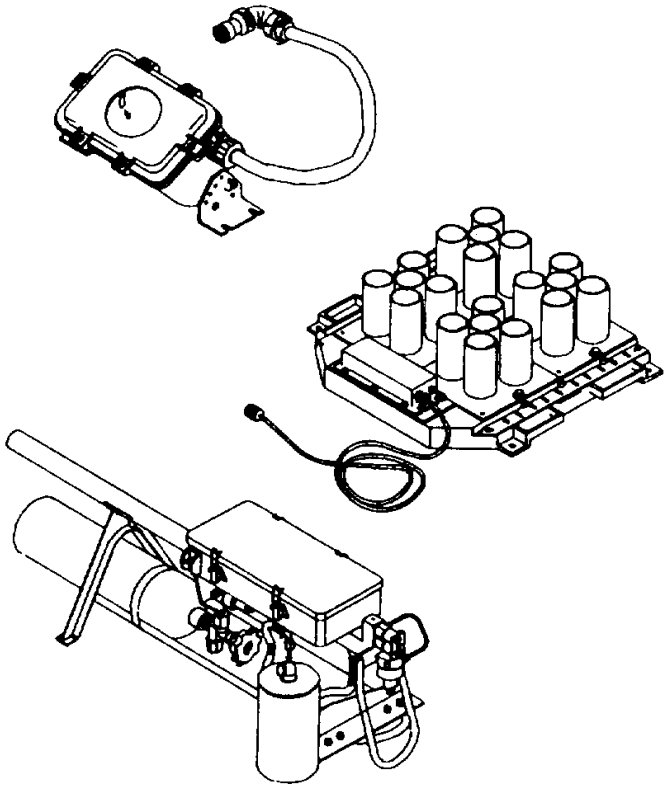
TECHNICAL MANUAL

OPERATOR, UNIT, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE MANUAL FOR ENHANCED REMOTED TARGET SYSTEM (ERETS) SMALL ARMS MUZZLE FLASH SIMULATOR (NSN 6920-01-146-3050) (PN 11829682) GUNFIRE SIMULATOR (NSN 6920-01-333-2362) (PN 12725085-1) SMALL ARMS SOUND SIMULATOR (NSN 6920-01-146-3046) (PN 11829734)



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H E A D Q U A R T E R S , D E P A R T M E N T O F T H E A R M Y

JUNE 1997

SAFETY SUMMARY

The following are general safety precautions that personnel must become familiar with and adhere to during operation, maintenance and troubleshooting of the Small Arms Muzzle Flash Simulator, Gunfire Simulator and Small Arms Sound Simulator.

KEEP AWAY FROM LIVE CIRCUITS

Maintenance personnel must observe all safety precautions during maintenance and troubleshooting of the Small Arms Muzzle Flash Simulator, Gunfire Simulator, and Small Arms Sound Simulator**.** Live circuits are exposed during some maintenance and troubleshooting procedures.

USE EXTREME PRECAUTION WHEN USING EXPLOSIVES.

Pyrotechnics are more dangerous than many other types of ammunition because they are more easily initiated**.** Items with primers should be guarded to prevent a blow on the primer because such a blow could activate the item.

Military pyrotechnics must be handled with care at all times**.** Safety precautions for handling and firing pyrotechnic items and accessories are included in TM 91300-206, TM 9-1370-12 and AR 385-64, as applicable.

ACCIDENTAL ACTIVATION

Firing equipment and targets can be accidentally activated; therefore, only personnel who have been instructed in the methods of safe operation of RETS components and simulators shall be authorized to enter areas where this equipment is in use.

STAY OUT OF LINE OF FIRE

Never bend, lean or stand over GUFS firing tube or adjacently positioned simulators when loading or unloading.

PROTECT YOUR EYES

Protect your eyes from pyrotechnic flash**.** Don't look at the flash of the simulator, some simulator's light intensity of 4 to 10 million candle-power can be harmful to your eyes.

KEEP AWAY FROM SMOKE

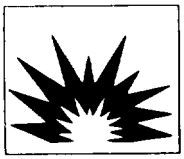
Keep 200 meters (about 220 yards) away from activated smoke rounds**.** The Surgeon General has determined that the safety zone for pyrotechnics emitting black smoke is 200 meters (220 yards) away from the simulator.

OBSERVE ALL SAFETY WARNING NOTES THROUGHOUT THIS TECHNICAL MANUAL

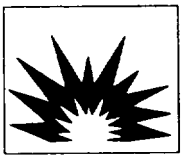
Firing ranges or similar areas where GUFS are used are dangerous**.** Enter these areas only with the knowledge and approval of the authority in control of the area**.** Personnel not directly involved in loading/unloading operations should remain at least 100 feet from the Gunfire Simulator.

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

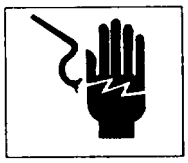
WARNING



Extreme caution should be exercised when handling pyrotechnic cartridges. Do not remove shorting cap until ready to install ignition plug into gunfire simulator output receptacle. Failure to do so may cause serious injury or death due to accidental ignition of pyrotechnic charges.

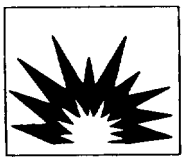


Disarm, then disconnect the GUFS connection from control assembly on the TTA, ILTEM or TIU. The GUFS must be disconnected prior to performing maintenance. Explosion is possible and can cause personal injury and/or damage to equipment.

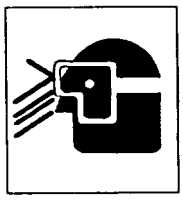


Care must be taken to prevent wires from shorting out to ground. Failure to do so may result in electrical shock.

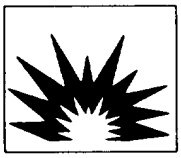
Dry cleaning solvent (SD2) is toxic and flammable Solvent to be used only in well ventilated area with protective mask, goggles and gloves.



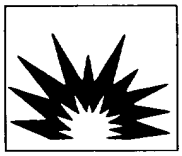
Purge the SASS prior to maintenance or troubleshooting by removing the solenoid assembly. Failure to do so could result in ignition of trapped gasses in the combustion chamber which could cause personal injury and/or damage to equipment.



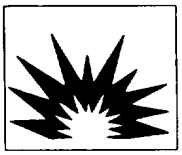
Compressed air used for cleaning purposes will not exceed 30 pounds per square inch (207 kilopascals). Use only with effective chip guarding and personal protective equipment or injury to personnel could result.



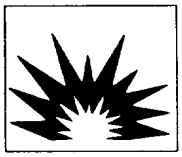
Never lean, bend or stand directly over a firing tube or externally fired simulator when loading/unloading. Doing so could cause serious injury or death due to accidental ignition of pyrotechnic charges.



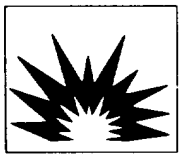
Prior to arming, disarming or performing maintenance, always touch metal frame of GUFS so as to ground static electricity. Failure to do so could cause serious injury or death due to accidental ignition of pyrotechnic charges.



Personnel loading/unloading the device should be qualified to handle electrically initiated pyrotechnics and shall wear approved hearing protection, hard hat, face shield (NSN 8415-01-039-6000) per MIL-STD1202 and high-temperature gloves (combat vehicle crewman type, NSN 8415-01-074-9428). Failure to do so could cause serious injury or death due to accidental ignition of pyrotechnic charges.



When an unfired simulator is found, immediately move 100 feet away from simulator and wait 15 minutes after activation to allow any slow burning pyrotechnic to ignite fully. Failure to do so may cause serious injury or death due to accidental ignition of pyrotechnic charges.



Never load the simulators into the GUFS during thunder or lightning storms. Doing so may cause serious injury or death due to accidental ignition of pyrotechnic charges.

Only M21 cartridges are authorized for use in the gunfire simulator. Unauthorized pyrotechnic cartridges can cause personal injury and/or damage to equipment.

TECHNICAL MANUAL

NO. 9-6920-742-14-2

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, D.C., *10 June 1997*

TECHNICAL MANUAL

OPERATOR, UNIT, DIRECT SUPPORT,
AND GENERAL SUPPORT MAINTENANCE MANUAL

ENHANCED REMOTED TARGET SYSTEM (ERETS)
SMALL ARMS MUZZLE FLASH SIMULATOR
(NSN 6920-01-146-3050) (PN 11829682)
GUNFIRE SIMULATOR
(NSN 6920-01-333-2362) (PN 12725085-1)
SMALL ARMS SOUND SIMULATOR
(NSN 6920-01-146-3046) (PN 11829734)

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.

HEADQUARTERS, DEPARTMENT OF THE ARMY

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NOTE

This manual replaces TM 9-6920-742-14&P-4, dated October 1986, TM 96920-742-14&P-5, dated July 1986, and TM 9-6920-742-14&P-7, dated July 1986, which have been rescinded.

CHAPTER 1

INTRODUCTION

SECTION I. GENERAL INFORMATION

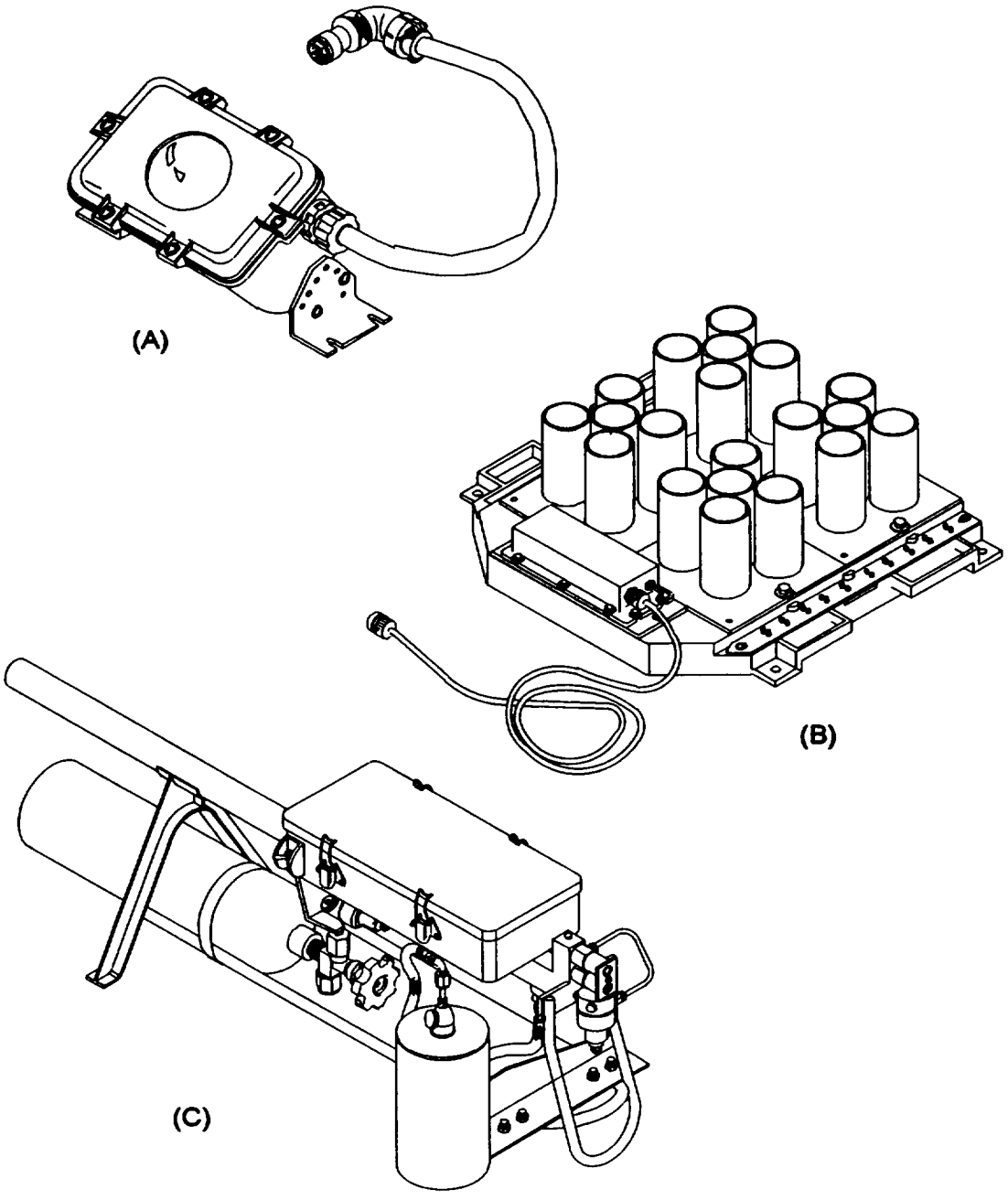


Figure 1-1. Small Arms Muzzle Flash Simulator (A), Gunfire Simulator (B), and Small Arms Sound Simulator (C).

1-1. HOW TO USE THIS MANUAL.

This manual contains operating instructions and maintenance procedures for the Small Arms Muzzle Flash Simulator (MFS), Gunfire Simulator (GUFS), and Small Arms Sound Simulator (SASS). 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 MFS, GUFS, and SASS that includes equipment description and principles of operation. Chapter 2 contains operating instructions for the MFS, GUFS, and SASS, 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. An index at the rear of the manual contains an alphabetical listing of subjects under every topic covered in the manual.

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. If the subject or procedure is not listed in the table of contents, try looking in the Index at the rear of the manual.

1-2. SCOPE.

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

The MFS, GUFS, and SASS are designed to operate on ERETS ranges. The MFS, GUFS, and SASS emulate enemy hostilities and/or kill of the enemy.

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, is not applicable to maintain the MFS, GUFS, and SASS. Appendix D provides a listing of expendable and durable items needed to operate and maintain the MFS, GUFS, and SASS. 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 385-40.

1-4. REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS.

If your MFS, GUFS, or SASS need 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-AC-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 MFS, GUFS, and SASS 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 SF 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-AC-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. Solvent to be used only in well ventilated area with protective mask, goggles and gloves.

(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.

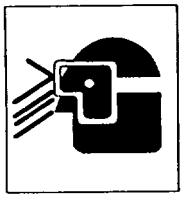
1-5. CORROSION PREVENTION AND CONTROL (CPC) (CONTINUED).

(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.

WARNING



Compressed air used for cleaning purposes will not exceed 30 pounds per square inch (207 kilopascals). Use only with effective chip guarding and personal protective equipment or injury to personnel could result.

(6) Dry parts by blowing with low-pressure compressed air or wiping with lint-free cloths.

(7) Paint metal surfaces after repair 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 for requirements for administrative storage.

1-8. NOMENCLATURE CROSS-REFERENCE LIST.

Table 1-1. Nomenclature Cross-Reference List.

OFFICIAL NOMENCLATURE	COMMON NAME
Adapter, Power Supply	Range Control Station Adapter (RCS Adapter)
Console. Target Training Set - ERETS (ARMOR)	Range Control Station, Enhanced Remoted Target System, Armor (RCS/ERETS Armor)
Console, Target Training Set - ERETS (INFANTRY)	Range Control Station, Enhanced Remoted Target System, Infantry (RCS/ERETS Infantry)

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

OFFICIAL NOMENCLATURE	COMMON NAME
Console, Target Training Set - RETS	Range Control Station, Remoted Target SYSTEM (RCS/RETS)
Interconnecting Box, High Power	Interconnecting Box (ICB)
Interconnecting Box, Low Power	Interconnecting Box (ICB)
Interconnecting Box, Target Interface	Target Interface Unit (TIU)
Simulator, Gunfire	Armor Target Kill Simulator (ATKS) Target Kill Simulator (TKS)Gunfire Simulator (GUFS)
Simulator, Muzzle Flash, Small Arms	Muzzle Flash Simulator (MFS)
Simulator, Sound, Small Arms	Rifle Fire Simulator (RFS)Small Arms Sound Simulator (SASS)
Target Holding Mechanism, Tank Gunnery	Target Holding Mechanism, Tank Gunnery (THM/TG)
Target Holding Set, Training	Infantry Target Mechanism (ITM)
Track System, Target Training Set - Armor	Armor Moving Target Carrier (AMTC)
Track System, Target Training Set - Infantry	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
CCA	Circuit Card Assembly
ERETS	Enhanced Remoted Target System
GUFS	Gunfire Simulator
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-2, Repair Parts and Special Tools List, for any special tools, TMDE, and support equipment required to maintain the MFS, GUFS, and SASS.

1-12. REPAIR PARTS.

Repair parts are listed and illustrated in the Repair Parts and Special Tools List, TM 9-6920-742-24P-2.

SECTION III. EQUIPMENT DESCRIPTION

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

a. Small Arms Muzzle Flash Simulator. The MFS, simulates the muzzle flash of small arms weapons. It utilizes light-emitting diodes reflecting off the target surface to provide the visual effect. The MFS operates as either single shot or automatic shot with a rate of fire of 600 rounds per minute. The MFS receives power and commands from the ITM.

b. **Gunfire Simulator.** The GUFS is a training device which ignites pyrotechnically charges on command. When used in conjunction with the M21, 50 mm pyrotechnic cartridge (PIN 9349243, NSN 1370-01-128-0418), it produces the flash and sound for realistic simulation of tank gunfire at distant target. The device has four metal plates on each of which is mounted five tubes to total 20 firing positions. The internal circuits terminate at 20 (2 pole) receptacles located on the sides of the frame. The GUFS can be connected in tandem for extended firing capacity in multiples of 20 firing tubes.

c. **Small Arms Sound Simulator.** The SASS is designed to provide realistic small arms audible single shot and automatic rifle fire of a weapon. The SASS receives power and commands through the MFS and operates independently of the MFS. The SASS consists of a tubular, gun-like barrel with a combustion chamber. A mixture of oxygen and propane gas is ignited by a spark plug producing the audible sound.

1-14. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS.

a. Small Arms Muzzle Flash Simulator.

(1) Housing Assembly. The housing assembly provides a watertight enclosure for the circuit card assembly.

(2) Cover Assembly. The cover assembly contains a Fresnel lens that focuses the light on the target surface.

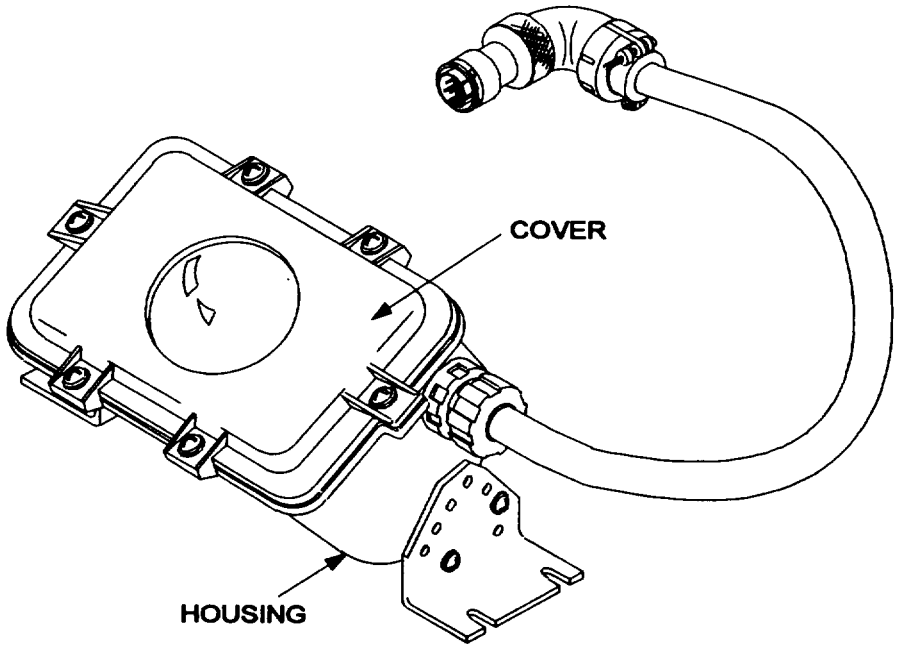


Figure 1-2. Location and Description of Major Components of Small Arms Muzzle Flash Simulator.

b. Gunfire Simulator.

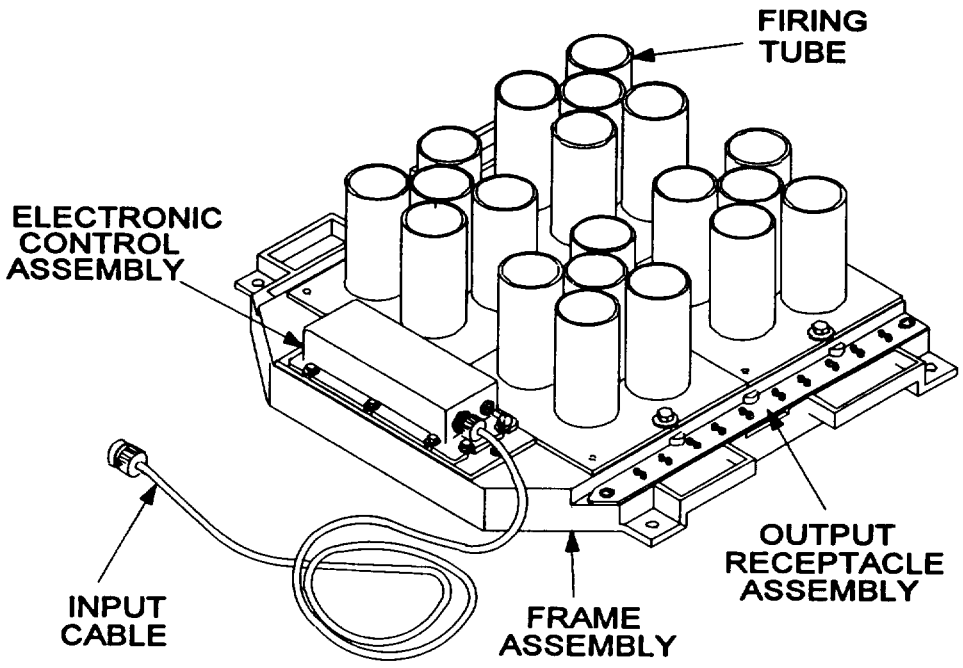


Figure 1-3. Location and Description of Major Components of Gunfire Simulator.

1-14. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS (CONTINUED).

(1) Firing Tube Assembly. The firing tube assemblies house the pyrotechnic cartridges prior to firing**.** There is no electrical connection to the firing tube assemblies.

(2) Output Receptacle. The output receptacles provide the electrical connection to detonate the pyrotechnic cartridges.

(3) Frame Assembly. The frame assembly provides the base for the firing tube assemblies and houses the electronic control assembly and output receptacles.

(4) Electronic Control Assembly. The electronic control assembly receives the firing command through the input cable and routes it to the output receptacles in sequential order**.** The control unit sequences to the next receptacle for each firing command received beginning with the current position of the counter and ending with 20.

c. Small Arms Sound Simulator.

(1) Barrel Assembly. The barrel assembly contains the frame, barrel and combustion chamber for the SASS.

(2) Oxygen Pressure Regulator. The oxygen pressure regulator reduces the inlet pressure from 2000 PSIG to 110 +10 PSIG (13.78 to 0.76 + 0.07 kPa).

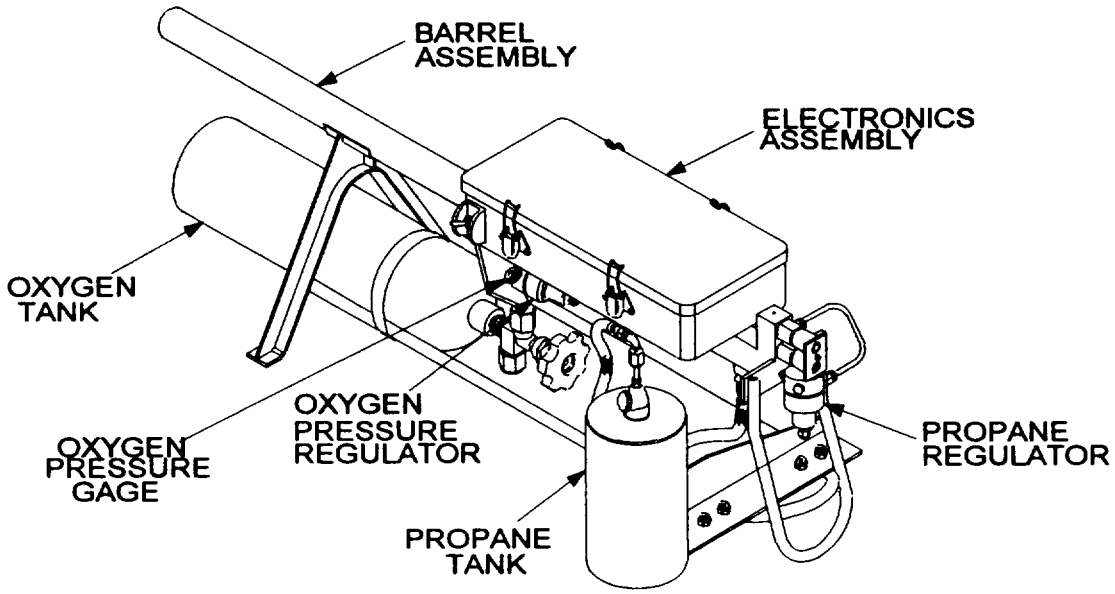


Figure 1-4. Location and Description of Major Components of Small Arms Sound Simulator.

(3) Oxygen Tank. The oxygen tank contains 20 cubic feet (0.56 cubic meters) of liquid oxygen.

(4) Oxygen Pressure Gauge. The oxygen pressure gauge measures the amount of oxygen in the oxygen tank.

(5) Propane Regulator. The propane regulator reduces the inlet pressure from 200 PSIG to 30 f3 PSIG (1.378 to 0.2067 ±.0207 kPa).

(6) Propane Tank. The propane tank contains 16.4 oz (464.92 gr) of commercial propane**.** Enough propane for 2500 shots before reloading.

(7) Electronics Assembly. The electronics assembly receives signal and power from the ITM and fires the SASS on command.

1-15. EQUIPMENT DATA.

Table 1-2. Equipment Data.

PHYSICAL CHARACTERISTICS	
Small Arms Muzzle Flash Simulator:	
Weight	3 lbs (1.36 kg)
Height	5 in (12.70 cm)
Length	8 in (20.32 cm)
Width	6 in (15.24 cm)
Gunfire Simulator:	
Weight	116 lbs (52.20 kg)
Height	10 in (25.40 cm)
Length	26 in (66.04 cm)
Width	30 in (76.20 cm)
Small Arms Sound Simulator:	
Weight	15 lbs (6.75 kg)
Height	12 in (30.48 cm)
Length	12 in (30.48 cm)
Width	32.5 in (82.55 cm)
ENVIRONMENTAL	
Small Arms Muzzle Flash Simulator:	
Temperature	-25 to 110 °F (-32 to 43 °C)
Relative Humidity	5 to 95 percent
Low Pressure Limit	16.9 Hg (15,000 ft altitude)

1-15. EQUIPMENT DATA (CONTINUED).

Table 1-2. Equipment Data (Continued).

Gunfire Simulator:	
Temperature	-25 to 149 °F (-32 to 65 °C)
Relative Humidity	5 to 95 percent
Low Pressure Limit	16.9 Hg (15,000 ft altitude)
Watertight	3-foot head (0.91 meter)
Small Arms Sound Simulator:	
Temperature	-25 to 110 °F (-32 to 43 °C)
Relative Humidity	5 to 95 percent
Low Pressure Limit	16.9 Hg (15,000 ft altitude)
POWER REQUIREMENTS	
Small Arms Muzzle Flash Simulator	24 +0.5 vdc from the ITM
Gunfire Simulator	12 ±1 vdc, 2.2 A, approximate duration 140 milliseconds
Small Arms Sound Simulator	24 ±1.5 vdc from the ITM

1-16. EQUIPMENT CONFIGURATION.

All RETS ranges are constructed differently. The configuration will depend upon design, climate, terrain, and mission. This technical manual was developed to the technical data packages. There are other configurations of the MFS, GUFS, and SASS 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

1-17. EQUIPMENT OPERATION.

a. Small Arms Muzzle Flash Simulator. The MFS receives power and control signals from the ITM or TIU. A single flash of light is produced for each input control pulse. The MFS provides a connecting point for control signals and power signals for the SASS. The MFS is provided with a pigtail assembly through which it receives power and control signals. Wiring for the SASS is included in the pigtail assembly.

b. Gunfire Simulator. The GUFS receives power and control from the THM/TG or AMTC. The SAFE/ARM switch interrupts power in the safe position. In the arm position, power is routed to safety interlock circuit. The safety interlock circuit provides an automatic 60 120 second time delay before permitting power to be applied to the ignition circuits. If fire command is received during lockout sequence, timing of the safety delay is reset and time delay is reinitiated. There must be a minimum delay of two seconds between fire commands. The last port fired is retained in memory even with the power disconnected as long as the safe arm switch is in the arm position. The firing sequence is reset when the arm switch is placed in the safe position.

c. Small Arms Sound Simulator. The SASS produces an audible sound of rifle fire. When a command pulse is received from the ITM or TIU, a mixture of oxygen and propane are released into a combustion chamber. A spark ignites the mixture in the combustion chamber, producing the audible sound.

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 simulators. It provides preliminary procedures which are required to place the unit in service.

2-2. CONTROLS AND INDICATORS.

Controls and indicators for the Gunfire Simulator (GUFS) are described in table 2-1 and illustrated in figure 2-1. The controls and indicators for the Small Arms Sound Simulator (SASS) are described in table 2-2 and illustrated in figure 2-2.

Table 2-1. Gunfire Simulator Controls and Indicators.

ITEM	NAME	FUNCTION
1	SAFE/ARM SWITCH	In SAFE position input power is disconnected preventing accidental ignition of pyrotechnic charge.

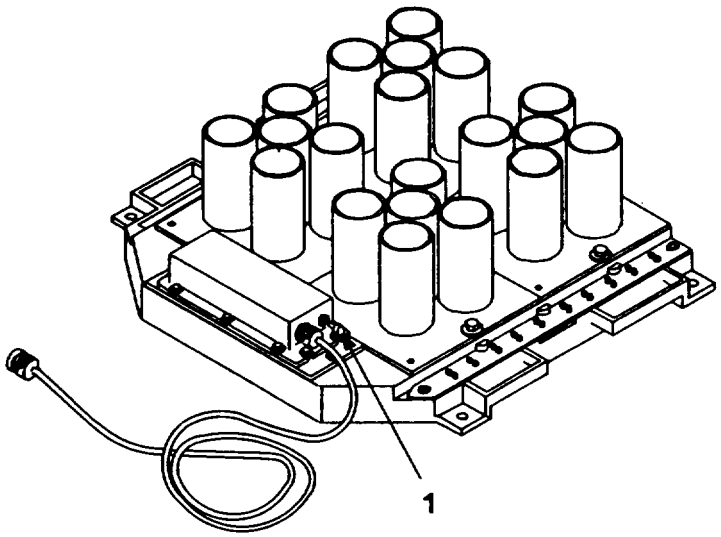


Figure 2-1. Gunfire Simulator Controls and Indicators.

2-2. CONTROLS AND INDICATORS (CONTINUED).

Table 2-1. Small Arms Sound Simulator Controls and Indicators.

ITEM	NAME	FUNCTION
1	Circuit Breaker	Serves as an on/off switch and provides overload protection.
2	Oxygen Gage	Indicates the pressure of the oxygen cylinder. Calibrated in PSIG.
3	Oxygen Shutoff Valve	Controls the flow of oxygen to the oxygen pressure regulator. Fully open during operation.
4	Propane Shutoff Valve	Controls the flow of propane to the propane pressure regulator. Fully open during operation.

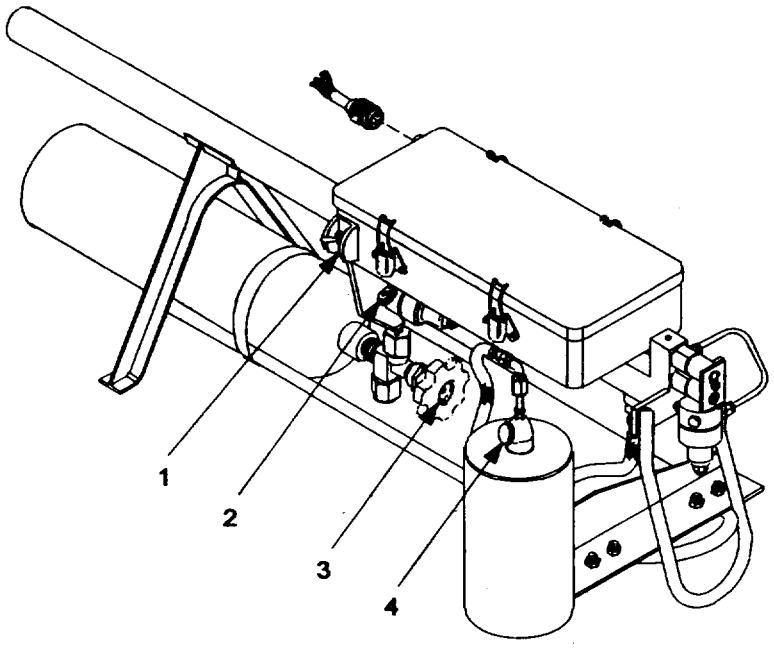


Figure 2-2. Small Arms Sound Simulator Controls and Indicators.

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.

c. Before You Operate. Always keep in mind the WARNINGS and CAUTIONS. Perform your (B) PMCS prior to the MFS, GUFS, and SASS performing their intended mission.

d. While You Operate. Always keep in mind the WARNINGS and CAUTIONS. Perform your during (D) PMCS when the MFS, GUFS, and SASS are being used for their intended mission.

e. After You Operate. Be sure to perform your after (A) PMCS after the MFS, GUFS, and SASS have been taken out of their mission mode.

f. If Your Equipment Fails to Operate. Troubleshoot with proper equipment. Report any deficiencies using the proper forms. See DA Pam 738750.

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, 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 MFS, GUFS, and SASS since the last weekly.

(2) You are operating the MFS, GUFS, and SASS 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.

2-3. GENERAL (CONTINUED).

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 unit 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 2-3. Operator Preventive Maintenance Checks and Services.

