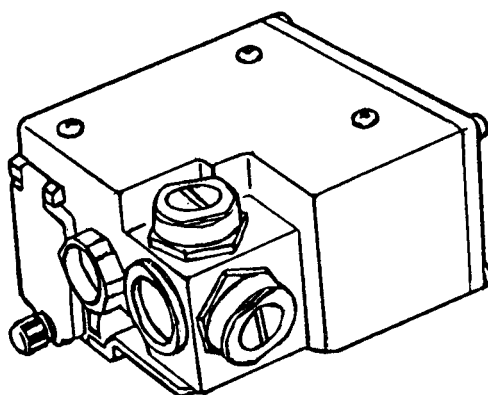


OPERATOR'S MANUAL
MULTIPLE INTEGRATED LASER
ENGAGEMENT SYSTEM (MILES)
SIMULATOR SYSTEM, FIRING, LASER: M89
(NSN 1265-01-236-6725)

FOR

M16A1/M16A2 RIFLE
AND
SIMULATOR SYSTEM, FIRING, LASER: M90
(NSN 1265-01-236-6724)

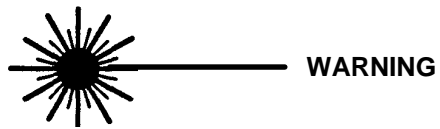
FOR
M249, SQUAD AUTOMATIC WEAPON (SAW)



Distribution Statement A: Approved for public release; distribution is unlimited.

HEADQUARTERS, DEPARTMENT OF THE ARMY

February 1989



Although the laser light emitted by MILES laser transmitters is considered eye safe by the Bureau of Radiological Health, suitable precautions must be taken to avoid possible eye damage from overexposure to this radiated energy. Take the following precautions:

- Never look at the laser emitter at close range (less than 12 meter).
- Never look at laser emitter through optics such as binoculars, telescope, or weapon sights at range less than 75 meters.
- Never look at the laser emitter directly along the axis of the bore of the weapon.
- Follow the Laser Range Safety Procedures in AR 385-63 and TB MED 279.

For information on first aid, see FM 21-11.

OPERATOR'S MANUAL
FOR
MULTIPLE INTEGRATED LASER ENGAGEMENT SYSTEM (MILES)
SIMULATOR SYSTEM, FIRING, LASER: M89
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M16A1/M16A2 RIFLE
AND
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(NSN 1265-01-236-6724)
FOR
M249, SQUAD AUTOMATIC WEAPON (SAW)

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in back of this manual direct to: Commander U.S. Army Simulation, Training, and Instrumentation Command (STRICOM), ATTN: AMSTI-LSM, 12350 Research Parkway, Orlando, FL 32826-3276. A reply will be furnished to you.

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TABLE OF CONTENTS

Page

CHAPTER 1	GENERAL INFORMATION	1-1
Section 1.1	Introduction	1-1
Section 1.2	How To Use This Manual	1-1
Section 1.3	Purpose of Equipment	1-1
Section 1.4	Equipment.....	1-2
Section 1.5	List of Terms	1-5
CHAPTER 2	SMALL ARMS TRANSMITTER	2-1
Section 2.1	Introduction	2-1
Section 2.2	Equipment Description.....	2-1
Section 2.3	Limitations of Equipment	2-3
Section 2.4	Inspection and Cleaning	2-3
Section 2.5	Installation.....	2-4
-2.5.1	Battery Installation.....	2-4
-2.5.2	Mounting Brackets	2-5
-2.5.3	Installing the SAT on the SAW.....	2-7
-2.5.4	Installing the SAT on the M16A1.....	2-8
-2.5.5	Installing the SAT on the M16A2.....	2-9
Section 2.6	Operation	2-10
-2.6.1	Blank-Fire Mode	2-10
-2.6.2	Dry-Fire Mode	2-12
Section 2.7	Alignment Using the SAAF	2-14
-2.7.1	Coarse Alignment Procedure	2-18
Section 2.8	Removal.....	2-19

Table of Contents (con't)

	-2.8.1	Removal of the SAT from the SAW	2-19
	-2.8.2	Removal of the SAT from the M16A1	2-19
	-2.8.3	Removal of the SAT from the M16A2	2-20
Section	2.9	Handling and Storage	2-20
CHAPTER	3	MAN-WORN LASER DETECTOR ASSEMBLY	3-1
Section	3.1	Introduction	3-1
Section	3.2	Equipment Description.....	3-1
	-3.2.1	Helmet Harness	3-1
	-3.2.2	Torso Harness.....	3-2
Section	3.3	Limitations of Equipment	3-3
Section	3.4	Inspection and Cleaning	3-3
Section	3.5	Installation.....	3-3
	-3.5.1	Attaching the Helmet Harness	3-4
	-3.5.2	Attaching the Torso Harness.....	3-5
Section	3.6	Operation	3-7
	-3.6.1	Helmet Harness Battery Installation.....	3-8
	-3.6.2	Torso Harness Battery Installation	3-9
	-3.6.3	Testing the MWLD System by a Controller	3-10
	-3.6.3.1	Testing the Torso Harness.....	3-10
	-3.6.3.2	Testing the Helmet Harness.....	3-11
	-3.6.3.3	Testing the Total MWLD System	3-11
	-3.6.4	Modes of Operation.....	3-12
	-3.6.4.1	KILLED	3-12
	-3.6.4.2	NEAR MISS.....	3-12
	-3.6.5	Resetting the MILD System.....	3-13
Section	3.7	Handling and Storage	3-13
CHAPTER	4	SMALL ARMS ALIGNMENT FIXTURE	4-1
Section	4.1	Introduction	4-1
Section	4.2	Equipment Description.....	4-1
Section	4.3	Limitations of Equipment	4-4
Section	4.4	Inspection and Cleaning	4-4
Section	4.5	Operation	4-5
	-4.5.1	Initial Set-up Conditions	4-5
	-4.5.2	Operating SAAF P/N 11835282	4-6
	-4.5.3	Operating SAAF P/N 9353020	4-7
Section	4.6	Handling and Storage	4-7
APPENDIX	A	REFERENCES.....	A-1
APPENDIX	B	COMPONENTS OF END ITEM AND BASIC ISSUE ITEMS LIST	B-1
APPENDIX	C	ADDITIONAL AUTHORIZATION LIST	C-1
APPENDIX	D	EXPENDABLE SUPPLIES AND MATERIALS LIST	D-1

LIST OF ILLUSTRATIONS

<u>FIGURE</u>	<u>TITLE</u>	<u>PAGE</u>
1-1	Infantry System	1-2
1-2	Support Equipment.....	1-3
1-3	Infantry System Equipment Location.....	1-4
2-1	SAT Assembly.....	2-2
2-2	Inspecting and Cleaning the SAT.....	2-3
2-3	SAT Battery Installation.....	2-4

List of Illustrations (con't)

2-4	SAW Mounting Bracket	2-5
2-5	Universal Mounting Bracket	2-6
2-6	Installing the SAT on the SAW Barrel	2-7
2-7	Installing the SAT on the M16A1 Using the Universal Mounting Bracket	2-8
2-8	Installing the SAT on the M16A2 Using the Universal Mounting Bracket.....	2-9
2-9	BLANK-FIRE Attachment (typical)	2-10
2-10	SAT Rear View.....	2-11
2-11	DRY-FIRE Cable Installation.....	2-13
2-12	SAAF Front Panel	2-15
2-13	SAAF Front Panel	2-16
2-14	Laser Adjustor 'Click' Marks.....	2-17
3-1	Helmet Harness Assembly.....	3-1
3-2	Torso Harness Assembly	3-2
3-3	Attaching the Helmet Harness	3-4
3-4	Attaching the Torso Harness to the Web Belt.....	3-5
3-5	Securing Clamp.....	3-5
3-6	Torso Harness Placement.....	3-6
3-7	Torso Harness Attachment	3-7
3-8	Helmet Harness Battery Installation.....	3-8
3-9	Torso Harness Battery Installation	3-9
4-1	Small Arms Alignment Fixture Assembly (P/N 11835282)	4-2
4-2	Small Arms Alignment Fixture Assembly (P/N 9353020)	4-3
4-3	SAAF	4-6

LIST OF TABLES

<u>TABLE</u>	<u>TITLE</u>	<u>PAGE</u>
1-1	Terminology	1-5

CHAPTER 1

GENERAL INFORMATION

1.1 INTRODUCTION

The instructions and procedures contained in this manual are intended for use by operating personnel of the Multiple Integrated Laser Engagement System (MILES) Infantry System.

NOTE

This publication contains application instructions pertaining to the M16A1, M16A2 and M249 SAW for the equipment listed. Do not confuse with earlier equipment identified as Simulator System, Firing, Laser: M60 for M16A1 Rifle (NSN 1265-01-085-1583).

1.2 HOW TO USE THIS MANUAL

Chapter 1 is a general overview of the purpose and identification of the total Infantry System. Each following chapter deals with a particular component of the system and all related information needed by the operator to use that component.

To perform the procedures discussed in this manual, the operating personnel must be able to:

- load and fire blank ammunition
- install a Blank-Fire Attachment (BFA) on the M16A1 and M16A2 rifles and on the M249 Squad Automatic Weapon (SAW)
- requisition basic military equipment through proper channels
- return defective equipment for servicing

It is suggested that this manual be read in its entirety to familiarize the reader with the total system.

1.3 PURPOSE OF EQUIPMENT

The purpose of the Infantry System is to provide realistic combat training exercise without using live ammunition.

The Infantry System is comprised of battery-powered laser transmitters and detector assemblies. When fired, the transmitter sends an invisible beam of radiated energy (laser) toward a target. The target is outfitted with the detector assembly which senses the laser beam and sounds an alarm. The alarm sounds in different tones, indicating whether the target was KILLED or NEAR MISSED by the laser beam.

Support equipment for the Infantry System includes a Controller Gun which is used by the umpire (or Controller) of the training exercise. A Small Arms Alignment Fixture (SAAF) is used to align the transmitter to the weapon sights of the weapon and to verify the operability of the transmitter.

1.4 EQUIPMENT

Figure 1-1 illustrates and identifies the major components and Figure 1-2 the support equipment of the Infantry System. They are the:

- Small Arms Transmitter (SAT) assembly
- Man-Worn Laser Detector (MWLD) assembly, which includes the Helmet and Torso Harnesses
- Controller Gun assembly
- Small Arms Alignment Fixture (SAAF) assembly

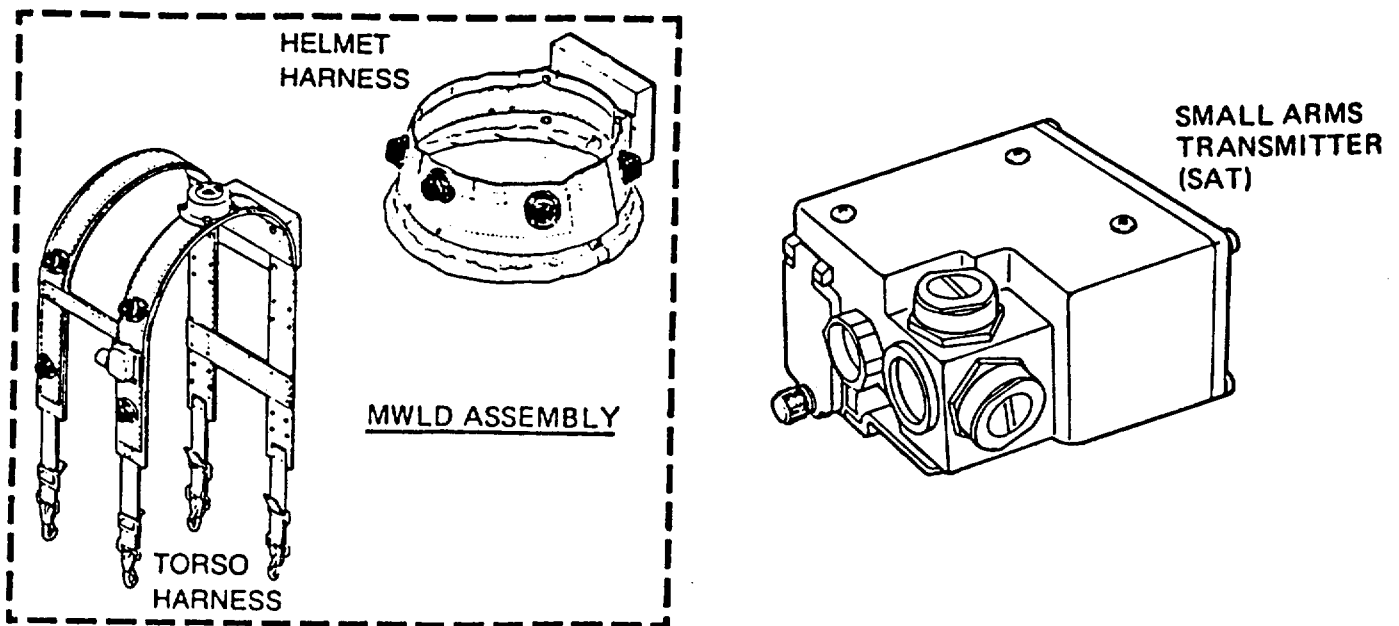
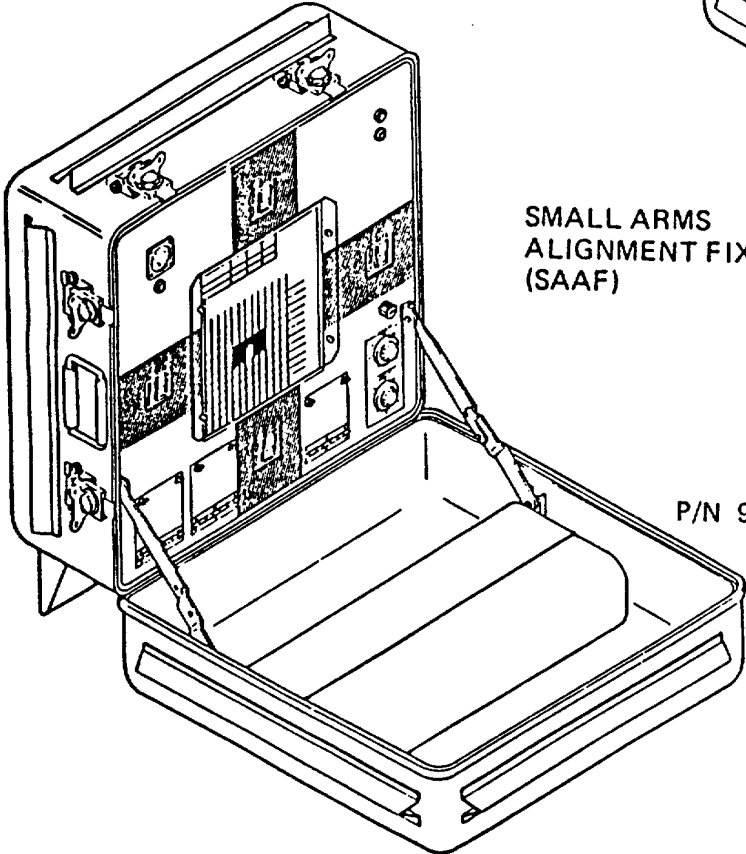
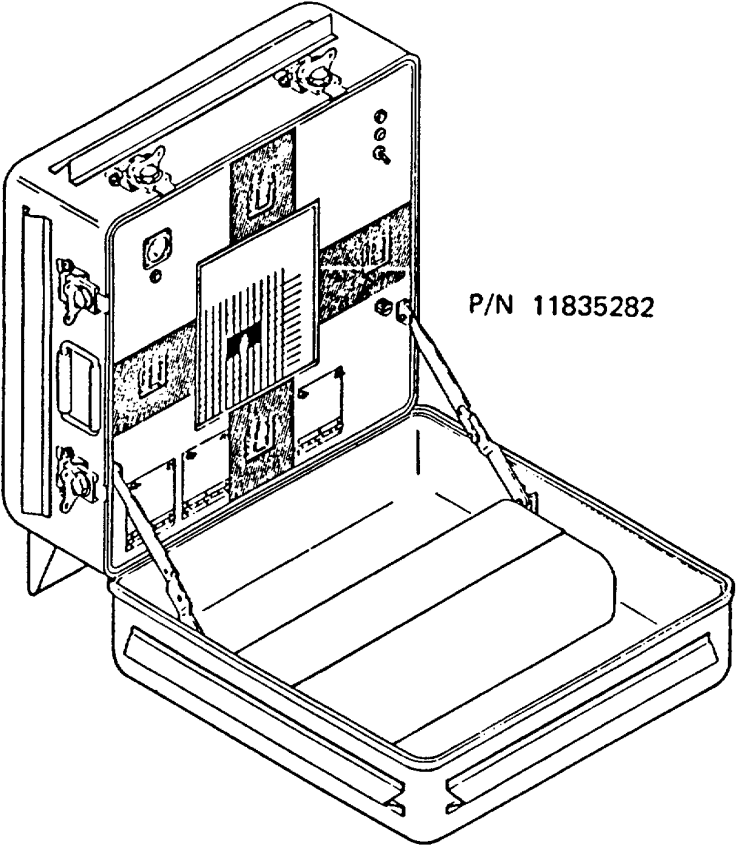
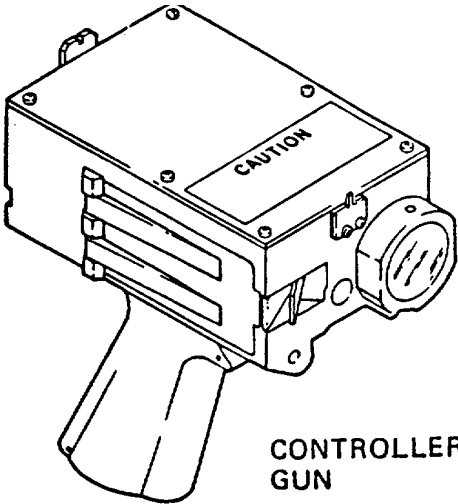


