

**OPERATOR'S MANUAL**

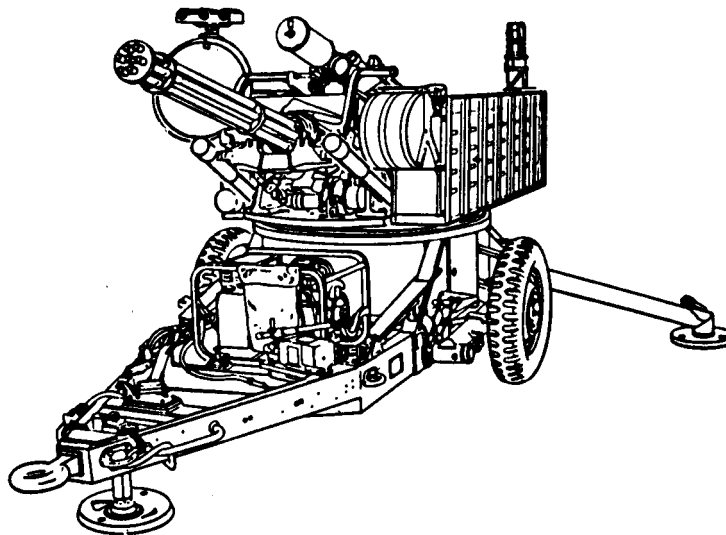
**FOR**

**MULTIPLE INTEGRATED LASER  
ENGAGEMENT SYSTEM  
(MILES)**

**SIMULATOR SYSTEM, FIRING LASER: M76  
(NSN 1265-01-159-0483)**

**FOR**

**VULCAN/PRODUCT IMPROVED VULCAN  
AIR DEFENSE SYSTEM, TOWED**

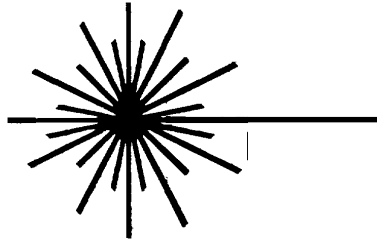


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**HEADQUARTERS, DEPARTMENT OF THE ARMY**

**AUGUST 1988**

**WARNING**

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

- NEVER look at a laser emitter at close range (less than 12 meters). Increasing the eye-to-laser distance greatly reduces the risks of overexposure.
- NEVER look at a laser emitter directly along the optical axis of the radiated beam.
- NEVER look along the axis of a laser emitter through magnifying optics at engagement ranges of less than 75 meters for STINGER, VULCAN, and TOW, and 110 meters for the CHAPARRAL.
- Avoid allowing personnel with optics of higher transmission or magnifying power the normal tank optics to view STINGER, VULCAN, or TOW within 150 meters, or the CHAPARRI within 330 meters.

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Primer is highly inflammable. Do not spray near Heat, Sparks, or Open Flame. No Smoking. Use only well-ventilated area.

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Ensure VULCAN cannon motor connector W3P3 is disconnected. Failure to disconnect connector c; cause damage to equipment and injury to personnel. Make sure it is disconnected.

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The Gunner must exercise caution when entering or leaving the Gunner's compartment to prevent possible injury to left leg/knee from the ICA mounting bolts.

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Reconnect motor connector W3P3. Ensure connector is safety laced.

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If task requires Vehicle and/or MILES Equipment Power to be turned ON, ensure Vehicle and/or MILE Equipment Power is turned OFF upon completion of task. Failure to comply may result in Personal Injury or Equipment Damage.

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Do not stand in front of radar when operating.

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For information on FIRST AID, see FM 21-11.

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**TECHNICAL MANUAL**  
**No. 9-1 265-207-10**

**HEADQUARTERS**  
**DEPARTMENT OF THE ARMY**  
 WASHINGTON, D.C., 4 AUGUST 1988

OPERATOR'S MANUAL  
 FOR  
 MULTIPLE INTEGRATED LASER ENGAGEMENT SYSTEM  
 (MILES)  
 SIMULATOR SYSTEM, FIRING, LASER: M76  
 NSN 1265-01-159-0483  
 FOR  
 VULCAN/PRODUCT IMPROVED VULCAN AIR  
 DEFENSE SYSTEM, TOWED

**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, US Army Armament, Munitions and Chemical Command, ATTN: AMSMC-MAS, Rock Island, IL 61299-6000. A reply will be furnished to you.

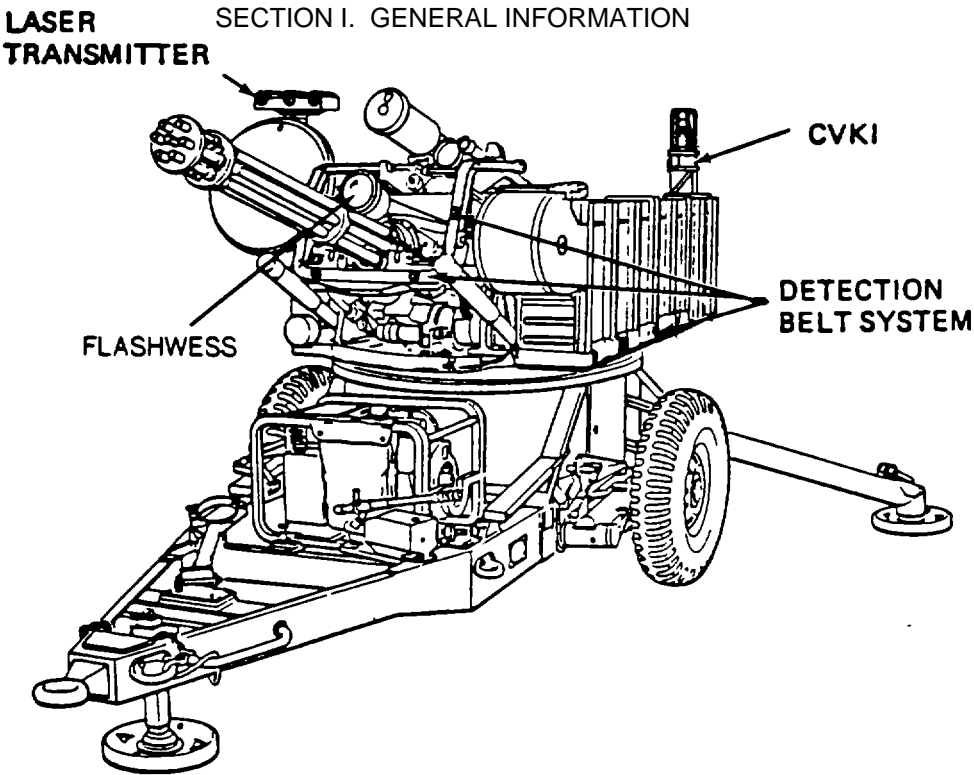
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\*Supersedes TM 9-1265-207-10 dated 22 October 1984

CHAPTER 1  
INTRODUCTION



NOTE

Unless otherwise specified in this manual, the term **VULCAN** refers to Vulcan Air Defense System (VADS) and Product Improved Vulcan Air Defense System (PIVADS), Towed

SCOPE

TYPE OF MANUAL. This manual shows you how to Inspect, install, operate, and maintain MILES AGES/AD equipment for the VULCAN, Towed, Weapon System. Step by step instructions are given In the procedures necessary to use the MILES system.

This manual covers only authorized Operator maintenance. Any maintenance problems not covered should be referred to Organizational ("O" Level) maintenance personnel.

**NOTE**

To use this manual you should be able to:

- 1 **Boresight, aim, and fire the Vulcan weapon (Ref TM 9-1005-286-10 (VADS), TM 9-1005-318-10 (PIVADS))**
- 2 **Complete DA Form 2402 and 2404.**

**If you cannot do these tasks, ask your NCOIC or Instructor to show you how. When you can do these tasks, proceed with the instructions in this manual.**

**PURPOSE OF EQUIPMENT.** MILES AGES/AD VULCAN simulator system equipment (M76) for the VULCAN, Towed, Weapon System consists of a laser transmitter and detection system. It permits realistic combat training without the hazards of using live ammunition. A weapon signature simulator (flash device) is provided to simulate light flashes from actual weapon firing.

**LIMITATIONS OF EQUIPMENT.** MILES-equipped weapons have the same range and operational capabilities as the real weapons. A dirty laser transmitter lens may reduce the effective range of a transmitter. Mission profiles for the MILES VULCAN system cover both air defense and ground targets. Ground targets may only be engaged with weapon in the MANUAL mode. The MILES VULCAN system is ineffective against all MILES-equipped aircraft, vehicles, and personnel.

**MAINTENANCE FORMS AND RECORDS.** 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 (TAMMS).

**HAND RECEIPT MANUAL..** This manual has a companion document with a TM number followed by '-HR' (which stands for Hand Receipt). The TM 9-1265-207-10-HR consists of preprinted hand receipts (DA Form 2062) that list end item related equipment (i.e., COEI, BII, and AAL) you must account for. As an aid to property accountability, additional HR manuals may be requisitioned from the following source in accordance with procedures in Chapter 3, AR 310-2.

Commander

The U.S Army Armament General Publications Center

2800 Eastern Boulevard

Baltimore, MD 21220

**REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIRs)** If your MILES equipment for the VULCAN, Towed, Weapon System needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design or performance. Put it on an SF 368 (Quality Deficiency Report). Mail the Quality Deficiency Report to us at Commander, U.S Army Armament, Munitions and Chemical Command, ATTN: AMSMC-QAD, Rock Island, IL 61299-6000. We'll send you a reply.

**REFERENCE INFORMATION**

This listing includes the Nomenclature Cross Reference List , List of Abbreviations, and explanation of terms (Glossary) used in this Technical Manual.

**Nomenclature Cross Reference List**

<u>Common Name</u>	<u>Official Nomenclature</u>
Adapter Set	Adapter Set, Simulator System, Laser: VULCAN, Towed
Battery Box	Battery Box Assembly
Control Indicator Assembly (CIA)	Console, Simulator System, Laser For M113 APC
Detector Belt	Detector Belt Assembly, Segment No. 1; Segment No. 2
Interface Control Assembly (ICA)	Adapter Assembly, Simulator System, Laser: Console, Vehicle Interface
Kill Indicator (CVKI)	Indicator, Simulator System, Laser: Combat Vehicle KILL/HIT/MISS
VULCAN, Towed, Simulator (MILES VULCAN)	Simulator System, Firing, Laser: VULCAN Towed
VULCAN (20 mm Cannon) Transmitter	Transmitter Assembly, Simulator System, Laser: SP and Towed
20 mm Cannon FLASHWESS	Adapter Assembly, Simulator, Weapon Fire

**List of Abbreviations**

AGES/AD	Air-to-Ground Engagement System/Air Defense
CIA	Control Indicator Assembly
CVKI	Combat Vehicle Kill Indicator
ICA	Interface Control Assembly
IR	Infrared Radiation
MILES	Multiple Integrated Laser Engagement System
PMCS	Preventive Maintenance Checks and Services
ROR	Range Only Radar
XMTR	Transmitter

**Glossary****Common Name****Official Nomenclature**

Combat Vehicle Kill Indicator	MILES device attached to vehicles to provide external flashing light. Indicates that vehicle is under opposing fire ("NEAR MISS"), has been "HIT" or "KILLED."
Control Indicator Assembly (CIA)	Receives detected laser pulse signals from detector belts. Decodes these signals and activates appropriate visual alarms. Displays information on attacking weaponry.
Controller	Umpire or Referee in a MILES training exercise.
Controller Gun	Device used to test MILES detector systems. Also used to disqualify soldiers or vehicles from an exercise.
Controller Key	Green key used by Controller to reset MILES transmitters and control consoles.
Fastener Tape	Hook and pile tape. Used to hold vehicle detector belts and other MILES equipment in place.
FLASHWESS	Device that simulates the flash of 20 mm cannon firing.
HIT	Simulated contact with opposing fire insufficient to disable vehicle or cause a fatality.
Interface Control Assembly (ICA)	Contains electronic circuitry to activate the laser transmitter when the weapon trigger is pressed.
KILL	Simulated contact with opposing fire sufficient to disable vehicle or cause a fatality.
Laser	Light Amplification by Stimulated Emission of Radiation.
Laser Beam	Invisible beam of light which simulates weapon fire.
Laser Detector Assembly	Device that senses laser beams directed at it.
Laser Transmitter	Device that sends laser beam.
NEAR MISS	Simulated closeness to contact with opposing fire.
Simulator	Training device which takes the place of real equipment and which has many of its characteristics.
Weapon Key	Orange key used to activates ICA. Silences vehicle intercom when inserted in CIA. Also used to "SELF-KILL" vehicle.

## SECTION II. EQUIPMENT DESCRIPTION

### EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

#### PURPOSE OF MILES SIMULATOR SYSTEM, LASER: VULCAN, TOWED

The MILES Simulator System, Laser: VULCAN, Towed, permits the gun system to take part in realistic combat training exercises. Actual firing conditions of the VULCAN weapon are simulated using laser beams. A FLASHWESS device adds to the system's realism.

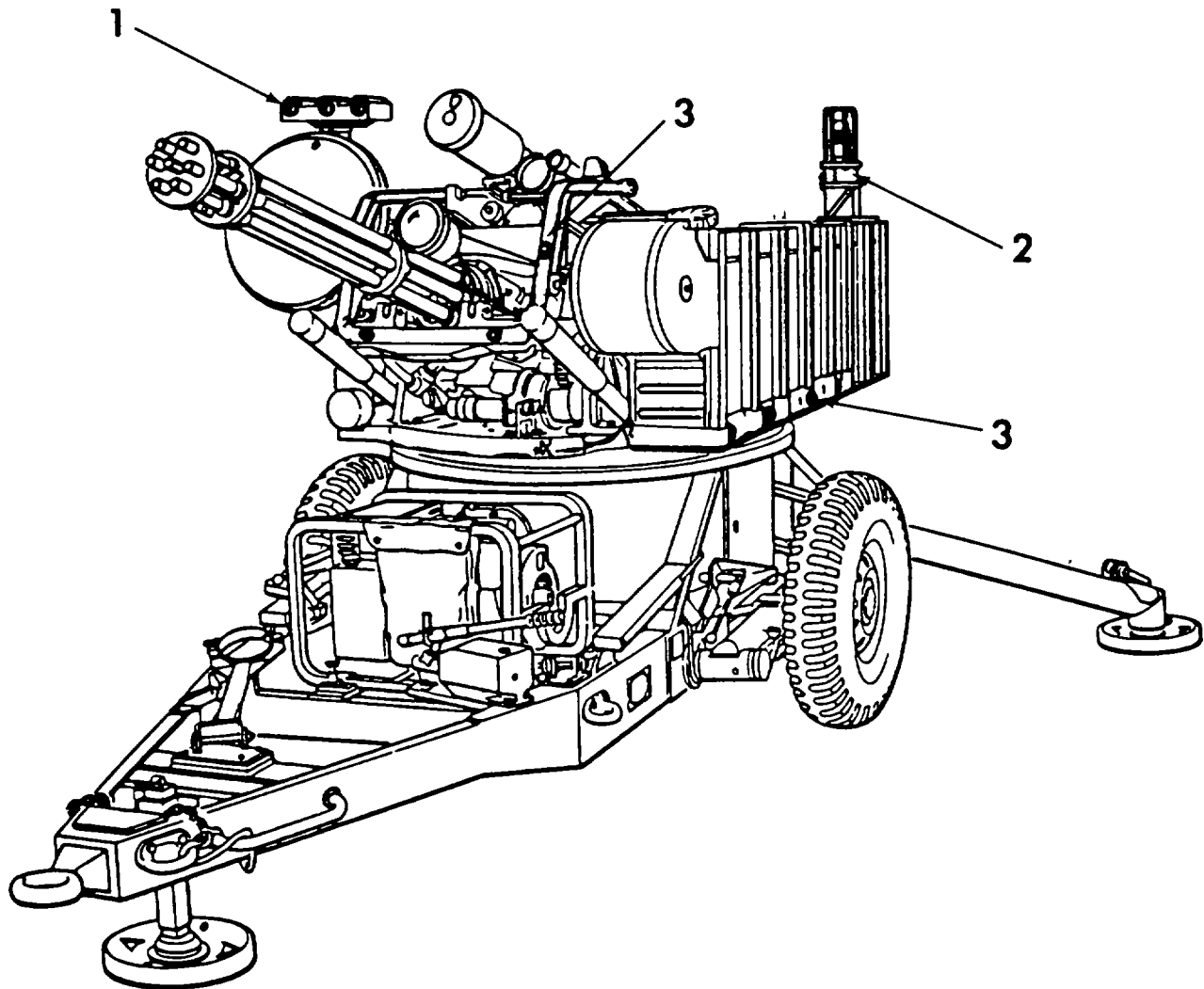
Laser detectors mounted on the VULCAN, Towed, sense enemy fire. MILES system electronics determine the accuracy and simulated damage of enemy fire. The system also detects the type of weapon directing enemy fire against the VULCAN, Towed.

#### FEATURES AND CAPABILITIES

- Easily installed and removed.
- Simulates firing capability of VULCAN 20 mm cannon.
  1. Range
  2. Firing rate
  3. Burst rate
- FLASHWESS device adds realism.
- Uses normal weapon firing procedures.
- Detects all opposing fire.
  1. Attacking weapon accuracy
    - a. "NEAR MISS"
    - b. "HIT"
    - c. "KILL"
  2. Attacking weapon identification
- Uses eye safe battery-powered laser transmitters.
- Operates in temperatures from - 350C (-31 "F) to 620C (1440F).
- Compatible with all other MILES training devices.
- High visibility CVKI strobe light signals vehicle "NEAR MISS", "HIT" or "KILL."



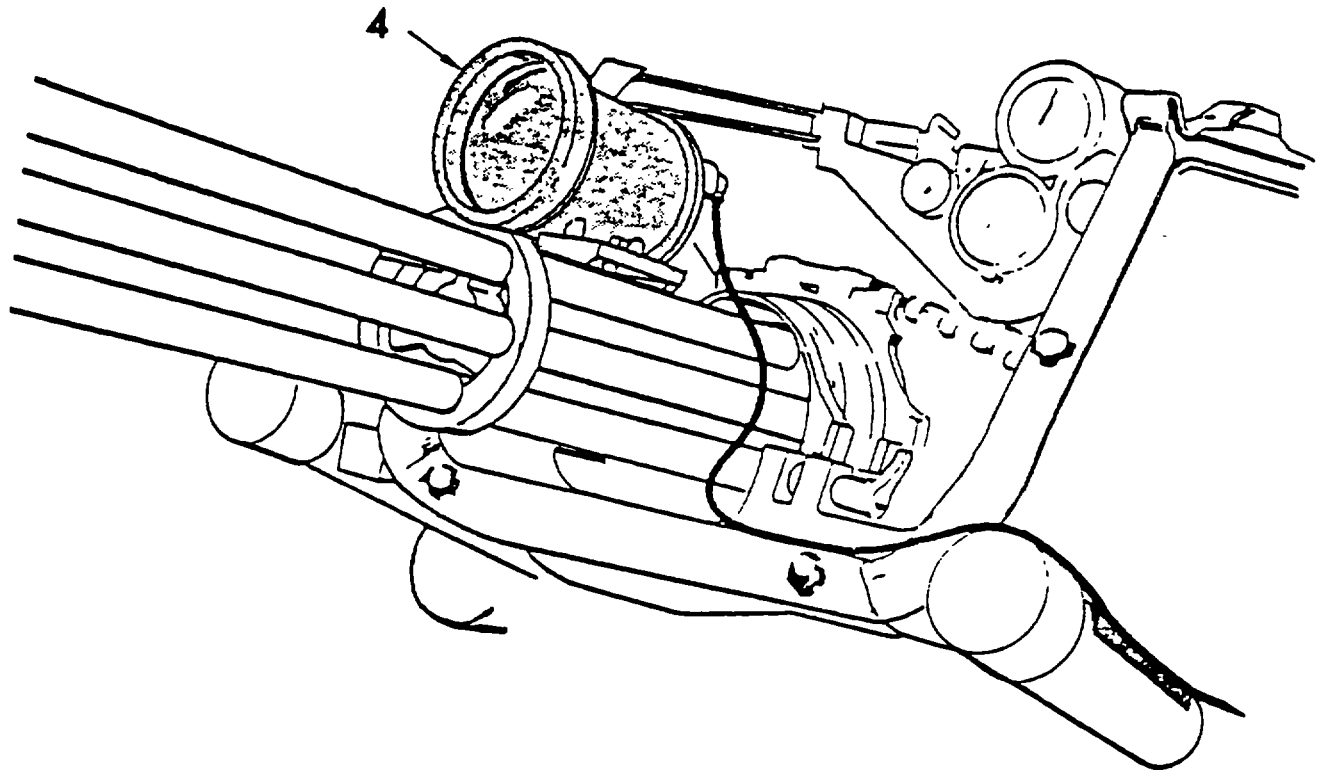
## LOCATION AND DESCRIPTION OF MAJOR COMPONENTS



**20 mm Cannon Laser Transmitter/Modulator (1).** Simulates firing effects of 20 mm cannon by transmitting a specially coded laser signal. Mounts on range only radar (ROR) antenna.

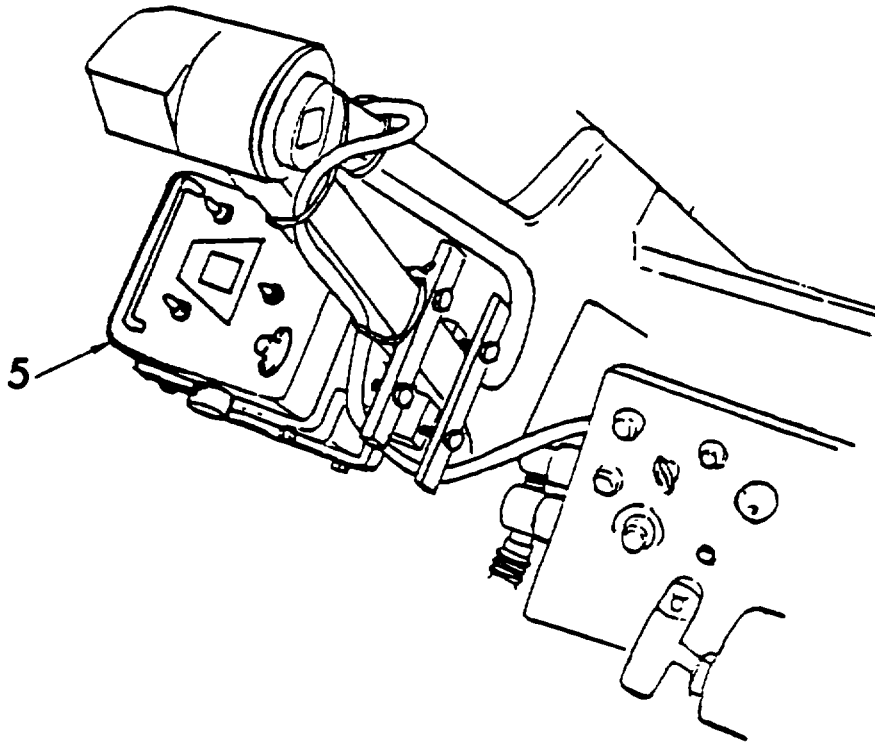
**CVKI (2).** Flashes strobe light for a "KILL", "HIT" or "NEAR MISS" indication. Mounts on top of ammunition storage container at left rear of towed vehicle.

**Detection -Belt System (3).** Receives laser pulses from MILES-equipped opposing weapons. Generates, amplifies and routes electrical signals to Control Indicator Assembly for determining whether signal was a "NEAR MISS", "HIT" or "KILL". Mounts on sides, front and rear of VULCAN, Towed.

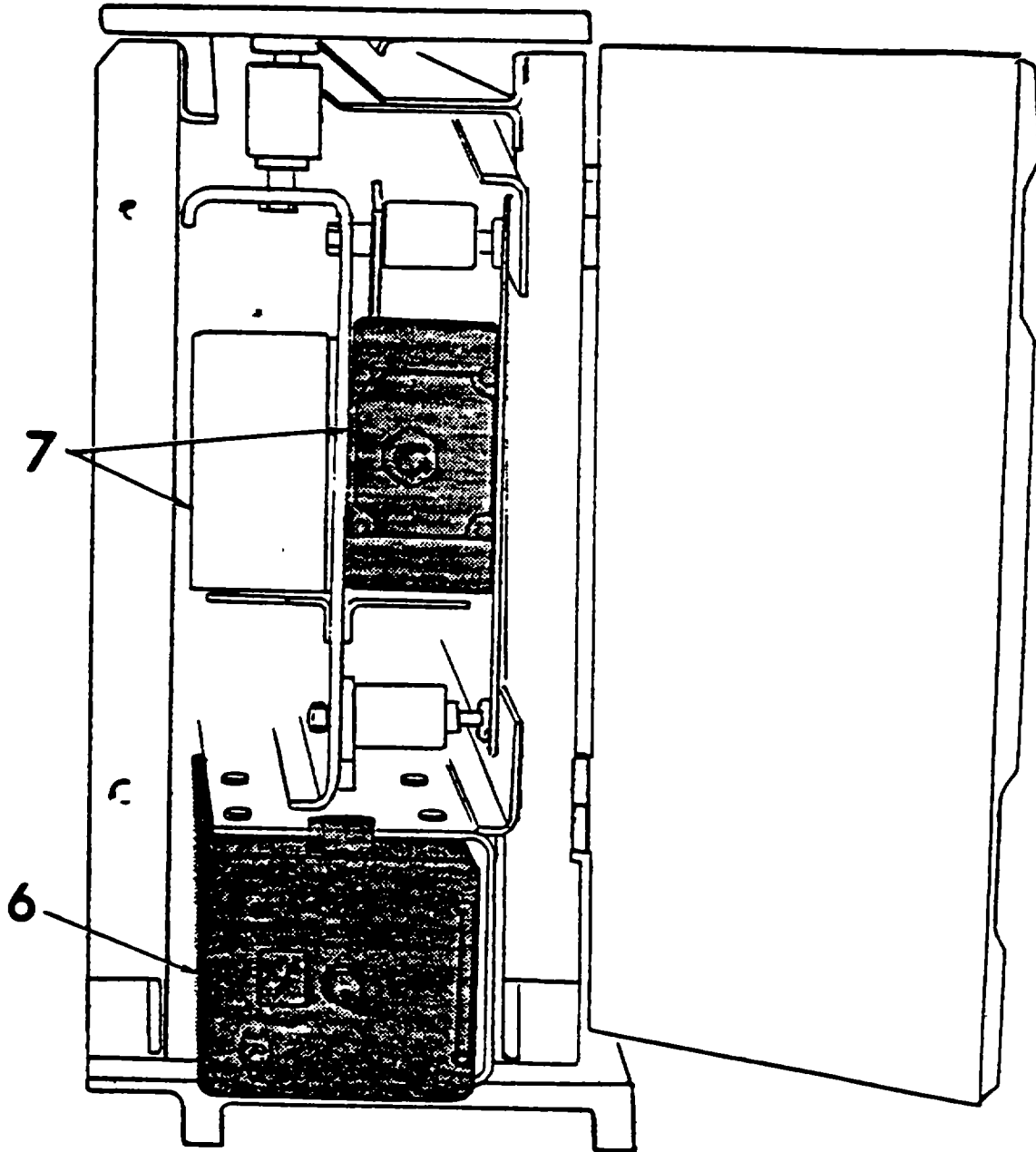


**FLASHWESS (4)**. Lamp device powered by 24 V dc vehicle power. Flashes 120 times per minute when activated by gun system. Simulates light flashes generated by firing live ammunition. Attaches to 20 mm cannon barrels

## LOCATION AND DESCRIPTION OF MAJOR COMPONENTS (Cont)



**Interface Control Assembly (ICA) (5)**. Provides interface with actual VULCAN weapon firing system, FLASHWESS and laser transmitter. ICA panel displays indicate total and ready rounds remaining and laser firing. Switches are used to select total and ready rounds remaining indication and to reload system. Mounts inside turret on left side of 20 mm cannon elevation pivot frame.



**Control Indicator Assembly (CIA) (6).** Receives detected laser pulse signals from detector belts, decodes these signals, and actuates appropriate visual alarms associated with CVKI. Has key receptacle for initializing and resetting system. A HIT/KILL identification display is also provided. Mounts inside ammunition storage container.

**Battery Box (7).** Contains two 6 V batteries for operating laser transmitter, detection system, ICA, and CIA. Mounts inside ammunition storage container.

EQUIPMENT DATA

Table 1-1. MILES VULCAN, Towed, Equipment Data

20 mm Cannon Laser Transmitter Characteristics			
Effective Standoff Range	Firing Rate (rounds/Basic Load (rounds))	Burst Rate (minute selectable)	
1500 Meters	500 Ready 1500 Stored	1000-3000	10, 30, 60, 100

Detector Assemblies	Weight (Pounds)	Dimensions (Inches)	Number of Detectors
Belt #1	1.375	167 x 2	6
Belt #2	1.5	91 x 2	4

Equipment	Weight (Pounds)	Dimensions (Inches)
CVKI (without adapter)	11.62	14 x 7.3 (diameter)
CIA (without adapter)	7.82	10.5 x 5.5 x 5.8
Battery Box Assembly	1.31	7 x 5 x 4
Laser Transmitter	2.0	3.5 x 4 x 7.5
Modulator	4.5	3 x 4 x 12-1/2
ICA	8.0	5 x 5-1/2 x 8-1/2
FLASHWESS	8.5	6 x 5-1/8 (diameter)

### SECTION III. TECHNICAL PRINCIPLES OF OPERATION

#### BASIC PRINCIPLES OF OPERATION

The MILES system uses semiconductor laser beams to simulate actual weapon fire. An eye-safe invisible laser beam is sent out by each weapon's transmitter when it is fired. The laser beam is coded and simulates all of the weapon's capabilities including range, accuracy and destructive capability.

Laser detection systems are used to sense opposing fire. The detection systems detect opposing laser beams and determine whether they have scored a "NEAR MISS", "HIT" or "KILL". The systems activate alarms indicating the presence and damage of opposing fire.

The MILES system of laser beam transmitters and detectors allow safe realistic training exercises with a complete range of weaponry and vehicles.

#### MILES VULCAN CONFIGURATION

The VULCAN 20 mm cannon is equipped with a laser transmitter that is fired using normal weapon operating procedures. Special detector belts that sense opposing laser fire are attached to the gun carriage exterior. A Control Indicator Assembly (CIA) mounted inside the ammunition storage unit determines the extent of opposing fire and its effect. A flashing light (CVKI) mounted atop the ammunition storage unit is activated by the Control Indicator Assembly when opposing fire is detected.

#### MILES-EQUIPPED GUN FIRING

The 20 mm MILES-equipped VULCAN cannon is fired using normal weapon procedures. A FLASHWESS device is used to add realism to gun firing. When the gun trigger is operated, this device and a laser transmitter mounted on the Range Only Radar (ROR) fire together.

The 20 mm cannon may be fired in either MANUAL mode or RADAR mode. Three separate laser tubes are located inside the MILES laser transmitter. When the cannon is locked on a target all three laser tubes will fire in the RADAR mode. The RADAR mode is used for airborne targets. Only the center tube fires in the MANUAL mode. The MANUAL mode is used for either ground targets or aerial targets. The GROUND mode is not used with the MILES system.

The MILES system allows a basic load of 2000 laser rounds for the 20 mm cannon. 500 laser rounds may be kept in the READY mode with the remaining rounds (1500 maximum) kept in a STORED mode.

After firing, you can check to see how many rounds the MILES system has left. This is done by turning a switch on the Interface Control Assembly (ICA) to either READY or TOTAL. The displayed number multiplied by 100 equals the laser rounds remaining.

The MILES-equipped cannon may be reloaded by pushing the PRESS TO RELOAD button on the ICA.. Each time the button is pressed 100 rounds are transferred from the stored mode to the ready mode. There is a thirty second delay for each reload of 100 rounds. The laser transmitter cannot be fired during reloading.

### **WEAPON SIGNATURE SIMULATION**

The FLASHWESS device uses a high intensity strobe lamp to simulate the light flash of actual gun firing. The device will flash approximately 120 times per minute.

### **DRY-FIRE OPERATION**

The laser transmitters on all MILES-equipped weapons can be fired without using the FLASHWESS device. Usually, this dry-fire mode is used only to test and boresight MILES equipment. FLASHWESS device is electrically disconnected when the Controller sets the ICA to TEST mode.

### **VEHICLE DETECTION SYSTEM**

Three detector belts containing 14 detectors are mounted on the exterior of the VULCAN, Towed. Opposing fire is sensed by the detectors. They generate electrical signals which are fed to a decoder in the Control Indicator Assembly (CIA).

The decoder identifies the type of weapon that fired the opposing laser beam. It determines whether the laser shot was accurate enough to cause a "HIT" or whether a "NEAR MISS" occurred. It also determines if the weapon was capable of causing damage to the target (an M16 rifle, for example, cannot disable the VULCAN) and the probability of "KILL" for that weapon. The probability of "KILLING" a target is different for each attacking weapon.

If a detector on the VULCAN is hit by laser fire, one of three things will happen:

1. CVKI light mounted on the gun exterior will flash two times. This means a "NEAR MISS" occurred.
2. CVKI light will flash four or six times. This means a "HIT" but not a "KILL" occurred.
3. CVKI light will flash continuously. This means a "KILL" occurred.

The VULCAN crew can determine what type of weapon has fired on them by turning a switch on the MILES Control Indicator Assembly and pushing a display button. A code number will appear on the display indicating the attacking weapon following a "HIT" or "KILL." No code number appears for a "NEAR MISS."

The CVKI light continues to flash until reset by a Controller.

## CHAPTER 2 OPERATING INSTRUCTIONS

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**SCOPE.** This chapter provides those instructions needed by the VULCAN crew to inspect, install, checkout, operate, and remove MILES VULCAN, TOWED, equipment.

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

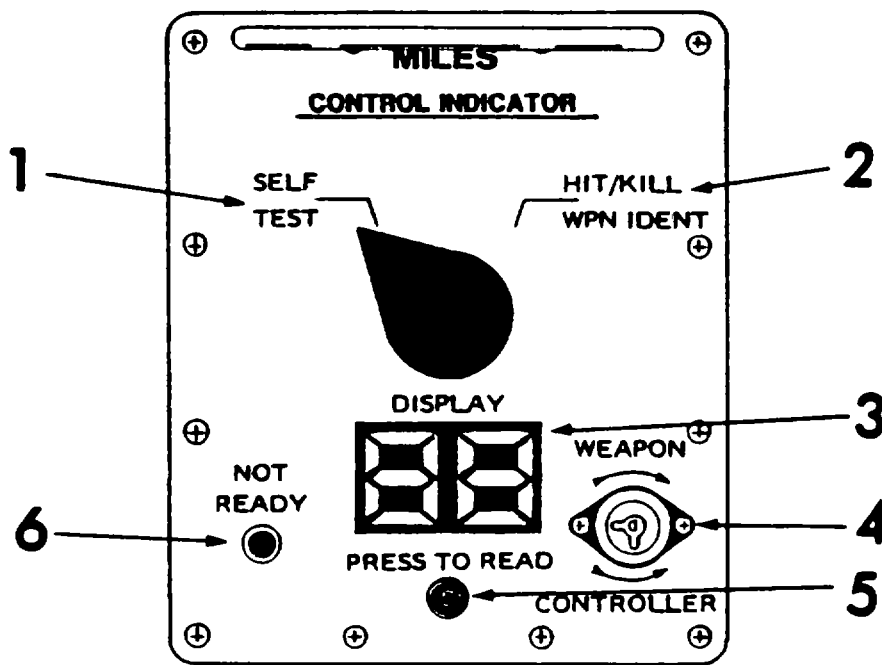
**MILES VULCAN, TOWED, CONTROLS AND INDICATORS.** The MILES VULCAN Controls and Indicators are only those associated with the Control Indicator Assembly (CIA) and Interface Control Assembly (ICA). All other Controls and Indicators, such as triggers and arming switches are those actually associated with the weapons.

**CONTROL INDICATOR ASSEMBLY (CIA) CONTROLS AND INDICATORS.** Controls and indicators for the CIA are listed in Table 2-1.



Table 2-1. Control Indicator Assembly Controls and Indicators

Key	Description	Function	Operating Position
1	SELF TEST	Performs self test	Turn to SELF TEST. Press PRESS TO READ. Display should read 88.
2	HIT/KILL WPN IDENT	Identifies weapon firing on you	Turn to HIT/KILL Press PRESS TO READ. Display will show a number if detection system has been hit or killed.
3	DISPLAY WEAPON/ CONTROLLER	Displays numbers Resets system or silence alarm	Turn orange weapon key to WEAPON to silence alarm or SELF KILL. Turn green controller key to CONT to reset.
5	PRESS TO READ	Activates display	Press to activate display
6	NOT READY	Lights when not ready or "KILLED"	



Control Indicator Assembly Controls and Indicators

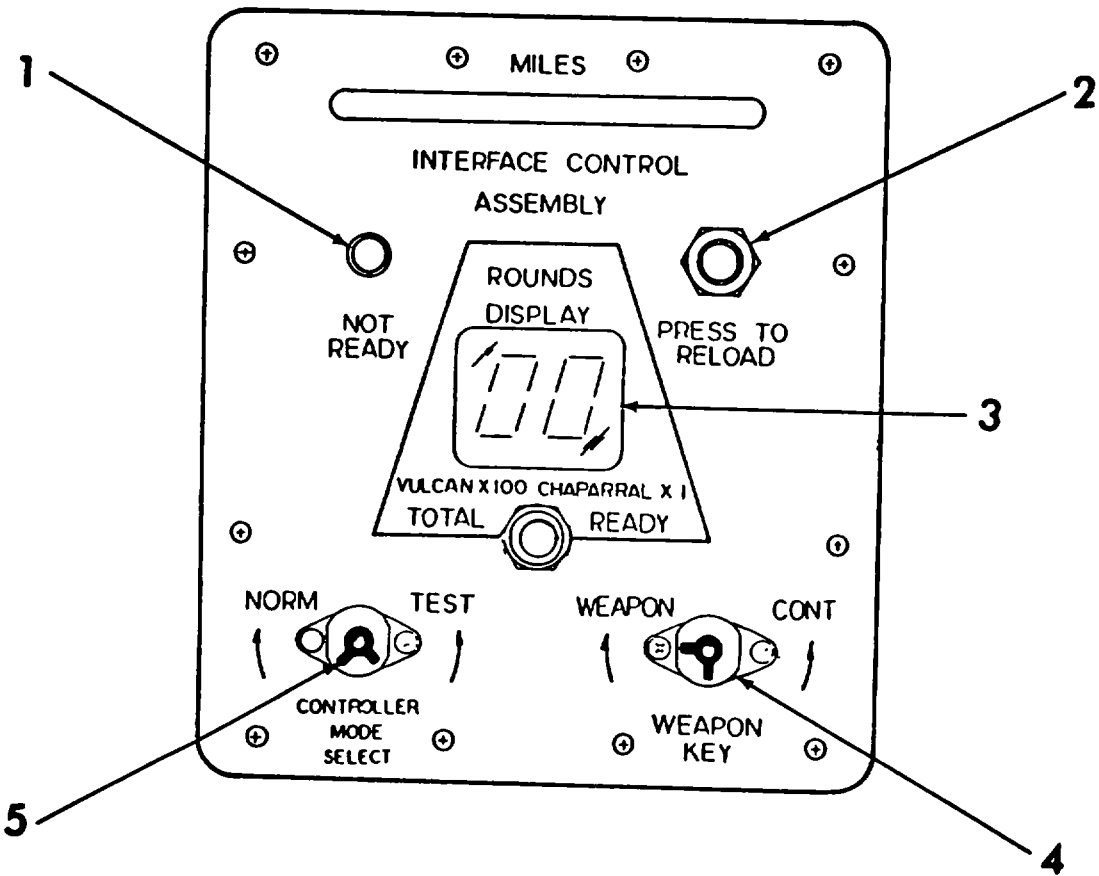
**INTERFACE CONTROL ASSEMBLY (ICA) CONTROLS AND INDICATORS.** Controls and indicators for the ICA are listed in Tables 2-2 and 2-3.

*Table 2-2. Interface Control Assembly Controls and Indicators  
(Not ready light and rounds display)*

<b>Not Ready Light Status</b>	<b>Rounds Display Switch Position</b>	<b>Display Reading</b>	<b>Indication</b>
ON	TOTAL OR READY	00	CONTROLLER KEY REQUIRED
OFF	TOTAL	1 to 20	TOTAL ROUNDS REMAINING (number multiplied times 100)
OFF	READY	1 to 5	ROUNDS READY TO FIRE (number multiplied times 100)
ON	TOTAL	0	ALL ROUNDS EXPENDED
ON	READY	0	RELOAD REQUIRED
ON	TOTAL OR READY	BLANK	RELOADING
ON	TOTAL	1 to 20	KILLED OR WEAPON KEY REQUIRED
ON	READY	1 to 5	KILLED OR WEAPON KEY REQUIRED
ON	CENTER	DECIMAL FLASHING	LASER FIRING

Table 2-3. Interface Control Assembly Controls and Indicators

Key Illustration	Description	Function	Operating Position
1	NOT READY	Lights when not ready	ON when: <ul style="list-style-type: none"> <li>• Weapon or controller key not engaged</li> <li>• Needs reset</li> <li>• During reload time</li> <li>• Ready rounds is zero</li> <li>• Total rounds is zero</li> <li>• System killed</li> </ul> OFF when: <ul style="list-style-type: none"> <li>• Ready to fire</li> </ul> (Refer to Table 2-2)
2	PRESS TO RELOAD	Reloads system	(Refer to Table 2-2)
3	ROUNDS ,DISPLAY TOTAL, READY	Displays rounds status	(Refer to Table 2-2)
4	WEAPON KEY WEAPON/CONT	Resets/turns system on	Weapon key in WEAPON position Controller key turns system on in CONT position resets system.
5	CONTROLLER MODE SELECT NORM/TEST	Selects normal or test mode	Turn controller key to NORM for normal operation. Turn to TEST to fire laser without FLASHWESS.



Interface Control Assembly Controls and Indicators

**SECTION II. PREVENTIVE MAINTENANCE CHECKS AND SERVICES**

**GENERAL.** Preventive Maintenance Checks and Services will ensure that the MILES equipment will always be ready for operation and perform satisfactory throughout its mission. Preventive maintenance checks consist of performing a systematic inspection to discover defects before they result in operational failure of the equipment. Defects or malfunctions discovered by the crew during use of the MILES equipment, or as a result of performing maintenance checks and services, will be reported using the proper forms (refer to TM 38-750). If you find any problems, turn the Item In to the Issuing facilities.

- (1) Before you operate. Always keep in mind the CAUTIONS and WARNINGS. Perform your Before (B) PMCS.
- (2) While you operate. Always keep in mind the CAUTIONS and WARNINGS. Perform your During (D) PMCS.
- (3) After you operate. Be sure to perform your After (A) PMCS.
- (4) If your equipment fails to operate. Troubleshoot with proper equipment. Ask your Controller to check your equipment. Report any deficiencies using the proper forms. See DA PAM 738-750.

Table 2-4. Operator/Crew Preventive Maintenance Checks and Services

<b>Note</b>								
<b>Within designated interval, these checks are to performed in the order listed</b>								
		<b>B - Before Operation</b>	<b>D - During Operation</b>	<b>A - After Operation</b>	<b>W - Weekly Operation</b>	<b>M - Monthly Operation</b>		
<b>ITEM NO.</b>	<b>INTERVAL</b>					<b>Item to be Inspected</b>	<b>Procedures Check for and have repaired or adjusted as necessary.</b>	<b>Equipment is Not Ready/ Available If:</b>
	<b>B</b>	<b>D</b>	<b>A</b>	<b>W</b>	<b>M</b>			
1	•					Batteries	Inspect for acid leaks	Acid is present.
2	•					Battery Box	Inspect for damaged connectors. Check that connectors and interior battery contacts are serviceable	Connectors are broken or contacts are rusted or damaged.
3	•					Cable Assemblies	Inspect for broken connectors and cut, worn, or bare wiring	Connectors are broken or wiring is cut, worn or bare.
4	•	•	•			Transmitter Assembly	Inspect for dirty or damaged lens Check connector for damage	Lens or connectors are damaged.
5	•					ICA	Inspect for cracks In display window Check that weapon key turns freely in WEAPON KEY receptacle Check that controller key turns freely in MODE SELECT receptacle. Inspect for evidence of switch damage.	Display window is cracked. Weapon key does not turn freely. Controller key does not turn freely. Switch is damaged.
6	•	•				Detector Belts Segments (3)	Look for loose or cracked detectors or damaged connectors	Detectors are loose or cracked; connectors are damaged.

Table 2-4. Operator/Crew Preventive Maintenance Checks and Services (Cont)

<p style="text-align: center;"><b>NOTE</b>                      Within designated interval, these checks are to be performed in the order listed.</p>											
		<p style="text-align: center;"><b>B - Before Operation</b></p>		<p style="text-align: center;"><b>D - During Operation</b></p>		<p style="text-align: center;"><b>A - After Operation</b></p>		<p style="text-align: center;"><b>W - Weekly Operation</b></p>		<p style="text-align: center;"><b>M - Monthly Operation</b></p>	
ITEM NO.	INTERVAL					Item to be Inspected	Procedures Check for and have repaired or adjusted as necessary.	Equipment is Not Ready/ Available If:			
	B	D	A	W	M						
7	•		•			CVKI	Inspect for cracks in plastic lens. Inspect for damaged receptacle Inspect for stripped mounting bracket threads	Lens is cracked Receptacle is damaged. CVKI cannot be securely mounted.			
8	•	•				CIA	Inspect for cracks in display window Check that weapon key turns freely in WEAPON KEY receptacle. Inspect for evidence of switch damage.	Display window is cracked. Weapon key does not turn freely. Switch is damaged.			
9	•						FLASHWESS damage to lens. Clean lens with soft dry cloth.	Inspect for cracks or Lens Is damaged.			

**SECTION III. OPERATION UNDER USUAL CONDITIONS**

**GENERAL.** Before the MILES equipment can be used, it must be properly installed on the VULCAN Weapon System, Towed gun. To speed up procedures, work has been organized into various tasks. While some crew members are performing one set of tasks, others can be performing another set.

Before you begin, READ ALL STEPS IN THE TASK AND LOOK AT EACH ILLUSTRATION CAREFULLY. To help perform a task, most steps have reference numbers to illustrations. Do each step just the way you are instructed and in the order in which it occurs in this manual.

**NOTE**

**Don't jump ahead. Don't skip any steps.**

If your MILES equipment has a problem you can't fix using this manual, report it on DA Form 2402. To get a replacement, turn in the faulty equipment and the completed form.

**TASK ASSIGNMENT.** The squad leader assigns crewmen to tasks. The crewman turns to the appropriate section in this manual and performs the required steps in order. Occasionally, the manual may tell a crewman to wait until he has made sure that another crewman has completed an earlier task. On some tasks, two crewmen may have to work together.

Certain steps must be done with the Controller present. A Controller key, carried only by the Controller, is required to reset the system. The squad leader will determine when to call the Controller.

Those tasks involving the Controller must be done in this order, after Installation.

1. Test Task 1 (CIA/CVKI Test) (See page 2-64)
2. Test Task 2 (Detector Belt Test) (See page 2-66)
3. Test Task 3 (ICA Test) (See page 2-67)
4. Test Task 4 (VULCAN Laser Transmitter Test) (See page 2-69)
5. Operational Task 3 (Recognizing Enemy Fire) (See page 2-76)
6. Operational Task 4 (Resetting after a "KILL") (See page 2-78)

The Squad Leader should coordinate the tasks, give assistance to any crewman who needs it, and check that everything gets done.

**NOTE**

**Unless otherwise indicated, references in this manual to right and left sides of VULCAN, Towed, use the seated gunner as a standard; i.e., ammunition bay is on left, firing interrupter is on right.**



## LIST OF TASKS

<u>Tasks</u>	<u>Page</u>
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Outside Installation Tasks	2-11
Cabling Tasks	2-45
<u>Initial Adjustments, Daily Checks and Self Test</u>	
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## ASSEMBLY AND PREPARATION FOR USE

**Preinstallation Task.**

Obtain all equipment needed to install and operate MILES VULCAN, Towed, system from your NCOIC.

**NOTE**

**Preparing the VULCAN, Towed, for MILES training requires two transit cases of MILES equipment. A MILES case for the M113 APC and a MILES case for the VULCAN, Towed, must both be obtained. Not all equipment in the cases will be used. See Outside Installation Task 1 for equipment to be used.**

Unpack MILES M113 APC transit case and MILES VULCAN, Towed, transit case. Verify that all equipment is present and not visibly damaged. Check VULCAN against illustrations in Appendix B, Comments of End Item. Refer to TM 9.1265-370-10-3 for MILES M113 APC.

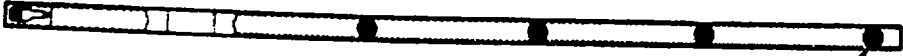
Obtain all Support Equipment (Appendix C) and Expendable/Durable Supplies and Materials (Appendix D).

## OUTSIDE INSTALLATION TASKS - LIST

<u>Task</u>	<u>Title</u>	<u>Page</u>
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3.	Install Fastener Tape	2-16
4.	Inspect Fastener Tape	2-23
5.	Inspect and Service Detector Belt Segments	2-24
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13.	Inspect VULCAN Laser Transmitter/Modulator	2-34
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14.1	Install VULCAN Laser Transmitter/Modulator (with updated boresight telescope mounting bracket)	2-36.1
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19.	Install Control Indicator Adapter Assembly	2-42
20.	Inspect Interface Control Assembly (ICA)	2-43
21.	Install Interface Control Assembly (ICA)	2-44

**Outside Installation Task 1: Obtain Equipment.** Completion of Outside Installation Tasks requires equipment listed and illustrated below. Equipment is supplied in either the MILES VULCAN, Towed, or the MILES M113 APC transit case. Locate and set aside this equipment.

