 from FCP J1. Connect W1P2 to FCP breakout box J1. Disconnect W59P1 from EU J1. Using multimeter, check for continuity between W59P1-77 and FCP breakout box test point J1-77.

Continuity

Replace EU (TM 9-1425-646-20). Disconnect breakout box and connect W1P2 to FCP J1.

No continuity

Continue.

Step 2. Connect W59P1 to EU J1. Disconnect W59P2 from W68J1. Using multimeter, check for continuity between W68J1-77 and FCP breakout box test point J1-77.

Continuity

Replace W59 cable (paragraph 4-6). Disconnect FCP breakout box and connect W1P2 to FCP J1.

No continuity

Continue.

Step 3. Connect W59P2 to W68J1. Disconnect W68P1 from W1J2. Using multimeter, check for continuity between W1J2-77 and FCP breakout box test point J1-77.

Continuity

Replace W68 cable assembly (paragraph 4-6). Disconnect FCP breakout box and connect W1P2 to FCP connector J1.

No continuity

Replace W1 cable (paragraph 4-6).

55. FCP ELAPSE TIME INDICATOR INOPERATIVE

Step 1. Turn system power off. Disconnect W1P2 from FCP J1. Connect W1P2 to the FCP breakout box connector J1. Connect FCP breakout box to FCP J1. Turn system power on. Using multimeter, check for 21 to 28 V dc between FCP breakout box test points J1-87(+) and J1-72(–).

Voltage correct

Replace FCP (TM 9-1425-646-20).

Table 2-2. Troubleshooting – Continued

MALFUNCTION TEST OR INSPECTION	CORRECTIVE ACTION
Voltage incorrect	Continue.
Step 2. Turn system power off. Disconnect W59P1 from EU J1. Using multimeter, check for continuity between FCP breakout box test points J1-72 and W59P1-72 and J1-87 and W59P1-87.	
Continuity	Replace EU (TM 9-1425-646-20). Disconnect FCU breakout box and connect W1P2 to FCP J1.
No continuity	Continue.
Step 3. Connect W59P1 to EU J1. Disconnect W59P2 from W68J1. Using multimeter, check for continuity between FCP breakout test points J1-72 and W68J1-72 and J1-87 and W68J1-87.	
Continuity	Replace W59 cable (paragraph 4-6). Disconnect FCP breakout box and connect W1P2 to FCP J1.
No continuity	Continue.
Step 4. Connect W59P2 to W68J1. Disconnect W68P1 from W1J2. Using multimeter, check for continuity between FCP breakout box test points J1-72 and W1J2-72 and J1-87 and W1J2-87.	
Continuity	Replace W68 cable (paragraph 4-6). Disconnect FCP breakout box and connect W1P2 to FCP J1.
No continuity	Replace W1 cable (paragraph 4-6).

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

56. FCP GOES BLANK DURING OPERATION

CAUTION

While the EB and battery box covers are off, use care not to drop metal objects or other items into box that might cause a short circuit. When making voltage checks, be sure of test locations and polarity before attempting test.

Step 1. Manually elevate LLM and install jury struts. Disconnect W33P2 from EB J3. Start vehicle and place INTERCONNECT switch to ON. Using multimeter, check for 26.0 to 28.5 V dc between W33P2-A(+) and W32P2-C(–).

Voltage incorrect

Troubleshoot vehicle generating system (TM 9-1450-646-20).

Voltage correct

Turn system power and INTERCONNECT switch to OFF. Connect W33P2 to EB J3, and then continue.

Step 2. Turn system power and carrier interlock switch off. Using crosstip screwdriver, remove 12 screws and washers securing EB cover. Remove cover and gasket. Unlatch and remove battery box cover. Disconnect W7P1 from EB J7. Using multimeter, check for 23 to 25 V dc between EB positive (+) bus E4 and negative (–) bus E1.

Voltage low

Replace batteries (TM 9-1425-646-20).

Voltage missing

Replace EB (paragraph 4-4).

Voltage correct

Continue.

Step 3. Connect W7P1 to EB J7. Place FCP power switch to on. Using multimeter, check for 21 to 25 V dc between EB filter FL3 terminal lugs A5 (+) and A1 (–), and then check between A8 (+) and A1 (–).

Voltage missing

Replace EB (paragraph 4-4).

Voltage correct

Continue.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	Step 4. Turn system power off. Install battery box and EB covers. Disconnect W1P2 from FCP J1. Connect FCP breakout box J1 to W1P2 and breakout box W1P2 to FCP J1. Place FCP PWR switch to on. Using multimeter, check for 21 to 25 V dc between breakout box test points J1-40 (+) and J1-27 (–).	
	Voltage correct	Disconnect breakout box and replace FCP (TM 9-1425-646-20).
	Voltage missing	Disconnect breakout box and connect W1P2 to FCP J1. Replace EU (TM 9-1425-646-20).
57. FCU BIT LIGHT WILL NOT COME ON		
	Step 1. Turn system power off and disconnect W1P2 from FCP J1. Connect W1P2 to FCP breakout box J1. Disconnect W59P1 from EU J1. Using multimeter, check for continuity between W59P1-34 and breakout box test point J1-34.	
	Continuity	Replace EU (TM 9-1425-646-20). Disconnect breakout box and connect W1P2 to FCP J1.
	No continuity	Continue.
	Step 2. Connect W59P1 to EU J1. Disconnect W59P2 from W68J1. Using multimeter, check for continuity between W68J1-34 and breakout box test point J1-34.	
	Continuity	Replace cable W59 (paragraph 4-6). Disconnect breakout box and connect W1P2 to FCP J1.
	No continuity	Continue.
	Step 3. Connect W59P2 to W68J1. Disconnect W68P1 from W1J2. Using multimeter, check for continuity between W1J2-34 and breakout box test point J1-34.	
	Continuity	Replace cable W68 (paragraph 4-6). Disconnect breakout box and connect W1P2 to FCP J1.
	No continuity	Replace cable W1 (paragraph 4-6).

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

58. FIRE LIGHT WILL NOT COME ON

Step 1. Turn system power off (TM 9-1425-646-10). Disconnect W1P2 from FCP connector J1. Connect W1P2 to FCP breakout box connector J1. Disconnect W59P1 from EU connector J1. Using multimeter, check for continuity between W59P1-79 and FCP breakout box test point J1-79.

Continuity

Replace EU (TM 9-1425-646-20). Disconnect FCP breakout box and connect W1P2 to FCP connector J1.

No continuity

Continue.

Step 2. Connect W59P1 to EU connector J1. Disconnect W59P2 from W68J1. Using multimeter, check for continuity between W68J1-79 and FCP breakout box test point J1-79.

Continuity

Replace W59 cable (paragraph 4-6). Disconnect FCP breakout box and connect W1P2 to FCP connector J1.

No continuity

Continue.

Step 3. Connect W59P2 to W68J1. Disconnect W68J1 from W1J2. Using multimeter, check for continuity between W1J2-79 and FCP breakout box test point J1-79.

Continuity

Replace W68 cable (paragraph 4-6). Disconnect FCP breakout box and connect W1P2 to FCP connector J1.

No continuity

Replace W1 cable (paragraph 4-6).

59. HANGFIRE LIGHT WILL NOT COME ON

Step 1. Turn system power off and disconnect W1P2 from FCP J1. Connect W1P2 to FCP breakout box J1. Disconnect W59P1 from EU J1. Using multimeter, check for continuity between W59P1-89 and breakout box test point J1-89.

Continuity

Replace EU (TM 9-1425-646-20). Disconnect breakout box and connect W1P2 to FCP J1.

No continuity

Continue.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

Step 2. Connect W59P1 to EU J1. Disconnect W59P2 from W68J1. Using multimeter, check for continuity between W68J1-89 and breakout box test point J1-89.

Continuity

Replace cable W59 (paragraph 4-6). Disconnect breakout box and connect W1P2 to FCP J1.

No continuity

Continue.

Step 3. Connect W59P2 to W68J1. Disconnect W68P1 from W1J2. Using multimeter, check for continuity between W1J2-89 and breakout box test point J1-89.

Continuity

Replace cable W68 (paragraph 4-6). Disconnect breakout box and connect W1P2 to FCP J1.

No continuity

Replace cable W1 (paragraph 4-6).

60. KYBD FUNCTIONS INOPERATIVE

Step 1. Turn system power off. Disconnect W1P2 from FCP J1. Connect W1P2 to FCP breakout box J1. Disconnect W59P1 from EU J1. Using multimeter, check for continuity between W59P1 and FCP breakout box J1 test points as follows: (Record failures.)

NOTE

Signal titles are provided in the following test as an assistance to technicians in fault detection of specific keyboard failures. Continuity tests should start with the most suspected pins.

W59P1 Pins	FCP Breakout Box J1 Test Points	Signal Title
18	18	+5 V dc
19	19	Digital return
21	21	–12 V dc
22	22	Analog ground return
27	27	Chassis ground
64	64	Keyboard BIT 7
65	65	Keyboard BIT 6
66	66	Keyboard BIT 5
75	75	Keyboard BIT 3
76	76	Keyboard BIT 4
83	83	Keyboard BIT 8
84	84	Keyboard BIT 1
85	85	Keyboard BIT 2
92	92	Keyboard output strobe
93	93	Keyboard input strobe

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	Continuity	Replace EU (TM 9-1425-646-20).
	No continuity	Continue.
	Step 2. Connect W59P1 to EU J1. Disconnect W59P2 from W68J1. Using multimeter, check for continuity between W68J1 and FCP breakout box test point J1 on the same pins as step 1. Check only those pins that failed in step 1.	
	Continuity	Replace cable W59 (paragraph 4-6). Disconnect FCP breakout box and connect W1P2 to FCP J1.
	No continuity	Continue.
	Step 3. Connect W59P2 to W68J1. Disconnect W68P1 from W1J2. Using multimeter, check for continuity between W1J2 and FCP breakout box test point J1 on the same pins as step 1. Check only those pins that failed in step 1.	
	Continuity	Replace cable W68 (paragraph 4-6).
	No continuity	Replace cable W1 (paragraph 4-6).
61. PLASMA DISPLAY FUNCTIONS INOPERATIVE		
	Step 1. Turn system power off. Disconnect W1P1 from FCP J2. Connect W1P1 to FCP breakout box J2. Disconnect W60P2 from EU J2. Using multimeter, check for continuity between W60P2 and FCP breakout box test points as follows:	

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

NOTE

Signal titles are provided in the following test as an assistance to technicians in the fault detection of a specific display failure. Continuity test should start with the most suspected pins.

W60P2 Pins	FCP Breakout Box J2 Test Points	Signal Title
1	1	Panel select
4	4	Column control 01
5	5	Column control 02
10	10	Column return
14	14	12 V dc
15	15	Border control
16	16	Positive sustain pulse
18	18	Column return
19	19	44 V ac, 18 kHz, SQ wave
20	20	44 V ac return
21	21	Analog ground
22	22	-12 V dc
23	23	Negative sustain pulse
24	24	Column clock
25	25	Gated column ER/WR Bottom
28	28	Digital return
29	29	Digital return
30	30	Digital return
31	31	Positive plateau pulse
32	32	Negative plateau pulse
34	34	Row left data true
35	35	Row left data complement
37	37	+5 V dc
38	38	+5 V dc
39	39	+5 V dc
40	40	Sustainer return
43	43	Row right data true
44	44	Row right data complement
48	48	+85 V dc
50	50	+245 V dc
51	51	Row clock true
52	52	Row clock complement
53	53	+115 volt tap
54	54	+175 volt tap
55	55	+32 V dc
56	56	+195 V dc reg control
58	58	Row positive data true
59	59	Row positive data complement
60	60	Gate column ER/WR top
61	61	Column data
62	62	+195 V dc return
63	63	+195 V dc
64	64	Row ER/WR pulse

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	Continuity on all suspect pins	Replace EU (TM 9-1425-646-20).
	No continuity	Continue.
Step 2.	Connect W60P2 to EU J2. Disconnect W60P1 from W67P1. Using multimeter, check for continuity between W67J1 and FCP breakout box test point J2 on the same pins as step 1. Check only those pins that failed test in step 1.	
	Continuity	Replace cable W60 (paragraph 4-6). Disconnect FCP breakout box and connect W1P1 to FCP J2.
	No continuity	Continue.
Step 3.	Connect W60P1 to W67J1. Disconnect W67P1 from W1J1. Using multimeter, check for continuity between W1J1 and FCP breakout box test point J2 on same pins as step 1. Check only those pins that failed in step 1.	
	Continuity	Replace cable W67 (paragraph 4-6). Disconnect FCP breakout box and connect W1P1 to FCP J2.
	No continuity	Replace cable W1 (paragraph 4-6).
62. SAFE LIGHT WILL NOT COME ON		
Step 1.	Turn system power off (TM 9-1425-646-10). Disconnect W1P2 from FCP connector J1. Connect W1P2 to FCP breakout box J1. Disconnect W59P1 from EU connector J1. Using multimeter, check for continuity between W59P1-80 and FCP breakout box test point J1-80.	
	Continuity	Replace EU (TM 9-1425-646-20). Disconnect FCP breakout box and connect W1P2 to FCP connector J1.
	No continuity	Continue.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

Step 2. Connect W59P1 to EU connector J1. Disconnect W59P2 from W68J1. Using multimeter, check for continuity between W68J1-80 and FCP breakout box test point J1-80.

Continuity

Replace cable W59 (paragraph 4-6). Disconnect FCP breakout box and connect W1P2 to FCP connector J1.

No continuity

Continue.

Step 3. Connect W59P2 to W68J1. Disconnect W68P1 from W1J2. Using multimeter, check for continuity between W1J2-80 and FCP breakout box test point J1-80.

Continuity

Replace cable W68 (paragraph 4-6). Disconnect FCP breakout box and connect W1P2 to FCP connector J1.

No continuity

Replace cable W1 (paragraph 4-6).

63. SRP/PDS BIT LIGHT WILL NOT COME ON

Step 1. Turn system power off and disconnect W1P2 from FCP J1. Connect W1P2 to FCP breakout box J1. Disconnect W59P1 from EU J1. Using multimeter, check for continuity between W59P1-31 and breakout box test point J1-31.

Continuity

Replace EU (TM 9-1425-646-20). Disconnect breakout box and connect W1P2 to FCP J1.

No continuity

Continue.

Step 2. Connect W59P1 to EU J1. Disconnect W59P2 from W68J1. Using multimeter, check for continuity between W68J1-31 and breakout box test point J1-31.

Continuity

Replace cable W59 (paragraph 4-6). Disconnect breakout box and connect W1P2 to FCP J1.

No continuity

Continue.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

64. SRP RDY LIGHT WILL NOT COME ON

Step 1. Turn system power off (TM 9-1425-646-10). Disconnect W1P2 from FCP connector J1. Connect W1P2 to FCP breakout box J1. Disconnect W59P1 from EU connector J1. Using multimeter, check for continuity between W59P1-67 and FCP breakout box test point J1-67.

Continuity

Replace EU (TM 9-1425-646-20). Disconnect FCP breakout box and connect W1P2 to FCP connector J1.

No continuity

Continue.

Step 2. Connect W59P1 to EU connector J1. Disconnect W59P2 from W68J1. Using multimeter, check for continuity between W68J1-67 and FCP breakout box test point J1-67.

Continuity

Replace cable W59 (paragraph 4-6). Disconnect FCP breakout box and connect W1P2 to FCP connector J1.

No continuity

Continue.

Step 3. Connect W59P2 to W68J1. Disconnect W68P1 from W1J2. Using multimeter, check for continuity between W1J2-67 and FCP breakout box test point J1-67.

Continuity

Replace cable W68 (paragraph 4-6). Disconnect FCP breakout box and connect W1P2 to FCP connector J1.

No continuity

Replace W1 cable (paragraph 4-6).

65. HOIST CABLE ASSEMBLY DAMAGED

None

Replace defective hoist cable assembly (paragraph 5-14).

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

66. LEFT OR RIGHT HOIST WILL NOT LOWER

CAUTION

Continuous operation of the hoist without stopping to allow the motor to cool may damage the motor.

NOTE

Normal operating time for hoist to be fully lowered or raised electrically, without an LP/C loaded, shall be less than 40 seconds.

Cables W19 and W20 must be properly connected in the stowed configuration before operation of the hoist or boom can be accomplished. If the left side operation fails, verify that W19P2 and W20P2 are properly connected. If the right side operation fails, verify that W19P3 and W20P3 are properly connected.

Step 1. **Position LLM at 3200 mils and extend boom. Turn system power off. Inspect hoist cable, pulleys, hoist assembly, and hoist hook and pulley assembly for obvious damage.**

Damage found

Replace hoist cable (paragraph 5-14), hoist pulleys (paragraph 5-17), hoist assembly (paragraph 5-15), and hoist hook and pulley assembly (paragraph 5-16).

No damage

Continue.

Step 2. **Disconnect W75P2(L)/W76P2(R) from hoist control J1. Connect W75P2(L)/W76P2(R) to hoist breakout box J1. Connect breakout box to hoist control J1. Enable BC. Using multimeter, check for 21 to 28 V dc between breakout box test points J1 as follows:**

J1 to J1

A(+) G(–)
E(+) D(–) BC HOOK DN switch pressed

Voltage incorrect

Go to step 6.

Voltage correct

Continue.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

Step 3. Turn system power off and disconnect W53P1 from hoist control J3. Connect W53P1 to hoist breakout box J3. Connect hoist breakout box to hoist control J3. Enable BC. Using multimeter, check for 21 to 28 V dc between hoist breakout box test point J3 pins each time the BC HOOK DN switch is pressed as follows:

J3 to J3 FUNCTION

E(+) F(–) Brake
D(+) A(–) Field
B(+) G(–) Armature
J(+) G(–) Temp switch
H(+) G(–) Temp switch

Voltage incorrect

Go to step 5.

All voltage correct except possibly H(+) to G(–)

Continue.

Step 4. Turn system power off and disconnect W53P2 from hoist motor. Using multimeter, check for continuity between hoist breakout box test point J3 pins and W53P2 pins as follows:

J3 to W53P2		J3 to W53P2	
A	A	F	F
B	B	G	G
D	D	H	H
E	E	J	J

No continuity

Replace cable W53 (paragraph 4-6). Disconnect breakout box and connect cables.

Continuity

Replace hoist assembly (paragraph 5-15). Disconnect breakout box and connect cables.

Step 5. Turn system power off and disconnect hoist down limit switch cable from hoist control J4. Connect cable to hoist breakout box J4. Using multimeter, check for continuity between breakout box test points J4-A and J4-C.

No continuity

Adjust or replace hoist down limit switch (paragraph 5-21). Disconnect breakout box and connect cables.

Continuity

Replace hoist control assembly (paragraph 5-19).

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

Step 6. Turn system power off and disconnect W75P1(L)/W76P1(R) from PDB J6(L)/J8(R). Connect W75P1(L)/W76P1(R) to PDB breakout box J6(L)/J8(R). Using multimeter, check for continuity between breakout box test points and W75P2(L)/W76P2(R) pins as follows:

J6(L)/J8(R) to W75P2(L)/W76P2(R)

A	A
G	G
E	E
D	D

No continuity

Replace cable W75 or W76 (paragraph 4-6).

Continuity

Continue.

Step 7. Connect W75P2(L)/W76P2(R) to hoist control J1. Connect PDB breakout box to PDB J6(L)/J8(R). Disconnect W24P1 from PDB J1. Connect breakout box to PDB J1. Disconnect W25P1 from PDB J3. Connect breakout box to PDB J3. Using multimeter, check for continuity between breakout box test point pins as follows:

J1 to J3		J1 to J6(L)/J8(R)			J6 to J8	
10	W	37	E		A	A
11	V	37		E	G	G
12	Y	25	D			
15	C	25		D		

No continuity

Replace PDB (paragraph 4-5).

Continuity

Continue.

Step 8. Disconnect breakout box from PDB J6(L)/J8(R). Disconnect W75P1(L)/W76P1(R) from breakout box. Connect W75P1(L)/W76P1(R) to PDB J6(L)/J8(R). Connect W25P1 to breakout box J3. Using multimeter, check for continuity between breakout box test point J3 pins as follows:

J3 to J3

15	12	BC HOOK DN switch pressed
15	10	BC L-BOTH-R switch to L
15	11	BC L-BOTH-R switch to R

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	Continuity	Go to step 11.
	No continuity	Continue.
Step 9.	Disconnect W18P2 from BC. Using multimeter, check for continuity between BC pins as follows: Pin to Pin 15 12 BC HOOK DN switch pressed 15 10 BC L-BOTH-R switch in L 15 11 BC L-BOTH-R switch in R	
	No continuity	Replace BC (paragraph 7-3). Disconnect breakout box and connect cables.
	Continuity	Continue.
Step 10.	Disconnect W18P1 from W25J1. Using multimeter, check for continuity between W18P1 and W18P2. W18P1 to W18P2 10 10 11 11 12 12 15 15	
	No continuity	Replace cable W18 (paragraph 4-6). Disconnect breakout box and connect cables.
	Continuity	Replace cable W25 (paragraph 4-6). Disconnect breakout box and connect cables.

Table 2-2. Troubleshooting - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

Step 11. Connect W24P1 to PDB breakout box J1. Disconnect W24P2 from FCU J2. Using multimeter, check for continuity between breakout box test points J1 and W24P2 pins as follows:

J1 to W24P2		J1 to W24P2	
10	10	25	25
11	11	37	37
12	12	77	77
15	15		

No continuity

Replace cable W24 (paragraph 4-6). Disconnect breakout box and connect cables.

Continuity

Continue.

Step 12. Disconnect breakout box and connect cables to PDB. Connect W24P2 to FCU J2. Disconnect W19P1 from FCU J4. Using multimeter, check for continuity between W19P1 pins as follows:

W19P1(L) to W19P1(L)		W19P1(R) to W19P1(R)	
8	7	13	83
8	91	13	14
8	98	13	60
8	100	13	96

Continuity

Go to step 14.

No continuity

Continue.

Step 13. Disconnect W19P2(L) from W32J1(L) or W19P3(R) from W32J2(R). Using multimeter, check for continuity between W32J1(L) or W23J2(R) pins as follows:

W32J1(L) to W32J1(L)		W32J2(R) to W32J2(R)	
18	17	18	17
18	45	18	45
18	51	18	51
18	54	18	54

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	No continuity	
		Replace cable W32 (paragraph 4-6). Connect W19P1 to FCU J4.
	Continuity	
		Replace cable W19 (paragraph 4-6).
Step 14.	Connect W19P1 to FCU J4. Disconnect W20P1 from FCU J1. Using multimeter, check for continuity between W20P1 pins as follows: W20P1 to W20P1 60(L) 62(L) 65(R) 66(R)	
	Continuity	
		Replace FCU (TM 9-1425-646-20).
	No continuity	
		Continue.
Step 15.	Disconnect W20P2(L) from left stowage connector or W20P3(R) from right stowage connector. Using multimeter, check for continuity between left(L) or right(R) stowage connector pins as follows: Left(L) to Left(L) Right(R) to Right(R) 50 52 50 52	
	No continuity	
		Replace defective stowage connector (paragraph 4-6). Connect W20P1 to FCU J1.
	Continuity	
		Replace cable W20 (paragraph 4-6).

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

67. LEFT OR RIGHT HOIST WILL NOT RAISE

CAUTION

Continuous operation of the hoist without stopping to allow the motor to cool may damage the motor.

NOTE

Normal operating time for hoist to be fully lowered or raised electrically, without an LP/C loaded, shall be less than 40 seconds.

Cables W19 and W20 must be properly connected before operation of hoist or boom can be accomplished. Refer to TM 9-1425-646-10 for proper connection.

If hoist failure occurred with an LP/C loaded and the hoist cannot be used to raise the LP/C, refer to paragraph 3-14; otherwise, start fault isolation at step 1.

Step 1. **Position LLM at 3200 mils and extend boom. Turn system power off. Inspect hoist cable, pulleys, hoist assembly, and hoist hook and pulley assembly for obvious damage.**

Damage found

Replace hoist cable (paragraph 5-14), hoist pulleys (paragraph 5-17), hoist assembly (paragraph 5-15), and hoist hook and pulley assembly (paragraph 5-16).

No damage

Continue.

Step 2. **Disconnect W75P2 (left hoist) or W76P2 (right hoist) from hoist control assembly J1. Connect hoist breakout box to the hoist control assembly J1. Connect W75P2 or W76P2 to the breakout box J1. Enable BC and using multimeter, check for 21 to 28 V dc between breakout box J1 test points as follows:**

J1 to J1

A(+) G(–)
E(+) B(–) BC HOOK UP switch pressed

Voltage incorrect

Go to step 7.

Voltage correct

Continue.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

Step 3. Turn system power off and disconnect W53P1 from hoist control assembly J3. Connect W53P1 to hoist breakout box J3. Connect breakout box to hoist control J3. Enable BC and using multimeter, check for 21 to 28 V dc between breakout box test points J3 each time BC HOOK UP switch is pressed.

J3 to J3

F(+) E(–)
A(+) D(–)
C(+) G(–)
J(+) G(–)
H(+) G(–)

Voltage incorrect

Go to step 5.

All voltage correct except possibly H(+) to G(–)

Continue.

Step 4. Turn system power off and disconnect W53P2 from hoist motor. Using multimeter, check for continuity between hoist breakout box J3 and W53P2 pins as follows:

J3 to W53P2		J3 to W53P2	
A	A	F	F
C	C	G	G
D	D	H	H
E	E	J	J

No continuity

Replace cable W53 (paragraph 4-6). Disconnect breakout box and connect W53.

Continuity

Replace hoist assembly (paragraph 5-15). Disconnect breakout box and connect cables.

Step 5. Turn system power off and disconnect W57P1 from hoist control assembly J2. Connect W57P1 to hoist control breakout box J2. Using multimeter, check for continuity between breakout box test points J2-A and J2-B.

Continuity

Replace hoist control assembly (paragraph 5-19).

No continuity

Continue.

Table 2-2. Troubleshooting - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

Step 6. Disconnect W57P2 from hoist up limit switch. Connect limit switch test cable to limit switch. Using multimeter, check for continuity between test cable pins 1 and 2.

No continuity

Adjust or replace limit switch (paragraph 5-20). Disconnect hoist breakout box and limit switch test cable. Connect cables.

Continuity

Replace cable W57 (paragraph 4-6). Disconnect hoist breakout box and limit switch test cable. Connect cables.

Step 7. Turn system power off. Disconnect W75P1(left) or W76P1(right) from PDB J6(left) or J8(right). Connect W75P1 or W76P1 to PDB breakout box J6 or J8. Using multimeter, check for continuity between breakout box test points and W75P2 or W76P2.