FIGURE 1-1. Infantry System



SMALL ARMS ALIGNMENT FIXTURE (SAAF)

FIGURE 1-2. Support Equipment

Figure 1-3 illustrates the location of the MWLD and SAT assemblies.

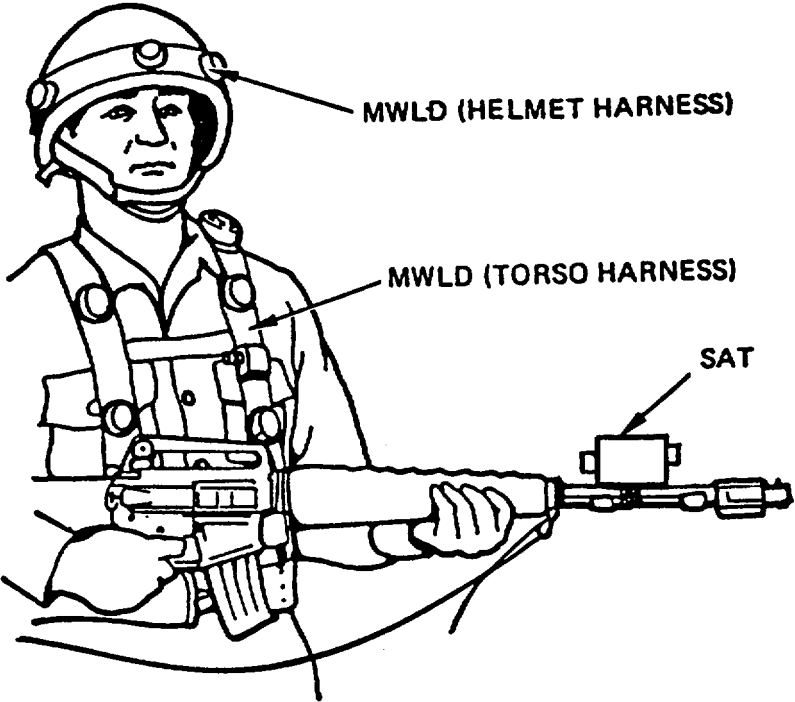


FIGURE 1-3. Infantry System Equipment Location

1.5 LIST OF TERMS

Refer to Table 1-1 for definitions of commonly used terms associated with the MILES Infantry System.

TABLE 1-1. TERMINOLOGY

TERM	DEFINITION
Adapter	Allows the Small Arms Transmitter to be attached onto the M16A1 or M16A2 rifles and the M249 Squad Automatic Weapon.
Alarm	Once the Man-Worn Laser Detector assembly senses a laser beam directed towards it, this alarm sounds different tones to signify which condition (KILLED or NEAR MISS) the target has suffered. The alarm is located on the Torso Harness.
BLANK-FIRE Mode	In a training exercise, when the Small Arms Transmitter is being used with blank ammunition.
Controller	The umpire of the training exercise.
Controller Gun	A hand-held, laser transmitting device used to (1) test the operability of the Infantry System, (2) disqualify soldiers from the exercise, and (3) determine the status of a target.
Controller Key (green)	This is a green WEAPON key used by the Controller to reset the Man-Worn Laser Detector assembly once a KILL has occurred. This key is used in the key receptacle located on the Torso Harness.
Detectors	Devices which sense a laser beam directed towards them. These devices are located on the Torso and Helmet Harnesses.
DRY-FIRE Mode	In a training exercise, when the Small Arms Transmitter is being used without blank ammunition.
DRY-FIRE Trigger Cable	A cable assembly which allows the use of the Small Arms Transmitter in DRY-FIRE mode. One end of this cable slips over the trigger of the rifle and the other end connects to the J1 connector located on the transmitter.

TABLE 1-1. TERMINOLOGY (Continued)

TERM	DEFINITION
Helmet Harness	The part of the Man-Worn Laser Detector assembly worn over the combat helmet.
KILL	The condition which indicates that the person wearing the Man-Worn Laser Detector assembly has been hit and totally disabled by a laser beam. The alarm sounds continuously to designate this condition.
Laser Beam	In this application, an invisible beam of light projected from a transmitter which is used to simulate weapon fire.
Man-Worn Laser Detector Assembly	This assembly consists of the Helmet and Torso Harness assemblies worn by military personnel.
NEAR MISS	The condition which indicates that laser fire is being directed towards a person wearing the Man-Worn Laser Detector assembly. The alarm sounds momentarily to designate this condition in lieu of a continuous tone.
Small Arms Alignment Fixture	A laser detecting device used to align the Small Arms Transmitter laser beam to the weapon sights of the rifle.
Small Arms Transmitter	A laser transmitting device, attached to the rifle, which is used to direct and fire a laser beam towards a desired target.
Torso Harness	The part of the Man-Worn Laser Detector assembly which is worn on the upper body.
WEAPON Key (yellow)	This is a yellow WEAPON key which is used to (1) turn on the Small Arms Transmitter and (2) silence the alarm on the Man-Worn Laser Detector assembly.
Key Receptacles	Devices on the Small Arms Transmitter and the Torso Harness which receive the WEAPON keys.
Universal Adapter	Allows the Small Arms Transmitter to be attached onto the M16A1 or the M16A2 rifle.

CHAPTER 2**SMALL ARMS TRANSMITTER**

2.1 INTRODUCTION

This chapter describes the inspection, cleaning, installation, operation, alignment, handling, and storage of the Small Arms Transmitter (SAT).

2.2 EQUIPMENT DESCRIPTION

The purpose of the SAT is to direct and fire a laser beam toward a desired target.

Refer to Figure 2-1 for an illustrated view of the SAT assembly, which consists of the following major parts.

LASER TUBE and WINDOW	the laser tube projects the laser beam toward a desired target. The glass window lens acts as a protective barrier for the laser tube.
LASER TUBE ADJUSTORS	allow for horizontal (windage) and vertical (elevation) adjustment of the laser tube.
MICROPHONE	senses the sound of a blank when a SAT-equipped rifle is fired. The microphone triggers the SATs electronics which, in turn, fire the laser beam.
BATTERY COMPARTMENT	houses a 9 volt, alkaline transistor-style battery which is needed to power the SAT.
KEY RECEPTACLE	accepts the yellow WEAPON key. Provides the following functions: <ol style="list-style-type: none">1. In the ON position, the SAT is ready to fire.2. In the off position (90 degrees from IN/OUT or ON), battery power to the SAT is off.3. In the IN/OUT position, the yellow key may be installed or removed.

FIRING/LOW BATTERY INDICATOR LIGHT

provides the following indications:

1. Operational: flashes 1 to 4 times when the SAT is initially turned ON. Indicates that the SAT is operationally ready.
2. Firing: momentarily flashes each time a laser round is fired.
3. Low Battery Voltage: flashes continually (approximately once a second) when battery voltage is too low for normal operation.

DRY-FIRE TRIGGER CONNECTOR RECEPTACLE (J1)

accepts the DRY-FIRE trigger cable. The DRY-FIRE cable is not included with the Infantry System and must be issued separately.

When not in use, a slip-on cap is used to protect the DRY-FIRE connector. This cap is attached to the SAT by a lanyard.

RIFLE MOUNTING BRACKET

allows the SAT to mount onto the weapons. It is made up of a diamond-shaped spring clamp and a securing clamp.

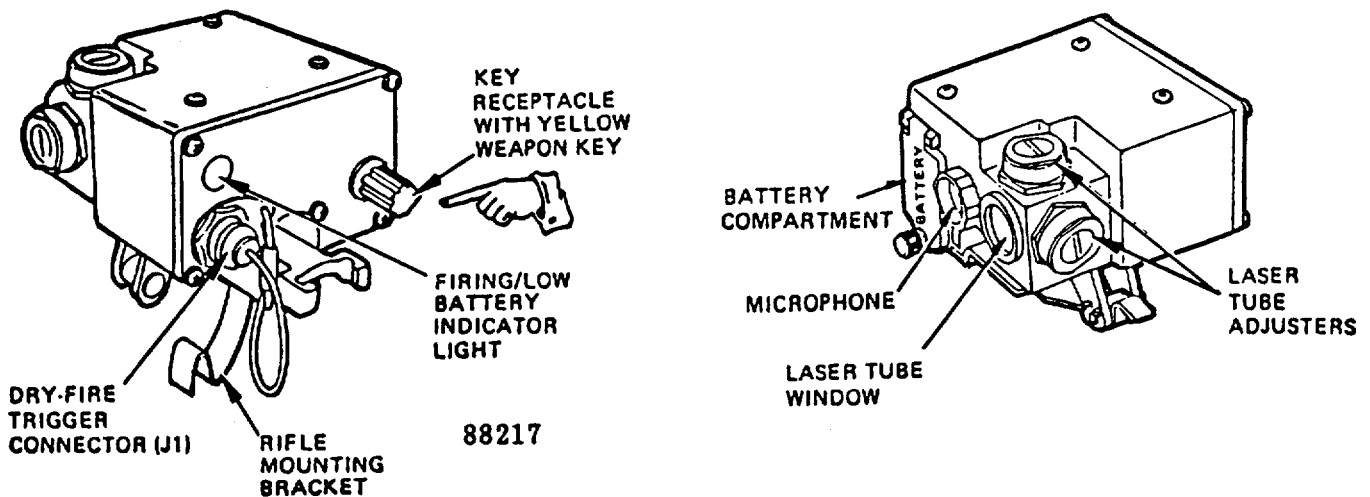


FIGURE 2-1. SAT Assembly

2.3 LIMITATIONS OF EQUIPMENT

The following limitations pertain to the SAT:

- 1. Even though the SAT has the same range and operational capabilities as the weapons, a dirty transmitter laser tube window may reduce its effective range.
- 2. In the DRY-FIRE mode, only semi-automatic (single shot) operation of the SAT is possible.
- 3. Do not force the laser tube adjusters. If the adjusters do not move freely, replace the SAT.

2.4 INSPECTION AND CLEANING

Refer to Figure 2-2 while performing the inspection and cleaning procedures for the SAT which follow:

- 1. Remove any dirt, blank-fire residue, or oil from the laser tube window with lens paper or a soft cloth. The cloth may be wet to remove stubborn dirt.
- 2. Ensure that the microphone aperture is not caked with dirt or blank-fire residue.

CAUTION

Do not use a sharp object to clean the microphone aperture.

- 3. Check for damage which would prevent normal operation of the SAT.

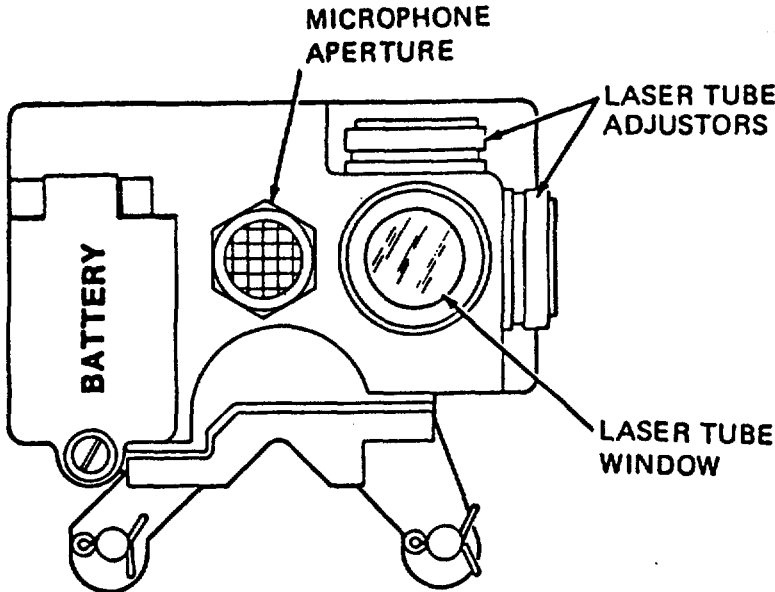


FIGURE 2-2. Inspecting and Cleaning the SAT

2.5 INSTALLATION

The following items must be installed:

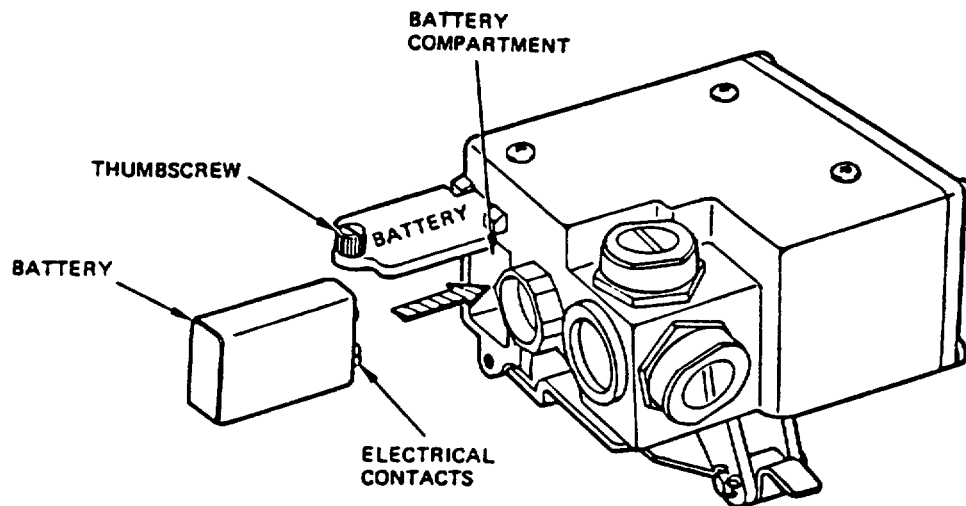
- 9 volt, alkaline battery in the SAT
- SAT on the weapon barrel

2.5.1 Battery Installation

Refer to Figure 2-3 while performing these procedures.