ITEM NO.	INTERVAL B	D	A	ITEM TO BE INSPECTED	PROCEDURES CHECK FOR AND HAVE REPAIRED OR ADJUSTED AS NECESSARY	EQUIPMENT NOT READY/ AVAILABLE IF:
1	•		•		SMALL ARMS MUZZLE FLASH SIMULATOR Visually inspect the simulator for physical damage. Report any damage to next higher level of maintenance.	Physical damage is present
					GUNFIRE SIMULATOR	
					**WARNING** Prior to arming, disarming or performing maintenance, always touch metal frame of GUFS so as to ground static electricity. Failure to do so could cause serious injury or death due to accidental ignition of pyrotechnic charges. Never lean, bend or stand directly over a firing tube of externally fired simulator when loading/unloading. Doing so could cause serious injury or death due to accidental ignition of pyrotechnics. Disarm, then disconnect the GUFS connection from control assembly on TTA, ILTEM, or TIU. The GUFS must be disconnected before performing maintenance. Explosion is possible and can cause personal injury and damage to equipment.	
					NOTE At cold temperatures (below -25 degrees F) lead wires of simulators become brittle. Handle wires with care to avoid damage or breakage.	
2	•		•	Firing Tube Assemblies	Visually inspect firing tube assemblies for any debris or bum damage. Remove any loose or flammable material from around the area.	Debris is around simulator.

Table 2-3. Operator Preventive Maintenance Checks and Services (Continued).

ITEM NO.	INTERVAL B	INTERVAL D	INTERVAL A	ITEM TO BE INSPECTED	PROCEDURES CHECK FOR AND HAVE REPAIRED OR ADJUSTED AS NECESSARY	EQUIPMENT NOT READY/ AVAILABLE IF:
3	•		•	Input Cables	Inspect electrical cables and connectors for damaged, missing or broken contacts. Also check for positive plug connections. Report any broken connector to next higher level of maintenance.	Contacts are broken or missing.
4	•		•	Control Assembly	Move the SAFE/ARM switch to the safe and arm positions. Ensure the switch will lock in both positions.	Switch will not lock in each position.
					SMALL ARMS SOUND SIMULATOR	
5	•		•		Visually inspect the simulator for physical damage Report any damage to next higher level of maintenance.	Physical damage is present

SECTION III. OPERATION UNDER USUAL CONDITIONS

2-5 ASSEMBLY AND PREPARATION FOR USE.

The following paragraphs detail the requirements for placing the MFS, GUFS, and SASS in operation.

a. Assembly and Preparation of the Small Arms Muzzle Flash Simulator. To place MFS into operation perform the following steps.

(1) Turn circuit breaker on ITM to the OFF position.

(2) Position MFS so the light will reflect off the target surface.

(3) Connect the cable (1) to J4 on ITM.

(4) Turn circuit breaker on ITM to the on position.

(5) Test the operation using the range control station.

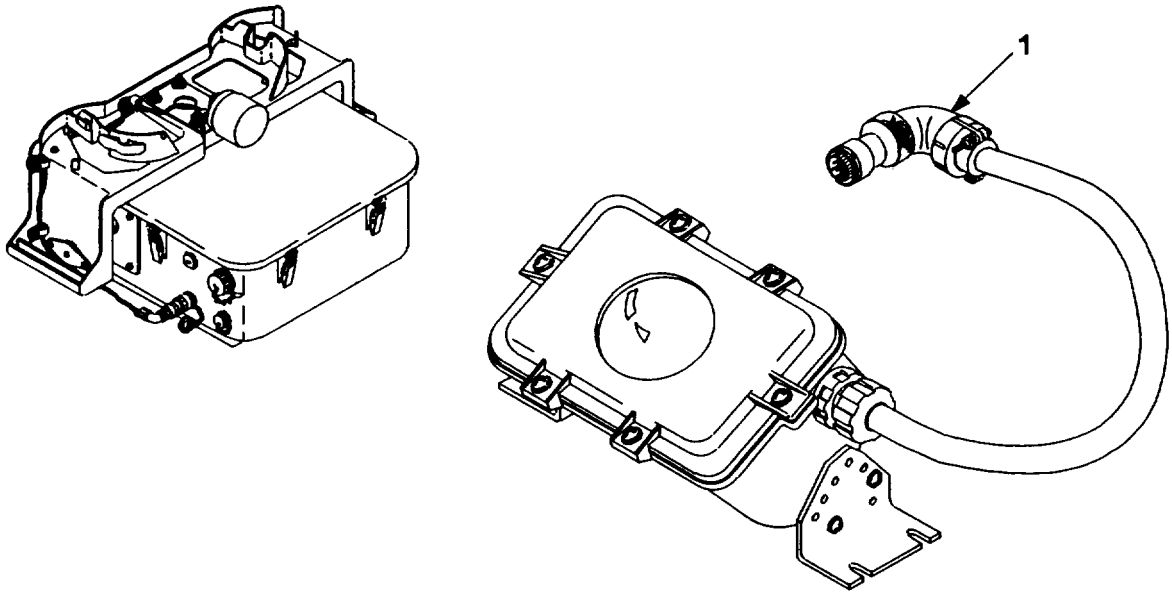


Figure 2-3. Small Arms Muzzle Flash Simulator Assembly.

2-5 ASSEMBLY AND PREPARATION FOR USE (CONTINUED).

b. Assembly and Preparation of the Gunfire Simulator. To place the GUFS in operation, perform the following steps.

NOTES

The GUFS must be placed in an area that is free of dry vegetation. Pyrotechnics charges firing could ignite dry vegetation.

4"x4"x24" wooden posts (2ea.) MAY BE ATTACHED BY LUB BOLTS TO EACH SIDE OF THE Gunfire Simulator prior to emplacement. This will prevent or reduce frame cracking by allowing the expanding gases (created during firing) to be vented more easily!

(1) Position GUFS within 25 ft of target.

(2) Place the SAFE/ARM switch (1) in the SAFE position.

NOTE

If the GUFS is not going to be used for firing exercises omit step 3.

(3) Load firing tubes following the procedures in paragraph 2-8.

(4) Connect the power cable (2) to input jack J1 on the electronic control unit (3).

(5) Connect the other end of the power cable to the electronic control assembly of the THM/TG, or ILTEM. When connected to ST1 (HOSTILE FIRE), the ATKS will fire on command from the transmitter of Range Control Station, 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. Additionally the ATKS may be connected to the THM/TG TIU and the ECU. The location of the TIU connection to the ECU will determine the firing mode of the ATKS (HOSTILE FIRE or SMOKE SCORER).

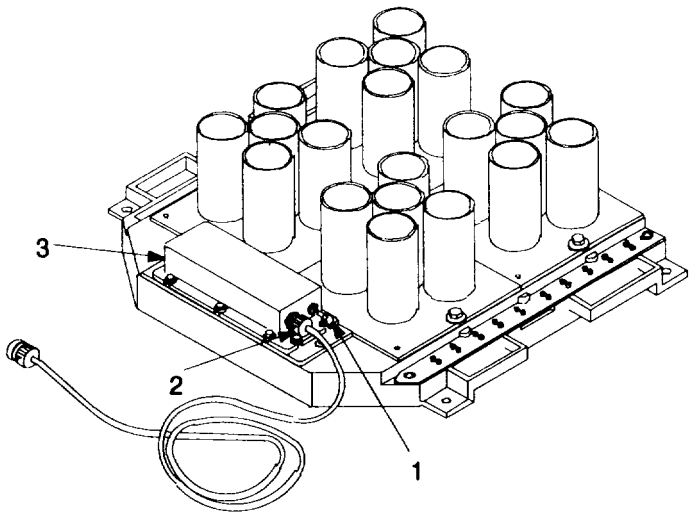


Figure 2-4. Gunfire Simulator.

c. Assembly and Preparation of the Small Arms Sound Simulator. To place the SASS in operation, perform the following steps.

(1) Position propane tank shield (1) on frame assembly.

(2) Install two U-bolts (2) under frame and through propane tank shield.

(3) Fasten the propane tank shield to frame using four washers and nuts.

NOTE

Ensure propane valve Is closed before proceeding to step 4.

(4) Insert propane tank (3) through propane shield lid and screw propane tank onto propane valve. Place propane tank into shield.

(5) Position oxygen cylinder (4) in frame assembly and fasten tie-down strap.

(6) Connect oxygen pressure regulator (5) on the oxygen cylinder.

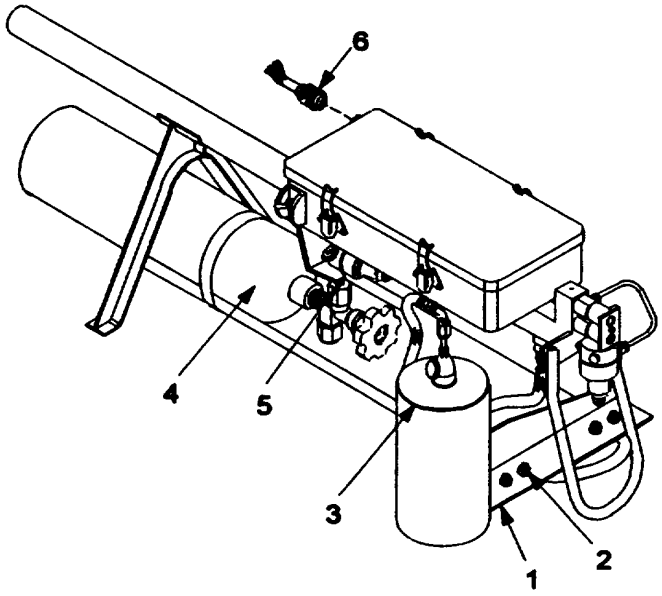


Figure 2-5. Small Arms Sound Simulator Assembly.

(7) Turn off circuit breaker on ITM.

(8) Connect power cable W106 (6) to MFS and J1 on control assembly.

(9) Turn circuit breaker on ITM to ON position.

(10) Open propane valve to the fully open position.

(11) Open oxygen control pressure valve to the fully open position.

(12) Turn circuit breaker on control assembly to the ON position.

(13) Test the operation using the range control station.

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

There are no initial adjustments or self-test for the MFS, GUFS, and SASS. Daily checks are performed during PMCS.

2-7 CONFIGURATION CHANGES TO THE ARMOR TARGET KILL SIMULATOR (ATKS)IGUNFIRE SIMULATOR (GUFS).

a. Due to a potential safety problem identified with the Gunfire Simulator (GUFS), a redesign of the electronic control unit was accomplished. This involved circuitry changes on the circuit card found within the control unit, a material change for the upper and lower housing assemblies, and the addition of an air valve. The new model GUFS created by the change is distinguished from the original configuration by the addition of a "-1" added to the end of the affected part numbers (except for the circuit card which has an entirely new part number) as shown below.

ITEM NAME	OLD PIN	NEW PIN
GUFS ASSEMBLY	12725085	12725085-1
GUFS	12725001	12725001-1
CONTROL UNIT	12725014	12725041-1
LOWER HOUSING	12725026	12725026-1
UPPER HOUSING	12725015	12725015-1
CIRCUIT CARD	12725073	12725086 *

*The old P/N is no longer stocked.

b. The old version of the GUFS can still be used with the radio controlled (non RETS range) Target Holding Mechanism/Tank Gunnery (THM/TG) ONLY. There is no safety problem when used with the radio controlled (non RETS range) THM/TG, only when used with the hardwire version (RETS range) of the THM/TG does the safety problem come into play. The new version can be used with both the radio (non RETS range) and hardwire controlled (RETS range) THM/TG. If both the new and old versions of the GUFS are utilized on a single installation, the possibility exists that the old versions could be used on RETS ranges (with hardwired THM/TGs). Failure to convert **ALL** GUFS to the newer configuration could result in injury to personnel. Therefore, it is recommended that the old control unit (P/N 12725014, NSN 6920-01-206-0177) be replaced on all old versions of the GUFS.

c. The old upper and lower housings had a material change which prevented water from entering the control unit and corroding the electronics. The old housings were made from a porous type of material which allowed water to actually seep through the housing. A valve was added to allow for the purging and addition of nitrogen to allow for a positive pressure when comparing the inside pressure to the outside pressure. This also prevented water/moisture from entering the control unit. Finally, circuit changes were implemented on the circuit card to include a timing lockout circuit which blocks all signals for a period of sixty seconds after the safe/arm switch is placed in the arm position. This circuit will automatically reset and repeat the lockout timing sequence upon receipt of any power transients during the lockout period. Included in the design is a feature which ensures that no single point failure modes will allow the likelihood of a charge being activated while personnel are in the area.

d. When an old version of the GUFS fails due to something in the control unit, it is highly recommended to replace the entire control unit. By doing this the GUFS will become the new configuration and the part numbers will need to reflect the new part numbers identified above for the GUFS assembly on down.

2-8 LOADING PYROTECHNIC CARTRIDGES.

a. Military pyrotechnics must be handled with care at all times. Besides the hazardous pyrotechnic composition, pyrotechnics are composed of sensitive compositions and primers.

b. Personnel not directly involved in loading of pyrotechnic cartridges must remain at least 100 feet from the Gunfire Simulator while loading is in progress. Firing equipment and target can be accidentally activated; therefore, only personnel who have been instructed in the methods of safe operation of the RETS components and simulators shall be authorized to enter when this equipment is in use.

c. Prior to loading, cable connection, maintenance service or transportation, the arm switch on the GUFS must be in the OFF position (switch down).

WARNING

Prior to arming, disarming or performing maintenance, always touch metal frame of GUFS so as to ground static electricity. Failure to do so could cause serious injury or death due to accidental ignition of pyrotechnic charges.

WARNING

For radio transmission less than 100 watts (including antenna gain): no radio transmission shall be permitted within three meters (approximately ten feet) from pyrotechnic items. This applies to all radio transmissions, including mobile.

WARNING

For radio transmissions greater than 100 watts but less than 320 kilowatts (including antenna gain): no radio transmission shall be permitted within 200 meters (approximately 660 feet) from all pyrotechnic items.

WARNING

Extreme caution should be exercised when handling pyrotechnic cartridges. Do not remove shorting cap until ready to install ignition plug into gunfire simulator output receptacle. Doing so may cause serious injury or death due to accidental ignition of pyrotechnic charges.

2-8 LOADING PYROTECHNIC CARTRIDGES (CONTINUED).

WARNING

Personnel loading/unloading the device should be qualified to handle electrically initiated pyrotechnics and shall wear approved hearing protection, hard hat, face shield (NSN 8415-01-039-6000) per MIL-STD-1202 and high-temperature gloves (combat vehicle crewman type, NSN 8415-01-074-9428). Failure to do so could cause serious injury or death due to accidental ignition of pyrotechnic charges.

WARNING

Only M21 cartridges (PIN 9349243, NSN 1370-01-128-0418) are authorized for use in the gunfire simulator. Unauthorized pyrotechnic cartridges can cause personal injury and/or damage to equipment.

WARNING

Never lean, bend or stand directly over a firing tube or externally fired simulator when loading. Doing so could cause serious injury or death due to accidental ignition of pyrotechnic charges.

WARNING

Never load the simulators into the GUFS during thunder or lightning storms. Doing so may cause serious injury or death due to accidental ignition of pyrotechnic charges.

CAUTION

Due to electromagnetic radiation (EMR) susceptibility, pyrotechnic items shall remain in aluminized barrier bags. Simulators are permitted outside barrier bags only during the loading and unloading of the GUFS system. When pyrotechnic items are not in their standard aluminized barrier bags, the preceding warnings apply.

CAUTION

At cold temperatures (below -25 degrees F) lead wires of simulators become brittle. Handle wires with care to avoid damage or breakage.

NOTE

Prior to operation inspect for damaged or misfired simulators. Damaged simulators will be removed in accordance with misfire disposal procedures and local EOD procedures.

NOTE

Unexpended simulators shall be transported to the applicable servicing Ammunition Supply Point (ASP).

NOTE

Insure that the GUFS is not physically damaged and that it has been properly serviced and maintained. Inspect firing tubes for debris or bum damage. Inspect electrical cables for damage and check for positive plug connections. Inspect simulator 2-prong receptacle holes for sand or other debris. Holes shall be cleaned and damaged cables replaced.

NOTE

If damaged, GUFS shall be disarmed and cleared of any live simulators in accordance with misfire disposal procedures and local EOD procedures.

d. Loading Procedures:

(1) Remove the cartridges (1), P/N 9349243, NSN 1370-01-128-0418, from their storage container.

(2) Remove closure tape (2) securing protective cap (3) to M21 cartridge.

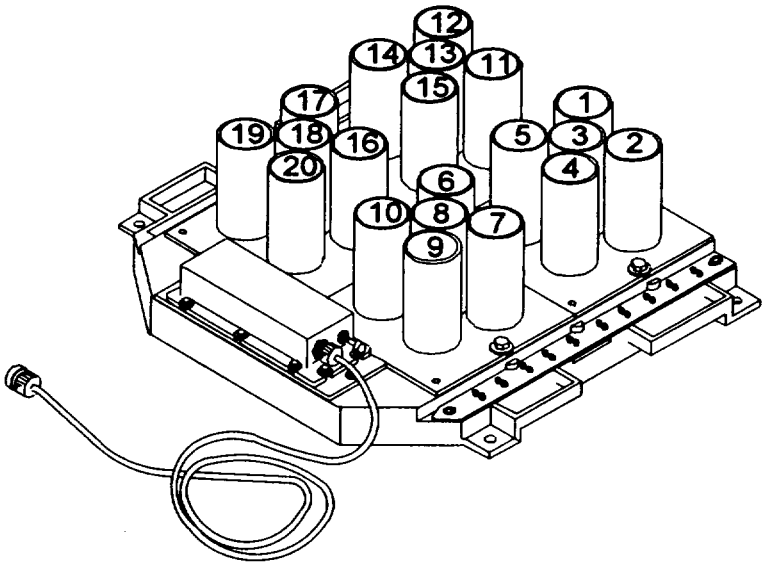


Figure 2-6. Firing Tubes Numbering.

2-8 LOADING PYROTECHNIC CARTRIDGES (CONTINUED).

(3) Loading of each firing tube assembly starts at its inner most firing tube and is loaded to the outer most firing tube. This provides the maximum operator safety. Refer to figure 2-6 for numbering of the tubes. Starting from the rear right hand cluster of tubes the following loading sequence must be followed:

LOADING SEQUENCE

Cluster 1 - Load in sequence firing tube numbers 1, 5, 3, 2, and 4.
Cluster 2 - Load in sequence firing tube numbers 10, 6, 8, 7, and 9.
Cluster 3 - Load in sequence firing tube numbers 11, 15, 13, 12, and 14.
Cluster 4 - Load in sequence firing tube numbers 16, 20, 18, 17, and 19.

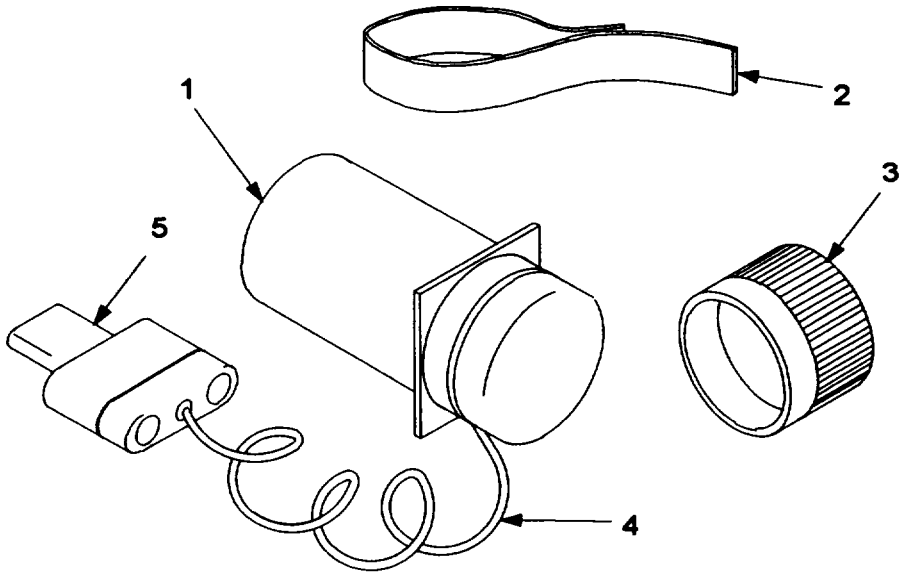


Figure 2-7. Loading Pyrotechnics.

(4) Carefully uncoil the ignition leads (4) to the cartridge, and install the cartridge into the firing tube with styrofoam end up.

(5) Run the leads to the corresponding output receptacle in sequence beginning with tube number one. See figure 2-6.

(6) Remove shorting safety cap (5) from the cartridge ignition plug, and install the plug into the output receptacle corresponding to the firing tube. Save safety caps for possible use in capping misfires.

(7) Repeat steps (1) through (6) for each of the twenty positions.

2-9 MISFIRE DISPOSAL AND UNLOADING PROCEDURES.

WARNING

Prior to arming, disarming or performing maintenance, always touch metal frame of GUFS so as to ground static electricity. Failure to do so could cause serious injury or death due to accidental ignition of pyrotechnic charges.

WARNING

For radio transmission less than 100 watts (including antenna gain): no radio transmission shall be permitted within three meters (approximately ten feet) from pyrotechnic items. This applies to all radio transmissions, including mobile.

WARNING

For radio transmissions greater than 100 watts but less than 320 kilowatts (including antenna gain): no radio transmission shall be permitted within 200 meters (approximately 660 feet) from all pyrotechnic items.

WARNING

Extreme caution should be exercised when handling pyrotechnic cartridges. Failure to do so may cause serious injury or death due to accidental ignition of pyrotechnic charges.

WARNING

Personnel unloading the device should be qualified to handle electrically initiated pyrotechnics and shall wear approved hearing protection, hard hat, face shield (NSN 8415-01-039-6000) per MIL-STD-1202 and high-temperature gloves (combat vehicle crewman type, NSN 8415-01-074-9428). Failure to do so could cause serious injury or death due to accidental ignition of pyrotechnic charges.

WARNING

Never lean, bend or stand directly over a firing tube or externally fired simulator when loading. Doing so could cause serious injury or death due to accidental ignition of pyrotechnic charges.

2-9 MISFIRE DISPOSAL AND UNLOADING PROCEDURES (CONTINUED)

WARNING

When an unfired simulator is found, immediately move 100 feet away from simulator and wait 15 minutes after activation. This will allow any slow burning pyrotechnic to ignite fully. Failure to do so could cause serious injury or death due to accidental ignition of pyrotechnic charges.

WARNING

Do not pull plug out of its receptacle by jerking or pulling on wire (ignition leads). This may sever a lead and cause it to become an aerial for electromagnetic radiation. This will give a false feeling of safety (if the lead is internally severed) to those observing that the shorting safety cap is properly positioned.

CAUTION

Due to electromagnetic radiation (EMR) susceptibility, pyrotechnic items shall remain in aluminized barrier bags. Simulators are permitted outside barrier bags only during the loading and unloading of the GUFS system. When pyrotechnic items are not in their standard aluminized barrier bags, the preceding warnings apply.

NOTE

This paragraph contains the procedures necessary for handling M21 artillery flash simulators that are suspected of having been actuated but did not function.

a. Misfire Disposal:

(1) Upon completion of firing cycle remove the remote firing power source (cable) to the GUFS and visually inspect GUFS unit for any simulators not fired.

(2) Move 100 feet away and wait 15 minutes to allow any slow burning pyrotechnic to fully ignite.

(3) Recheck that power has been turned off.

(4) Touch the GUFS frame to discharge any static electricity.

(5) Place the SAFE/ARM switch in the down position.

(6) Unplug the ignition leads from output receptacle and install shorting plug leads.

NOTE

When shorting safety cap is unavailable, cut off simulator plug, strip one inch of insulation from remaining lead ends and twist bare wires together to effect a short circuit.

(7) Immediately move 100 feet away and wait 15 minutes.

(8) After the 15 minute wait: remove unfired round, coil ignition leads and place on top of simulator, and store in suitable container. Surround with sand, cover, and leave in area suitable for temporary storage.

(9) Transfer to the servicing ammunition supply point.

b. Unloading Procedures: Unloading procedures for the GUFS are as stated below. Unload GUFS in the following sequence. (Refer to figure 2-6.)

(1) Tube positions 2, 4, 3, 1, and 5

(2) Tube positions 7, 9, 8, 6, and 10

(3) Tube positions 14, 12, 13, 11, and 15

(4) Tube positions 19, 17, 18, 16, and 20

2-10 DECALS AND INSTRUCTION PLATES.

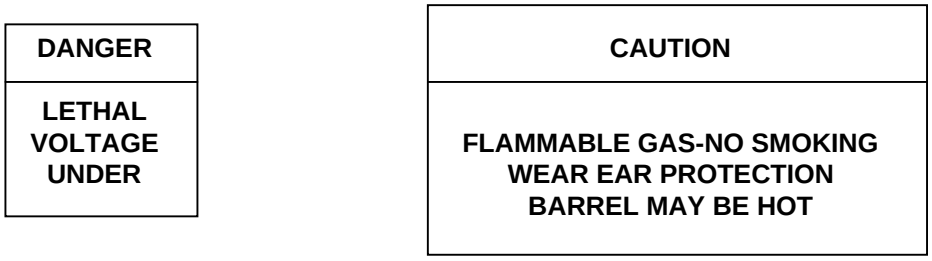


Figure 2-8. Small Arms Sound Simulator Decals.

CHAPTER 3

OPERATOR MAINTENANCE INSTRUCTIONS

SECTION I. LUBRICATION INSTRUCTIONS

3-1 LUBRICATION. There is no lubrication required for the Small Arms Muzzle Flash Simulator (MFS), Gunfire Simulator (GUFS), or Small Arms Sound Simulator (SASS).

SECTION II. OPERATOR TROUBLESHOOTING PROCEDURES

3-2 GENERAL Operator troubleshooting of the MFS, GUFS, and SASS is limited to testing for proper operation of the unit and reporting any malfunctions to unit maintenance. To test the MFS, GUFS, and SASS, refer to paragraph 2-5.

SECTION III. OPERATOR MAINTENANCE PROCEDURES

3-3 INTRODUCTION. Operator maintenance is limited to PMCS and loading/unloading of the Gunfire Simulator.

CHAPTER 4

MAINTENANCE INSTRUCTIONS

SECTION I. SERVICE UPON RECEIPT

4-1 GENERAL

The Small Arms Muzzle Flash Simulator (MFS) and Gunfire Simulator (GUFS) require no service upon receipt. The Small Arms Sound Simulator (SASS) requires assembly of the propane can tank shield. Refer to paragraph 2-5.

SECTION II. 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 simulators 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 738750.

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 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.

4-3 PMCS PROCEDURES (CONTINUED).

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

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

(2) You are operating the simulators 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.** 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 D	W	M	ITEM TO BE INSPECTED	PROCEDURES CHECK FOR AND HAVE REPAIRED OR ADJUSTED AS NECESSARY	EQUIPMENT NOT READY/ AVAILABLE IF:
					SMALL ARMS MUZZLE FLASH SIMULATOR	
1	•			Cover Assembly	Visually inspect the cover assembly for a cracked lens or evidence of leaking.	Lens is cracked or evidence of leaking.
					GUNFIRE SIMULATOR	
2	•			Gunfire Simulator	Visually inspect the gunfire simulator for physical damage.	Damage to any firing receptacles or firing tubes.
					SMALL ARMS SOUND SIMULATOR	
3	•			Oxygen Pressure Gage	Inspect pressure gage for cracks.	Gage is broken.
					Check pressure reading on gage.	Pressure reading is below 100 PSIG.

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 simulators. You should perform the test/inspections and corrective actions in the order listed. Before you begin troubleshooting the simulators, 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 24 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.

4-4 TROUBLESHOOTING PROCEDURES (CONTINUED).

WARNING

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
Muzzle Flash Simulator is inoperable.	1
No cartridges fired when target is hit	2
Small Arms Sound Simulator is inoperable.	3

Table 4-2. Unit Troubleshooting Procedures.

Malfunction Test or Inspection Corrective Action

Muzzle Flash Simulator

1. Muzzle flash simulator is inoperable.

If muzzle flash simulator is inoperable, remove and notify next higher level of maintenance.

Gunfire Simulator

2. No cartridges fired when target was hit.

WARNING

Prior to arming, disarming or performing maintenance, always touch metal frame of GUFS as to ground static electricity. Failure to do so could cause serious injury or death due to accidental ignition of pyrotechnic charges.

Step 1. Check that input cable is connected to proper output receptacle of THM/TG, ILTEM, or TIU.

If improperly connected, disconnect and reconnect to proper output receptacle.

If connected properly, remove cable and check continuity using the following table.

Table 4-2. Unit Troubleshooting Procedures (Continued).

Malfunction Test or Inspection Corrective Action		
	P1	**P2**
	N	A
	I	F
	J	E
	K	B
	A	G
	M	B

If continuity does not exist, replace defective cable.

If cable is good notify next higher level of maintenance.

WARNING

Purge the SASS prior to maintenance or troubleshooting by removing the solenoid assembly. Failure to do so could result in ignition of trapped gasses in the combustion chamber which could cause personal injury and damage to equipment.

3. Small Arms Sound Simulator is inoperable.

Step 1. Ensure the propane and oxygen cylinder are properly installed. Ensure the circuit breaker is in the ON position.

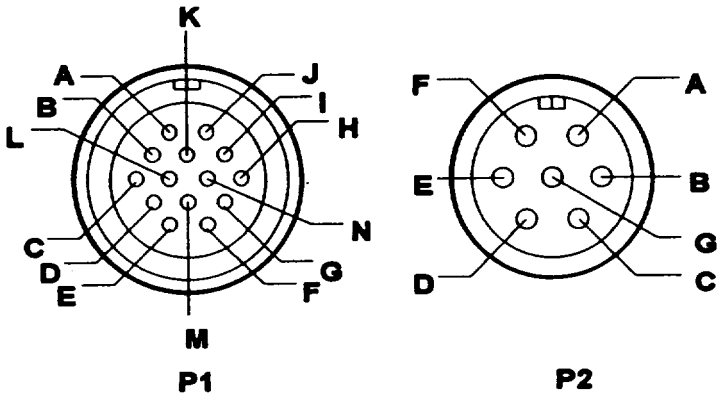
If either propane tank or oxygen cylinder is not properly installed, remove and reinstall cylinders/tank. If, upon command from the RCS, the SASS still does not function, proceed to step 2.

Step 2. Ensure that the power/data cable W106 is properly connected.

If cable W106 is not properly connected, disconnect and reconnect cable. If, upon command from the RCS, the simulator still does not fire, proceed to step 3.

Table 4-2. Unit Troubleshooting Procedures (Continued).

Malfunction Test or Inspection Corrective Action



Small Arms Sound Simulator

Step 3. Ensure that oxygen cylinder and propane tank are full.

If oxygen cylinder or propane tank is not full, replace it

If, upon command from RCS, the SASS still does not function, remove power cable W106 and test pin to pin for continuity and shorts. Pin B is not used. Replace defective cable.

If SASS still does not function go to step 4.

Step 4. Reconnect cable and turn CB1 on. Have RCS send burst command to SASS. Listen for an audible clicking sound at solenoids.

If no clicking is heard or only one solenoid is heard, turn off oxygen and propane. Turn CBI off and remove J2. Using multimeter, test for continuity of the solenoids between pins A and B and pins D and E. Replace defective solenoid assembly.

If continuity exists, using multimeter check for a surge up to 12 vdc between pins A and B and pins D and E of J2. If no voltage is present, replace the electronics assembly.

If reading is good, reconnect cable and go to step 5.

Table 4-2. Unit Troubleshooting Procedures (Continued).

Malfunction Test or Inspection Corrective Action

WARNING

High voltage is present when cover is open and commands are sent by the RCS. Care must be taken to prevent electrical shock.

Step 5. Remove cover of electronics assembly. Using multimeter between pins 4 and 5 of TB2, check for a surge up to 12 vdc to the primary side of coil when a command is sent from the RCS.

If 12 vdc is not present replace electronics assembly. If 12 vdc is present go to Step 6.

Step 6. Turn off CB1. Remove high voltage wire from spark plug. Turn on CB1. Ground high voltage wire to frame. When a command is sent from the RCS a spark should be seen.

If spark is visible, turn off CB1, and regap or replace spark plug.

If spark is not visible, turn off CB1 and replace coil assembly.

SECTION IV. UNIT MAINTENANCE PROCEDURES

4-5 GENERAL.

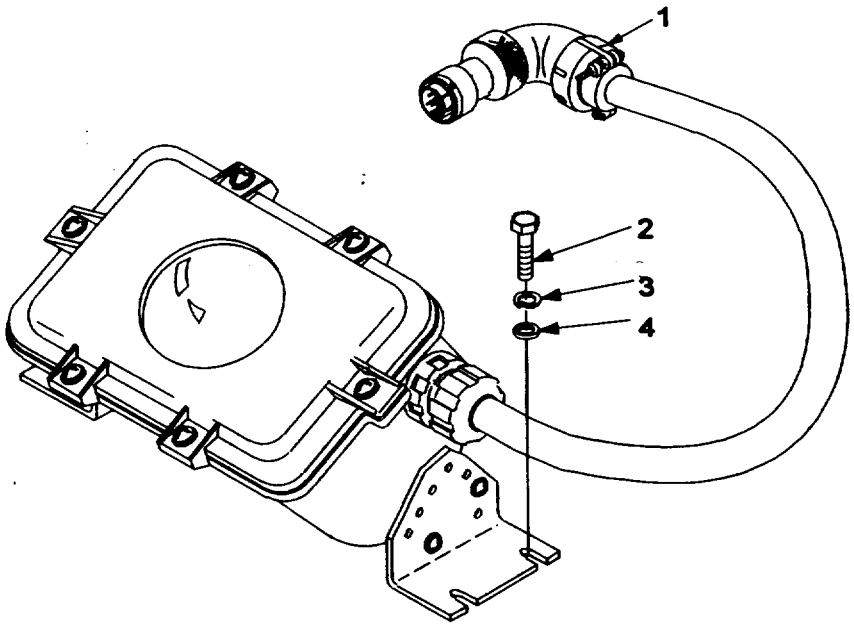
This section contains the instructions for removal, repair, and installation of major components of the MFS, GUFS, and SASS. The instructions consist of the initial setup and step-by-step procedures to perform the task.

4-6 MFS REPLACEMENT.

