

**SUPERSEDES TM 9-6920-442-14&P, DATED 29 DECEMBER 1987**

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**TECHNICAL MANUAL  
OPERATOR, UNIT, DIRECT SUPPORT,  
AND GENERAL SUPPORT MAINTENANCE MANUAL  
FOR  
ENHANCED REMOTED TARGET SYSTEM (ERETS)  
TARGET HOLDING MECHANISM,  
TANK GUNNERY  
(NSN 6920-01-235-1758)  
(PN 9375764)  
(NSN 6920-01-085-8514)  
(PN 11784501)**

**DISTRIBUTION STATEMENT A - Approved for public release; distribution is unlimited.**

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**HEADQUARTERS, DEPARTMENT OF THE ARMY  
NOVEMBER 1996**

**SAFETY SUMMARY**

The following are general safety precautions that must be followed during operation and maintenance of the Target Holding Mechanism, Tank Gunnery. Personnel should become familiar with these precautions and adhere to the requirements.

**KEEP AWAY FROM LIVE CIRCUITS**

Maintenance personnel must observe all safety precautions during maintenance and troubleshooting of the Target Holding Mechanism, Tank Gunnery. Live circuits are exposed during some maintenance and troubleshooting procedures.

**KEEP AWAY FROM MOVING PARTS**

During operation and maintenance, the target arms will move up and down. Do not stand in the way of the target arms.

**DO NOT LIFT HEAVY OBJECTS ALONE**

Always get help when lifting heavy objects. The Target Holding Mechanism, Tank Gunnery weighs 327 lbs (148 kg). Remove the target frames and use four persons when lifting tank target assembly.

**SERVICE OF BATTERIES**

When maintaining and servicing batteries in the field, safety devices such as water supply, proper ventilation, gloves, goggles, and aprons designated and approved by the local safety office must be utilized. Refer to TM 9-6140-200-14 for battery servicing.

Refer to FM 21-11, First Aid for Soldiers.

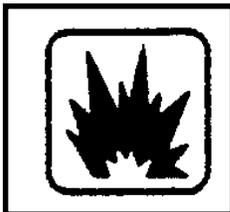
**CARDIOPULMONARY RESUSCITATION**

Personnel with or near high voltages must be trained and certified in mouth to mouth and cardiopulmonary resuscitation. Installation medical activities shall provide instruction. Newly assigned maintenance personnel must be trained as soon as practical. Ensure at least two persons are in the area at all times when work is being performed on exposed live circuits carrying 30 volts or more.

**WARNING**



Care must be taken to prevent wires from shorting out to ground, or electric shock may result.



Disarm, then disconnect the ATKS connection from control assembly on the TTA or TIU. The ATKS must be disconnected from the TTA before performing maintenance. Explosion is possible and can cause personal injury and damage to equipment. Pyrotechnics are used during range operation. Batteries can also explode.

**SAFETY SUMMARY - Continued**



**Chemicals can cause serious injuries or burns to personnel. Batteries 2contain sulfuric acid.**



**Moving mechanical equipment can cause injury to personnel standing in or obstructing the path of motion.**



**Dry cleaning solvent (SD2) is toxic and flammable. Wear protective goggles and gloves and use only in a well ventilated area.**

**b**

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REPORTING OF ERRORS AND RECOMMENDING IMPROVEMENTS  
You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in the back of this manual direct to: Director, Armament and Chemical Acquisition and Logistics Activity, ATTN: AMSTA-AC-NML, Rock Island, IL 61299-7630.

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CHAPTER 1

INTRODUCTION

SECTION I. GENERAL INFORMATION

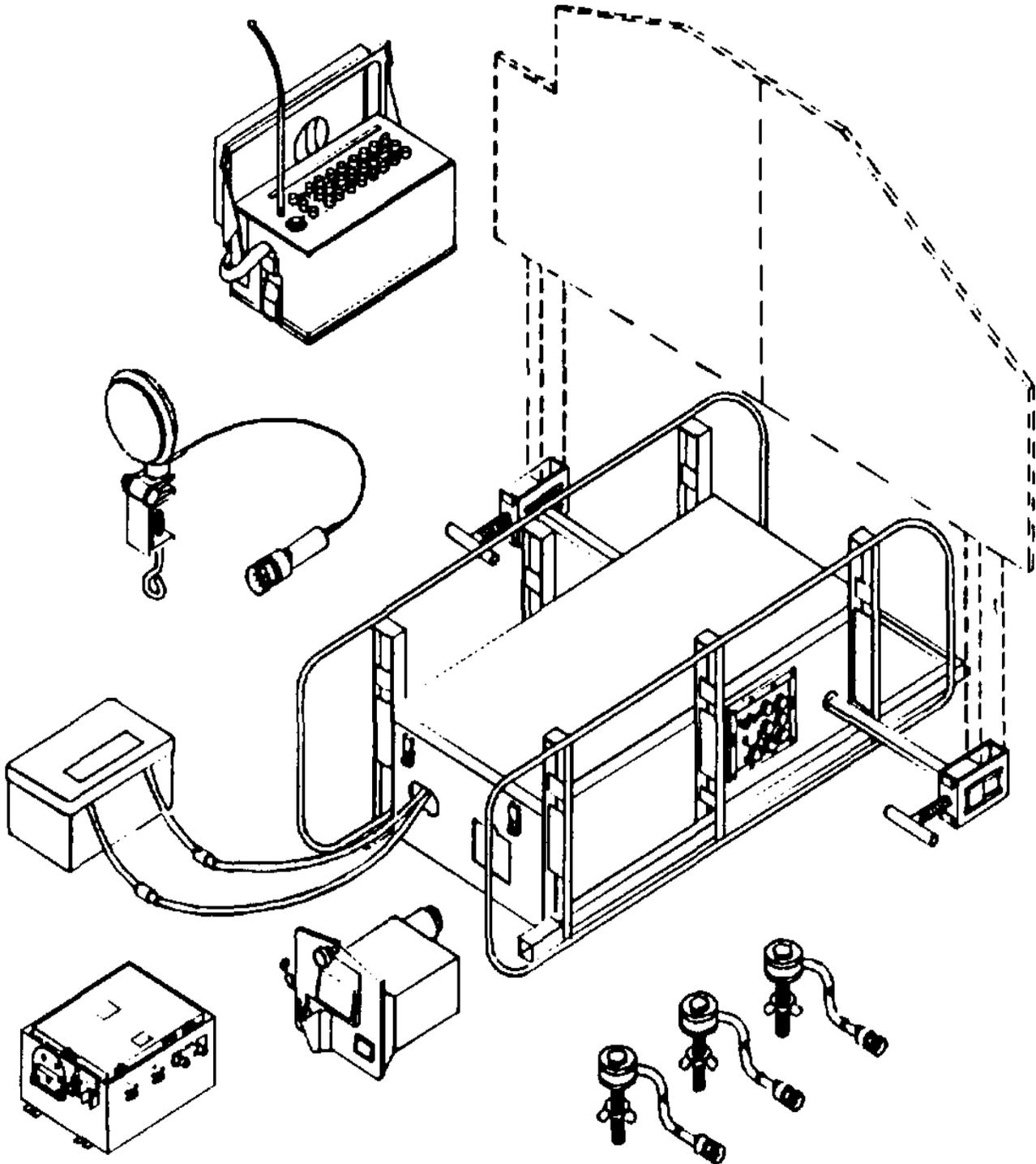


Figure 1-1. Target Holding Mechanism, Tank Gunnery.

## 1-1 HOW TO USE THIS MANUAL.

This manual contains operating instructions and maintenance procedures for the Target Holding Mechanism, Tank Gunnery (THM/TG). The manual includes five chapters, five appendixes, and an index. Chapters in this manual are divided into sections, and the sections are divided into paragraphs. Maintenance tasks are arranged in top-down breakdown order and are grouped by chapter in accordance with maintenance levels authorized to perform the tasks.

The manual follows the same presentation outlined in the table of contents. Chapter 1 provides an introduction to the THM/TG that includes equipment description and principles of operation. Chapter 2 contains operating instructions for the THMITG, as well as operator Preventive Maintenance Checks and Services (PMCS). Chapter 3 contains operator maintenance instructions. Chapter 4 contains unit troubleshooting procedures and maintenance instructions. Chapter 5 contains direct support troubleshooting procedures and maintenance instructions.

Appendixes follow the chapters. Appendix A lists references contained in the manual. Appendix B contains the Maintenance Allocation Chart (MAC). Appendix C contains the Common Tools and Supplements and Special Tools/Fixtures List. Appendix D contains the Expendable and Durable Items List. Appendix E is a standard torque chart for common hardware.

All chapter, section, paragraph, and appendix titles are listed in the table of contents. If you are looking for information on a specific subject or procedure, refer to the table of contents in the front of the manual. Find the subject or procedure in the table of contents and turn to the indicated page.

## 1-2 SCOPE.

This manual presents all the information and procedures necessary to operate and maintain the THM/TG at the operator, unit, and direct support levels. Since no maintenance tasks for the THM/TG are authorized at the general support level, the manual does not contain a chapter for general support maintenance instructions.

The THM/TG is an electronically controlled mechanism that simulates an enemy tank. The THM/TG can be operated by the Target Training Set Console (RCS) Enhanced Target Training Set (ERETS) or can be radio controlled.

Operating and maintenance procedures allocated to the operator, unit, and direct support levels are organized in accordance with the MAC contained in appendix B. Appendix C, Common Tools and Supplements and Special Tools/Fixtures List, lists the tools required to maintain the THMITG.

Appendix D provides a listing of expendable and durable items needed to operate and maintain the THM/TG. Appendix E provides a torque limits table for common bolts and defines the difference between grades.

## 1-3 MAINTENANCE FORMS, LOGBOOKS, RECORDS, AND REPORTS.

Department of the Army forms and procedures used for equipment maintenance will be those prescribed by DA PAM 738-750, The Army Maintenance Management System. Accidents involving injury to personnel or damage to material will be reported on DA form 285 (Accident Report) in accordance with AR 38540.

#### 1-4 REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS.

If your THMITG needs improvement, let us know. Send us an Equipment Improvement Recommendation (EIR). You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design or the performance. Put it on an SF 368, Product Quality Deficiency Report (QDR). Mail it to us at: Director, U.S. Army Armament Research, Development and Engineering Center, ATTN: AMSTA-AR-QAW-A (R), /Customer Feedback Center, Rock Island, IL 61299-7300. We will send you a reply.

#### 1-5 CORROSION PREVENTION AND CONTROL (CPC).

Corrosion prevention and control (CPC) for Army material is a continuing concern. It is important that any corrosion problems with the Target Holding Mechanism, Tank Gunnery be reported so that the problem can be corrected and improvements can be made to prevent the problem in future items.

a. What To Report. While corrosion is typically associated with rusting of metals, it can also include deterioration of other materials, such as rubber and plastic. Unusual cracking, softening, swelling, or breaking of these materials may be a corrosion problem.

b. How To Report CPC. If a corrosion problem is identified, it can be reported using Standard Form 368, Quality Deficiency Report. Use of key words such as "corrosion," "rust," "deterioration," or "cracking," will assure that the information is identified as a CPC problem.

c. Where To Send the Report. This form should be submitted to: Director, U.S. Army Armament Research, Development and Engineering Center, ATTN: AMSTA-AR-QAW-A (R)/Customer Feedback Center, Rock Island, IL 61299-7300.

#### d. Cleaning and Painting.

- (1) Wire brush metal parts to remove rust and corrosion.



#### **WARNING**

**Dry cleaning solvent (SD2) is toxic and flammable. Wear protective mask, goggles, and gloves and use only in well ventilated area.**

- (2) Clean metal parts with dry cleaning solvent. Metal or fiber brushes may be used to apply cleaning solvent and to remove softened or dissolved material. Hand scraping with metal scrapers may be used to remove soft coatings or deposits.
- (3) Soak very oily or greasy metal parts in a tank containing dry cleaning solvent. The time parts must be in solvent varies with the type and amount of material to be removed.
- (4) Do not use solvent to clean electrical insulation, wires, cables, or wiring harnesses. Clean these parts by wiping with a damp cloth. Use a mild soap solution if necessary. Dry immediately with clean, dry cloths. Clean contact points with flint abrasive paper and dust thoroughly after cleaning.
- (5) Do not use dry cleaning solvent to clean rubber parts. Clean rubber parts by washing with a mild solution of soap and water.

1-5 CORROSION PREVENTION AND CONTROL (CPC) - Continued.

- (6) Dry parts by blowing with low-pressure compressed air or wiping with lint-free cloths.
- (7) Paint metal surfaces after repaired as required. Sand and paint damaged areas. Apply one coat of rust inhibitor primer. Allow primer to dry for 30 minutes minimum before applying enamel. Paint with enamel to match existing color.

1-6 DESTRUCTION OF ARMY MATERIEL TO PREVENT ENEMY USE.

Destruction of Army materiel to prevent enemy use shall be in accordance with TM 750-244-3.

1-7 PREPARATION FOR STORAGE OR SHIPMENT.

Refer to AR 750-1 and paragraph 4-27 of this manual for requirements for administrative storage. Refer to paragraph 5-41 for shipping instructions.

1-8 NOMENCLATURE CROSS-REFERENCE LIST.

*Table 1-1. Nomenclature Cross-Reference List.*

OFFICIAL NOMENCLATURE	COMMON NAME
Adapter, Power Supply Console, Target Training Set - ERETS (ARMOR) Console, Target Training Set - ERETS (INFANTRY) Interconnecting Box, High Power Interconnecting Box, Low Power Interconnecting Box, Target Interface Simulator, Gunfire Target Kill Simulator (TKS) Gunfire Simulator Device (GUFS) Simulator, Muzzle Flash, Small Arms Simulator, Sound, Small Arms Small Arms Sound Simulator (SASS) Target Holding Mechanism, Tank Gunnery	Range Control Station Adapter (RCS Adapter) Range Control Station, Enhanced Remoted Target System, Armor (RCS/ERETS Armor) Range Control Station, Enhanced Remoted Target System, Infantry (RCS/ERETS Infantry) Interconnecting Box (ICB) Interconnecting Box (ICB) Target Interface Unit (TIU) Armor Target Kill Simulator (ATKS)  Muzzle Flash Simulator (MFS) Rifle Fire Simulator (RFS)  Target Holding Mechanism, Tank Gunnery (THM/TG)

Table 1-1. Nomenclature Cross-Reference List - Continued.

OFFICIAL NOMENCLATURE	COMMON NAME
Target Holding Set, Training Track System, Target Training Set - Armor Track System, Target Training Set - Infantry	Infantry Target Mechanism (ITM) Armor Moving Target Carrier (AMTC) Infantry Moving Target Carrier (IMTC)

1-9 LIST OF ABBREVIATIONS.

The following list contains the acronyms and abbreviations used throughout the manual and in conjunction with the range system.

AMTC	Armor Moving Target Carrier
ATKS	Armor Target Kill Simulator
BEA	Battery Eliminator Assembly
CCA	Circuit Card Assembly
ECU	Electronic Control Unit
ERETS	Enhanced Remoted Target System
ICB	Interconnecting Box
ILTEM	Improved Lift Target Elevating Mechanism
IMTC	Infantry Moving Target Carrier
ITM	Infantry Target Mechanism
RCS	Range Control Station
RFS	Rifle Fire Simulator
SASS	Small Arms Sound Simulator
THM/TG	Target Holding Mechanism, Tank Gunnery
TIU	Target Interface Unit
TTA	Tank Target Assembly

**SECTION II. REPAIR PARTS; SPECIAL TOOLS; TEST, MEASUREMENT,  
AND DIAGNOSTIC EQUIPMENT (TMDE); AND SUPPORT EQUIPMENT**

1-10 COMMON TOOLS AND EQUIPMENT.

For authorized common tools and equipment, refer to the Table of Distribution and Allowances (TDA) applicable to your unit.

1-11 SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT.

Refer to appendix B, Maintenance Allocation Chart, and TM 9-6920-742-24P-5, Repair Parts and Special Tools List, for any special tools, TMDE, and support equipment required to maintain the THM/TG.

1-12 REPAIR PARTS.

Repair parts are listed and illustrated in the Repair Parts and Special Tools List, TM 9-6920-74224P-5.

### SECTION III. EQUIPMENT DESCRIPTION

#### 1-13 EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES.

The Target Holding Mechanism, Tank Gunnery (THM/TG) is an electromechanical-hydraulic device which is used to provide targets for heavy weapons and armor. The THM/TG can be used in two different configurations, portable and stationary.

a. Portable. The first configuration less battery eliminator assembly (figure 1-2) consists of the THMITG, a receiver, and a transmitter. The receiver interfaces with the transmitter which is used to control the target holding mechanism by remote control. The Armor Target Kill Simulator (ATKS) may be attached to the THM/TG control assembly. The ATKS will detonate a pyrotechnic charge to simulate a target hit or enemy fire.

b. Stationary. The second configuration (less receiver and transmitter) (figure 1-2) is integrated with the Enhanced Remoted Target System Range Control Station (ERETS/RCS). This is accomplished through the Target Interface Unit (TIU) which allows remote control of the THM/TG by the Remoted Target System computer. The Armor Target Kill Simulator (ATKS) may be attached to the THM/TG control assembly or the TIU. The ATKS will detonate a pyrotechnic charge to simulate a target hit or to simulate enemy fire.

#### 1-14 LOCATION AND DESCRIPTION OF MAJOR COMPONENTS.

The following subparagraphs give a brief description of the major components of the THM/TG. Refer to figure 1-2 for the location.

##### a. Target Holding Mechanism, Tank Gunnery.

(1) Main Frame. The main frame consists of two protective frames used as carrying handles, a stabilizer bar, and a housing mounted between the two handles. The housing holds the hydraulic unit, the target holder assembly, the control assembly, and the receiver.

(2) Target Frames and Target Clamps. The target frames raise and lower the target. The frames are removable and are made to be stored in the main frame during shipment or storage. The target clamps fasten the target to the target frames.

(3) Control Assemble. The control assembly receives the signals from either the TIU or the receiver. The control assembly then raises or lowers the target, fires the ATKS, and causes the lamp to flash when the function switch is in the correct position.

(4) Hit Sensor. The three hit sensors sense the vibrations of the target when it has been hit and sends a signal to the control assembly.

(5) Receiver. The receiver translates command signals from the transmitter and sends them to the control assembly.

(6) Battery Box Assembly. The battery box assembly houses and protects the battery.

(7) Battery. The battery provides external power for the operation of the THM/TG. A deep cycle 12-volt marine type battery is recommended for use in the radio controlled version (900 cranking amps, equivalent to an oxide battery, P/N NG31 or Delco battery, P/N DC-31). In lieu of a size 31 deep cycle battery, a size 27 deep cycle (NSN 6140-01-262-2272) may be used. A standard heavy duty type 12-volt battery (6140-01-032-1326) is recommended for the computer controlled version.

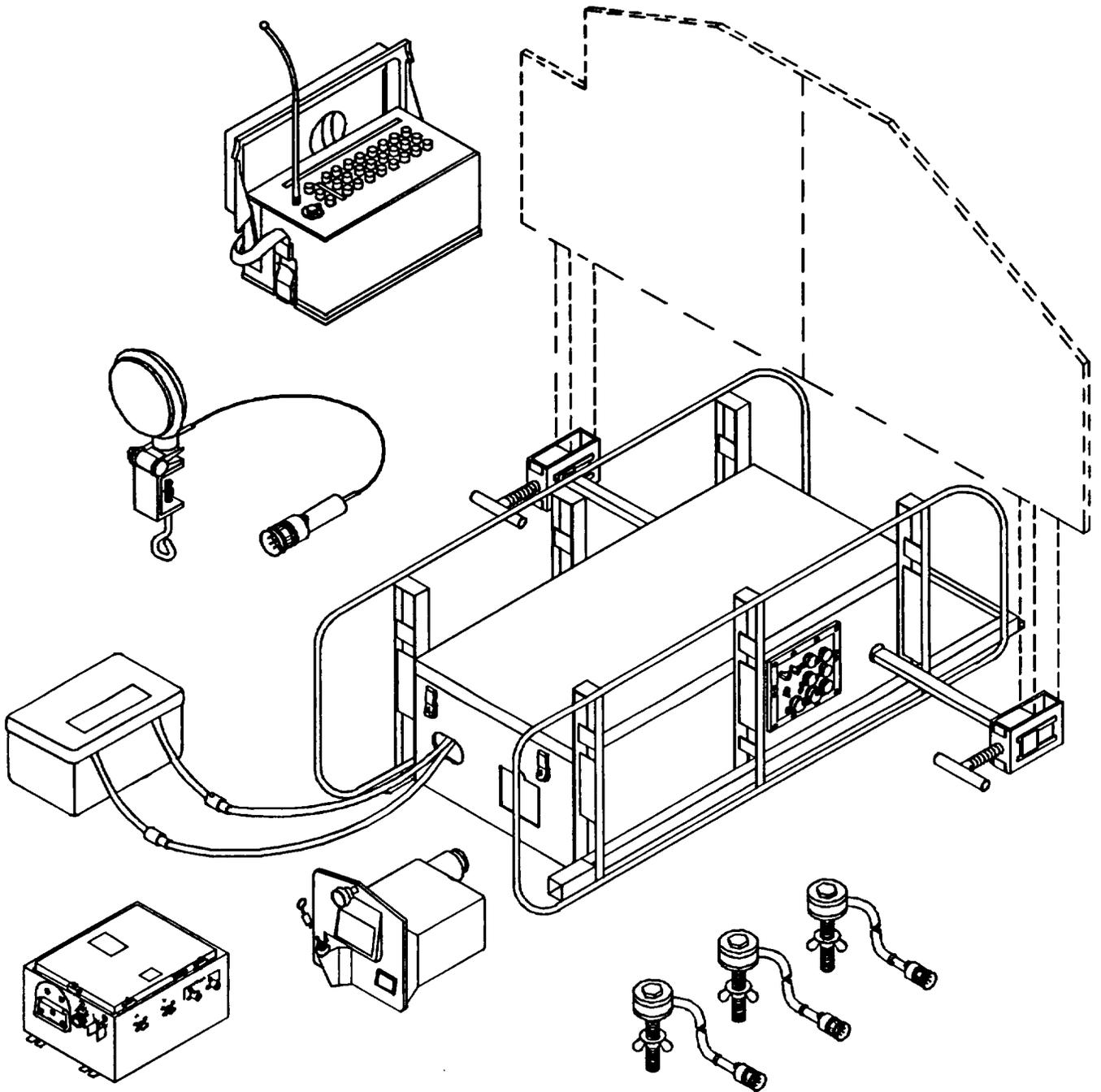


Figure 1-2. Location and Description of Major Components.

1-14 LOCATION AND DESCRIPTION OF MAJOR COMPONENTS Continued.

(8) Lamp Assembly. A 12-volt halogen spotlight flashes when the target has been hit. The lamp assembly is connected to the control assembly by a cable. The lamp assembly is equipped with a damp for attachment to a tree, stake, or other suitable mounting location.

(9) Battery Eliminator. The battery eliminator replaces the battery and battery box assembly on the computer-controlled THM/TG.

c. Transmitter Assembly.

(1) Transmitter. The transmitter sends the commands to the receiver on the THM/TG.

(2) Battery. The nicad battery supplies the 12-volt power for the transmitter.

1-15 DIFFERENCES BETWEEN MODELS.

There are two models of the THM/TG. One is radio-controlled and the second is computer-controlled from the Range Control Station (ERETS). Table 1-1 lists the equipment supplied with each model.

*Table 1-2. Differences Between Models*

Target Holding Mechanism, Tank Gunnery (Radio-Controlled) PN 11784501.	Target Holding Mechanism, Tank Gunnery (Computer-Controlled) PN 9375764.
Power Cables	Power Cables
Tank Target Assembly	Tank Target Assembly
Battery Box Assembly and Battery (deep cycle type)	Battery Box Assembly and Battery (standard heavy duty type) or Battery Eliminator
Lamp Assembly	Lamp Assembly
Three Hit Sensors	Three Hit Sensors
Transmitter Battery (NICAD)	
Receiver	
Transmitter (Not part of 11784501)	

1-16 EQUIPMENT DATA.

*Table 1-3. Equipment Data.*

PHYSICAL CHARACTERISTICS Target Holding Mechanism, Tank Gunnery:	
Weight	327 lbs (148 kg)
Height	18.25 in (46.36 cm)
Length	55.6 in (141.0 cm)
Width	24 in (60.96 cm)

Table 1-3. Equipment Data - Continued.

Transmitter:	
Weight	16.5 lbs (7.49 kg)
Height	7.26 in (18 cm)
Length	12.87 in (32 cm)
Width	6.75 in (16.5 cm)
ENVIRONMENTAL STANDARDS	
Target Holding Mechanism, Tank Gunnery:	
Temperature	-25 to +125 °F (-32 to +52 °C)
Relative Humidity	5 to 95 percent
Wind Velocity (Raised Target)	35 mph (56 kph) (maximum)
Transmitter:	
Temperature	-13 to +140 °F (-25 to +60 °C)
Relative Humidity	5 to 95 percent
POWER REQUIREMENTS	
Target Holding Mechanism, Tank Gunnery:	12 vdc
Transmitter:	12 vdc (nicad battery)
OPERATING CHARACTERISTICS	
Target Holding Mechanism, Tank Gunnery:	
Target Arc Radius	90 degrees
Maximum Fluid Pressure	2, 000 psi (13, 780 kPa)
Transmitter:	
Operating Range (maximum)	2.5 mi (4 km) maximum
Frequency Range	138- 165 Mhz
Frequency Tolerance	2.5 Khz
Channel Spacing	50 Khz
Output Power	6 watts
Number of Receivers per Channel	8
Number of Channels per Transmitter	5
Number of Receivers per Transmitter	40
Antenna Impedance	50 ohms

## 1-17 EQUIPMENT CONFIGURATION.

All ERETS ranges are constructed differently. The range layout will depend upon design, climate, terrain, and mission. This technical manual was developed to the technical data package. The configuration of ERETS hardware is standard for all ranges. There are other configurations (older versions) of the THM/TG in the field. The user/maintainer must consider the differences and make allowances between the specific unit and the manual.

### SECTION IV. PRINCIPLES OF OPERATION

## 1-18 FUNCTIONAL DESCRIPTION.

a. General. The THM/TG is designed to operate in two different modes: radio controlled; and ERETS RCS computer controlled.

With the radio controlled model, the operator uses a transmitter assembly to forward commands to a receiver assembly within the THM/TG. The radio controlled THM/TG is portable and is equipped with a 12 vdc battery for operation independent of an external power source. A deep cycle type battery is recommended due to the constant recharging the battery undergoes.

With the computer controlled model, operation is on a ERETS range and is controlled through interface with the target interface unit (TIU) by the ERETS RCS scenario. Power is provided by a 12 vdc battery or by a battery eliminator assembly (BEA). The TIU provides a trickle charge to maintain the battery at 12 vdc. A standard heavy duty type battery is recommended.

With both models, the THM/TG raises and lowers targets through a 90 degree arc. Hit sensors attached to the target sense target hits and forward information to the control assembly which determines target response based on the FUNCTION switch setting. The armor target kill simulator (ATKS) and the lamp assembly may be attached to the control assembly.

b. Power Supply. DC power for operation of the THM/TG is provided by a lead-acid battery (standard heavy duty type or deep cycle type) or BEA.

On the battery operated model, with the control assembly FUNCTION switch in any position other than 0, battery voltage is applied through S2A to pin 6 of the battery check circuit card assembly (CCA), and to connectors ST1 and ST2. Diode CR1 and capacitor C1 reduce voltage drop in conjunction with current surge. This voltage is applied to a second section (1-2) of S2A to the TEST switch, coils of various relays, and pin Z of the logic CCA. On radio controlled models voltage continues through pin P2D to the receiver. Battery voltage is dropped by resistor R6 and applied to pin S of the amplifier CCA and to the SENSITIVITY switch. With the FUNCTION switch in position 0, C1 is discharged through resistor R5 and S2B to ground. On computer controlled, battery operated models, a constant trickle charge voltage is provided from the TIU through the control assembly (in all FUNCTION switch settings except 0) to maintain the battery.

On the battery-eliminator operated model, the BEA functionally replaces the THM/TG battery in on ERETS RCS ranges. It operates on 198 to 264 vac, 50 or 60 hertz, from the modified low power interconnecting box. The BEA provides unfiltered 12 vdc to the THM/TG motor through the existing battery cables. The cable used to connect the control assembly and the hydraulic unit is rerouted from the control assembly to J2 of the BEA. A new cable provided with the BEA is connected from J1 of the BEA to P2 of the control assembly. The regulated 12 vdc output of the BEA can supply 4.5 continuous amps with built-in thermal overload protection. This is enough to power the control assembly, the ATKS, and the lamp assembly.

c. Control Assembly. The control assembly contains an amplifier CCA; a logic CCA; and a battery check CCA. The amplifier CCA receives hit pulses from the three hit sensors. The signals are amplified and compared with a threshold signal from the SENSITIVITY switch. If the signal is of sufficient strength, a hit signal is sent to the logic CCA. The logic CCA collects and processes information from the amplifier CCA hit circuits, the limit switches, The FUNCTION switch, and the Receiver or the TIU. Six relays contained within the control assembly are energized by the logic CCA to raise or lower the target, operate the Lamp Assembly, and operate the ATKS in the HOSTILE FIRE or SMOKE SCORER modes.

The control assembly contains a motor stop circuit to protect the equipment should the target be prevented from reaching the stop limit. Should a target fail to reach a stop limit, a reset signal is given and a counter is initiated. Approximately 12 seconds after power is initially applied to permit the target arms to move, output power is removed and the motor starting relay and solenoid valve relay are deenergized. A potential problem arises only when utilizing the THM/TG in the computer controlled (ERETS) configuration. The TIU may have the old version CCA (P/N 9363110). If so, the 12 second protection circuit in the control assembly is disabled. If motor burnout becomes a problem, the new CCA (P/N 9387536) should be ordered and installed, thus allowing the proper functioning of the 12 second protection circuit.

The control assembly also contains a hit sensor fault circuit. When a hit sensor is damaged or malfunctions, the target is moved to the DOWN position and is prevented from moving to the UP position.

The target will remain in the DOWN position until the defective hit sensor is disconnected from the control assembly.

d. Transmitter. The transmitter consists of three circuit card assemblies: a mother-board which contains the interconnecting wiring for the unit and comprises the front panel channel/function selectors and the RF-BATTERY lamp; a logic card that produces the command modulations; and a high frequency card which uses a crystal controlled oscillator to produce the carrier signal and modulation.

e. Transmitter Battery Charier. The transmitter is operated by a nicad battery which requires cycling to maintain full capacity. The transmitter battery charger operates off 120 vac and will continuously charge and discharge the transmitter battery until the battery is removed for use.

f. Receiver. The receiver receives FM command signals (143-165 MHz) from the transmitter and translates these RF signals into logic signals which are sent to the control assembly unit as RAISE, LOWER, or FIRE commands. The commands are used to operate the target and actuate the optional ATKS.

g. Hydraulic Unit. The force necessary to raise or lower the target is provided by a double action hydraulic cylinder which is powered by an electrically operated hydraulic pump and valve unit. The output of the pump is limited to 2000 psi.

When an UP command is received by the THM/TG, the logic CCA energizes relay K6. This applies a ground to the solenoid valve in the motor/valve unit. At the same time the logic CCA also energizes relay K3 and completes a ground for the motor solenoid switch. The motor solenoid switch delivers 12 vdc to the motor. When the target reaches the UP position, relay K3 and relay K6 are de-energized.

This stops the motor and de-energizes the solenoid valve. A solenoid check valve in the output of the pump blocks the hydraulic line and prevents hydraulic fluid from bleeding back out of the cylinder.

1-18 FUNCTIONAL DESCRIPTION - Continued.

When a DOWN command is received by the THM/TG, the logic CCA energizes relay K2. This applies a ground to the solenoid valve in the motor/valve unit. At the same time the logic CCA also energizes relay K3 and the motor solenoid switch. The motor solenoid switch delivers 12 vdc to the motor. When the target reaches the DOWN position, relay K2, and relay K3 are de-energized. This stops the motor and de-energizes the solenoid valve. A solenoid check valve in the output of the pump blocks the hydraulic line and prevents hydraulic fluid from bleeding back out of the cylinder.

h. THMITG Fuse Located in the Hydraulic Unit Assembly. The fuse is electronically located in the line between the battery and the THM/TG electronic control unit (ECU) and can be physically found on the hydraulic unit assembly enclosure box.

Hardwired version When the fuse is missing or opened, there is no trickle charge to the battery. However, because the TIU is connected to the ECU, there is enough power to raise and lower the target without the visual hit indicating light (VHIL) connected. When the VHIL is connected, there is too much power required and the result is the lamp won't light and the target only partially goes down. With no fuse, the battery is effectively removed from the system and the THM/TG doesn't have enough power to fully operate the system with the trickle charge only.

Radio controlled version Due to the fact that the battery is the only source of power for this version of the THMITG, when the fuse is opened or removed, the THM/TG is totally inoperable.

i. Armor Target Kill Simulator (ATKS). The THM/TG is capable of operating the ATKS in either the HOSTILE FIRE mode, or the SMOKE SCORER mode. When connected to ST1 (HOSTILE FIRE), the ATKS will fire on command from the transmitter or RCS simulating tank gunfire. When connected to ST2 (SMOKE SCORER), the ATKS simulates a tank which has been killed and is burning. In this mode the ATKS is controlled by the ECU and will fire every time the target is hit. If the ATKS is connected to the TIU, the TIU should be connected to the THMITG ECU. Location of the TIU connection to the ECU will determine the mode of the ATKS (HOSTILE FIRE or SMOKE SCORER).

CHAPTER 2

OPERATING INSTRUCTIONS

SECTION I. DESCRIPTION AND USE OF OPERATOR'S CONTROLS AND INDICATORS

2-1 GENERAL.

This section shows the location and describes the function and use of the controls and indicators used on the Target Holding Mechanism, Tank Gunnery (THM/TG). It provides preliminary procedures which are required to place the unit in service.

2-2 CONTROLS AND INDICATORS.

Controls and indicators on the THM/TG are described in the table 2-1 and illustrated in figure 2-1. The controls and indicators for the transmitter and battery charger are described in table 2-2 and illustrated in figure 2-2. The controls and indicators for the receiver are described in table 2-3 and illustrated in figure 2-3.

Table 2-1. THMITG Controls and Indicators.

KEY	CONTROL OR INDICATOR	FUNCTION	OPERATING POSITION
1	FUNCTION Switch	<p>Selects six different operating functions and an OFF position. This switch only works when used locally. When run from the RCS the switch function should be set at 4. This will enable the scenario to override the switch setting.</p> <p>Internal power is off. On computer controlled models the trickle charge from the TIU, through the control assembly to the battery is also turned off.</p> <p>Target remains in the UP position when hit.</p> <p>Target automatically goes DOWN when hit and remains in DOWN position.</p> <p>Target automatically goes DOWN when hit and should reach the down position within 8 seconds after a hit is detected. The target should begin to return to the UP position within 9-13 seconds after initial detection and should be completely raised within 8 seconds after starting towards the upright position.</p>	<p>0</p> <p>1</p> <p>2</p> <p>3</p>

Table 2-1. THMITG Controls and Indicators - Continued.

KEY	CONTROL OR INDICATOR	FUNCTION	OPERATING POSITION
1 (cont)		<p>Target remains UP when hit. Lamp flashes. Target automatically goes DOWN when hit and remains in the DOWN position and lamp flashes.</p> <p>Target automatically goes DOWN when hit<sup>6</sup> and should reach the down position within 8 seconds after a it is detected. The target should begin to return to the UP position within 913 seconds after initial detection and should be completely raised within 8 seconds after starting towards the upright position and lamp flashes.</p>	<p>4 5</p>
2	TEST Switch	Tests the operation of the target UP and DOWN circuitry.	UP or DOWN
3	SENSITIVITY Switch	<p>Allows for accurate hit sensing capability for several types of ammunition. (Only non-explosive ammunition will be used.)</p> <p>1. = 20mm at 300 rounds per minute (RPM). 2. =105mm at 10 RPM. 3. = 152mm at 10 RPM. 4. = Tow and Dragon missiles at 2 RPM.</p>	1 thru 4 (1 being the most sensitive)
4	BATTERY Lamp	<p>Indicates battery charge level. Lamp illuminates when target frame is being raised or lowered if battery is properly charged. Lamp flashes during target frame movement if battery requires charging/replacement</p>	
5	SMOKE SCORER	Connector for the target interface unit and ATKs. When the ATKs or TIU is connected to the smoke scorer, the ATKs will fire when target is hit	
6	HOSTILE FIRE SIMULATOR	Connector for the target interface unit and ATKs. Fires the ATKs when the target comes up (when programmed in the scenario).	
7	LAMP	Connector for lamp assembly.	
8	HIT SENSORS	Four connectors for the hit sensors mounted on the target. (Only 3 positions are needed for THM/TG. The fourth position is used with the AMTC.)	

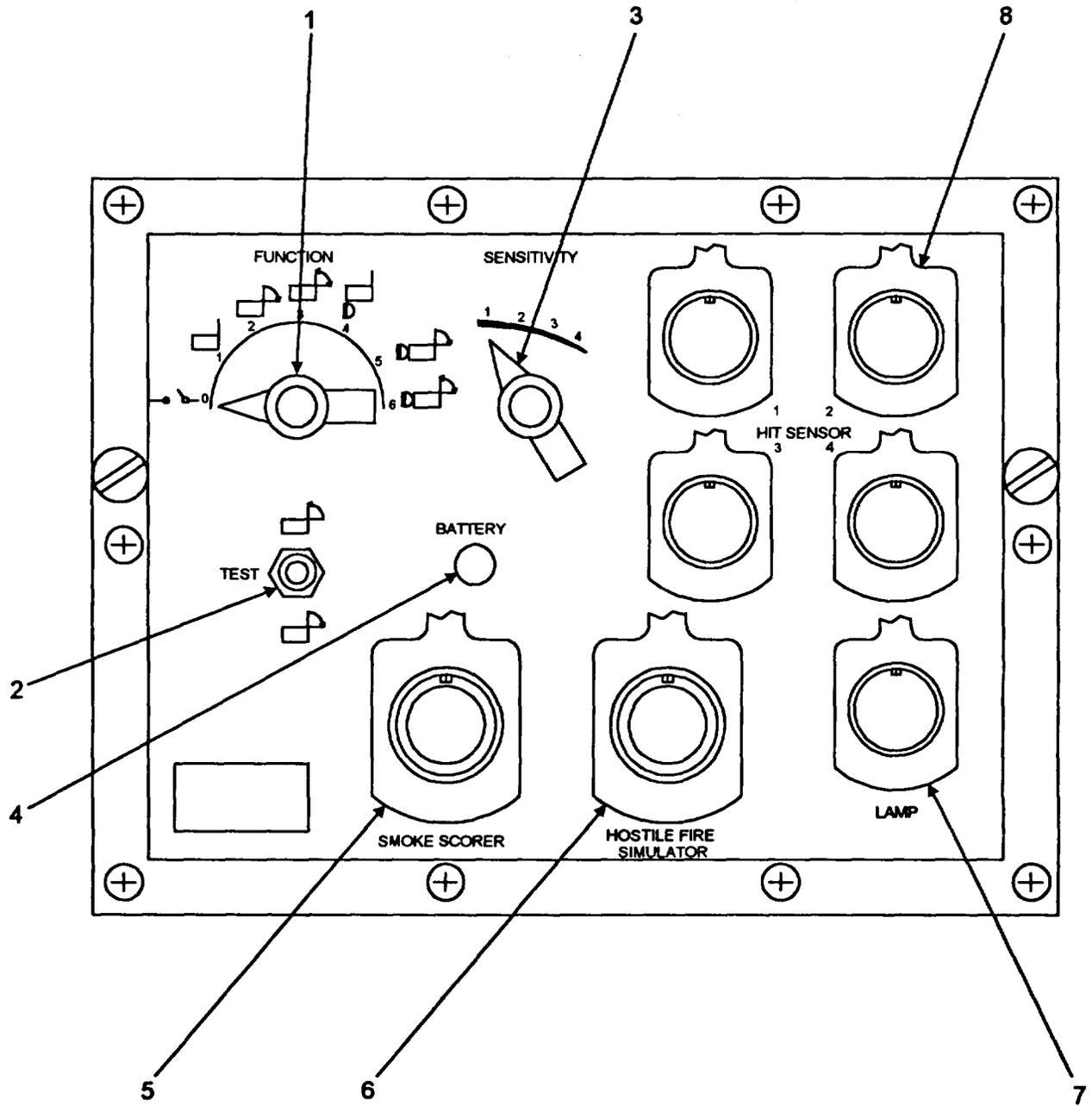


Figure 2-1. THM/TG Controls and Indicators.2-3

Table 2-2. Transmitter Controls and Indicators.

ITEM	NAME	FUNCTION
1	Group Letter and Channel Letter Decal	<p><b>Transmitter</b> Identifies transmitter group letter and channel letter.</p>
2	Channel Selector	<p>Selects the frequency channel either individually or in combinations. The knob is detachable. Transmitter cannot be used unless the knob is in place. Position O is off.</p>
3	Channel Selected Indicator	<p>Identifies selected channel.</p>
4	Command Pushbutton Switches	<p>Allow transmitting of FIRE WI, UP +, or DOWN 4, commands to as many as 40 receivers individually or in groups of 8. The push buttons to the right of the signs select the command to be individually transmitted. Pushbutton to the left selects the commands to all 8 receiver groups.</p>
5	RF/Battery Indicator	<p>Indicates low battery voltage if light flashes when pushbutton is pressed. Steady illumination indicates transmission of commands.</p>
6	Antenna Mount	<p>Antenna connection point.</p>

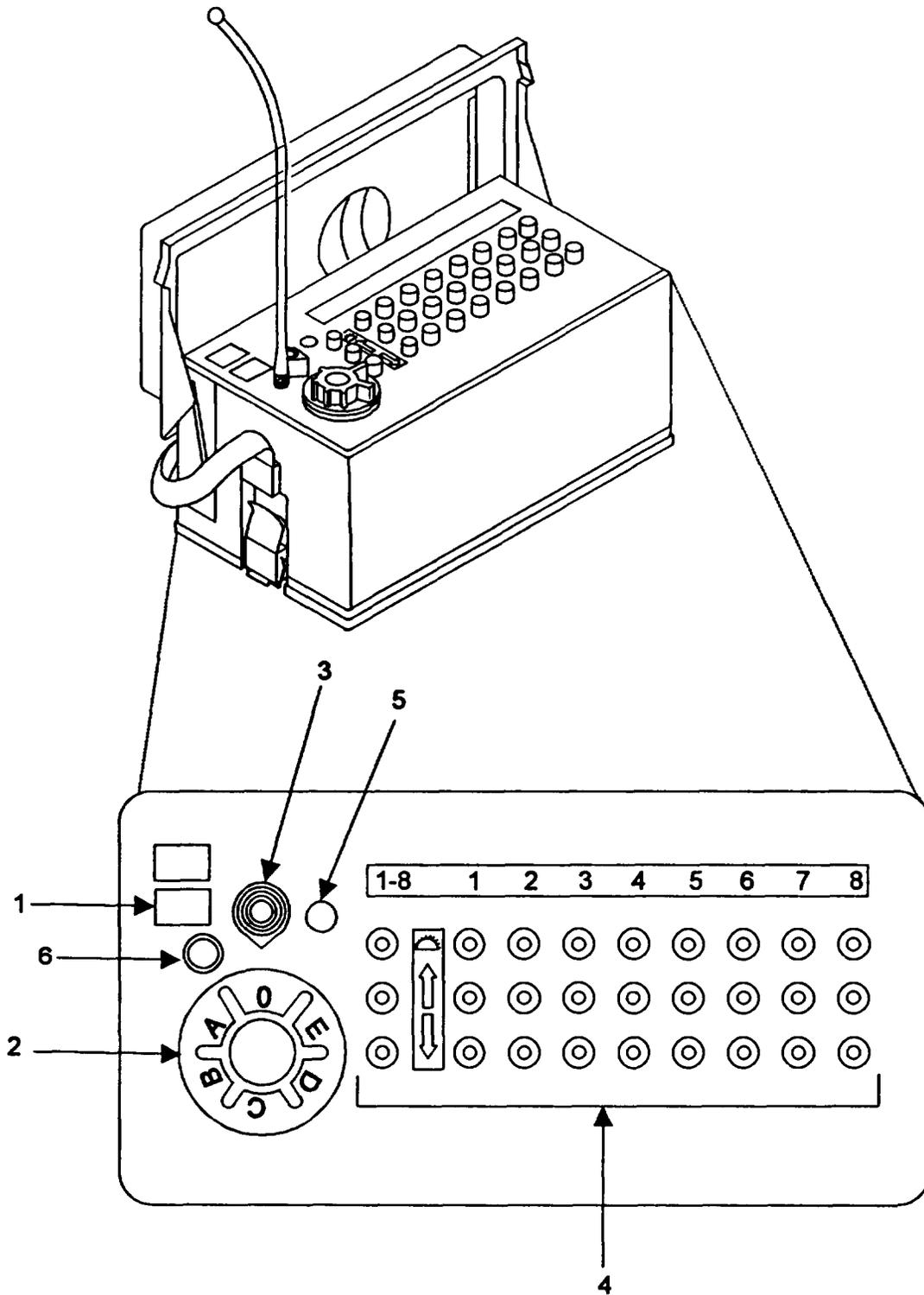


Figure 2-2. Transmitter Controls and Indicators.

Table 2-3. Receiver Controls and Indicators.

ITEM	NAME	FUNCTION
1	Antenna Socket	Mounting of the antenna.
2	Group Letter and Channel Letter and Receiver Number Decal	Identifies group letter and channel letter and receiver number.
3	Desiccator	Indicates moisture level inside receiver. Light blue indicates dry and pink indicates moisture.

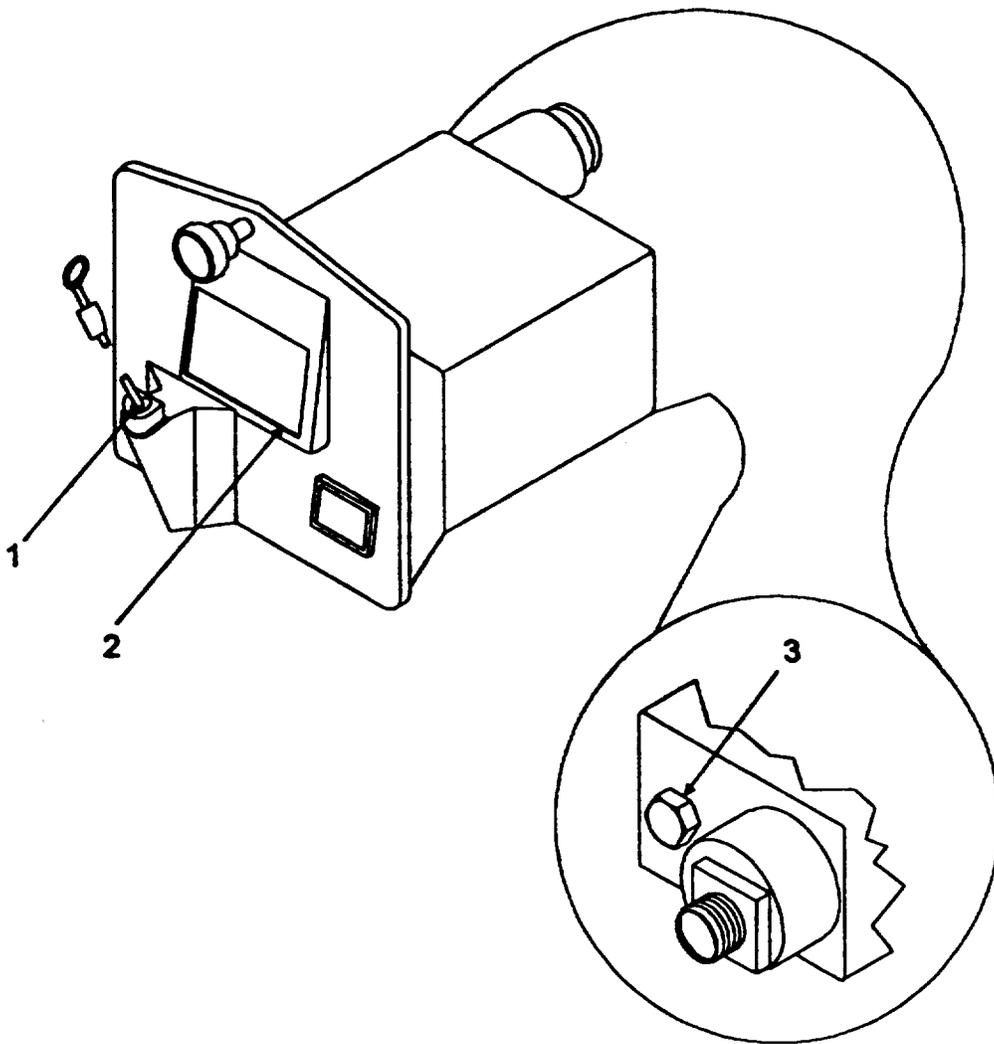


Figure 2-3. Receiver Controls and Indicators.

Table 2-4. Battery Eliminator Controls and Indicators.

ITEM	NAME	FUNCTION
1	Circuit Breaker	Removes input power to the Target Holding Mechanism, Tank Gunnery.
2	Power Cables (+ and -)	Provides 12 vdc power to the THM/TG.
3	Hydraulic Unit Cable	Provides connection to the control unit through the battery eliminator.
4	Control Unit Cable	Provides regulated 12 vdc to the control unit and also connection to the hydraulic unit.
5	Battery Eliminator Input Power Cable	Provides connection to the low power interconnecting box to allow 230 vac input power.

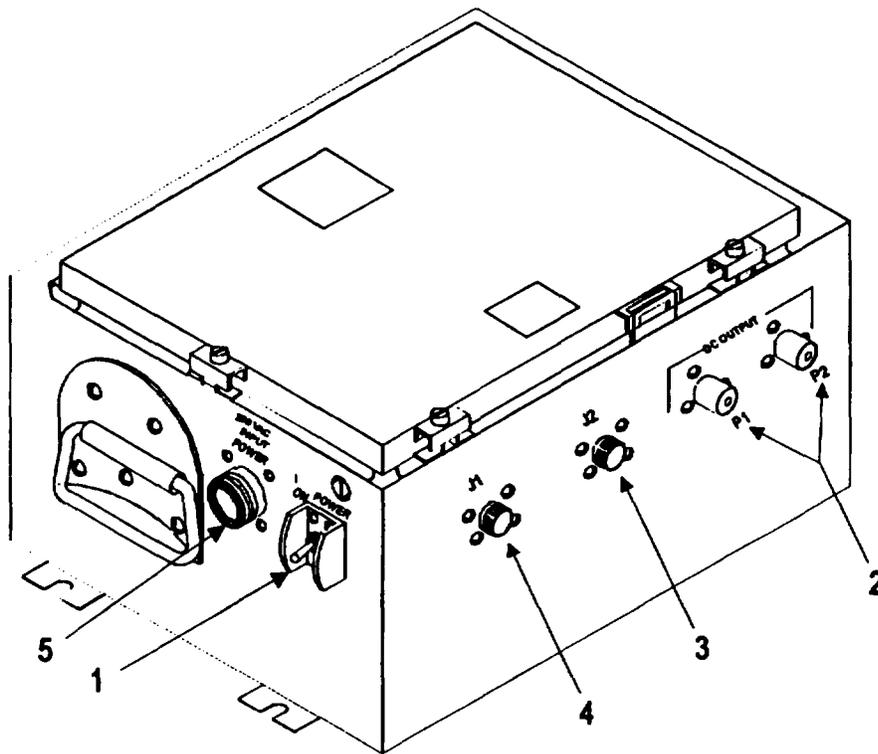


Figure 2-4. Battery Eliminator Controls and Indicators.

**SECTION II. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)**

2-3 **GENERAL.**

- a. Corrosion. Refer to paragraph 1-5.
- b. Monthly Touchup/Spot Painting. Painting is limited to touchup/spot painting.

2-3 GENERAL - Continued.

c. Before You Operate. Always keep in mind the WARNINGS and CAUTIONS. Perform your before (B) PMCS prior to the THM/TG performing its intended mission.

d. While You Operate. Always keep in mind the WARNINGS and CAUTIONS. Perform your during (D) PMCS when the THM/TG is being used for its intended mission.

e. After You Operate. Be sure to perform your after (A) PMCS after the THMITG has been taken out of its mission mode.

f. If Your Equipment Fails to Operate. Troubleshoot with proper equipment. Report any deficiencies using the proper forms. See DA Pam 738-750.

2-4 PMCS PROCEDURES.

a. Preventive Maintenance Checks and Services Table. Lists the inspections and care of your equipment required to keep it in good operating condition.

b. Item Number Column. The item number column is used for reference. When completing DA Form 2404, Equipment Inspection and Maintenance worksheet, include the item number for the check/service indicating a fault. Item numbers also appear in the order that you must do checks and services for intervals listed.

c. Interval Column. The interval column tells you when to do a certain check or service.

d. Perform Weekly as Well as Before Operations PMCS if.

(1) You are assigned operator and have not operated the THM/TG since the last weekly.

(2) You are operating the THM/TG for the first time.

e. While You Perform PMCS, Have Tools with You and Keep an Eye Out for the Following.

(1) Loose Bolts. A loose bolt can be difficult to spot without using a wrench. However, you can often identify loose bolts by observing loose or chipped paint around bolt head and bare metal or rust at its base. Tighten loose bolt and spot paint as required.

(2) Damaged Welds. Damaged welds may be detected by observing rust or chipped paint where cracks occur.

(3) Frayed Electrical Wires and Loose Connectors. Check electrical wiring for cracks due to aging and exposed wires that could cause an electrical short. Tighten loose clamps and connectors.

(4) Corrosion. Check for signs of deterioration, rust, unusual cracking, softening, swelling, or breaking.

f. Leakage Definitions for PMCS Shall be Classified as Follows.

**CAUTION**

Equipment operation is allowable with minor leakages (Class I or II). Of course, you must consider the fluid capacity in the item/system being checked or inspected. When in doubt, notify your supervisor. When operating with Class I or Class II leaks, continue to check fluid levels as required in your PMCS.

(1) Class I leakage is seepage of fluid (as indicated by wetness or discoloration) not great enough to form drops.

(2) Class II leakage is leakage of fluid great enough to form drops but not enough to cause drops to drip from item being checked/inspected.

(3) Class III leakage is leakage of fluid great enough to form drops that fall from item being checked/inspected. Class III leaks should be reported to your supervisor or direct support maintenance.

g. Damage Definitions Are as Follows.

- (1) Burr. A raised portion, restricting the entrance of a part, component, or assembly.
- (2) Crack. A narrow break or separation in material.
- (3) Gouge. A groove or cavity in a sealing surface that cannot be repaired.
- (4) Nick. An indentation caused by object(s) striking the material.

h. The Item to be Checked or Serviced Column. Indicates the item to be serviced.

i. The Procedures Column. Tells you how to do the required checks and services. Carefully follow these instructions. If you do not have the tools, or if the procedure tells you to, notify unit maintenance.

j. If Your Equipment Does Not Perform as Required. Refer to the troubleshooting table for possible problems. Report any malfunctions or failures on DA Form 2404, or refer to DA Pam 738-750.

Table 2-5. Operator Preventive Maintenance Checks and Services.

ITEM NO.	INTERVAL			ITEM TO BE INSPECTED	PROCEDURES CHECK FOR AND HAVE REPAIRED OR ADJUSTED AS NECESSARY	EQUIPMENT NOT READY/AVAILABLE IF
	B	D	A			
1	●			Battery Box	<p style="text-align: center;"><b>WARNING</b></p> <p>Disarm, then disconnect the ATKS connection from control assembly on TTA or TIU. The ATKS must be disconnected from TTA before performing maintenance. Explosion is possible and can cause personal injury and damage to equipment. Pyrotechnics are used during range operation.</p> <p style="text-align: center;"><b>WARNING</b></p> <p>Prevent cables from shorting. Shorted cable can cause the battery to explode.</p>	

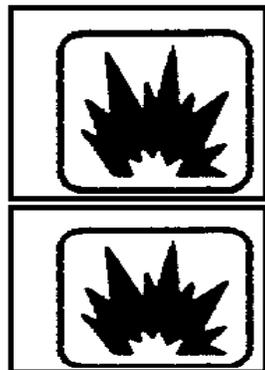


Table 2-5. Operator Preventive Maintenance Checks and Services - Continued.

ITEM NO.	INTERVAL			ITEM TO BE INSPECTED	PROCEDURES CHECK FOR AND HAVE REPAIRED OR ADJUSTED AS NECESSARY	EQUIPMENT NOT READY/AVAILABLE IF
	B	D	A			
1 (cont)					<p style="text-align: center;"><b>WARNING</b></p> <p><b>Use goggles, apron, and gloves when handling batteries or electrolyte.</b></p> <p>Turn FUNCTION switch to O position. Disconnect battery cables from battery box cable adapters. Inspect battery box cable adapter terminals and exterior of battery box for damage or corrosion. Clean as necessary. Refer to TM 9-6140-200-14.</p> <p>Remove battery box lid. Inspect cable assembly connections at battery for damage, looseness, or corrosion. Clean as necessary. Refer to TM 9-6140-200-14.</p> <p>Install battery box lid. Connect battery cables to battery box cable adapters. Turn FUNCTION switch to required position. Report all loose, worn, corroded, damaged, or missing parts to next higher maintenance level.</p>	<p>Terminals are loose or corroded.</p> <p>Terminals are loose or corroded.</p>
2	●			Battery Test	Place TEST switch in the up position and watch the BATTERY test lamp. The lamp should glow steadily during operation.	Lamp flashes or target raises too slowly.
3	●			Hydraulic Cylinder		

Table 2-5. Operator Preventive Maintenance Checks and Services - Continued.

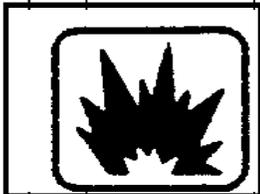
ITEM NO.	INTERVAL			ITEM TO BE INSPECTED	PROCEDURES CHECK FOR AND HAVE REPAIRED OR ADJUSTED AS NECESSARY	Equipment is not ready/available if:
	B	D	A			
					 	
4	•			Target Frame	<p>Disarm, then disconnect the ATKS connection from control assembly on TTA or TIU. The ATKS must be disconnected from TTA before performing maintenance. Explosion is possible and can cause personal injury and damage to equipment. Pyrotechnics are used during range operation.</p> <p>Remove access door.</p> <p>Raise and lower target assembly and observe action of hydraulic cylinder.</p> <p>Check for damage to hydraulic cylinder, cylinder rod, attaching parts. Check for leakage of hydraulic fluid.</p> <p>Report improper operation, or any damage or leakage to next higher maintenance level.</p> <p>Install access door. Ensure target and target frame are free to move and not frozen to ground.</p>	<p>Cylinder or cylinder rod is damaged. Hydraulic leaks are visible.</p> <p>Target or target frame are frozen.</p>
5	•			Transmitter Battery	<p>Install battery onto battery charger.</p> <p>Tighten thumbscrews into battery charger. Plug battery charger into 115 vac power source.</p>	<p>Battery is not fully charged.</p>
6	•			Transmitter Test	<p>Ensure transmitter and receiver have the same frequency.</p>	<p>Transmitter and receiver frequencies are different.</p>

Table 2-5. Operator Preventive Maintenance Checks and Services - Continued.

ITEM NO.	INTERVAL			ITEM TO BE INSPECTED	PROCEDURES CHECK FOR AND HAVE REPAIRED OR ADJUSTED AS NECESSARY	Equipment is not ready/available if:
	B	D	A			
6 (cont)					<p>Disarm, then disconnect the ATKS connection from control assembly on TTA or TIU. The ATKS must be disconnected from TTA before performing maintenance. Explosion is possible and can cause personal injury and damage to equipment. Pyrotechnics are used during range operation.</p> <p>Hold down a pushbutton on the transmitter.</p> <p>Check that the battery lamp illuminates steadily while pushbutton is held down.</p> <p>A flashing light indicates the battery needs to be recharged or replaced.</p> <p>Raise and lower the target mechanism.</p> <p>Report improper operation, or any damage to next higher maintenance level.</p>	<p>Battery is not fully charged or transmitter does not operate.</p>
7			•	<p>Base Frame</p> <p>Remove access door. Visually inspect base frame for cracks around stabilizer supports and welds. Install access door.</p> <p>Report cracks in welds or other damage to next higher maintenance level.</p>	<p>Frame is cracked or broken.</p>	

**SECTION III. OPERATION UNDER USUAL CONDITIONS****2-5 ASSEMBLY AND PREPARATION FOR USE**

The Target Holding Mechanism, Tank Gunnery (THM/TG) can be used with the ERETS range control station or with the transmitter and receiver. It also can be used with the battery as the power source or with the battery eliminator. The following procedures describe the steps necessary to prepare the THM/TG for operation.

**a. Assembly and Preparation of Radio-Controlled THMITG.** To assemble and prepare the radiocontrolled THM/TG for operation, refer to figure 2-5 and FO-1 and perform the following steps:

- (1) Extend the stabilizer assembly (1).

**NOTE**

**The radio receiver must have the same frequency group letters and channel letter and receiver number as the transmitter. The frequency group can be determined if receiver is not marked. Place the channel selector knob in position A. Press the pushbutton marked 1-8. Move the selector knob through the remaining channels until the THMITG operates. Then push each pushbutton one at a time until the unit operates. If you are on channel D and the number 6 pushbutton, the frequency group letter and receiver number is D6.**

- (2) Install radio receiver (2) into tank target assembly. Connect the receiver antenna to the receiver.
- (3) Remove access door and connect cable from control assembly P1 to rear of receiver J1.
- (4) Remove 14 screws, lockwashers, and flat washers and remove cover from hydraulic unit. Remove breather and check fluid level. Level should be within 1/2-in (13 mm) from top. Install breather and cover. Apply a bead of white petroleum around the edge of the hydraulic unit cover. Install access door.

**NOTE**

**The lamp assembly must be mounted within 19 ft (5.80 m) of the tank target assembly.**

- (5) Position lamp assembly (3) on mounting surface and tighten thumbscrew. Turn the lamp head toward the firing line of the range. Connect the lamp assembly cable to LAMP connector on control assembly (4).
- (6) Position the battery box assembly (5) near the tank target assembly in a protected area on bunker pad.

**WARNING**

Care must be taken to prevent wires from shorting out to ground, or electric shock may result.



**WARNING**

Explosion is possible and can cause personal injury and damage to equipment. Batteries can explode.



**WARNING**

Chemicals can cause serious injuries or burns to personnel. Batteries contain sulfuric acid.



- (7) Place the battery (deep cycle type) in the box. Connect red battery box cable adapter (6) to the positive terminal of the battery. Connect black battery box cable adapter (7) to negative terminal of the battery.
- (8) Connect the red battery cable (8) to the red connections on the tank target assembly and the battery box cable adapter (6). Connect the black battery cable (9) to the black connections on the tank target assembly and battery box cable adapter (7).

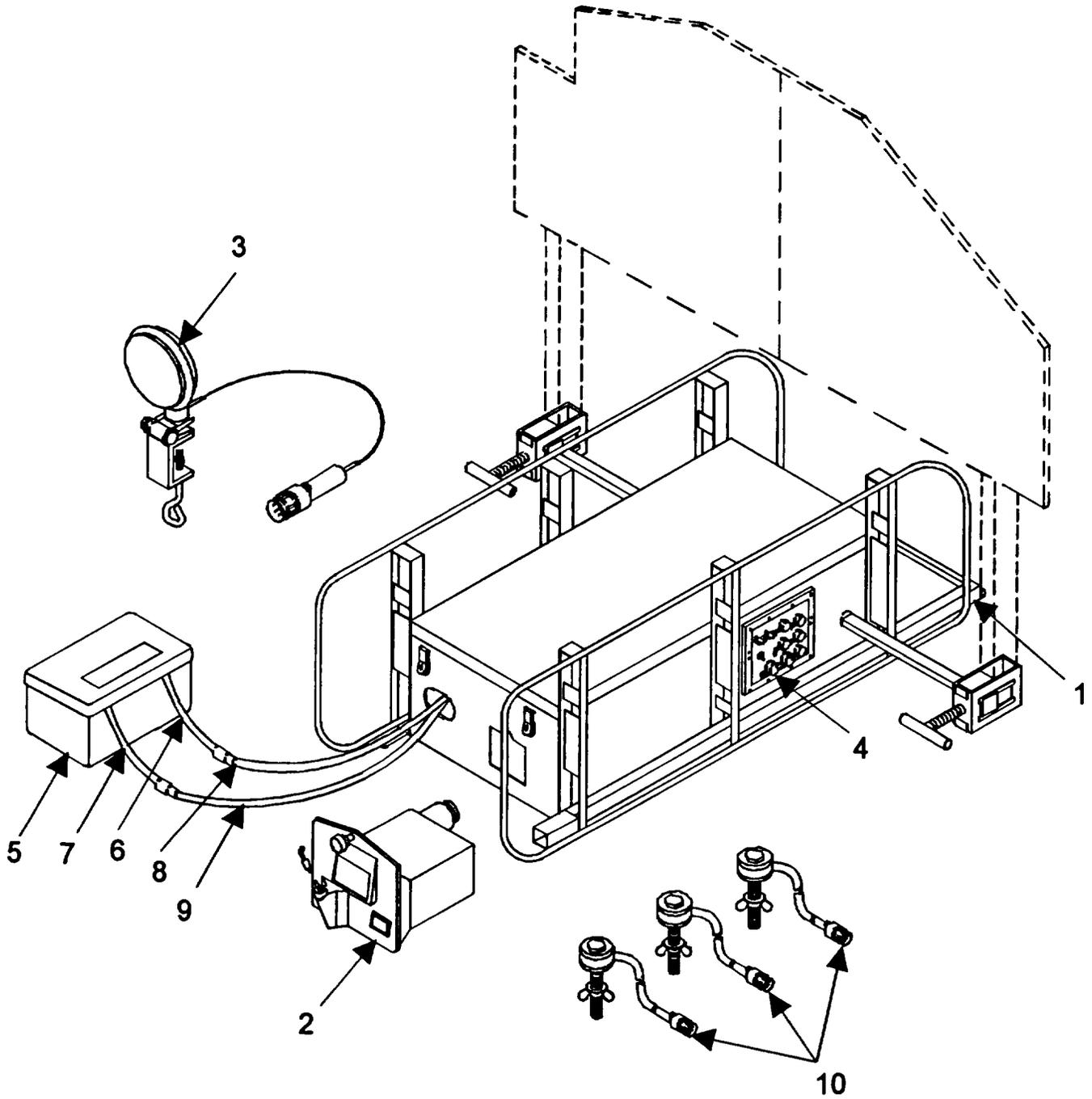


Figure 2-5. Preparation for Use of the Radio-Controlled THM/TG.

**WARNING**

Moving mechanical equipment can cause injury to personnel standing in or obstructing the path of motion. Stay clear of moving target assembly.

**NOTE**

Target is not part of the THM/TG and is supplied separately.

- (9) Install target in target holder by doing the following:
- (a) Ensure FUNCTION switch is set to O and the target arm is in the down position.
  - (b) Ensure target frame is free of obstruction which may inhibit target movement.

**CAUTION**

The target must be centered and the clamp screws tight to prevent damage to the equipment.

- (c) Connect the target frames to the THM/TG housing and secure the target to the target frame mounting dampers.

**CAUTION**

Hit sensor cables must be clear of moving target frames to prevent damage.

- (10) Install three hit sensors (10) in the holes at base of the target and secure with flatwashers and wing nuts. Connect the hit sensors' cables to the HIT SENSOR connectors on control assembly (4).
- (11) Perform operator PMCS. Refer to paragraph 2-3.

**WARNING**

Disarm, then disconnect the ATKS connection from control assembly on TTA or TIU. The ATKS must be disconnected from TTA before performing maintenance. Explosion is possible and can cause personal injury and damage to equipment. Pyrotechnics are used during range operation.

**NOTE**

For operation and maintenance of the ATKS, refer to TM 9-6920-742-14-2.

- (12) Position armor target kill simulator in protected area. Clear brush and other flammable material away from ATKS. Connect the simulator to SMOKE SCORER or HOSTILE FIRE connector on control assembly. Connection to the SMOKE SCORER connector activates the ATKS when target is hit and goes down. Connection to the HOSTILE FIRE connector activates the ATKS when commanded to do so by the radio controlled transmitter.

b. **Assembly and Preparation of Computer-Controlled THM/TG with Battery.** To assemble and prepare the computer-controlled THM/TG with battery for operation, refer to figure 2-6 and FO-2 and perform the following steps:

**NOTE**

**Ensure the circuit breaker of the TIU and the circuit breaker of the ICB are in the OFF position.**

- (1) Extend the stabilizer assembly (1).
- (2) Remove access door. Disconnect proximity switch cable P3 from control assembly (2) and connect it to P4 of cable W107 from the target interface unit (TIU). Connect P2 of cable W107 to P3 on the control assembly. Connect P3 of cable W107 to the SMOKE SCORER or HOSTILE FIRE connector on the front of control assembly. If P3 is connected to the SMOKE SCORER connector and the ATKS is connected to the TIU, the ATKS will activate when the target is hit. If P3 is connected to the HOSTILE FIRE connector and the ATKS is connected to the TIU, the ATKS will activate when programmed in the scenario.
- (3) Remove 14 screws, lockwashers, and flatwashers and remove cover from hydraulic unit. Remove breather and check fluid level. Level should be within 1/2-in (13 mm) from top. Install breather. Apply a bead of white petroleum to hydraulic unit cover gasket and install cover. Install access door.

**NOTE**

The lamp assembly must be mounted within 19 ft (5.80 m) of the tank target assembly.

- (4) Position lamp assembly (3) on mounting surface and tighten thumbscrew. Turn the lamp head toward the firing line of the range. Connect lamp assembly cable to the lamp connector on the control assembly.
- (5) Position the battery box assembly (4) near the tank target assembly in a protected area on bunker pad.

**WARNING**

Care must be taken to prevent wires from shorting out to ground, or electric shock may result.



**WARNING**

Explosion is possible and can cause personal injury and damage to equipment. Batteries can explode.

**WARNING**

Chemicals can cause serious injuries or burns to personnel. Batteries contain sulfuric acid.



- (6) Place the battery (standard heavy duty type) in the box. Connect red battery box cable adapter (5) to the positive terminal of the battery. Connect black battery box cable adapter (6) to negative terminal of the battery.
- (7) Connect the red battery cable (7) to the red connections on the tank target assembly and the battery box cable adapter (5). Connect the black battery cable (8) to the black connections on the tank target assembly and battery box cable adapter (6).

**WARNING**

Moving mechanical equipment can cause injury to personnel standing in or obstructing the path of motion. Stay clear of moving target assembly.

**NOTE**

Target is not part of the Target Holding Mechanism, Tank Gunnery and is supplied separately.

- (8) Install target in target holder by doing the following:
  - (a) Ensure FUNCTION switch is set to O and the target frame is in the down position.
  - (b) Ensure target frame is free of obstruction which may inhibit target movement.

**CAUTION**

The target must be centered and the clamp screws tight to prevent damage to equipment.

- (c) Connect the target frames to the THMITG housing and secure the target to the target frames mounting clamps.