To install the 9 volt battery in the SAT:

1. Ensure that the yellow WEAPON key is either not installed or in the off position (90 degrees from IN/OUT or ON).
2. Locate the compartment marked BATTERY on the front of the SAT. Notice that the door of the compartment is secured by a captive thumbscrew.
3. Loosen the thumbscrew with your fingers and open the compartment door.
4. With the electrical contacts pointing into the compartment, place the battery into the compartment. Polarity of the contacts is not important.
5. Close the battery compartment door and hand-tighten the thumbscrew.



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FIGURE 2-3. SAT Battery Installation

2.5.2 Mounting Brackets

The SAT system is equipped with two types of weapon mounting brackets. These brackets allow the SAT to be used with:

- the Squad Automatic Weapon (SAW)
- either the M16A1 or the M16A2 rifle (universal bracket)

The bracket used with the SAW may be identified by the long shaft that rests on the barrel. Figure 2-4 illustrates the SAW mounting bracket.

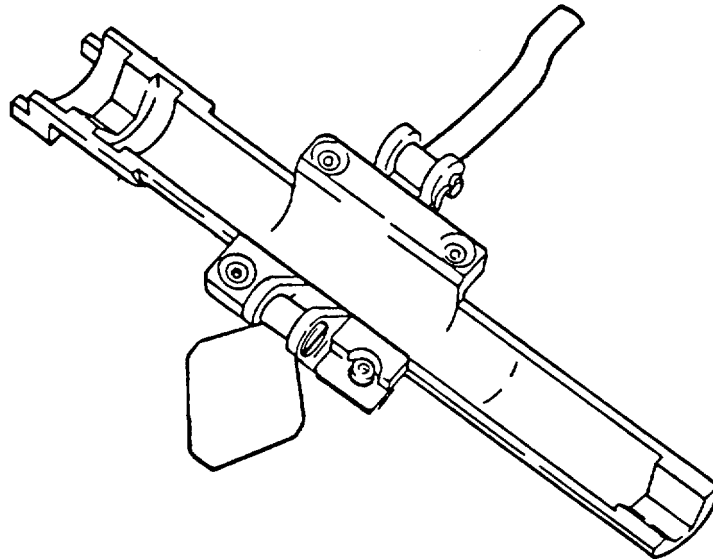


FIGURE 2-4. SAW Mounting Bracket

The universal bracket incorporates a spacer that enables the SAT to be mounted on either an M16A1 or M16A2 rifle. Refer to Figure 2-5 for an illustrated view of the universal bracket.

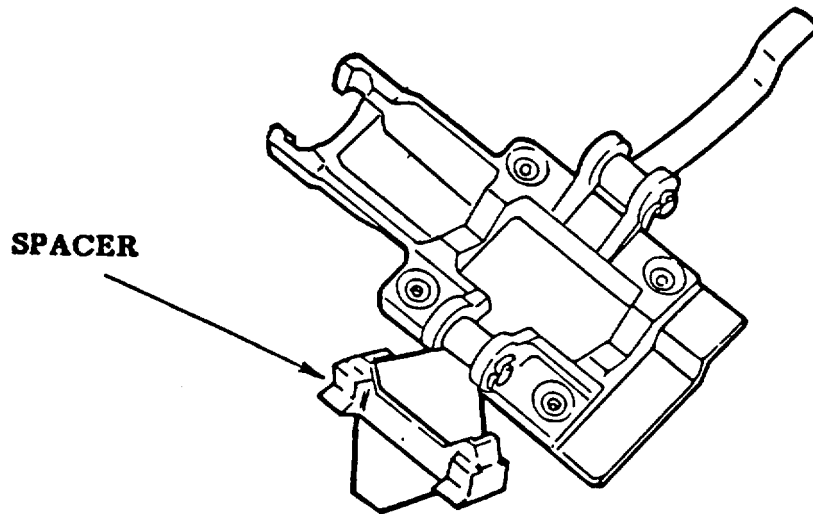


FIGURE 2-5. Universal Mounting Bracket

CAUTION

Before mounting the SAT on a weapon, ensure that you are using the proper bracket or damage may occur to the weapon.

2.5.3 Installing the SAT on the SAW Barrel

Refer to Figure 2-6 while performing these procedures. Note that the call-outs used on the figure correspond with the procedural steps.

To install the SAT on the SAW barrel:

1. Open the Bipod and place the weapon on a flat surface.
2. Open the SAT's spring clamp. Flip back the diamond-shaped clamp.
3. With the sight guides pointing toward the user and the two clamps pointing down, mate the SAT to the SAW's barrel. Place the sight guides straddling the weapon's front sight post and carefully lower the SAT until it rests on the barrel.
4. Position the SAT as shown and close the diamond-shaped clamp. Close and lock the spring clamp by applying pressure to the center.

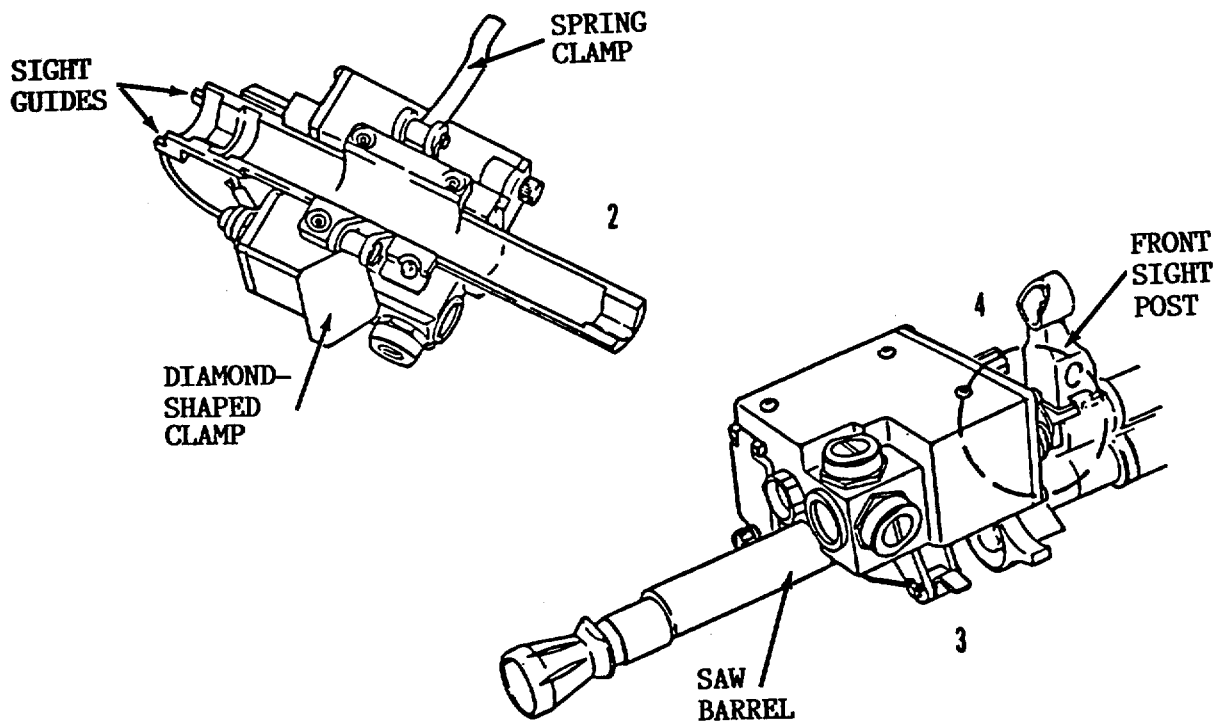


FIGURE 2-6. Installing the SAT on the SAW Barrel

2.5.4 installing the SAT on the M16A1

Refer to Figure 2-7 while performing these procedures. Note that the call-outs used on the figure correspond with the procedural steps.

Attach the SAT to the rifle barrel as follows when using an M16A1 rifle:

1. Open the spring clamp and the diamond-shaped clamp. Hold the SAT with both clamps fully open and the sight guides pointing toward the user.
2. Position the rifle so the shoulder stock is supported and the user is looking straight down into the magazine well.
3. Mate the SAT to the rifle's barrel by positioning the sight guides of the SAT so they straddle the front sight post of the rifle. Lift the SAT until it makes contact with the rifle barrel.
4. While closing the diamond-shaped clamp, position the spacer on the center of the barrel.
5. Close and lock the SAT in place by positioning the spring clamp over the diamondshaped clamp and pressing in the center.

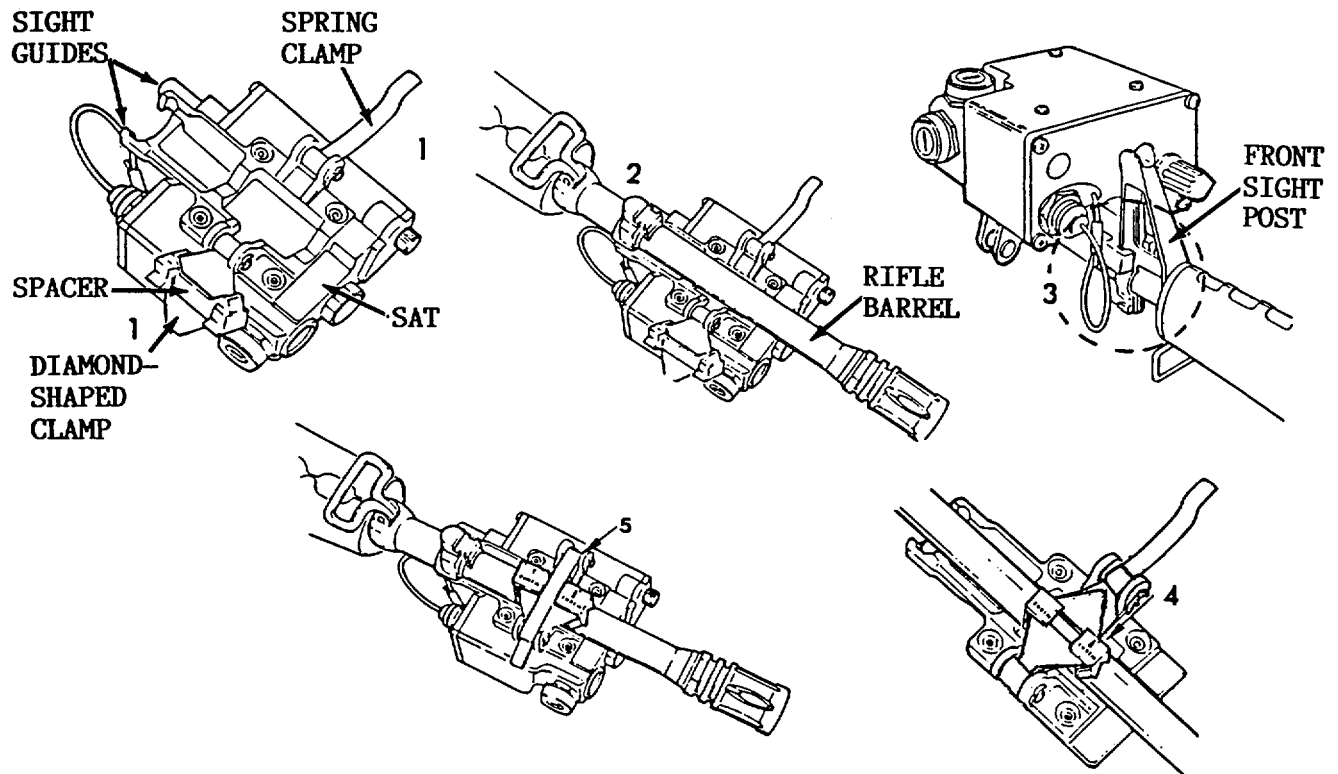


FIGURE 2-7. Installing the SAT on the M16A1 Using the Universal Bracket

2.5.5 Installing the SAT on the M16A2

Refer to Figure 2-8 while performing these procedures. Note that the call-outs used on the figure correspond with the procedural steps.

Attach the SAT to the rifle barrel as follows when using an M16A2 rifle:

1. Open the spring clamp and the diamond-shaped clamp. Hold the SAT with both clamps fully open and the sight guides pointing toward the user.
2. Position the rifle so the shoulder stock is supported and the user is looking straight down into the magazine well.
3. Mate the SAT to the rifle's barrel by positioning the sight guides of the SAT so they straddle the front sight post of the rifle. Lift the SAT until it makes contact with the rifle barrel.
4. While closing the diamond-shaped clamp, position the spacer to the side of the rifle barrel.
5. Close and lock the SAT in place by positioning the spring clamp over the diamondshaped clamp and pressing in the center.