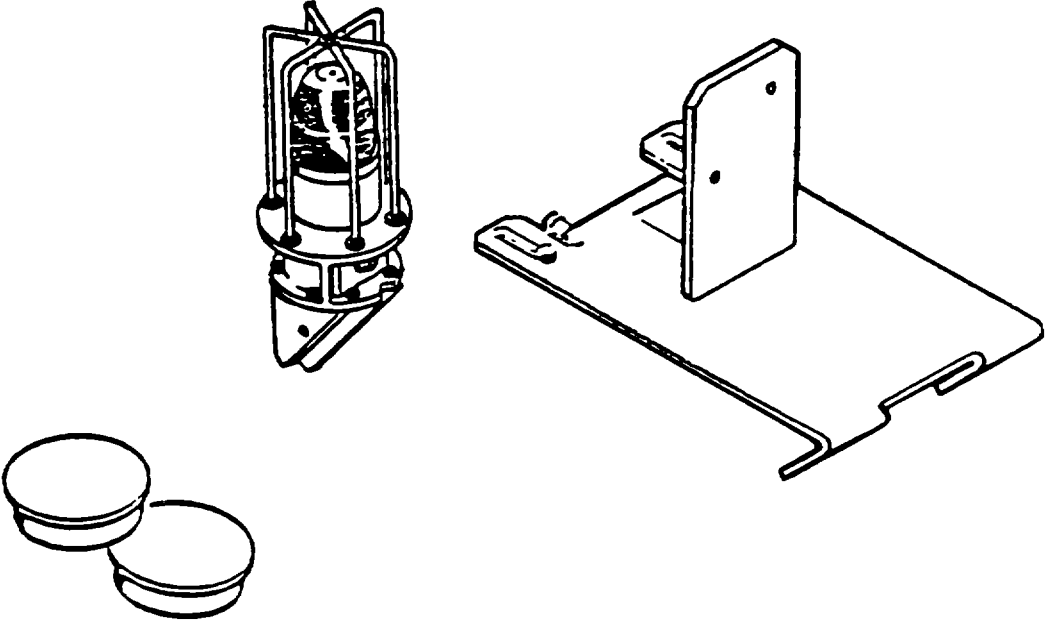
- 1 Detector Belt Assembly Segment number 1 (from MILES M113 APC transit case)



- 2 Detector Belt Assemblies Segment number 2 (from MILES M113 APC transit case)

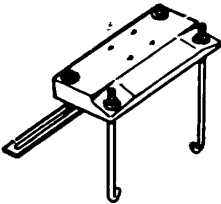


- 1 CVKI Assembly (from MILES M113 APC transit case) and CVKI Adapter Assembly

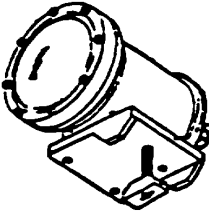


- 2 Protective Caps

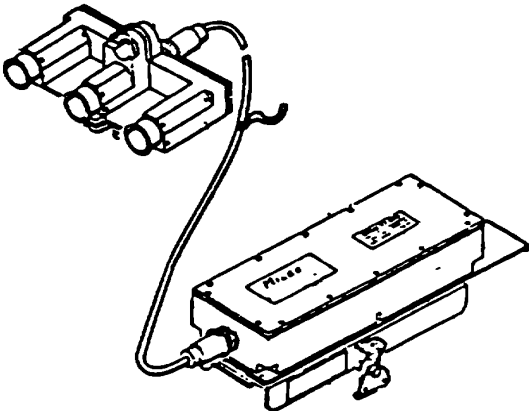
1 Transmitter Mount Assembly



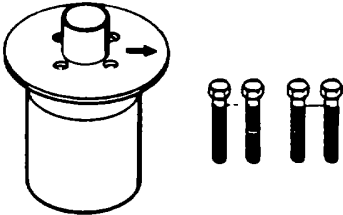
1 FLASHWESS



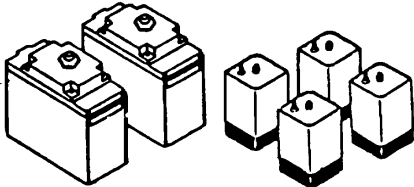
1 Laser Transmitter Assembly (includes modulator)



1 Transmitter Bottom Flange and 4 MILES screws

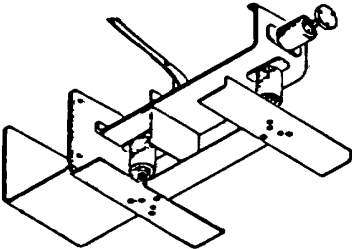


2 Battery Boxes (1 from MILES M113 APC transit case) and four 6 V batteries

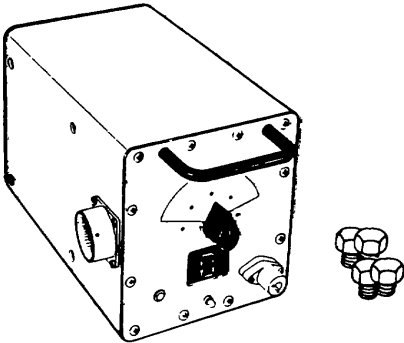


**Outside Installation Task 1: Obtain Equipment (Cont).**

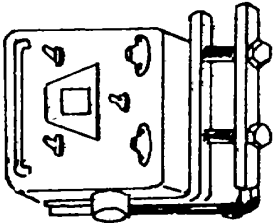
1 Control Indicator Adapter



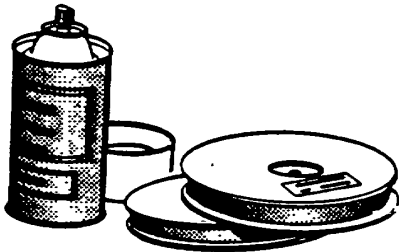
1 Control Indicator Assembly (from MYES M113 APC transit case) and 4 MILES capscrews



1 Interface Control Assembly



1 Installation Kit (1 can Primer and 1 roll of Fastener Tape)

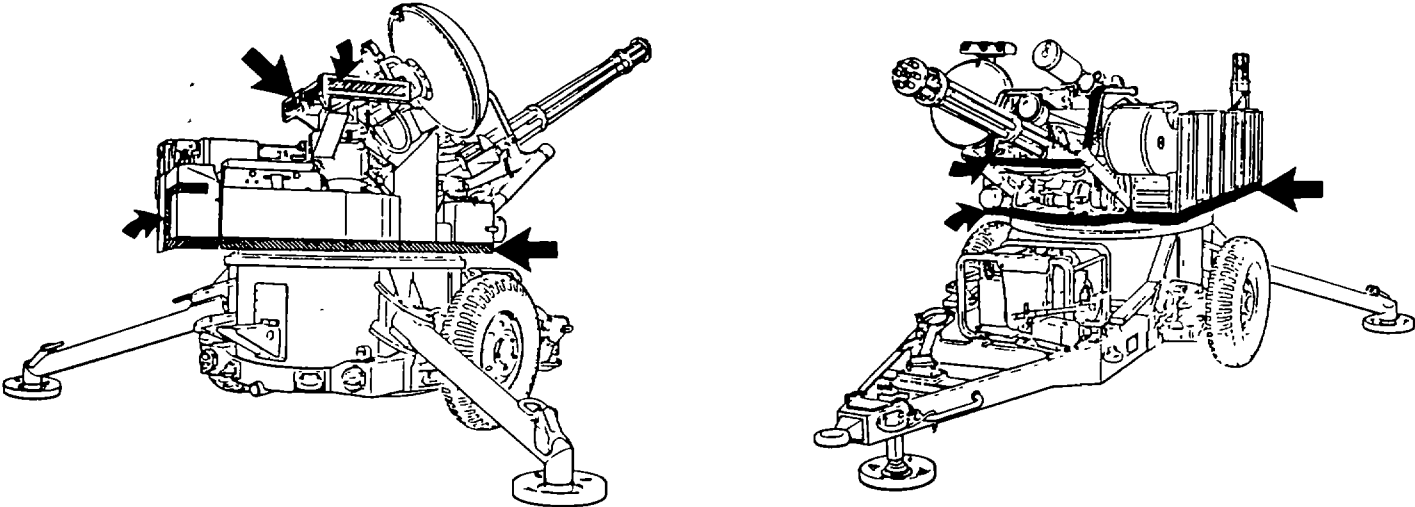


**Outside Installation Task 2: Clean Gun Carriage.** Hook fastener tape must be installed on the gun carriage as a base for mounting detector belts and cable assemblies. Gun carriage surface must be cleaned and primed before applying tape.

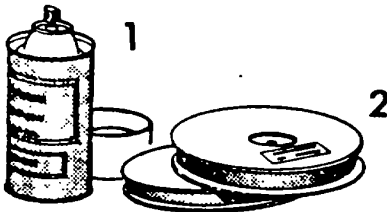
Use water, brush, and rags (Items 6 and 7, Appendix D), clean areas where tape will be installed as shown on shaded areas with arrows.

If gun is already equipped with fastener tape, go directly to Outside Task 4: Inspect Fastener Tape.

**NOTE**  
Tape will not stick to dirty or greasy surfaces.



An Installation Kit (Items 3 and 4, Appendix D) containing tape primer (1) and fastener tape (2) is required to complete this task.



**WARNING**

**Primer is highly Inflammable. Do not spray near Heat, Sparks, or Open Flame. No Smoking. Use only in well ventilated area.**

Before spraying tape primer, be sure you know where to mount the tape. Location of tape is illustrated in Outside Installation Task 3 steps.

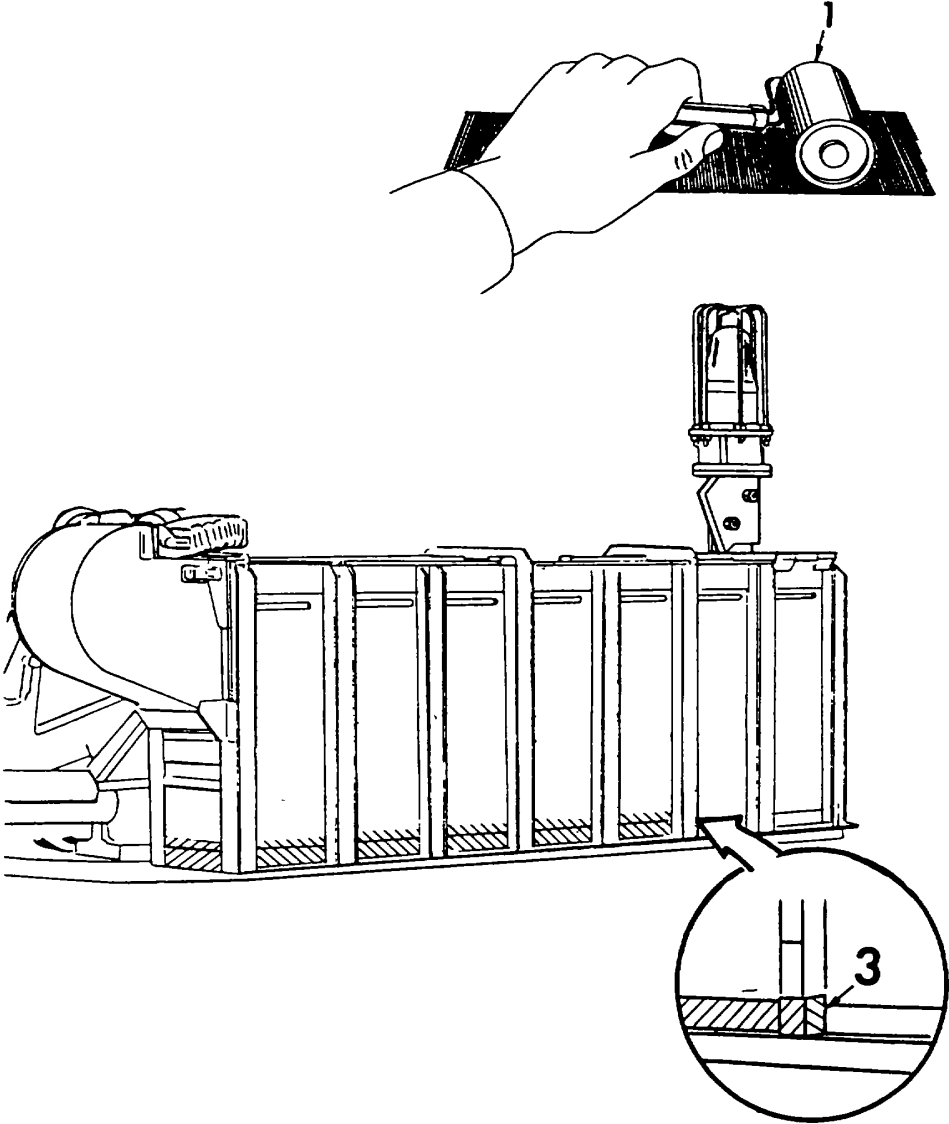
Spray a heavy coat of tape primer on cleaned areas of vehicle, one section at a time. Allow primer to dry 3 to 5 minutes before applying fastener tape.

**Outside Installation Task 3: Install Fastener Tape.**

The tape has a protective paper backing which must be removed before installing. For small lengths, the entire backing may be removed before installing tape. For long lengths of tape, however, it is recommended that the backing material be removed while the tape is being installed. This will prevent adhesive on the back of the tape from accidentally sticking to itself. Apply tape smoothly, cutting tape at all corners, sharp contours, weld beads, screw heads and at any point where tape will not adhere.

After tape is placed on primed areas, it must be pressed very hard with hand roller (Item 4, Appendix C). Use roller (1) as shown.

More spray primer may be added where necessary.



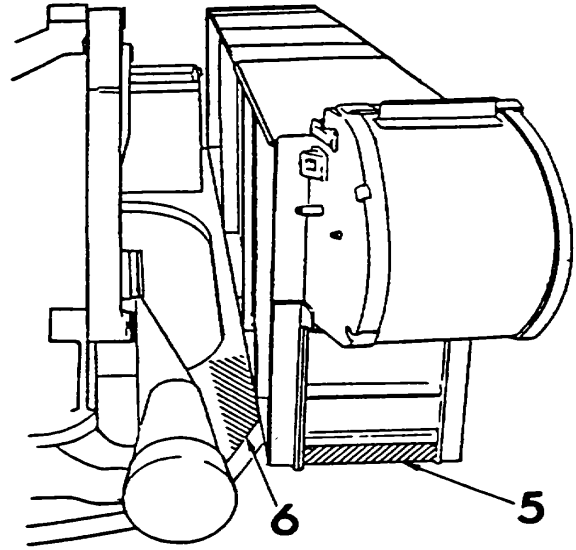
Cut six 7-inch tape strips. Install first strip on outside of ammunition storage unit. Place tape (2) in recessed area between third and fourth vertical rib from gun rear. Position tape at bottom of storage unit. Tape strip ends should be flush with edges of vertical strips.

Apply small piece of tape to rear edge of vertical strip (3).

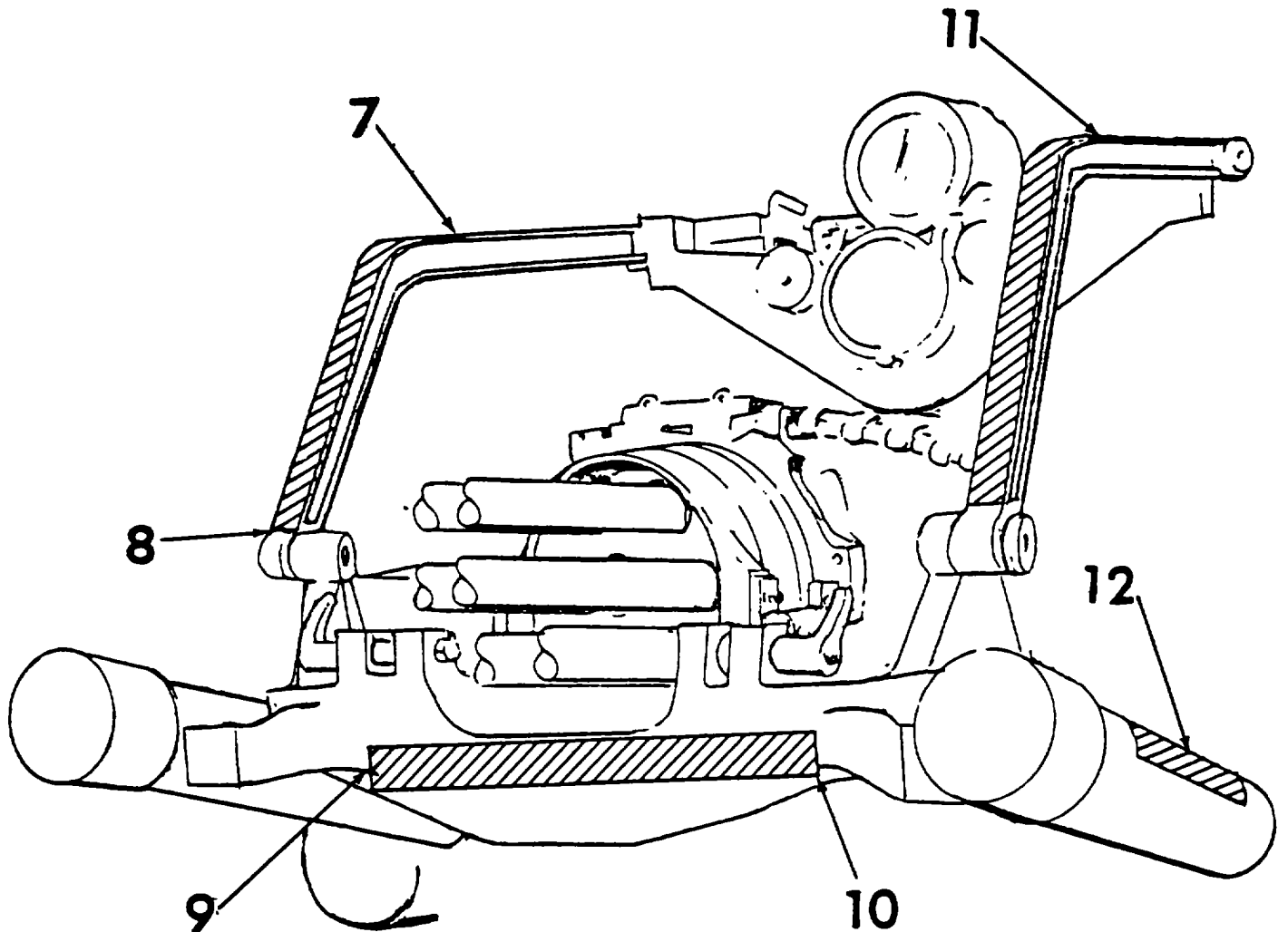
Work to your left. Apply four more strips in remaining recessed areas (4). Maintain all strips in a horizontal line.

Apply 7-inch strip (5) to front of ammunition storage unit below bellmouth door.

Cut a 16-inch tape strip. Apply to top surface of gun base (6) between equilibrator and ammunition storage unit. Start at front edge of surface. Press firmly with roller.





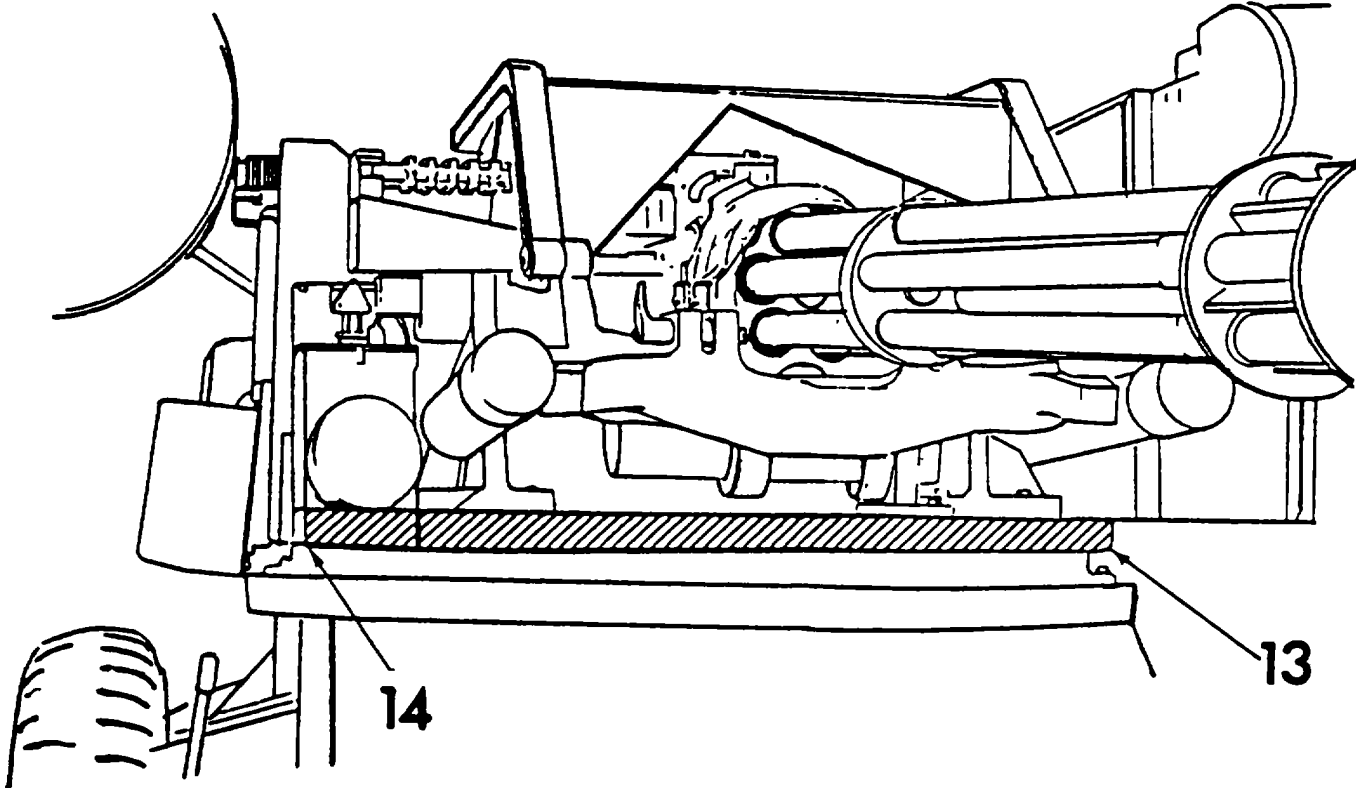
**Outside Installation Task 3: Install Fastener Tape (Cont).**

Start at top of right pivot (7). Apply tape to curved section at top and entire front of pivot. Cut tape at bottom of pivot (8). Trim tape to fit pivot.

Cut an 18-inch strip of tape. Start at right edge of gun saddle (9). Apply tape horizontally across length of saddle. Cut tape at left edge (10).

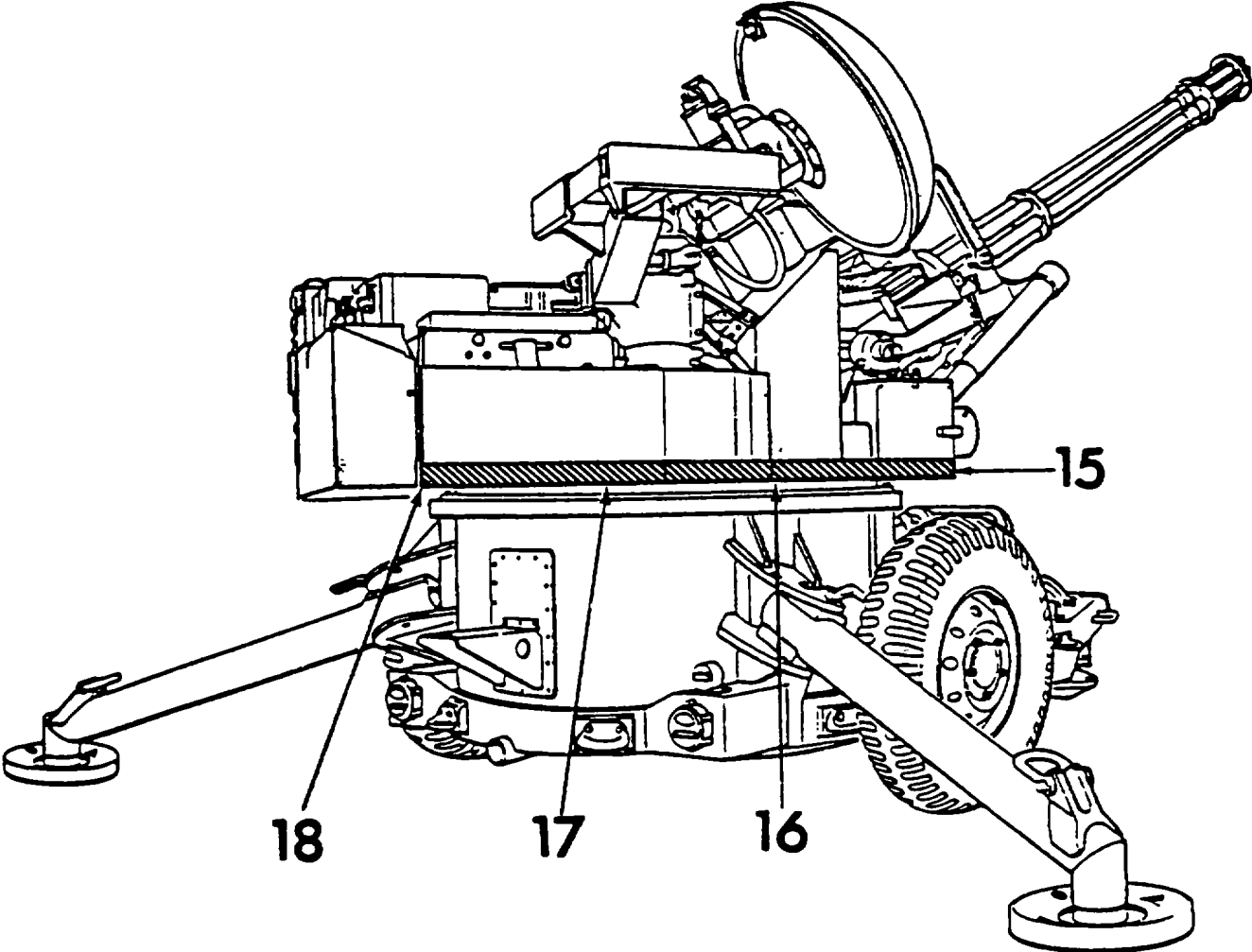
Start at top rear of left pivot (11). Apply tape to top and front of pivot. Cut tape at bottom of pivot. Trim tape to fit pivot.

Cut 12-inch strip of tape. Apply to top of left equilibrator (12).



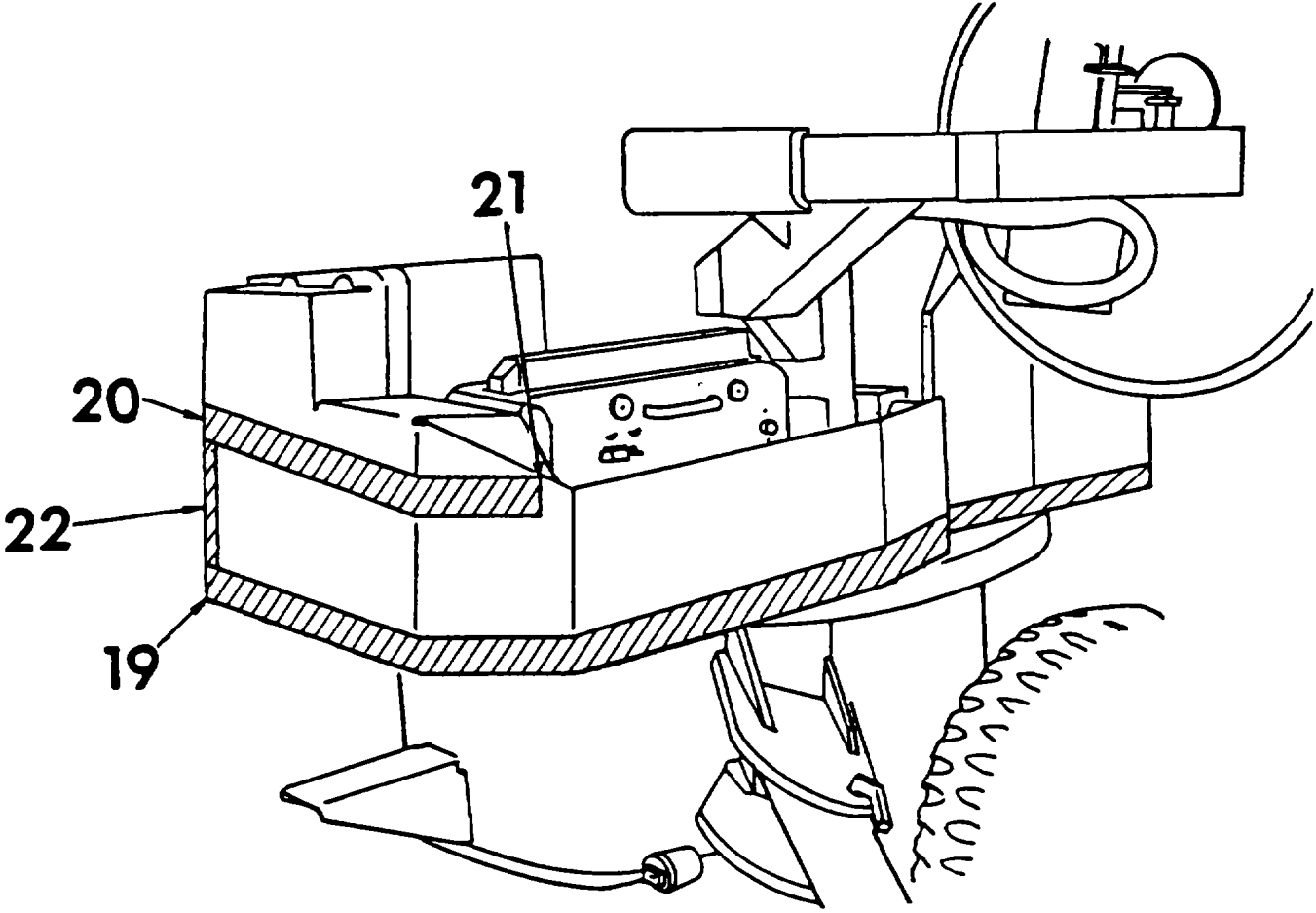
Start at left edge of gun platform (13) below equilibrator. Apply tape horizontally across length of platform. Cut tape at platform edge (14), below firing interrupter.

Outside Installation Task 3: Install Fastener Tape (Cont).



Start tape at front edge of platform (15), below firing interrupter. Apply tape working to your left. Cut tape at edge of gunner's station turret (16).

Apply new strip of tape at bottom of gunner's station turret (17). Butt and keep aligned with previously installed tape. Cut tape at break in turret section (18).

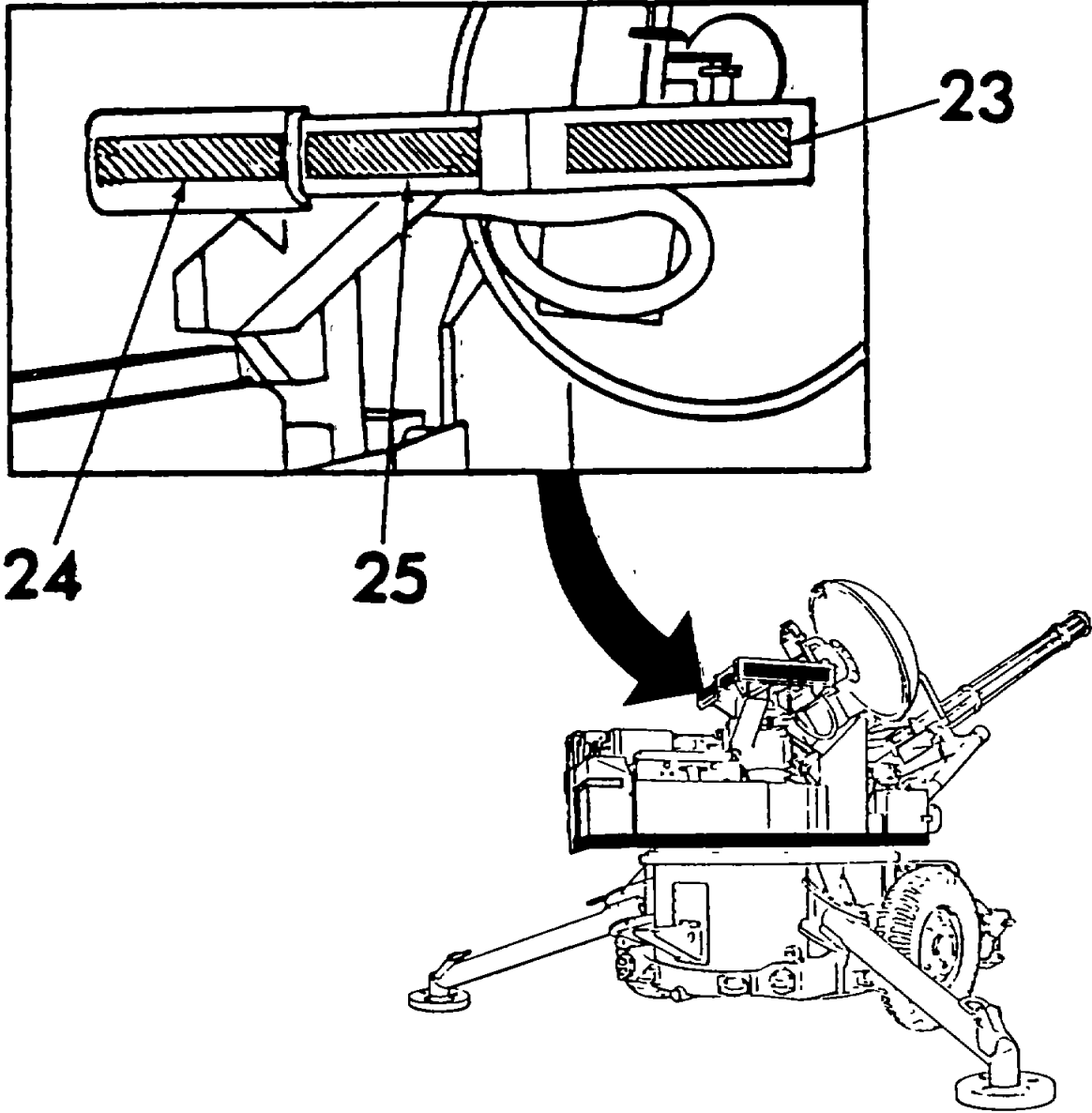


Apply strip across bottom rear of gunner's turret. Butt and align with previously installed tape. Cut tape at rear edge (19).

Apply a second strip parallel to and 8 inches above previous tape strip. Start at rear left edge (20). Cut tape at right edge (21).

Apply a tape strip vertically (22) along left rear edge connecting previously installed tape strips.

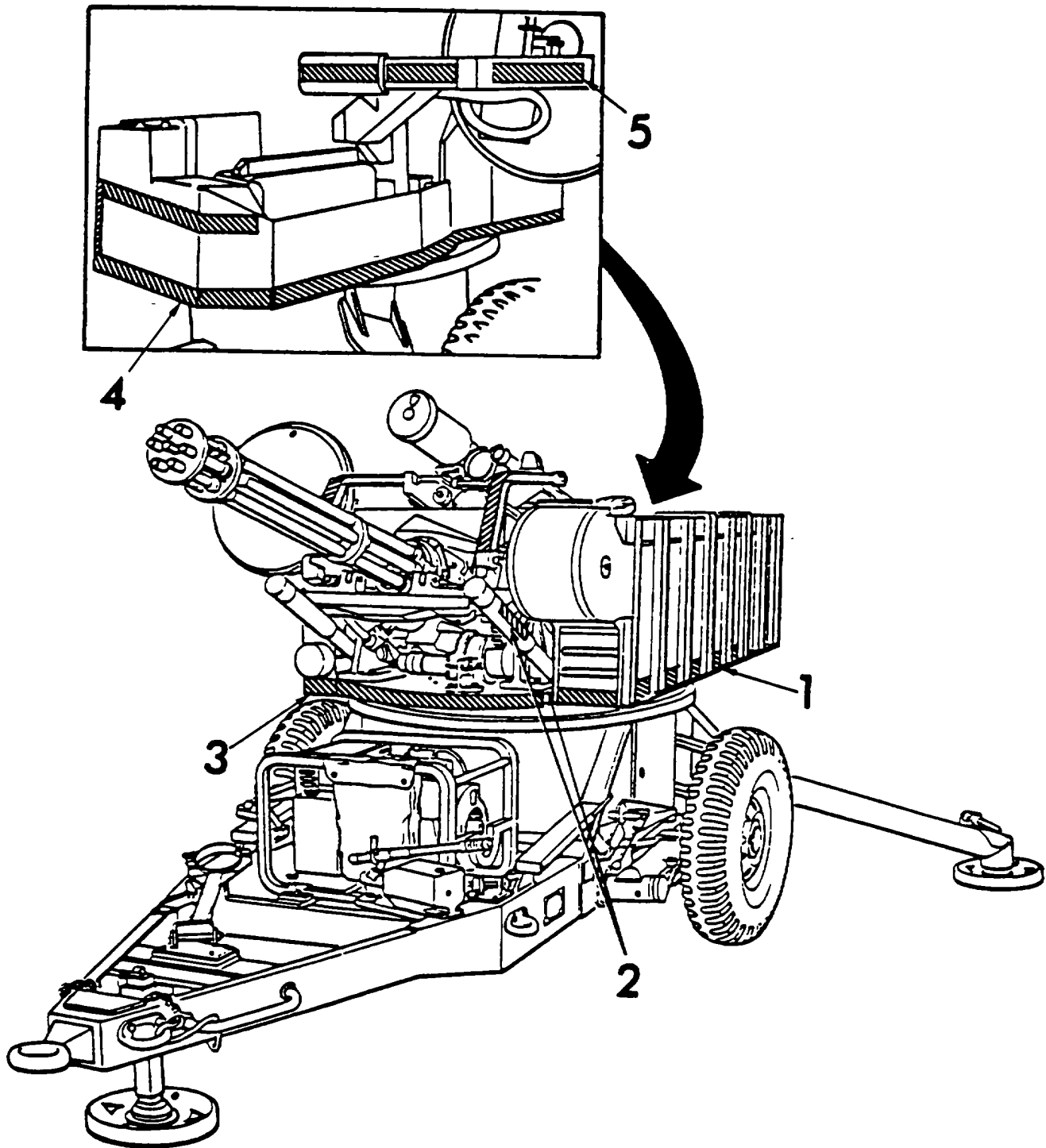
Outside Installation Task 3: Install Fastener Tape (Cont).



Install 14-inch tape strip (23) on exterior side of waveguide guard.

Install 24-inch strip of tape (24) on rear surface of waveguide guard. If equipped with protective rubber cover use two 12-inch tape strips (25) as illustrated.

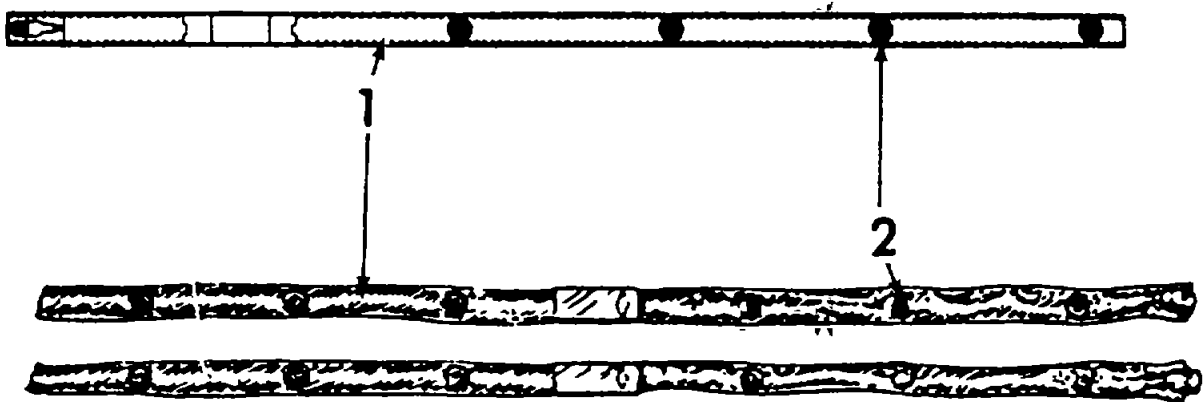
Outside Installation Task 4: Inspect Fastener Tape.



Check that fastener tape is mounted on front and side of ammunition storage unit (1), on left equilibrator and adjacent gun base (2) on pivot and saddle (3) along gun platform and gunner's station side and rear (4), and to waveguide guard (5).

If any fastener tape is missing from gun carriage, mount tape on places it belongs. Use instructions given for Outside Installation Tasks 2 and 3 (pages 2-15 and 2-16).

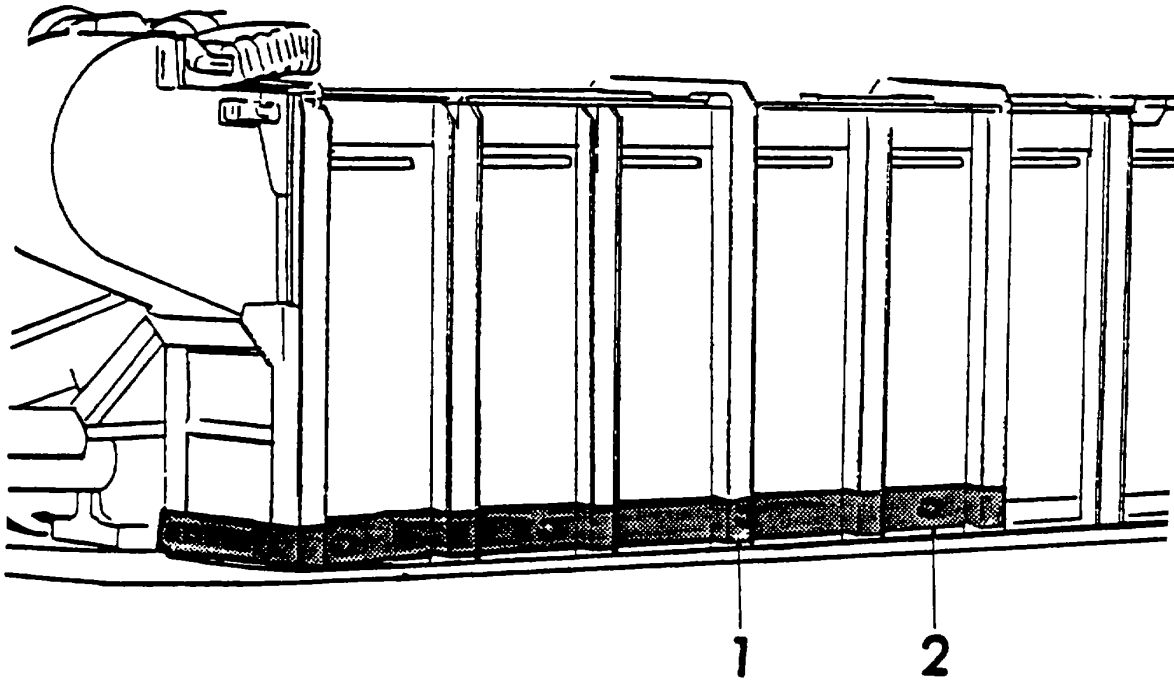
**Outside Installation Task 5: Inspect and Service Detector Belt Segments.** All three detector belt segments must be checked. They are supplied in the MILES M113 APC Simulator System.



Look for any damage that would prevent normal use of the belt segments (1).

Wipe detectors (2) clean. (Clean all detectors.) Report any damage on DA Form 2404.

**NOTE**  
Replace belt segments if damaged.

**Outside Installation Task 6: Install Left Side Detector Belt.**

Locate belt segment labeled No. 2. Arrange belt so that connector end is on your left.

Start at end without connector. Place second detector (1) from end against fifth vertical rib from rear of ammunition storage unit. Press belt against nearby fastener tape.

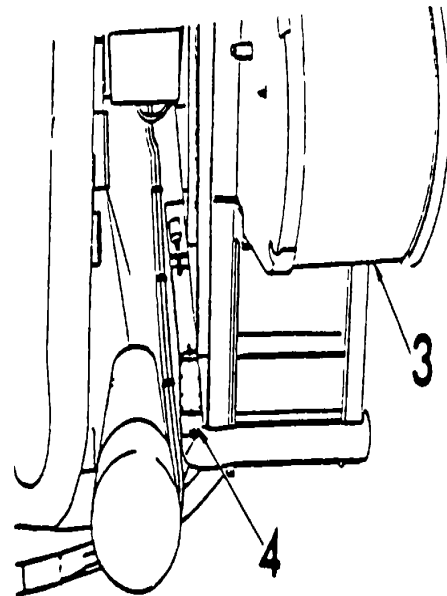
Press belt segment end against fastener tape to your right. Remaining detector (2) should be positioned midway between third and fourth vertical rib.

Work to your left pressing belt against tape. Belt will loop out on second vertical rib from front.

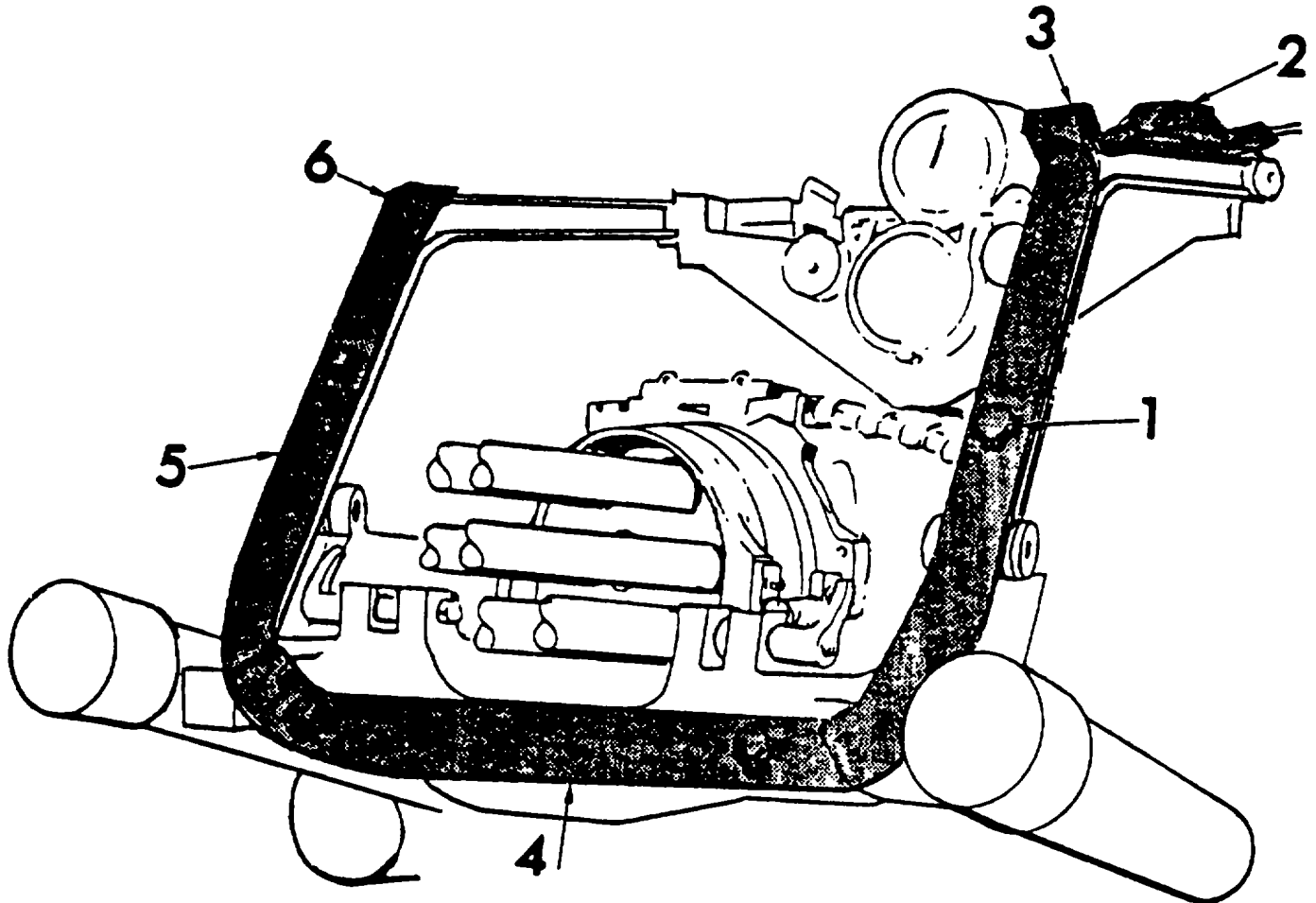
Continue around front of ammunition storage unit beneath bellmouth door (3).

Bend belt around corner and press electronics box (4) and connector against tape strip on gun base between side of ammunition storage unit and equilibrator.

Make sure all detectors are flush with ammunition storage unit side or on front of vertical ribs. If any detectors are on sides of vertical ribs, remove and reposition belt segment.





**Outside Installation Task 7: Install Front Detector Belt.****CAUTION**

**Manually depress gun barrels before attaching belt segments.  
Damage to belt segments could occur.**

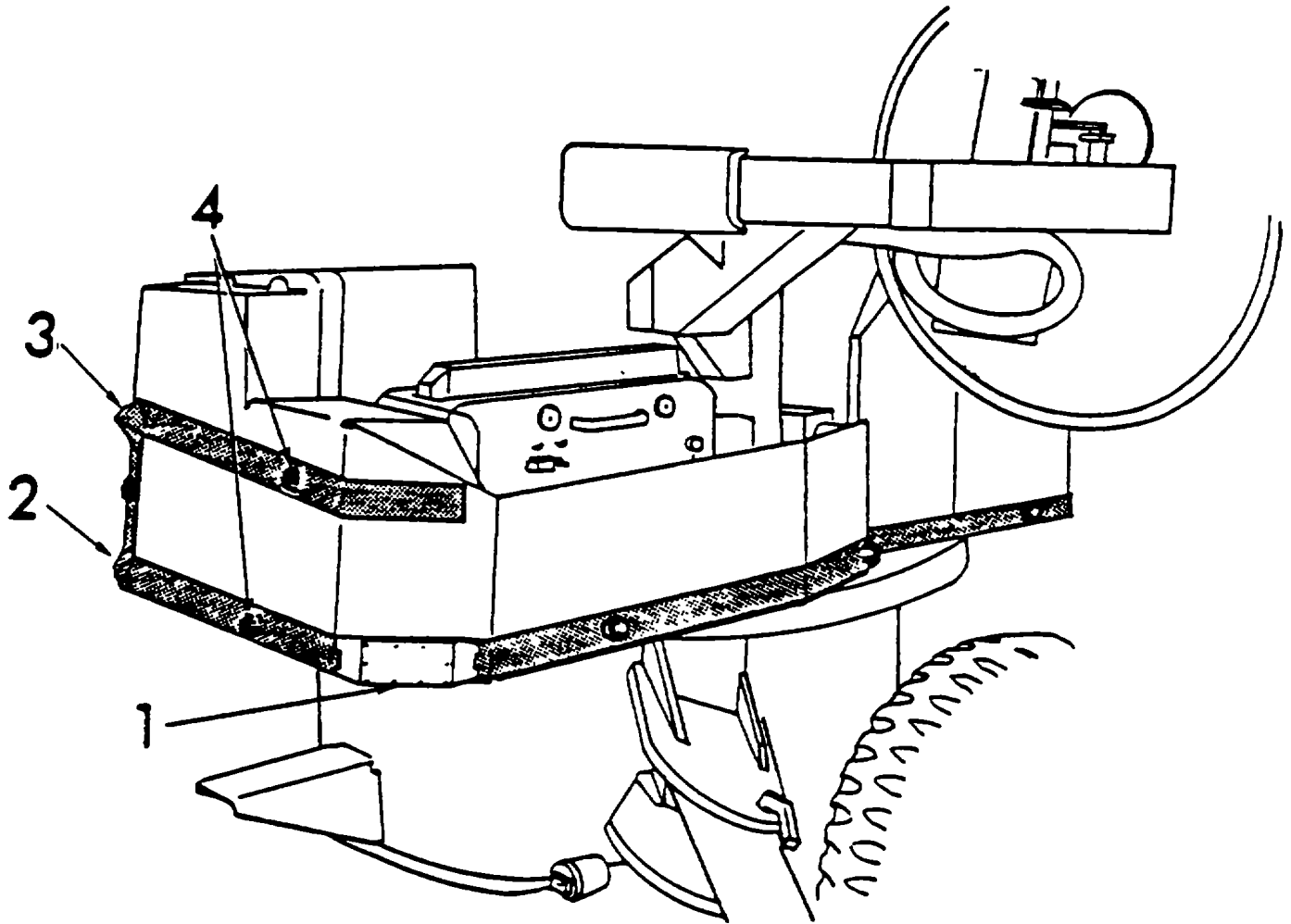
Locate belt segment labeled No. 2. Arrange belt so that connector end is on your right.