INITIAL SETUP

Tools:
General Mechanic's Automotive Tool Kit

Materials/Parts:
Small Arms Muzzle Flash Simulator (11829682)



a. Removal.

(1) Turn circuit breaker on ITM to the OFF position.

(2) Disconnect cable assembly (1) from ITM.

(3) Remove four mounting bolts (2), lockwashers (3), and flatwashers (4).

(4) Remove small arms muzzle flash simulator.

b. Installation.

(1) Position small arms muzzle flash simulator on range.

(2) Install four flatwashers (4), lockwashers (3), and mounting bolts (2).

(3) Connect cable assembly (1) to ITM.

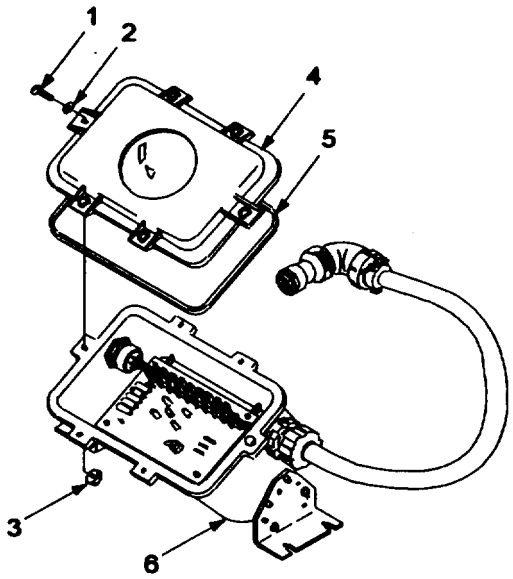
(4) Test the operation using range control station.

4-7 MFS O-RING REPLACEMENT.

INITIAL SETUP

Tools:
General Mechanic's Automotive Tool Kit
Torque Screwdriver
Grease (item 7, appendix D)

Materials/Parts:
O-Ring (11829556)
Adhesive (item 1, appendix D)



a. Removal.

(1) Turn circuit breaker on ITM to the OFF position.

(2) Remove six screws (1), flatwashers (2), and nuts (3).

(3) Remove cover (4).

(4) Remove O-ring (5) from housing (6) and clean housing surface.

b. Installation.

(1) Apply adhesive to comers and center of long sides of housing (6).

(2) Install O-ring (5) in housing.

(3) Apply grease to surface of O-ring.

(4) Install cover (4) on housing using six screws (1), flatwashers (2), and nuts (3).

(5) Torque cover screws to 27-30 inch pounds.

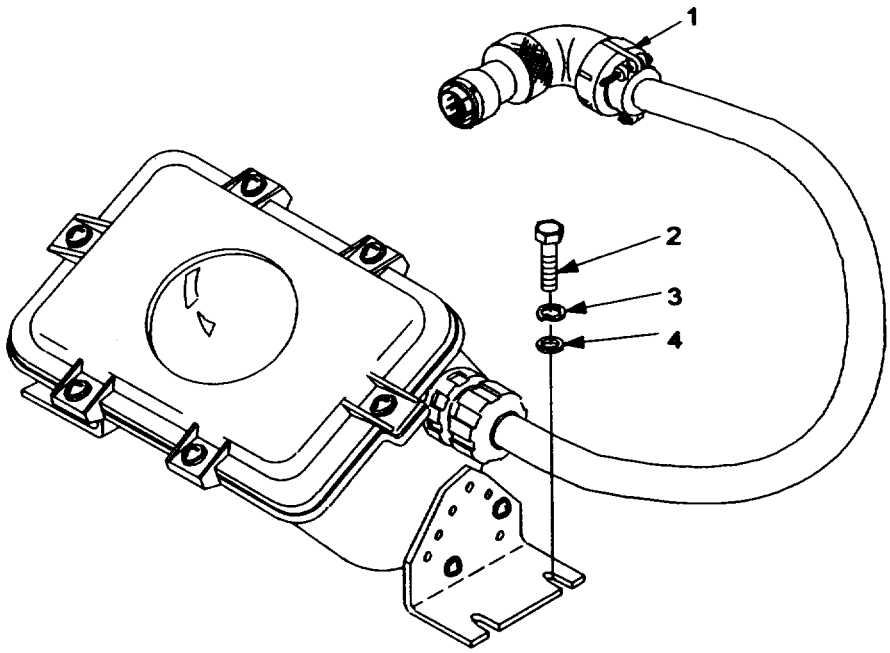
(6) Turn CB1 on ITM to the ON position.

4-8 MFS COVER REPLACEMENT.

INITIAL SETUP

Tools:
General Mechanic's Automotive Tool Kit
Torque Screwdriver

Materials/Parts:
Cover (11829683)



a. Removal.

(1) Turn CB1 on ITM to the OFF position.

(2) Remove six screws (1), washers (2), and nuts (3).

(3) Remove cover (4) from housing (5).

b. Installation.

(1) Position cover (4) on housing (5).

(2) Install six screws (1), washers (2), and nuts (3).

(3) Torque cover screws to 27-30 inch pounds.

(4) Turn CB1 on the ITM to the ON position.

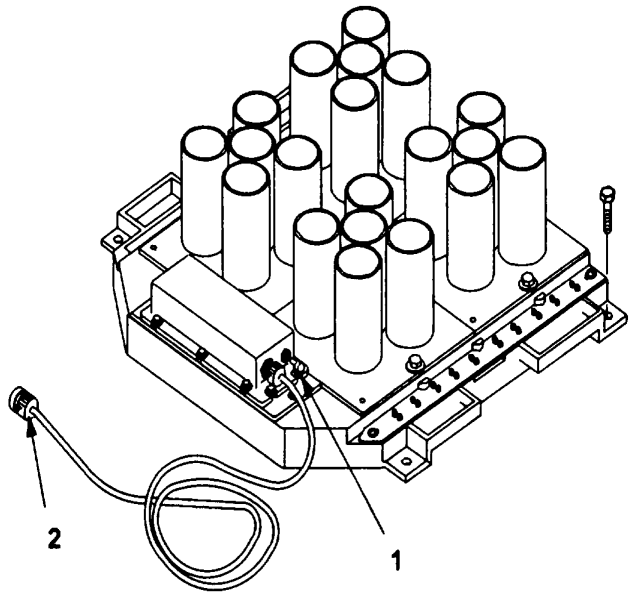
4-9 GUFS REPLACEMENT.

INITIAL SETUP

Tools:
General Mechanic's Automotive Tool Kit

Materials/Parts:
2 Persons

Materials/Parts:
Gunfire Simulator (12725085-1)



a. Removal.

WARNING

Prior to arming, disarming or performing maintenance, always touch metal frame of GUFS as to ground static electricity. Failure to do so could cause serious injury or death due to accidental ignition or pyrotechnic charges.

Never lean, bend or stand directly over a firing tube or externally fired simulator when loading/unloading. Doing so could cause serious injury or death due to accidental ignition of pyrotechnic charges.

Disarm, then disconnect the GUFS connection from control assembly on the TTA, ILTEM or TIU. The GUFS must be disconnected prior to performing maintenance. Explosion is possible and can cause personal injury and/or damage to equipment

4-9 GUFS REPLACEMENT (CONTINUED).

(1) Assure all firing tubes are unloaded prior to removing GUFS. Refer to paragraph 2-9.

(2) Place the SAFE/ARM switch (1) in the down position.

(3) Disconnect the power cable (2) from the power source.

(4) Remove mounting hardware.

(5) Remove the GUFS.

b. Installation.

(1) Position GUFS on range.

(2) Install mounting hardware.

NOTE

Do not perform the next steps until the GUFS is loaded. Refer to paragraph 2-4.

(3) Connect the power cable (2) to the power source.

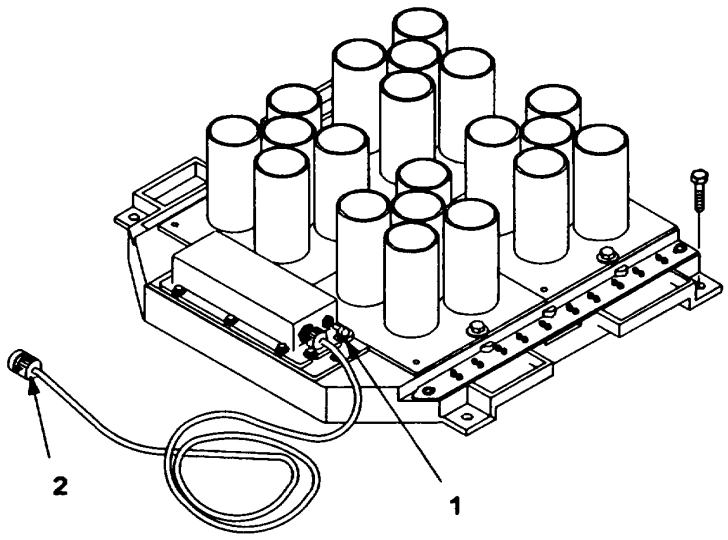
(4) Place the SAFE/ARM switch (1) in the up position.

4-10 GUFS POWER CABLE ASSEMBLY REPLACEMENT.

INITIAL SETUP

Materials/Parts:
Cable Assembly (12725002)

References:
Paragraph 2-8
Paragraph 2-9



a. Removal.

WARNING

Prior to arming, disarming or performing maintenance, always touch metal frame of GUFS as to ground static electricity. Failure to do so could cause serious injury or death due to accidental ignition of pyrotechnic charges.

Never lean, bend or stand directly over a firing tube or externally fired simulator when loading/unloading. Doing so could cause serious injury or death due to accidental ignition of pyrotechnic charges.

Disarm, then disconnect the GUFS connection from control assembly on the TTA, ILTEM or TIU. The GUFS must be disconnected prior to performing maintenance. Explosion is possible and can cause personal injury and/or damage to equipment.

(1) Assure all firing tubes are unloaded prior to removing GUFS. Refer to paragraph 2-9.

(2) Place the SAFE/ARM switch (1) in the down position.

(3) Disconnect the power cable (2) from the power source.

(4) Disconnect the power cable from the electronic control assembly (3).

b. Installation.

(1) Connect the power cable (2) to the electronic control assembly (3).

NOTE

Do not perform the next steps until the GUFS is loaded. Refer to paragraph 2-8.

(2) Connect the power cable to the power source.

(3) Place the SAFE/ARM switch (1) in the up position.

4-11 GUFS ASSEMBLY REPLACEMENT.

INITIAL SETUP

Tools:
General Mechanic's Automotive Tool Kit

Personnel Required:
2 persons

Materials/Parts:
Gunfire Simulator Assembly (12725001-1)

References:
Paragraph 2-8
Paragraph 2-9

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a. Removal.

WARNING

Prior to arming, disarming or performing maintenance, always touch metal frame of GUFS as to ground static electricity. Failure to do so could cause serious injury or death due to accidental ignition of pyrotechnic charges.

Never lean, bend or stand directly over a firing tube or externally fired simulator when loading/unloading. Doing so could cause serious injury or death due to accidental ignition of pyrotechnic charges.

Disarm, then disconnect the GUFS connection from control assembly on the TTA, ILTEM or TIU. The GUFS must be disconnected prior to performing maintenance. Explosion is possible and can cause personal injury and/or damage to equipment.

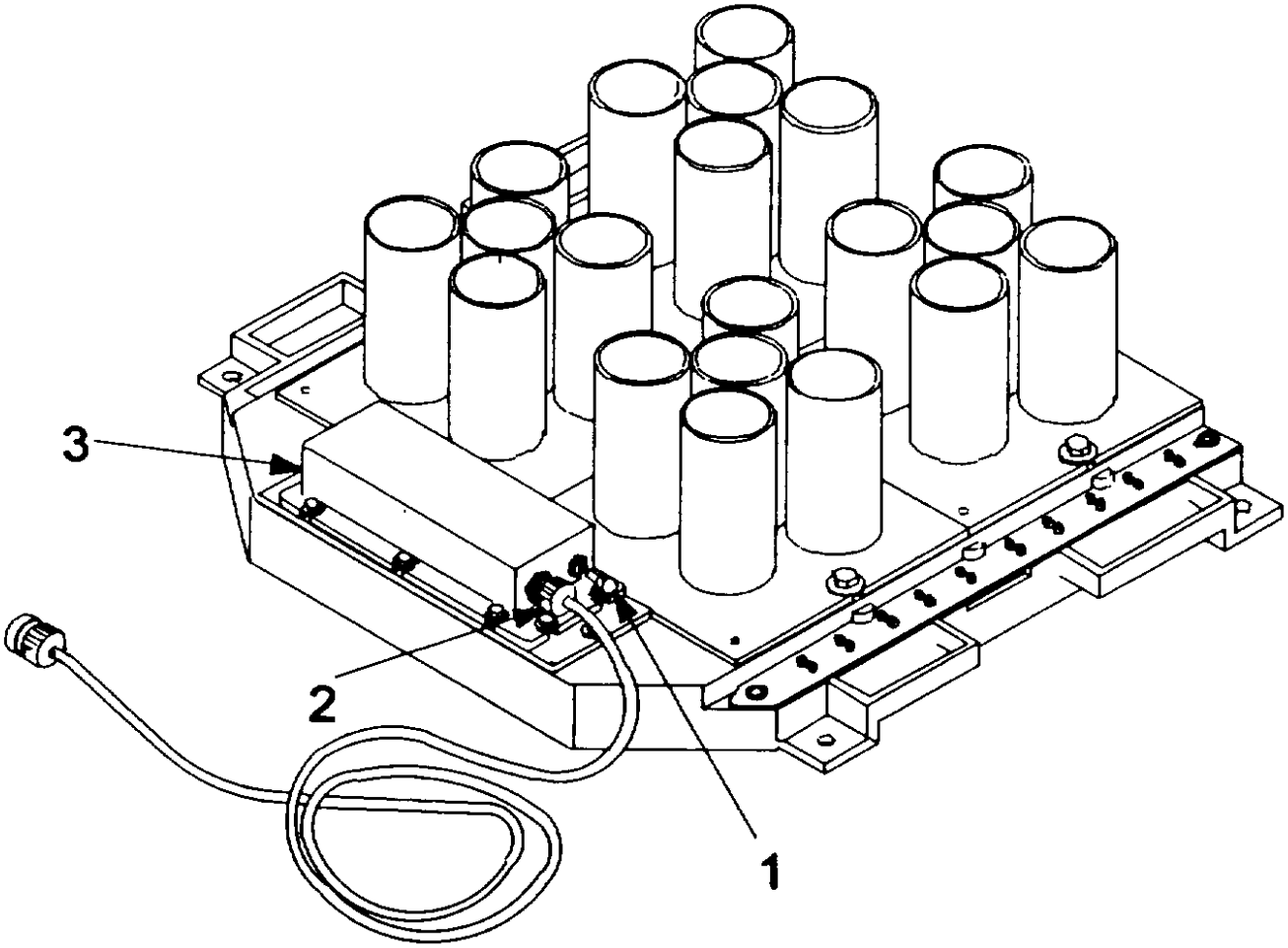
(1) Assure all firing tubes are unloaded prior to removing GUFS. Refer to paragraph 2-9.

(2) Place the SAFE/ARM switch (1) in the down position.

(3) Disconnect the power cable (2) from the electronic control assembly (3).

(4) Remove mounting hardware.

(5) Remove the gunfire simulator assembly.



b. Installation.

(1) Place the gunfire simulator assembly in position on range.

(2) Install mounting hardware.

NOTE

Do not perform the next steps until the GUFS is loaded. Refer to paragraph 2-8.

(3) Connect the power cable (2) to the electronic control assembly (3).

(4) Place the SAFE/ARM switch (1) in the up position.

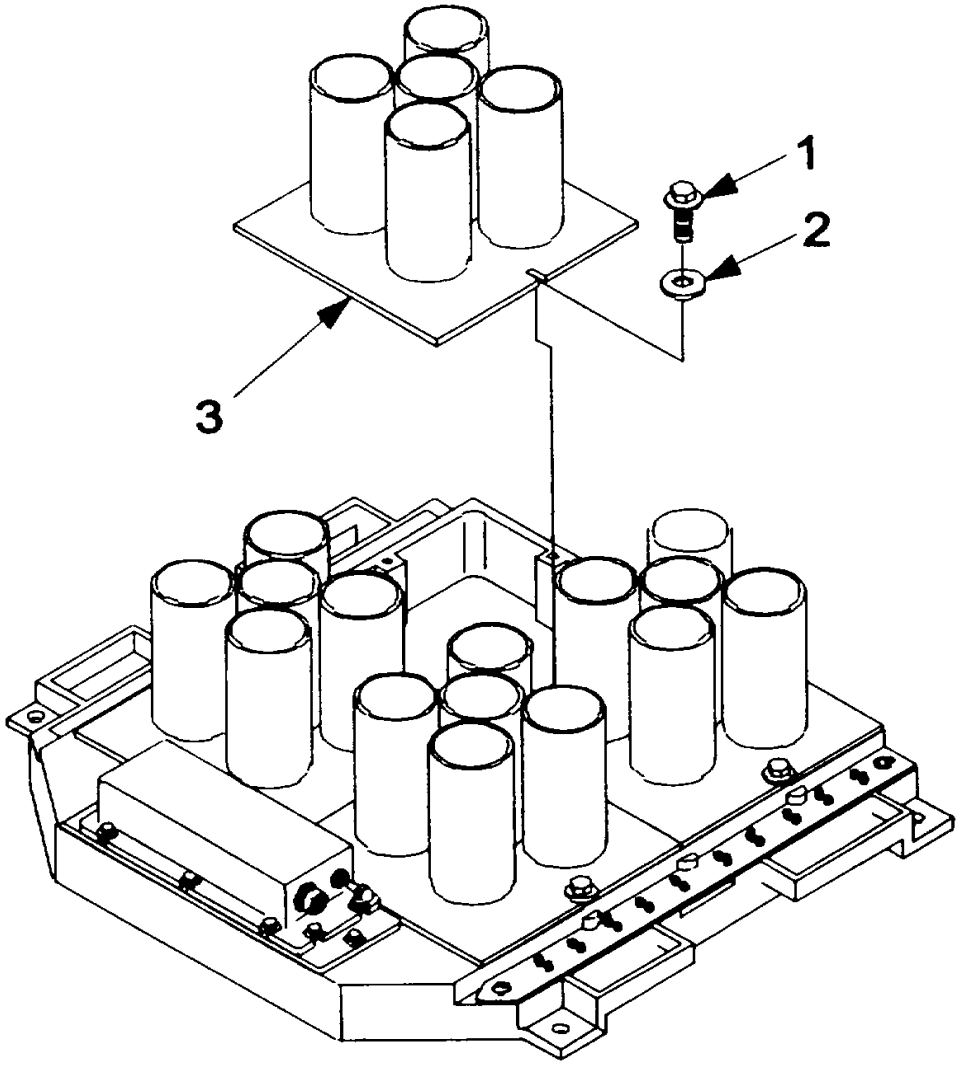
4-12 GUFS FIRING TUBE ASSEMBLY REPLACEMENT.

INITIAL SETUP

Tools:
General Mechanic's Automotive Tool Kit

Equipment Condition:
Gunfire simulator assembly removed (Reference paragraph 4-11)

Materials/Parts:
Firing Tube Assembly (12725004)



a. Removal.
(1) Remove two screws (1) and flatwashers (2).
(2) Remove firing tube assembly (3).

b. Installation.
(1) Position firing tube (3) on gunfire simulator assembly.
(2) Install two screws (1) and flatwashers (2).

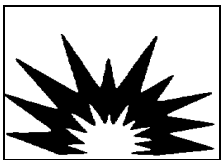
4-13 GUFS CONTROL ASSEMBLY TESTING AND PURGING.

INITIAL SETUP

Tools:
General Mechanic's Automotive Tool Kit
Pressure Gage
Purging Kit

Materials/Parts:
Adhesive (item 3, appendix D)

References:
Paragraph 2-9



WARNING

Prior to arming, disarming or performing maintenance, always touch metal frame of GUFS as to ground static electricity. Failure to do so could cause serious injury or death due to accidental ignition of pyrotechnic charges.

Never lean, bend or stand directly over a firing tube or externally fired simulator when loading/unloading. Doing so could cause serious injury or death due to accidental ignition of pyrotechnic charges.

Disarm, then disconnect the GUFS connection from control assembly on the TTA, ILTEM or TIU. The GUFS must be disconnected prior to performing maintenance. Explosion is possible and can cause personal injury and/or damage to equipment.

NOTE

The addition of the purge valve allows for nitrogen to be added to the ECU. This creates a "positive pressure" (higher pressure on the inside of the ECU vs. the outside). This has the effect of pushing out any water or moisture that would normally enter the ECU. The amount of pressure is not as critical as the need to create a positive pressure. The only concern of too much pressure would be the blowing of the seals between the two housing halves or the ribbon cable seals.

NOTE

Utilizing the seal screw during the purging procedure is a requirement. This will ensure that the required 5 psi of nitrogen is added and if there is any water in the bottom of the housing, it will be expelled from the seal screw at that time. Just filling the ECU housing assembly with nitrogen will not indicate if water is currently in the housing. If water is indicated, the entire housing assembly should be opened up and serviced as necessary.

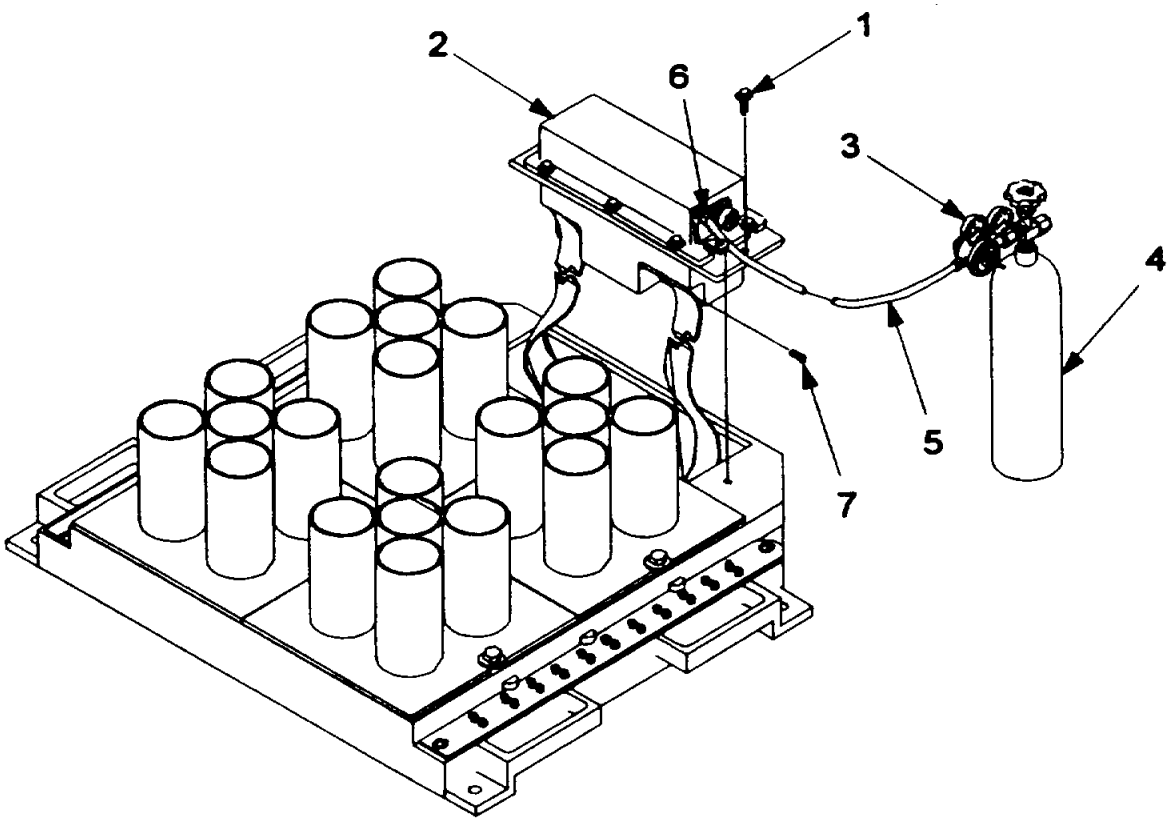
4-13 GUFS CONTROL ASSEMBLY TESTING AND PURGING (CONTINUED).

NOTE

Don't check or recheck the ECU housing assembly for pressure. The fact that the housing assembly is rigid and it's size, prohibit the checking for pressure. If this is done, most if not all of the pressure from the nitrogen will be lost due to escaping nitrogen when attaching the gate as the amount of nitrogen used to fill the gage. Our recommendation would be to just periodically re-pressurized each ECU housing assembly on a regular basis (the interval to be at the site's discretion) or after heavy rainfall where the ECU housing assembly may have been partially or fully submerged.

Purging Instructions.

(1) Remove two bolts (1) holding electronic control assembly (2) to gunfire simulator assembly.
(2) Lift electronic control assembly partially out of gunfire simulator assembly.
(3) Connect nitrogen purging kit (3) to a nitrogen source (4).
(4) Connect nitrogen purging kit output hose (5) to pressure valve (6).



(5) Set regulator output to 5 psi.
(6) Open regulator and allow nitrogen to flow.
(7) Loosen seal screw (7) on electronic control assembly until nitrogen flows out.
(8) With nitrogen flowing out of seal screw, tighten screw until sealed and apply a coating of sealant over screwhead for additional leakage protection.
(9) Close regulator and disconnect purging kit.

(10) Set electronic control assembly back into gunfire simulator assembly.

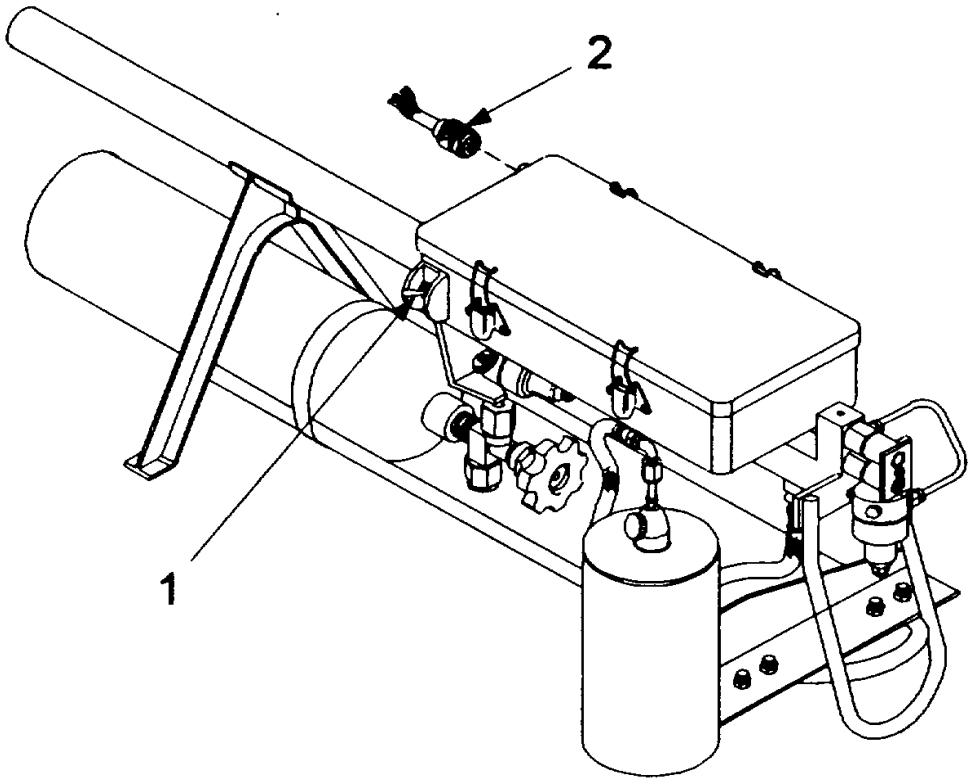
(11) Install two bolts retaining electronic control assembly.

4-14 SASS REPLACEMENT.

INITIAL SETUP

Materials/Parts:
Small Arms Sound Simulator (11829734)

References:
Paragraph 4-15
Paragraph 4-16



a. Removal.

(1) Turn circuit breaker on the ITM and CB1 (1) to the OFF position.
(2) Disconnect cable assembly W106 (2) from MFS.
(3) Remove oxygen cylinder. Refer to paragraph 4-15.
(4) Remove propane tank. Refer to paragraph 4-16.
(5) Remove small arms sound simulator.

b. Installation.

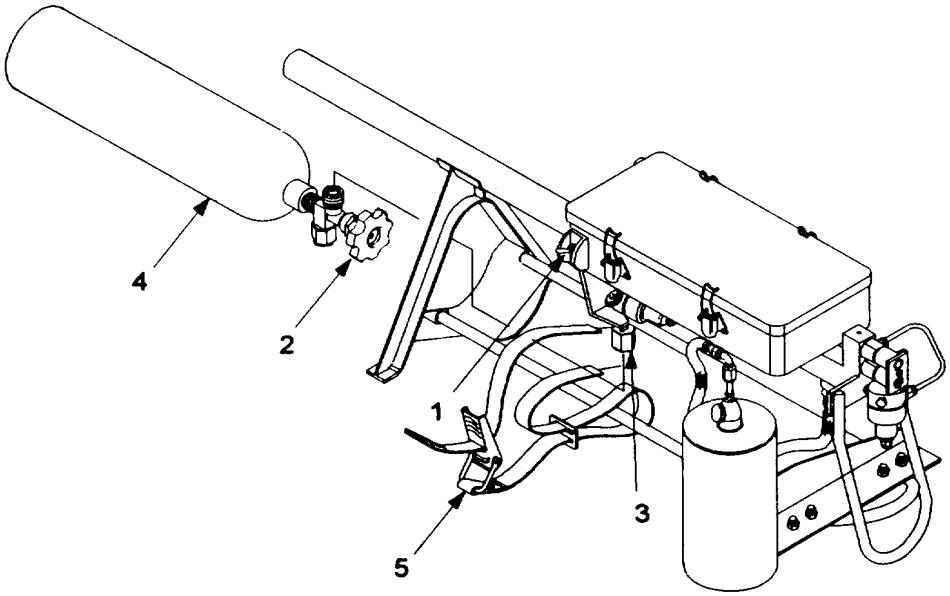
(1) Position small arms sound simulator on range.
(2) Install propane tank. Refer to paragraph 4-16.
(3) Install oxygen cylinder. Refer to paragraph 4-15.
(4) Connect cable assembly W106 (2) to MFS.
(5) Turn circuit breaker on the ITM and CB1 (1) to ON position.

4-15 SASS OXYGEN CYLINDER REPLACEMENT AND SERVICING.

INITIAL SETUP

Tools:
General Mechanic's Automotive Tool Kit

Materials/Parts:
Oxygen cylinder (9363072)



a. Removal.

(1) Turn circuit breaker CB1 (1) on the electronics assembly to the OFF position.

(2) Turn oxygen valve (2) off.

(3) Disconnect oxygen regulator (3) from oxygen cylinder (4).

(4) Loosen hold down strap (5) and remove oxygen cylinder.

b. Servicing.

(1) Return oxygen cylinder for refilling.

(2) Follow local operating procedures.

c. Installation.

(1) Position oxygen cylinder (4) in frame assembly and fasten hold down strap (5).

(2) Connect oxygen regulator (3) to oxygen cylinder.

(3) Turn oxygen valve (2) on.

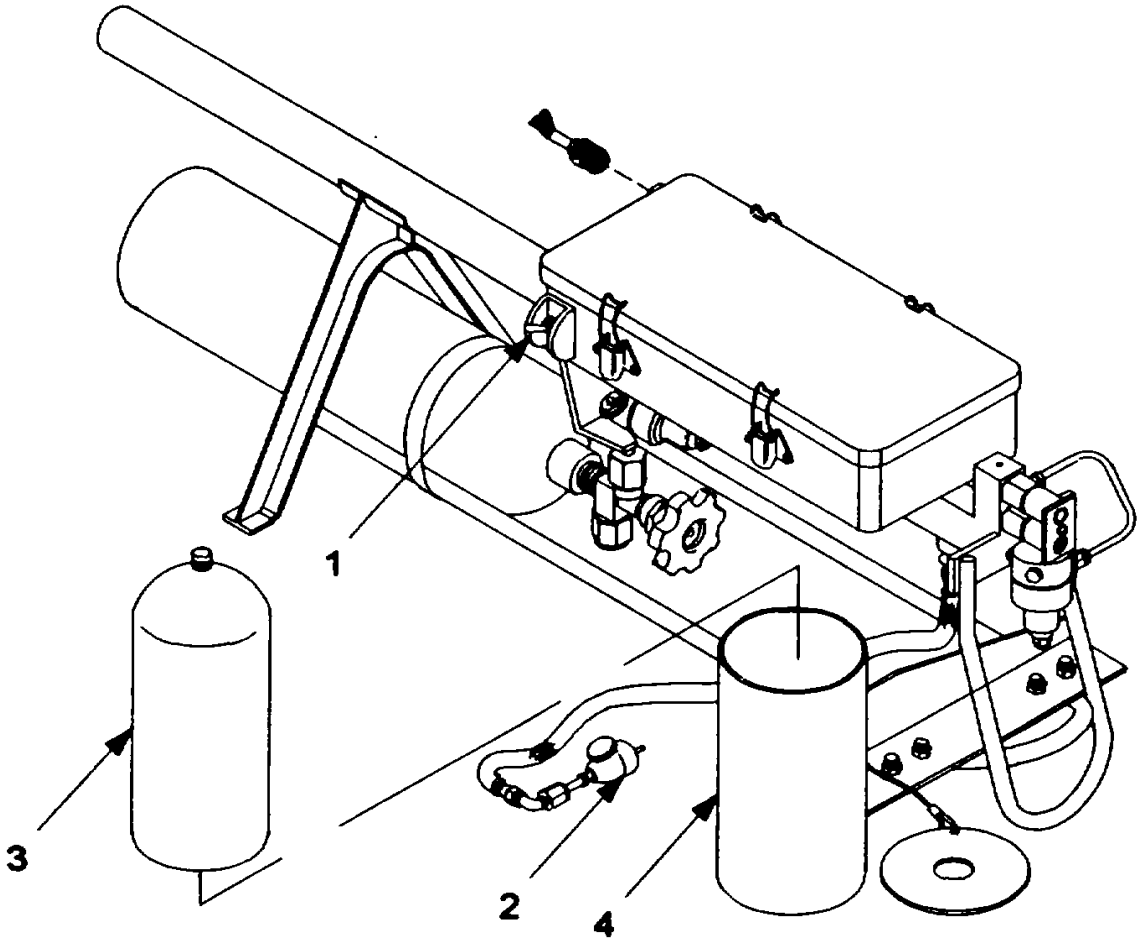
(4) Turn circuit breaker CB1 (1) on electronics assembly to the ON position.