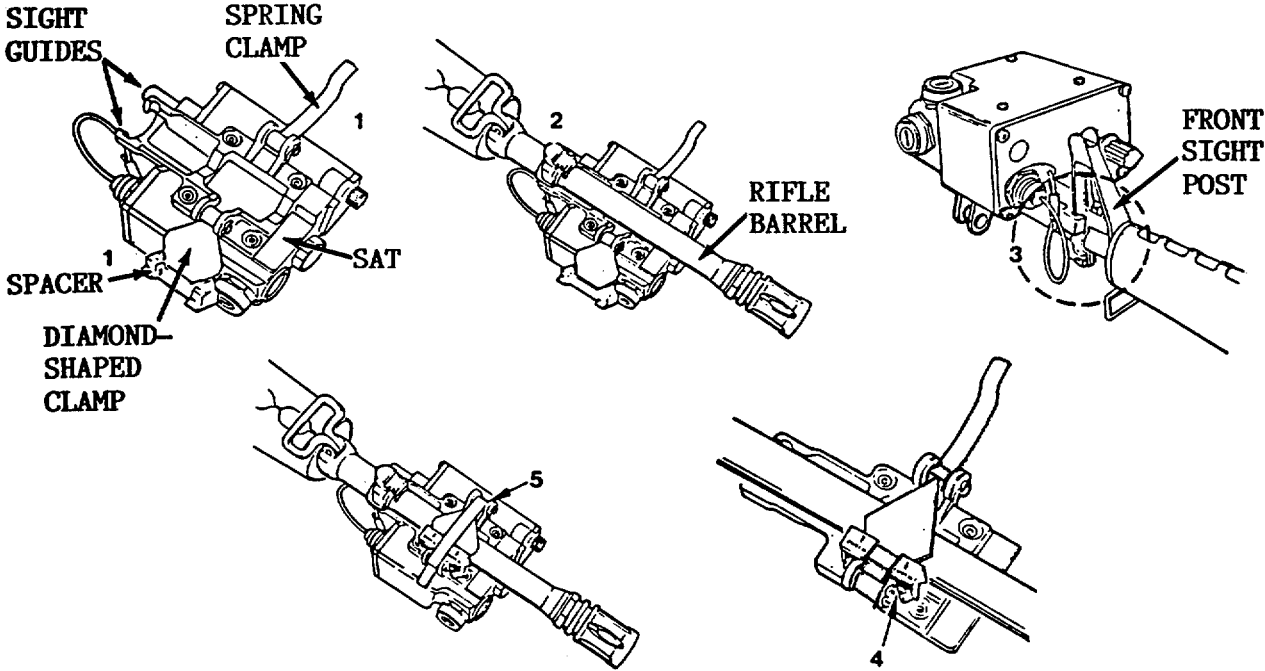


FIGURE 2-8. Installing the SAT on the M16A2 Using the Universal Bracket

2.6 OPERATION

The SAT may be operated in either of two modes:

- BLANK-FIRE mode
- DRY-FIRE mode

NOTE

For the SAT to perform any operational function, the yellow WEAPON key must be in the ON position.

2.6.1 BLANK-FIRE Mode

To operate the SAT in BLANK-FIRE mode:

1. Obtain a Blank-Fire Attachment (BFA).
2. Put the covered side of the BFA on the barrel of the rifle so that the covered side is towards the SAT's laser tube window (see Figure 2-9). This will protect the window from the muzzle blast residue.

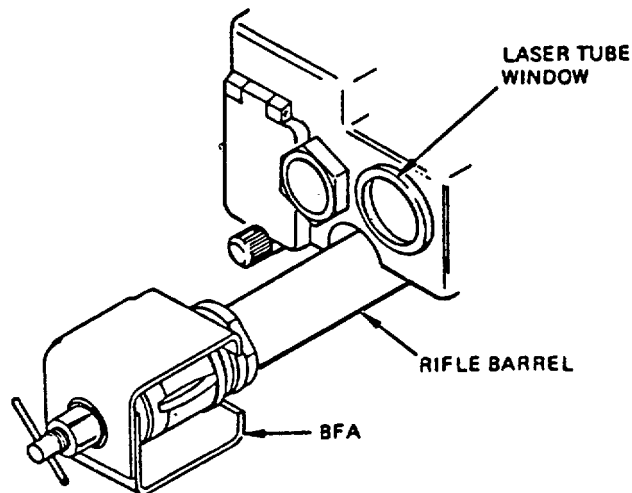


FIGURE 2-9. BLANK-FIRE Attachment (typical)

3. Insert a magazine with blank cartridges in the rifle.
4. Insert the yellow WEAPON key into the key receptacle on the SAT. Push in and turn the key clockwise to the ON position.

NOTE

Refer to Figure 2-10. The FIRING indicator light will flash 1 to 4 times and stop. This flashing indicates that the unit is operational. However, if the flashing continues, it indicates that the battery voltage is too low for normal operation. The battery should then be replaced before continuing.

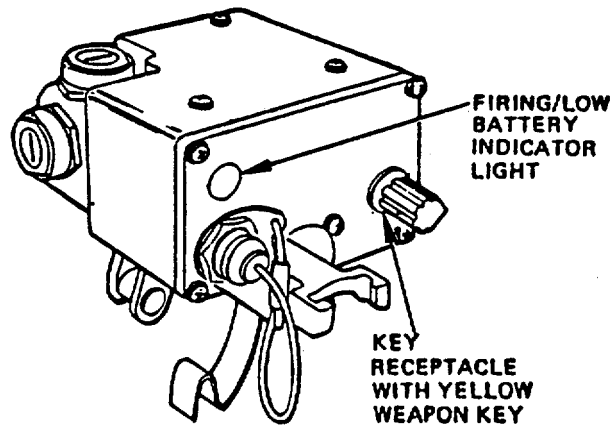


FIGURE 2-10. SAT Rear View

5. Chamber the first round of blank ammunition in the rifle.

WARNING

Avoid viewing the laser emitter directly along the optical axis of the radiated beam.

6. While watching the FIRING indicator light, fire one round. The FIRING light should illuminate briefly.

NOTE

If there is no illumination, fire again. If there is still no illumination, replace the SAT. Tag defective items as appropriate.

2.6.2 DRY-FIRE Mode

NOTES

- 1. During DRY-FIRE operation, the SAT will only fire in semiautomatic (single-shot) mode. The trigger must be squeezed once and released once for each round.**
- 2. DRY-FIRE mode may be used with either the M16A1 or M16A2 rifle. With some adjustments, the DRY-FIRE cable may be used to operate the SAW in DRY-FIRE mode, however, it is not primarily designed to do so.**

Refer to Figure 2-11 while performing the following steps.

To operate in the DRY-FIRE mode:

1. Obtain a DRY-FIRE trigger cable assembly. Ensure that the cable assembly has no cracks or tears. Check for bent pins in the connector. Ensure that there are two fastener tape straps on the cable.
2. On the rear of the SAT, remove the protective cap from receptacle J1.
3. Insert the connector located on the DRY-FIRE trigger cable into receptacle J1 by aligning the half circles in both connectors. Push the connector into position.
4. Wrap one fastener strap around the vent holes on the upper hand guards of the rifle.
5. Wrap the other fastener strap around the upper hand guard slip ring.
6. Cock the rifle. Open the trigger guard using a small probe.
7. Route the cable under the dust cover and gently push the trigger button up over the trigger.
8. Close the trigger guard.
9. Turn the yellow WEAPON key to the ON position.

NOTE

The FIRING indicator light should flash 1 to 4 times and stop. This flashing indicates that the unit is operational. However, if the flashing continues, it indicates that the battery voltage is too low for normal operation. The battery should then be replaced.

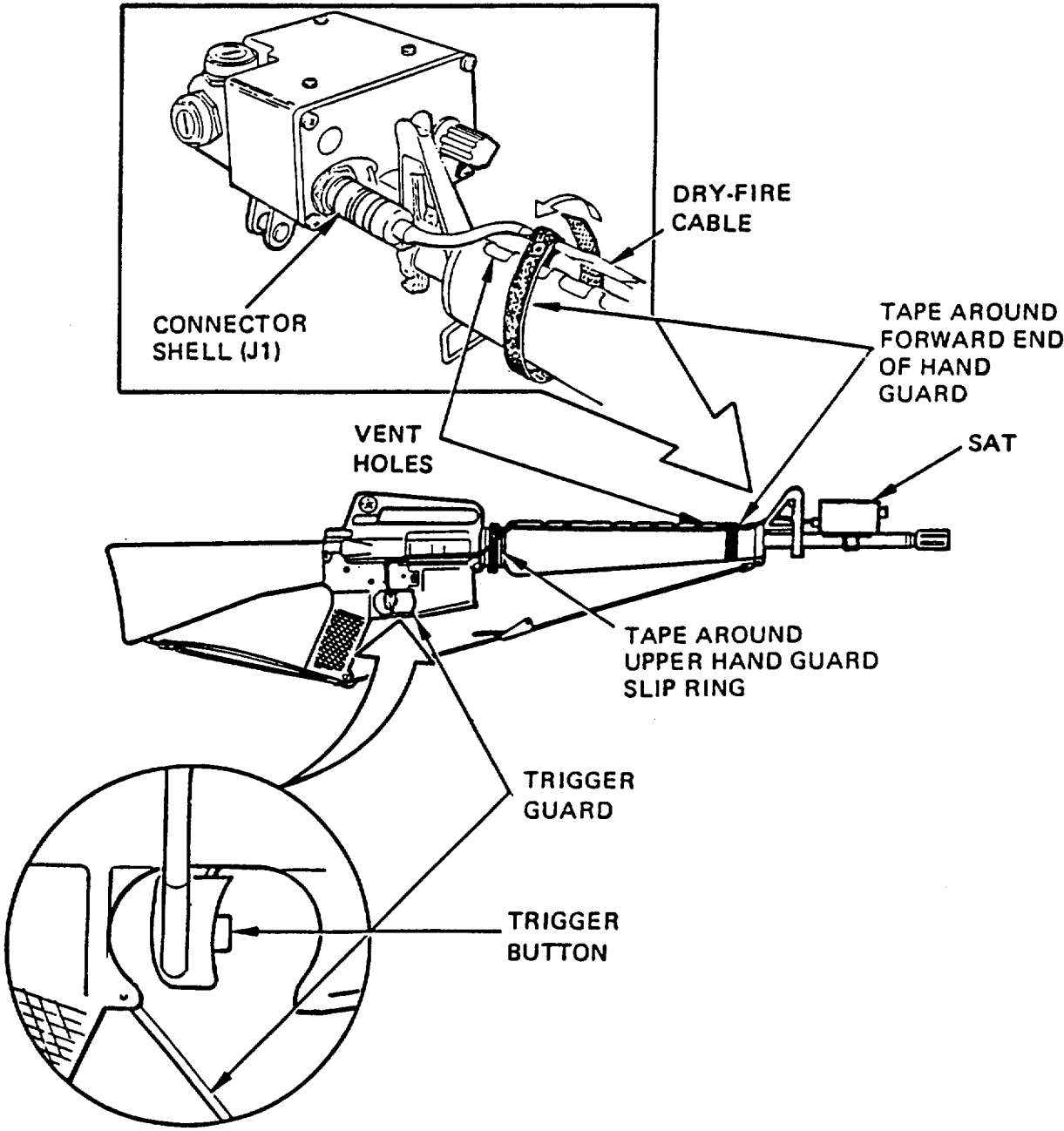


FIGURE 2-11. DRY-FIRE Cable Installation

10. Squeeze the trigger button. The red FIRING indicator light should illuminate briefly.

NOTE

If there is no illumination, replace the SAT.

CAUTION

To remove the DRY-FIRE cable, pull on the connector shell and not the cable insulation.

2.7 ALIGNMENT USING THE SAAF

The following instructions pertain to boresighting the SAT using the Small Arms Alignment Fixture (SAAF).

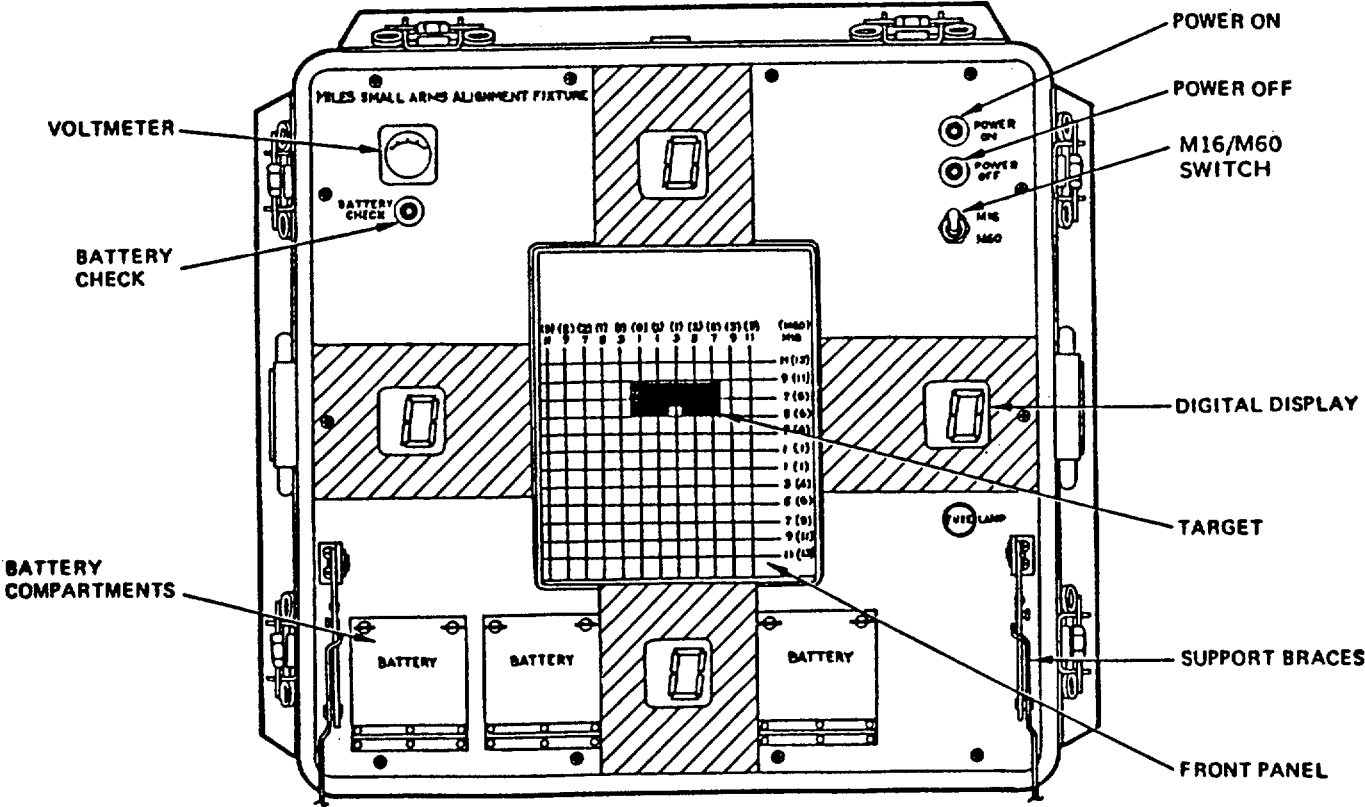
Before continuing, familiarize yourself with the information in Chapter 4, SMALL ARMS ALIGNMENT FIXTURE.

NOTES

1. **Only adjust the SAT laser tube adjustors when performing the SAT boresight alignment procedure.**
2. **Attach the SAT to the rifle in accordance with the installation instructions.**
3. **The SAT can be aligned in either the BLANK-FIRE or DRY-FIRE mode.**
4. **If using the BLANK-FIRE mode, ensure that the rifle is loaded with the proper blank amunition.**
5. **To use the DRY-FIRE. mode, refer to the instructions in Section 2.6.2.**
6. **The weapon sights of the rifle should already be set to your individual battle sight zero position.**
7. **Do not adjust the weapon sights.**
8. **Do not force the laser tube adjustors when making alignment corrections.**

To align the M16A1, M16A2, or SAW weapon sights with the SAT using the SAAF, perform the following procedures.