J6 or J8	W75P2 or W76P2
A	A
G	G
E	E
B	B

No continuity

Replace cable W75 or W76 (paragraph 4-6).

Continuity

Continue.

Step 8. Disconnect hoist breakout box from hoist control J1. Connect W75P2 or W76P2 to hoist control J1. Connect PDB breakout box to PDB J6 or J8. Disconnect W24P1 from PDB J1. Connect PDB breakout box to PDB J1. Disconnect W25P1 from PDB J3. Connect PDB breakout box to PDB J3. Using multimeter, check for continuity between PDB breakout box test points as follows:

J1 to J3		J1 to J6		J1 to J8		J6 to J8	
10	W	37	E	37	E	A	A
11	V	79	B	74	B	G	G
13	X						
15	C						

No continuity

Replace PDB (paragraph 4-5).

Continuity

Continue.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

Step 9. Disconnect PDB breakout box from PDB. Disconnect W75P1 or W76P1 from breakout box and connect W75P1 or W76P1 to PDB J6 or J8. Connect W25P1 to breakout box J3. Using multimeter, check for continuity between breakout box test points J3 as follows:

J3 to J3

C X BC HOOK UP switch pressed
C W BC L-BOTH-R switch to L
C V BC L-BOTH-R switch to R

Continuity

Go to step 12.

No continuity

Continue.

Step 10. Disconnect W18P2 from BC. Using multimeter, check for continuity between BC pins as follows:

15 to 13 BC HOOK UP switch pressed
15 to 10 BC L-BOTH-R switch to L
15 to 11 BC L-BOTH-R switch to R

No continuity

Replace BC (paragraph 7-3). Disconnect breakout box and connect cables.

Continuity

Continue.

Step 11. Disconnect W18P1 from W25J1. Using multimeter, check for continuity between W18P1 and W18P2 as follows:

W18P1 to W18P2

10	10
11	11
13	13
15	15

No continuity

Replace cable W18 (paragraph 4-6). Disconnect PDB breakout box and connect cables.

Continuity

Replace cable W25 (paragraph 4-6). Disconnect PDB breakout box and connect cables.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

Step 12. Connect W24P1 to PDB breakout box J1. Disconnect W24P2 from FCU J2. Using multimeter, check for continuity between breakout box test point J1 and W24P2 as follows:

J1 to W24P2		J1 to W24P2	
74	74	15	15
10	10	79	79
11	11	37	37
13	13		

No continuity

Replace cable W24 (paragraph 4-6). Disconnect breakout box and connect cables.

Continuity

Continue.

Step 13. Disconnect PDB breakout box and connect cables to PDB. Connect W24P2 to FCU J2. Disconnect W19P1 from FCU J4. Using multimeter, check for continuity between W19P1 pins as follows:

W19P1(L) to W19P1(L)		W19P1(R) to W19P1(R)	
7	8	13	83
7	91	13	14
7	98	13	60
7	100	13	96

Continuity

Go to step 15.

No continuity

Continue.

Step 14. Disconnect W19P2(L) from W32J1(L) or W19P3(R) from W32J2(R). Using multimeter, check for continuity between W32J1(L) and W32J2(R) as follows:

W32J1(L) to W32J1(L)		W32J2(R) to W32J2(R)	
18	17	18	17
18	45	18	45
18	51	18	51
18	54	18	54

Table 2-2. Troubleshooting - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	No continuity	Replace cable W32 (paragraph 4-6). Connect W19P1 to FCU J4.
	Continuity	Replace cable W19 (paragraph 4-6).
	Step 15. Connect W19P1 to FCU J4. Disconnect W20P1 from FCU J1. Using multimeter, check for continuity between W20P1 pins as follows: W20P1 to W20P1 60(L) 62(L) 65(R) 66(R)	
	Continuity	Replace FCU (TM 9-1425-646-20).
	No continuity	Continue.
	Step 16. Disconnect W20P2(L) from left stowage connector or W20P3(R) from right stowage connector. Using multimeter, check for continuity between stowage connector pins as follows: Left(L) to Left(L) Right(R) to Right(R) 50 52 50 52	
	No continuity	Replace defective stowage connector (paragraph 4-6). Connect W20P1 to FCU J1.
	Continuity	Replace cable W20 (paragraph 4-6).
68. HEAT EXCHANGER CLOGGED		
	None	Replace defective heat exchanger (paragraph 6-4).

Table 2-2. Troubleshooting – Continued

MALFUNCTION / TEST OR INSPECTION	CORRECTIVE ACTION

88. LDS PUMP MOTOR HAS SHUT OFF AND WILL NOT TURN BACK ON

NOTE

This procedure assumes the following conditions: vehicle is operating with power interlock switch on; battery box failure indication did not occur; LLM has not moved beyond software travel limits into an overtravel limit switch (travel limits in TM 9-1425-646-10); and if LLM will not move, see figure 2-13.

Step 1. Turn system power off. Disconnect W23P1 from PDB J4 and connect W23P1 to PDB breakout box J4. Remove LDS contactor cover. Using multimeter, check for continuity between PDB breakout box J4-23 and contactor X1.

No continuity

Connect W23P1 to PDB J4 and go to step 13.

Continuity

Connect W23P1 to PDB J4 and continue.

Step 2. Is LLM in the stowed position?

No

Go to step 6.

Yes

Continue.

Step 3. Enable BC (TM 9-1425-646-20). Did travel lock unlock?

No

Perform TRAVEL LOCK WILL NOT UNLATCH (malfunction 102).

Yes

Continue.

Step 4. Turn system power off. Disconnect W25P1 from PDB J3. Connect PDB breakout box to PDB connector J3 and W25P1 to PDB breakout box J3. Using multimeter, check for continuity between PDB breakout box test points J3-N and J3-J.

Continuity

Disconnect PDB breakout box. Connect W25P1 to PDB J3 and go to step 6.

No continuity

Continue.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	Step 5. Disconnect W25P2 from travel lock actuator. Using multimeter, check for continuity between W25P2-B and PDB breakout box test point J3-N.	
	Continuity	Replace travel lock actuator (paragraph 5-23).
	No continuity	Replace cable W25 (paragraph 4-6).
	NOTE Approximately 20 seconds after boom control manual is selected, LDS MALFUNCTION prompt will appear on FCP. Repairer should disregard the prompt and continue.	
	Step 6. Turn system power off. Disconnect the two quick-disconnect couplings from azimuth and elevation servomotors. Turn system power on and select BC manual on FCP (TM 9-1425-646-10). Using multimeter, check for 18 to 28 V dc between the positive (+) and negative (–) terminals on the hydraulic pump electric motor while pressing BC LLM UP/DN or LLM CW/CCW switch.	
	Voltage	Replace hydraulic pump electric motor (paragraph 6-5).
	No voltage	Continue.
	Step 7. Turn system power off and disconnect W14P2 from PDB. Turn system power on. Using multimeter, check for 18 to 28 V dc between W14P2 (+) and W14P2 (–) contacts.	
	No voltage	Verify that W14P1 is properly connected to electronics box J6. If properly connected, replace cable W14 (paragraph 4-6).
	Voltage	Turn system power off. Connect W14P2 to PDB J2 and continue.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	Step 8. Verify system power off. Disconnect W23P1 from PDB J4. Connect W23P1 to PDB breakout box J4 and connect breakout box to PDB J4. Turn system power on and select boom control manual on FCP (TM 9-1425-646-10). While pressing LLM UP switch, use multimeter and check for 18 to 28 V dc between breakout box test points J4-23 and J4-24.	
	No voltage	Go to step 17.
	Voltage	Continue.
	Step 9. Turn system power off. Remove LDS contactor cover. Turn system power on. Using multimeter, check for 18 to 28 V dc between contactor terminal B(+) and the negative (–) terminal on hydraulic pump electric motor.	
	No voltage	Turn system power off. Disconnect W13P1 from EB J5. Using multimeter, check for continuity from W13P1 pins A and B to terminal B on LDS contactor, then from W13P1 pins C and D to negative terminal of LDS hydraulic power supply. If cable is good, replace EB (paragraph 4-4). If cable is bad, replace cable W13 (paragraph 4-6). Reconnect quick-disconnects on azimuth and elevation servomotors.
	Voltage	Continue.
	Step 10. Select BC manual on FCP (TM 9-1425-646-10). While pressing LLM UP switch, use multimeter and check for 18 to 28 V dc between contactor terminals X1(+) and X2(–).	
	Voltage	Replace contactor (paragraph 6-6). Reconnect quick-disconnects to azimuth and elevation servomotors.
	No voltage	Install LDS contactor cover and continue.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

NOTE

Voltage missing in step 10 is caused by an open circuit in cable W23 or W35, an open azimuth position transducer switch, one of the left/right elevation actuator switches, the ±1.25 degree azimuth centering switch, the 15-degree elevation limit switch or the 27-degree elevation limit switch. Steps 10 and 11 check the condition of cables W23 and W35. Steps 12 through 15 check the condition of the limit switches.

Step 11. Turn system power off. Disconnect breakout box from PDB J4. Leave W23P1 connected to breakout box. Disconnect W23P5 from W35J1. Disconnect W23P4 from azimuth position transducer J2. Disconnect W23P6 from ±1.25 degree azimuth centering switch. Using multimeter, perform continuity check on cable W23 as follows:

Breakout box J4-23	to W23P4-11
W23P5-10	to contactor X1
Breakout box J4-24	to contactor X2
W23P5-9	to W23P4-2
W23P5-7	to W23P4-12
W23P5-6	to W23P4-13
W23P5-8	to W23P4-1
W23P5-7	to W23P6-3
W23P5-6	to W23P6-1
W23P4-12	to W23P6-3
W23P4-13	to W23P6-1

No continuity

Replace cable W23 (paragraph 4-6). Connect quick-disconnect to azimuth and elevation servomotors.

Continuity

Continue.

Step 12. Disconnect W23P1 from breakout box and connect W23P1 to PDB J4. Connect W23P6 to ±1.25 degree azimuth centering switch. Connect W23P4 to azimuth position transducer J2. Remove switch cover and disconnect W35P1 from 15-degree elevation switch. Disconnect W35P5 from 27-degree elevation switch. Disconnect W35P2 and W35P3 from elevation actuators. Using multimeter, perform continuity check on cable W35 as follows:

W35J1-8	to W35P5-1
W35J1-7	to W35P1-1
W35J1-9	to W35P2-A
W35J1-10	to W35P3-A
W35P5-3	to W35P1-2
W35P2-B	to W35P3-B

Table 2-2. Troubleshooting – Continued

MALFUNCTION / TEST OR INSPECTION	CORRECTIVE ACTION
No continuity	Replace cable W35 (paragraph 4-6). Connect quick-disconnects to azimuth and elevation servomotors.
Continuity	Replace azimuth position transducer/switch (paragraph 6-14).

NOTE

The position of the LLM is important when verifying condition of limit switches and it may be necessary to manually move the LLM. The LLM position may be determined by turning system power on and reading the azimuth and elevation positions on the FCP. Be sure that all cables are connected when obtaining LLM position indications.

Step 13. Check condition of the left or right elevation actuator switches as follows:

a. Verify LLM has not exceeded 1084-mil (61-degree) elevation.

b. Disconnect W35P2 and W35P3 from elevation actuator switches. Using multimeter, perform continuity check between pins J1-A and J1-B on both limit switches.

No continuity — Replace defective elevation actuator switch (paragraph 6-20). Reconnect cables, then pressure lines to azimuth and elevation servomotors.

Continuity — Continue.

Step 14. Check condition of the ±1.25 degree switch as follows:

a. Verify LLM is within ±1.25 degrees (±22 mils) of zero azimuth position.

b. Disconnect W23P6 from ±1.25 degree switch and connect the limit switch test cable to the switch. Using multimeter, check for continuity between test cable pins 1 and 3.

No continuity — Adjust or replace switch (paragraph 5-27). Reconnect hydraulic pressure lines to azimuth and elevation servomotors.

Continuity — Continue.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
Step 15. Check condition of the +15 degree limit switch as follows:		
	a. Verify that LLM is elevated more than 15 degrees (+267 mils).	
	b. Disconnect W35P1 from +15 degree limit switch and connect limit switch test cable to switch. Using multimeter, check for continuity between test cable pins 1 and 2.	
	No continuity	Adjust or replace +15 degree limit switch (paragraph 5-25). Reconnect hydraulic pressure lines to azimuth and elevation servomotors.
	Continuity	Continue.
Step 16. Check condition of +27 degree limit switch as follows:		
	a. Verify that LLM is elevated less than +27 degrees (+480 mils).	
	b. Disconnect W35P5 from the +27 degree limit switch and connect limit switch test cable to the switch. Using multimeter, check for continuity between test cable pins 1 and 3.	
	No continuity	Adjust or replace +27 degree limit switch (paragraph 5-25). Reconnect hydraulic lines to servomotors.
	Continuity	Go to step 11.
Step 17. Turn system power off. Disconnect W24P1 from PDB J1. Connect W24P1 to PDB breakout box J1. Connect breakout box to PDB J1. Enable BC. While pressing LLM UP switch on BC, use multimeter and check for 21 to 28 V dc between breakout box test points J1-38 and J1-65.		
	Voltage correct	Replace PDB (paragraph 4-5). Reconnect hydraulic pressure lines to servomotors.
	Voltage missing	Continue.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

Step 18. Turn system power off. Disconnect W24P2 from FCU J2. Disconnect breakout box from PDB J1. Using multimeter, check for continuity between breakout box test points J1 and W24P2 as follows:

J1-38 to W24P2-38
J1-65 to W24P2-65
J1-57 to W24P2-57

No continuity

Replace cable W24 (paragraph 4-6). Reconnect hydraulic pressure lines to servomotors.

Continuity

Replace FCU (TM 9-1425-646-20). Reconnect hydraulic pressure lines to servomotors.

70. STOW DISCONTINUED AT 35-MIL ELEVATION

NOTE

When the fire control system switches from normal operation to the stow function at 35-mil elevation, the LLM may stop stow operation due to lack of hydraulic pressure to either the servomotor or elevation brake, thereby applying the brake. This failure can occur without the UNABLE TO STOW prompt being displayed. This procedure assumes that the LDS functions normally, except to completely stow.

Step 1. Enable BC (TM 9-1425-646-20). Elevate the LLM to approximately 30 mils. Turn system power off.

CAUTION

The pressure lines may extend when pressurized with one end disconnected. Care should be taken when checking pressure lines in base/turret.

Step 2. Install hydraulic pressure gage (paragraph 3-13). Disconnect the two pressure lines from the azimuth and elevation servomotors. Turn system power on. While pressing the LLM STOW, read the gage.

Pressure reading 0 psi

Replace pressure reducer valve (paragraph 6-22). Connect pressure lines. Remove hydraulic pressure gage (paragraph 3-13).

Pressure reading 9.7 to 11 MPA

Replace pilot-operated shuttle valve and check valve (paragraph 6-22). Replace bleed valve (paragraph 6-23). Connect pressure lines to servomotors. Remove hydraulic pressure gage (paragraph 3-13).

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
71. DURING A FIRE MISSION, THE LDS SHUTS OFF BEFORE CAGE ELEVATES TO CLEAR CAB (PUMP PRESSURE LOW message may be displayed.)		
	NOTE This procedure should be completed if during a fire mission. After LAUNCHER LAY, the LDS turns on and the cage begins to elevate, and then the LDS shuts off. PUMP PRESSURE LOW message comes on in 10 seconds. If RESOLVER READOUT is selected from the test menu, the elevation readout indicated will be less than 310 mils and the azimuth indication will be greater than 20 mils. This condition occurs when the azimuth drive speed reducer brake allows the cage to move in azimuth off the 1.25-degree switch before the cage is elevated to clear the cab.	
	None	Perform azimuth drive speed reducer brake adjustment (paragraph 6-10).
72. AZIMUTH CENTERING SWITCH (+1.25 DEGREE) DEFECTIVE		
	None	Adjust or replace switch (paragraph 5-27).
73. AZIMUTH CENTERING SWITCH (–1.25 DEGREE) DEFECTIVE		
	None	Adjust or replace switch (paragraph 5-27).
74. AZIMUTH TRANSDUCER/SWITCH LIMIT FOR MAXIMUM TRAVEL TO THE RIGHT DEFECTIVE		
	None	Replace transducer/switch (paragraph 6-14).
75. AZIMUTH TRANSDUCER/SWITCH LIMIT FOR MAXIMUM TRAVEL TO THE LEFT DEFECTIVE		
	None	Replace transducer/switch (paragraph 6-14).
76. AZIMUTH TRANSDUCER/SWITCH AT +1304 MIL AZIMUTH AND 36-MIL ELEVATION DEFECTIVE		
	None	Replace transducer/switch (paragraph 6-14).

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
77. AZIMUTH TRANSDUCER/SWITCH AT – 1340 MIL AZIMUTH AND 36-MIL ELEVATION DEFECTIVE	None	Replace transducer/switch (paragraph 6-14).
78. ELEVATION ACTUATOR SWITCH AT MAXIMUM ELEVATION DEFECTIVE	None	Replace elevation actuator (paragraph 6-20).
79. 27-DEGREE (480-MIL) SWITCH LIMIT FOR MAXIMUM ELEVATION AT + 3200 MIL AZIMUTH DEFECTIVE	None	Adjust or replace elevation actuator switch (paragraph 6-20).
80. 27-DEGREE (480-MIL) SWITCH LIMIT FOR MAXIMUM ELEVATION AT – 3200 MIL AZIMUTH DEFECTIVE	None	Adjust or replace elevation actuator switch (paragraph 6-20).
81. + 15 DEGREE (267-MIL) SWITCH AT 302-MIL ELEVATION AND + 200 MIL AZIMUTH DEFECTIVE	None	Adjust or replace switch (paragraph 5-25).
82. + 15 DEGREE (267-MIL) SWITCH AT 302-MIL ELEVATION AND – 200 MIL AZIMUTH DEFECTIVE	None	Adjust or replace switch (paragraph 5-25).
83. 27-DEGREE (480-MIL) SWITCH AT + 1860 MIL AZIMUTH AND 510 MIL ELEVATION DEFECTIVE	None	Adjust or replace switch (paragraph 5-25).

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
84. 27-DEGREE (480-MIL) SWITCH AT – 1860 MIL AZIMUTH AND 510-MIL ELEVATION DEFECTIVE	None	Adjust or replace switch (paragraph 5-25).
85. ABLATIVE MATERIAL DAMAGED	None	Repair blast shield coating (paragraph 3-12).
86. AZIMUTH OR ELEVATION MOVEMENT ERRATIC	Enable BC (TM 9-1425-646-20). Operate the LDS in both azimuth and elevation. Observe the LDS operation and check for smoothness of operation.	
	Elevation movement erratic and azimuth movement smooth	Replace elevation servomotor (paragraph 6-15).
	Azimuth movement erratic and elevation movement smooth	Replace azimuth servomotor (paragraph 6-8).
	Azimuth and elevation movement erratic	Bleed hydraulic system (paragraph 6-3).
87. BLAST SHIELD DOOR DOES NOT CLOSE PROPERLY	Step 1. Check adjustment of boom in limit switch.	
	Out of adjustment	Adjust boom in limit switch (paragraph 5-12).
	Properly adjusted	Continue.
	Step 2. Inspect links, rollers, and cams for damage.	
	Damaged	Replace defective component (paragraph 5-24).
	Not damaged	Check adjustments and adjust as required (paragraph 5-24).

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

88. LLM AZIMUTH FAILURE

Perform LLM POSITION FAILURE (AZIMUTH MODE) (malfunction 17).

89. LLM CANNOT BE ELEVATED MANUALLY

Step 1. Inspect the following items for any visible mechanical damage or broken parts: angle drive unit, yokes, u-joints, propeller shafts, and elevation actuators.

Damaged

Replaced damaged component.

No damage

Continue.

NOTE

The transmission brake must be applied (hydraulic pressure released) for operation of the manual drive. If the manual drive spins freely with little resistance, the brake is not applied.

Step 2. Press manual bleed valve on the side of the turret. Try to manually elevate the LLM.

LLM will elevate.

Problem resolved.

LLM will not elevate.

Continue.

Step 3. Loosen nut connecting flexible drive shaft to elevation transmission. Disengage shaft core from transmission. Turn adapter assembly and monitor movement of flexible shaft core.

Flexible shaft core turns.

Replace elevation transmission (paragraph 6-16).

Flexible shaft core does not turn or bind.

Continue.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	Step 4. Loosen nut connecting flexible drive shaft to the adapter assembly on the turret. Disengage shaft core from the adapter. Try to turn the adapter.	
	Adapter turns freely.	Replace flexible drive shaft (paragraph 6-17).
	Adapter will not turn.	Replace adapter assembly (paragraph 6-17).
90. LLM CANNOT BE ROTATED MANUALLY IN AZIMUTH		
	Step 1. Loosen nut connecting flexible drive shaft to azimuth drive speed reducer. Disengage shaft core from speed reducer. Turn the adapter assembly and monitor the movement of the flexible shaft core.	
	Flexible shaft core turns.	Perform azimuth drive speed reducer brake adjustment (paragraph 6-10).
	Flexible shaft core does not turn or bind.	Continue.
	Step 2. Loosen nut connecting flexible drive shaft to adapter assembly. Disengage shaft core from adapter. Try to turn adapter.	
	Adapter turns freely.	Replace flexible drive shaft (paragraph 6-13).
	Adapter will not turn.	Replace adapter assembly (paragraph 6-13).
91. LLM DOES NOT STOW		
	NOTE LLM STOWED display appears on FCP. The resolver indications do not show that the LLM has stowed.	
	None	Replace cage down limit switch (paragraph 5-26).
92. LLM ELEVATION FAILURE		
		Perform LLM POSITION FAILURE (ELEVATION MODE) (malfunction 16).

Table 2-2. Troubleshooting - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

93. LLM REMAINS STRESSED AFTER STOW

NOTE

This fault differs from the STOW PRESSURE FAILURE which indicates the LLM was stowed under high pressure. The LLM STOWED UNDER STRESS is associated with a failure that keeps the cage and mechanical components under tension. This is evidenced by the absence of the normal structural gap between cage and turret after stow. Insure system power switch is left on approximately 30 seconds after LLM STOWED message appears on FCP.

Step 1. Enable BC (TM 9-1425-646-20).

Step 2. Elevate cage to 300 mils. Perform stow procedure (TM 9-1425-646-10).

Step 3. When the LDS shuts off, observe the splined shaft in the hub of the elevation actuators. The splined shafts should reverse direction of rotation a few turns as the LDS shuts off.

Shafts fail to unwind several turns.

Continue.

Step 4. Turn on FCS and position LLM to 1600 mils (90 degrees) to the right. Manually lower cage until it just touches the front side of the turret structure.

Cage can be lowered to touch turret.

Replace pilot check valve and relief valve on elevation module (paragraph 6-22).

Cage cannot be lowered to touch turret.

Check and adjust elevation actuators (paragraph 6-20).

94. LLM WILL NOT MOVE

See figure 2-13.

95. LOAD TEST OUTDATED

None

Perform load test (paragraph 3-9).

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

96. LP/C LATCH MECHANISM DOES NOT ENGAGE PROPERLY

Step 1. Visually inspect linkage and hooks for damage or obstructions.

Obstructions

Remove obstruction.

Damage

Replace damaged component (paragraph 5-22).

No damage or obstruction

Continue.

Step 2. Check adjustment of latch mechanism.

Out of Adjustment

Adjust hook (paragraph 5-22).

97. PDS CALIBRATION VALUES ARE NOT WITHIN LIMITS

Calibration Value	Limit
Odometer (encoder) scale factor	18 710 to 19 222
Azimuth crab angle	65 280 to 65 535; 0 to 00 256
Elevation crab angle	65 024 to 65 535; 0 to 00 512

Perform PDS DATA BAD (malfunction 25).

98. SPLL LOCATION ERROR

Perform PDS DATA BAD (malfunction 25).

99. SHORT/NO-VOLTAGE TESTER FAILS SELF-TEST

Step 1. Verify that system power is off. Disconnect cable connector W43P1 from PDB J9. Connect W43P1 to PDB breakout box J9. Connect PDB breakout box to PDB J9. Turn system power on (TM 9-1425-646-20). Using multimeter, check for 21 to 28 V dc between the pins of PDB breakout box test point J9 as follows:

J9 to J9	
A(+)	C(–)
B(+)	D(–)

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	Voltage incorrect	Go to step 3.
	Voltage correct	Continue.
Step 2.	Turn system power off. Disconnect the PDB breakout box from PDB J9. Disconnect W43P2 from SNVT J1. Using multimeter, check for continuity between PDB breakout box test points J9 and W43P2 pins as follows: J9 to W43P2 A A B B C C D D	
	No continuity	Replace cable W43 (paragraph 4-6).
	Continuity	Replace SNVT (TM 9-1425-646-20). Connect cable W43P1 to PDB J9.

NOTE

A visual inspection of cable W14 may be all that is required to determine a good or bad cable; otherwise, perform continuity check.

Step 3.	Turn system power off. Disconnect cable W43P1 from PDB breakout box J9. Disconnect PDB breakout box from PDB J9. Connect cable W43P1 to PDB J9. Disconnect cable W14P2 from PDB J2. Disconnect cable W14P1 from EB J6. Using multimeter, check for continuity between pins of W14P1 and W14P2 as follows: W14P1 to W14P2 E + pin B – pin	
	No continuity	Replace cable W14 (paragraph 4-6).
	Continuity	Replace EB (paragraph 4-4).

Table 2-2. Troubleshooting - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

100. UMBILICAL CABLE FAILS SNVT TEST

Step 1. Verify that system power is off. Disconnect W32P1 from SNVT connector J2. Disconnect W19P2 adapter from W32J1 and W19P3 adapter from W32J2. Using multimeter, check for continuity between the following connector pins:

W32P1 to W32J1 (Left Cable)		W32P1 to W32J2 (Right Cable)	
1	1	14	1
2	2	15	2
3	3	16	3
4	7	17	7
5	5	18	5
6	6	19	6
7	8	20	8
8	9	21	9
9	10	22	10
10	11	23	11
11	12	24	12
12	13	25	13
		27	17

W32J1 to W32J1 (Left Cable)		W32J2 to W32J2 (Right Cable)	
18	45	17	18
45	51	18	45
51	54	45	51
54	17	51	54

No continuity

Replace cable W32 (paragraph 4-6).

Continuity

Continue.

Step 2. Using multimeter, verify that infinity exists between each W32P1 connector pin and all other W32P1 connector pins and the connector shell.

Indication incorrect

Replace cable W32 (paragraph 4-6).

Indication correct

Replace cable W19 (paragraph 4-6).