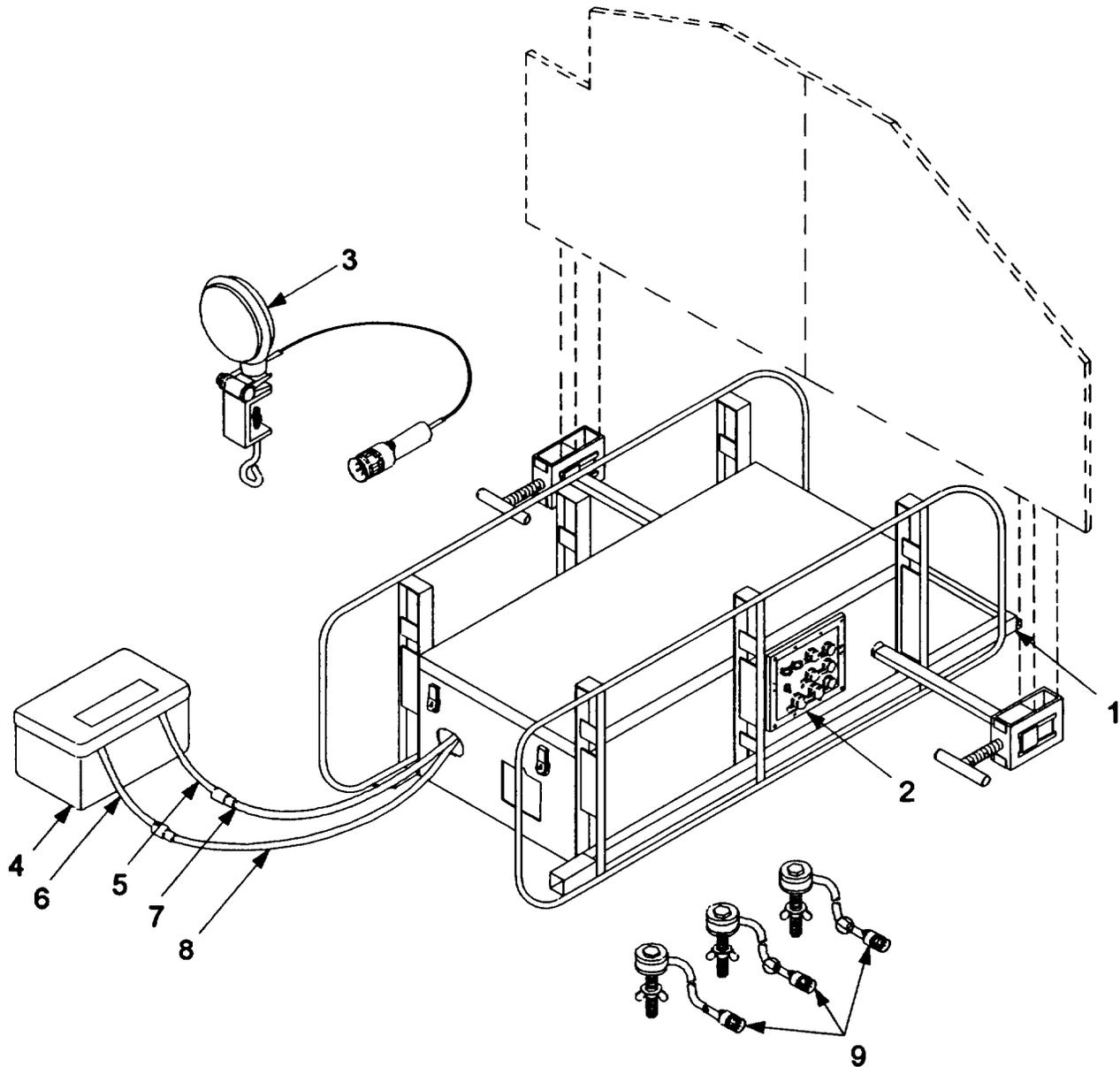


Figure 2-6. Preparation for Use of the Computer-Controlled THM/TG with Battery.

**CAUTION**

**Hit sensor cables must be clear of moving target frames to prevent damage.**

- (9) Install three hit sensors (9) in the holes at base of the target and secure with flatwashers and wingnuts. Connect the hit sensors' cables to the hit sensor connectors on the front of the 2-19 control assembly.
- (10) Perform operator PMCS. Refer to paragraph 2-3.

2-5 ASSEMBLY AND PREPARATION FOR USE - Continued.**WARNING**

Disarm, then disconnect the ATKS connection from control assembly on TTA or TIU. The ATKS must be disconnected from TTA before performing maintenance. Explosion is possible and can cause personal injury and damage to equipment. Pyrotechnics are used during range operation.

**NOTE**

For operation and maintenance of the ATKS, refer to TM 9-6920-742-14-2.

- (11) Position armor target kill simulator in protected area. Clear brush and other flammable material away from ATKS. Connect the simulator to SMOKE SCORER or HOSTILE FIRE connector on control assembly. Connection to the SMOKE SCORER connector activates the ATKS when target is hit and goes down. Connection to the HOSTILE FIRE connector activates the ATKS when programmed in the scenario or commanded to do so by the radio controlled transmitter. Connection to the TIU causes the ATKS to respond to the function of the connector that the TIU is connected to on the control assembly.

c. **Assembly and Preparation of Computer-Controlled THMITG with Battery Eliminator.** To assemble and prepare the computer-controlled THM/TG with battery eliminator for operation, refer to figure 2-7 and FO-3 and perform the following steps:

**NOTE**

**Ensure that circuit breakers/switches on the TIU, the ICB, and the battery eliminator are in the OFF position.**

- (1) Extend the stabilizer assembly (1).
- (2) Position the battery eliminator (2) near the tank target assembly in a protected area on bunker pad.
- (3) Remove access door. Disconnect proximity switch cable P3 from control assembly (3) and connect it to P4 of cable W107 from the target interface unit (TIU). Connect P2 of cable W107 to P3 on the control assembly. Connect P3 of cable W107 to the SMOKE SCORER/HOSTILE FIRE connector on the front of control assembly. If P3 is connected to the SMOKE SCORER connector and the ATKS is connected to the TIU, the ATKS will activate when the target is hit. If P3 is connected to the HOSTILE FIRE connector and the ATKS is connected to the TIU, the ATKS will activate when programmed in the scenario or commanded to do so by the radio controlled transmitter.

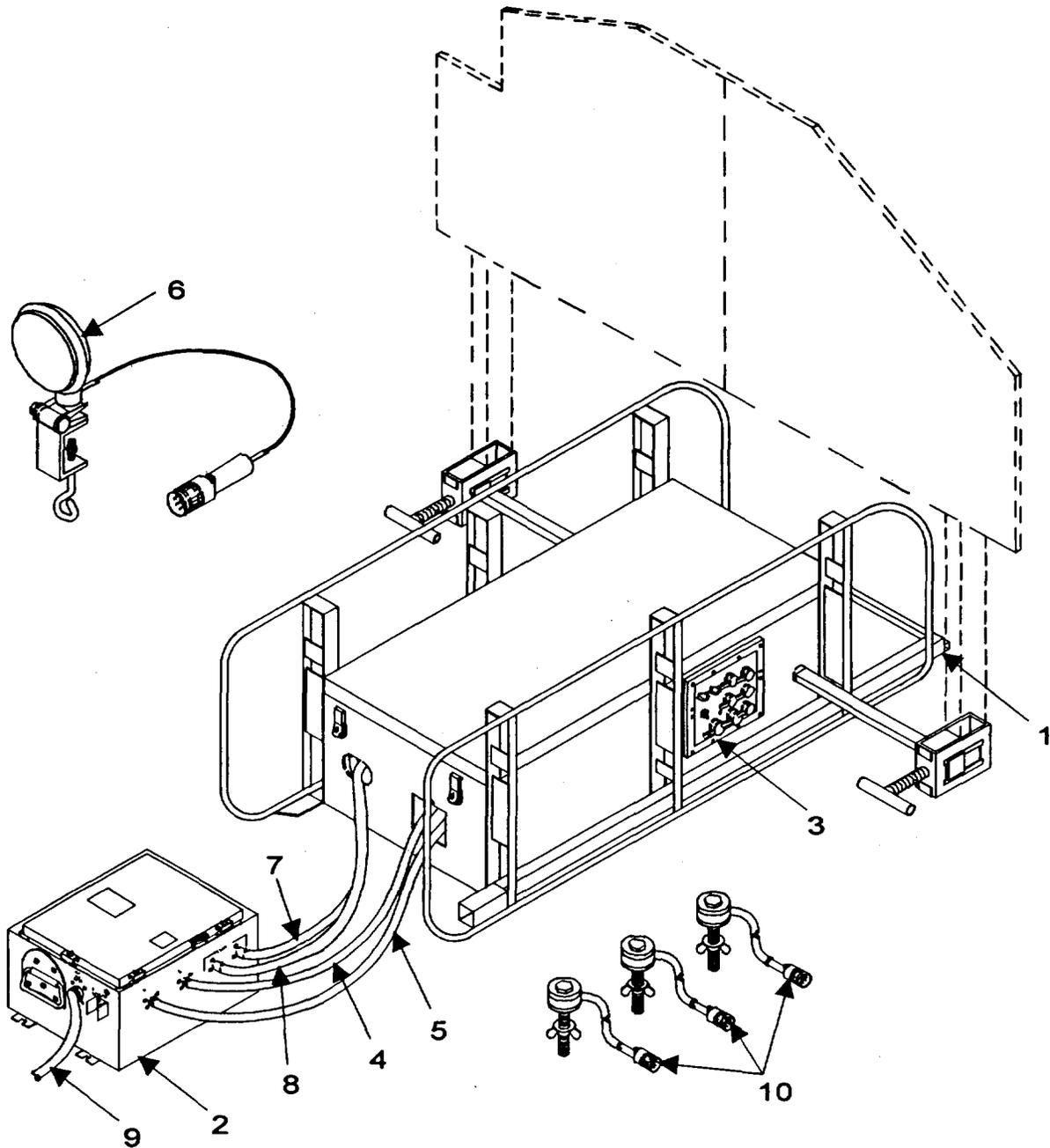


Figure 2-7. Preparation for Use of the Computer-Controlled THM/TG with Battery Eliminator.

- (4) Remove 14 screws, lockwashers, and flatwashers and remove cover from hydraulic unit. Remove breather and check fluid level. Level should be within 1/2-in (13 mm) from top. Install breather and cover. Apply a bead of white petroleum around the edge of hydraulic unit cover. Install access door.
- (5) Disconnect cable from P2 (4) on THM/TG control assembly and connect it to J2 on the 2-21 battery eliminator. Connect battery eliminator control cable from J1 (5) on battery eliminator to P2 on control assembly.

**WARNING**

Care must be taken to prevent wires from shorting out to ground, or electric shock may result.

**NOTE**

The lamp assembly must be mounted within 19 ft (5.80 m) of the tank target assembly.

- (6) Position lamp assembly (6) on mounting surface and tighten thumbscrew. Turn the lamp head toward the firing line of the range. Connect lamp assembly cable to the lamp connector on the control assembly.
- (7) Connect the red battery cable (7) to the red connections on the tank target assembly and the battery eliminator P1. Connect the black battery cable (8) to the black connections on the tank target assembly and battery eliminator P2.
- (8) Connect battery eliminator power cable P2 (9) to J3 at battery eliminator. Connect battery eliminator power cable P1 to J2 on the interconnecting box.

**WARNING**

Moving mechanical equipment can cause injury to personnel standing in or obstructing the path of motion. Stay clear of moving target assembly.

**NOTE**

Target is not part of the Target Holding Mechanism, Tank Gunnery and is supplied separately.

- (9) Install target in target holder by doing the following:
  - (a) Ensure FUNCTION switch is set to O and the target frame is in the down position.
  - (b) Ensure target frame is free of obstruction which may inhibit target movement.

**CAUTION**

The target must be centered and the clamp screws tight to prevent damage.

- (c) Connect the target frames to the THM/TG housing and secure the target to the target frame mounting clamps.

**CAUTION**

**Hit sensor cables must be clear of moving target frames to prevent damage.**

- (10) Install three hit sensors (10) in the holes at base of the target and secure with flatwashers and wingnuts. Connect the hit sensors' cables to the hit sensor connectors on the front of the control assembly.
- (11) Perform operator PMCS. Refer to paragraph 2-3.

**WARNING**



Disarm, then disconnect the ATKS connection from control assembly on TTA or TIU. The ATKS must be disconnected from TTA before performing maintenance. Explosion is possible and can cause personal injury and damage to equipment. Pyrotechnics are used during range operation.

**NOTE**

For operation and maintenance of the ATKS, refer to TM 9-6920-742-14-2.

- (12) Position armor target kill simulator in protected area. Clear brush and other flammable material away from ATKS. Connect the simulator to SMOKE SCORER or HOSTILE FIRE connector on control assembly. Connection to the SMOKE SCORER connector activates the ATKS when target is hit and goes down. Connection to the HOSTILE FIRE connector activates the ATKS when programmed in the scenario or commanded to do so by the radio controlled transmitter. Connection to the TIU causes the ATKS to respond to the function of the connector that the TIU is connected to on the control assembly.

**d. Target Replacement.**

**WARNING**

Disarm, then disconnect the ATKS connection from control assembly on TTA or TIU. The ATKS must be disconnected from TTA before performing maintenance. Explosion is possible and can cause personal injury and damage to equipment. Pyrotechnics are used during range operation.

**WARNING**

Moving mechanical equipment can cause injury to personnel standing in or obstructing the path of motion. Stay clear of moving target assembly.



- (1) Place target in the down position.

2-5 **ASSEMBLY AND PREPARATION FOR USE - Continued.**

- (2) Turn the THM/TG control assembly FUNCTION switch to O position.
- (3) Disconnect hit sensors from THM/TG control assembly and remove from target.
- (4) Loosen target frame clamps and slide target from target clamps.
- (5) Install target in target holder by doing the following:
  - (a) Ensure target frame is free of obstruction which may inhibit target movement.

**CAUTION**

**The target must be centered and the clamp screws tight to prevent damage.**

- (b) Connect the target frames to the THM/TG housing and secure the target to the target frame mounting clamps.
- (6) Mount hit sensors on target and connect cables to THM/TG control assembly.

2-6 **INITIAL ADJUSTMENTS, DAILY CHECKS, AND SELF-TEST.**

**WARNING**



Disarm, then disconnect the ATKS connection from control assembly on TTA or TIU. The ATKS must be disconnected from TTA before performing maintenance. Explosion is possible and can cause personal injury and damage to equipment. Pyrotechnics are used during range operation.

**WARNING**

Moving mechanical equipment can cause injury to personnel standing in or obstructing the path of motion. Stay clear of moving target assembly.



**CAUTION**

**Ensure target area is free of obstructions.**

Before operating the THM/TG, the unit must be tested for proper operation and report any malfunctions to unit maintenance. Refer to figure 2-1 and use the following procedure to test the operation of THM/TG:

- a. Turn FUNCTION switch to position 1.

- b. Using TEST switch raise target.
- c. Set SENSITIVITY switch to position 1.
- d. Tap target near hit sensor with metal object to simulate a target hit, and observe operation of the tank target assembly: Target should not go down with P3 of cable W107 connected to the control assembly.
- e. Repeat above steps changing FUNCTION switch to each of remaining five positions, and continue to test tank target assembly for following results:

Position 2: Target should go down when hit and remain down.

Position 3: The target automatically goes down when hit and should reach the down position within 8 seconds after a hit is detected. The target should begin to raise within 9-13 seconds after the initial hit detection and should be completely raised within 8 seconds after starting towards the upright position.

Position 4: Target remains up when hit and the lamp should flash with P3 of cable W107 connected to control assembly.

Position 5: Target should go down when hit and remain down, and lamp should flash.

Position 6: The target automatically goes down when hit and should reach the down position within 8 seconds after a hit is detected. The target should begin to raise within 9-13 seconds after the initial hit detection and should be completely raised within 8 seconds after starting towards the upright position and lamp should flash.

- f. Disconnect two of the three hit sensors. Set FUNCTION switch to position 3. Tap target near hit sensor. Target should go down and return to the up position in 9-13 seconds. Wait for target to go down and return to the full up. Reconnect other hit sensors one at a time and tap target.

**NOTE**

**The higher the number that the sensitivity switch is set to, the more force of impact needed when tapping the target to simulate a hit.**

- g. Set the SENSITIVITY switch to each one of the remaining three positions and repeat step f.
- h. Position armor target kill simulator in protected area. Clear brush and other flammable material away from ATKS. Connect the simulator to SMOKE SCORER or HOSTILE FIRE connector on control assembly or to the TIU. Connection to the SMOKE SCORER connector activates the ATKS when target is hit and goes down. Connection to the HOSTILE FIRE connector activates the ATKS when programmed in the scenario or commanded to do so by the radio controlled transmitter. Connection to the TIU causes the ATKS to respond to the function of the connector that the TIU is connected to on the control assembly.
- i. Arm ATKS as applicable.
- j. Report any malfunctions to next higher maintenance level.

## 2-7 OPERATING PROCEDURES.

The THM/ITG can be used with the ERETS range control station or with the transmitter and receiver. It also can be used with the battery as the power source or with the battery eliminator. The following procedures describe the steps necessary for THMITG operation.

**a. Placing the Radio-Controlled THM/TG in Operation.** The radio-controlled THM/TG can be used as a portable target or in a semipermanent installation. To place the unit into operation follow the procedures below.

- (1) With the FUNCTION switch in position 0, set SENSITIVITY switch to desired position (reference figure 2-1).
- (2) Connect the antenna to the receiver.
- (3) Connect antenna to transmitter (reference figure 2-2).
- (4) Install battery in transmitter.
- (5) Install channel selector knob.
- (6) Select channel for receiver of THM/TG.
- (7) Set the FUNCTION switch on the control assembly to the desired operating position.

### NOTE

**Do not operate the transmitter within 150 ft (45.75 m) of receivers. Operation at less than 150 ft (45.75 m) may cause a transmitter with a weak battery to appear to operate normally.**

- (8) Move the transmitter at least 150 ft (45.75 m) away from receiver.

### WARNING



**Disarm, then disconnect the ATKS connection from control assembly on TTA or TIU. The ATKS must be disconnected from TTA before performing maintenance. Explosion is possible and can cause personal injury and damage to equipment. Pyrotechnics are used during range operation.**

- (9) Test the operation of the THM/TG with the transmitter by raising and lowering the target frames with the pushbuttons.
  - b. Shutdown of Radio-Controlled THMITG.** To place the unit in shutdown status, follow the procedures below.
    - (1) Lower target.
    - (2) Place the channel selector on the transmitter to position 0.
    - (3) Turn FUNCTION switch on control assembly to position 0 (reference figure 2-1).

(4) Disarm and disconnect ATKS.

c. **Placing the Computer-Controlled THMITG with Battery in Operation.** To place the unit into operation, follow the procedures below.

(1) With the FUNCTION switch in position 0, place circuit breakers at the interconnecting box and the target interface unit in the ON position.

(2) Set the SENSITIVITY switch to desired position.

(3) Select the desired operating position on the control assembly.

**WARNING**



Disarm, then disconnect the ATKS connection from control assembly on TTA or TIU. The ATKS must be disconnected from TTA before performing maintenance. Explosion is possible and can cause personal injury and damage to equipment. Pyrotechnics are used during range operation.

**WARNING**

Moving mechanical equipment can cause injury to personnel standing in or obstructing the path of motion. Stay clear of moving target assembly.



(4) Contact the range control operator and using the RCS have him raise and lower the tank target to test operation of unit.

d. **Shutdown of Computer-Controlled THM/TG with Battery.** To place the unit in shutdown status, follow the procedures below.

(1) Lower target.

(2) Turn FUNCTION switch on control assembly to position 0.

(3) Disarm and disconnect ATKS.

**NOTE**

If the battery is going to be left in place, go to step (4) and stop. If the battery is going to be removed, go to step (5).

(4) Place FUNCTION switch in position 1.

(5) Place the circuit breakers at interconnecting box, TIU, and function switch on the control assembly in the OFF position.

(6) Disconnect red battery cable from red connections on tank target assembly and battery box cable adapter.

2-7 **OPERATING PROCEDURES - Continued.**

- (7) Disconnect black battery cable from black connections on tank target assembly and battery box cable adapter.
- (8) Store cables inside THM/TG.
- e. **Placing the Computer-Controlled THMITG with Battery Eliminator in Operation.** To place the unit into operation, follow the procedures below.
  - (1) With the FUNCTION switch in position 0, place circuit breakers at the interconnecting box and the target interface unit in the ON position.
  - (2) Place the circuit breaker on battery eliminator in the ON position.
  - (3) Set the SENSITIVITY switch to desired position.
  - (4) Select the desired operating position on the control assembly.

**WARNING**

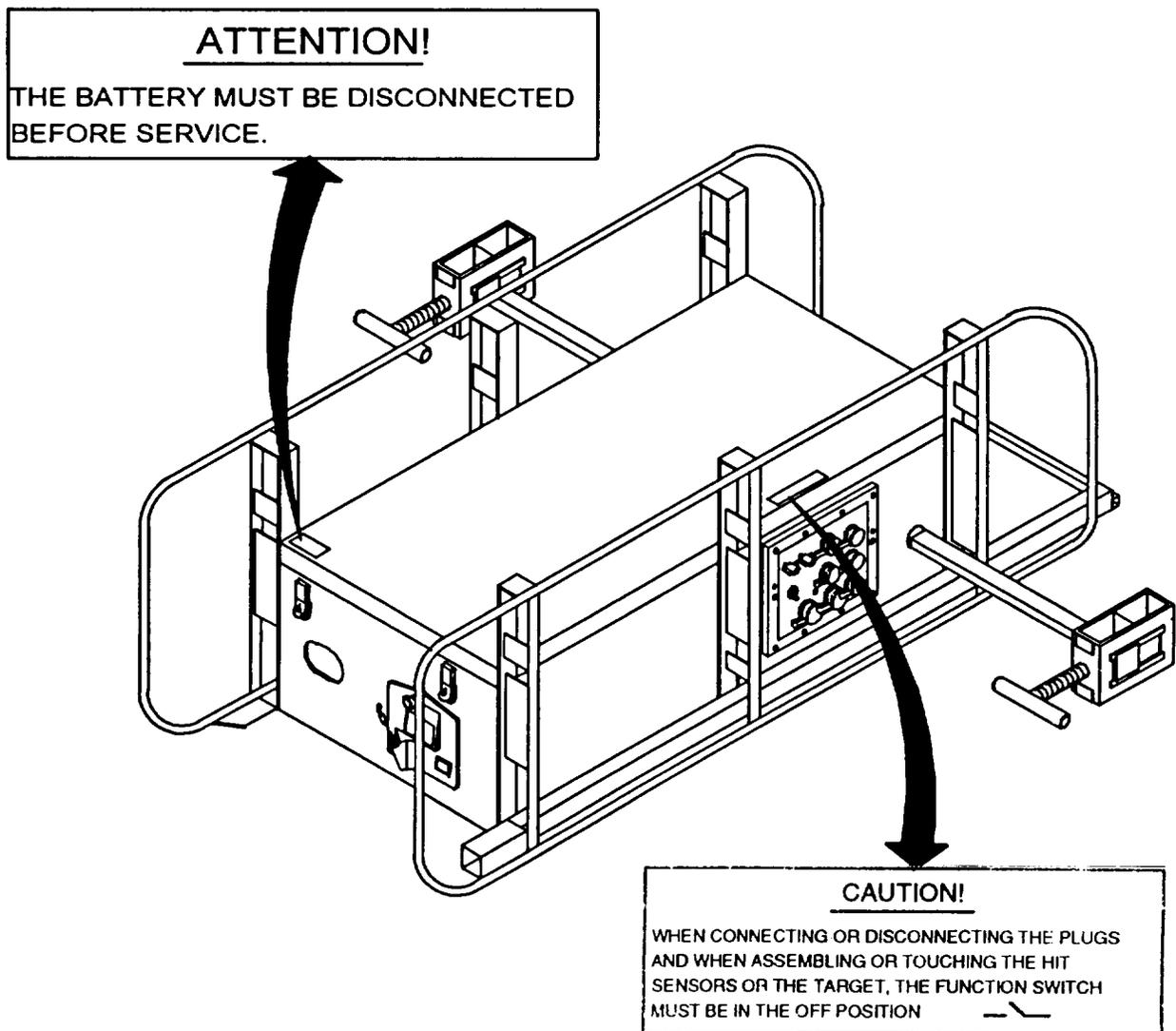
Disarm, then disconnect the ATKS connection from control assembly on TTA or TIU. The ATKS must be disconnected from TTA before performing maintenance. Explosion is possible and can cause personal injury and damage to equipment. Pyrotechnics are used during range operation.

**WARNING**

Moving mechanical equipment can cause injury to personnel standing in or obstructing the path of motion. Stay clear of moving target assembly.

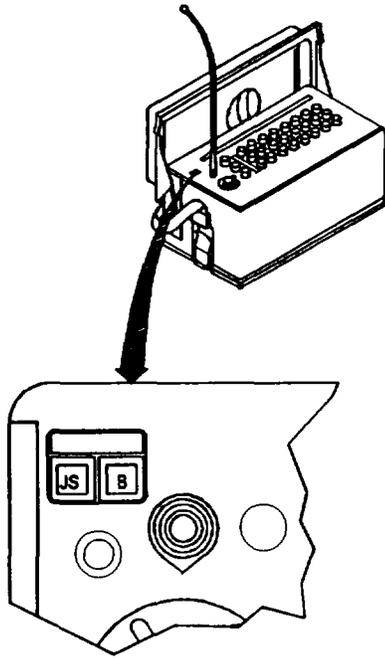


- (5) Contact the range control operator and using the RCS have him raise and lower the tank target to test operation of unit.
- f. **Shutdown of Computer-Controlled THMITG with Battery Eliminator.** To place the unit in shutdown status, follow the procedures below.
  - (1) Lower target.
  - (2) Turn FUNCTION switch on control assembly to position 0.
  - (3) Place the circuit breaker on battery eliminator in the OFF position.
  - (4) Place the circuit breakers at interconnecting box and TIU in the OFF position.
  - (5) Disarm and disconnect ATKS.

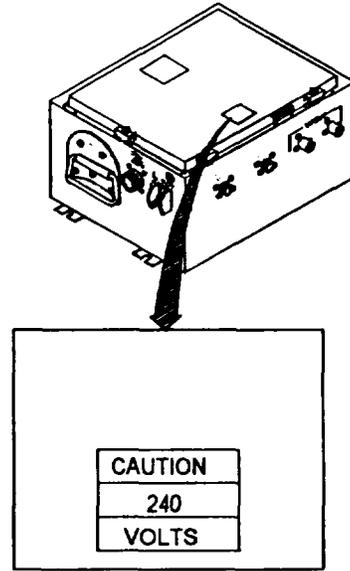


## THM/TG DECALS

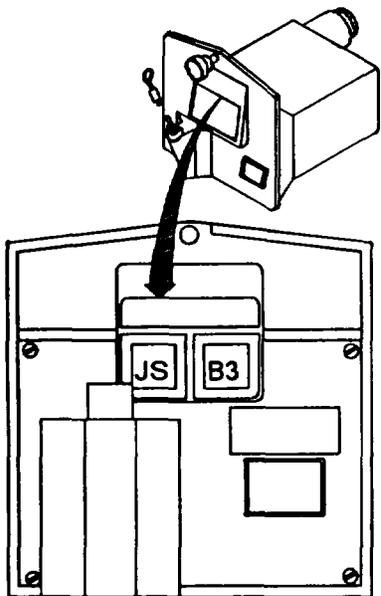
Figure 2-8. Decals and Instruction Plates (Sheet 1 of 2).



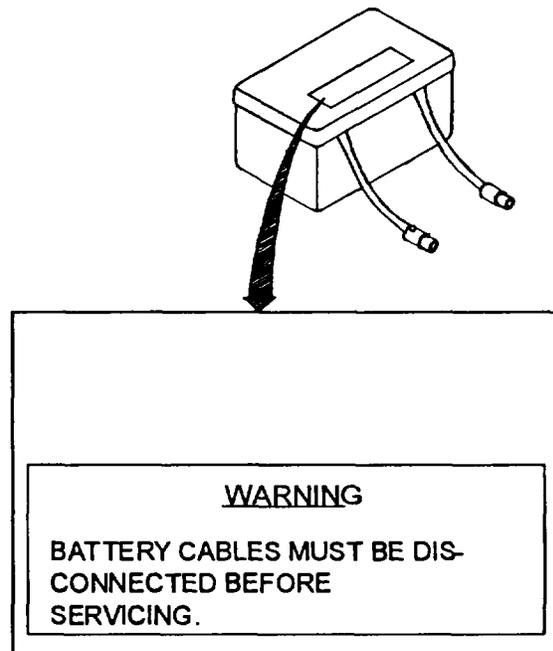
TRANSMITTER GROUP LETTER  
AND  
CHANNEL LETTER DECAL



BATTERY ELIMINATOR DECAL



RECEIVER GROUP LETTER  
AND  
CHANNEL LETTER AND  
RECEIVER NUMBER DECAL



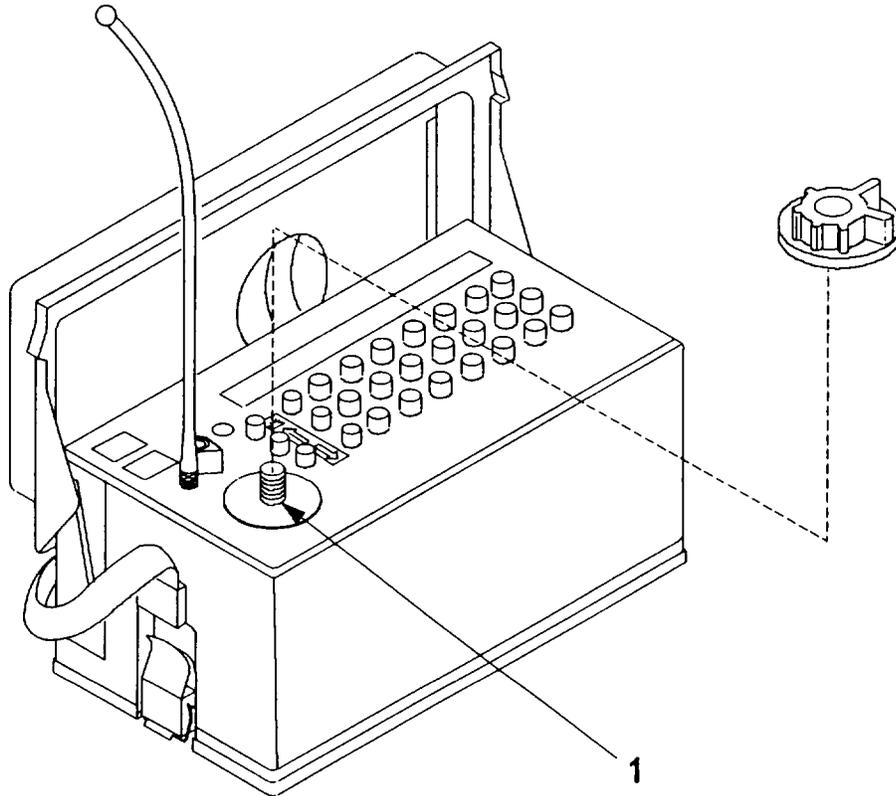
BATTERY BOX WARNING

Figure 2-8. Decals and Instruction Plates (Sheet 2 of 2).

**CHAPTER 3**  
**OPERATOR MAINTENANCE INSTRUCTIONS**  
**SECTION I. LUBRICATION INSTRUCTIONS**

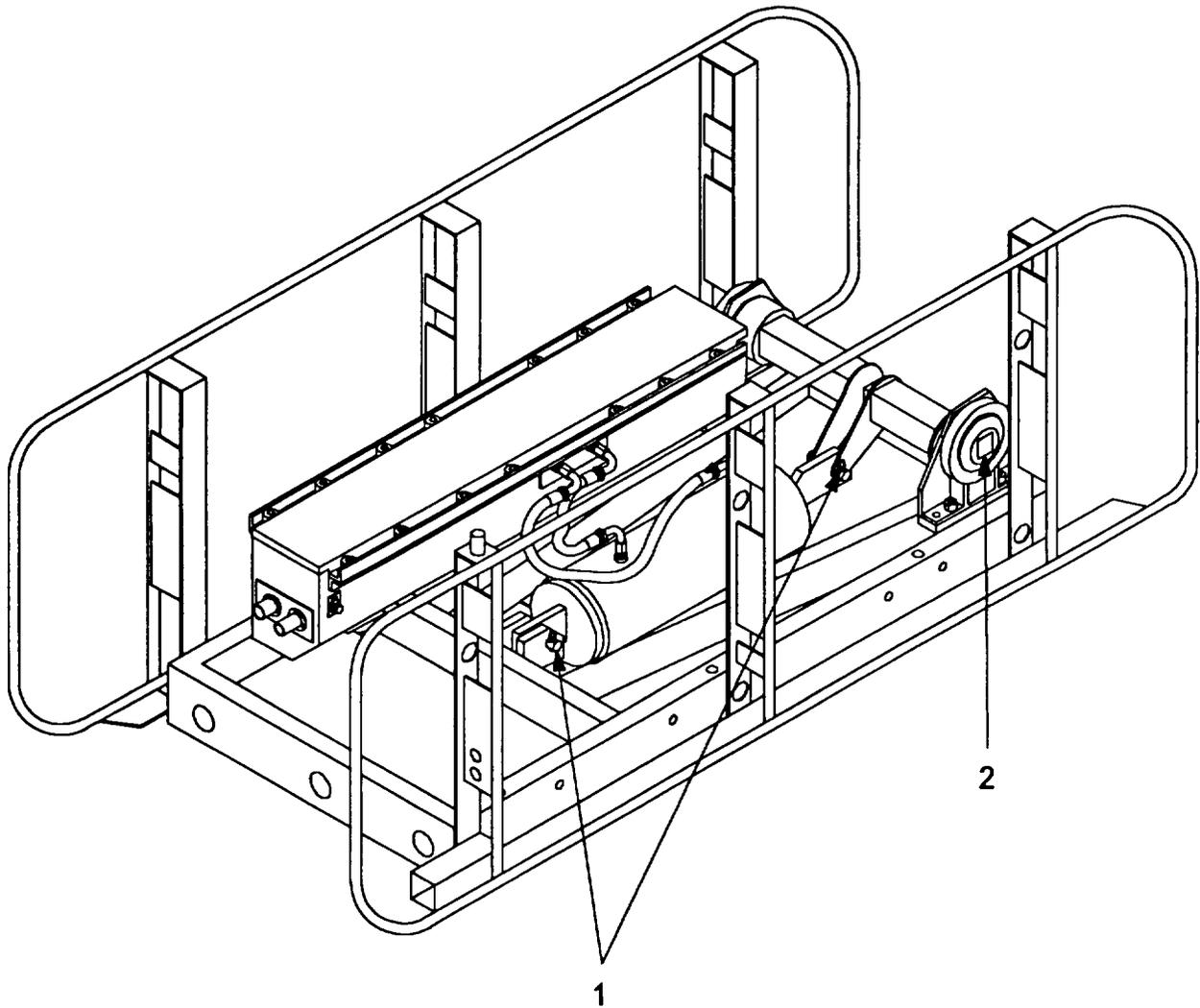
**3-1 LUBRICATION.**

**a. Monthly Lubrication.** Monthly lubrication of the transmitter consists of lightly oiling the select knob shaft (1) with lubricating oil W-L-800.



**b. Semiannual Lubrication.** Semiannual lubrication of the THM/TG consists of oiling the hydraulic cylinder bearing journals (1) with lubricating oil VV-L-800 and applying a thin coat of white petroleum NDC00168-0053-21 to the face of the shaft seals (2). This lubrication is performed every six months or when the units are removed for maintenance, whichever comes first.

3-1. LUBRICATION - Continued.



**SECTION II. OPERATOR TROUBLESHOOTING PROCEDURES**

3-2 GENERAL.

Operator troubleshooting of the THM/TG is limited to testing for proper operation of the unit and reporting any malfunctions to unit maintenance. To test the THM/TG, refer to paragraph 2-6.

**SECTION III. OPERATOR MAINTENANCE PROCEDURES**

3-3 INTRODUCTION.

Operator maintenance procedures consist of PMCS (refer to table 2-5) and charging the transmitter battery.

**3-4 TRANSMITTER BATTERY CHARGING.**

Nicad batteries require cycling in order to maintain full capacity. It is recommended that new batteries be cycled several times before use to attain full capacity. Used batteries sometimes exhibit memory problems and will require several cycles to regain full capacity. The battery charger provides for single cycle operation or continuous cycle for repeated discharge/charge. Single cycle operation discharges and recharges the battery one time. Continuous cycle operation discharges and recharges the battery as long as the unit is on. LED or lamp display indicates the status of the battery, charging, discharging, or ready. Battery chargers may differ. Refer to the operating instructions provided with battery charger.

**3-3/(3-4 blank)**

## CHAPTER 4

## UNIT MAINTENANCE INSTRUCTIONS

## SECTION I. SERVICE UPON RECEIPT

4-1 **GENERAL.**

The Target Holding Mechanism, Tank Gunnery (THM/TG) can be used with enhanced range control station or with the transmitter and receiver. It also can be used with the battery as the power source or with the battery eliminator. Refer to paragraph 2-5 for assembly and preparation for use.

**SECTION II. UNIT PREVENTIVE MAINTENANCE CHECKS AND SERVICES  
(PMCS)**4-2 **GENERAL.**

- a. **Corrosion.** Refer to paragraph 1-5.
- b. **Monthly Touchup/Spot Painting.** Painting is limited to touchup/spot painting.
- c. **Daily.** Always keep in mind the WARNINGS and CAUTIONS. Perform your daily (D) PMCS prior to the THM/TG performing its intended mission.
- d. **Weekly.** Always keep in mind the WARNINGS and CAUTIONS while you perform your weekly (W) PMCS.
- e. **Monthly.** Always keep in mind the WARNINGS and CAUTIONS while you perform your monthly (M) PMCS.
- f. **If Your Equipment Fails to Operate.** Troubleshoot with proper equipment. Report any deficiencies using the proper forms. See DA Pam 783-750.

4-3 **PMCS PROCEDURES.**

- a. **Preventive Maintenance Checks and Services Table.** Lists the inspections and care of your equipment required to keep it in good operating condition.
- b. **Item Number Column.** The item number column is used for reference. When completing, Equipment Inspection and Maintenance worksheet, include the item number for the check/service indicating a fault. Item numbers also appear in the order that you must do checks and services for intervals listed.
- c. **Interval Column.** The interval column tells you when to do a certain check or service.
- d. **Perform Weekly as Well as Before Operations PMCS if.**
  - (1) You are assigned operator and have not operated the THM/TG since the last weekly.
  - (2) You are operating the THM/TG for the first time.

4-3 **PMCS PROCEDURES - Continued.**e. **While You Perform PMCS, Have Tools with You and Keep an Eye Out for the Following.**

(1) **Loose Bolts.** A loose bolt can be difficult to spot without using a wrench. However, you can often identify loose bolts by observing loose or chipped paint around bolt head and bare metal or rust at its base. Tighten loose bolt and spot paint as required.

(2) **Damaged Welds.** Damaged welds may be detected by observing rust or chipped paint where cracks occur.

(3) **Frayed Electrical Wires and Loose Connectors.** Check electrical wiring for cracks due to aging and exposed wires that could cause an electrical short. Tighten loose clamps and connectors.

(4) **Corrosion.** Check for signs of deterioration, rust, unusual cracking, softening, swelling, or breaking.

f. **Leakage Definitions for PMCS Shall be Classified as Follows.**

<b>CAUTION</b>
----------------

**Equipment operation is allowable with minor leakages (Class I or II). Of course, you must consider the fluid capacity in the item/system being checked or inspected. When in doubt, notify your supervisor. When operating with Class I or Class II leaks, continue to check fluid levels as required in your PMCS.**

(1) Class I leakage is seepage of fluid (as indicated by wetness or discoloration) not great enough to form drops.

(2) Class II leakage is leakage of fluid great enough to form drops but not enough to cause drops to drip from item being checked/inspected.

(3) Class III leakage is leakage of fluid great enough to form drops that fall from item being checked/inspected. Class III leaks should be reported to your supervisor or direct support maintenance.

g. **Damage Definitions Are as Follows.**

(1) **Burr.** A raised portion, restricting the entrance of a part, component, or assembly.

(2) **Crack.** A narrow break or separation in material.

(3) **Gouge.** A groove or cavity in a sealing surface that cannot be repaired.

(4) **Nick.** An indentation caused by object(s) striking the material.

h. **The Item to be Checked or Serviced Column.** Identifies the item to be serviced.

i. **The Procedures Column.** Tells you how to do the required checks and services. Carefully follow these instructions. If you do not have the tools, or if the procedure tells you to, notify direct support maintenance.

j. **If Your Equipment Does Not Perform as Required.** Refer to the troubleshooting table for possible problems. Report any malfunctions or failures on DA Form 2404, or refer to DA Pam 738-750.

Table 4-1. Unit Preventive Maintenance Checks and Services.

ITEM NO.	INTERVAL			ITEM TO BE INSPECTED	PROCEDURES CHECK FOR AND HAVE REPAIRED OR ADJUSTED AS NECESSARY	Equipment is not ready/available if:
	B	D	A			
1	•			Radio Controlled THM/ TG Battery Service  	Remove battery box lid.  Disconnect power cables from battery box adapters.  <div style="border: 1px solid black; padding: 5px; text-align: center;"><b>WARNING</b></div> <p><b>Use gloves, apron, and goggles when handling batteries and electrolyte.</b></p> Remove caps from battery. Check battery cells for sufficient electrolyte. Refer to TM 9-6140-200-14. Add electrolyte as necessary. Refer to TM 9-6140-200-14. Using electrolyte tester, test electrolyte condition in each cell. Refer to TM 9-6140-200-14. Disconnect red and black cables from battery. Install battery caps. Remove battery from box before charging.  <div style="border: 1px solid black; padding: 5px; text-align: center;"><b>WARNING</b></div> <p>Battery caps must be off during charging. Remove battery caps from battery. Charge battery as necessary. Refer to TM 9-6140-200-14.</p> 	Electrolyte is below top of plates.  Electrolyte condition is poor.  Battery won't take or hold a charge.

Table 4-1. Unit Preventive Maintenance Checks and Services - Continued.

ITEM NO.	INTERVAL			ITEM TO BE INSPECTED	PROCEDURES CHECK FOR AND HAVE REPAIRED OR ADJUSTED AS NECESSARY	Equipment is not ready/available if:
	B	D	A			
1 (cont)	•			<p>After charging, wait a minimum of two hours before installing battery caps.</p> 	<p><b>NOTE</b></p> <p>Install battery caps.</p> <p>Check terminals for corrosion.</p> <p>Clean as necessary.</p> <p><b>WARNING</b></p> <p><b>Chemicals can cause serious injuries or burns to personnel. Batteries contain sulfuric acid.</b></p> <p>Wipe down exterior of battery. Install battery in battery box. Connect red and black battery cables to battery. Install battery box lid. Remove battery box lid.</p>	<p>Terminals are corroded.</p>
2	•			<p>Computer Controlled (ERETS) THM/TG Battery Service</p> 	<p>Disconnect power cables from battery box adapters.</p> <p><b>WARNING</b></p> <p><b>Use gloves, apron, and goggles when handling batteries and electrolyte.</b></p> <p>Remove caps from battery. Check battery cells for sufficient electrolyte. Refer to TM 9-6140-200-14. Add electrolyte as necessary. Refer to TM 9-6140-200-14.</p>	<p>Electrolyte is below top of plates.</p>

Table 4-1. Unit Preventive Maintenance Checks and Services - Continued.

ITEM NO.	INTERVAL			ITEM TO BE INSPECTED	PROCEDURES CHECK FOR AND HAVE REPAIRED OR ADJUSTED AS NECESSARY	Equipment is not ready/available if:
	B	D	A			
3	•			Hydraulic Unit	<p>Using electrolyte tester, test electrolyte condition in each cell. Refer to TM 9-6140-200-14. Move target to down position.</p> <p>Turn FUNCTION switch to O position. Remove access door assembly. Disconnect cables from rear of control assembly. Remove 14 screws, lockwashers, and flatwashers from hydraulic unit cover. Remove cover from hydraulic unit. Unscrew and remove breather from motor assembly. Add hydraulic fluid as necessary to bring fluid level to 1/2 in (13 mm) from top of breather hole. Apply a thin coat of white petroleum to the threads of the breather and install breather on motor assembly. Check connections on suppression board for tightness. Check hydraulic unit for cracks. Connect cables to control assembly. Apply a bead of white petroleum around the gasket on the hydraulic unit cover. Position cover on hydraulic unit. Install 14 flatwashers, lockwashers, and screws in hydraulic unit cover. Install access door assembly.</p>	<p>Electrolyte condition is poor.</p> <p>Fluid is below 1/2 in. (13 mm) from top.</p>
4	•			Cables	<p>Inspect all cables for damage or loose connections.</p>	<p>Connections are damaged or loose.</p>

SECTION III. TROUBLESHOOTING PROCEDURES

4-4 TROUBLESHOOTING PROCEDURES.

Table 4-2 lists the common malfunctions that you may find during operation or maintenance of the THM/TG. You should perform the test/inspections and corrective actions in the order listed. Before you begin troubleshooting the THM/TG, ensure that operator and unit PMCS have been performed. The following procedures are based on the premise that operator and unit PMCS have been completed. If in doubt, perform PMCS in accordance with the procedures described in table 2-4 and table 4-1. This manual cannot list all the malfunctions that may occur nor all the tests or inspections and corrective actions. Notify your supervisor if a malfunction persists and cannot be corrected by prescribed action.



Personnel working with or near high voltages must be trained and certified in mouth-to-mouth and cardiopulmonary resuscitation. Installation medical activities shall provide certified instructors. Newly assigned maintenance personnel must be trained as soon as practical. Make sure at least two persons are in the area at all times when work is being performed on exposed live circuits carrying 30 volts or more.

**Malfunction Index**

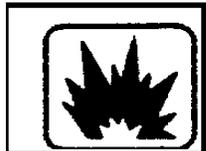
	<b>Malfunction</b>
Target will not raise or lower by TEST switch	1
Target goes down but will not respond to up commands from TEST switch	2
Target does not respond to hits	3
Target will not respond to RCS commands	4
Lamp assembly does not flash when hit occurs	5
Target will not respond to radio transmitter commands	6
Target operates too slowly	7
ATKS does not fire in HOSTILE FIRE/SMOKE SCORER mode	8
Control assembly is inoperative	9
No supply voltage from battery eliminator assembly connectors P1 and P2	10
No control voltage from battery eliminator connector J1	11

*Table 4-2. Unit Troubleshooting Procedures.*

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**MALFUNCTION  
TEST OR INSPECTION  
CORRECTIVE ACTION**

1. Target will not raise or lower by TEST switch.



Disarm, then disconnect the ATKS connection from control assembly on TTA or TIU. The ATKS must be disconnected from TTA before performing maintenance. Explosion is possible and can cause personal injury and damage to equipment. Pyrotechnics are used during range operation.

**TABLE 4-2. UNIT TROUBLESHOOTING PROCEDURES.**

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
Step 1.	Check all cables for serviceability. Ensure all cables are properly and securely connected and circuit breakers are in the ON position (see FO-1, FO-2, or FO-3).	
Step 2.	Ensure that FUNCTION switch is in any position except 0.	
Step 3.	Using TEST switch, attempt to raise or lower target. Target should respond and BATTERY lamp should steadily illuminate.	
	If target responds to TEST switch, THM/TG is operational.	
	<b>NOTE</b>	
	<b>On radio controlled versions, the THM/TG can operate with a battery as low as 9.5 vdc. Therefore readings may be less on radio versions, depending on battery charge.</b>	
	With radio/computer controlled battery operated models, if battery lamp flashes when the test switch is used, use multimeter to check for 12 vdc on computer controlled versions or for a minimum of 9.5 vdc on radio controlled versions. If voltage is present, proceed to step 4.	
	On the radio controlled model, if a minimum of 9.5 vdc is not present, the battery needs charging. Refer to TM 9-6140-200-14.	
	On the computer controlled model, if 12 vdc is not present, the battery needs replacing or check TIU trickle charge circuit. Refer to TM 9-6920-742-14-4.	
	With battery-eliminator-operated model, if BATTERY lamp flashes when the TEST switch is used, refer to next level of maintenance.	
	With radio-controlled model, if target does not respond to TEST switch and BATTERY lamp is steadily illuminated, remove fuse. Set multimeter to measure ohms and test fuse for continuity.	
	If fuse is good, proceed to step 4.	
	If fuse is bad, replace in accordance with paragraph 4-16 and retest.	
Step 4.	Set function switch to position 0.	
Step 5.	Remove access door.	
Step 6.	Remove hydraulic unit cover. Check that hydraulic fluid level is no more than ½ inch (13 mm) from bottom of filler spout.	
	If fluid level is correct, proceed to step 7.	
	If fluid level is low, service in accordance with table 2-4 and retest.	

Table 4-2. Unit Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
Step 7.	Remove all hit sensor connections from the ECU and place test switch in the UP position. If target moves to the up position, a hit sensor is defective. Proceed to step 8.	If target does not move to the UP position replace ECU (IAW para 4-15) with a known good one and retest. If problem is not corrected refer to next higher level of maintenance.
Step 8.	Set function switch to position 0. Connect a hit sensor and set function switch to position 5. Tap hit sensor.	If target does not move to the down position, that hit sensor is defective. Replace IAW para 4-7 and retest.
Step 9.	Repeat step 8 for remaining two hit sensors. Replace defective hit sensors and retest.	

2. Target goes down but will not respond to up commands from TEST switch.

**WARNING**



Disarm, then disconnect the ATKS connection from control assembly on TTA or TIU. The ATKS must be disconnected from TTA before performing maintenance. Explosion is possible and can cause personal injury and damage to equipment. Pyrotechnics are used during range operation.

Step 1. Set FUNCTION switch to position 2 and place TEST switch in the UP position. The target should move to the UP position.

If target moves to the UP position, target is operational.

If target does not move to the UP position, proceed to step 2.

Step 2. Remove all hit sensors and place TEST switch in the UP position.

If target moves to the UP position, a hit sensor is defective. Proceed to step 3.

If target does not move to the UP position, replace ECU (IAW para 4-15) with a known good one and retest. If problem is not corrected, refer to next higher level of maintenance.

Step 3. Set FUNCTION switch to position 0. Connect a hit sensor and set FUNCTION switch to position 2. Tap hit sensor.

If target does not move to the DOWN position, that hit sensor is defective. Replace in accordance with paragraph 4-7 and retest.

Table 4-2. Unit Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
Step 4.	Repeat step 3 for remaining two hit sensors. Replace defective hit sensors and retest.	

3. Target does not respond to hits.

**WARNING**



Disarm, then disconnect the ATKS connection from control assembly on

**TTA or TIU. The ATKS must be disconnected from TTA before performing maintenance. Explosion is possible and can cause personal injury and damage to equipment. Pyrotechnics are used during range operation.**

- Step 1. With target in the UP position, ensure that hit sensors are securely mounted to target and hit sensor connectors are properly attached to control assembly.
- Step 2. Place FUNCTION switch in position 3, 5, or 6.
- Step 3. Simulate a hit by tapping hit sensors one at a time. The target should move to the DOWN position for each hit sensor.

If target moves to DOWN position, target is responding properly to hits.

If target moves to DOWN position with one hit sensor but not another, replace the defective hit sensor in accordance with paragraph 4-7 and retest.

If target still fails to move to DOWN position, swap out the ECU with a known good one, or refer to next higher level of maintenance if problem isn't corrected.

#### **4. Target will not respond to RCS commands.**

##### **WARNING**



Disarm, then disconnect the ATKS connection from control assembly on TTA or TIU. The ATKS must be disconnected from TTA before performing maintenance. Explosion is possible and can cause personal injury and damage to equipment. Pyrotechnics are used during range operation.

- Step 1. Instruct RCS operator to command other THM/TGs on the range.

If other THM/TGs respond to RCS commands, proceed to step 2.

If no THM/TGs respond to RCS commands, the problem is outside the THMITG. Refer to TM 9-6920-742-14-1.

Table 4-2. Unit Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
Step 2.	Ensure FUNCTION switch is in any position other than 0. Place TEST switch in UP or DOWN position.	<p>If target moves to the UP or DOWN position, proceed to step 3.</p> <p>If target fails to respond to the TEST switch, proceed to malfunction 1.</p>
Step 3.	Check all cables for serviceability. Ensure all cables are properly and securely connected and retest. Refer to FO-2 or FO-3.	<p>If target still fails to respond to RCS commands, check target address in TIU and retest. Refer to TM 9-6920-742-14-4.</p> <p>If target still fails to respond to RCS commands, replace TIU and retest. Refer to TM 9-6920-742-1 4-4.</p> <p>If target still fails to respond to RCS commands, refer to next higher level of maintenance.</p>

#### 5. Lamp assembly does not flash when hit occurs.

#### WARNING



**Disarm, then disconnect the ATKS connection from control assembly on TTA or TIU. The ATKS must be disconnected from TTA before performing maintenance. Explosion is possible and can cause personal injury and damage to equipment. Pyrotechnics are used during range operation.**

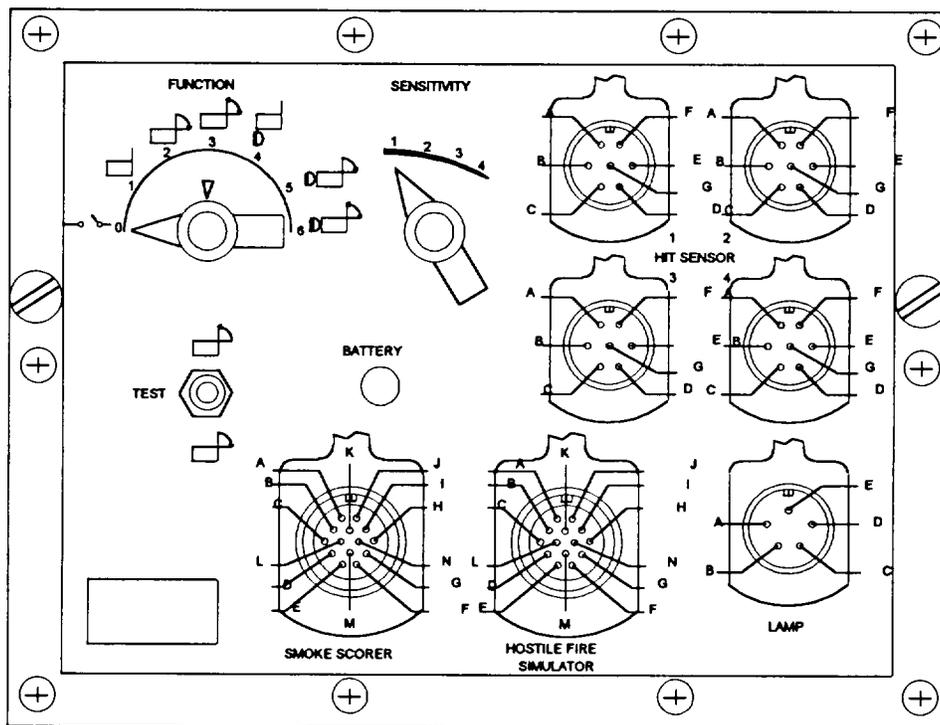
- Step 1. Set FUNCTION switch to position 6. Place TEST switch in UP position. As target moves upward, lamp assembly should blink.
- If lamp assembly blinks, refer to next higher level of maintenance.
- If lamp assembly fails to blink, proceed to step 2.
- Step 2. Disconnect lamp assembly from ST3. Set multimeter to measure 12 vdc. Connect multimeter positive lead to ST3 pin B and negative lead to pin A (ground). Refer to FO-4. Place TEST switch in the UP position. Multimeter should indicate 12 vdc on computer controlled versions or a minimum of 9.5 vdc on radio controlled versions.

Table 4-2. Unit Troubleshooting Procedures - Continued.

**MALFUNCTION**  
**TEST OR INSPECTION**  
**CORRECTIVE ACTION**

**NOTE**

On radio controlled versions, the THMITG can operate with a battery as low as 9.5 vdc. Therefore, readings may be less on radio versions, depending on battery charge.



If multimeter indication is correct, repair or replace lamp assembly in accordance with paragraph 4-18 and retest.

If multimeter indication is incorrect, replace control assembly (refer to paragraph 4-15) or refer to next higher level of maintenance.

**6. Target will not respond to radio transmitter commands.**

**WARNING**

Disarm, then disconnect the ATKS connection from control assembly on TTA or TIU. The ATKS must be disconnected from TTA before performing maintenance. Explosion is possible and can cause personal injury and damage to equipment. Pyrotechnics are used during range operation.



Table 4-2. Unit Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION	NOTE
			<b>THM/TG must operate with TEST switch prior to performing this malfunction. If THMITG does not operate with TEST switch, proceed to malfunction 1.</b>
	Step 1. Set FUNCTION switch to position 4. Using the transmitter, attempt to move the target to the UP position while observing the transmitter BATTERY lamp.		If target fails to move to the UP position and transmitter BATTERY lamp flashes or fails to illuminate, recharge battery in accordance with paragraph 3-4 and retest.
			If target fails to move to the UP position and transmitter BATTERY lamp illuminates continuously, proceed to step 2.
	Step 2. Check that transmitter and receiver display the same group letter and channel number decal.		Correct if necessary.
	Step 3. Check that transmitter CHANNEL SELECT matches channel of receiver.		Correct if necessary.
	Step 4. Check that receiver and transmitter antennas are properly mounted and not screened-off.		Correct if necessary.
	Step 5. Using the transmitter, again attempt to move target to the UP position.		If target still fails to move to the UP position, replace transmitter in accordance with paragraph 2-5 and retest.
			If target still fails to move to the UP position, replace receiver in accordance with paragraph 4-23 and retest.
			If target still fails to move to the UP position, check for continuity of receiver cable.
			Refer to FO-5. If continuity is not found, replace cable in accordance with paragraph 4-16.

Table 4-2. Unit troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
7. Target operates too slowly.		<p style="text-align: center;"><b>WARNING</b></p> <p>Disarm, then disconnect the ATKs connection from control assembly on TTA or TIU. The ATKs must be disconnected from TTA before performing maintenance. Explosion is possible and can cause personal injury and damage to equipment. Pyrotechnics are used during range operation.</p>
	Step 1.	Check all cables for serviceability. Ensure all cables are properly and securely connected. Refer to FO-1, FO-2, or FO-3.
	Step 2.	Ensure that FUNCTION switch is in any position except 0.
	Step 3.	Using TEST switch, raise or lower target. Target should reach limit within 9-13 seconds and BATTERY lamp should steadily illuminate. If target responds properly to TEST switch, THM/TG is operational.
		<b>NOTE</b>
		<b>On radio controlled versions, the THMITG can operate with a battery as low as 9.5 vdc. Therefore, readings may be less on radio versions, depending on battery charge.</b>
		With radio/computer controlled battery operated models, if battery lamp flashes when the test switch is used, use multimeter to check for 12 vdc on computer controlled versions or for a minimum of 9.5 vdc on radio controlled versions.
		On the radio controlled model, if a minimum of 9.5 vdc is not present, the battery needs charging. Refer to TM 9-6140-200-14.
		On the computer controlled model, if 12 vdc is not present the battery needs replacing or check TIU trickle charge circuit. Refer to TM 9-6920-742-14-4.
		With battery-eliminator-operated model, if BATTERY lamp flashes when the TEST switch is used, refer to next higher level of maintenance.
	Step 4.	Check that hydraulic fluid level is 1/2 (13 mm) inch from bottom of filler spout.
		If fluid level is correct, refer to next higher level of maintenance.
		If fluid level is low, inspect hydraulic system for leaks. Refer to paragraph 4-3f. Repair or replace any leaking hardware and service in accordance with paragraph 2-4 and retest.

Table 4-2. Unit Troubleshooting Procedures.

**MALFUNCTION**  
**TEST OR INSPECTION**  
**CORRECTIVE ACTION**

8. ATKS does not fire in HOSTILE FIRE OR SMOKE SCORER mode.

**WARNING**



Disarm, then disconnect the ATKS connection from control assembly on TTA or TIU. The ATKS must be disconnected from TTA before performing maintenance. Explosion is possible and can cause personal injury and damage to equipment. Pyrotechnics are used during range operation.

**NOTE**

During the next tests, if the TIU is connected to ST1, the checks are to be made on ST2. If the TIU is connected, to ST2 checks are to be made on ST1.

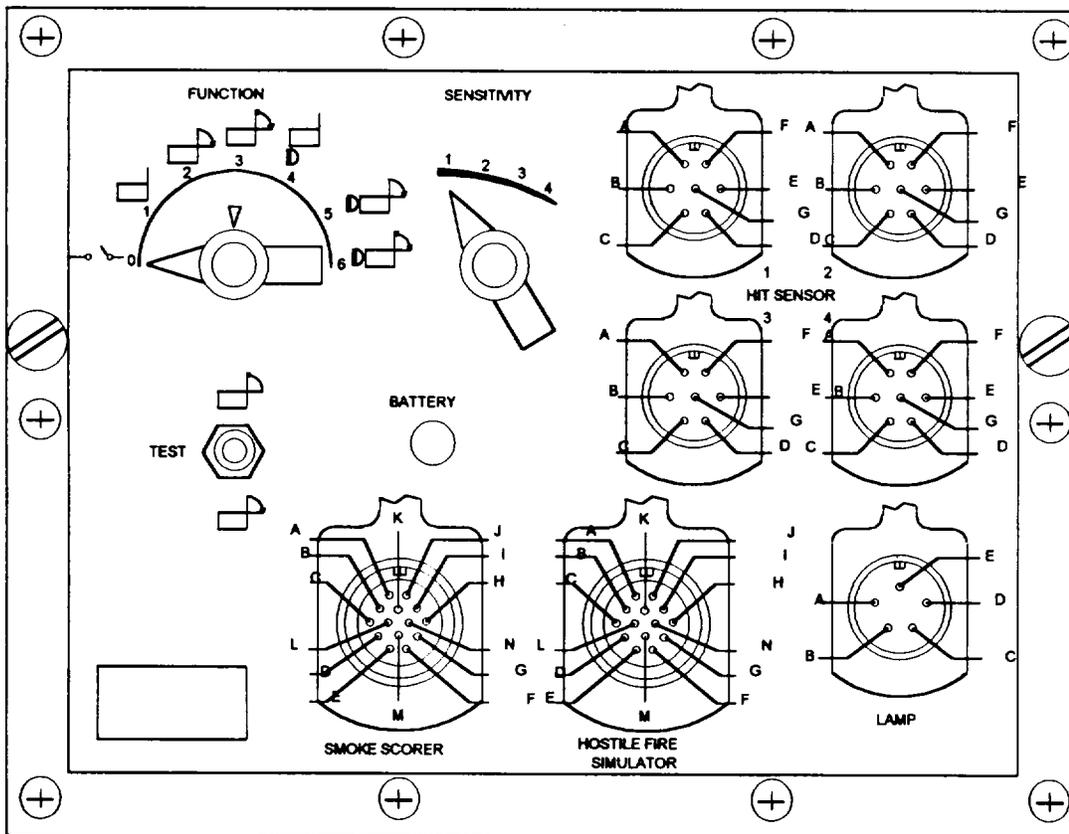


Table 4-2. Unit Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
Step 1.	Remove power. Disarm and disconnect ATKS.	
Step 2.	Set multimeter to measure ohms on the x10 scale. Set FUNCTION switch in position 6. Place multimeter positive lead on ST1/ST2 pin M and negative lead to ST1/ST2 pin N. Refer to FO-4. Momentarily connect a test wire with alligator clips between ST1/ST2 pins K and E. Multimeter should indicate continuity.	
	If multimeter indication is correct, remove power. Check continuity between ST1/ST2 pin E and P1 pin E. If continuity is not found, replace the control assembly (refer to paragraph 4-15) or refer to next higher level of maintenance.	
	If continuity is found, hostile fire/smoke scorer circuits are operational, problem is in the ATKS, refer to TM 9-6920-742-14-2.	

9. Control assembly is inoperative.

**WARNING**



Disarm, then disconnect the ATKS connection from control assembly on TTA or TIU. The ATKS must be disconnected from TTA before performing maintenance. Explosion is possible and can cause personal injury and damage to equipment. Pyrotechnics are used during range operation.

**NOTE**

Control assembly must be installed in an operational THM/TG to perform this malfunction. If a battery-operated model is used, ensure battery is fully charged in accordance with TM 9-6140-200-14.

**NOTE**

During the next tests, if the TIU is connected to ST1, the checks are to be made on ST2. If the TIU is connected to ST2, checks are to be made on ST1.

- Step 1. Set SENSITIVITY switch in position 2 and FUNCTION switch in position 1. Place TEST switch in the UP position. Target should move to the UP position and remain up.
- If target moves to the UP position and remains up, proceed to step 2.
- If target fails to move to the UP position, proceed to malfunction 2.
- Step 2. Place TEST switch in the DOWN position. Target should move to the DOWN position.
- If target moves to the DOWN position, proceed to step 3.

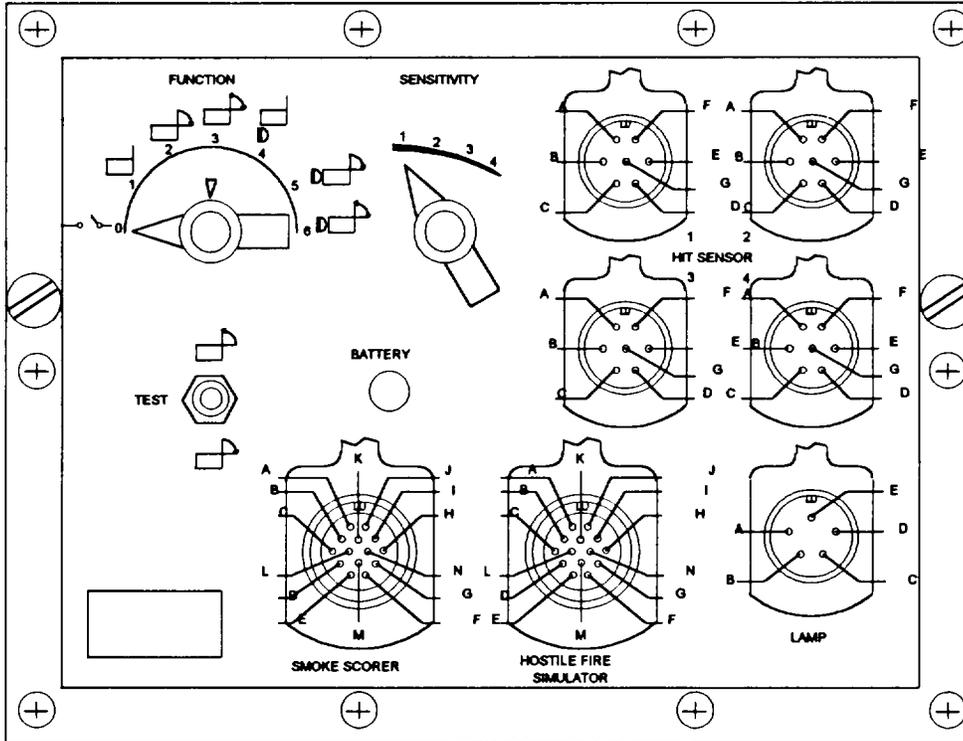
Table 4-2. Unit troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
		If target fails to move to the DOWN position, refer to next higher level of maintenance.
Step 3.	Set FUNCTION switch to position 4. Place TEST switch in the UP position. Target should raise and LAMP assembly blink.	
		If lamp assembly blinks, proceed to step 4.
		If lamp assembly fails to blink, proceed to malfunction 5.
Step 4.	Tap hit sensor on a solid surface. LAMP assembly should flash and the target remain in the UP position.	
		If lamp assembly flashes and target remains in the UP position, proceed to step 5.
		If lamp assembly fails to flash, move SENSITIVITY switch setting to position 1 and retest.
		If lamp assembly still fails to flash, proceed to malfunction 5. If lamp assembly now flashes, SENSITIVITY switch is defective. Replace control assembly (refer to paragraph 4-15) or refer to next higher level of maintenance.
		If target moves to the DOWN position, proceed to malfunction 4.
Step 5.	Set FUNCTION switch to position 5 and tap hit sensor on a solid surface. LAMP assembly should flash and target should move to the DOWN position and remain down.	
		If THM/TG responds correctly, proceed to step 6.
		If THM/TG fails to move to the DOWN position, proceed to malfunction 3.
Step 6.	Set FUNCTION switch to position 6. Set SENSITIVITY switch to position 4. Place TEST switch in the UP position. After target reaches the UP position, tap hit sensor on a solid surface. Lamp assembly should flash and target should move to the DOWN position. Within 9-13 seconds, target should move to the UP position and remain up.	
		If target responds correctly, proceed to step 7.
		If target fails to move to the DOWN position, proceed to malfunction 3.
		If target goes down but fails to return to the UP position within 9-13 seconds, refer to next higher level of maintenance.

Table 4-2. Unit Troubleshooting Procedures - Continued.

**MALFUNCTION  
TEST OR INSPECTION  
CORRECTIVE ACTION**

Step 7. Set multimeter to measure 2.5 vdc. Place multimeter positive lead on ST1 pin G and negative lead on chassis ground. Refer to FO-4. Tap hit sensor on a solid surface. Multimeter should deflect up scale.



If multimeter responds correctly, proceed to step 8.

If multimeter does not respond correctly, proceed to malfunction 4.

**NOTE**

**During the next tests, if the TIU is connected to ST1, the checks are to be made on ST2. If the TIU is connected to ST2, checks are to be made on ST1.**

Step 8. Set multimeter to measure ohms on the x10 scale. Place multimeter positive lead to ST2 pin M and negative lead to ST2 pin N. Refer to FO-4. Momentarily connect a test wire with alligator clips between ST2 pins K and E. Multimeter should indicate continuity.

If multimeter indication is correct, proceed to step 9.

If multimeter indication is incorrect, proceed to malfunction 8.

Table 4-2. Unit Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
Step 9.	Set multimeter to measure ohms on the xO1 scale. Place multimeter positive lead to ST1 pin M and negative lead to ST1 pin N. Tap hit sensor on a solid surface. Multimeter should indicate continuity.	<p>If multimeter indication is correct, proceed to step 10.</p> <p>If multimeter indication is incorrect, refer to next higher level of maintenance.</p>
Step 10.	Set FUNCTION switch to position 6 and SENSITIVITY switch to position 4. Place TEST switch in the DOWN position. As target responds to the TEST switch, BATTERY lamp should steadily illuminate.	<p>If BATTERY lamp steadily illuminates (no flashes), refer to next level of maintenance.</p> <p>If BATTERY lamp flashes or fails to illuminate, refer to next higher level of maintenance.</p>
<b>10. No supply voltage from battery eliminator assembly connectors P1 and P2.</b>		
Step 1.	Set CB1 to the ON position.	<p>If CB1 remains in the ON position, proceed to step 3.</p> <p>If CB1 will not remain in the on position, refer to next higher level of maintenance.</p>
Step 2.	Set multimeter to measure 12 vdc. Place multimeter positive lead on P1 and negative lead on ground. Refer to FO-3. Multimeter should indicate 12 vdc.	<p>If multimeter indication is correct, proceed to step 3.</p> <p>If multimeter indication is incorrect, refer to next higher level of maintenance.</p>
Step 3.	Set multimeter to measure 12 vdc. Place multimeter positive lead on P1 and negative lead on P2. Multimeter should indicate 12 vdc.	<p>If multimeter indication is correct, battery eliminator supply voltage circuit is operational.</p> <p>If multimeter indication is incorrect, refer to next higher level of maintenance.</p>

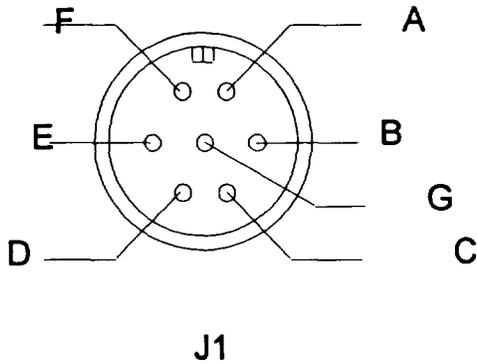
Table 4-2. Unit Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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11. No control voltage from battery eliminator connector J1.

Step 1. Ensure that supply voltage is present at terminals P1 and P2. Refer to malfunction 10.

Step 2. Set multimeter to measure 12 vdc. Place multimeter positive lead on Ji pin B and negative lead on ground. Multimeter should indicate 12 vdc. Place multimeter positive lead on J1 pin C and negative lead on ground. Multimeter should indicate 12 vdc.



If multimeter indications are correct, battery eliminator control voltage circuits are operational. Check continuity of cable to control assembly and replace as necessary.

If any multimeter indications are incorrect, refer to next higher level of maintenance.

**SECTION IV. UNIT MAINTENANCE PROCEDURES**

**4-5 GENERAL.**

This section contains the instructions for removal, repair, and installation of major components of the THM/TG. The instructions consist of the initial setup and step-by-step procedures to perform the task.