1. Set up the target at a range of 25 meters from the firing point.
2. Install three BA200 batteries into the SAAF.
3. Turn the POWER switch to the ON position.
- 4a. If using SAAF P/N 11835282 (refer to Figure 2-12):
 - set the M16/M60 switch to the M16 position for all SAT weapons: M16A1, M16A2, or SAW

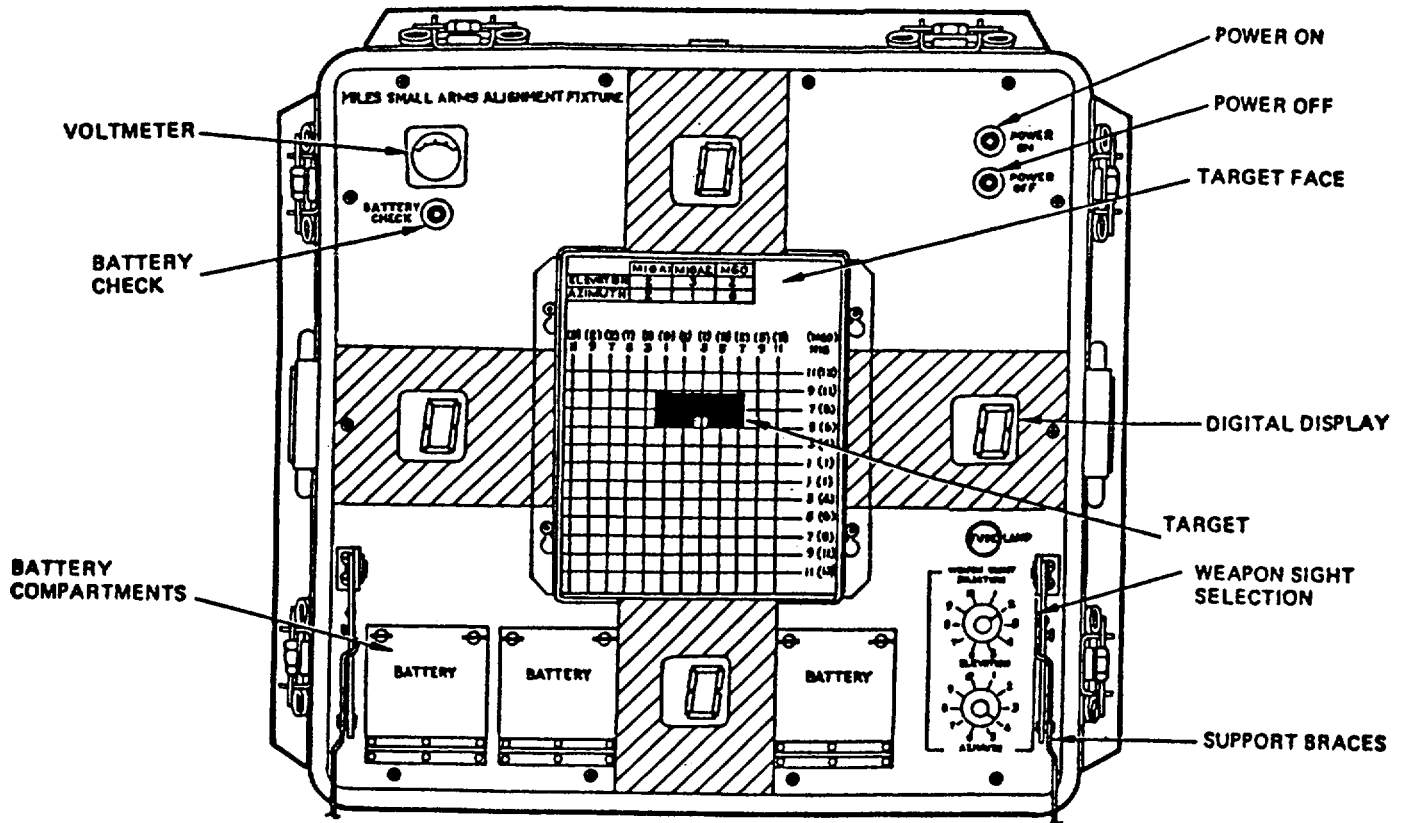


P/N 11835282

FIGURE 2-12. SAAF Front Panel

4b. If using SAAF P/N 9353020 (refer to Figure 2-13):

- set the WEAPON SIGHT SELECTION switches according to the elevation and azimuth information provided on the face plate for the M16A1 for all SAT weapons
- set the top switch (elevation) to 2
- set the bottom switch (azimuth) to 2



P/N 9353020

FIGURE 2-13. SAAF Front Panel

5. Assume the prone supported firing position.
6. Fire one round at the SAAF's sight alignment target.

NOTE

If no numbers are displayed on the SAAF after firing 2 or 3 rounds at the target, go to the Coarse Alignment Procedure (Section 2.7.1).

- The SAAF displays will indicate the direction and number of 'clicks' you will be required to turn the laser tube adjusters to align the SATs laser beam to the weapon sights of the rifle. Repeat firing until tolerance is achieved.

CAUTION

When using the laser tube adjusters, do not force them. If adjusters do not move freely, replace the SAT.

NOTE

The SAT laser tube adjusters are marked with 'click marks' (refer to Figure 2-14). Each mark represents 4 'clicks' and the 'clicks' represent the following:

- | | |
|-------------------|------------------|
| 1 'click' | = 1 digit (SAAF) |
| 1 full revolution | = 36 clicks |

Example:

On the SAAF, if the right display shows 8 and the lower (bottom) display shows 4, move the windage adjuster 8 'clicks' to the right (counterclockwise) and the elevation adjuster 4 'clicks' down (counterclockwise).

When the SAAF displays four zeroes 0000 (+2), the SAT is aligned.

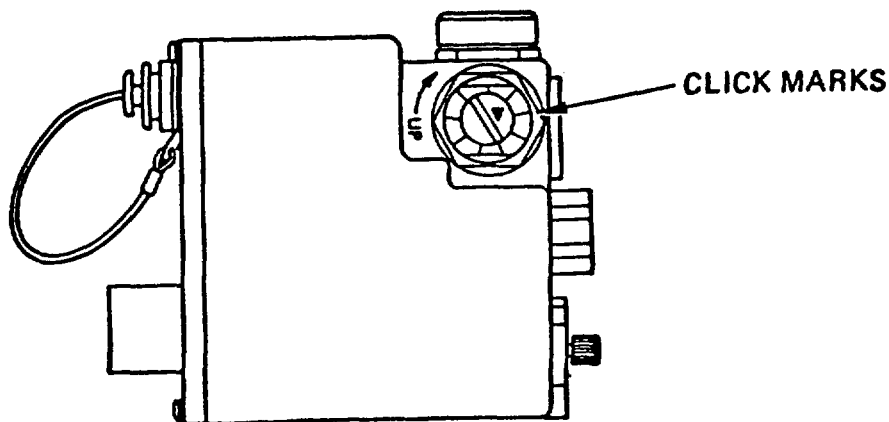


FIGURE 2-14. Laser Adjustor 'Click' Marks

WARNING

Avoid viewing the laser emitter along the optical axis of the radiated beam.

To verify the alignment:

- From a distance of 100 meters, fire at a soldier wearing a functional MWLD. The alarm on the MWLD should sound continuously indicating a KILL.

2. If the alarm does not sound or sounds only briefly (indicating a NEAR MISS) the SAT may not be properly aligned. Realign using the SAAF.

NOTE

After completing SAT boresighting, do not move the SAT laser tube adjusters.

2.7.1 Coarse Alignment Procedure

1. Verify that the laser tube is approximately centered in the laser tube window. If not, position the laser tube in the center on the window by rotating the adjusters as required. To rotate the adjusters, a coin may be used.

CAUTION

Do not force the laser tube adjusters. If adjusters do not move freely, replace the SAT.

2. At a distance of 5 meters from the SAAF, assume the prone supported firing position.
3. Fire one round at the SAAF target face bull's-eye.

NOTE

If no display registers on the SAAF, perform Step 4a. If a display registers, perform Step 4b.

- 4a. no display appears, at close range, fire at another soldier who is wearing an operable MWLD. While firing, observe the FIRING indicator light. It should light when the SAT fires. If there is no MWLD alarm or no FIRING light appears, the SAT should be replaced.
- 4b. the SAAF does display correction indicators, adjust the SAT laser tube in the direction indicated by the SAAF, but multiply the indicated numbers by 5.

Example: The display indicators are 6 up and 9 right.

$$6 \times 5 = 30 \text{ and } 9 \times 5 = 45$$

Now your adjustments are 30 up and 45 right.

NOTE

The SAT laser tube adjusters are marked with 'click marks' (refer to Figure 2-14). Each mark represents 4 'clicks' and the 'clicks' represent the following:

- | | |
|-------------------|------------------|
| 5 'clicks' | = 1 digit (SAAF) |
| 1 full revolution | = 36 clicks |

5. Fire another round at the SAAF target face bull's-eye.
6. Make corrections as in Step 4b, if required.
7. Return to and perform Step 5 thru the end of Section 2.7.

2.8 REMOVAL

2.8.1 Removal of the SAT from the SAW

CAUTION

Failure to follow the removal procedures could cause damage to the SAT.

1. Open the Bipod and place the weapon on a level surface.

NOTE

During the removal procedures do not bend, twist, or pull the SAT toward the front sight post. A small amount of force binding the sight guides can cause damage to the SAT.

2. Release the spring clamp. Remove both the spring and diamond-shaped clamp from the barrel while holding the SAT in the locked position.
3. Slowly lift the SAT straight up (at least 4 inches) from the SAW's barrel.
4. Close the diamond-shaped clamp and the spring clamp to the locked position. Store the SAT 1AW Para 2.9 of this technical manual.

2.8.2 Removal of the SAT from the M16A1

CAUTION

Failure to follow the removal procedures could cause damage to the SAT.

1. Position the rifle so that the shoulder stock is supported and the user is looking straight down into the magazine well.

NOTE

During the removal procedures do not bend, twist, or pull the SAT toward the front sight post.

2. While holding the SAT in the locked position with one hand, use the other hand to release the spring clamp and flip back the diamond-shaped clamp.

3. Following the line of the front sight post, slowly lower the SAT approximately 3/4 of the way down. When the sight post narrows enough to allow easy removal, carefully move the SAT toward the flash suppressor.
4. Close the diamond-shaped clamp and the spring clamp. Store the SAT 1AW Para 2.9 of this technical manual.

2.8.3 Removal of the SAT from the M16A2

CAUTION

Failure to follow the removal procedures could cause damage to the SAT.

1. Position the rifle so that the shoulder stock is supported and the user is looking straight down into the magazine well.

NOTE

During the removal procedures do not bend, twist, or pull the SAT toward the front sight post.

2. While holding the SAT in the locked position with one hand, use the other hand to release the spring clamp and flip back the diamond-shaped clamp.
3. Following the line of the front sight post, slowly lower the SAT approximately 3/4 of the way down. When the sight post narrows enough to allow easy removal, carefully move the SAT toward the flash suppressor.
4. Close the diamond-shaped clamp and the spring clamp. Store the SAT 1AW Para 2.9 of this technical manual.

2.9 HANDLING AND STORAGE

This section details the procedures used in the handling and storage of the SAT.

Prior to placing the SAT in storage, it should be cleaned and inspected using the procedures in Section 2.4.

Then perform the following tasks:

1. Ensure the SAT is clean and free from oil, dirt, or residue.
2. inspect the SAT to ensure there are no defects or missing parts which would hinder normal operation.
3. If the SAT is wet, dry it.
4. Ensure that all lettering and identification plates are legible.

5. Remove the battery.
6. Verify that the yellow WEAPON key is in the off position (90 degrees from IN/OUT or ON).
7. Verify that the DRY-FIRE connector cap is installed.
8. If the equipment has failed or is in need of servicing, report this to the proper personnel.
9. Pack the SAT so that there is no likelihood of it being damaged.

2-21/(2-22 blank)

CHAPTER 3

MAN-WORN LASER DETECTOR ASSEMBLY

3.1 INTRODUCTION

This chapter describes the inspection, cleaning, installation, operation, handling, and storage of the Man-Worn Laser Detector (MWLD) assembly.

3.2 EQUIPMENT DESCRIPTION

The MWLD assembly is made up of:

- a Helmet Harness assembly
- a Torso Harness assembly

The MWLD assembly is worn by soldiers involved in the training excersise. The purpose of the MWLD assembly is to receive the laser transmissions (beams) and determine whether the targeted soldier was NEAR MISSEd or KILLED by the laser beam.

3.2.1 Helmet Harness

Refer to Figure 3-1 for an illustrated view of the Helmet Harness assembly which consists of the following major parts.

ELECTRONICS MODULE	contains the battery and all the components needed to operate the Helmet Harness.
5 DETECTORS	receive the laser beam.
INDUCTIVE LOOP	acts as an antenna so that once the helmet is activated by the laser beam, the loop transfers this information to the Torso Harness which, in turn, activates the alarm system.

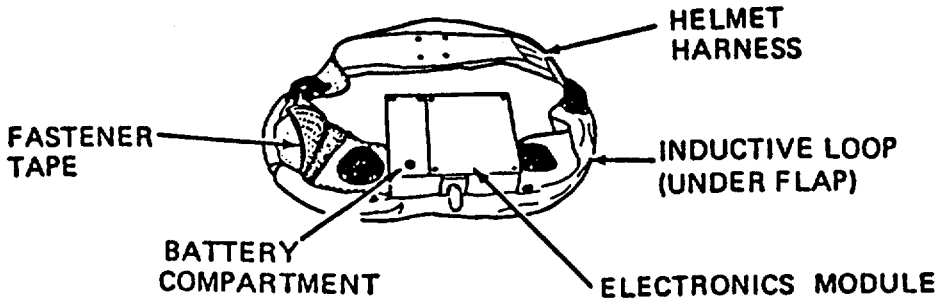


Figure 3-1. Helmet Harness Assembly

3.2.2 Torso Harness

Refer to Figure 3-2 for an illustrated view of the Torso Harness assembly which consists of the following major parts.

- ELECTRONICS MODULE contains the battery and all the components needed to operate the Torso Harness.
- 8 DETECTORS receive the laser beam.
- ALARM sounds a tone when the MWLD is struck by a laser beam.
- KEY RECEPTACLE is the device which receives the WEAPON key. The yellow WEAPON key is inserted into the key receptacle to turn off the alarm.
- INDUCTIVE LOOP receives the helmet-generated KILL or NEAR MISS information.
- 4 HOOKS allow the Torso Harness to be attached to the hip-worn web belt.