4-16 SASS PROPANE TANK REPLACEMENT.

INITIAL SETUP

Tools:
General Mechanic's Automotive Tool Kit

Materials/Parts:
Propane Tank (9387446)



a. Removal.

(1) Turn circuit breaker CB1 (1) on the electronics assembly to the OFF position.
(2) Turn propane valve (2) off.
(3) Disconnect propane valve from propane tank (3).
(4) Remove propane tank from propane can shield holder (4).

b. Installation.

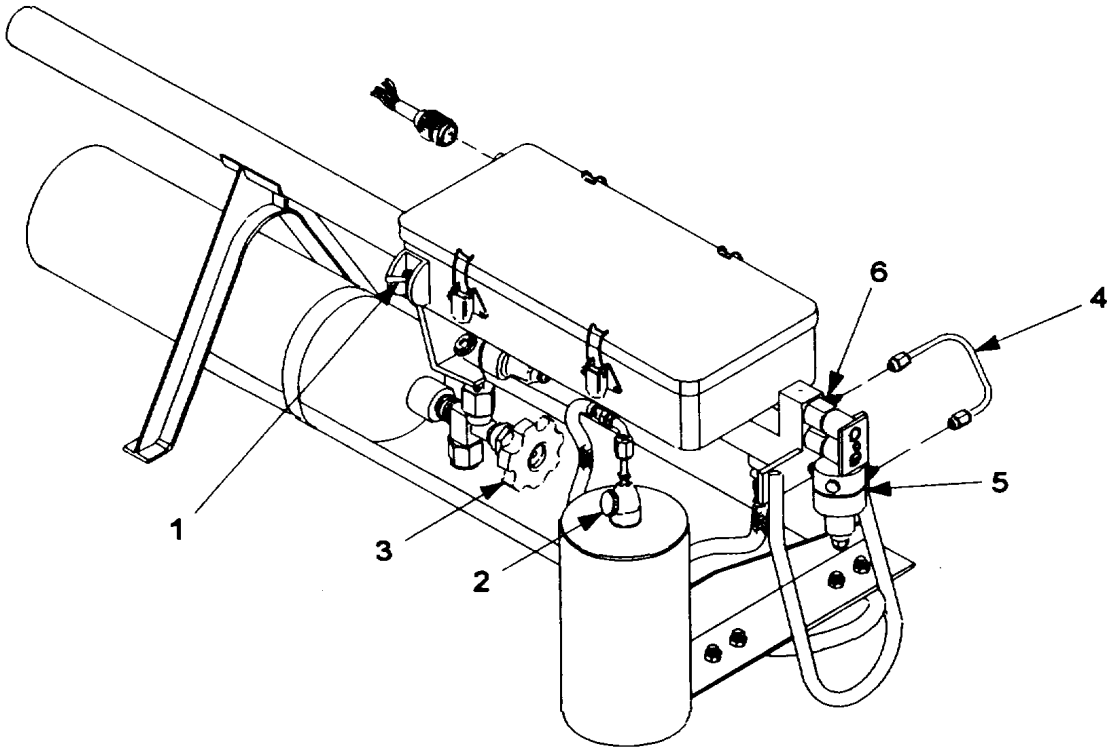
(1) Position propane tank (3) in propane tank can shield holder (4).
(2) Connect propane valve (2) to propane tank.
(3) Turn propane valve on.
(4) Turn circuit breaker CB1 (1) on electronics assembly to the ON position.

4-17 SASS TUBE ASSEMBLY REPLACEMENT.

INITIAL SETUP

Tools:
General Mechanic's Automotive Tool Kit
Tape (item 16, appendix D)

Materials/Parts:
Tube Assembly (11829802)



a. Removal.

(1) Turn circuit breaker CB1 (1) on the electronics assembly to the OFF position.

(2) Turn propane valve (2) off.

(3) Turn oxygen valve (3) off.

(4) Using two wrenches, disconnect tube assembly (4) from propane regulator (5).

(5) Using two wrenches, disconnect tube assembly from solenoid assembly (6).

(6) Remove tape from flared nipples on solenoid assembly and propane regulator.

b. Installation.

(1) Apply teflon tape to flared nipples on propane regulator (5) and solenoid valve (6). Wrap tape in a CCW direction.
(2) Using two wrenches connect tube assembly (4) to solenoid assembly.

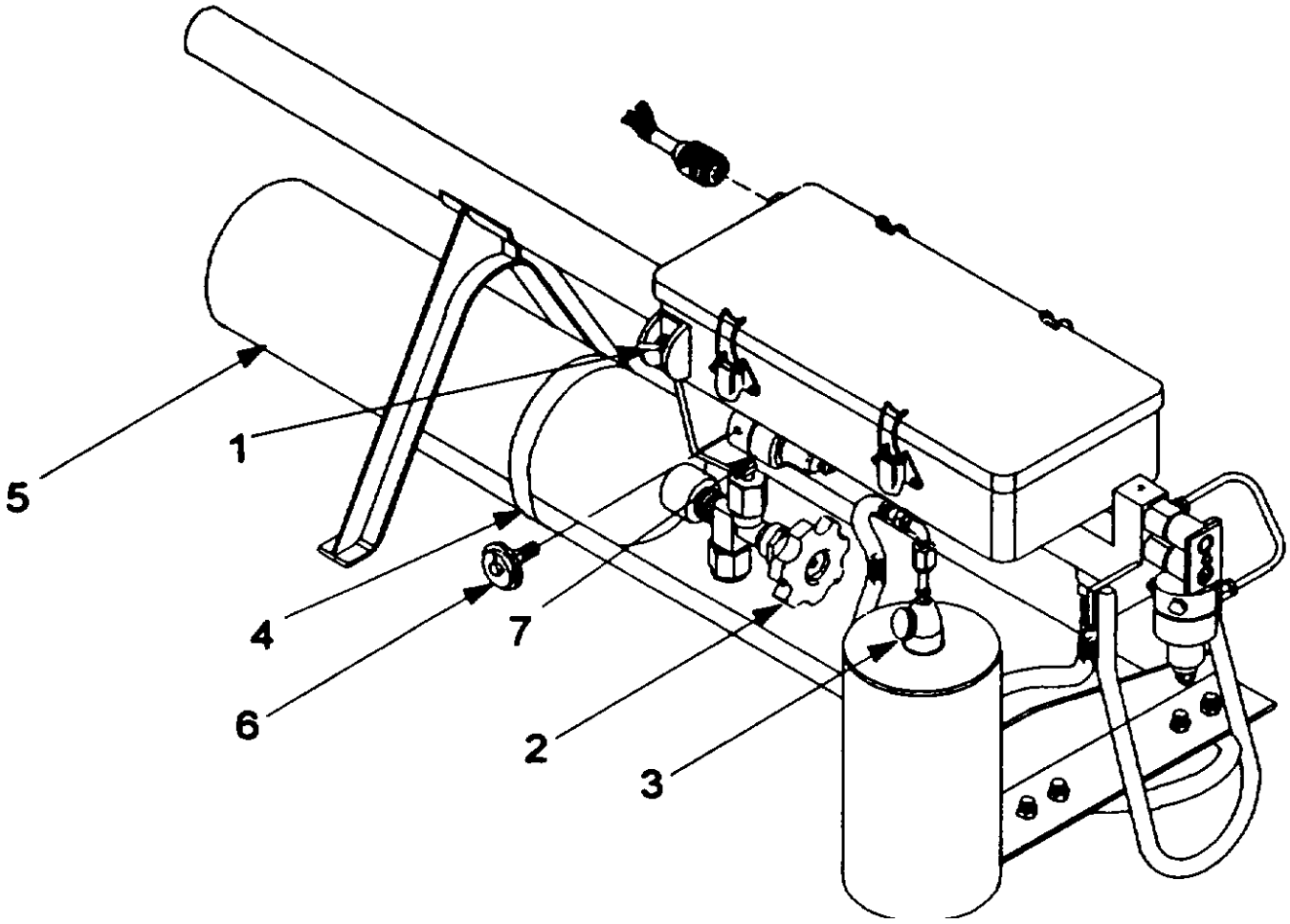
(3) Using two wrenches connect tube assembly to propane regulator.
(4) Turn propane valve (2) on.
(5) Turn oxygen valve (3) on.
(6) Inspect for leaks around fittings using soap bubble method.
(7) Turn circuit breaker CB1 (1) on electronics assembly to the ON position.

4-18 SASS PRESSURE GAGE REPLACEMENT.

INITIAL SETUP

Tools:
General Mechanic's Automotive Tool Kit
Pressure Gage

Materials/Parts:
Pressure Gage (9340902)
Tape (item 16, appendix D)



a. Removal.

(1) Turn circuit breaker CB1 (1) on electronics assembly to the OFF position.
(2) Turn oxygen valve (2) off.
(3) Turn propane valve (3) off.
(4) Loosen holding strap (4) and remove oxygen cylinder (5) from frame.

4-18 SASS PRESSURE GAGE REPLACEMENT (CONTINUED).

(5) Remove gage (6) from oxygen regulator (7). -

(6) Clean tape from threads.

b. Installation.

(1) Apply teflon tape to threads of gage (6). Wrap tape in a CCW direction. Do not overlap end of fitting.

(2) Install gage on oxygen regulator (7).

(3) Position oxygen cylinder (5) in frame and fasten holding strap (4).

(4) Turn oxygen valve (2) on.

(5) Turn propane valve (3) on.

(6) Inspect gage for leaks using soap bubble method.

(7) Turn circuit breaker CB1 (1) on electronics assembly to the ON position.

4-19 SASS OXYGEN HOSE ASSEMBLY REPLACEMENT.

INITIAL SETUP

Tools:
General Mechanic's Automotive Tool Kit

Materials/Parts:
Hose Assembly (11829801)
Tape (item 16, appendix D)

---

a. Removal.

(1) Turn circuit breaker CB1 (1) on electronics unit to the OFF position.

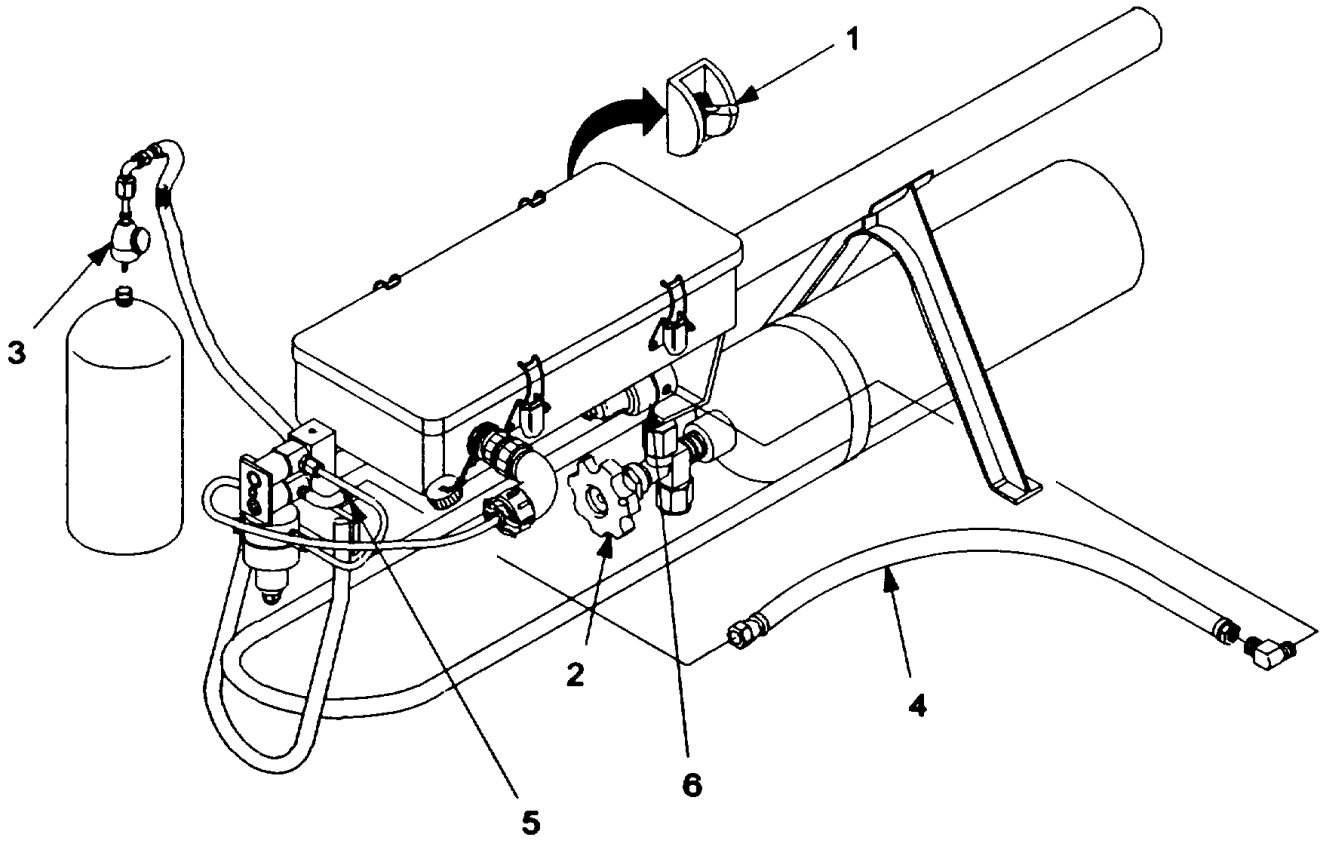
(2) Turn oxygen valve (2) off.

(3) Turn propane valve (3) off.

(4) Disconnect hose assembly (4) connection from elbow on solenoid assembly (5).

(5) Using two wrenches, disconnect hose assembly from pressure regulator (6).

(6) Clean tape from fittings.



b. Installation.

(1) Apply teflon tape to fittings. Wrap tape in a CCW direction. Do not overlap end of fittings.

(2) Using two wrenches, connect male fitting to pressure regulator (6).

(3) Connect female fitting to elbow on solenoid assembly (5).

(4) Turn oxygen valve (2) on.

(5) Turn propane valve (3) on.

(6) Inspect for leaks around fittings using soap bubble method.

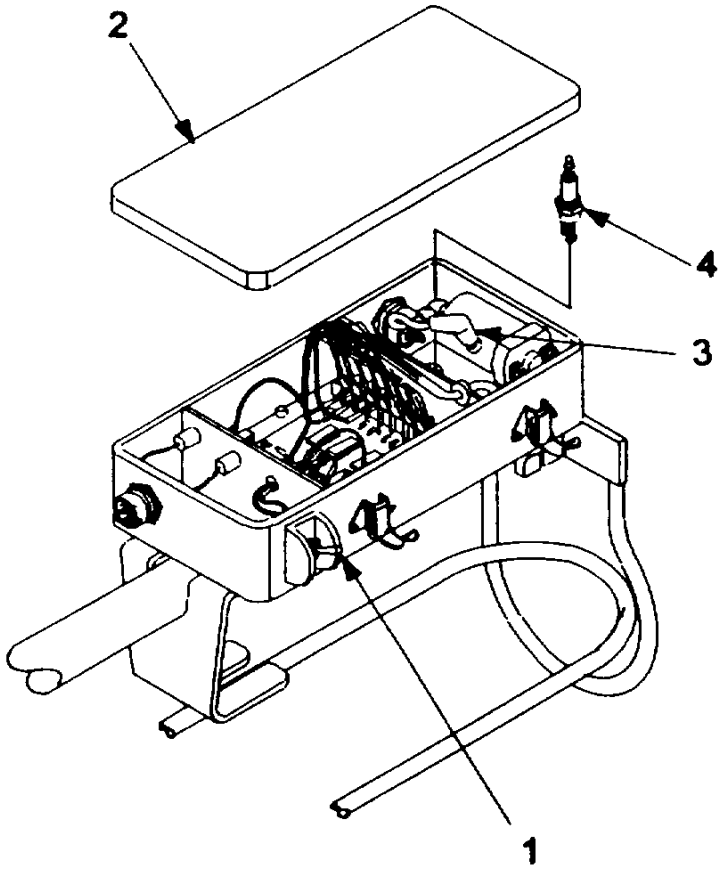
(7) Turn circuit breaker CB1 (1) on electronics assembly to the ON position.

4-20 SASS SPARK PLUG REPLACEMENT.

INITIAL SETUP

Tools:
General Mechanic's Automotive Tool Kit

Materials/Parts:
Spark Plug (R45)
Grease (item 7, appendix D)



a. Removal.

(1) Turn circuit breaker CB1 (1) on electronics assembly to the OFF position.
(2) Unlatch cover (2) of electronics assembly and remove cover.
(3) Disconnect high voltage wire (3) from spark plug (4).
(4) Remove spark plug from barrel assembly.

b. Installation.

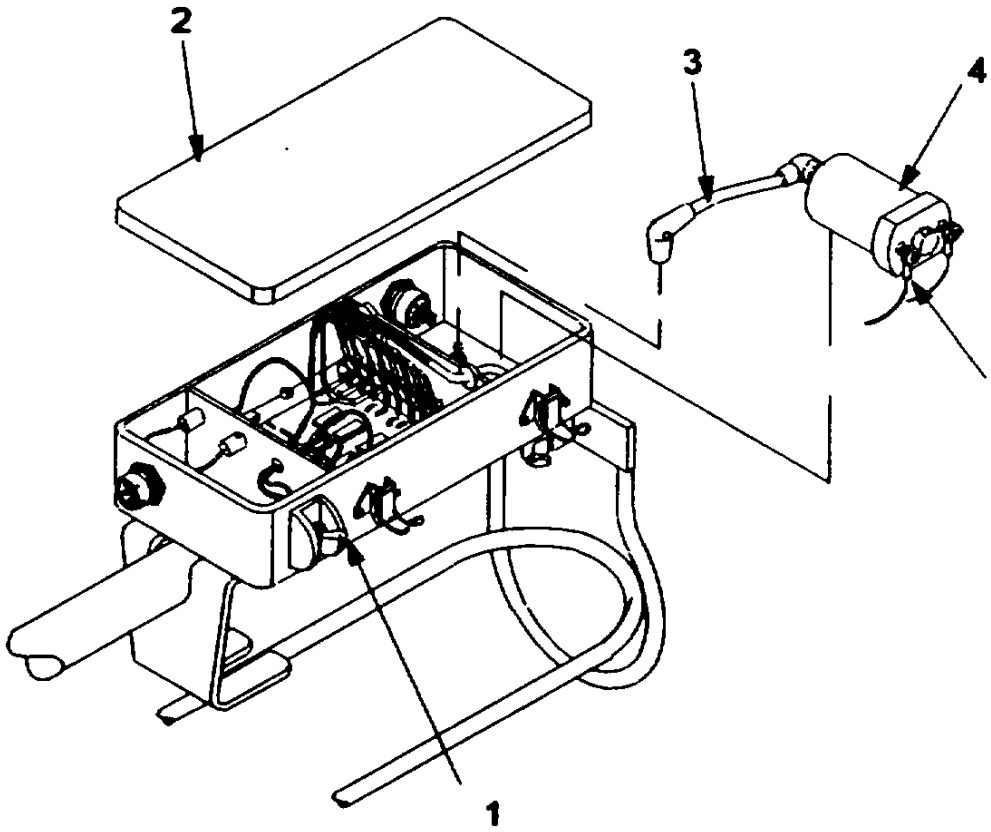
(1) Set spark plug gap to 0.026 to 0.030-in prior to installation.
(2) Install spark plug (4) into barrel assembly.
(3) Connect high voltage wire (3) on spark plug.
(4) Apply a thin uniform coating of grease to entire gasket surface.
(5) Install cover (2) on electronics assembly and fasten latches.
(6) Turn circuit breaker CB1 (1) on electronics assembly to the ON position.

4-21 SASS COIL ASSEMBLY REPLACEMENT.

INITIAL SETUP

Tools:
General Mechanic's Automotive Tool Kit

Materials/Parts:
Coil Assembly (9362991)
Grease (item 7, appendix D)



a. Removal.

(1) Turn circuit breaker CBI (1) on electronics assembly to the OFF position.
(2) Unlatch cover (2) of electronics assembly and remove cover.
(3) Unplug high voltage wire (3) from coil assembly (4).
(4) Tag and disconnect low voltage wires (5) from coil assembly.
(5) Remove coil assembly.

b. Installation.

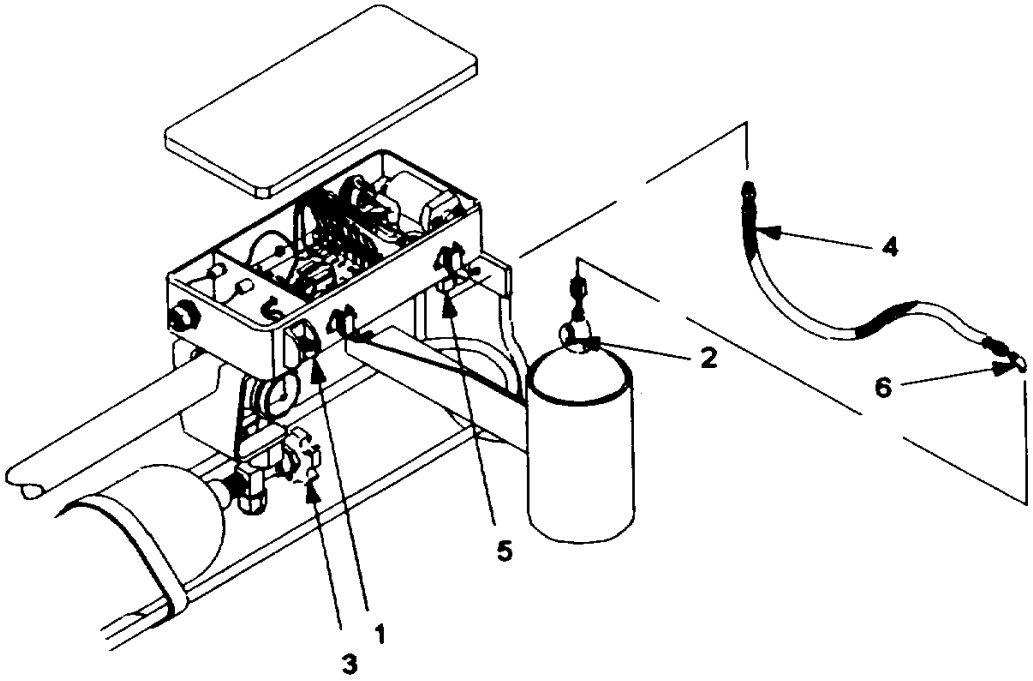
(1) Remove nuts from coil assembly (4) and connect low voltage wires (5).
(2) Plug high voltage wire (3) into coil.
(3) Position coil in electronics assembly.
(4) Apply a thin uniform coating of grease to entire gasket surface.
(5) Install cover (2) on electronics assembly and fasten latches.
(6) Turn circuit breaker CB1 (1) on electronics assembly to the ON position.

4-22 SASS PROPANE HOSE ASSEMBLY REPLACEMENT.

INITIAL SETUP

Tools:
General Mechanic's Automotive Tool Kit

Materials/Parts:
Hose Assembly (9387452)
Tape (item 16, appendix D)



a. Removal.

(1) Turn circuit breaker CBI (1) on electronics assembly to the OFF position.

(2) Turn propane valve (2) off.

(3) Turn oxygen valve (3) off.

(4) Disconnect hose assembly (4) from propane regulator (5).

(5) Disconnect hose assembly from propane nipple (6).

(6) Clean teflon tape from nipples.

b. Installation.

(1) Apply teflon tape to nipple (6). Wrap tape in CCW direction. Do not overlap end of fitting.

(2) Connect hose assembly (4) to propane nipple.

(3) Connect hose assembly to propane regulator (5).

(4) Turn propane valve (2) on.

(5) Turn oxygen valve (3) on.

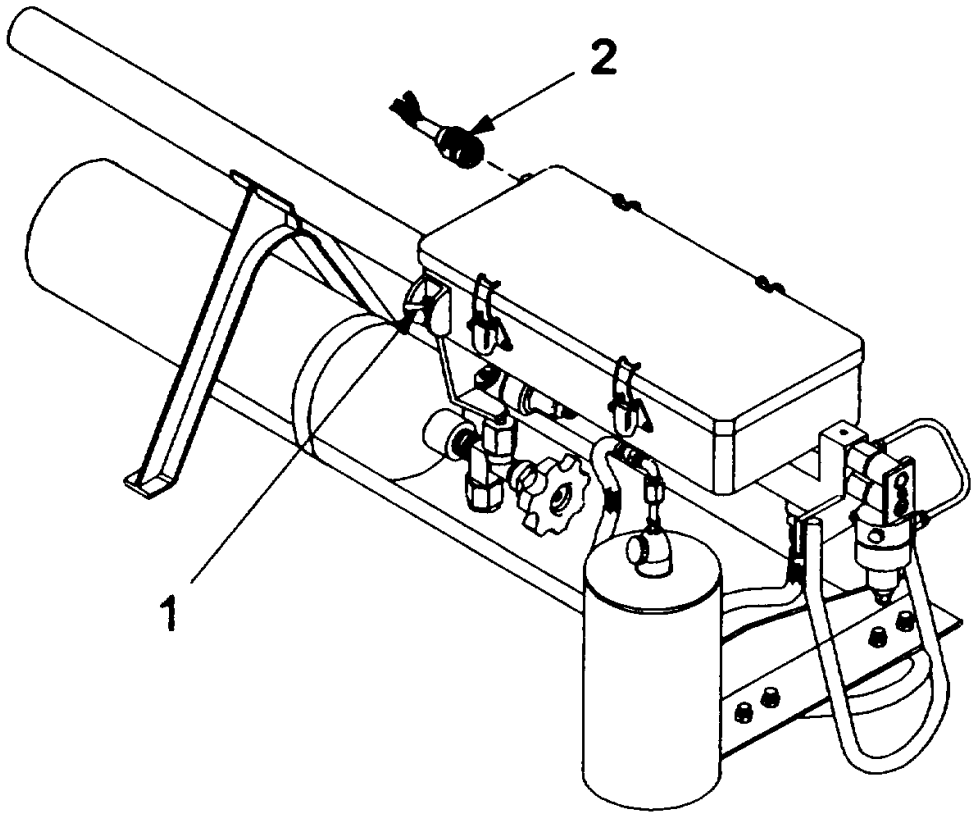
(6) Inspect connection for leaks using soap bubble method.

(7) Turn circuit breaker CB1 (1) on electronics assembly to the ON position.

4-23 SASS POWER CABLE ASSEMBLY REPLACEMENT.

INITIAL SETUP

Materials/Parts:
Cable Assembly (9354100)



a. Removal.

(1) Turn circuit breaker on ITM and CB1 (1) to the OFF position.
(1) Disconnect P2 of cable assembly (2) from small arms muzzle flash simulator or ITM.
(1) Disconnect P1 of cable assembly from J1 of electronics assembly.

b. Installation.

(1) Connect P1 of cable assembly (2) to J1 on electronics assembly.
(2) Connect P2 of cable assembly to small arms muzzle flash simulator or ITM.
(3) Turn circuit breaker on ITM and CB1 (1) to the ON position.

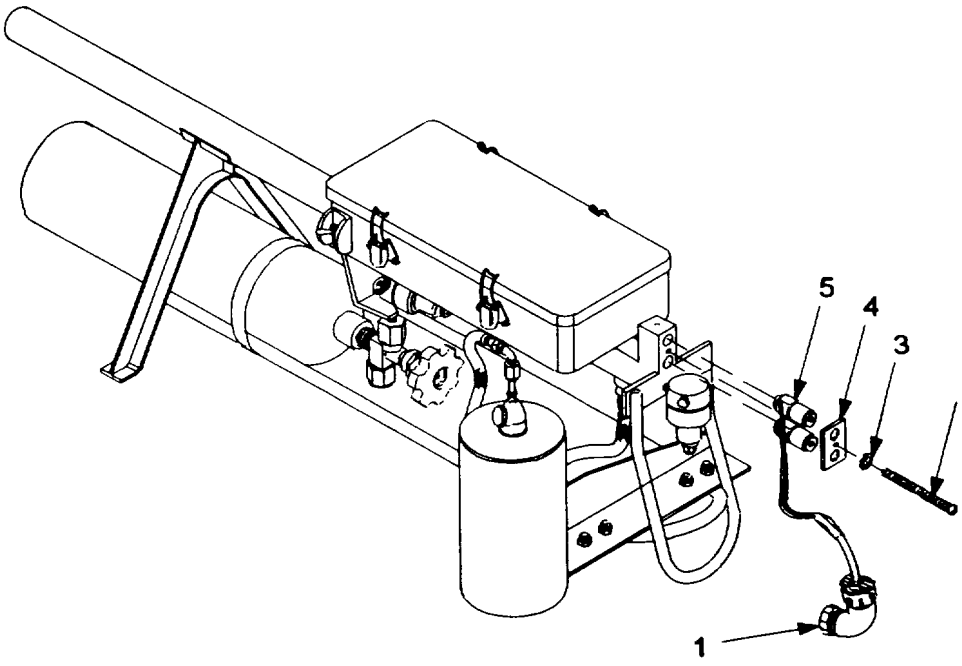
4-24 SASS SOLENOID ASSEMBLY REPLACEMENT.

INITIAL SETUP

Tools:
General Mechanic's Automotive Tool Kit

References:
Paragraph 4-17

Materials/Parts:
Solenoid Assembly (9340875)



a. Removal.

(1) Remove tube assembly. Refer to paragraph 4-17.

(2) Disconnect connector (1) from J2 of electronics assembly.

(3) Remove screw (2) and lockwasher (3) from retaining plate (4).

(4) Slide solenoid valves (5) from combustion chamber.

b. Installation.

(1) Slide solenoid valves (5) into combustion chamber.

(2) Orient valve so the leads are to the left.

(3) Install retaining plate (4) using screw (2) and lockwasher (3).

(4) Connect connector (1) to J2 on electronics assembly.

(5) Install tube assembly. Refer to paragraph 4-17.

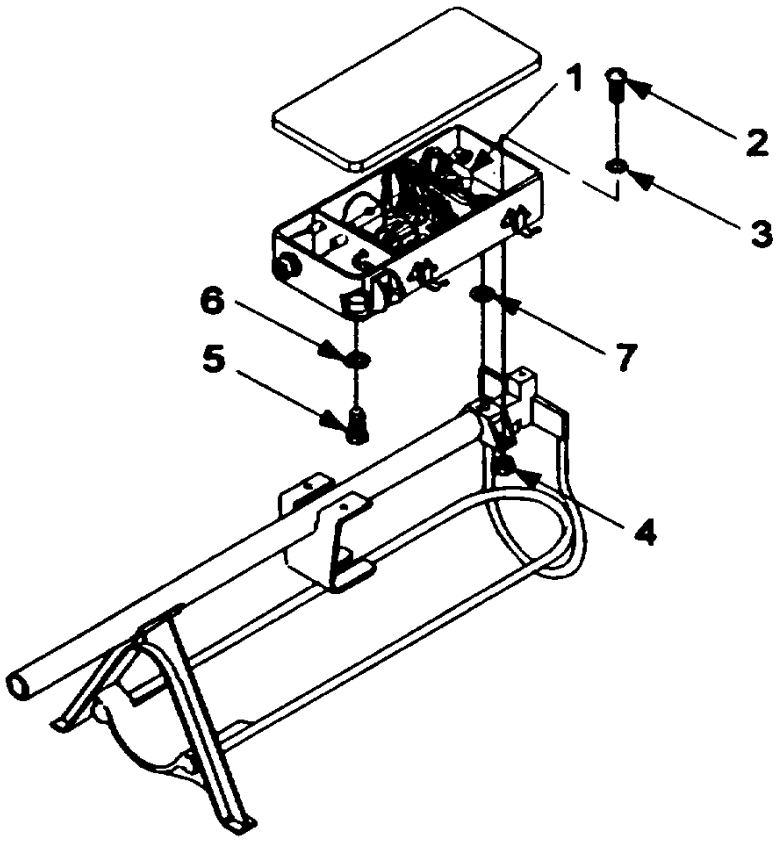
4-25 SASS ELECTRONICS ASSEMBLY REPLACEMENT.

INITIAL SETUP

Tools:
General Mechanic's Automotive Tool Kit

Equipment Condition:
Coil removed (reference paragraph 4-21)

Materials/Parts:
Electronics Assembly (9353778-1)
Gasket RFI (9340876)
Grease (item 7, appendix D)



a. Removal.

(1) Unlatch and remove cover from electronics assembly.
(2) Disconnect high voltage wire (1) from spark plug.
(3) Remove two screws (2), preformed packing (3), and nuts (4).

NOTE

Oxygen regulator support will be removed when the following step is performed.

(4) Remove two bolts (5) and lockwashers (6).
(5) Remove electronics assembly from barrel assembly.
(6) Remove RFI gasket (7).

4-25 SASS ELECTRONIC ASSEMBLY REPLACEMENT (CONTINUED).

b. Installation.

(1) Position RFI gasket (7) on barrel assembly.

(2) Position electronics assembly on barrel assembly.

(3) Install two bolts (5) and lockwashers (6) through oxygen support bracket and into housing assembly.

(4) Install two screws (2) and preformed packing (3) through electronics housing.

(5) Install two nuts (4).

(6) Connect high voltage wire (1) to spark plug.