Table 2-2. Troubleshooting – Continued

MALFUNCTION TEST OR INSPECTION	CORRECTIVE ACTION
101. TRAVEL LOCK HOOKS DO NOT ENGAGE PROPERLY	
Step 1. Visually check travel lock mechanism for obvious damage.	
Damage	Repair or replace defective component (paragraph 5-23).
No damage	Continue.
Step 2. Check adjustment of travel lock actuator (paragraph 5-23).	
Out of adjustment	Adjust actuator (paragraph 5-23).
In adjustment	Continue.
Step 3. Check adjustment of travel lock links (paragraph 5-23).	
Out of adjustment	Adjust links (paragraph 5-23).
In adjustment	Continue.
Step 4. Check adjustment of travel lock roller assembly (paragraph 5-23).	
Out of adjustment	Adjust rollers (paragraph 5-23).
102. TRAVEL LOCK WILL NOT UNLATCH	
NOTE Refer to the LLM Will Not Move Logic Diagram (figure 2-13).	
Step 1. Verify system power is off. Disconnect W24P1 from PDB J1. Connect W24P1 to PDB breakout box J1. Connect PDB breakout box to PDB J1. Using multimeter, check for 21 to 28 V dc between PDB breakout box test points J1-38(+) and J1-53(–) when the BC manual operation is selected on FCP.	
Voltage incorrect	Go to step 4.
Voltage correct	Continue.

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

Step 2. Turn system power off. Disconnect W25P1 from PDB J3. Connect W25P1 to PDB breakout box J3 and connect PDB breakout box to PDB J3. Using multimeter, check for 21 to 28 V dc between PDB breakout box test points J3-R(+) and J3-T(−) and J3-J(+) and J3-H(−) when the BC manual operation is selected on FCP.

Voltage incorrect

Replace PDB (paragraph 4-5).

Voltage correct

Continue.

Step 3. Turn system power off. Disconnect W25P2 from LLM travel lock actuator. Using multimeter, check for continuity between PDB breakout box J3 test points and W25P2 as follows:

W25P2 Pins	PDB Breakout Box J3 Test Points
G	R
E	J
H	T
D	H
F	M
A	S
C	G

Continuity

Replace travel lock actuator (paragraph 5-23). Disconnect PDB breakout box and connect cables to PDB.

No continuity

Replace cable W25 (paragraph 4-6). Disconnect the PDB breakout box and connect cables to PDB.

Step 4. Disconnect PDB breakout box from PDB J1. Disconnect W24P2 from FCU J2. Using multimeter, check for continuity between PDB breakout box J1 test points and W24P2 as follows:

W24P2 Pins	PDB Breakout Box J1 Test Points
73	73
53	53
38	38

Table 2-2. Troubleshooting – Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	No continuity	Replace cable W24 (paragraph 4-6).
	Continuity	Continue.
Step 5.	Disconnect breakout box and connect W24P1 to PDB J1 and W24P2 to FCU J2. Disconnect W9P1 from EU J3 and W9P2 from FCU J7. Place a good W9 cable on vehicle bed under turret on left side of base. Connect W9P1 to EU J3 and W9P2 to FCU J7. Turn system power on and verify correction of malfunction.	
	No malfunction	Replace cable W9 (paragraph 4-6).
	Malfunction	Replace FCU (TM 9-1425-646-20). Remove replacement cable W9 and reconnect original cable W9.
	Malfunction still exists	Replace EU (TM 9-1425-646-20).

CHAPTER 3
GENERAL MAINTENANCE

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Section I. SERVICE UPON RECEIPT

3-1. GENERAL. The maintenance organization should perform an inspection upon receipt of a self-propelled launcher loader (SPLL) to be sure of its condition.

3-2. CHECKING UNPACKED EQUIPMENT. The following should be accomplished upon receipt of SPLL:

a. Inspect the equipment for damage incurred during shipment. If the equipment has been damaged, report the damage on DD Form 6, Packaging Improvement Report.

b. Check the equipment against the packing slip to see if the shipment is complete. Report all discrepancies in accordance with the instructions in DA Pamphlet 738-750.

c. Check to see whether the equipment has been modified.

Section II. PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

3-3. INTRODUCTION. PMCS is the regular inspection and servicing of the SPLL. All deficiencies found during PMCS must be reported on DA Form 2404 along with the corrective action. Any deficiency that cannot be corrected must be reported to next higher maintenance level on DA Form 2407. The required PMCS is listed in table 3-1 as follows:

a. Item Number Column. Checks and services are numbered in a logical order of performance regardless of the interval. This column is used as a source of item numbers for the TM Number Column on DA Form 2404, Equipment Inspection and Maintenance Worksheet, in recording results of PMCS.

NOTE

Operation under bad conditions such as blowing sand or dust, heavy rainstorms, snow, or very high or very low temperatures, may require PMCS more often than scheduled. You will be notified whenever you need to do the PMCS more often than scheduled.

b. Interval Column. A code in this column indicates when the item is to be checked. The codes are:

Q (Quarterly) – performed once every three months
S (Semiannually) – performed once every six months
A (Annually) – performed once every year
H (Hourly) – performed at the number of hours indicated on the contactor elapsed time indicator
B (Biennially) – performed every two years

c. Item To Be Inspected Column. The items listed in this column are divided into groups indicating the system of the SPLL of which they are a part.

d. Procedure Column. This column contains the procedure required to perform the checks and services.

3-4. PREVENTIVE MAINTENANCE CHECKS AND SERVICES. The following items that are not listed in table 3-1 should be checked during each PMCS:

a. Bolts, Nuts, Screws, and Clamps. Check for looseness. Tighten if necessary.

b. Welds. Check for chipped paint, rust, or broken welds. Repair as required.

c. Electrical Cables and Connectors. Check for cracked or broken insulation, bare wires, and loose or broken connectors. Repair as required.

d. Hoses and Fluid Lines. Check for leaks, damaged hoses and fluid lines, and loose connections. Repair as required.

Table 3-1. Preventive Maintenance Checks and Services

Q = Quarterly S = Semiannually A = Annually H = Hours B = Biennially

ITEM	INTERVAL					ITEM TO BE INSPECTED
	Q	S	A	H	B	PROCEDURE
1				1000		**HYDRAULIC POWER SUPPLY ELECTRIC MOTOR BRUSHES** Perform inspection (paragraph 6-5).
2					•	**LP/C HOIST ASSEMBLY** Replace (paragraph 5-15).
3			•			**LP/C CENTERING PINS** a. Using boom controller (BC), position launcher loader module (LLM) to 1800-mil (90-degree) azimuth and 0-mil elevation. b. Inspect pins for raised areas caused by gouges. Dress down any raised area with a file. A minimum of 80 percent of the pin surface should be free of gouges. c. Using micrometer, measure the diameter of pins. If center pin is less than 36.4mm or forward and rear pins are less than 23.6mm, replace defective pin (paragraph 5-28).
4			•			**LP/C MOUNTING PLATES** a. Using BC, position LLM to 1800-mil (90-degree) azimuth and 0-mil elevation. b. Inspect plates for raised areas caused by gouges or nicks. Dress down any raised area with a file. c. Using depth gage, measure depth of nicks and gouges. If nicks or gouges exceed a depth of 0.2mm, replace plate (paragraph 5-28).

Section III. PREPARATION FOR STORAGE OR SHIPMENT

3-5. PREPARATION FOR STORAGE.

a. Perform PMCS in accordance with paragraph 3-3, TM 9-1425-646-10, and TM 9-1425-646-20.

b. Refer to TM 9-1425-646-10 and wash the SPLL.

c. Refer to TM 9-1450-646-20 for preparation of vehicle for storage.

d. Refer to TM 38-450 for storage and maintenance of prepositioned materiel configured to unit sets (POMCUS).

e. See figure 3-1 for parking distance required for uncontrolled open storage.

3-6. PREPARATION FOR SHIPMENT. The SPLL is prepared for shipment in the same manner as storage.

3-5. PREPARATION FOR STORAGE (CONT)

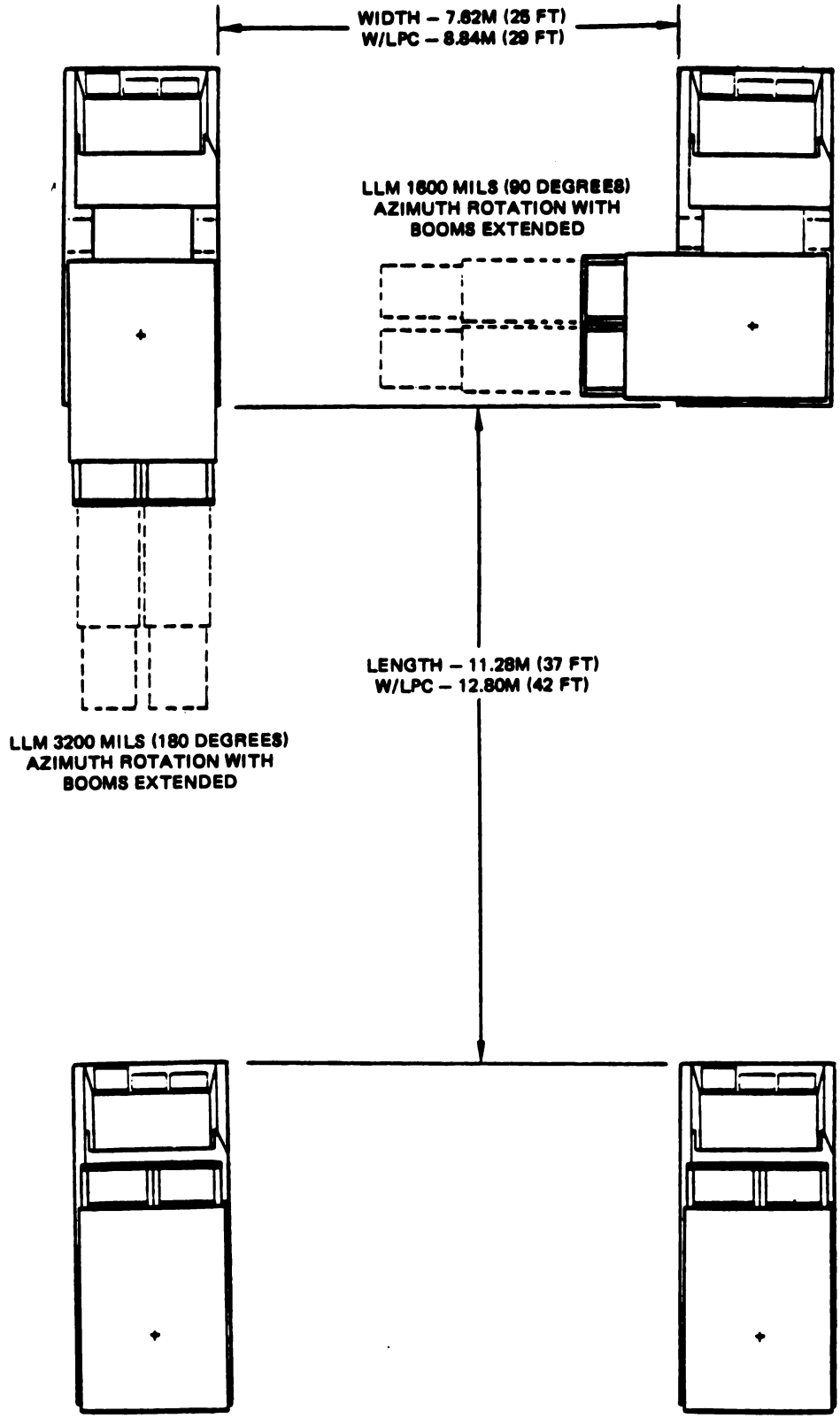


Figure 3-1. Parking Distance Requirements

Section IV. GENERAL MAINTENANCE PROCEDURES

3-7. INTRODUCTION. This section contains the general maintenance procedures authorized for direct support by the Maintenance Allocation Chart (MAC). The MAC is in Appendix B of TM 9-1425-646-20.

3-8. GENERAL MAINTENANCE PROCEDURES. The following general inspection and cleaning procedures should be used when performing maintenance tasks. Special inspections and cleaning procedures, when required, are included with each maintenance task.

a. Inspection.

(1) Check bolts, nuts, and screws for stripped threads or other damage. Repair or replace as necessary. Do not reuse self-locking nuts that do not meet minimum breakaway torque. (Refer to Appendix D.)

(2) Check bearings and bushings for scored, galled, or other visual damage. Replace if damaged.

(3) Check components for chipped paint, rust, broken welds, elongated holes, or other visual damage. Repair or replace as required.

(4) Check electrical cables and connectors for cracked or broken insulation, bare wires, and loose or damaged connectors. Repair or replace as required.

(5) Check hoses and fluid lines for frayed hoses, nicked or scratched fluid lines, and damaged connectors. Repair or replace as required.

b. Cleaning and Painting.

(1) Using cotton wiping cloth and approved solvent, if required, clean all components before installation.

(2) Spot paint all areas that have chipped or scratched paint.

3-9. LOAD TEST. This paragraph covers the maintenance tasks for load testing the SPLL.

Item	*Page*
1. Load Test After Repair	3-6
2. Annual Safety Load Test	3-7

INITIAL SETUP

Test/Support Equipment
2 LP/C test loads (Appendix C)

Tools
Kit, tool, 13032302
Set, shop, 13032303
Board, stencil, UU-S-625TY2GR1
Brush, stencil, NPN37
Gloves, cloth, JJG001396
Set, stencil, marking, NPN46

Materials/Parts
Coating, black (9, Appendix B)

Personnel Required
MLRS Repairer MOS 27M
MLRS Crewmember MOS 13M

References
TM 9-1425-646-10

1. LOAD TEST AFTER REPAIR.

WARNING

All personnel must remain clear of suspended loads and cables during test. If a cable breaks, it could cause injury or death.

CAUTION

This test must be performed on a firm, flat, level surface.

The suspension lockout system must be engaged and locked. Failure to do so may result in the front of the SPLL lifting off the ground.

NOTE

This test will be performed after the repair or replacement of any of the following items: hoist, hoist cable, hook and pulley assembly,hoist carriage assembly and booms.

This procedure assumes that the test load has already been prepositioned.

a. Inspection.

(1) Perform startup procedures and drive SPLL to the place where test load has been prepositioned. Place SPLL so the load may be picked up from 3200-mil (180-degree) azimuth position (TM 9-1425-646-10).

(2) Position LLM to 3200-mil (180-degree) azimuth. Engage suspension lockout (TM 9-1425-646-10).

(3) Using boom controller, extend appropriate boom. Traverse the LLM until hook and pulley assembly, when lowered, will clear test load (TM 9-1425-646-10).

(4) Using boom controller, lower appropriate hook and pulley assembly while observing the cable for smooth slack-free operation.Inspect cable (TM 9-1425-646-10).

(5) Lift the cable off pulleys in the hoist carriage and the hook and pulley assembly. Examine pulleys for rim nicks that might cut the cable and for other obvious damage. Spin pulleys to verify that they turn freely. Examine hook lock mechanism for damage and proper operation. If any damage is found or if a pulley does not turn freely,replace defective item (paragraph 5-16).

(6) Using boom controller, raise hook and pulley assembly to clear test load. Traverse the LLM until hook and pulley assembly is directly above test load lifting bar (TM 9-1425-646-10).

b. 125 Percent Load Test.

NOTE

This procedure must be carefully directed by the test supervisor.

(1) Using boom controller, lower hook and pulley assembly and attach it to test load (TM 9-1425-646-10).

(2) After making sure all personnel are clear of test load, raise test load about 1 foot (1/3 meter) off the ground.

3-9. LOAD TEST (CONT)

(3) Hold test load in this position for 30 seconds while observing cable for evidence of slippage. If slippage is noted, replace hoist assembly (paragraph 5-15).

(4) Using boom controller, lower test load and disconnect hook and pulley assembly (TM 9-1425-646-10).

c. Final Inspection.

(1) Using boom controller, raise hook and pulley assembly enough to clear the test load. Traverse LLM until hook and pulley clear test load, then lower hook and pulley as far as it will go (TM 9-1425-646-10).

(2) Inspect hoist cable and pulleys (paragraph a, steps (4)and (5)).

(3) Inspect boom structure for bent or warped beams. If beams are damaged, replace beams (paragraph 5-8).

(4) Using boom controller, raise hooks to full up position and retract boom (TM 9-1425-646-10).

(5) Perform stow procedure (TM 9-1425-646-10).

2. ANNUAL SAFETY LOAD TEST.

WARNING

All personnel must remain clear of suspended loads and cables during test. If a cable breaks, it could cause injury or death.

CAUTION

This test must be performed on a firm, flat, level surface.

The suspension lockout system must be engaged and locked. Failure to do so may result in the front of the SPLL lifting off the ground.

NOTE

This procedure is performed one year after date stencilled on the LLM.

This procedure assumes that the two test loads have been prepositioned in a location suitable for the test.

a. Inspection.

(1) Perform startup procedures and drive SPLL to place where two test loads have been prepositioned. Place SPLL so loads may be picked up from 1600-mil (90-degree) azimuth position (TM9-1425-646-10).

(2) Position LLM to 1600-mil (90-degree) azimuth. Engage suspension lockout (TM 9-1425-646-10).

(3) Using boom controller, extend both booms. Traverse LLM until hook and pulley assemblies, when lowered, will clear test loads (TM 9-1425-646-10).

(4) Using boom controller, lower both hook and pulley assemblies while observing cable for smooth slack-free operation. Inspect both cables (TM 9-1425-646-10).

(5) Lift cable off pulleys in hoist carriage and hook and pulley assemblies. Examine pulleys for rim nicks that might cut the cable and for other obvious damage. Spin pulleys to verify that they turn freely. Examine hook lock mechanism for damage and proper operation. If any damage is found or if pulley does not turn freely, replace defective item (paragraph 5-16).

(6) Using boom controller, raise both hook and pulley assemblies until they clear test loads. Traverse LLM until hook and pulley assembly for one boom is directly above test load lifting bar (TM 9-1425-646-10).

3-9. LOAD TEST (CONT)

b. 125 Percent Load Test.

CAUTION

Do not attempt to raise both loads from the 1600-mil (90-degree) position as it may cause the SPLL to tip over.

NOTE

This procedure must be carefully directed by the test supervisor.

(1) Using boom controller, lower one hook and pulley assembly and attach it to test load (TM 9-1425-646-10).

(2) After making sure all personnel are clear of test load, raise test load about 1 foot (1/3 meter) off ground.

(3) Hold test load in this position for 30 seconds while observing cable for evidence of slippage. If slippage is noted, replace hoist assembly (paragraph 5-15).

(4) Using boom controller, lower test load and disconnect hook and pulley assembly. Raise hook and pulley assembly, and then retract boom (TM 9-1425-646-10).

(5) Using boom controller, traverse LLM so other hook and pulley assembly is directly over test load lifting bar (TM 9-1425-646-10).

(6) Repeat paragraph b, steps (1) through (4) for second boom and hoist.

(7) Replace boom controller in its compartment and stow LLM. Disengage suspension lockout (TM 9-1425-646-10).

(8) Reposition SPLL to position to load test loads from 3200-mil (180-degree) azimuth. Position LLM to 3200-mil (180-degree) azimuth. Engage suspension lockout (TM 9-1425-646-10).

(9) Using boom controller, extend both booms. Lower hook and pulley assemblies, one at a time, while observing cable operation. Attach hook and pulley assemblies to test loads (TM 9-1425-646-10).

(10) After making sure all personnel are clear of test loads, raise both test loads together until hoist up limit switch stops the operation.

(11) Hold both test loads in this position for 30 seconds while observing cables for evidence of slippage and the cage-to-turret gap. If cable slips, replace hoist assembly (paragraph 5-15). If cage-to-turret gap closes, replace elevation transmission (paragraph 6-16).

(12) With one hand placed on side of cage, use boom controller to rotate cage in either direction about 36 mils (2 degrees) and observe that cage stops moving promptly when finger is lifted from boom controller switch. If cage movement does not stop promptly, replace azimuth drive speed reducer (paragraph 6-10).

(13) While observing EL RESOLVER READOUT on FCP, elevate LLM to about 267 mils (15 degrees) (TM 9-1425-646-10).

(14) With cage elevated to 267 mils (15 degrees), observe booms for evidence of slippage back into cage. If booms slip into cage, replace boom motor and reduction gearbox (paragraph 5-4).

(15) Using boom controller, lower LLM to horizontal. Then, lower test loads and disconnect hook and pulley assemblies from test loads (TM 9-1425-646-10).

3-9. LOAD TEST (CONT)

c. Final Inspection.

(1) Using boom controller, raise both hook and pulley assemblies enough to clear the test loads. Traverse LLM until hook and pulley assemblies will clear test loads, and then lower hook and pulley assemblies (TM 9-1425-646-10).

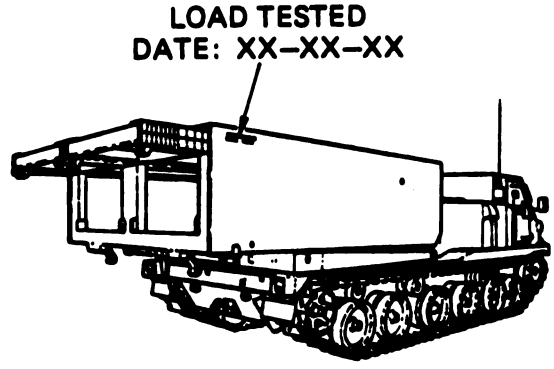
(2) Inspect hoist cables and pulleys (TM 9-1425-646-10).

(3) Inspect boom structures for warped or bent beams. If beams are damaged, replace beam (paragraph 5-8).

(4) Using boom controller, raise hook and pulley assemblies and retract both booms (TM 9-1425-646-10).

(5) Perform stow procedures (TM 9-1425-646-10).

(6) If SPLL has passed annual load test, stencil date of test on upper left forward side of cage using 12mm (1/2-inch) letters. Stencil markings shall be same color as vehicle markings.



3-10. ELECTRICAL BONDING. This paragraph covers the electrical bonding task required to provide a low resistance electrical path between required SPLL components and cleaning of ground straps.

INITIAL SETUP

Tools
Kit, tool, 13032302

Materials/Parts
Cloth, cleaning (6, Appendix B)
Compound, cleaning (12, Appendix B)
Iridite (22, Appendix B)
Paper, abrasive (44, Appendix B)
Solvent, drycleaning (61, Appendix B)
Varnish (71, Appendix B)

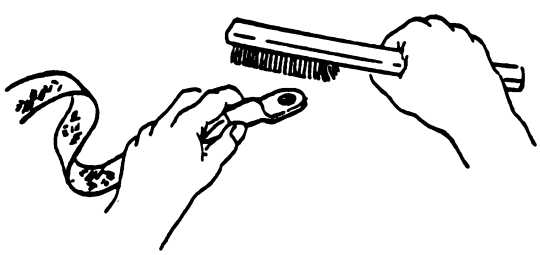
Personnel Required
MLRS Repairer MOS 27M

a. Clean.

WARNING

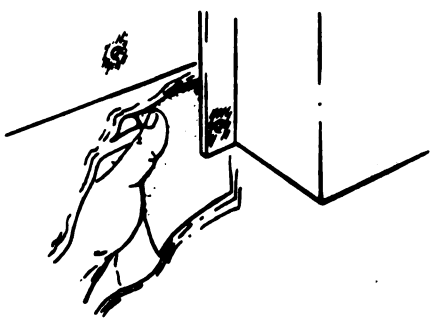
Drycleaning solvent vapors are toxic. Avoid prolonged or repeated breathing of vapors or contact with skin. Use with adequate ventilation. Solvent is flammable and should not be used near an open flame. Fire extinguishers should be available when solvent is used.

(1) Using solution of one part cleaning compound to four parts of drycleaning solvent and wire brush, remove all grease or oil from area to be bonded.



(2) After cleaning, rinse area with cold water and dry with cleaning cloth.

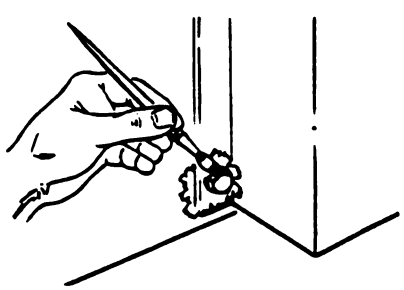
(3) Using abrasive paper, clean to bare metal area 1-1/2 times diameter of washer used for installation.



b. Bond.

(1) Using brush, apply light coat of iridite over area 1-1/2 times diameter of bare area.

(2) After installation of component, apply coat of varnish over attaching parts and surrounding area.



3-11. SPOT PAINTING. This paragraph covers the maintenance tasks for spot painting subordinate parts of the SPLL.

INITIAL SETUP

Tools
Kit, tool, 13032302

Materials/Parts
Coating (10, Appendix B)
Primer, epoxy coating (46, Appendix B)
Solvent, drycleaning (61, Appendix B)
Thinner, aliphatic (66, Appendix B)

Personnel Required
MLRS Repairer MOS 27M

a. Preparation.

WARNING

Primer, coating, and drycleaning solvent vapors are toxic. Avoid prolonged or repeated breathing of vapors or contact with skin. Use only with adequate ventilation. Observe all precautions printed on containers.

(1) Clean surface of dirt and grease with cleaning cloth or brush and suitable cleaning agent such as drycleaning solvent. Allow surface to dry.

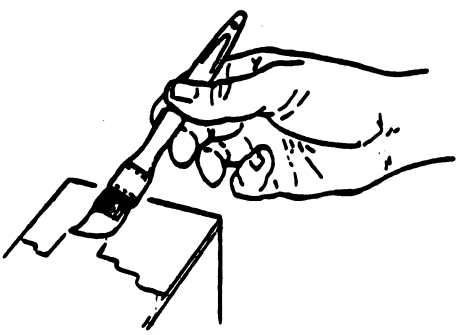
(2) Mix small quantity of coating primer as instructed on container. Allow mixture to stand 30 minutes before using.

(3) Using brush, apply coating of primer to required areas. Allow primer to dry 6 hours on aluminum parts and 1-1/2 hours on steel parts.

b. Painting.

(1) Mix small quantity of coating as instructed on container. If required, add thinner to mixture. Allow mixture to stand 30 minutes before using.

(2) Using brush, apply coating to primed surfaces. Allow coating to dry 30 minutes before handling. Dry aluminum parts 6 hours before packaging and issue. Dry steel parts 2 hours before packaging and issue.



3-12. BLAST PROTECTION COATING. This paragraph covers repairing the blast protection ablative coating.