**WARNING**



**Disarm, then disconnect the ATKS connection from control assembly on TTA or TIU. The ATKS must be disconnected from TTA before performing maintenance. Explosion is possible and can cause personal injury and damage to equipment. Pyrotechnics are used during range operation.**

**NOTE**

**Use new self-locking nuts during reassembly or installation procedures.**

**4-6 BLACK AND RED POWER CABLES REPLACEMENT (9375734 and 9375737).**

**INITIAL SETUP**

**Materials/Parts:**

Power Cable (black) (9375734)  
Cable Assembly (red) (9375737)

**Equipment Condition:**

Power off and disconnected  
(Reference paragraph 2-7)

**Personnel Required:**

1 Person

**References:**

Paragraph 2-7

**a. Removal.**

- (1) Place the THM/TG control assembly FUNCTION switch in the O position.
- (2) Disconnect power cables from battery box cable adapters or battery eliminator D.C. OUTPUT connections.
- (3) Disconnect power cables from tank target assembly.

**b. Installation.**

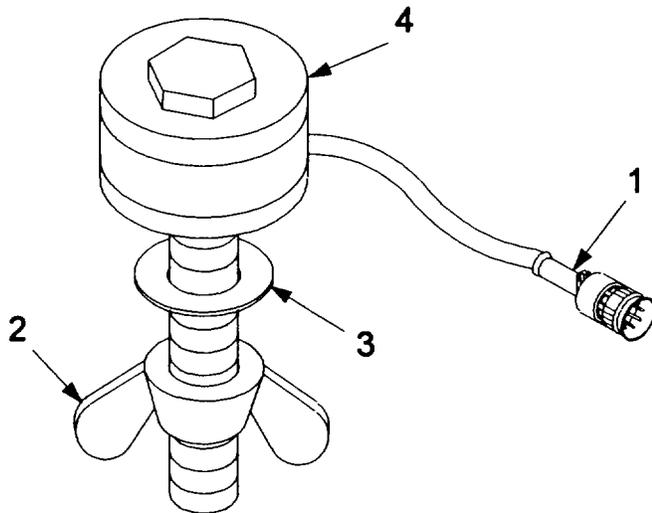
- (1) Connect power cables to tank target assembly.
- (2) Connect power cables to battery box cable adapters or battery eliminator D.C. OUTPUT connections.
- (3) Apply power and test/operate the THM/TG in accordance with paragraph 2-7.

**4-7 HIT SENSOR ASSEMBLY REPLACEMENT (12599363).****INITIAL SETUP****Materials/Parts:**

Hit Sensor (12599363)

**Equipment Condition:**Power off and disconnected  
(reference paragraph 2-7)**Personnel Required:**

1 Person

**References:**Paragraph 2-6  
Paragraph 2-7**a. Removal.**

- (1) Place the THM/TG control assembly FUNCTION switch in the O position.
- (2) Disconnect cable assembly connector (1) from control assembly.
- (3) Loosen wingnut (2) and remove flatwasher (3) and hit sensor assembly (4) from hole in target.

**b. Installation.**

- (1) Install hit sensor assembly (4) through hole in target. Position flatwasher (3) on shaft and tighten wingnut (2).

**CAUTION**

**Hit sensor cable must be clear of moving target frames to prevent damage.**

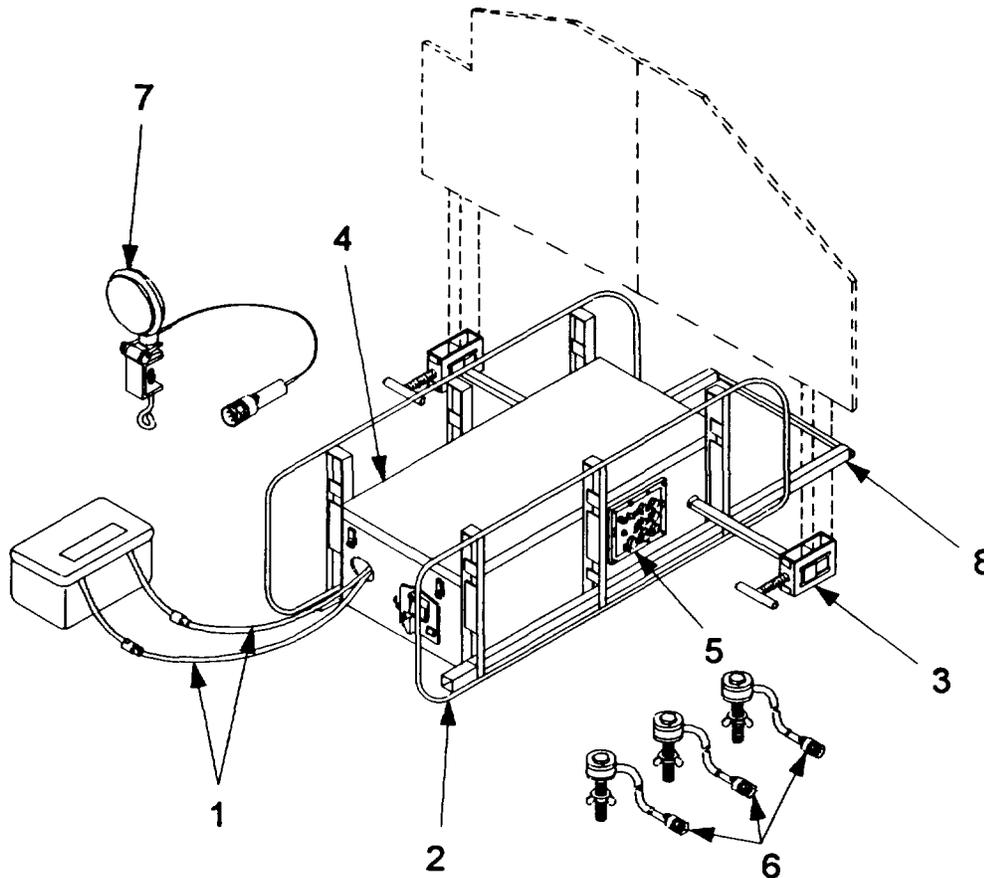
- (2) Connect hit sensor cable assembly connector (1) to hit sensor connector on control assembly.
- (3) Apply power and test/operate. Reference paragraphs 2-7 and 2-6.

**4-8 TANK TARGET ASSEMBLY REPLACEMENT (11784502).****INITIAL SETUP****Materials/ Parts:**

Tank Target Assembly (11784502)

**Equipment Condition:**Equipment shut down  
(reference paragraph 2-7)**Personnel Required:**

4 Persons

**References:**Paragraph 2-7  
Paragraph 4-13  
Paragraph 4-24  
Paragraph 4-9**a. Removal.**

- (1) Turn FUNCTION switch on THM/TG control assembly to the O position.
- (2) Disconnect red and black power cables (1) from battery box cable adapters or battery eliminator.
- (3) Disconnect red and black power cables from tank target assembly (2).
- (4) Disconnect hit sensor assemblies (6) from the front of the control assembly.

- (5) Remove hit sensors from target.
- (6) Remove target from target frame (3).
- (7) Remove target frame from tank target assembly. Refer to paragraph 4-13.

**NOTE**

**If retaining original radio receiver, remove receiver in accordance with paragraph 4-24.**

**NOTE**

**Steps (8) through (12) pertain to computer-controlled THM/TG only.**

- (8) Remove access door (4). Refer to paragraph 4-9.
- (9) Disconnect plug P2 of cable W107 from rear of control assembly (5).
- (10) Disconnect plug P4 of cable W107 from limit switch cable.
- (11) Install access door.
- (12) Disconnect plug P3 of cable W107 from the front of the control assembly SMOKE SCORER/HOSTILE FIRE connector.
- (13) Disconnect lamp assembly connector (7) from the front of the control assembly.
- (14) Disconnect any simulators from the front of control assembly.
- (15) Retract stabilizer (8).
- (16) Using four persons, remove tank target assembly.

**b. Installation.**

- (1) Using four persons, place tank target assembly (2) in position.
- (2) Extend stabilizer.
- (3) Ensure FUNCTION switch is on position 0.
- (4) Connect lamp assembly (7) to control assembly (5).

**NOTE**

**Steps (5) through (9) pertain to the computer-controlled THMITG only.**

- (5) Connect plug P3 of cable W107 to SMOKE SCORER/HOSTILE FIRE connection on front of control assembly.
- (6) Remove access door (4).

**4-8 TANK TARGET ASSEMBLY REPLACEMENT (11784502). - Continued.**

- (7) Connect plug P2 of cable W107 to rear of control assembly.
- (8) Connect plug P4 of cable W107 to limit switch cable.

**NOTE**

**If original radio receiver was retained, install receiver in accordance with paragraph 4-24.**

- (9) Install access door. Refer to paragraph 4-9.
- (10) Install target frame in tank target assembly. Refer to paragraph 4-13.
- (11) Install target in target frame by doing the following:
  - (a) Ensure FUNCTION switch is set to O and the target arm is in the down position.
  - (b) Ensure target arm is free of obstruction which may inhibit target movement.

**CAUTION**

**Target must be centered and the clamp screws tight to prevent damage to the equipment.**

- (c) Connect the target arms to the THM/TG housing and secure the target to the target arm mounting clamps.
- (12) Install hit sensors on target.
- (13) Connect hit sensor assemblies (6) to front of control assembly.
- (14) Connect red and black power cables (1) to tank target assembly (2).
- (15) Connect red and black power cables to battery box cable adapters or battery eliminator D.C. OUTPUT connections.
- (16) Reapply power. Refer to paragraph 2-7.
- (17) Test/operate tank target assembly using TEST switch. Reference paragraph 2-7.
- (18) Connect other simulators as required.

**4-9 ACCESS DOOR REPLACEMENT (11784606).****INITIAL SETUP****Materials/ Parts:**

Access door (11784606)

**Equipment Condition:**Equipment shut down  
(reference paragraph 2-7)**Personnel Required:**

1 Person

**References:**Paragraph 4-12  
Paragraph 2-7

---

**a. Removal.**

- (1) Release four clamping catches.
- (2) Remove access door from tank target assembly.

**NOTE****Access door does not come with catches attached.**

- (3) If new access door is to be used, remove upper half of clamping catch. Refer to paragraph 4-12.

**b. Installation.**

- (1) If new access door is to be used, install upper half of clamping catch. Refer to paragraph 4-12.
- (2) Install access door on tank target assembly.
- (3) Fasten four clamping catches.
- (4) Reapply power. Refer to paragraph 2-7.

**4-10 SIDE COVER REPLACEMENT (11784611).****INITIAL SETUP****Tools:**

General Mechanic's Automotive Tool Kit

**Materials/Parts:**

Side Cover (11784611)

White Petroleum (NDC00168-0053-21)

Tie Down Strap (MS3367-1-2)

**Personnel Required:**

2 Persons

**Equipment Condition:**

Equipment shut down and power disconnected (reference paragraph 2-7)

Target removed (reference paragraph 2-5d)

Target frames removed (reference paragraph 4-13)

Access door removed (reference paragraph 4-9)

**References:**

Paragraph 4-9

Paragraph 4-13

Paragraph 2-5d

Paragraph 2-7

**a. Removal.**

- (1) Disconnect red and black power cables from the tank target assembly.
- (2) Tag and disconnect all cables from rear of control assembly.
- (3) Loosen two thumbscrews (1) and remove control assembly (2).
- (4) Cut tiedown straps (3) holding cable to crossbars (4).
- (5) Remove 15 screws (5), lockwashers (6), and flatwashers (7) from side cover (8).
- (6) Remove six hex-head bolts (9) and lockwashers (10) and two crossbars from top of side cover.
- (7) Remove side cover from base assembly (11).

**b. Installation.**

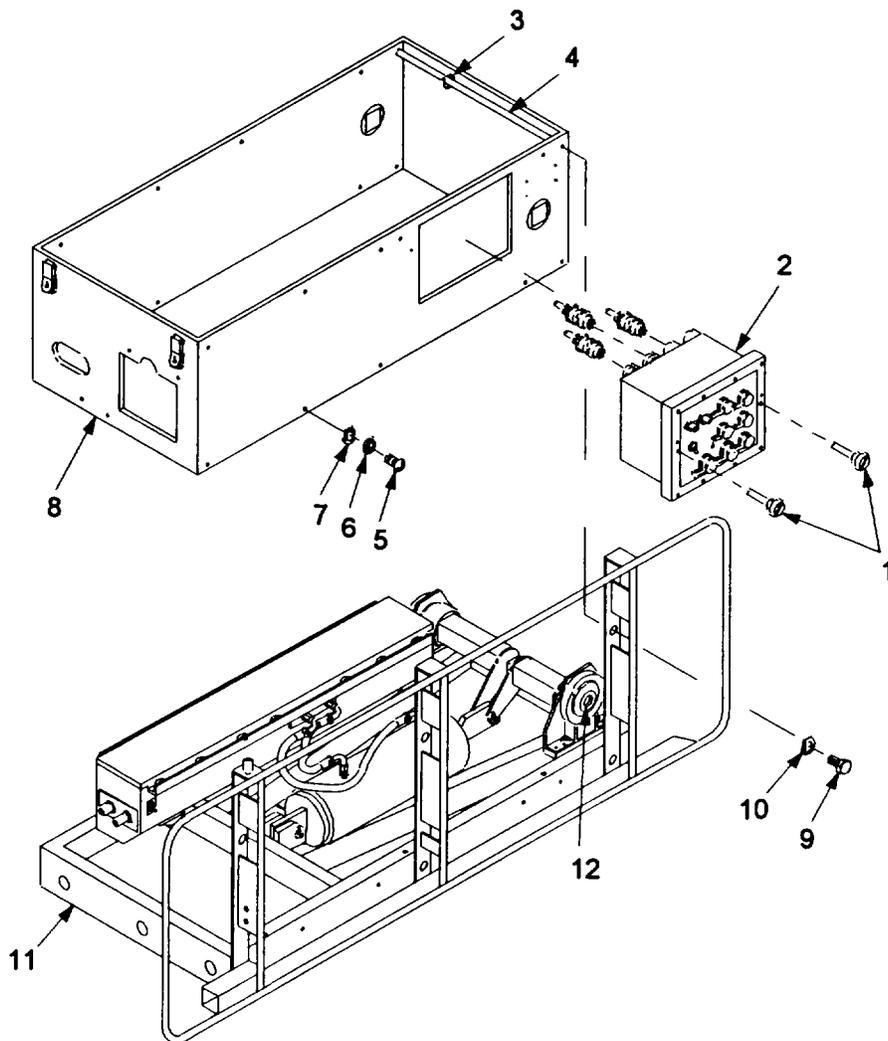
- (1) Apply a light film of petroleum to outside of shaft seal (12).

**CAUTION**

**When installing side cover on base assembly, align holes in side cover with shaft seals or damage to shaft seals could result.**

- (2) Install side cover (8) on base assembly (11).
- (3) Install 15 flatwashers (7), lockwashers (6), and screws (5) in side cover. Do not tighten.
- (4) Position two crossbars (4) in top of side cover.

(5) Install six hex-head bolts (9) and lockwashers (10) in side cover and tighten.



(6) Tighten 15 screws on side cover.

(7) Fasten cable to crossbar using tie down straps.

(8) Install control assembly (2) in side cover and tighten two thumbscrews (1).

(9) Connect cables to rear of control assembly.

(10) Install access door. Refer to paragraph 4-9.

(11) Connect black and red power cables to tank target assembly.

(12) Install target frame. Refer to paragraph 4-13.

(13) Install target. Refer to paragraph 2-5d.4-27

(14) Connect power. Refer to paragraph 2-7.

**4-11 HOSE ASSEMBLY REPLACEMENT (9375747).****INITIAL SETUP****Tools:**

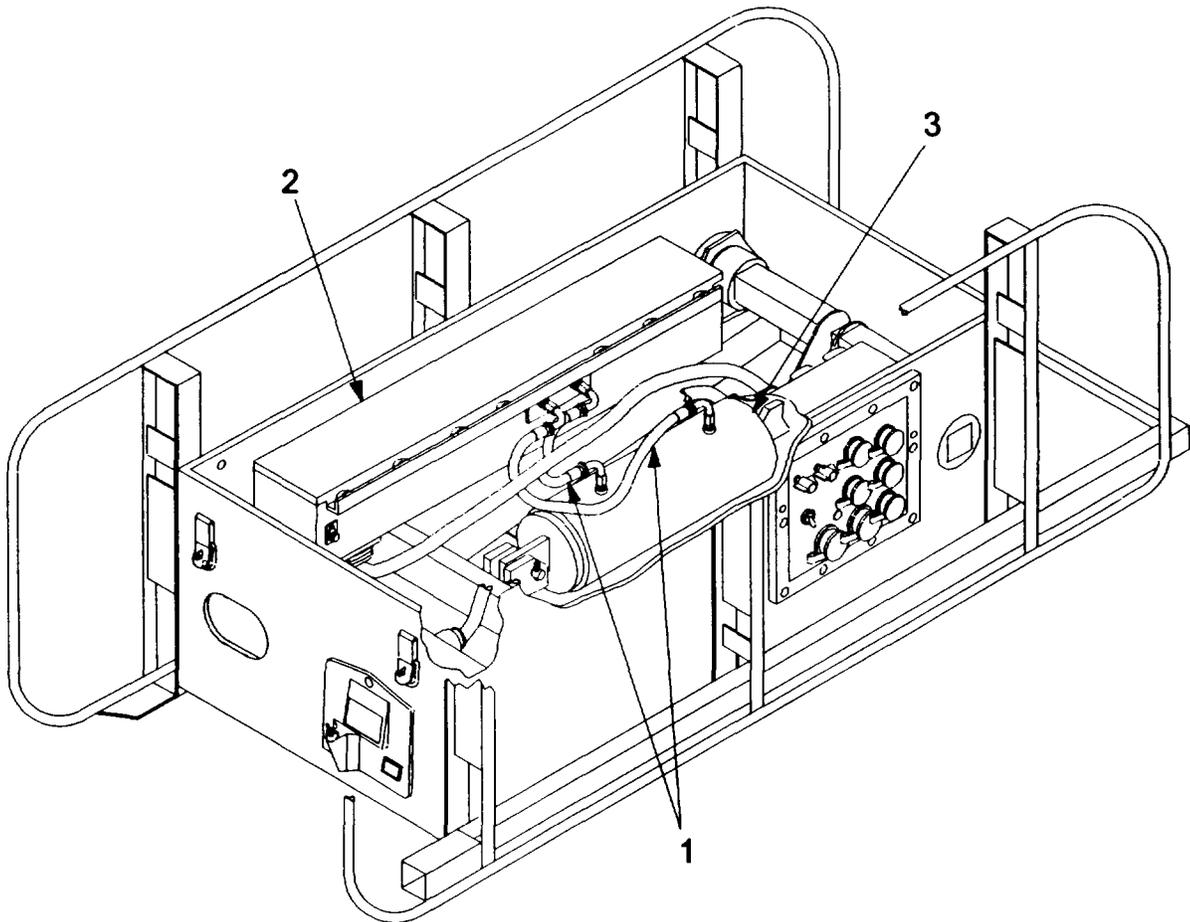
General Mechanic's Automotive Tool Kit

**Materials/Parts:**

Hose Assembly (9375747)

**Personnel Required:**

1 Person

**Equipment Condition:**Power off and disconnected  
(reference paragraph 2-7)Access door removed  
(reference paragraph 4-9)**References:**Table 4-1  
Paragraph 2-7  
Paragraph 4-9**a. Removal.**

(1) Using two wrenches, disconnect hose assemblies (1) from hydraulic unit (2).

(2) Using two wrenches, disconnect hose assemblies from hydraulic cylinder (3).

**b. Installation.**

- (1) Using two wrenches connect hose assemblies (1) to hydraulic unit (2).
- (2) Using two wrenches connect hose assemblies to hydraulic cylinder (3).
- (3) Service hydraulic unit. Refer to table 4-1.
- (4) Reapply power and test operate. Refer to paragraph 2-7. Look for leaks during operation.
- (5) Install access door. Refer to paragraph 4-9.

**4-12 CLAMPING CATCH REPLACEMENT (11784545).**

**INITIAL SETUP**

**Tools:**

General Mechanic's Automotive Tool Kit

**Equipment Condition:**

Equipment shutdown  
(reference paragraph 2-7)

**Materials/Parts:**

Clamping Catch (11784545)

Access door removed  
(reference paragraph 4-9)

**Personnel Required:**

1 Person

**References:**

Paragraph 2-7  
Paragraph 4-9

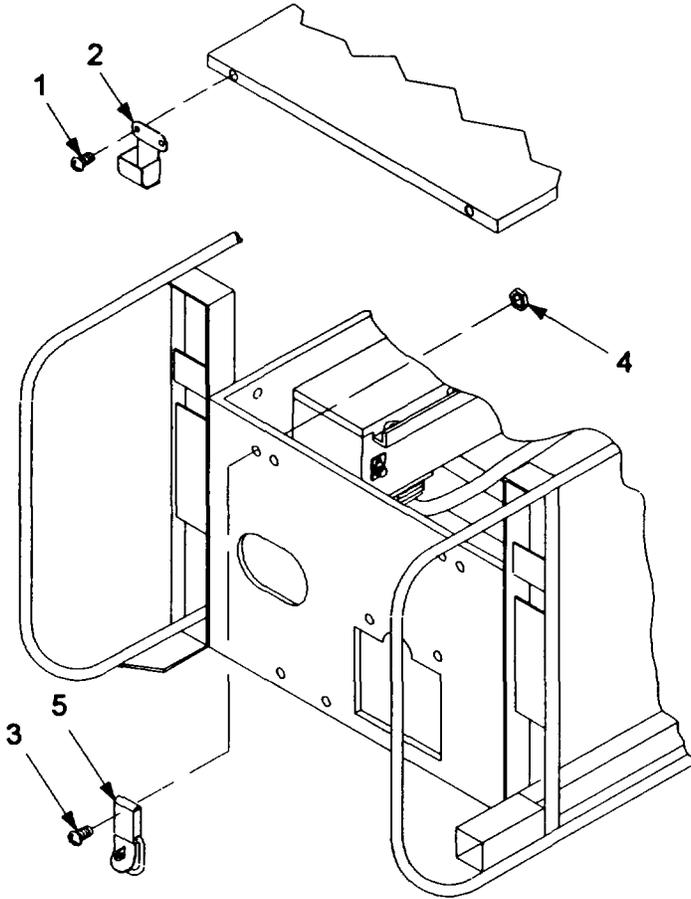
**a. Removal.**

- (1) Remove two screws (1) from the upper half of the catch assembly (2) and remove catch.
- (2) Remove two screws (3) and nuts (4) from the lower half of the catch assembly (5).

**b. Installation.**

- (1) Position lower half of catch assembly (5) on side cover.
- (2) Install two screws (3) and nuts (4).
- (3) Position upper half of catch assembly (2) on access door.

4-12 CLAMPING CATCH REPLACEMENT (11784545) - Continued.



(4) Install two screws (1).

(5) Install access door. Refer to paragraph 4-9.

(6) Reapply power. Refer to paragraph 2-7.

**4-13 TARGET FRAME REPLACEMENT/REPAIR (11784506).****INITIAL SETUP****Tools:**

General Mechanic's Automotive Tool Kit

**Equipment Condition:**

Power off (reference paragraph 2-7)

**Materials/Parts:**

Clamp holder (11784551)

Clamp screw (11784554)

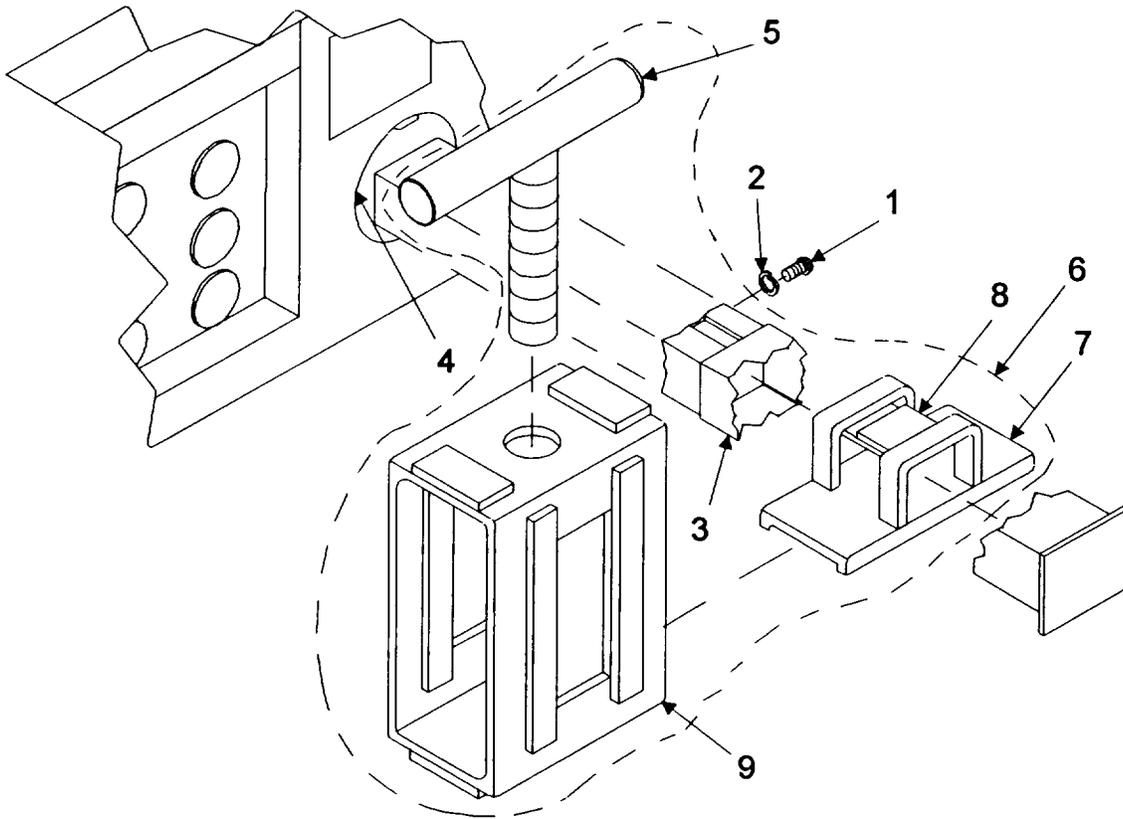
Lubricating Oil (VV-L-800)

**References:**

Paragraph 2-7

**Personnel Required:**

1 Person

**a. Removal.**

- (1) Remove target from target frame.
- (2) Remove screw (1) and lockwasher (2) from drive shaft extension.
- (3) Pull drive shaft extension (3) from drive shaft (4).
- (4) Loosen clamp screw (5) and slide clamp holder assembly (6) off drive shaft extension.4-31
- (5) Remove clamp screw, retainer (7), and clamp pad (8) from holder (9).

**4-13 TARGET FRAME REPLACEMENT/REPAIR (11784506) - Continued.****b. Repair.**

- (1) Visually inspect clamp screw (5) for stripped or damaged threads.
- (2) Visually inspect clamp holder (9) for stripped or damaged threads.
- (3) Replace any damaged or stripped parts.

**c. Installation.**

- (1) Place clamp pad (8) and retainer (7) inside holder (9).

**NOTE**

**A light coat of oil will help prevent rusting and seizing.**

- (2) Loosely install clamp screw (5) in clamp holder.
- (3) Install clamp holder assembly (6) on drive shaft extension (3).
- (4) Slide drive shaft extension (3) into drive shaft (4).
- (5) Install screw (1) and lockwasher (2) on drive shaft extension. Align groove on drive shaft extension with alignment pin on drive shaft.
- (6) Install target in target holder by doing the following:
  - (a) Ensure FUNCTION switch is set to O and the target arm is in the down position.
  - (b) Ensure target arm is free of obstruction which may inhibit target movement.

**CAUTION**

**Target must be centered and the clamp screws tight to prevent damage to equipment.**

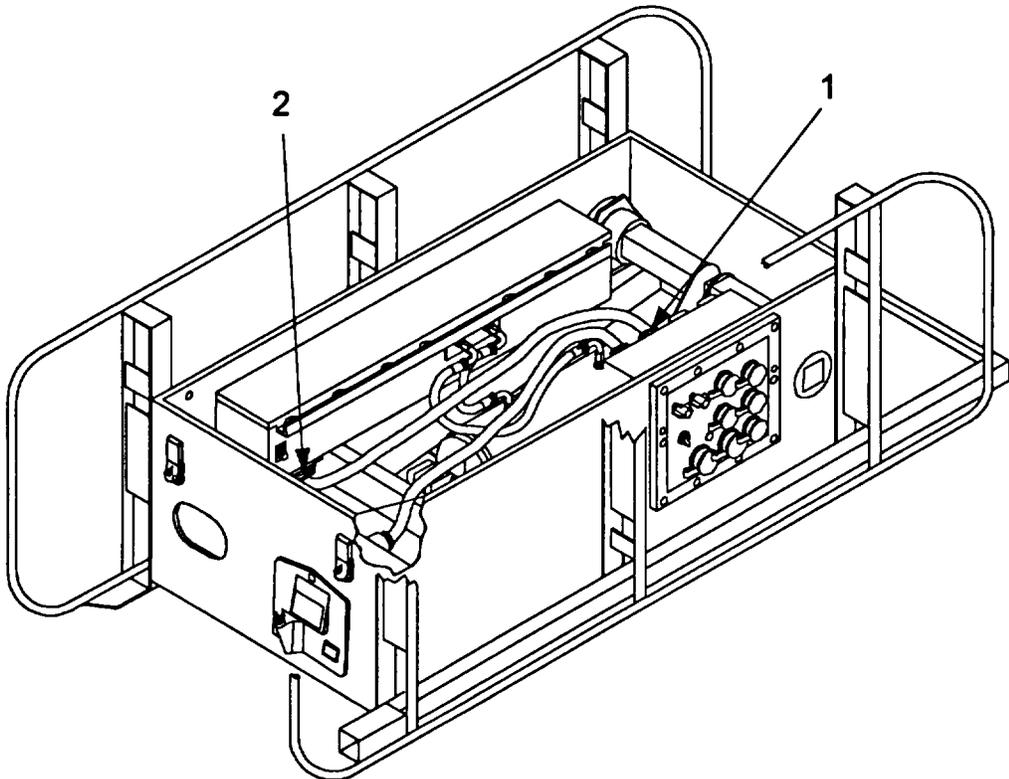
- (c) Connect the target arms to the THM/TG housing and secure the target to the target arm mounting clamps.
- (7) Reapply power. Refer to paragraph 2-7.

**4-14 CABLE ASSEMBLY (HYDRAULIC UNIT) REPLACEMENT (11784509).****INITIAL SETUP****Materials/Parts:**

Cable Assembly (11784509)

**Equipment Condition:**Power off and disconnected  
(reference paragraph 2-7)**Personnel Required:**

1 Person

**References:**Paragraph 4-9  
Paragraph 2-7**a. Removal.**

- (1) Remove access door. Refer to paragraph 4-9.
- (2) Disconnect P2 cable assembly from P2 (1) on rear of control assembly.
- (3) Disconnect P2 cable assembly from hydraulic unit (2).

**b. Installation.**

- (1) Connect P2 cable assembly to hydraulic unit (2).
- (2) Connect P2 cable assembly to P2 (1) on rear of control assembly.4-33
- (3) Install access door. Refer to paragraph 4-9.
- (4) Apply power. Refer to paragraph 2-7.

**4-15 CONTROL ASSEMBLY REPLACEMENT (11784504).****INITIAL SETUP****Materials/Parts:**

Control assembly (11784504)

**Equipment Condition:**

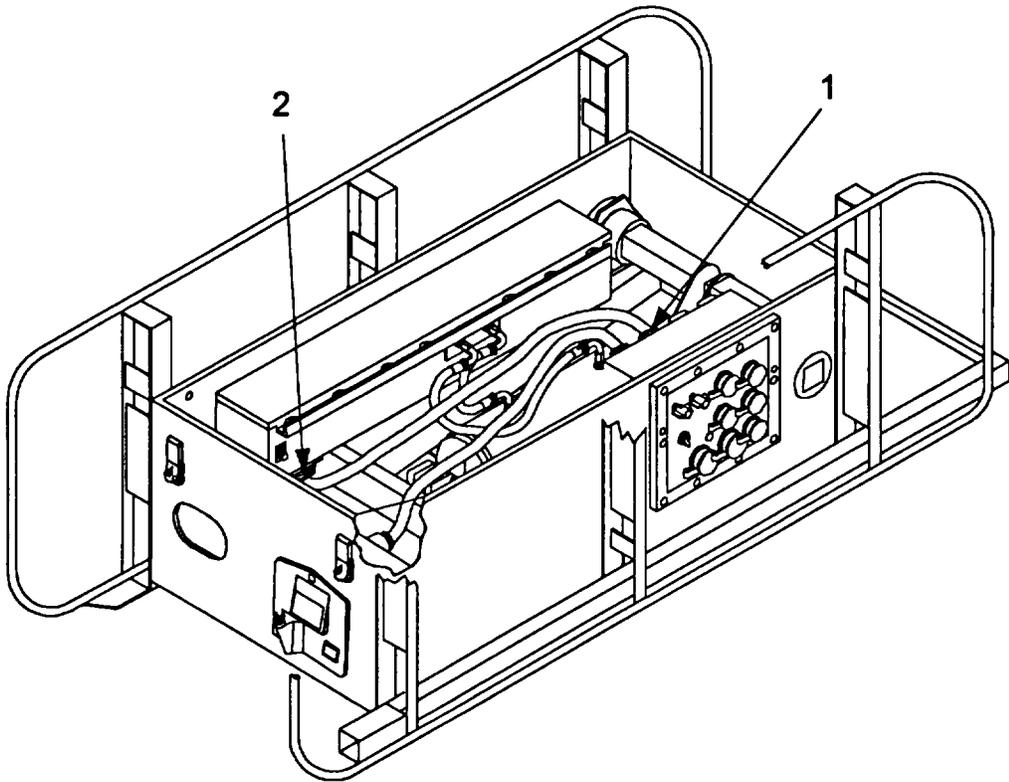
Power off (reference paragraph 2-7)

**Personnel Required:**

1 Person

**References:**

Paragraph 2-7

**a. Removal.**

- (1) Tag and disconnect all cables from front of control assembly (2).
- (2) Loosen two thumbscrews (1) and partially remove control assembly from side cover.
- (3) Tag and disconnect all cables (3) from rear of control assembly.
- (4) Remove control assembly from side cover.

**b. Installation.**

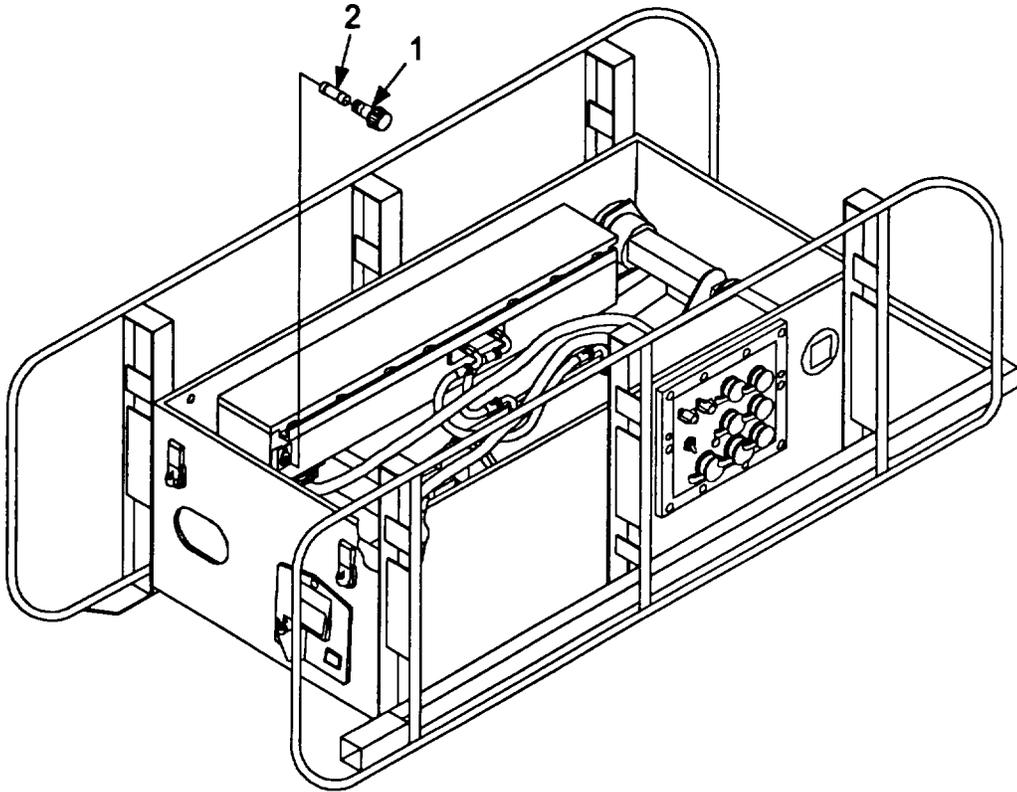
- (1) Connect cables (3) to rear of control assembly (2).
- (2) Install control assembly in side cover and tighten two thumbscrews (1).
- (3) Connect cables to front of control assembly.
- (4) Test/operate in accordance with paragraph 2-7.

**4-16 FUSE REPLACEMENT (F09B250V6-1/4A).****INITIAL SETUP****Materials/Parts:**

Fuse (FO9B250V6-1/4A)

**Equipment Condition:**Power off and disconnected  
(reference paragraph 2-7)**Personnel Required:**

1 Person

**References:**Paragraph 4-9  
Paragraph 2-7**a. Removal.**

- (1) Remove access door. Refer to paragraph 4-9.
- (2) Remove fuse holder assembly cap (1) from fuse holder on side of hydraulic unit.
- (3) Remove fuse (2) from fuse holder.

**b. Installation.**

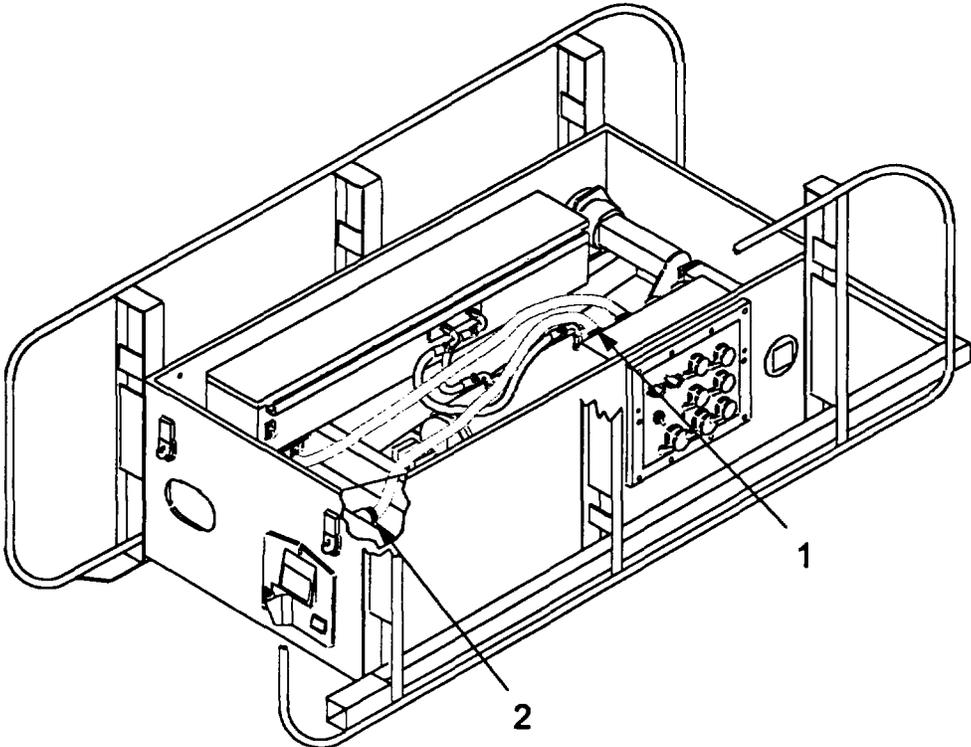
- (1) Insert fuse (2) in fuse holder assembly cap (1).
- (2) Insert fuse holder assembly cap (1) into fuse holder on side of hydraulic unit.4-35
- (3) Install access door. Refer to paragraph 4-9.
- (4) Reapply power. Refer to paragraph 2-7.

**4-17 CABLE ASSEMBLY (RECEIVER) REPLACEMENT (117845081).****INITIAL SETUP****Materials/Parts:**

Cable Assembly (11784508)

**Equipment Condition:**Power off and disconnected  
(reference paragraph 2-7)**Personnel Required:**

1 Person

**References:**Paragraph 4-9  
Paragraph 2-7**a. Removal.**

- (1) Remove access door. Refer to paragraph 4-9.
- (2) Disconnect cable assembly from P1 (1) on rear of control assembly.
- (3) Disconnect cable assembly from rear of receiver (2).

**b. Installation.**

- (1) Connect cable assembly to rear of receiver (2).
- (2) Connect cable assembly to P1 (1) on rear of control assembly.
- (3) Install access door. Refer to paragraph 4-9.
- (4) Reapply power. Refer to paragraph 2-7.

4-18 LAMP ASSEMBLY REPLACEMENT/REPAIR (11784475).

INITIAL SETUP

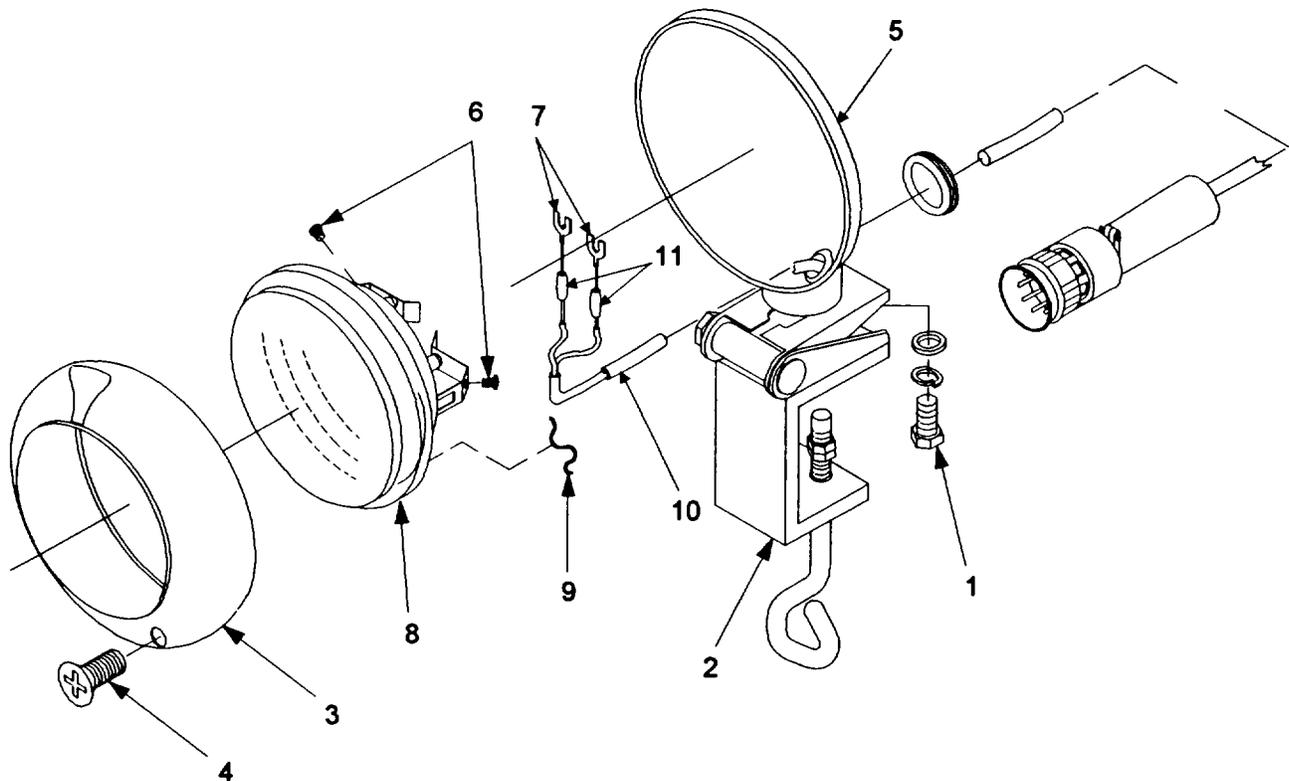
Tools:  
 General Mechanic's Automotive Tool Kit  
 (reference paragraph 2-7)

Equipment Condition:  
 Equipment shutdown

Materials/Parts:  
 Insulation Sleeving (M23053/5-104-4)  
 Lamp (11784473)  
 Lamp Assembly (11784475)  
 Terminal Lug (MS25036-149)

References:  
 Paragraph 2-7

Personnel Required:  
 1 Person



**a. Removal.**

- (1) Disconnect lamp cable from front of control assembly.
- (2) Loosen thumbscrew and remove lamp assembly from mount.

**b. Repair.**

- (1) Loosen bolt (1) that mounts lamp head to bracket (2).

**4-18 LAMP ASSEMBLY REPLACEMENT/REPAIR (11784475) - Continued.**

- (2) Swivel lamp head to allow removal of retaining ring (3).
- (3) Remove screw (4) from retaining ring and remove ring from lamp housing (5).
- (4) Loosen two screws (6) and remove two lugs (7) from lamp (8).
- (5) Remove four lamp retaining springs (9).
- (6) Remove lamp (8).
- (7) Pull cable (10) out of lamp housing.
- (8) Cut terminal lugs from wire.
- (9) Slide insulation sleeving (11) down wires.
- (10) Strip back insulation covering wires.
- (11) Insert wires into terminal lugs and crimp terminal lugs.
- (12) Install cable through housing.
- (13) Install lamp (8).
- (14) Install four lamp retaining springs (9).
- (15) Position two lugs (7) on lamp and tighten two screws (6).
- (16) Position retaining ring (3) on lamp housing (5) and install screw (4).
- (17) Swivel lamp head to proper position and tighten bolt (1).

**c. Installation.**

- (1) Position lamp assembly on mount and tighten thumbscrew.
- (2) Connect lamp cable to front of control assembly.
- (3) Reapply power. Refer to paragraph 2-7.

4-19 BATTERY BOX ASSEMBLY REPLACEMENT (9356194).

## INITIAL SETUP

## Materials/Parts:

Battery Box Assembly (9356194)

## Equipment Condition:

Power off and disconnected  
(reference paragraph 2-7)

## Personnel Required:

1 Person

## References:

TM 9-6140-200-14  
Paragraph 2-7**WARNING**

Use goggles, gloves, and apron when handling battery and battery electrolyte. Reference TM 9-6140-200-14.

**WARNING**

When disconnecting cables, ensure (+) and (-) terminals do not make contact with each other or with metal objects.

**a. Removal.**

- (1) Turn FUNCTION switch on THM/TG control assembly to O position.
- (2) Separate power cables where battery box cable adapters and tank target assembly cables meet.
- (3) Release strap (1) and remove battery box lid (2).
- (4) Remove wingnuts (3) and lockwashers (4) from both battery terminals and disconnect battery box cable adapters from battery beginning with the black cable first.

**NOTE**

Set battery on nonconductive surface (e.g., wood board or pallet).

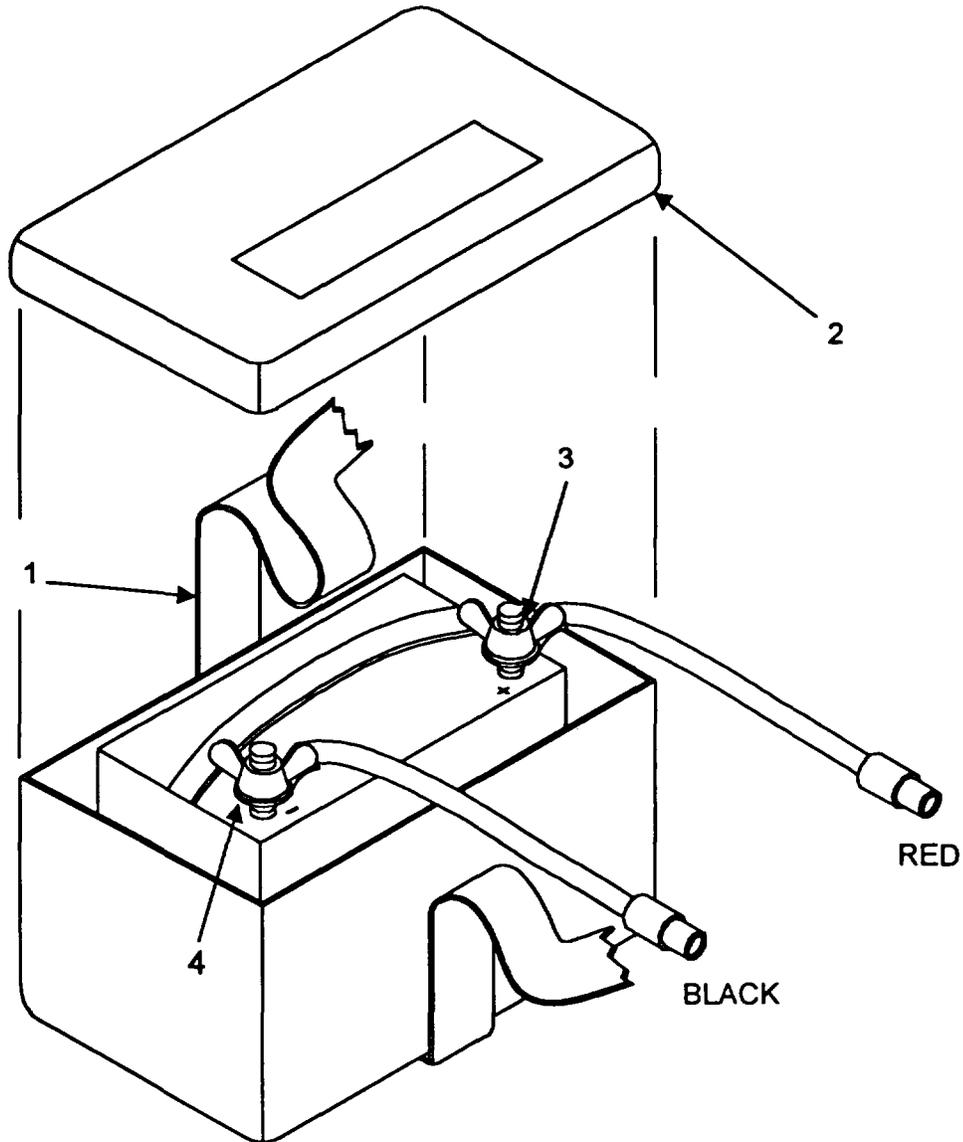
- (5) Carefully lift and remove battery from battery box.
- (6) Install battery box lid and fasten strap. Remove battery box assembly.

**b. Installation.**

- (1) Release strap (1) and remove battery box lid (2).

**4-19 BATTERY BOX ASSEMBLY REPLACEMENT (9356194) - Continued.**

- (2) Install battery in battery box.
- (3) Connect battery box cable adapters to battery terminals beginning with the red cable first.



- (4) Install lockwashers (4) and tighten wingnut (3) on each battery terminal.
- (5) Install lid on battery box and fasten strap.
- (6) Connect battery box adapter cables to tank target assembly cables.
- (7) Reapply power. Refer to paragraph 2-7.

**4-20 BATTERY REPLACEMENT (C31R-4 OR NG-31).**

INITIAL SETUP

Materials/Parts:

- Battery (6140-01-032-1326)  
C31R-4, hardwire version
- Battery  
(NG-31, radio controlled version)  
or size 27 (6140-01-262-2272)

Equipment Condition:

- Power off and disconnected  
(reference paragraph 2-7)

References:

- TM 9-6140-200-14  
Paragraph 2-7

Personnel Required:

1 Person

**WARNING**



Use goggles, gloves, and apron when handling battery and battery electrolyte. Reference TM 9-6140-200-14.

**WARNING**



When disconnecting cables, ensure (+) and (-) terminals do not make contact with each other or with metal objects.

**NOTE**

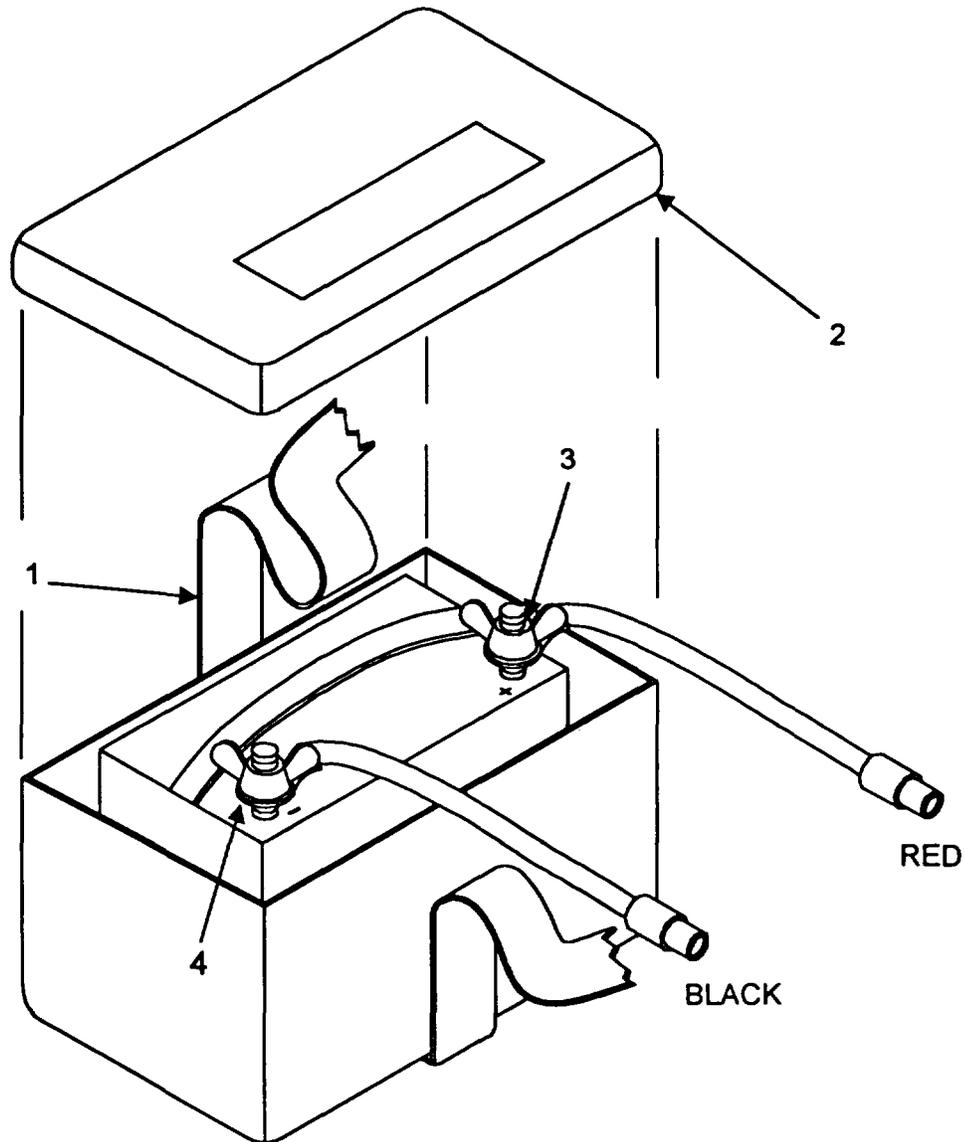
For radio controlled THM/TGs it is recommended that a deep cycle battery of 900 cranking amps be utilized, equivalent to an exide battery (PIN NG31).

**a. Removal.**

- (1) Turn FUNCTION switch on front of THM/TG control assembly to O position.
- (2) Separate power cables where battery box cable adapters and tank target assembly cables meet.
- (3) Release strap (1) and remove battery box lid (2).
- (4) Remove wingnuts (3) and lockwashers (4) from both battery terminals and disconnect battery box cable adapters from battery beginning with the black cable first.
- (5) Carefully lift battery from box with strap.
- (6) Dispose of in accordance with local directives.

4-20 **BATTERY REPLACEMENT (C31R-4 OR NG-31) - Continued.****b. Installation.**

- (1) Install battery in box.
- (2) Connect battery box cable adapters to battery terminals beginning with the red cable first.
- (3) Install wingnut (3) and lockwashers (4) on each battery terminal.
- (4) Install battery box lid (2) and fasten strap (1).



- (5) Connect battery box cable adapters to tank target assembly cables.
- (6) Place FUNCTION switch on front of control assembly to O position.
- (7) Apply power. Refer to paragraph 2-7.

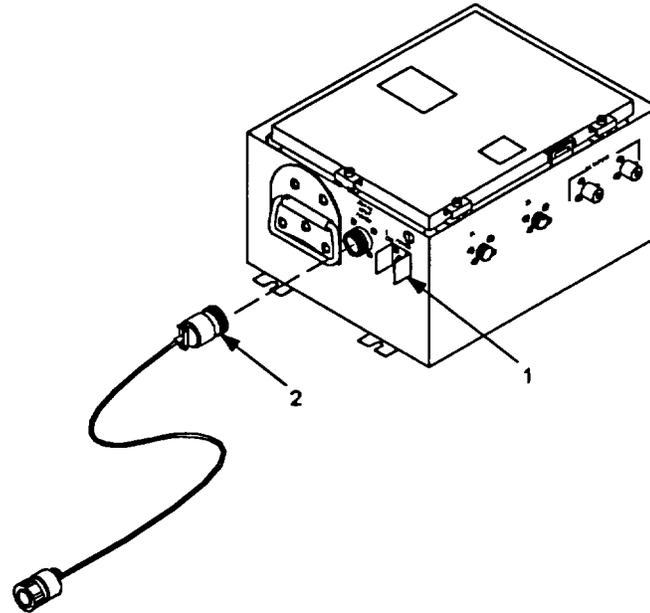
**4-21 BATTERY ELIMINATOR POWER CABLE ASSEMBLY REPLACEMENT (12934456).**

## INITIAL SETUP

Materials/Parts:  
Cable Assembly (12934456)

References:  
Paragraph 2-6  
Paragraph 2-7

Personnel Required:  
1 Person



**WARNING**



Disarm, then disconnect the ATKS connection from control assembly on TTA or TIU. The ATKS must be disconnected from TTA before performing maintenance. Explosion is possible and can cause personal injury and damage to equipment. Pyrotechnics are used during range operation.

**a. Removal.**

- (1) Turn power OFF at CB2 on interconnecting box and CB1 on target interface unit.
- (2) Turn circuit breaker CB1 (1) at battery eliminator to OFF position.
- (3) Turn FUNCTION switch on front of THM/TG control assembly to O position.
- (4) Disconnect connector P1 of power cable assembly from J2 at interconnecting box.
- (5) Disconnect connector P2 (2) of power cable assembly from input power connection at battery eliminator.

**4-21 BATTERY ELIMINATOR POWER CABLE ASSEMBLY REPLACEMENT (12934456) -Continued.****b. Installation.**

- (1) Connect connector P2 (2) of power cable assembly to input power connection at battery eliminator.
- (2) Connect connector P1 of power cable assembly to J2 at interconnecting box.
- (3) Turn circuit breaker CB1 (1) at battery eliminator to ON position.
- (4) Turn power ON at CB2 on interconnecting box and CB1 on target interface unit.
- (5) Turn FUNCTION switch on front of THM/TG control assembly to proper position.
- (6) Test/operate in accordance with paragraphs 2-6 and 2-7.

**4-22 BATTERY ELIMINATOR CONTROL CABLE REPLACEMENT (12934457).**

## INITIAL SETUP

## Materials/Parts:

Cable Assembly (12934457)

## References:

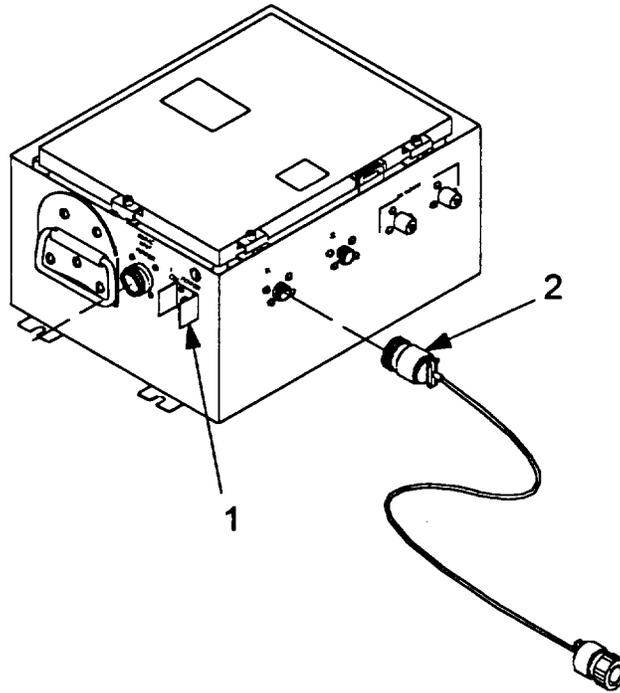
Paragraph 4-9

Paragraph 2-6

Paragraph 2-7

## Personnel Required:

1 Person

**WARNING**

Disarm, then disconnect the ATKS connection from control assembly on TTA or TIU. The ATKS must be disconnected from TTA before performing maintenance. Explosion is possible and can cause personal injury and damage to equipment. Pyrotechnics are used during range operation.

**a. Removal.**

- (1) Turn power off at CB2 on interconnecting box and at CB1 on target interface unit.
- (2) Turn circuit breaker CB1 (1) at battery eliminator to OFF position.
- (3) Turn FUNCTION switch on THM/TG control assembly to O position.
- (4) Remove access door from tank target assembly. Refer to paragraph 4-9.

**4-22 BATTERY ELIMINATOR CONTROL CABLE REPLACEMENT (12934457) - Continued.**

- (5) Disconnect connector P2 of control cable assembly (2) from P2 on rear of control assembly.
- (6) Disconnect connector P1 of control cable assembly (2) from J1 at battery eliminator.
- (7) Remove control cable assembly through opening in end of tank target assembly.

**b. Installation.**

- (1) Route connector P2 on control cable assembly (2) through opening in end of tank target assembly.
- (2) Connect connector P2 of control cable assembly to P2 on rear of control assembly.
- (3) Connect connector P1 of control cable assembly to J1 at battery eliminator.
- (4) Install access door. Refer to paragraph 4-9.
- (5) Turn circuit breaker CB2 at interconnecting box and CB1 at target interface unit to the ON position.
- (6) Turn circuit breaker CB1 (1) at battery eliminator to ON position.
- (7) Turn FUNCTION switch on THMITG control assembly to proper position.
- (8) Test/operate in accordance with paragraphs 2-6 and 2-7.

**4-23 POWER SUPPLY REPLACEMENT (12934455).**

## INITIAL SETUP

## Tools:

General Mechanic's Automotive Tool Kit

## Personnel Required:

1 Person

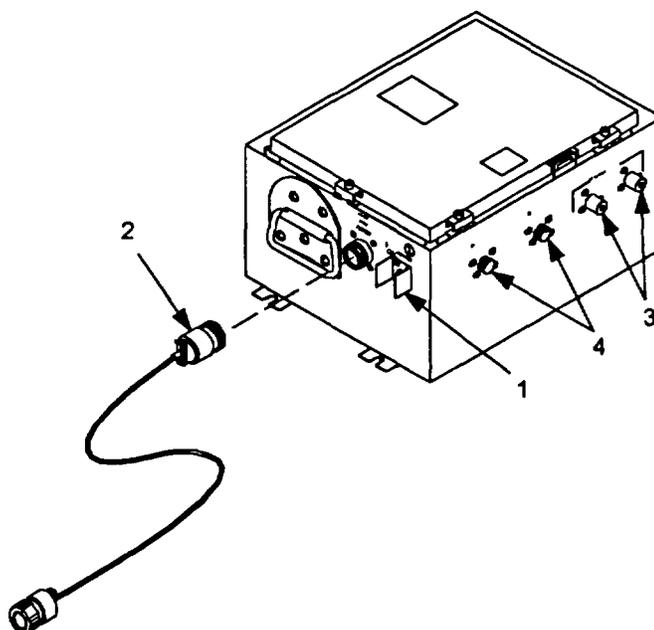
## Materials/Parts:

Power Supply (12934455)

## References:

Paragraph 2-6

Paragraph 2-7

**WARNING**

Disarm, then disconnect the ATKS connection from control assembly on TTA or TIU. The ATKS must be disconnected from TTA before performing maintenance. Explosion is possible and can cause personal injury and damage to equipment. Pyrotechnics are used during range operation.

**a. Removal.**

- (1) Turn power OFF at CB2 on interconnecting box and at CB1 on target interface unit.
- (2) Turn circuit breaker CB1 (1) at power supply to the OFF position.
- (3) Turn FUNCTION switch on THM/TG control assembly to O position.
- (4) Disconnect interconnecting box cable connector P2 (2) from power supply connector J3.

**4-23 POWER SUPPLY REPLACEMENT (12934455) - Continued.**

- (5) Disconnect power cables from power supply connectors P1 and P2 (3).
- (6) Disconnect tank target assembly cables from power supply connectors J1 and J2 (4).
- (7) Remove mounting hardware from power supply and retain for installation.

**b. Installation.**

- (1) Position power supply on site.
- (2) Install retained mounting hardware on power supply.
- (3) Connect tank target assembly cables to power supply connectors J1 and J2 (4).
- (4) Connect power cables to power supply connectors P1 and P2 (3).
- (5) Connect interconnecting box cable connector P2 (2) to power supply connector J3.
- (6) Turn power ON at CB2 on interconnecting box and at CB1 on target interface unit.
- (7) Turn circuit breaker CB1 (1) on the power supply to the ON position.
- (8) Turn FUNCTION switch on THM/TG control assembly to proper position.
- (9) Test/operate in accordance with paragraphs 2-6 and 2-7.

**4-24 RADIO RECEIVER REPLACEMENT (11784801).**

## INITIAL SETUP

## Materials/Parts:

Radio Receiver (11784801)

## Equipment Condition:

Equipment shut down  
(reference paragraph 2-7)

## Personnel Required:

1 Person

## References:

Paragraph 2-6  
Paragraph 2-7**WARNING**

Disarm, then disconnect the ATKS connection from control assembly on TTA or TIU. The ATKS must be disconnected from the TTA before performing maintenance on the THMITG. Failure to do so could cause serious injury to personnel.

**a. Removal.**

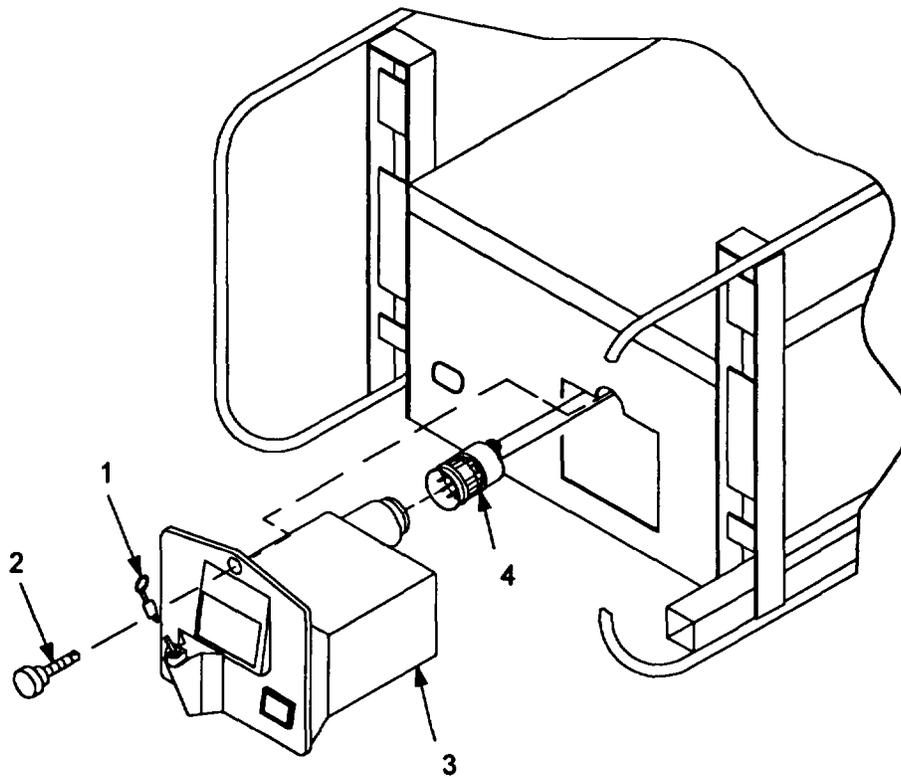
- (1) Turn FUNCTION switch on front of control assembly to O position.
- (2) Remove antenna (1) from receiver.
- (3) Loosen thumbscrew (2) and partially slide receiver (3) from tank target assembly.
- (4) Disconnect cable (4) from receiver and remove receiver.

**b. Installation.**

- (1) Connect cable (4) to rear of receiver (3).
- (2) Slide receiver into tank target assembly and tighten thumbscrew (2).

4-24 **RADIO RECEIVER REPLACEMENT (11784801) - Continued.**

- (3) Install antenna (1) on receiver.



- (4) Turn FUNCTION switch on front of control assembly to required position.  
 (5) Test/operate in accordance with paragraphs 2-6 and 2-7.

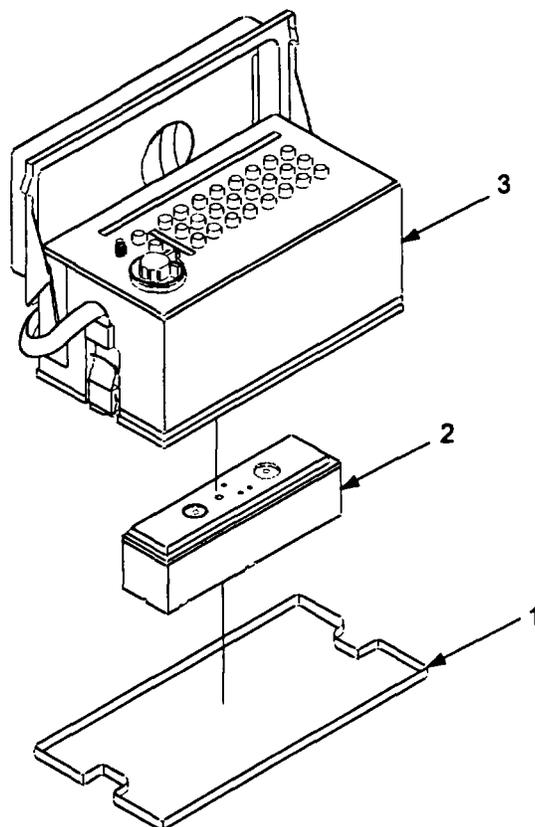
**4-25 TRANSMITTER BATTERY REPLACEMENT (11784703).**

## INITIAL SETUP

Materials/Parts:  
Battery (11784703)

Personnel Required:  
1 Person

---

**WARNING**

Nickel-cadmium battery gases can explode and cause personal injury and damage to equipment.

**a. Removal.**

- (1) Release latches and remove battery cover (1).
- (2) Loosen thumbscrews holding battery (2) in transmitter (3).4-51
- (3) Remove battery (2).