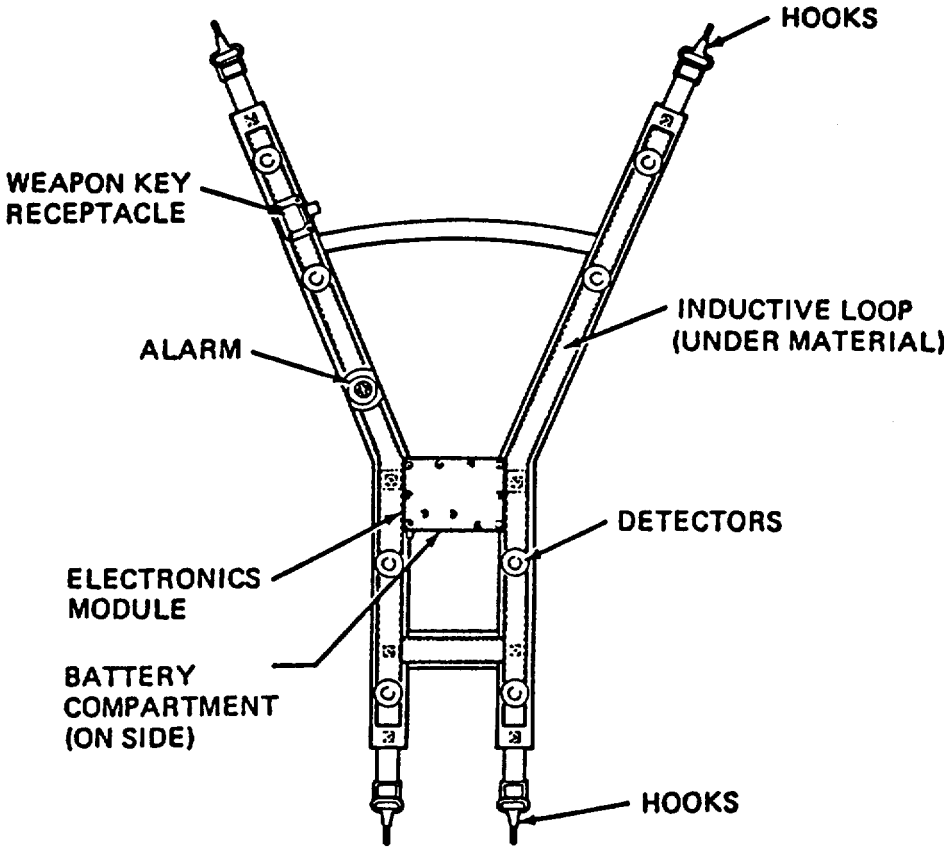


FIGURE 3-2. Torso Harness Assembly

3.3 LIMITATIONS OF EQUIPMENT

The following information pertains to the MWLD assembly:

1. Typically, each battery provides 100 hours of normal use.
2. MWLD assemblies use BA 3090/U, 9 volt alkaline batteries.
3. When the yellow WEAPON key is installed into the key receptacle, decoding is not disabled and when the key is removed, appropriate KILL alarms will sound until the system is reset.

3.4 INSPECTION AND CLEANING

This section explains the inspection and cleaning procedures for the:

- Helmet Harness
- Torso Harness

To inspect and clean the Helmet and Torso Harnesses:

1. On the Helmet Harness, wipe all 5 detectors clean with a cloth.
2. On the Torso Harness, wipe all 8 detectors clean with a cloth.
3. Inspect the Helmet and Torso Harnesses for damage which would prevent normal operation.

3.5 INSTALLATION

This section explains the attachment and installation procedures for the:

- Helmet Harness
- Torso Harness

3.5.1 Attaching the Helmet Harness

Refer to Figure 3-3 while performing these procedures.

Attach the Helmet Harness on the helmet using the following directions.

NOTE

Ensure that the chin strap of the helmet is hanging loose.

- 1. Locate the fastener tape on the harness and pull it apart.
- 2. Place the harness over the helmet with the electronic module positioned in the rear.
- 3. Ensure that the thick bottom edge of the harness containing the inductive loop completely overhangs the rim of the helmet.
- 4. Stick the fastener tape together so that the harness is securely attached to the helmet.
- 5. Place the helmet on your head and adjust the chin strap as necessary to ensure that the helmet is secure on your head.

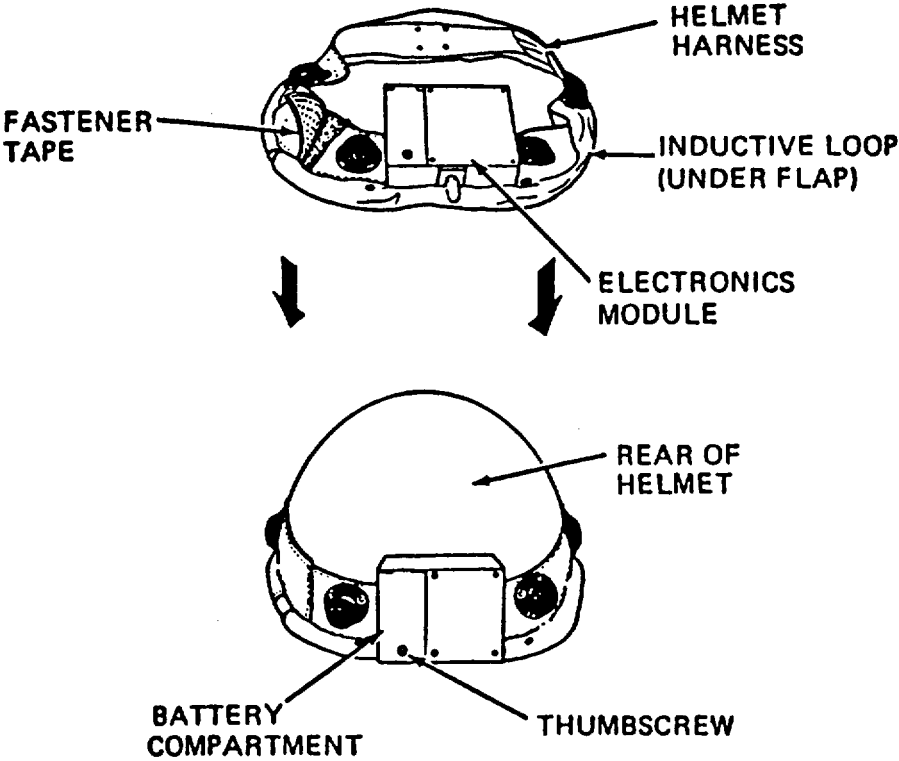


FIGURE 3-3. Attaching the Helmet Harness

3.5.2 Attaching the Torso Harness

- 1. Position the web belt next to the Torso Harness as shown in Figure 3-4 (the alarm should be positioned above the electronics module). If suspenders are attached to the web belt, remove them.

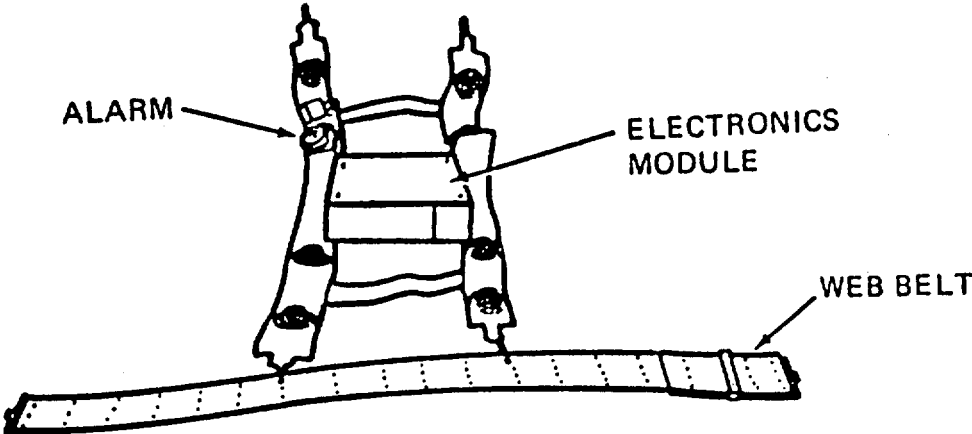


FIGURE 3-4. Attaching the Torso Harness to the Web Belt

- 2. Locate the securing clamp around each of the two hooks. On each of the hooks, push the pointed end of the clamp back with your thumb to reveal the exposed hook (refer to Figure 3-5). Connect the two hooks to the web belt. Secure the Torso Harness to the belt by pushing the securing clamp back over the hook.

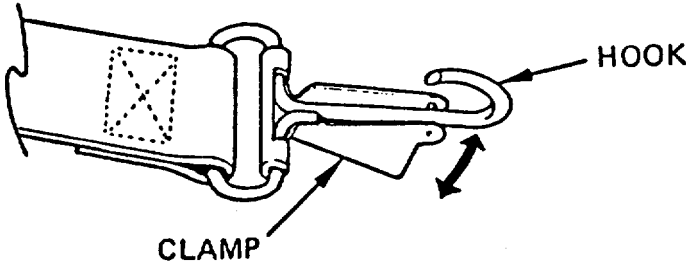


FIGURE 3-5. Securing Clamp

3. With the web belt positioned at your lower back (and not buckled to itself), raise the harness and lower it over your head (refer to Figure 3-6). Let the harness hang loose on your chest.

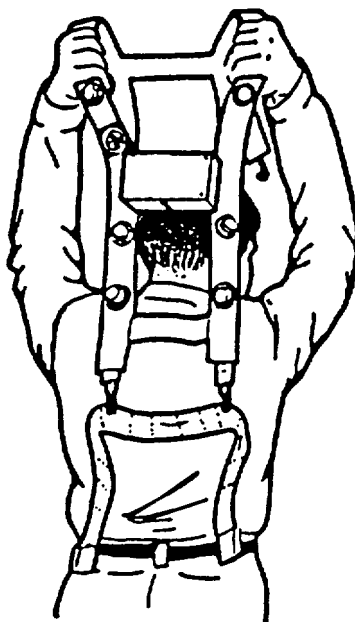


FIGURE 3-6. Torso Harness Placement

4. Fasten the web belt together using normal procedures.

- Secure the remaining two hooks as in Step 2, on the front of the harness to the belt (refer to Figure 3-7).

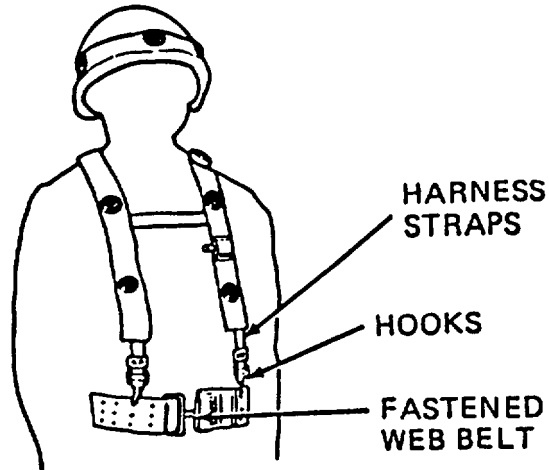


FIGURE 3-7. Torso Harness Attachment

- Adjust the harness straps so that the electronics module is at the back of your collar line.

3.6 OPERATION

Operation of the MWLD assemblies consists of:

- installing batteries into the Helmet and Torso Harnesses
- testing the Helmet and Torso Harnesses and the total system
- identifying the modes of operation
- resetting the system

3.6.1 Helmet Harness Battery Installation

NOTE

The Helmet Harness battery should be installed prior to the Torso Harness battery.

To install the Helmet Harness battery, perform the following procedures (refer to Figures 3-1 and 3-8):

1. Locate the compartment marked BATTERY on the left side of the electronics module. Notice that the compartment door is secured by a captive thumbscrew.
2. Loosen the thumbscrew with your fingers and open the compartment door.
3. With the electrical contacts aligned as shown in Figure 3-8, securely place a 9 volt alkaline battery (type BA3090/U) into the compartment. Polarity of the contacts is required.
4. Close the battery compartment door and hand-tighten the thumbscrew.

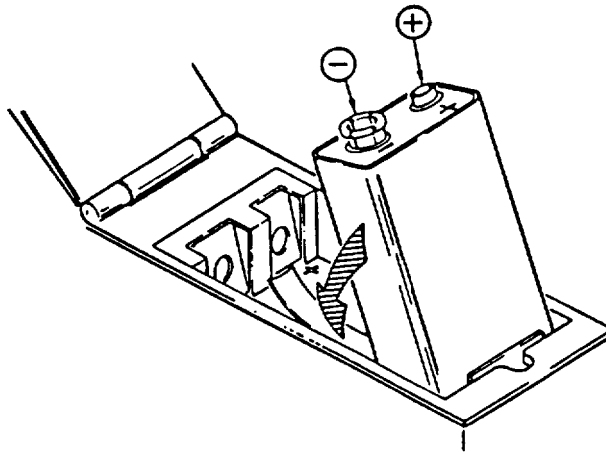


FIGURE 3-8. Helmet Harness Battery Installation

3.6.2 Torso Harness Battery Installation

NOTE

Before proceeding, ensure that the yellow WEAPON key is available.

To install the Torso Harness battery, perform the following procedures (refer to Figures 3-2 and 3-9):

1. Locate the battery compartment labeled BATTERY within the electronics module.
2. Loosen the thumbscrew and open the battery compartment door.
3. With the electrical contacts aligned as shown in Figure 3-9, put a 9 volt alkaline battery (type BA3090/U) in the battery compartment. Polarity of the contacts is required.

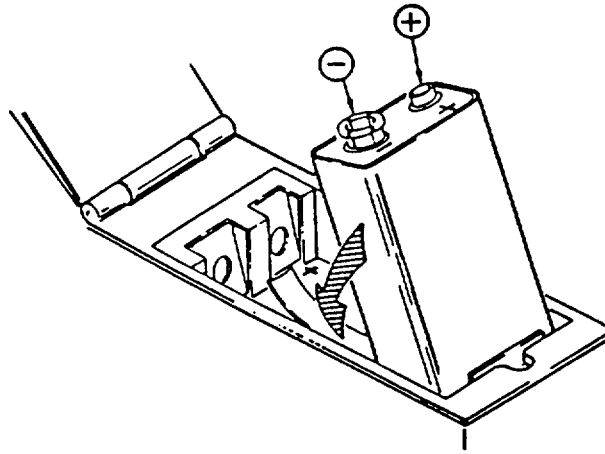


FIGURE 3-9. Torso Harness Battery Installation

NOTE

When the battery has been installed, the alarm will sound continuously. If the alarm does not sound try (1) reinstalling the battery or (2) inserting a new battery, or (3) replacing the harness. Tag defective items as appropriate.

4. Close the battery compartment door and hand-tighten the thumbscrew.
5. To turn off the alarm, insert the yellow WEAPON key in the Torso Harness key receptacle (refer to Figure 3-2) and turn it clockwise.

6. The MWLD system now needs to be reset as follows:

Remove the yellow WEAPON key from the Torso Harness key receptacle. Appropriate KILL alarm will sound. Have the Controller insert and turn the green key to silence the alarm and then remove the green key. The system is ready.

3.6.3 Testing the MWLD System By A Controller

Prior to operating the MWLD system, three items must be tested by the Controller. These items are the:

- Torso Harness
- Helmet Harness
- Total MWLD system

WARNING

Avoid viewing the laser emitter directly along the optical axis of the radiated beam.