INITIAL SETUP

Tools
Kit, tool, 13032302
Set, shop, 13032303
Drill, electric, 1046-09
Mixer, jiffy, 280-4508
Trowel, GGGT671ATYPE 3

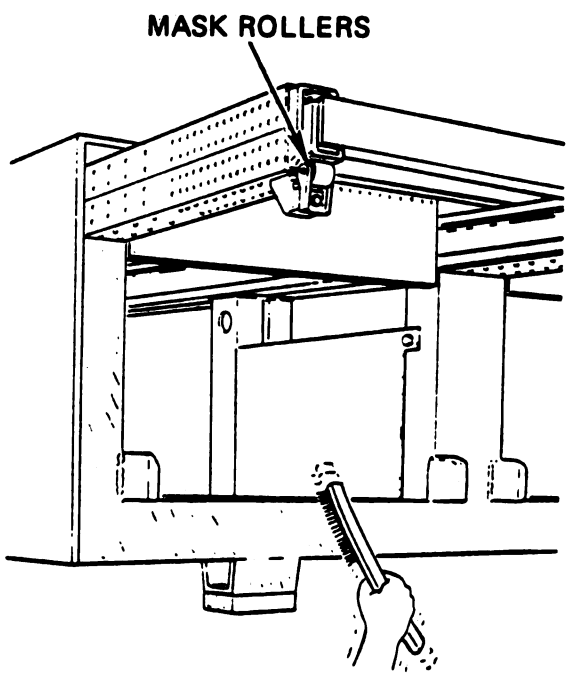
Materials/Parts
Alcohol, isopropyl (2, Appendix B)
Cloth, cleaning (6, Appendix B)
Coating, ablative (8, Appendix B)
Compound, cleaning (11, Appendix B)
Tape, marking, 3/4-inch (65, Appendix B)
Thinner, paint (67, Appendix B)

Personnel Required
MLRS Repairer MOS 27M

a. Preparation.

(1) Cover all bearings with masking tape to prevent entry of foreign material.

(2) Clean metal surfaces where ablative is to be applied with wire brush. Clean residue with soap and water. Wipe dry.



WARNING

Isopropyl alcohol vapors are toxic. Avoid prolonged or repeated breathing of vapors or contact with skin. Use only with adequate ventilation. Alcohol is flammable and should not be used near open flame. Fire extinguishers should be readily available when isopropyl alcohol is used.

(3) Clean surface thoroughly with isopropyl alcohol. Wipe dry with lint-free cloth. Allow ablative material time to dry and return to original color.

b. Mixing and Application.

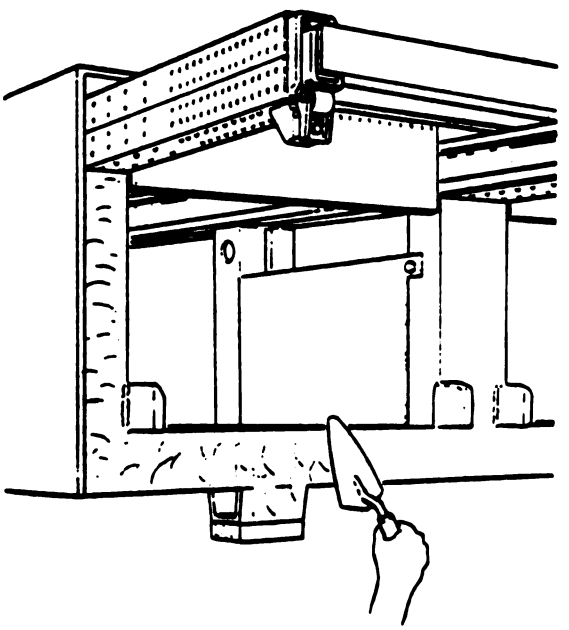
NOTE

Ablative material is supplied in premeasured kits of 150 parts by weight of Part A to 100 parts by weight of Part B.

(1) Using jiffy mixer with electrical drill, mix material thoroughly until uniform color or consistency is obtained (approximately 10 to 15 minutes).

3-12. BLAST PROTECTION COATING (CONT)

(2) Apply material with trowel using swirling motion until desired thickness is obtained.



NOTE

Curing time may be reduced by increasing the curing temperature.

(3) Allow coating to cure for 60 minutes. Dip trowel in isopropyl alcohol and smooth ablative material to desired finish.

(4) Using paint thinner, clean all equipment immediately after application of ablative material.

3-13. HYDRAULIC PRESSURE GAGE. This paragraph covers the installing of a hydraulic pressure gage on the elevation hydraulic valve module for use during troubleshooting.

INITIAL SETUP

Test/Support Equipment
Pan, drain, NPN8
Unit, hydraulic servicing, 13029784

Tools
Kit, tool, 13032302
Set, shop, 13032303
Gage, hydraulic

Materials/Parts
Cloth, cotton (6, Appendix B)
Fluid, hydraulic (17, Appendix B)
Tubing, plastic, clear (68, Appendix B)

Personnel Required
2 MLRS Repairers MOS 27M

a. Install.

NOTE

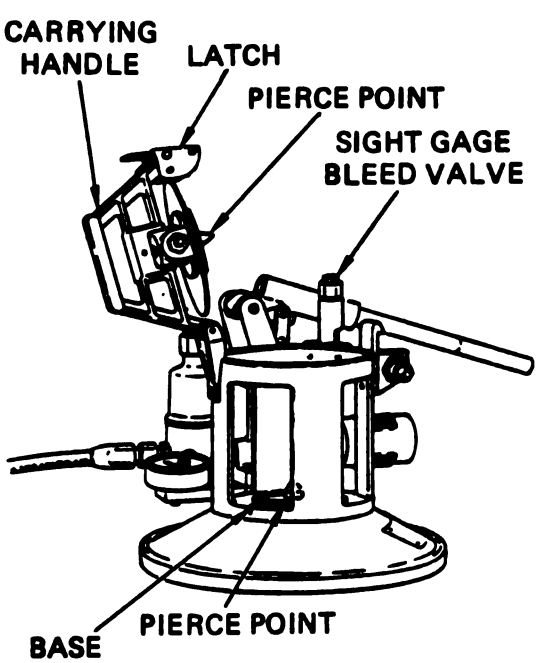
Monitor fluid level in servicing unit, to prevent air from entering system, by pressing down on sight gage bleed valve until fluid in sight gage stops rising.

(1) Using cleaning cloth and hydraulic fluid, clean top and bottom of fluid container.

(2) Clean pierce point and base of servicing unit.

(3) Unlatch and raise carrying handle.

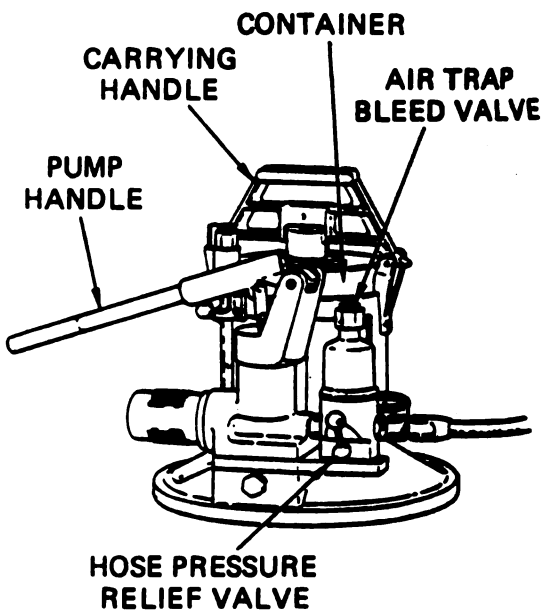
(4) Clean pierce point on handle.



(5) Place container in servicing unit and press down to pierce and seal bottom of container.

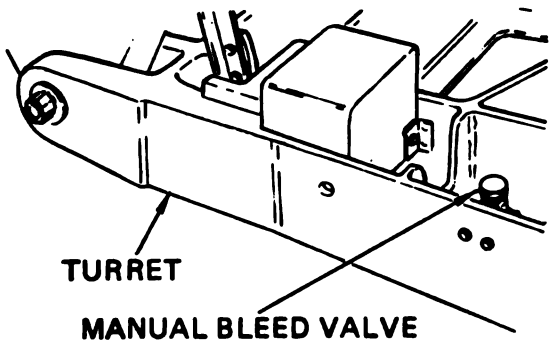
(6) Close and latch carrying handle to pierce and seal top of container.

(7) Stroke pump handle while depressing air trap bleed valve to bleed air from servicing unit. Release bleed valve when air-free fluid flows from bleed valve.



3-13. HYDRAULIC PRESSURE GAGE (CONT)

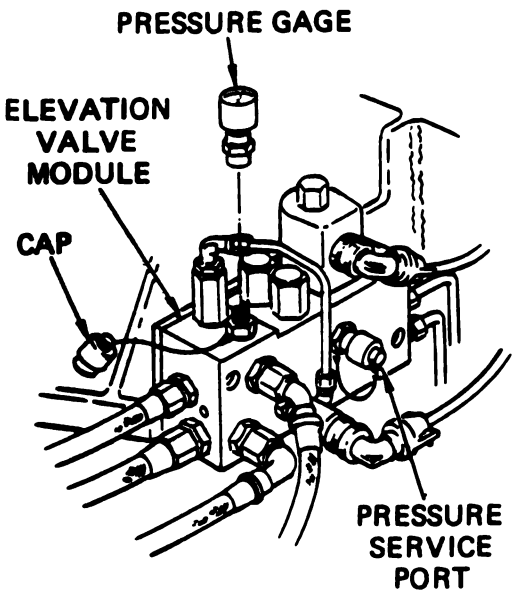
(8) Depress manual bleed valve on right rear of turret to release hydraulic pressure.



(9) Clean area around cap and union on top of elevation valve module. Remove and retain cap.

(10) Remove and retain storage cap from pressure gage and install gage in union. Tighten gage using 11/16-inch open end wrench.

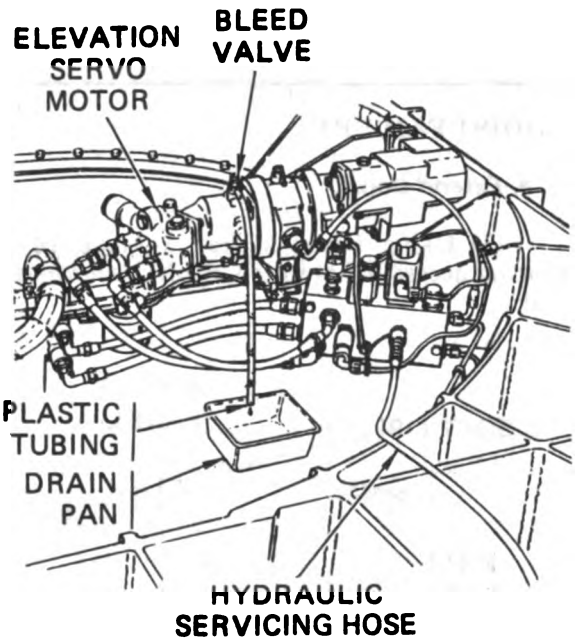
(11) Remove cap from pressure service port on elevation valve module. Clean pressure port coupling and connect hydraulic servicing hose to pressure service port.



(12) Attach plastic tubing to bleed valve on elevation servomotor and route tubing to drain pan.

(13) While pumping hydraulic servicing unit, open bleed valve. Continue pumping servicing unit until air-free oil is seen in tubing.

(14) Close bleed valve and disconnect hydraulic servicing hose. Replace cap on servicing hose and elevation valve module pressure port.



b. Remove.

(1) Depress bleed valve on right rear of turret to release hydraulic pressure.

(2) Using 11/16-inch open end wrench, remove pressure gage.

(3) Install cap on union and install storage cap on pressure gage.

3-14. HOIST OR BOOM ACTUATOR FAILURE WITH LP/C LOADED IN LLM.

This paragraph covers the replacement of the hoist or boom actuator when an LP/C is loaded in LLM.

Item	*Page*
1. Hoist Failure	3-16
2. Boom Actuator Failure	3-17

INITIAL SETUP

Test/Support Equipment
Rope, manila
Wrecker, HEMTT

Tools
Kit, tool, 13032302

Personnel Required
Wrecker Operator MOS 63H
2 MLRS Repairers MOS 27M (MLRS Crewmember MOS 13M to assist as required)

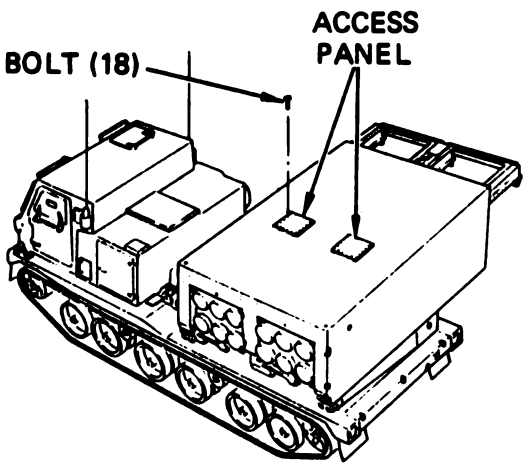
Troubleshooting
Paragraph 2-9

Equipment Condition
Position LLM to 1600-mil (90-degree) or 3200-mil (180-degree) azimuth and 0-mil elevation (TM 9-1425-646-20)

1. HOIST FAILURE.

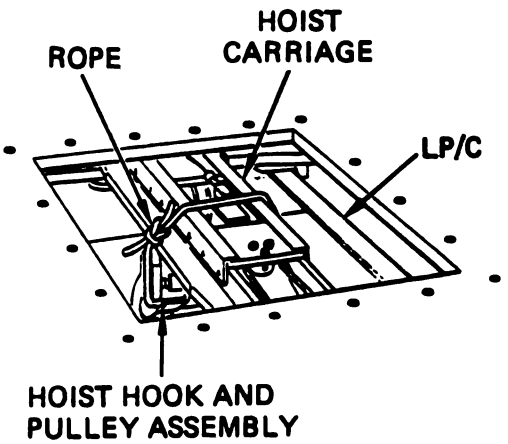
a. Extend Boom.

(1) Using 10mm socket, remove 18 bolts securing access panel to top of LLM over defective hoist.



(2) Unlatch hoist hook and pulley assembly from LP/C.

(3) Using rope, tie hoist hook and pulley assembly to hoist carriage to prevent hooks from catching on LP/C during boom extension.



(4) Manually extend boom slowly while watching hook and carriage for clearance (TM 9-1425-646-10).

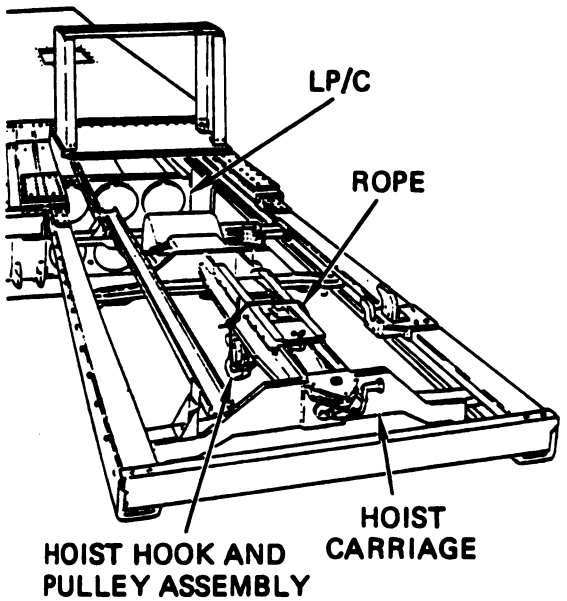
(5) If hoist is defective, replace hoist assembly (paragraph 5-15).

(6) If hoist cable is defective, replace cable (paragraph 5-14).

b. Retract Boom.

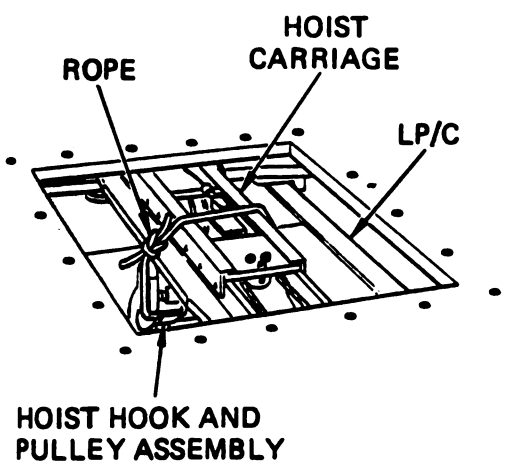
(1) Using rope, tie hoist hook and pulley assembly to hoist carriage to prevent hooks from catching on LP/C during retraction.

3-14. HOIST OR BOOM ACTUATOR FAILURE WITH LP/C LOADED IN LLM (CONT)

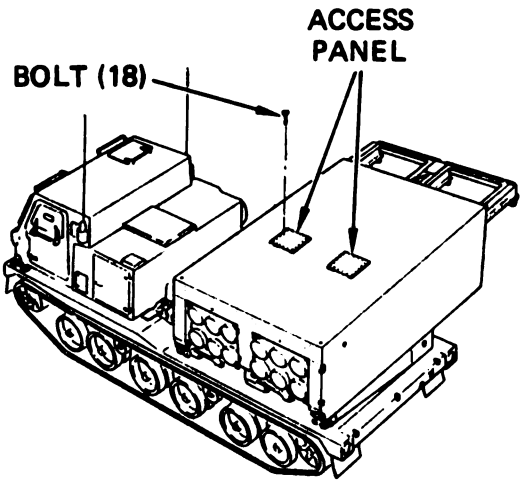


(2) While watching hooks and carriage, slowly manually retract boom (TM 9-1425-646-10).

(3) Untie hoist hook and pulley assembly and latch hoist hook and pulley assembly to LP/C.



(4) Apply zinc chromate primer to 18 bolts. Position access panel on top of cage and install 18 bolts. Using 10mm socket, tighten bolts.



(5) Unload LP/C (TM 9-1425-646-10).

2. BOOM ACTUATOR FAILURE.

a. Remove.

NOTE

This task assumes that the boom cannot be extended manually due to failed boom extension actuator and that the loaded LP/C prevents removal of the actuator using normal procedures.

(1) Cut and remove lockwire from suspected defective actuator drive shaft coupling nuts. Using 1-5/8 inch open end wrench, disconnect drive shaft from boom motor and reduction gearbox.

(2) Manually attempt to extend boom. If extension movement is now possible, perform step (4) as defective actuator is disconnected. If extension movement is not possible, reconnect drive shaft and perform step (3) (TM 9-1425-646-10).

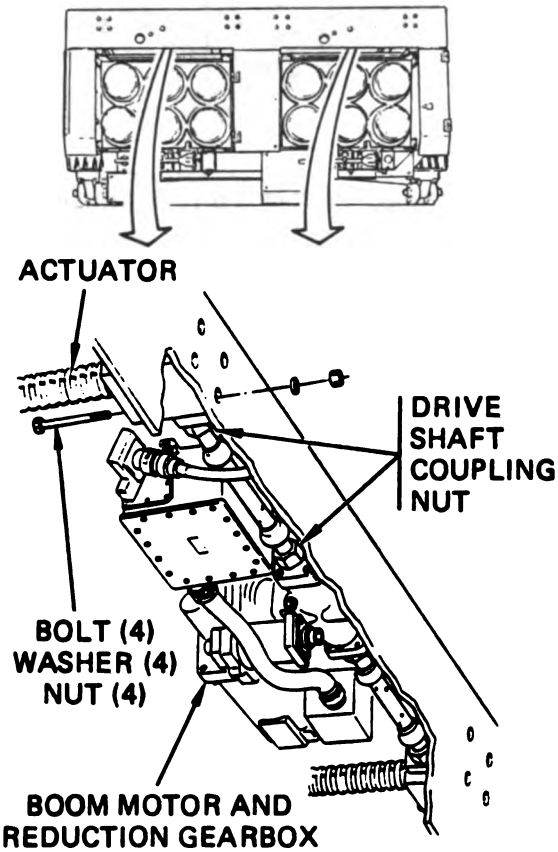
(3) Cut and remove lockwire from drive shaft coupling nuts on drive shaft to defective actuator. Using 1-5/8 inch open end wrench, disconnect drive shaft from actuator and boom motor and reduction gearbox. Remove drive shaft.

3-14. HOIST OR BOOM ACTUATOR FAILURE WITH LP/C LOADED IN LLM (CONT)

NOTE

The upper outboard bolt requires the use of two sockets.

(4) Using 19mm box end wrench, 14mm socket, and 19mm socket, remove 4 bolts, washers, and nuts securing defective actuator to cage. It may be necessary to use punch and hammer to tap bolts out of cage structure.



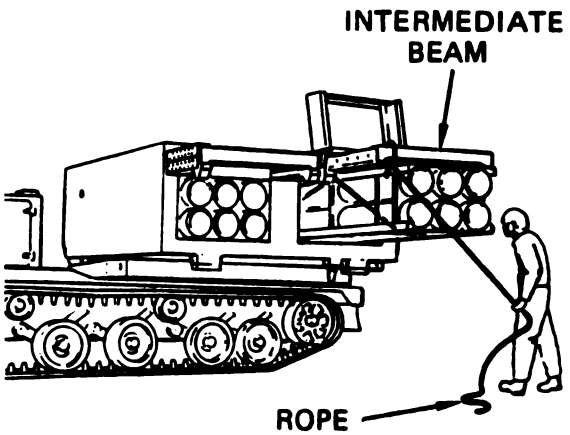
(5) Enable boom controller and raise LP/C to full up position off centering pins in cage. Turn system power off (TM 9-1425-646-20).

CAUTION

As the intermediate beam is being manually driven out by one actuator, observe the intermediate beam to determine if the beam is canting within the fixed beam.

(6) Tie a rope to forward end of intermediate beam on side with defective actuator.

(7) Manually extend beam while pulling on rope to prevent canting of intermediate beam. Fully extend beam until boom out cam contacts boom out switch (TM 9-1425-646-10).



(8) Enable boom controller. Lower and off load LP/C. Turn system power off (TM 9-1425-646-20).

(9) Remove defective actuator (paragraph 5-6).

b. Install.

(1) Install new boom extension actuator (paragraph 5-6).

(2) Install boom drive shaft (paragraph 5-5).

CHAPTER 4
ELECTRICAL POWER SYSTEM MAINTENANCE

CHAPTER CONTENTS

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	Power Distribution Box Maintenance Instructions	4-5	4-8
	Interconnecting Cable Assemblies Maintenance Instructions	4-6	4-10
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Section I. GENERAL

4-1. INTRODUCTION. This chapter contains the electrical power system maintenance procedures authorized for direct support by the Maintenance Allocation Chart (MAC). The MAC is in Appendix B of TM 9-1425-646-20.

Section II. MAINTENANCE PROCEDURES

4-2. GENERAL MAINTENANCE PROCEDURES. The following general inspection and cleaning procedures should be used when performing maintenance tasks. Special inspections and cleaning procedures, when required, are included with each maintenance task.

a. Inspection.

(1) Check bolts, nuts, and screws for stripped threads or other damage. Repair or replace as necessary. Do not reuse self-locking nuts that do not meet minimum breakaway torque. (Refer to Appendix D.)

(2) Check bearings and bushings for scored, galled, or other visual damage. Replace if damaged.

(3) Check components for chipped paint, rust, broken welds, elongated holes, or other visual damage. Repair or replace as required.

(4) Check electrical cables and connectors for cracked or broken insulation, bare wires, and loose or damaged connectors. Repair or replace as required.

(5) Check hoses and fluid lines for frayed hoses, nicked or scratched fluid lines, and damaged connectors. Repair or replace as required.

b. Cleaning and Painting.

(1) Using cotton wiping cloth and approved solvent, if required, clean all components before installation.

(2) Spot paint all areas that have chipped or scratched paint.

4-3. BATTERY BOX COVER MAINTENANCE INSTRUCTIONS. This paragraph covers the maintenance tasks for the following items:

Item	*Page*
1. Container Latch	4-2
2. Cover Handle	4-3
3. Cover Striker	4-3
4. Cover Channel	4-4

INITIAL SETUP

Tools
Kit, tool, 13032302
Set, shop, 13032303
Bar, bucking, rivet (for items 2, 3, and 4)
Drill, electric, 1/4-inch (for items 2, 3, and 4)
Drill, twist, 1/8-inch (for items 2 and 4)
Drill, twist, 3/16-inch (for item 3)
Hammer, pneumatic (for items 2, 3, and 4)
Rivet set, pneumatic (for items 2, 3, and 4)
Wrench, torque, 0 to 125 N•m

Materials/Parts
Cloth, cleaning (6, Appendix B)
Primer, zinc chromate (47, Appendix B)

Personnel Required
MLRS Repairer MOS 27M

References
TM 9-1425-646-10
TM 9-1425-646-20

Equipment Condition
Position LLM to 3200-mil (180-degree) azimuth and 0-mil elevation (TM 9-1425-646-10)

1. CONTAINER LATCH.

a. Remove.

(1) Remove batteries.

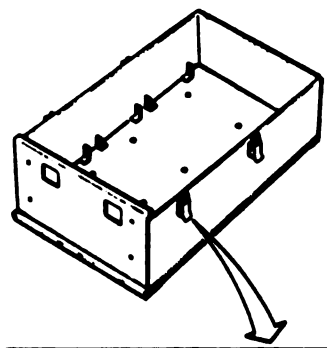
(2) Using electric drill and 1/8-inch twist drill, remove two rivets securing defective latch to container (TM 9-1425-646-20).

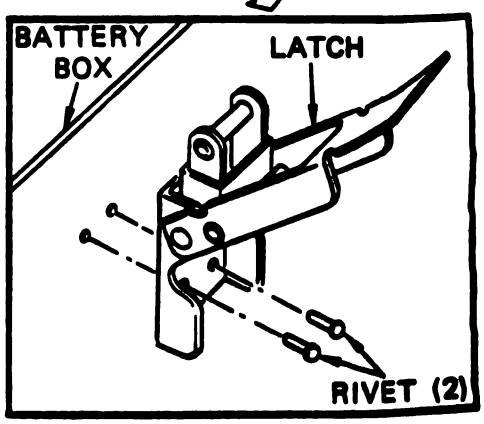
b. Install.

(1) Apply zinc chromate primer to two rivets. Position new latch on container and install two rivets using bucking bar, rivet set, and pneumatic hammer.

(2) Install batteries (TM 9-1425-646-20).

(3) If no further maintenance is required, perform follow-on procedure (page 4-4).





4-3. BATTERY BOX COVER MAINTENANCE INSTRUCTIONS (CONT)

2. COVER HANDLE.

a. Remove.