**4-25 TRANSMITTER BATTERY REPLACEMENT (11784703) - Continued.**

**b. Installation.**

- (1) Position battery (2) in transmitter (3).
- (2) Tighten thumbscrews.
- (3) Install battery cover (1) and fasten latches.
- (4) Ensure transmitter operates correctly. Refer to paragraph 2-7a

**4-26 THM/TG HYDRAULIC FLUID CHANGING.**

**INITIAL SETUP**

**Tools:**

General Mechanics Automotive Tool Kit  
Drain Pan

**Personnel Required:**

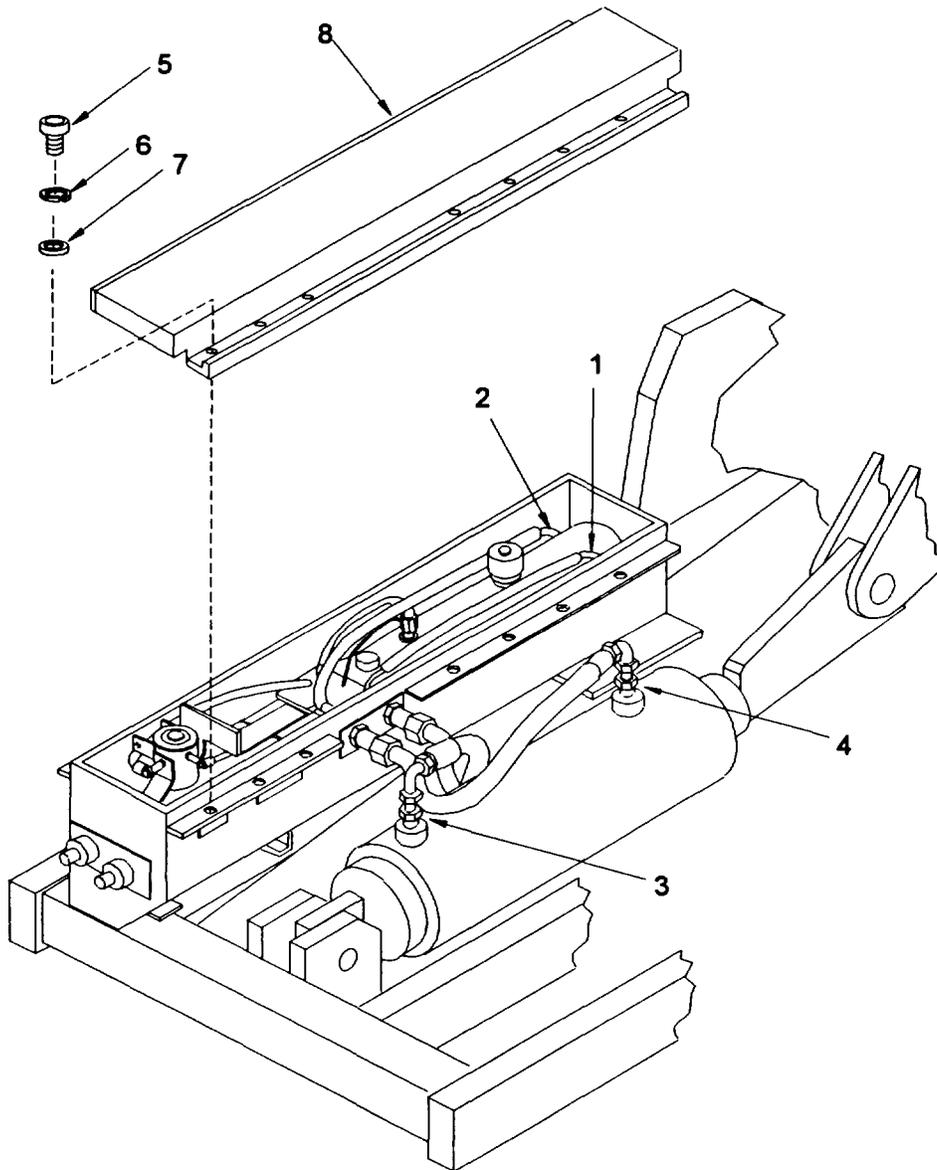
1 Person

**Materials/Parts:**

Hydraulic Fluid (Dexron II)  
Hydraulic Fluid (Dexron II D)  
Hydraulic Fluid (MIL-H-5606)  
Rags (A-A-2522)

**References:**

Paragraph 4-9



**4-26 THM/TG HYDRAULIC FLUID CHANGING - Continued.**Service**NOTE**

The THM/TG hydraulic fluid should be changed annually or any time the fluid is found to be contaminated. If the oil analysis program is being used, change the fluid according to the program results. Use Dexron II or Dexron II D for temperature range of 0° to 1100 F. Use MIL-H-5606 for temperature range -25° to 0° F. Dispose of hydraulic fluids in accordance with Environmental Protection Agency (EPA), state and local regulations.

- a. Lower the target using the THM/TG TEST switch.
- b. Set the FUNCTION switch to the 0 (off) position.
- c. Remove the access door (reference paragraph 4-9) and inspect the two hydraulic hoses connected to ports C1 (1) through C4 (4) for damage or leaks.
- d. Remove the hose connection at port C3 (3) on the hydraulic cylinder. Place the disconnected end of the hose in a one-gallon can to collect the old fluid (approximately 3 pints).
- e. Using the TEST switch, held in the UP position, pump all of the fluid out of the cylinder unit. Reconnect the hose to port C3.
- f. Remove screws (5), lockwashers (6) and flat washers (7) from hydraulic unit cover (8) and remove cover.
- g. Remove the filler cap and refill the reservoir to 1/2 +1/4 inch from the top with new fluid. Replace the cap.
- h. Remove the hose connection at port C2 (2) and place the disconnected end of the hose in a one-gallon can.
- i. Using the TEST switch, held in the UP position, pump all remaining fluid out of the upper port of the cylinder. Replace the hose connection.
- j. Remove the filler cap and refill the reservoir to 1/2 +1/4 inch from the top with new fluid. Replace the cap.
- k. Purge the system of air by exercising the device several times with the TEST switch.
- l. Clean the air filter in the filling cap and blow dry. Lubricate the filter with a few drops of hydraulic oil.
- m. Replace the filler cap and check the system for leaks.
- n. Replace hydraulic unit housing cover.
- o. Replace access door (reference paragraph 4-9).

**SECTION V. PREPARATION FOR STORAGE OR SHIPMENT**

**4-27 ADMINISTRATIVE STORAGE - 45 DAYS OR LESS.**

Refer to AR 750-1 for the requirements of administrative storage. Perform all preventive maintenance checks and services prior to placing unit in storage.

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**CHAPTER 5  
DIRECT SUPPORT MAINTENANCE INSTRUCTIONS**

**SECTION I. TROUBLESHOOTING PROCEDURES**

**5-1 TROUBLESHOOTING PROCEDURES.**

Table 5-1 lists the common malfunctions that you may find during operation or maintenance of the Target Holding Mechanism, Tank Gunnery (THM/TG). You should perform the tests/inspections and corrective actions in the order listed. Before you begin troubleshooting the THM/TG, ensure that operator and unit PMCS have been performed. The following procedures are based on the premise that operator and unit PMCS have been completed. If in doubt, perform PMCS in accordance with the procedures described in table 2-4 and table 4-1. This manual cannot list all the malfunctions that may occur nor all the tests or inspections and corrective actions. Notify your supervisor if a malfunction persists and cannot be corrected by prescribed action.



Personnel working with or near high voltages must be trained and certified in mouth-to-mouth and cardiopulmonary resuscitation. Installation medical activities shall provide certified instructors. Newly assigned maintenance personnel must be trained as soon as practical. Make sure at least two persons are in the area at all times when work is being performed on exposed live circuits carrying 30 volts or more.

**Malfunction Index**

	Malfunction
Target will not raise or lower by TEST switch	1
Target goes down but will not respond to up commands from TEST switch	2
Target goes up but will not respond to down commands from TEST switch	3
Target goes down when hit and FUNCTION switch is in position 1 or 4	4
Target does not return to the UP position when hit and FUNCTION switch is in position 3 or 6	5
Target does not respond to hits	6
Target goes down and continues driving into ground	7
Target goes up and continues driving into cover	8
LAMP assembly does not flash when hit occurs	9
Target operates too slowly	10
ATKS does not fire in SMOKE SCORER mode	11
ATKS does not fire in HOSTILE FIRE mode	12
Control assembly is inoperative	13
Target responds to hits but RCS does not record hits	14
BATTERY lamp flashes or fails to illuminate	15
No supply voltage from battery eliminator assembly connectors P1 and P2	16
No control voltage from battery eliminator assembly connector J1	17
P3 proximity switch cable is inoperative	18

Table 5-1. Direct Support Troubleshooting Procedures.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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1. Target will not raise or lower by TEST switch.

**WARNING**



**Disarm, then disconnect the ATKS connection from control assembly on TTA or TIU. The ATKS must be disconnected from TTA before performing maintenance. Explosion is possible and can cause personal injury and damage to equipment. Pyrotechnics are used during range operation.**

- Step 1. Check all cables for serviceability. Ensure all cables are properly and securely connected and circuit breakers are in the ON position (see FO-1, FO-2, and FO-3).
- Step 2. Ensure that FUNCTION switch is in any position except 0.
- Step 3. Using TEST switch, attempt to raise or lower target. Target should respond and BATTERY lamp should steadily illuminate.

If target responds to TEST switch, THM/TG is operational.

**NOTE**

**On radio controlled versions, the THMITG can operate with a battery as low as 9.5 vdc. Therefore, readings may be less on radio controlled versions, depending on battery charge.**

With radio/computer controlled battery operated models, if battery lamp flashes when the test switch is used, use multimeter to check for 12 vdc on computer controlled versions or for a minimum of 9.5 vdc on radio controlled versions

On the radio controlled model, if a minimum of 9.5 vdc is not present, the battery needs charging. Refer to TM 9-6140-200-14.

On the computer controlled model, if 12 vdc is not present the battery needs replacing or check TIU trickle charge circuit. Refer to TM 9-6920-742-14-4.

With battery-eliminator-operated model, if BATTERY lamp flashes when the TEST switch is used, refer to malfunction 16.

With radio-controlled model, if target does not respond to TEST switch and BATTERY lamp is steadily illuminated, remove fuse from side of hydraulic unit. Set multimeter to measure ohms and test fuse for continuity.

If fuse is good, proceed to step 4.

If fuse is bad, replace in accordance with paragraph 4-15 and retest.

Table 5-1. Direct Support Troubleshooting - Continued.

## MALFUNCTION

## TEST OR INSPECTION

## CORRECTIVE ACTION

Step 4. Remove access door.

Step 5. Remove hydraulic unit cover. Check that hydraulic fluid level is no more than ½ inch (13 mm) from bottom of filler spout.

If fluid level is correct, proceed to step 6.

If fluid level is low, service in accordance with table 2-4 and retest.

Step 6. Move drive shaft until magnetic actuator switch is out of S3. Remove P3 cable connector from control assembly or W107 cable. Set multimeter to measure ohms on the X10 scale. Place multimeter positive lead on P3 pin D and negative lead on P3 pin A. Multimeter should indicate continuity. Insert a putty knife blade or similar tool between S3 proximity switch legs. Multimeter should indicate no continuity.

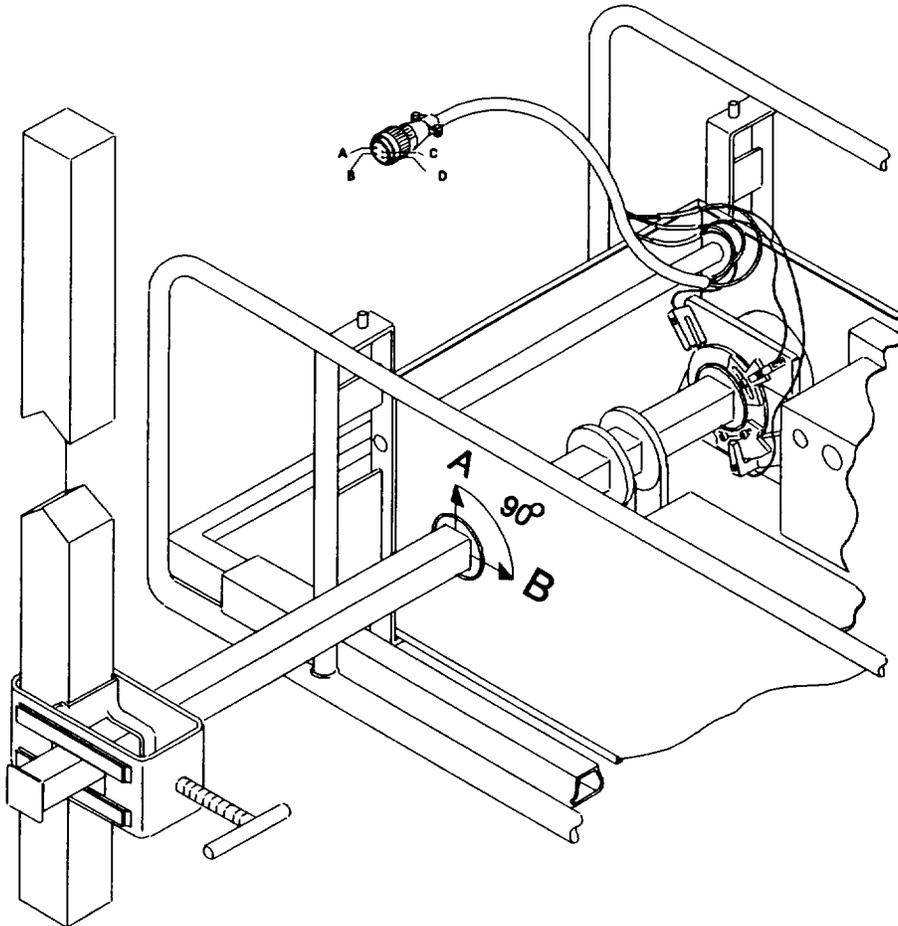


Table 5-1. Direct Support Troubleshooting - Continued.

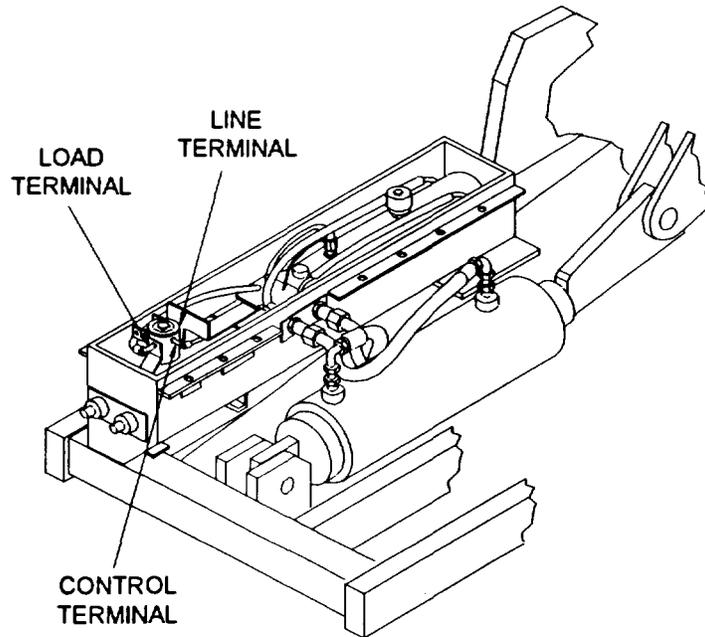
MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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If multimeter indications are correct, reconnect P3 cable and proceed to step 7.  
 If multimeter indications are incorrect, repair P3 cable or replace S3 in accordance with paragraph 5-13 or 5-14 and retest.

Step 7. Check for malfunctioning control assembly. Refer to malfunction 13.

**NOTE**

**On radio controlled versions, the THM/TG can operate with a battery as low as 9.5 vdc. Therefore, readings may be less on radio versions, depending on battery charge.**



Step 8. Set multimeter to measure 12 vdc. Place the multimeter positive lead on the solenoid switch load terminal (farthest from motor) and negative lead to ground. Refer to FO-5. Multimeter should indicate 12 vdc on computer controlled versions, or a minimum of 9.5 vdc on radio controlled versions

If multimeter indication is correct, proceed to step 9.

If multimeter indication is not correct, check battery cables for continuity.

If continuity is not found, replace battery cable in accordance with paragraph 4-6 and retest.

If 12 vdc on computer controlled versions or a minimum of 9.5 vdc on radio controlled versions is still not found at solenoid switch, check battery in accordance with TM 9-6140-200-14. Recharge or replace as necessary.

Table 5-1. Direct Support Troubleshooting - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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Step 9. Place multimeter positive lead on solenoid switch line terminal (closest to motor) and negative lead to ground. Place TEST switch in the UP or DOWN position. Multimeter should indicate 12 vdc (computer controlled) or a minimum of 9.5 vdc (radio controlled).

If multimeter reading is correct, proceed to step 10.

If multimeter reading is incorrect, place multimeter positive lead on solenoid switch control terminal (front of solenoid) and negative lead on ground. Multimeter should indicate 12 vdc (computer controlled) or a minimum of 9.5 vdc (radio controlled). Place TEST switch in the UP or DOWN position. Multimeter indication should drop to 0 vdc  $\pm 1.5$  vdc).

If multimeter indication is correct, replace solenoid switch in accordance with paragraph 5-31 and retest.

If multimeter indication is not correct, check cable from hydraulic unit to control assembly for continuity. Repair or replace in accordance with paragraph 5-11 and retest.

If 12 vdc (computer controlled) or a minimum of 9.5 vdc (radio controlled) is still not present at solenoid switch control terminal, proceed to malfunction 15.

Step 10. Set multimeter to measure 12 vdc. Place negative lead to ground. Place positive lead on suppression card contacts as shown and observe indications.

Suppression Card Pin #	Multimeter Indication
#1	12 vdc (computer controlled) or a minimum of 9.5 vdc (radio controlled), which drops to 0 vdc ( $\pm 1.5$ vdc) when the test switch is placed in the UP position.
#5	12 vdc (computer controlled) or a minimum of 9.5 vdc (radio controlled), which drops to 0 vdc ( $\pm 1.5$ vdc) when the test switch is placed in the DOWN position.
#3	12 vdc (computer controlled) or a minimum of 9.5 vdc (radio controlled), which drops to 0 vdc ( $\pm 1.5$ vdc) when the test switch is placed in the UP or DOWN position.

If multimeter indications are correct, replace or repair hydraulic motor assembly in accordance with paragraph 5-30 or 5-31 and retest.

If target still fails to respond to TEST switch, refer to malfunction 18.

If any multimeter indications are incorrect, check for continuity of wiring from suppression card to hydraulic unit connector and from hydraulic unit connector to control assembly connector. Repair or replace cables as necessary and retest.

Table 5-1. Direct Support Troubleshooting - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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2. Target goes down but will not respond to up commands from TEST switch.

**WARNING**



**Disarm, then disconnect the ATKS connection from control assembly on TTA or TIU. The ATKS must be disconnected from TTA before performing maintenance. Explosion is possible and can cause personal injury and damage to equipment. Pyrotechnics are used during range operation.**

Step 1. Set FUNCTION switch to position 2 and place TEST switch in the UP position. The target should move to the UP position.

If target moves to the up position, target is operational.

If target does not move to the UP position, proceed to step 2.

Step 2. Remove all hit sensors and place TEST switch in the UP position.

If target moves to the UP position, a hit sensor is defective. Proceed to step 3.

If target does not move to the UP position, proceed to step 5.

Step 3. Set FUNCTION switch to position 0. Connect a hit sensor and set FUNCTION switch to position 2. Tap hit sensor.

If target does not move to the DOWN position, that hit sensor is defective. Replace in accordance with paragraph 4-7 and retest

Step 4. Repeat step 3 for remaining two hit sensors. Replace defective hit sensors and retest.

If target still fails to move to the DOWN position, proceed to step 5.

Table 5-1. Direct Support Troubleshooting - Continued.

MALFUNCTION  
 TEST OR INSPECTION  
 CORRECTIVE ACTION



**WARNING**

Care must be taken during the next steps to prevent electrical shock and to keep wires from shorting out to ground.

- Step 5. Set FUNCTION switch to position O. Remove all connections from the front of control assembly. Remove front panel of control assembly to allow access to the circuit card assemblies. Connect test wire with alligator clips between front panel and control assembly case.
- Step 6. Turn power ON. Set multimeter to read 12 vdc. Using positive lead of multimeter, pierce wire entering battery check CCA connector pin 3. Place negative lead to ground. Refer to FO-4 and illustration below.

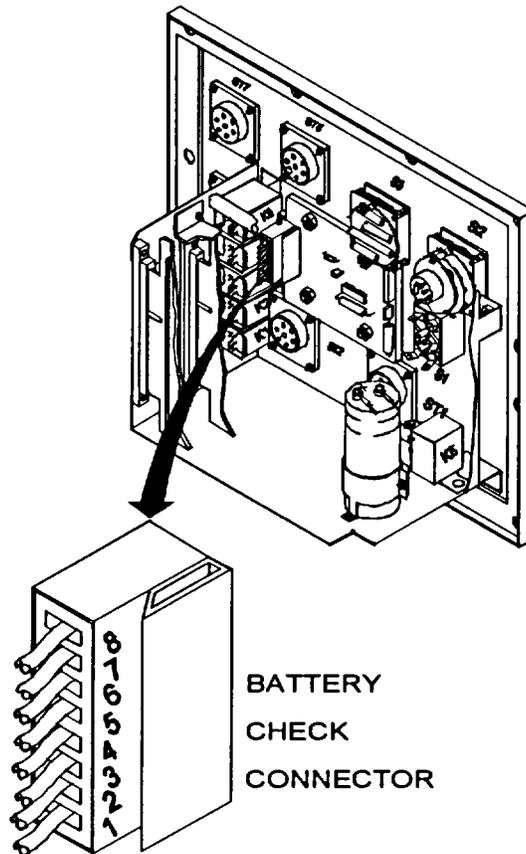
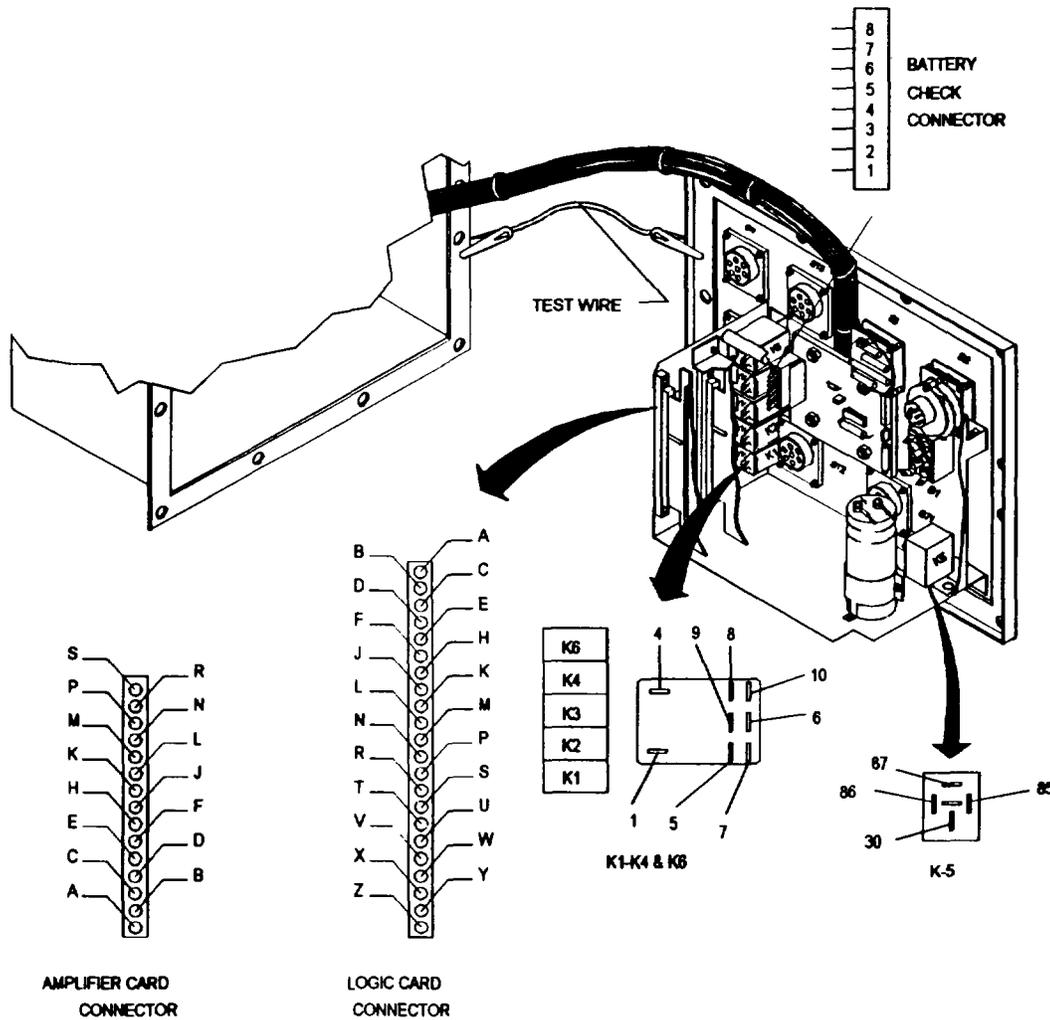


Table 5-1. Direct Support Troubleshooting - Continued.

MALFUNCTION  
 TEST OR INSPECTION  
 CORRECTIVE ACTION



Step 7. Place TEST switch in the UP position. Multimeter indication should drop from 12 vdc (computer controlled) or a minimum of 9.5 vdc (radio controlled) to 0 vdc +1.5 vdc) and then return to 12 vdc (computer controlled) or a minimum of 9.5 vdc (radio controlled).

If the multimeter drops to 0 vdc  $\pm$ 1.5 vdc), set FUNCTION switch to position O and check for continuity of wiring between battery check CCA pin 3 and relay K6 pin 4 and between relay K6 pin 6 and connector P2 pin g. Repair wiring or replace connectors as necessary.

If wiring is good, replace relay K6.

If multimeter continues to indicate 12 vdc (computer controlled) or a minimum of 9.5 vdc (radio controlled), proceed to step 8.

Table 5-1. Direct Support Troubleshooting - Continued.

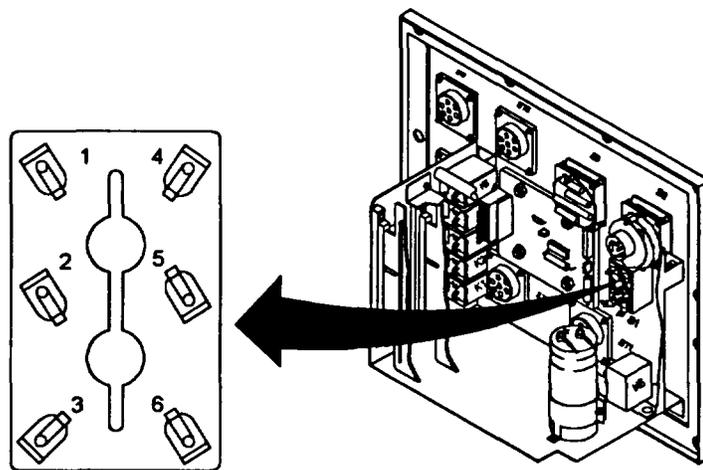
MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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Step 8. Set multimeter to measure 12 vdc. Connect positive lead to the logic CCA pin E and the negative lead to ground. Place the TEST switch in the UP position. The multimeter should indicate 10 vdc ( $\pm 1.5$  vdc) as long as the test switch is in the up position.

If indication is correct, proceed to step 10.

If indication is incorrect, check continuity of wiring between TEST switch pin 6 and logic CCA pin E. Repair as necessary and retest.

If target still does not respond to the TEST switch, proceed to step 9.



TEST SWITCH

Step 9. Turn power ON. Set multimeter to read 12 vdc. Connect positive lead to TEST switch pin 2 and negative lead to ground. Multimeter should indicate 12 vdc (computer controlled) or a minimum of 9.5 vdc (radio controlled).

If indication is correct, set FUNCTION switch to position O and replace TEST switch.

If indication is incorrect, set FUNCTION switch to position O and check for continuity between the TEST switch pin 5 and FUNCTION switch deck A, pin 2. Repair wiring as necessary and retest.

Step 10. Set multimeter to measure 12 vdc. Connect positive lead to the logic CCA pin M and the negative lead to ground. Place the TEST switch in the UP position. Multimeter should indicate 12 vdc (computer controlled) or a minimum of 9.5 vdc (radio controlled), then drop to 0 vdc  $\pm 1.5$  vdc) when the TEST switch is placed in the UP position, and then return to 12 vdc (computer controlled) or a minimum of 9.5 vdc (radio controlled).

If multimeter indications are correct, set FUNCTION switch to position O and check for continuity between logic CCA pin M and battery check CCA pin 4.

Table 5-1. Direct Support Troubleshooting - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
		If continuity is not found, repair as necessary and retest.
		If continuity is found, replace battery check CCA in accordance with paragraph 5-17 and retest.
		If target still fails to respond to TEST switch, proceed to step 11.
		If multimeter indication remains at 12 vdc (computer controlled) or a minimum of 9.5 vdc (radio controlled), set FUNCTION switch to position O and replace logic CCA in accordance with paragraph 5-15 and retest.
Step 11.	Set multimeter to measure 12 vdc. Connect positive lead to logic CCA pin N and negative lead to ground. Place the TEST switch in the UP position. Multimeter should indicate 12 vdc (computer controlled) or a minimum of 9.5 vdc (radio controlled), then drop to 0 vdc ( $\pm 1.5$ vdc) when the TEST switch is placed in the UP position, and then return to 12 vdc (computer controlled) or a minimum of 9.5 vdc (radio controlled).	
		If multimeter indications are incorrect, set FUNCTION switch to position O and replace logic CCA in accordance with paragraph 5-16 and retest.
		If multimeter indications are correct, set FUNCTION switch to position O and check for continuity between logic CCA pin N and relay K3 pin 4 and between relay K3 pin 7 and connector P2 pin E.
		If continuity is found, reconnect P2.
		If continuity is not found, repair wiring and retest.

**3. Target goes up but will not respond to down commands from TEST switch.**



**Disarm, then disconnect the ATKS connection from control assembly on TTA or TIU. The ATKS must be disconnected from TTA before performing maintenance. Explosion is possible and can cause personal injury and damage to equipment. Pyrotechnics are used during range operation.**

- Step 1. Set FUNCTION switch to position 2 and place TEST switch in the DOWN position. The target should move to the DOWN position.
- If target moves to the DOWN position, target is operational.
- If target does not move to the DOWN position, proceed to step 2.

Table 5-1. Direct Support Troubleshooting - Continued.

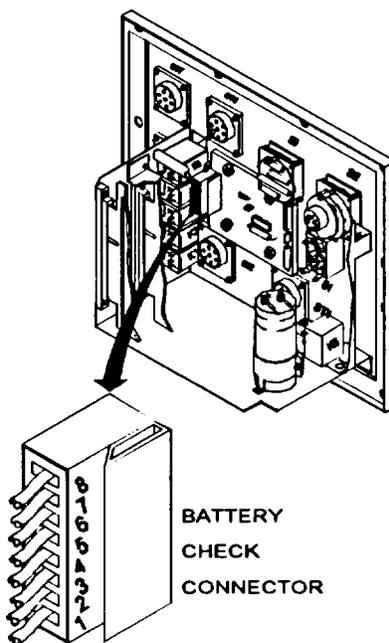
MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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**WARNING** I



Care must be taken during the next steps to prevent electrical shock and to keep wires from shorting out to ground.

- Step 2. Set FUNCTION switch to position 0. Remove front panel of control assembly to allow access to the circuit card assemblies. Connect test wire with alligator clips between front panel and control assembly case.
- Step 3. Turn power ON. Set multimeter to read 12 vdc. Place positive lead of multimeter on the top of the battery check CCA connector pin 1 and the negative lead on ground. Refer to FO-4 and illustration below.



- Step 4. Place TEST switch in the DOWN position. Multimeter indication should drop from 12 vdc (computer controlled) or a minimum of 9.5 vdc (radio controlled), to 0 vdc  $\pm 1.5$  vdc, and then return to 12 vdc (computer controlled) or a minimum of 9.5 vdc (radio controlled). If the multimeter drops to 0 vdc  $\pm 1.5$  vdc, set FUNCTION switch to position 0 and check for continuity of wiring between battery check CCA pin 1 and relay K2 pin 4 and between relay K2 pin 7 and connector P2 pin F. Repair wiring or replace connectors as necessary if continuity is not found.

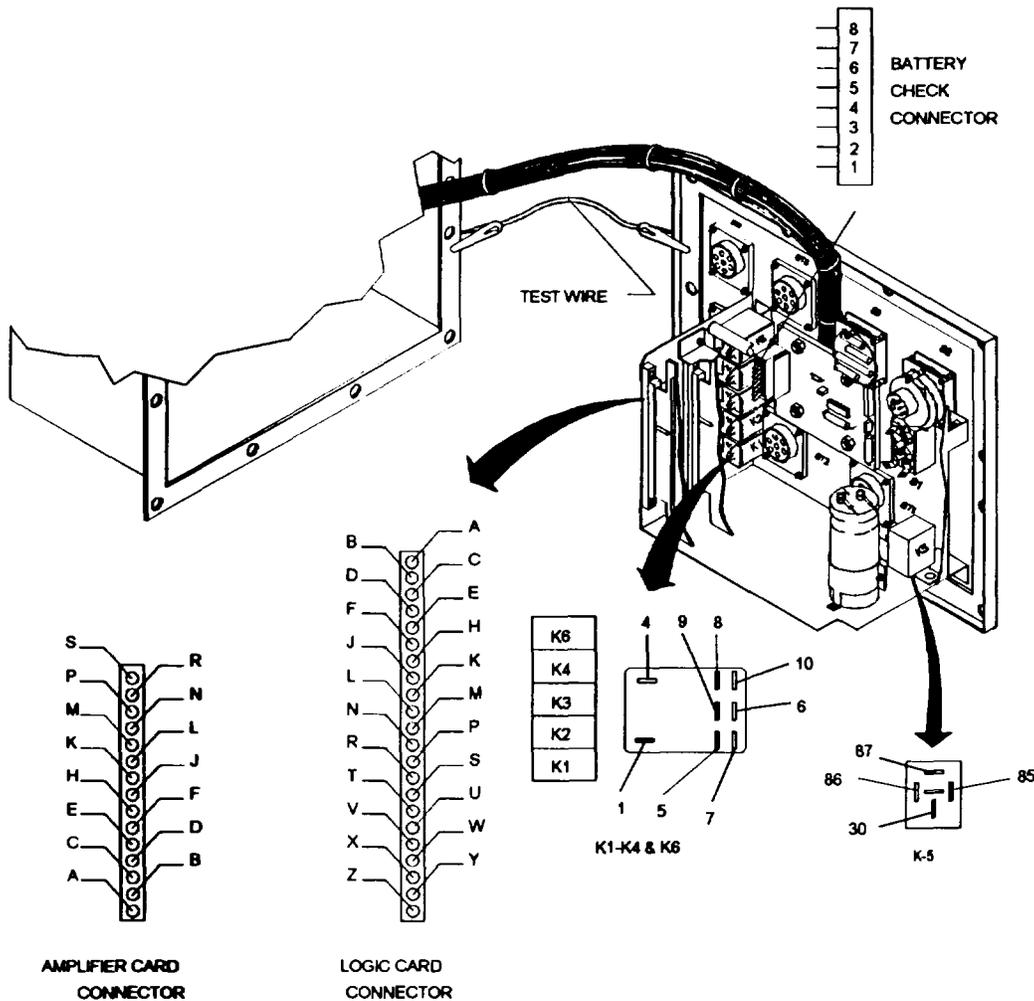
Table 5-1. Direct Support Troubleshooting - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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If wiring is good, reconnect P2 and replace K2 relay.

If multimeter continues to indicate a minimum of 9.5 vdc, proceed to step 5.

Step 5. Set multimeter to measure 12 vdc. Place positive lead on the logic CCA pin K and the negative lead on ground. Place the TEST switch in the DOWN position. The multimeter should indicate 10 vdc  $\pm$  1.5 vdc) as long as the test switch is in the down position.



If indication is correct, proceed to step 7.

If indication is incorrect, check continuity of wiring between TEST switch pin 4 and logic CCA pin K. Repair as necessary and retest.

If target still does not respond to the TEST switch, proceed to step 6.

Table 5-1. Direct Support Troubleshooting - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
Step 6. Turn power ON. Set multimeter to read 12 vdc. Place positive lead to TEST switch pin 2 and negative lead on ground. Multimeter should indicate 12 vdc (computer controlled) or a minimum of 9.5 vdc (radio controlled).		
If indication is correct, set FUNCTION switch to position O and replace TEST switch.	If indication is incorrect, set FUNCTION switch to position O and check for continuity between the TEST switch pin 5 and FUNCTION switch contacts 1, 2, 3, and 4. Repair wiring as necessary and retest.	
Step 7. Set FUNCTION switch to position 1. Set multimeter to measure 12 vdc. Place positive lead on the logic CCA pin R and the negative lead on ground. Place the TEST switch in the DOWN position. Multimeter should indicate 12 vdc (computer controlled) or a minimum of 9.5 vdc (radio controlled), then drop to 0 vdc $\pm$ 1.5 vdc) when the TEST switch is placed in the DOWN position.		
If multimeter indications are correct, set FUNCTION switch to position O and check for continuity between logic CCA pin M and battery check CCA pin 2.	If continuity is not found, repair as necessary and retest.	
If continuity is found, replace battery CCA in accordance with paragraph 5-17 and retest.		
If target still fails to respond to TEST switch, proceed to step 8.	If multimeter indication remains at 12 vdc (computer controlled) or a minimum of 9.5 vdc (radio controlled), set FUNCTION switch to position O and replace logic CCA in accordance with paragraph 5-15 and retest.	
Step 8. Set FUNCTION switch to position 1. Set multimeter to measure 12 vdc. Place positive lead on logic CCA pin N and negative lead on ground. Place the TEST switch in the DOWN position. Multimeter should indicate 12 vdc (computer controlled) or a minimum of 9.5 vdc (radio controlled), then drop to 0 vdc $\pm$ 1.5 vdc) when the TEST switch is placed in the DOWN position.		
If multimeter indications are incorrect, set FUNCTION switch to position O and replace logic CCA in accordance with paragraph 5-15 and retest.	If multimeter indications are correct, set FUNCTION switch to position O and check for continuity between logic CCA pin N and relay K3 pin 4, and between relay K3 pin 10 and connector P2 pin E.	
If continuity is not found, repair wiring and retest.		

Table 5-1. Direct Support Troubleshooting-Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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4. Target goes down when hit and FUNCTION switch is in position 1 or 4.

<b>WARNING</b>
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**Disarm, then disconnect the ATKS connection from control assembly on TTA or TIU. The ATKS must be disconnected from TTA before performing maintenance. Explosion is possible and can cause personal injury and damage to equipment. Pyrotechnics are used during range operation.**

- Step 1. Place FUNCTION switch in position 1. Tap hit sensor on a solid surface. Lamp assembly should not flash and target should remain in the UP position.

If target responds correctly, THMITG is operational.

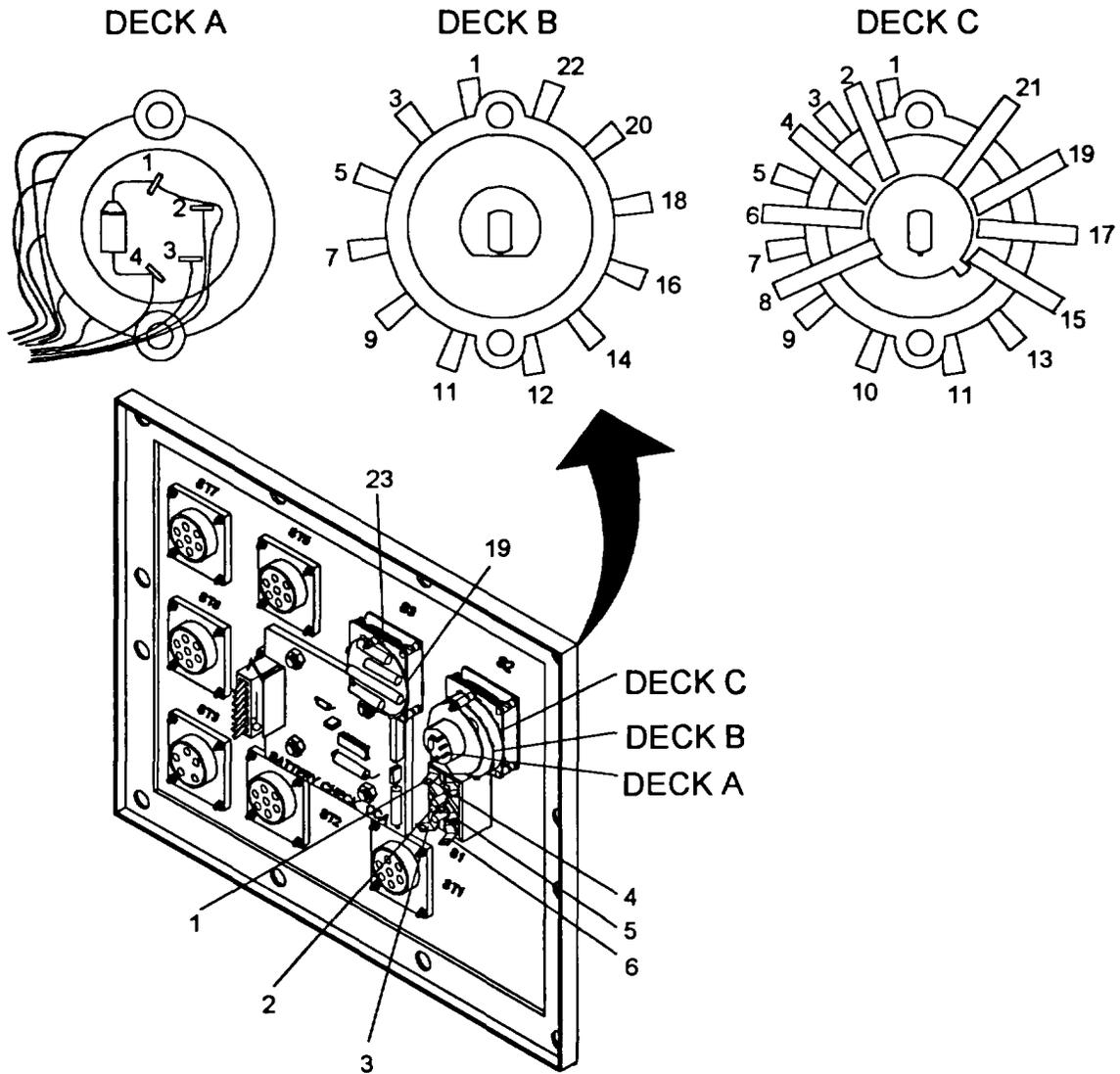
If lamp does not flash and target remains in the UP position, proceed to step 2.

If lamp assembly flashes and target moves to the DOWN position, set FUNCTION switch to position 0. Remove front panel of control assembly to allow access to the circuit card assemblies. Connect test wire with alligator clips between front panel and control assembly case. Check continuity on FUNCTION switch deck B pin 3 and ground. Refer to FO-4.

Table 5-1. Direct Support Troubleshooting-Continued

**MALFUNCTION**  
**TEST OR INSPECTION**  
**CORRECTIVE ACTION**

**FUNCTION SWITCH**



If FUNCTION switch is defective, replace in accordance with paragraph 5-24 and retest.

If target still moves to the DOWN position, set FUNCTION switch to position O. Replace logic CCA in accordance with paragraph 5-15 and retest.

Table 5-1. Direct Support Troubleshooting-Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	Step 2. Place FUNCTION switch in position 4. Tap hit sensor on a solid surface. Lamp assembly should flash and target should remain in the UP position.	<p>If target responds correctly, THM/TG is operational.</p> <p>If lamp does not flash, proceed to malfunction 9.</p> <p>If lamp assembly flashes and target moves to the DOWN position, set FUNCTION switch to position 0. Check continuity on FUNCTION switch deck B pin 9 and ground.</p> <p>If FUNCTION switch is defective, replace in accordance with paragraph 5-24 and retest.</p> <p>If target still moves to the DOWN position, set FUNCTION switch to position O. Replace logic CCA in accordance with paragraph 515 and retest.</p>
5.	Target does not return to the UP position when hit and FUNCTION switch is in position 3 or 6.	

**WARNING**



**Disarm, then disconnect the ATKS connection from control assembly on TTA or TIU. The ATKS must be disconnected from TTA before performing maintenance. Explosion is possible and can cause personal injury and damage to equipment. Pyrotechnics are used during range operation.**

- Step 1. Set the FUNCTION switch to position 3. Tap the hit sensor on a solid surface. The target automatically goes down when hit and should reach the down position within 8 seconds after a hit is detected. The target should begin to raise within 9-13 seconds after the initial hit detection and should be completely raised within 8 seconds after starting towards the upright position.
- If target responds correctly, THM/TG is operational.
- If target goes down but does not automatically move to the UP position after approximately 9-13 seconds, set FUNCTION switch to position 0. Replace logic CCA in accordance with paragraph 5-15 and retest
- Step 2. Set the FUNCTION switch to position 6. Tap the hit sensor on a solid surface. Lamp assembly should flash and the target automatically go down when hit and should reach the down position within 8 seconds after a hit is detected. The target should begin to raise within 9-13 seconds after the initial hit detection and should be completely raised within 8 seconds after starting towards the upright position.
- If lamp assembly and target respond correctly, THM/TG is operational.
- If lamp assembly does not flash, proceed to malfunction 9.

Table 5-1. Direct Support Troubleshooting - Continued.

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION
<p>If target goes down but does not automatically move to the UP position after approximately 913 seconds, set FUNCTION switch to position 0. Replace logic CCA in accordance with paragraph 5-15 and retest.</p>

6. Target does not respond to hits.

**WARNING**



**Disarm, then disconnect the ATKS connection from control assembly on TTA or TIU. The ATKS must be disconnected from TTA before performing maintenance. Explosion is possible and can cause personal injury and damage to equipment. Pyrotechnics are used during range operation.**

- Step 1. With target in the UP position, ensure that hit sensors are securely mounted to the target and hit sensor connectors are properly attached to the control assembly.
- Step 2. Place FUNCTION switch in position 2, 3, 5, or 6.
- Step 3. Simulate a hit by tapping hit sensors one at a time. The target should move to the DOWN position for each hit sensor.

If target moves to the DOWN position, target is responding properly to hits.

If target moves to the DOWN position with one hit sensor but not another, replace the defective hit sensor in accordance with paragraph 4-7 and retest.

If target still fails to move to the DOWN position proceed to step 4.

**WARNING**



**Care must be taken during the next steps to prevent electrical shock and to keep wires from shorting out to ground.**

- Step 4. Move drive shaft until magnetic actuator switch is out of S3. Set multimeter to measure ohms on the X10 scale. Place multimeter positive lead on proximity switch cable P3 pin D and negative lead on P3 pin A. Multimeter should indicate continuity. Insert a putty knife blade or similar tool between S3 proximity switch legs. Multimeter should indicate no continuity.

If multimeter indications are correct, P3 proximity switch cable is operational. Proceed to step 5.

If multimeter indications are incorrect, repair P3 cable or replace S3 in accordance with paragraph 5-13 or 5-14 and retest.

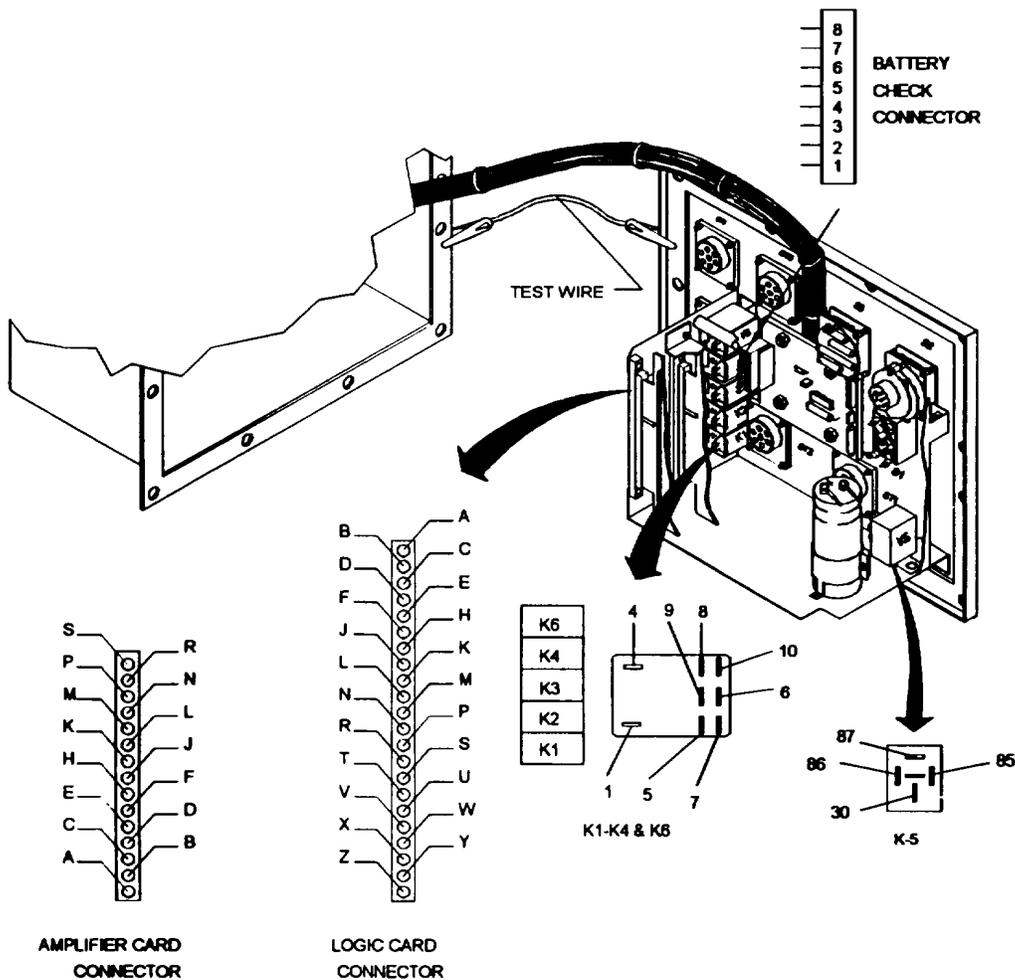
Table 5-1. Direct Support Troubleshooting - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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Step 5. Set FUNCTION switch to position O. Remove front panel of control assembly to allow access to the circuit card assemblies. Connect test wire between front panel and control assembly case.

Step 6. Place FUNCTION switch in position 5.

Step 7. Set multimeter to measure 12 vdc. Place positive lead on logic CCA pin R and negative lead on ground. Refer to FO-4.



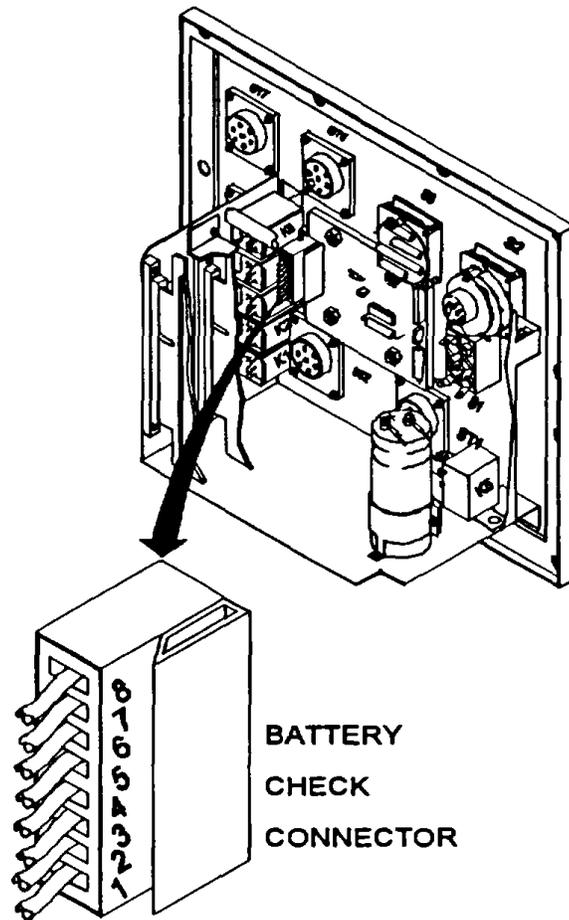
Step 8. Tap hit sensor on a solid surface. Multimeter should indicate 12 vdc (computer controlled) or a minimum of 9.5 vdc (radio controlled), then drop to 0 vdc  $\pm$  1.5 vdc when the hit sensor is tapped.

If multimeter indications are correct, proceed to step 9.

If multimeter indications are incorrect, proceed to step 11.

Table 5-1. Direct Support Troubleshooting - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>Step 9. Ensure the target is in the up position. Place multimeter positive lead on battery check CCA pin 1 and negative lead on ground. Tap hit sensor on a solid surface. Multimeter should indicate 12 vdc (computer controlled) or a minimum of 9.5 vdc (radio controlled), then drop to 0 vdc <math>\pm 1.5</math> vdc when the hit sensor is tapped.</p>	<p>If multimeter indications are correct, set FUNCTION switch to position 0. Check continuity between battery check CCA pin 1 and relay K2 pin 4 and between relay K2 pin 10 and pin F on connector P2. Repair wiring as necessary and retest.</p>	<p>If wiring is good, replace K2 relay.</p>
<p>If multimeter indications are not correct, proceed to step 10.</p>		



Step 10. Ensure the target is in the up position. Place multimeter positive lead on battery check CCA pin 2 and negative lead on ground. Tap hit sensor on a solid surface. Multimeter should indicate 12 vdc (computer controlled) or a minimum of 9.5 vdc (radio controlled), then drop to 0 vdc ( $\pm 1.5$  vdc) when the hit sensor is tapped.

If multimeter indications are correct, replace battery check CCA in accordance with paragraph 5-17 and retest.

Table 5-1. Direct Support Troubleshooting - Continued.

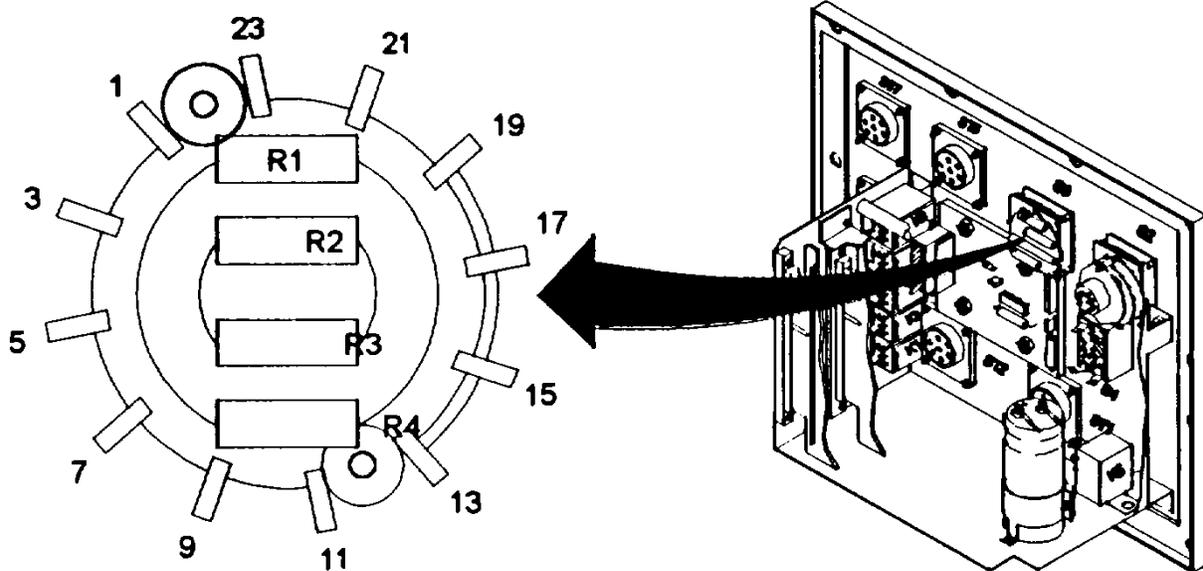
MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
		If multimeter indications are not correct, set FUNCTION switch to position 0. Check for continuity between logic CCA pin R and battery check CCA pin 2. If continuity is not found, repair wiring and retest.
Step 11.	Set multimeter to read 10 vdc. With target in the UP position, set FUNCTION switch to position 5. Place multimeter positive lead on logic CCA pin X and negative lead to ground. Tap hit sensor on a solid surface. Multimeter should show a slight increase in voltage.	<p>If multimeter indications are correct, set FUNCTION switch to position O. Replace logic CCA in accordance with paragraph 5-15 and retest.</p> <p>If multimeter indications are incorrect, set FUNCTION switch to position O. Replace amplifier CCA in accordance with paragraph 5-16 and retest.</p> <p>If multimeter reading is still incorrect, set FUNCTION switch to position O. Check continuity between hit sensor connectors and the amplifier CCA, and between the amplifier CCA and the logic CCA. Refer to FO-4.</p> <p>If continuity is not found, repair wiring as necessary and retest.</p>
Step 12.	With target in the UP position, use test wire with alligator clips to ground pin D on any hit sensor connector. Target should move to the DOWN position and remain in the DOWN position as long as pin D is grounded.	<p>If target responds correctly, proceed to step 13.</p> <p>If target does not respond correctly, set FUNCTION switch to position O. Replace amplifier CCA in accordance with paragraph 5-16 and retest.</p> <p>If target still fails to respond correctly, set FUNCTION switch to position O. Check continuity between hit sensor connectors and amplifier CCA.</p> <p>If continuity is not found, repair wiring and retest.</p> <p>If target still fails to respond correctly, set FUNCTION switch to position O. Replace logic CCA in accordance with paragraph 5-15 and retest.</p> <p>If target still fails to respond correctly, proceed to step 13.</p>

Table 5-1. Direct Support Troubleshooting - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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Step 13. Set multimeter to measure 12 vdc. Connect multimeter positive lead to SENSITIVITY switch pin 23 and negative lead to ground. Move SENSITIVITY switch to the positions indicated below and note the corresponding voltage indications.

Switch position	Voltage indication
1	1.5 vdc +0.15 vdc)
2	4 vdc +1 vdc)
3	6.5 vdc +1.5 vdc)
4	8 vdc +1.5 vdc)



If multimeter indications are correct, proceed to step 14.

If multimeter indicates no power, set FUNCTION switch to position O. Check for continuity between SENSITIVITY switch and amplifier CCA.

If continuity is not found, repair wiring as necessary and retest.

If continuity is found, proceed to step 14.

If voltage indications are incorrect for any position, set FUNCTION switch to position O. Replace SENSITIVITY switch in accordance with paragraph 5-25 and retest.

Step 14. Check continuity between SENSITIVITY switch contact 1 and FUNCTION switch contact 2.

If continuity is not found, repair wiring and retest.

If continuity is found, replace FUNCTION switch in accordance with paragraph 5-24 and retest.

Table 5-1. Direct Support Troubleshooting - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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**7. Target goes down and continues driving into ground.**

Step 1. Adjust small magnetic actuator switch in accordance with paragraph 5-5 and retest.

If target stops in correct position, THM/TG is now operational.

If target continues to drive into the ground, disconnect W107 cable from TIU and proceed to step 2.

Step 2. Move drive shaft until small magnetic actuator switch is out of S2. Remove P3 cable connector from control assembly or W107 cable. Set multimeter to measure ohms on the X10 scale. Place multimeter positive lead on proximity switch cable P3 pin B and negative lead on P3 pin A. Multimeter should indicate continuity. Insert a putty knife blade or similar tool between S2 proximity switch legs. Multimeter should indicate no continuity.

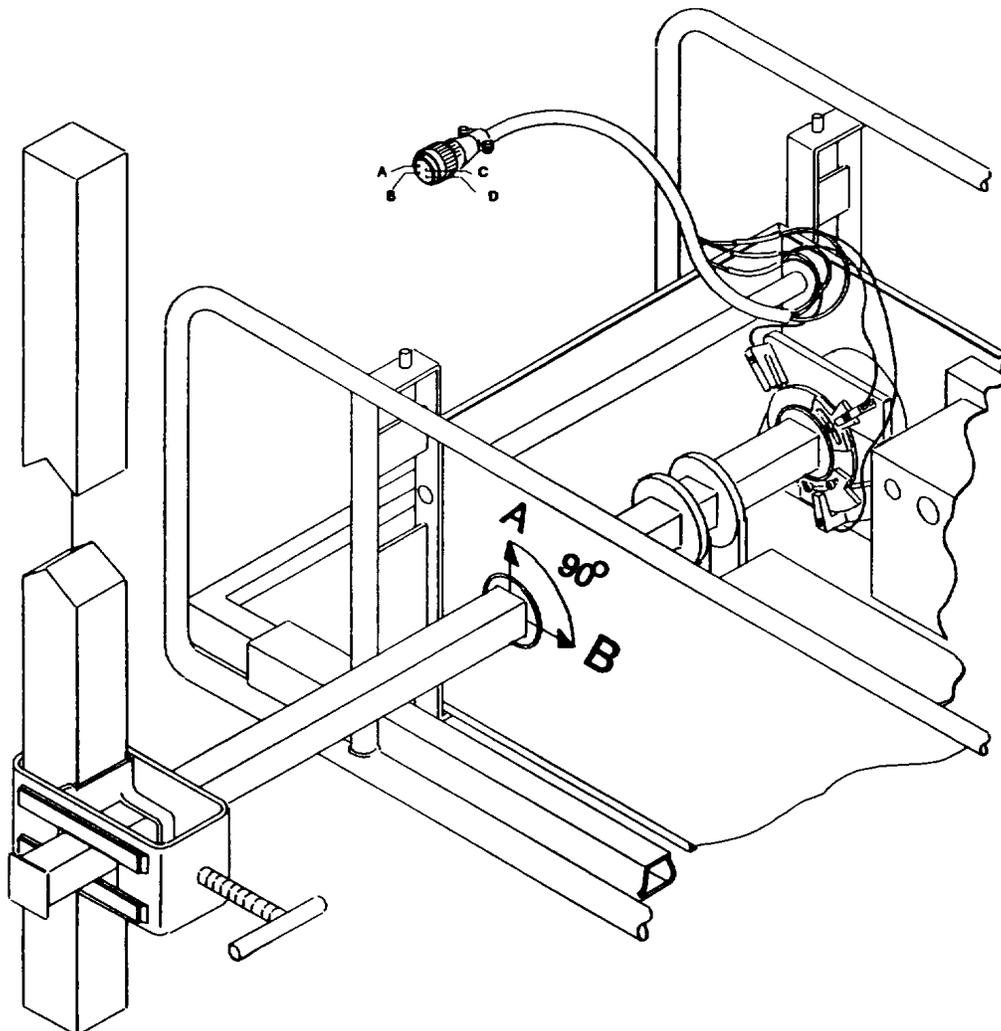
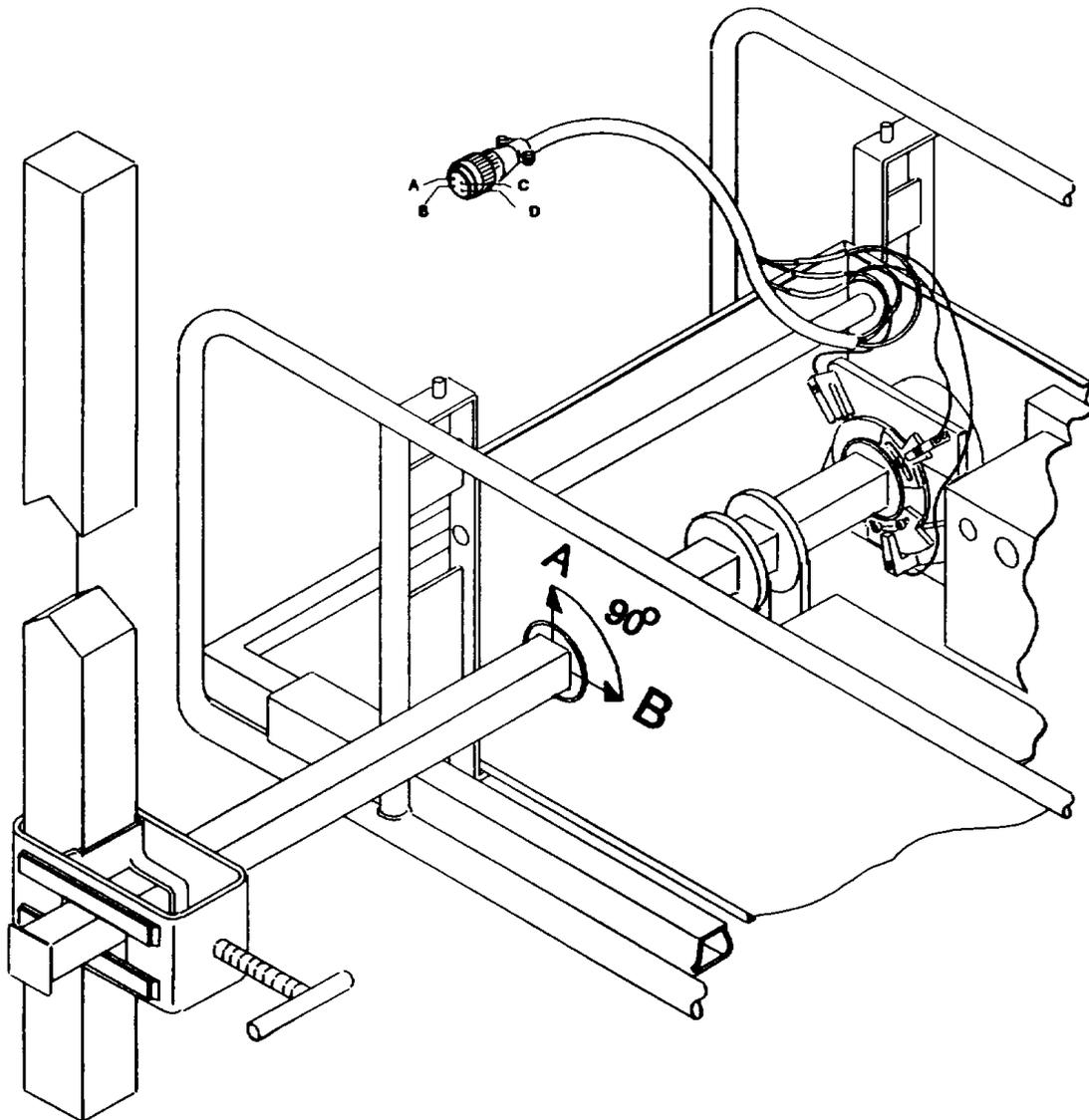


Table 5-1. Direct Support Troubleshooting - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
		If multimeter indications are correct proceed to step 3.
		If multimeter indications are incorrect, verify S1 and S2 are wired and mounted correctly and, if required, repair P3 cable or replace S2 in accordance with paragraph 5-13 or 5-14 and retest.
	Step 3. Move drive shaft until magnetic actuator switch is out of S1. Set multimeter to measure ohms on the X10 scale. Place multimeter positive lead on proximity switch cable P3 pin C and negative lead on P3 pin A. Multimeter should indicate continuity. Insert a putty knife blade or similar tool between S1 proximity switch legs. Multimeter should indicate no continuity.	
		If multimeter indications are correct, proceed to malfunction 13.
		If multimeter indications are incorrect, repair P3 cable or replace S1 in accordance with paragraph 5-13 or 5-14 and retest.
	Step 4. Reconnect W107 cable to P3 cable and other end of W107 cable to the TIU and retest.	
		If target does not overdrive, THM/TG is now operational.
		If target continues to overdrive, replace TIU. Refer to TM 9-6920-742-14-4.
<b>8. Target goes up and continues driving into cover.</b>		
	Step 1. Adjust small magnetic actuator switch in accordance with paragraph 5-5 and retest.	
		If target stops in correct position, THM/TG is now operational.
		If target continues to drive into the ground, disconnect W107 cable from TIU and proceed to step 2.
	Step 2. Move drive shaft until magnetic actuator switch is out of S2. Remove P3 cable connector from control assembly or W107 cable. Set multimeter to measure ohms on the X10 scale. Place multimeter positive lead on proximity switch cable P3 pin B and negative lead on P3 pin A. Multimeter should indicate continuity. Insert a putty knife blade or similar tool between S2 proximity switch legs. Multimeter should indicate no continuity.	

Table 5-1. Direct Support Troubleshooting - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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If multimeter indications are correct proceed to step 3.

If multimeter indications are incorrect, verify S1 and S2 wired and mounted correctly and if required repair P3 cable or replace S2 in accordance with paragraph 5-13 or 5-14 and retest

Step 3. Move drive shaft until magnetic actuator switch is out of S1. Set multimeter to measure ohms on the X10 scale. Place multimeter positive lead on proximity switch cable P3 pin C and negative lead on P3 pin A. Multimeter should indicate continuity. Insert a putty knife blade or similar tool between S1 proximity switch legs. Multimeter should indicate no continuity.

If multimeter indications are correct, proceed to malfunction 13.

Table 5-1. Direct Support Troubleshooting - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
		<p>If multimeter indications are incorrect, verify S1 and S2 are wired and mounted correctly and, if required, repair P3 cable or replace S1 in accordance with paragraph 5-13 or 5-14 and retest.</p> <p>Step 4. Reconnect W107 cable to P3 cable and other end of W107 cable to the TIU and retest.</p> <p>If target does not overdrive, THM/TG is now operational.</p> <p>If target continues to overdrive, replace TIU. Refer to TM 9-6920-742-14-4.</p>
<p><b>9. Lamp assembly does not flash when hit occurs.</b></p>		
<p><b>⚠ WARNING ⚠</b></p>		
	<p><b>Disarm, then disconnect the ATKS connection from control assembly on TTA or TIU. The ATKS must be disconnected from TTA before performing maintenance. Explosion is possible and can cause personal injury and damage to equipment. Pyrotechnics are used during range operation.</b></p>	
	<p>Step 1. Set FUNCTION switch to position 4. Place TEST switch in the UP position. As target moves upward, lamp assembly should blink.</p> <p>If lamp assembly blinks, proceed to step 3.</p> <p>If lamp assembly fails to blink, proceed to step 2.</p>	<p>Step 2. Disconnect lamp assembly from ST3. Set multimeter to measure 12 vdc. Connect multimeter positive lead to ST3 pin B and negative lead to ST3 pin A. Place target in the UP position. Multimeter should indicate 12 vdc (computer controlled) or a minimum of 9.5 vdc (radio controlled) when hit sensor is rapped.</p> <p>If multimeter indication is correct, repair or replace lamp assembly in accordance with paragraph 4-18 and retest.</p> <p>If multimeter indication is incorrect, proceed to step 3.</p>
	<p><b>⚠ WARNING ⚠</b></p> <p><b>Care must be taken during the next steps to prevent electrical shock and to keep wires from shorting out to ground.</b></p>	
	<p>Step 3. Set FUNCTION switch to position O. Remove front panel of control assembly to allow access to the circuit card assemblies. Connect test wire with alligator clips between front panel and control assembly case. Check continuity between ST3 pin B and relay K5 pin 87 and between relay K5 pin 87 and TEST switch pin 1. Refer to FO-4 and illustration below.</p>	

Table 5-1. Direct Support Troubleshooting - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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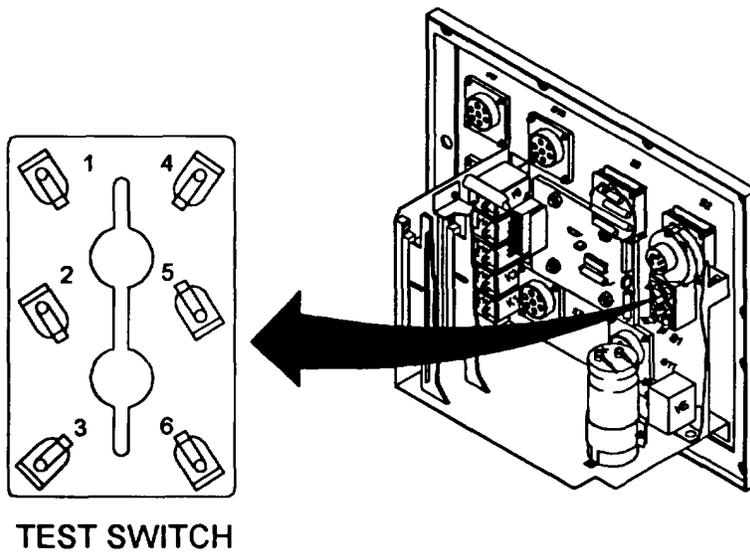
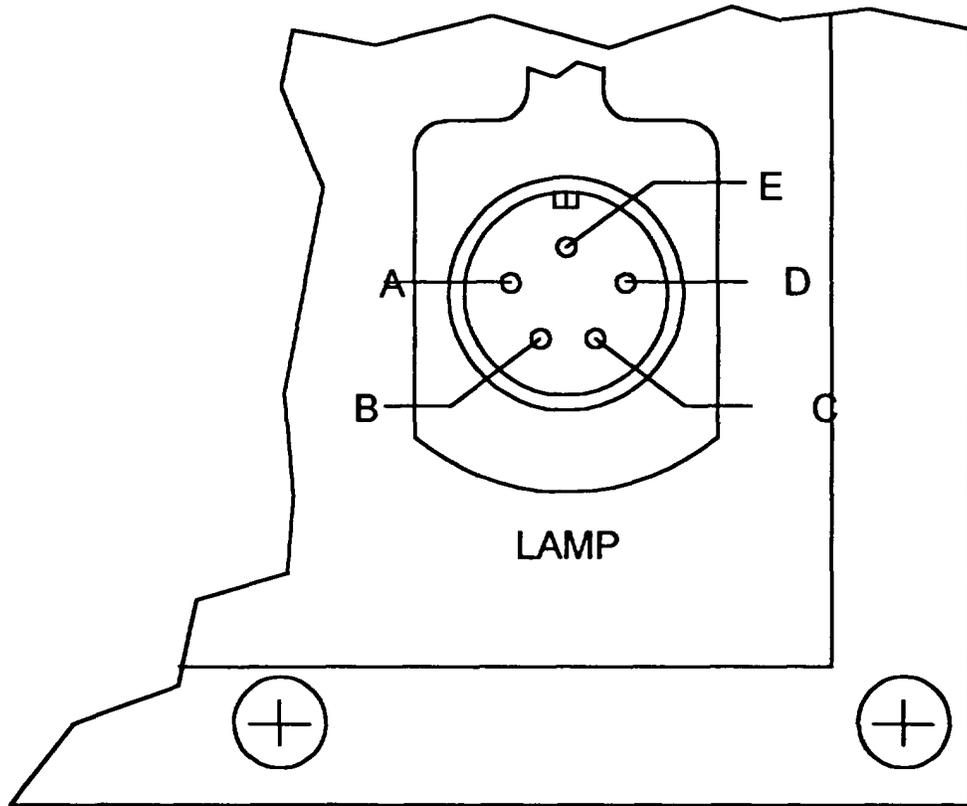


Table 5-1. Direct Support Troubleshooting - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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If continuity is found, proceed to step 4.