Start at end with connector. Place first detector (1) approximately 2 inches above pivot point of left arm.

Press against fastener tape. Continue pressing belt against pivot arm working upwards. Press electronics box (2) against top surface of pivot arm above gun shield. If necessary, leave slack in belt at bend (3) in pivot arm.

Work down from first detector pressing belt and detectors against pivot arm. Continue on to saddle (4) beneath gun barrels. Continue up right pivot arm (5) and onto top (6).

Manually raise and depress gun barrels to ensure proper fit.

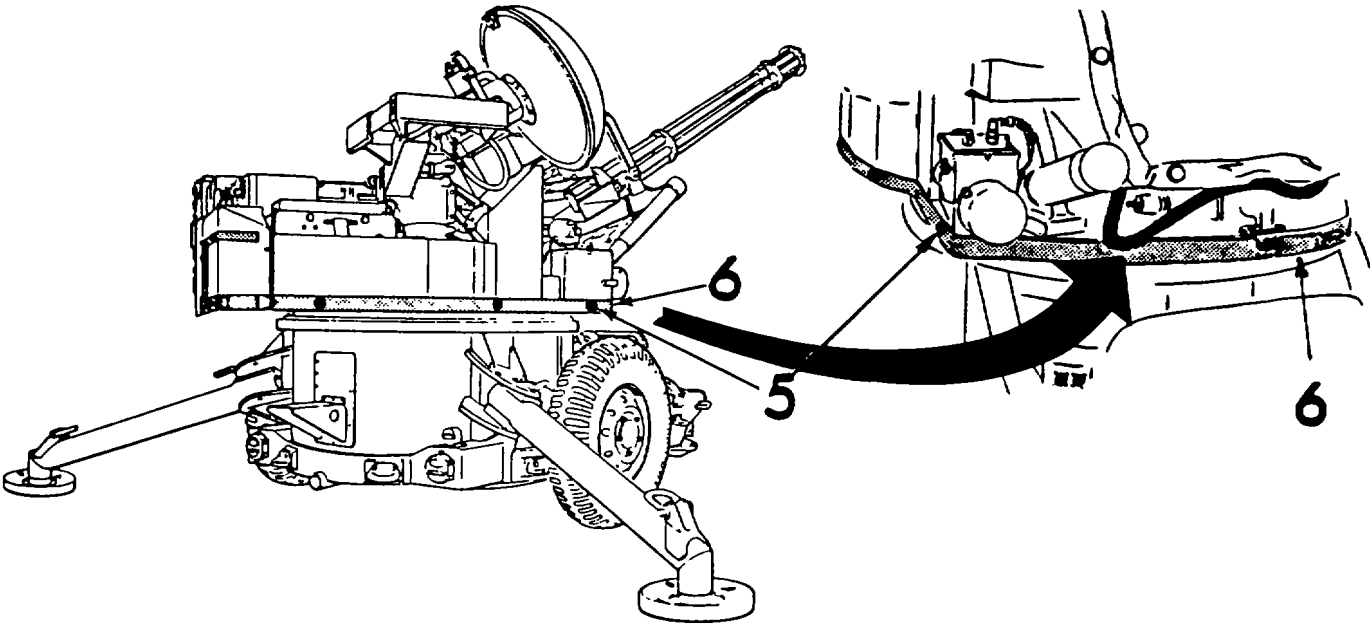
**Outside Installation 8: Install Right Side Detector Belt.**

Locate belt segment labeled No. 1. Arrange belt so that connector end is on your right.

Position electronics box (1) on tape at right rear corner of gunner's turret. If box overhangs corner, reposition belt so that it fits on corner properly.

Continue applying belt along bottom of turret. Fold (2) belt so that it follows fastener tape path up rear edge. Fold (3) belt towards right and apply remainder of belt to fastener tape. Make sure detectors (4) are positioned approximately as illustrated and are not covered with belt material. Reposition belt if necessary.

Outside Installation 8: Install Right Side Detector Belt (Cont).



Work back to your right. Apply belt against tape along bottom of gunner's turret. Position belt so that detector right (5) nearest connector is against fastener tape below midpoint of firing interrupter. Continue to your right, pressing belt and connector (6) against tape on end of gun platform.

**Outside Installation Task 9: Inspect CVKI and CVKI Adapter Assembly.****NOTE**

CVKI is included in the MILES equipment for the M113 APC. CVKI Adapter Assembly is in VULCAN Adapter Set.

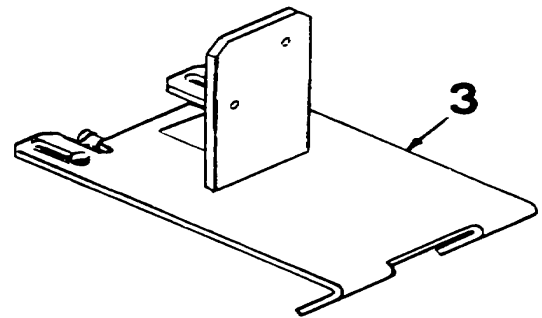
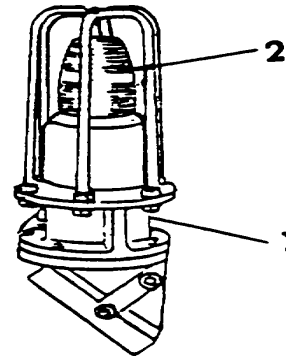
Inspect CVKI assembly (1) for any damage that would affect proper installation or operation.

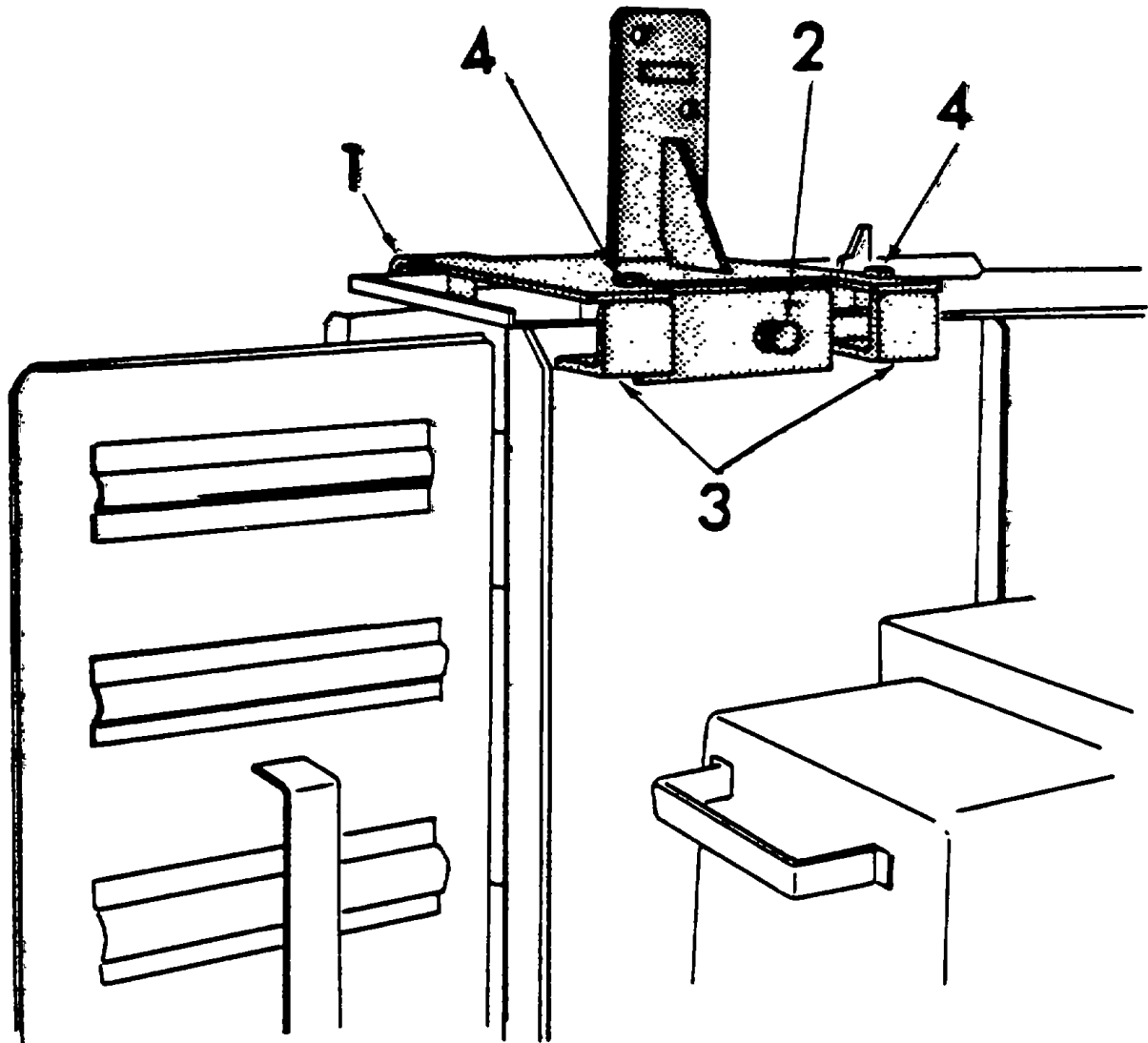
Inspect yellow lens (2) for cracks.

Inspect CVKI Adapter Assembly (3) for any damage that would affect proper installation or operation.

Report any damage on DA Form 2404.

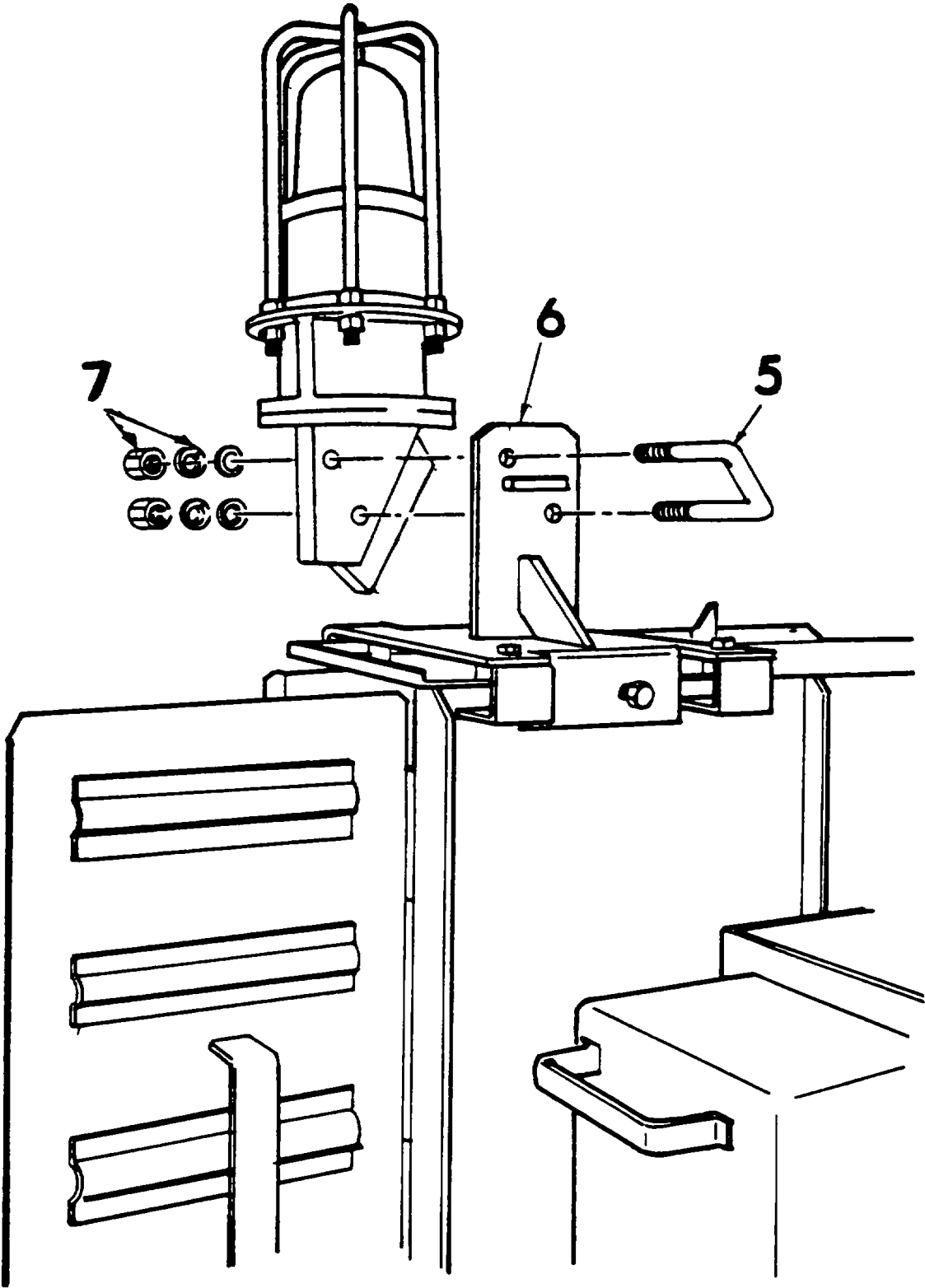
Replace CVKI Assembly only if lens is cracked or unit is damaged.



**Outside Installation Task 10: Install CVKI Assembly.**

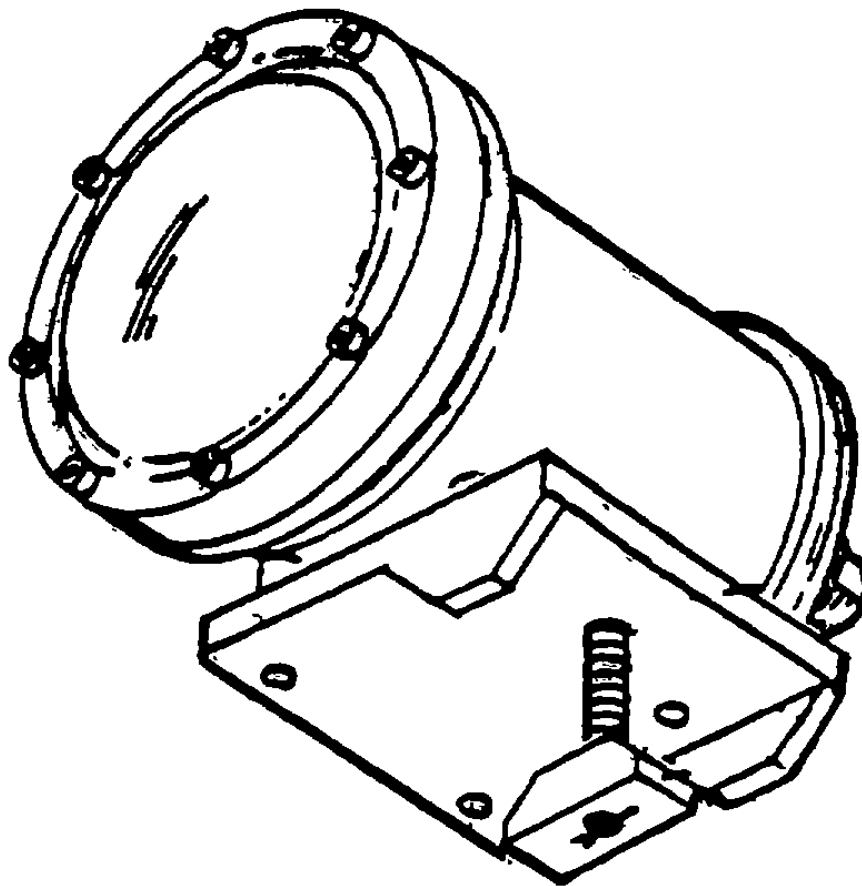
Position CVKI Adapter Assembly on top of ammunition storage unit just forward of rear door. Hook two bracket tabs (1) over outside edge of storage unit. Align clamps (3) and adjust until snug against side of storage unit. Tighten bolt (2) with adjustable wrench until bracket tabs are firmly locked against storage unit.

Tighten bolts (4) with adjustable wrench until clamps are secure against lip on top edge of ammunition supply unit.



Mount CVKI assembly against vertical flange on bracket. Slip mounting hook (5) through holes in bracket and CVKI assembly. Make sure CVKI assembly is flush against bracket tab (6).

Install nuts and washers (7) on mounting hook. Tighten with adjustable wrench.

**Outside Installation Task 1 1: Inspect FLASHWESS.**

Inspect FLASHWESS for any visible damage that would prevent operation or installation.

Check that lens has no cracks and all bolts are tight.

Report any damage on DA Form 2404.

Replace FLASHWESS if damaged.

**Outside Installation Task 12: Install FLASHWESS.**

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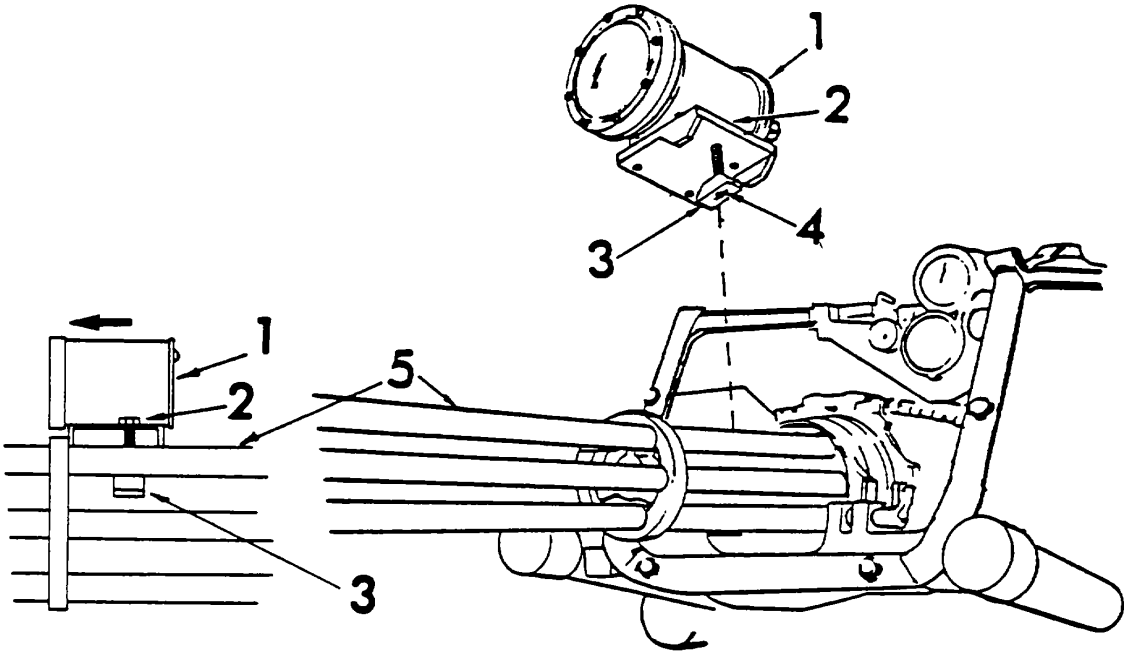
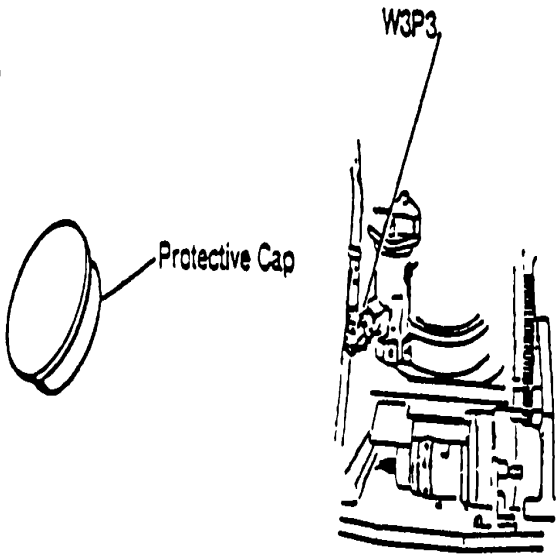
**WARNING**

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Failure to disconnect motor connector W3P3 can cause damage to equipment and/or Injury to personnel. Make sure It is disconnected.

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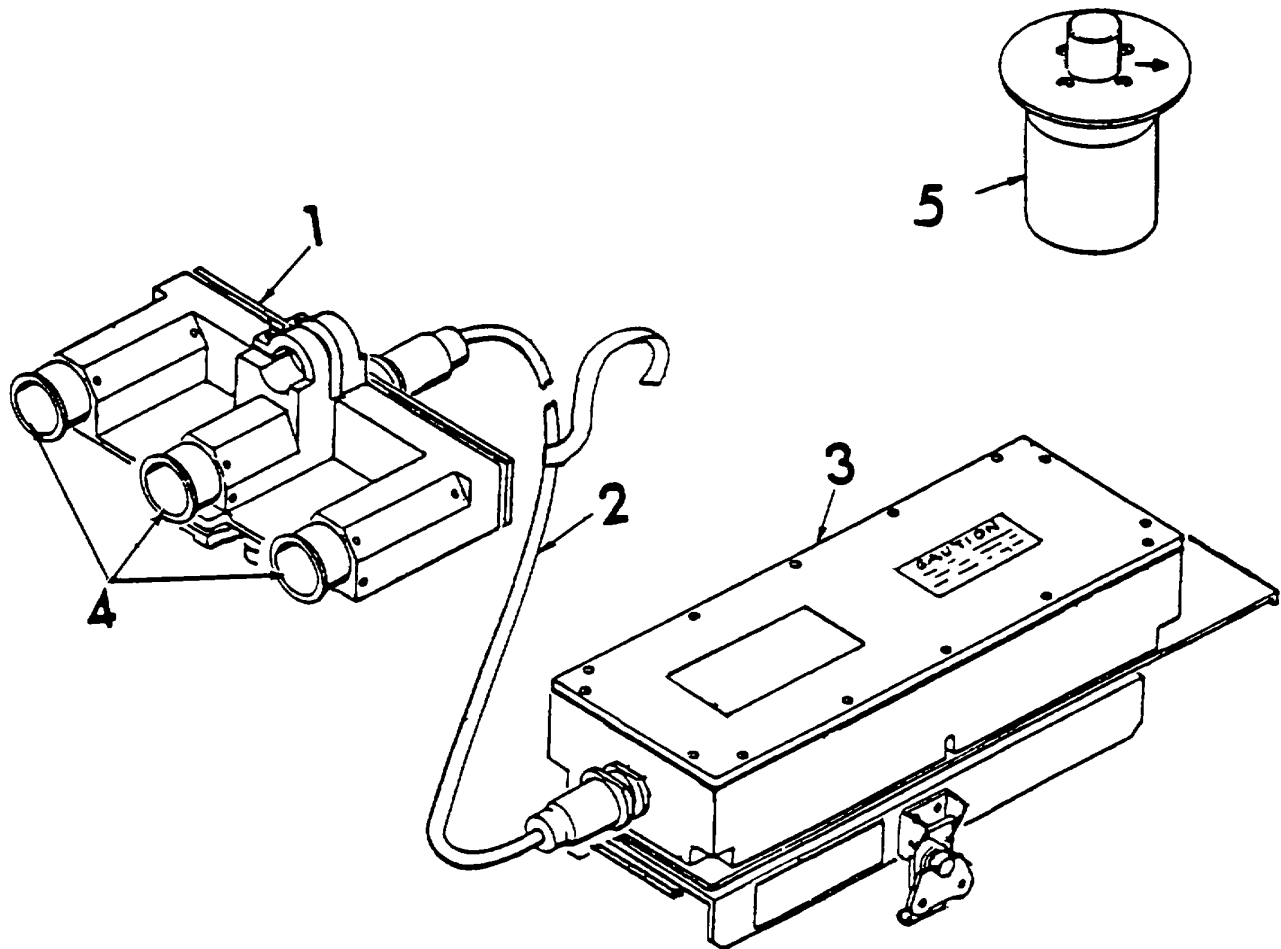
Disconnect VULCAN cannon motor connector W3P3. Fit MILES protective cover (see Item 3-G, Section II, Appendix B) over A6A2J1 gun motor and brake connector. Fit MILES protective cover (see Item 3.H, Section II, Appendix B) over motor connector W3P3. Secure cable out of way.



Loosen FLASHWESS wedge (3) until it touches cotter pin (4), Turn wedge to fit between top two cannon barrels (5).

Position FLASHWESS (1) on top rear of two barrels with connector toward rear and body behind mid. barrel clamp Insert wedge between barrels  
Slide FLASHWESS forward until aligned with barrel clamps. Turn longer side of wedge perpendicular to barrels. Tighten bolt (2) using adjustable wrench.



**Outside Installation Task 13: Inspect VULCAN Laser Transmitter/Modulator.**

Inspect transmitter (1), cable (2) and modulator (3) for any damage that would prevent installation or normal operation.

Remove any dirt or oil from lenses (4) with lens paper or a soft dry cloth.

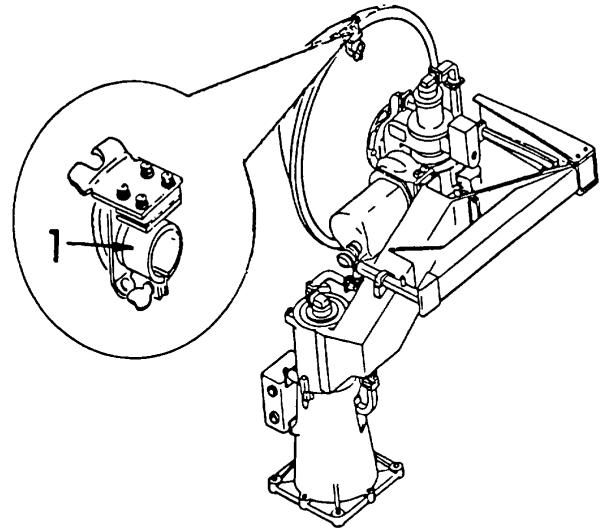
Inspect transmitter bottom flange (5) for any damage that would prevent normal installation.

Report any damage on DA Form 2404. Replace transmitter assembly flange or modulator if damaged.

**Outside Installation Task 14: Install VULCAN Laser Transmitter/Modulator.**

OMIT THIS TASK IF UPDATED BORESIGHT TELESCOPE MOUNTING BRACKET (without four Allen screws) IS USED.

Using Allen wrench from boresight kit, remove four screws securing boresight telescope mounting clamp, (1). Remove clamp.



**NOTE**

**Safeguard screws, they will be used to replace clamp after the transmitter adapter set is removed.**

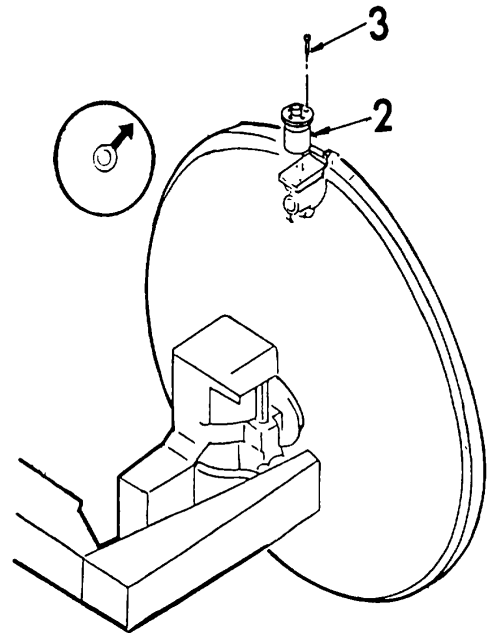
Reinstall telescope mounting clamp (1).

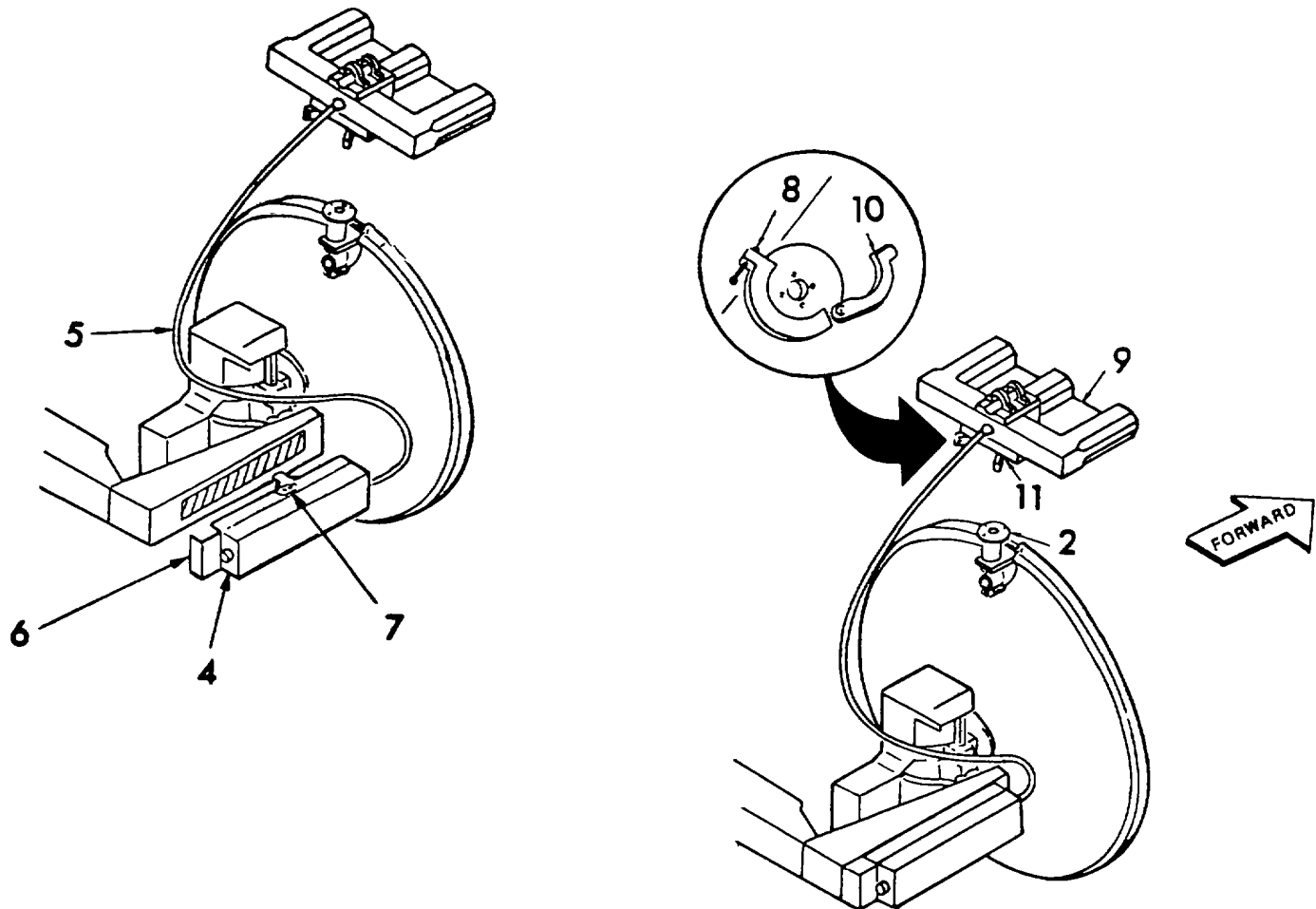
**NOTE**

**Be sure arrow on flange is on top and pointing forward.**

Install MILES transmitter bottom flange.

Secure telescope mounting clamp (1) and bottom flange (2) with four MILES supplied 2-inch long socket head cap screws (3) (see Item 31, Section II, Appendix B).



**Outside Installation Task 14: Install VULCAN Laser Transmitter/Modulator (Cont).**

Position modulator (4), with cable (5) toward antenna, on waveguide guard. Align modulator guide (6) with end of waveguide guard.

**CAUTION**

**Be sure locking clamps are properly seated on waveguide.**

Install modulator by meshing fastener tape on modulator firmly into fastener tape you installed. Secure modulator to waveguide guard with two locking clamps (7).

Loosen clamp retainer screw (8) on transmitter (9) Open clamp (10).

Position mounting base (11) on bottom flange (2). Tighten retainer screw just enough to hold transmitter on mount (Tighten screw securely only after completing Alignment Tasks, page 2-62).

**Outside Installation Task 14.1: Install VULCAN Laser Transmitter/Modulator.**

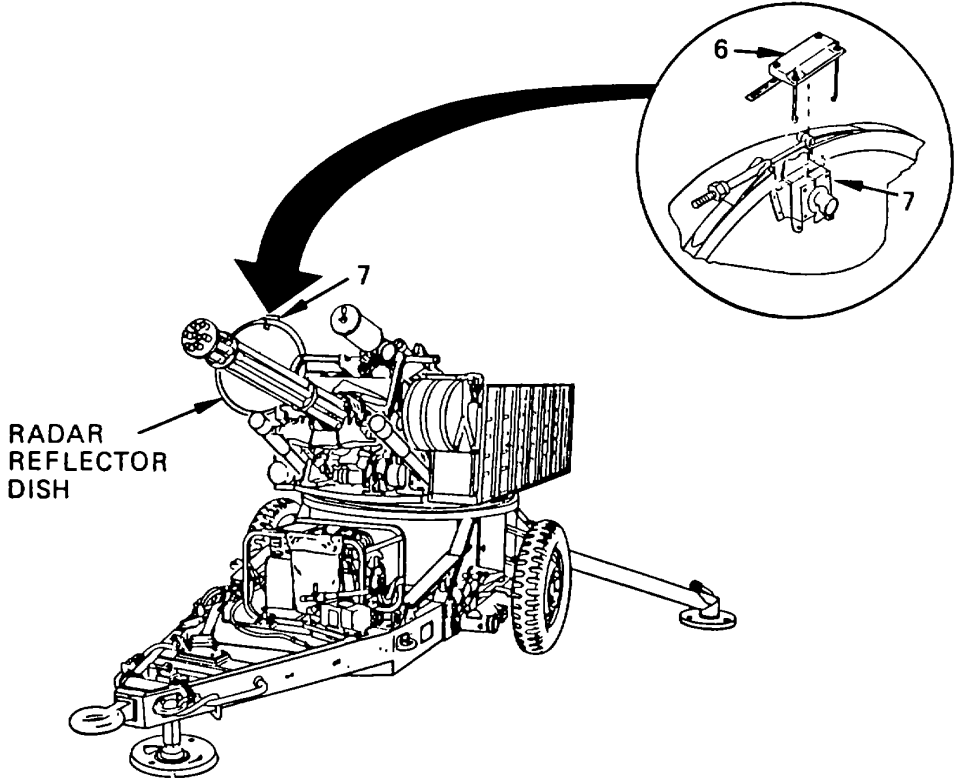
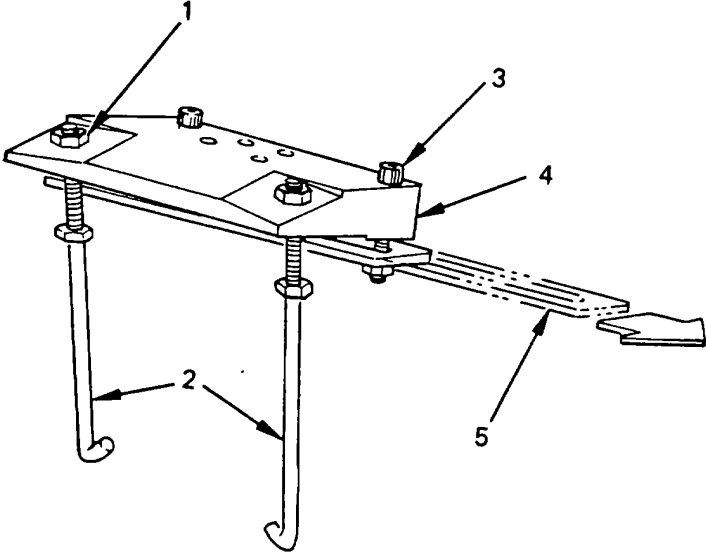
**OMIT THIS TASK IF ORIGINAL BORESIGHT TELESCOPE MOUNTING BRACKET (with four Allen screws) IS USED.**

Loosen upper nut (1) on each of two "J" hooks (2) and run both nuts up thread as far as they will go. (Each "J" hook thread has been purposely deformed at the end to prevent removal of nut and washer.)

Loosen both socket head screws (3) securing mounting plate (4) to mounting bracket (5). (Socket head screws have been purposely deformed at the ends to prevent removal of nut and washers.)

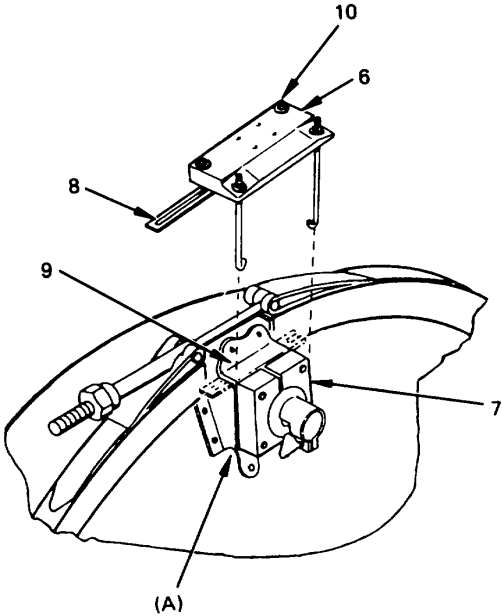
Install transmitter mount assembly (6) onto boresight telescope mounting bracket (7) as follows:

- Slide slotted mounting bracket (5) to its fullest extended position, as shown.

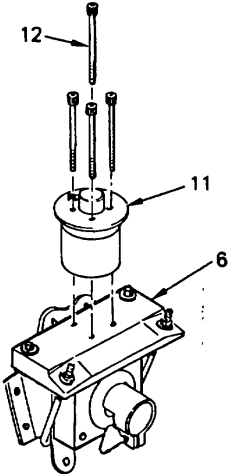


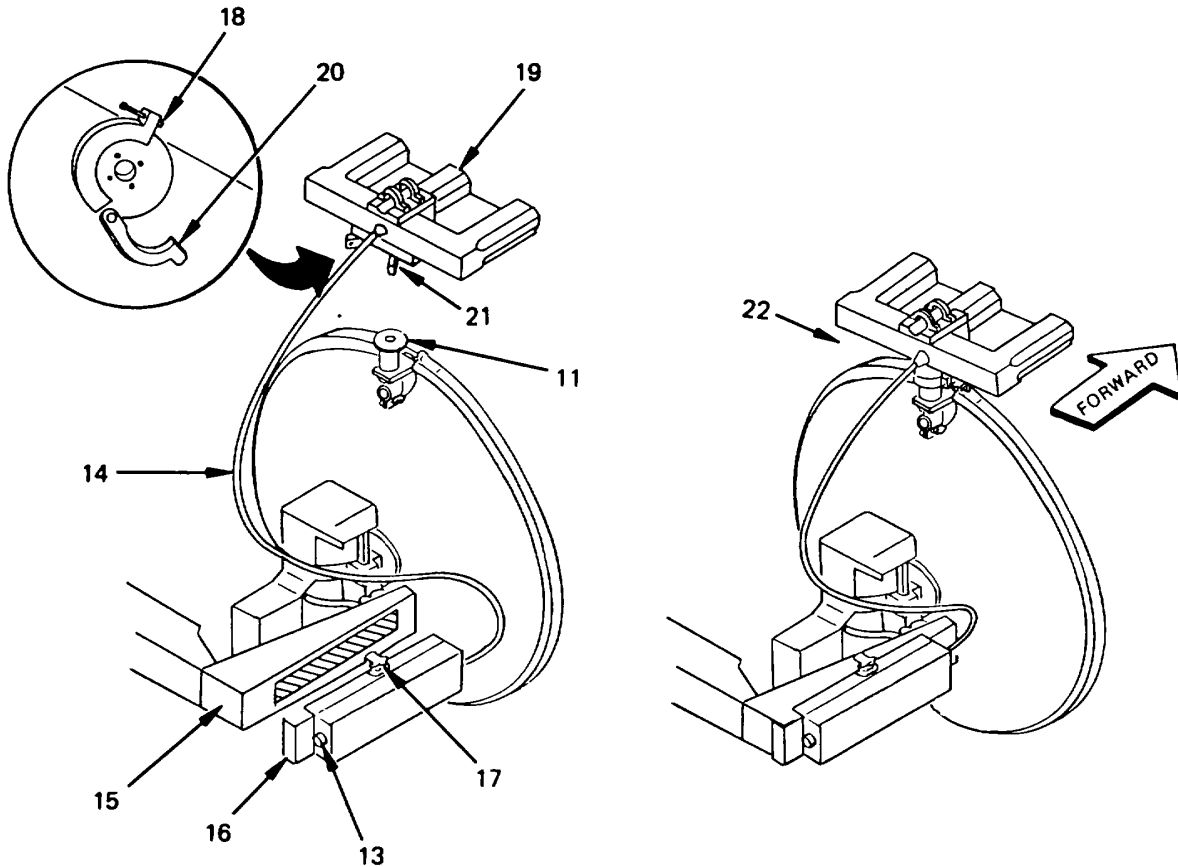
**Outside Installation Task 14.1: Install VULCAN Laser Transmitter/Modulator (Cont).**

- Place transmitter mounting assembly (6) onto the boresight telescope mounting bracket (7).
- Slide the extended transmitter mount bracket (5) under the boresight telescope mounting bracket clamp (9) until the open slot at end of bracket engages detached socket head screw (10).
- Tighten both socket head cap screws and torque 35 to 40 inch-pounds.
- Fasten ends of "J" hooks underneath each side of boresight telescope mounting bracket (A) and tighten "J" hook nuts. Torque nuts 30 to 35 inch-pounds.



Install bottom flange (11) onto transmitter mount assembly (6) so that arrow on top of flange is pointing forward. Secure with four MILES two inch long socket head cap screws (12).





Position modulator (13), with cable (14) toward antenna, on waveguide guard (15). Align modulator guide (16) with end of waveguide guard.

**CAUTION**

**Be sure locking clamps are properly seated on waveguide.**

Install modulator by meshing fastener tape on modulator firmly into fastener tape installed on waveguide guard. Secure modulator to waveguide guard with two locking clamps (17).

Loosen clamp retainer screw (18) on transmitter (19). Open clamp (20).

Position mounting base (21) on bottom flange (11). Tighten retainer screw just enough to hold transmitter on mount (22). (Tighten screw securely only after completing Alignment Tasks, page 2-62)

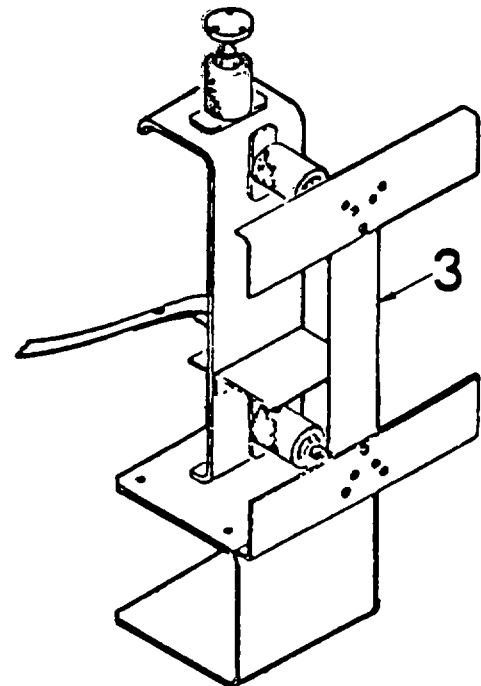
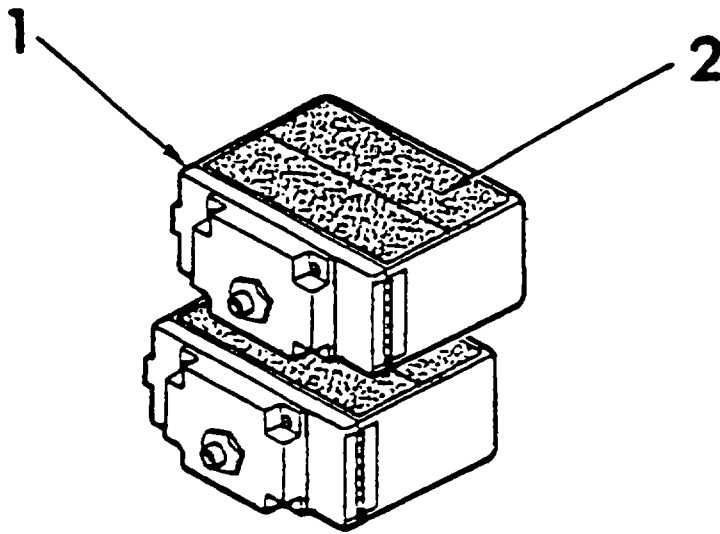
**Outside Installation Task 15: Inspect Battery Boxes and Control Indicator Adapter.****NOTE**

Two battery boxes are required. One is supplied with the MILES VULCAN, Towed, system. One must be obtained from the MILES M113 APC system.

Inspect battery boxes (1) for damage that would prevent normal use.

Make sure fastener tape (2) is attached to one side of each battery box. If fastener tape is missing, do not attempt to install new tape. Turn battery box in.

Report any damage on DA Form 2404. Replace only if not usable.



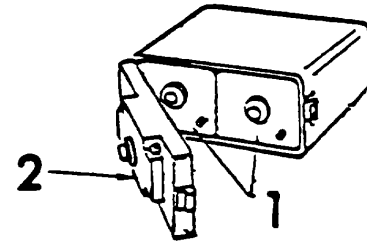
Inspect Control Indicator Adapter (3) for any damage that would prevent normal installation.

Report any damage on DA Form 2404. Replace if damaged.

**Outside Installation Task 16: Install Battery Boxes.**

Insert two 6 V batteries (1) in each box.

If a battery is sticky from acid leakage, ask your NCOIC for a replacement.



Close and latch cover (2).

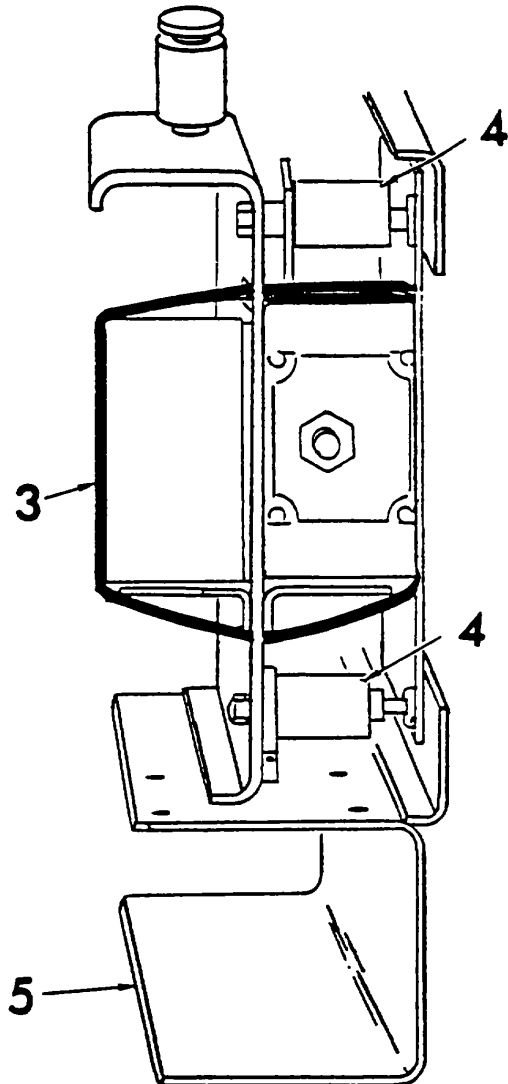
**NOTE**

**May need to loosen adjustable spacers (4) to fit battery boxes into compartment.**

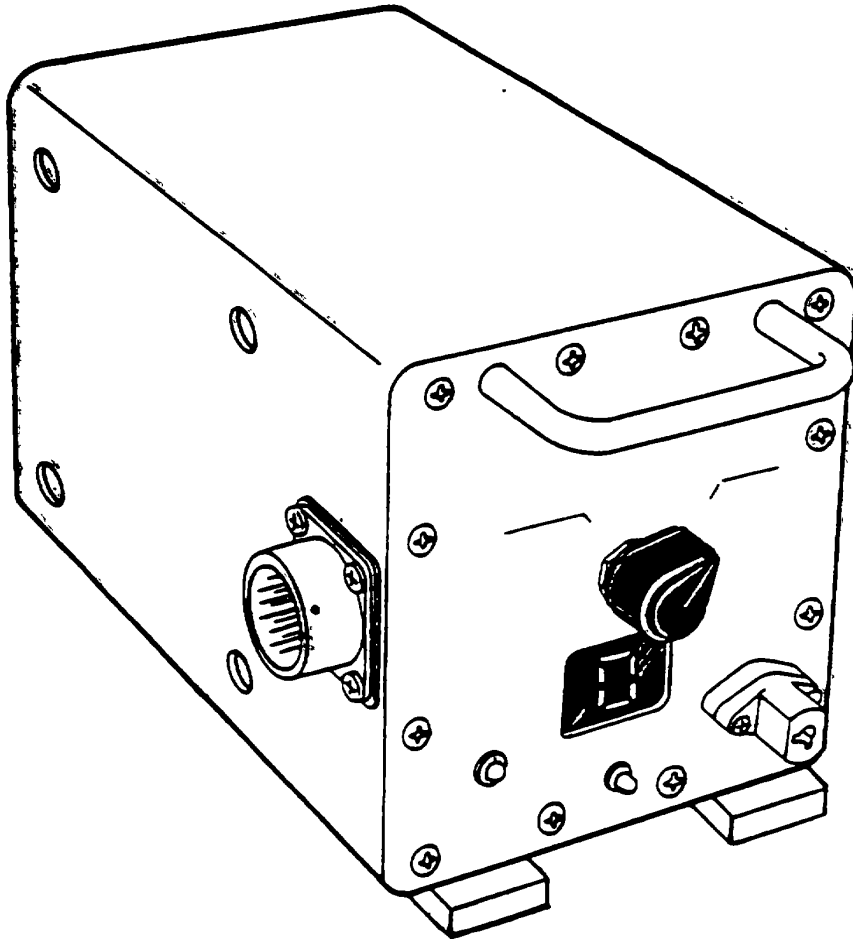
Undo straps (3). Slip battery boxes into compartments on Control Indicator Adapter (5). Position so that connectors point in opposite directions and fastener tape on boxes and bracket is aligned.

Press against fastener tape on bracket.

Secure by looping tie strap (3) around both boxes and cinching tight.





**Outside Installation Task 17: Inspect Control Indicator Assembly (CIA).**

Inspect Control Indicator Assembly for any damage that would prevent normal operation.