3.6.3.1 Testing the Torso Harness

1. The Controller must test the Torso Harness with the Controller Gun set in the NEAR MISS mode.
2. As the Controller fires at each detector, the alarm should sound briefly with a pulsating tone, indicating a NEAR MISS.

NOTE

If no alarm sounds try (1) reinstalling the battery and testing again, or (2) replace the battery and test again. If there is still no alarm, replace the Torso Harness.

3.6.3.2 Testing the Helmet Harness

NOTE

The Helmet Harness and Torso Harness must be worn to be tested.

1. The Controller must test the Helmet Harness with the Controller Gun set in the NEAR MISS mode.
2. As the Controller fires at each detector, the alarm should sound briefly with a pulsating tone, indicating a NEAR MISS.

NOTE

If no alarm sounds (1) ensure that the bottom of the harness overhangs the entire rim of the helmet and test again, (2) remove and reinstall the battery and test again, or (3) replace the battery in the Helmet Harness and test again.

If the alarm still does not sound, ask a soldier whose total MWLD assembly has already been checked and is operating properly to put on your helmet and test again. If the alarm does not sound, replace the Helmet Harness, however if the alarm sounds, replace the original Torso Harness. Tag defective items as appropriate.

3.6.3.3 Testing the Total MWLD System

1. The Controller must test the MWLD system with the Controller Gun set in the MAN KILL mode.
2. As the Controller fires at any one detector, the alarm should sound.
3. When the continuous tone sounds, the system may be reset as follows:
4. Have the Controller insert and turn the green key to silence the alarm and then remove the green key. The system is now reset.

3.6.4 Modes of Operation

Providing that all the equipment is installed as previously described in this manual and all precautionary measures have been followed, the Infantry System is now ready to be used.

The soldier who is hit by a laser beam falls under one of two states; he has either been KILLED or NEAR MISSED.

3.6.4.1 KILLED

When a soldier is KILLED by a laser beam, the alarm on the Torso Harness will sound continuously to indicate the KILLED state. The following actions are then necessary:

1. The KILLED soldier's yellow WEAPON key must be removed from the SAT located on the rifle and inserted into the key receptacle located on the Torso Harness.

NOTE: Once the yellow key has been removed from the SAT, the SAT becomes deactivated, thus disabling the soldier's ability to continue in the exercises.

2. Once the yellow key has been inserted into the receptacle on the Torso Harness, it must be rotated clockwise. This will silence the alarm.

NOTE: If the yellow key is removed from the Torso Harness, the alarm will once again continue to sound.

3. The KILLED MWLD system must now be reset by the Controller (see Section 3.6.5).

3.6.4.2 NEAR MISS

When a NEAR MISS laser beam strikes the soldier, the alarm sounds in short, pulsating tones to indicate the NEAR MISS.

The soldier should take evasive action to ensure he is not KILLED.

3.6.5 Resetting the MWLD System

The MWLD system may be reset after being KILLED as follows:

1. Remove the yellow WEAPON key from the Torso Harness key receptacle and insert the Controller's green key.
2. Turn the green key to silence the alarm and then remove the green key.
3. The system is now ready.

3.7 HANDLING AND STORAGE

This section details the procedures used in the handling and storage of the MWLD.

Prior to placing the equipment in storage perform the following tasks:

1. Ensure all the equipment is clean and free from oil, dirt, or residue.
2. Inspect the equipment to ensure there are no defects or missing parts which would hinder normal operation.
3. If the equipment is wet, dry it.
4. If the equipment has failed or is in need of servicing, report this to the proper personnel.
5. Remove the Helmet and Torso Harness batteries to prevent leakage and corrosion.
6. Pack the equipment so that there is no likelihood of it being damaged.

3-13/(3-14 blank)

CHAPTER 4

SMALL ARMS ALIGNMENT FIXTURE

4.1 INTRODUCTION

This chapter describes the inspection, cleaning, operation, handling, and storage of the Small Arms Alignment Fixture (SAAF).

4.2 EQUIPMENT DESCRIPTION

The SAAF is used to align the SAT to the weapon sights of the M16A1, M16A2, and M249 SAW.

Two models of the SAAF are available:

- SAAF P/N 11835282
- SAAF P/N 9353020

The differences of operation or use are identified according to the Part Number.

Refer to Figure 4-1 for an illustrated view of SAAF P/N 11835282 which consists of the following components, controls, and indicators.

POWER ON	used to turn power ON.
POWER OFF	used to turn power OFF.
M16/M60 SWITCH	used to select the weapon type.
BATTERY CHECK	used to verify battery voltage.
VOLTAGE METER	indicates battery voltage.
DIGITAL DISPLAY	indicates number of SAT adjustment clicks and direction that the laser beam strike point must be moved to align with the weapon sight axis.
3 BATTERY COMPARTMENTS	house three 6 volt lantern type batteries which are needed to provide power to the SAAF.
STAND	supports and stabilizes the vertical portion of the SAAF.
2 SUPPORT BRACES	lock the case in a 90 degree open position.
2 HANDLES	used to open the SAAF.

6 LOCKING LATCHES

used to secure and seal the case during transportation.

SATCHEL

contains a 25 meter cord, an instruction card, and extra storage space.

TARGET

sight alignment target

FRONT PANEL

contains diodes which detect the laser beam and the alignment reference grid.

PRESSURE RELIEF VALVES

equalize the inside/outside case pressure.

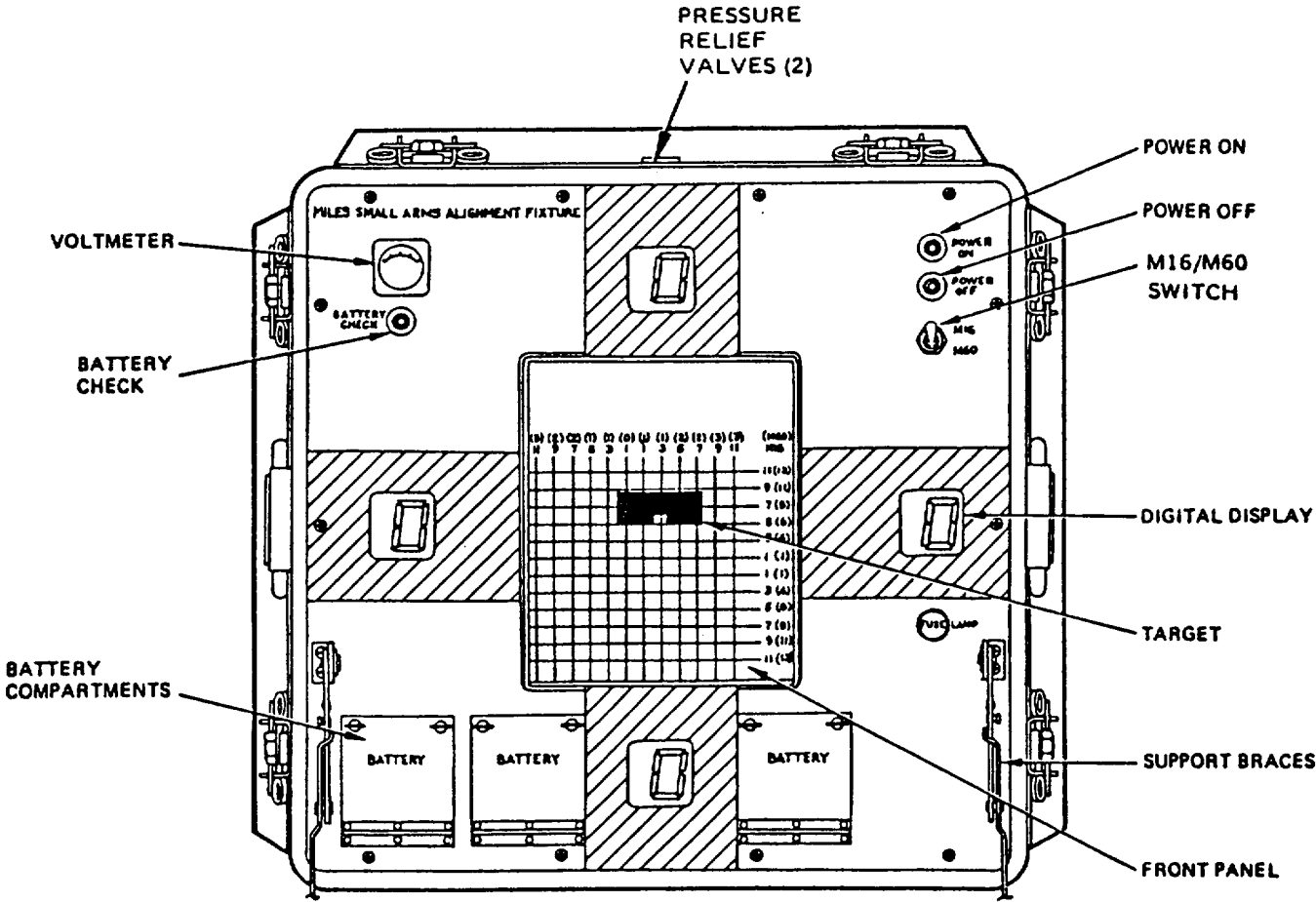


FIGURE 4-1. Small Arms Alignment Fixture Assembly (P/N 11835282)

Figure 4-2 illustrates SAAF P/N 9353020. SAAF P/N 9353020 consists of the following additional controls and indicators.

WEAPON SIGHT SELECTION

two rotary switches used to select the weapon type.

TARGET FACE

identifies the weapon sight selection switch settings and contains the sight alignment target.

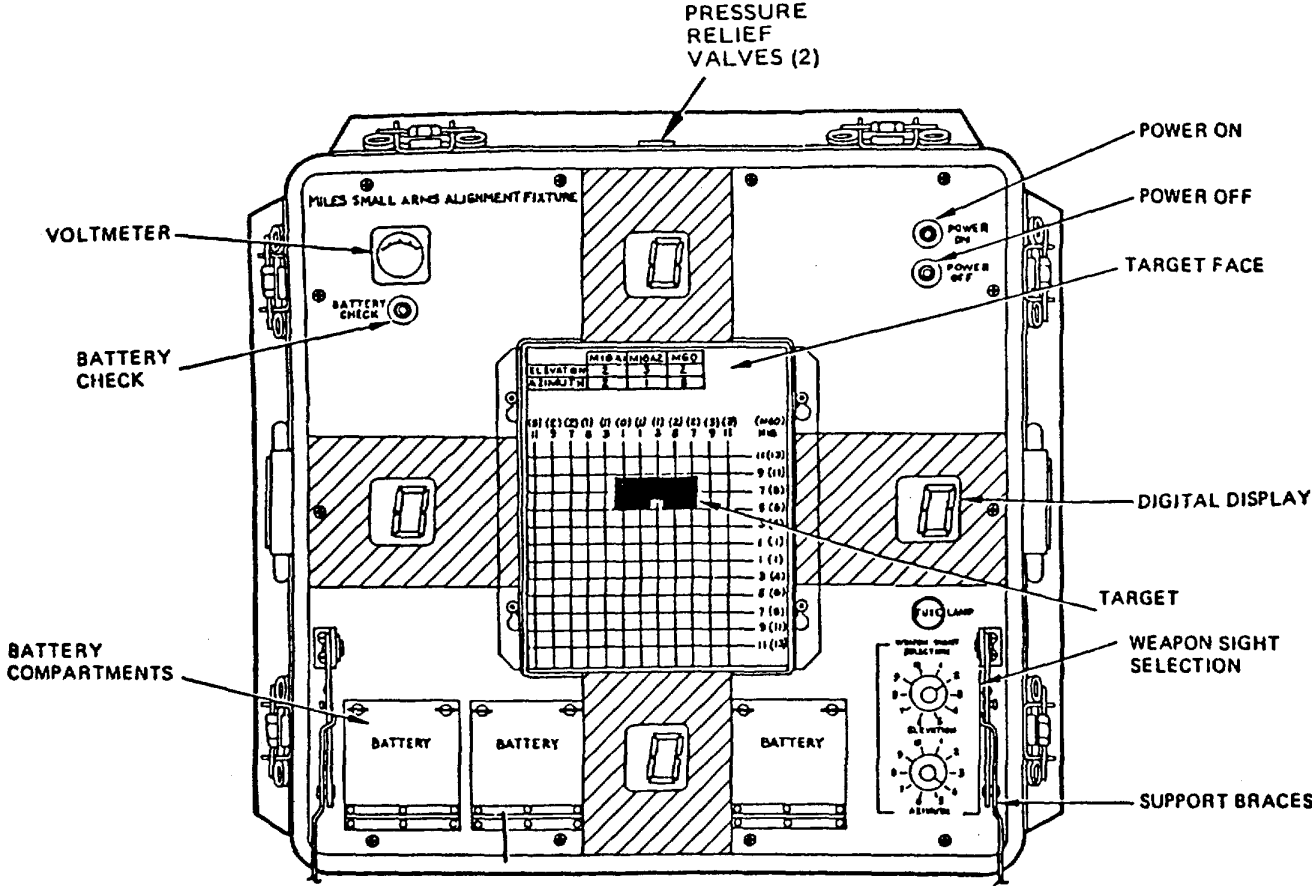


FIGURE 4-2. Small Arms Alignment Fixture Assembly (P/N 9353020)

4.3 LIMITATIONS OF EQUIPMENT

The following information pertains to both SAAFs:

1. To save battery power and prevent inadvertent battery discharge, power to the SAAF is automatically disconnected approximately 24 minutes after the last laser round is received. If no laser round has been received, power to the SAAF is disconnected 24 minutes after the unit has been turned on. Power may be restored to the SAAF by pressing the ON pushbutton.
2. The SAAF uses BA200/U type batteries.
3. When the weapons are fired from a distance of 25 meters, the SAAF displays will show misalignment of the SATs sights to within +1 'click' of the weapon's sights.

4.4 INSPECTION AND CLEANING

The following chart contains cleaning information for the SAAFs.

ITEM	PROCEDURE
DISPLAY	Clean the display by removing any dirt or oil with a clean, soft cloth. Water may be used on the cloth to remove stubborn dirt.
METAL SURFACES	Clean all exposed metal surfaces with a lint-free cloth. If necessary, dampen the cloth with water. Allow these surfaces to dry thoroughly before storing.

Inspect the SAAF using the following procedures:

1. If there is any dirt or oil on the SAAF, remove it.
2. Ensure that the switches and controls function properly.
3. Inspect the battery compartments for damage or corrosion and ensure that there are no missing parts.
4. Ensure that all lettering and identification plates are legible.
5. Inspect the remainder of the unit for any damage that would prevent normal operation.