If continuity is not found, repair wiring as necessary and retest.

Step 4. Set Function Switch to Position 4. Use TEST switch to raise target. Connect a hit sensor to hit sensor connector 1. Connect lamp assembly to ST3. Tap hit sensor on a solid surface, lamp assembly should flash.

If lamp assembly flashes, lamp circuits are operational.

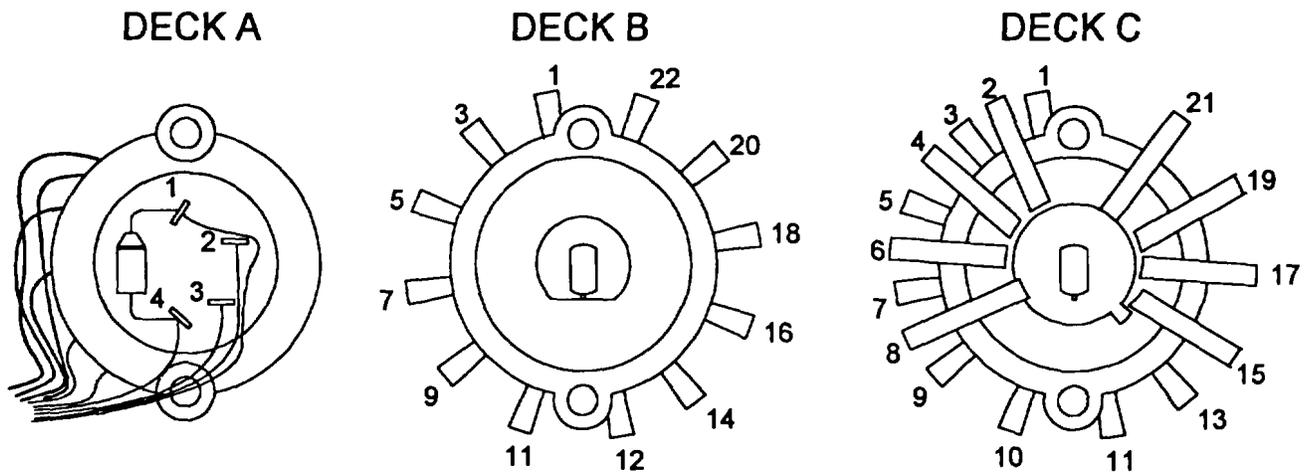
If lamp assembly fails to flash, proceed to step 5.

Step 5. Set multimeter to measure 12 vdc. Place multimeter positive lead on logic CCA pin B and negative lead to ground. Tap hit sensor on a solid surface. Multimeter should indicate 12 vdc (computer controlled) or a minimum of 9.5 vdc (radio controlled).

If multimeter indication is correct, set FUNCTION switch to position O and check for continuity between logic CCA pin B and FUNCTION switch decks C and B, and between FUNCTION switch decks C and B and relay K5 pin 85. Repair wiring or replace FUNCTION switch as necessary and retest.

If multimeter indication is incorrect, proceed to step 6.

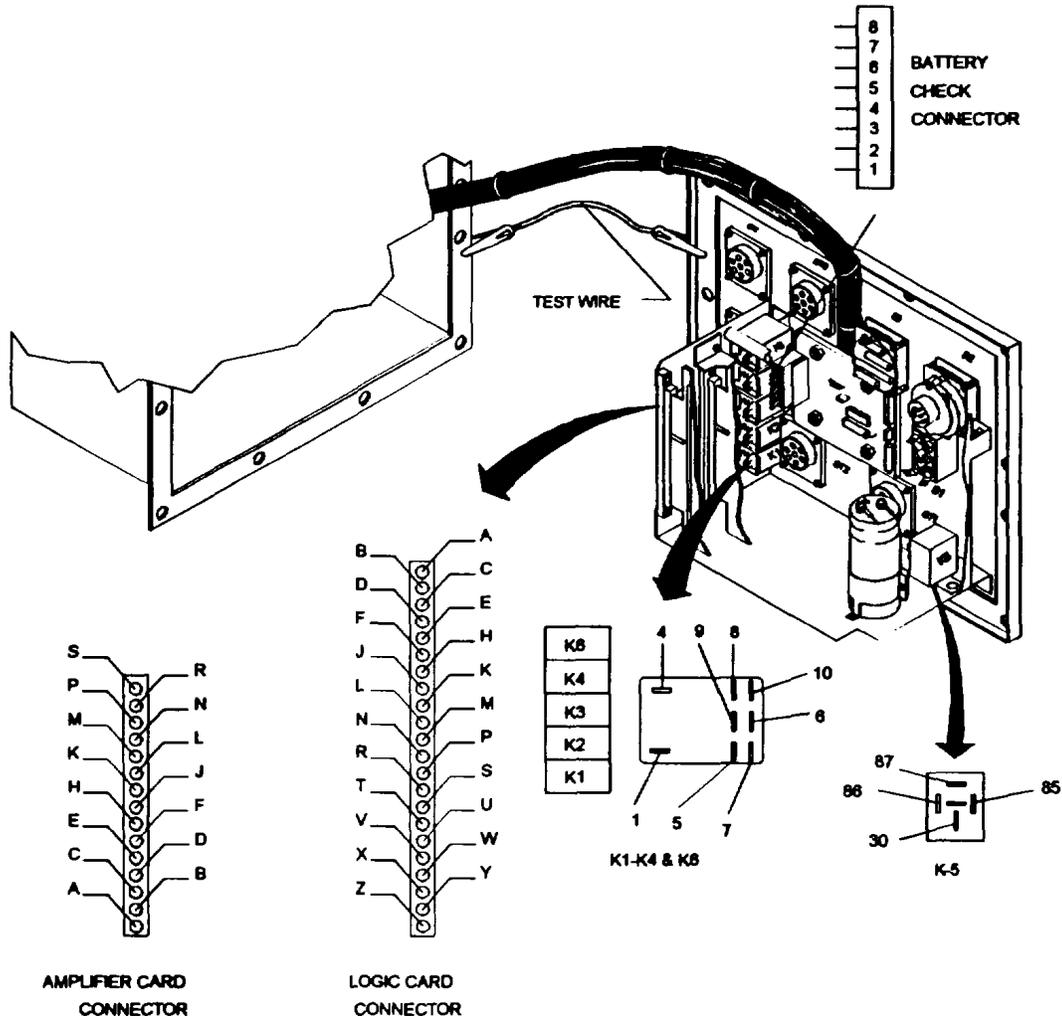
FUNCTION SWITCH



Step 6. Set multimeter to measure 10 vdc. Place multimeter positive lead on logic CCA pin X and negative lead to ground. Tap hit sensor on a solid surface. Multimeter should show a slight increase in voltage.

Table 5-1. Direct Support Troubleshooting - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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If multimeter indication is correct, set FUNCTION switch to position O. Replace logic CCA in accordance with paragraph 5-15 and retest.

If multimeter indication is incorrect, set FUNCTION switch to position O. Check continuity between amplifier CCA and logic CCA. Refer to FO-4. Repair as necessary and retest.

If multimeter indication is still incorrect, set FUNCTION switch to position O. Check continuity between hit sensor connectors and amplifier CCA. Refer to figure FO-4.

If continuity is not found, repair wiring or replace hit sensor connectors in accordance with paragraph 5-18 and retest. Refer to FO-4.

If multimeter indication is still incorrect, set FUNCTION switch to position O. Replace amplifier CCA in accordance with paragraph 5-16 and retest.

Table 5-1. Direct Support Troubleshooting - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
10. Target operates too slowly.	<b>WARNING</b> I	 <p>Disarm, then disconnect the ATKS connection from control assembly on TTA or TIU. The ATKS must be disconnected from TTA before performing maintenance. Explosion is possible and can cause personal injury and damage to equipment. Pyrotechnics are used during range operation.</p>
		<p>Step 1. Check all cables for serviceability. Ensure all cables are properly and securely connected. Refer to FO-1, FO-2, and FO-3.</p> <p>Step 2. Ensure that FUNCTION switch is in any position except 0.</p> <p>Step 3. Using TEST switch, raise or lower target. Target should reach limit within 9 -13 seconds and BATTERY lamp should steadily illuminate.</p> <p>If target responds properly to TEST switch, THM/TG is operational.</p> <p>With battery-operated model, if BATTERY lamp flashes when the TEST switch is used, use multimeter to check battery for 12 vdc (computer controlled) or a minimum of 9.5 vdc (radio controlled) across battery terminals. On radio controlled versions, if a minimum of 9.5 vdc is not present, the battery needs charging. Refer to TM 9-6140-200-14. On computer controlled versions, if 12 vdc is not present, the battery needs replacing or check TIU trickle charge circuit. Refer to TM 9-6920-742-14-4.</p> <p>With battery-eliminator-operated model, if BATTERY lamp flashes when the TEST switch is used, refer to malfunction 16.</p> <p>Step 4. Remove access door. Remove hydraulic unit cover. Check that hydraulic fluid level is 1/2 inch from bottom of filler spout.</p> <p>If fluid level is correct, proceed to step 5.</p> <p>If fluid level is low, inspect hydraulic system for leaks (refer to paragraph 2-3f), repair or replace any leaking hardware, service in accordance with paragraph 2-4, and retest.</p> <p>Step 5. Check for evidence of cracking and binding of bearing unit housings and base frame.</p> <p>If cracking or binding is not evident, proceed to step 6.</p> <p>If cracking or binding is evident, replace bearing unit housings in accordance with paragraph 5-7 or 5-8, or replace base frame in accordance with paragraph 5-10 and retest.</p>

Table 5-1. Direct Support Troubleshooting - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>Step 6. Set multimeter to measure 12 vdc. Place multimeter positive lead on solenoid line terminal connection (nearest hydraulic motor assembly) and negative lead on ground. Refer to FO-5. Using TEST switch, raise or lower target. Multimeter should indicate 12 vdc (computer controlled) or a minimum of 9.5 vdc (radio controlled) and target should reach limit within 8 seconds.</p>	<p>If multimeter indication is correct and target is too slow, replace or repair hydraulic motor assembly in accordance with paragraph 5-30 or 5-31 and retest.</p>	<p>If multimeter indication is incorrect, replace solenoid in accordance with paragraph 5-31 and retest.</p>

11. ATKS does not fire in SMOKE SCORER mode.

I WARNING



Disarm, then disconnect the ATKS connection from control assembly on TTA or TIU. The ATKS must be disconnected from TTA before performing maintenance. Explosion is possible and can cause personal injury and damage to equipment. Pyrotechnics are used during range operation.

I WARNING



Care must be taken during the next steps to prevent electrical shock and to keep wires from shorting out to ground.

Step 1. Set FUNCTION switch to position O. Disarm and disconnect ATKS.

Table 5-1. Direct Support Troubleshooting - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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Step 2. Remove front panel of control assembly to allow access to the circuit card assemblies. Connect test wire with alligator clips between front panel and control assembly case. Check continuity between the following points:

- a. Logic CCA pin B to relay K1 pin 1
- b. ST1 pin M to relay K1 pins 6 and 9
- c. ST1 pin N to relay K1 pins 7 and 10

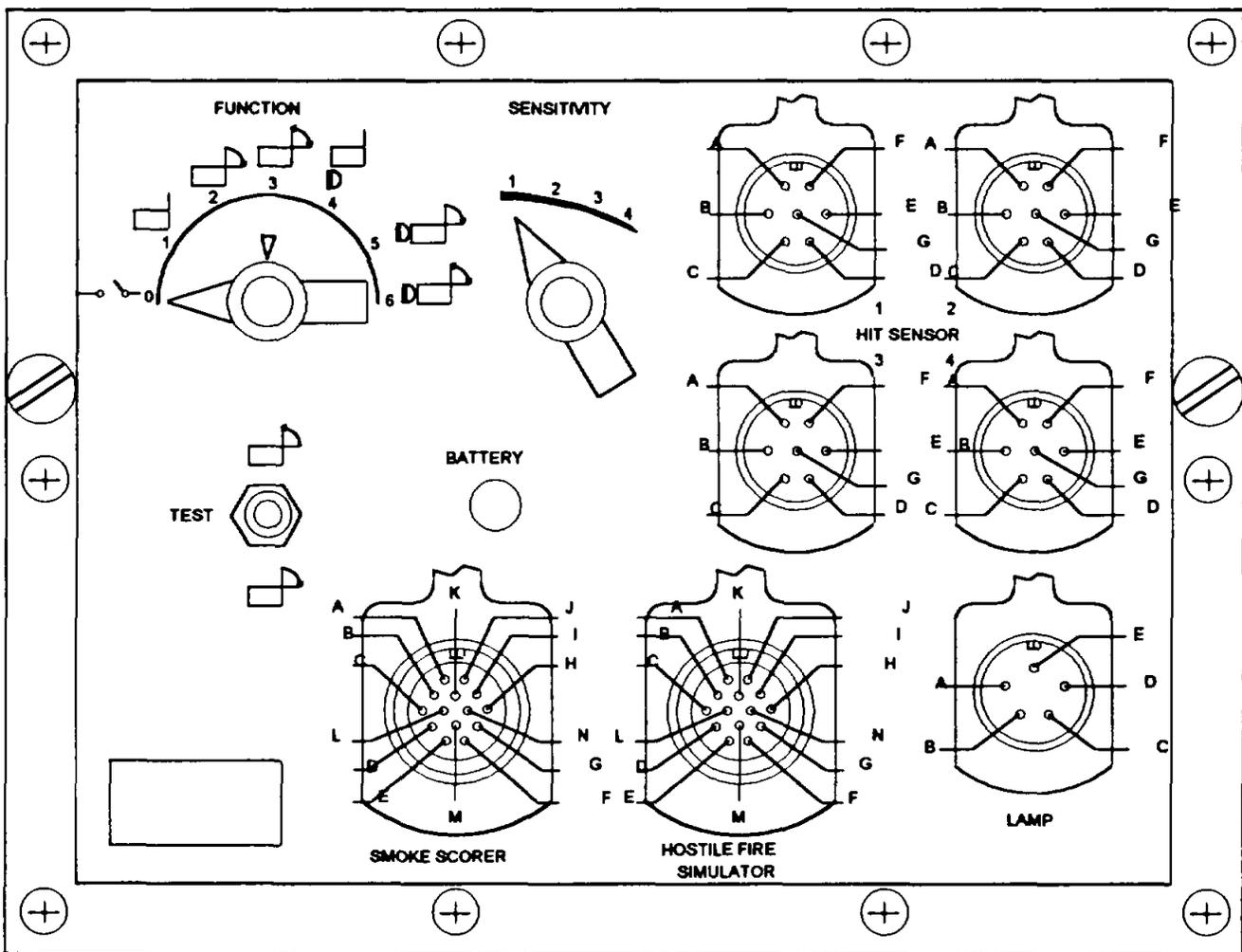
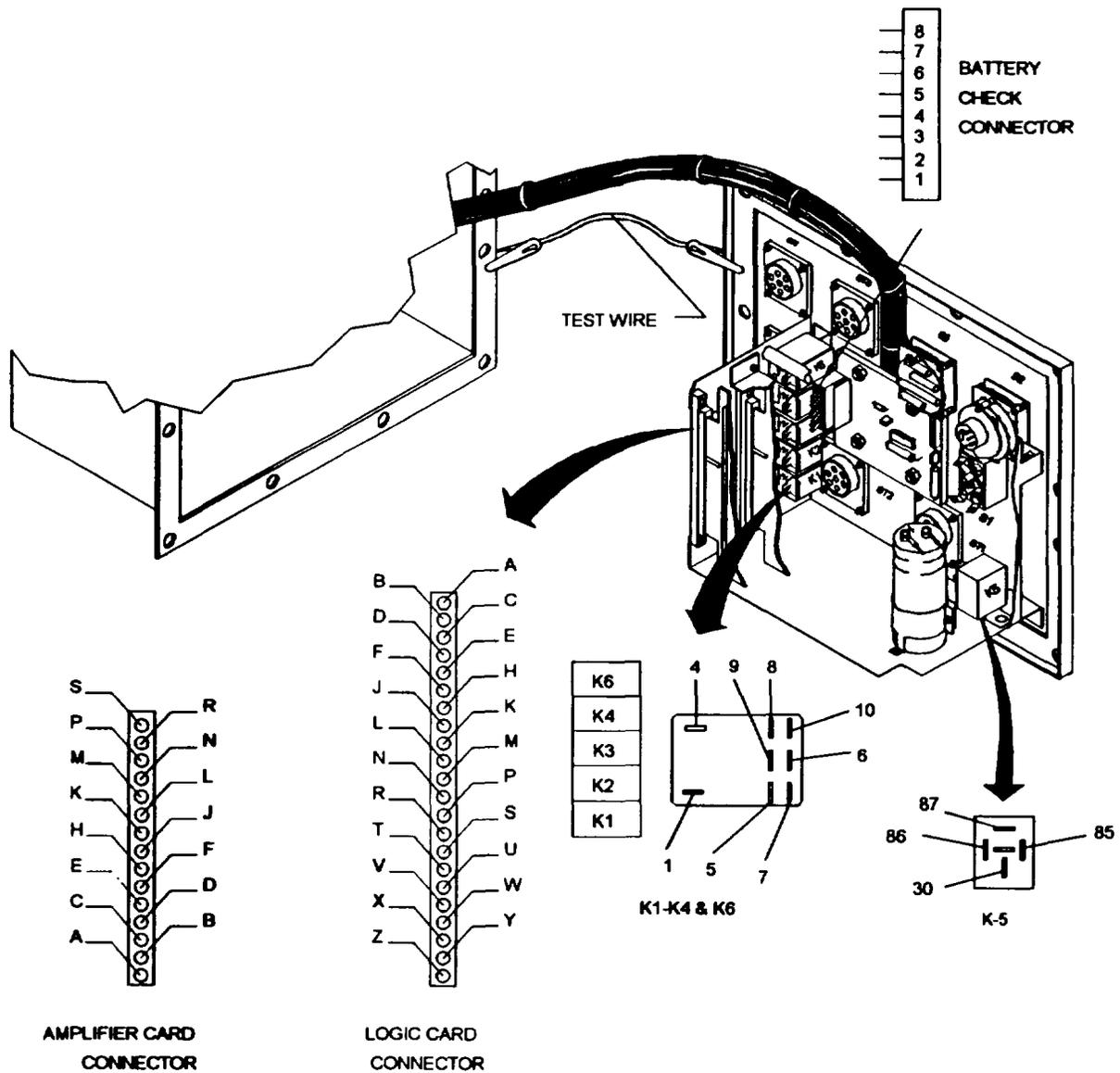


Table 5-1. Direct Support Troubleshooting - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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If continuity is not found, repair wiring and retest. Refer to FO-4.

If continuity is found, replace relay K1 and retest.

Step 3. If ATKS still fails to fire, refer to TM 9-6920742-14-2 for further troubleshooting.

Table 5-1. Direct Support Troubleshooting - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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12. ATKS does not fire in HOSTILE FIRE mode.

WARNING



Disarm, then disconnect the ATKS connection from control assembly on TTA or TIU. The ATKS must be disconnected from TTA before performing maintenance. Explosion is possible and can cause personal injury and damage to equipment. Pyrotechnics are used during range operation.

Step 1. Set FUNCTION switch to position O. Disarm and disconnect ATKS.

**NOTE**

Target must be in the up position and the TIU must be connected to the SMOKE SCORER connection.

Step 2. Set multimeter to measure ohms on the X10 scale. Set FUNCTION switch in position 6. Place multimeter positive lead on ST2 pin M and negative lead to ST2 pin N. Momentarily connect a test wire with alligator clips between ST2 pins K and E. Multimeter should indicate continuity.

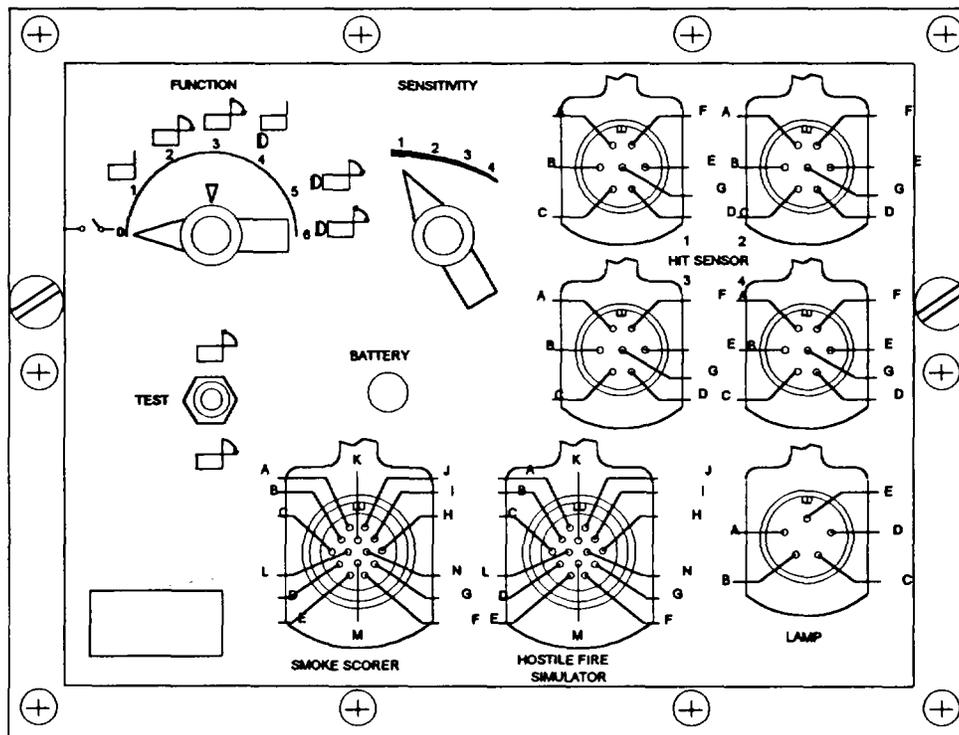


Table 5-1. Direct Support Troubleshooting - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
If multimeter indication is correct, set FUNCTION switch to position O. Check continuity between ST2 pin E and P1 pin E.	If continuity is not found, repair wiring and retest. Refer to FO-4.	If continuity is found, HOSTILE FIRE circuits are operational.
If multimeter indication is incorrect, set FUNCTION switch to position O. Remove front panel of control assembly to allow access to the circuit card assemblies. Connect test wire with alligator clips between front panel and control assembly case. Check continuity between ST2 pin E and relay K4 pin 1, ST2 pin M and K4 pins 6 and 9, and ST2 pin N and K4 pins 7 and 10.	If continuity is not found, repair wiring and retest.	

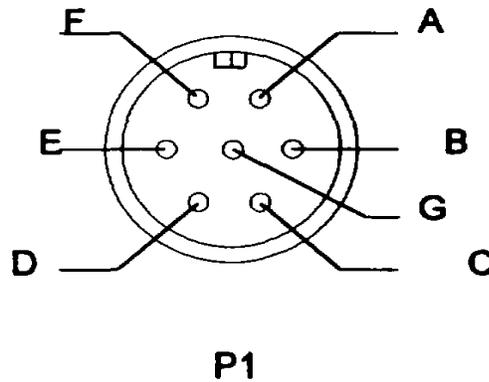
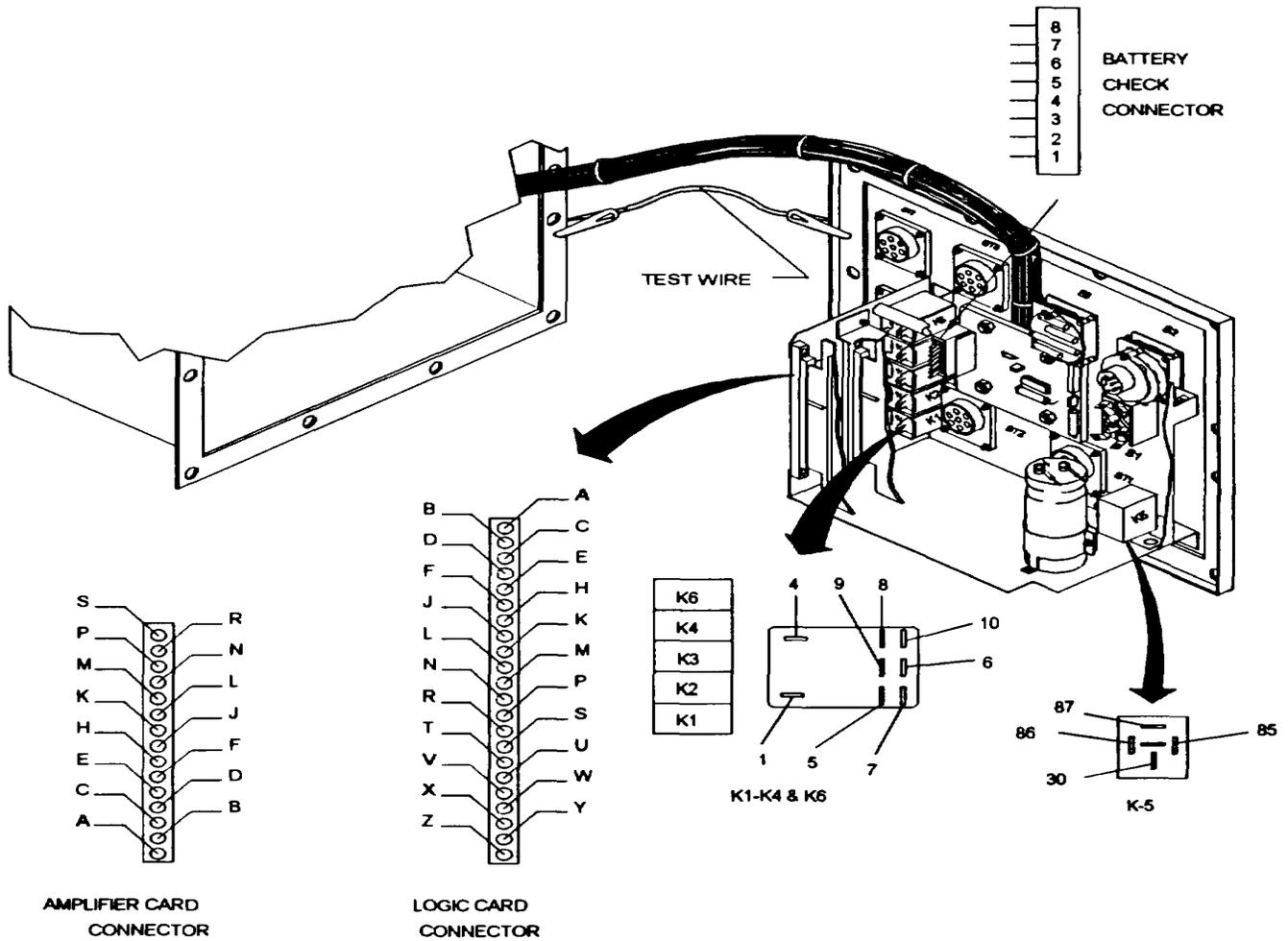


Table 5-1. Direct Support Troubleshooting - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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Step 3. If ATKs still fails to fire, refer to TM 9-6920-742-14-2 for further troubleshooting.

Table 5-1. Direct Support Troubleshooting - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
13. Control assembly is inoperative.	<b>I WARNING</b>	<div data-bbox="115 510 293 659" style="display: inline-block; vertical-align: middle;">  </div> <p>Disarm, then disconnect the ATKS connection from control assembly on TTA or TIU. The ATKS must be disconnected from TTA before performing maintenance. Explosion is possible and can cause personal injury and damage to equipment. Pyrotechnics are used during range operation.</p>
<b>NOTE</b>		
<p><b>Control assembly must be installed in an operational THM/TG to perform this malfunction. If a battery operated model is used, ensure battery is fully charged in accordance with TM 9-6140-200-14.</b></p>		
<p>Step 1. Set SENSITIVITY switch in position 2 and FUNCTION switch in position 1. Place TEST switch in the UP position. Target should move to the UP position and remain up.</p>		
<p>If target moves to the UP position and remains up, proceed to step 2.</p>		
<p>If target fails to move to the UP position, proceed to malfunction 2.</p>		
<p>Step 2. Place TEST switch in the DOWN position. Target should move to the DOWN position.</p>		
<p>If target moves to the DOWN position, proceed to step 3.</p>		
<p>If target fails to move to the DOWN position, proceed to malfunction 3.</p>		
<p>Step 3. Set FUNCTION switch to position 4. Place TEST switch in the UP position. Target should raise and LAMP assembly blink.</p>		
<p>If LAMP assembly blinks, proceed to step 4.</p>		
<p>If LAMP assembly fails to blink, proceed to malfunction 9.</p>		

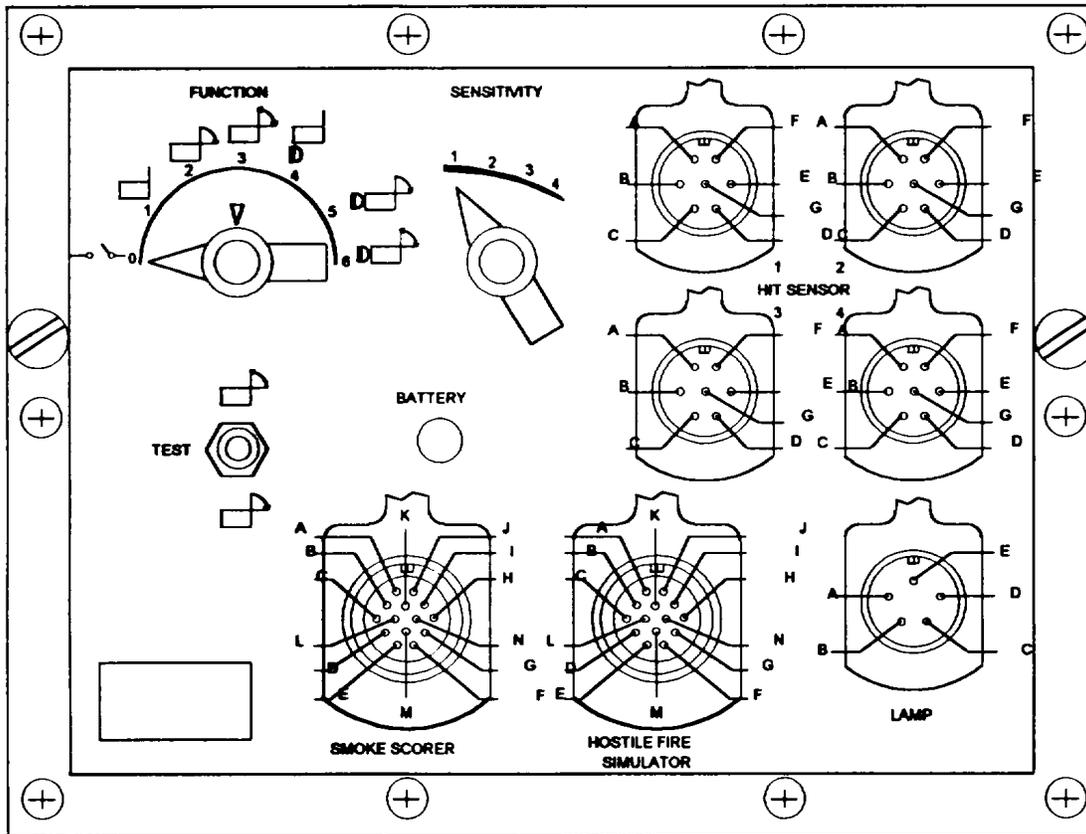
Table 5-1. Direct Support Troubleshooting - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
Step 4. Tap hit sensor on a solid surface. LAMP assembly should flash and the target remain in the UP position.	If LAMP assembly flashes and target remains in the UP position, proceed to step 5.	If LAMP assembly fails to flash, move SENSITIVITY switch setting to position 1 and retest.
	If LAMP assembly still fails to flash, proceed to malfunction 10.	If LAMP assembly now flashes, replace SENSITIVITY switch in accordance with paragraph 5-25 and retest.
	If target moves to the DOWN position, proceed to malfunction 4.	
Step 5. Set FUNCTION switch to position 5 and tap hit sensor on a solid surface. LAMP assembly should flash and target should move to the DOWN position and remain down.	If THM/TG responds correctly, proceed to step 6.	If THM/TG fails to move to the DOWN position, proceed to malfunction 6.
Step 6. Set FUNCTION switch to position 6. Set SENSITIVITY switch to position 4. Place TEST switch in the UP position. After target reaches the UP position, tap hit sensor on a solid surface. LAMP assembly should flash and the target automatically goes down when hit and should reach the down position within 8 seconds after a hit is detected. The target should begin to raise within 9-13 seconds after the initial hit detection and should be completely raised within 8 seconds after starting towards the upright position.	If target responds correctly, proceed to step 7.	If target fails to move to the DOWN position, proceed to malfunction 6.
	If target goes down but fails to return to the UP position within 9-13 seconds, proceed to malfunction 5.	

Table 5-1. Direct Support Troubleshooting - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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Step 7. Set multimeter to measure 2.5 vdc. Place multimeter positive lead on ST1 pin G and negative lead on ground. Refer to FO-4. Tap hit sensor on a solid surface. Multimeter should deflect up scale.



If multimeter responds correctly, proceed to step 8.

If multimeter does not respond correctly, proceed to unit maintenance malfunction 4.

**NOTE**

**Target must be in the UP position and the TIU connected to the SMOKE SCORER connector.**

Step 8. Set multimeter to measure ohms on the x10 scale. Place multimeter positive lead to ST2 pin M and negative lead to ST2 pin N. Momentarily connect a test wire with alligator clips between ST2 pins K and E. Multimeter should indicate continuity.

If multimeter indication is correct, proceed to step 9.

If multimeter indication is incorrect, proceed to malfunction 12.

Table 5-1. Direct Support Troubleshooting - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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Step 9. Set multimeter to measure ohms on the xO1 scale. Place multimeter positive lead to ST1 pin M and negative lead to ST1 pin N. Tap hit sensor on a solid surface. Multimeter should indicate continuity.

If multimeter indication is correct, proceed to step 10.

If multimeter Indication is incorrect, proceed to malfunction 11.

Step 10. Set FUNCTION switch to position 8 and SENSITIVITY switch to position 4. Place TEST switch in the DOWN position. As target responds to the TEST switch, BATTERY lamp should steadily illuminate.

If BATTERY lamp steadily illuminates (no flashes), proceed to step 11.

If BATTERY lamp flashes or fails to illuminate, proceed to malfunction 15.



**WARNING**

Care must be taken during the next steps to prevent electrical shock and to keep wires from shorting out to ground.

Step 11. Set FUNCTION switch to position O. Remove front panel of control assembly to allow access to the circuit card assemblies. Connect test wire with alligator clips between front panel and control assembly case. Set multimeter to measure ohms on the X10 scale. Check for continuity between the following points: (Refer to FO-4.)

- |           |                    |
|-----------|--------------------|
| ST1 pin F | Logic CCA pin K    |
| ST1 pin F | P1 connector pin F |
| ST1 pin D | Logic CCA pin E    |
| ST1 pin D | P1 connector pin D |

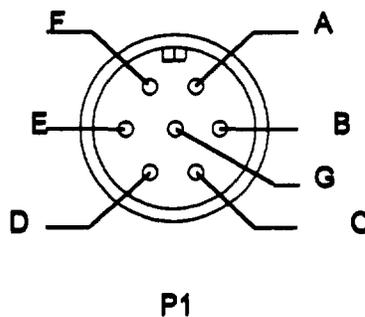


Table 5-1. Direct Support Troubleshooting - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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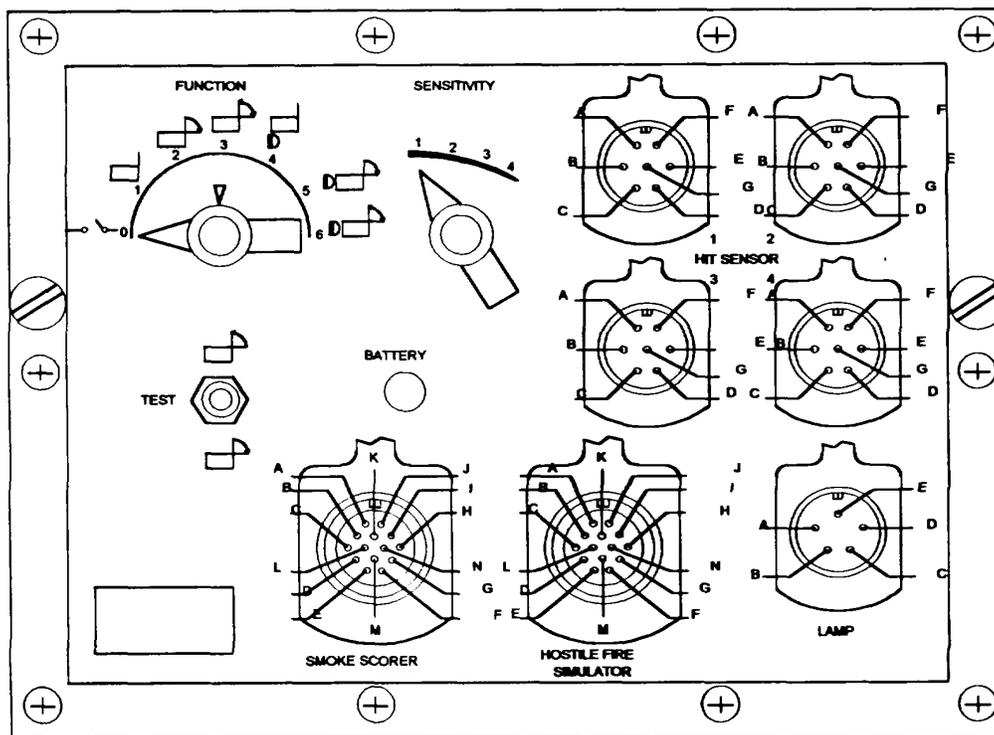
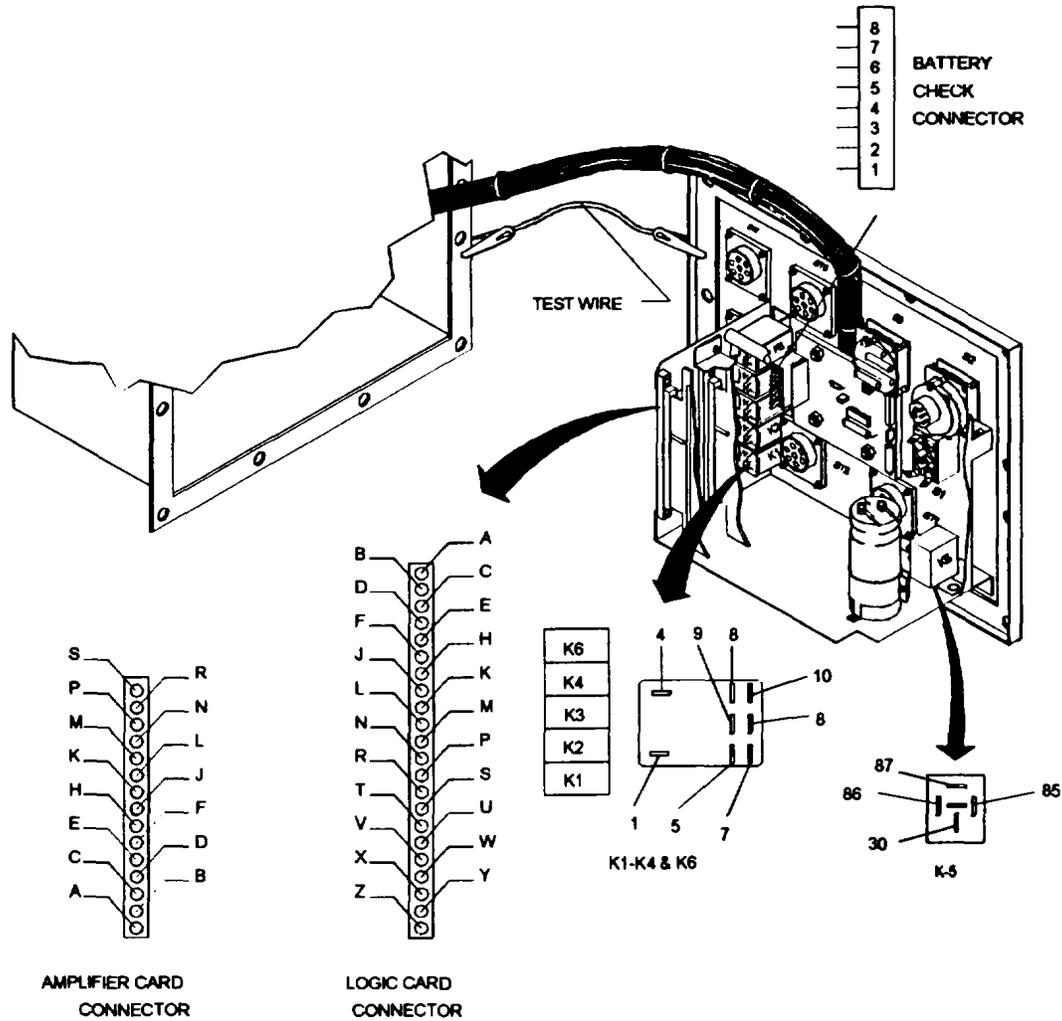


Table 5-1. Direct Support Troubleshooting - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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If continuity is found, the control assembly is operational. Remove test wire and install cover.

If continuity is not found in all cases, repair wiring as necessary and retest.

**14. Target responds to hits but RCS does not record hits.**

Step 1. Perform malfunction 13.

If RCS now records hits, target is now operational.

If RCS does not record hits proceed to step 2.

Step 2. Set FUNCTION switch to position O and replace TIU and retest. Refer to TM 9-6920-742-4.

Table 5-1. Direct Support Troubleshooting - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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15. BATTERY lamp flashes or fails to illuminate.

**WARNING**



Disarm, then disconnect the ATKS connection from control assembly on TTA or TIU. The ATKS must be disconnected from TTA before performing maintenance. Explosion is possible and can cause personal injury and damage to equipment. Pyrotechnics are used during range operation.

- Step 1. Ensure that battery is fully charged and that cables are clean and tight. Refer to TM 9-6140-200-14.
- Step 2. Set FUNCTION switch in position 6. Place TEST switch in the UP position then in the DOWN position.

If BATTERY lamp illuminates steadily, battery circuits are operational.

If BATTERY lamp flashes, set FUNCTION switch to position 0. Replace battery test CCA in accordance with paragraph 517 and retest.

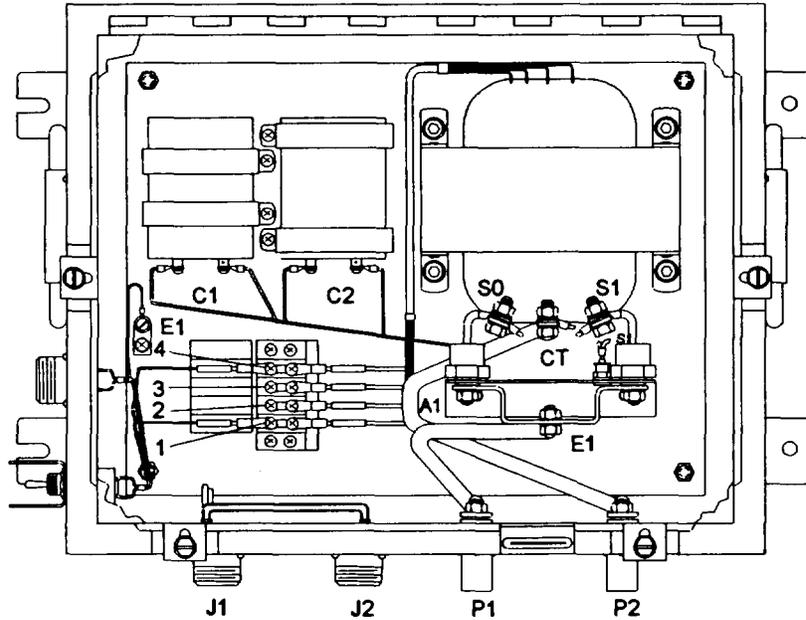
If BATTERY lamp fails to illuminate, set FUNCTION switch to position O. Replace battery test CCA in accordance with paragraph 5-18 and retest.

Table 5-1. Direct Support Troubleshooting - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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16. No supply voltage from battery eliminator assembly connectors P1 and P2.

Step 1. Set CB1 to the ON position.



**WARNING**



High voltage is present during the next steps. Care must be taken to prevent electrical shock.

If CB1 remains in the ON position, proceed to step 3.

If CB1 will not remain in the ON position, set FUNCTION switch to position O. Disconnect input power and remove power supply lid and disconnect CB1 assembly load leads from TBI-1, -2, -3, and -4. Apply power. Set CB1 to the ON position.

If CB1 now remains in the ON position, set FUNCTION switch to position O, install leads to TB1-1, -2, -3, and -4 and proceed to step 2.

If CB1 still fails to remain in the ON position, replace CB1 assembly in accordance with paragraph 5-34 and retest.

Table 5-1. Direct Support Troubleshooting - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
Step 2.	Set multimeter to measure 12 vdc. Place multimeter positive lead on P1 and negative lead on ground. Multimeter should indicate 12 vdc.	<p>If multimeter indication is correct, proceed to step 3.</p> <p>If multimeter indication is incorrect, proceed to step 4.</p>
Step 3.	Set multimeter to measure 12 vdc. Place multimeter positive lead on P1 and negative lead on P2. Multimeter should indicate 12 vdc.	<p>If multimeter indication is correct, battery eliminator supply voltage circuit is operational.</p> <p>If multimeter indication is incorrect, remove power. Check for continuity from P2 to transformer terminal CT.</p> <p>If continuity is found, replace transformer assembly in accordance with paragraph 5-33 and retest.</p>
Step 4.	Set multimeter to measure 25 vac. Place multimeter positive lead on transformer terminal SO and negative lead on SI. Multimeter should indicate 25 vdc ( $\pm 0.5$ vac).	<p>If multimeter indication is correct, replace rectifier assembly in accordance with paragraph 5-37 and retest.</p> <p>If multimeter indication is incorrect, proceed to step 5.</p>
Step 5.	Set multimeter to measure 240 vac. Place multimeter positive lead on TB1 terminal 1 and negative lead on TB1 terminal 4. Multimeter should indicate 240 $\pm 10$ vac.	<p>If multimeter indication is correct, replace transformer assembly in accordance with paragraph 5-35 and retest.</p> <p>If multimeter indication is incorrect, replace CB1 assembly in accordance with paragraph 534 and retest.</p>

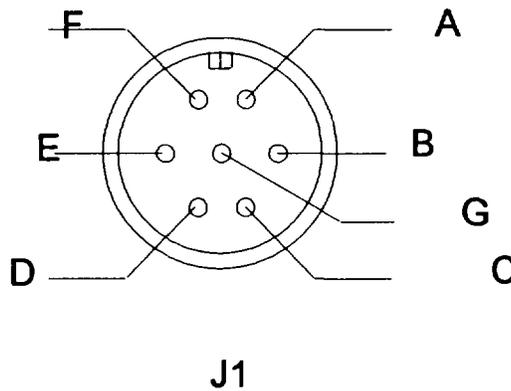
Table 5-1. Direct Support Troubleshooting - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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17. No control voltage from battery eliminator assembly connector J1.

Step 1. Ensure that supply voltage is present at terminals P1 and P2. Refer to malfunction 16.

Step 2. Set multimeter to measure 12 vdc. Place multimeter positive lead on J1 pin B and negative lead on ground. Multimeter should indicate 12 vdc. Place multimeter positive lead on J1 pin C and negative lead on ground. Multimeter should indicate 12 vdc.



If multimeter indications are correct, battery eliminator control voltage circuits are operational. Check continuity of cable to control assembly and replace as necessary.

If any multimeter indications are incorrect, replace J1 to J2 cable assembly in accordance with paragraph 5-36 and retest.

18. P3 proximity switch cable is inoperative.

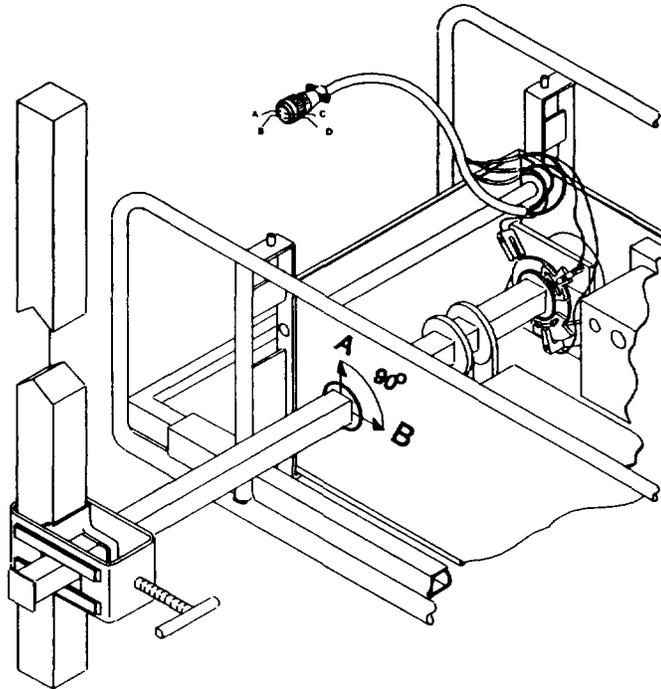
**NOTE**

**The cable does not have to be connected to the THM/TG to perform these steps.**

Step 1. Move drive shaft until magnetic actuator switch is out of S2. Remove P3 cable connector from control assembly or W107 cable. Set multimeter to measure ohms on the X10 scale. Place multimeter positive lead on proximity switch cable P3 pin B and negative lead on P3 pin A. Multimeter should indicate continuity. Insert a putty545 knife blade or similar tool between S2 proximity switch legs. Multimeter should indicate no continuity.

Table 5-1. Direct Support Troubleshooting - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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If multimeter indications are correct, proceed to step 2.

If multimeter indications are incorrect, repair P3 cable or replace S2 in accordance with paragraph 5-13 or 5-14 and retest.

Step 2. Move drive shaft until magnetic actuator switch is out of S1. Set multimeter to measure ohms on the X10 scale. Place multimeter positive lead on proximity switch cable P3 pin C and negative lead on P3 pin A. Multimeter should indicate continuity. Insert a putty knife blade or similar tool between S1 proximity switch legs. Multimeter should indicate no continuity.

If multimeter indications are correct, proceed to step 3.

If multimeter indications are incorrect, repair P3 cable or replace S1 in accordance with paragraph 5-13 or 5-14 and retest.

Step 3. Move drive shaft until magnetic actuator switch is out of S3. Set multimeter to measure ohms on the X10 scale. Place multimeter positive lead on proximity switch cable P3 pin D and negative lead on P3 pin A. Multimeter should indicate continuity. Insert a putty knife blade or similar tool between S3 proximity switch legs. Multimeter should indicate no continuity.

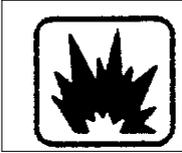
If multimeter indications are correct, P3 proximity switch cable is operational.

If multimeter indications are incorrect, repair P3 cable or replace S3 in accordance with paragraph 5-13 or 5-14 and retest.

## SECTION II. DIRECT SUPPORT MAINTENANCE PROCEDURES

## 5-2 GENERAL.

This section contains the instructions for removal, repair, and installation of major components of the THM/TG. The instructions consist of the initial setup and step-by-step procedures to perform the task. Observe all warnings, cautions, and safety precautions during the performance of these tasks.

**WARNING**

The following procedures require the equipment to be shut down as stated in paragraph 2-7 unless otherwise stated.

**NOTE**

Use new self-locking nuts during reassembly or installation procedures.

5-3 MAGNETIC ACTUATOR SWITCH (LARGE) ADJUSTMENT (11784622).**INITIAL SETUP****Tools:**

General Mechanic's Automotive Tool Kit

**References:**

Paragraph 4-9

**Personnel Required:**

1 Person

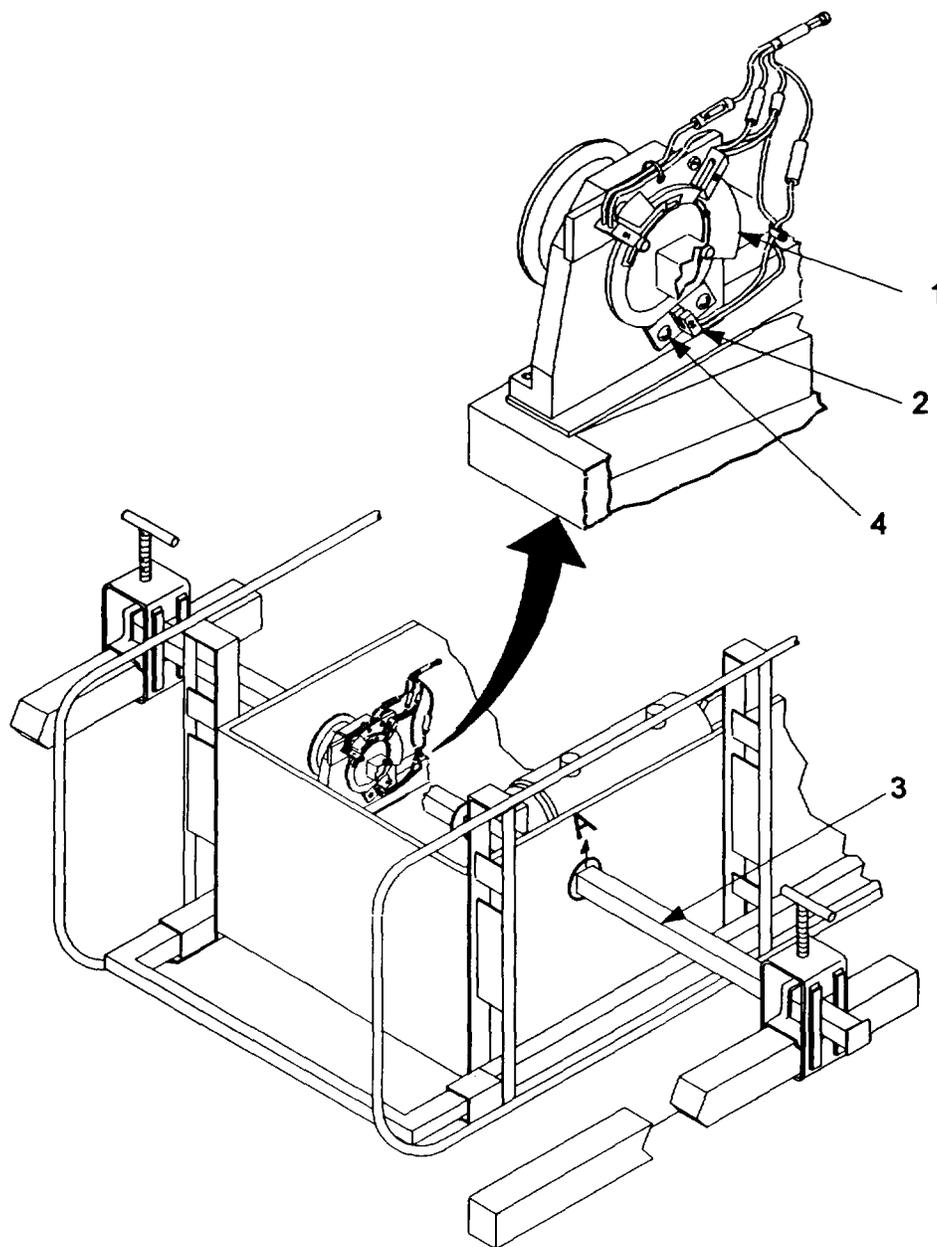
**WARNING**

Disarm, then disconnect the ATKS connection from control assembly on TTA or TIU. The ATKS must be disconnected from TTA before performing maintenance. Explosion is possible and can cause personal injury and damage to equipment. Pyrotechnics are used during range operation.

**Adjustment.****NOTE**

Target must be in target holder during switch adjustment.

- a. Remove access door. Refer to paragraph 4-9.
- b. Connect THMITG power cables to battery box cable adapters or battery eliminator.
- c. Place marks in position A on side cover.
- d. Turn FUNCTION switch to position 2.

5-3 MAGNETIC ACTUATOR SWITCH (LARGE) ADJUSTMENT (11784622) - Continued.

- e. Using TEST switch, lower target.
- f. Observe magnetic actuator switch (1) while target is raising: leading edge of magnetic actuator switch should enter proximity switch S3 (2) when corner edge (3) of drive shaft nears position A.
- g. If indication is incorrect, turn FUNCTION switch to position O. Loosen two capscrews (4) and adjust magnetic actuator switch 1/8 inch (3.2 millimeters) at a time for required entry into proximity switch. Tighten capscrews.
- h. Install access door. Refer to paragraph 4-9.

**5-4 MAGNETIC ACTUATOR SWITCH (LARGE) REPLACEMENT (11784622).**

**INITIAL SETUP**

**Tools:**

General Mechanic's Automotive Tool Kit

**Personnel Required:**

1 Person

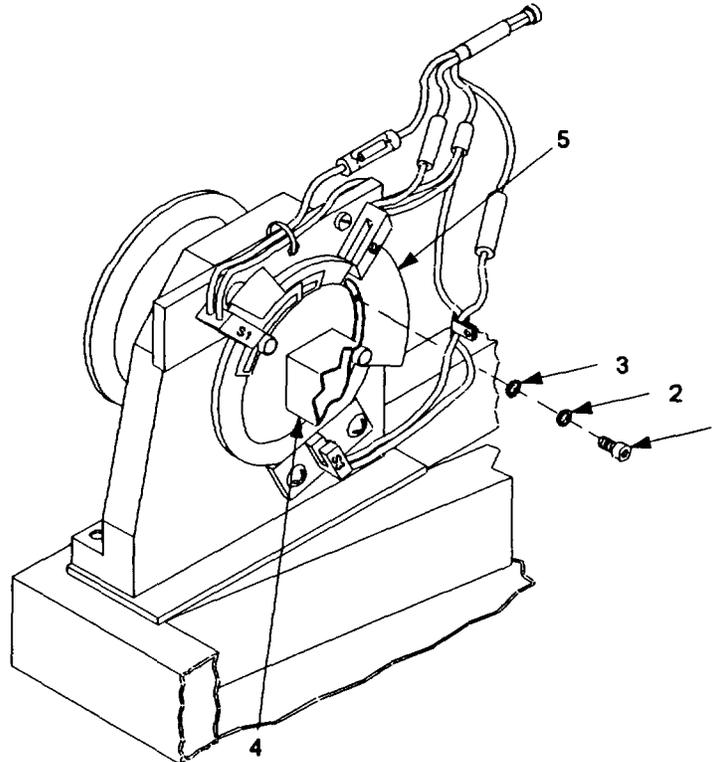
**Materials/Parts:**

Actuator, Switch (11784622)

**References:**

Paragraph 4-9

Paragraph 5-3 a. Removal.



a. Removal

**WARNING**



Disarm, then disconnect the ATKS connection from control assembly on TTA or TIU. The ATKS must be disconnected from TTA before performing maintenance. Explosion is possible and can cause personal injury and damage to equipment. Pyrotechnics are used during range operation.

- (1) Remove access door. Refer to paragraph 4-9.
- (2) Connect power cables to battery box cable adapters or battery eliminator.
- (3) Turn FUNCTION switch to position 1.

**5-4 MAGNETIC ACTUATOR SWITCH (LARGE) REPLACEMENT (11784622) - Continued.**

- (4) Using TEST switch, lower target.
- (5) Turn FUNCTION switch to position O.
- (6) Disconnect power cables from battery box cable adapters or battery eliminator.
- (7) Remove two capscrews (1), lockwashers (2), and flatwashers (3) from drive shaft (4).
- (8) Remove magnetic actuator switch (5).

**b. Installation.**

- (1) Position magnetic actuator switch (5) on drive shaft (4).
- (2) Install two capscrews (1), lockwashers (2), and flatwashers (3).
- (3) Adjust magnetic actuator switch. Refer to paragraph 5-3.
- (4) Install access door. Refer to paragraph 4-9.
- (5) Connect power cables to battery box cable adapters or battery eliminator.

**5-5 MAGNETIC ACTUATOR SWITCHES (SMALL) ADJUSTMENT (11784623).**

**INITIAL SETUP**

**Tools:**

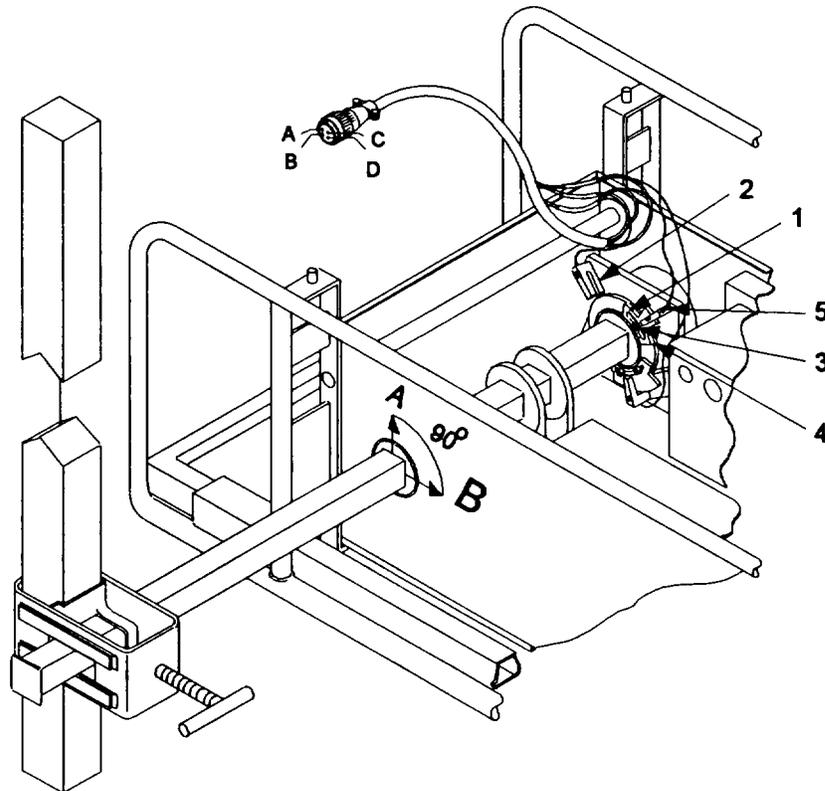
General Mechanic's Automotive Tool Kit

**References:**

Paragraph 4-9

**Personnel Required:**

1 Person



**Adjustment.**



**WARNING**

Disarm, then disconnect the ATKS connection from control assembly on TTA or TIU. The ATKS must be disconnected from TTA before performing maintenance. Explosion is possible and can cause personal injury and damage to equipment. Pyrotechnics are used during range operation.

**NOTE**

Target must be in target holder during switch adjustment.

- a. Remove access door. Refer to paragraph 4-9.

**5-5 MAGNETIC ACTUATOR SWITCHES (SMALL) ADJUSTMENT (11784623) - Continued.**

- b. Connect power cables to battery box cable adapters or battery eliminator.
- c. Place marks in positions A and B on side cover.
- d. Turn FUNCTION switch to position 2.
- e. Using TEST switch, lower target.
- f. Turn FUNCTION switch to position O.

**NOTE**

**If target has not reached position B before it stops, leading edge of magnetic actuator switch (1) is entering proximity switch (2) too soon.**

- g. Loosen capscrew (3) and adjust magnetic actuator switch 1/8 inch (0.32 centimeter) in a clockwise direction.
- h. If target goes beyond horizontal position, adjust one of magnetic actuator switches 1/8 inch (0.32 centimeter) in a counterclockwise direction. Tighten capscrew.
- i. Test THM/TG and readjust magnetic actuator switch 1/8 inch (3.2 millimeters) at a time as necessary.
- j. Turn FUNCTION switch to position 1. Using TEST switch, raise target
- k. Turn FUNCTION switch to position O. If target has not reached position A, leading edge of second magnetic actuator switch (4) is entering S2 proximity switch (5) too soon.

**NOTE**

**When adjusting second magnetic actuator switch, do not alter position of first switch.**

- l. Adjust second magnetic actuator switch using steps (8) through (10).
- m. Install access door. Refer to paragraph 49.

**5-6 MAGNETIC ACTUATOR SWITCHES (SMALL) REPLACEMENT (11784623).**

**INITIAL SETUP**

**Tools:**

General Mechanic's Automotive Tool Kit1 Person

**Personnel Required:**

**Materials/Parts:**

Actuator switch (11784623)

**References:**

Paragraph 4-9

Paragraph 5-5

- a. Removal.

**WARNING**



**Disarm, then disconnect the ATKS connection from control assembly on TTA or TIU. The ATKS must be disconnected from TTA before performing maintenance. Explosion is possible and can cause personal injury and damage to equipment. Pyrotechnics are used during range operation.**

- (1) Place the target in the down position.

**5-6 MAGNETIC ACTUATOR SWITCHES (SMALL) REPLACEMENT (11784623) - Continued.**

- (2) Turn FUNCTION switch to position O.
- (3) Disconnect power cables to battery box cable adapters or battery eliminator.
- (4) Remove access door. Refer to paragraph 4-9.
- (5) Remove capscrew (1), lockwasher (2), and flatwasher (3) from drive shaft (4).
- (6) Remove two magnetic actuator switches (5).

b. Installation.

- (1) Position two magnetic actuator switches (5) on drive shaft (4).
- (2) Install capscrew (1), lockwasher (2), and flatwasher (3) into drive shaft.
- (3) Connect power cables to battery box cable adapters or battery eliminator.
- (4) Adjust magnetic actuator switches. Refer to paragraph 55.
- (5) Install access door. Refer to paragraph 4-9.

**5-7 BEARING UNIT HOUSING ASSEMBLY (HYDRAULIC UNIT SIDE) REPLACEMENT (11784521).**

**INITIAL SETUP**

**Tools:**

General Mechanic's Automotive Tool Kit  
Spanner Wrench

**Personnel Required:**

1 Person

**Materials/Parts:**

Spring Pins (MS39086-251)  
Cotter Pins (MS24665-355)  
Shaft Seal (11784613)  
Bearing Unit Housing Assembly (11784521)

**Equipment Condition:**

Side cover removed  
(reference paragraph 4-10)

**References:**

Paragraph 2-7  
Paragraph 4-10

**a. Removal.**

- (1) Remove cotter pin (1) from journal (2).
- (2) Remove journal and two washers (3) from drive shaft (4) and cylinder rod (5).
- (3) Remove two capscrews (6) and lockwashers (7) from each bearing unit housing assembly (8).

**5-7 BEARING UNIT HOUSING ASSEMBLY (HYDRAULIC UNIT SIDE) REPLACEMENT (11784521) - Continued.**

- (4) Lift both bearing unit housing assemblies and drive shaft off base frame.
- (5) Remove shaft seal (9) and bearing unit housing assembly from drive shaft.
- (6) Remove spring pins (10) from bearing unit housing assembly and discard.
- (7) Inspect shaft seal and replace as necessary.

**b. Installation.**

- (1) Install two bearing unit housing assemblies (8) on drive shaft (4).
- (2) Set bearing unit housing assemblies and drive shaft on base frame.
- (3) Install two capscrews (6) and lockwashers (7) in each bearing unit housing assembly. Do not tighten.
- (4) Install two new spring pins (10) in each bearing unit housing assembly.
- (5) Tighten four capscrews (6).
- (6) Install shaft seal (9) on drive shaft.
- (7) Install journal (2) and two washers (3) on drive shaft (4) and cylinder rod (5).
- (8) Install cotter pin (1) in journal.
- (9) Install side cover. Refer to paragraph 4-10.
- (10) Test/operate in accordance with paragraph 2-7.

**5-8 BEARING UNIT HOUSING ASSEMBLY (CONTROL UNIT SIDE) REPLACEMENT (11784522).**

**INITIAL SETUP**

**Tools:**

General Mechanic's Automotive Tool Kit

**Personnel Required:**

1 Person

**Materials/Parts:**

Shaft Seal (11784613)

Bearing Unit Housing Assembly (11784522)

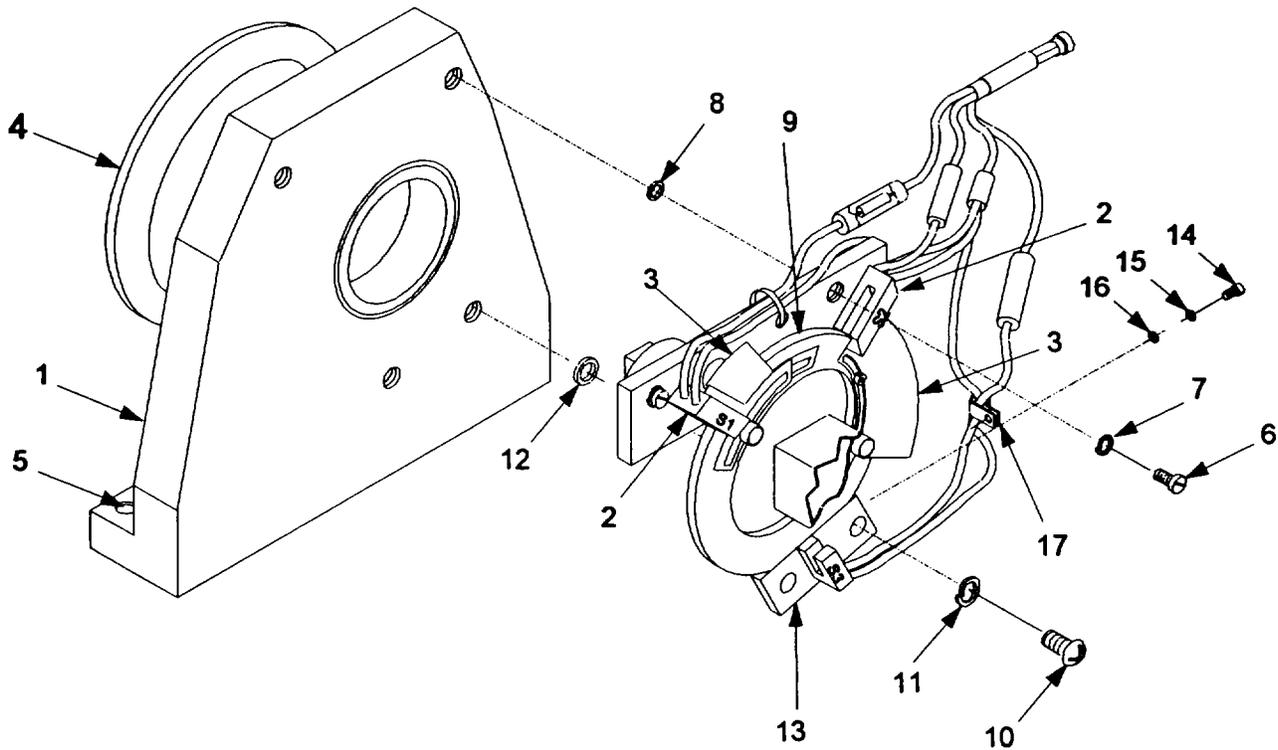
**Equipment Condition:**

Drive shaft assembly removed

(Reference paragraph 5-9)

**References:**

Paragraph 5-9



**a. Removal.**

- (1) Rotate bearing unit housing assembly (1) until proximity switches (2) are free from magnetic actuator switches (3).
- (2) Remove bearing unit housing assembly and shaft seal (4) from drive shaft.
- (3) Inspect shaft seal and replace as necessary.
- (4) Remove two screws (6), lockwashers (7), and flatwashers (8), and double proximity switch mounting plate (9) from bearing unit housing assembly.