Report any damage on DA Form 2404. Replace assembly if damaged.

**NOTE**

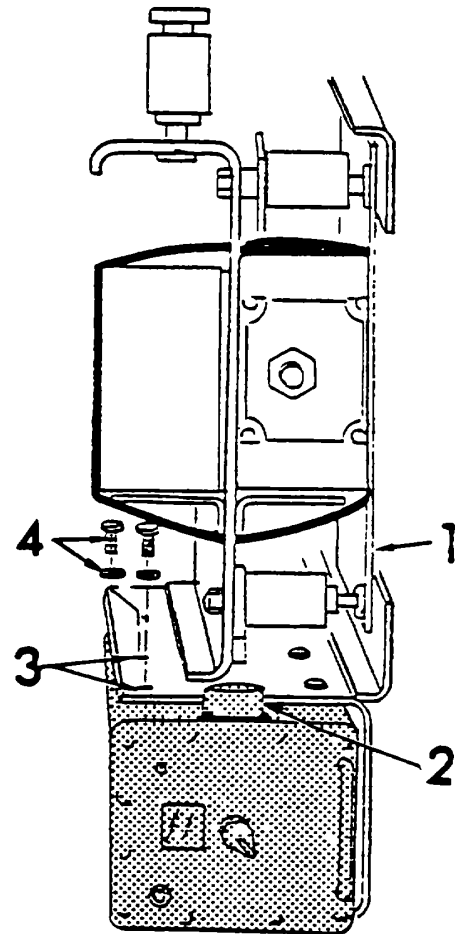
**Control Indicator Assembly (CIA) is supplied with the MILES M1 13'APC simulator system.**

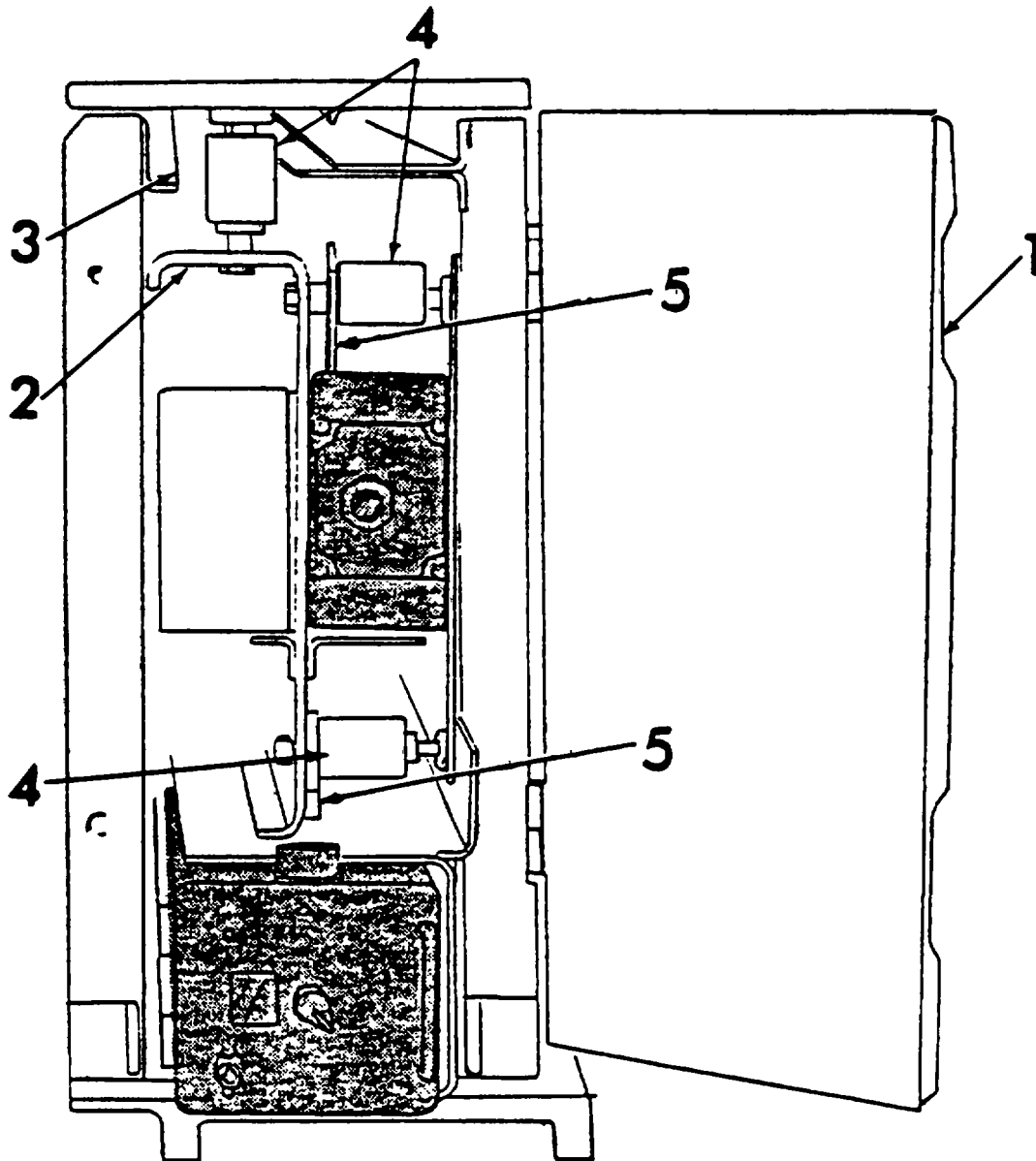
**Outside Installation Task 18: Install Control Indicator Assembly (CIA).**

Slide Control Indicator into compartment at bottom of Control Indicator Adapter (1). Position as illustrated. Connector (2) must be in front at top.

Align four bolt holes (3) in top of Control Indicator compartment with four holes in side of CIA.

Install four MILES cap screws (4) and washers (4). Tighten with adjustable wrench.



**Outside Installation Task 19: Install Control Indicator Adapter Assembly.**

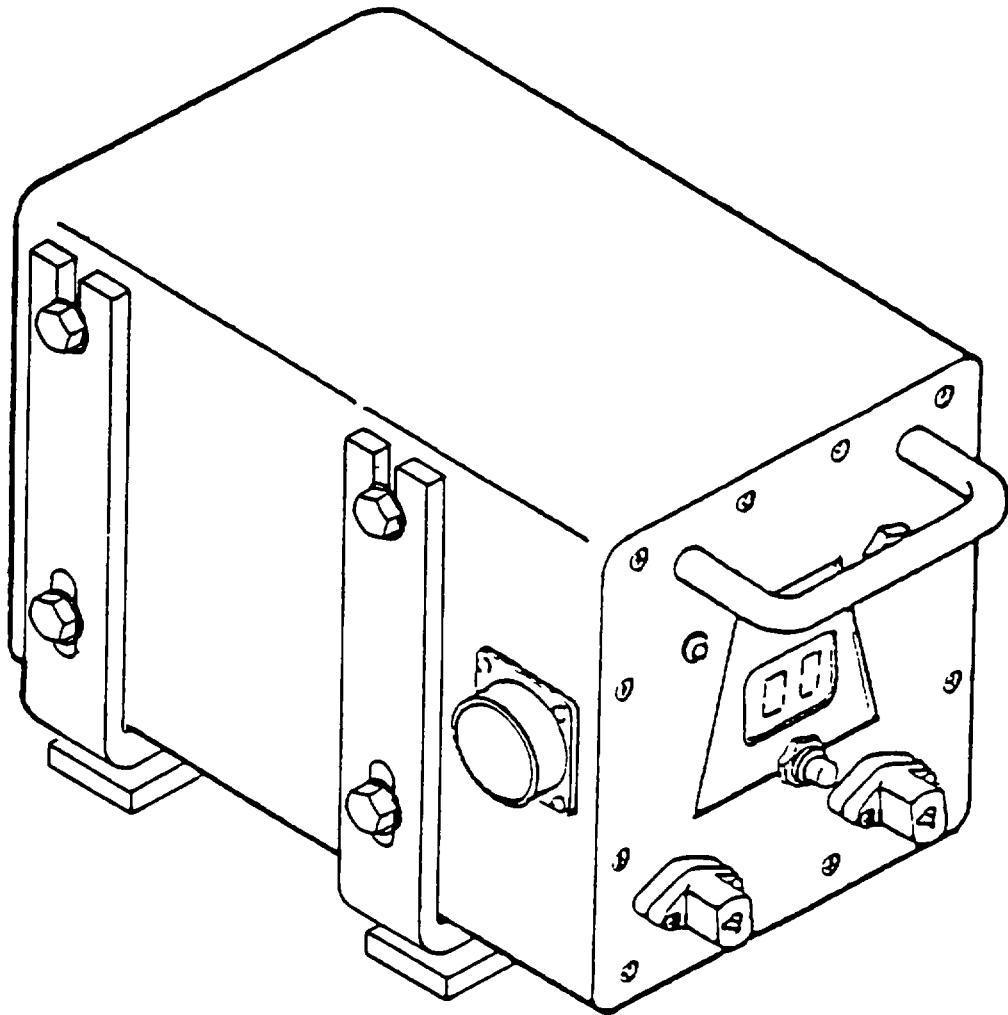
Open rear door (1) of ammunition storage unit.

Lift adapter assembly (2) into storage unit. Assembly must be positioned with CIA at bottom.

Slide adjustable spacer through slot (3) at top of storage unit.

Check that storage unit door can be closed.

Lock assembly into position by turning adjustable spacers (4) until they are tight against storage unit sides and top. Turn and tighten lock bars (5) against adjustable spacers.

**Outside Installation Task 20: Inspect Interface Control Assembly (ICA).**

Inspect Interface Control Assembly for any damage that would prevent normal operation

Report any damage on DA Form 2404. Replace assembly if damaged.

**Outside Installation Task 21: Install Interface Control Assembly (ICA).**

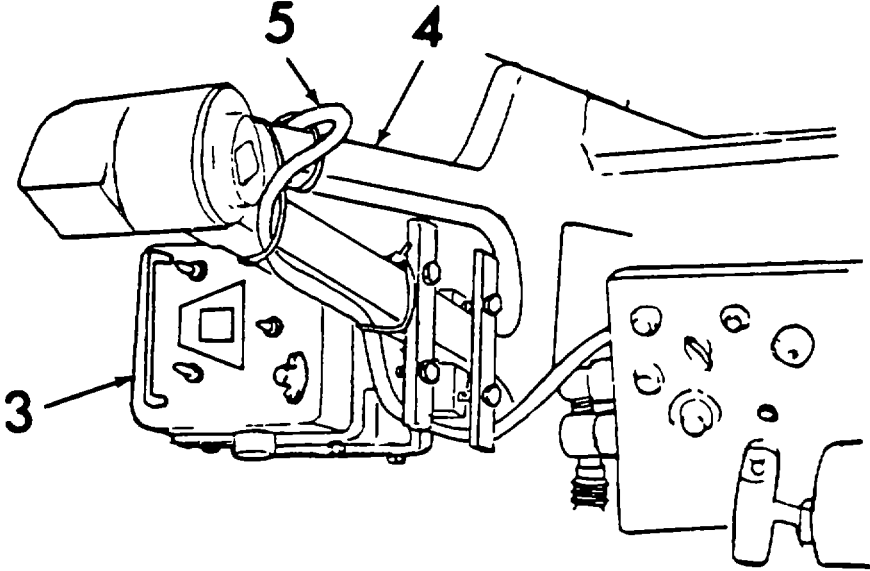
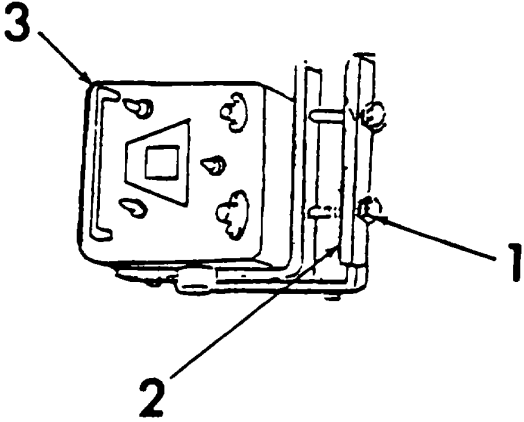
**WARNING**

The Gunner must exercise caution when entering or leaving the Gunner's compartment to prevent possible injury to left leg/knee from the ICA mounting bolts.

Remove bolts, lock washers, flat washer (1) and both bars (2) from ICA adapter assembly.

Position ICA (3) on left lower side of 20 mm cannon elevation pivot arm (4) as close as possible to control panel.

Secure ICA to pivot arm with bar, washers, and bolts. Make sure installation does not pinch or interfere with sight cable (5).



**CABLING TASKS - LIST**

<u>Task</u>	<u>Title</u>	<u>Page</u>
1.	Obtain Equipment	2-45
2.	Inspect Detection Cable Assembly	2-46
3.	Install Detection Cable Assembly	2-47
4.	Inspect Logic Cable Assembly	2-52
5.	Install Logic Cable Assembly	2-53
6.	Install Arming Connector	2-58

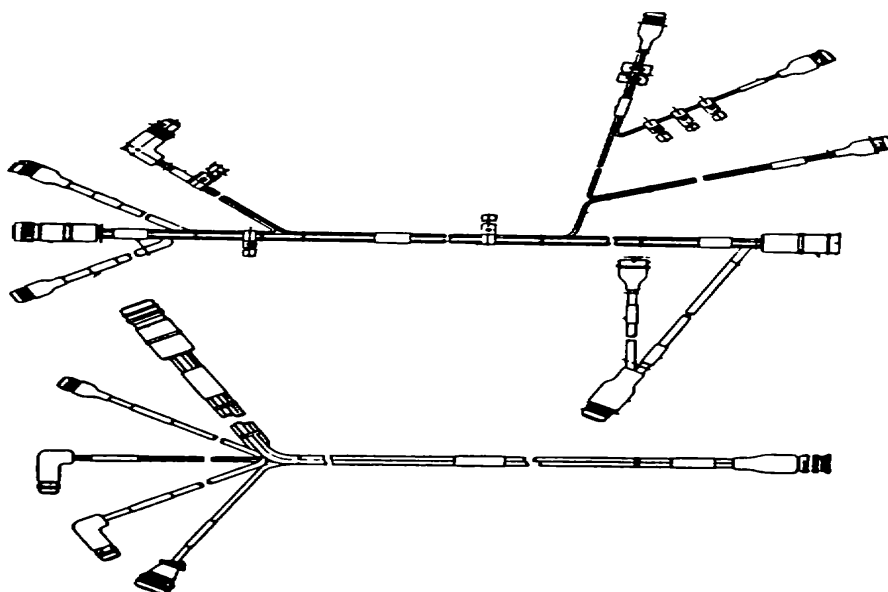
**NOTE**

**Perform these tasks in the order given.**

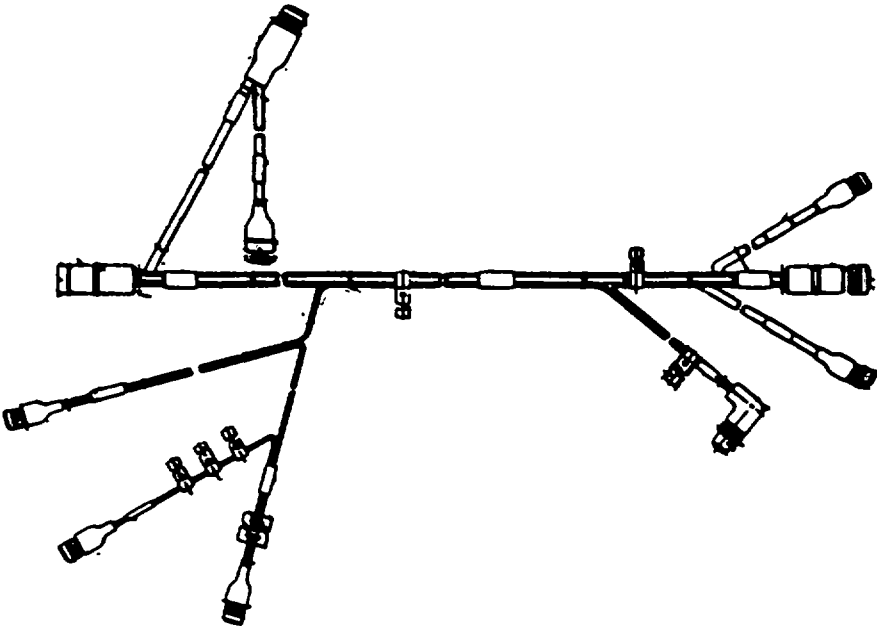
**Cabling Task 1: Obtain Equipment.** Completion of cabling tasks requires equipment listed and illustrated below. Locate and set aside this equipment.

Detection Cable Assembly

Logic Cable Assembly



Cabling Task 2: Inspect Detection Cable Assembly.



Find cable assembly labeled DETECTION.

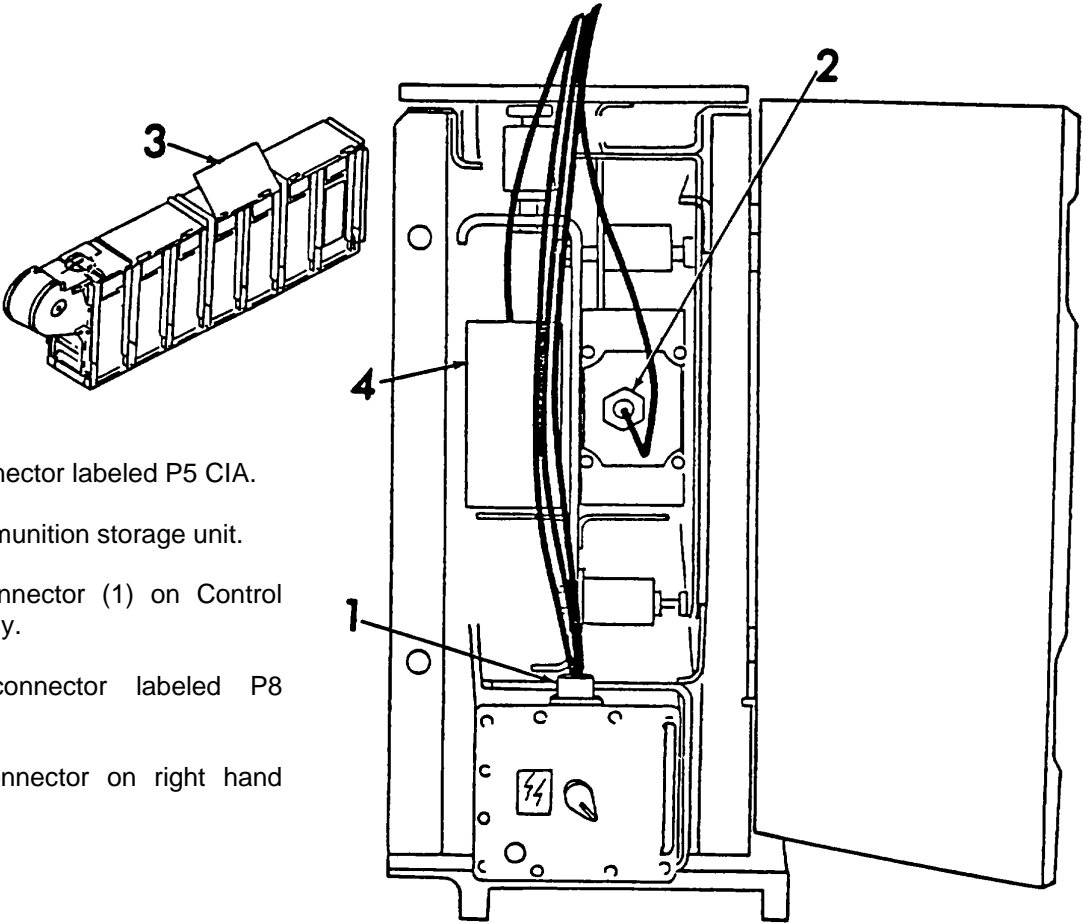
Check each cable for worn insulation and bare wires.

Each connector should have a label showing where it goes.

Check all connectors for obvious damage.

Report any damage on DA Form 2404. Replace cable assembly if damaged.

**Cabling Task 3: Install Detection Cable Assembly.**



Locate cable connector labeled P5 CIA.

Open door of ammunition storage unit.

Attach P5 to connector (1) on Control Indicator Assembly.

Locate cable connector labeled P8 Battery.

Attach P8 to connector on right hand battery box (2).

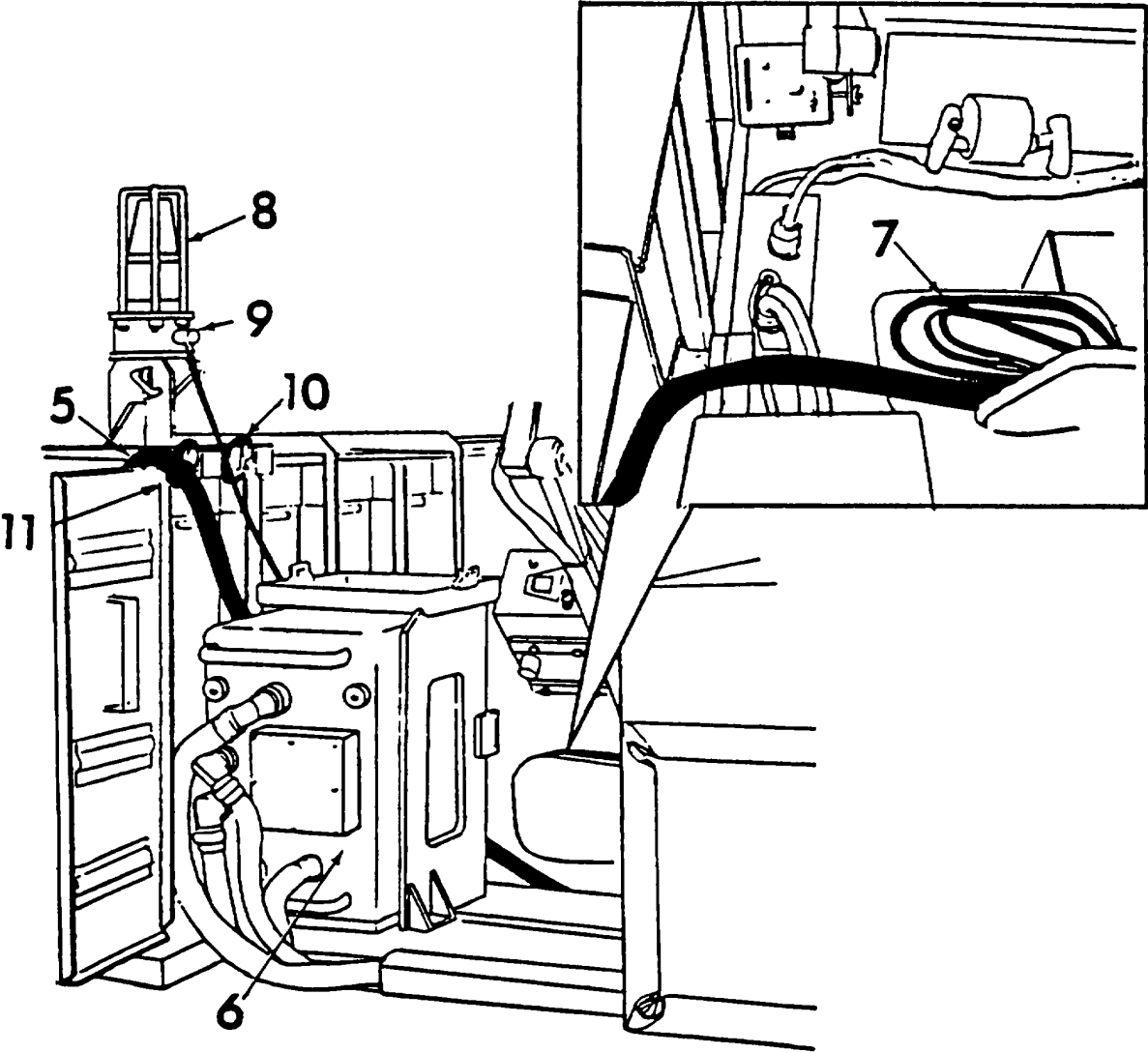
Locate cable connector labeled P7 Battery. Slip P7 connector through control indicator adapter toward connector on left hand battery box.

Open second door (3) from rear on top of ammunition storage unit.

Reach inside and attach P7 to connector on left hand battery box (4).



Cabling Task 3: Install Detection Cable Assembly (Cont).



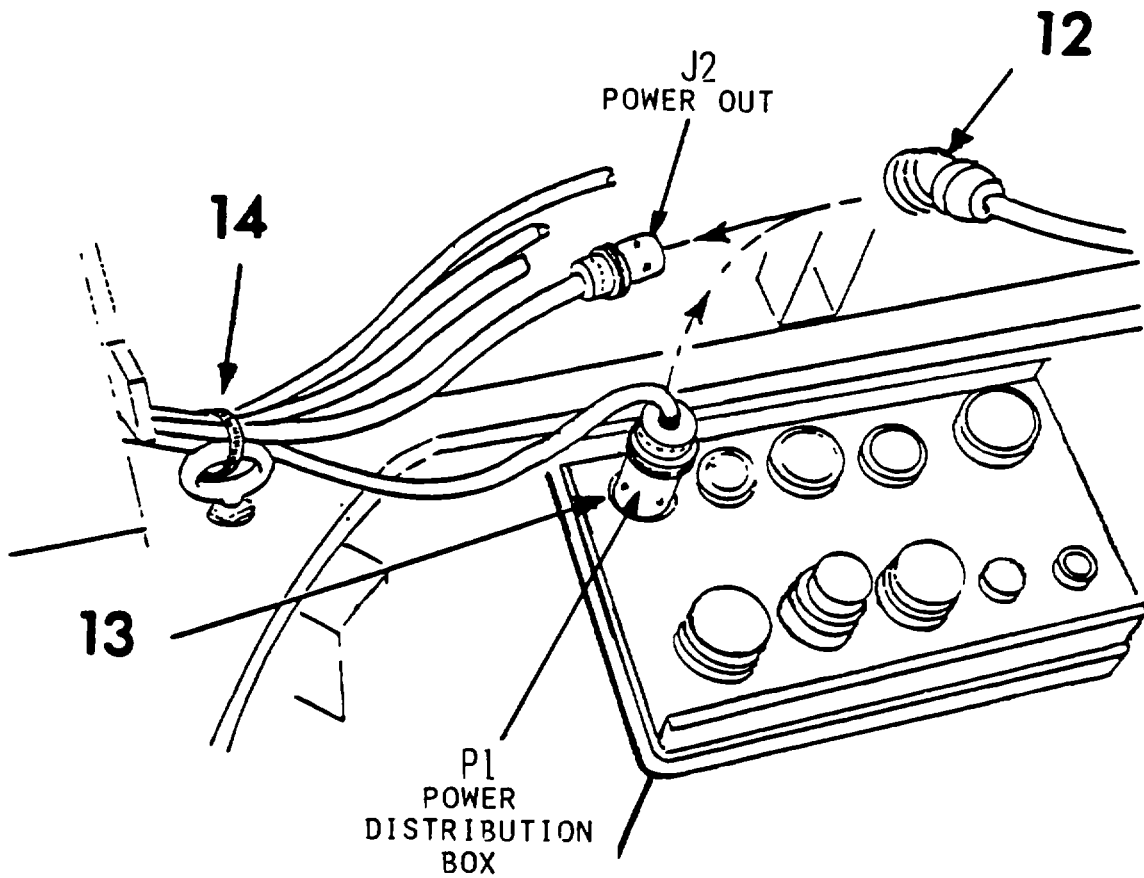
Route cable assembly upwards and close rear ammunition storage unit door. Make sure door is not bent and does not pinch cables (5).

Route cable assembly between ammunition storage unit and power supply unit (6). Temporarily lay remaining cables on gunner's seat (7).

Locate cable connector labeled P6 CVKI. Route up ammunition storage unit side toward CVKI (8).

Attach P6 to CVKI connector (9). Secure to forward CVKI clamp (10) with cable tie.

Secure cable assembly to slot on CVKI clamp with cable tie (11).



Connect cable assembly to eye on left side of turret using cable tie (14).

Disconnect gun cable connector W3 (12) from terminal J5 (13) on distribution box.

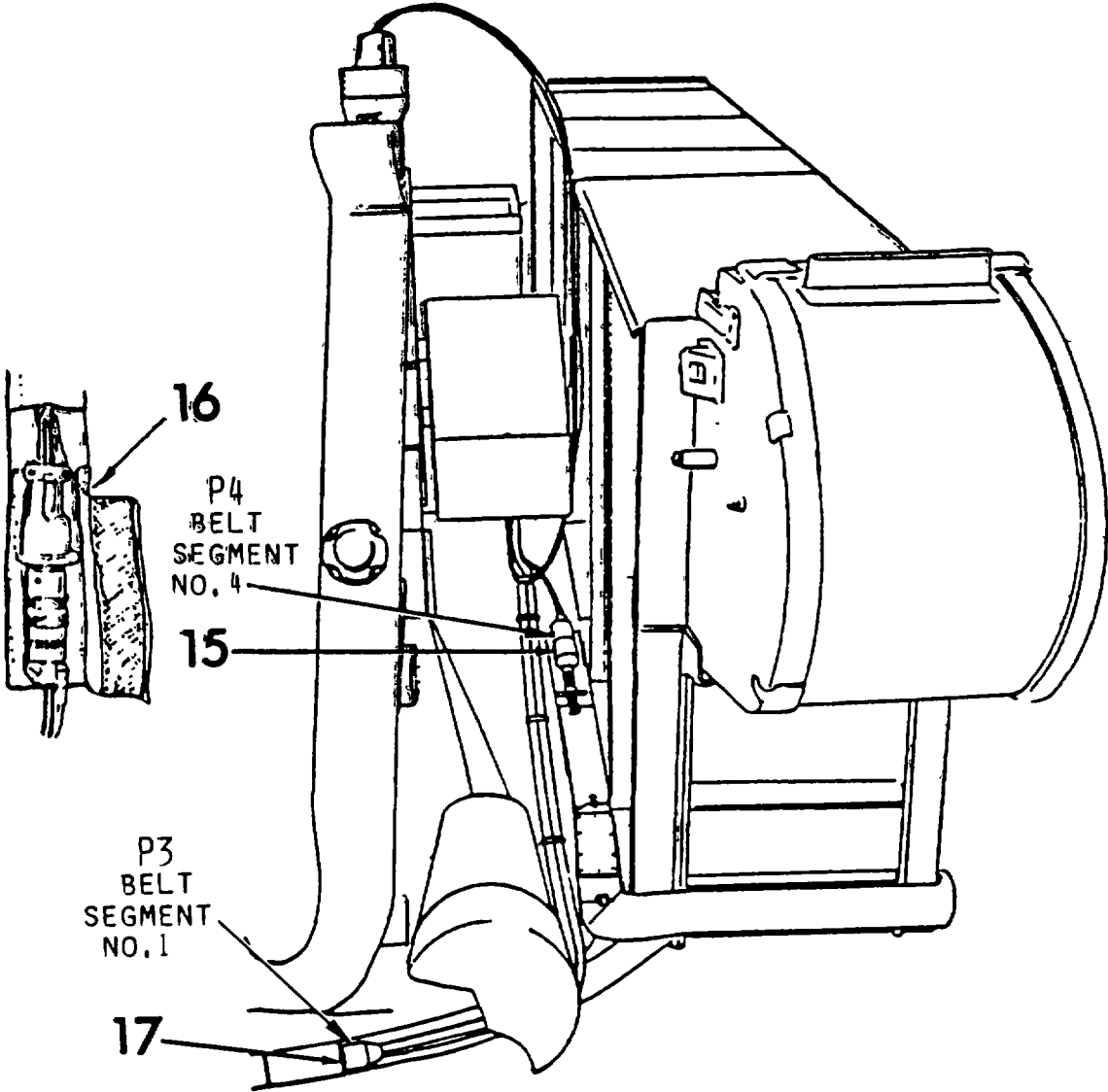
Locate connector labeled J2 POWER OUT on Detection Cable Assembly.

Connect J2 to gun cable connector W3 (12).

Locate connector labeled P1 POWER DISTRIBUTION BOX on Detection Cable Assembly.

Connect P1 to terminal J5 (13) on distribution box.

Cabling Task 3: Install Detection Cable Assembly (Cont).

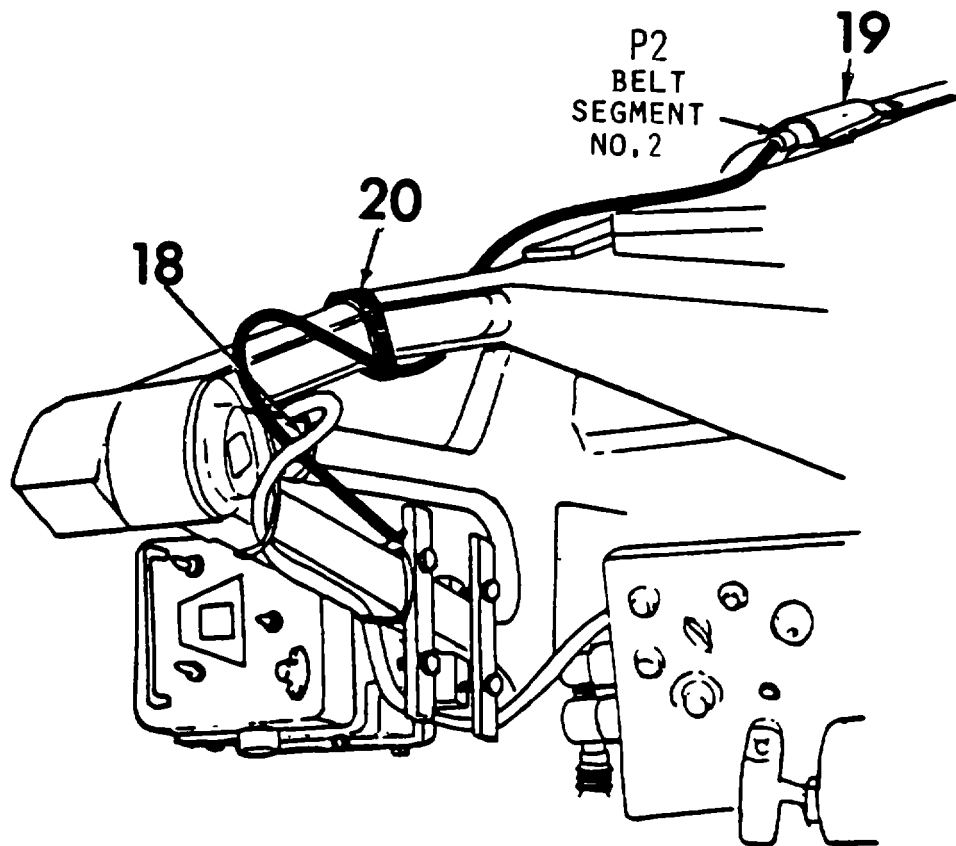


Locate connector labeled P4 BELT SEG No. 2 on Detection Cable Assembly Route cable under ICA and forward alongside ammunition storage unit. Attach to connector (15) on left side belt. Connector is located on top of gun base between ammunition storage unit and equilibrator.

Secure connectors under protective flap (16).

Locate cable connector labeled P3 BELT SEG No. 1 on Detection Cable Assembly Route forward under ICA and between equilibrator and ammunition storage unit. Attach P3 to connector (17) on right side belt. Connector is located on front edge of gun platform below left equilibrator. Press connector against fastener tape on gun platform edge.

Secure connectors under protective flap (16).



Manually raise gun to maximum elevation.

Locate connector labeled P2 BELT SEG No. 2 on Detection Cable Assembly.

Route cable under ICA and up outboard side of left pivot arm bracket.

Route cable inside bracket arm and under sight cable (18) towards top arm.

Route forward along bottom of top arm towards connector on front detector belt.

Attach P2 to belt connector (19). Connector is located on top of forward left pivot arm.

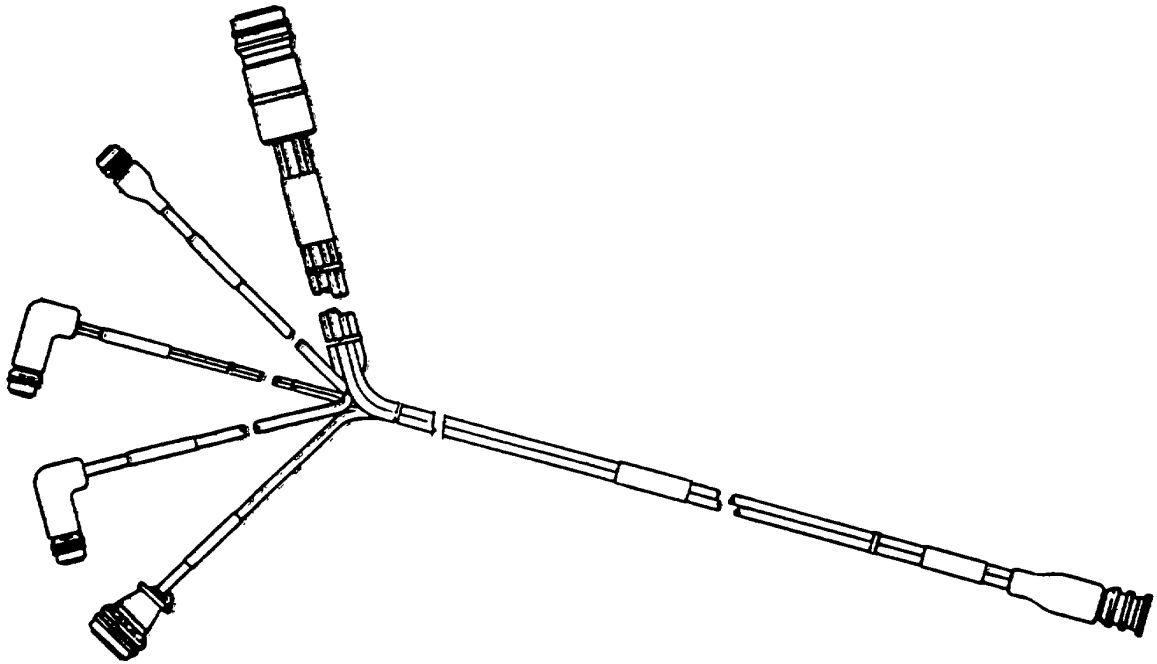
Secure cable to top arm near pivot point with cable tie (20).

#### CAUTION

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**Manually lower and raise gun to ensure cables do not bind.  
Adjust as required.**

---

**Cabling Task 4: Inspect Logic Cable Assembly.**

Find cable assembly labeled LOGIC.

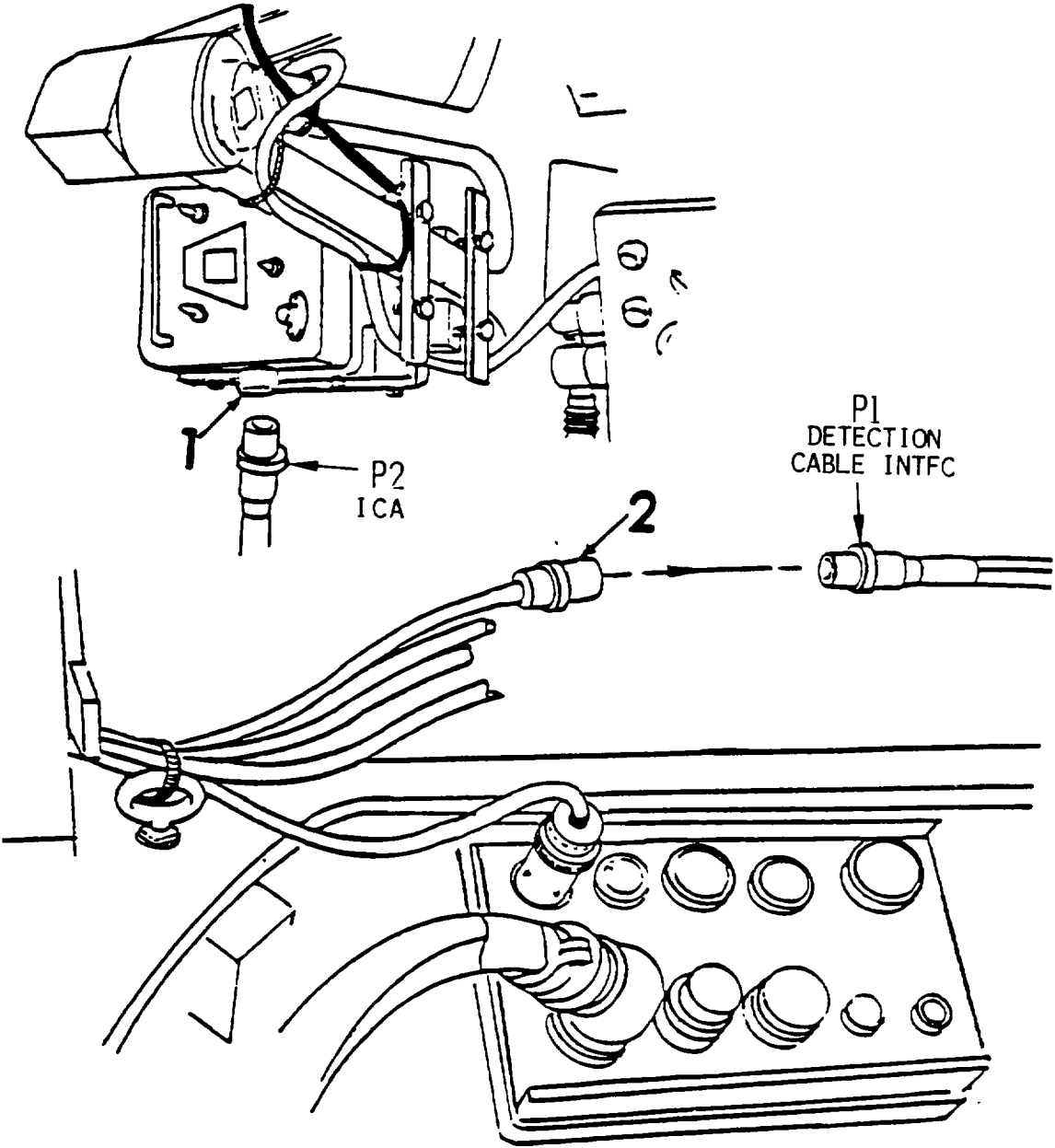
Check each cable for worn insulation and bare wires.

Each connector should have a label showing where it goes.

Check all connectors for obvious damage.

Report any damage on DA Form 2404. Replace cable assembly if damaged.

Cabling Task 5: Install Logic Cable Assembly.



Place cable assembly inside turret on gunner's seat.

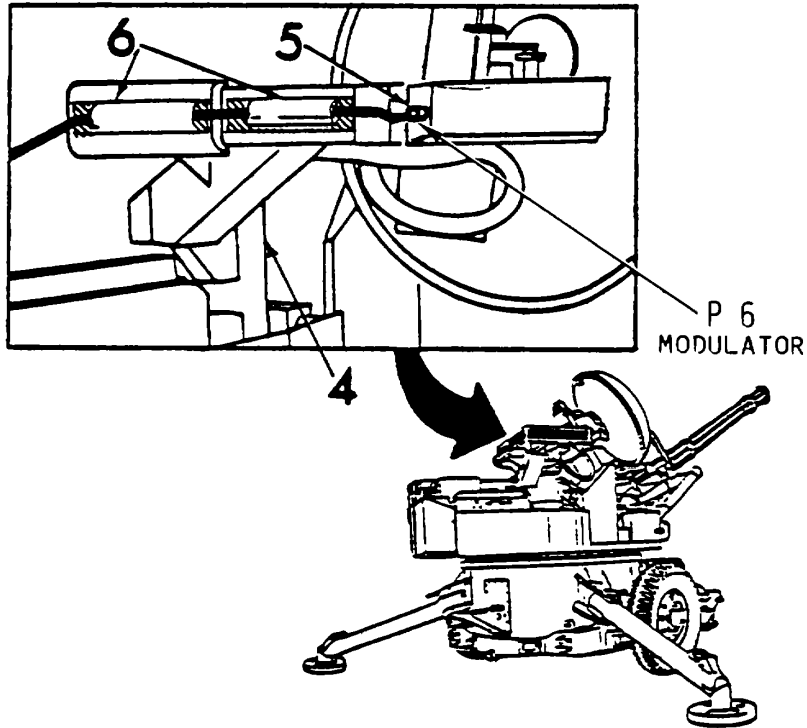
Locate cable connector labeled P2 ICA.

Attach P2 to connector J1 (1) on Interface Control Assembly.

Locate connector labeled P1 DETECTION CABLE INTFC on Logic Cable Assembly.

Attach P1 to connector J1 (2) on Detection Cable Assembly Detection cable connector J1 is located in vicinity of power distribution box.

**Cabling Task 5: Install Logic Cable Assembly (Cont).**



Locate cable labeled P6 MODULATOR.

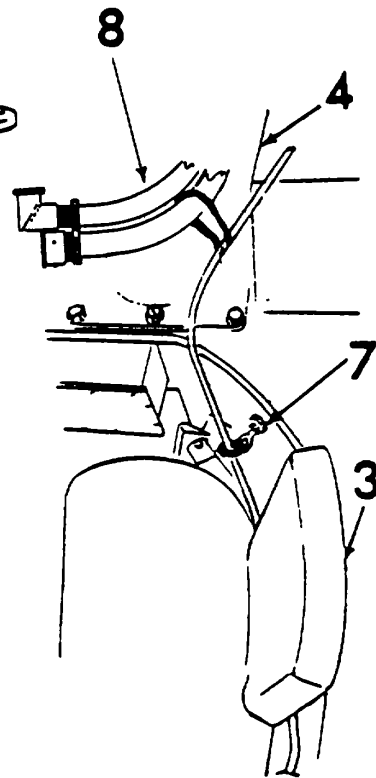
Route cable behind and under seat (3), up inside turret wall and up radar antenna mast (4).

Attach P6 to connector (5) on modulator.

Press pads (6) on cable against fastener tape on side of waveguide guard.

Attach cable to rings (7) inside turret using ties on cable.

Attach cable to antenna power cables (8) using tie on cable.



VULCAN INSTALLATION

Remove gunner's seat.

Locate cable labeled P5 SIGHT CURRENT GENERATOR.

Remove protective cover (9) from A21J7 on sight current from generator.

Route cable to right under gunner's control panel.

Use ties (11) to secure cable to vehicle cable on hardware to under control panel.

Connect P5 to vehicle A21J7 (10) connector on sight current generator

PIVADS INSTALLATION

Remove gunner's seat.

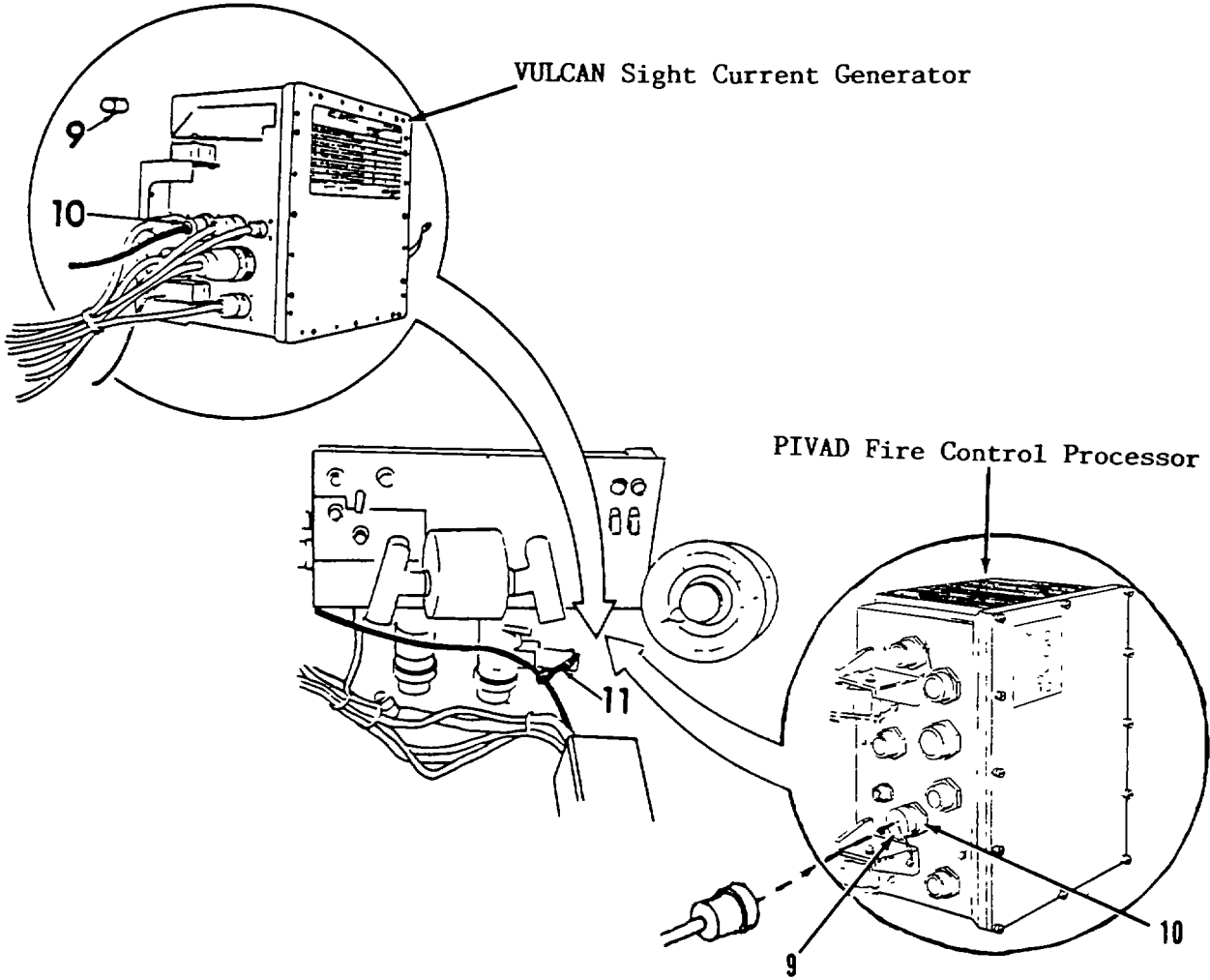
Locate cable labeled P5 SIGHT CURRENT GENERATOR.

Route Protective cover (9) A21J3 on Fire Control Processor.