4.5 OPERATION

4.5.1 Initial Set-up Conditions

Before operating the SAAF, perform the following procedures:

1. Press both the relief valves to equalize the inside/outside case pressure.
2. Release the six latches and open the case.
3. Lock the two support braces into place.
4. Verify that the case is placed level and that there is no damage which would make the SAAF non-functional.
5. Ensure that the target area is positioned to minimize glare from sunlight.
6. Using the 25-meter line, measure that distance to the firing point.
- 7a. If using SAAF PIN 11835282 (refer to Figure 4-1):
 - set the M16/M60 switch to the M16 position for all SAT weapons: M16A1, M16A2, or SAW
- 7b. If using SAAF P/N 9353020 (refer to Figure 4-2):
 - set the WEAPON SIGHT SELECTION switches according to the elevation and azimuth information provided on the face plate for the M16A1 for all SAT weapons
 - set the top switch (elevation) to 2
 - set the bottom switch (azimuth) to 2
8. Install three BA200/U type batteries.
9. Test the total voltage by pressing the BATTERY CHECK pushbutton while reading the voltage which registers on the built-in voltmeter. Acceptable voltage range is 13 to 18 volts.

NOTE

If the voltage is not in the acceptable range, replace the batteries and then retest for the voltage range.

NOTE

The SAAF automatically updates with each round fired.

4.5.2 Operating SAAF P/N 11835282

To operate the SAAF:

1. Press the POWER ON pushbutton to the ON position.

NOTE

Each of the four displays will show the number 18. This number indicates that the displays and the electronic circuits are operating properly. The numbers will remain displayed until they receive the first laser round or until the power is turned off.

If the numbers 18 do not appear, the SAAF requires maintenance.

2. Using a functional SAT, fire a laser beam at the SAAF sight alignment target (refer to Figure 4-3).

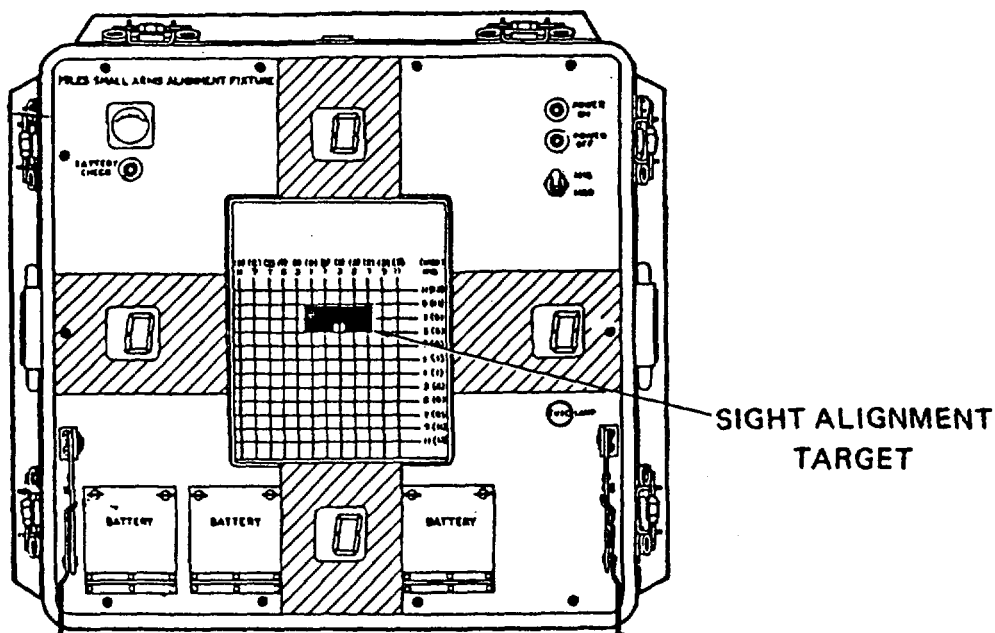


FIGURE 4-3. SAAF

3. Upon being hit by the laser beam, the displays blank out for approximately one half second and then indicate the appropriate aim correction data.

4.5.3 Operating SAAF P/N 9353020

To operate the SAAF:

1. Press the POWER ON pushbutton to the ON position.

NOTE

Each of the four displays will show the number 18. This number indicates that the displays and the electronic circuits are operating properly. The numbers will remain displayed until they receive the first laser round or until the power is turned off.

If the numbers 18 do not appear, the SAAF requires maintenance.

2. Using a functional SAT, fire a laser beam at the SAAF sight alignment target.
3. Upon being hit by the laser beam, the displays blank out for approximately one half second and then indicate the appropriate aim correction data.

4.6 HANDLING AND STORAGE

When the SAAF is not being used:

1. Press the POWER OFF pushbutton to the OFF position.
2. Return the 25-meter line, instruction card, and trigger cables (if any) to the satchel.
3. Remove the batteries to prevent leakage and corrosion.
4. Release the support braces.
5. Close the case and secure the six latches.

CAUTION

Do not store or transport the SAAF with batteries in it.

APPENDIX A

REFERENCES

A-1. SCOPE

This appendix lists all forms, field manuals, and technical manuals referenced in this manual.

A-2. FORMS

SF 368	Quality Deficiency Report
DA Form 2028-2	Recommended Changes to Equipment Technical Publications
DA Form 2062	Hand Receipt
DA Form 2402	Exchange Tag
DA Form 2404	Equipment Inspection and Maintenance Work Sheet

A-3. FIELD MANUALS

FM 21-11	Field Manual: First Aid for Soldiers
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A-4. TECHNICAL MANUALS

TM 9-1005-201-10	Operator's Manual: M249 SAW Machine Gun
TM 9-1005-249-10	Operator's Manual: M16/M16A1 Rifle
TM 9-1005-319-10	Operator's Manual: M16A2 Rifle

A-5. MISCELLANEOUS PUBLICATIONS

AR 310-2	Identification and Distribution of DA Publications
SB 11-6	Dry Battery Supply Data
DA PAM 738-750	The Army Maintenance Management System (TAMMS)

A-1/(A-2 blank)

APPENDIX B

COMPONENTS OF END ITEM AND BASIC ISSUE ITEMS LIST

SECTION I. INTRODUCTION

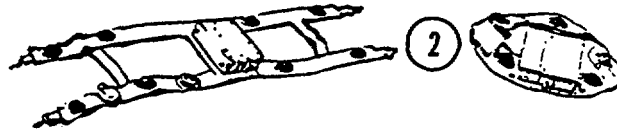
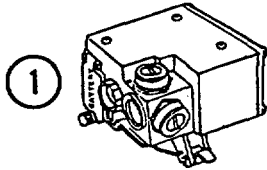
This appendix lists integral components of the M16A1/M16A2 and M249 MILES system. All of these items must be returned to your NCOIC following a training exercise.

Explanation of Columns:

National Stock Number:	Stock requisition number.
Description:	Lines 1 and 2 give a brief item description. Line 3 lists the Federal Supply Code for Manufacturer (FSCM) and the reference number.
U/M:	Unit of Measure.
Qty:	Quantity of item furnished.
Illustration Number:	Number of illustration that shows item.

SECTION II. COMPONENTS OF END ITEM

National Stock Number	Description FSCM & Part Number	U/M	Qty	Illustration Number
1265-01-236-6725	Small Arms Transmitter Assembly for M16A1/M16A2 (19200), 9359249	ea.	1	1
1265-01-236-6724	Small Arms Transmitter Assembly for M249 SAW (19200), 9359144	ea.	1	1
1265-01-075-4893	Man-Worn Laser Detector Assembly (19200), 11748808	ea.	1	2



SECTION III. BASIC ISSUE ITEMS

1 ea.	TM 9-1265-211-10	Operator's Manual f/ Simulator System, Firing, Laser: M89 f/ M16A1/M16A2 Rifle and f/ Simulator System, Firing, Laser: M90 f/ M249 Squad Automatic Weapon (SAW)
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B-1/(B-2 blank)

APPENDIX C

ADDITIONAL AUTHORIZATION LIST

This appendix lists additional items you will need to operate the M16A1/M16A2 and M249 MILES systems.

Explanation of Columns:

National stock numbers, description, unit of measure, and quantities are provided to help you identify and request the additional items you will need to operate the M16A1/M16A2 and M249 MILES systems.

National Stock Number	Description FSCM & Part Number	U/M	Qty	Illustration
6135-01-063-1978	*Battery, 9 volt (80058), BA-3090/U	ea.	3	Task 2.5.1

* Dry battery listed is used with the equipment. It will not be preshipped automatically but is to be requisitioned in quantities necessary for the particular organization in accordance with SB 11-6.

C-1/(C-2 blank)

APPENDIX D

EXPENDABLE SUPPLIES AND MATERIALS LIST

This appendix lists the expendable supplies and materials which you will need to operate and maintain the M16A1/M16A2 and M249 MILES systems.

Explanation of Columns:

National stock numbers, descriptions and unit of measure are provided to help you identify and request the expendable supplies and materials used with the M16A1/M16A2 and M249 MILES systems.

National Stock Number	Description FSCM & Part Number	U/M
6640-00-240-5851	Paper, Lens (81349), NNN-P-40	pk.
7920-00-205-1711	Rag, Wiping, Cot DDD-R-30, CL 12, GR B	ea.

D-1/(D-2 blank)

By Order of the Secretary of the Army:

CARL E. VUONO
General, United States Army
Chief of Staff

Official:

WILLIAM J. MEEHAN II
Brigadier General, United States Army
The Adjutant General

DISTRIBUTION:

To be distributed in accordance with DA Form 12-40, Operator maintenance requirements for Miles Simulator System, Firing, Laser, M60 (for M16A1 Rifle).

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS



THEN... JOT DOWN THE DOPE ABOUT IT ON THIS FORM, CAREFULLY TEAR IT OUT, FOLD IT AND DROP IT IN THE MAIL!

SOMETHING WRONG WITH THIS PUBLICATION?

FROM: (PRINT YOUR UNIT'S COMPLETE ADDRESS)

DATE SENT

PUBLICATION NUMBER

PUBLICATION DATE

PUBLICATION TITLE

BE EXACT... PIN-POINT WHERE IT IS

PAGE NO.	PARA-GRAPH	FIGURE NO.	TABLE NO.
----------	------------	------------	-----------

IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:

TEAR ALONG PERFORATED LINE

PRINTED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER

SIGN HERE:

DA FORM 2028-2 JUL 79

PREVIOUS EDITIONS ARE OBSOLETE.

P.S.—IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR RECOMMENDATION MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS.

THE METRIC SYSTEM AND EQUIVALENTS

LINEAR MEASURE

1 Centimeter = 10 Millimeters = 0.01 Meters = 0.3937 Inches
 1 Meter = 100 Centimeters = 1000 Millimeters = 39.37 Inches
 1 kilometer = 1000 Meters = 0.621 Miles

WEIGHTS

1 Gram = 0.001 Kilograms = 1000 Milligrams = 0.035 Ounces
 1 Kilogram = 1000 Grams = 2.2 Lb.
 1 Metric Ton = 1000 Kilograms = 1 Megagram = 1.1 Short Tons

LIQUID MEASURE

1 Milliliter = 0.001 Liters = 0.0338 Fluid Ounces
 1 Liter = 1000 Milliliters 33.82 Fluid Ounces

SQUARE MEASURE

1 Sq. Centimeter = 100 Sq. Millimeters = 0.155 Sq. Inches
 1 Sq. Meter = 10,000 Sq. Centimeters = 10.76 Sq. Feet
 1 Sq. Kilometer = 1,000,000 Sq. Meters = 0.386 Sq. Miles

CUBIC MEASURE

1 Cu. Centimeter = 1000 Cu. Millimeters = 0.06 Cu. Inches
 1 Cu. Meter = 1,000,000 Cu. Centimeters = 35.31 Cu. Feet

TEMPERATURE

$5/9 (^{\circ}\text{F} - 32) = ^{\circ}\text{C}$
 212° Fahrenheit is equivalent to 100° Celsius
 90° Fahrenheit is equivalent to 32.2° Celsius
 32° Fahrenheit is equivalent to 0° Celsius
 $9/5 (^{\circ}\text{C} + 32) = ^{\circ}\text{F}$

APPROXIMATE CONVERSION FACTORS

TO CHANGE

Inches
 Feet.....
 Yards
 Miles
 Square Inches.....
 Square Feet.....
 Square Yards.....
 Square Miles.....
 Acres.....
 Cubic Feet.....
 Cubic Yards.....
 Fluid Ounces.....
 Pints.....
 Quarts.....
 Gallons.....
 Ounces.....
 Pounds.....
 Short Tons.....
 Pound-Feet.....
 Pounds per Square Inch.....
 Miles per Gallon.....
 Miles per Hour.....

TO

Centimeters.....
 Meters.....
 Meters.....
 Kilometers.....
 Square Centimeters.....
 Square Meters.....
 Square Meters.....
 Square Kilometers.....
 Square Hectometers.....
 Cubic Meters.....
 Cubic Meters.....
 Milliliters.....
 Liters.....
 Liters.....
 Liters.....
 Grams.....
 Kilograms.....
 Metric Tons.....
 Newton-Meters.....
 Kilopascals.....
 Kilometers per Liter.....
 Kilometers per Hour.....

MULTIPLY BY

2.540
 0.305
 0.914
 1.609
 6.451
 0.093
 0.836
 2.590
 0.405
 0.028
 0.765
 29.573
 0.473
 0.946
 3.785
 28.349
 0.454
 0.907
 1.356
 6.895
 0.425
 1.609

TO CHANGE

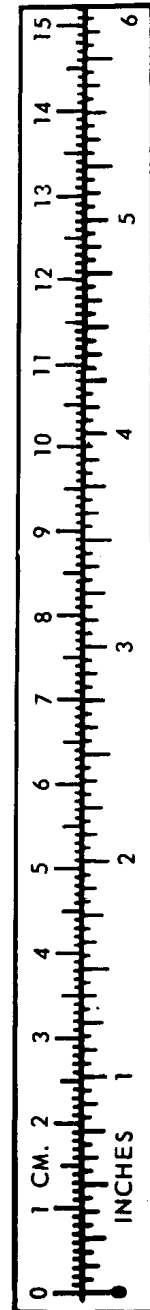
Centimeters.....
 Meters.....
 Meters.....
 Kilometers.....
 Square Centimeters.....
 Square Meters.....
 Square Meters.....
 Square Kilometers.....
 Square Hectometers.....
 Cubic Meters.....
 Cubic Meters.....
 Milliliters.....
 Liters.....
 Liters.....
 Liters.....
 Grams.....
 Kilograms.....
 Metric Tons.....
 Newton-Meters.....
 Kilopascals.....
 Kilometers per Liter.....
 Kilometers per Hour.....

TO

Inches
 Feet.....
 Yards.....
 Miles.....
 Square Inches.....
 Square Feet.....
 Square Yards.....
 Square Miles.....
 Acres.....
 Cubic Feet.....
 Cubic Yards.....
 Fluid Ounces.....
 Pints.....
 Quarts.....
 Gallons.....
 Ounces.....
 Pounds.....
 Short Tons.....
 Pound-Feet.....
 Pounds per Square Inch.....
 Miles per Gallon.....
 Miles per Hour.....

MULTIPLY BY

0.394
 3.280
 1.094
 0.621
 0.155
 10.764
 1.196
 0.386
 2.471
 35.315
 1.308
 0.034
 2.113
 1.057
 0.264
 0.035
 2.205
 1.102
 0.738
 0.145
 2.354
 0.621



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