**5-8 BEARING UNIT HOUSING ASSEMBLY (CONTROL UNIT SIDE) REPLACEMENT (11784522) Continued.**

- (5) Remove two screws (10), lockwashers (11), and flatwashers (12), and single proximity switch mounting plate (13) from bearing unit housing assembly.
- (6) Remove screw (14), lockwasher (15), flatwasher (16), and cable clamp (17) from bearing unit housing assembly.

**b. Installation.**

- (1) Position cable clamp (17) on bearing unit housing assembly (1) and install flatwasher (16), lockwasher (15), and screw (14).
- (2) Position single proximity switch mounting plate (13) on bearing unit housing assembly. Position two flatwashers (12) between mounting plate (13) and bearing unit housing. Install lockwashers (11), and screws (10).
- (3) Position double proximity switch mounting plate (9) on bearing unit housing assembly with notch toward center. Position two flatwashers (8) between mounting plate (13) and bearing unit housing. Install lockwashers (7), and screws (6).
- (4) Position bearing unit housing assembly (1) on drive shaft so that proximity switches are free of magnetic actuator switches. Install bearing unit housing assembly on drive shaft.
- (5) Reinstall drive shaft assembly. Refer to paragraph 5-9.

**5-9 DRIVE SHAFT REPLACEMENT (11784621).****INITIAL SETUP****Tools:**

General Mechanic's Automotive Tool Kit

**Personnel Required:**

1 Person

**Materials/Parts:**

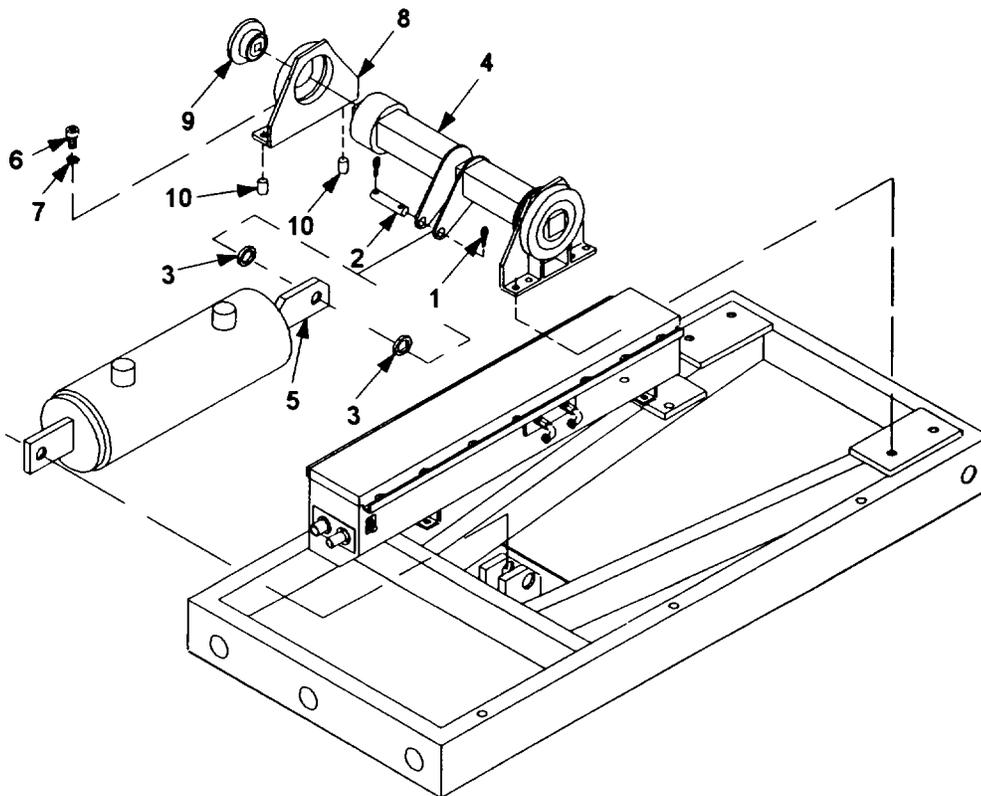
Spring Pins (MS39086-251)  
 Cotter Pins (MS24665-355)  
 Drive Shaft (11784621)  
 Shaft Seal (11784613)

**Equipment Condition:**

Side cover removed  
 (Reference paragraph 4-10)

**References:**

Paragraph 2-7  
 Paragraph 4-10

**a. Removal.**

- (1) Remove cotter pin (1) from journal (2).
- (2) Remove journal and two washers (3) from drive shaft (4) and cylinder rod (5).
- (3) Remove two capscrews (6) and lockwashers (7) from each bearing unit housing assembly (8).
- (4) Lift both bearing unit housing assemblies and drive shaft off base frame.

**5-9 DRIVE SHAFT REPLACEMENT (11784621) - Continued.**

- (5) Remove shaft seal (9) and bearing unit housing assembly (8) (hydraulic unit side) from drive shaft.
- (6) Remove spring pins (10) from bearing unit housing assemblies and discard.
- (7) Remove shaft seal (9) on control unit side.
- (8) Inspect shaft seals and replace as necessary.
- (9) Rotate drive shaft (4) until magnetic actuator switches are free from proximity switches.
- (10) Remove drive shaft

**b. Installation.**

- (1) Position drive shaft (4) into control side bearing unit housing with magnetic actuator switches free of proximity switches.
- (2) Install (hydraulic unit side) bearing unit housing assembly on drive shaft.
- (3) Set bearing unit housing assemblies and drive shaft on base frame.
- (4) Install two capscrews (6) and lockwashers (7) in each bearing unit housing assembly. Do not tighten.
- (5) Install two new spring pins (10) in each bearing unit housing assembly.
- (6) Tighten four capscrews (6).
- (7) Install journal (2) and two washers (3) on drive shaft and cylinder rod (5).
- (8) Install new cotter pins (1) in journal.
- (9) Install side cover. Refer to paragraph 4-10.
- (10) Test/operate in accordance with paragraph 2-7.

**5-10 BASE FRAME REPLACEMENT (11784627).**

INITIAL SETUP

**Tools:**

General Mechanic's Automotive Tool Kit

**Materials/Parts:**

Base Frame (11784627)

**Personnel Required:**

1 Person

**Equipment Condition:**

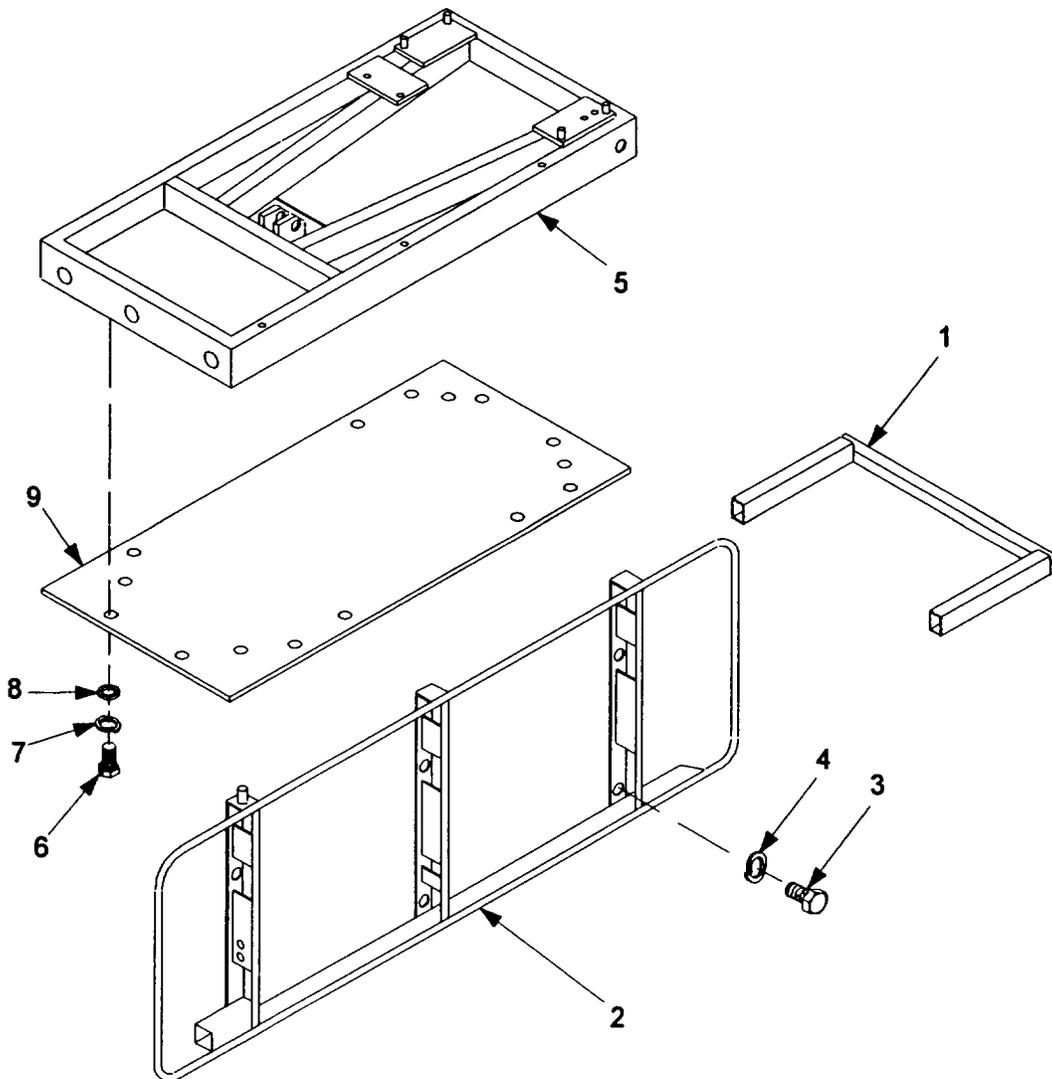
Hose assemblies removed  
(Reference paragraph 4-11)  
Hydraulic unit removed  
(Reference paragraph 5-28)

**Equipment Condition (Cont):**

Hydraulic cylinder removed  
(Reference paragraph 5-28)  
Bearing unit housing assemblies removed  
(Reference paragraph 5-7 and 5-8)

**References:**

Paragraph 4-11  
Paragraph 5-28  
Paragraph 5-26  
Paragraph 5-7  
Paragraph 5-8



**5-10 BASE FRAME REPLACEMENT (11784627) - Continued.****a. Removal.**

- (1) Remove stabilizer (1) from protection frames (2).
- (2) Remove six hex-head bolts (3) and lockwashers (4) from each protection frame.
- (3) Remove two protection frames from base frame (5).
- (4) Remove eight hex-head bolts (6), lockwasher (7), flatwashers (8) and remove base plate (9).

**b. Installation.**

- (1) Install base plate (9) to base frame (5) using eight flatwashers (8), lockwashers (7), and hexhead bolts (6).
- (2) Position protection frame (2) on each side of base frame (5).
- (3) Install six lockwashers (4) and hex-head bolts (3) in each protection frame.
- (4) Install stabilizer (1) on protection frames.
- (5) Install bearing unit housing assemblies. Refer to paragraphs 5-7 and 5-8.
- (6) Install hydraulic cylinder. Refer to paragraph 5-28.
- (7) Install hydraulic unit Refer to paragraph 5-30.
- (8) Install hose assemblies. Refer to paragraph 4-11.

**5-11 CABLE ASSEMBLY (HYDRAULIC) REPAIR (11784510).**

**INITIAL SETUP**

**Tools:**

- General Mechanic's Automotive Tool Kit
- Soldering and Desoldering Set
- Wire Strippers
- Heat Gun
- Multimeter

**Personnel Required:**

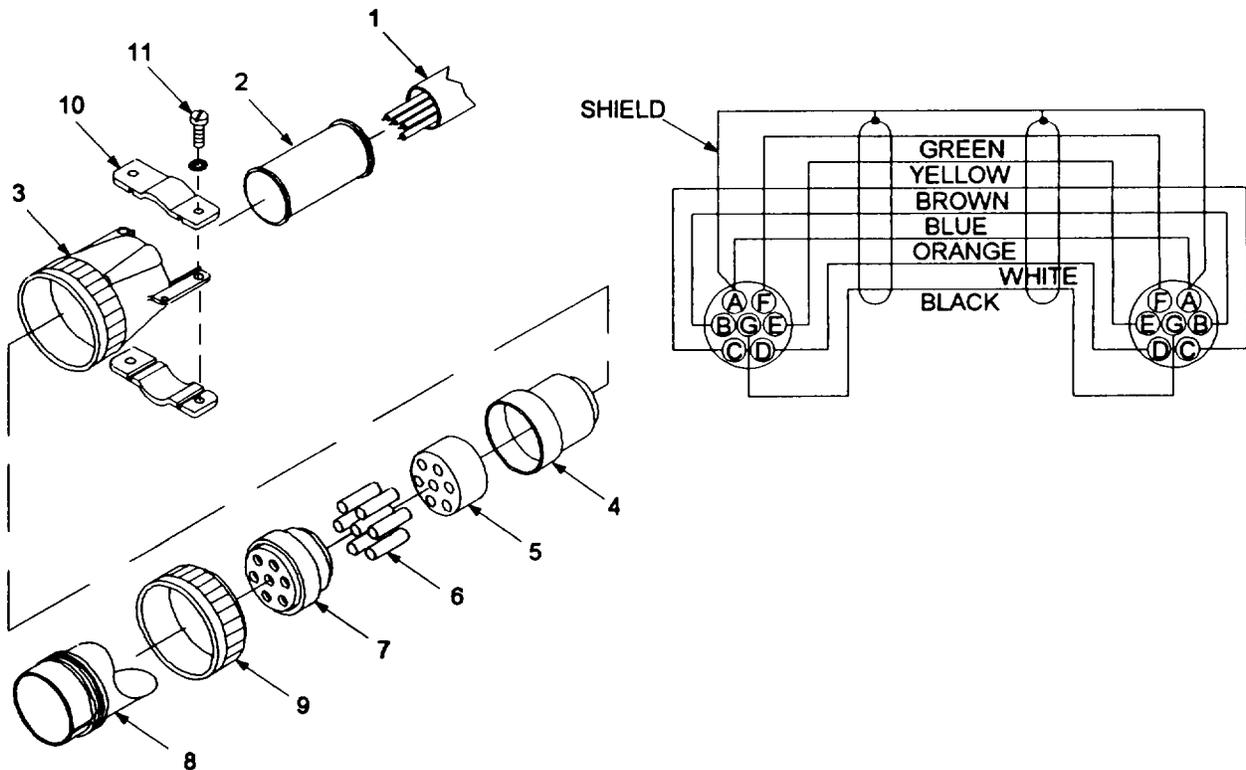
1 Person

**Equipment Condition:**

Cable removed  
(Reference paragraph 4-14)

**Materials/Parts:**

- Solder (SN63WRMAP3 0.036 1LB)
- Insulation Sleeving (M23053/5-108-0)
- Insulation Sleeving (M2305315-104-0)
- Connector (MS3106F16S-1S)



Repair.

- a. Cut cable as close as possible to connector to be replaced.

**NOTE**

**If cable is shortened by more than 2 inches (5 centimeters), cable must be replaced.**

**5-11 CABLE ASSEMBLY (HYDRAULIC) REPAIR (11784510) - Continued.**

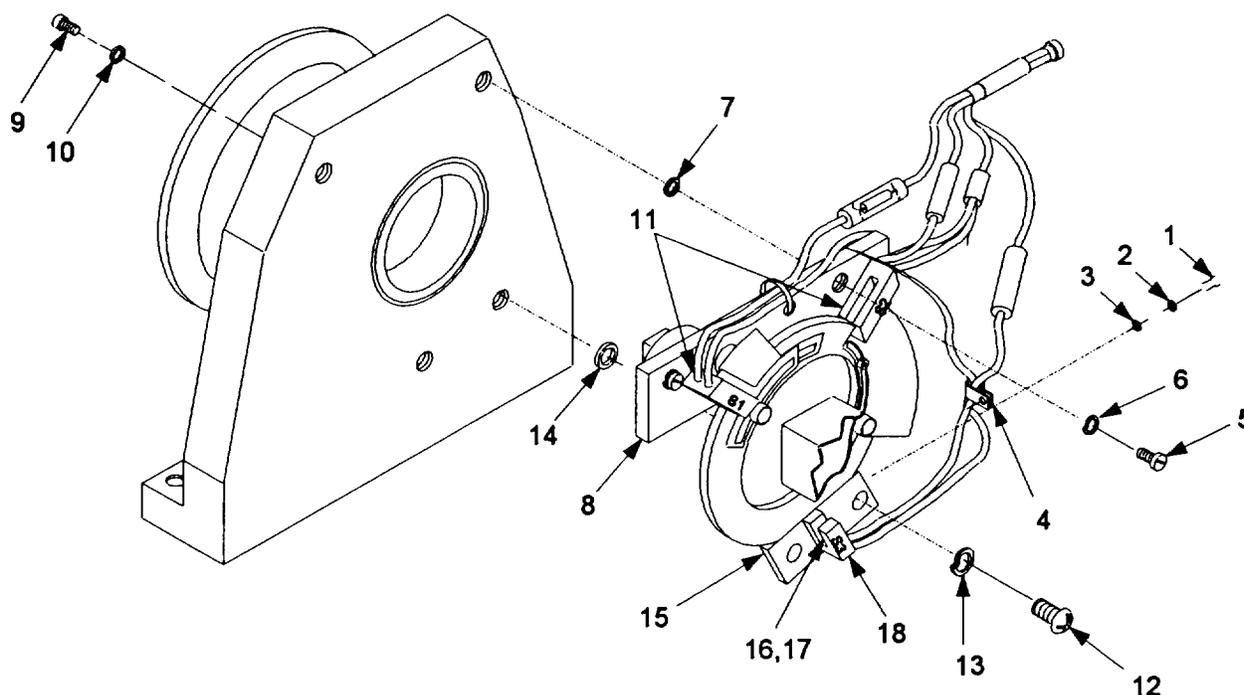
- b. Insert cable (1) through a two-inch (5-centimeter) piece of insulation sleeving (2).
- c. Strip outer insulation of cable 1 inch (2.5 centimeters) from end.
- d. Cut red wire off.
- e. Strip ends of wire 3/8 inch (1 centimeter).
- f. Insert cable through backshell (3) of connector and ferrule (4).
- g. Slide grommet (5) over cable leads.
- h. Insert cable leads into solder wells of contacts (6) and solder. Refer to TB SIG 222.
- i. Push insert (7) into barrel (8). Groove of insert must align with groove of barrel.
- j. Slide coupling nut (9) over barrel.
- k. Push contacts into insert using wiring diagram.
- l. Push grommet down cable leads and over contacts.
- m. Screw backshell onto barrel.
- n. Slide insulation sleeving under cable strain relief (10) and shrink insulation sleeving.
- o. Tighten two screws (11) on strain relief.
- p. Utilizing multimeter, check continuity as shown in diagram.

**5-12 PROXIMITY SWITCH CABLE ASSEMBLY REPLACEMENT (11784510).****INITIAL SETUP****Tools:**

General Mechanic's Automotive Tool Kit

**Personnel Required:**

1 Person

**Materials/Parts:**Cable Assembly (1 1784510)  
Tiedown Strap (MS3367-1)**References:**Paragraph 4-9  
Paragraph 2-7  
Paragraph 5-3  
Paragraph 5-4**a. Removal.**

- (1) Place target holding assembly in down position.
- (2) Place the THM/TG control assembly FUNCTION switch to O position.
- (3) Disconnect power cables from battery box cable adapters or battery eliminator.
- (4) Cut tiedown strap holding cable to cross bar.
- (5) Remove access door. Refer to paragraph 4-9.
- (6) Disconnect cable P3 from rear of electronic control unit.
- (7) Remove screw (1), lockwasher (2), flatwasher (3), and cable clamp (4) from bearing unit housing assembly.

**5-12 PROXIMITY SWITCH CABLE ASSEMBLY REPLACEMENT (11784510) - Continued.**

- (8) Remove two screws (5), lockwashers (6), and flatwashers (7), and double proximity switch mounting plate (8) from bearing unit housing assembly.
- (9) Remove screw (9) and lockwasher (10) from each proximity switch and remove two proximity switches (11) from double proximity switch mounting plate.
- (10) Remove two screws (12), lockwashers (13), and flatwashers (14), and single proximity switch mounting plate (15) from bearing unit housing assembly.
- (11) Remove screw (16), lockwasher (17), and proximity switch (18) from single proximity switch mounting plate.

**b. Installation.**

- (1) Position proximity switch (18) on single proximity switch mounting plate (15) and install lockwasher (17) and screw (16).
- (2) Position two proximity switches (11) on double proximity switch mounting plate and install lockwasher (10) and screw (9) in each proximity switch.
- (3) Position single proximity switch mounting plate on bearing unit housing assembly. Position two flatwashers (14) between mounting plate (15) and bearing unit housing. Install lockwashers (13), and screws (12).
- (4) Position double proximity switch mounting plate on bearing unit housing assembly. Position two flatwashers (7) between mounting plate (8) and bearing unit housing. Install lockwashers (6), and screws (5).
- (5) Install cable clamp (4), flatwasher (3), lockwasher (2), and screw (1) in bearing unit housing assembly.
- (6) Connect cable P3 to rear of electronic control unit.
- (7) Using tiedown strap, fasten cable assembly to cross bar.
- (8) Connect power cables to battery box cable adapters or battery eliminator.
- (9) Test operate THM/TG. Refer to paragraph 2-7.
- (10) Adjust magnetic actuator switches as necessary. Refer to paragraphs 5-3 and 5-4.
- (11) Install access door. Refer to paragraph 4-9.

**5-13 PROXIMITY SWITCH CABLE (11784510) CONNECTOR REPLACEMENT (11784662).**

**INITIAL SETUP**

**Tools:**

- General Mechanic's Automotive Tool Kit
- Soldering and Desoldering Set
- Wire Strippers
- Heat Gun
- Multimeter

**Personnel Required:**

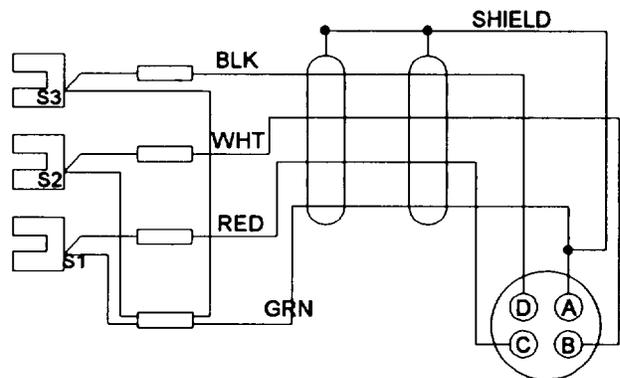
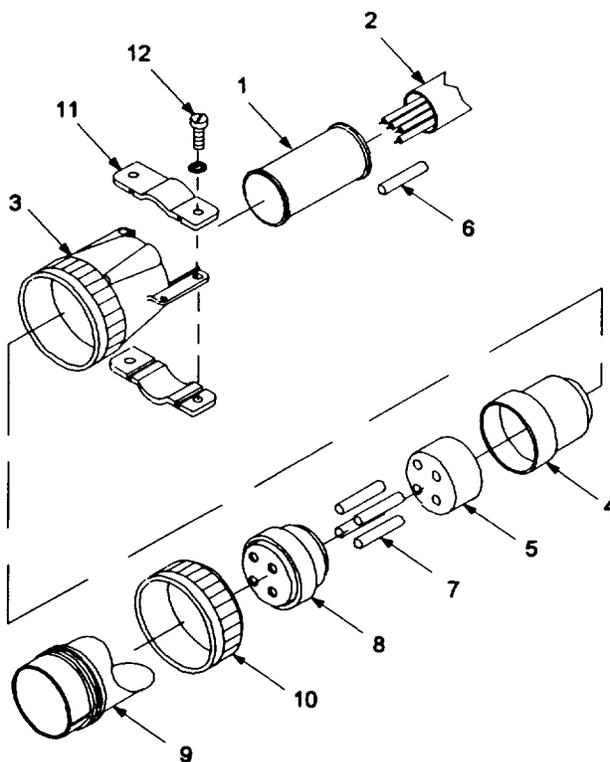
1 Person

**Equipment Condition:**

Proximity switch cable removed  
(Reference paragraph 5-12)

**Materials/Parts:**

- Solder (SN63WRMAP3 0.036 1LB)
- Insulation Sleeving (M23053/5-104-0)
- Insulation Sleeving (M23053/5-108-0)
- Connector (11784662)



**a. Removal.**

- (1) Cut cable as close to connector as possible.

**NOTE**

**If cable is shortened by more than 2 inches (5 centimeters), cable must be replaced.**

**5-13 PROXIMITY SWITCH CABLE (11784510) CONNECTOR REPLACEMENT (11784662) Continued.**

(2) Remove insulation sleeving (1) from cable assembly (2).

**b. Installation.**

(1) Insert cable (2) through two-inch (5-centimeter) piece of insulation sleeving (1).

(2) Insert cable through backshell (3) of ferrule (4).

(3) Strip outer insulation on cable 1 inch (2.5 centimeters) from end.

(4) Cut excess wires off cable.

(5) Strip ends of remaining wires 3/8 inch (1 centimeter) from end.

(6) Slide grommet (5) over cable leads.

(7) Insert individual wires through insulation sleeving (6).

(8) Insert wires into solder wells of contacts (7) and solder. Green wire and shield are inserted in the same contact. Refer to TB SIG 222.

(9) Slide insulation sleeving over solder connections and shrink using heat gun.

(10) Push insert (8) into barrel (9). Groove of insert must align with groove of barrel.

(11) Slide coupling nut (10) over barrel.

(12) Push contacts into insert using wiring diagram.

(13) Push grommet down over cable leads and over contacts.

(14) Screw backshell onto barrel.

(15) Slide insulation sleeving (1) under cable strain relief (11). Using heat gun, shrink sleeving.

(16) Tighten screws (12) on strain relief.

(17) Utilizing multimeter, check continuity as shown in diagram.

**5-14 PROXIMITY SWITCH REPLACEMENT (11784511).**

**INITIAL SETUP**

**Tools:**

- General Mechanic's Automotive Tool Kit
- Wire Strippers
- Heat Gun

**Personnel Required:**

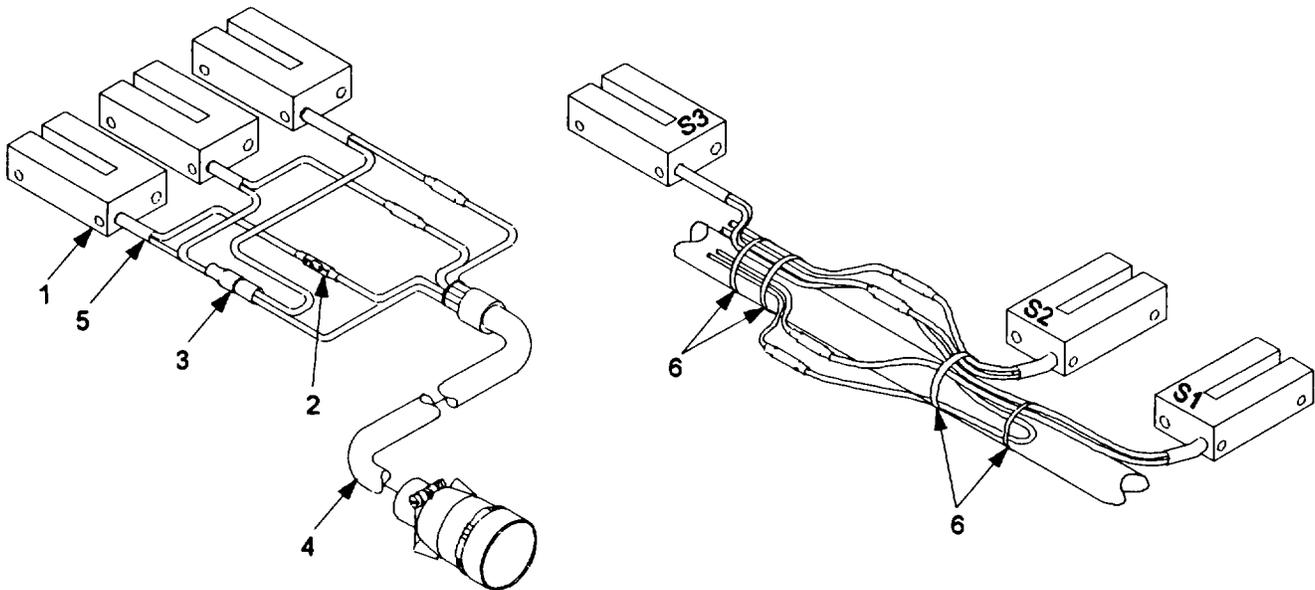
1 Person

**Equipment Condition:**

Proximity switch cable removed  
(Reference paragraph 5-12)

**Materials/Parts:**

- Butt Connector (11784474-1)
- Insulation Sleeving (M23053/5-106-0)
- Insulation Sleeving (M23053/5-104-0)
- Proximity Switch (11784511)
- Adhesive (MIL-A-46146)
- Tiedown Straps (MS3367-4)



**a. Removal.**

- (1) Cut proximity switch (1) wires on proximity switch side of butt connectors (2) and (3).
- (2) Cut butt connector from cable assembly (4).

**b. Installation.**

- (1) Strip insulation on cable wires 1/4 inch (0.6 centimeter) from end.
- (2) Strip insulation on proximity switch wires 1/4 inch (0.6 centimeter) from end. (3) Install two-inch (5-centimeter) piece of insulation sleeving (5) over proximity switch wires. Shrink insulation sleeving.

**5-14 PROXIMITY SWITCH REPLACEMENT (11784511) - Continued.**

- (4) Install a two-inch (5centimeters) piece of sleeving over cable assembly lead.
- (5) Insert cable wire and proximity switch wire into new butt connector (2). Crimp connector.
- (6) Slide insulation sleeving over connector.
- (7) Apply sealing compound to open ends of sleeving. Apply heat and shrink sleeving tight over connection.
- (8) Install common leads of proximity switches and cable assembly into new butt connector (3). Crimp connector.
- (9) Slide insulation sleeving over connector.
- (10) Apply sealing compound to opens ends of sleeving. Apply heat and shrink sleeving tight over connection.
- (11) Loop S1 and S2 over butt connectors and install tiedown straps (6) to form branches.
- (12) Install tiedown straps in two places on the S3 branch to hold cable wires together.

**5-15 LOGIC CIRCUIT CARD ASSEMBLY REPLACEMENT (11784523).**

**INITIAL SETUP**

**Tools:**

General Mechanic's Automotive Tool Kit  
Antistatic Wrist Strap

**Personnel Required:**

1 Person

**Equipment Condition:**

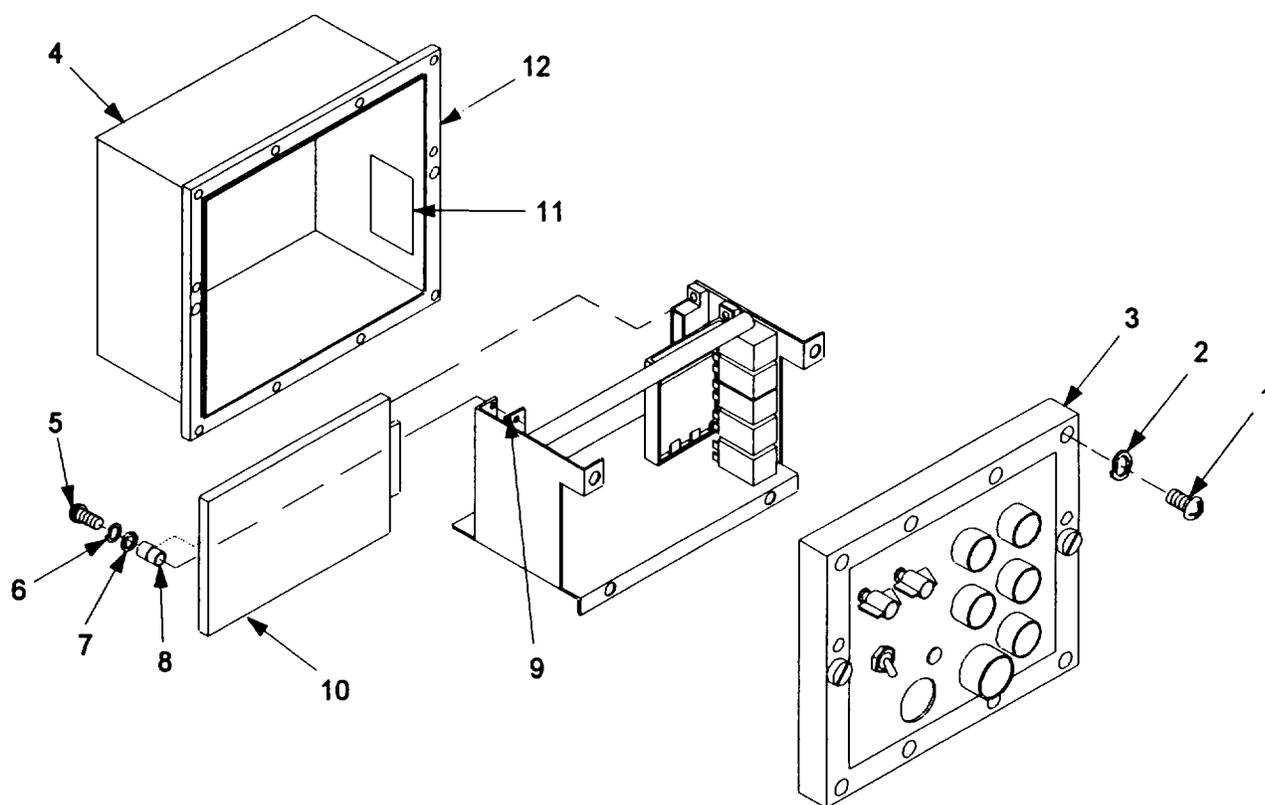
Control assembly removed  
(Reference paragraph 4-15)

**Materials/Parts:**

Circuit Card Assembly (11784523)  
Gasket (11784634)  
Rubber Cement (11784493)  
Desiccant (11784647)  
Tape, Filament (11784588)  
Grease (MIL-G-4343)

**References:**

Paragraph 4-15



**a. Removal.**

- (1) Use antistatic wrist strap and attach to earth ground.
- (2) Remove 10 screws (1) and lockwashers (2) from panel assembly (3) of control assembly.
- (3) Slide panel assembly away from housing (4).

**5-15 LOGIC CIRCUIT CARD ASSEMBLY REPLACEMENT (11784523) - Continued.**

- (4) Loosen two screws (5) from bracket (9).
- (5) Unplug and remove logic circuit card assembly (10) from end connector.
- (6) Remove desiccant pack (11) from side of housing and discard.

**b. Installation.**

- (1) Tape new desiccant pack (11) to side of housing.
- (2) Plug logic circuit card assembly (10) into end connector.
- (3) Tighten screws (5) in each retaining post.

**NOTE**

**Use rubber cement between panel assembly and new gasket. Apply thin coat of grease between gasket and box prior to assembly.**

- (4) Inspect gasket (12) on box and replace if necessary.
- (5) Slide panel assembly (3) into box (4).
- (6) Install 10 lockwashers (2) and screws (1) in panel assembly.
- (7) Install control assembly. Refer to paragraph 4-15.

**5-16 AMPLIFIER CIRCUIT CARD ASSEMBLY REPLACEMENT (1 1784526).**

**INITIAL SETUP**

**Tools:**

General Mechanic's Automotive Tool Kit  
Antistatic Wrist Strap

**Personnel Required:**

1 Person

**Equipment Condition:**

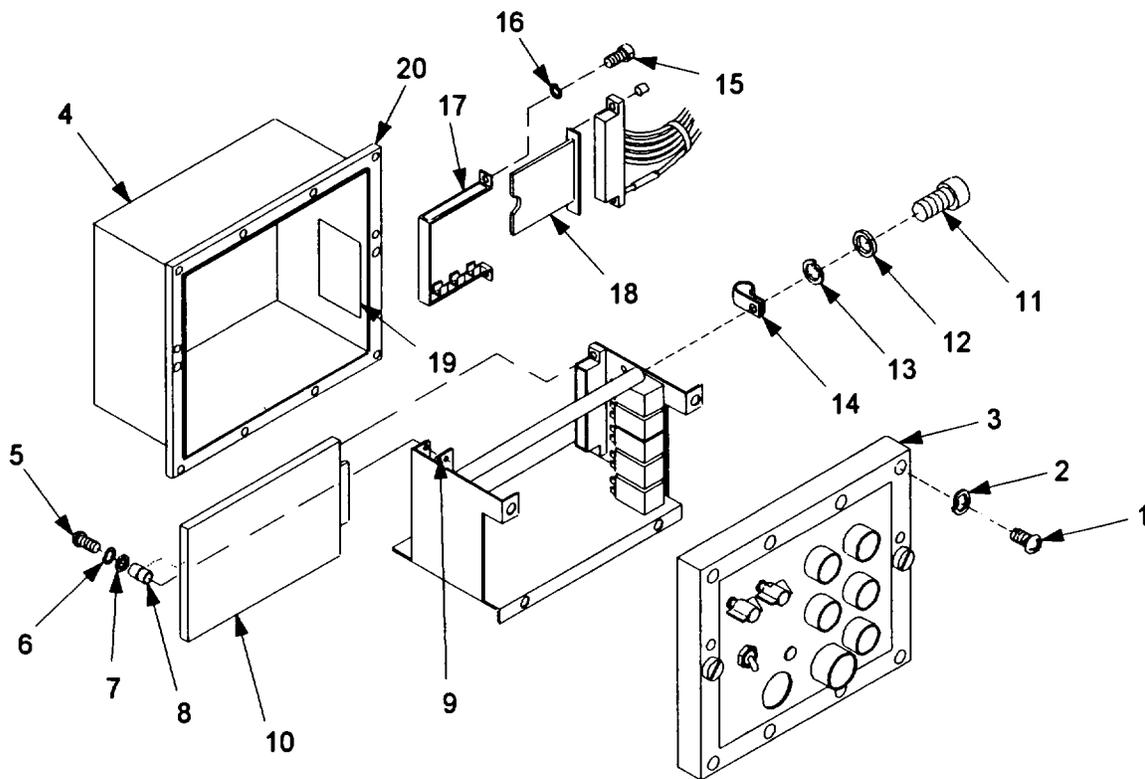
Control assembly removed  
(Reference paragraph 4-15)  
Logic CCA Removed  
(Reference paragraph 5-15)

**Materials/Parts:**

Circuit Card Assembly (11784526)  
Gasket (11784634)  
Rubber Cement (11784493)  
Desiccant (1 1784647)  
Tape, Filament (11784588)  
Grease (MIL-G-4343)

**References:**

Paragraphs 4-15 and 5-15



**a. Removal.**

- (1) Use antistatic wrist strap and attach to earth ground.
- (2) Remove 10 screws (1) and lockwashers (2) from panel assembly (3) of control assembly.
- (3) Slide panel assembly away from housing (4).

**5-16 AMPLIFIER CIRCUIT CARD ASSEMBLY REPLACEMENT (11784526) - Continued.**

- (4) Remove two screws (5), lockwashers (6), flatwashers (7), and retaining posts (8) from bracket (9).
- (5) Unplug and remove logic circuit card assembly (10) from end connector.
- (6) Remove screw (11), lockwasher (12), and flatwasher (13) from cable clamp (14).
- (7) Remove two screws (15) and lockwashers (16) from bracket (17). Remove bracket from chassis.
- (8) Unplug and remove amplifier circuit card assembly (18) from end connector.
- (9) Remove desiccant pack (19) from housing.

**b. Installation.**

- (1) Tape new desiccant pack (19) to housing (4).
- (2) Plug amplifier circuit card assembly (18) into end connector.
- (3) Position bracket (17) on chassis and install two lockwashers (16) and screws (15).
- (4) Install flatwasher (13), lockwasher (12), and screw (11) in cable clamp (14).
- (5) Plug logic circuit card assembly (10) into end connector.
- (6) Position two retaining posts (8) on bracket (9) and install flatwasher (7), lockwasher (6), and screw (5) in each retaining post.

**NOTE**

**Use rubber cement between panel assembly and new gasket. Apply thin coat of grease between gasket and box prior to assembly.**

- (7) Inspect gasket (20) on box and replace if necessary.
- (8) Slide panel assembly (3) into box (4).
- (9) Install 10 lockwashers (2) and screws (1) in panel assembly.
- (10) Install control assembly. Refer to paragraph 4-15.

**5-17 BATTERY TEST CIRCUIT CARD ASSEMBLY REPLACEMENT (11784531).**

**INITIAL SETUP**

**Tools:**

- General Mechanic's Automotive Tool Kit
- Antistatic Wrist Strap

**Materials/Parts:**

- Circuit Card Assembly (11784531)
- Gasket (11784634)
- Rubber Cement (11784493)
- Desiccant (11784647)
- Tape, Filament (11784588)
- Grease (MIL-G-4343)

**Equipment Condition:**

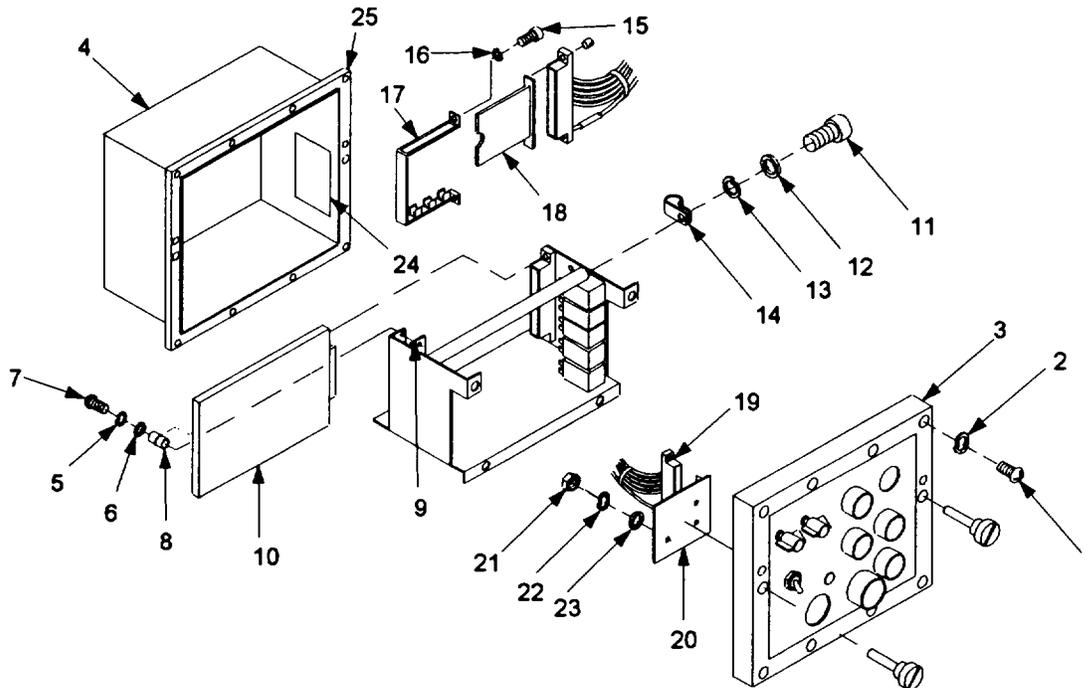
- Control assembly removed  
(Reference paragraph 4-15)
- Amplifier CCA Removed  
(Reference paragraph 5-16)
- Logic CCA Removed  
(Reference paragraph 5-15)

**References:**

- Paragraph 4-15
- Paragraph 5-15
- Paragraph 5-16

**Personnel Required:**

1 Person



**a. Removal.**

- (1) Use antistatic wrist strap and attach to earth ground.
- (2) Remove 10 screws (1) and lockwashers (2) from panel assembly (3) of control assembly.
- (3) Slide panel assembly away from housing (4).

**5-17 BATTERY TEST CIRCUIT CARD ASSEMBLY REPLACEMENT (11784531) - Continued.**

- (4) Unplug connector (19) from battery test circuit card assembly (20).
- (5) Remove four nuts (21), lockwashers (22), and flatwashers (23). Remove battery test circuit card assembly.
- (6) Remove desiccant pack (24) from housing.

**b. Installation.**

- (1) Tape new desiccant pack (24) to housing.
- (2) Position battery test circuit card assembly (20) on studs and install four flatwashers (23), lockwashers (22), and nuts (21).
- (3) Plug connector (19) into battery test circuit card assembly.
- (4) Install amplifier circuit card assembly (18). Refer to paragraph 5-16.
- (5) Install logic circuit card assembly (10). Refer to paragraph 5-15.

**NOTE**

**Use rubber cement between panel assembly and new gasket. Apply thin coat of grease between gasket and box prior to assembly.**

- (6) Inspect gasket (25) on box and replace if necessary.
- (7) Slide panel assembly (3) into housing (4).
- (8) Install 10 screws (1) and lockwashers (2) in panel assembly.
- (9) Install control assembly. Refer to paragraph 4-15.

**5-18 HIT SENSOR CONNECTOR REPLACEMENT (11784663).**

**INITIAL SETUP**

**Tools:**

- General Mechanic's Automotive Tool Kit
- Soldering and Desoldering Set
- Antistatic Wrist Strap

**Personnel Required:**

1 Person

**Equipment Condition:**

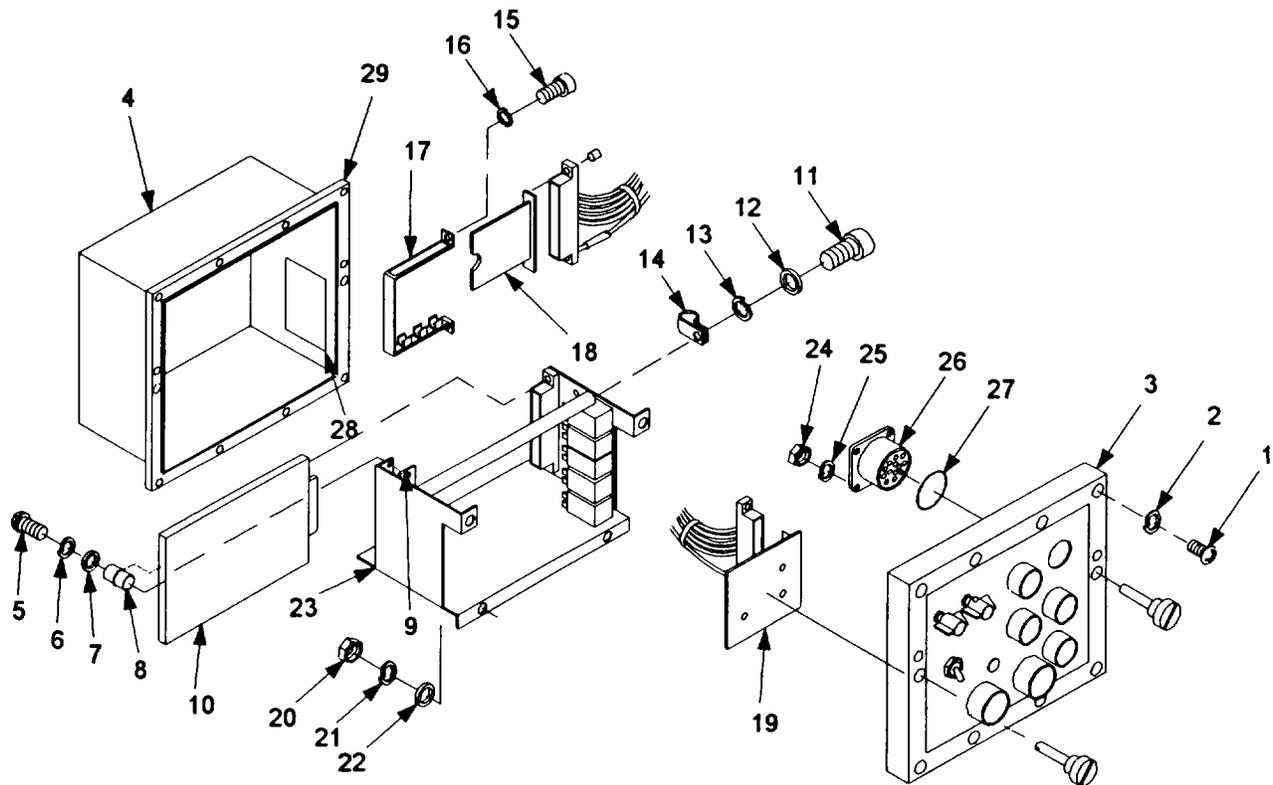
- Control assembly removed
- Reference paragraph 4-15)

**Materials/Parts:**

- Connector (11784663)
- Solder (SN63WRMAP3 0.036 1LB)
- Gasket (11784634)
- Rubber Cement (11784493)
- Desiccant (11784647)
- Packing, Performed (MS52000-5)
- Petroleum Jelly (NDC00168-0053-21)
- Tape, Filament (11784588)

**References:**

Paragraph 4-15



**a. Removal.**

- (1) Use antistatic wrist strap and attach to earth ground.
- (2) Remove 10 screws (1) and lockwashers (2) from panel assembly (3) of control assembly.

**5-18 HIT SENSOR CONNECTOR REPLACEMENT (11784663) - Continued.**

- (3) Slide panel assembly away from box (4).
- (4) Remove two screws (5), lockwashers (6), flatwashers (7), and retaining posts (8) from bracket (9).
- (5) Unplug and remove logic circuit card assembly (10) from end connector.
- (6) Remove screw (11), lockwasher (12), and flatwasher (13) from cable clamp (14).
- (7) Remove two screws (15) and lockwashers (16) from bracket (17). Remove bracket from chassis.
- (8) Unplug and remove amplifier circuit card assembly (18) from end connector.
- (9) Unplug connector from battery test circuit card assembly (19).
- (10) Remove four nuts (20), lockwashers (21), and flatwashers (22) holding chassis (23) to panel.

<b>CAUTION</b>
----------------

**Care must be taken during the following steps to prevent wires from breaking or pulling loose.**

- (11) Lift chassis from panel to expose connectors.
- (12) Remove four nuts (24) and lockwashers (25) from hit sensor connector studs.
- (13) Remove hit sensor connector (26) and gasket (27) from panel.
- (14) Tag and desolder wires and capacitor from hit sensor connector.
- (15) Remove desiccant pack (28) from housing.

**b. Installation.**

- (1) Tape new desiccant pack (28) to housing.
- (2) Connect capacitor between pins A and B of hit sensor connector.
- (3) Connect wires to contacts on hit sensor connector and solder connections. Refer to TB SIG 222.
- (4) Apply a thin film of petroleum jelly on new gasket (27) and install on connector.
- (5) Install hit sensor connector (26) on panel with keyway up.
- (6) Install four lockwashers (25) and nuts (24) on hit sensor connector.
- (7) Position chassis (23) on panel.

- (8) Install four flatwashers (22), lockwashers (21), and nuts (20) that hold chassis to panel.
- (9) Plug connector into battery test circuit card assembly (19).
- (10) Plug amplifier circuit card assembly (18) into end connector.
- (11) Position bracket (17) on chassis and install two lockwashers (16) and screws (15).
- (12) Install flatwasher (13), lockwasher (12), and screw (11) in cable clamp (14).
- (13) Plug logic circuit card assembly (10) into end connector.
- (14) Position two retaining posts (8) on bracket (9) and install flatwasher (7), lockwasher (6), and screw (5) in each retaining post.

#### NOTE

**Use rubber cement between panel assembly and new gasket. Apply thin coat of grease between gasket and box prior to assembly.**

- (15) Inspect gasket (29) on box and replace if necessary.
- (16) Slide panel assembly (3) into box (4).
- (17) Install 10 screws (1) and lockwashers (2) in panel assembly.
- (18) Install control assembly. Refer to paragraph 4-15.

**5-19 LAMP CONNECTOR REPLACEMENT (11784665).****INITIAL SETUP****Tools:**

General Mechanic's Automotive Tool Kit  
Soldering and Desoldering Set  
Antistatic Wrist Strap

**Personnel Required:**

1 Person

**Equipment Condition:**

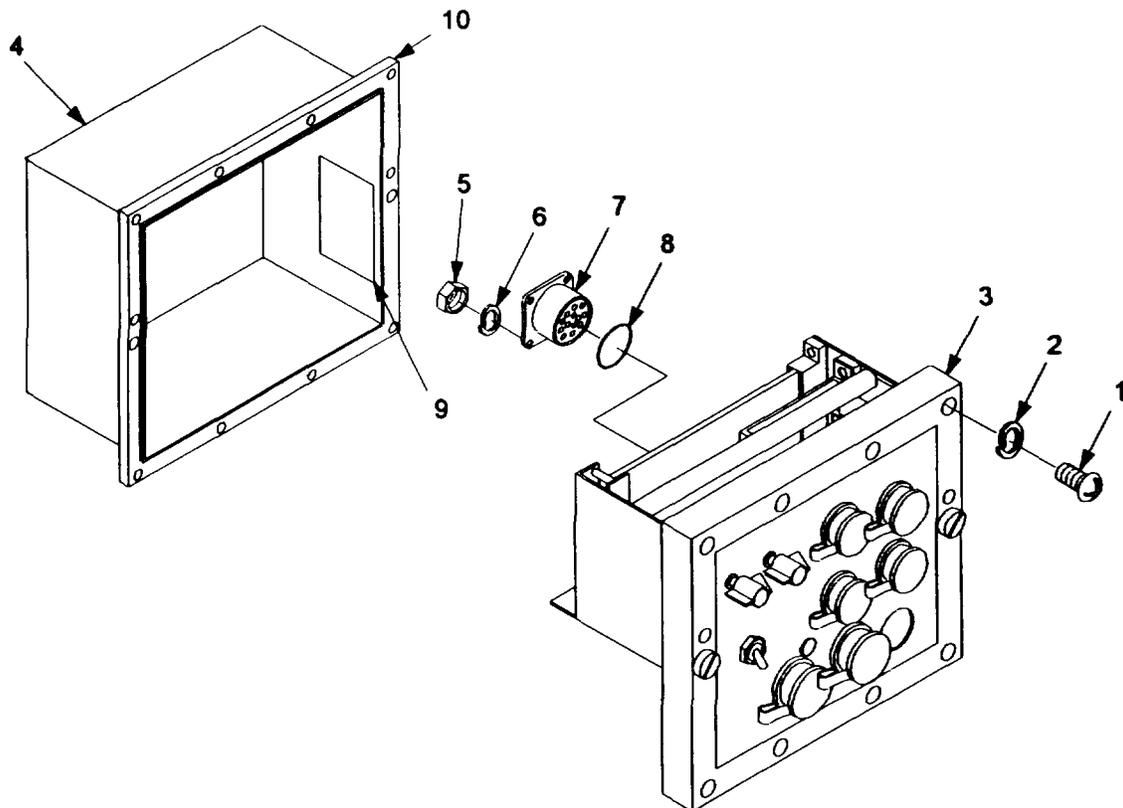
Control assembly removed  
(Reference paragraph 4-15)

**Materials/Parts:**

Connector (11784665)  
Solder (SN63WRMAP3 0.036 1LB)  
Gasket (11784634)  
Rubber Cement (11784493)  
Packing, Preformed (MS52000-5)  
Desiccant (11784647)  
Petroleum Jelly (NDC001680053-21)  
Tape, Filament (11784588)

**References:**

Paragraph 4-15

**a. Removal.**

- (1) Use antistatic wrist strap and attach to earth ground.
- (2) Remove 10 screws (1) and lockwashers (2) from panel assembly (3) on control assembly.

- (3) Slide panel assembly away from box (4).
- (4) Remove four nuts (5) and lockwashers (6) from lamp connector (7) studs.
- (5) Remove lamp connector and gasket (8) from panel.
- (6) Tag and desolder wires from lamp connector.
- (7) Remove desiccant pack (9) from housing.

**b. Installation.**

- (1) Tape new desiccant pack (9) to housing.
- (2) Connect wires to contacts on lamp connector (7) and solder connections. Refer to TB SIG 222.
- (3) Apply a thin film of petroleum jelly on new gasket (8) and install on lamp connector.
- (4) Install lamp connector on panel (3) with keyway up.
- (5) Install four lockwashers (6) and nuts (5) on studs on lamp connector.

**NOTE**

**Use rubber cement between panel assembly and new gasket. Apply thin coat of grease between gasket and box prior to assembly.**

- (6) Inspect gasket (10) and replace as necessary.
- (7) Slide panel assembly (3) into box (4).
- (8) Install 10 screws (1) and lockwashers (2) in panel assembly.
- (9) Install control assembly. Refer to paragraph 4-15.

**5-20 SMOKE SCORER/HOSTILE FIRE CONNECTOR REPLACEMENT (9384688).**

**INITIAL SETUP**

**Tools:**

General Mechanic's Automotive Tool Kit  
Soldering and Desoldering Set  
Antistatic Wrist Strap

**Personnel Required:**

1 Person

**Equipment Condition:**

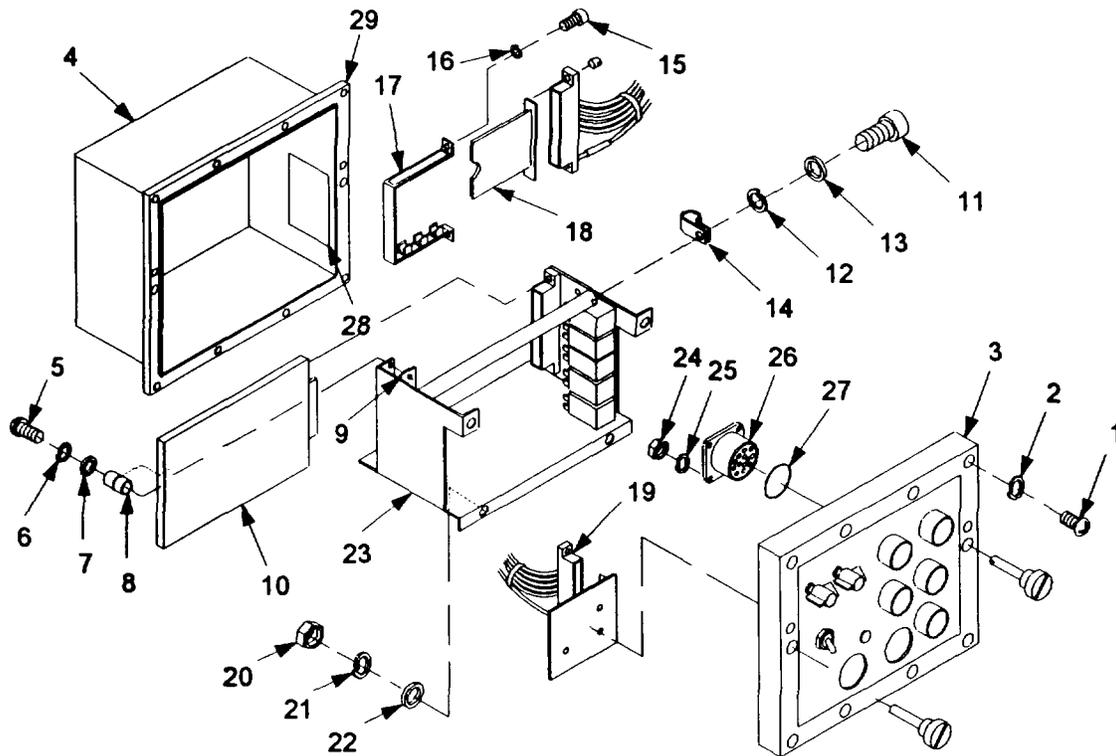
Control assembly removed  
(Reference paragraph 4-15)

**Materials/Parts:**

Connector (9384688)  
Solder (SN63WRMAP3 0.036 1LB)  
Gasket (11784634)  
Rubber Cement (11784493)  
Packing, Performed (MS52000-7)  
Petroleum Jelly (NDC00168-0053-21)  
Desiccant (11784647)  
Tape, Filament (11784588)

**References**

Paragraph 4-15



**a. Removal.**

- (1) Use antistatic wrist strap and attach to earth ground.
- (2) Remove 10 screws (1) and lockwashers (2) from panel assembly (3) of control assembly.
- (3) Slide panel assembly away from box (4).

- (4) Remove two screws (5), lockwashers (6), flatwashers (7), and retaining posts (8) from bracket (9).
- (5) Unplug and remove logic circuit card assembly (10) from end connector.
- (6) Remove screw (11), lockwasher (12), and flatwasher (13) from cable clamp (14).
- (7) Remove two screws (15) and lockwashers (16) from bracket (17). Remove bracket from chassis.
- (8) Unplug and remove amplifier circuit card assembly (18) from end connector.
- (9) Unplug connector (19) from battery test circuit card assembly.
- (10) Remove four nuts (20), lockwashers (21), and flatwashers (22) holding chassis (23) to panel.

**CAUTION**

**I Care must be taken during following steps to prevent wires from breaking or pulling loose.**

- (11) Lift chassis from panel to expose connectors.
- (12) Remove four nuts (24) and lockwashers (25) from stud on smoke scorer/hostile fire connector.
- (13) Remove smoke scorer/hostile fire connector (26) and gasket (27) from panel.
- (14) Tag and desolder wires from smoke scorer/hostile fire connector.
- (15) Remove desiccant pack (28) from housing.

**b. Installation.**

- (1) Tape new desiccant pack (28) to housing.
- (2) Connect wires to contacts on smoke scorer/hostile fire connector (26) and solder connections. Refer to TB SIG 222.
- (3) Apply a thin film of petroleum jelly on new gasket (27) and install on smoke scorer/hostile fire connector (26).
- (4) Install smoke scorer/hostile fire connector on panel (3) with keyway up.

**5-20 SMOKE SCORER/HOSTILE FIRE CONNECTOR REPLACEMENT (9384688) - CONTINUED.**

- (5) Install four lockwashers (25) and nuts (24) on studs on smoke scorer/hostile fire connector.
- (6) Position chassis (23) on panel. Install four flatwashers (22), lockwashers (21), and nuts (20) that hold chassis to panel.
- (7) Plug connector into battery test circuit card assembly (19).
- (8) Plug amplifier circuit card assembly (18) into end connector.
- (9) Position bracket (17) on chassis and install two lockwashers (16) and screws (15).
- (10) Install flatwasher (13), lockwasher (12), and screw (11) in cable clamp (14).
- (11) Plug logic circuit card assembly (10) into end connector.
- (12) Position two retaining posts (8) on bracket (9) and install flatwasher (7), lockwasher (6), and screw (5) in each retaining post.

**NOTE**

**Use rubber cement between panel assembly and gasket. Apply thin coat of grease between gasket and box prior to assembly.**

- (13) Inspect gasket (29) on box and replace if necessary.
- (14) Slide panel assembly (3) into box (4).
- (15) Install 10 screws (1) and lockwashers (2) in panel assembly.
- (16) Install control assembly. Refer to paragraph 4-15.

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**5-21 RECEIVER CONNECTOR REPLACEMENT (MS3452W16S-IS).**

**INITIAL SETUP**

**Tools:**

General Mechanic's Automotive Tool Kit  
Soldering and Desoldering Set  
Heat Gun

**Personnel Required:**

1 Person

**Equipment Condition:**

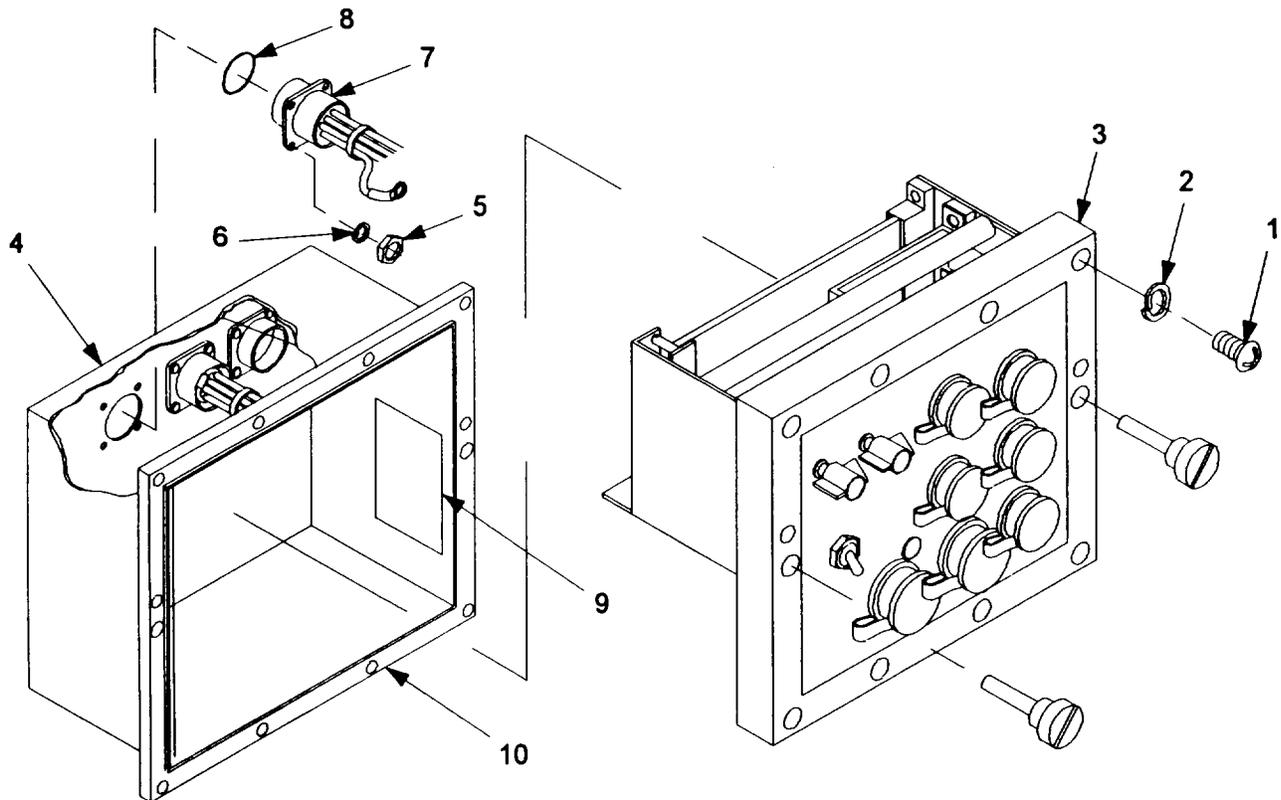
Control assembly removed  
(Reference paragraph 4-15)

**Material/Parts:**

Insulation Sleeving (M23053/5-104-0)  
Connector (MS3452W1 6S-1 S)  
Solder (SN63WRMAP3 0.036 1LB)  
Gasket (11784634)  
Rubber Cement (11784493)  
Packing, Performed (MS52000-5)  
Petroleum Jelly (NDC00168-0053-21)  
Desiccant (11784647)  
Tape, Filament (11784588)

**References:**

Paragraph 4-15



**a. Removal.**

- (1) Remove 10 screws (1) and lockwashers (2) from panel assembly (3) on control assembly.
- (2) Slide panel assembly away from housing (4).

- (3) Remove four nuts (5) and lockwashers (6) from receiver connector (7).
- (4) Remove receiver connector and gasket (8) from housing.
- (5) Tag and desolder wires from receiver connector.
- (6) Remove insulation sleeving from wires.
- (7) Remove desiccant pack (9) from housing.

**b. Installation.**

- (1) Tape new desiccant pack (9) to housing.
- (2) Install insulation sleeving on wires.
- (3) Connect wires to contacts on receiver connector (7) and solder connections. Refer to TB SIG 222.
- (4) Slide insulation sleeving over connections and apply heat.
- (5) Apply a thin film of petroleum jelly on new gasket (8) and install on receiver connector.
- (6) Install receiver connector on box (4) with keyway up. Install four lockwashers (6) and nuts (5) on studs on receiver connector.

**NOTE**

**Use rubber cement between panel assembly and new gasket. Apply thin coat of grease between gasket and box prior to assembly.**

- (7) Inspect gasket (10) and replace as necessary.
- (8) Slide panel assembly (3) into housing (4).
- (9) Install 10 screws (1) and lockwashers (2) in panel assembly.
- (10) Install control assembly. Refer to paragraph 4-15.

**5-22 HYDRAULIC UNIT CONNECTOR REPLACEMENT (MS3452W16SIP).**

**INITIAL SETUP**

**Tools:**

General Mechanic's Automotive Tool Kit  
Soldering and Desoldering Set

**Materials/Parts:**

Connector (MS3452W16S1 P)  
Solder (SN63WRMAP3 0.036 1 LB)  
Gasket (11784634)  
Rubber Cement (11784493)  
Packing, Performed (MS52000-5)  
Petroleum Jelly (NDC00168-0053-21)  
Desiccant (11784647)  
Tape, Filament (11784588)

**Personnel Required:**

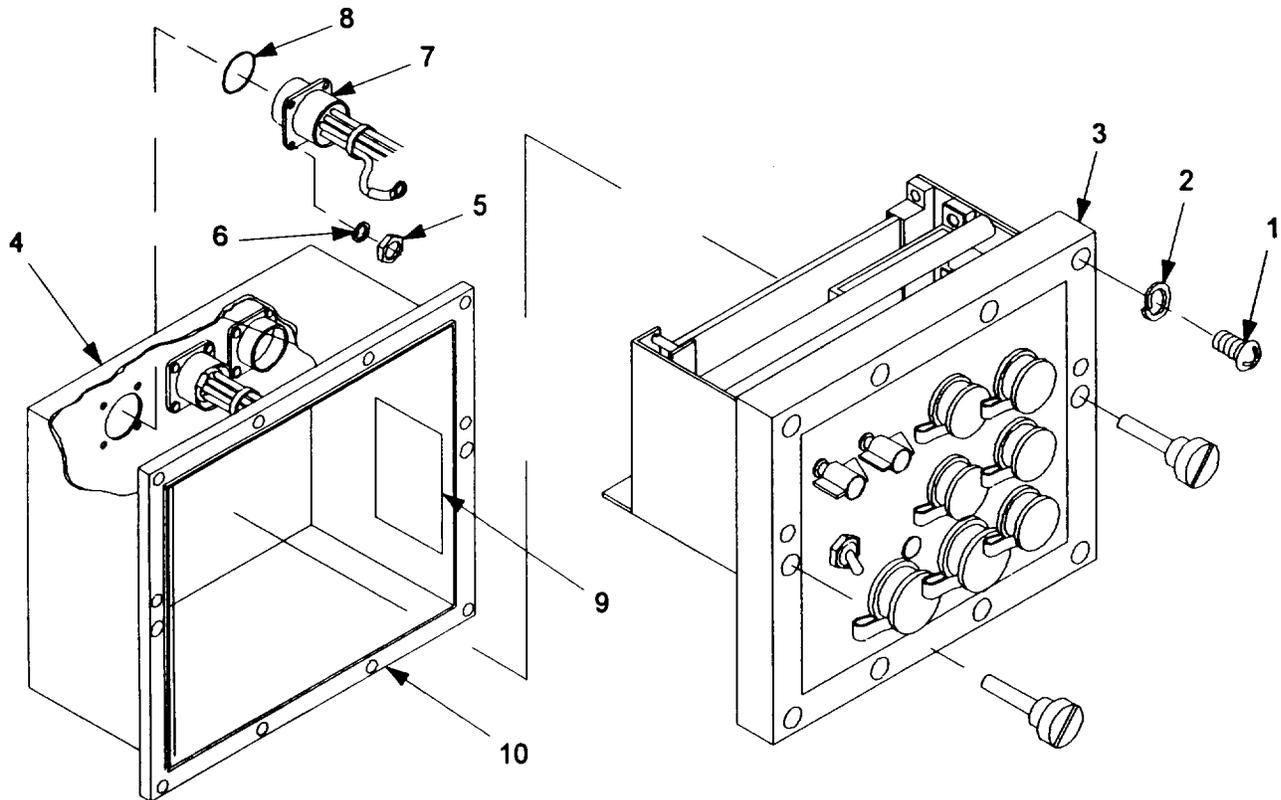
1 Person

**Equipment Condition:**

Control assembly removed  
(Reference paragraph 4-15)

**References:**

Paragraph 4-15



**a. Removal.**

- (1) Remove 10 screws (1) and lockwashers (2) from panel assembly (3) on control assembly.
- (2) Slide panel assembly away from box (4).