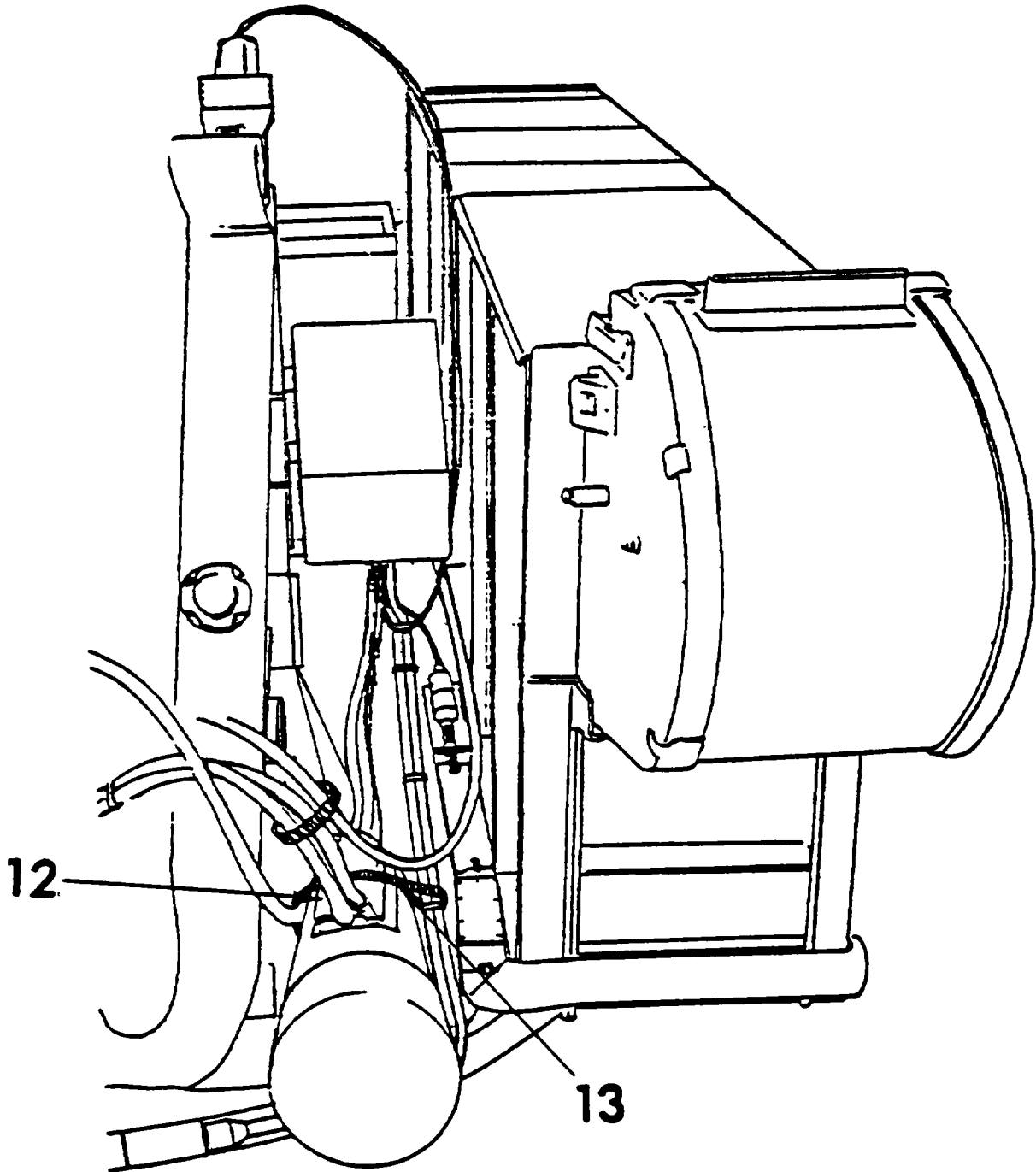
Route cable to right under gunner's control panel.

Use ties (11) to secure cable to vehicle cable on hardware control panel.

Connect P5 to vehicle A21J3 (10) connector on fire control processor.





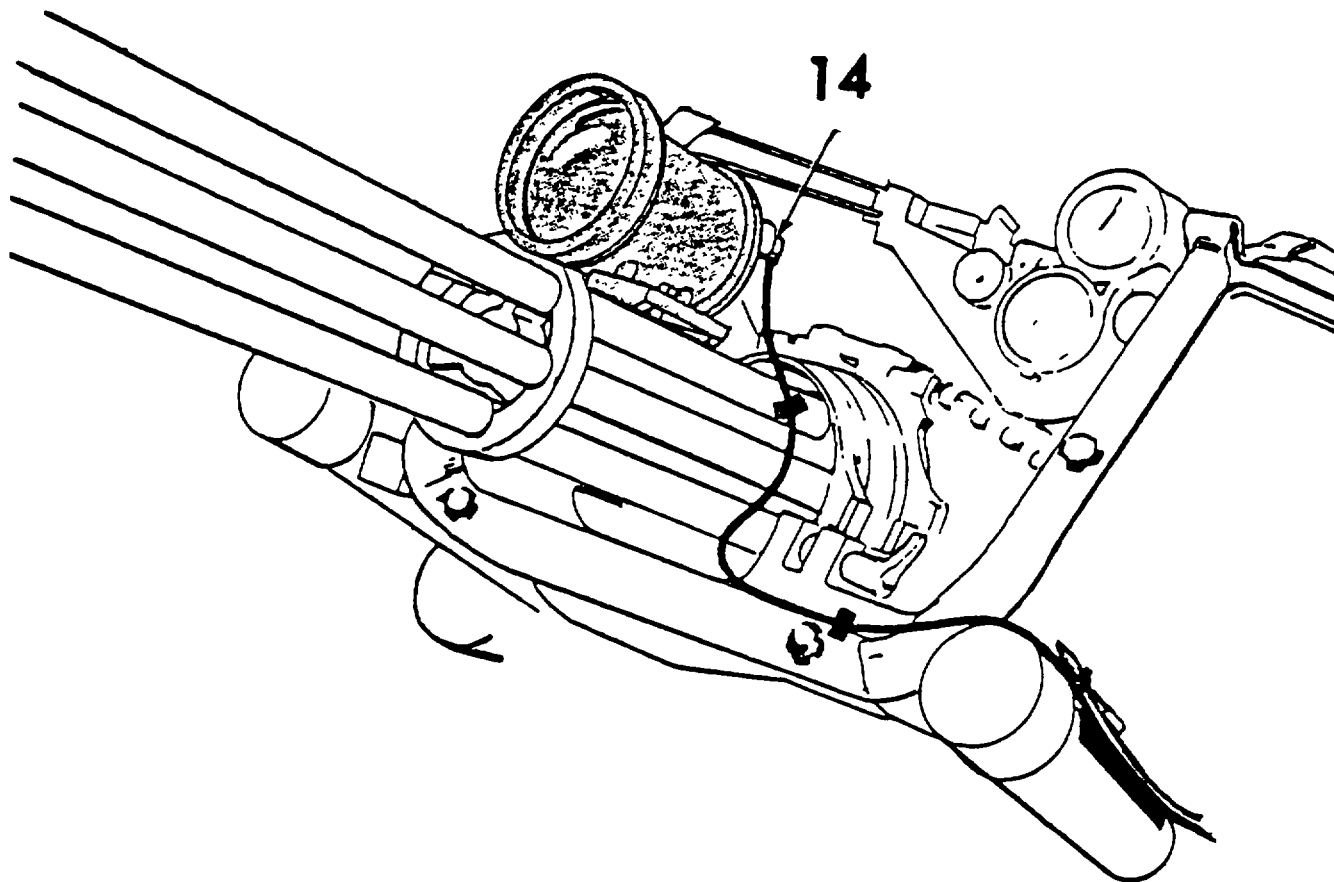
**Cabling Task 5: Install Logic Cable Assembly (Cont).**

Locate cable connectors labeled P3 MIC and P4 AWESS.

Route cables forward between ICA and ammunition storage unit.

Press pad (12) on cable P4 against fastener tape on left equilibrator.

Tie unused P3 connector on logic cable to equilibrator with cable tie (13).



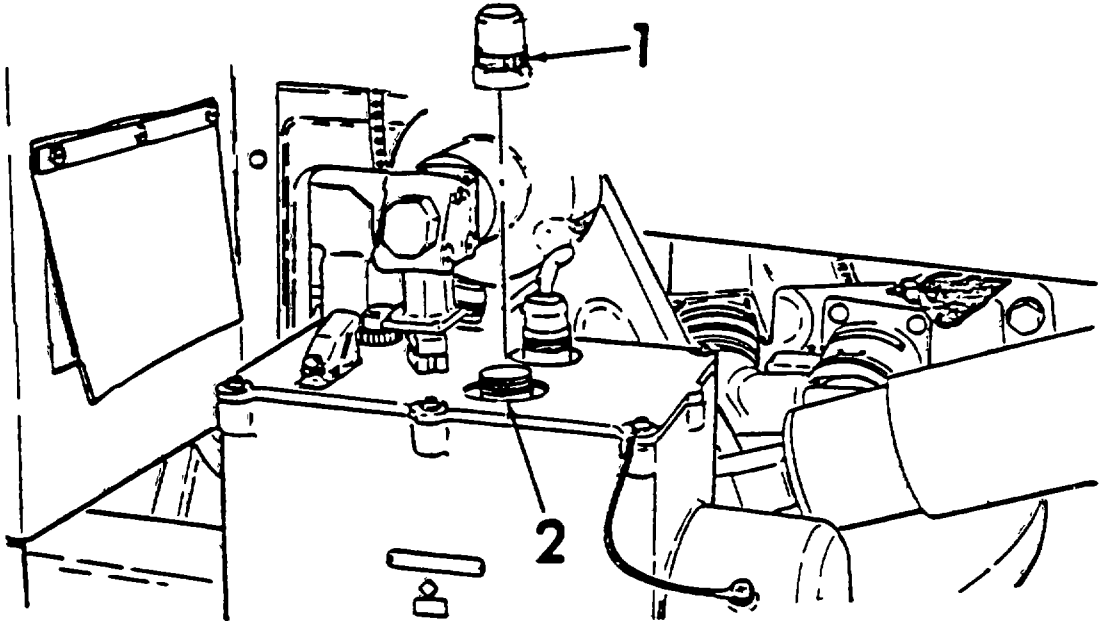
Route cable P4 over gun barrels to rear of FLASHWESS.

Attach P4 to connector on rear of FLASHWESS (14).

Manually elevate and depress gun to check that all cables are free and not binding. Reposition cables as necessary.

Reinstall gunner's seat.

Cabling Task 6: Install Arming Connector.



Install arming connector (1) on firing interrupter J2 terminal (2).

## INITIAL ADJUSTMENTS, DAILY CHECKS AND SELF TEST

## ALIGNMENT TASKS - LIST

<u>Task</u>	<u>Title</u>	<u>Page</u>
1.	Good visibility. Used when there is good visibility for at least 2500 meters.	2-60
2.	Poor visibility. Used when visibility is limited to under 2500 meters.	2-62

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**WARNING**

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**If task requires Vehicle and/or MILES Equipment Power to be turned ON, ensure Vehicle and/or MILES Equipment Power is turned OFF upon completion of task. Failure to comply may result in Personal Injury or Equipment Damage.**

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**NOTE**

**Perform either Task 1 or Task 2 depending on visibility conditions.**

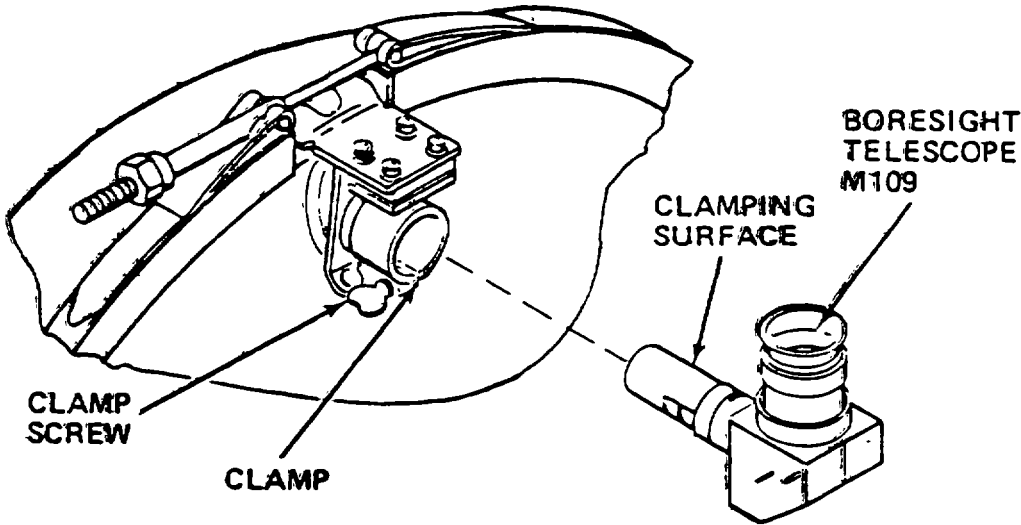
**Alignment Task 1: Good Visibility.**

THIS TASK IS THE SAME FOR BOTH THE ORIGINAL AND UPDATED BORESIGHT TELESCOPE MOUNTING BRACKET.

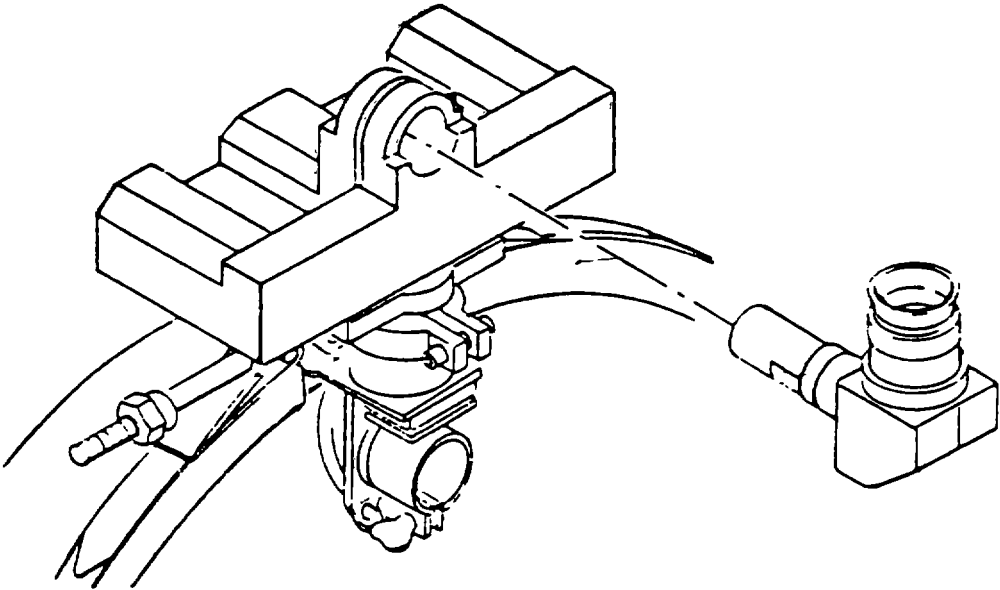
**NOTE**

**VULCAN ROR AND GUNNER SIGHT MUST BE BORESIGHTED.**

Perform normal VULCAN Boresight tasks for good visibility as described In TM 9-1005286-10.



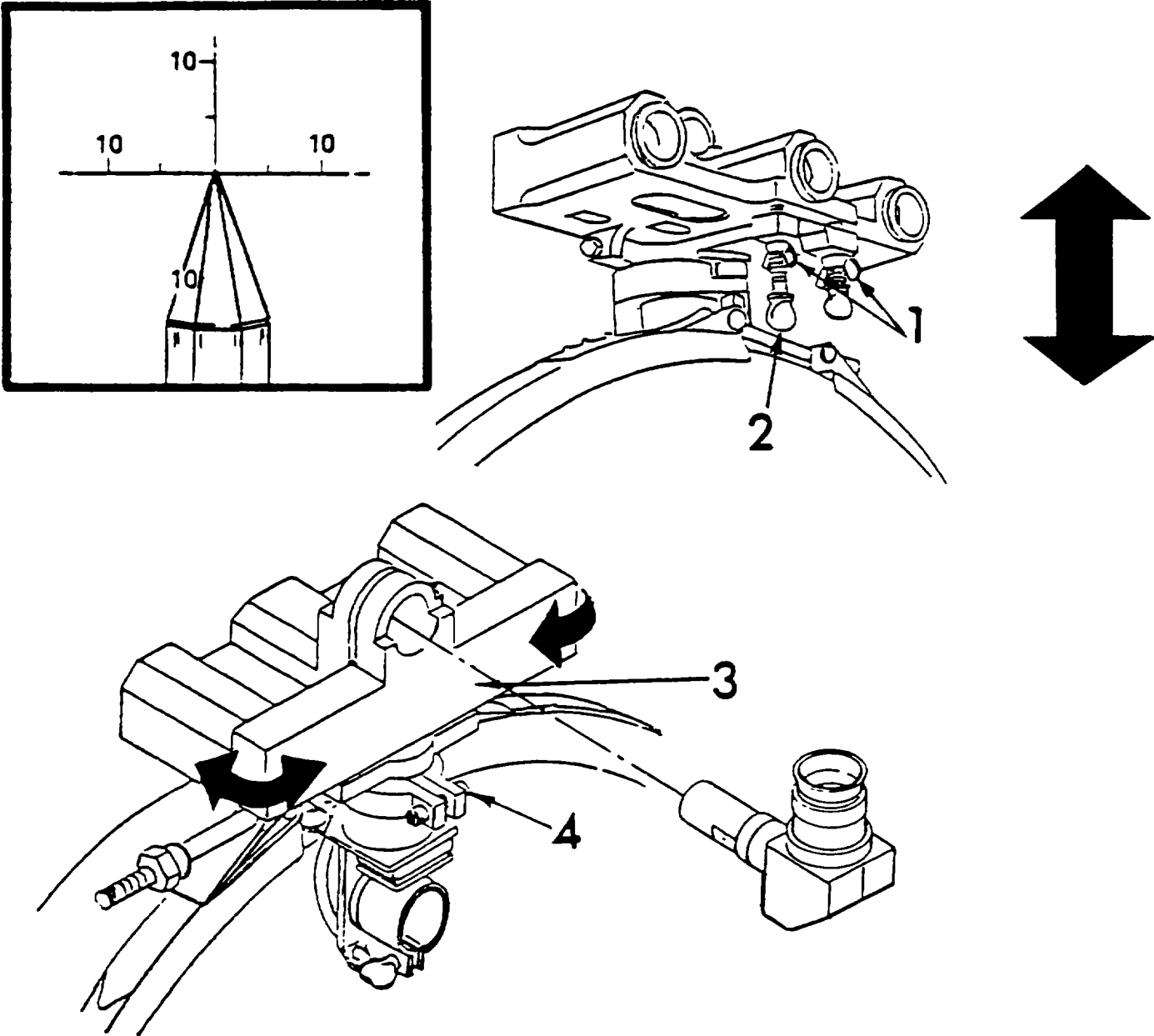
Remove M109 boresight telescope from ROR boresight telescope clamp.



Install M109 boresight telescope in mount on top of laser transmitter.

Set boresight target at a range of approximately 2500 meters.

Turn on system power. Select RADAR mode.



Sight through telescope mounted on laser transmitter. Using elevation and transmitter base rotation (azimuth) adjustments, align laser transmitter to ROR and VULCAN sight M134 aiming point. Unlock wing nuts (1). For elevation adjustment use thumbscrews (2), starting at lowest setting. Lock elevation with wing nuts (1). For azimuth adjustment rotate transmitter (3) atop spacer. Lock azimuth with screw (4).

Remove telescope from laser transmitter after boresighting is completed.

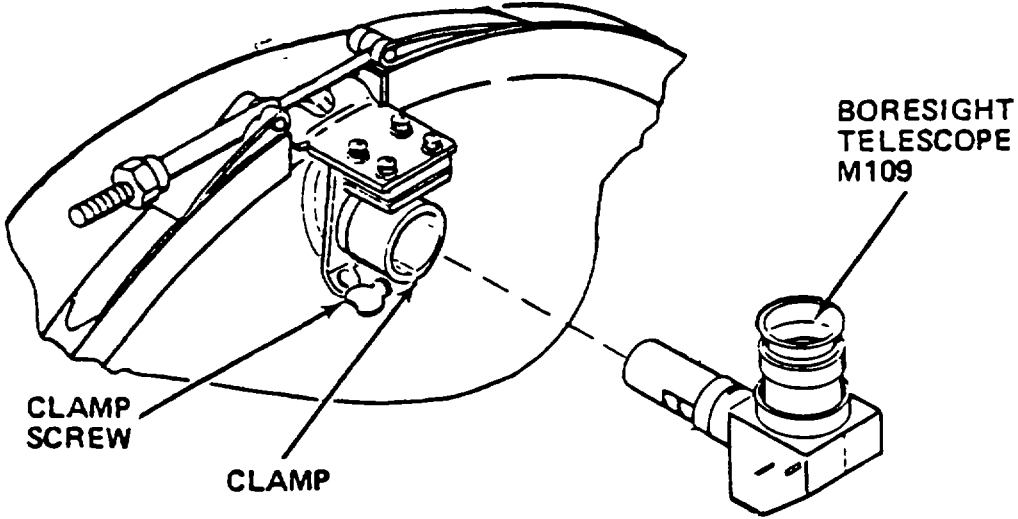
**Alignment Task 2: Poor Visibility.**

THIS TASK IS THE SAME FOR BOTH THE ORIGINAL AND UPDATED BORESIGHT TELESCOPE MOUNTING BRACKET.

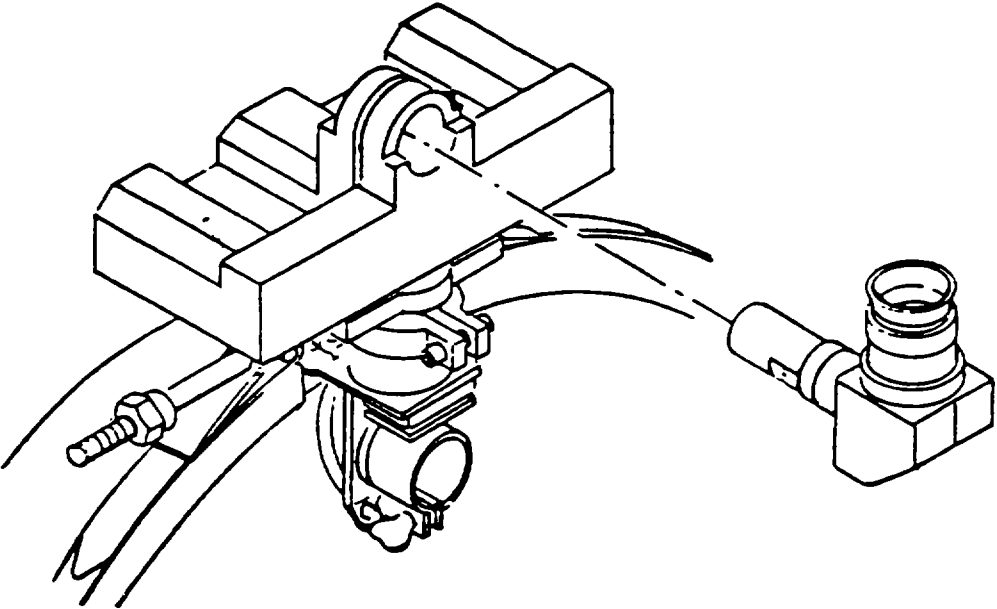
**NOTE**

**VULCAN ROR AND GUNNER SIGHT MUST BE BORESIGHTED.**

Perform normal VULCAN boresight tasks for poor visibility as described in TM9-1005-286-10.



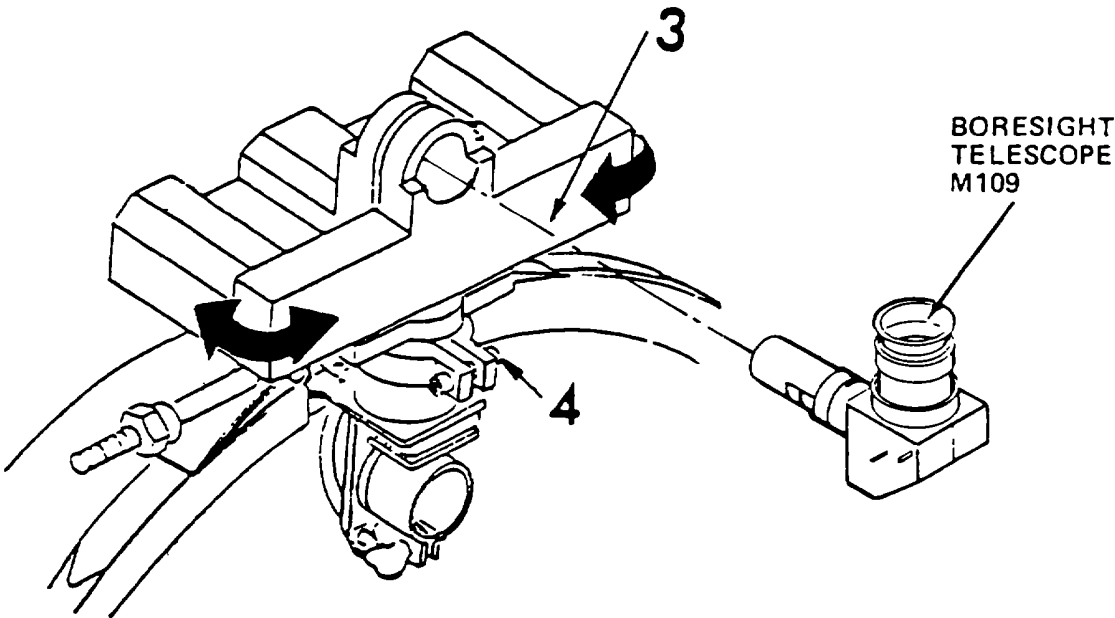
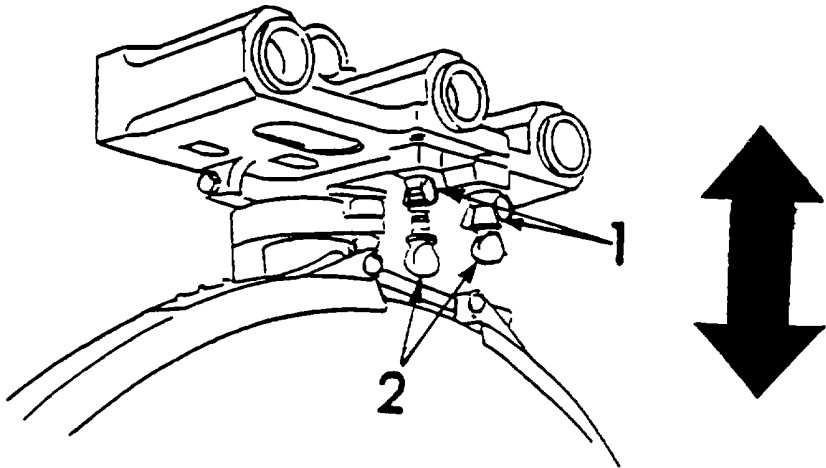
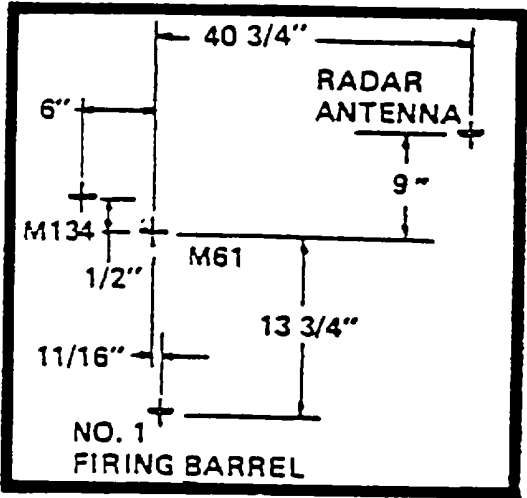
Remove M109 boresight telescope from ROR boresight telescope clamp.



Install M109 boresight telescope in mount on top of laser transmitter.

Set boresight target at a range of approximately 25 meters (34 paces).

Turn on system power. Select RADAR mode.



Sight through telescope mounted on laser transmitter. Using elevation and transmitter base rotation (azimuth) adjustments, align laser transmitter on radar antenna cross on target card. Unlock wing nuts (1). For elevation adjustment use thumbscrews (2), starting at lowest setting. Lock elevation with wing nuts (1). For azimuth adjustment rotate transmitter (3) atop spacer. Lock azimuth with screw (4). Remove telescope from laser transmitter after boresighting is completed.



<u>Tasks</u>	<u>Title</u>	<u>Page</u>
1.	CIA/CVKI Test	2-64
2.	Detector Belt Test	2-66
3.	ICA Test	2-67
4.	VULCAN Transmitter Test	2-69

**NOTE**

Perform these tasks in the order given.

**WARNING**

If task requires Vehicle and/or MILES Equipment Power to be turned ON, ensure Vehicle and/or MILES Equipment Power is turned OFF upon completion of task. Failure to comply may result in Personal Injury or Equipment Damage.

**Test Task 1: CIA/CVKI Test.**

**NOTE**

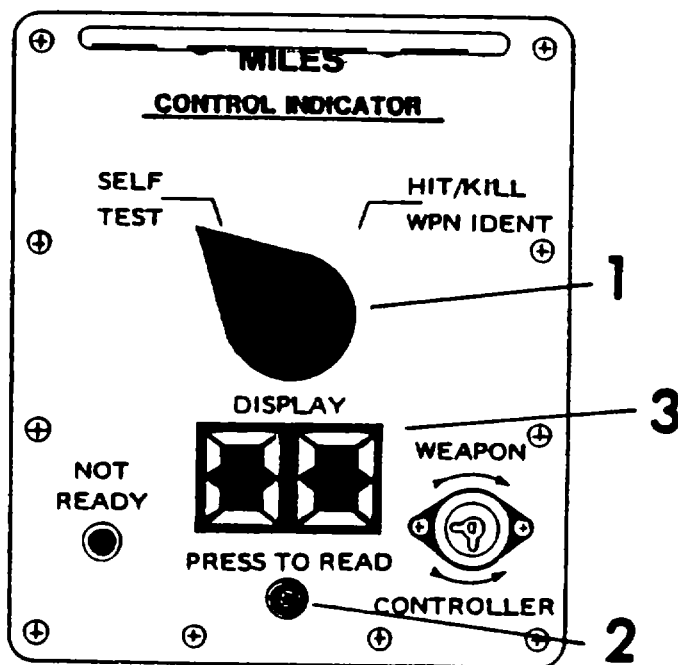
Before doing this task check with your gun crew chief to make sure all Outside and Cabling Tasks have already been done.

Turn gun SYSTEM POWER switch ON.

Turn Control Indicator Assembly switch (1) to SELF TEST.

Press display button (2) on Control Indicator Assembly (CIA). Display (3) should show 00.

If display does NOT show 00, go to Troubleshooting, page 3-1.



Ask Controller to reset system by inserting his Green Key in key receptacle (4) on Control Indicator Assembly. Turn to CONTROLLER. Turn back and remove key.

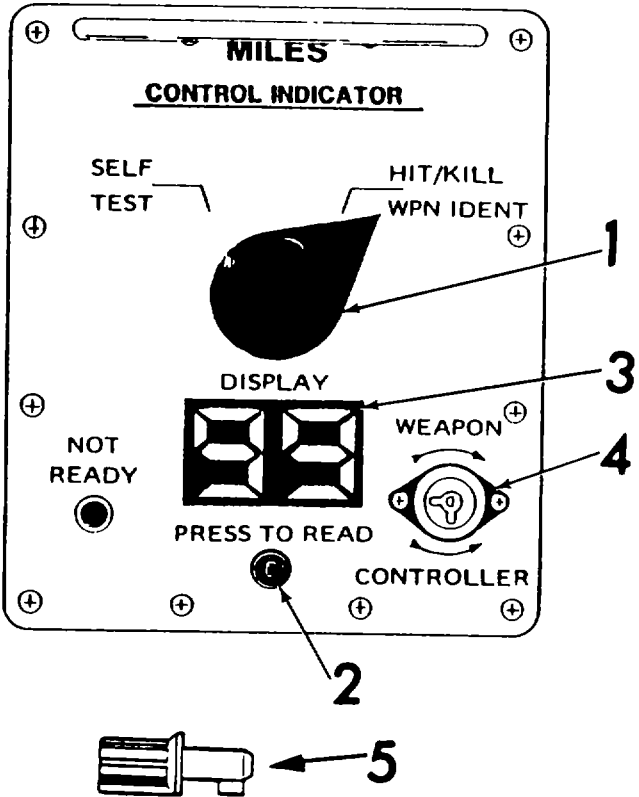
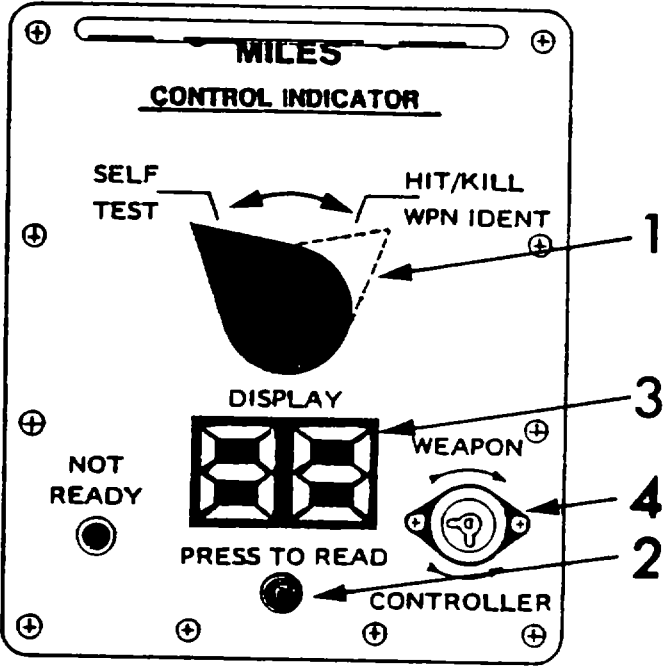
Turn CIA switch (1) to HIT/KILL. Then turn to SELF-TEST. Press display button (2). Display (3) should show 88.

If display does not show 88, go to Troubleshooting, page 3-1.

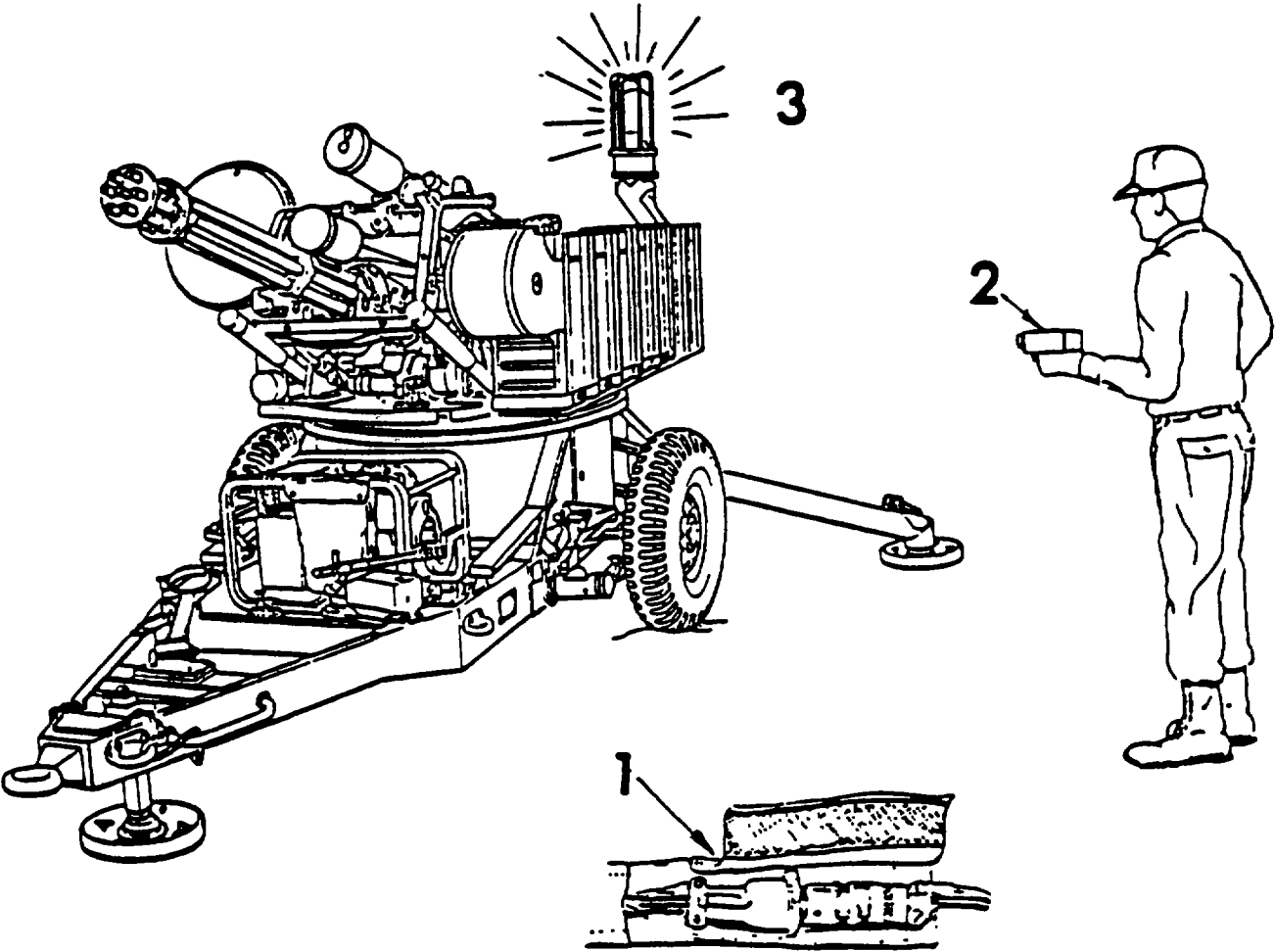
Turn CIA switch (1) to HIT/KILL. Insert Orange Weapon Key (5) into Control Indicator Assembly key receptacle (4). Turn key clockwise then turn key back and remove. Verify that CVKI light flashes continuously. Press display button (2). Verify display (3) shows 99.

If CVKI does not flash, go to Troubleshooting, pages 3-14, 3-52, 3-53, and 3-54.

Ask Controller to reset system.



Test Task 2: Detector Belt Test.



Check that all cable connections (1) to detector belt segments are tight.

Ask Controller to test your belt segments by aiming controller gun (2) at a detector and firing in "NEAR MISS" mode from a distance of 3 to 5 feet. Each time he does, CVKI vehicle light (3) should flash.

Test each belt segment by firing at all detectors.

If the CVKI fails to flash for some or all of the detectors, go to Troubleshooting, pages 3-14, 3-52, 3-53, and 3-54.

**NOTE**

**It is OK for one detector on each belt segment to be bad.**

Test Task 3: ICA Test.

**WARNING**

Ensure VULCAN cannon motor connector W3P3 is disconnected.

Turn VULCAN system power ON, Ground Mode.

Check ICA:

- NOT READY light (1) should be ON
- ROUNDS DISPLAY (2) should read 00 when moving rounds display switch to both TOTAL and READY

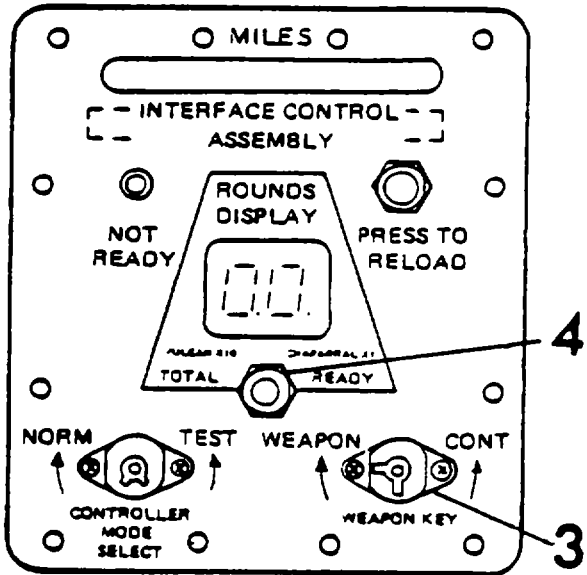
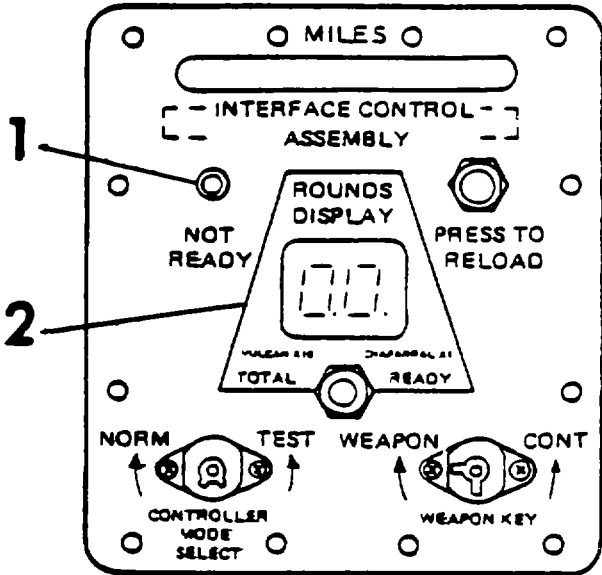
If display shows a number other than 00 or is blank; go to Troubleshooting, pages 3-3, 3-4, 3-15, 3-16, 3-17, and 3-18.

Ask Controller to reset system by inserting Controller (Green) Key in key receptacle (3) on ICA. Turn to CONT. Turn back and remove key.

Verify on ICA using TOTAL/READY toggle switch (4):

ROUNDS DISPLAY:

TOTAL 20  
 READY 5



**Test Task 3: ICA Test (Cont).**

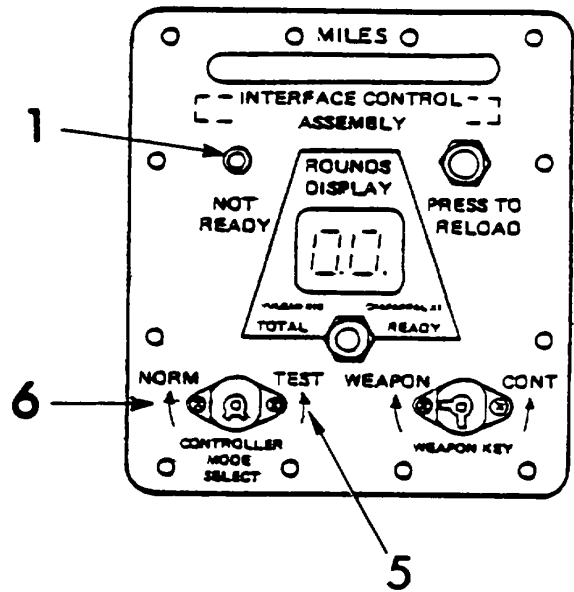
Ask Controller to:

- Reset ICA
- Select TEST MODE (6)

Insert orange Weapon Key into ICA receptacle and rotate clockwise.

(If Controller and Weapon Key functions are not performed NOT READY indicator (1) will light on ICA).

Turn Gun Power ON.



Aim VULCAN weapon at MILES-equipped vehicle or MILES Controller supplied MILES target. Squeeze VULCAN trigger and action switches.

When firing, note two decimal points on ICA ROUNDS DISPLAY. This indicates laser fire. Strobe flash in boresight target indicates laser hit.

Verify ROUNDS DISPLAY on ICA decreases after firing is completed.

**NOTE**

**The M134 sight, ROR antenna, and laser transmitter may require re-adjusting after firing the laser transmitter at the boresight target.**

Ask Controller to select NORM MODE (5). Squeeze VULCAN trigger and action switches. Verify FLASHWESS flashes.

Turn System power and Gun power OFF.

**Test Task 4: VULCAN Transmitter Test.**

THIS TASK IS THE SAME FOR BOTH THE ORIGINAL AND UPDATED VERSIONS OF THE BORESIGHT TELESCOPE MOUNTING BRACKET.

**NOTE**

**The target utilized for the VULCAN Transmitter Test must be at a distance of at least 1500 meters. Any suitable target may be used, however, it is recommended that the MILES Multiple Range Alignment Device, (MMRAD) be used for any laser transmitter testing.**

Set up MMRAD at a range of at least 1500 meters.

Install four BA-200/U batteries (1).

Turn INDICATOR SELECT switch (2) to LONG RANGE.

Unlatch hinged panel assembly (3) and place in the DOWN position.

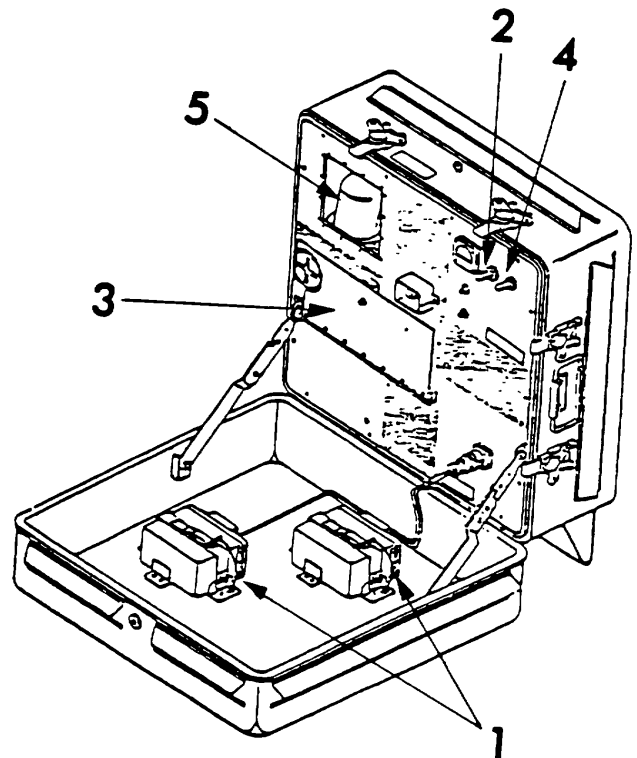
Turn POWER switch (4) ON.

Aim and fire VULCAN mounted transmitter at the center of the MMRAD.

The strobe light (5) on the MMRAD will flash each time a laser pulse from the laser transmitter is received.

If the strobe light fails to flash, check the transmitter alignment and retest.

If the strobe light fails to flash after realignment, the transmitter boresight procedure on page 2-60 and 2-62 should be followed and the transmitter retested.



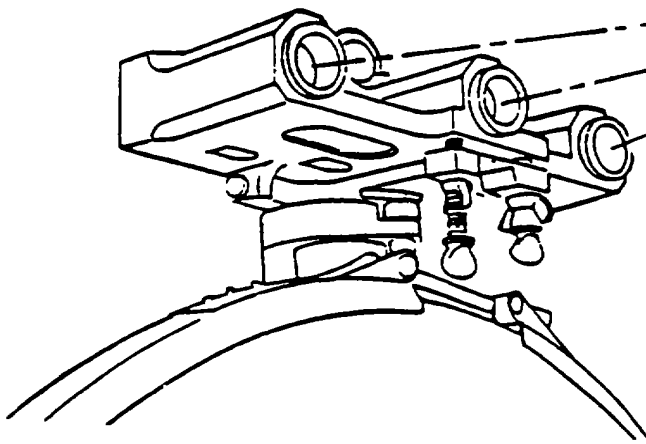
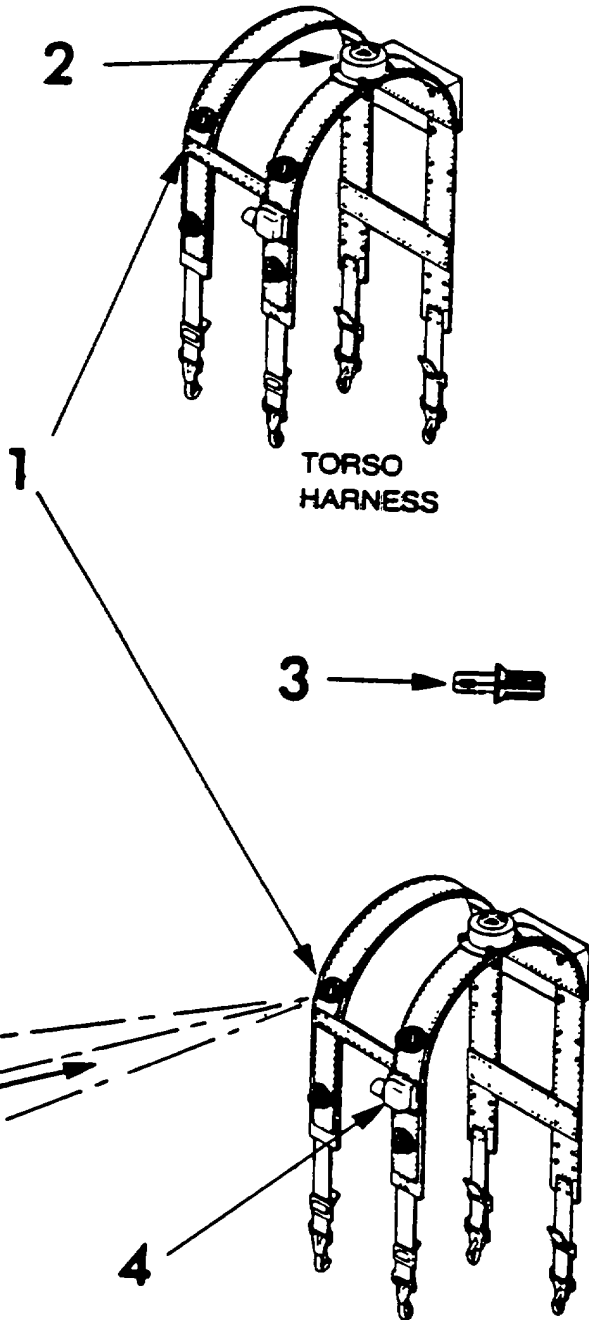
**Test Task 4: VULCAN Transmitter Test (Cont).**

If the strobe light does not flash after reboresighting the transmitter and retesting, substitute a Man Worn Laser Detector (MWLD) Torso Harness for the MMRAD, and repeat the test.

**NOTE**  
MWLD Torso Harness is supplied with the MILES 113 APC System. Align a detector (1) on the Torso Harness in front of the transmitter and retest. An alarm

(2) on the harness should sound. **NOTE**  
The MWLD Torso Harness alarm is silenced by inserting a MILES supplied yellow key (3) into the key receptacle (4) on the harness and turning the key in a counterclockwise direction.

If there is still no "HIT" indication, ask Controller to check out equipment and reset the CONTROLLER MODE SELECT Switch.



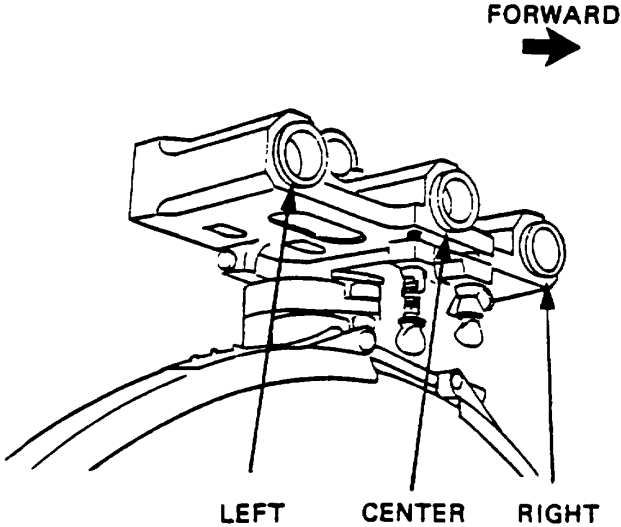
If there is a "HIT" indication, repeat the firing test while covering Center and Left Laser Tubes (1) with a helmet, hand, or any other opaque material. Note whether there is or is not a "HIT" indication.