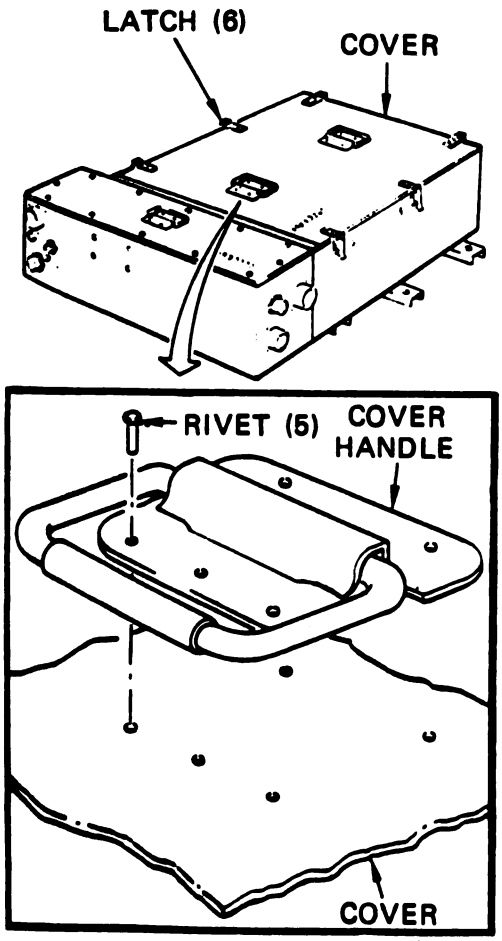
(1) Unlatch six latches securing cover to battery box. Remove cover.

(2) Using electric drill and 3/16-inch twist drill, remove five rivets securing defective handle to cover. Remove handle.

b. Install.

(1) Apply zinc chromate primer to five rivets. Position new handle on cover and install five rivets using bucking bar, rivet set, and pneumatic hammer.

(2) Position cover on battery box and secure with six latches.



(3) If no further maintenance is required, perform follow-on procedure (page 4-4).

3. COVER STRIKER.

a. Remove.

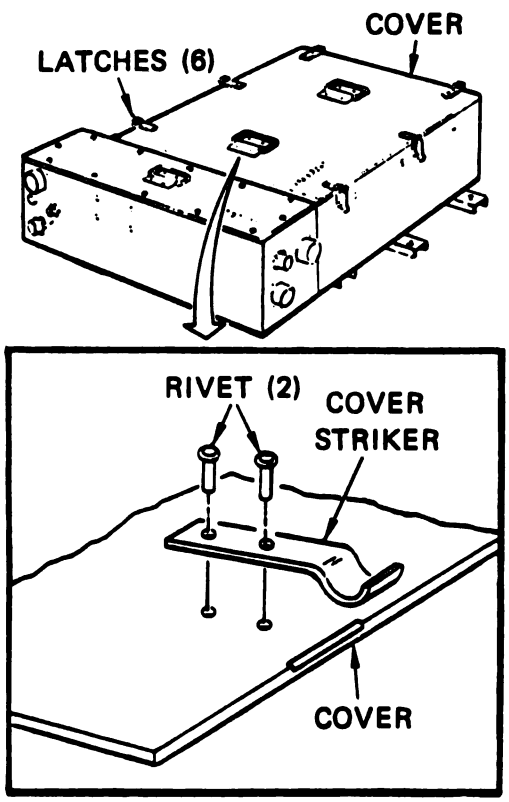
(1) Unlatch six latches securing cover to battery box. Remove cover.

(2) Using electric drill and 1/8-inch twist drill, remove two rivets securing defective striker to cover.

b. Install.

(1) Apply zinc chromate primer to two rivets. Position new striker on cover and install two rivets using bucking bar, rivet set, and pneumatic hammer.

(2) Position cover on battery box and secure with six latches.



(3) If no further maintenance is required, perform follow-on procedure (page 4-4).

4-3. BATTERY BOX COVER MAINTENANCE INSTRUCTIONS (CONT)

4. COVER CHANNEL.

a. Remove.

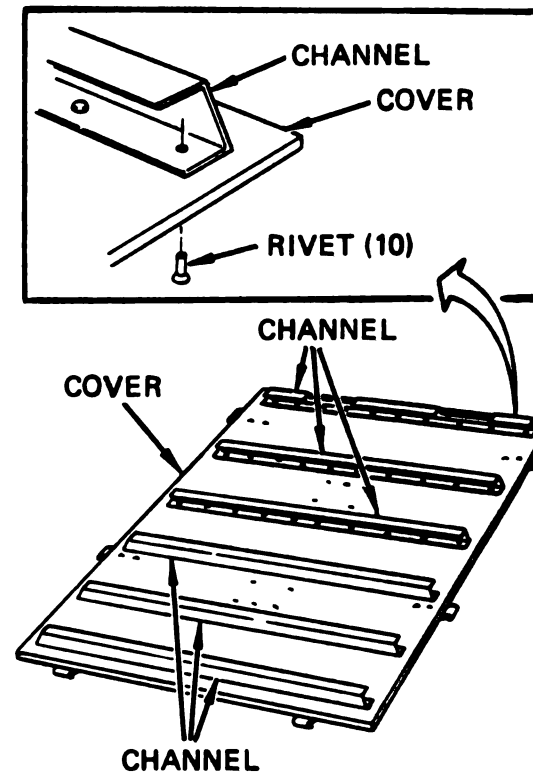
(1) Unlatch six latches securing cover to battery box. Remove cover.

(2) Using electric drill and 1/8-inch twist drill, remove rivets securing defective channel to cover.

b. Install.

(1) Apply zinc chromate primer to rivets. Position new channel to cover and install rivets using bucking bar, rivet set, and pneumatic hammer.

(2) Position cover on battery box and secure with six latches.



FOLLOW-ON PROCEDURE

Cycle LLM two times in elevation and azimuth and check for smooth operation (TM 9-1425-646-10).

4-4. ELECTRONICS BOX MAINTENANCE INSTRUCTIONS. This paragraph covers the replacement of the electronics box.

INITIAL SETUP

Tools
Kit, tool, 13032302

Materials/Parts
Varnish (71, Appendix B)

Personnel Required
MLRS Repairer MOS 27M

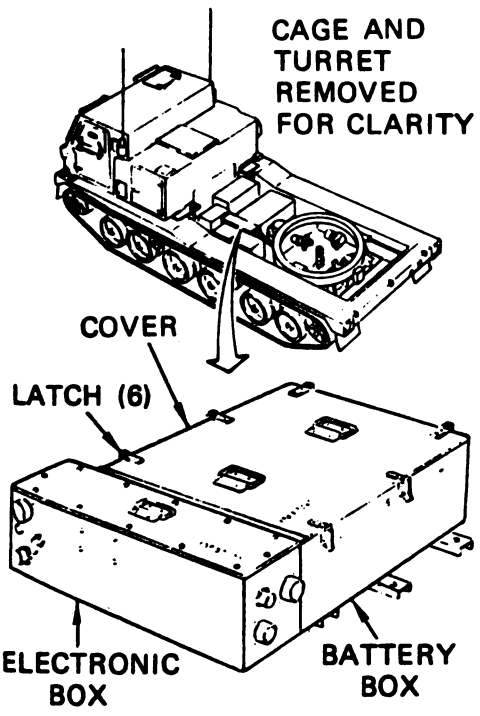
References
TM 9-1425-646-10

Troubleshooting
Paragraph 2-9

Equipment Condition
Position LLM to 3200-mil (180-degree) azimuth and 0-mil elevation (TM 9-1425-646-10)

a. ***Remove.***

(1) Unlatch six latches securing cover to battery box. Remove cover.

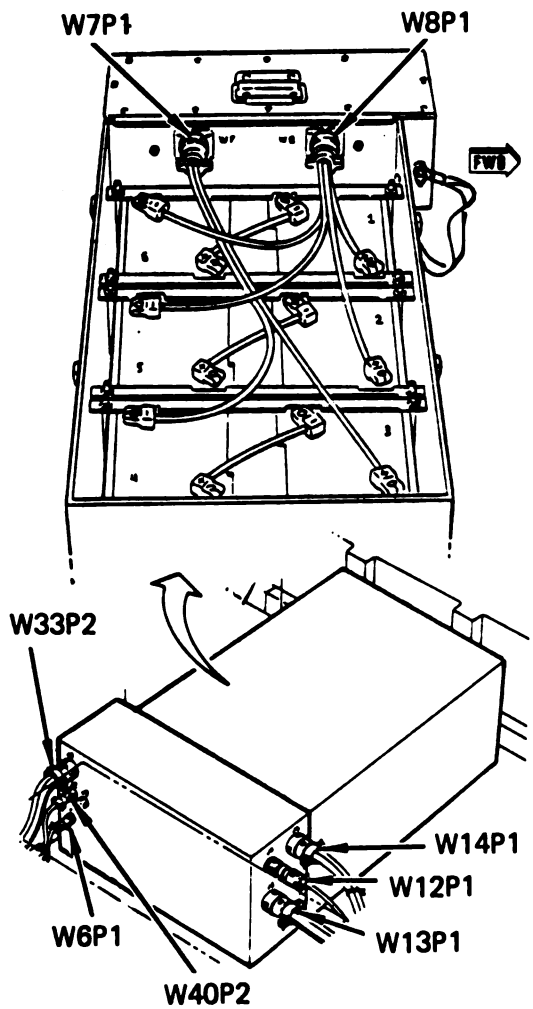


(2) Disconnect battery cable connectors W7P1 and W8P1 from J7 and J8 on electronics box.

(3) Cut and remove lockwire from W33P2, W40P2, W14P1, and W13P1. Disconnect the following electrical connectors from the electronics box.

Connector	From
W40P2	J2
W33P2	J3
W13P1	J5
W14P1	J6
W12P1	J4
W6P1	J1

(4) Using 17mm box end wrench, remove nut and washer securing ground strap to electronics box.



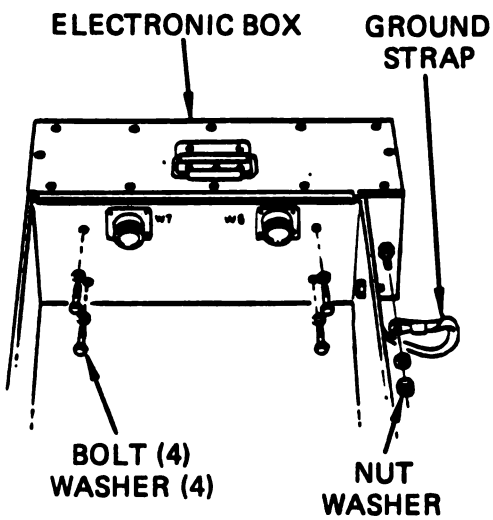
4-4. ELECTRONICS BOX MAINTENANCE INSTRUCTIONS (CONT)

(5) Using 17mm socket, remove four bolts and four washers securing electronics box to battery box. Remove electronics box.

b. Install.

(1) Position new electronics box at end of battery box and install four bolts and washers. Using 17mm socket, tighten four bolts.

(2) Install ground strap and secure with nut and washer. Using 17mm box end wrench, tighten nut. Apply varnish on connection.



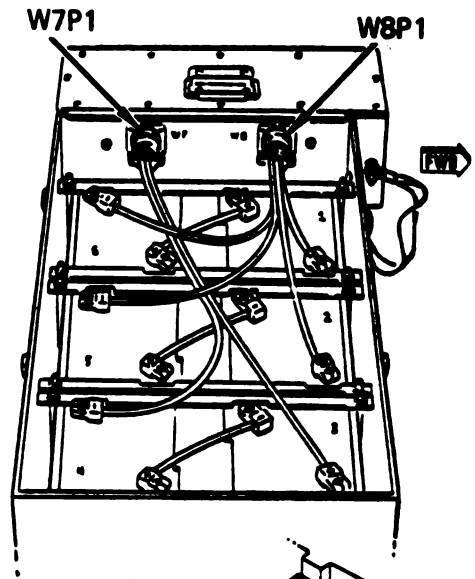
(3) Connect the following electrical connectors to the electronics box.

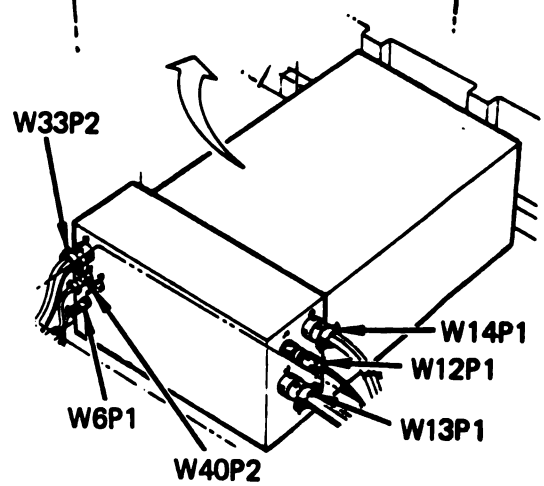
Connector	To
W40P2	J2
W33P2	J3
W13P1	J5
W14P1	J6
W12P1	J4
W6P1	J1

(4) Connect battery cable connectors W7P1 to J7 and W8P1 to J8.

(5) Lockwire the following electrical connectors:

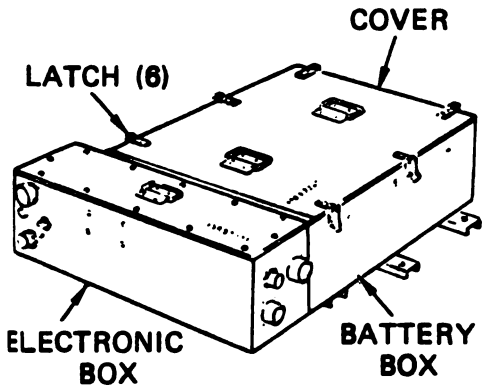
Connector	To
W40P2	W33P2
W14P1	W13P1





44. ELECTRONICS BOX MAINTENANCE INSTRUCTIONS (CONT)

(6) Position cover on battery box and secure with six latches.



(7) Perform follow-on procedure.

FOLLOW-ON PROCEDURE

Cycle LLM two times in elevation and azimuth and check for smooth operation (TM 9-1425-646-10).

4-5. POWER DISTRIBUTION BOX MAINTENANCE INSTRUCTIONS. This paragraph covers the replacement of the power distribution box.

INITIAL SETUP

Tools
Kit, tool, 13032302

Personnel Required
MLRS Repairer MOS 27M
(MLRS Crewmember MOS 13M
to assist as required)

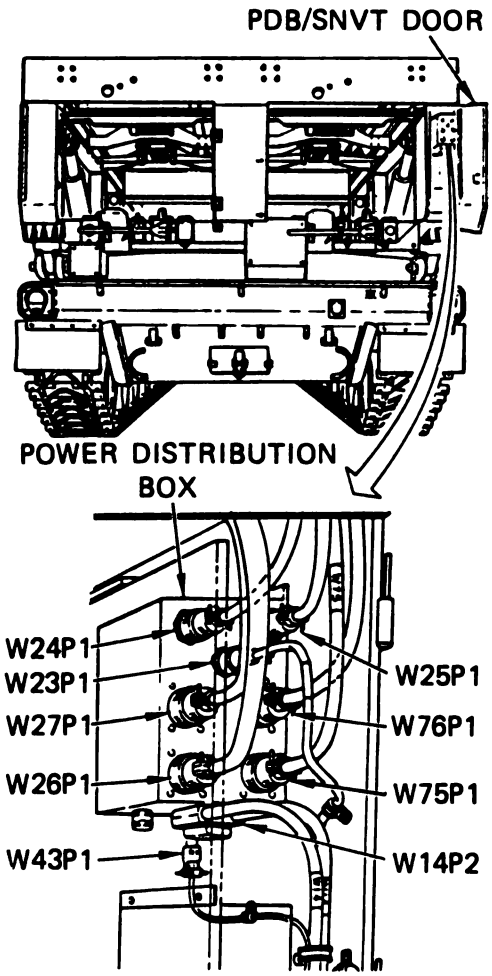
References
TM 9-1425-646-10

Troubleshooting
Paragraph 2-9

a. Remove.

(1) Unlatch and open power distribution box/short-no voltage tester (PDB/SNVT) door.

(2) Disconnect nine electrical cable connectors from power distribution box.

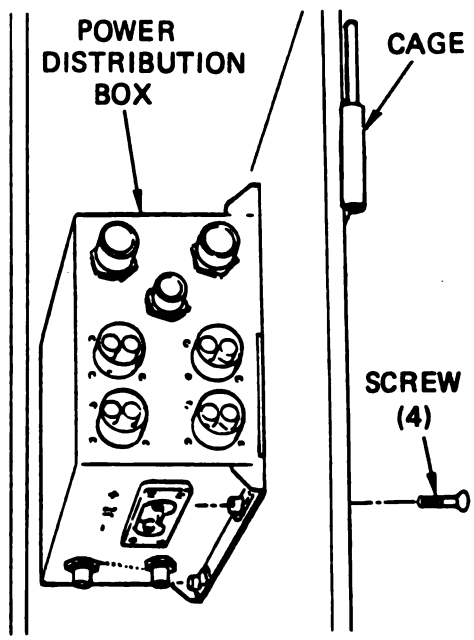


(3) Using 5mm socket attachment, remove four screws securing power distribution box to cage. Remove power distribution box.

b. Install.

(1) Prepare power distribution box mounting surface and mounting surface on cage for electrical bond (paragraph 3-10).

(2) Position power distribution box on cage and install four screws. Using 5mm socket attachment, tighten screws.

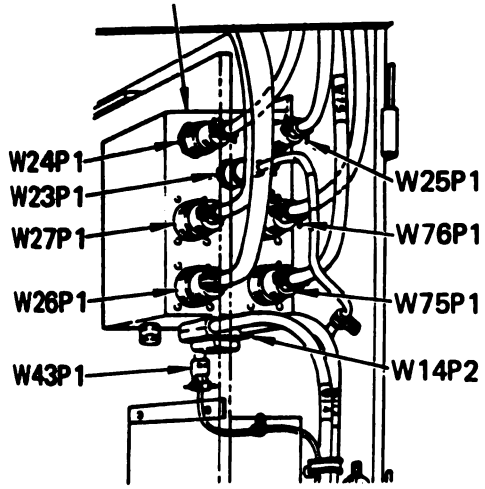


45. POWER DISTRIBUTION BOX MAINTENANCE INSTRUCTIONS (CONT)

(3) Connect electrical connectors to power distribution box as follows:

Connector	To
W43P1	J9
W14P2	J2
W24P1	J1
W25P1	J3
W23P1	J4
W27P1	J7
W26P1	J5
W76P1	J8
W75P1	J6

POWER DISTRIUBTION BOX



(4) Close and latch PDB/SNVT door.

(5) Perform follow-on procedure.

FOLLOW-ON PROCEDURE

Cycle LLM in elevation and azimuth two times and check for smooth operation (TM 9-1425-646-10).

4-6. INTERCONNECTING CABLE ASSEMBLIES MAINTENANCE INSTRUCTIONS. This paragraph covers the maintenance tasks for the following interconnecting cable assemblies:

Cable Assembly	*Page*
W1	4-11
W4	4-11
W6	4-17
W9	4-26
W10	4-11
W12	4-20
W13	4-20
W14	4-20
W15	4-26
W18	4-26
W19	4-26
W20	4-26
W23	4-20
W24	4-26
W25	4-26
W26	4-26
W27	4-26
W32	4-27
W33	4-17
W34	4-20
W35	4-21
W38	4-21
W40	4-17
W41	4-14
W43	4-27
W53	4-27
W57	4-27
W59	4-17
W60	4-17
W61	4-17
W65	4-21
W67	4-14
W68	4-14
W74	4-14
W75	4-27
W76	4-27
W80	4-14
W81	4-17
W82	4-11
W83	4-11
W84	4-11

INITIAL SETUP

Tools
Kit, tool, 13032302

Materials/Parts
Lockwire (23, Appendix B)
Sealant (59, Appendix B)
Twine, lacing (70, Appendix B)
Varnish (71, Appendix B)

Personnel Required
2 MLRS Repairers MOS 27M (MLRS Crewmember MOS 13M to assist as required)

References
TM 9-1425-646-10
TM 9-1425-646-20

Troubleshooting
Paragraph 2-9

4-6. INTERCONNECTING CABLE ASSEMBLIES MAINTENANCE INSTRUCTIONS (CONT)

GENERAL INFORMATION. Cable routing and clamp locations are illustrated in figures 4-1 through 4-5. Tables 4-1 through 4-5 list each cable, cable connectors, and where cable connectors are terminated. The tables also list any special instructions required to remove and install the cable. There are standard maintenance procedures that must be followed when removing and installing a cable assembly. These standard procedures are:

a. When removing clamps from cable, temporarily reinstall clamp and attaching hardware so they may be reinstalled in same location during cable installation. Apply zinc chromate primer to screws for clamps when installing clamps during cable installation.

CAUTION

Insure that SYS PWR switch on FCP is in OFF before disconnecting any electrical cable.

b. When connector is secured to structure, old sealant must be removed from structure with a scraping knife before new connector is installed. After scraping the structure clean, apply sealant to structure and new connector. Install connector on structure and secure with attaching hardware and safety wire.

c. All cable terminal lug connections must have coat of varnish applied after installation.

Table 4-1. Interconnecting Cable Assemblies - Vehicle Cab

CABLE	CONNECTOR	TERMINATION	REMARKS
	NOTE See figure 4-1 for cable location.		
W1	P1	J2-FCP	Tilt vehicle cab forward.
	P2	J1-FCP	
	P3	DOOR INTERLOCK	
	J1	P1-W67	
	J2	P1-W68	
W4	P1	J1-COMM PROCESSOR	Lock-wire W4P2 to W84P1.
	P2	J2-W83	
	P3	J510-AM1780/VRC	
W10	P1	J4-COMM PROCESSOR	
	P2	DATA-KY57 C-10377	
W82	J1	P1-W84	Tilt vehicle cab forward.
	J2	P1-W41	
W83	J1	P1-W74	Tilt vehicle cab forward.
	J2	P2-W4	
W84	P1	J1-W82	Lock-wire W84P1 to W4P2.
	P2	J2-COMM PROCESSOR	Lock-wire W84P2 to shim on mounting bracket.

4-6. INTERCONNECTING CABLE ASSEMBLIES MAINTENANCE INSTRUCTIONS (CONT)

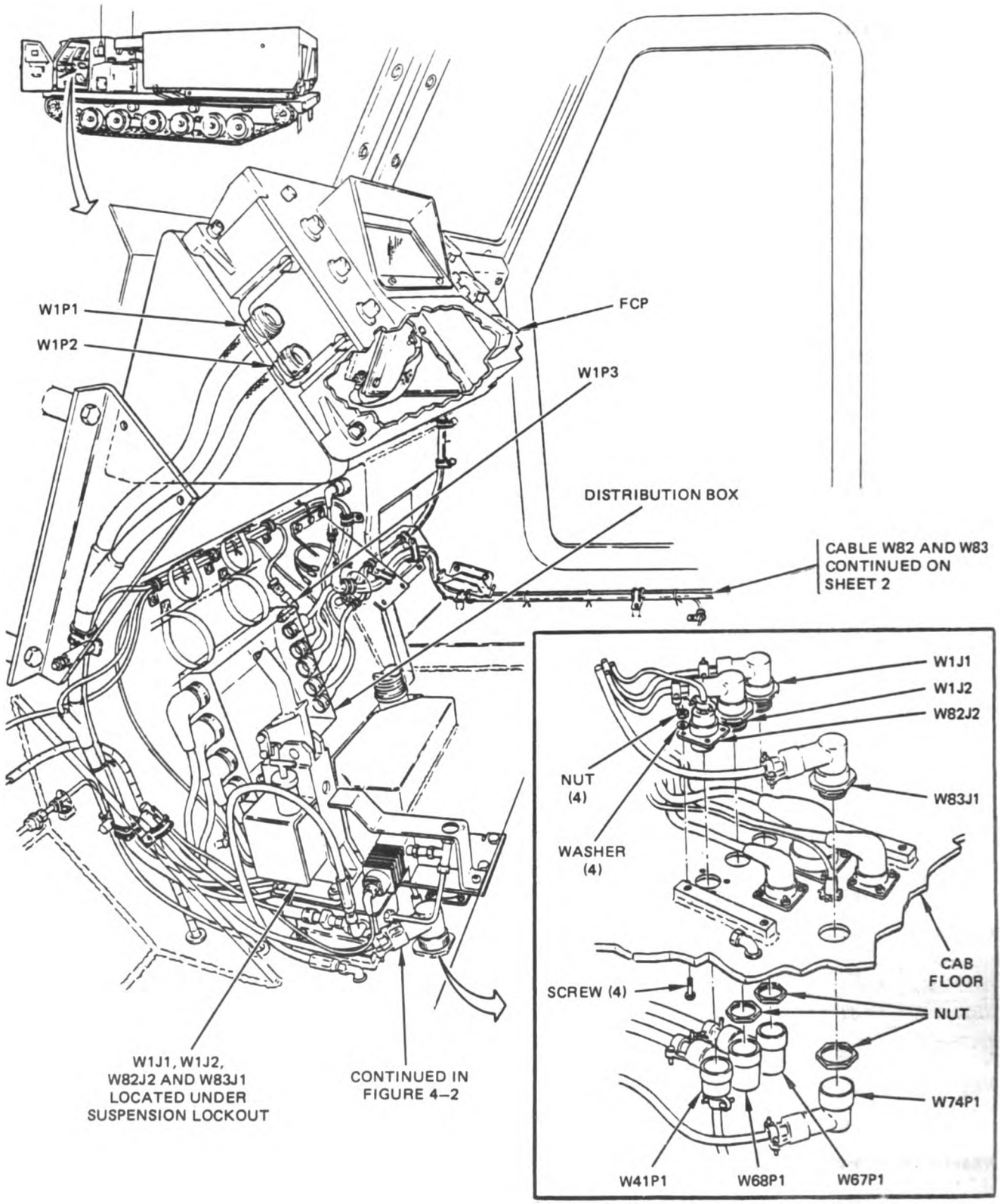


Figure 4-1. Vehicle Cab Interconnecting Cable Assemblies (Sheet 1 of 2)

4-6. INTERCONNECTING CABLE ASSEMBLIES MAINTENANCE INSTRUCTIONS (CONT)