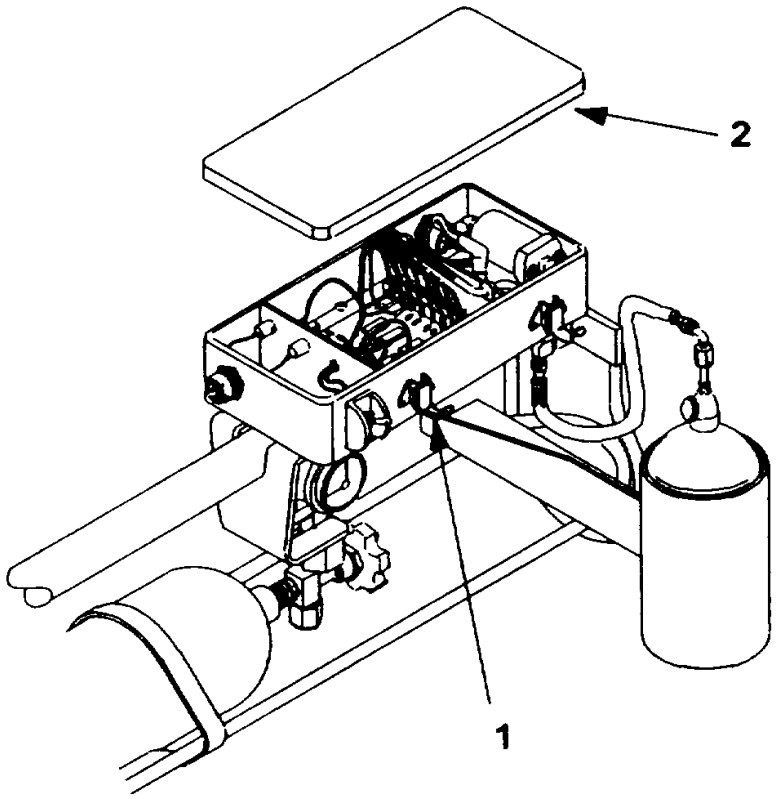
(7) Apply a thin uniform coating of grease to entire gasket surface.

(8) Position cover on electronics assembly and fasten latches.

4-26 SASS COVER ASSEMBLY REPLACEMENT.

INITIAL SETUP

Materials/Parts:
Cover Assembly (9340859)
Grease (item 7, appendix D)



a. Removal.

(1) Release four latches (1).

(2) Remove cover assembly (2).

b. Installation.

(1) Apply a thin uniform coating of grease to entire gasket surface.

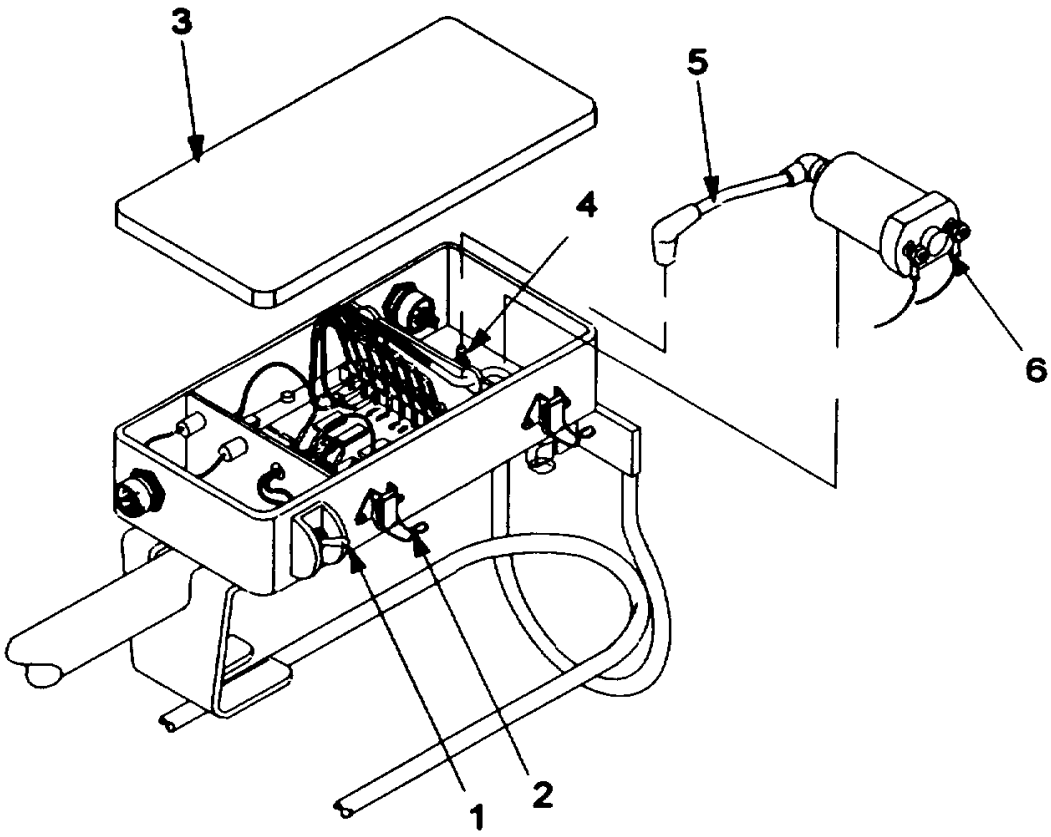
(2) Position cover assembly (2) on electronics assembly.

(3) Fasten four latches (1).

4-27 SASS WIRE ASSEMBLY REPLACEMENT.

INITIAL SETUP

Materials/Parts:
Wire Assembly (9341014)
Grease (item 7, appendix D)



a. Removal.

(1) Turn circuit breaker CB1 (1) to the OFF position.

4-27 SASS WIRE ASSEMBLY REPLACEMENT (CONTINUED).

(2) Release four latches (2) and remove cover assembly (3).

(3) Disconnect high voltage wire from spark plug (4).

(4) Disconnect high voltage wire (5) from coil assembly (6).

b. Installation.

(1) Connect high voltage wire to coil assembly (6).

(2) Connect high voltage wire (5) to spark plug (4).

(3) Apply a thin uniform coating of grease to entire gasket surface.

(4) Position cover assembly (3) on electronics assembly and fasten four latches (2).

(5) Turn CB1 (1) to the ON position.

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 Small Arms Muzzle Flash Simulator (MFS), Gunfire Simulator (GUFS), and Small Arms Sound Simulator (SASS). You should perform the tests/inspections and corrective actions in the order listed. Before you begin troubleshooting the simulators, 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.

WARNING

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

Table 5-1. Direct Support Troubleshooting Procedures.

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

Small Arms Muzzle Flash Simulator

1. Small Arms Muzzle Flash Simulator inoperative.

NOTE

An RCS adapter and multimeter will be required to perform these procedures on the MFS unit under test (UUT).

Step 1. Refer to TM 9-6920-742-14-1 and set RCS adapter controls prior to application of power.

Step 2. Perform RCS adapter internal test procedures.

Step 3. Connect test cable PN 9387316 P1 to the RCS adapter J1 and P3 to P1 of the MFS.

Step 4. Set the RCS adapter mode control POWER switch to the ON position and UUT power switch to the ON position.

CAUTION

Power is now applied to the UUT

Step 5. On the RCS Adapter set the hostile fire control switches to the following positions and observe the indications.

Switches		Indications
Toggle ENABLE	SINGLE/BURST	MFS
UP	SINGLE	Random single flashes
UP	BURST	Random burst flashes

If indications are correct, MFS flash circuits are functional. Trouble is outside the MFS, refer to TM 96920-742-14-3.

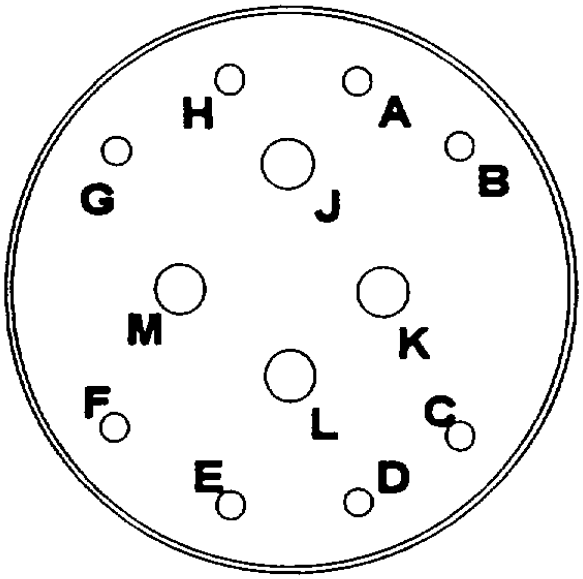
If indications are incorrect, go to step 6.

Step 6. Remove power, disconnect power cable and remove cover from MFS and perform the following continuity point to point checks:

TB1-1 to P1-C	TB1-6 to P1-D
TB1-5 to P1-M	TB1-9 to P1-J
TB1-7 to P1-K	TB1-8 to P1-L

Table 5-1. Direct Support Troubleshooting Procedure (Continued).

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION



P1

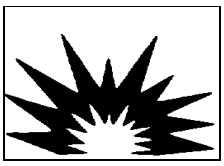
If any indications are incorrect, replace wiring as required and repeat step 5.

If all indications are correct go to step 7.

Step 7. Remove MFS cover. Replace CCA and repeat step 5. Gunfire Simulator

2. All GUFS firing tubes fail to operate.

WARNING



Prior to arming, disarming or performing maintenance always touch metal frame of GUFS so as to ground static electricity. Failure to do so could cause serious injury or death due to accidental ignition of pyrotechnic charges.

Never lean, bend or stand directly over a firing tube of externally fired simulator when loading/unloading. Doing so could cause serious injury or death due to accidental ignition of pyrotechnic charges.

Disarm, then disconnect the GUFS connection from control assembly on the TTA, ILTEM or TIU. The GUFS must be disconnected prior to performing maintenance. Explosion is and can cause personal injury and/or damage to equipment.

Table 5-1. Direct Support Troubleshooting Procedure (Continued).

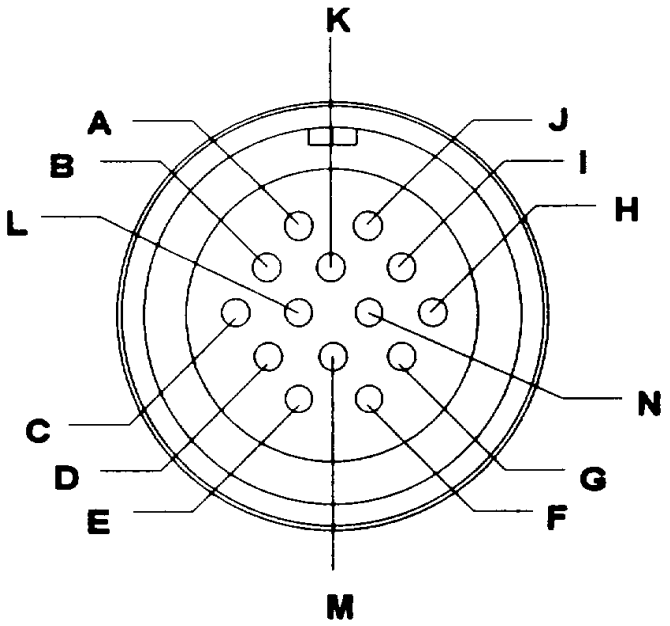
MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 1. Assure all firing tubes are unloaded prior to removing GUFS. Refer to paragraph 2-9.

Step 2. Remove electronics assembly and separate control panel from housing.

Step 3. Using multimeter, check continuity between the INPUT connector and the safe/arm switch. Refer to FO-2.

Pin B	to	T3
Pin G	to	T5



INPUT CONNECTOR

If continuity does not exist, repair wiring or replace INPUT connector in accordance with paragraph 5-18.

If continuity exists, check continuity through safe/arm switch to P3 connector on CCA as follows (refer to FO-2):

T1	to	Pin 4
T2	to	Pin 6
T6	to	Pin 5

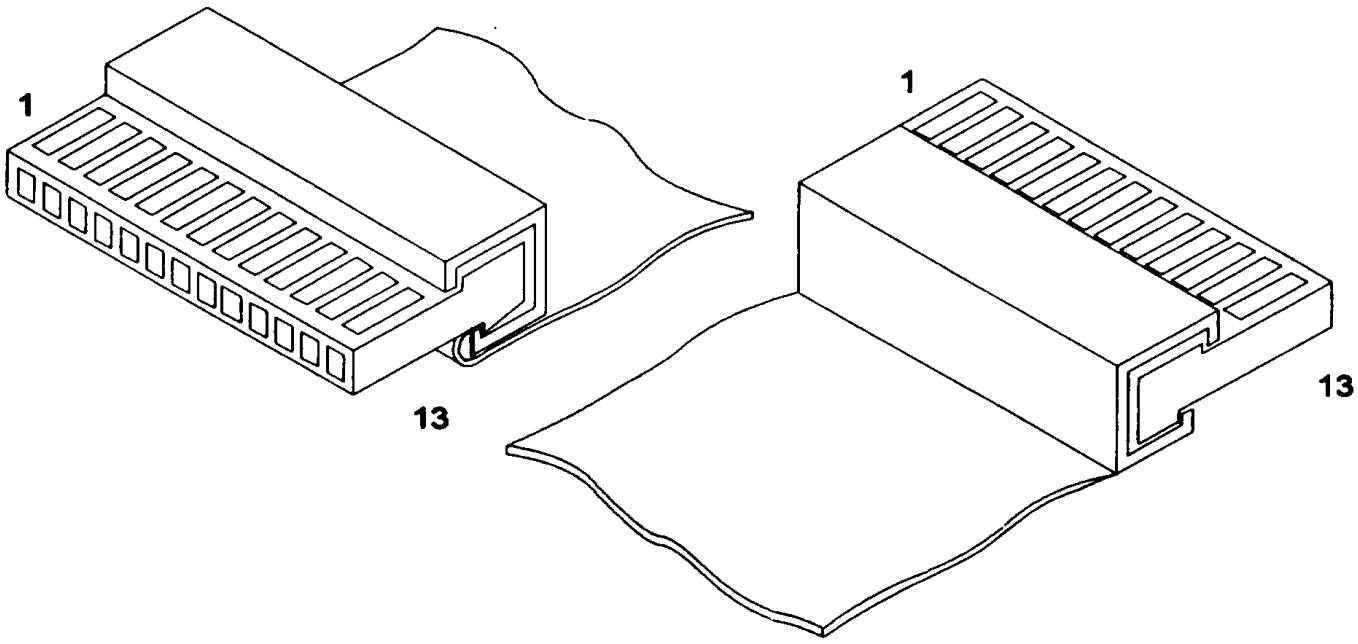
If continuity does not exist, repair wiring or replace safe/arm switch in accordance paragraph 5-19.

If continuity does exist, proceed to step 3.

Table 5-1. Direct Support Troubleshooting Procedure (Continued).

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 4. Using multimeter check for continuity between output receptacle assembly and opposite end of the output receptacle assembly cable.



If continuity exists, replace CCA in accordance with paragraph 5-18.

If continuity does not exist, proceed to step 4.

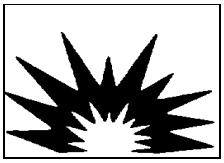
Step 5. Remove output receptacle assembly and disconnect cable. Using multimeter check continuity of cable from pin to pin. Refer to FO-2.

If continuity exists, replace output receptacle assembly in accordance with paragraph 5-13.

If continuity does not exist replace cable in accordance with paragraph 5-21.

Table 5-1. Direct Support Troubleshooting Procedure (Continued).

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION	
3. One or more tubes fail to fire.	



WARNING

Prior to arming, disarming or performing maintenance, always touch metal frame of GUFS as to ground static electricity. Failure to do so could cause serious injury or death due to accidental ignition of pyrotechnic charges.

Never lean, bend or stand directly over a firing tube or externally fired simulator when loading/unloading. Doing so could cause serious injury or death due to accidental ignition of pyrotechnic charges.

Disarm, then disconnect the GUFS connection from control assembly on the TTA, ILTEM or TIU. The GUFS must be disconnected prior to performing maintenance. Explosion is possible and can cause personal injury and/or damage to equipment.

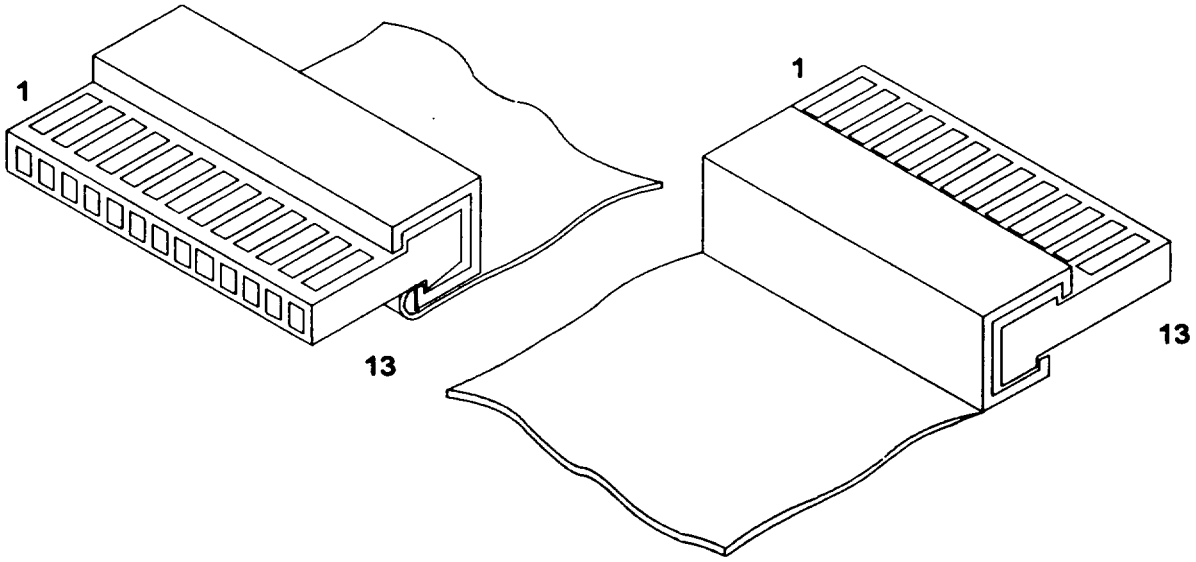
Step 1. Assure all firing tubes are unloaded prior to removing GUFS. Refer to paragraph 2-9.

Step 2. Remove electronics assembly and separate control panel from housing.

Step 3. Remove output receptacle assembly and disconnect cable. Using multimeter check continuity of cable from pin to pin. Refer to FO-2.

Table 5-1. Direct Support Troubleshooting Procedure (Continued).

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION



If continuity exists, replace output receptacle assembly in accordance with paragraph 5-13.

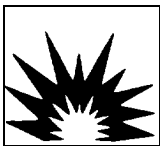
If continuity does not exist replace cable in accordance with paragraph 5-21.

Table 5-1. Direct Support Troubleshooting Procedure (Continued).

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

4. Tandem unit fails to fire.

WARNING



Prior to arming, disarming or performing maintenance, always touch metal frame of GUFS as to ground static electricity. Failure to do so could cause serious injury or death due to accidental ignition of pyrotechnic charges.

Never lean, bend or stand directly over a firing tube or externally fired simulator when loading/unloading. Doing so could cause serious injury or death due to accidental ignition of pyrotechnic charges.

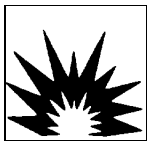
Disarm, then disconnect the GUFS connection from control assembly on the TTA, ILTEM or TIU. The GUFS must be disconnected prior to performing maintenance. Explosion is possible and can cause personal injury and/or damage to equipment.

Step 1. Assure all firing tubes are unloaded prior to removing GUFS. Refer to paragraph 2-9.

Step 2. Disconnect tandem unit input cable from electronic assembly of primary unit. Perform procedures of table 4-2 malfunction 1. Perform troubleshooting procedures of malfunctions 2 or 3 above.

Small Arms Sound Simulator

WARNING



Purge the SASS prior to maintenance or troubleshooting by removing the solenoid assembly. Failure to do so could result in ignition of trapped gasses in the combustion chamber which could cause personal injury and damage to equipment.

5. Small Arms Sound Simulator is inoperative.

NOTE

A RCS adapter, multimeter and FO-3 will be required to perform this test on the Small Arms Sound Simulator UUT.

Table 5-1. Direct Support Troubleshooting Procedure (Continued).

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 1. Refer to TM 9-5910-742-14-1 and set RCS adapter controls before applying power.

Step 2. Perform RCS adapter internal test procedures.

Step 3. Connect test cable PN 9387316 P1 to RCS adapter J1 and P2 to Small Arms Sound Simulator J1.

Step 4. Set RCS adapter hostile fire controls SINGLE/BURST switch to the SINGLE position.

Step 5. Set RCS adapter hostile fire control ENABLE switch to down position.

Step 6. Set the RCS adapter mode controls POWER switch to the ON position.

Step 7. Set the RCS adapter UUT POWER switch to the ON position.

Step 8. Set the Small Arms Sound Simulator circuit breaker to the ON position.

WARNING

Power is now applied to the UUT.

Step 9. Set the RCS adapter hostile fire controls ENABLE switch to the ENABLE position. Listen for an audible single click of metering solenoids.

If click is heard, proceed to step 10. If no click is heard, proceed to step 18.

Step 10. Set UUT CB1 to OFF. Set the RCS adapter hostile fire controls ENABLE switch to the down position. Remove wire from terminal 6 on TB2 on CCA.

Step 11. Set UUT CB1 to ON and set RCS adapter hostile fire controls ENABLE switch to ENABLE. Listen for an audible click of the metering solenoid. Set UUT CB1 to OFF, reconnect wire on terminal 6 and remove wire from terminal 7 on TB2. Set ENABLE switch to down position. Set UUT CB1 to ON. Set ENABLE switch to ENABLE and listen for an audible click of the metering solenoid. Set UUT CB1 to OFF and reconnect terminal 7.

If propane solenoid does not click, proceed to step 12.

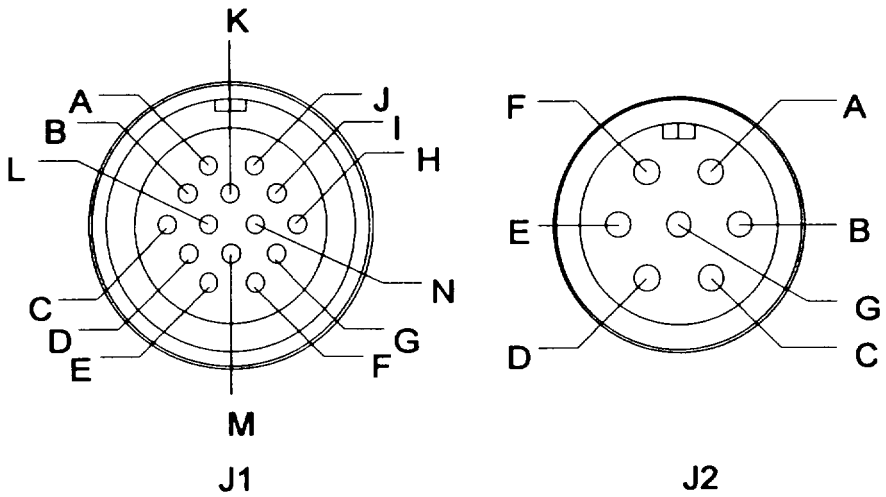
If the oxygen solenoid does not click, proceed to step 15.

If both metering solenoids energize, proceed to step 22.

Table 5-1. Direct Support Troubleshooting Procedure (Continued).

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 12. Set UUT CB1 to OFF and disconnect UUT J2. Set multimeter to measure 15 vdc. Insert multimeter negative lead into J2 pin D and the positive lead into J2 pin E.



Step 13. Set UUT CB1 to ON. Set RCS adapter hostile fire controls SINGLE/BURST switch to BURST. Multimeter should read 15 ± 5 vdc.

If multimeter reads 15 ± 5 vdc, remove power and check continuity of J2 connector. If connector is serviceable, replace metering valve assembly and retest.

If multimeter does not read 15 ± 5 vdc, remove power. Disconnect multimeter and reconnect positive lead to TB2 pin 7 and negative lead to TB2 pin 3. Turn power back on and proceed to step 14.

Step 14. Set RCS adapter hostile fire control SINGLE/BURST switch to SINGLE and then to BURST. Multimeter should read 15 ± 5 vdc.

If multimeter reads 15 ± 5 vdc, remove power and check continuity between TB2 pin 7 and J2 pin E, and TB2 pin 3 and J2 pin D. Repair wiring as necessary.

If multimeter does not read 15 ± 5 vdc, remove power and replace CCA and retest.

Step 15. Set UUT CB1 to OFF and disconnect UUT J2. Set multimeter to measure 15 volts vdc. Insert multimeter negative lead into J2 pin A and positive lead into J2 pin B.

Table 5-1. Direct Support Troubleshooting Procedure (Continued).

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 16. Set UUT CB1 to ON. Set RCS adapter hostile fire control SINGLE/BURST switch to SINGLE and then to BURST. Multimeter should read 15 ± 5 vdc.

If multimeter reads 15 ± 5 vdc, remove power and check continuity of J2 connector. If connector is serviceable, replace metering valve assembly and retest.

If multimeter does not read 15 ± 5 vdc, remove power. Disconnect multimeter and reconnect positive lead to TB2 pin 6 and negative lead to TB2 pin 3. Turn power on and proceed to step 17.

Step 17. Set RCS adapter hostile fire control SINGLE/BURST switch to SINGLE and then to BURST. Multimeter should read 15 +5 vdc.

If multimeter reads 15 ± 15 vdc, remove power and check continuity between TB2 pin 6 and J2 pin B, and TB2 pin 3 and J2 pin A. Repair wiring as necessary.

If multimeter does not read 15 ± 5 vdc, remove power and replace CCA and retest.

Step 18. Turn off CB1, reconnect J2 and turn CB1 on. Set RCS adapter hostile fire control SINGLE/BURST switch to BURST. Listen for clicking of metering solenoids.

If there is an audible clicking in the in the BURST position but not in the SINGLE position, replace CCA and retest.

If there is no audible clicking of the metering solenoids, proceed to step 19.

Step 19. Set UUT CB1 to OFF. Disconnect J2 connector and set UUT CB1 to ON.

Step 20. Disconnect high voltage wire from spark plug and ground to frame. Set the RCS adapter hostile fire control SINGLE/BURST switch to SINGLE and then to BURST. A spark should be visible when the command is sent by the RCS adapter.

If spark is visible, remove power and replace metering valve assembly and retest.

If spark is not visible, reconnect spark plug wire and proceed to step 21.

Table 5-1. Direct Support Troubleshooting Procedure (Continued).

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 21. Set UUT CB1 to OFF. Set multimeter to 30 vdc. Place positive lead on UUT TB1 pin 6 negative lead to TB1 pin 2. Set UUT CB1 to ON. Multimeter should read 30 ± 10 vdc.

If multimeter does not read 30 ± 10 vdc, remove power and check continuity between J1 pin J, CB1, and TB1 pin 6. Repair as required. If continuity check is good, malfunction is external of UUT.

If multimeter reads 30 ± 10 vdc set UUT CB1 to OFF and place multimeter positive lead on TB1 pin 4 referenced to TB1 pin 2. Set UUT CB1 to ON and RCS adapter SINGLE/BURST switch to BURST. Multimeter should momentarily show a deflection.

If multimeter shows a deflection, remove power and replace CCA and retest.

If multimeter does not show a deflection, remove power and check continuity of test cable. Repair as necessary.

Step 22. Set UUT CB1 to OFF. Remove ignition wire and spark plug. Check and set spark plug gap to 0.026-0.030-in.

Step 23. Insure that ignition wire is connected to spark plug and coil. Ground plug to side of electronic housing assembly.

Step 24. Set UUT CB1 to ON. Set RCS adapter hostile fire control SINGLE/BURST switch to BURST. Observe for spark.

If spark is visible, the ignition system is functional. Set Small Arms Sound Simulator CB1 to OFF, and install spark plug. Replace ignition wire and proceed to malfunction 5 or 6.

If there is not a visible spark, check continuity of ignition wire, replace if necessary.

If continuity of ignition wire is good, replace spark plug and retest. If there is still no spark, proceed to step 25.

Step 25. Set UUT CB1 to OFF. Set multimeter to Amps position. Remove wire from terminal 4 of TB2. Attach multimeter negative lead to TB2 pin 4 and positive lead to coil wire that was removed from TB2 pin 4.

Step 26. Set UUT CB1 to ON. Set RCS adapter hostile fire control SINGLE/BURST switch to SINGLE and then BURST. Multimeter should read 75 ± 7.5 ma.

If multimeter reads 75 ± 7.5 ma, replace coil and retest.

If multimeter does not read 75 ± 7.5 ma, replace CCA and retest.

Table 5-1. Direct Support Troubleshooting Procedure (Continued).

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

6. Oxygen cylinder empties prematurely.

Step 1. Install a full oxygen cylinder. Open pressure seal valve and listen at muzzle for hissing sound.

If oxygen leak is detected, close valve and replace solenoid assembly.

Step 2. If a oxygen leak is not detected, soap bubble check all connections.

If a leak is detected, repair leaks by retaping and tightening connections, or by replacing leaking hoses, fittings regulators, or valves. Repeat soap bubble test.

7. Propane tank empties prematurely.

Step 1. Install a full propane tank. Open propane valve and listen at muzzle for hissing sound.

If propane leak is detected, close valve and replace solenoid assembly.

Step 2. If a propane leak is not detected, soap bubble check all connections.

If a leak is detected, repair leaks by retaping and tightening connections, or by replacing leaking hoses, fittings, regulators, or valves. Repeat soap bubbles test.

SECTION II. DIRECT SUPPORT MAINTENANCE PROCEDURES

5-2 GENERAL.

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

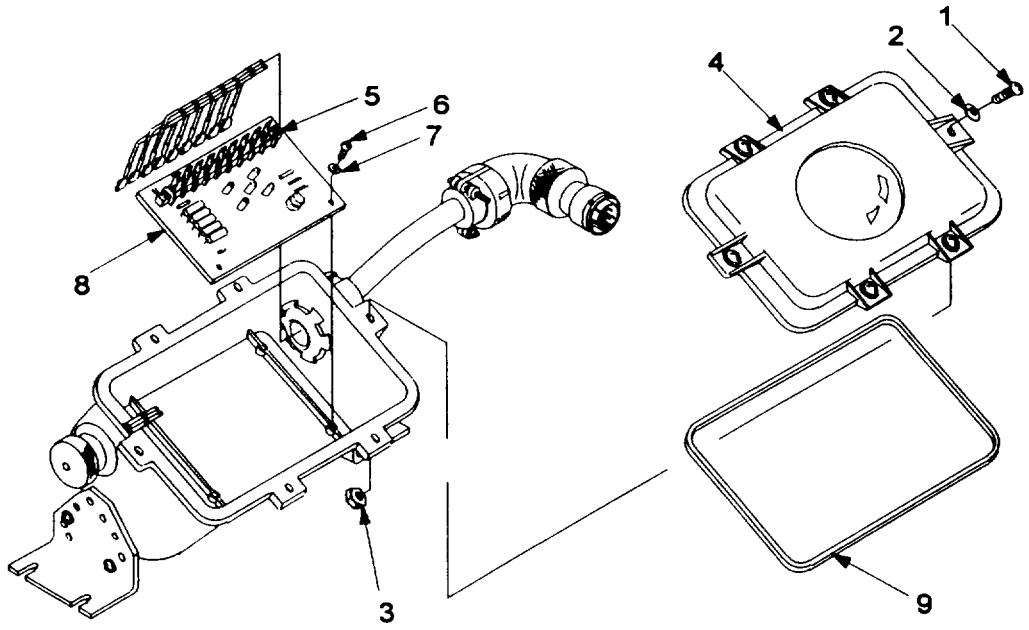
5-3 MFS HOUSING REPLACEMENT.

INITIAL SETUP

Tools:
General Mechanic's Automotive Tool Kit
Torque Screwdriver

References:
Paragraph 5-6
Paragraph 5-8
Paragraph 4-7

Material/Parts:
Housing (11829681)
O-Ring (11829556)
Adhesive (item 1, appendix D)



a. Removal.

(1) Remove six screws (1), flatwashers (2), and nuts (3).

(2) Remove cover (4).

(3) Tag and disconnect wires on TB1 (5).

(4) Remove J1 from housing and remove wiring harness. Refer to paragraph 5-6.

(5) Remove cable assembly. Refer to paragraph 5-8.

(6) Remove four screws (6) and washers (7) and remove printed wiring assembly (8).

b. Installation.

(1) Install O-ring (9) on housing. Refer to paragraph 4-7.

(2) Position printed wiring assembly (8) and install four screws (6) and washers (7).

(3) Install cable assembly in housing. Refer to paragraph 5-8.

(4) Install wiring harness in housing. Refer to paragraph 5-6.

(5) Connect wires to proper terminals on TB1 (5).

(6) Install cover (4) using six screws (1), flat washers (2), and nuts (3).

(7) Torque cover screws to 27-30 inch pounds.

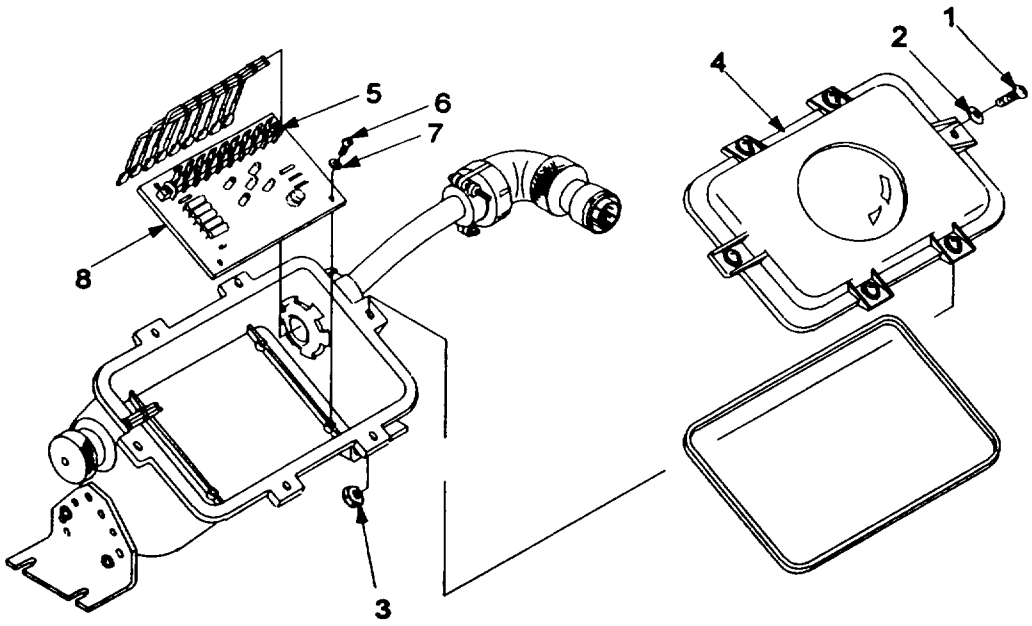
5-4 MFS CIRCUIT CARD ASSEMBLY REPLACEMENT.