Repeat firing test while covering the Center and Right Laser Tubes (2). Note whether there is or is not a "HIT" indication.

Repeat firing test while covering the Left and Right Laser Tubes (3). Note whether there is or is not a "HIT" indication.

If a "HIT" indication was received for each of the test conditions, all Laser Tubes are firing correctly.

If a "HIT" indication was not received for each of the test conditions, go to Troubleshooting, pages 3-7 through 3-9 or 3-27 through 3-34.



**HIT INDICATION**

	LEFT	CENTER	RIGHT	YES	NO
1	*	*	*		
2	*	*			
3		*	*		
	*		*		



## OPERATING PROCEDURE

## OPERATIONAL TASKS - LIST

<b>Task</b>	<b><u>Title</u></b>	<b><u>Page</u></b>
1.	Air Defense Operation	2-73
2.	Observing Your Target	2-75
3.	Recognizing Enemy Fire	2-76
4.	Resetting After a "KILL"	2-78

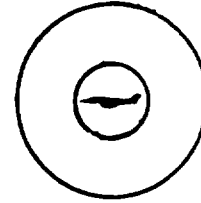
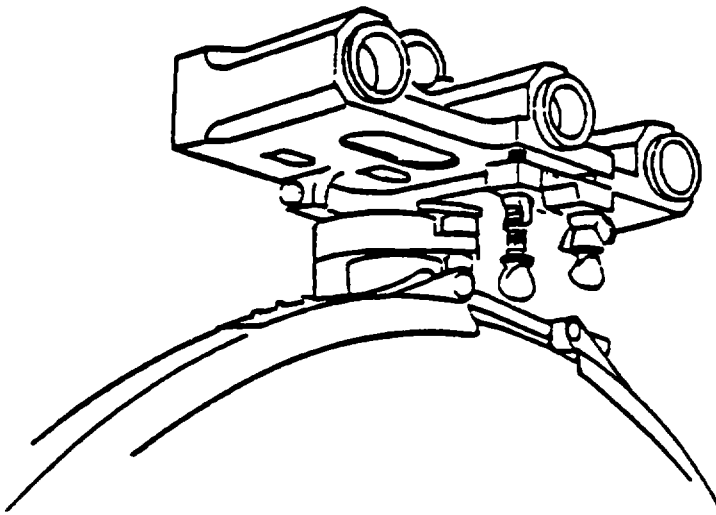
**NOTE**

Perform Test Tasks (page 2-64) daily.

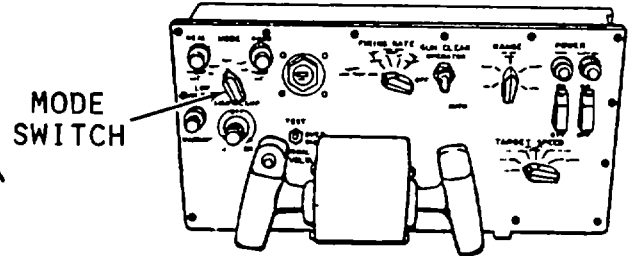
**WARNING**

If task requires Vehicle and/or MILES Equipment Power to be turned ON, ensure Vehicle and/or MILES Equipment Power is turned OFF upon completion of task. Failure to comply may result in Personal Injury or Equipment Damage.

Operational Task 1: Air Defense Operation.



AIRBORNE TARGET



VULCAN CONTROL ASSEMBLY

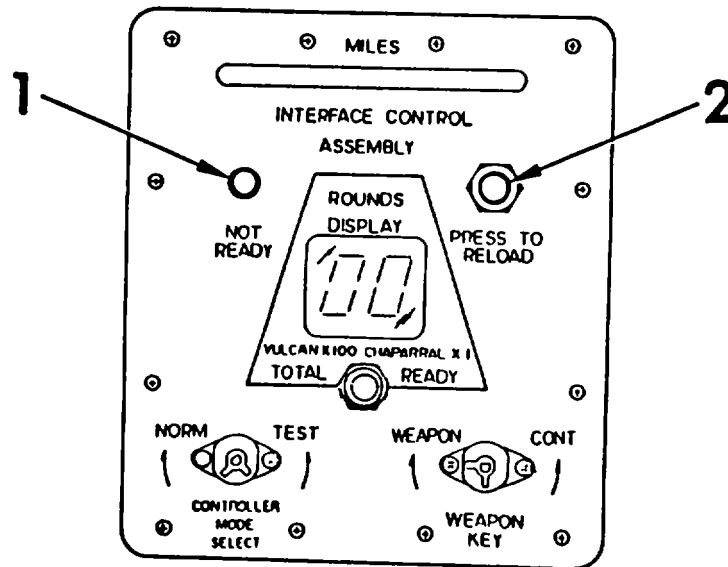
Place VULCAN MODE switch in RADAR MODE.  
Turn radar ON. Allow two minutes warmup.

**NOTE**

**In RADAR MODE, all three laser tubes fire when locked on target. In MANUAL MODE, only center laser tube fires.**

During laser transmitter firing (MANUAL or RADAR mode), when all laser rounds have been expended (ROUNDS DISPLAY is 0) the ICA NOT READY indicator (1) will light.

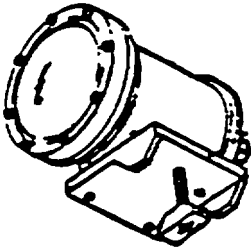
To reload laser transmitter, press PRESS TO RELOAD pushbutton switch (2) on ICA. 100 rounds may be reloaded at a time with a 30-second delay. During reloading ICA NOT READY indicator (1) will light.



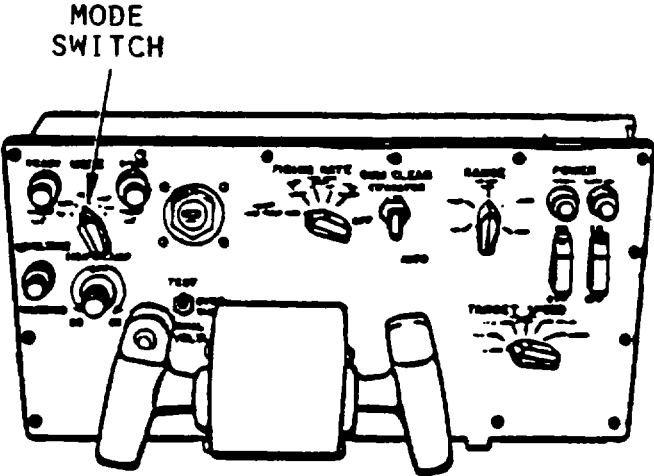
Operational Task 1: Air Defense Operation (Cont).

**NOTE**

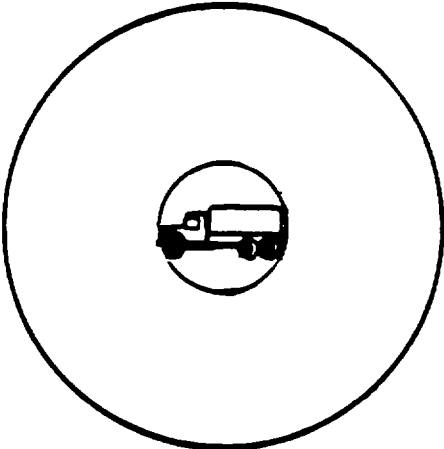
When the laser transmitter is fired, the FLASHWESS lamp will flash approximately 120 flashes per minute.



During MILES exercises the GROUND mode should not be used. Laser firing in the GROUND mode will be INACCURATE. MANUAL mode should be used for ground targets during MILES exercises.

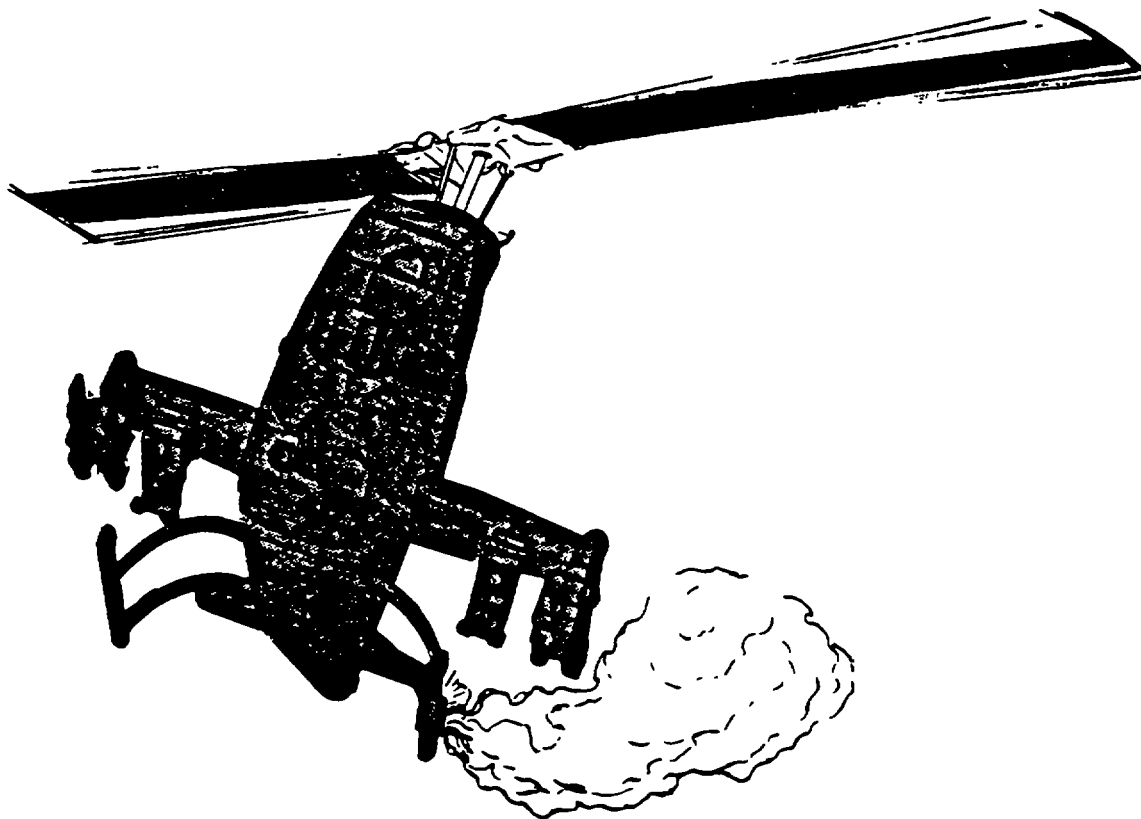


VULCAN CONTROL ASSEMBLY



GROUND TARGET

MILES equipped VULCAN can be fired without activating the FLASHWESS. This is normally only necessary during system testing and/or troubleshooting. The controller must set the system for this "dry fire" or test firing mode.

**Operational Task 2: Observing Your Target.**

The effect of your MILES-equipped weapon fire can be evaluated by observing your target during training exercises.

If detectors are "HIT" by laser fire, strobe lights on vehicles and aircraft will flash continuously and personnel MWLDs will sound. Usually, you will not be close enough to hear alarms. When "KILLED", smoke grenades mounted on some aircraft will discharge yellow smoke.

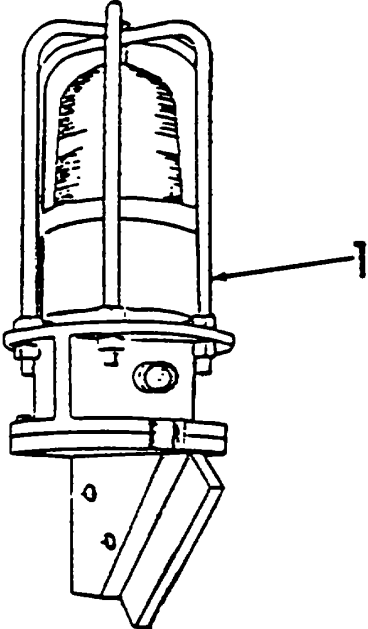
If a vehicle or aircraft is "HIT" but not "KILLED", strobe light alarm flashes four to six times.

If a vehicle or aircraft is "NEAR MISSED", strobe light alarm flashes twice.

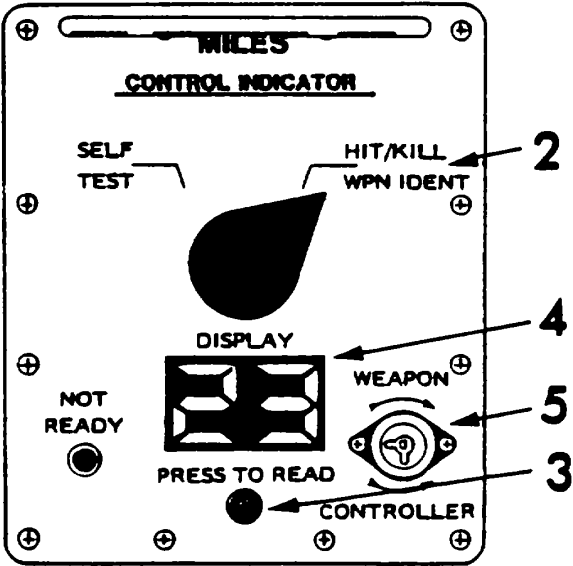
If you "KILL" personnel, soldiers remove yellow keys from laser transmitters and insert in their MWLDs to turn off buzzers.

**Operational Task 3: Recognizing Enemy Fire.**

1. If you are hit by laser fire, CVKI light (1) will flash. A brief alarm (2 CVKI flashes) means a "NEAR MISS." Repeated 4 to 6 CVKI flashes mean a "HIT." Continuous CVKI flashing indicates a "KILL."
2. To determine what kind of weapon has fired on you, turn the switch (2) on the Control Indicator Assembly to HIT/KILL position.
3. Press display button (3).
4. The display (4) will show a number. Use the chart below to match number on display with type of weapon firing on you.

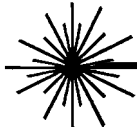


<u>Display Number</u>	<u>Weapon</u>
00	Controller Gun
07	TOW or Shillelagh
08	DRAGON
12	105 mm
13	152 mm
14	2.75 inch Rocket
15	VIPER
16	120 mm
22	25 mm
23	VULCAN
24	M2, M85
99	SELF-KILL



5. "SELF-KILL" results when orange Weapon Key is put in the Control Indicator Assembly receptacle (5) when you have not been "KILLED" by the laser fire. When the key is inserted and turned to WEAPON position, the number 99 will show, and the CVKI light will flash continuously. You must then call the Controller to reset your system.

Operational Task 3: Recognizing Enemy Fire (Cont).



**WARNING**

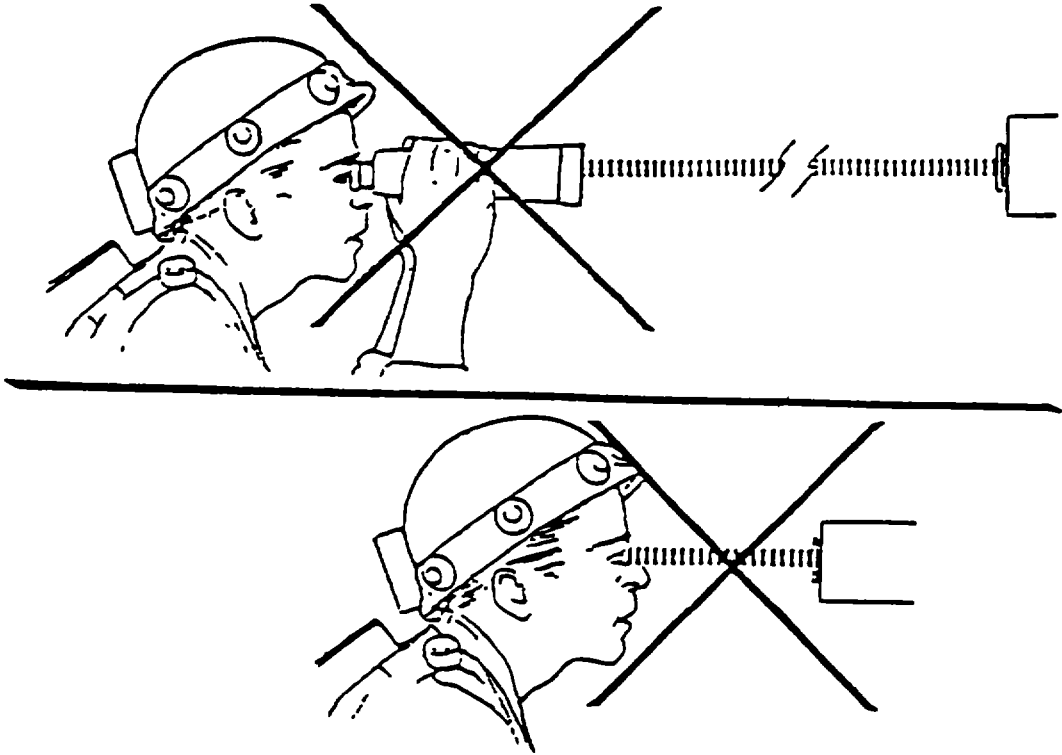
Although the laser light emitted by MILES laser transmitters is considered eye safe by the Bureau of Radiological Health, suitable precautions must be taken to avoid possible eye damage from overexposure to this radiated energy. Precautionary measures include the following.

Avoid viewing laser emitter at close range (less than 12 meters). Increasing the eye-to-laser distance greatly reduces the risks of overexposure.

Avoid viewing emitter directly along optical axis of radiated beam.

Especially avoid viewing emitter through magnifying optics at engagement ranges of less than 75 meters for Stinger, Vulcan, and TOW, and 110 meters for the Chaparral.

Avoid allowing personnel with optics of higher transmission or magnifying power than normal tank optics to view Stinger, Vulcan, or TOW within 150 meters or the Chaparral within 330 meters.



**Operational Task 4: Resetting After a "KILL".**

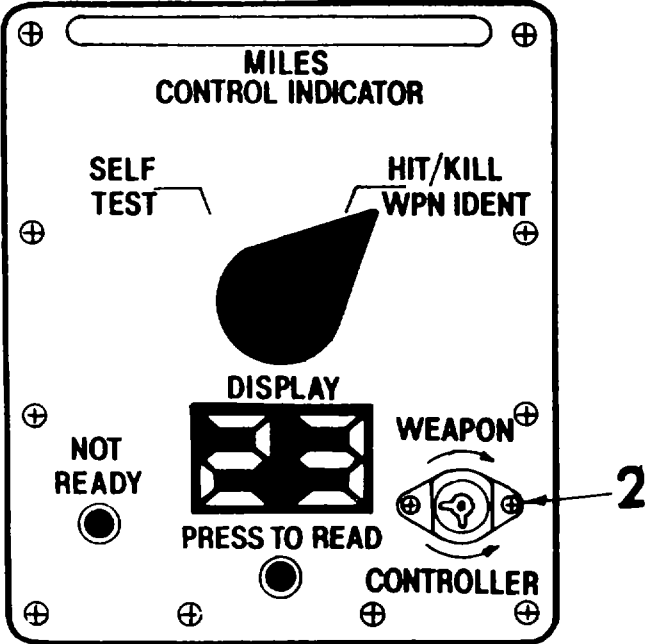
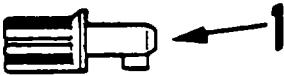
If your gun is "KILLED," the laser transmitter is automatically turned off.

To silence your intercom alarm after a "KILL" use the Weapon (Orange) Key (1).

Insert the weapon key in the Control Indicator Assembly receptacle (2) and turn off the intercom alarm. IF YOU REMOVE KEY FROM RECEPTACLE, THE ALARM WILL BEGIN AGAIN. The CVKI light continues to flash. It can be turned off only by the Controller.

To reset, remove Weapon Key. Alarm will sound. Ask the Controller to turn off your intercom alarm and CVKI light. This resets Control Indicator Assembly.

The Controller will determine when to reset your system.



**POSTOPERATIONAL TASKS - LIST.**

<b><u>Task</u></b>	<b><u>Title</u></b>	<b><u>Page</u></b>
1.	Cabling Postoperational Tasks	2-79
2.	Outside Postoperational Tasks	2-80
3.	Transit Case Packing Instructions	2-81
4.	Return All Equipment	2-81

**Postoperational Task 1: Cable Postoperational Task.**

Disconnect and remove logic cable, See Cabling Task 5.

Disconnect and remove detection cable, See Cabling Task 3.

**NOTE**

**Reconnect vehicle plug W3 to connector J3 on power distribution box.**

Inspect cable assemblies.



**Postoperational Task 2: Outside Postoperational Task.**

Remove and inspect ICA. See Outside Installation Tasks 20 and 21.

Remove Control Indicator Adapter Assembly. See Outside Installation Task 19.

Remove and inspect Battery Boxes. See Outside Installation Tasks 15 and 16.

Remove and inspect CIA and CIA bracket. See Outside Installation Tasks 17 and 18.

Remove and inspect Flashwess. See Outside Installation Tasks 11 and 12.

Remove and inspect Laser Transmitter and Modulator. Remove and inspect MILES screws, spacer and mount. See Outside Installation Tasks 13 and 14.

Remove and inspect CVKI and CVKI mounting bracket. Disconnect CVKI assembly from mounting bracket See Outside Installation Tasks 9 and 10.

Remove Detector Belts. See Outside Installation Tasks 5, 6, 7 and 8.

---

**WARNING**

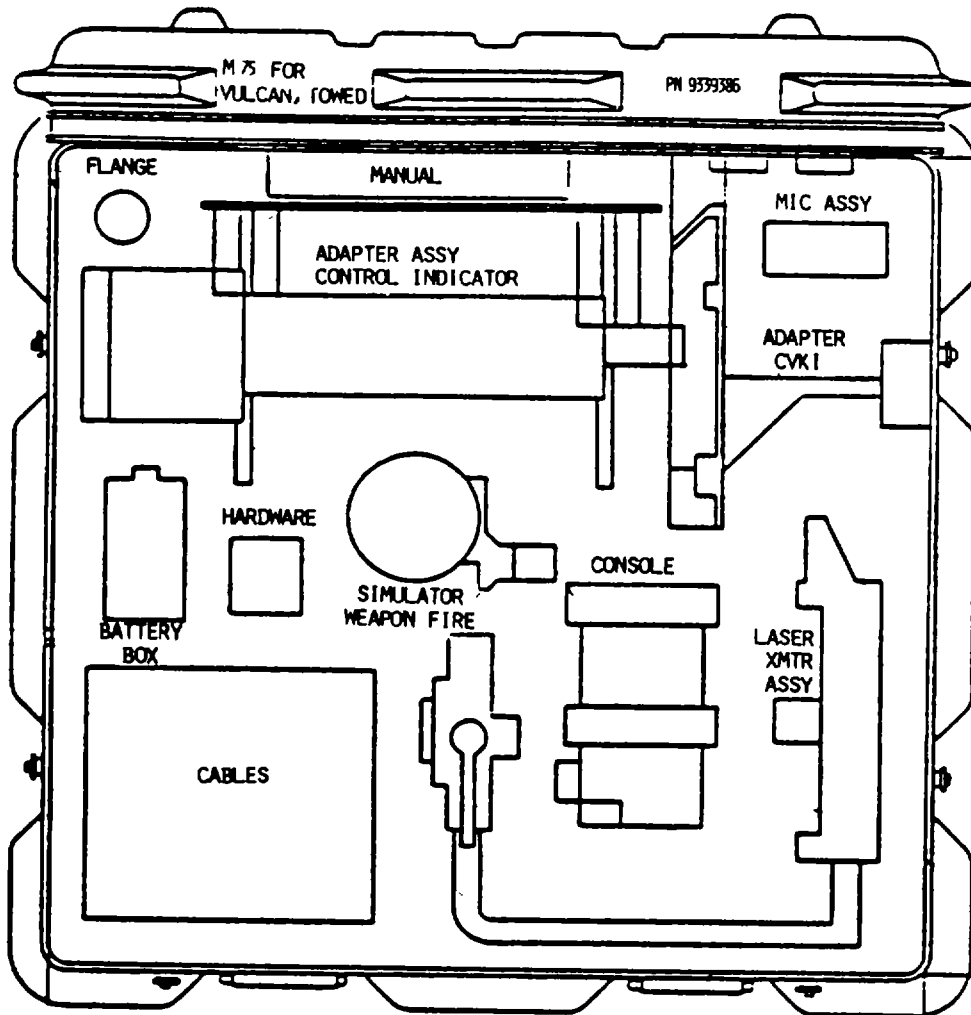
---

**Ensure connector is safety laced.**

---

Reconnect motor connector W3P3.

**Postoperational Task 3: Transit Case Packing Instructions.**



Place MILES AGES/AD VULCAN equipment in storage locations as marked in the transit case.

**Postoperational Task 4: Return All Equipment.**

- Return all equipment to your NCOIC.
- Return MILES VULCAN transit case.
- Return MILES M113 APC transit case.

**SECTION IV. OPERATION UNDER UNUSUAL CONDITIONS**

Operational procedures for the MILES equipment have the same limitations as the towed VULCAN (see TM 9-1005-286-10).

CHAPTER 3

MAINTENANCE INSTRUCTIONS

SECTION I. LUBRICATION INSTRUCTIONS

MILES equipment for the VULCAN, Towed, requires no operator lubrication.

SECTION II. TROUBLESHOOTING PROCEDURES

Tables 3-1 and 3-2 list the common malfunctions which you may find during the operation or maintenance of the MILES simulator system for the VULCAN, Towed, or its components. You should perform the Tests/Inspections and Corrective Actions in the order listed.

This manual cannot list all malfunctions that may occur, nor all tests or inspections and corrective actions. If a malfunction is not listed or is not corrected by listed corrective actions, notify your supervisor.

Troubleshooting of the VULCAN, Towed requires the assistance of a Controller, a MILES System Test Set (MSTS) (Section II, Appendix C), and Controller Gun (Section II, Appendix C). The Controller will obtain and provide this equipment. A Man Worn Laser Detector (MWLD) torso harness supplied in the M113 APC MILES system is also required. (Section II, Appendix C). The VULCAN crew shall assist the Controller. (This equipment is shown on page 3-2.1)

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**WARNING**

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**Do not disconnect cables from power distribution box or sight current generator when VULCAN system Power is ON. Electrical shock could occur.**

---

**NOTE**

**If no MILES System Test Set (MSTS) is available, refer to Table 3-1, page 3-3. If an MSTS is available, go to Table 3-2, page 3-15.**

**SYMPTOM INDEX  
NO TEST SET)**

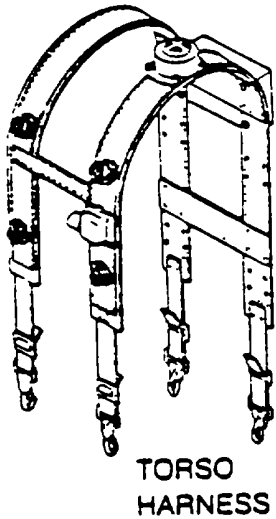
<u>Unit</u>	<u>Symptom</u>	<u>Troubleshooting Procedure Page</u>
1. Interface Control Assembly (ICA)	(1) Display Is Blank	3-3
	(2) Incorrect ROUNDS DISPLAY Indication	3-4
	(3) ROUNDS DISPLAY Indication Does Not Change	3-4
	(4) Firing Indicators Do Not Light	3-4
	(5) ICA Cannot Be Triggered	3-5
	(6) Rounds Cannot Be Reloaded	3-5
	(7) NOT READY Light Always On	3-6

**SYMPTOM INDEX (Cont)**

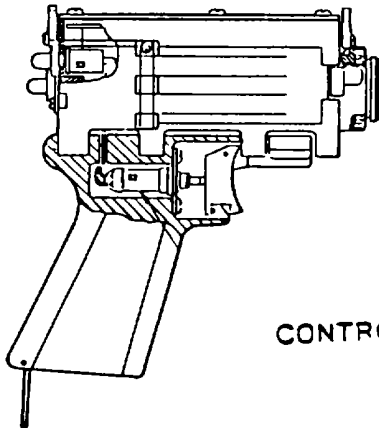
<u>Unit</u>	<u>Symptom</u>	<u>Troubleshooting Procedure Page</u>
2. VULCAN Transmitter Test	(1) One Laser Tube Inoperative	3-7
	(2) Center And One Outside Laser Tube Inoperative	3-7
	(3) All Laser Tubes Inoperative	3-7
	(4) Both Outside Laser Tubes Inoperative	3-8
	(5) Outside Laser Tubes Operate When MANUAL Firing Mode Selected	3-9
3. FLASHWESS Test	(1) FLASHWESS Inoperative	3-10
4. Control Indicator Assembly	(1) Display Is Blank	3-11
	(2) Display Does Not Indicate 88	3-12
	(3) Weapon Identification Code Is Not Displayed	3-12
	(4) NOT READY Light Does Not Light	3-12
5. Vehicle Detector Belts	(1) One Detector Belt Faulty	3-13
	(2) All Detector Belts Faulty	3-13
6. Combat Vehicle Kill Indicator	(1) CVKI Fails To Operate	3-14

(Using MILES System Test Set - MSTTS)

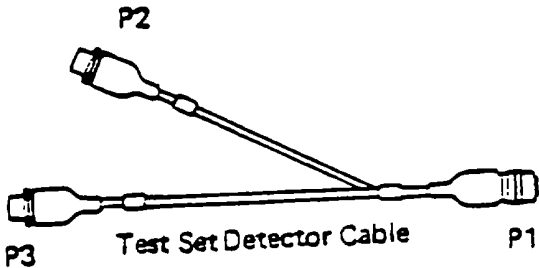
1. Interface Control Assembly (ICA)	(1) Display Is Blank	3-15
	(2) Incorrect ROUNDS DISPLAY Indication	3-18
	(3) ROUNDS DISPLAY Indication Does Not Change	3-19
	(4) Firing Indicators Do Not Light	3-19
	(5) ICA Cannot Be Triggered In Either LO-NO or HIGH BURST LIMIT Rate	3-19
	(5.1) ICA Cannot Be Triggered In Either LO-NO or HIGH BURST LIMIT Rate - Firing Indication Correct	3-22
	(6) ICA Cannot Be Triggered In The HIGH BURST LIMIT Rate	3-22
	(7) ICA Cannot Be Triggered In The LO-NO BURST Rate	3-24
	(8) Rounds Cannot Be Reloaded	3-25
	(9) NOT READY Light Always On	3-25
2. VULCAN Transmitter Test	(1) One Laser Tube Inoperative	3-27
	(2) Center And One Outside Laser Tube Inoperative	3-27
	(3) All Laser Tubes Inoperative	3-28
	(4) Both Outside Laser Tubes Inoperative	3-30
	(5) Outside Laser Tubes Operate When MANUAL Firing Mode Selected	3-33
3. FLASHWESS Test	(1) FLASHWESS Inoperative	3-35
	(1.1) FLASHWESS Inoperative - No Indication Flash	3-36
	(1.2) FLASHWESS Inoperative - Detection Cable	3-38
	(2) FLASHWESS Inoperative - HI-BURST LIMIT Rate	3-39
4. Control Indicator Assembly	(3) FLASHWESS Inoperative - LO-NO BURST LIMIT Rate	3-40
	(1) Display Is Blank	3-42
	(1.1) Display Is Blank - Batteries/Belts/CVKI	3-44
	(2) Display Does Not Indicate 88	3-46
	(3) Weapon Identification Code Is Not Displayed	3-47
5. Vehicle Detector Belts	(4) NOT READY Light Does Not Light	3-47
	(1) One Detector Belt Faulty	3-48
	(2) All Detector Belts Faulty	3-49
6. Combat Vehicle Kill Indicator	(2.1) All Detector Belts Faulty , - Controller Gun Test	3-51
	(1) CVKI Fails To Operate	3-52
	(1.1) CVKI Fails To Operate - Voltage Check	3-54



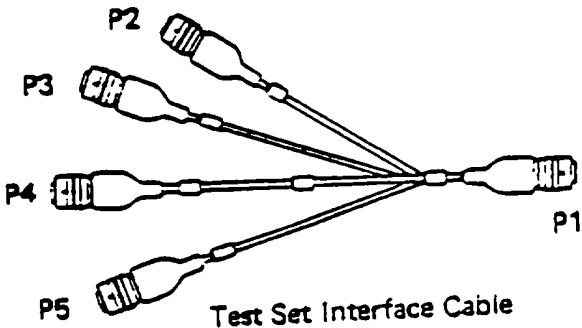
TORSO HARNESS



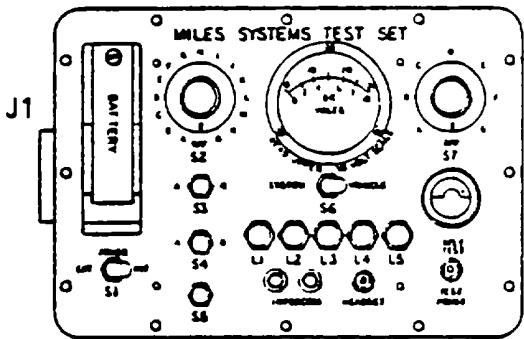
CONTROLLER GUN



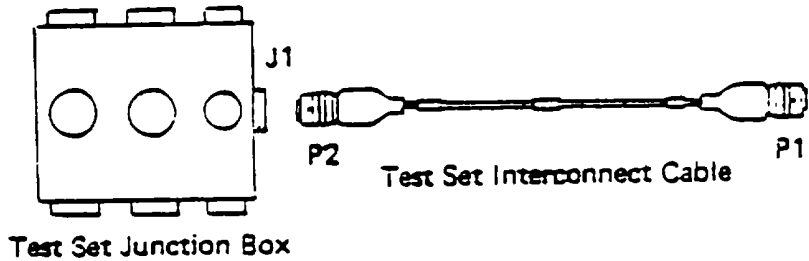
Test Set Detector Cable



Test Set Interface Cable



MILES SYSTEM TEST SET



Test Set Junction Box

Test Set Interconnect Cable

TROUBLESHOOTING EQUIPMENT

Table 3-1. Troubleshooting - No Test Set

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
-------------	--------------------	-------------------

**NOTE**

During this Troubleshooting procedure, any item that is replaced -, that is, removed from service - should be tagged with a DA Form 2402.

**1. INTERFACF CONTROL ASSEMBLY (ICA)**

(1) Display Is Blank

Disconnect connector P2 from ICA, wait one second and reconnect.

Return system to service if ICA Is now operable.

Disconnect battery box from Detection Cable, connector P8. Pause for one second and reconnect. Check display reading.

Return system to service if display shows 00.

If display is still blank, remove Interface Control Assembly (ICA) and replace with unit known to be operable. Retest system.

Return system to service if display shows 00.

If display is still blank, reinstall former ICA. Remove Vulcan transmitter assembly and replace with unit known to be operable. Retest system.

Return system to service If display shows 00

If display is still blank, reinstall former transmitter. Remove Logic Cable Assembly and replace with unit known to be operable. Retest system.

Return system to service if display shows 00.

If display is still blank, reinstall former Logic Cable Assembly. Remove Detection Cable Assembly and replace with unit known to be operable. Retest system.

Return system to service If display shows 00.

If display is still blank, reinstall former Detection Cable Assembly Remove battery box and replace with unit known to be operable. Retest system.

Return system to service if display shows 00.

If display is still blank, reinstall former battery box and Install new batteries. Return system to service.

Table 3-1. Troubleshooting - No Test Set (Cont)

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
1. <u>INTERFACE CONTROL ASSEMBLY (ICA) (CONT)</u>		
(2) Incorrect ROUNDS DISPLAY Indication		<p>Insert the Controller (Green) Key into the WEAPON key receptacle on the ICA. Turn to the CONTROLLER position. Turn back and remove key.</p> <p>Check ROUNDS DISPLAY indication for Total Rounds = 20 Ready Rounds = 5</p> <p>If ROUNDS DISPLAY indications are correct, return system to service.</p> <p>If ROUNDS DISPLAY indication is incorrect, remove Interface Control Assembly (ICA) and replace with unit known to be operable. Retest system.</p> <p>If ROUNDS DISPLAY indication is correct, return system to service.</p> <p>If ROUNDS DISPLAY indication is still incorrect, reinstall former ICA. Install new batteries and return system to service.</p>
(3) ROUNDS DISPLAY Indication Does Not Change		<p>Failure of ROUNDS DISPLAY indication to change indicates a problem with Interface Control Assembly (ICA).</p> <p>Replace defective ICA and return system to service.</p>
(4) Firing Indicators Do Not Light		<p>Failure of the Firing Indicators (decimal points on the display) to light indicates a problem with Interface Control Assembly (ICA).</p> <p>Replace defective ICA and return system to service.</p>

---

<b>MALFUNCTION</b>	<b>TEST OR INSPECTION</b>	<b>CORRECTIVE ACTION</b>
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---

(5) ICA Cannot Be Triggered

Remove the Interface Control Assembly (ICA) and replace with unit known to be operable. Retest system.

If ICA can be triggered, return system to service.

If ICA cannot be triggered, reinstall former ICA.. Remove Logic Cable Assembly and replace with unit known to be operable. Retest system.

If ICA can be triggered, return system to service.

If ICA cannot be triggered, reinstall former Logic Cable Assembly. Remove Detection Cable Assembly and replace with unit known to be operable. Retest system.

If ICA can be triggered, return system to service.

If ICA cannot be triggered, reinstall former Detection Cable Assembly Remove FLASHWESS Assembly and replace with unit known to be operable. Retest system.

If ICA can be triggered, return system to service.

If ICA cannot be triggered, reinstall former FLASHWESS Assembly. Inspect VULCAN Weapon System for malfunctions. See TM 9-1005-286-10.

Return system to service.

(6) Rounds Cannot Be Reloaded

Failure of READY ROUNDS display Indication to increase 30 seconds after PRESS TO RELOAD pushbutton is depressed indicates a problem with the Interface Control Assembly (ICA).

Replace defective ICA and return system to service.



Table 3-1. Troubleshooting - No Test Se (Cont)t

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MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
-------------	--------------------	-------------------

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1. INTERFACE CONTROL ASSEMBLY (ICA) (CONT)

## (7) NOT READY Light Always ON

Before proceeding, check the following:

- a. A Vehicle (Orange) Key Is inserted in the WEAPON key receptacle on the ICA, and rotated clockwise. If NOT READY light goes out, return system to service.
- b. ROUND REMAINING indication indicates 1 or more on the ICA.
- c. NOT READY LED is OFF on the CIA. If ON, reset CIA with Controller (Green) Key. Remove the Interface Control Assembly and replace with a unit known to be operable. Retest system.

If NOT READY light is not always ON, return system to service.

If NOT READY light is always ON, reinstall former ICA. Remove Control Indicator Assembly (CIA) and replace with unit known to be operable. Retest system.

If NOT READY light is not always ON, return system to service.

If NOT READY light is always ON, reinstall former CIA. Remove Logic Cable Assembly and replace with unit known to be operable. Retest system.

If NOT READY light is not always ON, return system to service.

If NOT READY light is always ON, reinstall former Logic Cable Assembly. Remove Detection Cable Assembly and replace with unit known to be operable.

Return system to service.

---

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

---

## 2. VULCAN TRANSMITTER TEST

### (1) One Laser Tube Inoperative

One laser tube inoperative indicates a problem with the Transmitter Assembly.

Replace the defective Transmitter Assembly and return system to service.

### (2) Center And One Outside Laser Tube Inoperative

The center laser tube and one outside laser tube inoperative Indicates a problem with the Transmitter Assembly.

Replace defective Transmitter Assembly and return system to service.

### (3) All Laser Tubes Inoperative

Disconnect connector P6 from transmitter. Wait one second and reconnect.

Return system to service if transmitter is operable.

Remove Transmitter Assembly and replace with unit known to be operable. Retest system.

Return system to service if all laser tubes are now operational.

If all laser tubes are still inoperative, reinstall former transmitter. Replace Interface Control Assembly (ICA) with a unit known to be operable. Retest system.

Return system to service if all laser tubes are now operational.

If all laser tubes are still inoperative, reinstall former ICA. Replace Logic Cable Assembly with a unit known to be operable. Retest system.

Return system to service.

Table 3-1. Troubleshooting - No Test Set (Cont)

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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2. VULCAN TRANSMITTER TEST (CONT)

## (4) Both Outside Laser Tubes Inoperative

Cover the center laser tube with a helmet, hand or other opaque material.

Place VULCAN system in MANUAL mode.

Insert Controller (Green) Key in CONTROLLER TEST key receptacle on modulator. Turn key counterclockwise to select TEST mode.

Place a MWLD harness with a detector directly in front of the transmitter.

Select LO-NO firing rate. Verify sufficient rounds remain for test. Trigger the VULCAN Weapon System. Verify that the MWLD detector harness responds with either "KILL" or a "NEAR MISS" alarms.

If MWLD alarm responds, replace defective Transmitter Assembly and return system to service.

Remove the Interface Control Assembly (ICA) and replace with a unit known to be operable. Retest system.

Return system to service if outside tubes are now operational.

If outside tubes are still inoperative, reinstall former ICA. Remove Logic Cable Assembly and replace with unit known to be operable. Retest system.

Return system to service if outside tubes are now operational.

If outside tubes are still inoperative, reinstall former Logic Cable Assembly. Repair all VULCAN Weapon System malfunctions. See TM 9-1005-286-10.

Return system to service.

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<b>MALFUNCTION</b>	<b>TEST OR INSPECTION</b>	<b>CORRECTIVE ACTION</b>
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(5) Outside Laser Tubes Operate When MANUAL Firing Mode Selected

Remove VULCAN Transmitter Assembly and replace with a unit known to be operable. Retest system.

Return system to service if outside tubes are now operational.

If tubes are still not operational, reinstall former Transmitter Assembly. Remove Interface Control Assembly (ICA) and replace with unit known to be operable. Retest system.

Return system to service if outside tubes are now operational.

If outside tubes are still not operational, reinstall former ICA. Remove Logic Cable Assembly and replace with unit known to be operable. Retest system.

Return system to service if outside tubes are now operational.

If tubes are still not operational, reinstall former Logic Cable Assembly. Repair all VULCAN Weapon System malfunctions. See TM 9-1005-286-10.

Return system to service.

Table 3-1. Troubleshooting - No Test Set (Cont)

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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3. FLASHWESS TEST

## (1) FLASHWESS Inoperative

Ensure that ICA is in NORM mode.

If FLASHWESS is still inoperative, disconnect connector P4 from FLASHWESS. Wait one second and reconnect.

Return system to service if FLASHWESS is operable.

Replace FLASHWESS assembly with unit known to be operable. Retest system.

Return system to service if FLASHWESS is now operational.

If FLASHWESS is still inoperative, reinstall former FLASHWESS assembly. Remove Interface Control Assembly (ICA) and replace with unit known to be operable. Retest system.

Return system to service if FLASHWESS is now operational.

If FLASHWESS is still inoperative, reinstall former ICA. Remove Logic Cable Assembly and replace with unit known to be operable. Retest system.

Return system to service if FLASHWESS is now operational.

If FLASHWESS is still inoperative, reinstall former Logic Cable Assembly. Remove Detection Cable Assembly and replace with unit known to be operable. Retest system.

Return system to service if FLASHWESS is now operational.

If FLASHWESS is still inoperative, reinstall former Detection Cable Assembly. Repair all VULCAN Weapon System malfunctions. See TM 9-1005-286-10.

Return system to service.

4. CONTROL INDICATOR ASSEMBLY (CIA)

## (1) Display Is Blank

Disconnect connector P5 from CIA. Wait one second and reconnect.

Return system to service if CIA is operable.

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

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Disconnect the Detection Cable, connection P7, from the battery box. Pause one second and reconnect.

Check CIA display.

If display reads 00, return system to service.

If display is still blank, remove Control Indicator Assembly (CIA) and replace with unit known to be operable. Retest system.

If display reads 00, return system to service.

If display is still blank, reinstall former CIA. Remove Logic Cable Assembly and replace with unit known to be operable. Retest system.

If display reads 00, return system to service.

If display is still blank, reinstall former Logic Cable Assembly. Remove Detection Cable Assembly and replace with unit known to be operable. Retest system.

If display reads 00, return system to service.

If display is still blank, reinstall former Detection Cable Assembly. Remove CVKI assembly and replace with unit known to be operable. Retest system.

If display reads 00, return system to service.

If display is still blank, reinstall former CVKI assembly. Remove a detector belt and replace with a unit known to be operable. Retest system.

If display reads 00, return system to service.

If display is still blank, reinstall the detector belt. Remove one of the two remaining detector belts and replace with a unit known to be operable. Retest system.

If display reads 00, return system to service.

If display is still blank, reinstall the detector belt. Remove the remaining detector belt and replace with a unit known to be operable. Retest system.

If display reads 00, return system to service.

Table 3-1. Troubleshooting - No Test Set (Cont)

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MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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4. CONTROL INDICATOR ASSEMBLY (CIA) (CONT)

## (1) Display Is Blank (Cont)

If display is still blank, reinstall detector belt. Remove battery box and replace with unit known to be operable. Retest system.

If display reads 00, return system to service.

If display is still blank, reinstall former battery box with NEW batteries and return system to service.

## (2) Display Does Not Indicate 88

Insert a Controller (Green) Key into the WEAPON key receptacle on the CIA. Turn counterclockwise to the CONTROLLER position. Turn back and remove key.

Turn CIA Console Switch to HIT/KILL. Then turn to SELF TEST. Check CIA display.

If display reads 88, return system to service.

If display does not show 88, remove Control Indicator Assembly (CIA) and replace with unit known to be operable Retest.

If display Indicates 88, return system to service.

If display does not Indicate 88, Install NEW batteries In battery box and return system to service.

## (3) Weapon Identification Code Is Not Displayed

Failure of the CIA to display a Weapon Identification Code indicates a problem with the CIA.

Replace defective CIA and return system to service.

## (4) NOT READY Light Does Not Light

Failure of the NOT READY light to light when a KILL response is indicated by the CVKI indicates a problem with the CIA.

Replace defective CIA and return system to service.

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MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

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5. VEHICLE DETECTOR BELTS

## (1) One Detector Belt Faulty

Remove the suspected faulty detector belt and replace with a belt known to be operational. Retest.

If system responds correctly, return to service.

If belt still gives faulty indication, reinstall former belt. Remove defective Detection Belt Assembly and replace with unit known to be operable.

Return system to service.

## (2) All Detector Belts Faulty

Remove one of suspected faulty detector belts and replace with unit known to be operable. Retest.

If system now responds correctly, return to service.

If belts still give faulty indication, replace former belt and repeat test with each of two remaining belts.

If system now responds correctly, return to service.

If belts still give faulty indication, replace former belts. Remove Detector Cable Assembly and replace with unit known to be operable. Retest.

If system now responds correctly, return to service.

If belts still give faulty indication, reinstall former Detection Cable Assembly Remove defective Control Indicator Assembly (CIA) and replace with unit known to be operable.

Return system to service.



Table 3-1. Troubleshooting - No Test Set (Cont)

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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6. COMBAT VEHICLE KILL INDICATOR (CVKI)

## (1) CVKI Fails To Operate

Check that the gun system power switch is ON.

Disconnect connector P6 from CVKI. Wait one second and reconnect.

Return system to service if CVKI is operable.

If CVKI is still inoperative, remove CVKI and replace with unit known to be operable. Retest system.

If CVKI now operates, return system to service.

If CVKI is still inoperative, reinstall former CVKI. Remove the Control Indicator Assembly (CIA) and replace with a unit known to be operable. Perform CIA self test. If CIA does not operate, perform CIA troubleshooting, page 3-11. If CIA operates, retest CVKI.

If CVKI now operates, return system to service.

If CVKI is still inoperative, reinstall former CIA. Remove the Detection Cable Assembly and replace with a unit known to be operable. Retest system.

If CVKI now operates, return system to service.

If CVKI is still inoperative, reinstall former Detection Cable Assembly. Repair all VULCAN Weapon System malfunctions. See TM 9-1005-286-10.

Return system to service if CVKI is operable.

Table 3-2. Troubleshooting - MILES System Test Set (Cont)

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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**CAUTION**

Do not misuse equipment.

**NOTE**

During this Troubleshooting procedure, any item that is replaced - that is, removed from service - should be tagged with a DA Form 2402.

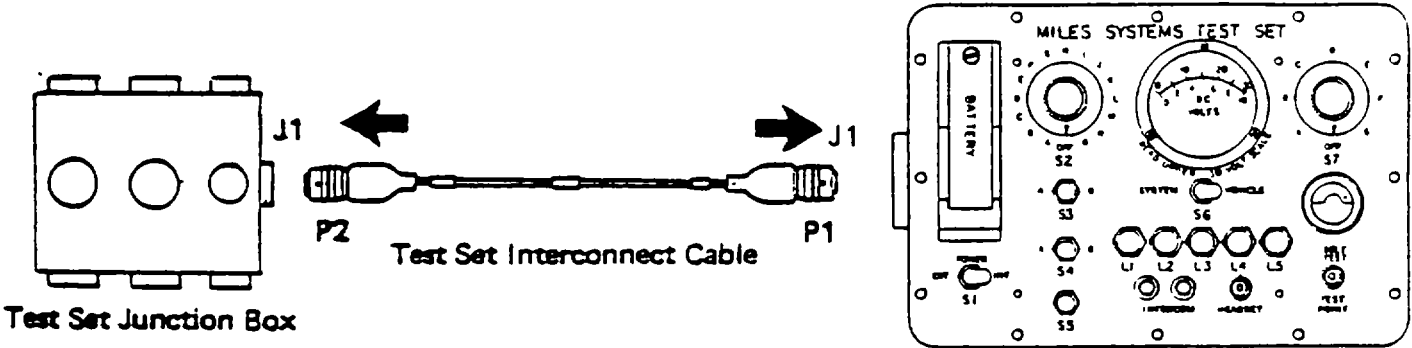
1. INTERFACE CONTROL ASSEMBLY (ICA)

(1) Display Is Blank

Disconnect battery box from Detection Cable, connector P8. Pause for one second and reconnect. Check display reading.

Return system to service if display shows 00.

If display is still blank, connect Test Set Interconnect Cable, connector P1, to test set, connector J1. Connect Test Set Interconnect Cable, connector P2, to Test Set Junction Box, connector J1.



Disconnect Logic Cable, connector P2, from the ICA. Connect to Test Set Junction box, connector J10.

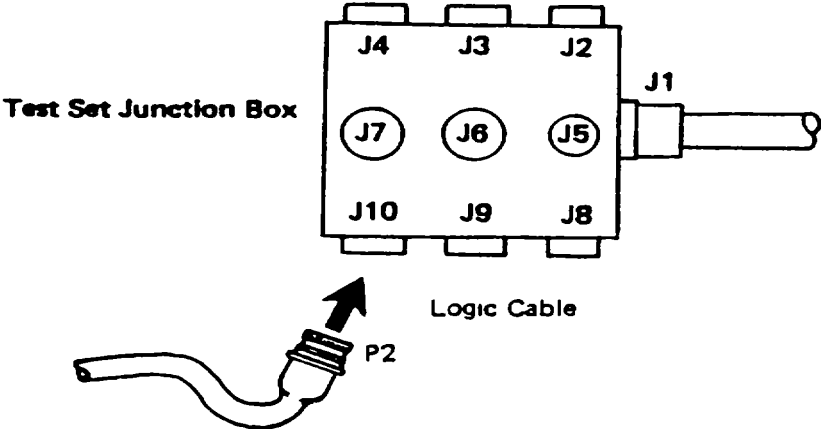


Table 3-2. Troubleshooting - MILES System Test Set (Cont)

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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1. INTERFACE CONTROL ASSEMBLY (ICA) (CONT)

(1) Display Is Blank (Cont)

Place test set switch S1 to EXT position.