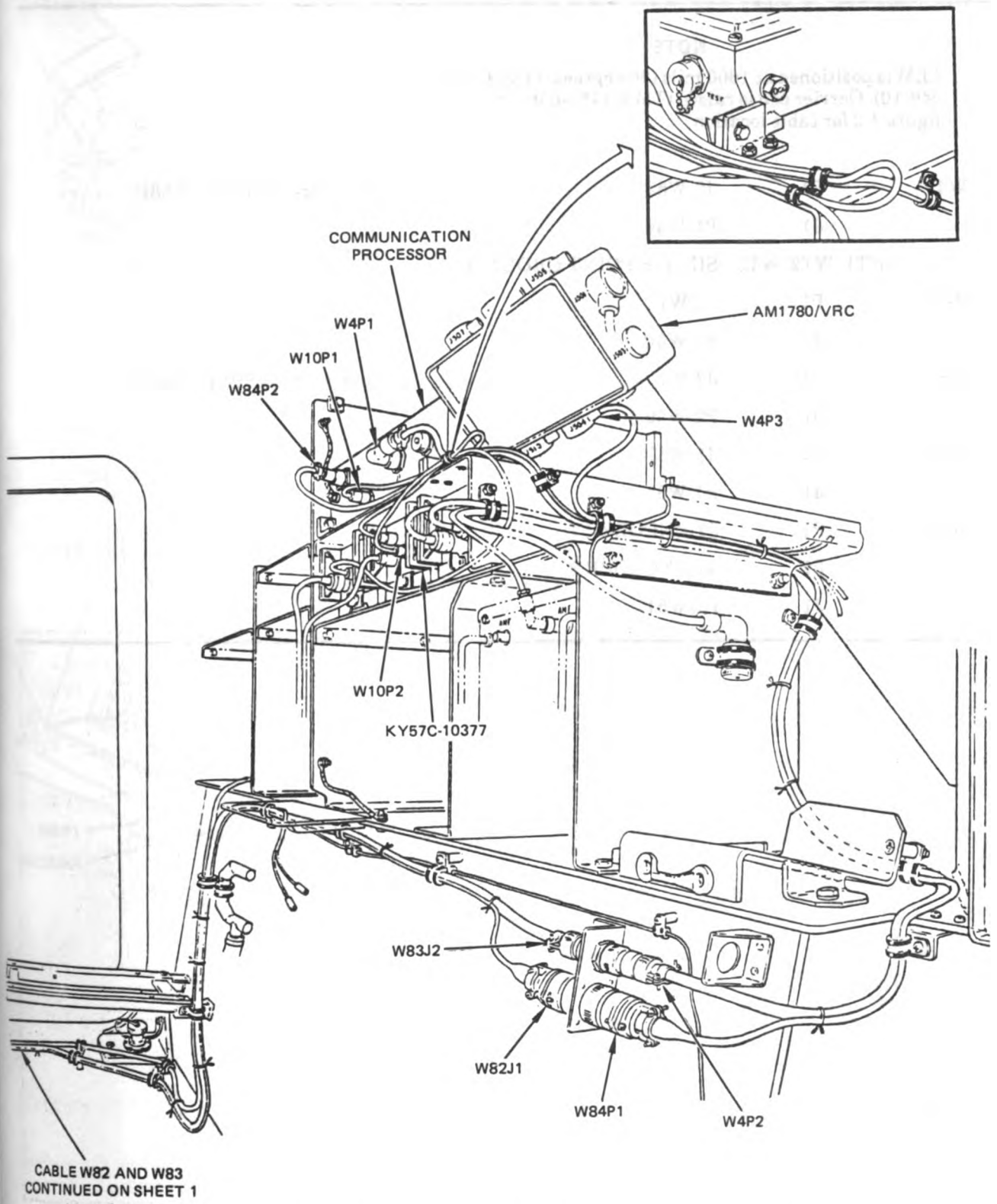


Figure 4-1. Vehicle Cab Interconnecting Cable Assemblies (Sheet 2 of 2)

Table 4-2. Interconnecting Cable Assemblies – Engine Compartment

CABLE	CONNECTOR	TERMINATION	REMARKS
		NOTE LLM is positioned at 1600 mils (90 degrees) (TM 9-1425-646-10). Carrier cab is raised (TM 9-1450-646-10). See figure 4-2 for cable location.	
W41	P1	J2-W82	Lock-wire W41P1 to W68P1.
	J1	P1-W40	
	WT1, WT2, WT3	SINGLE POINT GROUND	
W67	P1	J1-W1	
	J1	P1-W60	
W68	P1	J2-W1	Lock-wire W68P1 to W41P1.
	J1	P2-W59	
W74	P1	J1-W83	
	J1	P1-W61	
W80	P1	J1-ENCODER 1	
	P2	J1-ENCODER 2	
	J1	P1-W81	

4-6. INTERCONNECTING CABLE ASSEMBLIES MAINTENANCE INSTRUCTIONS (CONT)

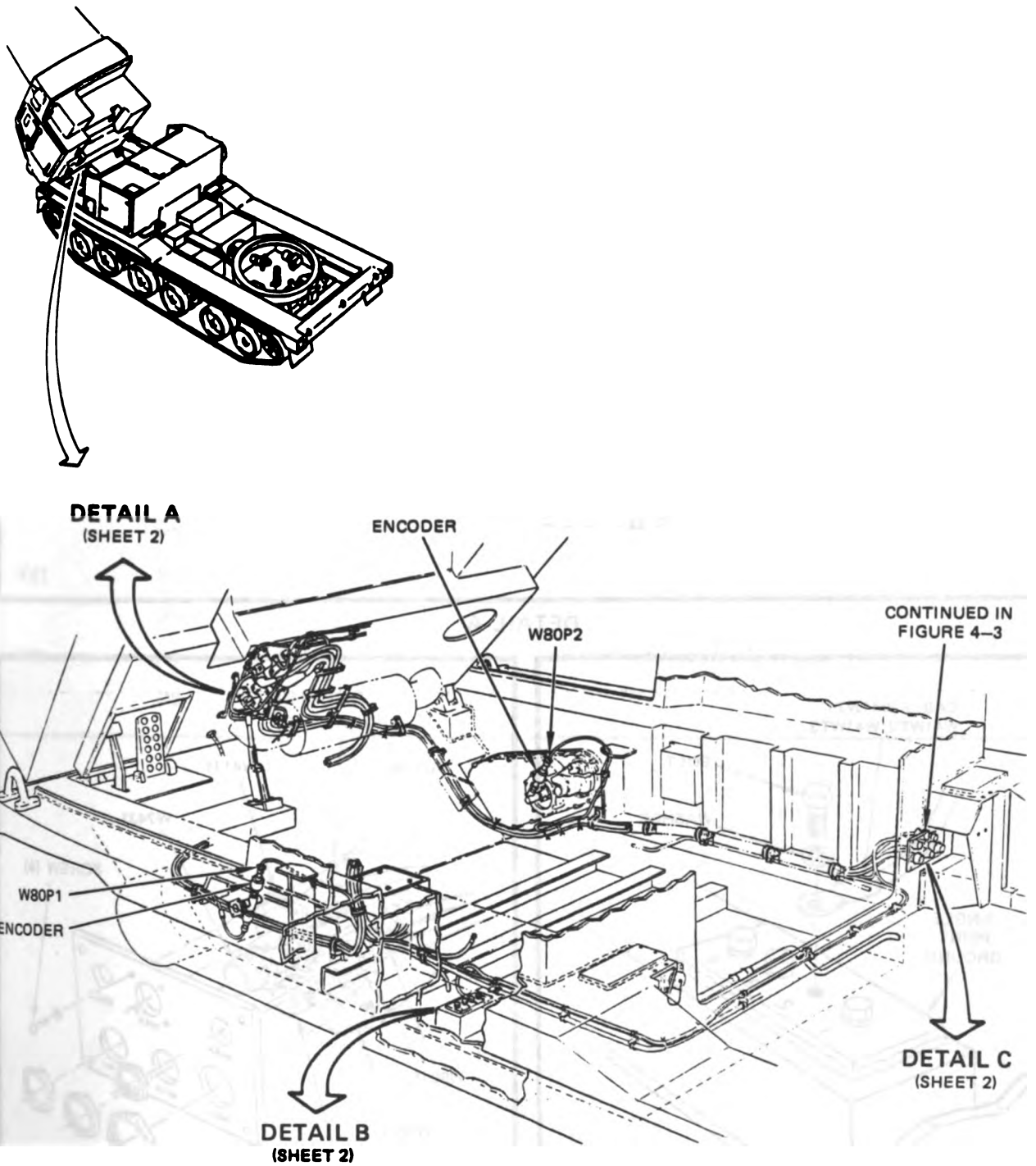
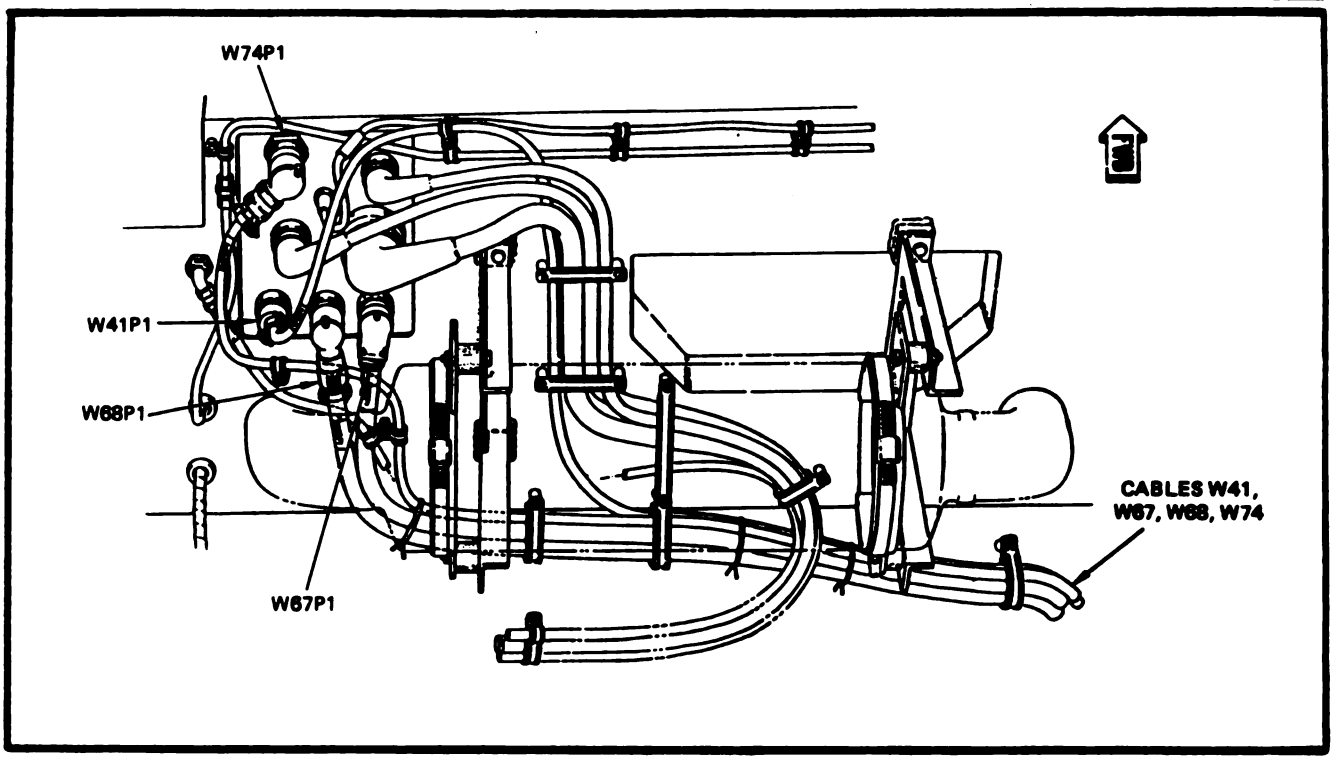
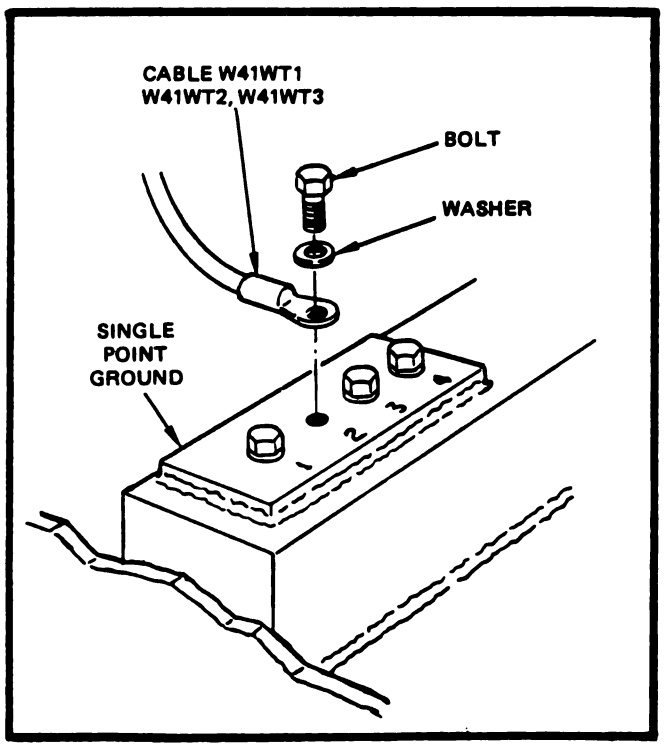


Figure 4-2. Engine Compartment Interconnecting Cable Assemblies (Sheet 1 of 2)

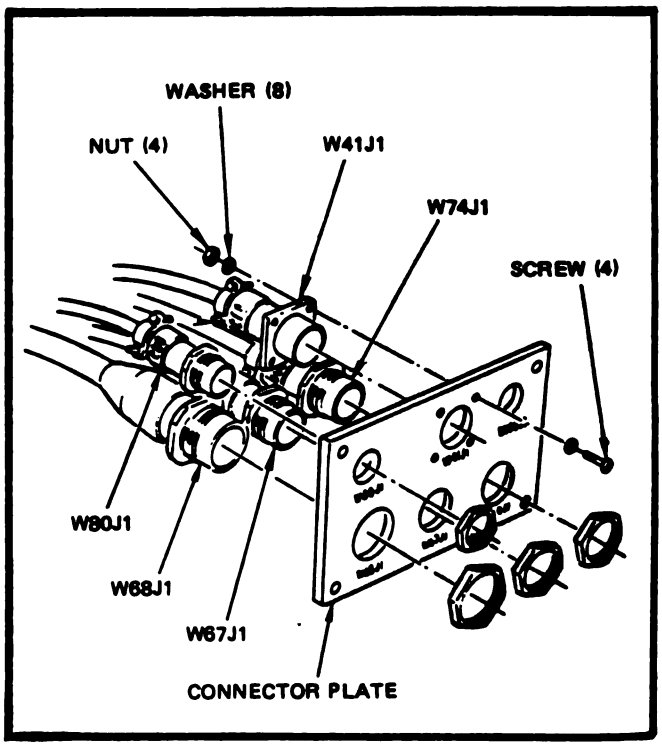
4-6. INTERCONNECTING CABLE ASSEMBLIES MAINTENANCE INSTRUCTIONS (CONT)



DETAIL A



DETAIL B



DETAIL C

Figure 4-2. Engine Compartment Interconnecting Cable Assemblies (Sheet 2 of 2)

Table 4-3. Interconnecting Cable Assemblies – Vehicle Bed

CABLE	CONNECTOR	TERMINATION	REMARKS
		NOTE LLM is positioned at 1600 mils (90 degrees) (TM 9-1425-646-10). See figure 4-3 for cable location.	
W6	P1	J1-ELECTRONICS BOX	
	P2	J6-EU	
W33	P1	J1-VEHICLE WIRING	
	P2	J3-ELECTRONICS BOX	Lock-wire W33P2 to W40P2.
W40	P1	J1-W41	Lock-wire W40P1 to bracket.
	P2	J2-ELECTRONICS BOX	Lock-wire W40P2 to W33P2.
W59	P1	J1-EU	
	P2	J1-W68	
W60	P1	J1-W67	
	P2	J2-EU	
W61	P1	J1-W74	
	P2	J4-EU	
W81	P1	J1-W80	FCU/SRP door open
	P2	SRP/PDS	

4-6. INTERCONNECTING CABLE ASSEMBLIES MAINTENANCE INSTRUCTIONS (CONT)

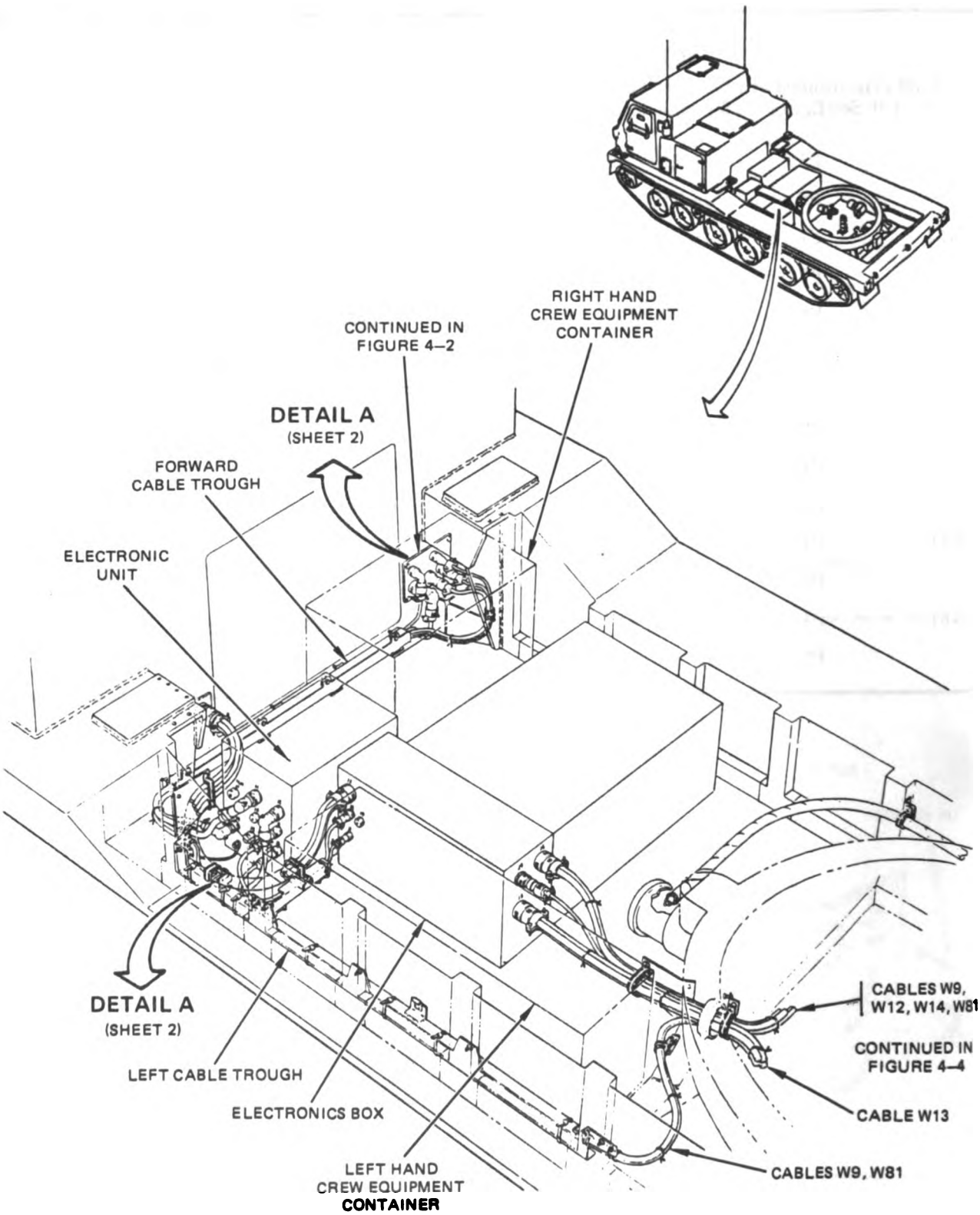
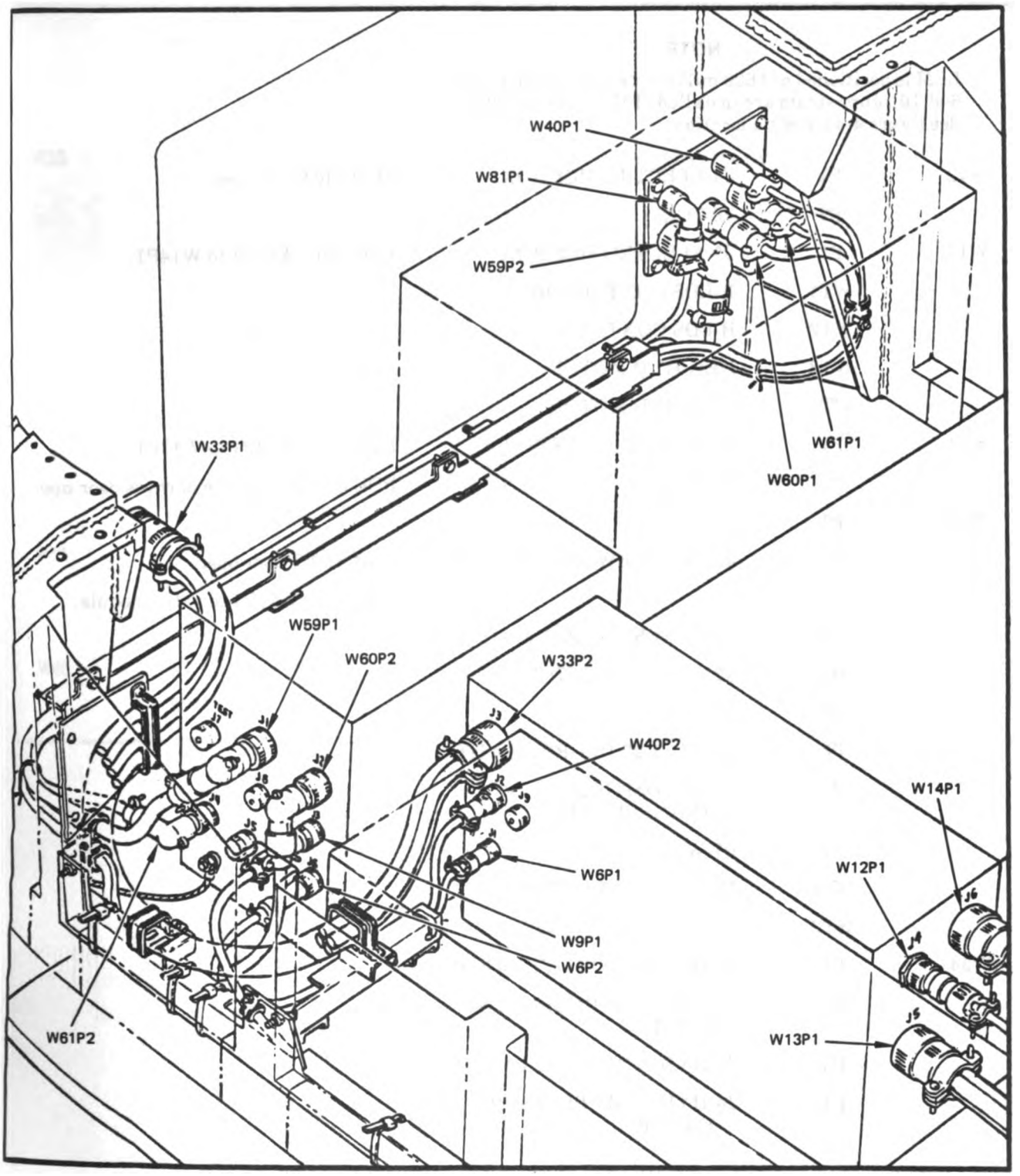


Figure 4-3. Vehicle Bed Interconnecting Cable Assemblies (Sheet 1 of 2)

4-6. INTERCONNECTING CABLE ASSEMBLIES MAINTENANCE INSTRUCTIONS (CONT)



DETAIL A

Figure 4-3. Vehicle Bed Interconnecting Cable Assemblies (Sheet 2 of 2)

Table 4-4. Interconnecting Cable Assemblies – Base/Turret

CABLE	CONNECTOR	TERMINATION	REMARKS
		NOTE LLM is positioned at 1600 mils (90 degrees) (TM 9-1425-646-10). Jury struts are installed (TM 9-1425-646-20). See figure 4-4 for cable location.	
W12	P1	J4-ELECTRONICS BOX	FCU/SRP door open
	P2	J6-FCU	
W13	P1	J5-ELECTRONICS BOX	Lock-wire W13P1 to W14P1.
	WT1	B-LDS CONTACTOR	
	WT2	B-LDS CONTACTOR	
	WT3	NEG-HYD MOTOR	
	WT4	NEG-HYD MOTOR	
W14	P1	J6-ELECTRONICS BOX	Lock-wire W14P1 to W13P1
	P2	J2-PDB	PDB/SNVT and wire harness door open.
W23	P1	J4-PDB	
	P2	J1-AZ FREEWHEEL VALVE	PDB/SNVT door open Lock-wire W23P1 to valve module.
	P3	J1-AZ SERVO VALVE	
	P4	J2-AZ LIMIT SWITCH	
	P5	J1-W35	
	P6	J1-AZ +1.25 DEGREE SWITCH	
	P7	J1-AZ POSITION TRANSDUCER	
	J1	P7-W34	
	WT1	X1-LDS CONTACTOR	
	WT2	X2-LDS CONTACTOR	
W34	P1	J1-HYD MOTOR OVER TEMP	
	P2	J2-HYD RESERVOIR LOW FLUID	
	P3	J3-HYD PUMP RETURN FLTER	
	P4	J4-HYD PUMP PRESSURE FILTER	

Table 4-4. Interconnecting Cable Assemblies – Base/Turret – Continued

CABLE	CONNECTOR	TERMINATION	REMARKS
	P5	J5-HYD PUMP FLUID TEMP	
	P6	J6-HYD PUMP PRESSURE	
	P7	J1-W23	
W35	P1	J1-EL 15-DEGREE LIMIT SWITCH	Switch cover removed
	P2	J1-EL LEFT ACTUATOR LIMIT SWITCH	
	P3	J1-EL RIGHT ACTUATOR LIMIT SWITCH	
	P4	J1-EL SERVO VALVE	
	P5	J1-EL 27-DEGREE LIMIT SWITCH	
	P6	J1-STOW PRESSURE VALVE	Lock-wire W35P6 to valve module.
	P7	J1-HYD PRESSURE SWITCH	Lock-wire W35P7 to valve module.
	J1	P5-W23	
W38	P1	HEAT EXCHANGER	
	WT1	POS-HYD MOTOR	
	WT2	NEG-HYD MOTOR	
W65	WT1	M-LDS CONTACTOR	
	WT2	POS-HYD MOTOR	

4-6. INTERCONNECTING CABLE ASSEMBLIES MAINTENANCE INSTRUCTIONS (CONT)