- (3) Remove four nuts (5) and lockwashers (6) from hydraulic unit connector(7).
- (4) Remove hydraulic unit connector and gasket (8) from box.
- (5) Tag and desolder wires and capacitors from hydraulic unit connector.
- (6) Remove desiccant pack (9) from housing.

**b. Installation.**

- (1) Tape new desiccant pack (9) to housing.
- (2) Connect one capacitor between pins A and B and one between pins C and D.
- (3) Connect wires to contacts on hydraulic unit connector (7) and solder connections. Refer to TB SIG 222.
- (4) Apply a thin film of petroleum jelly on new gasket (8) and install on connector.
- (5) Install hydraulic unit connector (7) on box (4) with keyway up.
- (6) Install four lockwashers (6) and nuts (5) on studs on hydraulic unit connector.

**NOTE**

**Use rubber cement between panel assembly and new gasket. Apply thin coat of grease between gasket and box prior to assembly.**

- (7) Inspect gasket (10) and replace as necessary.
- (8) Slide panel assembly (3) into box (4).
- (9) Install 10 screws (1) and lockwashers (2) in panel assembly.
- (10) Install control assembly. Refer to paragraph 4-15.

**5-23 PROXIMITY SWITCH CONNECTOR REPLACEMENT (11784661).**

**INITIAL SETUP**

**Tools:**

General Mechanic's Automotive Tool Kit  
Soldering and Desoldering Set

**Materials/Parts:**

Connector (11784661)  
Gasket (11784634)  
Solder (SN63WRMAP3 0.036 1LB)  
Rubber Cement (11784493)  
Packing, Performed (MS52000-4)  
Desiccant (11784647)  
Petroleum Jelly (NDC00168-0053-21)  
Tape, Filament (11784588)

**Personnel Required:**

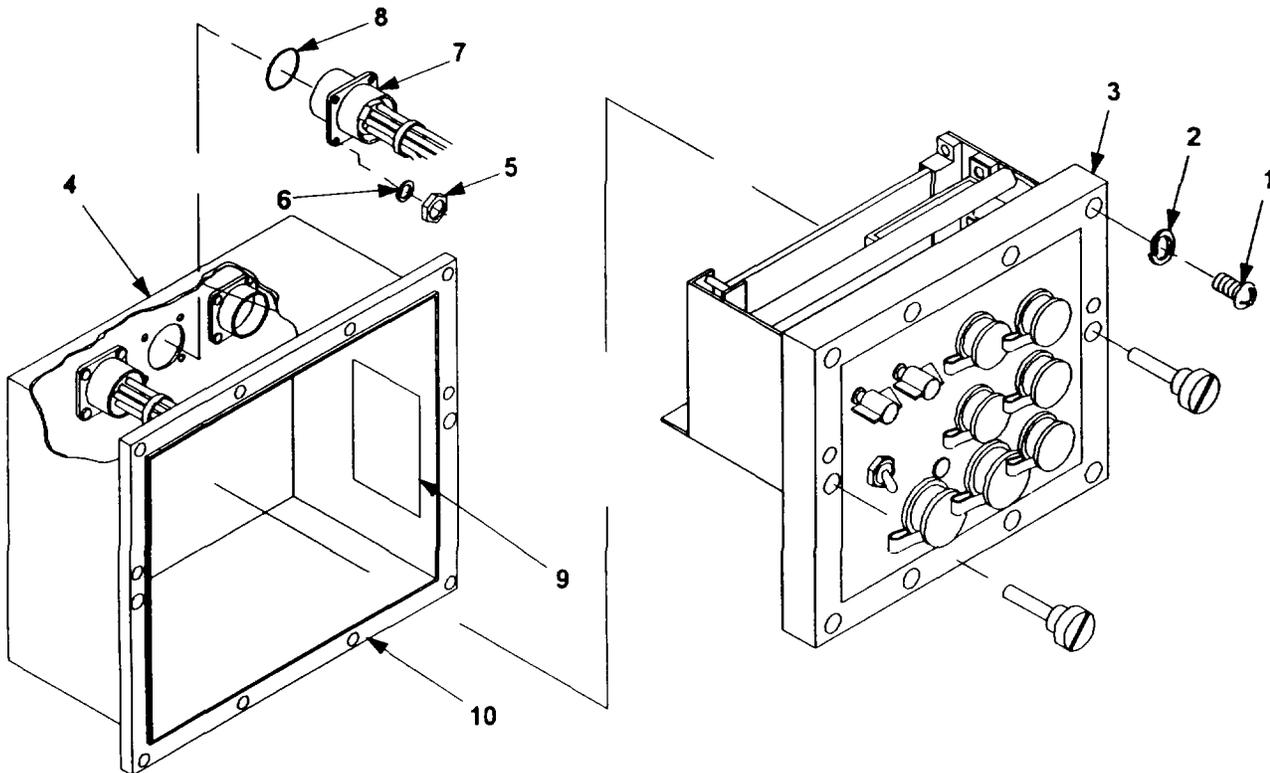
1 Person

**Equipment Condition:**

Control assembly removed  
(Reference paragraph 4-15)

**References:**

Paragraph 4-15



**a. Removal.**

- (1) Remove 10 screws (1) and lockwashers (2) from panel assembly (3) on control assembly.
- (2) Slide panel assembly away from box (4).

- (3) Remove four nuts (5) and lockwashers (6) from proximity switch connector (7).
- (4) Remove proximity switch connector and gasket (8) from box.
- (5) Tag and desolder wires from proximity switch connector.
- (6) Remove desiccant pack (9) from housing.

**b. Installation.**

- (1) Tape new desiccant pack (9) to housing.
- (2) Connect wires to contacts on proximity switch connector (7) and solder connections. Refer to TB SIG 222.
- (3) Apply a thin film of petroleum jelly on new gasket (8) and install on proximity switch connector.
- (4) Install proximity switch connector on box (4) with keyway up.
- (5) Install four lockwashers (6) and nuts (5) on studs on proximity switch connector.

**NOTE**

**Use rubber cement between panel assembly and new gasket. Apply thin coat of grease between gasket and box prior to assembly.**

- (6) Inspect gasket (10) and replace as necessary.
- (7) Slide panel assembly (3) into box (4).
- (8) Install 10 screws (1) and lockwashers (2) in panel assembly.
- (9) Install control assembly. Refer to paragraph 4-15.

**5-24 FUNCTION SWITCH REPLACEMENT (11784529).**

**INITIAL SETUP**

**Tools:**

General Mechanic's Automotive Tool Kit  
Soldering and Desoldering Set  
Antistatic Wrist Strap

**Personnel Required:**

1 Person

**Equipment Condition:**

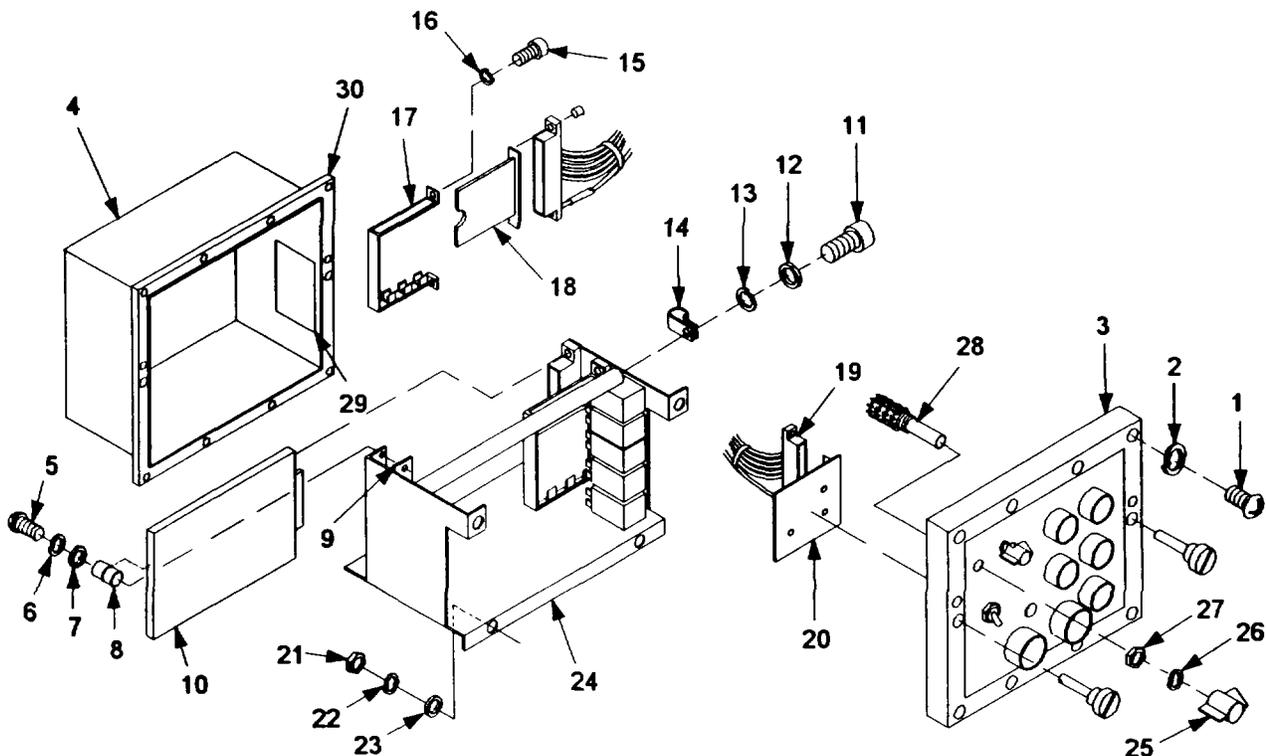
Control assembly removed

**Material/Parts:**

Rotary Switch (11784529)  
Gasket (11784634)  
Solder (SN63WRMAP3 0.036 1 LB)  
Rubber Cement (11784493)  
Desiccant (11784647)  
Tape, Filament (11784588)

**References:**

Paragraph 415



**a. Removal.**

- (1) Use antistatic wrist strap and attach to earth ground.
- (2) Remove 10 screws (1) and lockwashers (2) from panel assembly (3) of control assembly.
- (3) Slide panel assembly away from box (4).

- (4) Remove two screws (5), lockwashers (6), flatwashers (7), and retaining posts (8) from bracket (9).
- (5) Unplug and remove logic circuit card assembly (10) from end connector.
- (6) Remove screw (11), lockwasher (12), and flatwasher (13) from cable clamp (14).
- (7) Remove two screws (15) and lockwashers (16) from bracket (17). Remove bracket from chassis.
- (8) Unplug and remove amplifier circuit card assembly (18) from end connector.
- (9) Unplug connector (19) from battery test circuit card assembly (20).
- (10) Remove four nuts (21), lockwashers (22), and flatwashers (23) holding chassis (24) to panel.

**CAUTION**

**I Care must be taken during the following steps to prevent wires from breaking or pulling loose.**

- (11) Lift chassis from panel to expose FUNCTION switch.
- (12) Tag and desolder wires from terminals of FUNCTION switch.
- (13) Loosen setscrew and remove knob (25).
- (14) Remove nut (26) and lockwasher (27) from FUNCTION switch (28) and remove switch.
- (15) Remove desiccant pack (29) from housing.

**b. Installation.**

- (1) Tape new desiccant pack (29) to housing.
- (2) Insert FUNCTION switch (28) in front panel and install lockwasher (27) and nut (26).
- (3) Place knob (25) on switch and tighten setscrew.
- (4) Connect and solder wires to proper terminals of FUNCTION switch. Refer to TB SIG 222.
- (5) Position chassis (24) on panel.
- (6) Install four flatwashers (23), lockwashers (22), and nuts (21) that hold chassis to panel.
- (7) Plug connector (19) into battery test circuit card assembly (20).
- (8) Plug amplifier circuit card assembly (18) into end connector.

**5-24 FUNCTION SWITCH REPLACEMENT (11784529) - Continued.**

- (9) Position bracket (17) on chassis and install two lockwashers (16) and screws (15).
- (10) Install flatwasher (13), lockwasher (12), and screw (11) in cable clamp (14).
- (11) Plug logic circuit card assembly (10) into end connector.

(12) Position two retaining posts (8) on bracket (9) and install flatwasher (7), lockwasher (6), and screw (5) in each retaining post.

**NOTE**

**Use rubber cement between panel assembly and new gasket. Apply thin coat of grease between gasket and box prior to assembly.**

- (13) Inspect gasket (30) on box and replace if necessary.
- (14) Slide panel assembly (3) into box (4).
- (15) Install 10 screws (1) and lockwashers (2) in panel assembly.
- (16) Install control assembly. Refer to paragraph 4-15.

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**5-25 SENSITIVITY SWITCH REPLACEMENT (11784530).**

**INITIAL SETUP**

**Tools:**

General Mechanic's Automotive Tool Kit  
Soldering and Desoldering Set  
Antistatic Wrist Strap

**Personnel Required:**

1 Person

**Equipment Condition:**

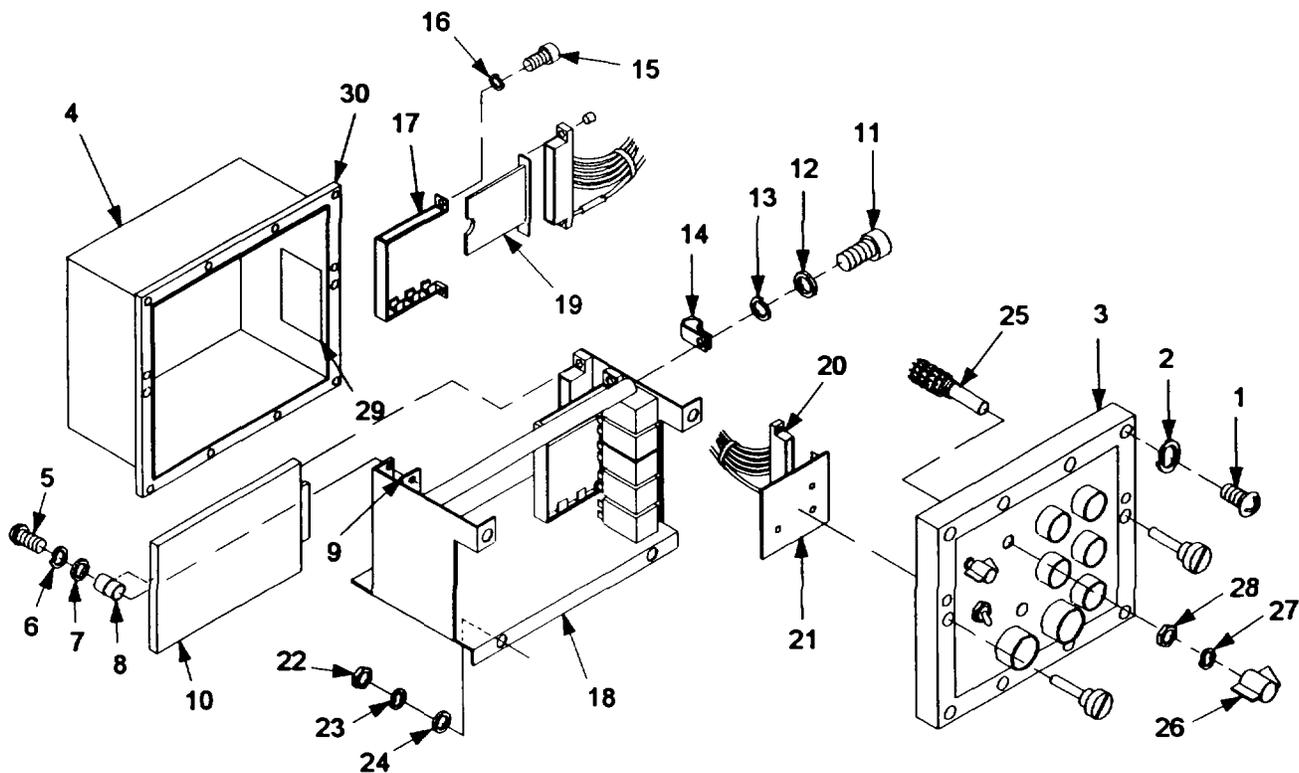
Control assembly removed  
(Reference paragraph 4-15)

**Material/Parts:**

Rotary Switch (11784530)  
Gasket (11784634)  
Solder (SN63WRMAP3 0.036 1LB)  
Rubber Cement (11784493)  
Desiccant (11784647)  
Tape, Filament (11784588)

**References:**

Paragraph 4-15



**a. Removal.**

- (1) Use antistatic wrist strap and attach to earth ground.
- (2) Remove 10 screws (1) and lockwashers (2) from panel assembly (3) of control assembly.
- (3) Slide panel assembly away from box (4).

- (4) Remove two screws (5), lockwashers (6), flatwashers (7), and retaining posts (8) from bracket (9).
- (5) Unplug and remove logic circuit card assembly (10) from end connector.
- (6) Remove screw (11), lockwasher (12), and flatwasher (13) from cable clamp (14).
- (7) Remove two screws (15) and lockwashers (16) from bracket (17). Remove bracket from chassis (18).
- (8) Unplug and remove amplifier circuit card assembly (19) from end connector.
- (9) Unplug connector (20) from battery test circuit card assembly (21).
- (10) Remove four nuts (22), lockwashers (23), and flatwashers (24) holding chassis to panel.

**CAUTION**

**I Care must be taken during following steps to prevent wires from breaking or pulling loose.**

- (11) Lift chassis from panel to expose sensitivity switch (25).
- (12) Tag and desolder wires from terminals of sensitivity switch.
- (13) Loosen setscrew and remove knob (26).
- (14) Remove nut (27) and lockwasher (28) from sensitivity switch and remove switch.
- (15) Remove desiccant pack (29) from housing.

**b. Installation.**

- (1) Tape new desiccant pack (29) to housing.
- (2) Insert FUNCTION switch (25) in front panel and install lockwasher (28) and nut (27).
- (3) Place knob (26) on switch and tighten setscrew.
- (4) Connect and solder wires to proper terminals of sensitivity switch.
- (5) Position chassis (18) on panel.
- (6) Install four flatwashers (24), lockwashers (23), and nuts (22) that hold chassis to panel.
- (7) Plug connector (20) into battery test circuit card assembly (21).
- (8) Plug amplifier circuit card assembly (19) into end connector.
- (9) Position bracket (17) on chassis and install two lockwashers (16) and screws (15).
- (10) Install flatwasher (13), lockwasher (12), and screw (11) in cable clamp (14).

**5-25 SENSITIVITY SWITCH REPLACEMENT (11784530) Continued.**

- (11) Plug logic circuit card assembly (10) into end connector.
- (12) Position two retaining posts (8) on bracket (9) and install flatwasher (7), lockwasher (6), and screw (5) in each retaining post.

**NOTE**

**Use rubber cement between panel assembly and new gasket. Apply thin coat of grease between gasket and box prior to assembly (13) Inspect gasket (30) on box and replace if necessary.**

- (14) Slide panel assembly (3) into box (4).
- (15) Install 10 screws (1) and lockwashers (2) in panel assembly.
- (16) Install control assembly. Refer to paragraph 4-15.

**5-26 RELAY ASSEMBLIES, K1 THROUGH K4 AND K6 REPLACEMENT (11784684).**

**INITIAL SETUP**

**Tools:**

General Mechanic's Automotive Tool Kit  
Antistatic Wrist Strap

**Personnel Required:**

1 Person

**Equipment Condition:**

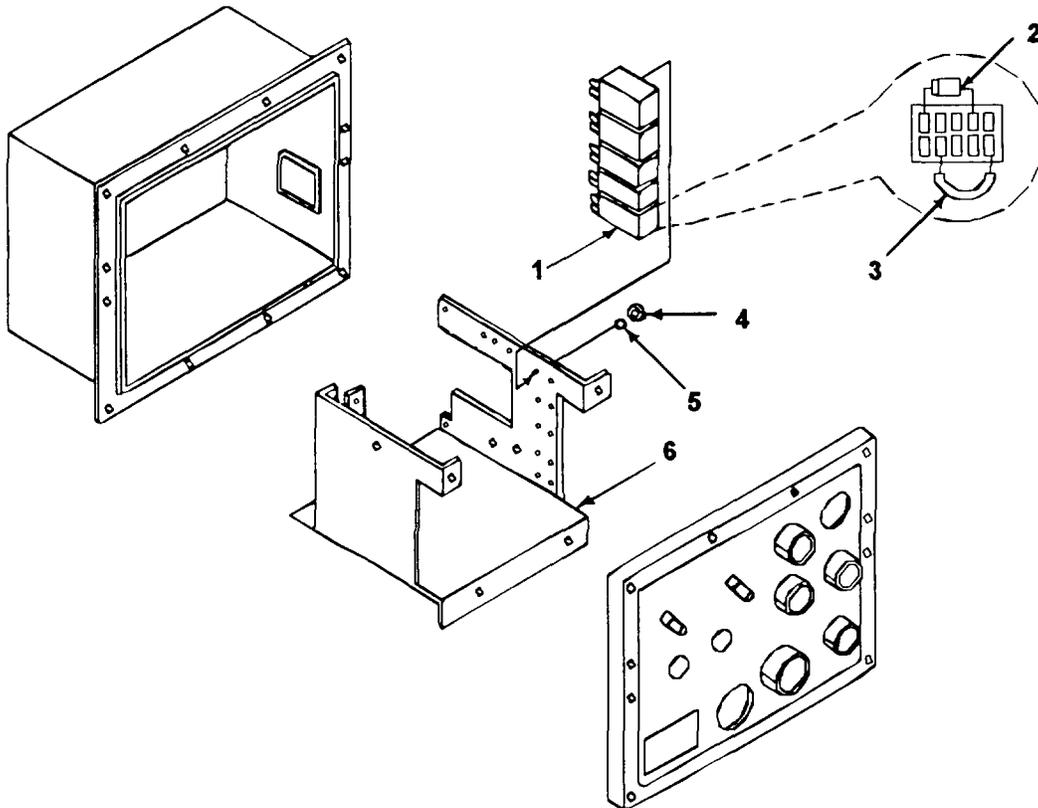
Amplifier Circuit Card removed (Reference paragraph 5-16)

**Material/Parts:**

Relay K1-K4 and K6 (11784684)  
Insulation Sleeving (MIL-1-22129)

**References:**

Paragraph 5-16



**a. Removal.**

- (1) Tag and unsolder the electrical leads from the K1 relay (1) contacts.
- (2) Unsolder the jumper wire (3) from pins 7 and 10 on the K1 relay (1).

**5-26 RELAY ASSEMBLIES, KIT THROUGH K4 AND K6 REPLACEMENT (11784684)**  
**- Continued.**

<b>CAUTION</b>
----------------

**Use only the heat required for unsoldering. Excessive heat can damage diodes.**

- (3) Unsolder the diodes (2) from the K1 relay (1) pins 1 and 4.
- (4) Remove the nut (4) and lockwasher (5) that secure the K1 relay (1) to the chassis (6); then remove the K1 relay (1).
- (5) Repeat this procedure for relays K2-K4 and K6.

**b. Installation.**

- (1) Solder the diodes (2) onto pins 1 and 4 of the replacement relay (1). Make sure that the black banded end of the diode (2) goes to pin 1.
- (2) Position the replacement relay (1) on the chassis (6); then secure the relay with a lockwasher (5), and a nut (4).
- (3) Solder the jumper wire (3) between pins 7 and 10 of the replacement relay.
- (4) Place sleeving on the tagged electrical leads; then solder the leads to the correct relay (1) contacts.
- (5) Repeat these procedures for relays K2-K4 and K6.
- (6) Install the amplifier circuit card assembly. Refer to paragraph 5-16.

**5-27 TOGGLE SWITCH (TEST) REPLACEMENT(MS25307-272).****INITIAL SETUP****Tools:**

General Mechanic's Automotive Tool  
Kit  
Antistatic Wrist Strap

**Equipment Condition:**

Battery Circuit Card  
removed (Reference  
paragraph 5-17)

**Material/Parts**

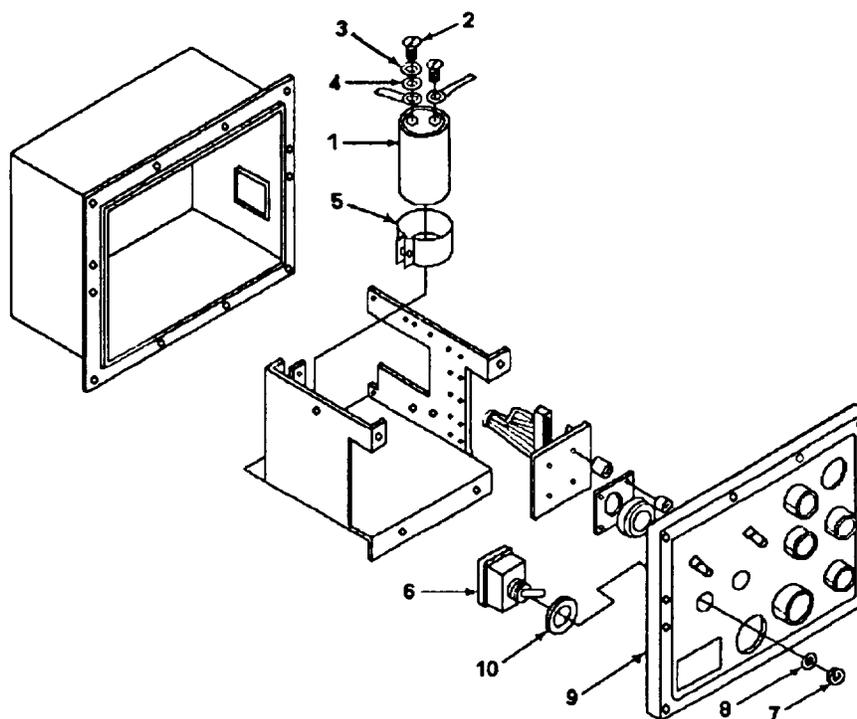
Switch Toggle (MS25307-272)

**References:**

Paragraph 5-15  
Paragraph 5-16  
Paragraph 5-17

**Personnel Required:**

1 Person

**a. Removal.**

- (1) Tag the positive (+) and negative (-) electrical leads on the C1 capacitor (1).
- (2) Remove the two screws (2), lockwashers (3), and flat washers (4) from the C1 capacitor (1).
- (3) Loosen the nut on the capacitor (1) loop clamp (5), and remove capacitor (1).

**5-27 TOGGLE SWITCH (TEST) REPLACEMENT (MS25307-272) - Continued.**

- (4) Tag and unsolder the electrical wiring leads and the jumper wire from the toggle switch (6) contacts.
- (5) Remove the nut (7) and washer (8) that secure the toggle switch (6) to the plate (9); then remove the toggle switch (6) and the "O" ring (10) from plate (9).

**b. Installation.**

- (1) Position the "O" ring (4) on the toggle switch (6); then secure the switch to the plate (9) with a washer (8) and a nut (7).
- (2) Solder the tagged electrical wiring leads to the toggle switch (6) contacts.
- (3) Install the battery check circuit card assembly. Refer to paragraph 5-17.
- (4) Install the C1 capacitor (1) into the loop clamp (5) and tighten nut.
- (5) Install two screws (2), lockwashers (3), and flat washers (4) securing the positive (+) and negative (-) electrical leads to capacitor C1 (1).
- (6) Install the amplifier circuit card assembly. Refer to paragraph 5-16.
- (7) Install the logic circuit card assembly. Refer to paragraph 5-15.

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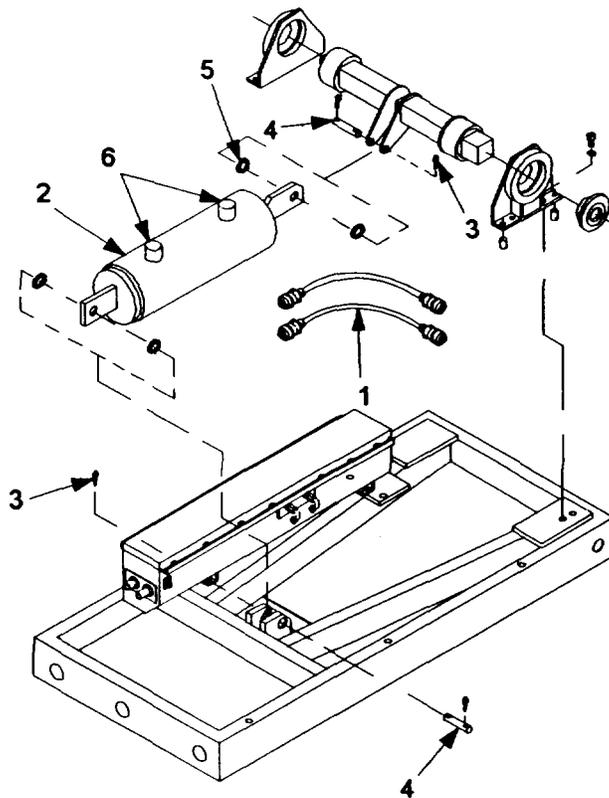
5-103

**5-28 CYLINDER ASSEMBLY REPLACEMENT (11784619-1).****INITIAL SETUP****Tools:**

General Mechanic's Automotive Tool Kit

**Equipment Condition:**Slip cover removed  
(Reference paragraph 410)**Materials/Parts:**Cotter Pins (MS24665355)  
Hydraulic Cylinder (11784619-1)  
Hydraulic Fluid (11784579)**References:**Paragraph 2-7  
Paragraph 4-10  
Table 4-1**Personnel Required:**

1 Person

**a. Removal.****NOTE****Tag hose assemblies prior to disconnection.**

- (1) Using two wrenches, disconnect two hose assemblies (1) from hydraulic cylinder (2).
- (2) Remove cotter pins (3) from both journals (4) on hydraulic cylinder.
- (3) Remove journals and four washers (5) from hydraulic cylinder.

- (4) Remove hydraulic cylinder from base frame.
- (5) Remove and retain two hose assemblies adapters (6) from hydraulic cylinder.

**b. Installation.**

- (1) Install two hose assemblies adapters (6) on hydraulic cylinder (2).
- (2) Position hydraulic cylinder on base frame.
- (3) Install two journals (4) and four washers (5) to mount hydraulic cylinder to mounting bracket on base frame.
- (4) Install new cotter pins (3) in journal.
- (5) Using two wrenches, connect two hose assemblies to hydraulic adapters.
- (6) Install side cover. Refer to paragraph 4-10.
- (7) Check hydraulic fluid level; refer to table 4-1.
- (8) Test/operate in accordance with paragraph 2-7.

**5-29 CYLINDER ASSEMBLY REPAIR (11784619-1).**

**INITIAL SETUP**

**Tools:**

General Mechanic's Automotive Tool Kit  
Spanner Wrench

Cloth (A-A-2522)

**Personnel Required:**

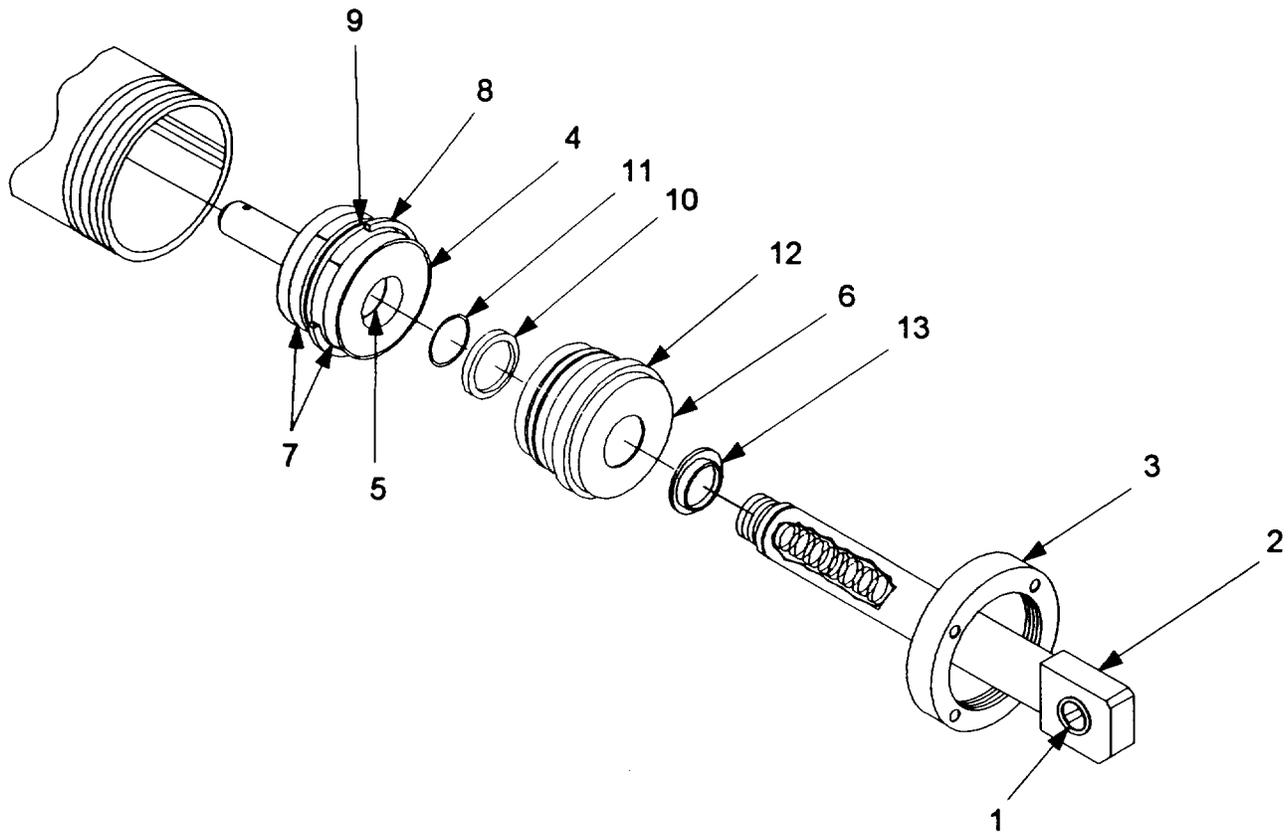
1 Person

**Materials/Parts:**

Parts Kit (BT01PK001)  
Hydraulic Fluid (11784579)  
Sealing Compound (569-31)

**Equipment Condition:**

Hydraulic cylinder removed  
(Reference paragraph 5-28)



a. **Disassembly.**

**NOTE**

Repair of the hydraulic cylinder consists of disassembly; replacing gaskets, seals, packing glands; and reassembly. Any items other than those provided as part of seal kit will require replacement of hydraulic cylinder.

**NOTE**

**Temporarily place a rod through front bearing (1) to aid in pulling piston rod forward.**

- (1) Extend piston rod (2) forward and drain hydraulic fluid.
- (2) Using spanner wrench, remove collar (3) from assembly.
- (3) Pull piston rod forward to remove piston rod assembly.
- (4) Remove excess fluid and place piston rod assembly on clean surface.

<b>CAUTION</b>
----------------

**Protect piston rod assembly sealing surfaces from damage.**

- (5) Using spanner wrench, unscrew piston (4) from piston rod.
- (6) Remove piston and rod seal (5) from piston rod.
- (7) Remove gland (6) from piston rod.
- (8) Remove two piston wear rings (7).
- (9) Remove piston seal (8).
- (10) Remove piston seal expander (9) from beneath piston seal.
- (11) Remove rod seal from gland (10).
- (12) Remove rod seal expander (11) from beneath rod seal.
- (13) Remove gland seal (12).
- (14) Remove rod wiper (13).

**b. Assembly.**

- (1) Replace all kit parts.
- (2) If cylinder is scored, gouged, or shows wear, replace it.

**NOTE**

**New seals must be used.**

- (3) Install two piston wear rings (7) onto piston.
- (4) Install piston seal expander (9) onto piston.
- (5) Install piston seal (8) onto piston seal expander.

**5-29 CYLINDER ASSEMBLY REPAIR (11784619-1) - Continued.****NOTE**

**Rod seal expander must be installed to rear of gland.**

- (6) Install rod seal expander (11) on gland.
- (7) Install rod seal (5) facing rear of gland (10) and covering rod seal expander.
- (8) Install gland seal (12).
- (9) Install rod wiper (13) with flat surface facing rear of gland.
- (10) Install gland (6) onto piston rod (2) with rod wiper in front.
- (11) Install piston and rod seal (5) to piston rod and tighten with spanner wrench.

**NOTE**

**Ensure spear cushion and spring are installed prior to assembly of piston on piston rod.**

- (12) Clean piston rod assembly with a clean cloth.
- (13) Coat all piston rod assembly surfaces with hydraulic fluid and insert piston rod assembly into barrel.

**NOTE**

**Ensure that spear cushion is properly seated.**

- (14) Ensure that collar is properly seated and not cross-threaded.
- (15) Apply hydraulic sealant to large threads that collar (3) will be attached to.
- (16) Install collar (3) to barrel and tighten with spanner wrench.
- (17) Clean piston rod bearings (1) with a clean cloth and lightly lubricate using hydraulic fluid.
- (18) Install hydraulic cylinder. Refer to paragraph 5-28.

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**5-30 HYDRAULIC UNIT REPLACEMENT (9375758).**

**INITIAL SETUP**

**Tools**

: General Mechanic's Automotive Tool Kit

**Materials/Parts:**

Hydraulic Unit (9375758)  
Hydraulic Fluid (11784579)

**Personnel Required:**

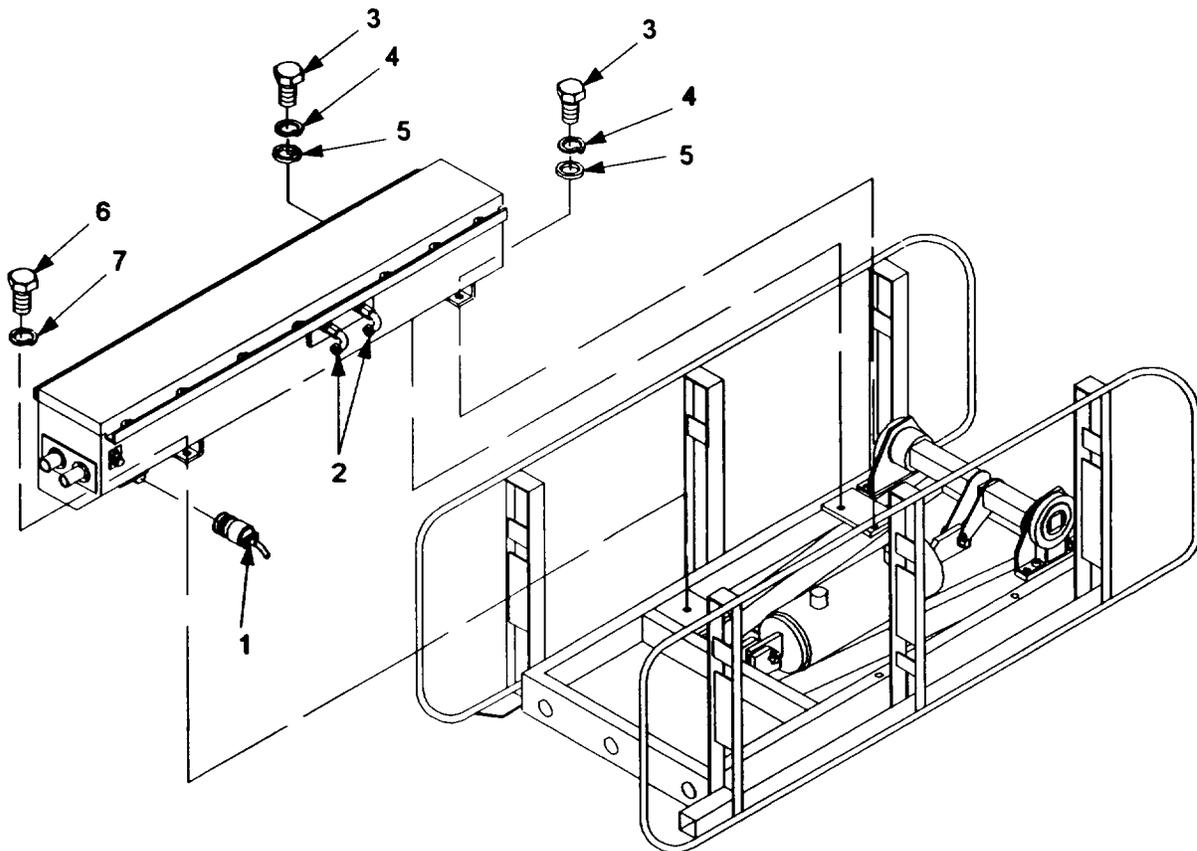
1 Person

**Equipment Condition:**

Side cover assembly removed  
(Reference paragraph 410)

**References:**

Paragraph 2-7  
Paragraph 4-10  
Table 4-1



**a. Removal.**

- (1) Disconnect cable connector (1) from hydraulic unit

**NOTE**

**Tag hose assemblies prior to disconnection.**

- (2) Using two wrenches, disconnect two hose assemblies (2) from hydraulic unit.

- (3) Remove two bolts (3), lockwashers (4), and flatwashers (5) from mounting bracket beneath hydraulic unit on bearing unit housing end of base frame.
- (4) Remove bolt (6) and lockwasher (7) from mounting bracket beneath hydraulic unit on opposite end of base frame.
- (5) Remove hydraulic unit from base frame.

**b. Installation.**

- (1) Position hydraulic unit on base frame.
- (2) Install two flatwashers (5), lockwashers (4), and bolts (3) in mounting bracket beneath hydraulic unit on bearing unit housing end of base frame.
- (3) Install lockwasher (7) and bolt (6) in mounting bracket beneath hydraulic unit on opposite end of base frame.
- (4) Connect two hose assemblies (2) to hydraulic unit.
- (5) Connect cable connector (1) to hydraulic unit.
- (6) Service hydraulic unit. Refer to PMCS table 4-1.
- (7) Install side cover. Refer to paragraph 4-10.
- (8) Test/operate in accordance with paragraph 2-7.

**5-31 HYDRAULIC UNIT REPAIR (9375758).**

**INITIAL SETUP**

**Tools:**

- General Mechanic's Automotive Tool Kit
- Soldering and Desoldering Set

**Materials/Parts:**

- Gasket (9375743)
- Solder (SN63WRMAP3 0.036 1 LB)
- Rubber Cement (11784493)
- Petroleum Jelly (NDC00168-0053-21)
- Adapter (MS51520B4)
- Circuit Card (11784514)
- Hydraulic Motor (12598336)
- Solenoid (9360576)
- Bus (9375712)
- Packing, Preformed (MS28775-022)
- Packing, Preformed (M83461/1-012)
- Sealing Compound (569-31)
- Hydraulic fluid (11784579)
- Bus (9375713)
- Bus (9375714)

**Materials/Parts: (cont)**

- Connector (9375717)
- Connector (9375718)
- Fuse Holder (9375730)
- Hose (9375746)
- Hose Assembly (9375748)
- Cable Assembly (9375751)
- Bracket (9375752)
- Bracket (9375753)

**Personnel Required:**

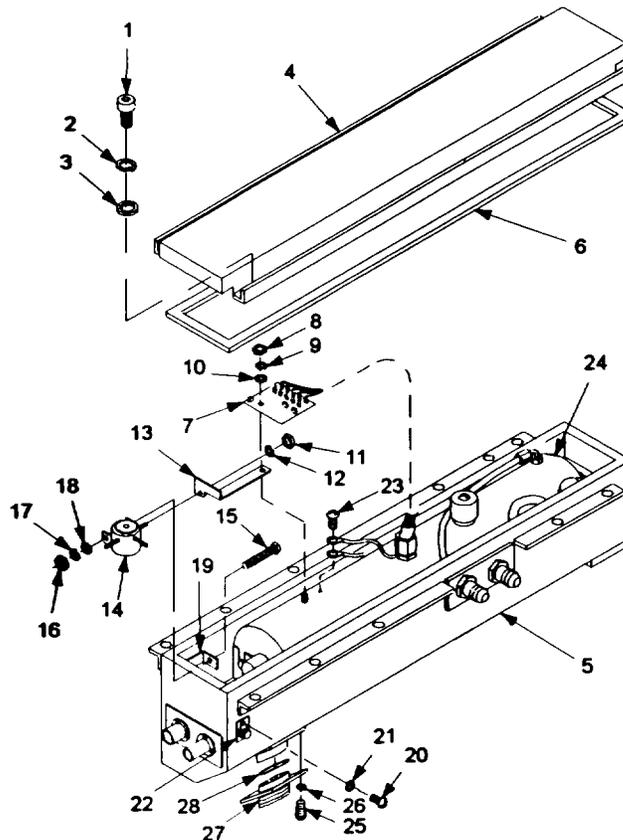
- 1 Person

**Equipment Condition:**

- Hydraulic unit removed  
(Reference paragraph 5-30)

**References:**

- Paragraph 5-30
- Table 4-1



**a. Disassembly.**

- (1) Remove 14 screws (1), lockwashers (2), and flatwashers (3) from hydraulic unit cover (4).
- (2) Remove cover from hydraulic unit (5).
- (3) Inspect gasket (6) for wear or damage. Replace as necessary using rubber cement between gasket and cover; apply rubber cement every four inches (10.16 centimeters). Apply white petroleum to gasket after gluing.
- (4) Tag and disconnect all wires from circuit card assembly (7).

<b>CAUTION</b>
----------------

**Handle circuit card with care to prevent damage to card and terminals.**

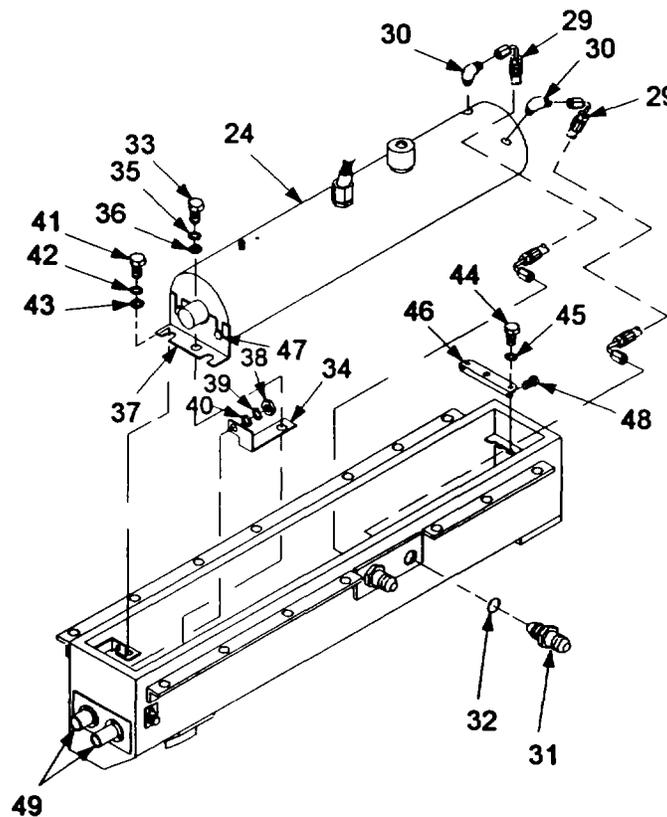
- (5) Remove nut (8), lockwasher (9), flatwasher (10), and circuit card assembly.
- (6) Remove nut (11), flatwasher (12), and bus bar (13) from solenoid (14).
- (7) Tag all wires attached to solenoid.
- (8) Remove lockwasher, flatwasher, and nut from each solenoid terminal.
- (9) Disconnect wires from each terminal.
- (10) Remove solenoid mounting bolt (15), nut (16), lockwasher (17), and flatwasher (18) from bracket (19).
- (11) Reinstall flatwasher, lockwasher, and nut onto each terminal.
- (12) Remove solenoid from bracket.
- (13) Remove two mounting screws (20) and lockwashers (21) and remove fuse holder (22) from housing.
- (14) Desolder two fuse holder connections from cable assembly and remove fuse holder.
- (15) Tag wires to motor assembly ground terminal screw (23).
- (16) Remove screw (23) from motor assembly (24) and remove cable assembly ground wire.
- (17) Reinstall screw (23).
- (18) Remove four cable assembly connector mounting screws (25) and lockwashers (26).
- (19) Remove cable assembly connector (27) and gasket (28) through front of housing.
- (20) Tag hose assemblies (29) attached to motor assembly.

5-31 HYDRAULIC UNIT REPAIR (9375758) - Continued.

<b>CAUTION</b>
----------------

**Protect all hydraulic openings to prevent dirt and other material from entering the system.**

- (21) Using two wrenches, remove two hose assemblies.
- (22) Remove two hydraulic nipples (31) and preformed packing (32) from hydraulic unit housing.
- (23) Remove bolt (33) attaching bus bar (34), lockwasher (35), and flatwasher (36) from motor assembly mounting bracket (37).
- (24) Remove nut (38), lockwasher (39), flatwasher (40), and remove bus from negative terminal.
- (25) Remove two bolts (41), lockwashers (42), and flatwashers (43) from mounting bracket on motor end of motor assembly.
- (26) Remove two bolts (44) and lockwashers (45) from mounting bracket (46) on pump end of motor assembly.
- (27) Remove motor assembly from hydraulic unit housing.



- (28) Remove two hydraulic adapters (30) from motor assembly.

- (29) Loosen two bolts (47) and two bolts (48) remove two mounting brackets from motor assembly. Retighten bolts.
- (30) Inspect remaining bus bars and battery cable receptacles (49) for wear or damage.
- (31) Replace parts as necessary.

**b. Assembly.**

- (1) Install two hydraulic adapters (30) in motor assembly.
- (2) Loosen two bolts (48) and two bolts (47) on motor assembly and install two mounting brackets (37) and (46) on motor assembly (24). Tighten bolts.
- (3) Position motor assembly in hydraulic unit housing.
- (4) Install two lockwashers (45) and bolts (44) in mounting bracket (46) on pump end of motor assembly.
- (5) Install two flatwashers (43), lockwashers (42), and bolts (41) in mounting bracket (37) on motor end of motor assembly.
- (6) Install bus (34) on negative terminal using flatwasher (40), lockwasher (39), and nut (38).
- (7) Install attaching flatwasher (36), lockwasher (35), and bolt (33) through bus bar (34) into motor assembly mounting bracket.
- (8) Install new preformed packing (32) and apply hydraulic sealant to the threads of the two hydraulic nipples (31) and install in hydraulic unit housing.
- (9) Install two hose assemblies (29).
- (10) Apply a light film of petroleum jelly to the gasket (28) and install gasket on cable assembly connector (27).
- (11) Pull cable assembly connector through hydraulic unit housing.
- (12) Install four lockwashers (26) and mounting screws (25) in connector on cable assembly.
- (13) Solder two fuse holder connections to cable assembly. Refer to TB SIG 222.
- (14) Remove screw (23) from motor assembly (24) and install cable assembly ground wire and motor assembly ground wire. Reinstall screw (23).
- (15) Position fuse holder (22) in housing and install two lockwashers (21) and mounting screws (20).
- (16) Remove attaching hardware from terminal posts of solenoid.
- (17) Position solenoid (14) on mounting bracket (19).
- (18) Install solenoid mounting bolt (15), flatwasher (18), lockwasher (17), and nut (16).

**5-31 HYDRAULIC UNIT REPAIR (9375758) - Continued.**

- (19) Connect wires to each terminal on solenoid using existing flatwasher, lockwasher, and nut on each terminal.
- (20) Position bus bar (13) between solenoid and hydraulic motor assembly and install flatwasher (12) and nut (11) on solenoid.
- (21) Position circuit card assembly (7) and install flatwasher (10). lockwasher (9) and nut (8). Connect all wires to circuit card assembly.
- (22) Service hydraulic unit Refer to PMCS table 4-1.
- (23) Position cover (4) on hydraulic unit (5).
- (24) Install 14 flatwashers (3), lockwashers (2), and screws (1) in hydraulic unit cover.
- (25) Apply bead of white petroleum around the edge of hydraulic unit cover.
- (26) Install hydraulic unit Refer to paragraph 5-30.

**c. Special Instructions for Hydraulic Motor Repair.** The Target Holding Mechanism, Tank Gunnery (THM/TG) hydraulic motor, NSN 4320-01-342-2401, part number 12598336, is authorized local repair action. For those installations choosing to implement the local repair concept, Director, ACALA will provide a copy of the hydraulic pump commercial manual to assist in maintenance. Additionally, telephone numbers will be provided whereby both repair parts and/or service can be obtained directly from the manufacturer without the involvement of Director, ACALA or the Army supply system.

Installations not choosing to adopt this local repair concept may still continue to requisition new pumps through normal Army supply channels. Installations desiring to adopt local repair as set forth above are requested to do the following:

- (1) Forward an official written request for the Monarch Commercial Manual to Director, Armament and Chemical Acquisition and Logistics Activity, ATTN: AMSTA-AC-CTRR, Rock Island, IL 61299-7630.
- (2) Provide written notification (message or memorandum) to Director, Armament and Chemical Acquisition and Logistics Activity, ATTN: AMSTA-AC-CTRR, Rock Island, IL 61299-7630 upon completion of each local repair action. It is requested that specific data regarding cost of repair be provided to include the type and cost of parts, the cost of labor (irrespective of who provided the labor), and elapsed time between failure detection and completion of repair. This is necessary to track assets, project asset buy quantities, and to properly assess the cost effectiveness and efficiency of the local repair concept

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5-117

**5-32 CABLE ASSEMBLY (RECEIVER) REPAIR (11784508).**

**INITIAL SETUP**

**Tools:**

- General Mechanic's Automotive Tool Kit
- Soldering and Desoldering Set
- Heat gun
- Multimeter
- Wire Stripper

**Personnel Required:**

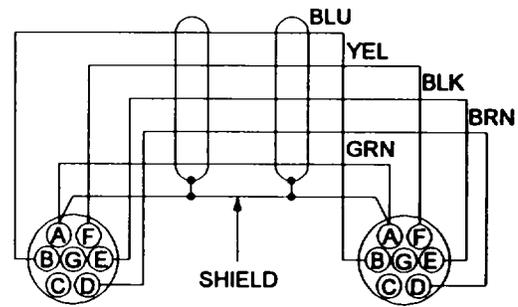
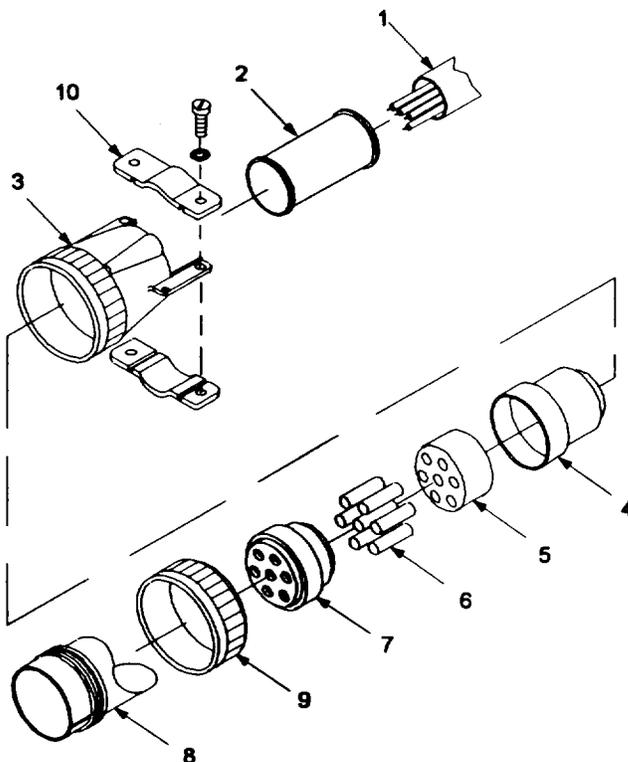
1 Person

**Equipment Condition:**

Cable removed  
(Reference paragraph 4-17)

**Materials/Parts:**

- Solder (SN63WRMAP3 0.036 1 LB)
- Insulation Sleeving (M23053/5-108-0)
- Connector (MS3456W16S-1P)



**Repair.**

- a. Cut cable as close as possible to connector to be replaced.

**NOTE**

If cable is shortened by more than 2-inches (5.0 centimeters), cable must be replaced.

- b. Insert cable (1) through 2-inch (5-centimeter) piece of insulation sleeving (2).
- c. Insert cable through backshell (3) of connector and ferrule (4).
- d. Strip outer insulation 1 inch (2.5 centimeters) from end.
- e. Cut white, red, and orange wires from cable.
- f. Strip ends of remaining wires 3/8 inch (1 centimeter)
- g. Slide grommet (5) over cable leads.
- h. Insert cable leads into solder wells of contacts (6) Insert shield and green lead in one contact. Solder connections. Refer to TB SIG 222.
- i. Push insert (7) into barrel (8). Groove of insert must align with groove of barrel.
- j. Slide coupling nut (9) over barrel.
- k. Push contacts into insert using wiring diagram shown.
- l. Push grommet down cable leads and over contacts.
- m. Screw backshell onto barrel.
- n. Slide insulation sleeving under cable strain relief (10) and shrink using heat gun.
- o. Tighten two screws (11) on strain relief.
- p. Utilizing multimeter check continuity as shown in diagram.

**5-33 LAMP ASSEMBLY CABLE REPAIR (11784475).**

**INITIAL SETUP**

**Tools:**

- General Mechanic's Automotive Tool Kit
- Soldering and Desoldering Set
- Heat Gun
- Wire Strippers
- Crimping Tool
- Multimeter

**Personnel Required:**

1 Person

**Equipment Condition:**

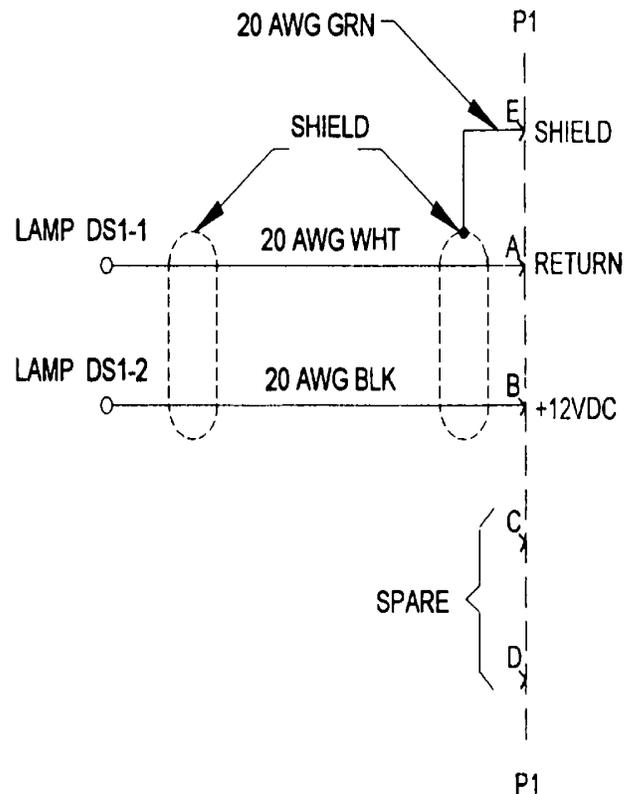
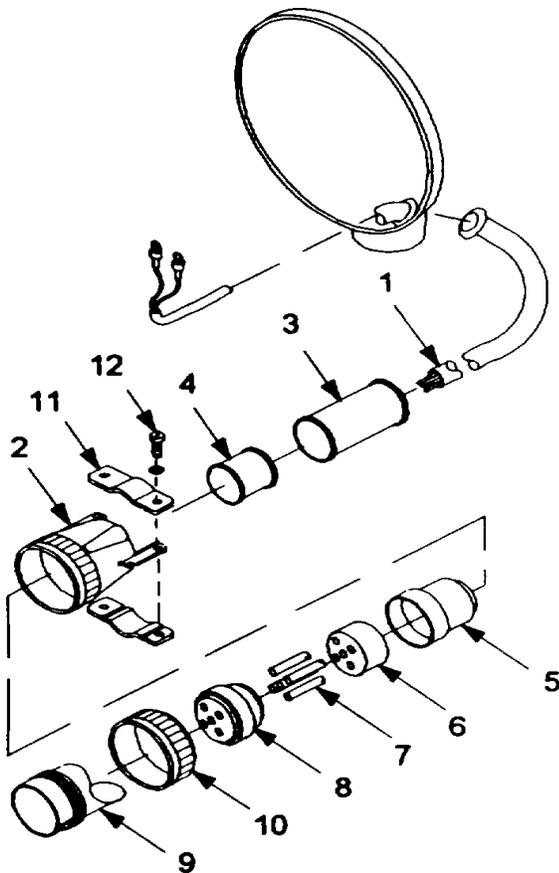
Lamp assembly removed  
(Reference paragraph 4-18)

**References:**

Paragraph 4-18

**Materials/Parts:**

- Cable Assembly (CO-02MDE(2/20)SJ0278)
- Bushing (MS3420-8)
- Tiedown (MS3367-4)
- Connector (11784666)
- Splice, Conductor (M83519/1-5)
- Insulation Sleeving (M23053/5-109-4)
- Wire, Green (M22759/11-20-5)
- Solder (SN63WRMAP3 0.036 1 LB)



**a. Removal.**

- (1) Remove lamp. (See paragraph 4-18.)
- (2) Pull cable (1) out of lamp housing.

**b. Repair.**

- (1) Cut cable as close to connector backshell (2) as possible.
- (2) Cut tiedown strap and remove bushing (3) from cable.
- (3) Install bushing over cable.
- (4) Strip outer insulation on cable 1 inch (2.5 centimeters) from end.
- (5) Slide insulation sleeving (4) over bushing at connector end of bushing. Using heat gun, shrink sleeving.
- (6) Install tiedown on other end of bushing.
- (7) Insert cable in backshell (2) and ferrule (5).
- (8) Using solder sleeve, connect a short green wire to shield and solder. Refer to TB SIG 222.
- (9) Strip insulation from wires 1/4 inch (0.6 centimeter) from end.
- (10) Slide grommet (6) over cable leads.
- (11) Insert cable leads into solder wells of contacts (7) and solder. Refer to TB SIG 222.
- (12) Push insert (8) into barrel (9). Groove of insert must align with groove of barrel.
- (13) Slide coupling nut (10) over barrel.
- (14) Insert contacts into insert using wiring diagram shown.
- (15) Slide grommet down cable leads and over contacts.
- (16) Screw backshell onto barrel.
- (17) Slide bushing (3) into cable strain relief (11).
- (18) Tighten screws (12) on cable strain relief.
- (19) Utilizing multimeter, check continuity as shown in diagram.

**c. Installation.**

- (1) Insert cable through grommet in lamp housing.
- (2) Install lamp. (See paragraph 4-18.)

**5-34 CIRCUIT BREAKER ASSEMBLY REPLACEMENT (12934471).**

**INITIAL SETUP**

**Tools:**

General Mechanic's Automotive Tool Kit  
Torque Screwdriver

**Personnel Required:**

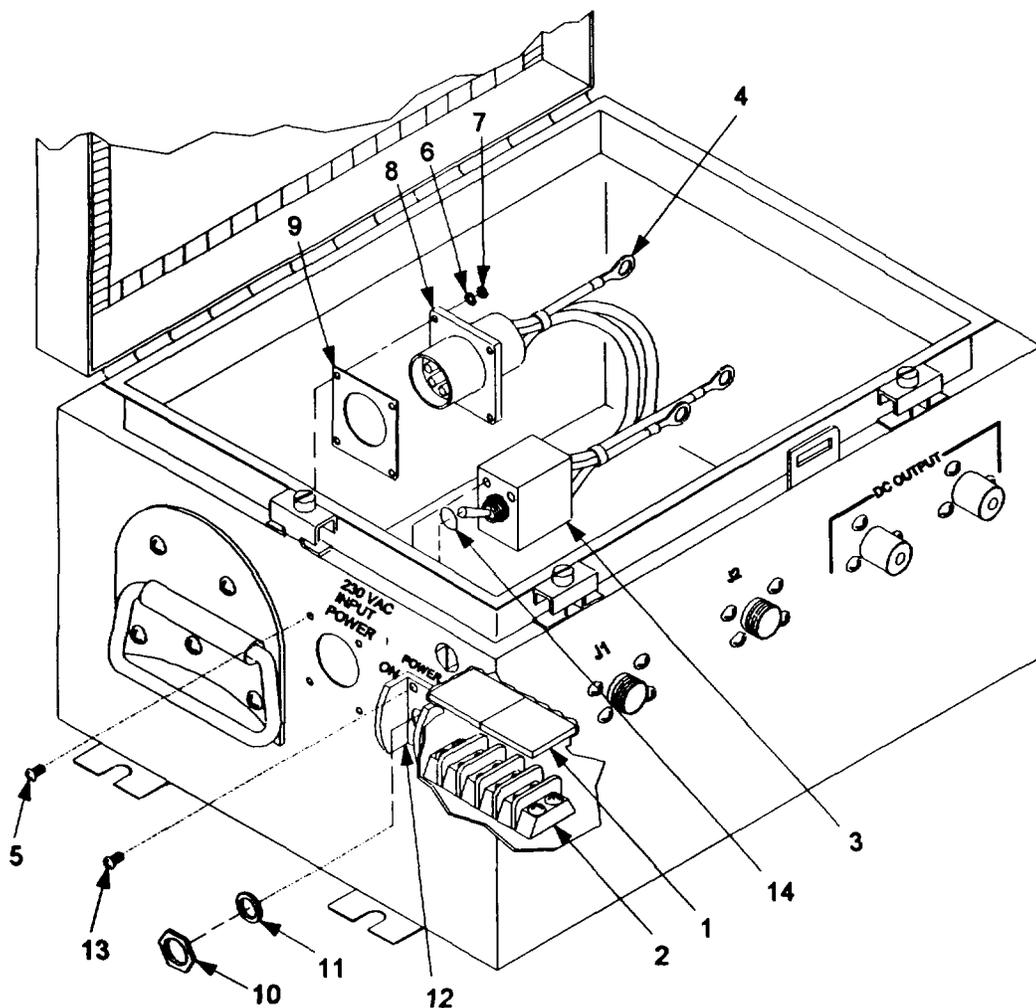
1 Person

**Materials/Parts:**

Circuit Breaker Assembly (12934471)  
Gasket (MS52000-9)  
Gasket (12934478)References:  
Grease (HIGH VACUUM GREASE 976V)Paragraph 4-23  
Adhesive (MMM-A-121)  
White Petroleum (NDC001680053-21)

**Equipment Condition:**

Power supply removed  
(Reference paragraph 4-23)



**a. Removal.**

- (1) Remove four screws and raise lid on power supply.

- (2) Inspect lid gasket for damage. Replace, if necessary, adhering gasket to lid with adhesive.
- (3) Remove plastic cover (1) from TB1 (2).
- (4) Tag and disconnect circuit breaker assembly (3) wires from TB1.
- (5) Disconnect ground wire (4) from terminal EI.
- (6) Remove four screws (5), flatwashers (6), and nuts (7). Remove input power connector J3 (8) and gasket (9) from enclosure.
- (7) Remove retaining nut (10), lockwasher (11).
- (8) Remove switch guard (12), two screws (13), circuit breaker assembly, and gasket (14) from enclosure.

**b. Installation.**

**NOTE**

**Apply a thin coat of grease to circuit breaker assembly gasket and connector gasket prior to installation.**

- (1) Install gasket (14) on circuit breaker assembly (3).
- (2) Position circuit breaker assembly in enclosure and install switch guard (12), and two screws (13). Torque screws to 8 to 10 in-lbs (0.91 to 1.14 Newton-meters).
- (3) Install lockwasher (11), and retaining nut (10).
- (4) Apply thin film of white petroleum to gasket (9) and position gasket on connector J3 (8).
- (5) Position input power connector J3 in enclosure and install four screws (5), flatwashers (6), and nuts (7). Torque screws to 8 to 10 in-lbs (0.91 to 1.14 Newton-meters).
- (6) Connect ground wire (4) to terminal EI. Torque screws to 20 to 24 in-lbs (2.28 to 2.73 Newton-meters).
- (7) Connect circuit breaker assembly wires to TB1 (2). Torque screws to 20 to 24 in-lbs (2.28 to 2.73 Newton-meters).
- (8) Install plastic cover (1) on TB1.
- (9) Close lid on power supply and install four screws.
- (10) Install power supply. Refer to paragraph 4-23.

**5-35 TRANSFORMER ASSEMBLY REPLACEMENT (12934465).**

**INITIAL SETUP**

**Tools:**

- General Mechanic's Automotive Tool Kit
- Torque Screwdriver Set
- Torque Wrench

**Personnel Required:**

1 Person

**Equipment Condition:**

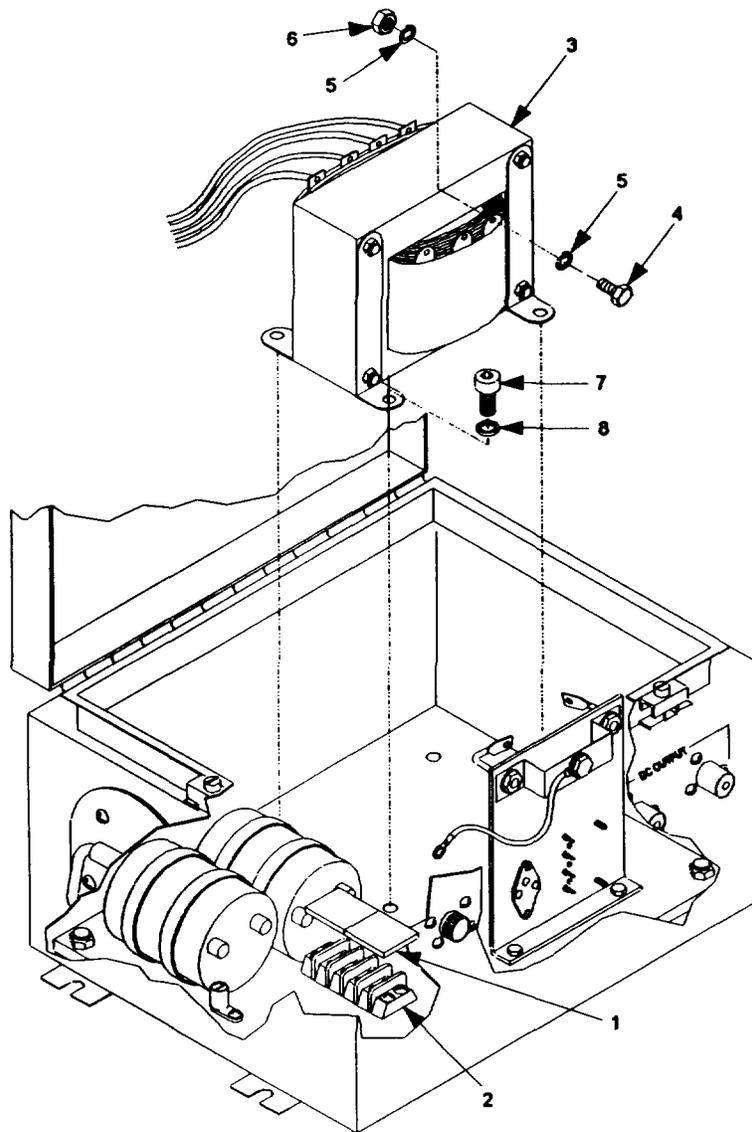
Power supply removed  
(Reference paragraph 4-23)

**Materials/Parts:**

- Transformer (12934465)
- Lockwashers (MS35333-74)
- Gasket (12934478)
- Adhesive (MMM-A-121)

**References:**

Paragraph 4-23



**a. Removal.**

- (1) Remove four screws and raise lid on power supply.
- (2) Inspect lid gasket for damage. Replace, if necessary, adhering gasket to lid with adhesive.
- (3) Remove plastic cover (1) from TB1 (2).
- (4) Tag and disconnect transformer assembly (3) wires from TB1.
- (5) Tag and disconnect wires from output terminals on transformer assembly by removing three screws (4), six lockwashers (5), and three nuts (6).
- (6) Remove four screws (7) and washers (8), and remove transformer assembly from chassis.