Place test set switch S6 to the SYSTEM position.

Read voltage on voltmeter.

If voltage reading is 8.5 to 13 volts, replace defective ICA and return system to service.

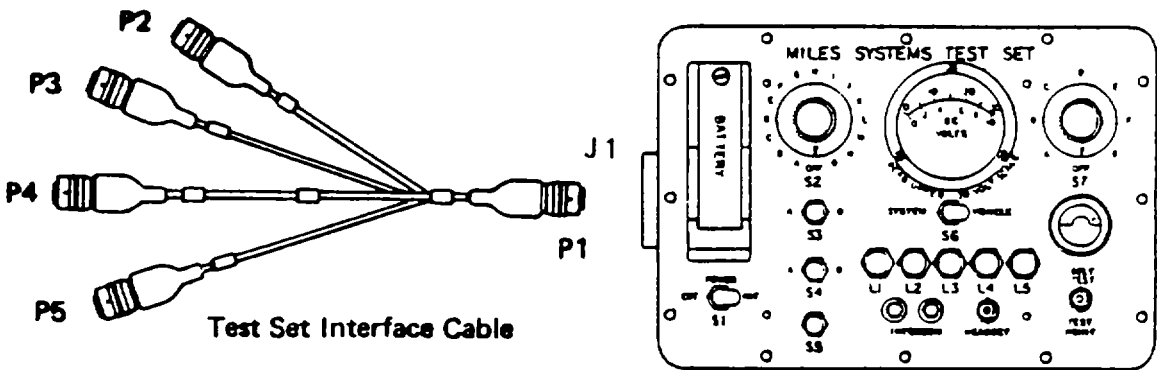
If voltage reading is less than 8.5 volts, disconnect connector P6 on VULCAN Transmitter Assembly.

Read voltage on voltmeter.

If voltage reading is 8.5 to 13 volts, replace defective Transmitter Assembly and return system to service.

If voltage reading is less than 8.5 volts, disconnect Logic Cable, connector P2, from Test Set Junction Box Reconnect to the ICA.

Disconnect Test Set Interconnect Cable from test set. Connect Test Set Interface Cable, connector P1, to the test set, connector J1.



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

Disconnect Logic Cable, connector P1, from Detection Cable, connector J1.

Connect Detection Cable, connector J1, to connector P5 on Test Set Interface Cable

Read voltage on voltmeter.

If voltage reading is 8.5 to 13 volts, replace defective Logic Cable and return system to service.

If voltage reading is less than 8.5 volts, disconnect Detection Cable from Test Set Interface Cable. Reconnect to Logic Cable, connector P1.

Disconnect Detection Cable, connector P8, from battery box. Connect Test Set Interface Cable, connector P4, to battery box.

Place test set switch S1 to EXT position.

Place test set switch S6 to the SYSTEM position.

Read voltage on voltmeter.

If voltage reading is 8.5 to 13 volts, replace defective Detection Cable and return system to service.

If voltage reading is less than 8.5 volts, disconnect Detection Cable connections P5 from CIA and P7 from battery box. Temporarily disconnect Test Set Interface Cable from battery box.

Remove Control Indicator Adapter Assembly from ammunition storage unit. Remove battery box assembly previously connected to Detection Cable, connector P8, from Adapter Assembly. Reconnect Test Set Interface Cable, connector P4, to battery box.

Install two new 6 V batteries in the battery box.

Read voltage on voltmeter

If voltage reading is 8.5 to 13 volts, discard old batteries and return system to service.

If voltage reading is less than 8.5 volts, replace defective battery box and return system to service.

Table 3-2. Troubleshooting - MILES System Test Set (Cont)

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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1. INTERFACE CONTROL ASSEMBLY (ICA) (CONT)

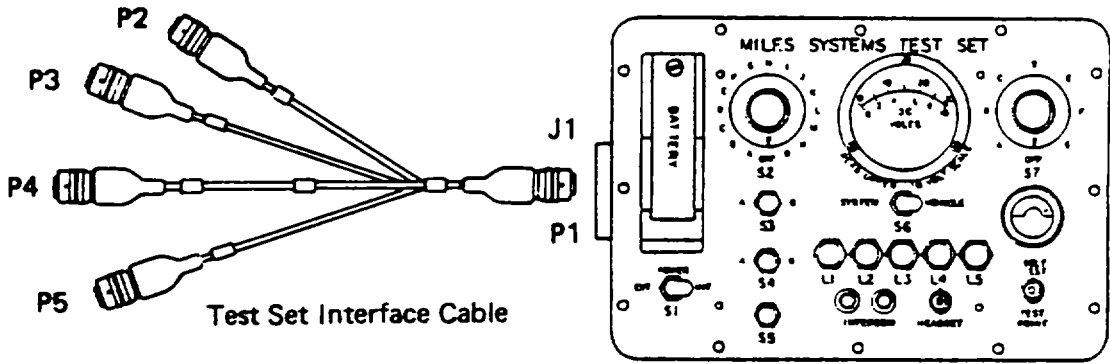
(2) Incorrect ROUNDS DISPLAY Indication

Insert the Controller (Green) Key into the WEAPON key receptacle on the ICA. Turn to the CONTROLLER position. Turn back and remove key.

Check ROUNDS DISPLAY indication for Total Rounds = 20  
Ready Rounds = 5

If ROUNDS DISPLAY Indications are correct, return system to service.

If ROUNDS DISPLAY indication is incorrect, connect Test Set Interface Cable, connector P1, to test set, connector J1.



Disconnect Detection Cable, connector P8, from battery box. Connect Test Set Interface Cable, connector P4, to battery box.

Place test set switch S6 to the SYSTEM position.

Place test set switch S1 to the EXT position.

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<b>MALFUNCTION</b>	<b>TEST OR INSPECTION</b>	<b>CORRECTIVE ACTION</b>
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Read voltage on voltmeter.

If voltage reading is 8.5 to 13 volts, replace defective ICA and return system to service.

If voltage reading is less than 8.5 volts, discard old batteries. Install two new batteries and return system to service.

(3) ROUNDS DISPLAY Indication Does Not Change

Failure of ROUNDS DISPLAY Indication to change indicates a problem with Interface Control Assembly (ICA).

Replace defective ICA and return system to service.

(4) Firing Indicators Do Not Light

Failure of the Firing Indicators (decimal points on the display) to light indicates a problem with Interface Control Assembly (ICA).

Replace defective ICA and return system to service.

(5) ICA Cannot Be Triggered In Either LO-NO Or HIGH BURST LIMIT Rate

Select TEST MODE by inserting the Controller (Green) Key into CONTROLLER MODE SELECT key receptacle on the ICA. Rotate controller key counterclockwise, then remove key.

Select MANUAL mode and 100-ROUND BURST firing rate on the VULCAN Control Assembly. Verify Orange Weapon Key is in WEAPON key receptacle on ICA in WEAPON position. On ICA verify sufficient laser rounds remain for test. Trigger the VULCAN firing system.

If Firing Indicators (decimal points on display) appear, go to Troubleshooting Malfunction (5.1), ICA Cannot Be Triggered In Either LO-NO Or HIGH BURST LIMIT Rate - Firing Indications Correct (page 3-22).

Table 3-2. Troubleshooting - MILES System Test Set (Cont)

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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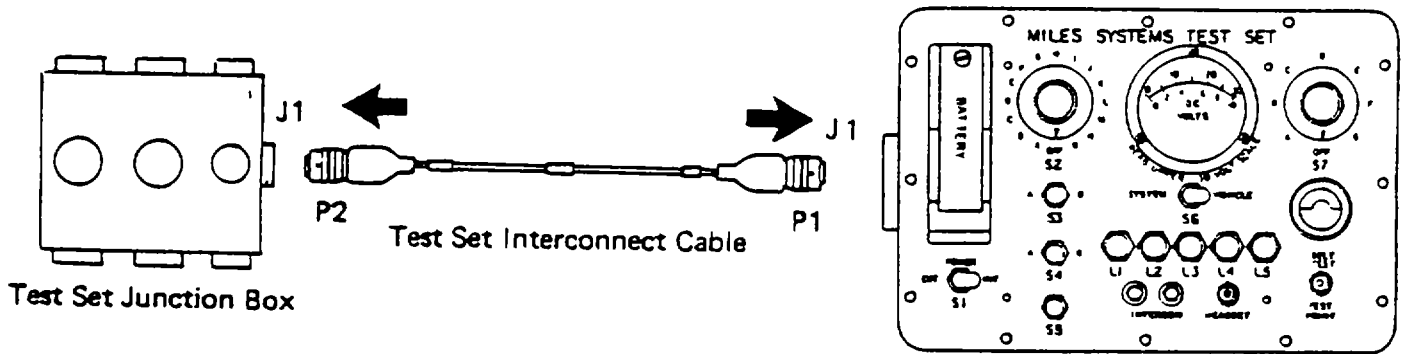
1. INTERFACE CONTROL ASSEMBLY (ICA) (CONT)

(5) ICA Cannot Be Triggered In Either LO-NO Or HIGH BURST LIMIT Rate (Cont)

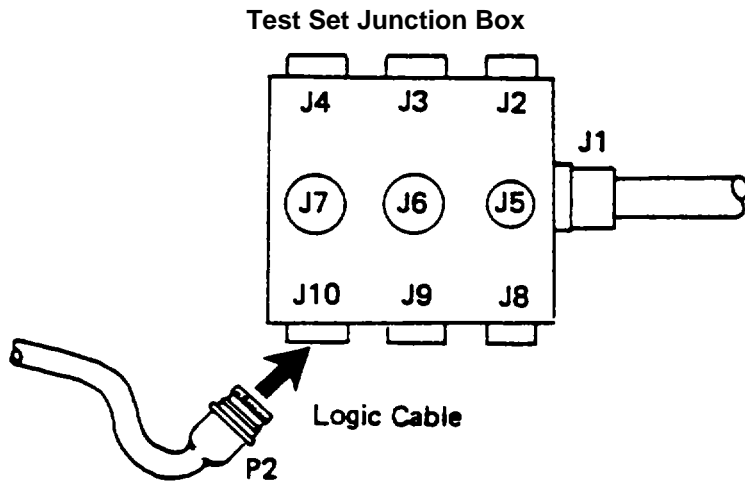
If Firing Indicators do not appear, select LO - NO firing rate on VULCAN Control Assembly. Verify sufficient laser rounds remain for test. Trigger the VULCAN Weapon System. Check ICA display.

If Firing Indicators (decimal points on display) appear, replace defective ICA and return system to service.

If Firing Indicators do not appear, connect the Test Set Interconnect Cable, connector P1, to the test set, connector J1. Connect Test Set Interconnect Cable, connector P2, to the Test Set Junction Box, connector J1.



Disconnect Logic Cable, connector P2, from the ICA. Connect to Test Set Junction Box, connector J10.



MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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Place test set switch S6 to the VEHICLE position.

Place test set switch S1 to EXT position.

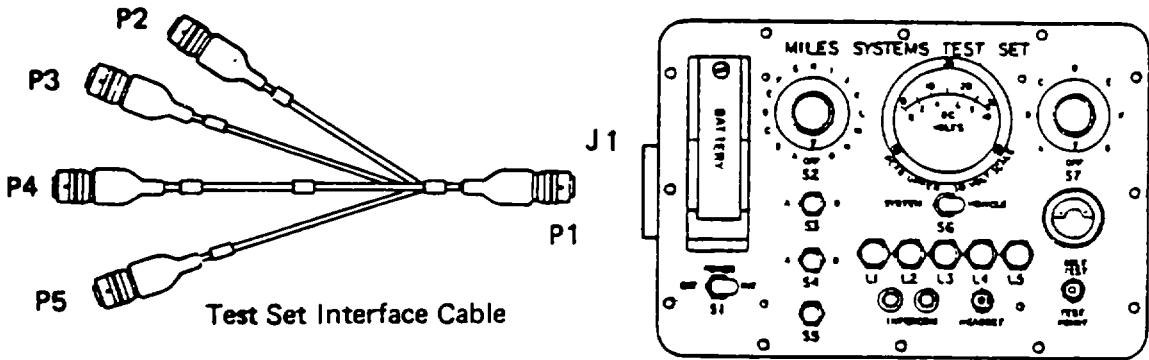
Place test set switch S2 to K position.

Select a 100-ROUND BURST firing rate on VULCAN Control Assembly Verify sufficient laser rounds remain for testing. Trigger VULCAN Weapon System. Read trigger voltage on voltmeter.

If voltage reading is 18 to 30 volts, replace defective ICA and return system to service.

If voltage reading is less than 18 volts, disconnect Logic Cable from the Test Set Junction Box and reconnect to the ICA.

Disconnect Test Set Interconnect Cable from test set. Connect Test Set Interface Cable, connector P1, to test set, connector J1.



Disconnect Logic Cable, connector P1, from Detection Cable, connector J1.

Connect Detection Cable, connector J1, to connector J5 on the Test Set Interface Cable.

Place test set switch S2 to position K.

Select a 100-ROUND BURST firing rate on VULCAN Control Assembly Verify sufficient laser rounds remain for testing. Trigger the VULCAN Weapon System. Read trigger voltage on voltmeter.



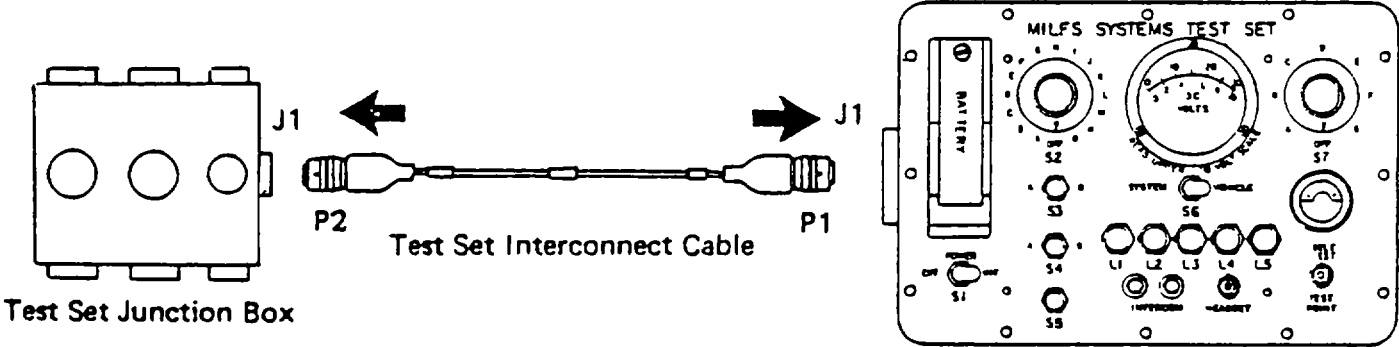
Table 3-2. Troubleshooting - MILES System Test Set (Cont)

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
1. <u>INTERFACE CONTROL ASSEMBLY (ICA) (CONT)</u>		
(5) ICA Cannot Be Triggered In Either LO-NO Or HIGH BURST LIMIT Rate (Cont)		
	If voltage reading is 18 to 30 volts, replace defective Logic Cable and return system to service.	
	If voltage reading is less than 18 volts, verify that VULCAN Weapon System is operational.	
	If weapon system is operational, replace Detection Cable.	
	If weapon system is not operational, repair as necessary. See TM 9-1005 286-10.	
(5.1) ICA Cannot Be Triggered In Either LO-NO Or HIGH BURST LIMIT Rate - Firing Indications Correct		
	Select NORM MODE by inserting the Controller (Green) Key into CONTROLLER MODE SELECT key receptacle on the ICA. Rotate the controller key clockwise, then remove key.	
	Exchange the FLASHWESS Assembly for a unit known to be operational.	
	Verify sufficient laser rounds remain for testing.	
	Select a 100-ROUND BURST firing rate on VULCAN Control Assembly. Trigger the VULCAN Weapon System. Check ICA display.	
	If Firing Indicators (decimal points on display) appear, replace defective FLASHWESS Assembly and return system to service.	
	If Firing Indicators do not appear, replace defective Logic Cable and return system to service.	
(6) ICA Cannot Be Triggered In The HIGH BURST LIMIT Rate		
	Connect the Test Set Interconnect Cable, connector P1, to test set, connector, J1. Connect Test Set Interconnect Cable, connector P2, to the Test Set Junction Box, connector J1.	

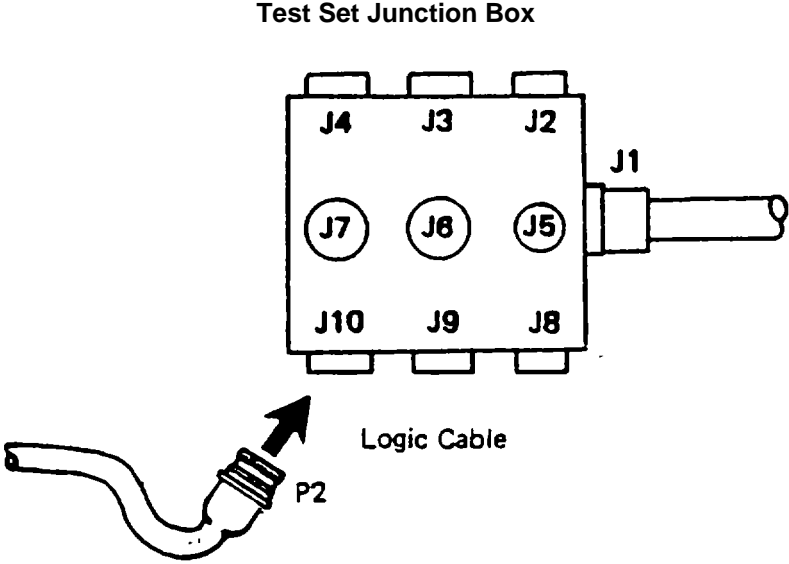
**MALFUNCTION**

**TEST OR INSPECTION**

**CORRECTIVE ACTION**



Disconnect Logic Cable, connector P2, from the ICA and connect to Test Set Junction Box, connector J10.



Place test set switch S6 to the VEHICLE position.

Place test set switch S2 to position K.

Select a 100-ROUND BURST firing rate. Trigger the VULCAN Weapon System. Read trigger voltage on voltmeter.

Table 3-2. Troubleshooting - MILES System Test Set (Cont)

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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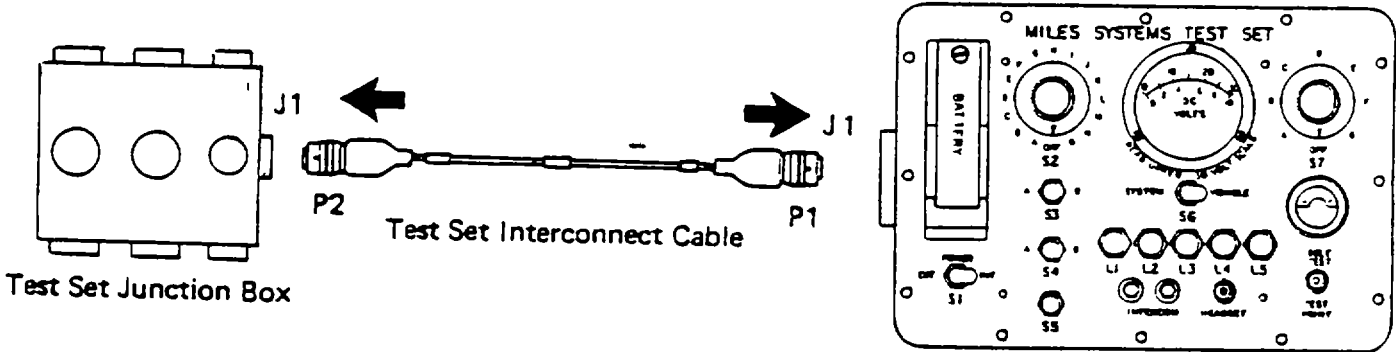
1. INTERFACE CONTROL ASSEMBLY (ICA) (CONT)

(6) ICA Cannot Be Triggered In The HIGH BURST LIMIT Rate (Cont)  
 If voltage reading is 18 to 30 volts, replace defective ICA and return system to service.  
 If voltage reading is less than 18 volts, VULCAN Weapon System is defective. Correct malfunction (see TM 9-1005-286-10) and return system to service.

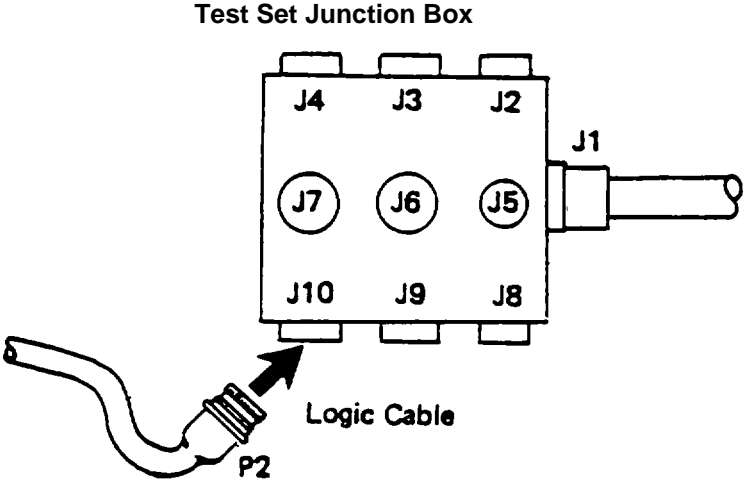
(7) ICA Cannot Be Triggered In The LO-NO BURST Rate

Connect the Test Set Interconnect Cable, connector P1, to the test set, connector J1

Connect the Test Set Interconnect Cable, connector P2, to the Test Set Junction Box, connector J1.



Disconnect Logic Cable, connector P2, from the ICA and connect to connector J10 on the Test Set Junction Box.



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

Place test set switch S6 to the VEHICLE position.

Place test set switch S2 to position K.

Select MANUAL mode and LO-NO BURST firing rate on VULCAN Control Assembly.

Trigger the VULCAN Weapon System. Read trigger voltage on voltmeter.

If voltage reading is 6 to 10 volts, replace defective ICA and return system to service.

If voltage reading is less than 6 volts, VULCAN Weapon System Is defective. Correct malfunction (see TM 9-1005-286-10) and return system to service.

**(8) Rounds Cannot Be Reloaded**

Failure of READY ROUNDS display indication to increase 30 seconds after PRESS TO RELOAD pushbutton is depressed indicates a problem with the Interface Control Assembly (ICA).

Replace defective ICA and return system to service.

**(9) NOT READY Light Always ON**

Before proceeding, check the following:

- a. A vehicle (orange) key is inserted in the WEAPON key receptacle on the ICA, and rotated clockwise.
- b. ROUND REMAINING indication indicates 1 or more on the ICA.
- c. NOT READY LED is OFF on the CIA. If ON, reset CIA with Controller (Green) Key.

Connect the Test Set Interconnect Cable, connector P1, to the test set, connector J1. Connect Test Set Interconnect Cable, connector P2, to the Test Set Junction Box, connector J1.

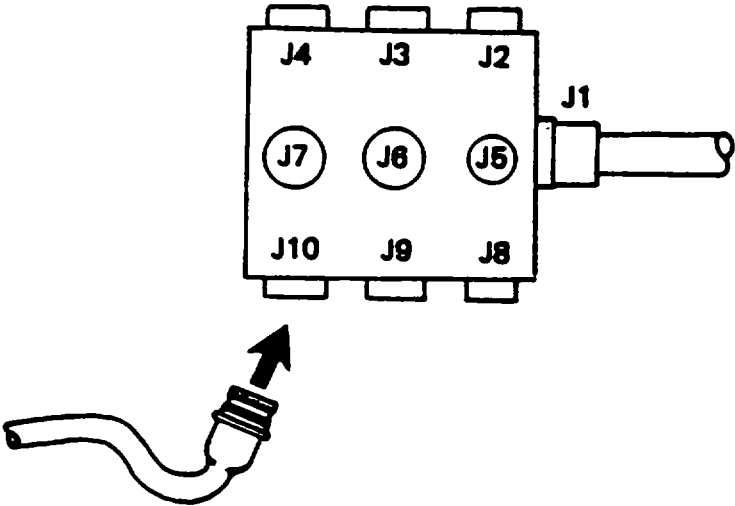
Table 3-2. Troubleshooting - MILES System Test Set (Cont)

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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1. Interface Control ASSEMBLY (ICA) (CONT)

(9) NOT READY Light Always ON (Cont)

Disconnect Logic Cable, connector P2, from the ICA. Connect to Test Set Junction box, connector J10.



**Test Set Junction Box**

Check test set indicator light L5.

If light L5 is OFF, replace defective ICA and return system to service.

If light L5 is ON, disconnect Logic Cable from Test Set Junction Box. Reconnect to the ICA.

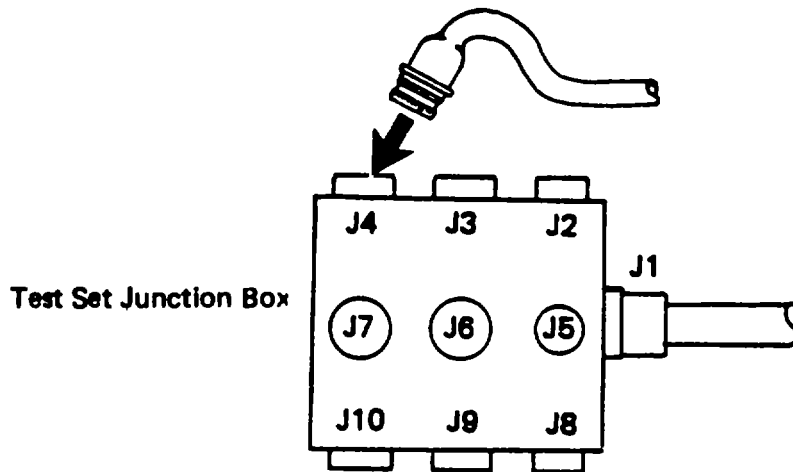
Reset the ICA with a Controller (Green) Key. Reinstall Vehicle (Orange) Key in the WEAPON key receptacle.

**MALFUNCTION**

**TEST OR INSPECTION**

**CORRECTIVE ACTION**

Disconnect Detection Cable, connector P5, from the ICA. Connect to Test Set Junction Box, connector J4.



Check NOT READY light on the ICA.

If NOT READY light is OFF, replace defective ICA and return system to service.

If NOT READY light is ON, replace Detection Cable with new cable assembly. Recheck the NOT READY light on the ICA.

If NOT READY light is ON, replace Logic Cable Assembly and return system to service.

If NOT READY light is now OFF, previous Detection Cable was faulty. Permanently replace with new cable assembly.

2. VULCAN TRANSMITTER TEST

(1) One Laser Tube Inoperative

One laser tube inoperative indicates a problem with the Transmitter Assembly. Replace the defective Transmitter Assembly and return system to service.

(2) Center And One Outside Laser Tube Inoperative

The center laser tube and one outside laser tube inoperative indicates a problem with the Transmitter Assembly.

Replace defective Transmitter Assembly and return system to service

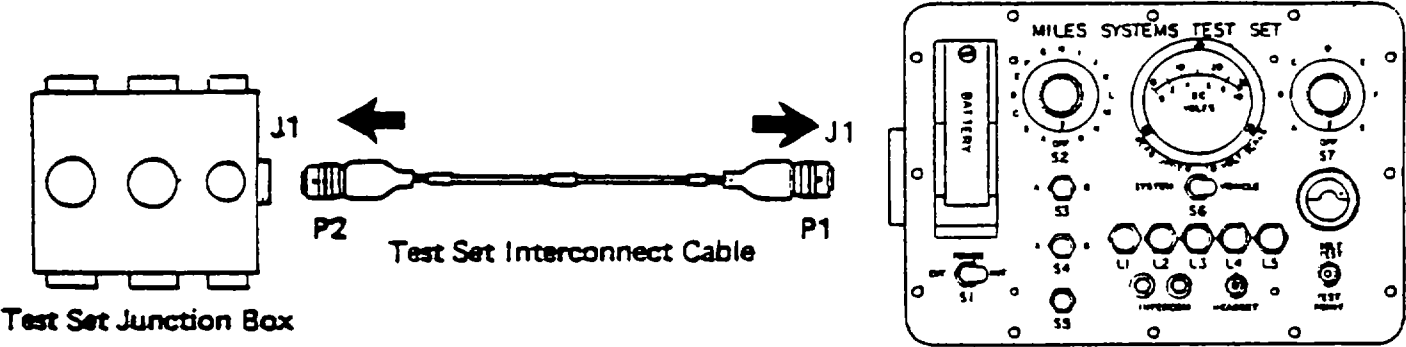
Table 3-2. Troubleshooting - MILES System Test Set (Cont)

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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2. VULCAN TRANSMITTER TEST (CONT)

(3) All Laser Tubes Inoperative

Connect Test Set Interconnect Cable, connector P1, to the test set, connector J1.  
Connect Test Set Interconnect Cable, connector P2, to the Test Set Junction Box, connector J1.

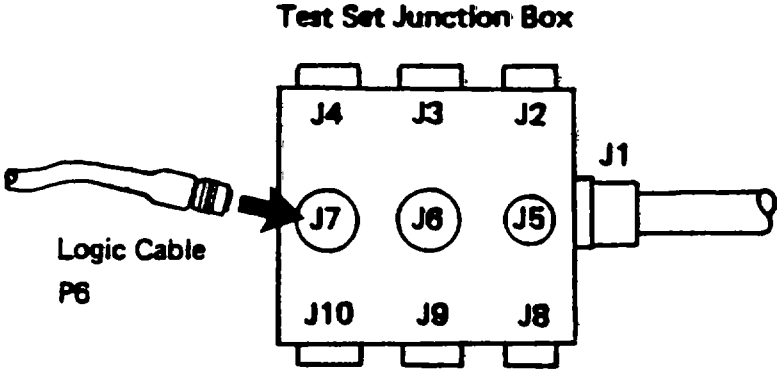


Place test set switch S1 to EXT position.

Disconnect Logic Cable, connector P6, from the Transmitter Assembly.

Connect Logic Cable, connector P6, to Test Set Junction Box, connector J7.

L5 lights (disregard).



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

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Select TEST MODE by inserting a Controller (Green) Key into the CONTROLLER MODE SELECT key receptacle on the ICA. Rotate controller key counterclockwise, then remove key.

Insert orange key in WEAPON key receptacle on ICA. Turn to WEAPON position.

Place VULCAN System in MANUAL mode.

Select MANUAL mode and LO-NO firing rate on VULCAN Control Assembly. Verify that sufficient laser rounds remain for testing. Trigger the VULCAN Weapon System. Check test set indicator lights L1, L2, and L3 when trigger is depressed.

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**CAUTION**

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**Do not operate range only radar.**

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If lights L1, L2, and L3 flash ON, then OFF, replace defective transmitter and return system to service.

If lights L1, L2, and L3 do not flash ON, then OFF, disconnect Logic Cable from Test Set Junction Box and reconnect to the Transmitter Assembly.

Disconnect Logic Cable, connector P2, from the ICA. Connect to Test Set Junction Box, connector J10.

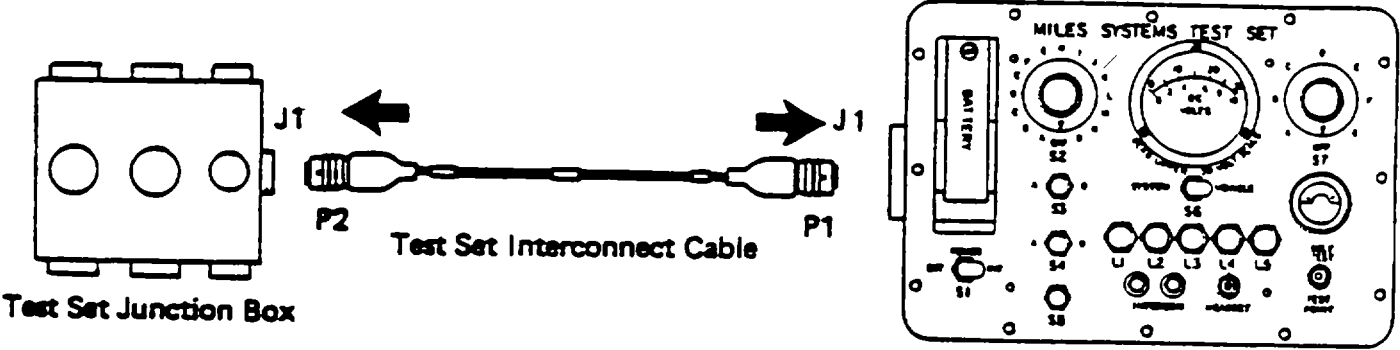


Table 3-2. Troubleshooting - MILES System Test Set (Cont)

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
2.	<u>VULCAN TRANSMITTER TEST (CONT)</u>	
(3)	All Laser Tubes Inoperative (Cont)	<p>Place a MWLD harness with a detector directly in front of the Transmitter.</p> <p>Place test set switch S2 to position B.</p> <p>Momentarily place test set switch S3 to position B.</p> <p>Verify that the MWLD detector harness responds with a "NEAR MISS" indication.</p> <p>Momentarily place test set switch S3 to position A</p> <p>Verify that the MWLD detector harness responds with a "HIT" indication.</p> <p style="padding-left: 40px;">If MWLD alarm responds, replace defective ICA and return system to service.</p> <p style="padding-left: 40px;">If MWLD alarm fails to respond, replace defective Logic Cable and return system to service.</p>
(4)	Both Outside Laser Tubes Inoperative	<p>Cover the center laser tube with a helmet, hand or other opaque material.</p> <p>Place VULCAN system in MANUAL mode.</p> <p>Insert Controller (Green) Key in CONTROLLER TEST key receptacle on modulator. Turn key counterclockwise to select TEST mode.</p> <p>Place a MWLD harness with a detector directly in front of the transmitter.</p> <p>Select LO-NO firing rate. Verify sufficient rounds remain for test. Trigger the VULCAN Weapon System. Verify that the MWLD detector harness responds with either "KILL" or a "NEAR MISS" alarms.</p> <p style="padding-left: 40px;">If MWLD alarm responds, replace defective Transmitter Assembly and return system to service.</p>

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

If MWLD alarm fails to respond, connect the Test Set Interconnect Cable, connector P1, to the test set, connector J1. Connect the Test Set Interconnect Cable, connector P2, to the Test Set Junction Box, connector J1.



Place test switch S1 to EXT position.

Disconnect Logic Cable, connector P2, from the ICA. Connect to Test Set Junction Box, connector J10.

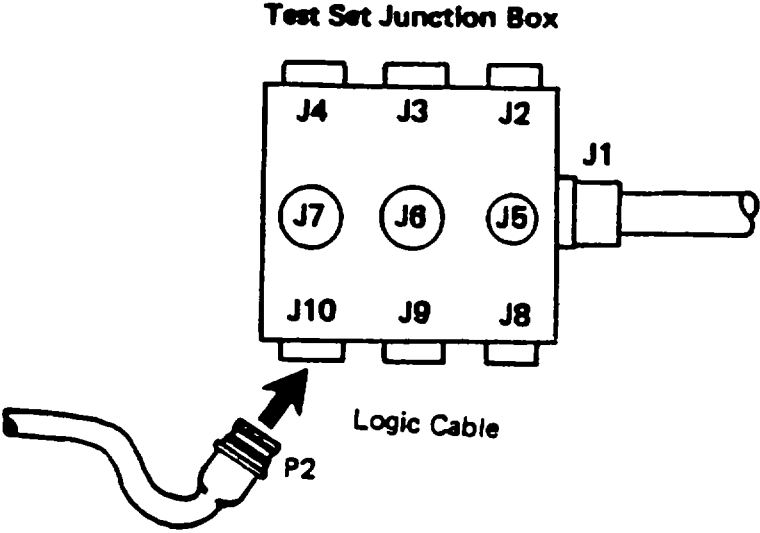


Table 3-2. Troubleshooting - MILES System Test Set (Cont)

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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2. VULCAN TRANSMITTER TEST (CONT)

(4) Both Outside Laser Tubes Inoperative (Cont)

Check test set indicator light L5.

If light L5 is ON, replace defective Logic Cable and return system to service.

If light L5 is OFF, place switch S2 to N position.

Place test set switch S6 to VEHICLE position.

Check test set voltmeter.

If voltage reading is less than 10 to 18 volts, verify that weapon system is operational. If weapon system is operational, replace defective Logic Cable Assembly and return system to service.

If weapon system is not operational, repair as necessary. See TM 9-1005-286-10.

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**WARNING**

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**Do not stand in front of radar when operating.**

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If voltage reading is 10 to 18 volts, select RADAR mode on VULCAN Control Assembly. Select LO-NO firing rate on VULCAN Control Assembly. Lock on a target and insure radar READY WHEN LIT indicator is ON. Trigger the Vulcan Weapon System with the RANGE ONLY RADAR operating.

Check test set voltmeter.

If voltage reading is 0 to 1 volt, replace defective ICA and return system to service.

If voltage reading is greater than 1 volt, VULCAN Weapon System is not operating properly. Repair malfunction (see TM 9-1005-286-10) and return system to service.

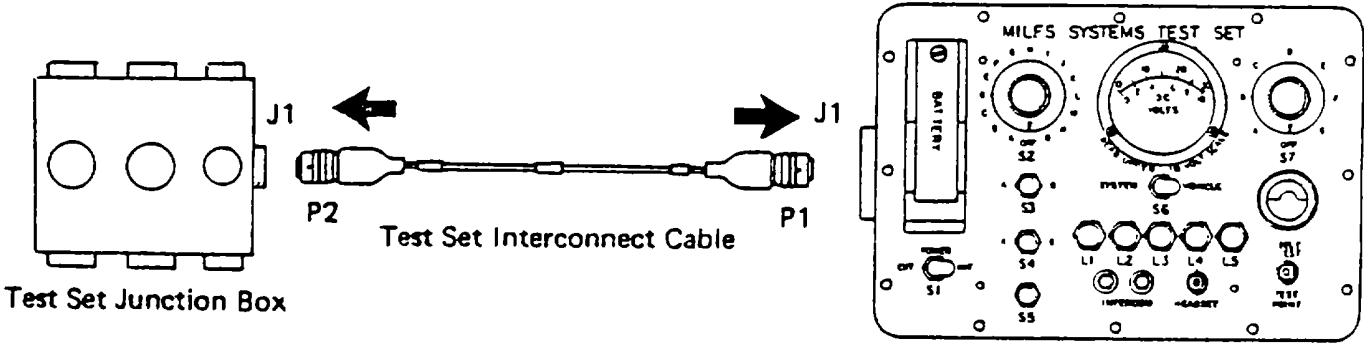
**MALFUNCTION**

**TEST OR INSPECTION**

**CORRECTIVE ACTION**

(5) Outside Laser Tubes Operate When MANUAL Firing Mode Selected

Connect Test Set Interconnect Cable, connector P1, to the test set, connector J1  
Connect Test Set Interconnect Cable, connector P2, to the Test Set Junction Box, P1.



Place test set switch S1 to EXT position.

Disconnect Logic Cable, connector P6, from the Transmitter Assembly.

Connect Logic Cable, connector P6, to Test Set Junction Box, connector J7.

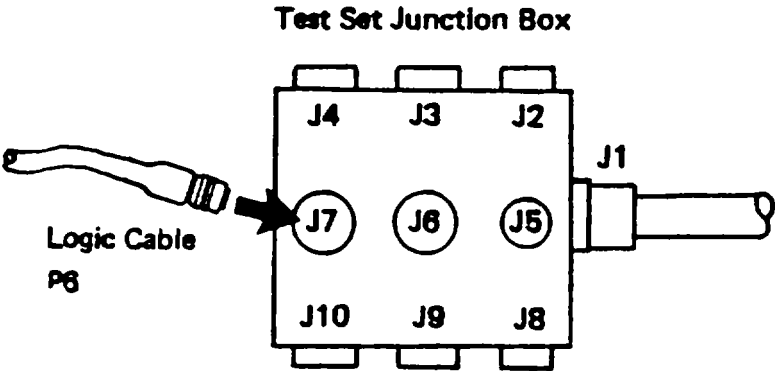


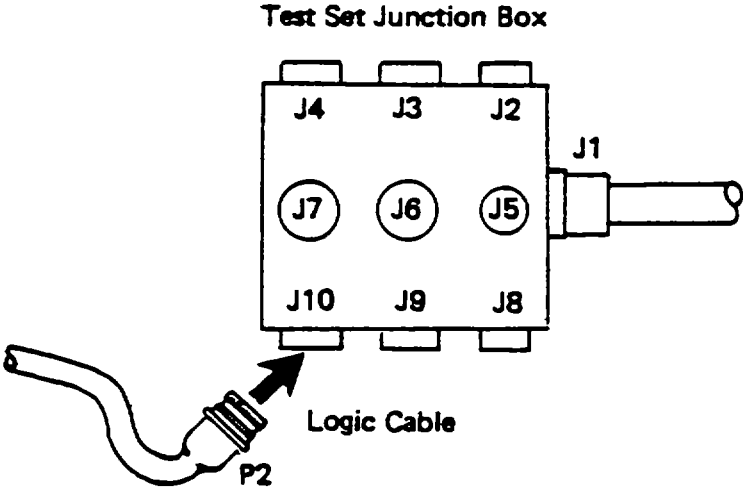
Table 3-2. Troubleshooting - MILES System Test Set (Cont)

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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2. VULCAN TRANSMITTER TEST (CONT)

(5) Outside Laser Tubes Operate When Manual Firing Mode Selected (Cont)

Check test set indicator light L5.  
 If light L5 is ON, replace defective Transmitter Assembly and return system to service.  
 If light L5 is OFF, reconnect Logic Cable, connector P6, to the Transmitter Assembly.  
 Disconnect Logic Cable, connector P2, from the ICA. Connect to Test Set Junction Box, connector J10.



Place test set switch S7 to position A.

Check test set indicator light L5.

If light L5 is ON, replace defective ICA and return system to service.  
 If light L5 is not ON, replace defective System Cable and return system to service.

**MALFUNCTION**

**TEST OR INSPECTION**

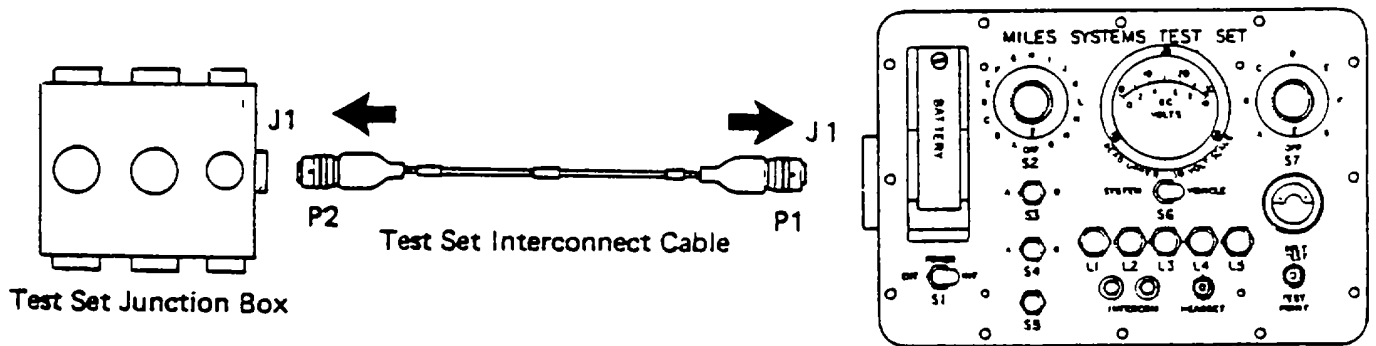
**CORRECTIVE ACTION**

3. FLASHWESS TEST

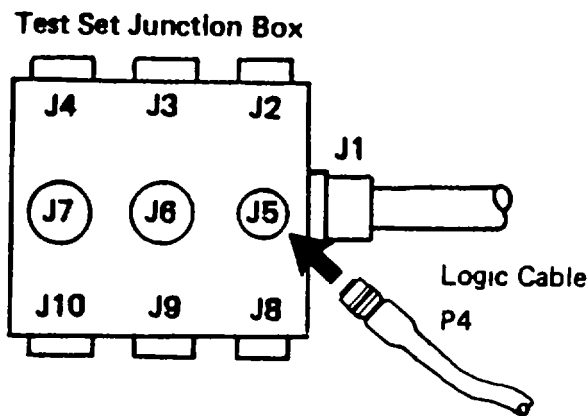
(1) FLASHWESS Inoperative

Ensure that ICA is In NORM mode.

Connect Test Set Interconnect Cable, connector P1, to test set, connector J1. Connect Test Set Interconnect Cable, connector P2 to the Test Set Junction Box, connector J1.



Disconnect Logic Cable, connector P4, from the FLASHWESS and connect to Test Set Junction Box, connector J5.



Place test set switch S6 to the VEHICLE position.

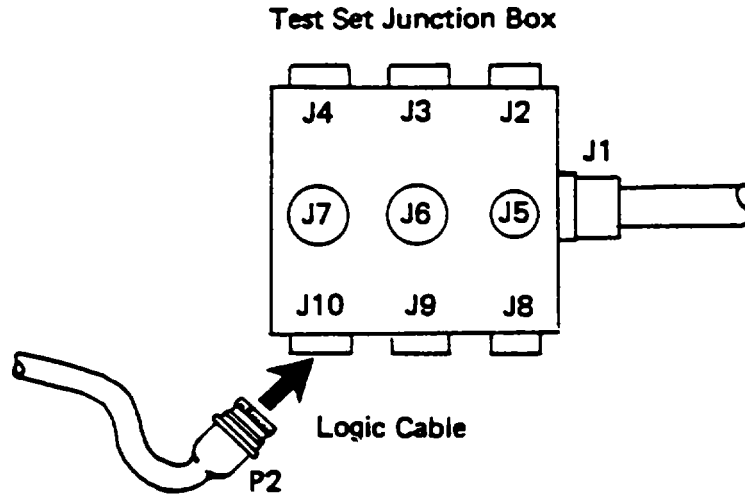
Place test set switch S2 to the 0 position.

Table 3-2. Troubleshooting - MILES System Test Set (Cont)

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
3.	<u>FLASHWESS TEST (CONT)</u>	
(1)	FLASHWESS Inoperative (Cont)	
		Read voltage on voltmeter.
		If voltage reading is less than 18 volts, go to (1.2) FLASHWESS Inoperative - Detection Cable (page 3-38)
		If voltage reading is 18 to 30 volts, insert 9 V battery in test set. Replace test set switch S1 to INT position.
		Select Manual mode and LO-NO firing rate on VULCAN Control Assembly. Verify sufficient laser ready rounds remain for testing. Trigger the VULCAN Weapon System. Check test set indicator lamp L1.
		If lamp L1 does not flash ON/OFF, go to (1.1) FLASHWESS Inoperative - No Indicator Flash (below)
		If lamp L1 flashes ON/OFF, set switch S7 to position D.
		Select 100-ROUND BURST firing rate on Vulcan Control Assembly. Verify sufficient laser rounds remain for testing
		Trigger the VULCAN Weapon System in the 100.ROUND BURST mode. Check test set indicator lamp L2.
		If lamp L2 flashes ON/OFF, replace defective FLASHWESS Assembly and return system to service.
		Remove battery from test set.
		If lamp L2 does not flash ON/OFF, go to (1.1) FLASHWESS Inoperative - No Indicator Flash (below)
(1.1)	FLASHWESS Inoperative - No Indicator Flash	
		Disconnect the Logic Cable, connector P4, from the test set. Reconnect it to the FLASHWESS.
		Place test set switch S1 to EXT position.

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

Disconnect Logic Cable, connector P2, from the ICA. Connect to Test Set Junction Box, connector J 10.



Place test set switch S2 to M position.

Read voltage on voltmeter.

If voltage is less than 18 volts, replace defective Logic Cable and return system to service.

Remove battery from test set.

If voltage is 18 to 30 volts, momentarily place test set switch S4 to position A. Observe FLASHWESS. Then momentarily switch to position B. Observe FLASHWESS.

If FLASHWESS operates in both switch positions, replace defective ICA and return system to service.

If FLASHWESS fails to operate in either positions, replace defective Logic Cable and return system to service.

Remove battery from test set.



Table 3-2. Troubleshooting - MILES System Test Set (Cont)

**MALFUNCTION**

**TEST OR INSPECTION**

**CORRECTIVE ACTION**

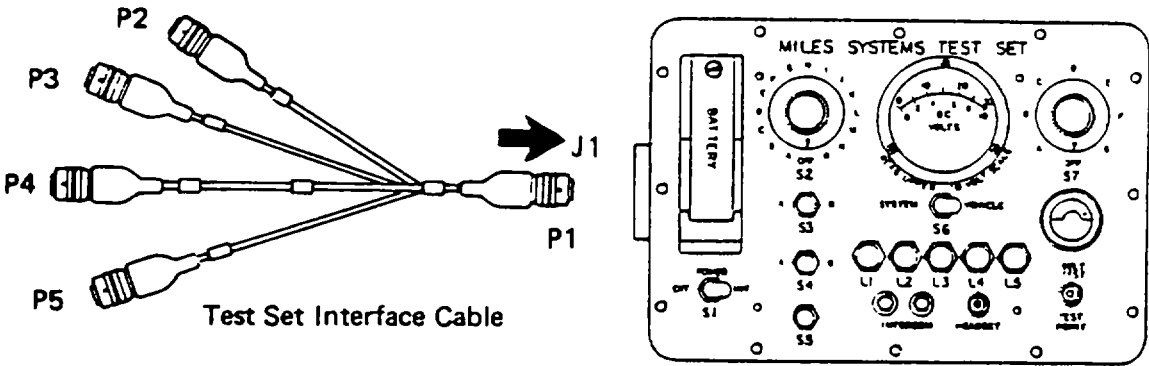
3. FLASHWESS TEST (CONT)

(1.2) FLASHWESS Inoperative - Detection Cable

Disconnect the Logic Cable from the Test Set Junction Box. Reconnect to the FLASHWESS.

Disconnect Test Set Interconnect Cable from test set.

Connect the Test Set Interface Cable, connector P1, to the test set, connector.J1.



Disconnect Logic Cable, connector P1, from Detection Cable, connector J1.

Connect Detection Cable, connector J1, to Test Set Interface Cable, connector P5.

Check the test set voltmeter.

If voltage is 18 to 30 volts, replace defective Logic Cable and return system to service.

If meter indicates less than 18 volts, verify VULCAN Weapon System is operational.

If weapon system is not operational, repair all malfunctions (see TM 9-1005.286-10) and return system to service.

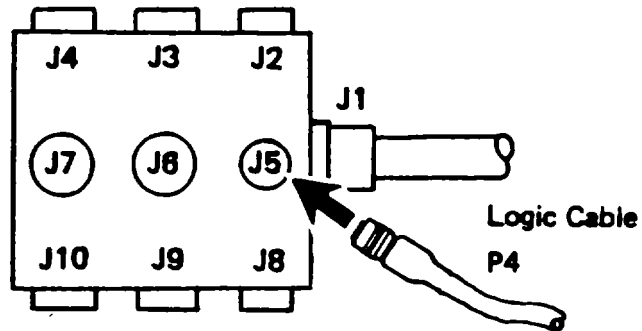
If weapon system is operational, replace Detection Cable and return unit to service.