INITIAL SETUP

Tools:
General Mechanic's Automotive Tool Kit
Torque Screwdriver

Equipment Condition:
MFS removed (reference paragraph 4-6)

Materials/Parts:
Printed Wiring Assembly (11829552)



5-4 MFS CIRCUIT CARD ASSEMBLY REPLACEMENT (CONTINUED).

a. Removal.

(1) Remove six screws (1) flatwashers (2), and nuts (3).

(2) Remove cover (4).

(3) Tag and disconnect wires from TBI (5).

(4) Remove four screws (6) and washers (7).

(5) Remove printed wiring assembly (8).

b. Installation.

(1) Position printed wiring assembly (8) in housing.

(2) Install four screws (6) and washers (7).

(3) Connect wires to the proper terminals on TBI (5).

(4) Install cover (4) on housing using six screws (1), washers (2), and nuts (3).

(5) Torque cover screws to 27-30 inch pounds.

(6) Install MFS. Refer to paragraph 4-6.

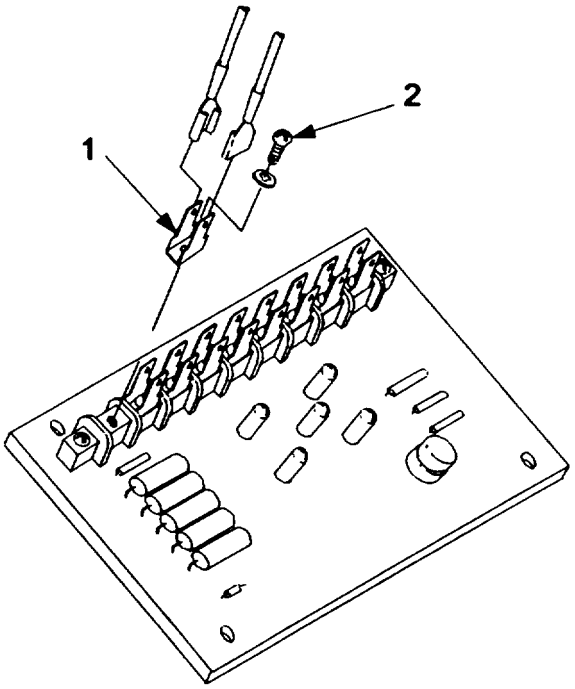
5-5 MFS TAB REPLACEMENT.

INITIAL SETUP

Tools:
General Mechanic's Automotive Tool Kit

Equipment Conditions:
MFS removed (reference paragraph 4-6)

Materials/Parts:
Tab (9340880)



a. Removal.

(1) Disconnect wires from tab (1).

(2) Remove screw (2) holding tab to TB1.

b. Installation.

(1) Position tab (1) on TB1.

(2) Install screw (2) on TB1.

(3) Connect wires to tab.

(4) Install MFS. Refer to paragraph 4-6.

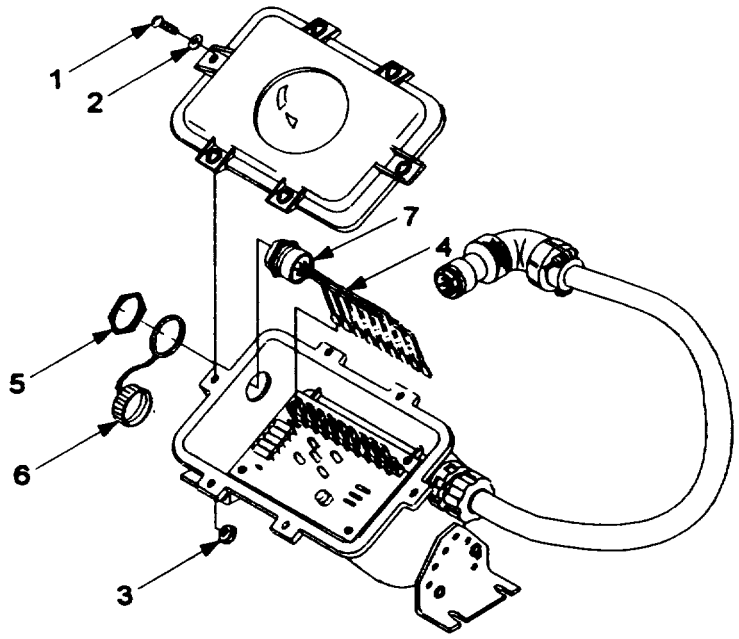
5-6 MFS WIRING HARNESS REPLACEMENT.

INITIAL SETUP

Tools:
General Mechanic's Automotive Tool Kit
Torque Screwdriver
Torque Wrench

Equipment Condition:
MFS removed (reference paragraph 4-6)

Materials/Parts:
Wiring Harness (11829687)
Grease (item 7, Appendix D)



a. Removal.

(1) Remove six screws (1), washers (2), and nuts (3) and remove cover.

(2) Tag and disconnect wires of wiring harness (4) from TB1 and E1.

(3) Remove retaining nut (5) and dust cap (6) and remove J1 (7) from housing.

b. Installation.

(1) Install J1 (7) into housing.

(2) Install retaining nut (5) and dust cap (6).

(3) Torque retaining nut to 55-60 inch pounds.

(4) Connect wiring harness (4) to proper terminals on TB1 and E1.

(5) Apply a thin coating of grease to entire surface of O-ring.

(6) Install cover on housing using six screws (1), washers (2), and nuts (3).

(7) Torque cover screws to 27-30 inch pounds.

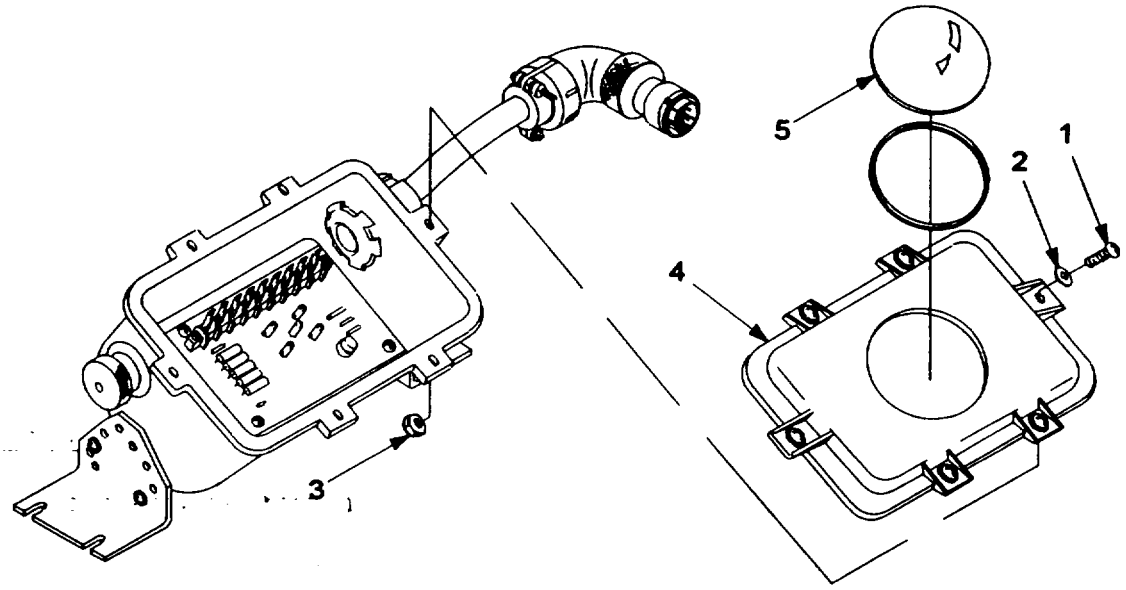
(8) Install MFS. Refer to paragraph 4-6.

5-7 MFS LENS REPLACEMENT.

INITIAL SETUP

Tools:
General Mechanic's Automotive Tool Kit
Torque Screwdriver

Materials/Parts:
Lens (11829685)
Adhesive (item 1, appendix D)
Grease (item 7, appendix D)



a. Removal.

(1) Remove six screws (1), flatwashers (2), and nuts (3) and cover (4).

(2) Remove lens (5) from cover.

(3) Clean any adhesive or residue from cover lens opening.

5-7 MFS LENS REPLACEMENT (CONTINUED).

b. Installation.

(1) Apply adhesive to inside edges of lens (5).

(2) Insert lens of cover (4) in opening with smooth side out.

(3) Apply a uniform layer of adhesive around the outside edge of lens so the layer is overlapping the lens and cover.

(4) Apply a thin coating of grease to entire O-ring surface.

(5) Install cover and fasten with six screws (1), flatwashers (2), and nuts (3).

(6) Torque cover screws to 27-30 inch pounds.

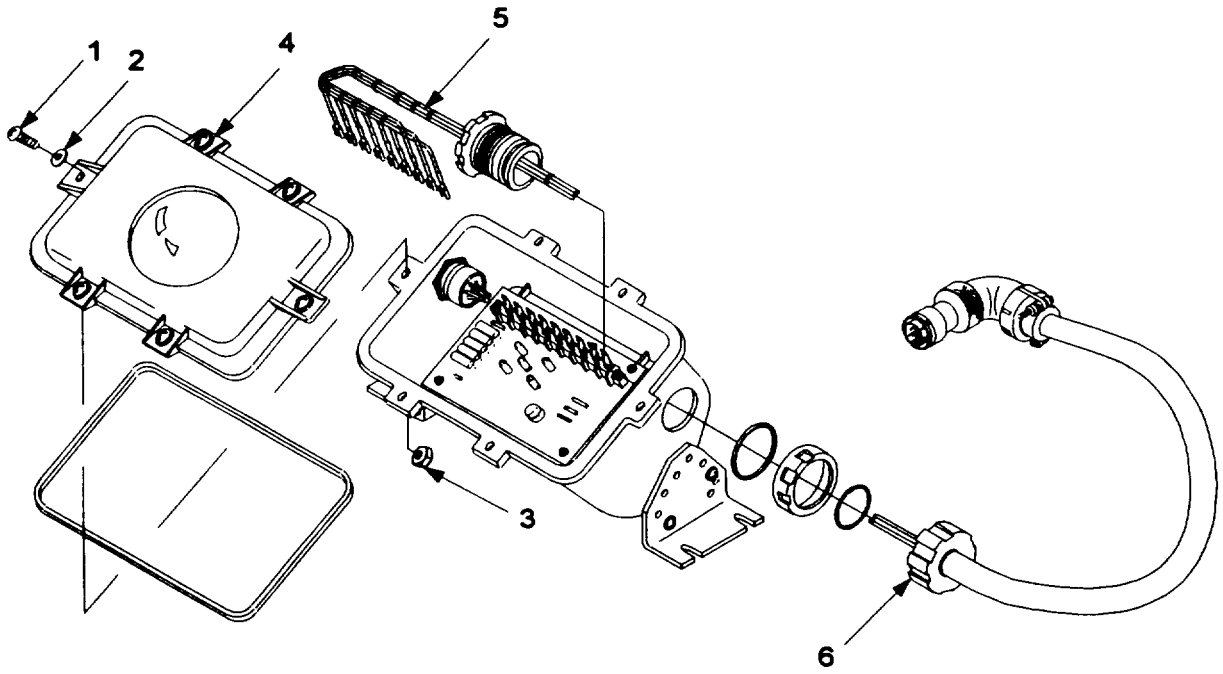
5-8 MFS CABLE ASSEMBLY REPLACEMENT.

INITIAL SETUP

Tools:
General Mechanic's Automotive Tool Kit
Torque Screwdriver

Equipment Condition:
MFS removed (Reference paragraph 4-6)

Materials/Parts:
Cable Assembly (11829686)
Grease (item 7, appendix D)



a. Removal.

(1) Remove six screws (1), flatwashers (2), and nuts (3) and remove cover (4).

(2) Tag and disconnect cable (5) terminal lugs from TB1.

(3) Loosen retaining nut (6) and slide off of cable.

(4) Remove cable from housing.

b. Installation.

(1) Install cable (5) into housing and through retaining nut (6). Tighten nut.

(2) Connect terminal lug to proper terminals on TB1.

(3) Apply a thin coating of grease to entire O-ring surface.

(4) Install cover (4) and fasten six screws (1), flatwashers (2), and nuts (3).

(5) Torque cover screws to 27-30 inch pounds.

(6) Install MFS. Refer to paragraph 4-6.

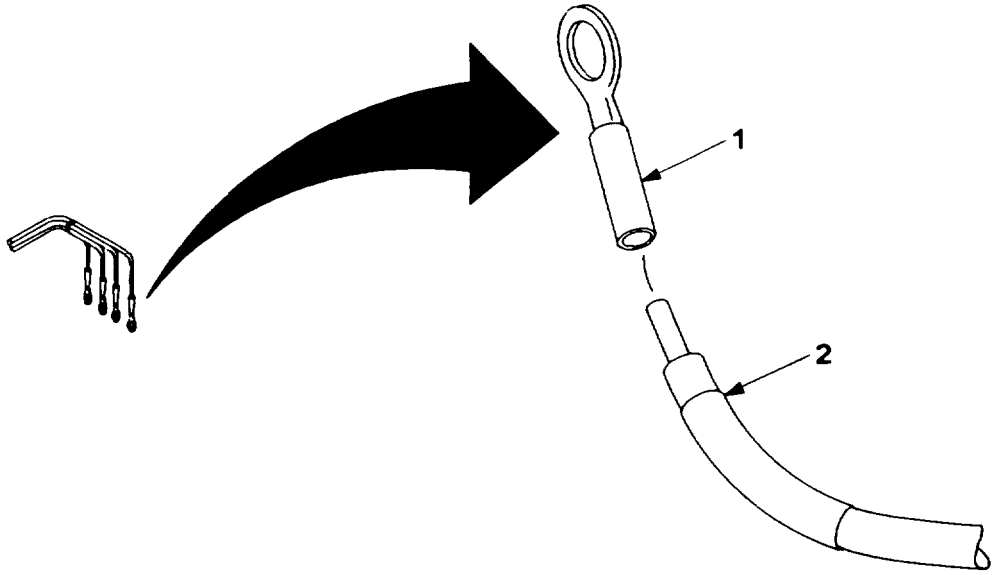
5-9 MFS TERMINAL LUG REPLACEMENT.

INITIAL SETUP

Tools:
General Mechanic's Automotive Tool Kit
Crimping Tool (reference paragraph 5-8)

Equipment Condition:
Cable assembly removed

Materials/Parts:
Terminal Lug (MS25036-102)



a. Removal.

Cut terminal lug (1) from wire (2) as close to terminal lug as possible.

b. Installation.

(1) Strip wire (2) 3/8 inch from end.

(2) Insert wire into terminal lug (1) and crimp lug.

(3) Install cable assembly. Refer to paragraph 5-8.

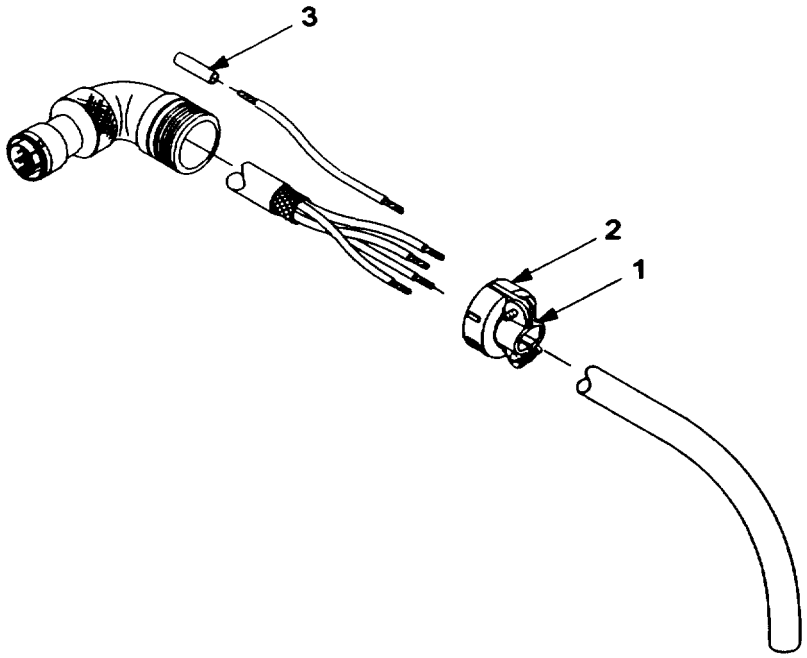
5-10 MFS CONNECTOR REPLACEMENT.

INITIAL SETUP

Tools:
General Mechanic's Automotive Tool Kit
Crimping Tool (reference paragraph 5-8)

Equipment Condition:
Cable assembly removed

Materials/Parts:
Connector (9353932)



a. Removal.

(1) Loosen strain relief (1) on cable.

(2) Separate backshell (2) from connector P1.

(3) Remove crimp connector (3) from shield.

b. Installation.

(1) Install crimp connector (3) on shield.

(2) Crimp the connector.

(3) Install backshell (2).

(4) Tighten strain relief (1).

(5) Install cable assembly. Refer to paragraph 5-8.

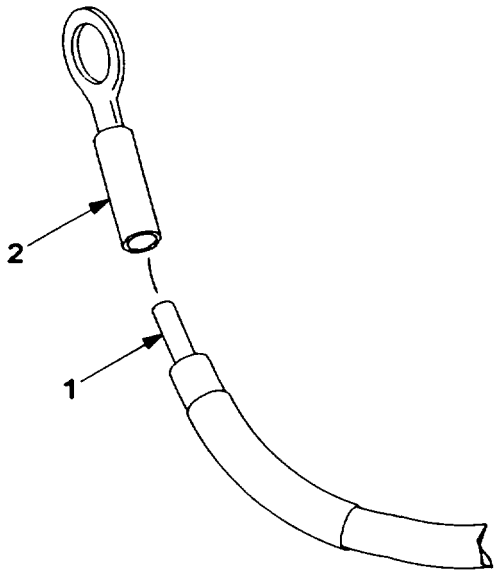
5-11 MFS TERMINAL LUG REPLACEMENT.

INITIAL SETUP

Tools:
General Mechanic's Automotive Tool Kit
Crimping Tool (reference paragraph 5-8)

Equipment Condition:
Cable assembly removed

Materials/Parts:
Terminal Lug (9340878)



a. Removal.

Cut terminal lug (1) from wire (2) as close to terminal lug as possible.

b. Installation.

(1) Strip wire (2) 3/8 inch from end.

(2) Insert wire into terminal lug (1).

(3) Crimp the terminal lug.

(4) Install cable assembly. Refer to paragraph 5-8.

5-12 GUFS HOUSING ASSEMBLY REPLACEMENT.

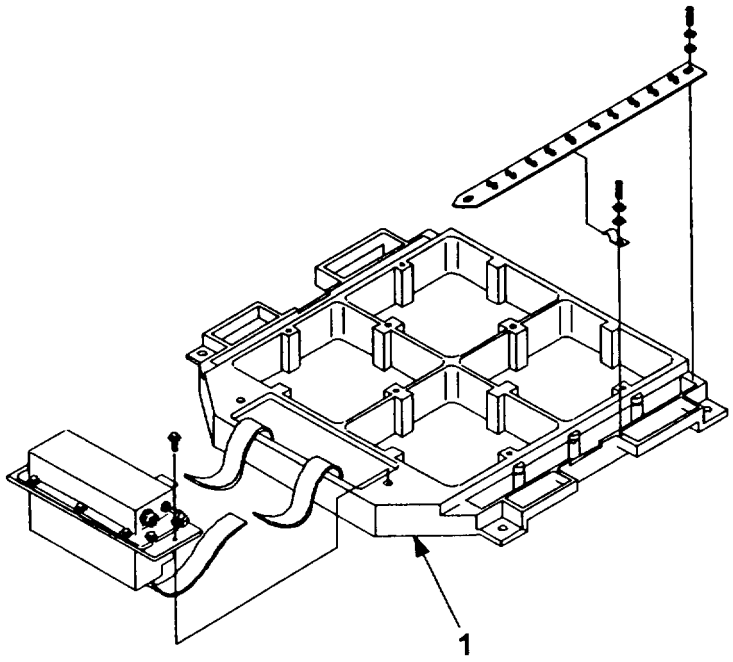
INITIAL SETUP

Tools:
General Mechanic's Automotive Tool Kit

Materials/Parts:
Housing (12725003-1)

Equipment Condition:
Firing tubes removed.
(Reference paragraph 4-12)

References:
Paragraph 5-13
Paragraph 5-14



a. Removal.

(1) Remove receptacle assemblies. Refer to paragraph 5-13.

(2) Remove electronic control assembly. Refer to paragraph 5-14.

(3) Remove housing (1).

b. Installation.

(1) Position housing (1).

(2) Install electronic control assembly. Refer to paragraph 5-14.

(3) Install receptacle assemblies. Refer to paragraph 5-13.

(4) Install firing tube assemblies. Refer to paragraph 5-12.

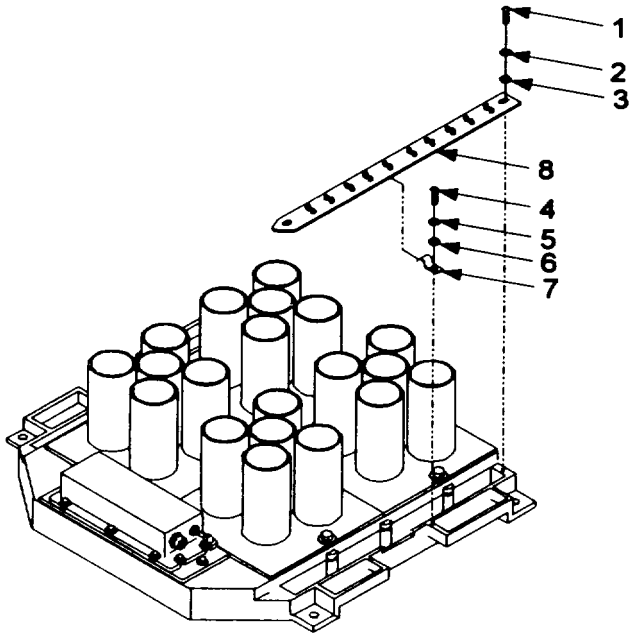
5-13 GUFS RECEPTACLE ASSEMBLY REPLACEMENT.

INITIAL SETUP

Tools:
General Mechanic's Automotive Tool Kit
(Reference paragraph 4-9)

Equipment Condition:
GUFS removed

Materials/Parts:
Receptacle Assembly (12725006)



a. Removal.

(1) Remove two screws (1), lockwashers (2), and flatwashers (3).

(2) Remove two screws (4), lockwashers (5), flatwashers (6), and retaining clips (7).

(3) Lift receptacle (8) from housing.

(4) Disconnect cable from receptacle.

b. Installation.

(1) Connect cable to receptacle assembly.

(2) Position receptacle assembly on housing.

(3) Install two retaining clips (7), flatwashers (6), lockwashers (5), and screws (4).

(4) Install two flatwashers (3), lockwashers (2), and screws (1).

(5) Install GUFS. Refer to paragraph 4-9.

5-14 GUFS ELECTRONIC CONTROL ASSEMBLY REPLACEMENT.

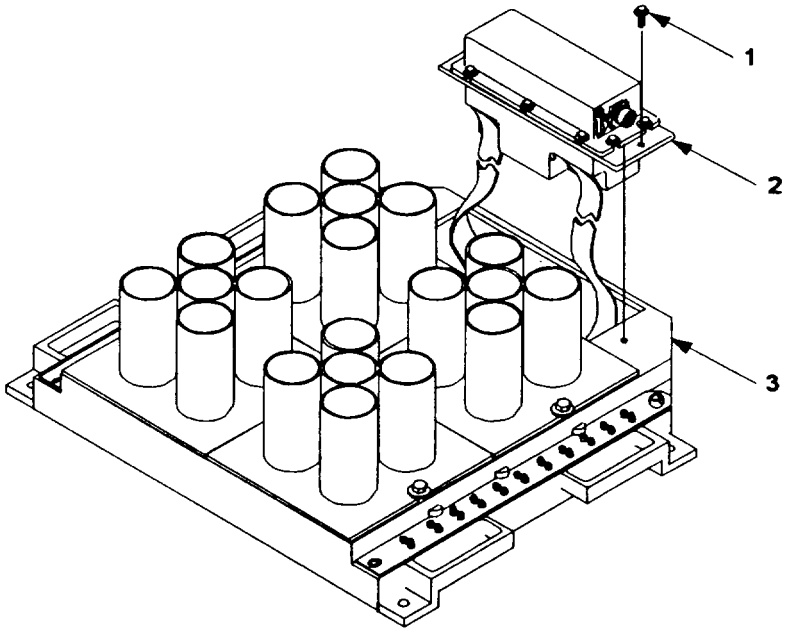
INITIAL SETUP

Tools:
General Mechanic's Automotive Tool Kit

Equipment Condition:
Receptacle assemblies removed
(Reference paragraph 5-13)

Material/Parts:
Electronic Control Assembly (12725014-1)

References:
Paragraph 4-13



a. Removal.

(1) Remove two capscrews (1).

(2) Lift electronic control assembly (2) from housing (3).

(3) Gently remove cables from housing.

b. Installation.

(1) Route cables through opening in housing (3) and connect to respective receptacle assembly position.

(2) Position electronic control assembly (2) in housing.

(3) Install two capscrews (1).

(4) Test pressure of electronic control assembly. Refer to paragraph 4-13.

(5) Install receptacle assemblies. Refer to paragraph 5-13.

5-15 GUFS GASKET REPLACEMENT.

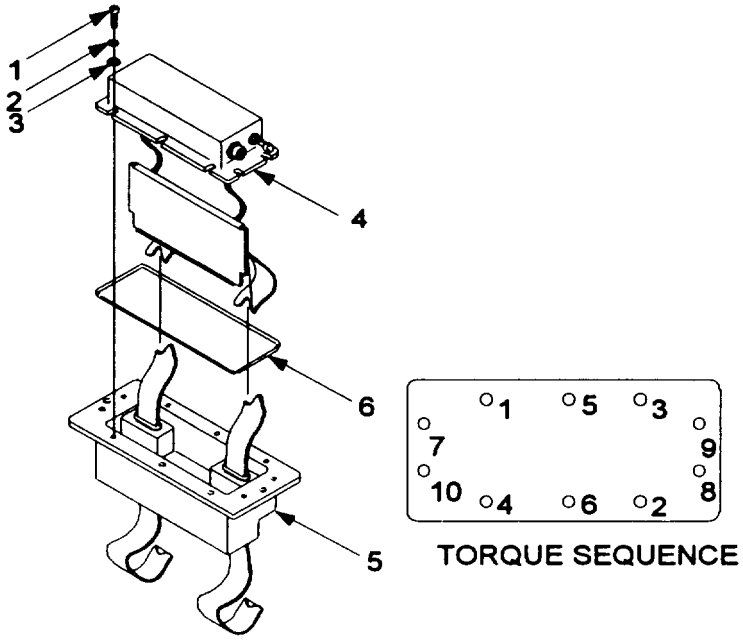
INITIAL SETUP

Tools:
General Mechanic's Automotive Tool Kit
Torque Screwdriver

Equipment Condition:
Electronics control assembly removed
(Reference paragraph 5-14)

Materials/Parts:
Gasket (12725031)
Lockwashers (MS15759807)

References:
Paragraph 4-13



a. Removal.

(1) Vent pressure from electronic control assembly by opening air valve.

(2) Remove 10 screws (1), lockwashers (2), and flatwashers (3).

(3) Lift control panel assembly (4) from housing (5).

(4) Disconnect cable P3 and P4 from J3 and J4 on CCA.

(5) Remove gasket (6) from housing.

b. Installation.

(1) Position gasket (6) on housing.

(2) Connect P3 and P4 to J3 and J4 on CCA.

(3) Place control panel assembly (4) in housing (5).

(4) Install 10 flatwashers (3), lockwashers (2), and screws (1) in housing.

(5) Torque to 10 - 20 inch pounds (1.10 - 2.20 Newton-meters) in sequence.

(6) Purge and pressurize electronic control assembly. Refer to paragraph 4-13.

(7) Install electronic control assembly. Refer to paragraph 5-14.

5-16 GUFS CIRCUIT CARD ASSEMBLY REPLACEMENT.

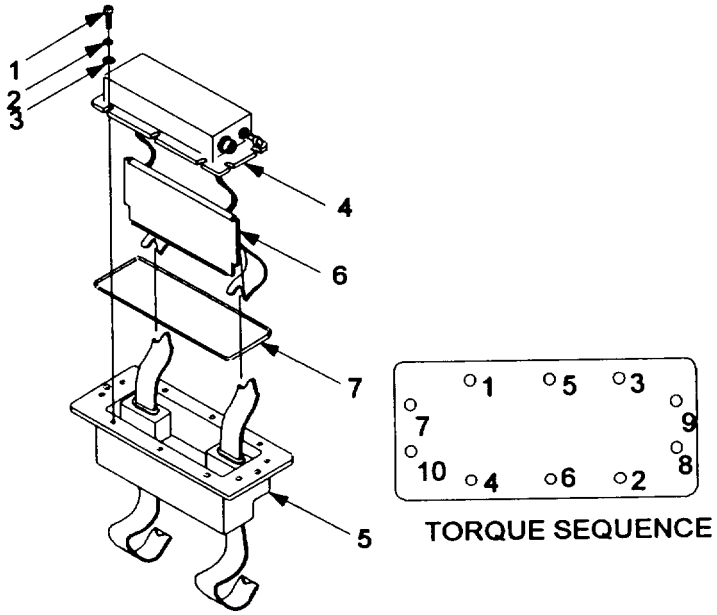
INITIAL SETUP

Tools:
General Mechanic's Automotive Tool Kit
Torque Screwdriver

Equipment Condition:
Electronics control assembly removed
(Reference paragraph 5-14)

Materials/Parts:
Circuit Card Assembly (12725086)
Lockwashers (MS15759-807)

References:
Paragraph 4-13



5-16 GUFS CIRCUIT CARD ASSEMBLY REPLACEMENT (CONTINUED).

a. Removal.

(1) Vent pressure from electronic control assembly by opening air valve.

(2) Remove 10 screws (1), lockwashers (2), and flatwashers (3).

(3) Lift control panel assembly (4) from housing (5).

(4) Disconnect cable P3 and P4 from J3 and J4 on CCA (6).

(5) Remove CCA from housing and disconnect P1 and P2 from J1 and J2.

b. Installation.

(1) Position gasket (7) on housing (5).

(2) Install CCA (6) in housing and reconnect P1 and P2 to J1 and J2.

(3) Connect P3 and P4 to J3 and J4 on CCA.

(4) Place control panel assembly (4) in housing.

(5) Install 10 flatwashers (3), lockwashers (2), and screws (1) in housing.

(6) Torque to 10 - 20 inch pounds (1.10 - 2.20 Newton-meters) in sequence.

(7) Purge and pressurize electronic control assembly. Refer to paragraph 4-13.

(8) Install electronic control assembly. Refer to paragraph 5-14.

5-17 GUFS CIRCUIT CARD ASSEMBLY, LITHIUM BATTERY REPLACEMENT (LTC-7PN).

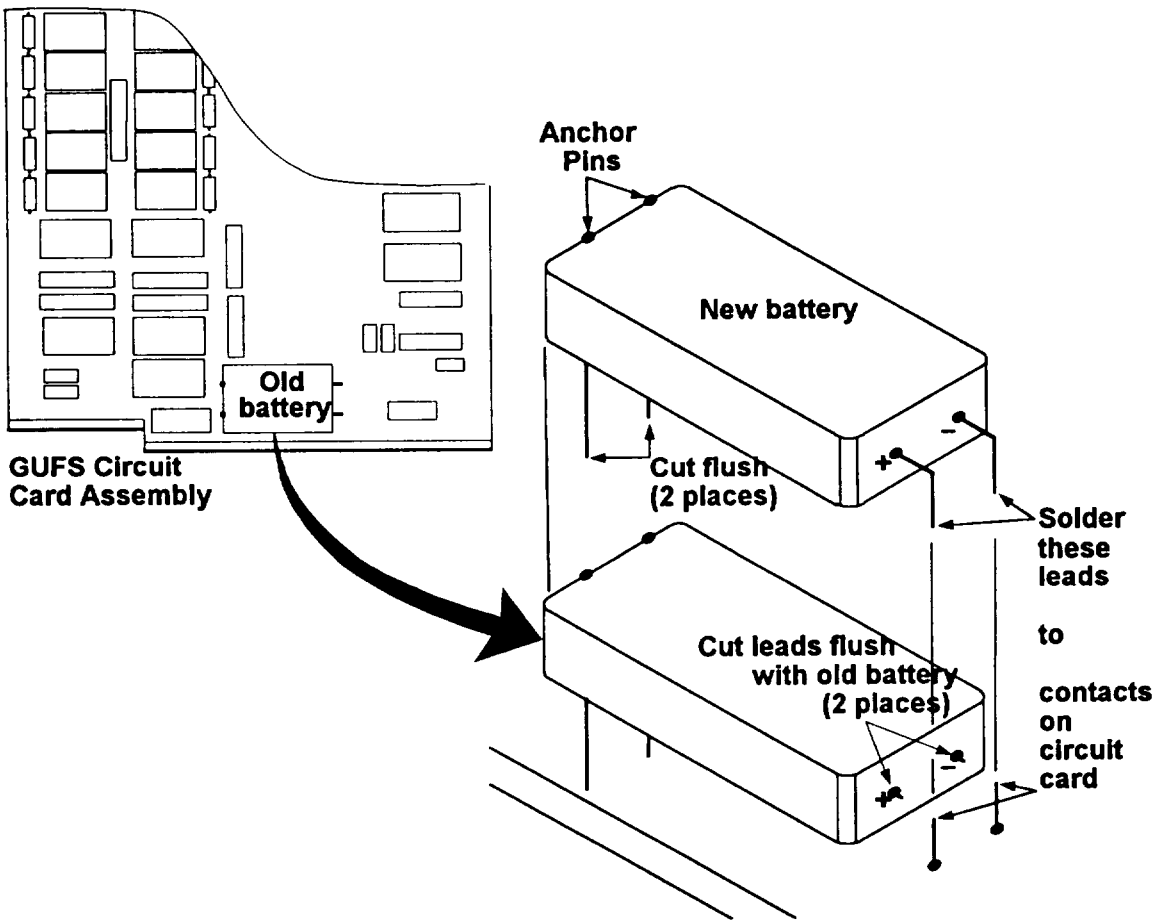
INITIAL SETUP

Tools:
General Mechanic's Automotive Tool Kit
Soldering and desoldering set

Equipment Condition:
Circuit Card Assembly removed
(Reference paragraph 5-16)

Materials/Parts:
Circuit Lithium Battery (LTC-7PN)
(NSN 6135-01-380-4396)
Adhesive (item 1, appendix D)

References:
Paragraph 4-13
Paragraph 5-14



5-17 GUFS CIRCUIT CARD ASSEMBLY, LITHIUM BATTERY REPLACEMENT (LTC-7PN) (CONTINUED).

a. Removal.