**b. Installation.**

- (1) Position transformer assembly (3) on chassis and install four washers (8) and screws (7). Torque screws to 75 to 80 in-lbs (8.53 to 9.10 Newton-meters).
- (2) Connect wires to output terminals on transformer assembly, ensuring wires are between the two new lockwashers, using three screws (4), six lockwashers (5), and three nuts (6). Torque screws to 75 to 80 in-lbs (8.53 to 9.10 Newton-meters).
- (3) Connect transformer assembly wires to TB1 (2). Torque screws to 20 to 24 in-lbs (2.28 to 2.73 Newton-meters).
- (4) Install plastic cover (1) on TB1.
- (5) Close lid on power supply and install four screws.
- (6) Install power supply. Refer to paragraph 4-23.

**5-36 CABLE ASSEMBLY (CONTROL) REPLACEMENT (12934470).**

**INITIAL SETUP**

**Tools:**

General Mechanic's Automotive Tool Kit  
Torque Screwdriver

**Personnel Required:**

1 Person

**Materials/Parts:**

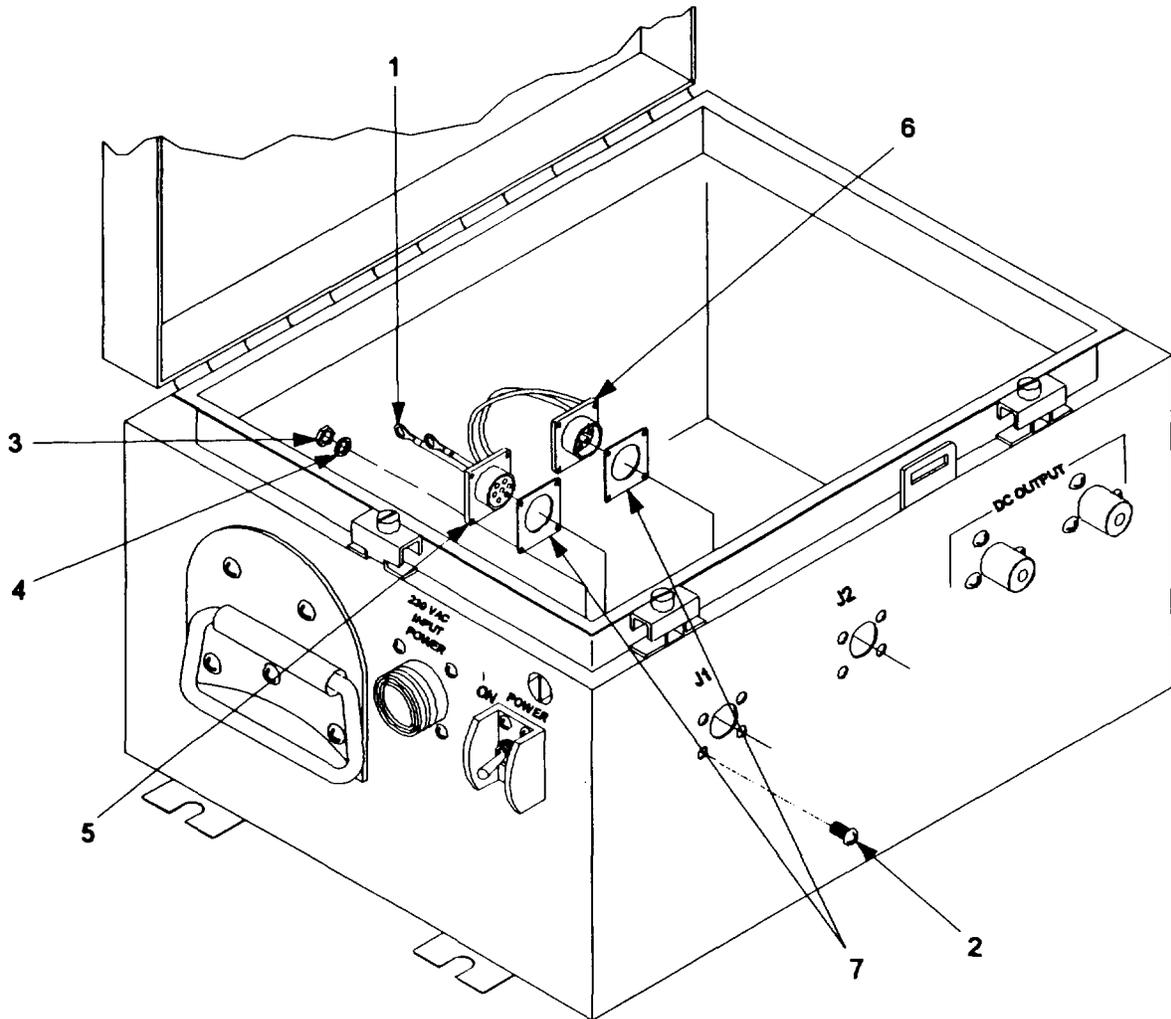
Cable Assembly (12934470)  
Gasket (MS52000-5)  
Gasket (12934478)  
Grease (HIGH VACUUM GREASE 976V)  
Adhesive (MMM-A-121)

**Equipment Condition:**

Power supply removed  
(Reference paragraph 4-23)

**References:**

Paragraph 4-23



**a. Removal.**

- (1) Remove four screws and raise lid on power supply.
- (2) Inspect lid gasket for damage. Replace, if necessary, adhering gasket to lid with adhesive.
- (3) Tag and disconnect wires (1) from positive terminal on capacitor C2.
- (4) Remove eight screws (2), nuts (3), and lockwashers (4) securing J1 (5) and J2 (6) to enclosure.
- (5) Remove both connectors and gaskets (7).

**b. Installation.**

**NOTE**

**Prior to installing gasket, apply a thin coat of grease.**

- (1) Position J1 (5), J2 (6), and gaskets (7) in enclosure and install eight screws (2), nuts (3), and lockwashers (4). Torque screws to 4 to 8 in-lbs (0.46 to 0.91 Newton-meters).
- (2) Connect wires (1) to positive terminal on capacitor C2.
- (3) Close lid on power supply and install four screws.
- (4) Install power supply. Refer to paragraph 4-23.

**5-37 RECTIFIER ASSEMBLY REPLACEMENT (12934462).**

**INITIAL SETUP**

**Tools:**

- General Mechanic's Automotive Tool Kit
- Torque Wrench
- Torque Screwdriver

**Materials/Parts:**

- Rectifier Assembly (12934462)
- Cable assembly (12934473)
- Lockwasher (MS35333-74)
- Lockwasher (MS35333-75)
- Gasket (12934478)
- Grease (HIGH VACUUM GREASE 976V)
- Adhesive (MMM-A-121)

**Personnel Required:**

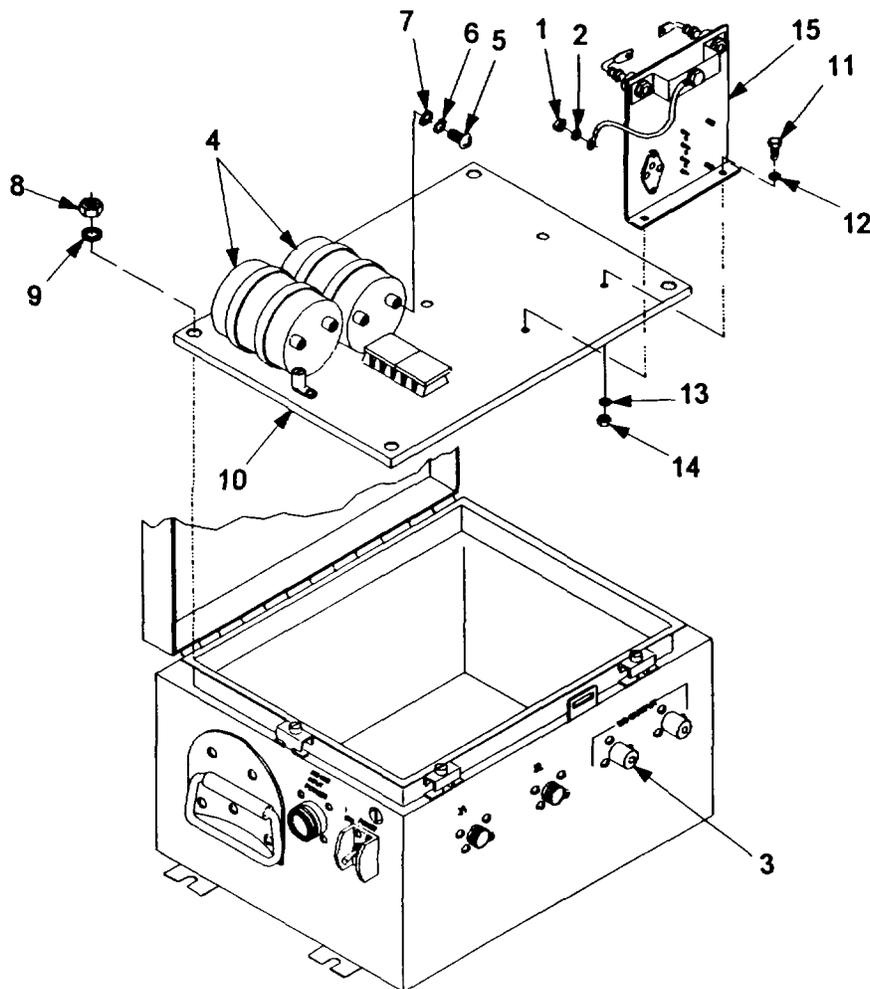
- 1 Person

**Equipment Condition:**

- Power supply removed  
(Reference paragraph 4-23)
- Circuit breaker assembly removed  
(Reference paragraph 5-34)
- Transformer assembly removed  
(Reference paragraph 5-35)
- Control cable assembly removed  
(Reference paragraph 5-36)

**References:**

- Paragraph 4-23
- Paragraph 5-34
- Paragraph 5-35
- Paragraph 5-36



**a. Removal.**

- (1) Remove four screws and raise lid on power supply.
- (2) Inspect lid gasket for damage. Replace, if necessary, adhering gasket to lid with adhesive.
- (3) Remove nut (1), lockwasher (2), and disconnect rectifier assembly wire from power connector P1 (3) on enclosure.
- (4) Tag wires on the positive and negative terminals of the capacitors C1 and C2 (4).
- (5) Remove screw (5), lockwasher (6), and flatwasher (7) and remove wire from terminals of capacitors.
- (6) Remove nut (8) and lockwasher (9) from plate assembly (10).
- (7) Remove plate assembly from enclosure.
- (8) Remove two screws (11), flatwasher (12), lockwashers (13), and nuts (14), and remove rectifier assembly (15) from chassis.

**b. Installation.**

- (1) Position rectifier assembly (15) on chassis and install two screws (11), flatwasher (12), lockwashers (13), and nuts (14). Torque to 75 to 80 in-lbs (8.53 to 9.10 Newton-meters).
- (2) Position plate assembly (10) on studs in enclosure.
- (3) Install lockwasher (9) and nut (8) on studs. Torque nuts to 100 to 107 in-lbs (11.38 to 12.17 Newton-meters).
- (4) Connect rectifier assembly wires to positive and negative terminals on capacitors C1 and C2 (4), using screw (5), lockwasher (6), and flatwasher (7). Torque screw to 20 to 24 in-lbs (2.28 to 2.73 Newton-meters).
- (5) Connect rectifier assembly wire to power connector P1 (3) on enclosure, using lockwasher (2) and nut (1). Torque nut to 100 to 107 in-lbs (11.38 to 12.17 Newton-meters).
- (6) Close lid on power supply and install four screws.
- (7) Install control cable assembly. Refer to paragraph 5-36.
- (8) Install transformer assembly. Refer to paragraph 5-35.
- (9) Install circuit breaker assembly. Refer to paragraph 5-34.
- (10) Install power supply. Refer to paragraph 4-23.

**5-38 RADIO RECEIVER DESICCATOR REPLACEMENT (12950861).****INITIAL SETUP****Tools:**

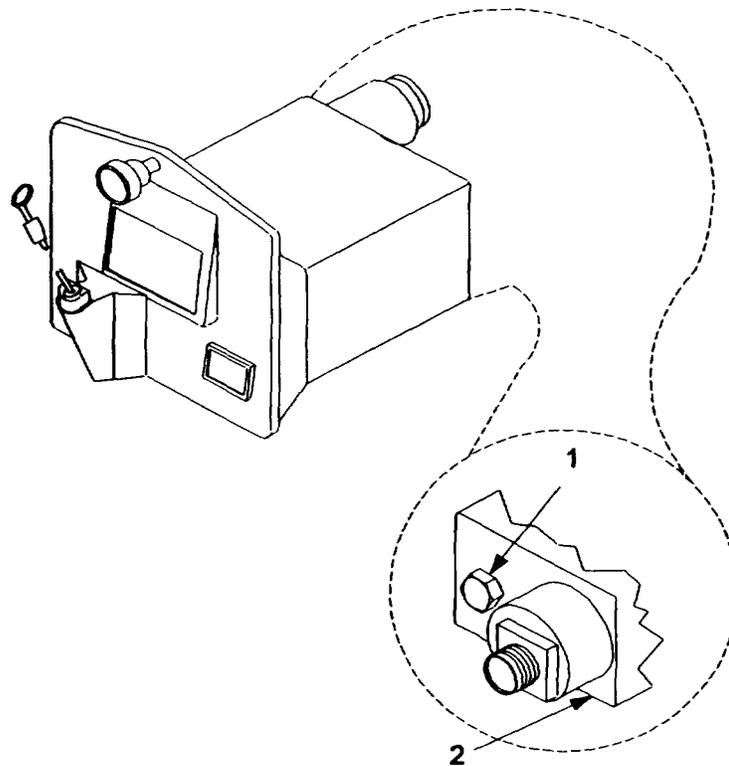
General Mechanic's Automotive Tool Kit

**Equipment Condition:**Radio receiver removed  
(Reference paragraph 4-24)**Materials/Parts:**Desiccator (12950861)  
White Petroleum (NDC001680053-21)**References:**

Paragraph 4-24

**Personnel Required:**

1 Person

**a. Removal.**

- (1) Unscrew desiccator (1) from rear of radio receiver (2).
- (2) Remove desiccator.

**b. Installation.**

- (1) Coat threads and preformed packing of new desiccator with white petroleum.
- (2) Insert desiccator (1) into radio receiver (2) and tighten.
- (3) Install receiver. Refer to paragraph 4-24.

**5-39 TRANSMITTER DESICCATOR REPLACEMENT (12950862).****INITIAL SETUP****Tools:**

General Mechanic's Automotive Tool Kit

**Personnel Required:**

1 Person

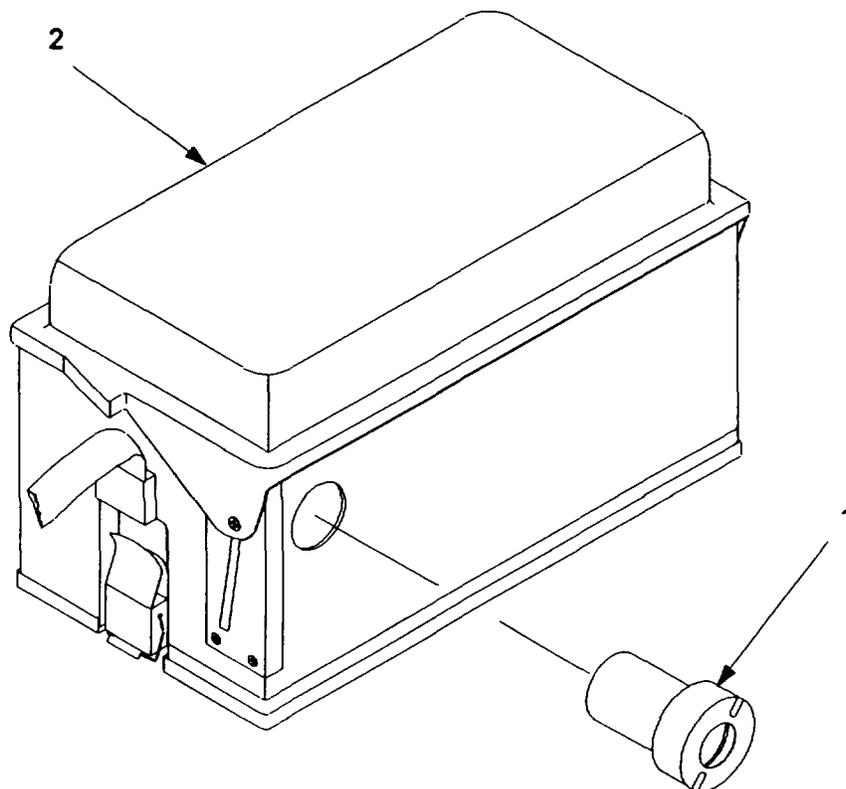
**Materials/Parts:**

Desiccator (12950862)

White Petroleum (NDC00168-0053-21)

**References;**

Paragraph 2-7

**a. Removal.**

- (1) Unscrew desiccator (1) from rear of transmitter (2).
- (2) Remove desiccator.

**b. Installation.**

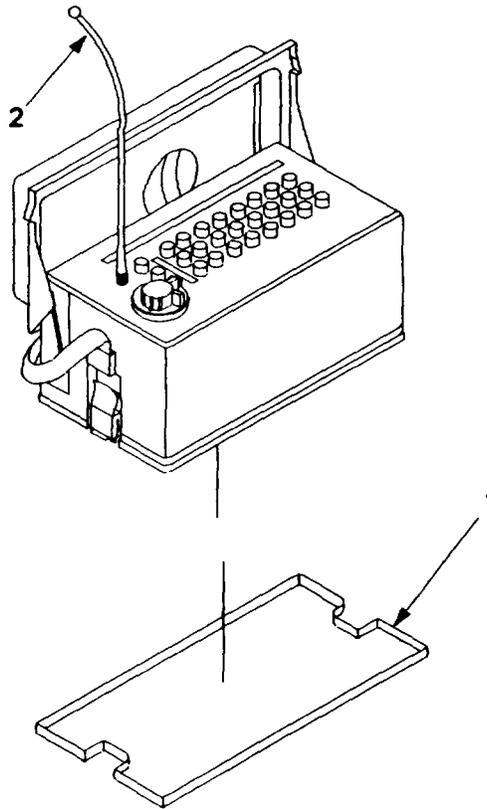
- (1) Coat threads and performed packing on new desiccator (1) with white petroleum.
- (2) Screw desiccator into base (2) and tighten.
- (3) Test/operate transmitter in accordance with paragraph 2-7.

**5-40 TRANSMITTER REPAIR (11784700).****INITIAL SETUP****Materials/Parts:**

Plate, Bottom (11784706)  
Antenna (11784704)

**Personnel Required:**

1 Person

**a. Removal.**

- (1) Release catches holding bottom plate (1) to housing.
- (2) Remove bottom plate from housing.
- (3) Inspect bottom plate for dents, cracks, or damage.
- (4) Unscrew antenna (2) from transmitter.

**b. Installation.**

- (1) Install new antenna (2) on transmitter.
- (2) Position new bottom plate (1) on housing.
- (3) Fasten catches to housing.

**SECTION III. PREPARATION FOR SHIPMENT.****5-41 GENERAL.**

The THM/TG must be packaged for shipment in accordance with the following procedures or similar methods which will ensure the safety and security of the item.

- a. Clean and dry all THMITG components in accordance with paragraph 1-5d.
- b. Apply lubrication in accordance with paragraph 3-1.
- c. Using four people, place the tank target assembly on a wooden pallet.
- d. Place two target arms adjacent to the tank target assembly on the pallet.
- e. Open battery box assembly and remove battery and battery cable extensions.
- f. Disconnect battery cable extensions and dispose of battery locally in accordance with standing operating procedures.
- g. Place battery box assembly on the pallet.
- h. Place tape (appendix D, item 14) over cable connections on lamp assembly, hit sensor assembly, battery cable extensions, black and red battery cables, and hydraulic unit assembly.
- i. Wrap lamp assembly head in packaging cushioning material and secure with tape (appendix D, item 14).
- j. Wrap each hit sensor head in packaging cushioning material and secure with tape (appendix D, item 14).
- k. Coil lamp assembly cable, hit sensor cables, battery cable extensions, and black and red battery cables.
- l. Open cover, place all coiled cables inside the tank target assembly, and close cover.
- m. Strap tank target assembly, target arms, and battery box assembly to pallet in accordance with or similar method which will securely band and immobilize the items to the pallet.
- n. Skin pack pallet in accordance with paragraph 3.6.6 or similar procedure which will ensure physical and mechanical protection of the item.

**5-133/(5-134 blank)**

**APPENDIX A**

**REFERENCES**

**A-1 SCOPE.**

This appendix lists all forms, technical manuals, and miscellaneous publications referenced in this manual.

**A-2 PUBLICATION INDEXES.**

The following publication indexes should be consulted frequently for latest changes or revisions of references given in this appendix and for new publications relating to material covered in this manual:

Consolidated Index of Army Publications and Blank Forms..... DA PAM 25-30

The Army Maintenance Management System (TAMMS) ..... DA PAM 738-750

**A-3 TECHNICAL PUBLICATIONS.**

Unit, Direct Support, and General Support Maintenance Repair Parts and Special Tool Lists/ Illustrated Parts Breakdown (Including Depot Repair Parts and Special Tools), Enhanced Remoted Target System (ERETS) Target Holding Mechanism, Tank Gunnery..... TM 9-6920-742-24P-5

Operator, Unit, Direct Support, and General Support Maintenance Manual, Enhanced Remoted Target System (ERETS) Simulator, Armor Target Kill ..... TM 9-6920-742-14-2

Operator's, Organizational, Direct Support, and General Support Maintenance Manual for Lead-Acid Storage Batteries..... TM 9-6140-200-14

Soldering Techniques ..... TB SIG 222

Destruction of Army Materiel to Prevent Enemy Use..... TM 750-244-3

Inspection of Bearings ..... TM 9214

Painting ..... TM 43-0139

Safety Requirements for Maintenance of Electrical and Electronic Equipment .....TB 385-4

**A-4 FIELD MANUALS.**

First Aid for So ..... FM 21-11

**A-5 FORMS**

Product Quality Deficiency Report..... SF 368

Accident Report ..... DA Form 285

Recommended Changes to Publications and Blank Forms ..... DA Form 2028

**A-1/(A-2 blank)**

## APPENDIX B

## MAINTENANCE ALLOCATION CHART

## SECTION I. INTRODUCTION

**B-1 GENERAL.**

a. This section provides a general explanation of all maintenance and repair functions authorized at various maintenance levels.

b. The F.MAC in Section II designates overall authority and responsibility for the performance of maintenance functions on the Target Holding Mechanism, Tank Gunnery (THM/TG). The application of the maintenance functions to the THM/TG will be consistent with the capacities and capabilities of the designated maintenance levels.

c. Section III lists the tools and test equipment (both special tools and common tool sets) required for each maintenance function as referenced from Section II.

d. Section IV contains supplemental instructions and explanatory notes for a particular maintenance function.

**B-2 MAINTENANCE FUNCTIONS.**

Maintenance functions will be limited to and defined as follow

a. **Inspect.** To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination (e.g., by sight, sound, or feel).

b. **Test.** To verify serviceability by measuring the mechanical, pneumatic, hydraulic, or electrical characteristics of an item and comparing those characteristics with prescribed standards.

c. **Service.** Operations required periodically to keep an item in proper operating condition, i.e., to clean (includes decontaminate when required), to preserve, to drain, to paint, or to replenish fuel, lubricants, chemical fluids or gases.

d. **Adjust.** To maintain or regulate, within prescribed limits, by bringing into proper or exact position or by setting the operating characteristics to specified parameters.

e. **Align.** To adjust specified variable elements of an item to bring about optimum or desired performance.

f. **Calibrate.** To determine and cause corrections to be made or to be adjusted on instruments or test, measuring, and diagnostic equipments used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

**g. Remove/Install.** To remove and install the same item when required to perform service or other maintenance functions. Install may be the act of emplacing, seating, or fixing into position a spare, repair part, or module (component or assembly) in a manner to allow the proper functioning of an equipment or system.

**h. Replace.** To remove an unserviceable item and install a serviceable counterpart in its place. Replace is authorized by the MAC and is shown as the 3rd position code of the SMR code.

**i. Repair.** The application of maintenance services 1 including fault location/ troubleshooting 2, removal/installation, and disassembly/assembly 3 procedures, and maintenance actions 4 to identify troubles and restore serviceability to an item by correcting specific damage, fault, malfunction or failure in a part, subassembly, module (component or assembly), end item or system.

**j. Overhaul.** That maintenance effort (service/action) prescribed to restore an item to a completely serviceable/operational condition as required by maintenance standards in appropriate technical publications. Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like-new condition.

**k. Rebuild.** Consists of those services/actions necessary for the restoration of unserviceable equipment to a like-new condition in accordance with original manufacturing standards. Rebuild is the highest degree of materiel maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (hours/miles, etc) considered in classifying Army equipment/components.

**B-3 EXPLANATION OF COLUMNS IN THE MAC, SECTION II.**

**a. Column 1, Group Number.** Column 1 lists functional group code numbers, the purpose of which is to identify maintenance significant components, assemblies, subassemblies, and modules with the next higher assembly. End item group number shall be "00."

**b. Column 2, Component/Assembly.** Column 2 contains the names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

**c. Column 3, Maintenance Function.** Column 3 lists the functions to be performed on the item listed in column 2. (For detailed explanation of these functions, see paragraph B2.)

- 
- 1 Services inspect, test, service, adjust, align, calibrate, and/or replace.
  - 2 Fault locate/troubleshoot the process of investigating and detecting the cause of equipment malfunctioning; the act of isolating a fault within a system or unit under test
  - 3 Disassemble/assemble encompasses the step-by-step taking apart (or breakdown) of a spare/functional group coded item to the level of its least componency identified as maintenance significant (i.e., assigned an SMR code) for the level of maintenance under consideration.
  - 4 Actions welding, grinding, riveting, straightening, facing, remachining, and/or resurfacing.

**d. Column 4, Maintenance Level.** Column 4 specifies, by the listing of a work time figure in the appropriate subcolumn(s), the level of maintenance authorized to perform the function listed in column 3. This figure represents the active time required to perform that maintenance function at the indicated level of maintenance. If the number or complexity of the tasks within the listed maintenance function varies at different maintenance levels, appropriate work time figures will be shown for each level. The work time figure represents the average time required to restore an item (assembly, subassembly, component, module, end item, or system) to a serviceable condition under typical field operating conditions. This time includes preparation time (including any necessary disassembly/assembly time), troubleshooting/fault location time, and quality assurance/quality control time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the maintenance allocation chart. The symbol designations for the various maintenance levels are as follows

- C..... OPERATOR OR CREW
- O..... UNIT MAINTENANCE
- F..... DIRECT SUPPORT MAINTENANCE
- H..... GENERAL SUPPORT MAINTENANCE
- L..... SPECIALIZED REPAIR ACTIVITY (SRA)
- D..... OVERHAU/DEPOT LEVEL MAINTENANCE

**e. Column 5, Tools and Equipment.** Column 5 specifies, by code, those common tool sets (not individual tools) and special tools, TMDE, and support equipment required to perform the designated function.

**f. Column 6, Remarks.** This column shall, when applicable, contain a letter code, in alphabetic order, which shall be keyed to the remarks contained in Section IV.

**B-4 EXPLANATION OF COLUMNS IN TOOL AND TEST EQUIPMENT REQUIREMENTS, SECTION III.**

- a. Column 1, Reference Code.** The tool and test equipment reference code correlates with a code used in the MAC, Section II, column 5.
- b. Column 2, Maintenance Level.** The lowest level of maintenance authorized to use the tool or test equipment.
- c. Column 3, Nomenclature.** Name or identification of the tool or test equipment.
- d. Column 4, National Stock Number.** The national stock number of the tool or test equipment.
- e. Column 5, Tool Number.** The manufacturer's part number.

**B-5 EXPLANATION OF COLUMNS IN REMARKS, SECTION IV**

- a. Column 1, Reference Code.** The code recorded in column 6, Section II.
- b. Column 2, Remarks.** This column lists information pertinent to the maintenance function being performed as indicated in the MAC, Section II.

(1) GROUP NUMBER	(2) COMPONENT ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY					(5) TOOLS AND EQUIPMENT	(6) REMARKS
			C	O	F	H	D		
00	TARGET HOLDING MECHANISM, TANK GUNNERY (9375764 REPAIR AND 11784501)	TEST	.5					13	A
01	TANK TARGET ASSEMBLY (11784502-1 AND 11784502-2)	INSPECT	.1	2		5		13	
		ADJUST				.5		13	
		REMOVE AND REPLACE			.9			13	
		REPAIR		1.5	1.2			8,13	
0101	TARGET FRAME, SINGLE (11784506)	REMOVE AND REPLACE		.2					
		REPAIR		.1				13	
0102	CABLE ASSEMBLY (11784509)	REMOVE AND REPLACE		.3					
		REPAIR			.6			6,8,10,12, 13	
0103	CABLE ASSEMBLY, POWER (11784510)	REMOVE AND REPLACE			.5				
		REPAIR			.3			6,8,10,12, 13	A
0104	CONTROL ASSEMBLY (11784504)	REMOVE AND REPLACE		.1					
		REPAIR			.8			6,10,11,13	A
0105	CYLINDER ASSEM- BLY (11784619-1)	INSPECT	.2						
		REMOVE AND REPLACE			1.5			13	
		REPAIR			2.0			13,16	
0106	HYDRAULIC UNIT ASSEMBLY (9375758)	SERVICE		.7				13	
		REMOVE AND REPLACE			1.8			13	
		REPAIR		.3	3.5			10,13	A
		<b>B-4</b>							

(1) GROUP NUMBER	(2) COMPONENT ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY					(5) TOOLS AND EQUIPMENT	(6) REMARKS
			C	O	F	H	D		
0109	CABLE ASSEMBLY (11784508)	REMOVE AND REPLACE		.1					
		REPAIR			.4			6,8,10,12, 13	
03	LAMP ASSEMBLY (11784475)	TEST		.1				8	
		REMOVE AND REPLACE		.1				13	
		REPAIR		.4				13	
0301	CABLE ASSEMBLY (11784476)	REMOVE AND REPLACE			.4			13	
		REPAIR			.4			6,8,10,12, 13	
04	BATTERY BOX AS- SEMBLY (12950811)	REMOVE AND REPLACE		.1					
		REPAIR		.5				13	A
0401	BATTERY (C31 R-4) (NG-31)	TEST		.2					
		SERVICE		.4				1	
		REMOVE AND REPLACE		.2					
06	BATTERY ELIMINA- TOR (9356185)	REPAIR			.2			13	A
0601	POWER SUPPLY (12934455)	REMOVE AND REPLACE		.4				13	
		REPAIR			.7			9,13,15	A
07	RECEIVER (11784801)	REMOVE AND REPLACE		.1					
		REPAIR			.2			13	A
08	TRANSMITTER AS- SEMBLY (11784700)	TEST	.1						
		REPAIR		.1				A	
		<b>B-5</b>							

SECTION II. MAINTENANCE ALLOCATION CHART - Continued.

(1) GROUP NUMBER	(2) COMPONENT ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY					(5) TOOLS AND EQUIPMENT	(6) REMARKS
			C	O	F	H	D		
0801	BATTERY (11784703)	SERVICE		.2					2
		REMOVE AND REPLACE		.1					
0802	TRANSMITTER ASSEMBLY (11784701)	REPAIR			.1				13

**SECTION III. TOOL AND TEST EQUIPMENT REQUIREMENTS FOR TARGET HOLDING MECHANISM, TANK GUNNERY.**

(1) TOOL OR TEST EQUIPMENT REF CODE	(2) MAINTENANCE LEVEL	(3) NOMENCLATURE	(4) NATIONAL/NATO STOCK NUMBER	(5) TOOL NUMBER
1	0	BATTERY CHARGER ASSEMBLY	6130-01-236-7454	11784485
2	0	BATTERY CHARGER	6130-01-350-7763	9356098
3	0	BRUSH, WIRE	7920-00-044-4857	1182
4	0	GLOVES, RUBBER	4240-01-066-9067	MIL-G- 44005S
5	0	GOGGLES, INDUSTRIAL	4240-00-052-3776	A-A-1110
6	F	HEATER, GUN-TYPE, ELECTRIC	4940-01-181-5876	1264T585
7	0	MASK, AIR FILTERING	4240-01-105-8995	11-875-54
8	0	MULTIMETER	6625-01-265-6000	AN/PSM-45A
9	F	SCREWDRIVER SET, TORQUE	5120-00-127-2525	KIT2
10	F	SOLDERING AND DESOLDERING SET	3439-00-460-7198	W-TCP-K
11	F	STRAP, WRIST, GROUND	6150-01-175-8730	13143304
12	F	STRIPPERS, WIRE	5110-00-063-3037	101S
13	0	TOOL KIT, GEN MECHANIC'S AUTOMOTIVE	5180-00-177-7033	SC5180-90- CL-N26
14	F	TOOL, CRIMPER	5120-00-165-3912	11-3284-2
15	F	WRENCH, TORQUE	5120-00-001-3733	28414
16	F	WRENCH, SPANNER	5120-00-277-9076	1474
		<b>B-7</b>		

**SECTION IV. REMARKS.**

REFERENCE CODE	REMARKS
A	Repair consists of replacing subassemblies and component parts.

**APPENDIX C**

**UNIT MAINTENANCE  
COMMON TOOLS AND SUPPLEMENTS  
AND SPECIAL TOOLS/FIXTURES LIST**

**"NOT APPLICABLE"**

**C-1/(C-2 blank)**

APPENDIX D

EXPENDABLE AND DURABLE ITEMS LIST

SECTION I. INTRODUCTION

D-1 **SCOPE.**

This appendix lists expendable and durable items that you will need to operate and maintain the Target Holding Mechanism, Tank Gunnery. This listing is for information only and is not authority to requisition the listed items. These items are authorized to you by CTA 50-970, Expendable/Durable Items.

D-2 **EXPLANATION OF COLUMNS.**

- a. **Column (1) Item Number.** This number is assigned to the entry in the listing.
- b. **Column (2) Level.** This column identifies the lowest level of maintenance that requires the item.
- c. **Column (3) National Stock Number.** This is the National stock number assigned to the item and is used to requisition it.
- d. **Column (4) Item Name, Description, Commercial and Government Entity Code (CAGEC), and Part Number.** This provides the other information you need to identify the item.
- e. **Column (5) Unit of Measure.** This code shows the physical measurement or count of an item, such as gallon, dozen, gross, etc.

SECTION II. EXPENDABLE AND DURABLE ITEMS LIST.				
(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) ITEM NAME, DESCRIPTION CAGEC PART NO. AND FSCM	(5) UNIT OF MEAS.
1	F	8040-00-273-8716	Adhesive 81348 (MMM-A-121)	CN
2	0	9150-00-119-9291	Grease, Aircraft 81349 (MIL-G-4343)	OZ
3	0	9150-00-698-2382 24617 (DEXRON II)	Fluid, Hydraulic (1 QT)	OZ
	0	9150-00-657-4959	Fluid, Hydraulic (5 GAL) 24617 (DEXRON II)	GL
	0	9150-01-114-9968	Fluid, Hydraulic (55 GAL) 24617 (DEXRON IID)	GL
<b>D-1</b>				

## SECTION II. EXPENDABLE AND DURABLE ITEMS LIST - Continued.

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) ITEM NAME, DESCRIPTION CAGEC PART NO. AND FSCM	(5) UNIT OF MEAS.
3 (cont)	O	9150-00-252-6383	Fluid, Hydraulic (1 QT) 81349 (MIL-H-5606)	OZ
	O	9150-00-223-4134	Fluid, Hydraulic (1 GAL) 81349 (MIL-H-5606)	GL
	O	9150-00-265-9408	Fluid, Hydraulic (55 GAL) 81349 (MIL-H-5606)	GL
4	O	9150-00-273-2389	Oil, Lubricating 81348 (W-L-800)	OZ
5	O	8010-00-297-2124	Enamel 96906 (MS35530-2)	GL
6	O	5350-00-186-8858	Paper, Abrasive 58536 (A-A-1049)	PG
7	O	8010-00-899-8825	Primer, Coating 83421 (8010-00-8998825)	PT
8	C	7920-00-205-3570	Rag, Wiping 58536 (A-A-2522)	BE
9	F	8030-01-239-1558	Contact Cement 19200(11784493)	OZ
10	F	8040-01-009-1562	Adhesive 81349 (MIL-A-46146)	EA
11	F	8030-00-339-0310	Sealing, Compound 05972 (569-31)	EA
12	F	3439-01-008-7578	Solder, Rosin Core 81348 (SN63WRMAP3 0.036 lib)	OZ
13	O	6850-00-110-4498	Solvent, Dry Cleaning 81348 (PD680)	PT
14	F	6920-01-235-0250	Tape, Filament 19200(11784588)	EA
15	O	6505-00-254-5527	White Petroleum 23301 (NDC00168-0053-21)	EA
16	O	9150-00-965-2408	Grease, Ground Glass 19200 (9362987)	OZ
			<b>D-2</b>	

APPENDIX E

TORQUE LIMITS

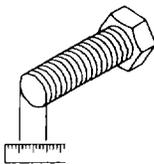
SECTION I. INTRODUCTION.

E-1 GENERAL.

This appendix contains the torque standards for specific type and size of hardware. It defines the different types of bolts by grade.

SECTION II. TORQUE TABLE.

HOW TO USE TORQUE TABLE:



a. Measure the diameter of the screw you are installing.

c. Under the SIZE, look down the left-hand column until you find the diameter of the screw you are installing. (There will usually be two lines beginning with the same size.)

d. In the second column under SIZE, find the number of threads per inch that matches the number of threads you counted in step 2. (Not required for metric screws.)

CAPSCREW HEAD MARKINGS

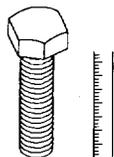
Manufacturer's marks may vary. These are all SAE Grade 5 (3-line).

Metric screws are of three grades: 8.8, 10.9, and 12.9. Grades & Manufacturer's marks appear on the screw head.



STANDARD

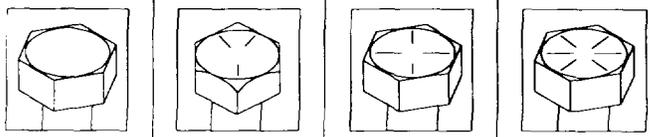
METRIC



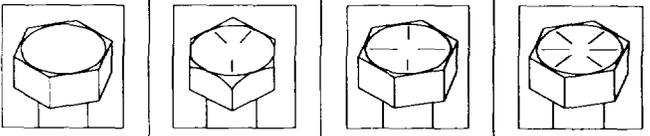
b. Count the number of threads per inch or use a pitch gage.

f. Look down the column under the picture you found in step 5 until you find the torque limit (LB-IN./FT or N.M) for the diameter and threads per inch of the screw you are installing.

**TORQUE LIMITS FOR DRY FASTENERS**

<b>CAPSCREW HEAD MARKINGS</b>  Manufacturer's marks may vary. These are all SAE Grade 5 (3-line).										
			<b>TORQUE</b>							
<b>SIZE</b>			<b>SAE GRADE NO. 2</b>		<b>SAE GRADE NO. 5</b>		<b>SAE GRADE NO. 6 OR 7</b>		<b>SAE GRADE NO. 8</b>	
Dia. Inches	Threads Per Inch	Millimeters	PoundNewton- Feet Meters		PoundNewton- Feet Meters		PoundNewton- Feet Meters		PoundNewton- Feet Meters	
1/4	20	6.35	5	7	7	8	10	14	12	16
1/4	28	6.35	6	9	9	10	12	16	14	19
5/16	18	7.94	11	15	15	17	21	28	25	34
5/16	24	7.94	12	16	16	19	24	22	25	34

**TORQUE LIMITS FOR WET FASTENERS**

<b>CAPSCREW HEAD MARKINGS</b>  Manufacturer's marks may vary. These are all SAE Grade 5 (3-line).										
			<b>TORQUE</b>							
<b>SIZE</b>			<b>SAE GRADE NO. 2</b>		<b>SAE GRADE NO. 5</b>		<b>SAE GRADE NO. 6 OR 7</b>		<b>SAE GRADE NO. 8</b>	
Dia. Inches	Threads Per Inch	Millimeters	PoundNewton- Feet Meters		PoundNewton- Feet Meters		PoundNewton- Feet Meters		PoundNewton- Feet Meters	
1/4	20	6.35	4	6	6	8	8	11	9	12
1/4	28	6.35	5	7	7	9	9	12	10	14
5/16	18	7.94	8	11	3	18	16	22	18	24
5/16	24	7.94	9	12	14	19	18	24	20	27

**TIGHTENING METAL FASTENERS**

When torquing a fastener, select a wrench whose range fits the required torque value. A torque wrench is most accurate from 25% to 75% of its stated range. A wrench with a stated range of 0 to 100 will be most accurate from 25 to 75 Pound-Feet. The accuracy or readings will decrease as you approach 0 Pound-Feet or 100 Pound-Feet. The following ranges are based on this principle.

TORQUE RANGES

STATED RANGE		MOST EFFECTIVE RANGE	
0-200	lb-ft	4-13	lb-ft
0-600	lb-ft	50-450	lb-ft
0-170	lb-ft	44-131	lb-ft
15-75	lb-ft	30-60	lb-ft

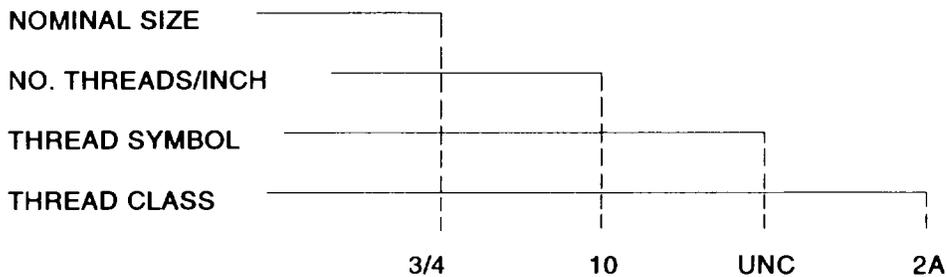
FASTENER SIZE AND THREAD PATTERN

Threaded fasteners are categorized according to diameter of the fastener shank. Thread styles are divided into broad groups, the two most common being coarse (Unified Coarse-UNC) and fine (Unified Fine-UNF). These groups are defined by the number of threads per inch on the bolt shanks. In addition, threads are categorized by thread class, which is a measure of the degree of fit between the threads of the bolt or screw (external threads) and the threads of the attaching nut or tapped hole (internal threads). The most common thread class for bolts and screws is Class 2.

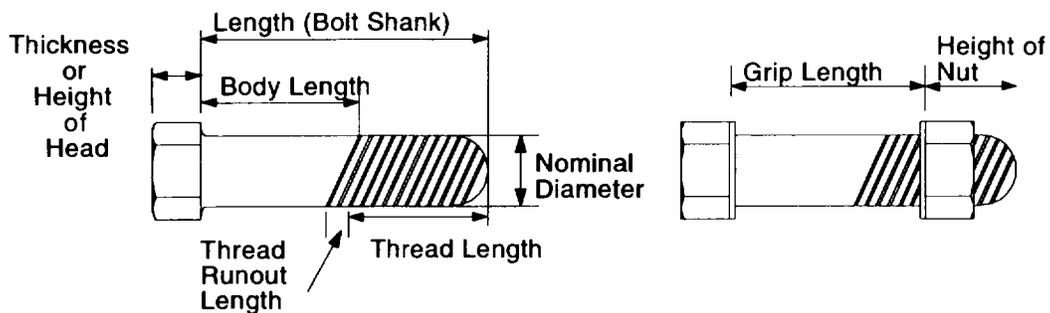
THREAD CLASSES AND DESCRIPTION

EXTERNAL	INTERNAL	FIT
1A	1B	LOOSE FIT
2A	2B	MEDIUM FIT
3A	3B	CLOSE FIT

Thread patterns are designated as follows:



NOTE: Unless followed with -LH (eg, 3/4-10UNC-2a-LH), threads are right-hand.



FASTENER GRADE

In addition to being classified by thread type, threaded fasteners are also classified by material. The most familiar fastener classification system is the SAE grading system.

SAE SCREW AND BOLT MARKINGS

SCREWS	BOLTS
SAE GRADE 2 NO MARKING	SAE GRADE 6 4 RADIAL DASHES 90° APART
SAE GRADE 3 2 RADIAL DASHES 180° APART	SAE GRADE 7 5 RADIAL DASHES 72° APART
SAE GRADE 5 3 RADIAL DASHES 120° APART	SAE GRADE 8 6 RADIAL DASHES 60° APART
	GRADE 8.2 6 RADIAL DASHES 30° APART

NOTE

Torque values for Grade 8.2 bolts are the same as for Grade B.

MARKINGS ON HEX LOCKNUTS

GRADE A - No Marks	GRADE A - No Mark
GRADE B - 3 Marks	GRADE B - Letter B
GRADE C - 6 Marks	GRADE C - Letter C
GRADE A - No Notches	
GRADE B - One Notch	
GRADE C - Two Notches	

## TORQUE VALUE GUIDE

SCREW DIAMETER	TORQUE NO DASHES (SAE GRADE 2)	TORQUE 3 DASHES (SAE GRADE 5)	TORQUE 6 DASHES (SAE GRADE 8)	SOCKET SIZE
1/4-20 UNC	3-5 ft-lb (4-7 N.m)	6-8 ft-lb (8-11 N.m)	10-12 ft-lb (14-16 N.m)	7/16
1/4-28 UNF	4-6 ft-lb (5-8 N.m)	8-10 ft-lb (11-14 N.m)	9-14 ft-lb (12-19 N.m)	7/16
5/16-18 UNC	7-11 ft-lb (9-15 N.m)	13-17 ft-lb (18-23 N.m)	19-24 ft-lb (26-33 N.m)	1/2
5/16-24 UNF	7-11 ft-lb (9-15 N.m)	14-19 ft-lb (19-26 N.m)	23-28ft-lb (31-38 N.m)	1/2
3/8-16 UNC	14-18 ft-lb (19-24 N.m)	26-31 ft-lb (35-32 N.m)	39-44 ft-lb (53-60 N.m)	9/16
3/8-24 UNF	15-19 ft-lb (20-26 N.m)	30-35 ft-lb (41-47 N.m)	46-51 ft-lb (62-69 N.m)	9/16
7/16-14 UNC	23-28 ft-lb (31-38 N.m)	44-49 ft-lb (60-66 N.m)	65-70 ft-lb (88-95 N.m)	5/8
7/16-20 UNF	23-28 ft-lb (31-38 N.m)	44-54 ft-lb (60-73 N.m)	69-79 ft-lb (94-107 N.m)	5/8
1/2-13 UNC	32-37 ft-lb (43-50 N.m)	65-75 ft-lb (88-102 N.m)	95-105 ft-lb (129-142 N.m)	3/4
1/2-20 UNF	34-41 ft-lb (46-56 N.m)	73-83 ft-lb (99-113 N.m)	113-123 ft-lb (153-167 N.m)	3/4
9/16-12 UNC	46-56 ft-lb (62-76 N.m)	100-110 ft-lb (136-149 N.m)	145-155 ft-lb (197-210 N.m)	13/16
9/16-18 UNF	47-57 ft-lb (64-77 N.m)	107-117 ft-lb (145-159 N.m)	165-175 ft-lb (224-237 N.m)	13/16
5/8-11 UNC	62-72 ft-lb (84-98 N.m)	140-150 ft-lb (190-203 N.m)	200-210 ft-lb (271-285 N.m)	15/16
5/8-18 UNF	67-77 ft-lb (91-104 N.m)	153-163 ft-lb (207-221 N.m)	235-245 ft-lb (319-332 N.m)	15/16
3/4-10 UNC	106-116 ft-lb (144-157 N.m)	260-270 ft-lb (353-366 N.m)	365-375 ft-lb (495-508 N.m)	1-1/4
3/4-16 UNF	115-125 ft-lb (156-169 N.m)	268-278 ft-lb (363-377 N.m)	417-427 ft-lb (565-579 N.m)	1-1/4
7/8-9 UNC	165-175 ft-lb 1 (224-237 N.m)	385-395 ft-lb (522-536 N.m)	595-605 ft-lb (807-820 N.m)	1-5/16
7/8-14 UNF	178-188 ft-lb (241-255 N.m)	424-434 ft-lb (575-588 N.m)	663-673 ft-lb (899-912 N.m)	1-5/16
1-8 UNC	251-261 ft-lb (340-354 N.m)	580-590 ft-lb (786-800 N.m)	900-910 ft-lb (1220-1234 N.m)	1-1/2
1-14 UNF	255-265 ft-lb (346-359 N.m)	585-634 ft-lb (793-860 N.m)	943-993 ft-lb (1279-1346 N.m)	1-1/2
1-1/4-7 UNC	451-461 ft-lb (611-625 N.m)	1070-1120 ft-lb (1451-1518 N.m)	1767-1817 ft-lb (2396-2463 N.m)	1-7/8
1-1/4-12 UNF	488-498 ft-lb (662-675 N.m)	1211-1261 ft-lb (1642-1710 N.m)	1963-2013 ft-lb (2661-2729 N.m)	1-7/8
1-1/2-6 UNC	727-737 ft-lb (986-999 N.m)	1899-1949 ft-lb (2575-2642 N.m)	3111-3161 ft-lb (4218-4286 N.m)	2-1/4
1-1/2-12 UNF	816-826 ft-lb (1106-1120 N.m)	2144-2194 ft-lb (2907-2975 N.m)	3506-3556 ft-lb (4753-4821 N.m)	2-1/4

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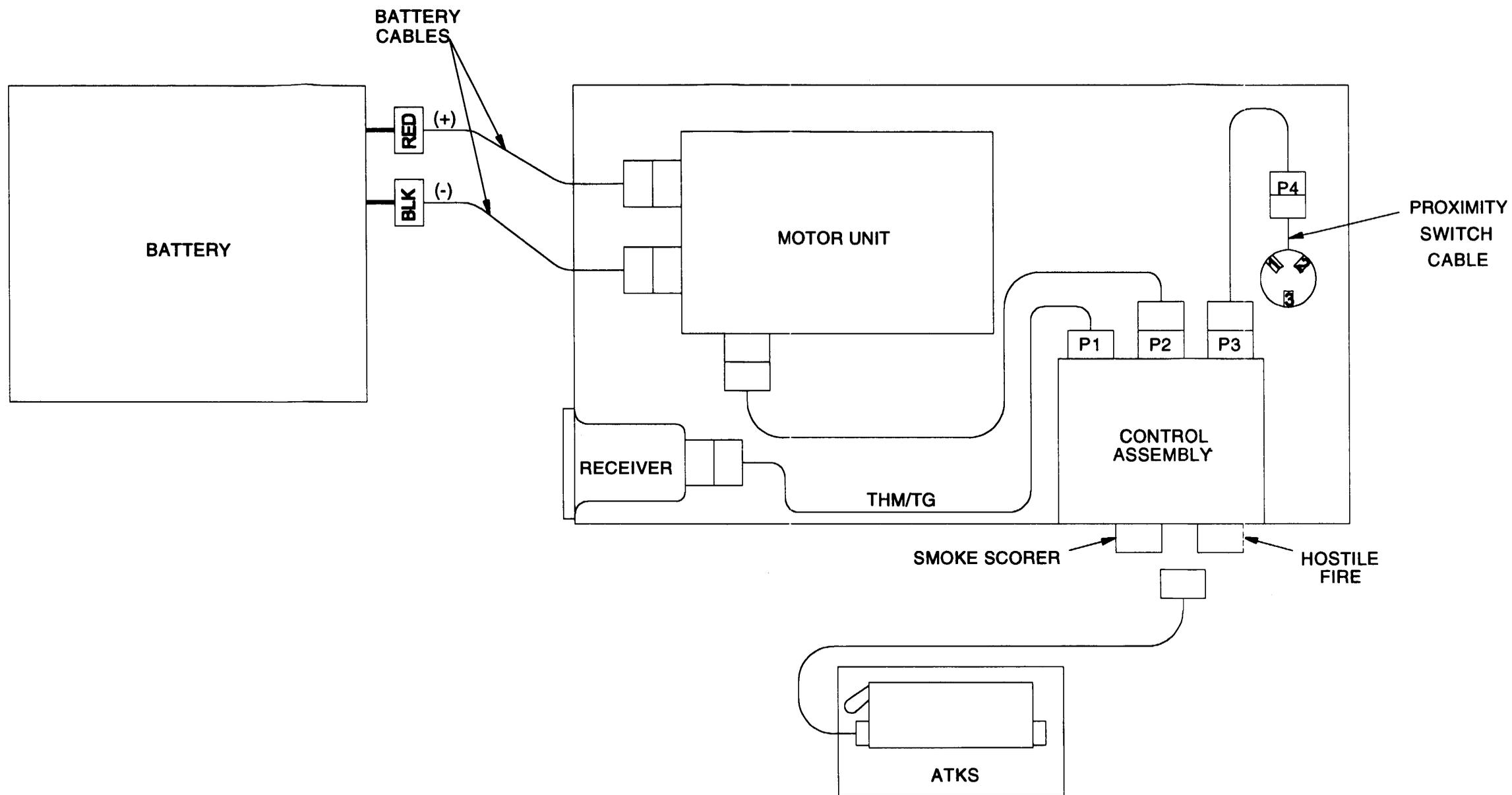
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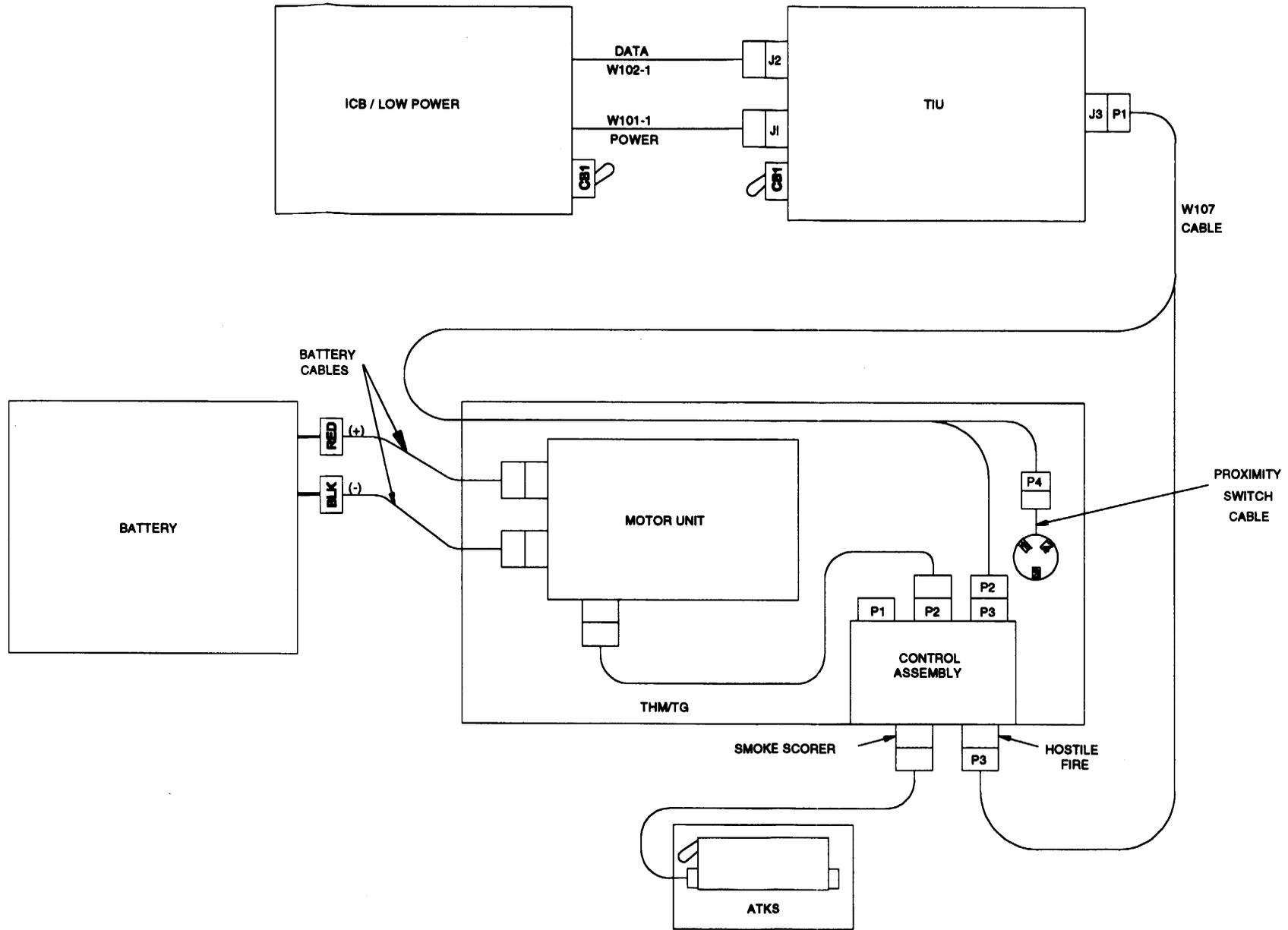
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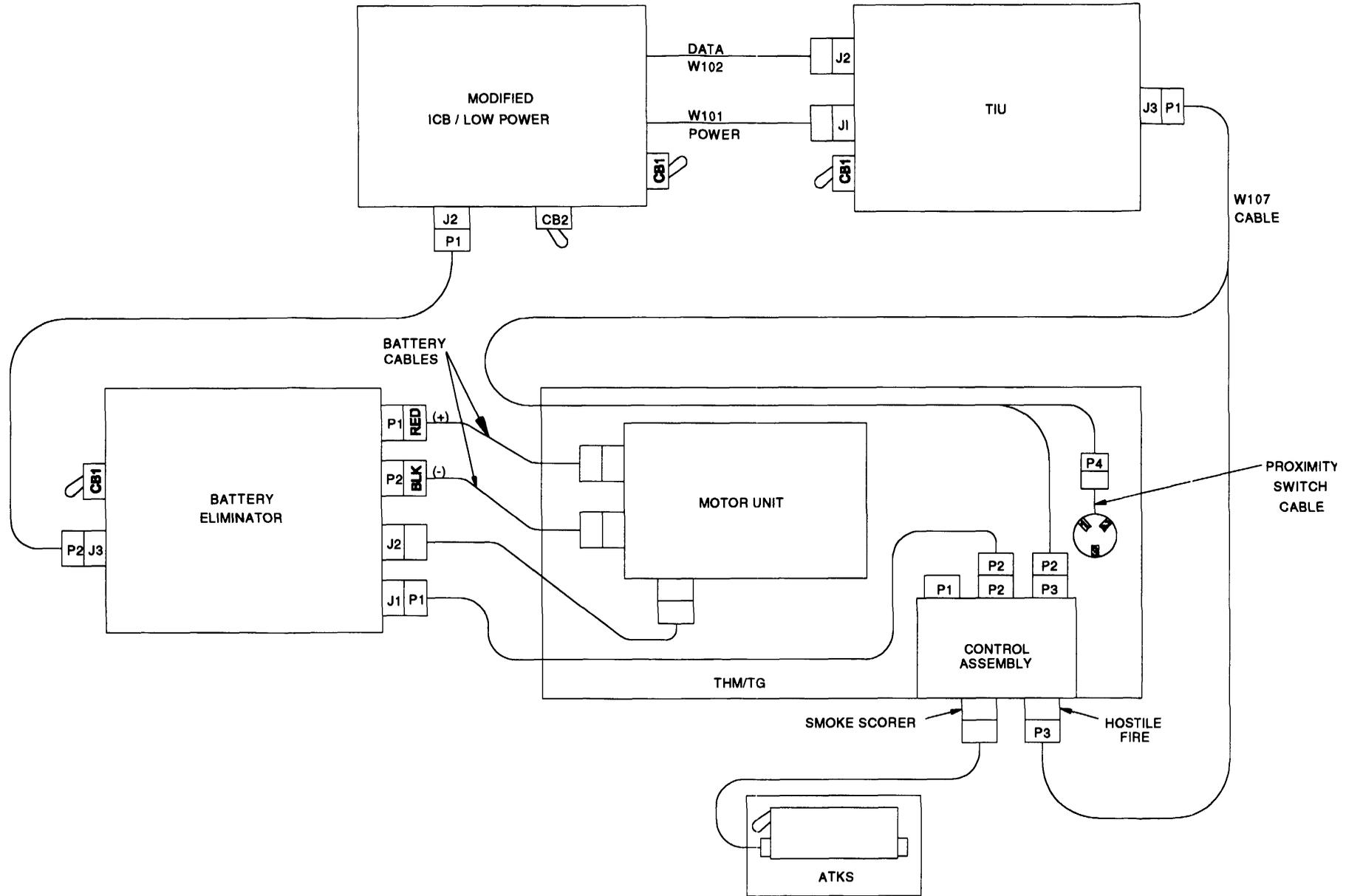


FO-1. Radio-Controlled With Battery Wiring Diagram  
FO-1/FO-2 Blank



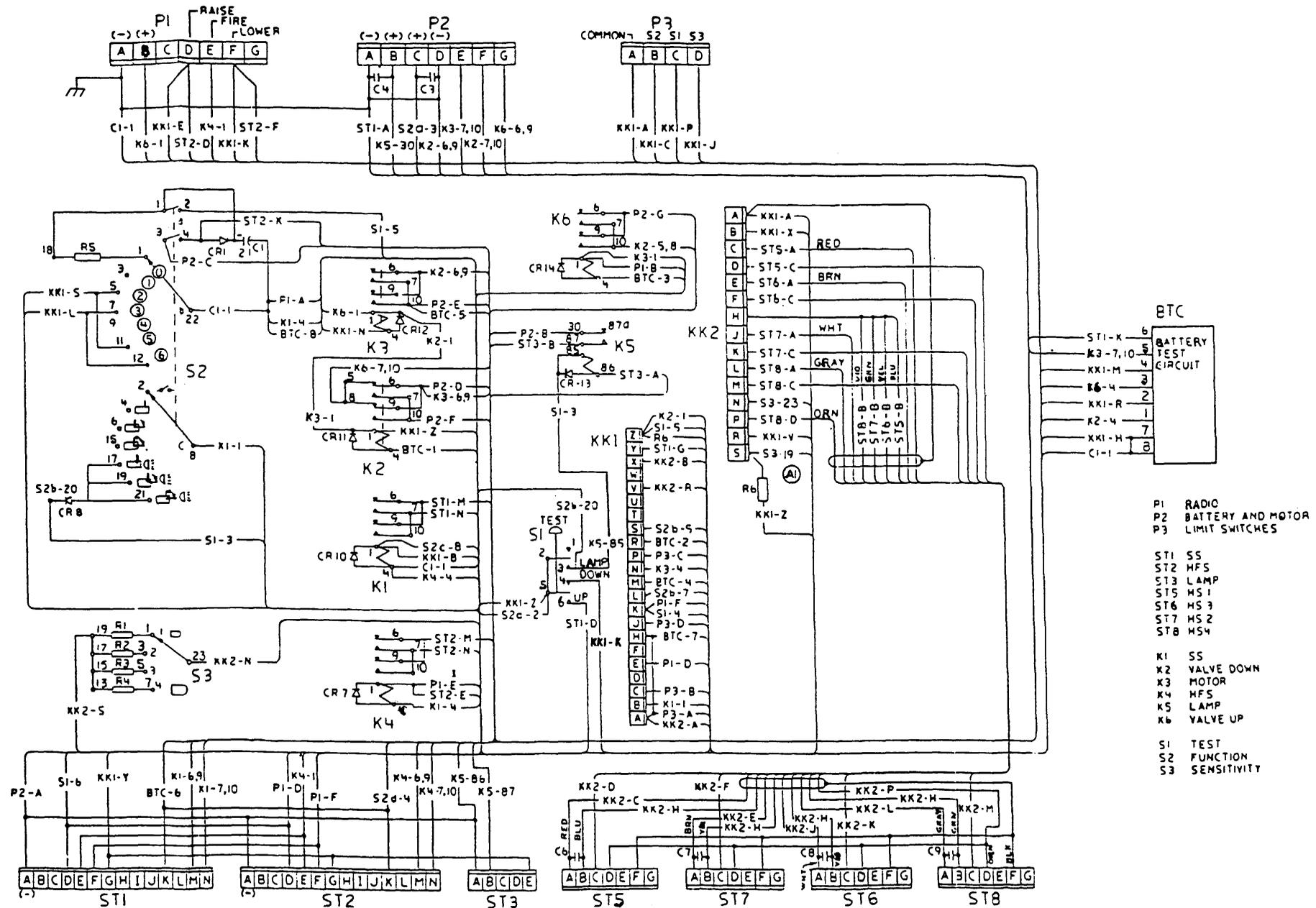
FO-2. Computer-Controlled With Battery Wiring Diagram

FO-3/FO-4 Blank



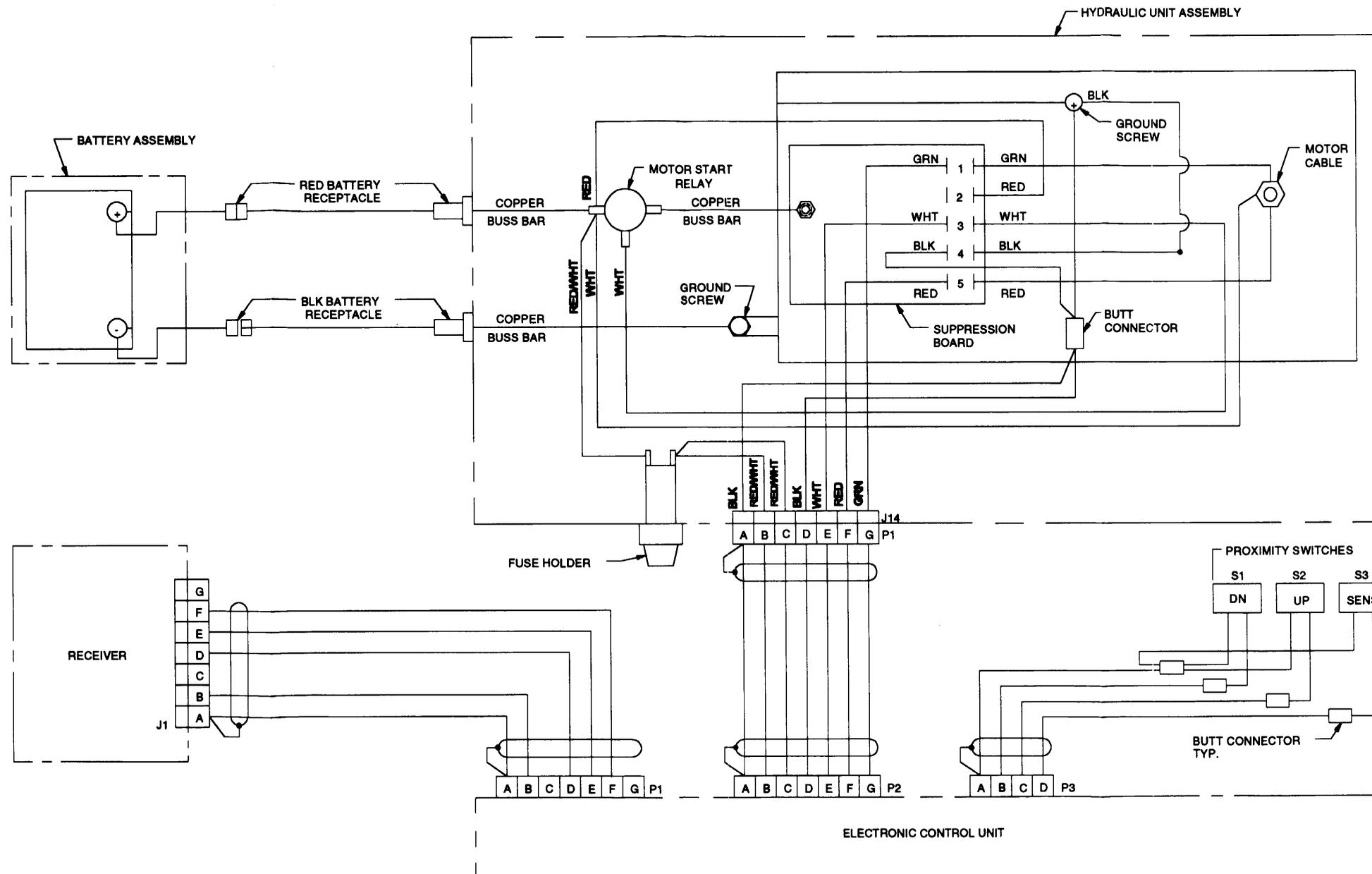
FO-3. Computer-Controlled With Battery Eliminator Wiring Diagram

FO-5/FO-6 Blank

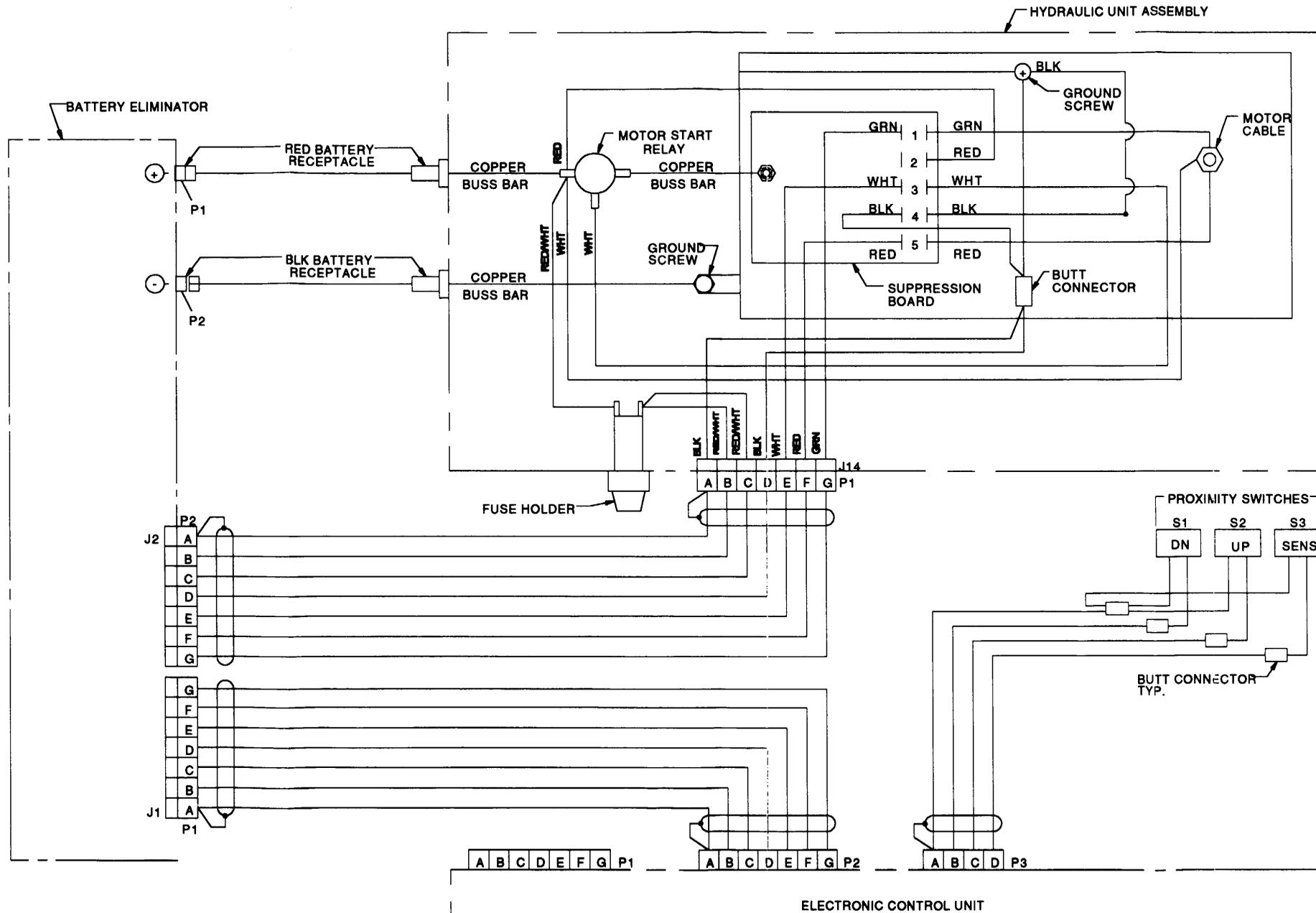


FO-4. THM/TG Control Assembly Wiring Diagram

FO-7/FO-8 Blank



FO-5. THM/TG Target Device Wiring Diagram  
FO-9/FO-10 Blank



FO-6. THM/TG Target Device Wiring Diagram (Battery Eliminator)  
 FO-11/FO-12 Blank

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