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

## (2) FLASHWESS Inoperative - HI-BURST LIMIT Rate

Connect Test Set Interconnect Cable, connector P1, to test set, connector J1. Connect Test Set Interconnect Cable, connector P2, to Test Set Junction Box, connector J1.

Disconnect Logic Cable, connector P4, from the FLASHWESS and connect it to connector J5 on Test Set Junction Box.

**Test Set Junction Box**

Place test set switch S1 to EXT position.

Place test set switch S7 to position D.

Select MANUAL mode and 100 round, HI-BURST LIMIT firing rate on VULCAN Control Assembly. Verify sufficient laser ready firing rounds remain for testing. Check test set indicator light L2. Trigger VULCAN System. (Note that firing indicators on ICA will not appear for this test.)

If light L2 flashes ON/OFF, replace defective FLASHWESS and return system service.

If light L2 does not flash ON/OFF, disconnect the Logic Cable from the Test Set Junction Box and reconnect it to the FLASHWESS.

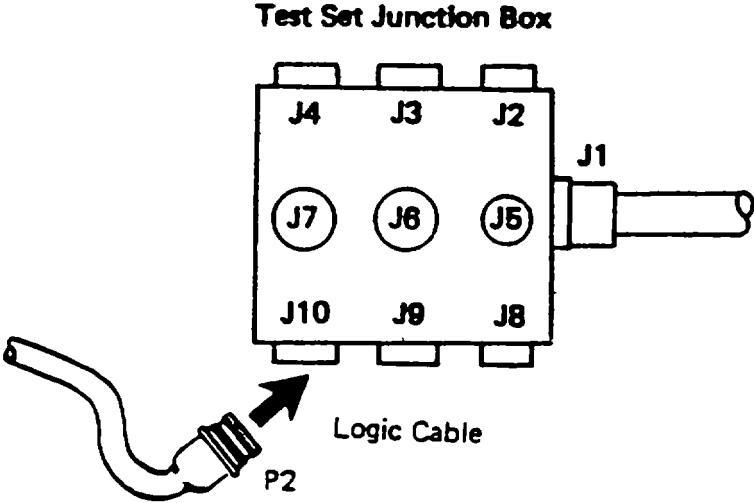
Table 3-2. Troubleshooting - MILES System Test Set (Cont)

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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3. FLASHWESS TEST (CONT)

(2) FLASHWESS Inoperative - HI-BURST LIMIT Rate (Cont)

Disconnect Logic Cable, connector P2, from the ICA and connect it to connector J10 on the Test Set Junction Box.



Momentarily place switch S4 to position B. Check FLASHWESS response.

If FLASHWESS flashes, replace defective ICA and return system to service.

If FLASHWESS does not flash, replace defective Logic Cable and return system to service.

(3) FLASHWESS Inoperative - LO-NO BURST LIMIT Rate

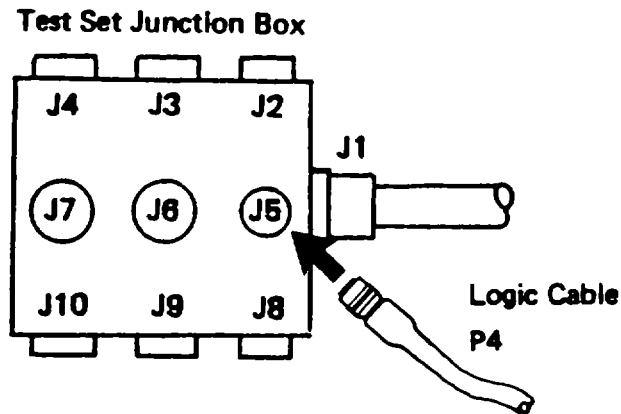
Connect Test Set Interconnect Cable, connector P1, to test set, connector J1. Connect Test Set Interconnect Cable, connector P2, to Test Set Junction Box, connector J1.

Install 9 V battery in test set battery box.

Place test set switch S1 to INT position.

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

Disconnect Logic Cable, connector P4, from the FLASHWESS and connect to connector J5 on Test Set Junction Box.



Select MANUAL mode and LO-NO BURST LIMIT firing rate on VULCAN Control Assembly. Verify sufficient laser firing rounds remain for testing. Check test set indicator light L1.

If light L1 flashes ON/OFF, replace defective FLASHWESS and return system to service. Remove 9-volt battery from test set.

If light L1 does not flash ON/OFF, disconnect the Logic Cable from the Test Set Junction Box and reconnect it to the FLASHWESS.

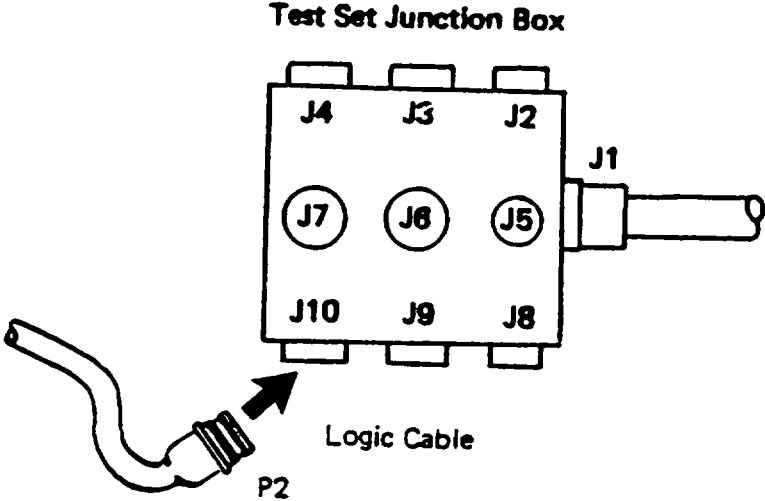
Table 3-2. Troubleshooting - MILES System Test Set (Cont)

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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3. FLASHWESS TEST (CONT)

(3) FLASHWESS Inoperative - LO-NO BURST LIMIT Rate (Cont)

Disconnect Logic Cable, connector P2, from the ICA and connect it to connector J10 on the Test Set Junction Box.



Momentarily place switch S4 to position A. Check FLASHWESS response.

If FLASHWESS flashes, replace defective ICA and return system to service.

If FLASHWESS does not flash, replace defective Logic Cable and return system to service.

Remove 9-volt battery from test set.

4. CONTROL INDICATOR ASSEMBLY (CIA)

(1) Display Is Blank

Disconnect the Detection Cable, connection P7, from the battery box. Pause one second and reconnect.

Check CIA display.

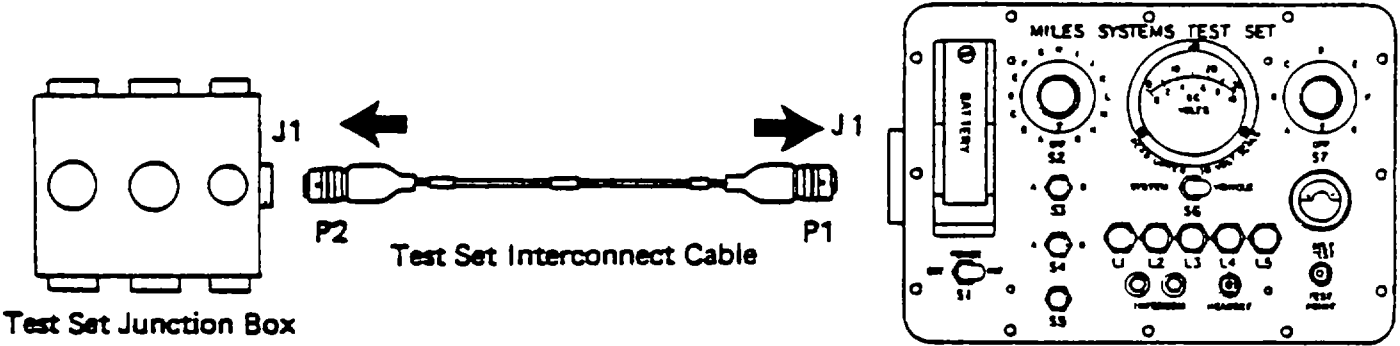
If display reads 00, return system to service.

**MALFUNCTION**

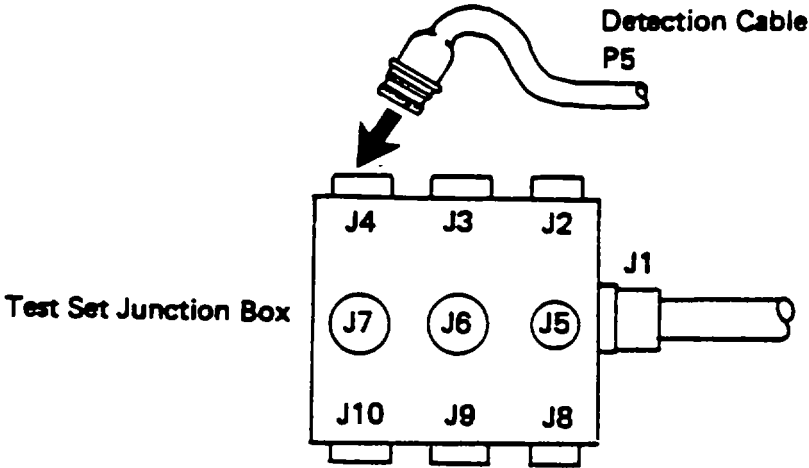
**TEST OR INSPECTION**

**CORRECTIVE ACTION**

If display is still blank, connect Test Set Interconnect Cable, connector P1, to the test set, connector J1. Connect Test Set Interconnect Cable, connector P2, to the Test Set Junction Box, connector J1.



Disconnect Detection Cable, connector P5, from the CIA. Connect it to Test Set Junction Box, connector J4.



Place test set switch S6 to the SYSTEM position.

Place test set switch S1 to EXT position.

Table 3-2. Troubleshooting - MILES System Test Set (Cont)

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
4.	<u>CONTROL INDICATOR ASSEMBLY (CIA) (CONT)</u>	
(1)	Display Is Blank (Cont)	<p>Read voltage on the voltmeter.</p> <p>If voltage reading is 8.5 to 13 volts, replace defective CIA and return system to service.</p> <p>If voltage reading is less than 8.5 volts, disconnect Logic Cable, connector P1, from Detection Cable, connector J1.</p> <p>Read voltage on voltmeter.</p> <p>If voltage reading is 8.5 to 13 volts, go to troubleshooting malfunction (1.1), Display Blank - Batteries/Belts/CVKI (below)</p> <p>If voltage reading is less than 8.5 volts, reconnect the Logic Cable to the Detection Cable.</p> <p>Disconnect Logic Cable, connector P6, from the laser transmitter. Check test set voltmeter.</p> <p>If voltage reading is 8.5 to 13 volts, replace transmitter and return unit to service.</p> <p>If voltage reading is less than 8.5 volts, reconnect Logic Cable to transmitter.</p> <p>Disconnect the Logic Cable, connector P2, from the CIA.</p> <p>Read voltage on voltmeter.</p> <p>If voltage reading is 8.5 to 13 volts, replace defective CIA and return system to service.</p> <p>If voltage reading is less than 8.5 volts, replace defective Logic Cable and return system to service.</p>
(1.1)	Display Blank - Batteries/Belts/CVKI	<p>Disconnect each Detector Belt Assembly. Read voltage on voltmeter.</p> <p>If voltage reading is 8.5 to 13 volts, the disconnected detector assembly is defective. Replace assembly and return system to service.</p>

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

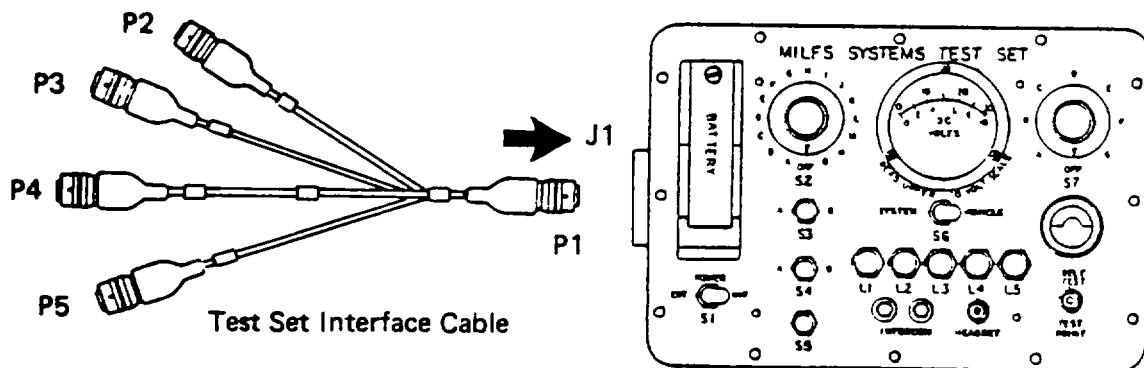
If voltage reading is less than 8.5 volts, disconnect CVKI assembly. Read voltage on voltmeter.

If voltage reading is 8.5 to 13 volts, replace defective CVKI. Return system to service.

If voltage reading is less than 8.5 volts, reconnect the CVKI.

Disconnect the Test Set Interconnect Cable from the test set.

Connect Test Set Interface Cable, connector P1, to the test set, connector J1.



Disconnect Detection Cable, connector P7, from battery box. Connect Test Set Interface Cable, connector P4, to battery box.

Place test set switch S1 to the 12 V position.

Read voltage on voltmeter.

If voltage reading is 8.5 to 13 volts, replace defective Detection Cable and return system to service.

If voltage reading is less than 8.5 volts, disconnect Detection Cable connectors P5 and P8 from CIA and battery box. Disconnect test set.

Remove Control Indicator Adapter Assembly from ammunition storage unit. Remove battery box assembly from Adapter Assembly. Reconnect test set.



Table 3-2. Troubleshooting - MILES System Test Set (Cont)

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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4. CONTROL INDICATOR ASSEMBLY (CIA) (CONT)

(1.1) Display Blank - Batteries/Belts/CVKI (Cont)

Install two new 6 V batteries in the battery box.

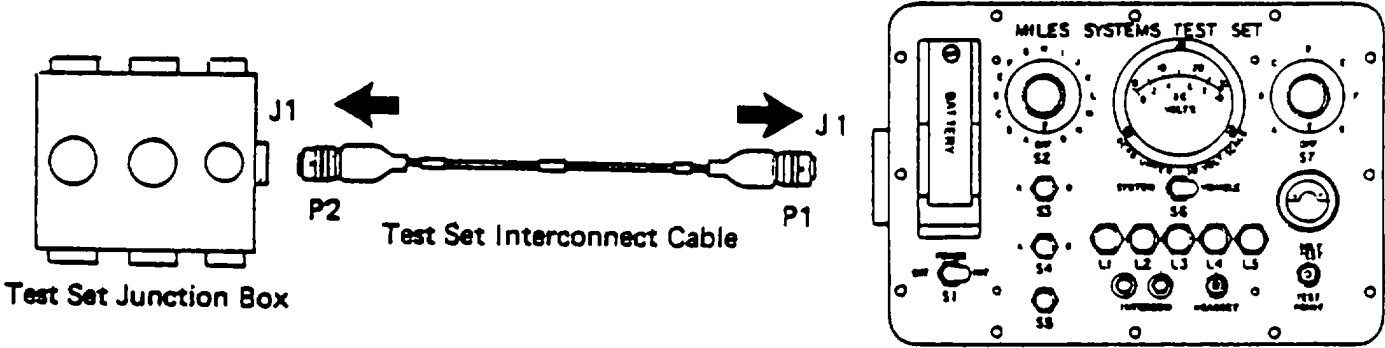
Read voltage on voltmeter.

If voltage reading is 8.5 to 13 volts, discard old batteries and return system to service.

If voltage reading is less than 8.5 volts, replace defective battery box and return system to service.

(2) Display Does Not Indicate 88

Connect Test Set Interconnect Cable, connector P1, to test set, connector J1. Connect Test Set Interconnect Cable, connector P2, to Test Set Junction Box, connector J1.



Place test set switch S1 to EXT position.

Insert a Controller (Green) Key into the WEAPON key receptacle on the CIA. Turn counterclockwise to the CONTROLLER position. Turn back and remove key.

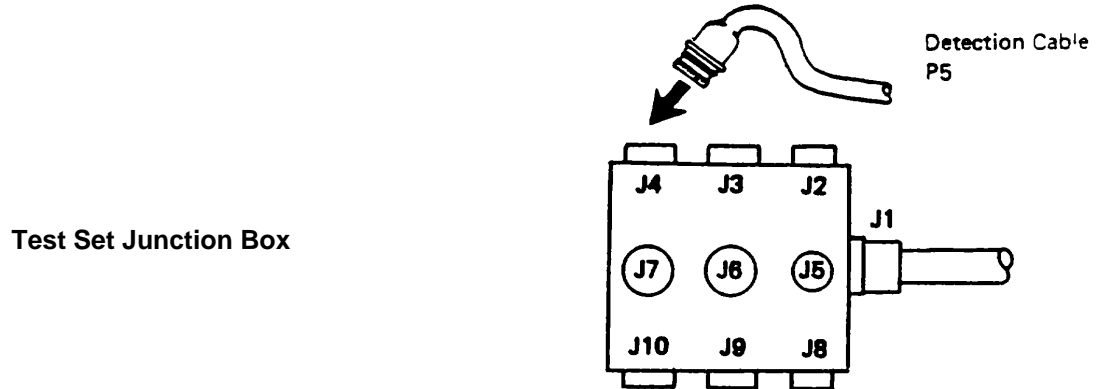
Turn CIA Console Switch to HIT/KILL. Then turn to SELF TEST. Check CIA display. If display reads 88, return system to service.

**MALFUNCTION**

**TEST OR INSPECTION**

**CORRECTIVE ACTION**

If display does not show 88, disconnect Detection Cable, connector P5, from the CIA. Connect it to Test Set Junction Box, connector J4.



Place test set switch S6 to the SYSTEM position.

Read voltage on voltmeter.

If voltage reading is 8.5 to 13 volts, replace defective CIA and return system to service.

If voltage reading is less than 8.5 volts, discard old batteries. Install two new 6 V batteries. Return system to service.

(3) **Weapon Identification Code Is Not Displayed**

Failure of the CIA to display a Weapon Identification Code indicates a problem with the CIA.

Replace defective CIA and return system to service.

(4) **NOT READY Light Does Not Light**

Failure of the NOT READY light to light when a KILL response is indicated by the CVKI indicates a problem with the CIA.

Replace defective CIA and return system to service.

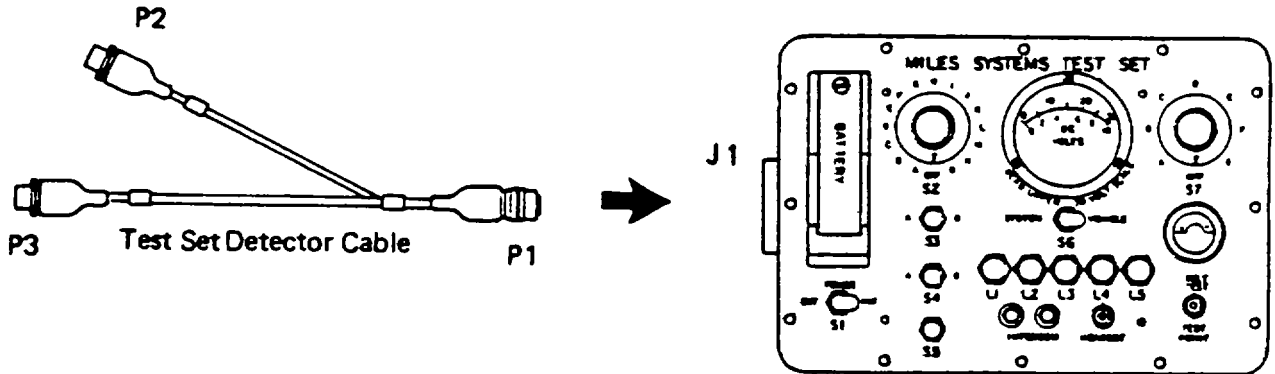
Table 3-2. Troubleshooting - MILES System Test Set (Cont)

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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5. VEHICLE DETECTOR BELTS

(1) One Detector Belt Faulty

Connect Test Set Detector Cable, connector P1, to the test set, connector J1.



Disconnect suspected faulty detector belt.

Connect Test Set Detector Cable, connector P2, to the faulty detector belt and connector P3 to the Detection Cable.

Place test set switch S1 to EXT position

Place test set switch S6 to the SYSTEM position.

Read voltage on voltmeter.

If voltage reading is less than 8.5 volts, replace defective Detection Cable and return system to service.

If voltage reading is 8 r to 13 volts, aim a Controller Gun at the faulty detector belt and fire a "NEAR MISS" signal. Check the test set BELT TEST meter.

**MALFUNCTION**

**TEST OR INSPECTION**

**CORRECTIVE ACTION**

**NOTE**

When firing the Controller Gun at the faulty Detector Belts, maintain a minimum of 5 feet between the Controller Gun and the Detector Belts. At distances less than 5 feet, a FALSE rate reading is possible.

If BELT TEST meter rate is greater than 96, replace defective Detection Cable and return system to service.

If BELT TEST meter rate is less than 96, replace faulty detector belt and return system to service.

(2) All Detector Belts Faulty

Connect Test Set Interconnect Cable, connector P1, to the test set, connector J1.

Connect Test Set Interconnect Cable, connector P2, to the Test Set Junction Box, connector J1.

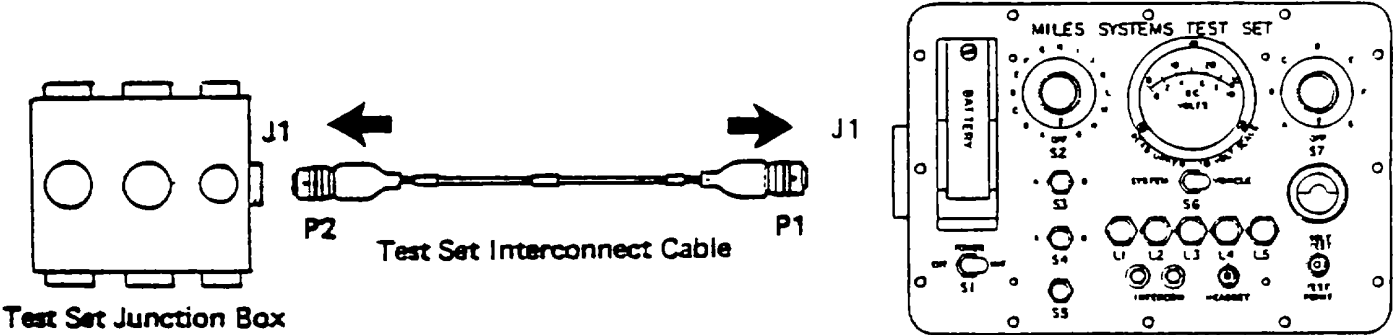


Table 3-2. Troubleshooting - MILES System Test Set (Cont)

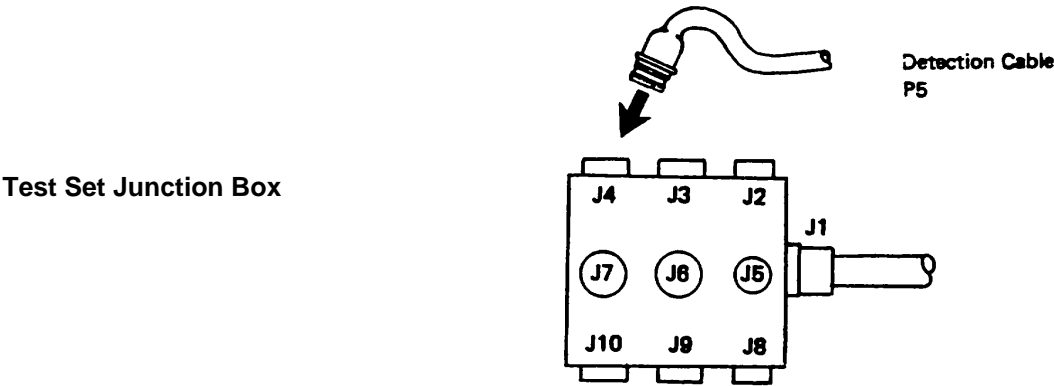
MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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5. VEHICLE DETECTOR BELTS (CONT)

(2) All Detector Belts Faulty (Cont)

Place test set switch S1 to EXT position.

Disconnect Detection Cable, connector P5, from the CIA. Connect it to Test Set Junction Box, connector J4.



Read the rate from the detector belts on the test set BELT TEST meter. See Table 3-2.1 for determining the acceptable rate for 3 detector belts.

<i>Table 3-2.1</i>		
<b>Detector Belt Rate</b>		
<u>Number of Belts</u>	<u>Full Sun</u>	<u>Shade</u>
1	0-10	0-2
2	0-15	0-4
3	0-20	0-8
4	0-30	0-10

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

If BELT TEST meter rate is acceptable, go to troubleshooting malfunction (2.1), All Detector Belts Faulty - Controller Gun Test (below).

If BELT TEST meter rate is unacceptable, disconnect one vehicle detector belt.

Read the detector belt rate on test set BELT TEST meter. See Table 3-2.1 for determining the acceptable rate for 2 detector belts.

If BELT TEST meter rate is acceptable, replace the detector belt that was disconnected and return system to service.

If BELT TEST meter rate was unacceptable, reconnect the detector belt previously disconnected and repeat rate test on each of the remaining detector belts until the faulty belt is isolated.

If all belts are checked and BELT TEST meter rate is still unacceptable, replace the Detection Cable and return system to service.

**(2.1) All Detector Belts Faulty - Controller Gun Test**

Aim a Controller Gun at the detector belts and fire a "NEAR MISS" signal. Check the test set BELT TEST meter

**NOTE**

**When firing the Controller Gun at the faulty Detector Belts, maintain a minimum of 5 feet between the Controller Gun and the Detector Belts. At distances less than 5 feet, a FALSE belt test meter reading is possible.**

If BELT TEST meter rate is greater than 96, replace defective CIA and return system to service.

If BELT TEST meter rate is less than 96, disconnect one belt. Aim a Controller Gun at the remaining detector belts and fire a "NEAR MISS" signal. Check test set BELT TEST meter.

If BELT TEST meter rate is now greater than 96, replace disconnected belt.

If BELT TEST meter rate is still less than 96, repeat tests on remaining belts.

If BELT TEST meter rate is greater than 96, replace disconnected belt.

If BELT TEST meter rate remains less than 96, for all belts, replace Detection Cable Assembly.

Table 3-2. Troubleshooting - MILES System Test Set (Cont)

**MALFUNCTION**

**TEST OR INSPECTION**

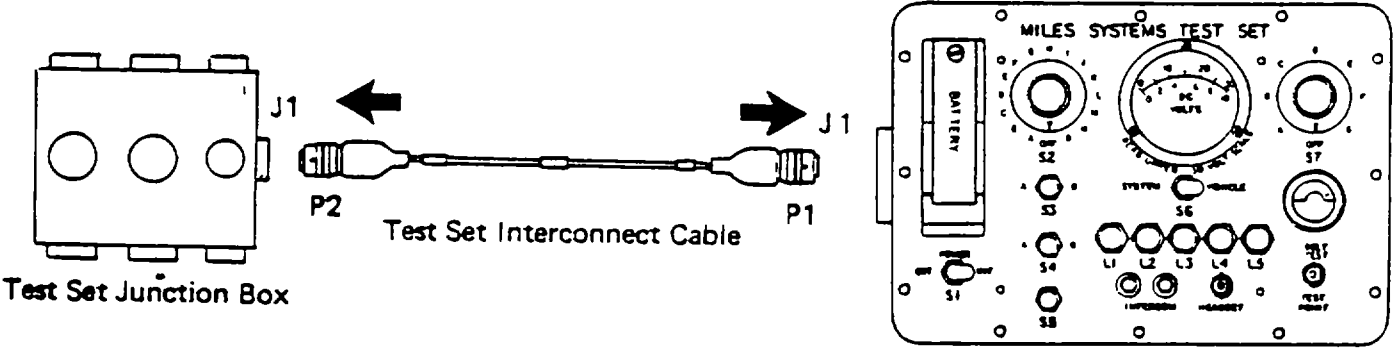
**CORRECTIVE ACTION**

6. COMBAT VEHICLE KILL INDICATOR (CVKI)

(1) CVKI Fails To Operate

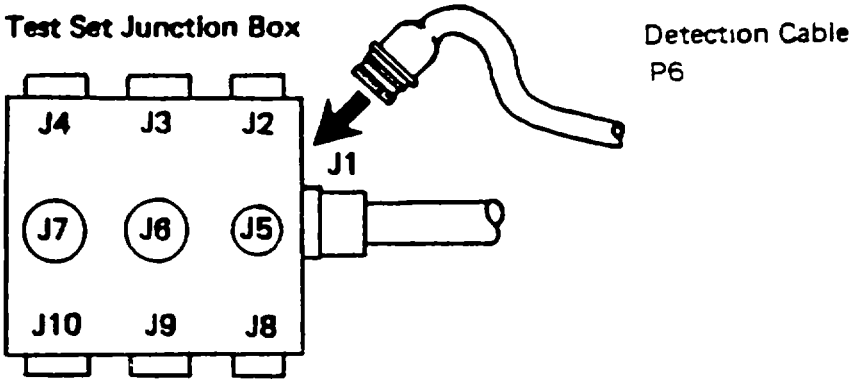
Connect Test Set Interconnect Cable, connector P1, to the test set, connector J1.

Connect Test Set Interconnect Cable, connector P2, to the Test Set Junction Box, connector J1.



Check that the system power switch is ON.

Disconnect Detection Cable, connector P6, from the CVKI. Connect it to Test Set Junction Box, connector J5.



**MALFUNCTION**

**TEST OR INSPECTION**

**CORRECTIVE ACTION**

Place test set switch S6 to the VEHICLE position.

Read voltage on voltmeter.

If voltage reading is less than 18 volts, check Vulcan's electrical system for malfunction. See TM 9-1005-286-10. Repair defect and return system to service.

If there is no voltage reading, go to troubleshooting malfunction (1.1), CVKI Falls to Operate - Voltage Check (page 3-54).

If voltage reading is 18 to 30 volts, insert 9 V battery in test set. Set test set switch S1 to INT position. If L1 lights, disregard. Insert a Vehicle (Orange) Key into CIA WEAPON key receptacle. Turn clockwise to WEAPON position.

Place test set switch S7 at E position.

Check test set indicator light L2.

If light L2 flashes ON/OFF, replace defective CVKI and return system to service. Remove battery from test set.

If light L2 does not flash ON/OFF, disconnect the Detection Cable, connector P6, from the Test Set Junction Box.

Reconnect the Detection Cable, connector P6, to the CVKI.

Disconnect Detection Cable, connector P5, from the CIA. Connect It to Test Set Junction Box, connector J4.

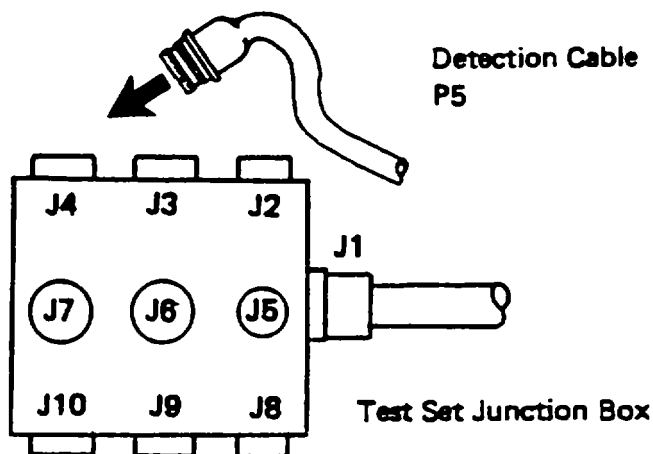




Table 3-2. Troubleshooting - MILES System Test Set (Cont)

---

**MALFUNCTION**

**TEST OR INSPECTION**

**CORRECTIVE ACTION**

---

6. VEHICLE KILL INDICATOR (CVKI) (CONT)

(1) CVKI Fails To Operate (Cont)

Place test set switch S7 to position G. Momentarily depress test set switch S5. Check CVKI.(Test set indicator L4 may come on. This indication has no effect on troubleshooting procedures.)

If CVKI flashes, replace defective CIA and return system to service.

Remove battery from test set.

If CVKI does not flash, replace defective Detection Cable and return system to service.

Remove battery from test set.

(1.1) CVKI Fails To Operate - Voltage Check

Check that Detection Cable, connector P1 and J1 (located at Power Distribution Box) are tight.

Read voltage on voltmeter.

If voltage reading is 18 to 30 volts, return system to service.

If voltage reading is less than 18 volts, inspect VULCAN Weapon System for malfunction. See TM 9-1005-286-10.

If VULCAN System is not operational, repair and return to service.

If VULCAN System is operational, replace Detection Cable and return system to service.

---

## APPENDIX A

## REFERENCES

**A-1. SCOPE**

This appendix lists all forms, field manuals, technical manuals and miscellaneous publications 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 Worksheet

**A-3. FIELD MANUALS**  
FM 21-11

Field Manual: First Aid for Soldiers

**A-4. TECHNICAL MANUALS**

TM 9-1005-286-10	Operator's Manual (Crew) for Gun, Air Defense Artillery, TOWED, 20mm, M167A1
TM 9-1005-318-10	Operation and Maintenance Manual (Crew) for Gun. Air Defense Artillery, Towed 20-MM. M167A2 Cannon M168, Gun Carriage M42A2. Sigt M61A1, and Radar AN, 'VPS-2A
TM 9-1265-207-10-HR	Hand Receipt for Simulator System, Firing, Laser: M76 For VULCAN Weapon System, Towed
TM 9-1265-370-10-3	Operator's Manual for Multiple Integrated Laser Engagement System (MILES) Simulator System, Firing, Laser' M63 for M113 APC
TM 9-5860-225-14&P	Operator, Organizational, Direct Support and General Support Maintenance, Alignment Device. Laser Transmitter, Multiple Range (M3)

**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)

**APPENDIX B****COMPONENTS OF END ITEM AND BASIC ISSUE ITEMS LISTS**

---

**SECTION I. INTRODUCTION****B-1. SCOPE**

This appendix lists components of end item and basic issue items for the MILES VULCAN, Towed, System to help you inventory items required for safe and efficient operation.

**B-2. GENERAL**

The Components of End Item and Basic Issue Items Lists are divided into the following sections:

a. Section II. Components of End Item. This listing is for informational purposes only, and is not authority to requisition replacements. These items are part of the end item, but are removed and separately packaged for transportation or shipment. As part of the end item, these items must be with the end item whenever it is issued or transferred between property accounts. Illustrations are furnished to assist you in identifying the items.

b. Section III. Basic Issue Items. These are the minimum essential items required to place the MILES VULCAN, Towed, System In operation, to operate it, and to perform emergency repairs. Although shipped separately packaged, BII must be with the MILES VULCAN, Towed, System during operation and whenever it is transferred between property accounts. The illustrations will assist you with hard-to-identify items. This manual is your authority to request/requisition replacement BII, based on TOE/MTOE authorization of the end item.

**B-3. EXPLANATION OF COLUMNS**

The following provides an explanation of columns found in the tabular listings:

- a. Column (1) - Illustration Number. This column indicates the number of the illustration in which the item is shown.
- b. Column (2) - National Stock Number. Indicates the National Stock number assigned to the item and will be used for requisitioning purposes.
- c. Column (3) - Description. Indicates the Federal item name and, if required, a minimum description to identify and locate the item. The last line for each item indicates the FSCM (in parentheses) followed by the part number.

d. Column (4) - Unit of Measure (U/M). Indicates the measure used in performing the actual operational/maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g., ea, in, pr).

e. Column (5) - Quantity required (Qty rqr). Indicates the quantity of the item authorized to be used with/on the equipment.

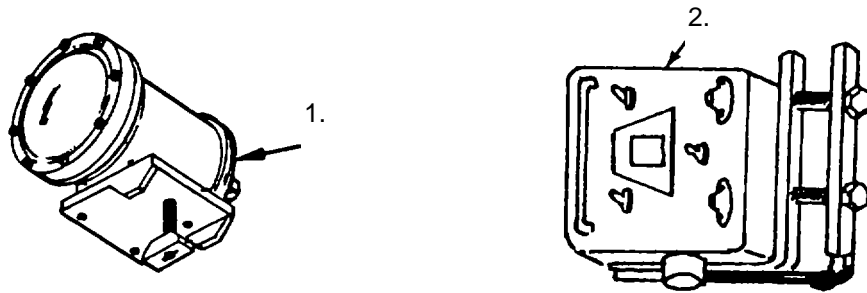
**SECTION II. COMPONENTS OF END ITEM**

**SIMULATOR SYSTEM, FIRING, LASER: M76 FOR VULCAN, TOWED**

(1) Illus. No.	(2) National Stock Number	(3) Description FSCM and Part Number	(4) U/M	(5) Qty Reqd
1	*	Adapter Assembly, Simulator, Weapon Fire (19200) 9339391-2	EA	1
2	*	Adapter Assembly, Simulator System, Laser: Console Vehicle Interface (19200) 9339390	EA	1
3	*	Adapter Set, Simulator System, Laser: VULCAN, Towed (19200) 9339550	EA	1

**NOTE**

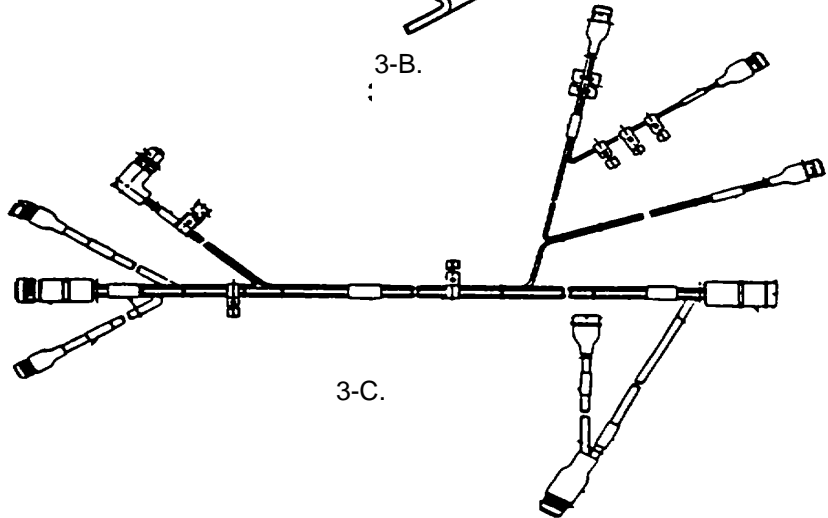
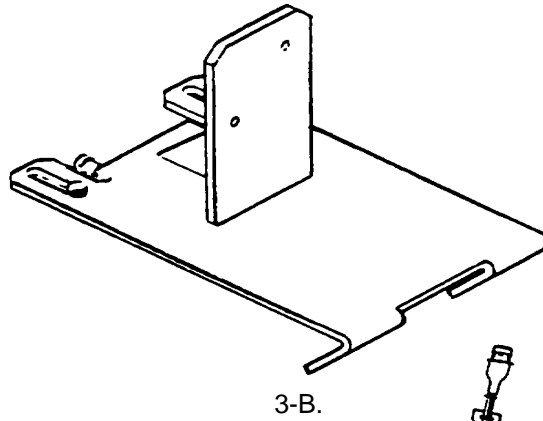
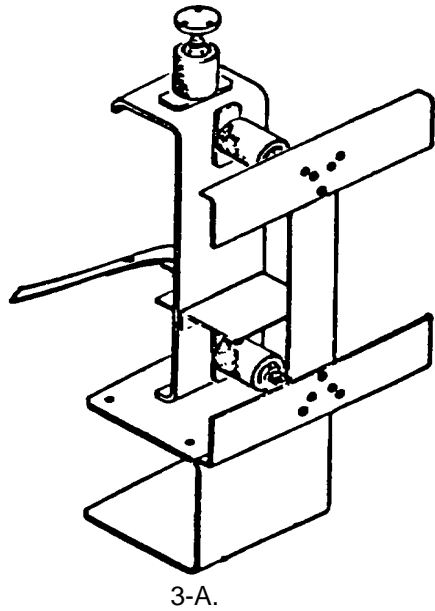
Adapter set is shown on page B-3.



\*NOT AVAILABLE ON PUBLICATION DATE

SECTION II. COMPONENTS OF END ITEM

SIMULATOR SYSTEM, FIRING, LASER: M76 FOR VULCAN, TOWED



(1) Illus. No.	(2) National Stock Number	(3) FSCM and Part Number Description	(4) U/M	(5) Qty Reqd
3-A	*	Line item 3/part number 9339550 consists of the following components: Adapter Assembly, Control Indicator (19200) 9339880	EA	1
3-B	*	Adapter Assembly, CVKI (19200) 9339826	EA	1
3-C	*	Cable Assembly, VULCAN, Towed, Detection (19200) 9339426	EA	1

\*NOT AVAILABLE ON PUBLICATION DATE

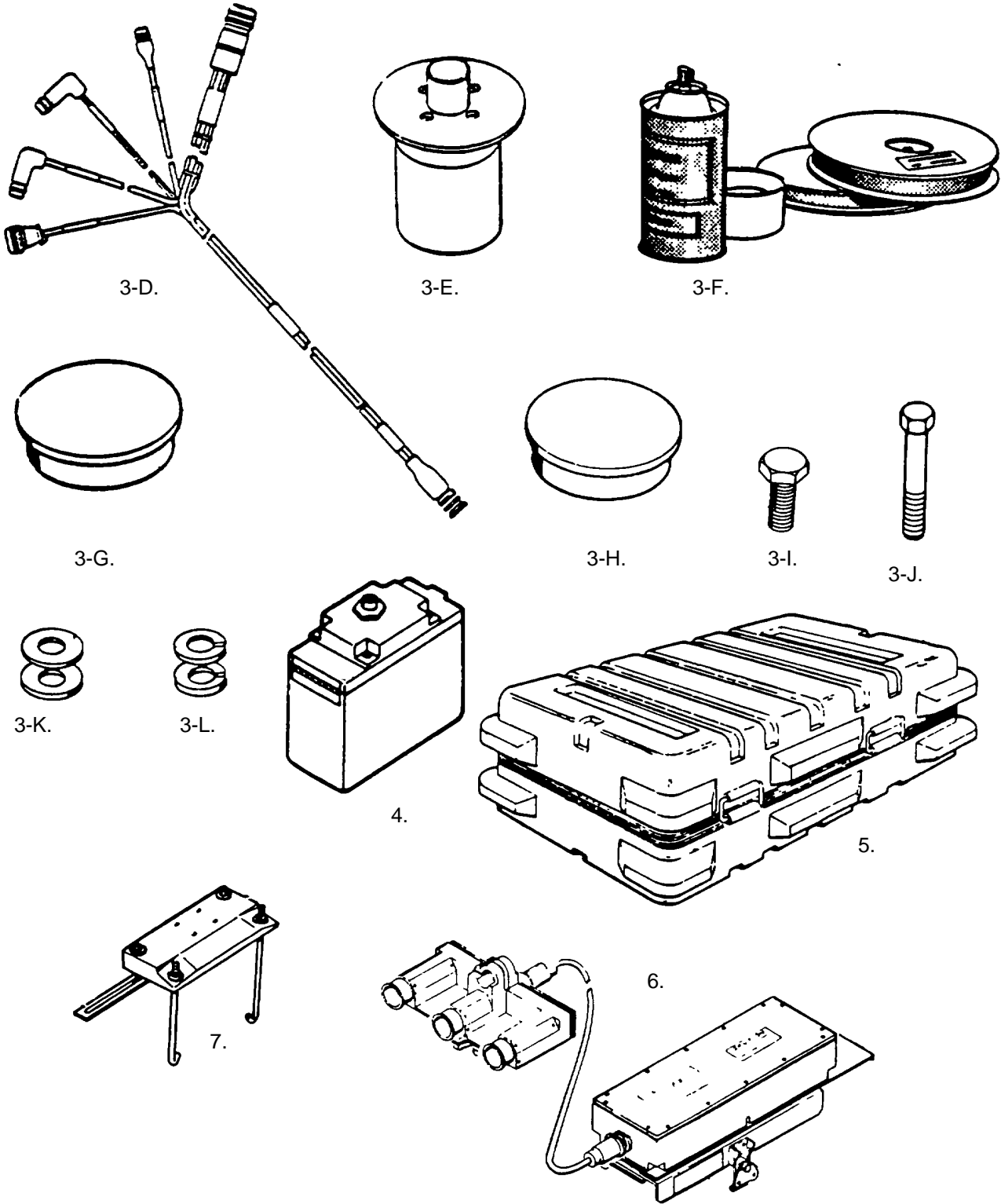
**SECTION II. COMPONENTS OF END ITEM**

SIMULATOR SYSTEM, FIRING, LASER: M76 FOR VULCAN, TOWED (Cont)

(1) Illus. No.	(2) National Stock Number	(3) Description FSCM and Part Number	(4) U/M	(5) Qty Reqd
3-D	*	Cable Assembly, VULCAN, Towed, Logic (19200) 9339792	EA	1
3-E	*	Flange, Bottom (19200) 9339727	EA	1
3-F	*	Protective Cap (00756) NAS813-28	EA	2
3-G	*	Protective Cap (00756) NAS813-32	EA	2
3-H	*	Screw, Cap, Hex HD, .375-16 UNC-2A x .625 LG (96906) MS35307-357	EA	4
3-I	*	Screw, Cap, Socket HD., 6-32 UNC-3A x 2.00 LG (00756) NAS1352C06-32	EA	8
3-J	*	Washer, Flat No. 3/8 (96906) MS 15795-813	EA	4
3-K	*	Washer, Lock No. 3/8 (96906) MS35338-141	EA	4
4	*	Battery Box Assembly (19200) 11749790	EA	1
5	*	Transit Case, Assembly, VULCAN (Towed) (19200) 9339563	EA	1
6	*	Transmitter Assembly, Simulator System, Laser: VULCAN (19200) 9339554	EA	1
7	*	Transmitter Mount Assembly (19200) 9359418	EA	1

\*NOT AVAILABLE ON PUBLICATION DATE

COMPONENTS OF END ITEM



**SECTION III. BASIC ISSUE ITEMS**

1 ea. TM 9-1265-207-10

Operator's Manual f/Simulator System, Firing  
Laser: M76 f/Vulcan Weapon System, Towed



APPENDIX C

ADDITIONAL AUTHORIZATION LIST

SECTION I. INTRODUCTION

**C-1. SCOPE**

This appendix lists additional items you are authorized for the support of the MILES VULCAN, Towed, System.

**C-2. GENERAL**

This list identifies items that do not have to accompany the MILES VULCAN, Towed, System and that do not have to be turned in with it. These items are all authorized to you by CTA, MTOE, TDA, or JTA.

**C-3. EXPLANATION OF LISTING**

National stock numbers, descriptions, and quantities are provided to help you identify and request the additional items you require to support this equipment. The items are listed in alphabetical sequence by item name.

SECTION II. ADDITIONAL AUTHORIZATION LIST

<b>(1) NATIONAL STOCK NUMBER</b>	<b>(2) DESCRIPTION  (FSCM &amp; Part Number)</b>	<b>(3)  U/M</b>	<b>(4)  QTY AUTH</b>
5860-01-155-5478	Alignment Device, Laser Transmitter Multiple Range (19200) 9339389	EA	1
1265-01-092.0891	Controller's Gun, Simulator System, Laser (19200) 11748811	EA	1
5120-00-243-9401	MILES System Test Set (19200) 9358670	EA	1
1265-01-077.6082	Roller, Hand (24617) 6523520	EA	1
1265-01-077.6082	Simulator System, Firing, Laser: M63 for M113 APC (19200) 11749272	EA	1
<b>C-1/(C-2 blank)</b>			

## APPENDIX D

EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST

---

## SECTION I. INTRODUCTION

**D-1. SCOPE**

This appendix lists expendable supplies and materials you will need to operate and maintain the MILES VULCAN, Towed, System. These items are authorized to you by CTA 50-970, Expendable/Durable Items (Except Medical, Class V, Repair Parts, and Heraldic Items).

**D-2. EXPLANATION OF COLUMNS**

a. Column (1)- Item number. This number is assigned to the entry in the listing and is referenced in the narrative instructions to identify the material (e. g., "Use cleaning compound, Item 5, Appendix D").

b. Column (2) - Level. This column identifies the lowest level of maintenance that requires the listed item.

C - Operator/Crew

c. (3) - National Stock Number. This is the National stock number assigned to the item; use it to request or requisition the item.

d. Column (4) - Description. Indicates the Federal item name and, if required, a description to identify the item. The last line for each item indicates the Federal Supply Code for Manufacturer (FSCM) in parentheses followed by the part number.

e. Column (5) - Unit of Measure (U/M). Indicates the measure used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g., ea, in, pr). If the unit of measure differs from the unit of issue, requisition the lowest unit of issue that will satisfy your requirements.

SECTION II. EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST

(1) Item Number	(2) Level	(3) National Stock Number	(4) Description	(5) U/M
*1	C	6135-00-643-1310	Battery, 6 volt (80058), BA-200/U	EA
*2	C	6135-01-063-1978	Battery, 9 volt (80058), BA-3090/U	EA
3	C	8010-01-040-0947	Primer, Tape (19200), 11749034	OZ
4	C	8315-01-111-7170	Tape, Fastener (19200), 11749428	YD
5	C	6640-00-240-5851	Paper, Lens Cleaning (81349), NNN-P-40	PK
6	C	7920-00-205-1711	Cloth	PK
7	C	7920-00-255-7536	Brush, Cleaning	EA
<p>* 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.</p>				

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**By Order of the Secretary of the Army:**

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*General United States Army*  
*Chief of Staff*

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**DISTRIBUTION:**

To be distributed in accordance with DA Form 12-37, Operator's Maintenance requirements for MILES Simulator Sys, Firing, Laser M76 (for M167A1 VADS).

\*U. S. GOVERNMENT PRINTING OFFICE : 1992 O - 311-831 (44187)

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  
1 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 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**

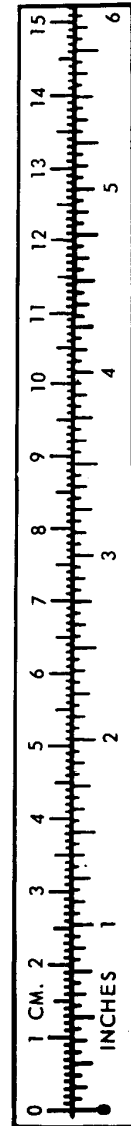
Centimeters .....  
 Meters .....  
 Meters .....  
 Kilometers .....  
 Square Centimeters .....  
 Square Meters .....  
 Square Meters .....  
 Square Kilometers .....  
 Square Hectometers .....  
 Cubic Meters .....  
 Cubic Meters .....  
 Milliliters .....  
 Liters .....  
 Liters .....  
 Liters .....  
 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



TA089991

PIN: 056891-000