CAUTION

There is no removal of the old battery off the GUFS circuit card. The original battery is sealed to the circuit card with conformal coating. The use of heat or force by prying to remove the old battery will cause significant damage to the circuit card.

b. Installation.

NOTE

When looking at the top of the battery, there are two electrical leads on one side (identified by a + and - symbol) and on the opposite side are two mounting posts. These mounting posts are there only to anchor the battery to the circuit card. Do not confuse these two mounting posts with the two electrical leads that are on the other side of the battery when performing the following steps.

(1) Clip the mounting post leads on one end of the new battery so they are flush with the battery case and won't interfere when the new battery is glued to the top of the old battery.

(2) Using adhesive (item 1, appendix D), glue the new battery on top of the old battery.

(3) Cut the two wires (positive and negative) coming out of the old battery as close to the battery as possible, leaving as much lead length coming out of the circuit card as possible.

(4) Solder the positive and negative leads of the new battery to the positive and negative wires going through the circuit card. Ensure the correct polarity is maintained and that there is no chance that the new battery and wires come in contact with the old battery or it's contacts.

(5) Purge and pressurize the electronic control assembly. Refer to paragraph 4-13.

(6) Install electronic control assembly. Refer to paragraph 5-14.

5-18 GUFS CONTROL PANEL ASSEMBLY REPLACEMENT.

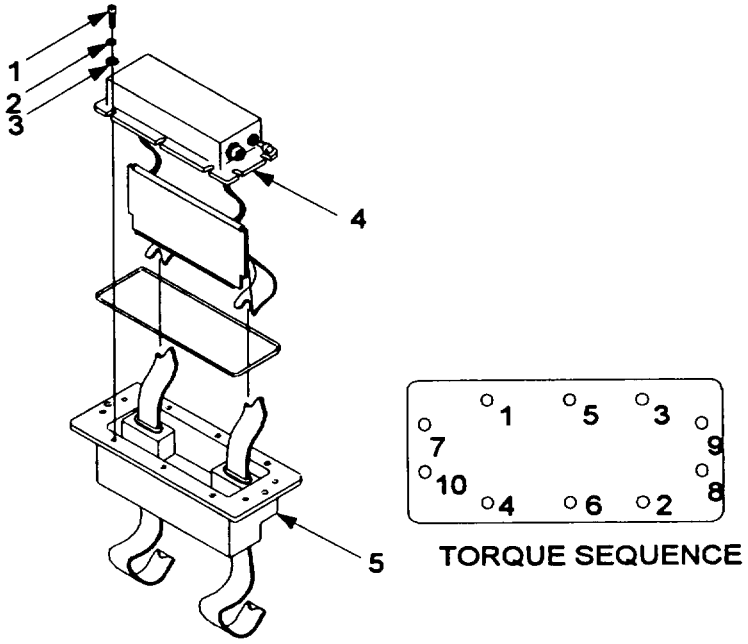
INITIAL SETUP

Tools:
General Mechanic's Automotive Tool Kit
Torque Screwdriver

Equipment Condition:
Electronic control assembly removed
(Reference paragraph 5-14)

Materials/Parts:
Control Panel Assembly (12725015-1)
Lockwashers (MS15759-807)

References:
Paragraph 4-13



a. Removal.

(1) Vent pressure from electronic control assembly by opening air valve.

(2) Remove 10 screws (1), lockwashers (2), and flatwashers (3).

(3) Lift control panel assembly (4) from housing (5).

(4) Disconnect plugs from J3 and J4 on CCA.

b. Installation.

(1) Connect plugs P3 to J3 and P4 to J4 on CCA.

(2) Position control panel assembly (4) on housing (5).

(3) Install 10 flatwashers (3), lockwashers (2), and screws (1).

5-18 GUFS CONTROL PANEL ASSEMBLY REPLACEMENT (CONTINUED).

(4) Torque screws to 1020 inch-pounds (1.10 - 2.20 Newton-meters) in sequence.

(5) Purge and pressurize electronic control assembly. Refer to paragraph 4-13.

(6) Install electronic control assembly. Refer to paragraph 5-14.

5-19 GUFS CONTROL PANEL ASSEMBLY REPAIR.

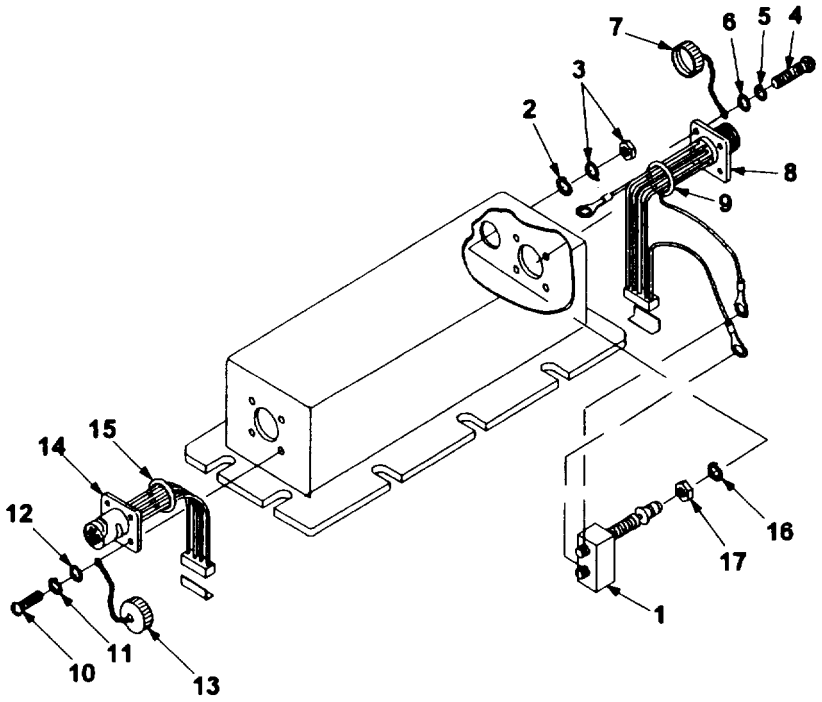
INITIAL SETUP

Tools:
General Mechanic's Automotive Tool Kit
Gasket (MS52000-5)

Materials/Parts:
Toggle Switch (MS24659-23D)
Boot (M5423/16-001)
Receptacle (12725090)
Receptacle (12725021)

Materials/Parts (Continued):
Gasket (MS52000-7)

Equipment Condition:
Control panel assembly removed
(Reference paragraph 5-18)



a. Removal.

(1) Tag and disconnect wires from toggle switch (1).

(2) Remove lockwasher (2) and retaining nut with tabwasher (3) from switch.

(3) Remove toggle switch.

(4) Disconnect T4 from ground in housing.

(5) Remove four screws (4), lockwashers (5), flatwashers (6), and dust cap (7).

(6) Remove input connector (8) and gasket (9) from housing.

(7) Remove four screws (10), lockwashers (11), flatwashers (12), and dust cap (13).

(8) Remove output receptacle (14) and gasket (15) from housing.

b. Installation.

(1) Position output receptacle (14) and gasket (15) in housing.

(2) Install dust cap (13) four flatwashers (12), lockwashers (11), and screws (10).

(3) Position input receptacle (8) and gasket (9) in housing.

(4) Install dust cap (7) four flatwashers (6), lockwashers (5), and screws (4).

(5) Connect T4 to ground in housing.

(6) Connect wires to toggle switch.

(7) Remove and discard locking ring supplied with the switch.

(8) Install boot (rubber washer) (16) and retaining nut (17) on switch.

(9) Position toggle switch (1) in control panel assembly.

(10) Install lockwasher (2) and retaining nut (3) on switch and tighten securely.

(11) Install control panel assembly. Refer to paragraph 5-18.

5-20. GUFS ELECTRONIC CONTROL ASSEMBLY HOUSING REPLACEMENT.

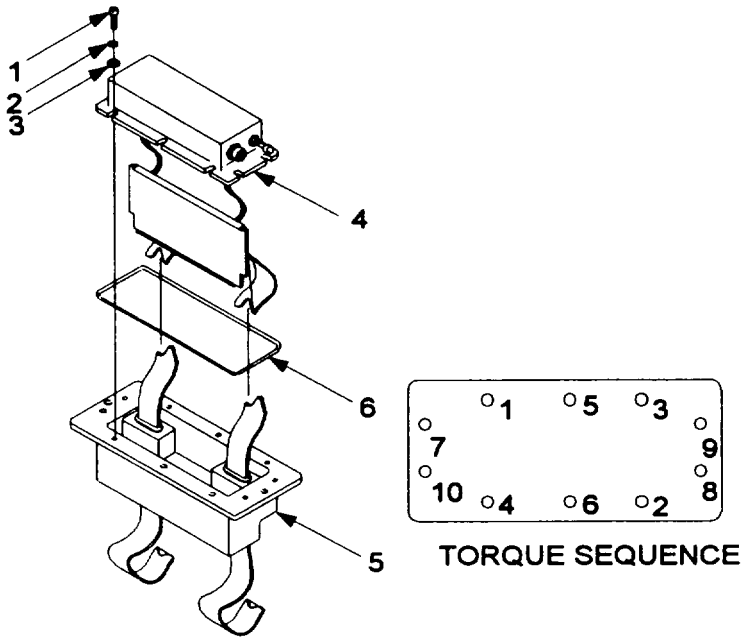
INITIAL SETUP

Tools:
General Mechanic's Automotive Tool Kit
Torque Screwdriver

Equipment Condition:
Electronic control assembly removed (reference paragraph 5-14)

Materials/Parts:
Housing Assembly (12725026-1)
Lockwashers (MS15759807)

References:
Paragraph 4-13



a. Removal.

(1) Vent pressure from electronic control assembly by opening air valve.

(2) Remove 10 screws (1), lockwashers (2), and flatwashers (3).

(3) Lift control panel assembly (4) from housing (5).

(4) Disconnect cables P1, P2, P3 and P4 from circuit card.

(5) Remove gasket (6) from housing.

(6) Remove housing.

b. Installation.

(1) Install gasket (6) on housing (5).

(2) Connect cables P1, P2, P3 and P4 to J1, J2, J3 and J4 on circuit card.

(3) Place control panel assembly (4) in housing.

(4) Install 10 flatwashers (3), lockwashers (2), and screws (1) in housing.

(5) Torque screws to 10 - 20 inch-pounds (1.10 - 2.20 Newton meters) in sequence.

(6) Purge and pressurize control assembly. Refer to paragraph 4-13.

(7) Install electronic control assembly. Refer to paragraph 5-14.

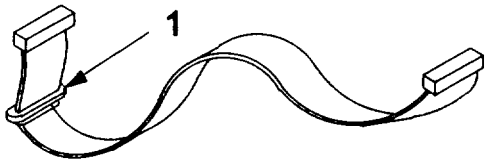
5-21. GUFS ELECTRONIC CONTROL ASSEMBLY HOUSING REPAIR.

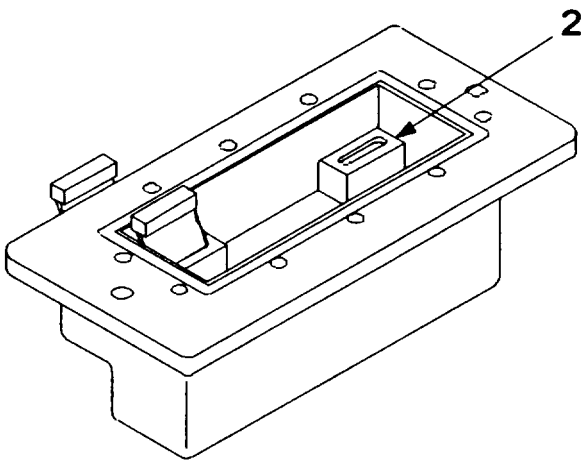
INITIAL SETUP

Tools:
General Mechanic's Automotive Tool Kit

Materials/Parts:
Cable Assembly (12725010)
Adhesive (item 1, appendix D)
Isopropyl Alcohol (item 4, appendix D)

Equipment Condition:
Housing removed
(Reference paragraph 5-20)





5-21. GUFS ELECTRONIC CONTROL ASSEMBLY HOUSING REPAIR (CONTINUED).

a. Removal.

(1) Remove adhesive holding cable grommets (1) in housing.

(2) Carefully remove the black plastic connector covers off the end connectors and slide cable out through housing.

b. Installation.

(1) Clean grommet mating surface (2) of housing with isopropyl alcohol and allow to air dry 15 minutes.

(2) Coat mating surface for grommet with adhesive.

(3) With black plastic cover removed, slide cable through feed-thru, reattach black plastic cover to connector end and press grommet to adhesive.

(4) Install housing. Refer to paragraph 5-20.

5-22. SASS FRAME ASSEMBLY REPLACEMENT.

INITIAL SETUP

Tools:
General Mechanic's Automotive Tool Kit

Materials/Parts:
Frame Assembly (9340866)

References:
Paragraph 4-15
Paragraph 4-16
Paragraph 4-19
Paragraph 4-20
Paragraph 4-23
Paragraph 5-24

a. Removal.

(1) Remove cable assembly. Refer to paragraph 4-23.

(2) Remove oxygen tank. Refer to paragraph 4-15.

(3) Remove propane tank. Refer to paragraph 4-16.

(4) Remove hose assembly. Refer to paragraph 4-19.

(5) Remove propane regulator. Refer to paragraph 5-23.

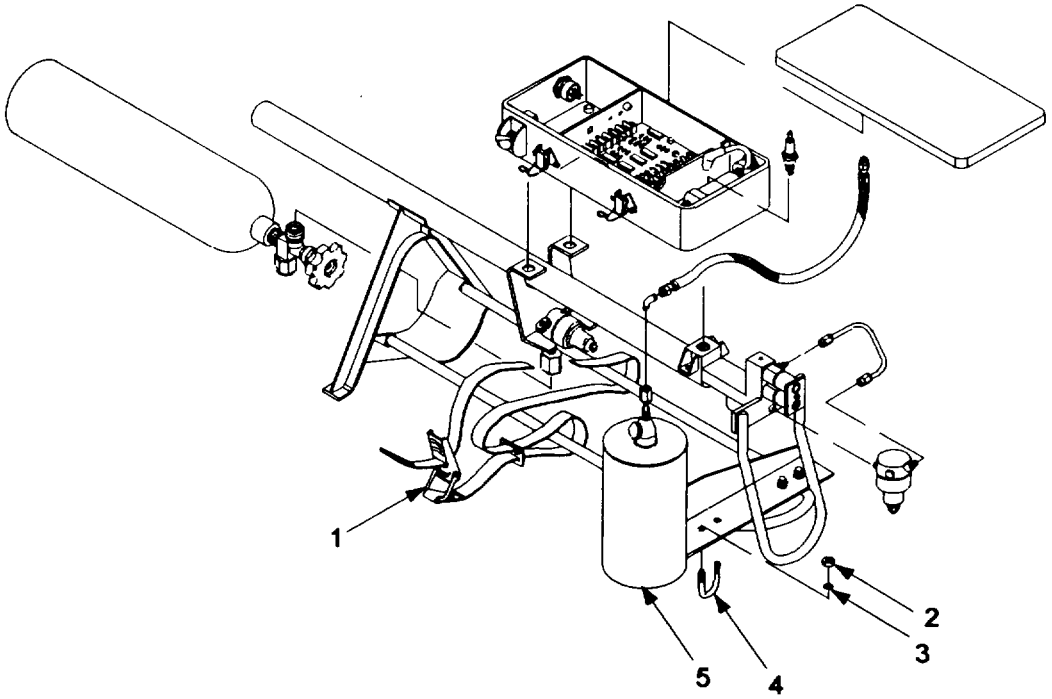
(6) Remove spark plug. Refer to paragraph 4-20.

(7) Remove electronics assembly. Refer to paragraph 4-25.

(8) Remove strap from frame (1).

(9) Remove nuts (2) and washers (3) from u-bolts (4).

(10) Remove propane can shield holder (5).



b. Installation.

(1) Position propane can shield holder (5) on frame.

(2) Install two u-bolt (4) and four nuts (3) and washers (2).

(3) Install strap (1) on frame.

(4) Install electronics assembly. Refer to paragraph 4-25.

(5) Install spark plug. Refer to paragraph 4-20.

(6) Install propane regulator. Refer to paragraph 5-24.

(7) Install hose assembly. Refer to paragraph 4-19.

(8) Install propane tank. Refer to paragraph 4-16.

(9) Install oxygen tank. Refer to paragraph 4-15.

(10) Install cable assembly. Refer to paragraph 4-23.

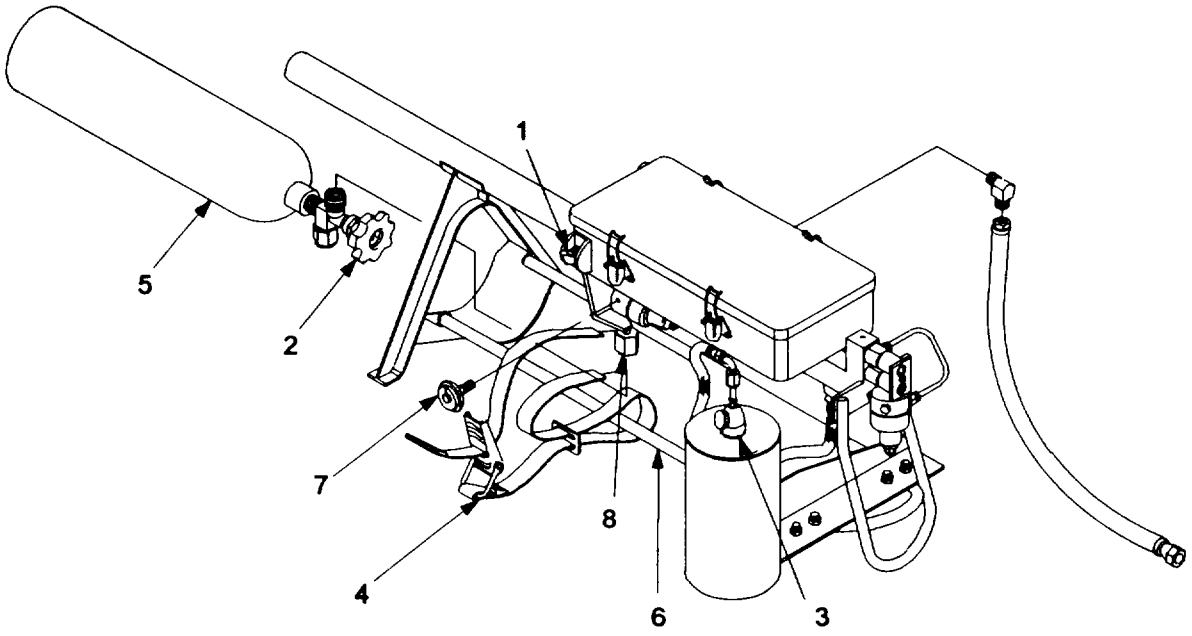
5-23. SASS PRESSURE REGULATOR REPLACEMENT.

INITIAL SETUP

Tools:
General Mechanic's Automotive Tool Kit

References:
Paragraph 4-19

Materials/Parts:
Pressure Regulator (12961220)
Tape (item 16, appendix D)



a. Removal.

(1) Turn circuit breaker (1) to the OFF position.

(2) Turn oxygen valve (2) off.

(3) Turn propane valve (3) off.

(4) Remove hose assembly. Refer to paragraph 4-19.

(5) Release holding strap (4) and remove oxygen cylinder assembly (5) from frame (6).

(6) Remove pressure gage (7) from pressure regulator (8).

(7) Disconnect pressure regulator from oxygen cylinder assembly.

b. Installation.

(1) Connect pressure regulator (8) to oxygen cylinder assembly (4).

(2) Apply teflon tape to pressure gage (7) fitting. Wrap tape in a CCW direction.

(3) Install pressure gage on pressure regulator.

(4) Install oxygen cylinder assembly on frame (6).

(5) Fasten holding strap (4).

(6) Install hose assembly. Refer to paragraph 4-19.

(7) Turn propane valve (3) on.

(8) Turn oxygen valve (2) on.

(9) Inspect for leaks around fittings using soap bubble method.

(10) Turn circuit breaker (1) to the ON position.

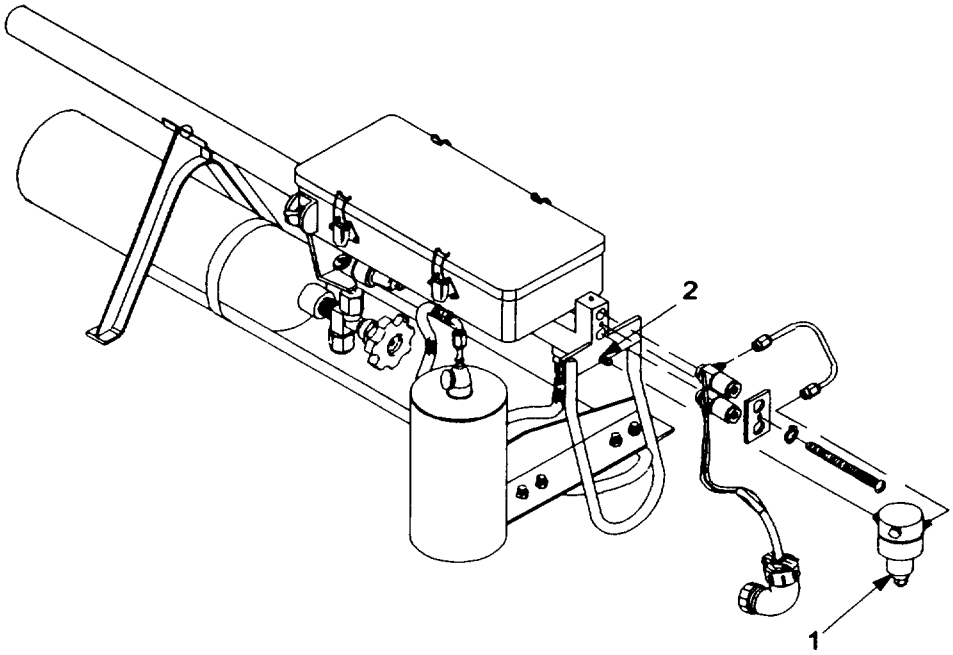
5-24. SASS PROPANE REGULATOR REPLACEMENT.

INITIAL SETUP

Tools:
General Mechanic's Automotive Tool Kit

References:
Paragraph 4-17
Paragraph 4-24

Materials/Parts:
Propane Regulator (11829804)
Tape (item 16, appendix D)



a. Removal.

(1) Remove tube assembly. Refer to paragraph 4-17.

(2) Remove solenoid assembly. Refer to paragraph 4-24.

(3) Disconnect propane regulator (1) from nipple (2).

(4) Clean teflon tape from nipple.

b. Installation.

(1) Apply teflon tape in CCW direction on nipple (2).

(2) Connect propane regulator (1) on nipple.

(3) Install solenoid assembly. Refer to paragraph 4-24.

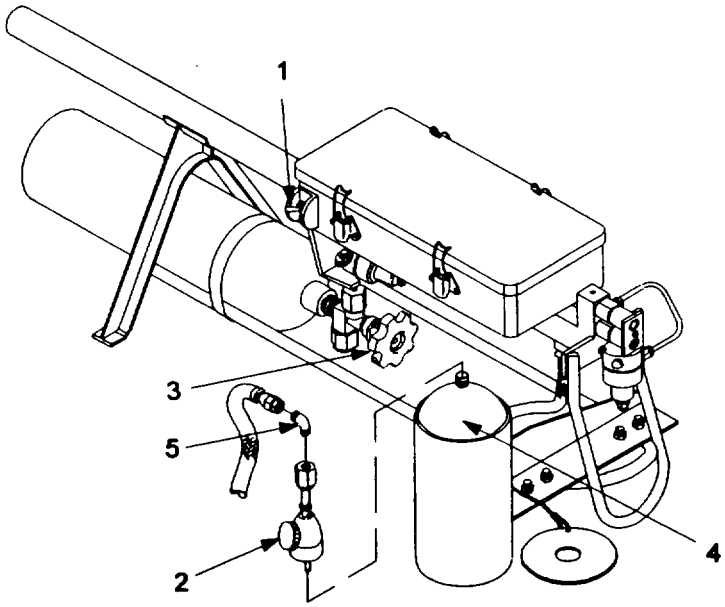
(4) Install tube assembly. Refer to paragraph 4-17.

5-25. SASS PROPANE VALVE REPLACEMENT.

INITIAL SETUP

Tools:
General Mechanic's Automotive Tool Kit

Materials/Parts:
Propane Valve (9387448)
Tape (item 16, appendix D)



a. Removal.

(1) Turn circuit breaker (1) to the OFF position.

(2) Close propane valve (2).

(3) Unscrew propane tank (3) from valve.

(4) Disconnect elbow (4) from valve.

(5) Clean teflon tape from elbow.

b. Installation.

(1) Apply teflon tape in a CCW direction on elbow (4).

(2) Connect elbow to valve (2).

(3) Install propane tank (3) to valve.

(4) Open propane valve and check for leaks.

(5) Turn circuit breaker (1) to the ON position.

5-26. SASS HOUSING ASSEMBLY REPLACEMENT.

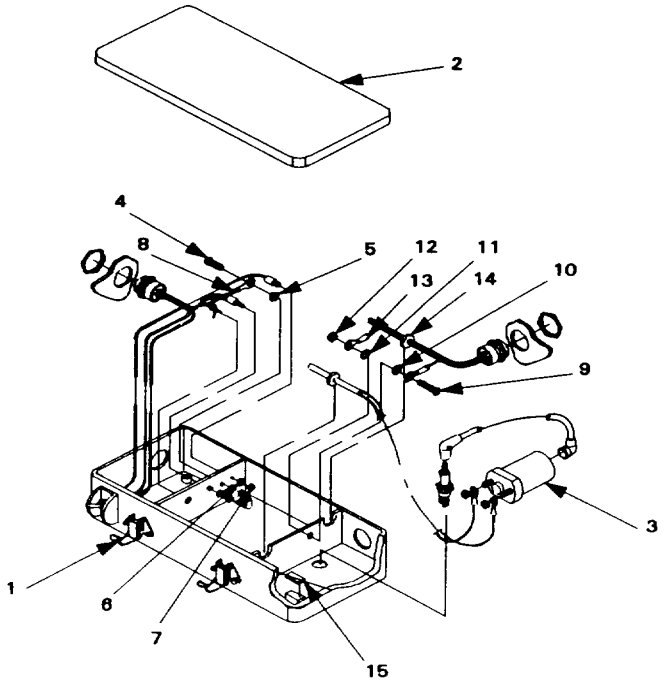
INITIAL SETUP

Tools:
General Mechanic's Automotive Tool Kit

Materials/Parts:
Housing Assembly (9340858)
Insulating Pad (9353876)
Grease (item 7, appendix D)

References:
Paragraph 4-27
Paragraph 5-27
Paragraph 5-28
Paragraph 5-29
Paragraph 5-30
Paragraph 5-31

Equipment Condition:
Electronic Assembly removed
(reference paragraph 4-25)



a. Removal.

(1) Release four latches (1) and remove cover assembly (2).

(2) Remove CCA. Refer to paragraph 5-27.

(3) Remove filters. Refer to paragraph 5-28.

(4) Remove circuit breaker. Refer to paragraph 5-29.

(5) Remove wire assembly. Refer to paragraph 4-27.

(6) Remove connector J1. Refer to paragraph 5-30.

(7) Remove connector J2. Refer to paragraph 5-31.

(8) Remove cable assembly. Refer to paragraph 5-32.

(9) Remove coil assembly (3) from housing.

(10) Remove screw (4), flatwashers (5), lockwasher (6), and nut (7) from terminal E1 and tag grounding wire (8).

(11) Remove screw (9), flatwashers (10), lockwasher (11), and nut (12) from terminal E2 and remove bonding wire (13).

(12) Remove grommets (14) from housing.

b. Installation.

(1) Split grommets (14) and insert into housing.

(2) Install insulating pad (15) on housing.

(3) Install bonding wire (13) on terminal E2, using screw (9), flatwashers (10), lockwasher (11), and nut (12).

(4) Install ground wire (7) on terminal El using screw (4), flatwashers (5), lockwasher (6), and nut (7).

(5) Position coil assembly (3) into housing.

(6) Install cable assembly. Refer to paragraph 5-31.

(7) Install connector J2. Refer to paragraph 5-30.

(8) Install connector J1. Refer to Paragraph 5-30.

(9) Install wire assembly. Refer to paragraph 4-27.

(10) Install circuit breaker. Refer to paragraph 5-29.

(11) Install filters. Refer to paragraph 5-28.

(12) Install CCA. Refer to paragraph 5-27.

(13) Apply a thin coating of grease to entire gasket surface.

(14) Install cover assembly (2) and fasten four latches (1).

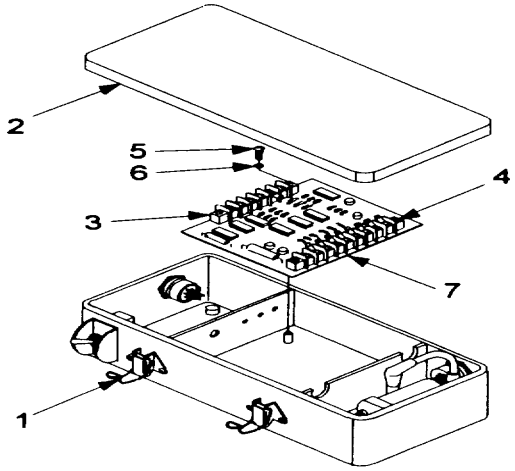
(15) Install electronics assembly. Refer to paragraph 4-25.

5-27. SASS CIRCUIT CARD ASSEMBLY REPLACEMENT.

INITIAL SETUP

Tools:
General Mechanic's Automotive Tool Kit

Materials/Parts:
Circuit Card Assembly (9363107)
Sealing Compound (item 12, appendix D)
Grease (item 7, appendix D)



a. Removal.

(1) Release four latches (1) and remove cover assembly (2).

(2) Tag and disconnect wires from TB1 (3) and TB2 (4).

(3) Remove four screws (5) and flatwashers (6) that hold CCA (7) to electronics assembly.

(4) Remove CCA.

b. Installation.

(1) Position CCA (7) in housing.

(2) Apply sealing compound to threads of screws.

(3) Install four screws (5) and flatwashers (6) to hold CCA in electronics assembly.

(4) Connect wires to proper terminals on TB1 (3) and TB2 (4).

(5) Apply a thin coating of grease to entire gasket surface.

(6) Position cover (2) on electronics assembly and fasten four latches (1).

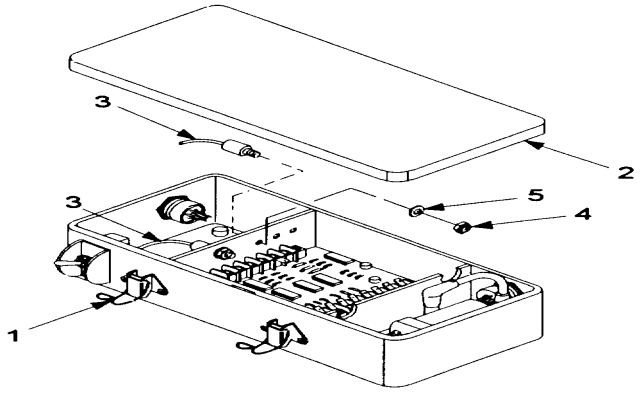
5-28. SASS FILTER ASSEMBLY REPLACEMENT.

INITIAL SETUP

Tools:
General Mechanic's Automotive Tool Kit
Soldering and Desoldering Set

References:
TB SIG 222

Materials/Parts:
Filter (M15733/24-0008)
Solder (item 14, appendix D)
Grease (item 7, appendix D)



a. Removal.

(1) Release four latches (1) and remove cover (2).

(2) Tag and remove wires from filter (3).

(3) Remove nut (4) and insulating washer (5) that holds filter to electronic housing.

(4) Remove filter from housing.

b. Installation.

(1) Install filter (3) in housing.

(2) Install insulating washer (5) and nut (4) on filter.

(3) Solder wires to filter. Refer to TB SIG 222.

(4) Apply a thin coating of grease to entire gasket surface.

(5) Install cover (2) and fasten latches (1).

5-29. SASS CIRCUIT BREAKER ASSEMBLY REPLACEMENT.