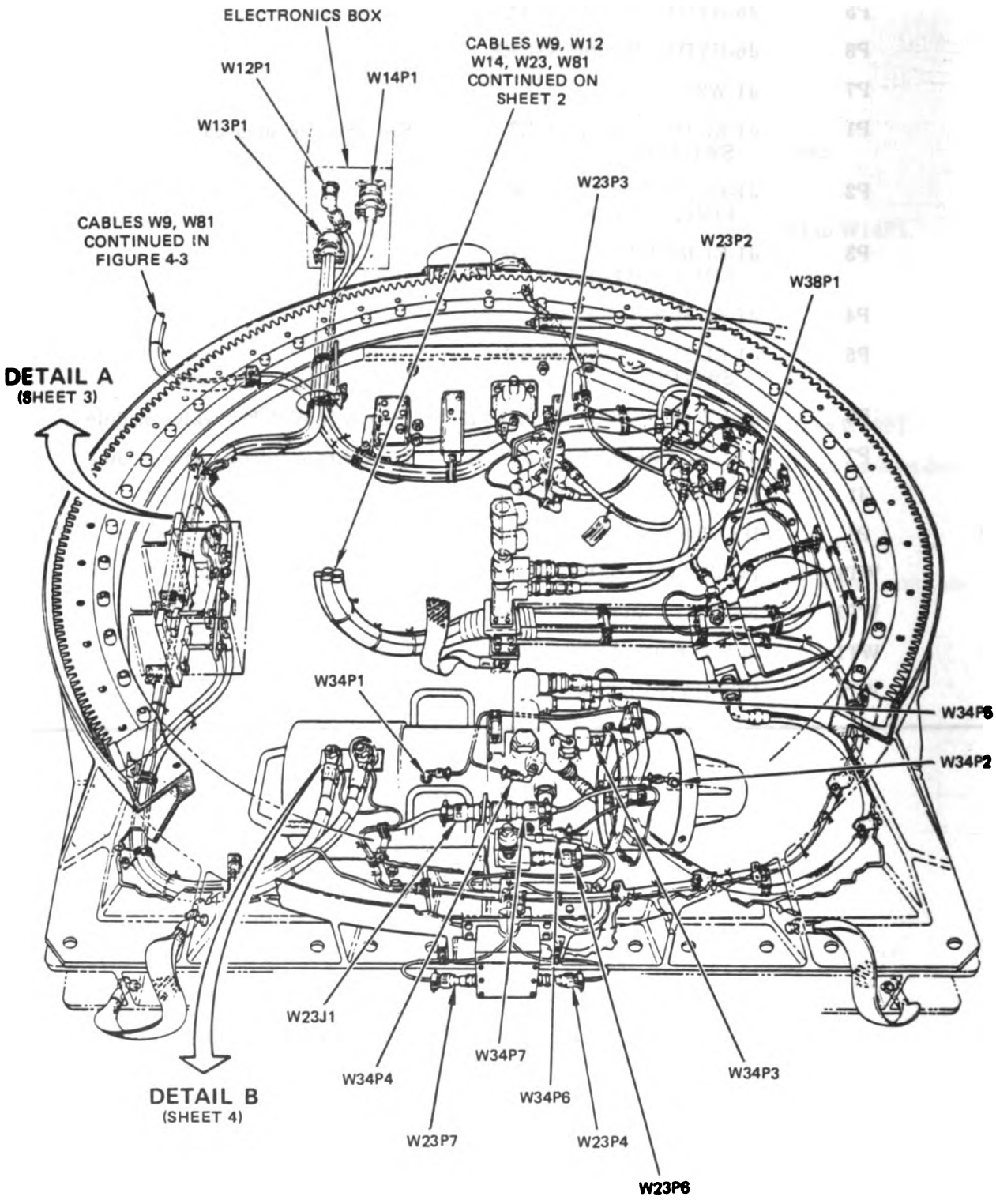


Figure 4-4. Base/Turret Interconnecting Cable Assemblies (Sheet 1 of 4)

46. INTERCONNECTING CABLE ASSEMBLIES MAINTENANCE INSTRUCTIONS (CONT)

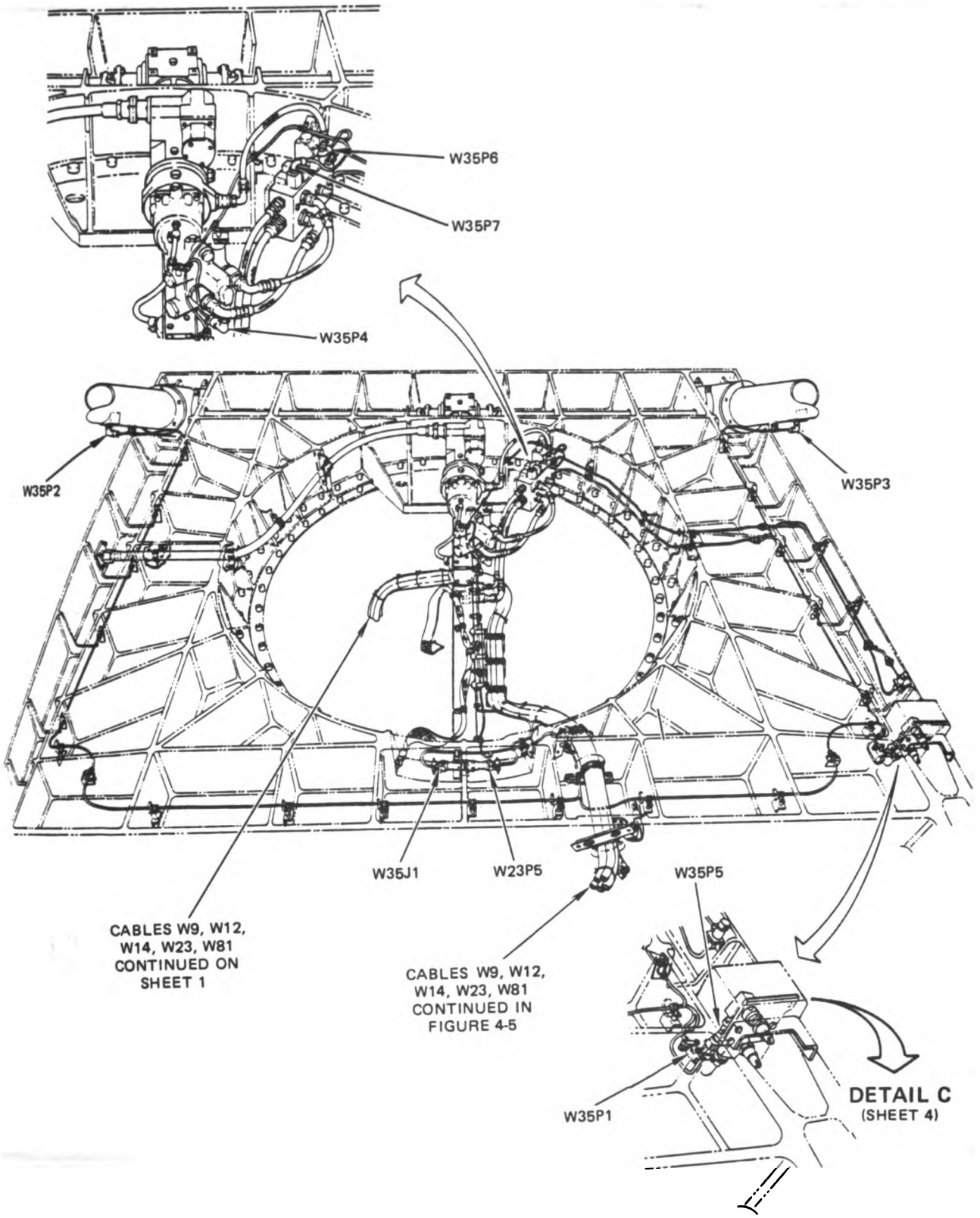
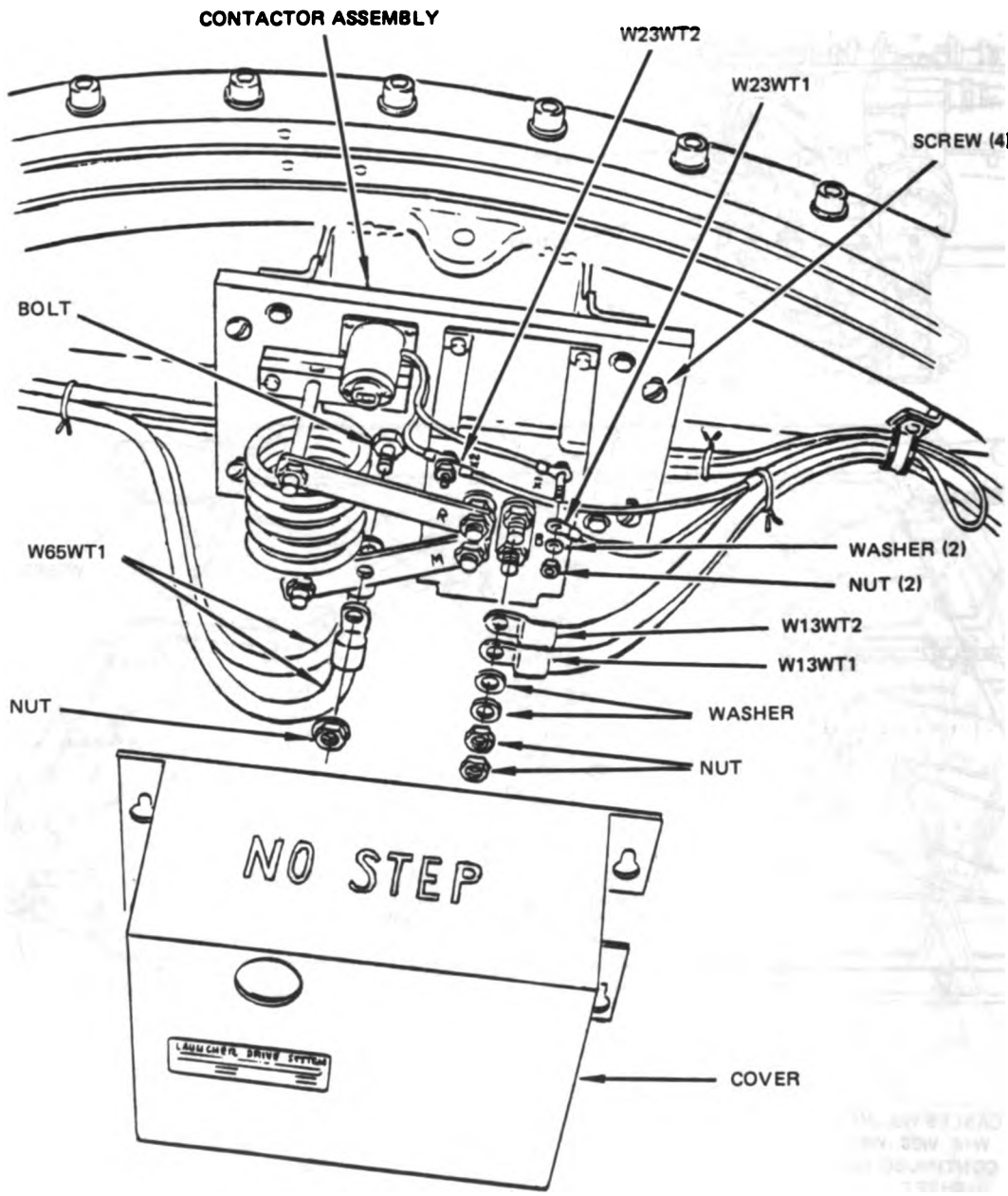


Figure 4-4. Base/Turret Interconnecting Cable Assemblies (Sheet 2 of 4)

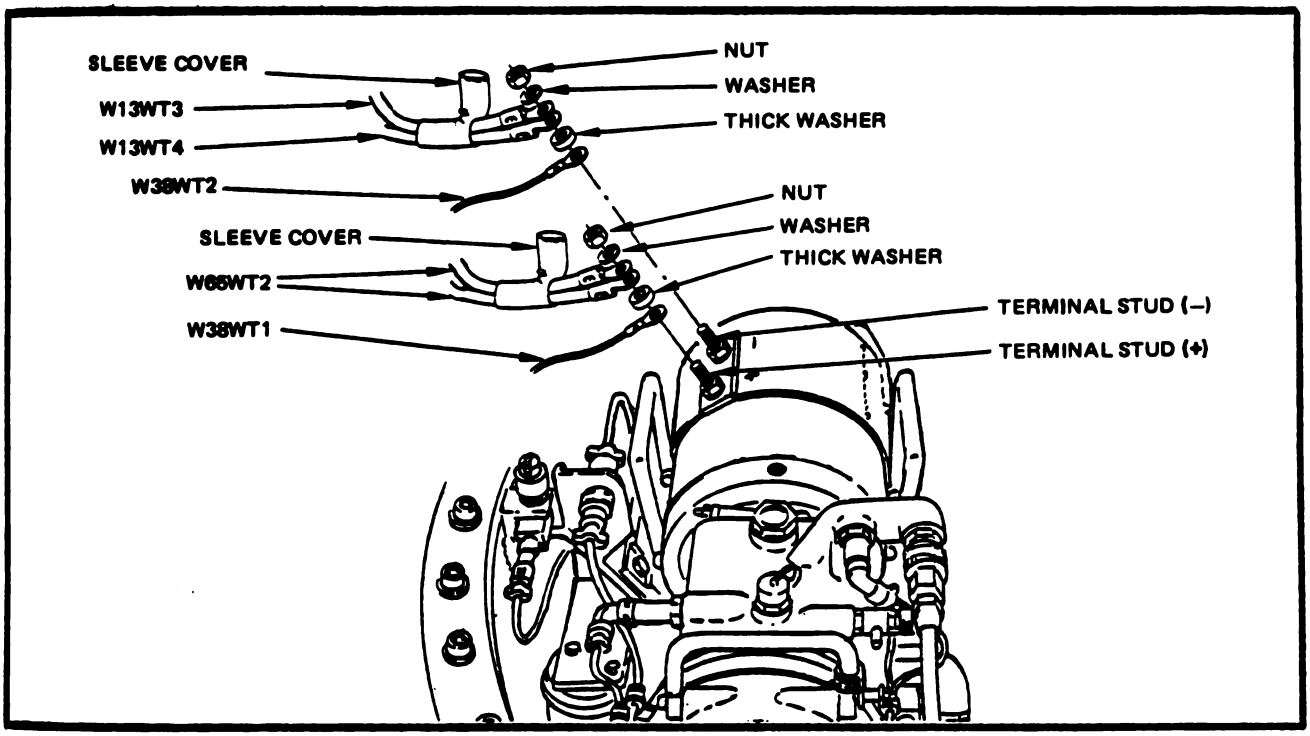
4-6. INTERCONNECTING CABLE ASSEMBLIES MAINTENANCE INSTRUCTIONS (CONT)



DETAIL A

Figure 4-4. Base/Turret Interconnecting Cable Assemblies (Sheet 3 of 4)

4-6. INTERCONNECTING CABLE ASSEMBLIES MAINTENANCE INSTRUCTIONS (CONT)



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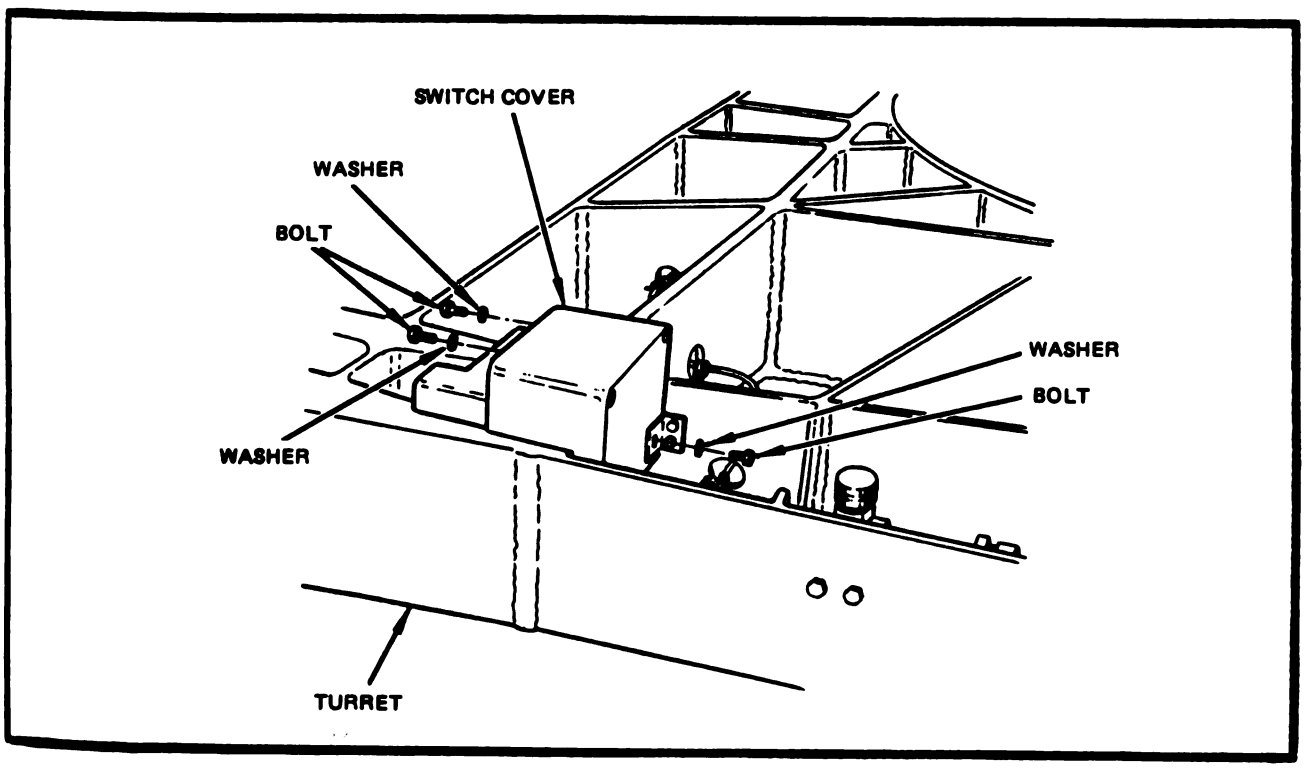


DETAIL C

Figure 4-4. Base/Turret Interconnecting Cable Assemblies (Sheet 4 of 4)

Table 4-5. Interconnecting Cable Assemblies – Cage

CABLE	CONNECTOR	TERMINATION	REMARKS
		NOTE	
		See figure 4-5 for cable location.	
W9	P1	J3-EU	FCU/SRP and power harness door open
	P2	J7-FCU	Jury struts installed (TM 9-1425-646-20)
W15	P1	J5-FCU	FCU/SRP door open
	P2	J1-SRP/PDS	
W18	P1	J1-W25	Boom controller door open
	P2	J1-BOOM CONTROLLER	
W19	P1	J4-FCU	FCU/SRP door open
	P2	J1-LEFT LP/C	LP/C connector doors open
	P3	J1-RIGHT LP/C	Wire harness door open
W20	P1	J1-FCU	FCU/SRP door open
	P2	J2-LEFT LP/C	LP/C connector doors open
	P3	J2-RIGHT LP/C	Wire harness doors open
W24	P1	J1-PDB	PDB/SNVT door open
	P2	J2-FCU	FCU/SRP door open
	P3	J1-EL POSITION TRANSDUCER	Left wire harness door open
			Elevation resolver door removed
W25	P1	J3-PDB	PDB/SNVT door open
	P2	J1-TRAVEL LOCK ACTUATOR	Jury struts installed (TM 9-1425-646-20)
	P3	J1-CAGE DOWN SWITCH OR W25-101-J1	W25-101 used on earlier configured AVMRLs
	J1	P1-W18	
W25-101	J1	P3-W25	
	P1	J1-CAGE DOWN SWITCH	Used on earlier configured AVMRLs
W26	P1	J5-PDB	PDB/SNVT door open
	P2	J2-LEFT BOOM CONTROL	Boom extended
	P3	J1-LEFT BOOM IN LIMIT SWITCH	
	P4	J1-LEFT BOOM OUT LIMIT SWITCH	
W27	P1	J7-PDB	PDB/SNVT door open
	P2	J2-RIGHT BOOM CONTROL	Boom extended

Table 4-5. Interconnecting Cable Assemblies - Cage - Continued

CABLE	CONNECTOR	TERMINATION	REMARKS
	P3	J1-RIGHT BOOM IN LIMIT SWITCH	
	P4	J1-RIGHT BOOM OUT LIMIT SWITCH	
W32	P1	J2-SNVT	PDB/SNVT door open
	J1	P2-W19 (SNVT TEST)	LP/C connector doors open
	J2	P3-W19 (SNVT TEST)	Wire harness doors on cage open
W43	P1	J9-PDB	PDB/SNVT door open
	P2	J1-SNVT	
W53	P1	J3-HOIST CONTROL	Boom extended (TM 9-1425-646-10)
	P2	J1-HOIST MOTOR	
W57	P1	J2-HOIST CONTROL	Boom extended (TM 9-1425-646-10)
	P2	J1-HOIST UP LIMIT SWITCH	
W75	P1	J6-PDB	PDB/SNVT door open
	P2	J1-LEFT HOIST CONTROL	Left boom extended (TM 9-1425-646-10)
			Lock-wire W75P2 to hoist down limit switch P1.
W76	P1	J8-PDB	PDB/SNVT door open
	P2	J1-RIGHT HOIST CONTROL	Right boom extended (TM 9-1425-646-10)
			Lock-wire W76P2 to hoist down limit switch P1.

4-6. INTERCONNECTING CABLE ASSEMBLIES MAINTENANCE INSTRUCTIONS (CONT)

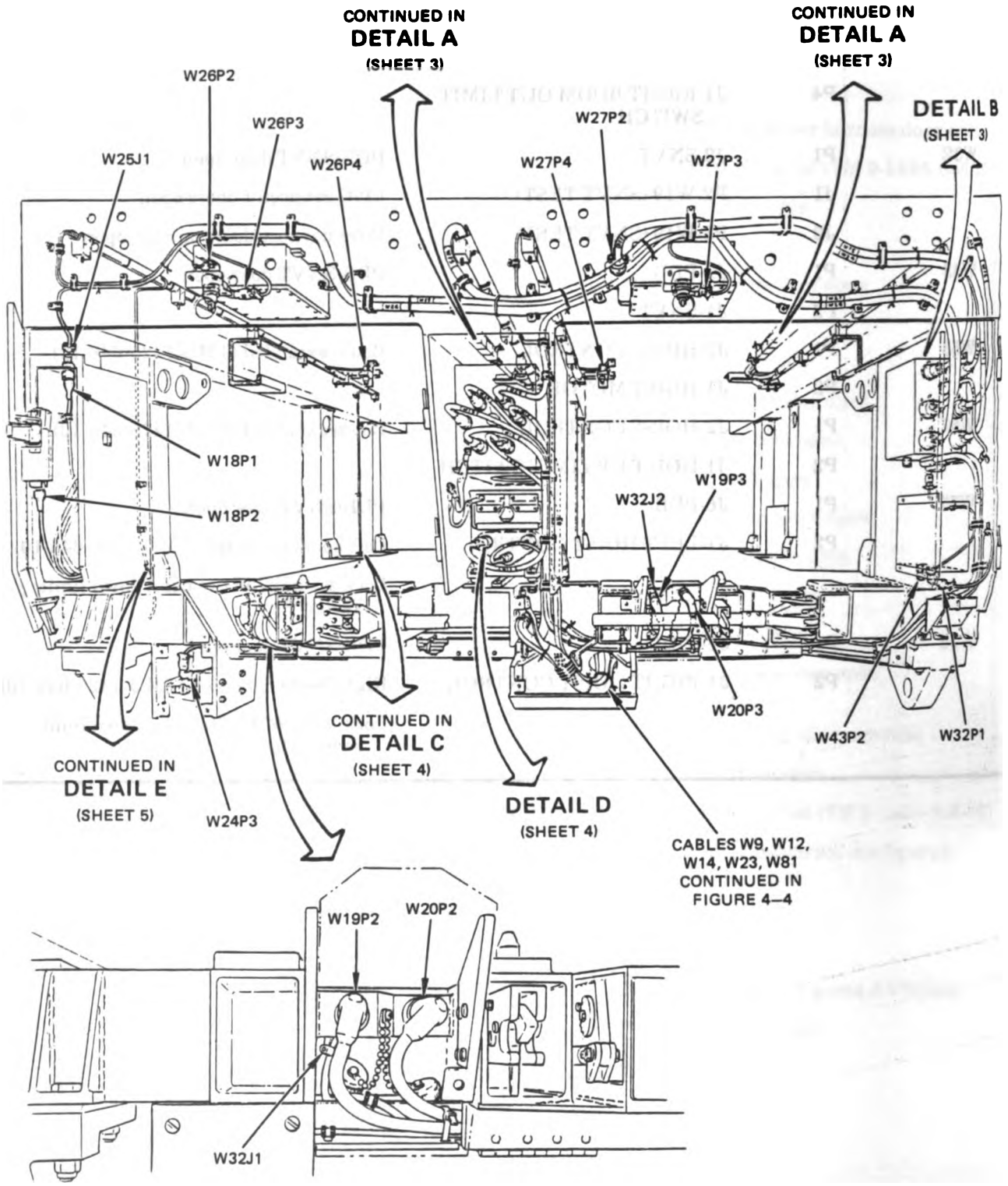


Figure 4-5. Cage Interconnecting Cable Assemblies (Sheet 1 of 5)

4-6. INTERCONNECTING CABLE ASSEMBLIES MAINTENANCE INSTRUCTIONS (CONT)

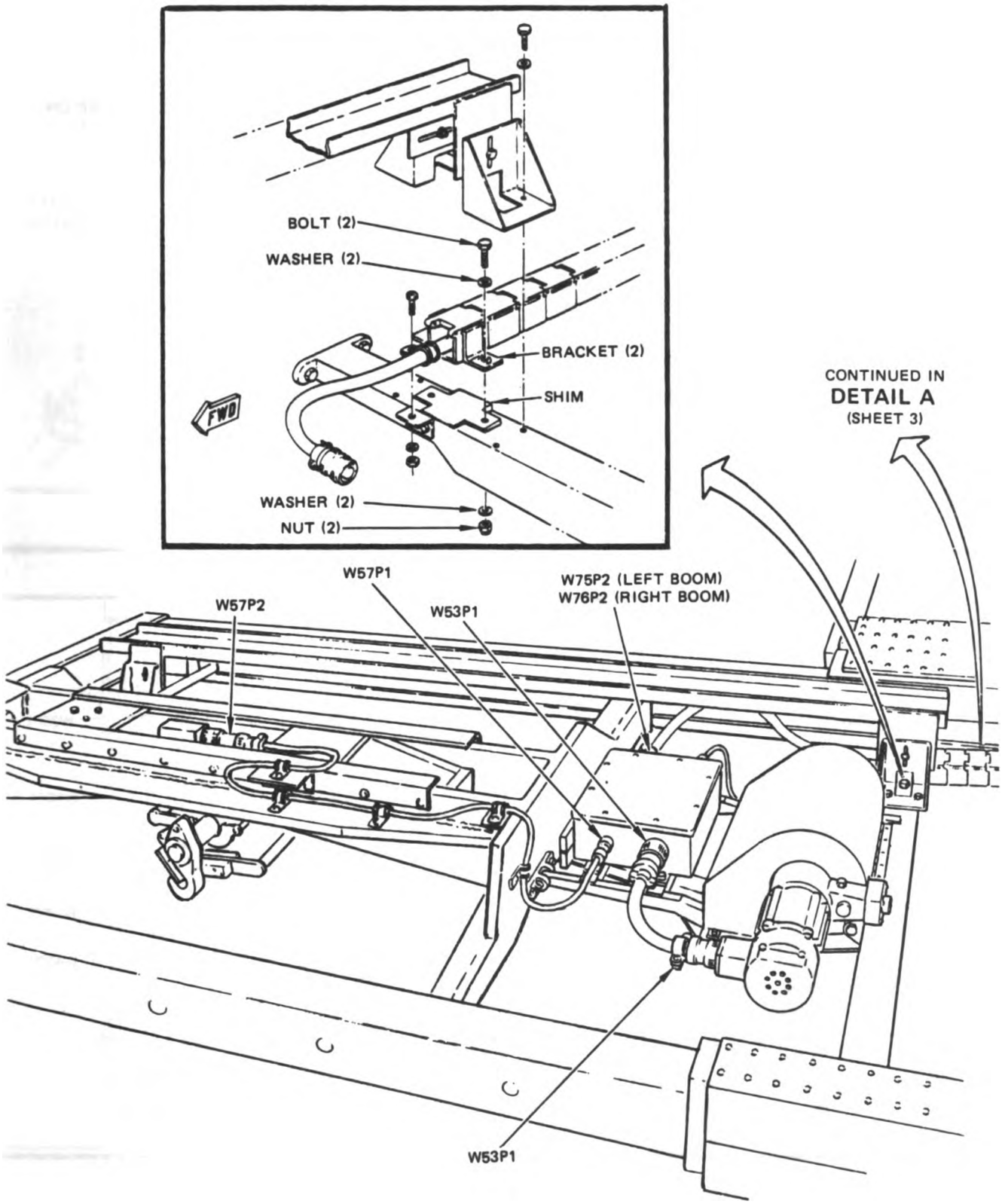
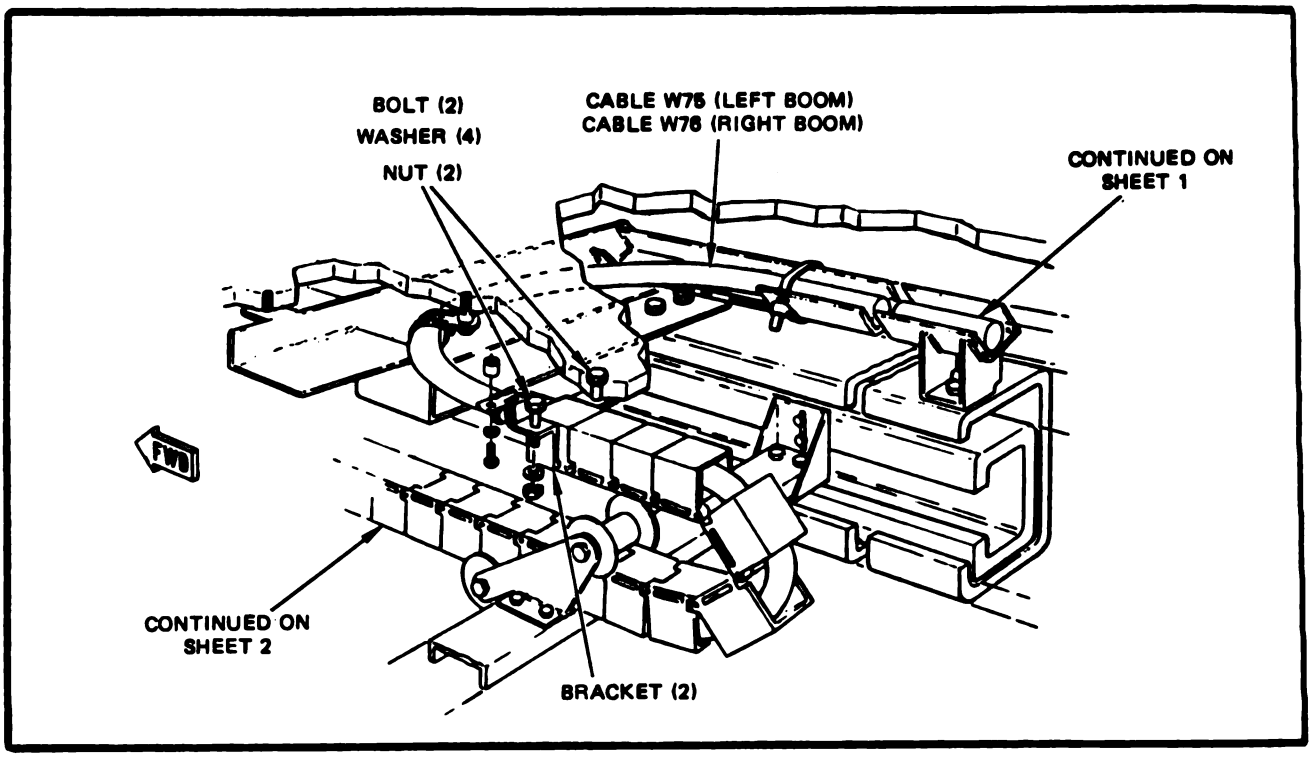


Figure 4-5. Cage Interconnecting Cable Assemblies (Sheet 2 of 5)

4-6. INTERCONNECTING CABLE ASSEMBLIES MAINTENANCE INSTRUCTIONS (CONT)



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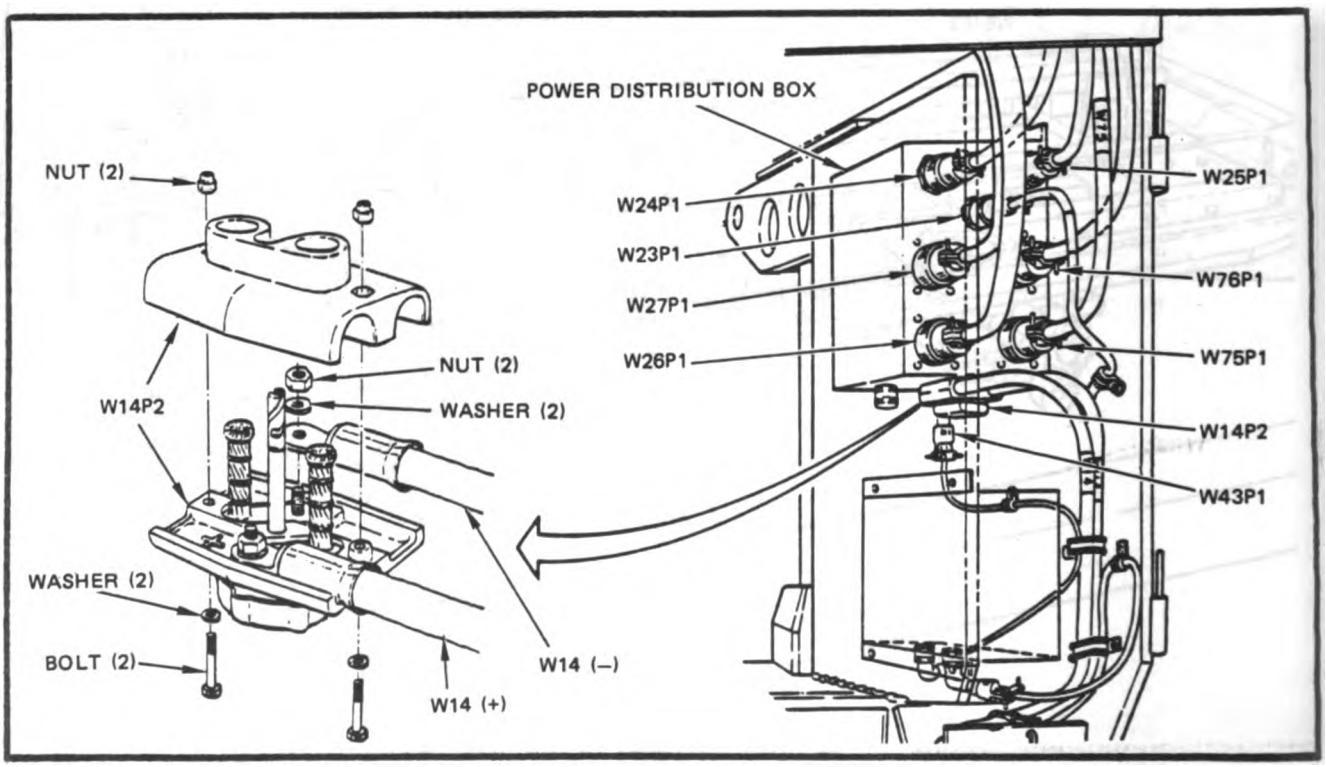
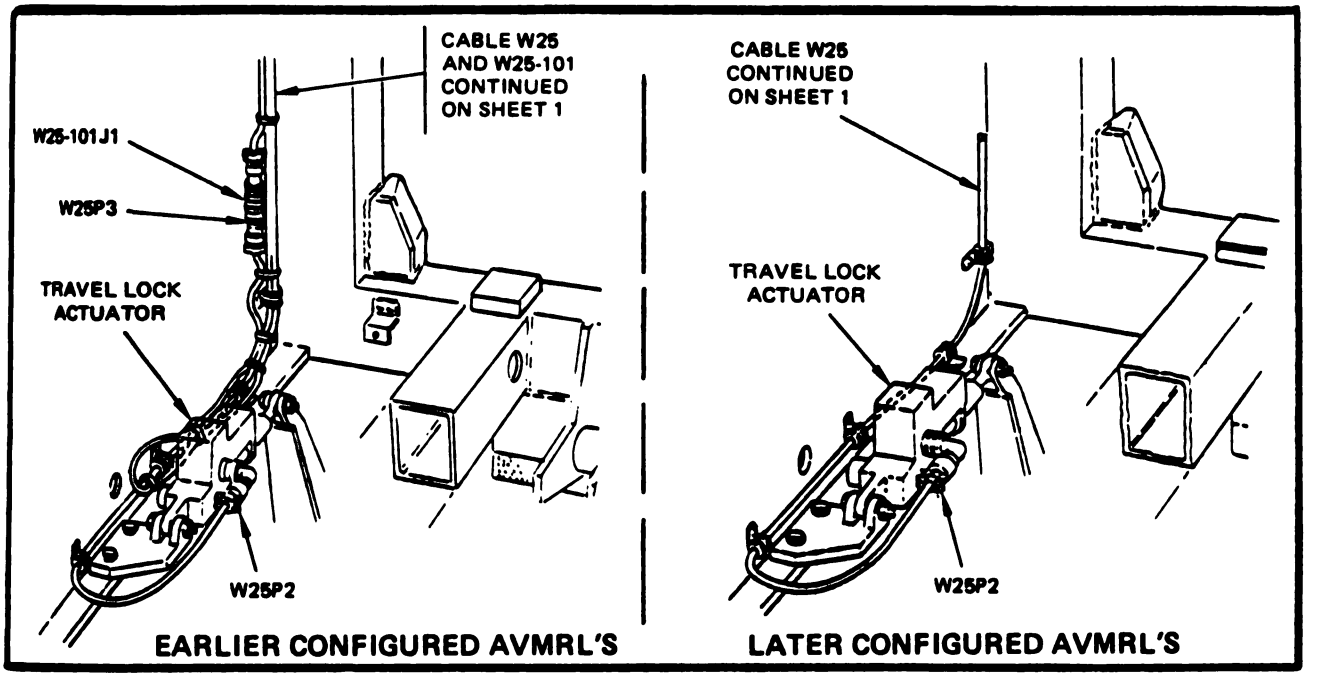


DETAIL B

Figure 4-5. Cage Interconnecting Cable Assemblies (Sheet 3 of 5)

4-6. INTERCONNECTING CABLE ASSEMBLIES MAINTENANCE INSTRUCTIONS (CONT)



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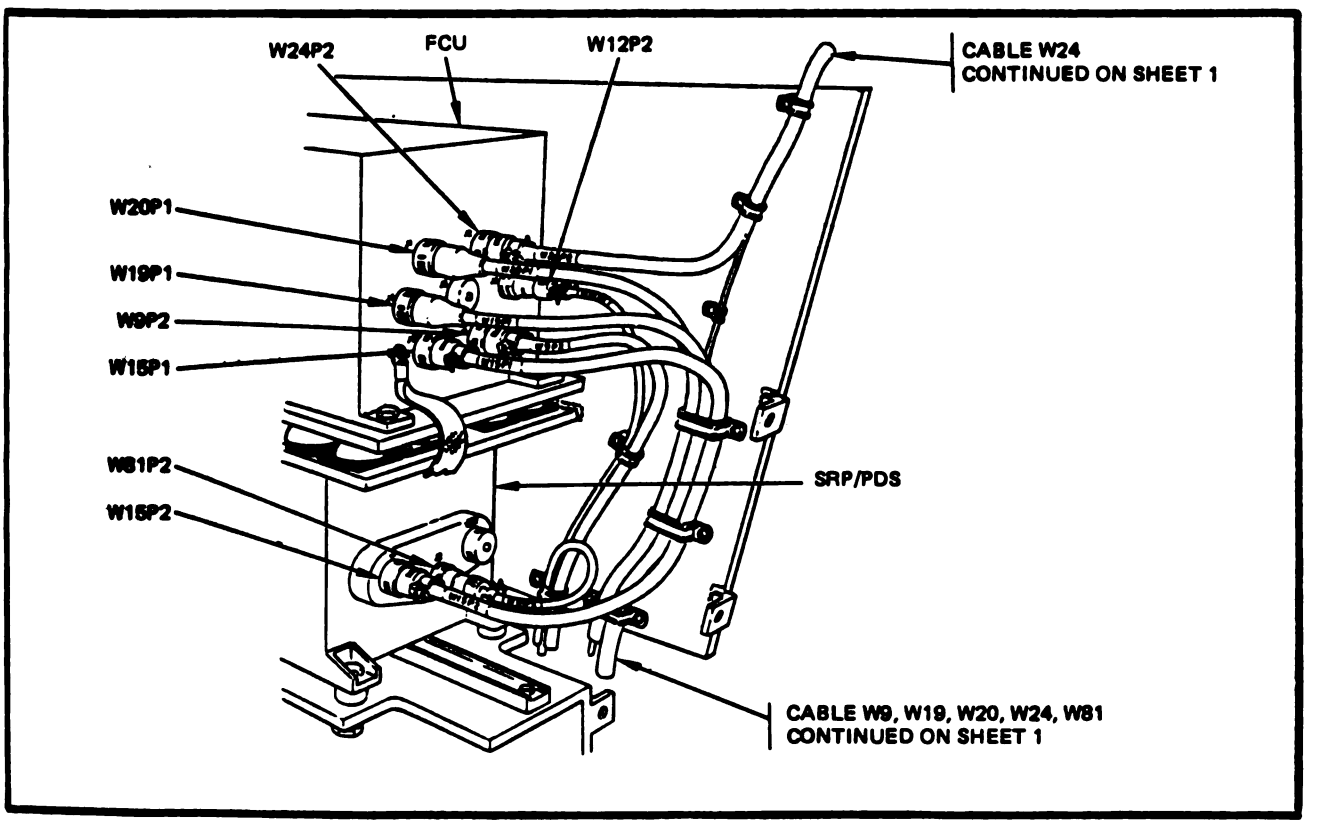
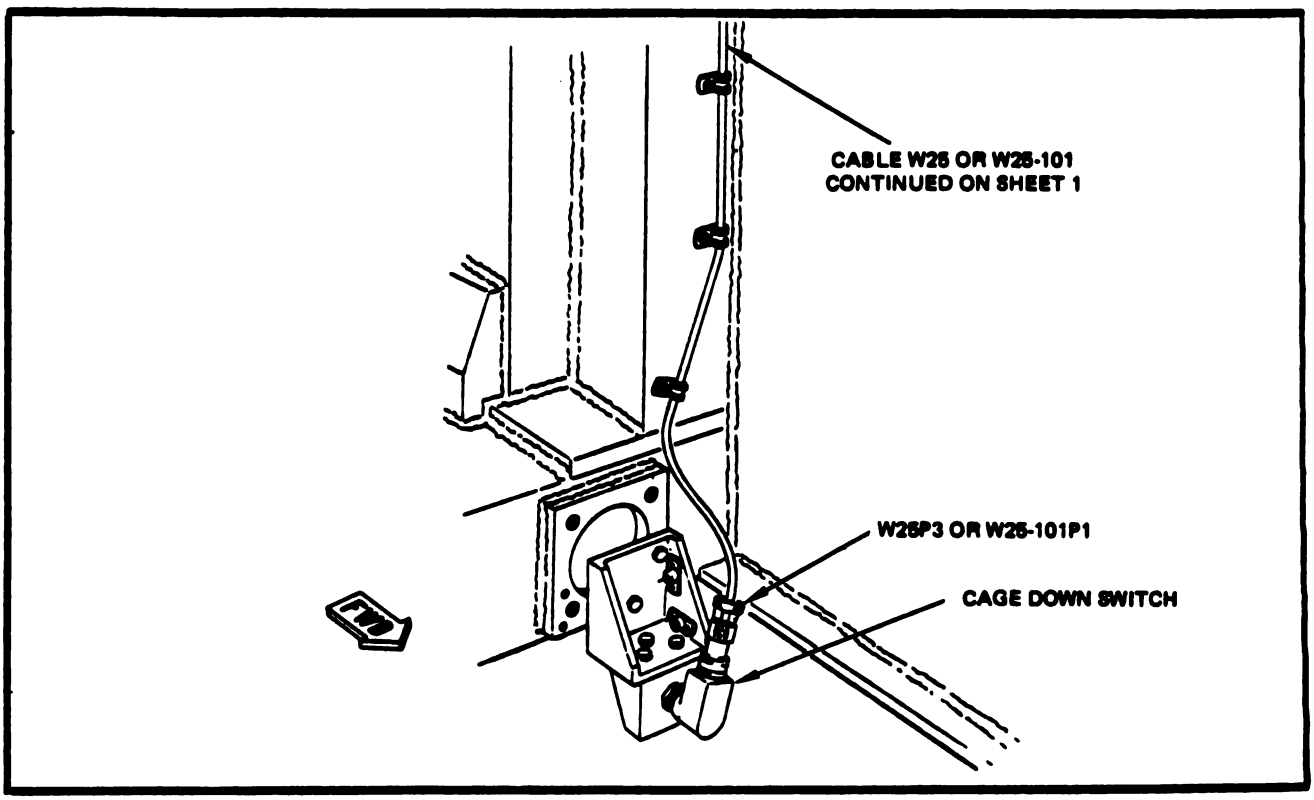


DETAIL D

Figure 4-5. Cage Interconnecting Cable Assemblies (Sheet 4 of 5)

4-6. INTERCONNECTING CABLE ASSEMBLIES MAINTENANCE INSTRUCTIONS (CONT)



DETAIL E

Figure 4-5. Cage Interconnecting Cable Assemblies (Sheet 5 of 5)

4-7. CABLE ASSEMBLY W14 REPAIR. This paragraph covers the replacement of the W14P2 connector.

INITIAL SETUP

Tools
Kit, tool, 13032302

Materials/Parts
Varnish (71, Appendix B)

Personnel Required
MLRS Repairer MOS 27M

References
TM 9-1425-646-10

Troubleshooting
Paragraph 2-9

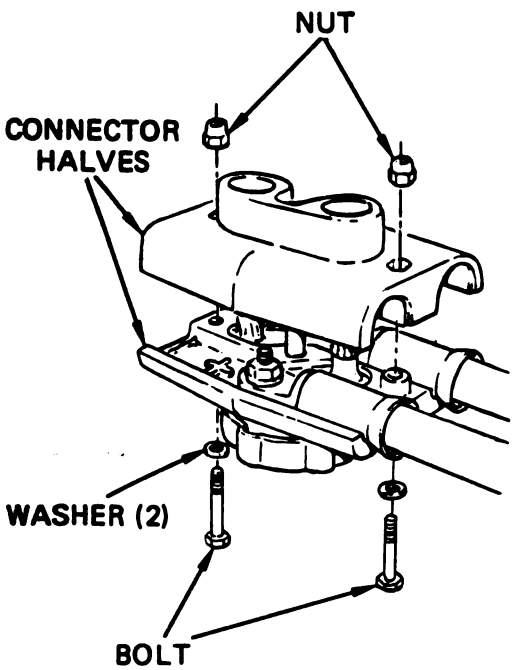
Equipment Condition
Position LLM to 3200-mil (180-degree) azimuth and 0-mil elevation (TM 9-1425-646-10)

NOTE

The only repair permitted is the replacement of W14P2 connector.

a. Removal.

(1) Using 3/8-inch socket, remove two nuts, bolts, and washers securing two connector halves together. Separate connector halves.



NOTE

Observe direction cables enter connector prior to removal. Install new cables in same manner.

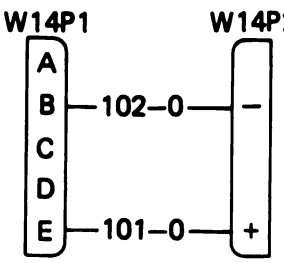
(2) Using 1/2-inch socket, remove two nuts and lockwashers securing two cables to connector. Remove two cables.

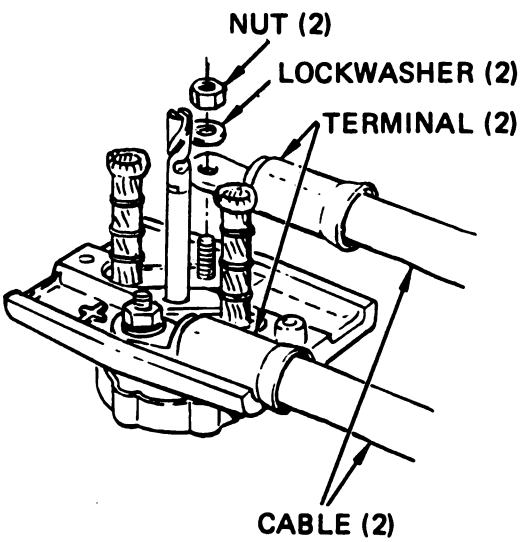
b. Installation.

(1) Noting proper direction and polarity of cables, position cable terminals over connector studs and secure with two lockwashers and nuts.

(2) Using 1/2-inch socket, torque nuts to 18 to 21 N•m.

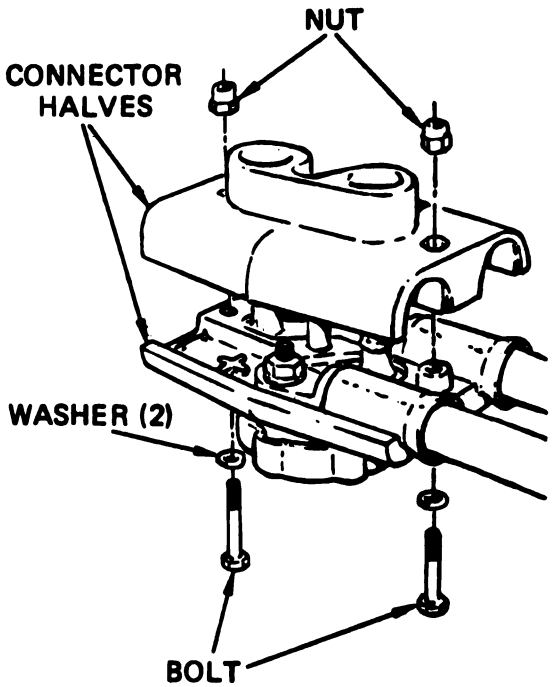
(3) Using varnish brush, apply a thin coat of varnish to cable terminals, nuts, and connector studs.





4-7. CABLE ASSEMBLY W14 REPAIR (CONT)

(4) Assemble connector halves and secure with two bolts, washers, and nuts. Using 3/8-inch socket, tighten nuts.



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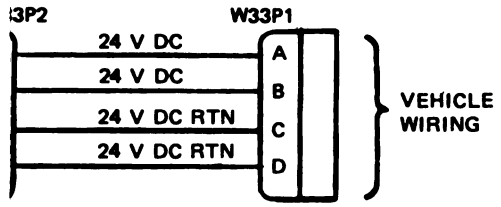
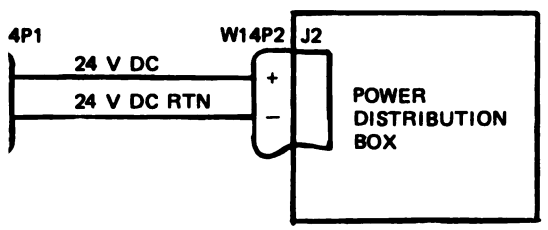


0P2 FIRE CONTROL SYSTEM (FIGURE FO–4)

3P1 FIRE CONTROL SYSTEM (FIGURE FO–4)

2P1 FIRE CONTROL SYSTEM (FIGURE FO–4)

3P1 LDS (FIGURE FO–3)



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PAGE NO	PARA-GRAPH	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.

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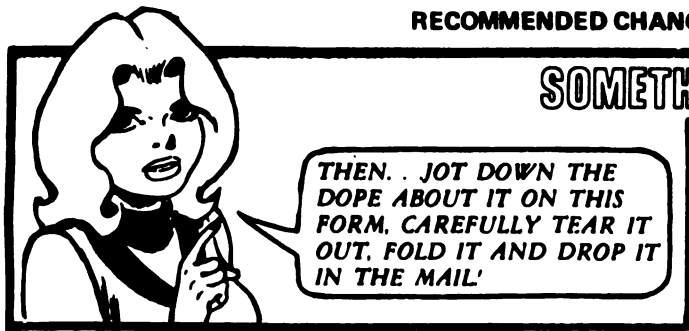

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