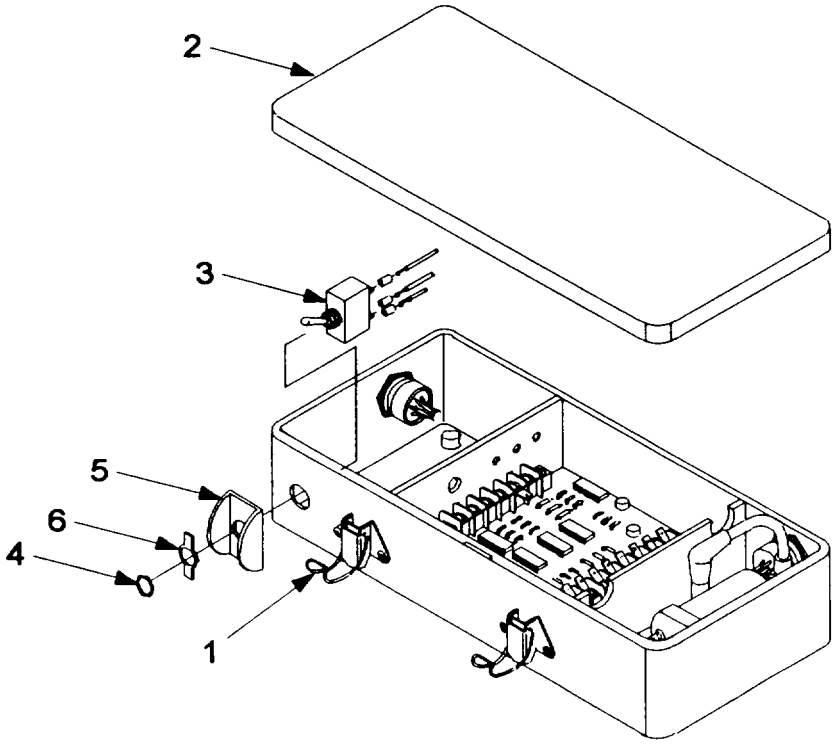
INITIAL SETUP

Tools:
General Mechanic's Automotive Tool Kit
Soldering and Desoldering Set

Equipment Condition:
Electronics assembly removed
(reference paragraph 4-25)

Materials/Parts:
Circuit Breaker (M39019/01-235)
Solder (item 14, appendix D)
Grease (item 7, appendix D)

References:
TB SIG 222



a. Removal.

(1) Release four latches (1) and remove cover (2).

(2) Tag and desolder wires from circuit breaker (3).

(3) Remove nut (4) from circuit breaker.

(4) Remove circuit breaker and switch guard (5).

(5) Remove ON/OFF plate (6).

b. Installation.

(1) Apply sealing compound to threads of circuit breaker (3).

(2) Position circuit breaker in electronic housing.

(3) Position switch guard (5) on front of circuit breaker.

(4) Orient circuit breaker so that the keyway is up.

(5) Install ON/OFF plate (6).

(6) Install nut (4) on circuit breaker (3).

(7) Solder wires to proper terminals. Refer to TB SIG 222.

(8) Apply a thin coating of grease to entire gasket surface.

(9) Install cover (2) and fasten four latches (1).

(10) Install electronics assembly. Refer to paragraph 4-25.

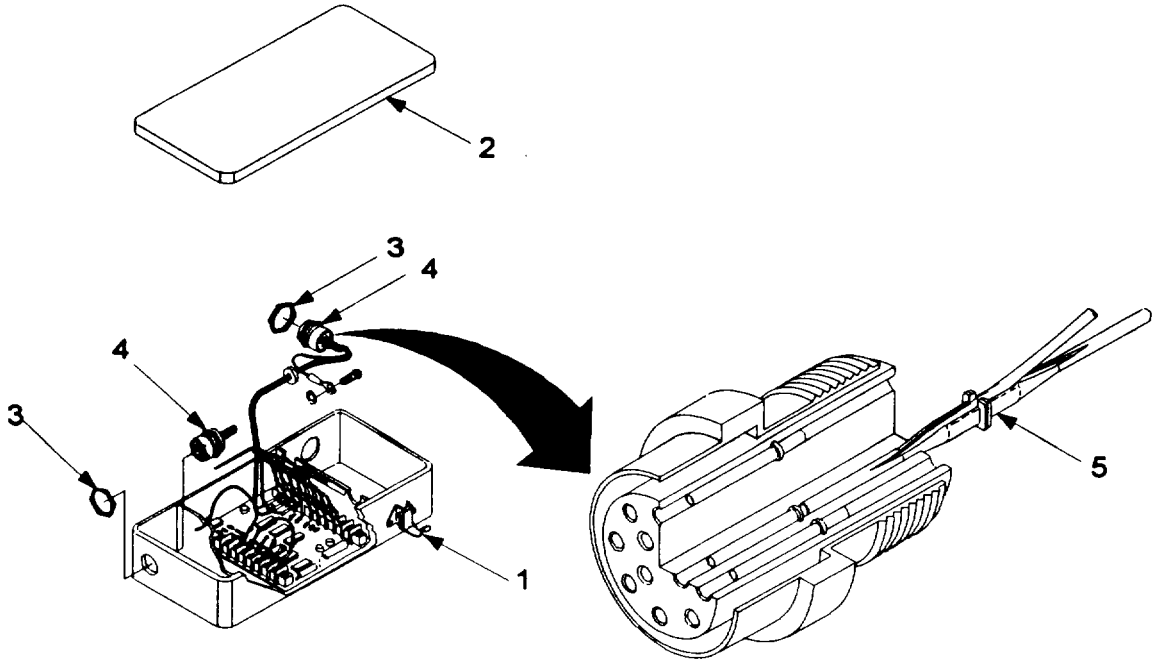
5-30. SASS CONNECTOR REPLACEMENT.

INITIAL SETUP

Tools:
General Mechanic's Automotive Tool Kit
Crimping Tool
Inserter/Remover
Torque Wrench

Equipment Condition:
Electronics assembly removed
(reference paragraph 4-25)

Materials/Parts:
Connector J1 (MS3474W14-12P)
Connector J2 (MS3474w12-8S)
Sealing Compound (item 12, appendix D)
Grease (item 7, appendix D)



a. Removal.

(1) Release four latches (1) and remove cover (2).

(2) Remove jam nut (3) from connector (4).

(3) Remove connector from housing.

(4) Loosen grommet from connector.

(5) Tag each wire and cut contact as it is removed.

b. Installation.

(1) Strip wire 1/4-inch.

(2) Insert wires through grommet.

(3) Crimp contacts on wires.

(4) Using inserter/remover (5), insert wires in connector (4) in proper location.

(5) Tighten grommet to connector.

(6) Apply locking compound to threads of connector.

(7) Insert connector through housing.

(8) Install jam nut (3) and torque to 50 +5 in-lbs.

(9) Apply a thin coating of grease to entire gasket surface.

(10) Install cover (2) and fasten four latches (1).

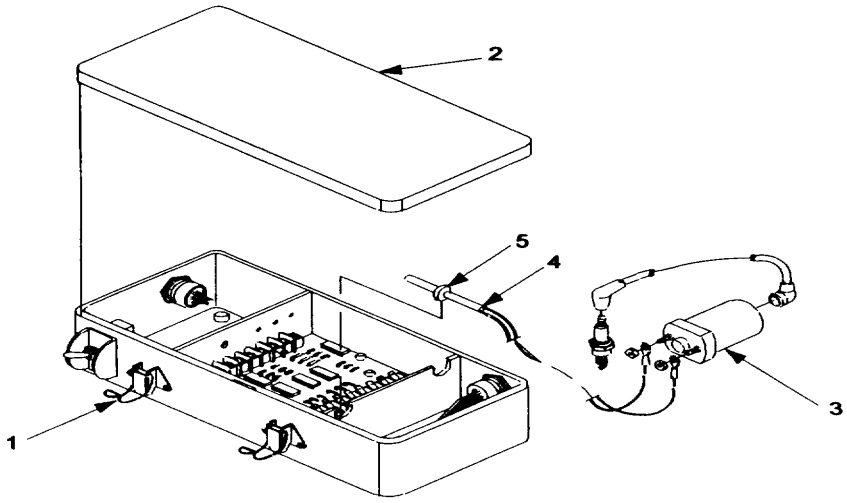
(11) Install electronics assembly. Refer to paragraph 4-25.

5-31. SASS CABLE ASSEMBLY REPLACEMENT.

INITIAL SETUP

Tools:
General Mechanic's Automotive Tool Kit

Materials/Parts:
Cable Assembly (9340956)
Grease (item 7, appendix D)



a. Removal.

(1) Release four latches (1) and remove cover (2).

(2) Tag and disconnect wires from coil assembly (3).

(3) Tag and disconnect wires from terminals TB2-1, TB2-4, and TB2-5.

(4) Remove cable assembly (4) from grommet (5).

b. Installation.

(1) Insert cable assembly (4) through split in grommet (5).

(2) Connect wires to connections on terminals TB2-1, TB2-4, and TB2-5.

(3) Connect wires to proper terminals on coil assembly (3).

(4) Apply a thin coating of grease to entire gasket surface.

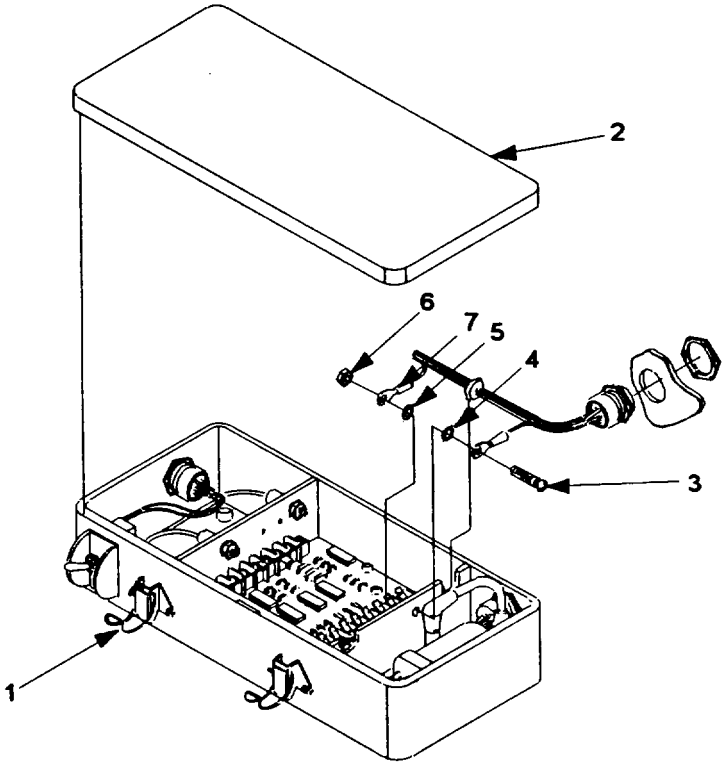
(5) Install cover (2) and fasten four latches (1).

5-32. SASS BONDING WIRE REPLACEMENT.

INITIAL SETUP

Tools:
General Mechanic's Automotive Tool Kit

Materials/Parts:
Bonding Wire (9354093)
Grease (item 7, appendix D)



a. Removal.

(1) Release four latches (1) and remove cover (2).

(2) Remove screw (3), flatwasher (4), lockwasher (5), and nut (6) from terminal E2.

(3) Disconnect bonding wire (7) from terminal TB2-1.

b. Installation.

(1) Connect bonding wire (7) to terminal TB2-1.

(2) Connect bonding wire to terminal E2 using screw (3), flatwasher (4), lockwasher (5), and nut (6).

(3) Apply a thin coating of grease to entire gasket surface.

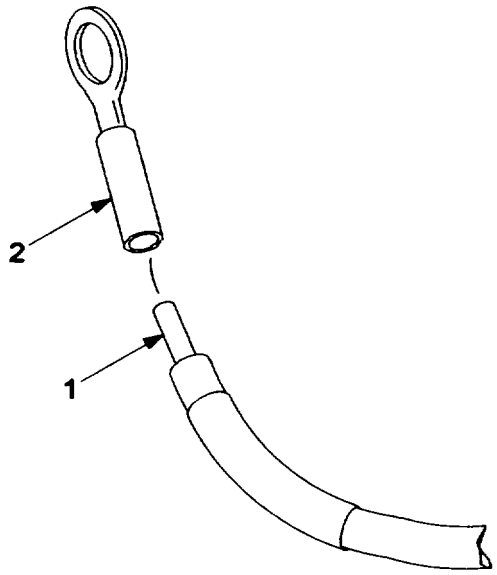
(4) Install cover (2) and fasten four latches (1).

5-33. SASS BONDING WIRE ASSEMBLY.

INITIAL SETUP

Tools:
General Mechanic's Automotive Tool Kit
Crimping Tool

Materials/Parts:
Wire (M22759/11-20-9)
Terminal Lug (MS45036-103)
Terminal (60972-1)



Assembly.

a. Cut 3.5-in length of 20 awg insulated wire.

b. Strip insulation on wire 1/4 in from each end.

c. Insert end of wire (1) into terminal lug (2) and crimp tight.

d. Repeat for other end of wire.

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), Remoted Target System (RETS) Small Arms Muzzle Flash Simulator, Gunfire Simulator, and Small Arms Sound Simulator ..... TM 9-6920-742-24P-2

Operator, Unit, Direct Support, and General Support Maintenance Manual, Remoted Target System (RETS) for Small Arms Muzzle Flash Simulator, Gunfire Simulator, and Small Arms Sound Simulator ..... TM 9-6920-742-14-2

Operator, Unit, Direct Support, and General Support Maintenance Manual, Remoted Target System (RETS) for Console, Target Training Set - RETS, Console, Target Training Set - ERETS, Adapter, Power Supply ..... TM 9-6920-742-14-1

Soldering Techniques ..... TB SIG 222

Destruction of Army Materiel to Prevent Enemy Use ..... TM 750-244-3

Painting ..... TM 43-0139

A-4. FIELD MANUALS.

First Aid for Soldiers ..... FM 21-11

APPENDIX A
REFERENCES (CONTINUED)

A-5. FORMS.

Product Quality Deficiency Report..... SF 368

Accident Report.....DA Form 285

Recommended Changes to Publications and Blank Forms.....DA Form 2028

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 MAC in Section II designates overall authority and responsibility for the performance of maintenance functions on the Small Arms Muzzle Flash Simulator, Gunfire Simulator, and Small Arms Sound Simulator. The application of the maintenance functions to the simulators 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 follows:

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.

B-2. MAINTENANCE FUNCTIONS (CONTINUED).

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 I 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 B-2.)

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[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.

c. 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..... Overhaul/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.

SECTION II. MAINTENANCE ALLOCATION CHART

(1) Group Number	(2) Component/ Assembly	(3) Maintenance Function	(4) Maintenance Category C	O	F	H	D	(5) Tools and Equipment	(6) Remarks
00	SMALL ARMS MUZZLE FLASH SIMULATOR 11829682	INSPECT REMOVE AND REPLACE REPAIR		.1 .2 .2	1			4, 7,12	
001	COVER ASSEMBLY 11829683	REMOVE AND REPLACE REPAIR		.1 5					
002	CABLE ASSEMBLY 11829686	REMOVE AND REPLACE REPAIR			1 1			13	
01	GUNFIRE SIMULATOR 12725085-1	INSPECT REMOVE AND REPLACE REPAIR	.3	1 .1				6,12	
0101	GUNFIRE SIMULATOR REMOVE AND 12725001-1	REPLACE REPAIR		.2 2				6, 12	
010101	CONTROL ASSEMBLY 12725014-1	REMOVE AND REPLACE REPAIR			.5 2			6, 12	
01010101	PANEL ASSEMBLY 12725015-1	REMOVE AND REPLACE REPAIR			1 2.0			12	
01010102	HOUSING ASSEMBLY REMOVE AND 12725026-1	REPLACE REPAIR			.3 .5			12 12	
02	SMALL ARMS SOUND SIMULATOR 11829734	INSPECT REMOVE AND REPLACE REPAIR		.1 .2 .5	.5			6, 12, 14	

(1) Group Number	(2) Component/ Assembly	(3) Maintenance Function	(4) Maintenance Category C	O	F	H	D	(5) Tools and Equipment	(6) Remarks
0201	ELECTRONIC ASSEMBLY 9353778-1	TEST		.1					
		REMOVE AND REPLACE		.2				6, 8, 9	
		REPAIR		.5	.5			12, 14	
020101	BONDING WIRE 9354093	REMOVE AND REPLACE			.3			12	
		DISASSEMBLY/ ASSEMBLY			.5				

SECTION III. TOOL AND TEST EQUIPMENT REQUIREMENTS FOR SIMULATORS

TOOL OR TEST EQUIPMENT REF CODE	MAINTENANCE CATEGORY	NOMENCLATURE	NATIONAL/NATO STOCK NUMBER	TOOL NUMBER
1	O	BRUSH, WIRE	7920-00-044-4857	1182
2	O	GAGE, PRESSURE	6685-00-087-3143	8035247
3	O	GLOVES, COMBAT VEHICLE	8415-01-074-9428	MIL-G-44108
4	F	HEATER, GUN-TYPE, ELECTRIC	4940-01-181-5876	1264T585
5	O	HELMET, FIREMAN'S	8415-01-039-6000	MIL-H-1987
6	F	INSERTER/REMOVER	5120-00-915-4588	M81969/14-03
7	F	INSERTER/REMOVER	5120-01-300-0095	M81969/14-11
8	O	MULTIMETER	6625-01-265-6000	AN/PSM-45A5
9	O	PURGING KIT, FIRE CONTROL	4931-00-065-1110	SC4931-95C-LJ54
10	F	SCREWDRIVER SET, TORQUE	5120-00-127-2525	KIT2
11	F	SOLDERING AND DESOLDERING SET	3439-00-460-7198	W-TCP-K
12	F	STRAP, WRIST, GROUND	6150-01-175-8730	13143304
13	F	STRIPPERS, WIRE	5110-00-063-3037	101S
14	O	TOOL KIT, GEN MECHANIC'S AUTOMOTIVE	5180-00-177-7033	SC5180-90-CL-N26
15	F	TOOL, CRIMPER	5120-00-165-3912	11-3284-2
16	F	WRENCH, TORQUE	5120-00-001-3733	28414

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)

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 simulators. This listing is for information only and is not authority to requisition the listed items. These items are authorized to you by CTA 50-790, 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 NUMBER	(5) U/M
1	F	8040-00-273-8717	Adhesive 96096 (12A68BT1-51)	PT
2	F	8040-00-266-0824	Adhesive 81348 (MMM-A-122)	OZ
3	F	8040-00-145-0020	Adhesive 80063 (SM-B-586250)	OZ

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) ITEM NAME, DESCRIPTION CAGEC, PART NUMBER	(5) U/M
4	F	6810-00-227-0410	Alcohol, Isopropyl 81348 (O-C-265)	GL
5	O	8010-00-515-0800	Enamel, gray 96906 (MS35727-21)	GL
6	O	8010-00-965-2078	Enamel, white 81349 (MIL-C-52227)	PT
7	O	9150-00-965-2408	Grease 19200 (9362987)	EA
8	O	8010-00-297-2124	Paint, OD 96906 (MS35330-2)	GL
9	O	5350-00-186-8858	Paper, Abrasive 58536 (A-A-1049)	PG
10	F	8010-00-899-8825	Primer, Coating 83421 (8010-00-899-8825)	PT
11	O	7920-00-205-3570	Rags 58536 (A-A-2522)	BE
12	F	8030-00-964-7537	Sealing Compound 05972 (08441)	TU
13	F	8030-01-055-6126	Sealing Compound 05972 (222-41)	
14	F	3439-01-108-7578	Solder, Rosin Core 81348 (SN63WRMAP3 0.036 1 lb)	SL
15	O	6850-00-110-4498	Solvent, Dry Cleaning 81348 (PD680)	PT
16	O	8030-00-889-3535	Tape, Antiseizing 19200 (9384768)	RL
17	F	8030-00-889-3534	Tape, Antiseizing 81755 (P5025-1)	EA
18	F	5970-00-686-9151	Tape, Insulation, Electrical 20999 (27-1IN22HITE)	

APPENDIX E

TORQUE LIMITS

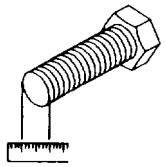
SECTION I. INTRODUCTION

E-1 GENERAL.

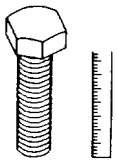
This appendix contains the torque standards for specific type and size of hardware. It defines the different types of bolts by grade.

SECTION II. TORQUE TABLE

HOW TO USE TORQUE TABLE:



a. Measure the diameter of the screw you are installing.



b. Count the number of threads per inch or use a pitch gage.

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 fines beginning wit 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).

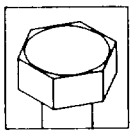
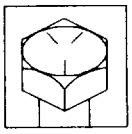
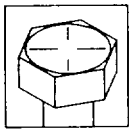
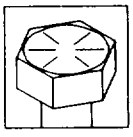
Metric screws are of three grades: 8.8, 10.9, and 12.9. Grades & Manufacturer's marks appear on the screw

STANDARD METRIC

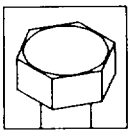
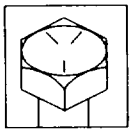
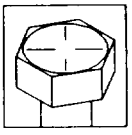
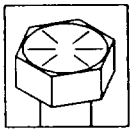
e. To find the grade screw you are installing, match the markings on the head to the correct picture of CAPSCREW HEAD MARKINGS on the torque table.

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

CAPSCREW HEAD MARKINGS Manufacturer's marks may vary. These are all SAE Grade 5 (3-line).										
SIZE			TORQUE							
			SAE GRADE NO. 2		SAE GRADE NO. 5		SAE GRADE NO. 6 OR 7		SAE GRADE NO. 8	
Dia. Inches	Threads Per Inch	Millimeters	Pound Feet	Newton-Meters	Pound Feet	Newton-Meters	Pound Feet	Newton-Meters	Pound Feet	Newton-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

CAPSCREW HEAD MARKINGS Manufacturer's marks may vary. These are all SAE Grade 5 (3-line).										
SIZE			TORQUE							
			SAE GRADE NO. 2		SAE GRADE NO. 5		SAE GRADE NO. 6 OR 7		SAE GRADE NO. 8	
Dia. Inches	Threads Per Inch	Millimeters	Pound Feet	Newton-Meters	Pound Feet	Newton-Meters	Pound Feet	Newton-Meters	Pound Feet	Newton-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	30-0	lb-ft

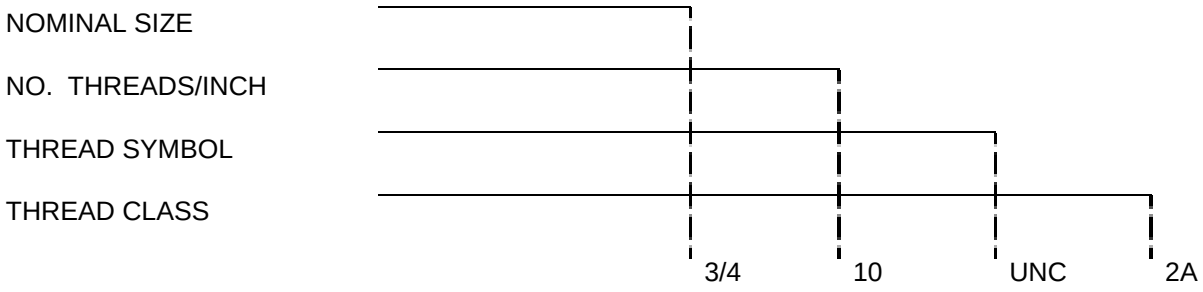
FASTENER SIZE AND THREAD PATTERN

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.

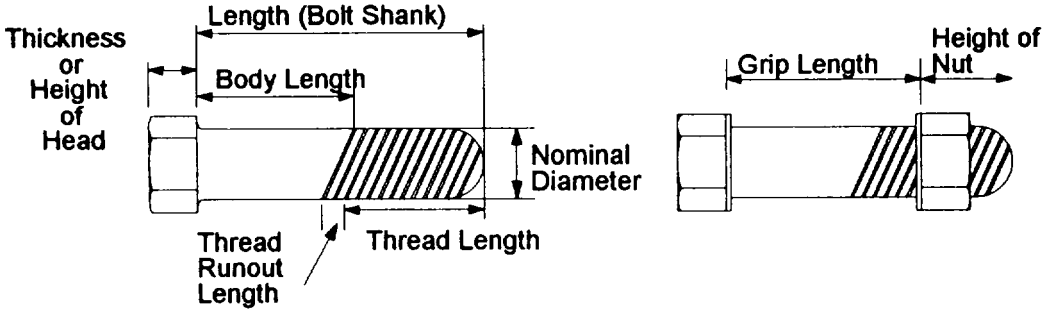
THREAD CLASSES AND DESCRIPTION

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 900 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 B - 3 Marks GRADE C - 6 Marks	GRADE A - No Mark GRADE B - Letter B GRADE C - Letter C
GRADE A - No Notches GRADE 8 - 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 (1-14 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 fl-lb (19-26 N.m)	23-28 fl-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 (99113 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 (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

By Order of the Secretary of the Army:

DENNIS J. REIMER
General, United States Army
Chief of Staff

Official:

JOEL B. HUDSON
Administrative Assistant to the
Secretary of the Army
03545

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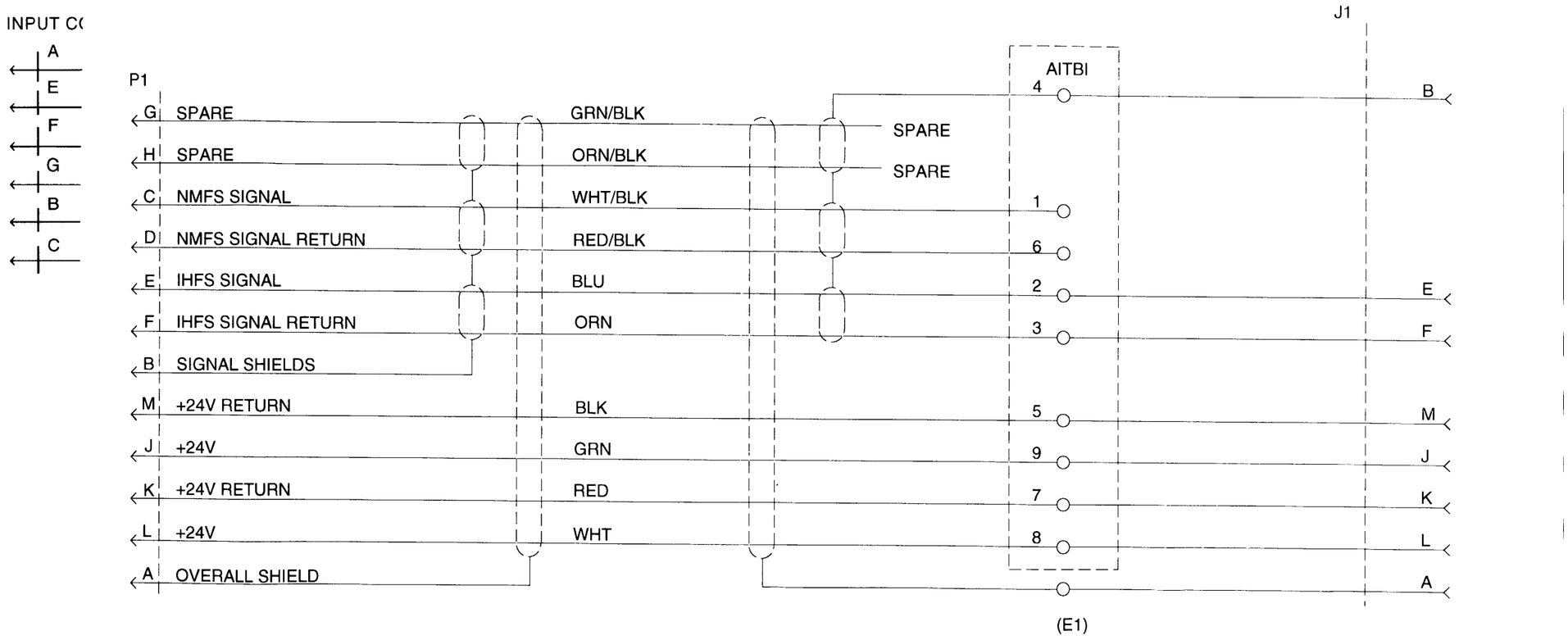

FO-1. Small Arms Muzzle Flash Simulator Wiring Diagram

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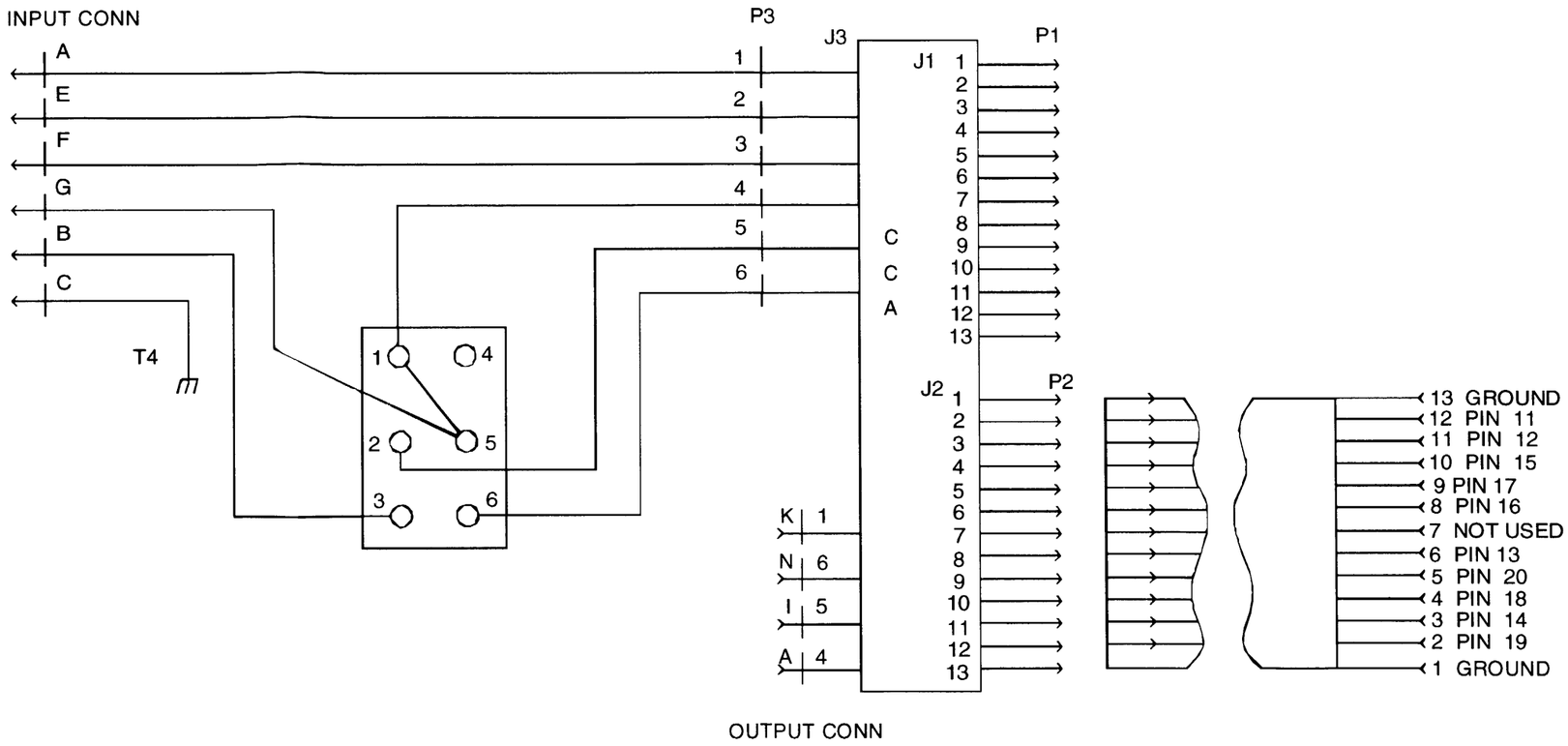

FO-2. Gunfire Simulator Wiring Diagram

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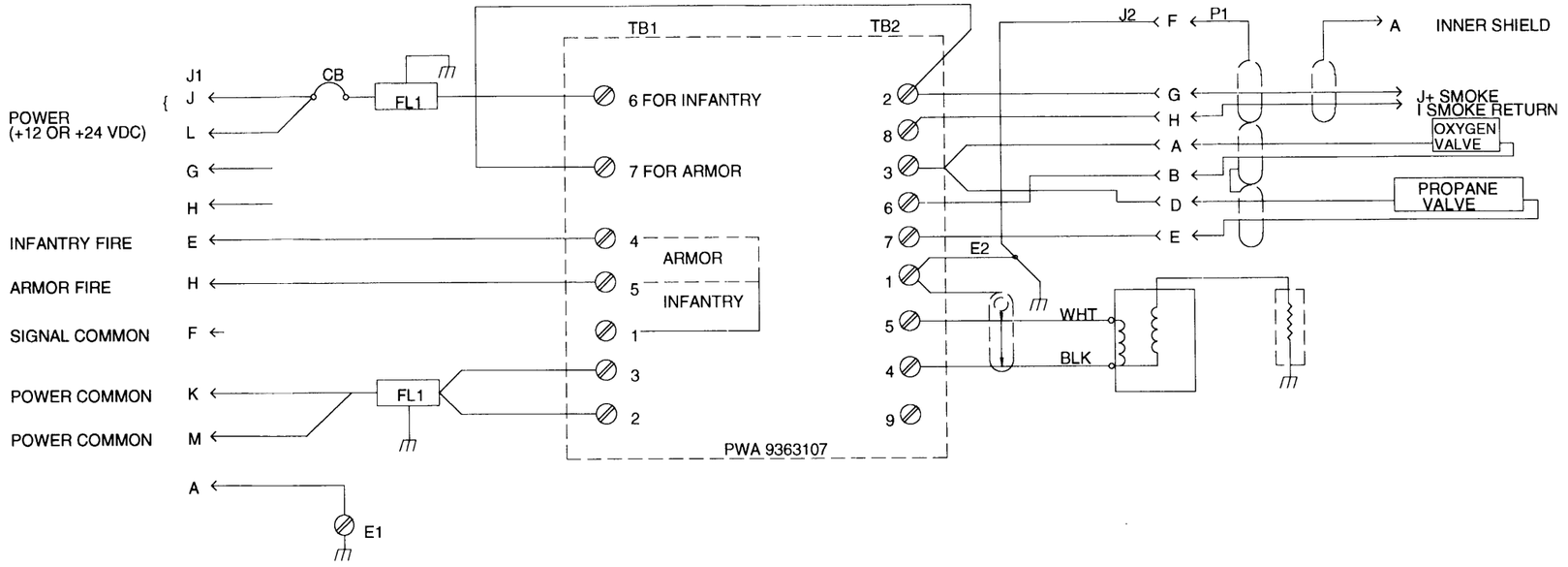

FO-3. Small Arms Sound Simulator wiring Diagram

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